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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Adaptive Capacities of Community to cope up with flood situations

Flood and Livelihood Adaptive Capacity based Compilation

Adaptive Capacities of Community to cope up with flood situations - Flood and Livelihood Adaptive Capacity based Compilation

Compilation :
Consortium of 20 NGOs
Eastern Uttar Pradesh

Coordinated by :
Gorakhpur Environmental Action Group
Post Box # 60, Gorakhpur-273001 (U.P.)

Supported by :
Oxfam Novib
The Netherlands

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Adaptive Capacities of Community to cope up with flood situations

Flood and Livelihood Adaptive Capacity based Compilation

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Adaptive Capacities of Community to
cope up with flood situations

Preface

Changing climatic situations are affecting livelihoods of people-especially the most deprived communities. The changes like floods, droughts, desertification are directly affecting agriculture and agriculture related livelihoods-directly and indirectly. People normally cope with such climatic variations. The adaptive capacities enable people to address the adverse situations arising due to floods, droughts and climatic variabilities.

The local knowledge, wisdom and skills of people help them, to a large extent, in developing such adaptive capacities. The traditional knowledge and skills in the local communities evolve over a period of time according to local agro-climatic conditions.

In this context, efforts were made by a group of non-governmental organizations of eastern Uttar Pradesh, to compile such knowledge and practices related to agriculture and related issues which have helped communities in developing their adaptive capacities in response to floods of the area.

The contribution of all the involved NGOs have been valuable in the process. Dr. Ajai Kumar of Rajendra Agriculture University provided necessary guidance and support in compiling practices. Mr. Biju Negi helped in developing the English version of this compilation. The team members of GEAG made all efforts to make the compilation useful and effective.

We are grateful to Oxfam Novib, especially Ms Gina Castillo, for providing necessary support and continuous inputs.

We are also thankful to Mr. Sanjay Mathur for helping in video documentation of the practices.

We are grateful to all those who have directly or indirectly helped in developing this compilation.

And above all, we are grateful to the farmers and villagers who have shared their knowledge and experiences with us and provided information in compiling the practices.

January, 2008

Dr. Shiraz A. Wajih
President

The original version of this compilation is in Hindi with 100 documented practices.

The present form in English comprises only 43 practices.

Video documentation was also done, with Hindi commentary, for 52 practices.

Adaptive Capacities of Community to
cope up with flood situations

Contents

Adaptive Capacities of Community to cope up with flood situations

1 BACKGROUND AND INTRODUCTION

Floods and eastern Uttar Pradesh have an age old association. But changes in the climatic conditions, for various reasons, have altered the nature of floods and redefined the damage caused by them.

BACKGROUND AND NEED FOR THE COMPILATION

Eastern Uttar Pradesh is among the most naturally bountiful regions in the country, with a plentiful availability of underground and surface water. Rivers and streams issuing from the mountains have, over time, carried and deposited precious silt in these plains, which has made the land here extremely fertile. Consequently, the region is inhabited with a high population density.

But large parts of eastern Uttar Pradesh are also poverty-stricken and flood-affected. In a region where agriculture on small holdings is predominant, floods have caused extreme devastation. However, floods have been a natural phenomenon here. With the gradient of the land being very gentle and the current of the river water not so swift, seasonal water retention over land for short periods has always been there. It is only that, over the last several decades, changes in the pattern, character, duration and extent of floods have brought untold misery to the people, had an adverse effect on agriculture, health and livelihood of the people, caused loss of life and property, decreased the productivity of the land and worsened the state of water retention into a problem of water-logging.

Effectively, the flood related changes observed in the region are :

- Change in time, volume, pattern, *etc.* of rain.
- Increasing frequency of flash floods resulting in fissures in or collapsing of embankments.
- Smaller rivers and streams becoming a major cause for floods.
- Decreasing lakes and reservoirs and

People have always found ingenious ways to overcome adverse conditions, but because of lack of wider dissemination, these initiatives have remained localized to limited areas.

their decreasing capacity to hold large volumes of water.

- Increasing duration of water-logging.

Government and development organizations have tried to deal with the situation, but their initiatives have been more relief oriented and short period targetted. As a result, there have been no long-term solutions to the people's problems nor have such initiatives had a positive impact on the people's coping mechanisms and capacities.

On the other hand, over centuries, local people have developed their own ways and means to deal with floods. These measures and techniques are local specific, require no external help or support and are inherently scientific. These ways and means have shaped the people's lifestyles in these regions and strengthened their adaptive capabilities.

Today, such adaptive capabilities of the local communities are being seen as extremely important in dealing with problems of flood, water-logging and climate change. However, it must also be realized that the people's local adaptive ways and means have by and large remained confined to the respective local areas, and have not been documented for wider dissemination, use and benefit.

This booklet, collectively brought together by voluntary organizations working with the poorest population in the flood and water-log affected regions, seeks to address this shortcoming. The broad objective of this compilation is to share these various local and traditional flood responsive ways and measures, with people over a larger area in order to build and strengthen their adaptive capabilities and capacities in tackling disasters like floods and thereby mitigating their impacts.

ENVIRONMENTAL CHANGE AND ADAPTATION

Every year, floods affect a large part of the country. But whereas earlier, floods came and receded as a natural phenomenon, today these are becoming more unpredictable and damaging. There is increasing loss of life and property as also an increasing extent of water-logged and submergences areas. In the region that is agriculture predominant, it is the farmers whose livelihood and very survival is dependent on land and hundreds of related work that are the most affected. Crops and houses get submerged in flood, health problems become acute and water-logging seriously delays and affects the next crop. Options and opportunities for work and labour decrease and the multi-pronged problems make the community extremely vulnerable.

It has been seen that a community's adaptive capacities are affected mainly by

- The state of natural resources in the area.
- The livelihood system and opportunities at the local level.
- Income generating opportunities outside, in the nearby areas.
- Basic physical infrastructures, services and facilities like roads, housing, drinking water, *etc.* at the local level.
- The area's socio-economic and gender sensitivities.
- People's accessibility to information and know-how.
- Social capital in the community, such as the existence of social infrastructures as well as networking with government and formal sector organizations like bank, government departments, voluntary organizations, *etc.*

As such, in order for people to deal better with floods and their changing character, one of the ways is to build people's adaptive capabilities through raising their awareness, knowledge base and capacities to earn a living through a selection of appropriate crops and techniques. This is essential, but as much a challenge.

Environmental change and floods in Uttar Pradesh

The geography of eastern Uttar Pradesh makes the region naturally sensitive to floods. Spread along the *terai* region, there is a wide network of rivers, which originate in the mountains of Nepal and are known for their inordinate temperament. Heavy rains in Nepal result in a sudden rise in water level in rivers here. The rushing waters from the mountains slow down and spread out on reaching comparatively gentle gradient of the slopes and the low lying land in *purvanchal* and induce water retention which becomes a menace as flood. Changes in the climatic conditions have only worsened the problem.

In the last several decades, the ferocity and frequency of floods in *purvanchal* has considerably increased, recurring every 3-4 years. At places, it has even become a regular, annual feature, which greatly affects the livelihood of the people. The people inhabiting the flood-affected regions attribute this to climate change.

Indeed, the climate of eastern Uttar Pradesh has undergone a definite change in the last few years. For example, it has now become normal for the temperature to cross 45^0C and remain so for long periods during the summers. Such temperature rise causes rapid melting of glaciers which is increasing the water level in the rivers.

On the other hand, there has been a significant change in the monsoon period. The timings of rain have become very unpredictable. While earlier, August-September was the usual period of flood, today it is not. In 2007, there were heavy rains in July itself causing sudden floods here, for which the people were ill prepared, had very little time to respond and there was considerable loss of life and property.

Once a friend, the floods have now turned into a foe. Considering that their most severe impact is on the agriculture of the region, it is essential that we discuss and anticipate the possible changes that can happen or be made to people's livelihood options.

People have enhanced their adaptive capacities with the changing climatic conditions, and taken a positive initiative in the rediscovery and use of their traditional knowledge.

THE PRINCIPLES OF LIVELIHOOD RESILIENCE IN FLOOD-AFFECTED REGIONS

Today, the effects of increased frequency and ferocity of floods are being felt at some level or the other every month during the monsoon period (July-September). At such time, everyone from the government to organizations and the public tries to help the affected people, and every other work comes to a virtual standstill.

But with the receding of floods, individuals and agencies that were hitherto working for the flood-affected people soon return to their respective routine jobs, and the extensive destruction of the people's basic resources and infrastructures in floods are left unattended or the intensity and pace of attention gets slow. The people themselves too, bearing their losses, seek to return to their normal lives as soon as possible with whatever resources they are left with. Remarkably, there is no wide scale migration and people continue to inhabit these regions and learn to live with floods.

In order to understand why and how it is so, we sought to analyze the practices people have adopted, and found how these practices underline the people's livelihood resilience in flood affected regions. The people's resilience is based on and strengthened by the following: -

Adaptation

The effects of environmental changes - irregular flow in rivers, irregular rain and impractical external measures to prevent floods (embankments, canals, drainage, *etc.*) have exacerbated the havoc from floods. Yet, by accepting natural disasters as inevitable, the people living in disaster-prone areas have integrated these into their lifestyles, and always evolved rapidly and imbibed indigenous ways and means to get over their flood problems. This has not only helped reduced the impact of disasters but also considerably helped secure people's livelihood.

Certainly, people's livelihood resilience depends a great deal on how well the community uses the available resources through its adaptive strategies. It has been seen that the community that is rapidly able to adapt itself to the changing character of disasters, faces must less erosion of its livelihood. It may not be an exaggeration then to say that people's livelihood resilience and their adaptive capacities are dependent on each other.

Intensification

The more intensively people in flood-affected regions practice adaptive strategies and activities or the more conducive the situations are to the adaptation of these strategies, the more easy it becomes for the people to return to their normal lives once the floods recede. Though floods have a drastic effect on the people's activities, they are still able to recover some harvest or income. Take sugarcane for example. Despite the occurrence of floods and the sorry state of the sugar-mills in the region, people use their knowledge and skills to produce and sell jaggery and find a way out by growing hemp and vegetables like okra.

By way of adaptive strategies for livelihood, people have adopted both agricultural and non-agricultural practices, which can be classified as pre-flood, during flood and post-flood, and are as follows:-

- Fuel collection and storage
- Fodder collection and storage
- Grain and seeds collection and storage
- Selection and storage of seeds of quick growing crop varieties
- Vegetable growing
- Agricultural work and labour
- Animal husbandry
- Afforestation
- Employment generating small business / industry, organization development and community initiatives and seeking government facilities and services
- Fish catch and sale
- Short-term migration, sand dredging and sale.

Diversification

Looking at the various activities compiled, it appears that the flood-affected region is richly biodiverse. There is a tremendous diversity of crop varieties, trees, plants, grass and animals, besides people's knowledge, experience, skills and enterprises. The landless are able to make a living on small and useful animals and plants or temporarily migrate in search of employment. When silt and sand spreads over paddy fields, people learn to grow watermelons, gourds and other appropriate vegetables and fruit. Indeed, this diversity forms the basis of people's livelihood as well. So, be it in agriculture, labour work, animal husbandry or other employment, during the floods and post-flood scenario, people adopt different measures and activities that they can afford and which suit their skills.

These various activities can be classified as:-

- *Agriculture* Mixed farming, subsidiary farming vegetables, fruit, spices, *etc.*
- *Animal husbandry* Milch cattle, poulty, duckery, sheep, goatary, fishery.
- *Employment* Farm labour, brick kiln, short-term migration, construction labour, door-to-door product selling, and sale-purchase of grains.
- *Fuel* Wood, crop residue (mustard, pigeon pea stalks), dung fuel, hay, dry leaves, sugarcane residue, *etc.*
- *Fodder* Hay, green fodder, nitrogenous plants, coarse grains like millet, maize, sorghum, *etc.*

Value Addition

Value addition enhances the use and price of a product. The people of the flood affected region are aware of this, but lack marketing facilities. For instance, the local women groups are engaged in giving value addition to various products from paddy, milk, vegetables, *etc.* People in the area also prepare jaggery and other by-products from sugarcane or even manufacture sugar. The possibilities are immense, but due to lack of resources and information, the initiatives by farmers remain improperly or incompletely harnessed.

Indigenous Technical Knowledge

In these collected practices, we find that there is a strong element of people's indigenous knowledge. Neither the government nor non-government nor private organizations have been able to develop and provide technical know-how for people to survive in disaster prone areas. In fact, at times, external, alien knowledge or know-how tends to even mislead the people. People solely survive on the strength of their traditional knowledge and their ingenuity. From these collected practices, it is apparent that people ingenuously use a mix of their local and externally gathered knowledge, as required.

People's indigenous technical knowledge is very rich, as can be seen in their practices of treatment of sick cattle, seed preservation and storage, seed improvement, grain storage, house construction, water purification, *etc.* This knowledge together with their generational experience and memories enables many people to anticipate events, make accurate forecasts and prepare themselves accordingly.

As a result of changing climatic conditions, the tendency of floods and drought has increased, and so has the damage inflicted by them. In view of this, it is absolutely important to consider ever new sources and options of relevant livelihood.

Flood is defined as a state of water filling up and overflowing the rivers, streams, lakes and low-lying lands to create a negative impact on the lives and livelihood of the people.

Marketing

Market is emerging as an important factor in people's livelihood accretion and resilience. People in flood-affected regions have poor access to market, and though they are able to sell products like jaggery from sugarcane, *khoya* from milk, vegetables, fish, brooms, *etc.*, they do not get appropriate price for their products, while middlemen corner most of the profits. Because of market distances, lack of transport, meagre production, the people's own, immediate monetary needs for their basic requirements and the fact that they are unorganized, forces the people to sell their products in the villages itself.

Collective Action

It is obvious that people realize the strength of unity and collective action, particularly for livelihood sustenance in the face of grave problems in the flood-affected regions. People have collectively repaired embankments, constructed bridges and culverts, removed silt and sand from the fields, organized themselves into a “Livelihood Rights Association” to rally, demonstrate and even sit-in on protests for their demands of livelihood. repaired embankments, constructed bridges and culverts, removed silt and sand from the fields, organized themselves into a “Livelihood Rights Association” to rally, demonstrate and even sit-in on protests for their demands of livelihood.

UNDERSTANDING FLOODS

Introduction

Water in one of the most important features on earth, and rivers are its main carrier from one place to another. They originate in the mountains, move through the plains to finally drain into seas and oceans. But rivers have their definite water carrying capacities, which is different for each river according to its geographical location. Whenever there is excess water released from the mountains or heavy rainfall in a river's watershed, which rushes downstream to collect in the plains, it gives rise to a state of flood. Human attempts to contain the rivers through artificial means like dams and embankments have steadily worsened the state and character of floods and made them increasingly severe and destructive.

Definition

Stated simply, a flood means more than normal flow of water in a river or an abnormal rise in its water level. The excess water in the river during the rainy season overflows its banks to spread over the adjoining areas. This is flood. At times, improper drainage or water outlet, forces the river to overflow its banks and cause a state of water retention on land. That too is flood. Likewise, high tides, cyclones and hurricanes, *etc.* in the seas causing water to spread on land along the coasts, is also flood.

The International Commission on Irrigation and Water Drainage has defined floods as

A more than expected flow of water or more than the normal high water level in a river or a state of water retention in lowlands, which may be caused by a sudden increase in the volume of water or its sudden flow and spread and as a result of which the adjoining land gets submerged, is called flood.

It can be said that flood is a state of inordinate water retention in an area, mainly because of excess rain in the watershed area, excess water release from the water source, the inability of rivers for whatever reasons to hold this excess water within its banks or due to use of artificial means to contain the natural flow of water.

Nature and type of floods

Primarily, floods are naturally beneficial. The silt coming along with floods makes the land fertile. However, the tendency to hold the rivers within embankments or restrict its natural water flow has been largely harmful and has, in fact, escalated the disastrous tendency of the floods.

Floods can be divided into three broad categories, depending on their duration:-

1. Short duration flood - Duration twenty-four hours or less. Flash floods, high speed flow, where river gradient is high. These prove disastrous as these come without any warning and the people living downstream do not get enough time to move to safety.

2. Medium duration flood - Duration two to seven days. Medium-slow speed of water flow, in river with fewer gradients. Less damage as people get some time to take safety measures.

3. Long duration flood - Duration one week to one month or even more. In flat plains that offer very slow water outlet speed. Normal life completely is disturbed and the damage or loss is widespread.

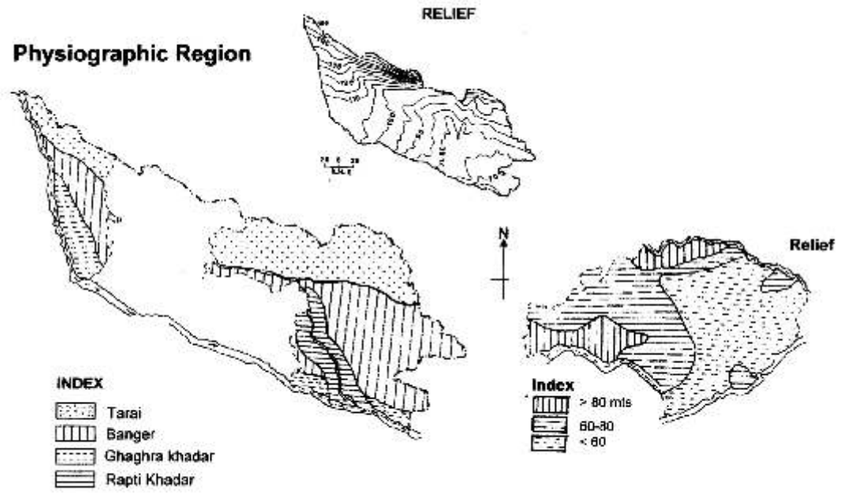
Floods can also be categorized as:-

Low water level flood - Water level about two feet or up to the knees. This and drains out quickly and is less damaging. On the contrary, it is even beneficial.

Medium water level flood - Water level about four feet or up to the waist. Remains for some days. Damage may be limited and situational, but crops get affected.

High water level flood - Water level about five feet or higher. Generally remains for long time. Extensive loss of life, property and crops. Long-term effects.

Floods have both short-term and long-term impact, most severely on agriculture and land, which affect the entire humankind, for which some positive and urgent initiatives have to be taken.



2 FLOODS IN EASTERN U.P.

Because of the increasing recurrence of floods and drought, it becomes important to look at the diversification of agriculture and livelihood aspects, and select crops from the point of view of the market.

Floods have been there for centuries but only in the last 60 years their frequency has increased dramatically. In the context of eastern Uttar Pradesh and Bihar, 1922, 1923, 1924, 1925, 1954, 1955, 1960, 1961, 1963, 1969, 1978, 1980, 1981, 1983, 1988, 1989, 1995, 1998 and 2007 have been major years when floods have caused severe damages, and people's lives have been seriously affected. Rivers Ghaghra, its tributary Sharda and others like Rapti, Rohin, Gorra, Chhoti Gandak, Burhi Gandak have been the main rivers in question.

The cause of floods

Flood is a natural phenomenon occurring in the majority of the rivers in India. The country's tropical climate is governed by monsoons. The majority of its regions (except coastal Tamil Nadu) receive their maximum precipitation in the four months from June to September, while the rest of the year largely remains arid or semi-arid. During the four months, the south-westerly monsoon rises in the equatorial region and branches into two, entering the Indian sub-continent through the Bay of Bengal and the Arabian Sea. According to a report of the National Agriculture Commission 1976 the Bay of Bengal monsoon carries about 7700 ha / m water, while the Arabian Sea bring 3400 lakh ha / m water into India. About 25-30% of this moisture (3000-4000 lakh ha / m) precipitates as rain.

The north-eastern region of Uttar Pradesh Bahraich, Sidharthnagar, Maharajganj, Gorakhpur, Kushinagar and Deoria, and district Ghazipur in south-eastern Uttar Pradesh are located in the heavy monsoon region, receiving over 101 cm of rain, which accounts for over 80% of their annual precipitation, across almost 75% of their annual rain-days between mid-June and mid-September (*See Table below*).

Table 1 – Rainfall in north-eastern and south-eastern Uttar Pradesh

No.	District	Annual rainfall		South-west monsoon period (June-September)			
		Rain days	Volume (mm)	Rain days	% of annual rain days	Volume (mm)	% of annual rain
1.	Bahraich	82	1228	60	73.2	947	77.1
2.	Sidharthnagar	78	1595	62	79.5	985.5	8.8
3.	Maharajganj	76	1295.8	61	80.3	1181.2	91.2
4.	Gorakhpur	74	1244.5	58	78.4	1020	81.9
5.	Kushinagar	77	1268.3	63	81.8	1150.9	82.9
6.	Deoria	68	1146.7	59	86.8	1047.1	91.4
7.	Ghazipur	50	1012.9	41	8.0	875	86.4

Excessive rains are the primary reason for floods, when in the aftermath of heavy downpour, the rivers are not able to hold the extra volume of water, which then overflows their banks to spread and collect in low lying areas.

Lack of proper water drainage and the inability of the rivers to hold water are other reasons for the floods. Rivers have always carried out the erosion of their banks. This silt load, in the process of being carried further, also tends to settle and raise the river beds, resulting in water overflowing and spreading out.

Development infrastructures like roads, railway tracks, canals, housings, embankments, agriculture, *etc.* in the watershed regions, further impede the outlets for water flow, which effect flood or water-logging. In fact, the dense network of transport laid out as part of urbanization, have been created without considering the slope of the land and the natural flow of water in the region. Such hindrance to the natural flow of river water becomes another major reason for water-logging.

Human activities also play a major role is flood creation. Ponds and lakes meant for storing rainwater are being converted into land for housing or agriculture. Or post-monsoon, farmers intensively cultivate the newly created fertile silt stretches left behind by the receding floods. Subsequently, this encourages expansion of human settlements closer and closer towards the rivers, which only adds to the problem. Over a period of time, the decrease in natural water reservoirs and increase in human activities along riversides further impede water drainage and cause floods. People also cut embankments for their commuting or rats excavate holes therein, which further weaken the embankments, providing another cause for floods.

The rivers in this region - Ghaghra, Saryu, Rapti, Rohin, Chhoti Gandak, Burhi Gandak and others rise in Nepal where because of lack of water-control facilities and measures, the sluice gates of the dams are opened on heavy rain, and this too becomes a cause for floods in the plains of India.

The rivers changing their course, expansion in their impact area, deforestation in their watershed, *etc.* are other reasons for floods in the river basins.

The impact of floods

Large parts of eastern Uttar Pradesh are regularly affected by floods, which not only disturb the livelihood of the people but have a deep psychological impact on them as well. During the monsoon period, in flood prone regions, people get traumatized even before the floods actually come. The community, social organizations and the government administration discuss and plan

In the changed environmental conditions, it is important to combine the conservation of traditional knowledge with adoption of newer techniques and discoveries.

In earlier time, people settled alongside rivers in order to strengthen and enhance their resources. Today, however, these very settlements have become the most vulnerable to floods. This has led to the need to collect various information and know-how which can help mitigate people's problems.

extensive security options and also initiate preventive and safety measures on the basis of available funds and other resources. But it has been seen that all safety measures prove ineffective and despite continuous efforts, the menace of floods is ever increasing.

The trans-Saryu plains between Bahraich and Deoria suffer the onslaught of floods every year, which deeply affect the economic system of the area, as follows:-

- *Resources* Severe effect on the availability of water, forest, land, soil, plant and animal life.
- *Crops* Destruction of *kharif* crops, the main produce of the region.
- *Delay in rabi or winter crop sowing* Post-flood, water still standing over land, delays the sowing for the next season, sometimes as much as by several months.
- *Houses* Total or partial destruction of houses and other infrastructures.
- *Public and private products and facilities* Destruction to road, electricity lines and communication facilities. Disruption of transport, industrial and economic enterprises
- *Shortage of life sustaining items* Post-flood shortage of food, water, electricity, transport and of other things of daily needs.
- *Loss of property* - Household possessions get swept away or cattle get swept away and die.
- *Loss of life* - .Death from boats capsizing, snakebite or by other animals, through hunger or famishment and lack of water.
- *Epidemics* During and post-floods, foul water or mosquito generated epidemics, such malaria, gastroenteritis, smallpox, food poisoning, Japanese encephalitis, optic diseases, *etc.* spread widely.
- *Migration* With disruption of livelihood options, the men folk migrate in search of employment. The major impact of such migration is on the women, children and adults who remain behind.

Flood impact mitigation

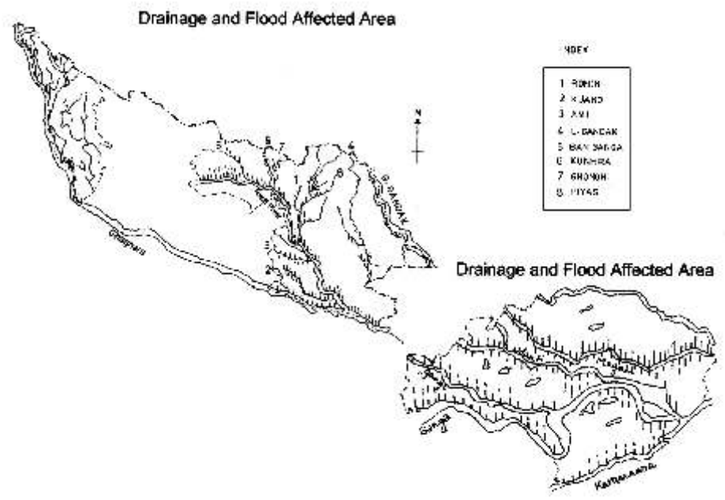
While the havoc from floods cannot entirely be prevented, its impact can certainly be softened by adopting measures for improved flood management such as

- Continuous monitoring of river-water flow and level, and sounding warning accordingly.
- People moving from problematic or potentially problematic areas to more safe places.
- Moving valuables, cattle, food, etc. to safer locations.
- As a first response to floods, quick supply of food and drinking water, kerosene, candles, matchboxes, soaps, chlorine, bleaching powder, *etc.* and speeding up relief.
- Raising of embankments, their timely repair, preventing water retention, construction of proper water outlet drainage.
- Flood related public awareness generation.
- Proper training of government officials.
- Clearing water blockages, proper arrangements and safety works in the affected areas.
- Construction of water reservoirs, clearing and dredging of old reservoirs.
- Execution of multi-purpose projects and schemes on rivers.
- Systematic planning and organization of pre, during and post-flood disaster management.
- Provision of small motor boats, seeking help from army and voluntary organizations as and when required.

UNDERSTANDING THE RIVERS AND THEIR TRIBUTARIES IN THE STUDY AREA

(A) RAPTI

In ancient literature, river Rapti has been known by different names such as Iravati, Achiravati and later Ravati before it came to be called by its present name. It originates in the Dhaulagiri mountains in Nepal and travels about 250 km before it reaches the plains in India. In Nepal, it flows rapidly through the mountain terrain, where small rivers and streams join it at various places. On entering the *terai* plains and thereafter in India, it continuously changes its course, flowing through Babaganj, Jamunaha and Haridaspur development blocks of Bahraich district, on to Balrampur, Dumariagang and Baansi (Sidharthnagar district) and Maharajganj and Gorakhpur districts before meeting with the Ghaghra river at the borders of Gorakhpur and Deoria.



(B) ROHIN

Originating in Mudawas (Nepal), the Rohin travels 130 km before it merges into the Rapti river at Domingarh in district Gorakhpur. In Nepal and India, many small streams such as Jhhardi, Baghela, Pyaas, Basmaniyan and Potaha become its tributaries accounting for as much as 60 km of the water stretch which add to Rohin's ferocity during the monsoons. In its entire journey, the Rohin erodes its banks and collects and carries plants, stones and other debris, which make agriculture difficult but further downstream, for almost a hundred kilometers, it carries fine silt which makes the land fertile for the seasonal, intermediary *jaayad* crop.

The effluent of Sonwal sugar-mill in Nepal, is carried by the Jhharhi river into the Rohin. The pollutants not only kill the microbes in the river but also infect the drinking water in the villages along the Rohin. According to a study by *Vikalp* organization in the floods of 1998, 18 embankments along the Rohin had breached. The study also reported that earlier there were thorny bushes and

There is a vast network of rivers in eastern Uttar Pradesh. Although the major rivers here like Rapti, Rohin, Ghaghra, Kuano, Chhoti Gandak, Burhi Gandak, *etc.* are primarily beneficial, because of human interferences and mistakes they take on disastrous form during the monsoons.

As floods are primarily a natural and beneficial phenomenon, and throughout history people have evolved and adjusted their lives around them, it is best that even today we try to prevent them, but continue to seek ways to live better with them.

other vegetation growing alongside the river, which in due course of time, were cleared to make way for cultivation. This is now seen as the main reason for the disastrous spread in the river.

(C) GHAGHRA

In Nepal, the Ghaghra is known as Karnali, while in *purvanchal,* it is called the Saryu. It originates in the mountains of Mansar in the Nepal Himalaya in the form of two rivers by the names Chhibra Chu and Gurla Chu, which together give rise to the Karnali.

Accumulating water from three watersheds - Dhaulagiri in the east, Vyas Himalaya in the west and Manas Khand in the north the river hurtles down to a place called Sheesha Paani, with a resounding roar. Moving into India, in Uttar Pradesh, it marks natural boundaries between several districts like Khiri-Bahraich, Sitapur-Gonda, Faizabad-Gonda, Faizabad-Basti, Faizabad-Azamgarh, Ambedkarnagar-Basti, Sant Kabir Nagar-Ambedkarnagar, Gorakhpur-Azamgarh, Gorakhpur-Mau, Deoria-Mau before merging with the Ganga at the border of Bihar.

(D) KUANO

A tributary of the Rapti, Kuano river issues from the Rasulpur *pargana* in district Basti. Crossing Sant Kabir Nagar, it enters the Gorakhpur district at village Rampur (*pargana* Hasanpur, Maghar) and travels south-east through Sahjanwa, Khajni, Baansgaon before meeting with the Rapti near village Sohgora (Pargana Bhauhapaar, *tehsil* Baansgaon). Although in normal times, it appears to be an ordinary drain, during the floods it adopts a disastrous form. As there are no embankments along this river, its overflowing waters spread wide and submerge and damage a large area in Sahjanwa, Khajni, Baansgaon and Sadar.

(E) AAMI

A tributary of the Ghaghra, Aami issues from the eastern part of district Bahraich, and passing through districts Gonda, Basti and Sant Kabir Nagar, it enters district Gorakhpur in the Belghat development block (*tehsil* Khajni). It then crosses Ghooriyapaar *pargana* from the west and merges with the Ghaghra near village Shahpur. The bed of the river is sandy and its banks are high on the both sides. During the monsoons and in flood, its water spreads over a wide area, thereby affecting the agriculture in the region.

LIVING WITH FLOODS

Today, floods are considered a curse by the people and yet they have continued to remain in the flood-affected regions, which they have inhabited for long. Why?

Major civilizations through history have settled alongside rivers. And floods have been a natural phenomenon, which were once seen as a boon. However, in the course of time, the lifestyles of the people underwent considerable change with an overt preference for materialism. Infrastructures like embankments and roads came up here and there. There was increasing deforestation, excessive soil excavation and sand mining, which interfered with and disturbed nature. This has resulted in increased natural calamities. Floods are no longer a boon but have wrought havoc and long-lasting problems.

We have now come to a state that we cannot undo our interferences and mistakes, and devastating floods have, more or less, become inevitable. But it may be more appropriate and prudent to stop further interference, not think of preventing or running away from flood, but rather seriously consider the concept of 'living with floods'.

If we are now talking about living with floods, then we need to consider every necessary aspect from the perspective of floods. The questions we specially need to pose and find answers to are How can we meet our every need for a normal life despite floods? Or, how can floods be a help for us to meet those needs? It is essential that everyone government, organizations, institutions, universities, policy and law makers, community workers and people collectively and individually meditate upon, plan and execute programmes from such a perspective.

Some of the important issues that need to be addressed to bring about an improvement in the lives of the people living in flood affected areas are :-

Public Campaign

Increasing people's participation in the planning and execution of developmental works can be a fundamental task. Hitherto, all decisions on developmental activities are taken by technical experts who plan at much wider - *purvanchal*, state or even the country level. The works are executed by a contractor or external service agency, without the local people becoming even aware of it. They are the ones left to bear the maleffects of such works. The administrative system then gets active to develop a new plan to lessen the impact of the earlier work. And so the circle of problem widens and recurs on and on.

It is absolutely important that the people must not only seriously and actively participate in developmental planning and execution but their decisive role in project or work approval be also ensured. Toward this, it is essential that there be an intensive movement for people to come together strongly, and for them to coordinate the activities at village *panchayat, khetra and district panchayat* levels to strengthen the local self-governance process.

1. Prepare the people to change their lifestyles and use of the livelihood resources in accordance with the physical changes in the flood-prone areas.
2. Houses and fields of people, and at times entire villages in river valleys are swept away in floods. During the construction of embankments, the villages and population with these are considered river submergence area. But there are neither arrangements nor any policy to rehabilitate such villages and population. There is an urgent need to campaign for this.
3. Everyone must have the basic right to a live with dignity. It must be the government's primary responsibility to provide and ensure this right in times of calamity. There is need for an extensive public campaign to ensure government's responsibility to provide people help and compensation for damages from floods as per the standards developed for relief from the disaster relief fund.
4. Floods are an issue of international concern. As such it is important to seek formulation of an international policy on it.
5. People in the flood prone regions must be given all support and opportunities to provide value additions to their important products. Initiatives are taken to find newer opportunities for dates and palms, or mushroom cultivation, *etc.*
6. Animal husbandry is a major occupation in the flood-affected regions. As such, there is need to lobby for developing a cattle improvement policy and preventing misuse of the cruelty to animals rule.

Research and extension

Floods bring benefits as well to people's lives. Government / non-government organizations, universities, *etc.* engaged in conducting research towards ensuring livelihood and food security of the people living in flood-affected regions, need to identify these benefits and thereby

There is need to have a people's campaign in the first phase of awareness generation. Today it has become essential, for instance, that we accept the need for change in the field of agricultural livelihood options.

Adaptive Capacities of Community to cope up with flood situations

With reference to floods and disasters, there is need for extensive changes at the policy level. The government must not take a short term approach to relief, safety and rehabilitation but rather include these in their long-term planning. The community too must be sensitized to floods and disaster at the first instance.

develop and share with people different methodologies and options for 'living with floods'. For instance, research can be conducted on crop varieties that experience less damage from floods or those that are getting extinct, and on developing ways and means to provide value addition to these, or on pre-flood, during flood and post-flood time management.

Government / policy issues

- Flood disaster needs to be placed at the centre of development planning and execution, rather than considering preventing or completely eliminating it.
- Need to develop a planned system of transportation during floods, including awarding contracts for boat hire and labour, safe boat maneuverability, boat harbour, sand mining, fishing, *etc.* in consultation with community / *panchayat*.
- In flood-affected regions, disaster management teams and their various sub-committees set up must not be seen in isolation but in fact be integrated in the existing community *panchayat* system to make them more practical.
- Developing and strengthening community based marketing or value added enterprises.
- Including flood and disaster as topics of study in the school and college syllabi.
- Need to work on river pollution issues as well, particularly on the effluents of various factories or urban waste products.
- Need to look into the closure of sugar-mills, and policy decision making and execution on sugarcane payment to farmers.
- With water inundation everywhere, people are deprived of health services and facilities. At such times, there is need to provide mobile health services.

Other issues

Regulator, drainage, seepage and embankments

On the basis of survey and plans, the Government ensures a system of regulator, drainage and embankments, which ultimately prove to be contrary to people's interests.

- Ensuring community participation. Government and people' organizations must together lobby that appropriate location points be identified for putting up water regulators, and that these must number 5-7. Moreover, all drains and outlets must be connected to the regulators so that the water spread could be quickly drained out so as to ensure that agricultural activities do not suffer for time or otherwise.
- The embankments are raised with sand or soil taken from land between the river and embankments, as a result of which the embankments weaken. There must be arrangements for permanent pitching or bringing soil from elsewhere.
- For making embankments, fertile soil from agricultural fields is used, thereby impoverishing farmers' land because soil fertility takes a long time to replenish. In such cases, farmers need to be provided equivalent compensatory land elsewhere.
- As a result of silt accumulating in the riverbeds over the years, the heights of the embankments have to be constantly raised. This causes water seepage, thereby affecting the crops whether there is flood or no flood.

3 DOCUMENTATION OF ADAPTIVE STRATEGIES IN FLOOD AFFECTED AREAS

There are a number of practices which local people have developed or adopted which help them to for their livelihood in the flood affected areas. The technologies and practices, developed by other resource organization are tested, tried and adopted according to the suitability and local relevance. These are several other practices and techniques which have been developed and evolved, over a period of time, by the local communities in response to flooding situations. Such practices are locally developed and practiced for a long time.

100 such practices have been documented, in the present effort, by the associated 20 organizations and classified in following categories. The original documentation was done in Hindi:

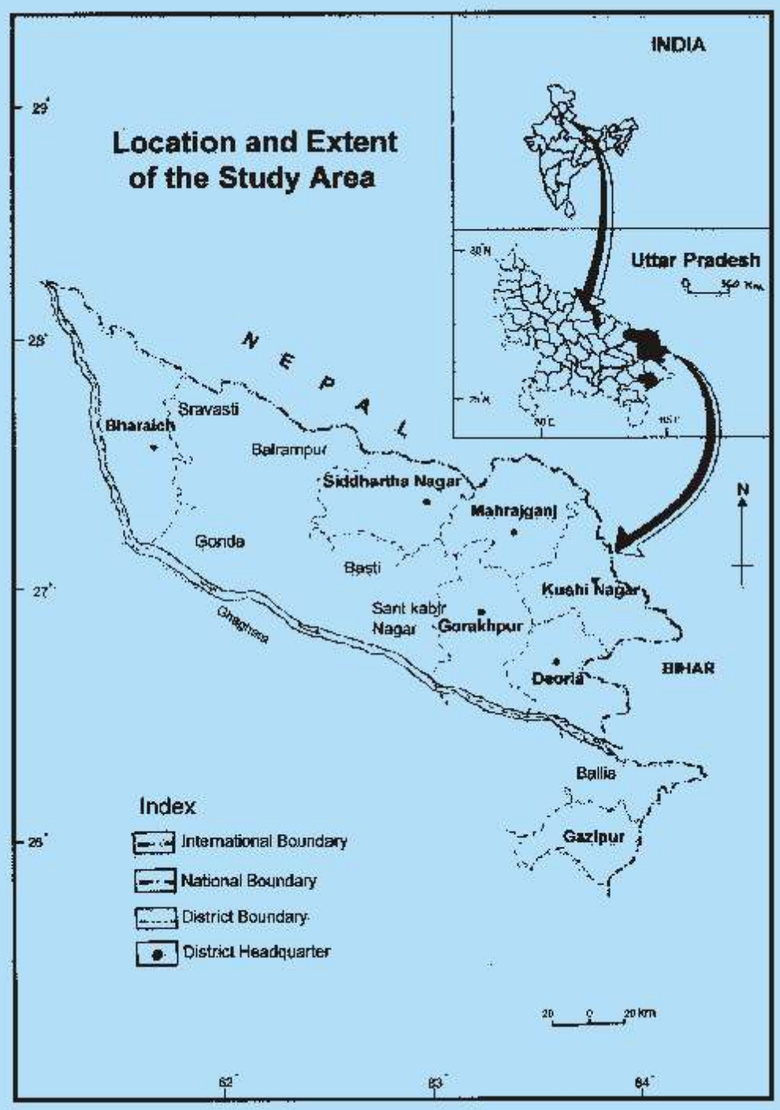
- *Crop based activities*
- *Off farm activities*
- *Disaster preparedness*
- *Land and Water Management*
- *Advocacy*

The present version in English, comprises of concepts and approaches of documentation alongwith 43 sample practices.

Classification in present version is done in following categories:

Category	No. of Practices
Pre flood activities	9
Disaster Management	8
Crops in deep water	11
Collective Efforts	6
Post flood activities	9

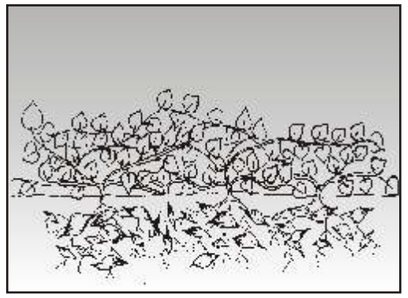
As mentioned earlier also, for the benefit of illiterate farmers practices were also video documented. The list of practices which have been video documented is being furnished in the end of this compilation.



Pre-flood Cultivation

There are a number of practices which help the communities to harvest before the advent of floods. This is generally managed by appropriate varieties and pre-ponement of cropping period.

Sweet Potato



Consumed during fasting and on auspicious occasions, Sweet Potato grows on sandy soil and plays an important role in mitigating the losses from floods.

Sweet potato (locally called *aluha* or *shakarkand*) is a tuber that grows well in light sandy soil, and is much in demand as a fruit for consumption particularly during fasting days like the *ekadashi* and *chauth*.

Cultivation process

There are some high yielding varieties of sweet potato available Cross-4, Rajendra Shakarkand 36, Arya, *etc.* It is planted in January-February or sometimes even earlier. The field is ploughed thoroughly 4-5 times to make it dry and powdery. The vines (30-35 cm long each) of the fruit are placed in dug rows and covered with soil. The distance between each vine and rows is 45 cm each.

Normally sweet potato does not require any irrigation, but one or two irrigations give good production. Locally, people do not apply any fertilizer to the crop, but agriculture scientists recommend use of nitrogen, phosphate and potash besides compost. Weeding is done twice.

Sweet potato is harvested by May. Once it rains, preserving the vines can be a big problem. It can be stored for three months and farmers can sell it at high price when in demand. Traditionally, sweet potato is stored underground and covered in a way that moisture does not seep in. However, as there is lack of any large-scale storage facility, most of the farmers have to sell off there produce at low prices.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Sale (Rs)	Net profit (Rs)
Ploughing	1000.00	80 Qtl per acre @ Rs 500 per qtl	40,000.00	37,050.00
Vines 600.00				
Weeding 900.00				
Digging 450.00				
Total	**2950.00**		**40,000.00**	**37,050.00**

Case study

Sh Jaleshwar Yadav, is a native of village Gamhariya (Block Satdhara, District Madhubani, Bihar). His family comprises eight members and he owns two acre land on which he grows sweet potato between January and May-June. He grows sweet potato to compensate for the losses in floods. From his fields, he harvests about 80 qtl per acre and it sells readily for about Rs 35,000. Traders from eastern Uttar Pradesh and Bihar buy off the produce from the fields itself. Jaleshwar says that he could earn up to Rs 40,000 from the produce if he could store the harvest and sell it later, when it is in great demand during the fasting on chauth and Krishna janmashtami.

Maize Cultivation

The people of Singhorhwa village (Block Brahmpur) started cultivating maize as a cash crop to overcome the losses caused by floods. This has proved to be financially beneficial, besides providing the people fodder for their cattle.

People have often gone in for cash crops as a means for mitigating their losses from floods. Sugarcane cultivation is a very good option for people, for it can withstand floods for some time and provide the people good income. But increasing floods and the poor state of the sugar-mills in the region have badly affected sugarcane cultivation. In such circumstances, farmers have sought to change their agricultural practices and have reverted to some of their traditional agricultural practices. The adoption of maize cultivation in flood-affected areas is one such example, which is harvested before the arrival of the floods. Its corn can be stored and sold, while the rest of the harvested plant makes good fodder.

Cultivation process

The fields for maize are prepared immediately after the wheat harvest by April, and ploughed thoroughly. The plant should attain adequate growth before the onset of the monsoons. While compost is best, certain amount of DAP is also used at the time of sowing. Later, urea is also used as top-dressing.

During the entire period of cultivation, about 6-7 irrigations are required, *i.e.* approximately once every 8-10 days. Weeding is done as felt necessary. More important is to be extra vigilant to protect the crop in the field from animals and birds. The other problem is that small holding farmers find it difficult to cultivate maize for their home consumption.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Sale (Rs)	Net profit (Rs)
Field preparation– 6 times	725.00	Average 20,000 stalks; 2 corns per stalk	18,000.00	13,475
Seeds 10 kg	700.00			
Fertilizers (compost, dye, urea)	400.00			
Irrigation – 6 times	1500.00			
Weeding – 2 times	1200.00			
Total	**4525.00**		**18,000.00**	**13,475**

Case study

Barely 100 mts from the river Rapti, village Singhorhwa (Block Brahmpur, District Gorakhpur, UP) is one of the 52 villages in the Doaba region that lie between Gorra and Rapti rivers. Located within a ring-embankment, Singhorhwa and its fields get entirely marooned during floods. As such, maize cultivation provides a good option for the farmers.

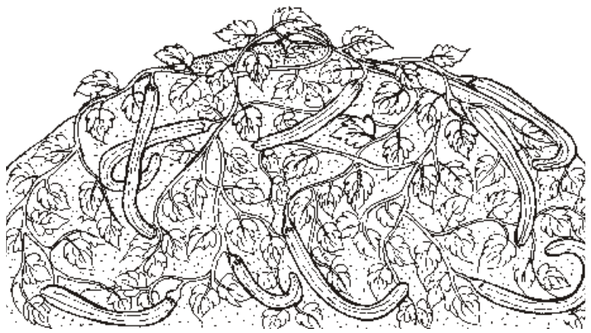
In 1999, Sh Gauri Yadav, son of Sh Ram Lakhan Yadav, started cultivating maize in his half acre land. He uses about 5 kg seeds and about two trolleys of compost along with some DAP and urea. He irrigates his field about 6 times. And he harvests about 20,000 corns. According to Gauri Yadav, damage by animals is a major problem, still he is able to make a good earning from the land that would have remained fallow after the wheat harvest.

Cucumber Cultivation on Sandy Soil

The lands along the rivers and embankments where silt gets deposited are ideal for cultivation of cucumber as a source of livelihood.

Cucumber is a major crop along the rivers on sand and silt spreads brought in by floods. As it is completely harvested by June, farmers can sell the produce to arrange for food stock for the flood period.

Rudrapur and Barhaj development blocks in Deoria district are criss-crossed by a network of Ghaghra, Rapti, Gorra, Bathua and other rivers, which means that the possibility of floods is always present. The farmers cannot grow paddy or wheat on lands adjoining the embankments, since the rushing waters can break through and spread silt all over the fields. So, as an alternative, the farmers have taken to growing cucumber here. There are many varieties of cucumber available, the popular ones being green cucumber, white cucumber and long cucumber.



Cultivation process

Cucumber needs a constantly humid and hot climate, for which February to mid-June is the most appropriate period.

A 1-1.6 ft deep pit is dug in different parts of the sandy field and left open for one to two weeks. The pits are thereafter filled with a dry mixture of compost and soil. It is important to germinate the seeds before sowing, for which they are soaked in water for about 12 hours. Seeds that sink to the bottom are considered worth sowing, while those that float on top are taken out and not used, as these will not germinate. The soaked seeds are then slightly dried and wrapped in a cotton cloth and then placed in a warm place. The seeds germinate in three-four days. These seeds are then sowed in the pre-prepared pits five to six seeds, 2 inches from each other - and the pit is covered with moist sand and lightly pressed. Sowing must be done by March-April or else the crop will get affected by floods. The seeds sprout within 8-10 days.

Cucumber cultivation demands extreme care right from sowing till the time it is sold in the market. The plants must be protected from the westerly winds between mid-February and mid-April. As the vines begin to grow and lengthen, these need to be spread out evenly all over the field. Vines, moving in the wind, often get entangled with one another, which need to be separated every day. Some leaves on the older vines are buried in the sand to prevent them from getting entangled with one another. The yellowing leaves must be nipped.

Cucumber requires very little external irrigation, except at the beginning. However, it is essential to maintain adequate humidity around the crop or else the yield will be affected. The farmers generally dig 10-12 pits per acre, each two to four feet deep, and fill these up with water, which seeps into the ground and maintains adequate humidity around the plants.

Fertilizer requirement too is minimal. At the time of sowing, some organic fertilizer is applied and later, urea is mixed with water and sprinkled near the roots of the plant.

Cucumber fields need to be constantly watched over against stray cattle and other animals, particularly at night. And harvested crop must be sold as soon as possible as it cannot be stored for over two days. Farmers prefer to harvest soft cucumber, which fetches good price. However, marketing is a problem and farmers are generally forced to sell their produce in the local market, getting less price.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Sale (Rs)	Net profit (Rs)
Field preparation – 1 person, 8 days @ Rs 50 per day	400.00	About 6500 cucumber @ Rs. 2.00 per cucumber	12,960.00	9,985.00
Seeds – 3 kg	750.00			
Weeding, *etc.* – 4 times	1800.00			
Fertilizer – compost, 15 kg urea	75.00			
Pesticide	150.00			
Total	**2975.00**		**12,960.00**	**9,985.00**

Case study

Smt Subhashkali Devi, age 40 years, wife of Sh Jawahar Kurmi lives is village Chhapra Bujurg (Block Rudrapur, District Deoria, UP). She has 1 acre land. In 1999, she decided to cultivate cucumber but as a precaution, sowed it along with other vegetables on half acre of her land. However, from cucumber alone, she was able to earn Rs 5000 that season. Encouraged by this, she has ever since been growing cucumber in her field. Taking inspiration from Subhashkali Devi, seven other farmers in the village have taken to growing cucumber.

Meticulous attention and care are important in cucumber cultivation, *e.g.* spreading out the vines, maintaining humidity and plucking tender cucumber. Only then does this crop yield good harvest and fetch good price.

Barnyard Millet

Among the varieties fast getting lost, barnyard millet holds a special place. A coarse grain that readies in 60-65 days, its special characteristic is its ability to withstand drought.

Barnyard millet is a coarse warm climate crop that can be easily grown all over eastern Uttar Pradesh, needs very little water, ripens in 60-65 days, and is cultivated and harvested before the advent of floods.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Sale (Rs)	Net profit (Rs)
Field preparation	600.00	10 Qtl millet	12,000.00	11,852.00
Seeds – 4 kg @ Rs 12 per kg	48.00	20 qtl fodder	1,000.00	
Harvest and threshing	500.00			
Total	**1148.00**		**13,000.00**	**11,852.00**

Cultivation process

Loamy or light loamy soil, with good drainage, is ideal for the cultivation of barnyard millet. It cannot be grown on saline land. The field is prepared by turning the soil once and ploughing it twice by traditional plough and yoke or a cultivator. Seeds are sown through broadcasting in April. The crop does not require any fertilizer, and needs irrigation only once in April at the time of sowing. It does not require weeding either.

Barnyard millet cultivation is free of any pest or disease. Only, farmers need to keep a watch over the crop against birds, particularly parrots. The crop ripens and is harvested in the first week of June. It gives considerable fodder as well.

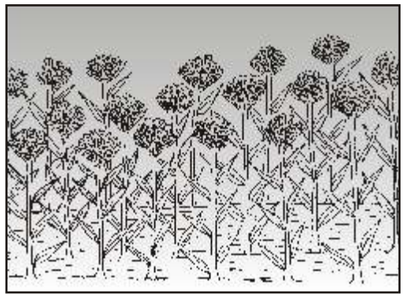
The major problem in barnyard millet cultivation is that its seeds are steadily getting lost and becoming increasingly difficult to obtain.

Case study

Sh Jaleshwar Yadav is a native of village Gamhariya (Block Satdhara, District, Madhubani, Bihar). His family coprises eitht members and he own two acre land, (see Case Study on Sweet Potato cultivation) cultivates barnyard millet on half acre land from which he earns about Rs 8000/-, and gets fodder for his cattle. This gives him some cushion against problems and threats to his livelihood from floods.

Finger Millet

Among coarse grains, finger millet not only ensures food security but, endowed with medicinal properties, provides essential minerals and vitamins to the body.



Finger millet is a traditional *kharif* crop, very rich in nutrition and easy to cultivate. In fact, of late, many companies have started marketing nutritious meals from it, and so is being sought to be developed as a cash crop.

Finger millet is sowed in the first week of June and harvested in end-August or early-September. Late sowing delivers less yield. The land is ploughed to turn the soil and then the cultivator is used straight and across and the field is leveled. Though the seeds are broadcast but, in some areas, people sow first in nursery and then transplant the saplings, as in paddy. One month after planting, the field is harrowed lightly, which weeds out the grasses.

Finger millet is primarily a rainfed crop, and though it needs irrigation if the rains are not on time, it is particularly important that the field has good drainage. Normally the crop does not require fertilizer, but compost is applied for good production.

The problem with finger millet is that since people do not prefer it as a daily intake for long, it is not cultivated over extensive areas. Also, there is no good market for it at the local level, so it does not fetch good price. Its yield too is not high nor does it have any improved variety.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Sale (Rs)	Net profit (Rs)
Seeds – 12 kg	150.00	5 qtl @ Rs 1200 Fodder/fuel	6000.00	6000.00
Ploughing, weeding, etc.	1350.00		1500.00	
Total	**1500.00**		**7500.00**	**6000.00**

Case study

Sh Pardesi of village Bhainswa (Block Jogia, District Sidharthnagar, UP) is a Mallah by caste and owns a mere 0.25 acre of land. With floods ravaging his crops regularly, he really has a very difficult time. In 1999, falling back on his traditional indigenous knowledge, he sowed finger millet on 0.06 acre land area. That year, again, the floods came and inundated Pardesi's fields for 4-6 days. But his crop of finger millet was not destroyed. On the contrary, the yield was quite good. Today, Pardesi considers finger millet his only hope, which provides him food security for about three months. He says, unlike earlier, he is no longer faced with the spectre of hunger nor does he have to borrow money to make ends meet.

Two Paddy varieties in Mixed Cropping

Mixed sowing of two paddy varieties one early and one normal variety - is a unique and useful initiative to mitigate the loss of crop from floods.

Garma (also known as *bhadai* or *dudhi*) paddy, grown pre-flood on slightly sloping land, ripens in just three months. It thus provides food and fodder during the critical flood period. It is red in colour and its starch water too is bright red. The local people believe it to be good for blood.

The other paddy is *aghani*, of which there are several local varieties such as *kherha, bakoy, dolam* and *kusumi*. These are grown in deep water areas. And though, in floods, farmers are always anxious about its production, they reduce their risk by growing it along with *garma*, in mixed cropping.

Cultivation process

Aghani cannot be cultivated on sandy soil and needs fine clayey soil. Traditionally, before preparing the field, cattle are kept on it for about 15 days. The fields, saturated with cattle dung and urine, are then ploughed to make the soil loose and dry, ploughing straight and across every time.

In early June, *garma* and one or more of the *aghani* varieties are sown in alternate rows. No chemical fertilizers or pesticides are used. However, some farmers use 5 kg of potash per acre at the time of preparing the fields, which the farmers say works as pesticide as well.

Since the crop is sown during the pre-monsoon period, irrigation is generally not required. Weeding is done two-three times.

Garma is ready in August. Of course, harvesting can sometimes pose a problem, since in August it rains quite heavily. The other *aghani* varieties are harvested by mid-November.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Sale (Rs)	Net profit (Rs)
Ploughing – 3 times	1170.00	*Garma* rice 13 qtl per acre	13,000.00	}
Seeds 26 kg	364.00	*Aghani* rice 5 qtl per acre	3000.00	} 12,281.00
Weeding – 25 labourers, 3 times @ Rs 15/-	1125.00			}
Potash	60.00			
Harvest – 25 labourers @ Rs 40/-	1000.00			
Total	**3719.00**		**16,000.00**	**12,281.00**

Case study

55 years old Bandhu Sahni, son of Chokar Sahni, lives in village Bagahi (Block Bairia, District West Champaran, Bihar), which is extremely vulnerable to floods. There are 12 members in his family, and he owns one and half acres of land. Troubled by regular flooding, in 1993 Bandhu started growing garma paddy, which proved very successful. Today, many other villagers prefer growing the garma variety.

According to Bandhu, it was almost by chance that he once sowed a mix of garma and kherha varieties as no other seeds were available. While weeding kherha paddy, he noticed that garma had already ripened. So he harvested garma and simulateously cleared the weeds as well, which helped fresh sprouting on the khera paddy stalks. That year he got 6 qtl per acre of kherha paddy as well. Ever since he has been doing this mixed cropping. Since the garma and aghani varieties are grown in separate, alternate rows, and their harvest periods are three months apart, the harvesting of the former does not disturb the growth of aghani, but rather acts as de-weeding of the latter.

Mixed cropping demands less inputs and is hence more profitable than other crops, but care has to be taken that the different varieties are sown in separate lines and their times of sowing noted.

Turanta Paddy

Developed by Rajendra Prasad Agriculture and Industrial University (Pusa, Bihar), the *Turanta* paddy is an early growing variety, which is able to withstand both, the floods as well as drought.

As its name suggests, this is an early growing dwarf paddy variety. Developed by Rajendra Agriculture and Technology University, Pusa (Patna, Bihar), it ripens in 80 days and can, in fact be grown both before and after floods, and suffers less from pest infestation.

Cultivation process

The crop can be cultivated by direct sowing or transplantation method. For the former, the seeds are sown in the first week of June. For the latter, however, the nursery is prepared by mid-May and the saplings transplanted by mid-June. The timing is important or else the crops may not ripen before the floods arrive. Harvesting later, when there is water in the fields, would mean foregoing the fodder.

The seeds are treated with Tricoderma before sowing. Traditionally, seed treatment was giving with a mixture of soil from beneath a ficus tree and cow's urine. In fact, this traditional method has been known to encourage better germination, keep plant free of disease and insects and from birds.

While sowing, care is to be taken that the seeds are not sown too densely. At the time of sowing or transplanting, DAP, potash and urea are used. Urea is actually used thrice one-fourth at the time of transplanting, another one-fourth at the time of weeding and the remainder when the ears or spikes on the plant appear. Zinc is also used.

Weeding is done within 20 days of sowing or transplanting. Irrigation is particularly important in June and thereafter at different stages of plant growth. The crop is ready for harvest by end-August.

The only problem with turanta is that its seeds are not easily available.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Sale (Rs)	Net profit (Rs)
Ploughing – 3 times	500.00	Rice 12 qtl	12,000.00	9,600.00
Seeds – 20 kg	200.00	Fodder 4 qtl	1,000.00	
Transplanting	600.00			
Fertilizer and pesticides	800.00			
Irrigation	400.00			
Weeding	600.00			
Harvest and threshing	300.00			
Total	**3400.00**		**13,000.00**	**9,600.00**

Case study

Sri Shambhusharan Nishad of Thakurnagar village (Block Campierganj, District Gorakhpur, UP) has four acres of land, located near the Sarua lake, which is annually affected by floods. In October 2006, on an officially organized tour to Madhubani in Bihar, he learnt about the turanta paddy being cultivated in the flood-affected areas there. It was not just the paddy's ability to tolerate water but also its quick growing feature that impressed Shambhu Sharan Nishad and he decided to cultivate turanta the next season in his own fields. In June 2007, he sowed this paddy, al beit only on half an acre for want of seeds. Then on 30 July floods came and along with other rivers, the Sarua lake too swelled and all nearby fields got inundated. When the water receded after 15 days, Shambhu found that there were no negative effects on the turanta crop. On the contrary, newer shoots had emerged from the sides of the plants. The paddy continued to thrive and in time it was harvested. From a mere half an acre, he got 7 qtl yield. Encouraged by this, other farmers from the nearby villagers too are now keen to plant this rice variety.

Despite its ability to stand both floods and drought, the unavailability of its seeds is the biggest problem with *Turanta* paddy. Besides, being a dwarf variety, it cannot be cultivated in water-logged areas.

Narendra-97 :
An Early variety of paddy

The early growing characteristic of Narendra-97 paddy together with its ability to withstand the intense temperatures of May-June, have made this variety quite popular among the farmers in the flood-affected regions.

The flood menace is at its highest in the Jogia development block in district Sidharthnagar. Normally, people practice only one cropping season here *rabi* (in the winters) as the *kharif* (summer) crop, which takes 135-150 days to complete, always gets deluged. The farmers lose their investment and the prospect of food distress stares them starkly in the face. As such, it was important to look into the possibility of having an early variety of paddy that could be harvested before the onset of floods.

After intense deliberation among agriculture scientists, there was general consensus on going for Narendra-97 paddy variety developed by Acharya Narendradev Agriculture and Technology University in Faizabad. The significant features of this variety are that it ripens in 90-100 days, can stand the intense heat of May-June, provides good fodder and is relatively free of the *Chaffy grains*. Narendra-97 rice also makes good *cheura* (beaten rice), which eaten as snack - a readymade meal during the floods, and sells well.

Cultivation process

It may be important to consider the following before going for Narendra-97 cultivation :-

- Determine the time and period of flood in the area.
- Plan to begin cultivation 110 days prior to the onset of that period, but select a variety that ripens in less than hundred days.
- Select a level field with plot mounds, particularly one that has access to irrigation.
- The soil should preferably be clayey, loamy or sandy-loam.

A germination test conducted on the seeds ensures their 80% or more success rate. Before sowing, the seeds are treated with either an organic mixture of cow's urine or with Tricoderma (4 gm per kg seed) or chemical medicine Bavistin (2 gm per kg seed).

The nursery is irrigated prior to sowing. After a while, compost is added to the soil. Take care that only germinated seeds sown, and that too only in the evening. On the eight day, the nursery is watered as required and 3 kg urea with 100 gm Multiplex are added. On the 15th day, the saplings are ready for transplanting.

The field is leveled and the edges of the plots raised. Compost and *neem* extract residue are added for prevention against insects and pests, and then the field is inundated. Only after that, and if required, fertilizers like DAP and potash can be administered.

Saplings are planted by holding their roots and in lines, with the distance between each plant and between lines being 8" each, which is less than is kept in other paddy varieties.

The crop requires only light irrigation. However, humidity must be maintained throughout the crop's life cycle and particularly when applying fertilizers. Locally, people test the soil's humidity by scooping some of it into a ball and dropping it from waist height. If the ball splits then it means the field needs irrigation; if not, then the humidity is considered adequate.

As Narendra-97 is an early variety, pest attacks are relatively less. However, like other paddy varieties, it is vulnerable to fungal and bacterial diseases.

Time planning or time management in Narendra-97 cultivation is very critical. It must be sown by the first week of May and harvested by the first week of August.

The availability of *chiura* (parched rice) in the dry months of June-July, brings a different flavor to the people's palette and, at the same time, provides an additional dietary option to store for flood and disaster periods.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Sale (Rs)	Net profit (Rs)
Seeds 15 kg @ Rs 13/kg.	195.00	15 qtl	8,250.00	4,650.00
Nursery (Seed and land treatment, compost/fertilizer, *etc*)	60.00			
Field preparation (Seed treatment, ploughing, compost/fertilizer, *etc.*)	840.00			
Transplanting, including puddling	510.00			
Compost/fertilizer	705.00			
Irrigation	600.00			
Weeding	360.00			
Disease and pest control	60.00			
Harvest	270.00			
Total	**3600.00**		**8,250.00**	**4,650.00**

Shohratgarh Environmental Society has played a major role in encouraging the cultivation of Narendra-97 paddy in district Sidharthnagar, and has been quite successful in it as well.

Case study

Village Kusumhi (Block Jogia, District Sidharthnagar, UP) is located between rivers Rapti and Burhi Rapti. As the area is extremely flood-prone, the summer or kharif crop invariably gets destroyed in floods and people have to do with just the winter or rabi crop. Consequently, the people have felt forced to migrate for livelihood. In 2004, a local NGO Shohratgarh Environmental Society conducted a survey of the village to see if a change in the farming pattern could offer a solution to the problem. But the poor, marginal and backward class farmers, fearing loss of their investments, were not willing to take any risk and experiment.

One Sh Ram Chander took up the cudgels and on one bigha land started cultivating Narendra-97. His assumption was that as the flood period is normally between 15 August and 15 September, there should be no problem with Narendra-97, which would be ready for harvest earlier. Ram Chander sowed the nursery in May and, as expected, harvested the crop in the first week of August.

In July when there is normally water in the field or just dust storms, it was a sight to see a crop in full bloom in Ram Chander's field. Upon harvest, he obtained 8 qtl rice from one bigha. And as the floods were still not that severe, he followed it up with sowing lahi, an oilseed cash crop, which was harvested in the first week of November. This was then followed-up with wheat! Thus, in the entire year, Ram Chander was able to take three crops, and without any loss. It worked wonders for his self-confidence.

Saatha Paddy

Saatha paddy is an early variety that is sown along with *bajra* millet and jute, and harvested before the onset of floods.

Saatha, also known as *bhadai*, is a traditional, early variety paddy being grown in Bihar, and in *purvanchal* and Chitrakoot, Banda region of Bundelkhand in UP. It ripens in mere 60 days, which is what gives it its name *saatha*. In eastern Uttar Pradesh, it is especially in demand during the auspicious day of *chhatt* and so fetches a good price as well. It is generally grown in mixed cropping, along with millet, jute, *etc.* But their harvesting periods are different. Rice is harvested first, then during the floods, *bajra* millet is harvested (which also provides fodder), while post-flood, jute is harvested. Thereafter, the fields are available for *rabi* cultivation.

Cultivation process

The field is given one plough, in the first week of June, and compost is applied. Thereafter, the seeds are sown directly. There is no need to put DAP and urea. In fact, application of chemical fertilizers restricts the formation of grains.

Saatha is a rainfed crop, but if there are no rains then it requires one or two irrigation. As the variety is free of pest attacks, pesticides too are not needed. Even weeding is done just once. After the harvests, the labourers prefer to take the stalks for their hut-roofs instead of money as payment.

As *saatha* is a local variety, its seeds are not available in government stores. So seed availability is problem. Also, the variety doesn't have a very good yield, but then it is cultivated with very little inputs and provides valuable food security during the flood season.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Sale (Rs)	Net profit (Rs)
Ploughing – once	300.00	5 qtl @ Rs 1000	5000.00	2900.00
Seeds – 30 kg @ Rs 60	1800.00			
Total	**2100.00**		**5000.00**	**2900.00**

Case study

Smt Vidya Devi, wife of Ram Bhuvan, is a farmer from village Kolhua (Block Brahmpur, District Gorakhpu, UP). There are eight members in her family. She has 2.41 acres land on which she grows diverse paddy varieties, but saata receives her special attention. When she first learnt about saata in 1991, she started by growing it in just 0.25 acre and obtained a yield of 1 qtl and 25 kg (80 kg in rice form). Vidya Devi says that even though the yield from this variety is relatively less, as a staple food, saata provides adequate food security to her family for two months. However, as this variety is in considerable demand during auspicious and fasting occasions, she shares her produce free with other people in the village as well.

Disaster Preparedness

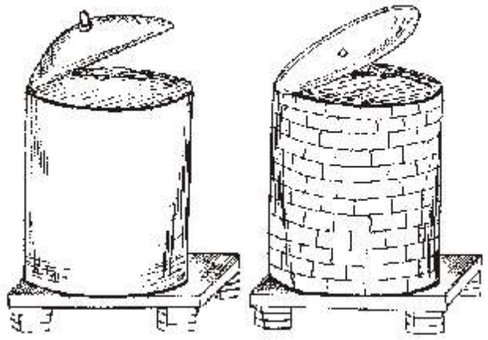
Adaptive Capacities of Community to cope up with flood situations

Grain Bank

Considering that every second year we are faced with some disaster or the other, it is important that we extend our family cultural practice and traditional knowledge in saving grains to develop Grain Banks at the community level, so that it is not dependent on external help for immediate relief in times of disaster

The concept of grain bank has developed traditionally. People have always had a habit of keeping aside a little grain everyday for use in times of distress. Among the Muslims, the practice of donating a fistful of grain to the Maulvi in the mosque so that his needs for food are met is still prevalent. Such personal practices are now sought to be extended to the community level so that food grain is available to the meet the sudden needs of the people in times of floods and other disasters. It has been named the Grain Bank concept.

Rudrapur and Barhaj development blocks in Deoria district (UP) are home to a network of Ghaghra, Rapti, Gorra, Bathua and other rivers. In Rudrapur block, there are 52 villages between Rapti and Gorra, which are vulnerable to the ravages of floods every year. Here, Purva is a hamlet on the banks of the Gorra river. About 27 women of this village got together to give form to the concept of grain bank, and within one *rabi* season collected 432 kg of grain. That year, a massive fire broke out in the village, whereupon the women used the collected grain to organize a community kitchen for eight days for all the 52 families of the village. The relevance of the grain bank was forcefully driven home; and following this example, today there are eight grain banks existing in the area.



Setting up a grain bank

The grain bank should be located in the centre of the village for security reasons and on a higher elevation so that it is not affected by floods. However, it should be slightly away from grass huts that may be prone to catching fire in the summers.

The grain bank may be made of bamboo or bricks. In the former, bamboo strips are so placed as to make an oval structure, which is thickly plastered with a mixture of mud and dung. Its roof is round and made from bamboo and straw. In the case of bricks and cement, the structure is 6-7 ft high, with 4 inch thick walls. So it is more solid and secure, even if more costly to construct. However, it roof-top too is of bamboo and straw. The only problem with such a top is that it does not provide any adequate protection against rats.

It i important to prevent humidity, since the bank is frequently opened for grain distribution. To prevent humidity, the grain is topped by straw, it is turned over every three months and the grain bank structure is plastered with dung and mud mixture every season. In case of wheat, *neem* leaves, onion, *etc.* are placed alongside to prevent pest infestation.

Normally, wheat and rice are stored in the grain bank. But other produces like maize, barley, *etc.* which are collectively grown by the community are also stored.

After the harvest, in order to determine the contributory grain amount per family, the most economically weak member is taken as the base, *e.g.* if the said member is capable of saving or contributing 16-20 kg grain, then that becomes the standard for all other members as well, and the required quantity of grain is stored in the bank. It is compulsory for all members to contribute their share of grain for storage at the time determined. However, if any member has no grain to store, she can deposit an equivalent amount of money instead.

In normal times, if a member has no grain left at home, she is provided from the grain bank according to her family's consumption capacity which she must return at the next harvest along with one-fourth grain interest. Members who do not grow adequate crops and buy food grains from the market, can also buy from the grain bank at less than market price. During the disaster period, everyone is provided according to one's needs. At the end of the season, grain left over after distribution and internal sale, is sold in the market. From the money received, wheat or rice is purchased in the next season for the grain bank. However, as yet, this is seen as a constraint.

In 2001, 47 women from three groups in Chhapra Bujurg, collected 16 kg wheat each and stored it in the *bakhari* they had constructed and which they called the grain bank. A committee comprising 5 women was constituted to manage the grain bank. One woman extra from each of the three groups was nominated as additional member. The committee formulated rules and regulations for the conduct of the grain bank and duly maintained a register for its various activities and transactions.

The capacity of the grain bank at 45 qtl is a limiting factor for the existing grain bank and the inter-diversity of crops in the fields, too is seen by the people as a disadvantage in grain storage.

After storing the grain, it has to be properly maintained to prevent it from rotting or going waste. A little extra care can go a long way to maintain the community's food security in times of disaster and scarcity.

Seed Production :
as a livelihoods option

Seeds are farmers' traditional heritage from thousands of years, which are now in danger of getting lost, and so urgently need to be preserved. One way of doing this could be to encourage farmers to take up local seeds production, which would give them a means of livelihood and at the same time help preserve traditional seeds.

Village Koyrha (Block Jogia, District Sidharthnagar, UP) is located between the Burhi Rapti and Baanganga rivers. Agriculture and dependent labour is the main livelihood of the people. Paddy, wheat, mustard, peas and potato are the main crops here. However, being a flood prone region, almost the entire *kharif* crop gets destroyed in floods, resulting in a severe threat to people's survival, including an acute scarcity of appropriate seeds for cultivation. As such, growing crops exclusively for seed production provides a good livelihood alternative to the people.

This is exactly what the people of Koyrha did, which has not only helped them find a solution to their problem of seeds scarcity but also enabled them make an earning to compensate for the losses in flood. The villagers set up a committee, comprising six members, which they termed "Seed Bank". The objective was to grow, conserve, sell or make available seeds through collective initiative.

Proper seed production and selection is a simple but diligent process demanding meticulous care. *Shohratgarh Environmental Society* has been the main motivator, disseminating requisite technical information, know-how, demonstration and training to the members of the Seed Bank from time to time. They have also been taken on exposure tours to Acharya Narendradev Agriculture University (Faizabad) and Agriculture Science Centre (Sohna). Such capacity building has worked well and the Seed Bank strictly follows all guidelines and methodologies like distance maintenance, balanced fertilization, weeding and irrigation. The crops are regularly inspected as well. For proper and good quality seeds selection, seeds isolation is practiced. For this, one and half metres from the edges are left on the all four sides and markers are placed accordingly. This central area of the plot is harvested and threshed separately. Post-production too, the selected seeds are treated, packed and safely stored in the Seed Bank. *Shohratgarh Environmental Society* has also lent the use of its name to the Seed Bank for packaging of seeds, in order to develop a market identity.

However, arranging for breeder or foundation seeds is still a major challenge. Another limiting factor, in the flood-affected region, is that only seeds of pre-flood and post-flood crops can be produced. The mindset of the local people is a yet another drawback, which does not show too much confidence on locally collected seeds.

Seed Bank Committee's Cost-Benefit Analysis

Name of seed	Cost of input (Rs)	Yield	Sale	Price (Rs)	Net profit (Rs)
Paddy – Narendra-97	15,700.00	40 qtl	40 qtl @ Rs 800 per qtl	32,000.00	16,300.00
Mustard - *Bhawani*	1,500.00	5 qtl	5 qtl @ Rs 35 per kg	17,500.00	16,000.00
Total	**17,200.00**			**49,500.00**	**32,300.00**

Benefits of seed bank

In 2004, the Seed Bank cultivated Narendra-97 paddy on three acres land and obtained a yield of 40 qtl. They followed this up by growing *Bhawani* mustard on 2 acres, which yielded 10 qtl seeds. So, the Seed Bank committee earned over Rs 32,000 in just five and half months. With this earning, the Seed Bank enhanced its resources and bought one pair of bullocks and a pesticide sprinkling implement, which the local farmers are now benefiting from. The committee is now planning to grow seeds of early paddy variety on 3.33 acres and in fact, work has already started on it so that people are ensured seed availability during the *kharif* cropping season itself. The committee has also started vegetable seeds production and preservation as well, which is reflective of its growth and popularity.

With this Seed Bank in the village, the poor farmers of Koyrha are now able to access good quality seeds, besides benefiting from access to agriculture related information and know-how. For the members of the Seed Bank, there is a definite improvement in their livelihood.

In order to make Seed Banks authentic, the associated farmers were provided with technical information and educational material from various agricultural universities, from time to time.

Fodder Storage

Animal husbandry is the lifeline of agriculture, and its care becomes extremely critically during floods. At such times, fodder storage provides a valuable alternative to ensure fodder availability to the cattle.

Animal husbandry is the backbone of agriculture, particularly for the small, marginal and landless farmers. In times of disaster, cattle too, like humans or perhaps even more, undergo severe difficulty and suffering. In floods, arranging for their fodder is a serious constraint. As such, people store fodder beforehand in structures that may be termed Fodder Storage or Fodder Bank.

Village Padriya (Block Mihinpurva, District Bahraich) is surrounded by a network of river and streams - river Bhaada to its west and Pithruwa and Jangli nallah to its north-east. In the monsoons, the water from these streams spreads all over the village, rising as high as 6-8 ft.

The villagers consider fodder storage to be more important that grain storage because there are alternatives for grain scarcity but not for fodder. As such, the people in the village traditionally store fodder, in which 20 families are collectively involved.

On the roof of a house at an elevation, fodder is stored in a structure, locally called *bhusaila*, made from wood and bamboo. Care needs to be taken that the storage has adequate protection from rain, though there is always the possibility that the bottom 2-3 ft layer of fodder or straw rots or goes waste.

Generally wheat straw, *masoor* lentil leaves and stalks, *arhar* leaves are stored. The capacity of a *bhusaila* is 10 to 50 qtl. Fodder is stored in April-May and used July-August onwards. Ten quintal fodder is sufficient for two cattle for up to three months. So a small farmer can feed the cattle during the floods, and sell what is left. In fact, many people who do not have adequate fodder in their fields, even buy and store it at the rate of Rs 50/qtl and sell it post-flood for Rs 120-150/qtl for very good profit.

Case study

Sh Jagdish Singh, 35 yrs, is a resident of village Matehi (Block Mihinpura, District Bahraich, UP). He has been a farmer for the last 10 years. He also owns 4 buffaloes, 5 buffalo female calves, 2 bullocks and 1 male buffalo. He keeps 50-60 qtl fodder from his rabi wheat crop in fodder storages in and outside his home, for his cattle in times of flood and also for some free distribution to the poor in the village. He sells about 10 qtl fodder as well, which fetches him Rs 1000. Considered overall, Jagdish effectively makes a saving of Rs 5000-6000. Taking inspiration from him, farmers from the adjoining 10 gram panchayat are now practicing fodder storage.

Silage

Fodder availability is a major problem during floods. At such times, preserved green fodder in the form of *silage* proves to be a boon, which is easy to prepare and preserve, and provides cattle adequate nutrition.

Silage is green fodder, preserved for periods of scarcity like during floods. It can be preserved for as long as six months, without losing most of nutrients found in green fodder except Vitamin-D. Crops and plants with more carbohydrate, like *jowar* (sorghum), maize and *Barley*, make superior silage. It is important that crops being used for silage should not have more than 30-40% dry or fibre contents.

Silos are of two types Pit Silo and Tower Silo. Pit silos are in square or preferably round pits. For a farmer with 5 cattle, a pit 3 mts diameter and 3.5 mts deep would be sufficient. However, Pit Silos should not be constructed in areas with high water-table. There, Tower Silos are a better option even if more costly to construct. Tower Silos are also better in dairy farms where the number of cattle is more. These are constructed with wood, bricks or concrete, in dimensions 3 mts by 6 mts.

Preparation process

For silage, the fodder should be cut at the time of flowering, as later the plant become more fibrous and has less digestive contents. The fodder is cut in the morning and left out in the field to dry through the day. The fodder is then chopped fine by machine. In the Pit, grass is spread out at the bottom and the chopped fodder placed over it. Similar grass padding is done on the sides. The fodder is pressed down as it is filled so that no air remains trapped within. This can be done by hand, cattle or machine, but the person filling the pit has to work fast and at one go. The fodder is raised 1-2 ft above the ground since it always settles down later. It is then topped with grass and densely plastered with mud to prevent air or water from entering. Air prevention is important as the live cells in the fodder continue to consume the existing oxygen in the pit for some time and release carbon dioxide. It takes about 5 hrs for the oxygen to be exhausted, whereafter the 70-80% carbon dioxide in the pit helps prevent fungus formation. If there are any holes or cracks in the pit or mud plaster, there is chance that the fodder inside will rot and give foul smell, and the entire effort would end up being a huge waste of time, labour and money.

Silage is ready for feeding in three months. It takes some time for the cattle to get used to its taste. Silage must be taken out in chunks from one side. About 10-15 kg is adequate per cattle, per day. A word of advice, in case of milch cattle, it is better to feed them after milking, as the milk may retain the smell of the silage.

Cost-Benefit Analysis

Inputs	Cost (Rs)	Silage yield	Price (Rs)	Net profit (Rs)
170 qtl green fodder @ Rs 40	6800.00	At 5% depletion Yield 162 qtl @ Rs 80	12,960.00	5478.00
Pit digging	442.00			
Pit filling	140.00			
Other expenses, like plastic, *etc.*	100.00			
Total	**7482.00**		**12,960.00**	**5478.00**

Elevation of Village Level

Floods mean fields covered by sand and houses submerged in water. The only practical solution to this problem is to raise the level of the entire village.

Village Machharihava in Ranipur panchayat (District Maharajganj, UP) is located in majhaar region, between Basmaniya river and Pyaas nallah. As the embankments built along the Basmaniya river end at Machharihava in Ranipur hamlet, the entire water of the river turns into the village and the fields get covered by silt brought in by the swift flow of the river. With the village being at some distance from the main road, its link with the latter is also effectively cut-off. All this affects the land's fertility as well as the people's livelihood. Moreover, during floods, it is the people living closer to the road, who corner the rescue boats, while the Machharihava inhabitants have great difficulty moving to safety. The village gets virtually marooned and people are forced to spend 3-4 days on roof-tops of pucca houses, of which there are only three in the village.

Earlier, every year after harvesting the wheat, the people would excavate soil from the vacant fields and fill it in and around their houses. As a result, the water from the village would drain out. However, the practice has been stopped for the last several years and consequently, the soil of the village has been steadily eroding. So now the flood waters enter the village straightaway.

Concerned at this, the people sought ways to minimize the impact of floods. In 2003, a grassroots NGO, Vikalp called a meeting of the villagers and proposed raising the level of the houses in the village. It was agreed that one person per family would provide physical labour towards this effort. Vikalp assured an assistance of Rs 12,646, initially to arrange for the food of the people contributing labour, but at the instance of some villagers, it was decided to instead use this financial assistance towards the hire charges of a tractor-trolley for transporting soil.

But soil was not easy to obtain, as the fields in the village were almost entirely covered with silt and sand. Sh Kalpnath from the village suggested that this very silt and sand be used from the field, which would not only save from the necessity of looking for soil, but would also expose the soil beneath to the sun and air, and that would be good for agriculture.

Subsequently, a tractor-trolley was hired for Rs 60 per trip. Each day, six trips were undertaken and in mere 20 days all the houses, streets and lanes in the village were raised and leveled. Sh Ram Achal's and Sh Kalpnath's contribution towards the successful execution of this work was vital. At the completion of the task, a community feast was organized.

In retrospect, it was not easy to bring people together initially to think of and discuss their own problems, or later to keep their participation from flagging. Countless sittings and meetings had to be persisted with to maintain people's interest and involvement. But as, ever since, Machharihava has been secure from the impending dangers of flood, and flood waters have not entered the village or its houses, the people are now justifiably proud of their collective achievement.

Improving Drainage

The Amba *panchayat* in district Bahraich is a living example of strength in collective action, whereby the people got together to physically clean and clear the drainage in their area.

Land and water are nature's invaluable gifts and boon to mankind, but can soon become a curse if not managed properly. Orai nallah in Amba *panchayat* (Block Mihinpurva, District Bahraich) is a testimony to something similar. It carries rainwater from the mountains which works like nectar for agriculture, but with the coming of the monsoons, it gets over-flooded and takes on disastrous dimensions water-logging the entire area and destroying the crops. In the absence of any maintenance, the soil from the adjoining land washes into the nallah and chokes the drainage, so that even a little excess water spreads all over. However, if this nallah could be dredged and maintained properly, water-logging and its impact could be reduced by at least 25-30%.

The Amba *panchayat* comprises three Tharu tribe dominated villages Bartia, Vishunpur and Fakisuri. These villages are surrounded on three sides by forests and in the north by the Gairuwa river. Every year, the area faces the wrath of floods, affecting over a third of its area. Paddy and maize perish completely, while the sowing of *rabi* crops (wheat, peas, *khesari, masoor* lentils) is seriously affected.

To overcome the problem, *Bhartiya Manav Samaj Kalyan Seva Sansthan* (Bahraich) organized the people, held frequent meetings and sought to develop local leadership to find a solution to the problem. The organization provided the people with requisite information and contacts, and set up pressure groups in villages to plan the work strategy.

As a result, now every year in the month of May, 50 farmers from Bartia, 150 from Vishunpur and 95 from Fakirpuri collectively clear the nallah in their respective areas. This dredging allows the water in the nallah to harmlessly flow on to the main river and the *kharif* crops remain unharmed. Besides, in June and July, the nallah is the main source for irrigation.

Earlier, people would contribute with their labour. However, since the last five years, this regulation has been changed, and anyone not physically participating in the labour has to contribute Rs 60. This goes towards meeting the cost of dredging the nallah, and any shortfall in monetary collection is met through contributions. On the other hand, if there is a surplus, it is spent on community feasting.

Such collective work has also promoted goodwill, unity and self-reliance among the people.

Deep tillage for aeration

It is quite common for land to become waste as a result of floods. Deep ploughing of such wasteland can help revitalize its fertility.

Village Raghunathpur lying between Rohin and Basmaniya rivers, is a victim of both floods and drought, as the silt and sand spread over the fields by the overflowing rivers do not allow any cultivation. Extended duration of water-logging and moisture retention in the fields not only delays the next sowing but causes poor seed germination as well. Over a period of time, this has seriously affected land fertility, *rabi* crop cultivation and people's livelihood, forcing the 30-35 farming families living alongside the river to undergo severe deprivation and give up farming. Consequently, the fields are left to waste and are now overgrown with weeds and other plants.

In flood prone areas, deep ploughing of fields is seen as an appropriate land and water management methodology, whereby the nutrient rich silt arriving with floods is retained on the field, humidity of the soil is maintained, the ploughed back weeds and plant lend further fertility and porosity to the soil, beneficial insects forced up in the process nourish the plants' roots on their way down again all contributing to good crop yield.

Then, post-flood, deep ploughing is done to turn the soil up and minimize the moisture in the field, to enable timely sowing of the next crop. However, sand deposition does not make such ploughing easy.

Process

Between April and May, the fields are deep ploughed (to a depth of 9 cm) twice by either the local plough or tractor, as feasible. The money and labour saved in weeding compensates for the extra expenditure of double ploughing. When the field is thoroughly dried, it must be given a light irrigation and ploughed again, which is very important to allow even spread of fertilizers during inundation and less weed infestation. The fields are deep ploughed twice again during transplantation.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Benefits	Cost (Rs)	Net profit (Rs)
Ploughing – 4 times @ Rs 300	1200.00	Saving in weeding by 10 labourers @ Rs 40	400.00	4200.00
		Crop yield minimum 10 qtl @ Rs 500	5000.00	
Total	**1200.00**		**5400.00**	**4200.00**

Case study

Sh Mohit, son of Sh Prabhu, of Raghunathpur village owns mere one and half acre land, of which half acre is declared wasteland. He was constantly faced with economic hardships. In 2000, at the instance of Vikalp, before sowing for the kharif crop, he deep ploughed his land thrice between May and June, and left the field to dry. It was very hard labour, but Mohit persisted. In June-July, he ploughed the field once more and sowed paddy. On 50 decimal land, he was able to obtain 5 qtl paddy yield, which at the current market price worked out to Rs 2500. More importantly, it provided his family of six, food security for three months. Mohit says that he is satisfied, even though this intensely laborious process has to be followed every year.

Deep ploughing of flood-affected land is not easy, but if done then it gives one and half to two times more yield.

Information Reference Centre

Information Reference Centres are a strong medium for empowering community through information. Learning from the harsh experiences of 2001, such Reference Centres were set up in each *gram panchayat*, wherein village development related information is made available to the people.

Acting as powerful mediums for information communication, an Information Reference Centre has a vital role in disaster affected villages. All it needs is a small room at an elevated level to house all relevant information and documents.

In the devastating floods of 1998, it was seen that the people faced immense difficulties in getting aid and other assistance, having to run from pillar to post and, in the process, being cheated by middlemen. Addressing this problem, *Purv Yuva Chetna Kendra* (District Deoria, UP) started the first Information Reference Centre in 2001. A 10-day camp was conducted in the Pidra Ghat area of Doaba region in Rudrapur development block, in which the people were provided with various information, such as the location of the Flood Post, the name and address of the Sector In-charge and Lekhpal of the concerned *gram panchayat*, the items received in relief, the medicines being distributed in the health camp, the boats available, how to reach the distant villages, *etc*. People's access to such vital information helped them considerably in meeting the adverse challenges in the flood period.

The experiences of this camp encouraged *Purv Yuva Chetna Kendra* and it subsequently established such Information Reference Centre in 6 *gram panchayat*, as follows :-

Gram Panchayat	No of people seeking information	
	In the past	At present
Awasthi	111	201
Bhirnwa	149	230
Nagwa Khas	210	267
Sachauli Patvaniya	136	241
Narayanpur	91	309
Jagdishpur	81	148
Total	**778**	**1416**

On 28 May 2005, the Marachhi Tola in Nagwa Khas was burnt to ashes. Fortunately, the Information Reference Centre there escaped fire. Based on the information available at the Centre, people took the initiative and 62 families availed of the following aid and support:-

- Indira Awas - 62
- MLA support, per family - Rs 2000
- Government aid at Tehsil level, per family - Rs 1500
- Community food arrangement by the organization (35 days) and *gram panchayat* (15 days)

Soon after that, another village in the region also suffered fire, but could not get any aid. The people there approached *Purv Yuva Chetna Kendra* and invited them to work in their village as well. Subsequently, on the basis of information provided by the NGO, people approached their *tehsil* and five families in the village were given Rs 500 each as aid.

An Information Reference Centre can keep and provide the following information and documents :-

- *Maps* Village, Development Block, District and others.
- *Government Rules* Details of government aid and relief in disasters (floods, drought, fire, accident, earthquake, *etc.*). Minimum standards or requirements for receiving immediate relief or survival aid, aid to dependents of the dead, handicap, serious injury, old age, homeless children, house collapse, employment, *etc.*
- *Human Rights* The rights of the people under the Indian constitution political rights, social rights, economic rights, health related rights, legal rights, *etc.*
- *Panchayat related literature* The rights, duties and functions of the three-tier *panchayat* system.
- *Organic farming* Know-how and manuals on how to make organic composts like *naadep*, vermiculture; and other technical information.
- *Posters and pamphlets* Environment awareness campaigns, disaster preparedness, *etc.*
- *Telephone numbers* - District level government offices and officials, police control room, fire brigade and other important offices, organizations and agencies.

As an Information Reference Centre is set up for the people, at the community level, it is best that its functioning too be handled by the community members of farmers' group and women's group. However, certain care and precautions have to be taken, such as

- Every literature, book or periodical must be entered in a register.
- Information on books loaned out must be noted on the register, along with the dates of return.
- The management of the Information Reference Centre must be clearly determined.
- Transparency must be maintained. No information must be kept secret.
- Village related information must be updated periodically.
- The facilitator must be consulted from time to time on the maintenance of the Centre.
- Due consideration must be given to the opinions of the elders and the experienced people.
- Officials visiting the area must be shown the Information Reference Centre and their suggestions invited.

After the fire that engulfed Marathi hamlet in Nagwa Tola on 28 May 2005, people got relevant information from the Information Reference Centre in the village, on the basis of which 62 people received financial aid.

Deep Water Crops

Adaptive Capacities of Community to cope up with flood situations

Berra *(Nymphaea Stellata)* (Neel Kamal)

Berra coming up on its own on lowlands or reservoir beds where nothing else can be grown because of floods provides a very good source of livelihood for landless farmers.

The *berra* fruit gets its name from its innumerable seeds, which make good porridge that is eaten during fasts and festivals. It grows in stagnant water, ponds and lakes, and attains a height of 3-4 ft. The plant also has an edible nodule at its roots, called *serki*, which is boiled and eaten and is helpful in lower back pains. In low lands where nothing can be grown, this self-growing *berra* proves profitable from the economic point of view as well.

As soon as the monsoons begin, *berra* plants can be seen in stagnant waters. Around the festival of *Nagpanchami* (in August), small but elongated white flowers, with a trace of purple, appear on it and in the third week of August *berra* starts fruiting. By the second week of September, it begins to ripen. After plucking, the fruit is kept in shade, and in 8-10 days, the fruit splits by itself. Ripe fruit have black seeds while the raw ones have red. Ash is smeared to separate each seed and these are then dried in the sun for two days and then stored.

By this time, nodules (*serki*) form at the roots of the plant, which are easily broken and dried.

As there are no input costs involved in *berra* cultivation, demanding only a week's labour for extraction, it offers economic benefits. However, currently, most of profit is being taken away by the traders. The major problem with *berra* is that one needs to enter water (waist deep) to pluck the fruit, so it is not without health and other risks. Also, the seeds are so tiny that these require extra care to collect.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Labour – 10 days	600.00	100 kg @ Rs 50	5000.00	4400.00
Total	**600.00**		**5000.00**	**4400.00**

Case study

Sh Gorakhi belongs to Mahuari Jhangha village (Block Khorabaar, District Gorakhpur, UP). The area is severely affected by floods from Borra river and Turra nallah, as a result of which people generally do not grow kharif crops. Gorakhi collects berra from nearby ponds and stagnant waters in September-October, processes and earns good money by selling it on fasting occasions. Apart from his own consumption, he is able to sell almost 100 kg through the season. From the earnings, he is able to buy rice and wheat, or make other necessary purchases and expenditures.

Trapa Cultivation

In the water reservoir rich regions of eastern Uttar Pradesh and Bihar, *Singharha* is a major crop. Although it is generally consumed during fasting and other auspicious occasions, the possibilities of its commercial usage are immense.

Singharha (water chestnut, *Trapa bispinosa*) is cultivated in ponds, lakes and stagnant waters. It is mainly eaten on fasting occasions, festivals, *etc*, either raw or boiled, or cooked as vegetable. It is also dried and ground to make flour. There are several traditional varieties of *singharha* available *chaupaati* that is flat with thin peel, *Mindhava* that is round with thick peel, and a wild variety, which is a little bitter and generally not cultivated. As yet, no high-yielding varieties of *singharha* have been developed.

In Baansi (District Sidharthnagar, UP) people often take ponds and lakes on lease from *panchayat* to earn their livelihood from *singharha* cultivation. Before planting *singharha*, the lake or pond is first cleared of water hyacinth, moss, *etc.* In fact, these need to be cleared periodically. No chemical fertilizers or pesticides are used at first. But later, as the plant is prone to several diseases like *dahia* (leaves turn white and rot), *kanara* (powdery mildew on the stalks) and *laali* (leaves turn red and whither), carboryte, chloropyree fall and keldron pesticides are used.

The *singharha* plants are allowed to mature in safe ponds, whereupon new saplings grow in the riverbed from the seeds in the ripened fruit. A reservoir with one acre circumference would require about one thousand saplings. June-July is the best time for planting. Fruiting starts in October and continues up to December and can be harvested accordingly.

Singharha cultivation is very labour intensive and poses other practical difficulties as well. Considering the limited number of water reservoirs available and their varied ownership,

taking one on lease for the season is not always easy, while taking it for the entire year is not economical, since the plant is only seasonal. Also, using the water from the said reservoirs for irrigation of fields can hamper *singharha* production.

Moreover, as the water reservoir can be deep, *singharha* is generally harvested or weed clearing done from small *dongi* boats, which demands being careful, particularly as the plant is thorny.

Singharha is economically profitable, but its cultivation is not without risks as it is grown in deep ponds and lakes.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Seasonal hire charges for the reservoir (6 months)	2000.00	70 qtl @ Rs 600	42,000.00	21,950.00
Reservoir clearing	2300.00			
Saplings	5250.00			
Fertilizers and pesticides	1000.00			
Watch-keeping	500.00			
Labour for harvesting - 3	9000.00			
	20,050.00		**42,000.00**	**21,950.00**

Case study

Sh Ashrafi, son of Sh Ram, is a daily wage labourer and lives in village Devariya, (Block Baansi, District Sidharthnagar, UP). Every year, for six months (July-December), he migrates to Majhvan village along with his family of three, where he hires a pond to do singharha cultivation. Ashrafi says that even though it is not easy to look for available ponds and leave home every year to establish temporary settlements afresh, still singharha cultivation provides his some income and sustenance for the next six months. If the climate remains favourable, singharha can be cropped in three months.

Tal Makhana Cultivation
(Euryale ferox)

Makhana cultivations are particularly popular in Bihar, where the fisher-community grows it in 5-7 ft deep still waters.

Makhana (water lily, *Anneslea spinosa*) is considered a dry fruit, eaten roasted or prepared into *kheer*, as well as used in medicine or in starch cutting of Banarsi sarees. It is mainly cultivated in Bihar, West Bengal and Assam, and also in Orissa, Rajasthan, Jammu & Kashmir, Tripura and Manipur. As much as 60-70% of *makhana* output comes from the flood prone regions of north Bihar alone Darbhanga, Madhubani, Sitamarhi, Saharsa, Katihar, Purnia, Samastipur, Supol, Kishanganj and Araria. Primarily, the people from the fisher community are engaged in *makhana* cultivation, as people from the other communities are less able to withstand water-borne difficulties, skin irritations and diseases.

Makhana's entire lifecycle, from seed sowing to ripening, takes place 5-7 ft deep within the stagnant waters of ponds, lakes, *chanwar*, *dabra* and *khatta*. The seeds are sown on clayey soil in November-December, and the saplings are transplanted in water in January-February. It is important that there be at least 2-6 ft deep water in the reservoir. The water of the reservoir must be clear but its bed must have a 6-9 inches layer of slush.

In March-April, thorny leaves appear on the plant, which cover the surface water entirely. This is also the period when there is some pest infestation on the soft, new leaves and roots of *makhana*. But chemical pesticides are not generally used, to prevent water pollution or causing harm to other water-life. Pest management is done by keeping the reservoir and its adjoining areas clean. However, of late, some people are beginning to use some chemical pesticides as well.

In May-June, the plants begin to flower and fruit. The fruit is round and thorny, which splits below the water surface in July-August and its seeds spread and settle on the reservoir bed. In September-October, the leaves and plants begin to wither and that is when the seeds at the bottom of the reservoir need to be gathered. Traditionally, people do this by entering the water and sweeping the reservoir bed to collect seeds in different piles, and then brings these up in cane baskets, *etc.*

The collected seeds are thoroughly mashed by feet and then washed in water and sieved as much as seven times, till its skin is cleared. These are then dried and tied in a cloth for three days, and thereafter double roasted in a mud utensil, without using sand. The roasted seeds are beaten to split open their parch.

Some amount of fishery can be done alongside *makhana* cultivation, but it is not easy. Extreme care has to be taken that the plants' leaves do not entirely cover the reservoir's surface and cut off oxygen supply for the fish. Fish varieties can be chosen according to the size of the reservoirs *kavai*, *maangur*, *sighi*, *girai*, *etc.* for small lakes and ponds; and *rohu*, *katla*, *mringirla*, *etc.* for the larger reservoirs.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Hire/lease charges for reservoir	1000.00	240 kg @ Rs 100	24,000.00	13,300.00
Seeds	5000.00			
Irrigation	2000.00			
Pesticides	500.00			
Cutting or harvest	1200.00			
Post-yield processes	1000.00			
Total	**10,700.00**		**24,000.00**	**13,300.00**

Makhana cultivation is profitable and can be even more so if the farmer owns the pond or reservoir.

Case study

Sh Paltan Mukhiya, son of Taiter Mukhiya, a resident of village Israr (Block Jhanjharpur, District Madhubani, Bihar) is a landless labourer and also makes a living from selling fish catch, existing in perpetual economic hardship. In 2001, he took two ponds on lease in village Rakhwari and started makhana cultivation, which has proved to be profitable and his family of ten is now better off than before. According to Paltan, the demand for makhana is year round. He sells the produce in Jhanjharpur and other nearby townships. Traders from as far as Patna, Lucknow, Delhi, etc. too come to the village to buy the produce. According to him, this cultivation would have been more profitable if he had owned the ponds. He does some fishery alongside, but not much as fish are able to survive only in ponds that have some opening on the surface, which makhana cultivation doesn't easily allow.

Kamalgatta
(Nelumbium Speciosum)

Kamalgatta, a fruit bearing water-plant, has medicinal value and is also important from an economic point of view.

Found in lakes and reservoirs, *kamalgatta* is a beautiful fruit bearing water plant that has medicinal and food value and is also used in religious rituals as well made into leaf plates. It is normally not planted, for once sowed it continues to multiply and bear fruit for decades. No fertilizers or pesticides are required.

Since its entire lifecycle is in water, *kamalgatta's* seeds fallen from ripe fruits, begin to germinate in February-March. If being planned in a new location, the reservoir must be at least 3 ft deep and *kamalgatta* seeds must be put in the water by February. About 3-4 kg seeds are adequate for one acre area. The plant steadily rises above the water surface, and by mid-August, lotus-like flowers bloom on the plant. *Kamalgatta* is ready for plucking from September through October, While plucking, particular care has to be taken as the plant has thorny hair on its stalk which can cause skin irritation. During the ripening stage, watch has to be kept against birds.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Prevention or watch against birds	1200.00	5000 *kamalgatta* @ Re 1	5000.00	2200.00
Plucking	600.00			
Labour - sale	1000.00			
Total	**2800.00**		**5000.00**	**2200.00**

Case study

Smt Rabarhi Devi, wife of Sh Rajdev, is a resident of Mundera Bazar (Block Sardarnagar, District Gorakhpur, UP) and sells vegetables in the Mundera market for her living. Along with the vegetables, she also sells as many as 5000 kamalgatta fruit annually, which provides her the maximum income. With her earnings, she has been able to marry off her four daughters and makes an adequate living. There is good market for kamalgatta, for which buyers and traders come from Gorakhpur even.

Serki Cultivation
(Cyperus esculenta)

Serki are primarily the roots of *Berra* enmeshed in slush, but are a source of livelihood for the people as these are good to taste and have medicinal properties.

Serki, also known as *neelkamal*, is a water plant, whose rhizome (*Serki*) and seeds are edible and have medicinal properties. It is considered beneficial in back pain. Its roots are established in slush, while its leaves float on the water surface. Its stalk rises with the level of the water. The plant is capable of surviving in 1-10 ft water and slush for 8-10 months and only wilts when water becomes scarce. It is important that the soil where *sairukhi* is grown is not excavated.

Serki does not need to be sowed every year. It germinates by itself in June-July. When the plant matures, it splits and sits on the water-floor from where new plants emerge the next year. So, really no preparation is required to be done for its cultivation. But if one wishes to cultivate it in a new area, it has to be sowed in slush. During the growing period, other plants appearing on the surface of the water need to be cleared also. *Serki* is ready for extraction in October, when the entire plant must be uprooted. This is laborious and time consuming, and one should also not extract the entire crop all at once. Due precaution must be taken against leeches at the time of harvesting.

Each plant bears one *Serki*, weighing 30-50 gms. From one acre, one can extract about 5000 *Serki.*

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Labour - harvesting	1200.00	7.5 qtl @ Rs 2000	15, 000.00	13,300.00
Transport and labour - sale	500.00			
Total	**1700.00**		**15,000.00**	**13,300.00**

Case study

Sh Rampreet, son of Sh Sahdev, is a resident of village Kolhua (District Gorakhpur, UP). He has a family of seven and owns just half an acre of land, and so he mostly practices share-cropping on the fields of other people. He informed that there is a pond, known as Bhaktiseema, near his house, where serki grows naturally. Two months after serki flowers, Rampreet plucks the plants. He keeps the fruit in a utensil for two days and when its cover splits, he dries the fruit under the sun. Rampreet says that he collect about 20 kg serki everyday, which easily sells for about Rs 20 per kg in Brahmpur market. In fact, people who know about the medicinal properties of serki, eagerly await its arrival and give him an advanced demand for the next day. In all, he is able to earn Rs 5000 every year from serki. Besides, Rampreet, a few other people too in the village are doing this work.

Karmua Cultivation
(Ipomoea aquatica I.)

Karmua is an iron rich water creeper, which can stay under water the entire year without being affected.

Karmua, a water plant that grows as vine, is rich in iodine and its leaves and stalk are made into a vegetable preparation, particularly on specific auspicious occasions. For the poor in flood-affected regions, *karmua* is an easily obtainable food.

Like *sairukhi*, the roots of *karmua* are established in slush, its leaves float on the water surface and it is capable of surviving in 8-10 ft water. The plant rises with the water level, but its stalk tends to shrink as the water level recedes, and withers and dries out when there is no water left.

Karmua multiplies both through seeds and stalk. So, in July, with the coming of the first rain, the plants start to germinate wherever its seeds may have fallen, or wherever the old stalks may be lying on the ground. *Karmua* germinates very rapidly and covers up entire areas. Its leaves and stalks are plucked for eating and sale purposes, from July to November. Since the vine of *karmua* can be almost 50-70 mts long and floats on water, its leaves and stalks have to be plucked carefully.

With people becoming more and more aware of *karmua's* significance, it sells at good price in towns and cities. However, decreasing water reservoirs in and around villages pose a threat to its survival.

Case study

Vegetable seller Smt Rabarhi Devi wife of Sri Rajdev, is a resident of Mundera Bazar (Block Sardarnagr, District Gorakhpur, U.P.) also sells karmua collected from the pond near her house. She says it sells well and adds to her income from vegetable selling in the market.

Nevsa

Water plant *Nevsa* is a good source of livelihood for the Nishad community as it demands no inputs except the farmer's labour.

Nevsa is a traditional water plant and a good source of energy for the body. Its roots and lower stalk are deep under the water floor, while the upper stalk with leaves stays above water. In rain, the leaves can sometimes sink in water but can continue to survive thus for over a month and half. The thick portion of its stalk is eaten (one plant gives about 15-20 gms of edible tuber) and is also sold in the market at the rate of Rs 30-40 per kg. Primarily the *Nishad* (fisher) community does this work.

Nevsa grows by itself. The plants grow from the existing roots on the water floor. New plants also emerge from seeds that fell and settled in water after the plant flowered in June the previous season. If the climate is favourable, the germination begins in January-February. It is dug and harvested until June. However, it is not easy to dig in water or slush. The older plants give out more *nevsa.* One person can collect about 4-5 kg of *nevsa* per day.

Case study

Sh Nirpat Sahni lives in village Kalavan (Gauri Bazar, District Deoria, UP) and owns one acre of land. Adjoining the village is Majhna nallah which gets flooded every year. As there are no embankments on this nallah, its overflowing water collects in small holes and pits that are formed alongside. Nevsa grows in these holes naturally every year. Nirpat digs the plant and sells it in the local market or Gauri Bazar, from which he earns about Rs 200 daily. However, if the weather is inclement, he suffers a loss.

Desariya Paddy

Desariya paddy is a long duration variety that can grow in 8-10 ft deep water, and yet, can also withstand drought.

Desariya is a hardy, traditional variety of paddy that grows on clayey soil and is able to withstand high water inundation for as long as six months, as well as drought-like conditions. Its most remarkable characteristic is that once the plant attains a height of one foot, thereafter it grows and stays a foot above whatever level the water rises to up to 10 ft. Beyond that water level, the crop begins to rot. The crop takes 160-170 days to ripen and is generally harvested from boat, when only the ears or spikes are collected.

In May, the field is ploughed three times. This practice, locally called *somra*, is essential otherwise weeds and other growth can suppress the crop and affect its growth.

The seeds are either broadcast or sowed in a nursery the latter using almost half the amount of seeds. In the former method, the seeds are broadcast and the field immediately leveled. In the latter method, the saplings from the nursery are transplanted using the *khurpi* or weed-scraper. This is done by June-July.

Irrigation is not required, nor any compost or pesticides, but weeding is done twice. The crop is ready for harvest in December.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Ploughing – 3 times	975.00	6 qtl @ Rs 1200	7200.00	3495.00
Seeds 28 kg @ Rs 15	390.00			
Sohni or weeding with weed-scraper	780.00			
Cutting or harvest	1560.00			
Total	**3705.00**		**7200.00**	**3495.00**

Case study

Sh Bunilal Chaudhary (50 yrs), son of late Sh Simrikh Chaudhary, is a resident of village Bagahi (Block Bairiya, District West Champaran, Bihar). He has an 8-member family and owns one and half acre of land, but his crops would invariably to get destroyed in floods. In 1990, on the advice of some people, he cultivated desariya paddy on part of his land, on an experimental basis. Happy at the success in retrieving paddy yield at the end of the season, he is currently growing this variety on his entire land. According to Bunilal, the seeds of desariya are readily available in the village. In fact, they are not available in town.

Sengar Paddy

Sengar paddy rises with the level of the water. Its plants flow along with the water, and fresh shoots emerge from wherever they fall and take root on the ground.

Sengar (also known as *jarhhani*) is a traditional early variety of paddy that is widely grown in the *terai* and flood-affected regions. It can withstand drought as well as flood inundation for even 15 days and so can be successfully grown in water-logged areas. Like *desariya*, it rises with the level of the water. If the plant flows along with the water, it takes root wherever it falls on the ground. As the water recedes, the plant begins to stand up, and fresh shoots emerge from every nodule to take root, from where still newer spikes rise.

Sengar is generally sowed by broadcasting, but can also be sown in a nursery. In flood-affected or water-logged areas, it is mixed cropped, and sowed as early as February beginning-March, so that the plant grows and becomes sturdy by the time the floods come. In the other method, it is sown in a nursery third less seeds) and transplanted by May-June. In another method of planting, if there is even knee-deep water standing in the field, the seeds are smeared with mud to make pills, which are dried in shade and then broadcast evenly in the field. However, the only consideration while using such a method is to ensure that water must drain out from the field within 10-15 days of sowing.

Sowing by broadcasting is done between 15 May and 15 June. If through transplantation, then the nursery is prepared in June and the saplings transplanted in the first week of July The spikes on the plant begin to appear by October-end.

As the crop is cultivated in a flood-affected or water-logged area, irrigation is not required. Nor are fertilizers and pesticides essential. Weeding, however, is important and done by harrow once the plant attains a height of one and half feet. The practice is locally called *pandaahan*. The crop is harvested from mid to end November. Its rice makes a tasty *bhujia* (parched grain) preparation.

Being a coarse variety, the rice does not fetch a good price, but it does as seed since it is not available in the market.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Ploughing	300.00	10 qtl @ Rs 600	6000.00	4550.00
Seeds 30 kg @ Rs 15	450.00			
Weeding - *Pandaahan*	200.00			
Cutting or harvest	500.00			
Total	**1450.00**		**6000.00**	**4550.00**

Case study

Sh Munni Lal (55 yrs), a resident of village Tendua Khurd (Block Brahmpur, District Gorakhpur, UP) is Highschool pass. He own three acres of land which has seriously affected by water-logging in the floods of 2001-02. However, since 2002, he has been successfully growing sengar paddy in two acres of low, water-logged land. In the very first year, he got a yield of 17 qtl, of which he sold off 8 qtl. Thus, sengar paddy provided his family food security as well as ready cash. Today, many other farmers in his village are also growing this variety in about 10 acres, which had all but got lost since the advent of high-yielding varieties.

Bhainsa Lotun Paddy

With its capacity to withstand water retention for up to 15-20 days, the *Bhainsa Lotun* paddy variety has proved to be quite successful in flood-affected areas, ensuring people's food security.

Bhainsa Lotun paddy is a traditional, coarse variety and is known by different names in different areas, *e.g. naibuar, ghoghari, aghani, etc.* It is of black and reddish hue and has a thick and solid stalk, so the plant does not fall with the wind. It takes about 120-125 days to ripen and its rice has a sweet taste. It is able to withstand floods for 15-20 days even if just its top portion remains above the water level. It can also withstand drought, though in that case, it might give less yield. It does not require much fertilizer.

In May, the field is ploughed twice, and then again twice in June, to make the soil loose and powdery. The seeds are sown by broadcasting between 15 and 30 June. If there are drought-like conditions, the field is irrigated twice. In July, when the saplings appear and are 3-4 cm tall, the field is ploughed by harrow once. About 45-60 days after sowing, a top dressing of urea is applied. The crop is ready for harvest by October end.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Ploughing – 4 times	1000.00	15 qtl @ Rs 800	12,000.00	9170.00
Seeds - 25 kg @ Rs 8	200.00			
Urea – 30 kg @ Rs 6	180.00			
Treatment	200.00			
Labour - harvest	750.00			
Labour - carriage	500.00			
Total	**2830.00**		**12,0000.00**	**9170.00**

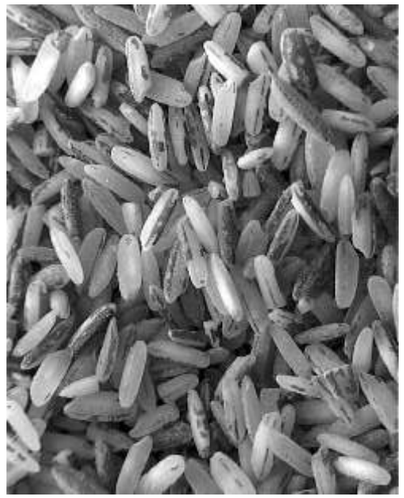
Case study

60 yrs old Sh Krishna Bahadur, son of Sh Ram Bahadur, is a resident of village Rekhat (Block Barhni, District Sidharthnagar, UP) and owns two and half acres of land. After the floods of 1969, in 1970 he started cultivating bhainsa lotun paddy. Not having much information on the variety, he did not get adequate yield the first season. However, with the help of his father, he persisted with it, and the next year he was able to obtain 15 qtl yield from mere one acre land. According to Krishna Bahadur, he is now able to meet the food requirements of his family for the whole year, and at the same time is also able to sell some of the produce and make some money. Today, the hardy bhainsa lotun paddy has become really popular in the region, and farmers in as many as 8-10 villages have taken to its cultivation.

Cultivation of Tinni Paddy

Tinni paddy is a crop of deep water. Whatever the level or depth of water, the crop always stays a foot above it.

Tinni is a traditional, entirely organic wild paddy variety which is suitable for deep water cultivation and best on clayey soil. Like several other traditional varieties exemplified in this booklet, *tinni* too takes root and grows in water always keeping its head about one foot above water. Even if the volume of water were to increase suddenly, the plant will not wilt and can stay submerged for as long as two months, establishing its roots when the water subsides. Its rice is



particularly used on special and auspicious occasions, particularly on the *chhat* before *Janmashtami* and on *Navratra.*

Since *tinni* is not sowed or planted and grows naturally, its seeds fallen on water-logged ground begin to germinate with the onset of rains in June-July. When spikes appear on the plants grow somewhat, the plants are tied in bunches of 30-40. This extremely laborious practice is locally called *jhuriya,* which is essential because the plant has a long spike and even a little delay in harvesting may result in the entire grain falling into the water.

For this reason too, the crop is harvested a little before the plant gets dried. Only the spikes are cut over a hand-held winnower and collected in a cloth. After drying it for a couple of days, it is beaten to separate chaff from grain. A word of caution - While harvesting, precaution must be taken against leeches in the water.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Labour	2000.00	6 qtl paddy. Or 3 qtl rice @ 5000	15,000.00	13,000.00
Total	**2000.00**		**15,000.00**	**13,000.00**

Case study

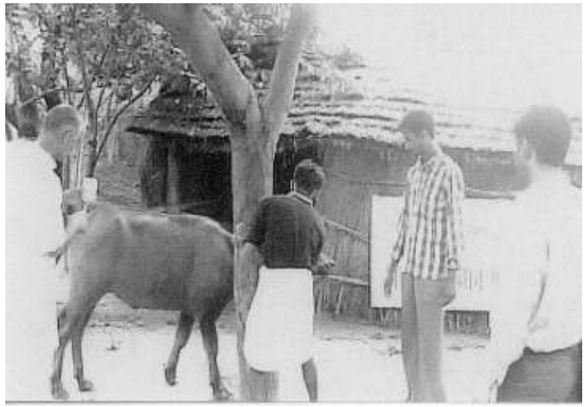
Sh Rampreet son of Sri Sahdev, is a resident of Village Kolhua, District Gorakhpur U.P. informed in Bhaktiseema pond near his house, *tinni* paddy also grows by itself every year. Rampreet does the *jhuriya* on the plants, and from the yield he is able to earn about Rs 1000-2000 every year. He believes he could have made an adequate living if the paddy was growing in a larger area, as *tinni* rice fetches good price during auspicious occasions.

Collective Efforts

Vaccination of Cattle

Among the silent sufferers of floods are the cattle which get infected with various diseases, thereby causing problems for the families dependent upon them. However, timely inoculation of cattle can save them from these diseases.

In the flood-affected regions, a large percentage of the population is of marginal and landless farmers for whom animal husbandry is a major source of survival. The prime period for floods in *Purvanchal* is from the second week of August to the third week of September, which is when cattle health and care too emerge as major problems. There is acute fodder scarcity and cattle are vulnerable to infectious diseases, which impact the farmers' livelihood. Increasing frequency and recurrence of floods in the region have deepened the crises in cattle rearing. Addressing this concern, a case of pre-flood initiative by a women's organization in village Konha (Block Brahmpur, District Gorakhpur, UP) to ensure cattle vaccination against foot and mouth diseases before the floods arrive has proved to be exemplary.



A survey on the status of cattle in village Konha revealed that 25 families were dependent for their livelihood on 66 animals, which were as follows :

- *Cow* - *7*
- *Bullock* - *17*
- *Cow Calf (Male)* - *4*
- *Cow Calf (Female)* - *1*
- *Buffalo* - *24*
- *Buffalo Calf (Male)* - *4*
- *Buffalo Calf (Female)* - *9*

With the help of the *Mahila Mandal* in the village, the people contacted the Veterinarian at the Vetinary Centre, Dhihaghat. They presented him with their village cattle data, finalized the date, time and place for a vaccination programme and requested his support for conducting it.

The villagers also deposited the cost of the vaccines at the government rates of Re 1 and Rs 2, as applicable. The programme was organized at the community centre in the village itself, so the people were saved from having to take their cattle to the distant vetinary centre.

As a result of this vaccination in advance, the people found that cattle deaths from various flood related infectious diseases came down substantially. Ever since, Community Based Organization have been regularly conducting pre-flood cattle vaccination programmes.

Preparatory considerations for vaccination

- Cattle survey.
- Contacting vetinary doctor and arrange for medicines and vaccines.
- Selection of date, time and place for vaccination.
- Bringing cattle to the vaccination centre.
- Vaccination with vetinary doctor's help.
- Post-vaccination care of cattle and follow-up.

Culvert Construction

For long, the people in Ranipur were experiencing problems in commuting as a result of erosions along many streams and nallahs. In 2004, *Vikalp* helped set up *Mahila Mandal* and *Youth Club* and provided their members training in disaster management.

The Mallah (boatmen) community dominated village Ranipur (Block Lakshmipur, District Maharajganj, UP) is surrounded by a network of rivers, streams and rivulets. There are Pyaas nallah and thick forests in the east, the Vasmaniya river in the west, Gauharpur in the north and in the south Belauhaghat where Rohin, Vasmaniya rivers and Pyaas nallah meet. Many streams and rivulets entering from the forests in the east, pass through the village to drain into the Vasmaniya river.

The Amhava-Ranipur road connects the village to the Ranipur Chauraha and further on to the Sonauli-Gorakhpur highway. But the floods of 1998, washed away a big chunk of the connecting road, which remained un-repaired ever since. This not only led to loss in commuting time and related problems for the people, but also meant that with people having to wade through water on this section of the road, there were severe health and other constraints as well, particularly for women and in emergency situations. The construction of a culvert or bridge at this point was seen as the main priority requirement of the people in the area.

Vikalp, which is active in the area, set up *Mahila Mandal* and youth clubs to make a collective effort to resolve the problem. Towards this, the responsibility of contacting the various departments was given to Smt Durgawati Devi (President, *Mahila Mandal*), Sh Lalu Prasad (President, *Youth Club*) and Sh Arvind Vishwakarma (Secretary, *Youth Club*). These people pressurized the BDC Member Sh Hari Ram to ask Sh Durgashankar Pandey (Block President, Lakshmipur) take on the responsibility of constructing a culvert. Working to a plan, they obtained an application to the effect from Sh Hari Ram and handed it to Sh Pandey. and through maintaining constant pressure, the budget for the construction of the culvert was at last passed.

A month later, the work started. Smt Koyla Devi (Member, *Mahila Mandal*), while on her way to the market, checked on and objected to the cement-sand ratio being used in the construction, and accordingly warned the person on site. Soon, this cement-sand ratio was rectified and the culvert got constructed. However, it was seen that high culvert was not sloped to join to the connecting paths, as a result of which it was still difficult for the people to cross over. Sh Lalu Prasad made enquiries and found that the amount sanctioned for the slopes had been siphoned off by the contractor.

At a joint meeting of the *Mahila Mandal* and *Youth Club* on 20 December 2004, a letter duly signed by the 38 members of the two groups was handed over the Sh Ramdev (ADO, Panchayat, Lakshmipur).

A culvert that had remained unattended for over five years, was constructed through the efforts of people's organizations, in which the members of *Mahila Mandal* and *Youth Club* contributed about Rs 4900 worth of labour.

But when it did not elicit any positive response, another letter was sent on 24 December 2004 to Sh RS Gupta (CDO, Maharajganj) who ordered the BDO to conduct a site inspection.

Thus, through the collective efforts of the two organizations, a 5 mt long and 2.25 mt broad culvert with suitable slopes on either side got satisfactorily constructed. In this entire process, members of *Mahila Mandal* and *Youth Club* left aside their respective engagements to meet thrice. The members also contributed labour worth Rs 4900, including ten days each by the President, *Mahila Mandal* and Secretary, *Youth Club*. Rs 50 on photocopying and Rs 1000 on to and fro travel to Lakshmipur (Maharajganj) were the other expenditures, totaling Rs 5950. On the credit side, the construction of the culvert has greatly eased the commuting problems for over 3000 people in the area. More importantly, people who go for labour work, save considerable time and in cases of illness, patients can be taken to seek medical help elsewhere.

People's initiatives to get a culvert constructed that had been lying unattended for five years, has had a profound impact on their direct involvement in development programmes. Regular meetings have strengthened community organizations and elicited positive support for people's struggles. The interventions by the women have strengthened the process. Development of local leadership which facilitated the resolution of the problem, was another major positive outcome from this experience.

Understandably, the realization of their collective strength has energized the people to take similar collective initiatives on their various other problems.

Public Efforts for preventing erosions

It seems hypocritical to talk of development when people themselves do not have adequate food to eat. Such was the impression felt when the Ghaghra was eroding extensive agricultural land in district Bahraich. Once 40 km away, the Ghaghra today flows alongside Mahasi and is the cause for much of its sorrow.

River Ghaghra emerges from Nepal to enter Uttar Pradesh in district Bahraich, passes through Gaighat, on to Chahlarighat, and marking the boundary between Bahraich and Lakhimpur-Khiri districts, reaches the Barabanki district. A major and big river by any standards, the Ghaghra becomes ominous during the floods and is at its worst in the Mahasi *tehsil*.

Long ago, the distance between Mahasi and the Ghaghra river was about 40 km. Seriously damaging floods would come but once in five-six years. The people had adequate land, cattle and other resources to lead a normal, healthy life.

But rivers forever alter their course. About 8-9 years ago, things began changing for the bad for the people of Mahasi. The Ghaghra began cutting into their land. Among the villages badly affected were Rehwa, Mansoor, Kayampur, Golaganj, Tepra, Trivedipurva, Shuklpurva, Silauta, Munshipurva, Mathurapurva, Chacherva, Churalia, Atodar, Chamrahi, Baurhi, Ratanpur, Bhauri, *et.al*. Secondary data from 2004 reveals that 21 villages and 3051 houses were severely affected by erosion from the Ghaghra. At the time, the people who were rendered homeless got neither any immediate relief, nor were they rehabilitated elsewhere. In effect, the people were pauperized and relegated to being marginal and landless farmers.

Today, Mahasi is considered most sensitive and prone to floods. The people are in a state of deprivation. People have lost vast areas of their land to the river. Food security is jeopardized and the condition of the cattle is even worse. There is an utter lack of basic facilities and amenities in the village no clean drinking water, electricity, health, education, *etc.* The people have even lost the infrastructures they once had. For example, the primary school in village Silauta, which was washed away in floods. Subsequently, on government records, the children of that school were attached to the one in *gramsabha* Raja Baundi, but as the people were not rehabilitated, the children's transfer to the other school has remained cosmetic.

The continuous hardships led people to realize that they must stand united. They decided to, and with the support of *Panchsheel Development Trust* collectively put pressure on the administration to look into their problem and prevent any further erosion of their land. A *Sangharsh Samiti* was formed, comprising 12 active and young people. Sh Shivshankar Tiwari was made its president.

Under the banner of the *Sangharsh Samiti* and with the active support of Sh Rajesh Tripathi of *Bahraich Vikas Manch*, the affected people demonstrated and staged sit-in outside the offices of the District Magistrate (Bahraich), SDM and Tehsildar (Mahasi). The protests, including the people's threat to fast unto death or commit suicide by jumping into the river, attracted considerable media attention, following which many leading politicians in the state, including the then Chief Minister Sh Rajnath Singh, Sh Munna Singh (Irrigation Minister) and Sh Motilal Vohra (National General Secretary, Congress) visited the site. This resulted in the immediate construction of two studs/spurs on the river, but

If the people are willing and the government support forthcoming, then nothing is impossible to achieve. This was amply demonstrated by the people of Mahasi.

ironically these were swept away in the swift flow of the river. Thereafter, under a long-term planning, seven studs/spurs were constructed in the affected area on the river, over the next four years, which resulted in some positive benefits, such as -

- About 650 houses in Baundi and Ratanpur, and about 250 houses in Jogapurva have been saved from erosion.
- A PIL was filed by Sh Suresh Kumar Kaaliya through advocate Vijay Kumar Kaaliya, on which the Supreme Court directed the Administration to make every possible effort to prevent erosion.
- Sh Motilal Vohra raised the issue in Lok Sabha and Rajya Sabha, which added to the pressure on the Administration to look into the issue.
- The Irrigation Department constructed an embankment on the river from a Rs 7 crore loan from NABARD to the State administration.
- As result of the construction of the embankment, the number of people affected by erosion is steadily coming down. This can be truly seen as a success of people's initiatives.
- At the social level, people became more sensitive to the issue and were more unified.

In this entire process, *Shohratgarh Environmental Society* and *Panchsheel Development Trust* have, directly and indirectly, provided significant support by way of

- Developing people's understanding on the issue.
- Training and capacity building of workers and volunteers.
- Printing leaflets to publicize the issue.
- Printing booklets, pamphlets and other reference material.
- Arranging for the transport of people between the village and the state offices.
- Bearing the expenditures for microphones, food, photographs, press-release, *etc.*
- Providing moral support during demonstrations and rallies.
- Helping prepare the Demand Note.
- Preparing the people to be bold in front of officials and politicians.

The two organizations spent approximately Rs 3-4 lakhs on the entire campaign. But the benefits from this have far exceeded the costs. As many as 900 families have benefited directly and been saved from being evicted from their homes. The entire population in the area (5000) too have benefited. The economic condition of the people has substantially improved, and their lives and livelihood have steadied. They are now no longer constantly apprehensive about having to relocate, and have started taking more constructive role in discussing and determining there development issues, plans and programmes.

Protection of Embankment

Roads and embankments may be owned by the government but are for the use of the common man. As such, along with the government, the community too should feel responsible for the safety and maintenance of such public properties.

The people's mindset is such that embankments and roads are government property and so their upkeep is also the government's responsibility. Therefore, by and large, people tend to misuse or have a callous attitude towards these. It is only in extreme situations that people realize the worth of such infrastructures and resources and accept a sense of responsibility towards them.

Bhaluha (Block Uska Bazar, District Sidharthnagar, UP) is a small village on the banks of Jamuar nallah, that faces the wrath of floods virtually every year. In 1950, the then MLA Sh Mathura Prasad Pandey urged the administration to construct a ring-embankment all around the village, which provided immediate safety to the village from floods. For almost 40 years, people took ample advantage of the ring-embankment, using it to store hay and even planting grass on it for fodder. But no one, neither the government nor the villagers, took any interest in its maintenance and repair. Consequently, on the one hand, , rats began frequenting the area because of hay stacks thereby creating holes in the ring-embankment; and on the other hand, it started getting infested with weeds that led to rain-cuts, which weakened the ring-embankment.

On 18 August 1998, at 7 pm, the water in Jamuar nallah was at its peak. The entire night, the people stayed up in apprehension. Suddenly, there was news that seepage had started near the *Mahua* tree to the north. There was confusion all around. People rushed to the site to plug the seepage with whatever they could lay their hands on old clothes, sacks, whatever. Working throughout the night, they managed to close the seepage.

It was then that people realized that embankments are for the safety of the village and that the people themselves must feel responsible for their maintenance and repair. And they also realized the value of cooperation and coordination. In this entire process, the role of *Gautam Buddh Jagriti Samiti* was invaluable. It was instrumental in creating self help groups in the village, in getting them to discuss the various dimensions of development, and in executing the programmes.

In the village, the problem of the ring-embankment was underlined as the most critical, and the people decided to contribute collective labour towards a permanent solution of the problem. Consequently, 100 people, two from each family, worked continuously for 21 days, to clear and repair the ring-embankment and also raise its height. Once done, the people proposed to repeat this collective effort annually. Ever since, the repair and maintenance of the ring-embankment is being carried out regularly every year.

The community initiative of the people of Bhaluha village to secure their lives and properties from floods was exemplary and done without any external assistance.

Case study

Village Baluha, on the bank of Jamuar nallah, is located 3 km from the block headquarters Uska Bazar. The nearest village is over one kilometer away. The village has no connecting road to the main Uska-Sohaas road, and people have to walk across the fields of others. The Jamuar nallah originates in Nepal. On the one side of the village, it meets the Bajaha Sagar river, marking the boundary between Nepal and India. On the other side, encircling the village on its three sides, Jamuar nallah meets with the Koorha river about 1.5 km downstream. So, from a distance, the village appears as an island which, in fact, it does become during the monsoons. Within the ring-embankment, people cultivate two crops in the year, while outside it only one crop is grown.

There are only 40 families in the village, belonging to the Paasi and Lodh/Nishad community. The village lacks in basic infrastructure and facilities no drinking water, no electricity, no school. Daily wage labour is the main source of livelihood of the people, though a few grow and sell vegetables as well. Every house here has at least one member, who has migrated to towns for employment and livelihood.

During the monsoons, an increase in flow in the Koorha river, forces the Jamuar to fill up Bajaha Sagar, resulting in floods in the entire area. Being low-lying, the area remains water-logged for one-two months. The ring-embankment around the village is over 50 years old and in a poor state of repair. Ever since it was constructed, no department has cared to take it up in its work-plan or undertake any repair whatsoever. It was only in 1998-99 that the people themselves repaired it. In bare economic terms, the repair cost the people 210 x 21 man-days x Rs 57 (the then daily wage rate), i.e. Rs 2,51,370/-.

More importantly, with this initiative, the people learnt to be cooperative and helpful of each other, and have carried out the repair and maintenance work every year since then. As a result, the life, property and livelihood of the people in the village are now considerably safe and secure.

Disaster Management Federation

The Bandaiya embankment protects the Purandarpur *gram panchayat* from floods, but hadn't been repaired for over 20-22 years. In 2002, Disaster Management Groups were set up in villages to specifically look into this issue.

Bandaiya Tola (Block Dhaani, District Maharajganj, UP), one of the 16 hamlets in *gram panchayat* Purandarpur, is surrounded on two sides by rivers from which it is protected by the Bandaiya embankment. But the embankment is not high and during the floods, water invariably tops it. Agriculture is the main occupation of the people here, but they also do seasonal labour and even migrate for livelihood. Floods are a recurrent feature here, and the four months of the monsoons are spent in fear, apprehension and resignation. To protect the village from the ravages of flood, the forest department had constructed an embankment long ago but it was just wide enough for walking or for cycling with some difficulty and hasn't seen any repair in the last 20-22 years.

In 2002, *Gramin Development Services* started an awareness programme in the village, and “Disaster Management Groups” were set up in 25 hamlets to develop their micro-level work plans. The micro-planning exercises carried out underlined Bandaiya embankment's state of disrepair as the main problem needing priority attention.

The Disaster Management Groups, started to work on a plan to apprise the district administration, *tehsil* administration and the forest department on the Bandaiya embankment's utter state of disrepair. Accordingly, memorandums and representations were sent to the District Magistrate (Maharajganj), SDM (Phrainda), *tehsil* officials and district level forest officials. From time to time, people also collectively visited their offices to inform them of their fears and apprehensions. The local MLA and state minister were also informed.

However, the monsoon of 2003 arrived and neither the administration nor the MLA had taken any initiative on the people's representations. By August, the ponds and the rivers had filled up so much that water started seeping from the Bandaiya embankment. The news of the leakage spread like wildfire in the adjoining areas, and the people immediately informed the *tehsil* administration and forest department and rushed to the embankment to physically prevent any mishap. On 27 August 2003, about 450-500 men and women, young and old from 25 hamlets worked through the day to plug the leakages in the embankment with mud filled sacks. A possible disaster was thus averted.

Looking at the people's response to the impending disaster, *Gramin Development Services* then decided to call a meeting of all 25 hamlets to discuss and find a collective solution to the problem. But as it was not logistically feasible to have such a meeting at a single place, it was decided to divide the entire area into two clusters and accordingly have two meetings. The first meeting was held on 29 December 2003 at Primary School, Belanhawa Chauraha. The meeting reiterated the primacy of the Bandaiya embankment issue and a resolution was passed on the proposal for all Disaster Management Groups to jointly work on the issue. This also led to a demand by the people for a wider, regional Disaster Management Federation.

The other meeting was held on 11 January 2004 at Dhorhghat Chauraha where people took a similar oath to do

By August, water had started seeping from the Bandaiya embankment. In an open meeting of all the 25 hamlets in the area, the issue was given the highest priority and it was decided to form a Disaster Management Federation for finding a long lasting solution to the problem.

everything possible for the repair, maintenance and upkeep of the Bandaiya embankment. A formal declaration was made to set up the Disaster Management Federation proposed at the previous meeting.

Subsequently, a larger meeting of the Disaster Management Groups of both the clusters was called, which reiterated the urgent need to repair the Bandaiya embankment and also construction of check-dams on the Ghonghi nallah. The meeting considered involving the people of the *gram panchayat* affected by this problem also. The members of the Disaster Management Groups gathered for the meeting, formally set up a Regional Disaster Management Federation, comprising two members from each Disaster Management Group. The meeting also selected the office bearers of the Federation, allocated their responsibilities and charted out a work-plan. Sh Tapasi (village Kevataliya) was nominated President, Sh Budhiram (village Barhi Manhiya) Secretary and Sh Ayodhya Prasad (village Rampur), Treasurer of this Federation. It was also decided that the office-bearers and members of the Federation would meet once a month to plan their work and programme strategies.

On 15 May 2004, a meeting was organized, attended by *gram pradhans* and members of the Disaster Management Groups. At the meeting, no sooner had the Chief Guest, Minister started addressing the gathering, that a voice from the crowd stated that the people were not interested to hear anything except on what the administration was doing about repairing the Bandaiya embankment. Somewhat taken aback, the Minister assured the gathering to look into the issue. He realized that politicians could no longer detract from the issues of people's welfare, or else the people will reject the politicians.

Then came the monsoons, and suddenly there was a flurry of activities as government officers started visiting the area. After a couple of days, a tractor with some labourers came and started work at the site. It was learnt that the Minister had sanctioned Rs 8 lakhs for the repair of the entire embankment. Not impressed, the villagers immediately protested and demanded why the work hadn't started earlier, as all fillings now would wash away with the rains. Five-six days later, it rained heavily and the work on the embankment had to be stopped. Fortunately, the monsoon that year wasn't heavy and did not result in a flood-like situation. Work was taken up again after the monsoons, and the members of the Disaster Management Groups visited the embankment to ensure that the quality of the work did not suffer. Thus, work on the repair of 4 km long embankment was completed successfully. It's rightly said - 'God helps those who help themselves'!

The way the gram panchayats constitutionally included and passed a resolution on the issue of Bandaiya embankment in their formal meetings needs to be praised. This led to rallying of the people and members from kshetra panchayat to district panchayat. Pradhans of every related gram panchayat sent a proposal demanding the repair of Bandaiya embankment to the district administration and local MLA, with copies of the minutes to their offices. Thus, the entire process took the form of a people's movement which resulted in the successful repair of the Bandaiya embankment.

Livelihood Rights Association

To mitigate the impact of floods and drought on livelihood, Shohratgarh Environmental Society encouraged the people of Jogia development block to form a district level Livelihood Rights Association, which was an apex body of nine different issue-specific groups in each village.

In floods or drought, the livelihood of a large section of the society gets affected. When villages, fields and houses get washed away or marooned in floods, it is the small and marginal farmers or the poor, who neither have the resources nor are organized, that are the most adversely affected. In the Jogia block (District Sidharthnagar), *Shohratgarh Environmental Society* set up an *Aajeevika Adhikar Samiti* (AAS) or Livelihood Rights Association to galvanize, organize and empower the people at the block and district levels.

AAS was set up with the aim to develop and strengthen positive thinking among the people, seek continuity of development works in the area, and help make official and relevant information and know-how available to the people. AAS comprises 27 members of which seven are women. Each community or community based organization in the area is represented in the AAS by three members each. The Association has been further divided into subject or issue specific *Working Groups*, wherein members develop a keener understanding of and information on the respective subjects, and work as pressure groups for proper execution of development works. These various issue specific *Working Groups* are-

- *Women Self Help Groups* - To provide relevant information and help women become economically self-reliant.
- *Farmers Group* To change and adopt agricultural practices in view of the social and geographical conditions of the area.
- *Relief and Security Group* To look into proper and smooth distribution of relief during calamities, including moving people and cattle to safer locations and looking into other security aspects.
- *Para Veterinarians* Cattle are the lifeline of people's livelihood, and mute victims of floods. Workers have been selected and provided capacity building orientation to work on veterinarian issues.
- *Health Volunteers* - People's health in a major concern during the flood periods. As such, it is important to select and build the capacity of health volunteers to be in a state of preparedness during the floods.
- *Maternity Health Workers* For better health and maternity care of women and children, particularly in times of flood, when such problems escalate manifold.
- *Grain Bank* To revive old village traditions of brotherhood and helping one another in times of need and to ensure food security.
- *Seed Bank* To ensure the availability of high quality seeds and provide agriculture related current and technical information
- *Panchayat* Topping these all, this working group seeks to organize and provide capacity to *panchayat* members to remain ever alert to disaster situations, to plan and manage safety and relief measures from pre- to post-flood periods.

As its name suggests, *Aajeevika Adhikar Samiti* or Livelihood Rights Association seeks to work for the livelihood and other rights of the people. Towards this, as its first engagements, AAS has taken out rallies and demonstrations on development issues, particularly that of BPL cards. As a consequence, 16 deserving families received their BPL cards.

Post Flood Cultivation

Adaptive Capacities of Community to cope up with flood situations

Cultivation of Early Varietyof Lobia

The early variety of leguminous *Lobiya* CP-4 is rich in protein and carbohydrate. Besides, its stalks provide useful green manure if, after harvest, these are ploughed in after watering the field.

CP-4 *Lobiya*, a dwarf leguminous variety developed by the Indian Vegetable Research Institute, Varanasi, is rich in protein and carbohydrate, and has nitrogenous rhizomes at its roots. The pulse has long, green pods which can be plucked within 45 days and cooked as vegetable. After the harvest, if the field is irrigated and the plant stalk and other residue ploughed in, it works as green manure as well.

Lobiya is a versatile crop that can be grown anywhere in the country where the land is a bit arid or has good water drainage. It does not thrive on land where water stays for long. The field is ploughed thoroughly, but must retain a little moisture at the time of sowing. It is sowed in rows that are 2 ft apart and the distance between the plants is kept 1.5 ft.

It is a warm weather crop, so the best period of sowing for this specific variety is between February and March for *jaayad* season, and June to July for *kharif*. It can also be grown in October. Indeed, it gives good results at what ever time of the year it is sown. However, it must not be sown in November-December.

Being a member of the bean family, *Lobiya* does not require much fertilizer. However, before sowing, compost is mixed into the soil. Also, if the seeds can be treated with a rhizobium culture, it would save about 77 kg urea later. A

month after its germination, pot fertilizer is sprinkled every 10 days. When flowers appear, the plant may be given vermi-wash every 10 days. It might also be better to spray a mixture of *neem* oil with a *phuphundinaashak* (fungus destroyer), to prevent disease infestation. Generally, leaf pests attack the plant, for which 300 ml of kerosene mixed with 3 kg ash is sprayed early in the mornings when the dew is still there. If the leaves turn yellow, then one litre cow's urine mixed in 4 lts water is sprinkled twice at an interval of 10 days. For leaf borers, neem oil with *rogar* is applied. Special care has to be taken in winters against yellow mosaic disease.

Irrigation is given, depending on the moisture in the field - every 7-10 days in summer and every 15 days during the monsoons, if it does not rain. Weeding is done as required.

The only problem with cultivating this is that, being a new variety, its seeds or any composite reference material on its farming is not readily available.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Ploughing – 3 times @ Rs 300	900.00	28 qtl @ Rs 800	22, 400.00	14,650.00
Compost – 4 trolleys @ Rs 500	2000.00			
Labour	300.00			
Fertilizers – Urea 2 sacks	800.00			
Fertilizers – Dye 1 sack	500.00			
Pesticides	350.00			
Irrigation – 7 times	1400.00			
Labour – harvesting, etc.	1000.00			
Other expenses	500.00			
Total	**7750.00**		**22,400.00**	**14,650.00**

Generally, February-March is the most appropriate time for the sowing of *Lobiya*. However, it has been seen that sowing at even other times has given good yield.

Case study

Sh Ramkewal Maurya lives in village Aaraji Chauri (Block Pipraich, UP). He has been cultivating CP-4 Lobiya. Earlier, he used to cultivate Spong Gourd but has shifted to CP-4 Lobiya, as the latter gives 4-5 times more profit than even paddy or wheat cultivation. He came to know about this variety in 2004 at a sate-level Farmer's Seminar organized by Sustainable Human Development Association, where Dr AK Pandey, a scientist from the Indian Vegetable Research Institute spoke about it virtues. He grew this lobiya on half a bigha land with an input cost of Rs 3000, and was able to sell Rs 12,000 worth of vegetable in the local vegetable market at Rajahi. According to him, "This variety has changed the very face of the area." Today, over a hundred farmers in the area are cultivating this crop variety. It has indeed proved to be a boon for the small and marginal farmers in the flood-affected areas.

Cultivation of Oil Seed Crop (*Lahi*)

Lahi uses less inputs and readies in 90-120 days. Its seeds bear oil and are also used as condiment, while its stalks are good fodder and can also be used for fuel.

Lahi (a mustard variety) is an oilseed and also used as a condiment, that grows in less time with minimum inputs. Its stalks can be used for fodder and fuel. In these regions, people do extensive *parval* (vegetable) cultivation, which grows through the monsoons. It is uprooted and the fields are vacated after monsoons. *Lahi* is sown after that as an intermediary crop and is harvested in January, to be followed-up by late sowing of wheat. Thus, post-flood two crops are taken, and so the cultivation of cash crop *lahi* is a boon for the people in the flood-affected regions.

Bhagarhiya village (Block Mihinpurva, District Bahraich, UP) was severely affected by flood in 1969, and with its cultivable land covered entirely with sand, agriculture there had become virtually impossible. In such a situation, the farmers sought information on *lahi* and started cultivating it. It gave good yield and steadily this became a major *lahi* growing area, which considerably compensates for the damages incurred in the annual floods.

In September, once the floods recede, the fields are ploughed straight and across four times to dry out the soil. While preparing the land, compost is added to the field. *Lahi* is sown between 15 September and 15 October. There are many varieties of *lahi* available, but the more popular ones here are PT-303, Type-9 and a local variety. DAP and potash fertilizers are applied twice. The first irrigation is done 40 days after sowing and the next, 20 days later, but care needs to be taken that there is no water-logging in the field. For pesticides, Indo sulphan / Thyodaan / Rogaar is mixed in a little water and sprayed to prevent the crop from pest and disease infestation like Aphid and *white grubs*. Prevention has to be taken against frost and stray cattle also. The crop is ready for harvest in 90-120 days, and harvested in January.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Ploughing – 4 times @ Rs 250	1000.00	6 qtl @ Rs 1400	8400.00	4335.00
Compost – 3 trolleys @ Rs 400	1200.00			
Seeds – 1.5 kg @ Rs 30	45.00			
Fertilizers – Urea 60 kg, DAP 50 kg, Potash 20 kg	925.00			
Pesticides	100.00			
Irrigation – 7 hrs @ Rs 60	420.00			
Labour – harvest, etc.	225.00			
Labour - threshing, etc.	150.00			
Total	**4065.00**		**8400.00**	**4335.00**

Case study

55 yrs old Sh Gorakhnath Singh, son of Sh Gupteshwar Singh, lives in Bhagarhia village (Block Mihinpurva, District Bahraich, UP) and is high-school educated. He owns 9 acres of agriculture land. Since 1972, he has been growing lahi in 4-6 acres and on the rest of the land he grows paddy, maize, wheat, parval, sugarcane, masoor, etc. For lahi, Gorakhnath prefers the local variety Type-9, which gives good yield and fetches good price. According to him, since he started cultivating lahi, his economic condition has improved, which has had a positive effect on the health and education of his children, and on the family status in the society. Lahi's popularity as a cash crop can be gauged from the fact that as many as 330 families in the village are cultivating it.

If due care is taken in its cultivation, *Lahi* can be harvested in January and the field sowed with a late variety of wheat. Thus, in one season, as many as three crops can be grown.

Successive Potato Cultivation

If harvested and sold in December, potato fetches good price, and the field is available for growing wheat. Thus, by taking two crops, the loss from floods can be compensated for.

Potato has been found to be among the most suitable crops for cultivation on the sandy banks of rivers. As the demand for potato is throughout the year, it is an appropriate crop for providing people food security as well a good income.

Mohammadabad region of Ghazipur is famous for potato cultivation. Two popular varieties being cultivated in the region are C-1 and C-40, the former whitish and the latter wheatish in colour. The C-40 variety is more popular of the two, for its yield and taste and also the fact that it can be stored longer in open.

The field is thoroughly ploughed (8-10 times) in early October and the seeds are sown from 15 October to 15 November.

Sowing is done in lines and rows the distance being 45-60 cm between rows and 15-20 cm between plants. Weeding is done once, but care needs to be taken that the plant does not get pressed in and the potato does not get exposed to the sun. On the contrary, it is essential to layer the soil around the plant as it grows, which helps improve the size and yield of the potato.

During the entire season, irrigation is given four times. But care has to be taken that water does not stay along the plot mounds, which will affect the yield. Dye, urea, potash and zinc are used as fertilizers. To prevent the plants from frost, in January, it is important to spray Dythani-M 45 and Menkojeb two or three times, or else the crop is likely to wilt and rot.

Potato is harvested January onwards and until March when it is ripe and just right for keeping in cold storage. After March, the farmers sow melons in the fields. However, farmers who wish to cultivate potato as an intermediary crop and wish to use the fields for wheat as well, dig out the potato in December.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Ploughing – 10 times @ Rs 375	3750.00	150 qtl @ Rs 350	52,500.00	28,725.00
Seeds – 1350 kg @ Rs 5.50	7425.00			
Labour – sowing	1800.00			
Fertilizers – Urea 6 sacks, dye 6 sacks, potash 3 sacks	3600.00			
Pesticides	1800.00			
Irrigation – 4 times	1800.00			
Labour – other	1800.00			
Crop digging	1800.00			
Total	**23,775.00**		**52,500.00**	**28,725.00**

Case study

Sh Vashisht Bind, son of Sh Sumer Bind is a 40 yrs old farmer, belongs to village Paharipur (District Ghazipur, UP), located 8 km from its block headquarters Muhammadabad and on the Varanasi-Ballia National Highway. For livelihood, Vashisht and his family of 15 depend entirely on agriculture and related labour. To the south of the village is river Magai, which gets flooded every year and destroys crops over extensive area. To overcome this problem, Vashisht Bind started growing potatoes on one acre field in the year 2000. Considering the number and frequency of inputs required in potato cultivation, Vashisht was initially worried that it might be a loss making venture. But when the yield was harvested, it gave a big boost to his enthusiasm. According to him, with potato cultivation, there are no question marks over the family's food security any more, as it gives year round vegetable supply to the family and also brings in good money through sale of the surplus. Today, potato has become a major cash crop in the region.

Potato crop is generally affected by frost, as such appropriate medicine must be sprayed about once a week.

Cultivation of Arkil Peas

The early ripening *Arkil* peas is very profitable from the market point of view, especially as post-floods, the farmer is particularly in need of ready cash.

Arkil peas grow well in fields where pulses are grown. It is a quick growing variety, sown in September-October and harvested completely latest by March. In areas where floods affect paddy crops, the cultivation of Arkil peas provides food (both green and dried / preserved for times of scarcity) as well as income. Moreover, Arkil being an early variety, other crops like onion, maize, *etc.* too can be grown thereafter on the same land.

Soft and loamy soil is the most appropriate for this peas variety. It is important that the field is elevated and has good drainage. Water in the field should not remain for more than two days. Compost is applied at the time of field preparation, while nitrogenous fertilizer may be added in small measure later. The crop is lightly and manually irrigated just once, particularly when the effect of frost begins to show. A week after irrigation, the pea-buds appear, which are plucked. The process is locally called *khontai,* which strengthens the plant and multiplies its branches.

Farmers sprinkle ash on the crop, early in the morning while the dew is still there to prevent cattle from eating or pest infesting it. The peas are ready for picking November-December onwards. There is good demand in the market for fresh peas. It is often better to pick daily for the market, as picked green peas cannot be retained for more than three days. The picking continues up to January, giving good income to the farmers. In March, the ripened peas are harvested, dried and preserved for use later during the lean periods. The rest of the plant makes good fodder for the cattle.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Ploughing – once	450.00	Green vegetable – 50 kg	400.00	5,070.00
Seed – 30 kg	1500.00	Green peas – 6 qtl	6000.00	
Fertilizer – Urea 1 sack, DAP 1 sack	900.00	Dry peas – 2 qtl	2800.00	
Irrigation – 9 hrs	630.00	Seeds – 10 kg	500.00	
Labour – 15 persons	1050.00	Dry fodder – 5 maunds	400.00	
Transport	500.00			
Total	**5030.00**		**10,100.00**	**5,070.00**

Case study

In Tola Dhodghat-Gulhariya (Block Dhaani, District Maharajganj, UP), people have been traditionally growing peas, and though no cost-benefit analysis was ever done, it was apparent that it did not provide much profit to the farmers. A local NGO, Dawood Memorial Development Organization, informed the farmers about the Arkil variety and its benefits and the farmers were also provided with its know-how.

Seeing hope in this, Smt Sunara Devi, wife of Sh Laalu of village Dhodghat decided to grow Arkil peas. She lives at the north-eastern end, near the Ghoghi nallah embankment and owns one acre land. On one bigha she used to grow traditional peas. Taking the organization's guidance and advice from time to time, she started cultivating Arkil peas. After the appearance of the first buds and khontai, she sold the pea-buds in the market and earned Rs 130. She says that Arkil peas cultivation is profitable and beneficial in many ways it provides food, income and also fodder for the cattle.

The biggest threat to peas cultivation is frost. So if, at the slightest apprehension of frost, the crop can be given a light irrigation, it contains the damage.

Cultivation of Lentil

The farmers in flood-affected areas accord more importance to *Masoor* pulse over even wheat because it demands fewer inputs and does not particularly require irrigation.

Crops like *masoor* lentil are a boon to the flood-affected areas, as they demand less water and less inputs but give good yield. Farmers find the cultivation of this *rabi* crop to be profitable. *Masoor* seeds do not germinate in rain, but can be sown in slush. So, while sowing, all that the farmers need to be sure of is that the weather will hold and it will not rain for the next few days. Once the saplings emerge, then water inundation will do it no harm.

The fields are ploughed twice in October and left for 8-10 days, after which they are ploughed again twice. This is done to make the soil fine and powdery. The sowing is done with the help of cultivator, between 14 October and 10 November. However, because of general paucity of bullocks and ploughers, the tractor is being used for ploughing now and the sowing is done by seed-drill. *Masoor* is also sowed by broadcasting, though the farmers say that this method gives less yield.

Masoor cultivation general does not need irrigation, but in special cases, as on elevated land or near the village, a light irrigation is given. The farmers also apply DAP fertilizer for better yield. *Masoor* is prone to *wilt* disease, which affects the plants after 35 days and as a consequence the entire crop begins to waste. For this, it is important that ploughing is done at the right time.

The crop is ready for harvest by early March. It is threshed by bullocks or machine, as applicable. To save time, some small farmers even take on threshing machine on hire. However, threshing by machine may break the pulse seeds.

So, while *masoor* cultivation cannot be done in heavily water-logged area, it provides considerable relief to small farmers in less flood-affected areas.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Ploughing – 4 times	1500.00	6 qtl @ Rs 2000	12,000.00	6,150.00
Seeds – 15 kg @ Rs 20	300.00			
Seed-drill machine on hire	450.00			
DAP – 60 kg	600.00			
Labour – harvesting and threshing	3000.00			
Total	**5850.00**		**12,000.00**	**6,150.00**

Case study

45 years old Sh Jaishankar Rajbhar, son of late Sh Ramdeni Rajbhar lives in Silaich village and owns two bigha of land. He works as a labourer for his livelihood. But life is difficult for his 13 members family, specially as floods wipe out his crops almost every year.

Jaishankar considered changing his farming practice and decided to go in for masoor cultivation. He sowed masoor on one bigha land in October and by March, the crop was harvested and brought home. The yield was three and half quintals. In this entire process, he spent Rs 2250 and got a crop whose market value was Rs 7000 a clear profit of Rs 4750. This helped him both ways taking care of his family's food security and providing him some income.

Water retention for long periods is proving to be harmful for *Masoor* cultivation, and so, in view of changing climatic conditions and untimely rains, it is threshed by machine.

Kulthi Cultivation
(Dolichus biglorus Horse gram)

Kulthi is a climber pulse and had medicinal properties particularly useful for problems of kidney. Taking its pulse preparation for 15 days continuously clears the body of stones in the kidney.

Horsegram (*kulthi*) pulse is a creeper and has soyabean like pods. It makes very tasty preparation and has medicinal properties, particularly useful in kidney stone problems. Its dried vines make good fodder, and skin on its beads that comes off while cooking is particularly good for milch cattle. The plant grows well in areas with less temperature, in less fertile soil and requires very little fertilizer and water.

Usauthon *gram sabha* (Block Bisphi, District Madhubani, Bihar) is a backward, flood-affected area, where people are not able to do any agriculture in the monsoons. However, after the floods recede in September, people cultivate Horsegram which is used for consumption and is sold as well. In the Campierganj block of district Gorakhpur too, Horsegram cultivation has been successfully started in one or two areas.

Sandy and sandy-loam soil is good for Horsegram. In September, once the floods have receded, the field is ploughed twice to soften the soil, then once more along with sowing, after which the field is immediately leveled with a cultivator to retain some moisture. The seeds are generally broadcast, though sometimes also sowed in lines. It is always better to test the germination of seeds before sowing.

Being leguminous, Horsegram does not require much fertilizer. However, treatment of seeds with rhizobium culture, gives better yield. Also, treating the seeds with 4 gm Tricoderma before sowing prevents diseases infestation. Weeding is not really necessary unless there is dense undergrowth. Irrigation too is not really necessary and certainly never at the time of flowering, but if it can be given at the time of gram formation in the plant, it gives better yield.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
	500.00	8 qtl @ Rs 1500	12,000.00	10,235.00
Seeds – 12 kg @ Rs 25	300.00			
Fertilizers and pesticides	15.00			
Irrigation	250.00			
Labour – harvest and transport	500.00			
Labour – other	200.00			
Total	**1765.00**		**12,000.00**	**10,235.00**

Case study

Located on the banks of river Rapti, Gairuyi Khurd (Block Campierganj, District Gorakhpur, UP) is a victim of floods every year. Sitaram Chaudhary in this village is a progressive farmer, ever keen on adopting newer experiments and methods in farming. On an exposure visit to Madhubani (Bihar), organized by GEAG, he saw and got interested in Horsegram cultivation, understood its farming technique and brought back with him seeds to sow on his land. Although the time for sowing had delayed, Sitaram still obtained a good yield. This encouraged him, particularly as his arhar crop always failed because of floods. Sitaram grows Horsegram from September to November, so rabi cropping too is not affected. In fact, the nitrogen fixing roots of Horsegram make the field more fertile for the next crop. Encouraged by the results obtained by Sitaram, other farmers in the village too are getting attracted towards Horsegram cultivation.

A crop of the arid land, the cultivation of *Kulthi* does not require any special care, uses less inputs and gives good yield and profit.

Boro Paddy

In low-lying, water-logged areas where it is not possible to grow *rabi* crops, the cultivation of different varieties of *Boro* paddy, with their ability to withstand low temperatures as well, is being done successfully.

Paddy is essentially a *kharif* crop, but the traditional variety *Boro* is grown as a *rabi* crop in the water-logged areas and shallow lands. In other words, the fields which are unsuitable for sowing of *rabi* crops because of water-logging or other reasons, can be used for *Boro* cultivation. In certain parts of East Bengal and Bihar, where there is water-retention on land the whole year round, people draw three crops of paddy, of which *boro* is one. This medium period coarse variety gives good yield on very little inputs - about one and half times than that of normal paddy varieties - and has a very good taste.

About 20 years ago that, impressed with the qualities of *boro* paddy, the farmers of eight *gram panchayat* in Campierganj block of district Gorakhpur Thakurnagar, Gopalpur, Lohurpurva, Kattaiya, Musabaar, Kaktahi, Chhitahi and Bhaurabari decided to go in for its cultivation. Today, there are many sub-varieties of *boro* available, of which Baranideep, Gautam, Prabhat, Richcharia, Saroj, Dhanlakshmi and Jayanti are particularly popular. Farmers can make a selection from these to suit their local geographical conditions.

Boro cultivation involves the following processes:-

- *Preparing nursery* Seeds are sown in nursery after 15 November. However, until they become firmly rooted and established, its saplings are very tender and prone to being killed by frost. As such, a variety which can adequately withstand cold during the early stage is selected. Alternatively, some farmers have started delaying nursery preparation to end-December. The nursery is made on a high land, and raised further to sow the seeds. No compost or fertilizer is used while sowing. The seeds need to be protected from birds. The saplings are ready for transplanting in 1-2 months.
- *Field preparation* As the field is water-logged, ploughing by cultivator is not feasible. But tractor can be used. However, the farmers generally dig-up the field with a hand-hoe (*kudaal*). The practice is called *korhai.*
- *Transplanting* The saplings from the nursery are tied loosely in bunches of 2-3 (locally called *puja*) and transplanted, keeping the distance 6 inches between both the bunches and the rows. Transplanting is generally done after *sankranti* (new lunar month).
- *Fertilizer* Fertilizer is not required as due to water-logging, weeds and other plants already rotting in the field provide adequate manure. However, some farmers apply 50 kg / acre urea, twice after transplanting.
- *Weeding* Weeding is required to be done two or three times to clear and aerate the field hardened by moss accumulation. The soil around the roots is loosened by hand and not with the weeder-hoe. It is a laborious work.
- *Irrigation* As this paddy grows in water-logged areas, no special arrangements have to be made for irrigation. But water must be shifted every two-three days so that the roots do not rot. This is done by cutting the mound at one end to drain the water out, which is replaced by water from the lower surface. In April-May, however, irrigation is done as necessary.
- *Harvesting* *Boro* paddy takes almost six months to ripen, and is ready for harvest in May.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Ploughing - once	300.00	8 qtl @ Rs 1500	11,200.00	8,170.00
Seeds – 15 kg @ Rs 12	180.00			
Urea – 50 kg	250.00			
Irrigation	1500.00			
Labour	800.00			
Total	**3030.00**		**11,2,000.00**	**8,170.00**

Constraints

Boro cultivation, from planting to harvesting, is extremely labour intensive.

Generally labour is not hired from outside, nor is machine used, but members of the family do all the work. So, for small families or physically weak members *boro* cultivation can be very difficult.

Also, over time, sand and silt deposition by floods is changing the characteristics of shallow and low lands, as a result of which the water retention period is steadily decreasing in these areas. So, people have started cultivating some other crops as well, including wheat.

All told, *boro* is an ideal crop for water-logged lands, which helps people overcome some of the adversities brought upon by floods. In fact, it is recommended that, on the basis of local conditions and resources, *boro* cultivation can be tried on a large scale.

Boro gives one and half time more yield than normal *kharif* paddy, but its cultivation is not easy considering that its transplantation, weeding and harvest are all done in water.

Case study

Smt Gyanmati Devi is a farmer from village Kattaiya and owns one acre of land to the east of the village in the Kalan nallah. Her land is perpetually inundated with water, as a result of which she is not able to do any agriculture. In 1988, with the encouragement of GEAG, she started cultivating boro paddy. She used about 242 kg of seeds in one acre of land.

As the water-logged land cannot be ploughed, she mixes and mashes the soil with feet. Weeding too is done by hand, breaking the soil near the roots of the plants. Gyanmati says that all this is extremely hard and labourious, but considering that very little inputs are required and a high yield obtained, boro cultivation is worth it. From one quintal paddy, she gets 50-55 kg of rice, which is tasty and quite filling. Importantly, boro cultivation ensures her family's food security for the entire year, and she sells a part of her produce to get some valuable income as well.

Adaptive Capacities of Community to cope up with flood situations

Melon Cultivation on Sand

On lands adjoining the rivers that are heavily laden with silt left behind by floods and have become uncultivable for growing other crops, melon cultivation is seen as an economically profitable option.

Melon thrives on the sandy banks of rivers or land with a thick layer of sand, left behind by floods, where nothing else grows easily. The fruit is ready in mere 60 days and so, is in the market before the rains arrive and the farmers are able to make a good earning. Once the rain bearing easterly winds begin to blow, the fruit lose some of its sweetness.

Village Bharkachha (Block Brahmpur, District Gorakhpur), is located in *majhaar*, between the river Rapti flowing about 400 mts to the west of it and the river's embankment. During floods, the village gets completely marooned and its fields are filled with huge deposits of sand. People in this village, cultivate Melon on these fields to make a living and meet the basic needs of their families.

For Melon, the field is ploughed once and small pits in the form of shallow plates are dug for sowing the seeds. In one acre, about 1500 such plates are dug. Urea, potash, *etc.* are mixed into the soil and sowing is done from end-January to the first week of February. About 8-10 days after sowing, the field is irrigated. In all, irrigation is done three times. After the fruits appear, some pesticide is applied.

Every plate bears 4-5 fruits, which are plucked in April-May as and when they ripen.

Cattle, left to forage on barren fields after the wheat harvest in March-April, and particularly *neelgai* (blue-bull), cause a lot of destruction to the Melon crop. As such, it is important to keep a look out for the cattle, which is an onerous task indeed.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Yield	Price (Rs)	Net profit (Rs)
Ploughing – once	300.00	1500 pits @ 4-5 fruit per plate @ Rs 20 each	30,000.00	20,500.00
Seed – 750 gms	3000.00			
Fertilizer – urea 60 kg, phosphate 24 kg, potash 24 kg	700.00			
Irrigation – 3 times	300.00			
Pesticides	200.00			
Labour	5000.00			
Total	**9500.00**		**30,000.00**	**20,500.00**

Case study

Sh Dayanand Sahni is a landless farmer living in village Bharkachha. Every year, he takes a bigha of land on lease at the rate of Rs 2000, to grow Melons. On that land, he is able to prepare 500 plates and his other cost inputs total Rs 1500. At the end of the season, from the sale of Melons, he makes a profit of Rs 5000, which eases the economic burden of his family and somewhat compensates for the losses in flood. Dayanand says that because of Melon, he does not feel forced to migrate in search of livelihood.

Since melon is grown when the land is left fallow, the fields have to be watched against stray cattle. This, however, is a minor cost for the good yield that the crop gives.

Mat Weaving

Landless families can somewhat secure their livelihood by extracting and weaving mats from the *Narkat* grass that grows naturally in the low-lying areas of the flood-affected regions.

Narkat is a tall grass plant, which grows naturally in low lands. People use its grass blades to make mats. So, for no investment except their own labour, weaving *narkat* mats provides a good livelihood option for the small and landless farmers.

Narkat is found in bamboo growing areas, and grows aplenty, year round, on wastelands, alongside ponds and nallahs. It does not require any kind of investment on land or seeds. Mats made from it are used for floor, roofing, boundary partition, *etc.* Although people make and sells these mats throughout the year, the maximum sale is seen in October-November.

When *narkat* attains a height of at least 8-10 ft, it is cut and dried slightly. The grass is not uprooted but only its blades are cut. The grass re-grows to its full height in two-four months. Though *narkat* is available throughout the year, it is difficult to cut if there is more water in the pond or nallah. So, monsoon is a lean period for mat-making.

Before the cut blades become completely dry, they are beaten thin and fine, and then weaved into mats. Normally, in a day, a person can weave 15 mats, which sell in the market for Rs 15-20 each.

A broad cost-benefit analysis for a person engaged full time in *narkat* mat weaving occupation and working for about 8 months (240 days) in the year, when the grass is available in good condition, is given in the table below. This is taking into consideration that the person is able to make 15 mats per day, which means that he makes 3600 mats per year. Of course, actual profits would depend on how much the person is actually able to sell, which is not an easy task.

Of late, one of the problems being faced in this enterprise is the decreasing state of water resources and ponds, which is affecting the availability of *narkat* grass.

Cost-Benefit Analysis (Per Acre)

Inputs	Cost (Rs)	Production/sale	Price (Rs)	Net profit (Rs)
Cost of *narkat* grass @ Rs 2 per mat.	7200.00	3600 mats @ Rs 15	54,000.00	46,800.00
Total	**7200.00**		**54,000.00**	**46,800.00**

Case study

48 years old Sh Ramsahare lives in Bintolia village (Block Khorabaar, District Gorakhpur, UP) and owns just marginal land. He finds making livelihood from narkat mat-weaving much easier and better than working as a daily labourer, as the former requires no special, separate cultivation. He has to go out to collect narkat grass, which he does mainly from nearby the Pipraich sugar mill, alongside the embankments in Khorabaar, and from the land adjoining Majhna nallah in Ahirauli, Kushinagar. He weaves narkat mats before the floods, during floods and also after the floods. He is able to make 15-20 mats per day, which sell for Rs 15-20. He says, with this, he does not feel any lack of livelihood source.

Though decreasing water sources are making the availability of *Narkat* grass difficult, some landless families still practice *Narkat* mat weaving as a livelihood enterprise.

Video Documentation

A. Crop based Activities

1. *Boro Paddy*
2. *Ghoghar Paddy*
3. *Turanta Paddy*
4. *Early variety of paddy Narendra-97*
5. *Oil Crop - Lahi*
6. *Satha Paddy*
7. *Sonkhar Paddy*
8. *Sengar Paddy*
9. *Bangali / China Paddy*
10. *Bhainsa Lotan paddy*
11. *Maize Cultivation*
12. *Kulthi (Horse gram) Cultivation*
13. *Barseem Cultivation*
14. *Dhaincha Cultivation*
15. *Lentil Cultivation*
16. *Two pulse crop in mixed cropping*
17. *Cultivation of Elephant foot yam*

B. Livelihood based Activities

1. *Berra*
2. *Kamalgatta*
3. *Trapa*
4. *Tissue Culture Banana*
5. *Guava*
6. *Tinni Paddy*
7. *Cultivation of Karmua Leaves*
8. *Tomato Cultivation*
9. *Cultivation of pointed guard*
10. *Potato Cultivation*
11. *Musk Melon*
12. *Water Melon*
13. *Lady finger Cultivation*
14. *Onion Cultivation*
15. *Lobia CP-4*
16. *Vegetables Nursery*
17. *Eve Guard*
18. *Ajawain*
19. *Bottle Guard*
20. *Duckery*
21. *Pidar (Vegetables)*

C. Disaster Preparedness

1. *Silage*
2. *Grain Bank*
3. *Fodder Storage*
4. *Boat Maintenance*

D. Land and Water Management

1. *Bent Cultivation*
2. *Deep tillage for aeration*
3. *Elevation of village level*
4. *Improving Drainage*
5. *Bamboo Cultivation*

E. Advocacy

1. *Culvert Cultivation*
2. *Information Reference Centre*
3. *Livelihood Rights Association*
4. *Vaccination of Cattle*
5. *Protection of Embankment*

Adaptive Capacities of Community to
cope up with flood situations

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