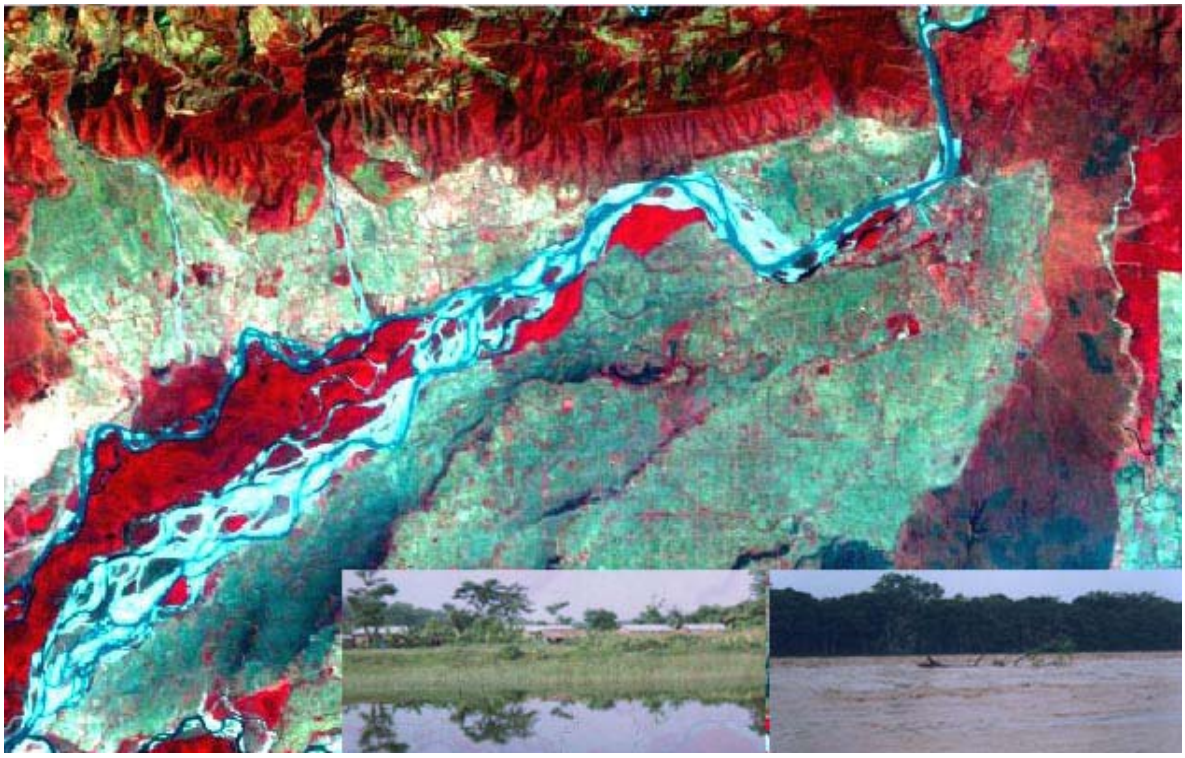
Impacts of Flood Hazard and Coping Strategies:

A Case Study of Jagatpur Village Development Committee in Chitwan District, Nepal



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Conversion Table

1 NRs = 72 U$D (July, 2004)

1 Mana = 0.454 Kilogram

1 Muri = 53 Kilograms

1 Kattha = 0.03387 Hectare

1 Bigha = 20 Kattha

CHAPTER I

Introduction

This chapter's addresses the background it also gives a description and justification for the project, together with research problem and objectives.

1.1 Background:

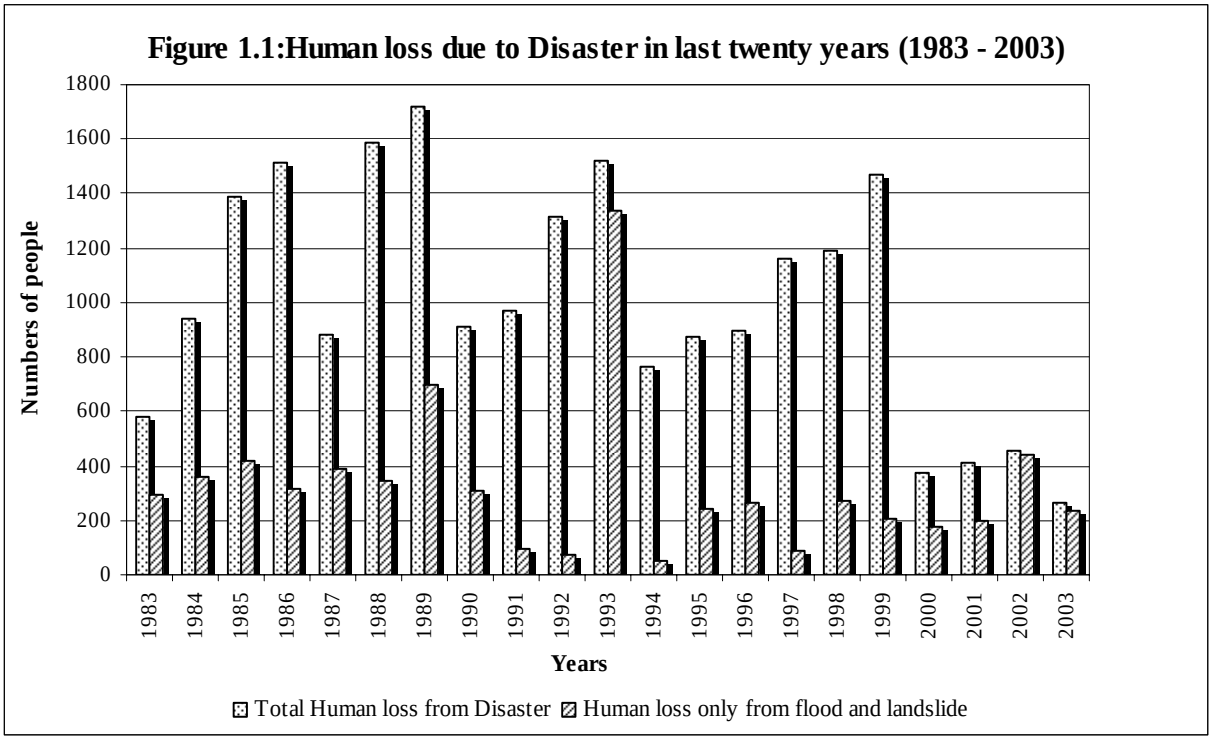
River flooding represents the most common global hazard causing phenomenal losses. Throughout human history, swelling rivers and floods have taken a heavy toll on properties and lives and caused more economic losses than any other hazard. The largest disasters in terms of human casualties ever were the floods of 1887 in the Huang He (Yellow river) in Henan region in China. This cost about 900,000 lives. And the floods in the Hwai and Yangtze rivers in August 1950 destroyed around 890,000 dwellings in eastern China. In addition, 1.4 million hector of land in the affected area was untellable for the entire planting season (*Guinness world record, 2004*).

According to a study (UN, cited in BBC), at least 2.5 billion people have been affected by natural disasters over the past 10 years, an increase of 60 percent compared to the previous decade. More than 478,000 people were killed by disasters such as earthquakes, floods and hurricanes, from 1994 to 2003. The most vulnerable people are those who are living in developing nations. Asia is the most affected continent, representing more than half the casualties and over 90 percent of the affected people over the decade. About 44 percent of the flood disasters that occurred in the world during the period 1987–1996 affected Asia.

Nepal has about 83 per cent of its land area covered with mountainous terrain and the remaining 17 percent in the south lies in the alluvial plains. Himalayas is highly susceptible to water induced disaster due to the high relief, steep slopes, relatively steep river gradient with large sediment loads and intensive nature of rains.

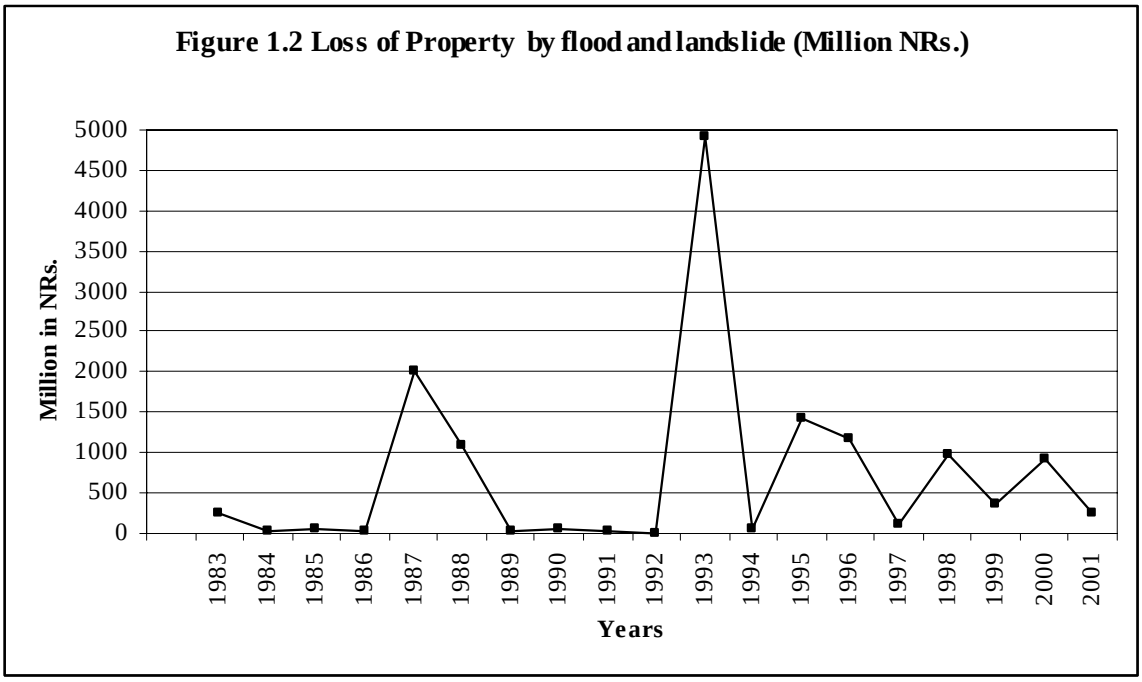
A flood may be defined as a discharge of excessive water which exceeds the channel capacity. Since Nepal is highly prone to catastrophic hydrological events such as frequent events of cloudbursts, glacial lake outburst floods, the breaching of landslide dams etc., the discharge associated with these events often causes devastating floods.

Flooding is one of the most pervasive and costly natural hazards faced by the Nepalese people. The problem of flood hazard is particularly prominent in the southern plains of Nepal. According to Ministry of Home Affairs (MOHA, fig 1.1), 21196 individuals lost their lives from different disasters in the period between 1983 and 2003. Out of this, 6799 lost their lives due to water induced disaster (flood and landslide). Around 100 people each year disappear due to natural disasters. An estimated loss of NRs. 14257 million due to natural disaster (excluding epidemics) and 85862.5 ha of land is destroyed by land cutting and siltation. (Ministry of Home Affairs HMG/Nepal, September 2003). Out of these 85862.5 ha of estimated destroyed land, the portion of loss of agriculturally productive land is significant (NPC 1994, as cited in Blaikie & Sadeque 2000).



Source: Ministry of home Affairs, Disaster section HMG/Nepal 2003

The problem of flood hazard is particularly prominent in the southern plains of Nepal where the gradient of the river channel is very low. Rivers in the Tarai are most capricious and cause the heaviest flood damage. The southern slopes of the Chure hills and Mahabharat receive some of the heaviest and most intense rainfalls. This leads to high run-off in stream channels. The peak monsoon (July to September) flow of these streams can be thousand times greater than its lowest flow (December to April) level. Some of the rivers are dry during the winter season, while in the monsoon they become active and cause immense damage (Dixit, 1999).



Source: Ministry of Home Affairs, Disaster section HMG/Nepal 2003

The chart above (fig1.2) shows that the year of 1993 was the most disastrous year, when worth approx. 4904 million NRs. of properties were destroyed. Chitwan district lies in the inner Tarai belt between Mahabharat lekh and Chure hills on the north, and the flatland Terai in the south. The past history shows that this district is extremely vulnerable to water induced disasters. Since 1993 more than 77 people have lost their lives due to floods and landslides in this area. The recent floods of 1993 and 2002 had some very devastating effects in the district. The total numbers of human deaths were higher after the flood of 2002, where as the loss of land, property, housing and livestock were higher in 1993 (table1.1).

Table 1.1: Loss of lives, family affected, land and livestock loss in Chitwan district

Year	Death (No.)	Injured (No.)	Affected Families (No.)	Livestock's loss (No.)	Land Damages (Ha.)
1993	24	17	5293	5880	3062
1994	0	0	0	0	0
1995	0	0	0	0	5.4
1996	0	0	12	NA	1
1997	2	1	55	NA	NA
1998	0	0	37	NA	1.47
1999	20	0	890	NA	0.13
2000	0	2	124	NA	NA
2001	1	0	222	NA	270.89
2002	30	147	1928	859	3625.56

Source: Ministry of home Affairs, Disaster section HMG/Nepal 2003

A total of 5293 families were directly affected by the floods of 1993 where as only 1928 families were directly affected by the floods of 2002. However, the loss of land was almost the same in these cases, accounting 3062 hectare in 1993 and 3626 hectare in 2002. (Source: Ministry of Home Affairs HMG/Nepal 2002).

Jagatpur Village Development Committee (VDC) of Chitwan district, which is located in the Central Eastern region of Chitwan, is one of the most vulnerable areas in the region to floods. The effect of the flood of 2002 on the VDC was so serious, that it even caught the media attention with huge and highlighted headlines. Many people became homeless and poor overnight. They were forced to live in tents for more than 6 months. 40 household families lived in tents for more than a year because their land was turned to a lake, waterlogged by the flood of 2002 and 2003. Later on, these 40 households were rehabilitated by Nepal Red Cross Society.

This VDC was selected for my study because of these recent flood related disaster impacts on the local people of the affected areas, and their attempts to find different strategies to sustain their livelihoods. In this study I have focused mostly on the nature and extent of the impact of the flood and how the nature, dynamics and processes by which the victims of the disasters mobilize and sustain their coping strategies for their livelihood.

1.2 Research Agenda:

The problem of flood in certain plain areas in Nepal is a chronic problem. This causes a great deal of uncertainty to the people's livelihood in this affected areas, as more than 80 percent of the rural people are engaged in subsistence agriculture and agriculture related productive activities.

The growing increase of population in these low-land plains is what characterizes the general trend, particularly after the eradication of malaria which was launched in the in the 1950s and 1960s. After the eradication of malaria, huge numbers people from the northern hill/mountain areas migrated to these plain areas in search of fertile land. My study area was no exception to this process. The pressure was increasingly mounting on the occupation and use of fertile and productive land. This processes forced to utilize even the most marginal and vulnerable land areas which very prone to floods. This leads to a large proportion of the population settling in

such areas are becoming increasingly vulnerable to natural disasters (Tianchi and Berns, 2002). My study areas are a case that arrests this situation and process.

Prior to the flood of 2002, the economic situation in the VDC seem to be doing good, mainly because of the increasing expansion of the tourism related activities and the establishment of National Park in this study area. The value of land soared in this area almost every year. People of Ghailaghari village in Jagatpur VDC could were using some of their fertile land to settlement purposes. People were slowly moving from subsistence agriculture to tourism. The flood in August 2002, turned every thing upside down for the local people who were directly affected by it. The flood affected the people living in areas of the Ward 1, 2 and 7. And the floods that took place in the three subsequent years made things even worse for the local people in the affected areas. Although they had faced floods before this as well, only the flood of 1974 has had the same the same magnitude.

The impact of flood on the lives and livelihoods of the local people was enormous. Most of the fertile land in areas Ward number 1 and 2 were silted by course sand and gravels. This turned most of the affected land uncultivable. Some households tried to grow paddy in semi partially silted areas, but the productivity was comparative extremely low. These circumstances have forced the affected local people to choose other diversified strategies, for income, survival and livelihood.

The flood has given rise to many problems. They damaged crops and too human lives. The infrastructure such as roads, brides, embankment, schools and public buildings, hotels and bazaar are damaged or destroyed. Hundreds of homes and shades were washed away. Livestock's including cattle, goats and poultry that people own and were heavily dependent on were complete destroyed. The farmers lost their stocks of food grains seeds and agricultural implements and the valuable properties. The agricultural wage-laborers who were completely dependent on the daily wage earning from the agricultural labor activity lost the basis of the payable labor engagement. After this it was difficult for them to find jobs in the fields. Many people had to flee their homes and take shelter on elevate areas, and now they were entirely depended on charity for survival. The people of Ghailaghari and Dhruwa village stayed in tents for more than 6 months.

Now, after the silting of fertile land and destruction of irrigation canals and other infrastructure, most of the local people have abandoned the area. Because of all this the values of land has now sunk greatly. This has made it difficult for the local people to sell their land,

nor are they able to mortgage it. Neither the Government nor the National Park has yet provided compensation to the local people, though the area lies in the buffer zone of Royal Chitwan National Park. Before the flood of 2002, the local people residing along the riverbanks had faced effects of floods in different manner and different magnitude: from severe to moderate in nature, quite regularly, though. However, as it has been pointed out above, the people of the study area had not experienced such a severe flood earlier. Before 1993, the major problems were associated with the damages caused by the cutting of the river banks and the shifting of the course of the river. The Rapti river has changed its course more than 2 km in 30 years time. The government has rehabilitated 84 families by replacing them to Banke (Khajura) and Bardia (Kathapur) districts of mid western region of Nepal. The rest, around 100 households moved to the other areas of the same VDC in Dhruwa Tadi, in 1974.

In the study area there are mostly mixed socio economic and caste/ ethnic groups. Most of them migrated to this VDC after 1950s and 1960s, after effective implementation of the malaria eradication program. Because of the nature of short history of their settlement and mixed ethnic and case combination, the people in these are seemed to have weaker reliable social networks or more networks.

Before the flood of 2002, the livelihood of the people in the study area was, as mentioned above, mostly based on subsistence agriculture and tourism related activities. Now as these two main bases have been severely affected, they have to adapt to different livelihood strategies to secure their livelihood. The local people's livelihood in my study area as else where in developing countries, can be categorized into three broad groups (Scoones, 1998). These strategies are subsistence agriculture, livelihood diversification through non – agricultural activities and migration to other areas. In the study area it was seen that people are mostly adopting the non-farm activities and very few people are migrating in search of jobs or move permanently to settle in other parts of the country.

So, the major focus of my study will be to examine the coping strategy of local people and explore the alternative flood related livelihood strategies.

1.3 Specific Objectives of the Study:

- To identify and map the area affected by flood or susceptible to flood;
- To analyze the impact of flood on the livelihood;
- To examine coping strategies developed by the local people to flood hazard, and explore the alternatives.

Thus, the following are my research questions that I would like to answer.

- Which parts of the study are most prone to flood hazards?
- Identification of Flood hazards prone area mapping based on community focus groups and geomorphic features.
- What are the effects of flood to the livelihood of different groups affected by flood?
- What is the extent of flood problem and its acuteness in different parts of the study area?
- How do the flood victim have been coping the problem of flood?

1.4 Structure of Thesis:

The thesis is divided into eight chapters. This chapter sets the context of the study. The second chapter deals with the theoretical framework used in this research. Third chapter presents methodological issues and field research procedure. The fourth chapter gives a general overview of the study area. Fifth chapter deals with the history of flood and its causes. Chapter six deals with the impact of flood hazard, economic, social conditions. Chapter seven focuses on the coping strategy adopted by the people in the study area during different phases of the crises, such as pre disaster, during disaster and post disaster. The final chapter discuses the results and gives conclusion of the study.

CHAPTER II

Theoretical Framework

Theories are very important in any research projects because they serve as a guideline in the research process. According to Jogger and Rothenberg (1993) 'A theory, in the broadest sense, offers a general account of how ranges of phenomena are systematically interconnected; by placing individual items in a larger context, it increases our understanding both of the whole and of the parts constituting the whole. Because people always want to make sense of their worlds, for the sake of intellectual satisfaction as well as practical control, every human society develops theories designed to organize reality in ways that make it intelligible' (Jaggar and Rothenberg: 1993; p.75).

In the context of my study I have used two theoretical frameworks to discuss the finding of my research, Sen's Entitlement and Vulnerability approach (1981) and Carney's Sustainable livelihood frameworks (1998) as a single integrated approach to my study.

2.1 The Entitlement Approach to Vulnerability:

Sen's entitlement approach to hunger and famine is very influential in the Vulnerability research. It is necessary to assess all various channels that a household can use to obtain the food. He calls those channels as Entitlements. In normal years entitlement to food and livelihood is gained through a combination of production, exchange of cash, goods, services, sale of labour and assets including investment, stores and claim this can be labeled the endowments. Food can either come from a direct entitlement, when a household grows its own food, and indirect entitlement, when a household obtain food by using income to purchase food, or a transfer entitlement when a household obtain food by charity and social networks.

The failure of food availability approach gave birth to the entitlement approach. Food availability alone does not ensure access by all. Inequality in access to resources will lead to unequal distribution of food and opportunities, and the purchasing power is of paramount important that lead to decline of this approach.

The entitlement approach originated from the pioneering work of Amartya Sen (1981), Sen summarizes the belief the entitlement approach thus:

" *The entitlement approach to starvation and famines concentrate on the ability of people to command food through the legal means available in the society, including the use of production, possibilities, trade opportunities, entitlement vis – a – vis the state, and the other methods of acquiring food. A person starves either because he does not have the ability to command enough food or because he does not use this ability to avoid starvation"* (Sen. 1981, 45)

According to Sen, famine is not cause by food failure but by a failure of people to command over food, e.g. exchange failure or entitlement failure. Famine occurs when large groups of people experience this type of entitlement failure (ibid.).

Household with an adequate endowments portfolio are relatively secured, than the household with less endowment. In terms of food stress, coping strategies form an additional set of entitlement that is derived from endowments (land, labour, livestock and other resources). Households characteristic represent various forms of assets, which ensure entitlement, that will determine whether the household will cope or not.

Sen, uses the term entitlement to cover a set of resources and relationship determining the control a household has over food and other basis needs. A household entitlement has two dimensions: endowments and exchange. Firstly, a household is considered to be endowed with a set of resources which conditions the range of economic options available to it (Pryer, 2000).

The entitlement model is dynamic, and potential is provided by exchange of any part of what is owned (for money or kind) with food and other basis needs. For example, human labour may be sold for a wage; commodities produced may be used for domestic production or sold on to market. A household may therefore have a large range of possible sources of entitlement which together may be seen as constituting its livelihood (ibid.). A livelihood strategy is defined as the way in which a household combines and utilizes its various form entitlement to maintain its member on a daily basis. Vulnerable livelihoods are than considered vulnerable to extreme weather, illness and disease, loss of land, loss of earning and labour and adverse treatment in the socio political system. When such households are unable to cope with difficulties of this kind, they may be reduced to starvation and beyond (ibid.). A person has to starve if his entitlement set does not include any commodity bundle with enough food. A person is reduced to starvation if some change either in endowments (e.g. alienation of land, loss of land, or loss of labour power due to ill health), or in his exchange entitlement mapping

(e.g. fall of wages, rise in food prices, loss of employment, drop in the price of goods he/ she produces and sells, makes it longer possible for him to acquire any commodity bundle with enough food (Sen, 1995).

For many the only substantial asset that they may own is their ability to work i.e. labour power. If a person or household fails to secure employment, then that means of acquiring food (through getting job, earning an income and buying food with that income) fails. If, in addition, the laws of the land do not provide any social security arrangements, e.g. unemployment insurance, the person will fail to secure the means of subsistence (ibid, 1987).

Entitlement approach argues that crop failure due to natural calamities often result in high food prices because of supply shortage. Ultimately, the poor and who are negatively affected by bad weather becomes famine victim, because of reduced purchasing power. (Yifu Lins, 2000)

The entitlement approach, which focuses on both ownership and exchange, offer a useful framework for summarizing the impact of flood or drought on different livelihoods groups (Chen, 1991).

The Sen Approach has been critisised by many authors for its vagueness and multiplicity of associations attached to the term entitlement. The entitlement approach basically based on explaining the famine related disaster. The entitlement approach is narrowly focus, confinement to analysis to one final outcome namely food, Davis, (1996) argues that food security is only a part of livelihood strategies. There is no reference to endowments mapping in Sen (1981), such as he avoids asking what determines the endowment set of the people or the household, how endowments are transferred in to entitlement and how people gain it. And the other shortcoming of earlier Sen work is he principally compared with the command over resources based on market channels, for instance the formal legal property rights are neglected, formal and informal institutional arrangement, (structural and processes) shape the process of endowments mapping.

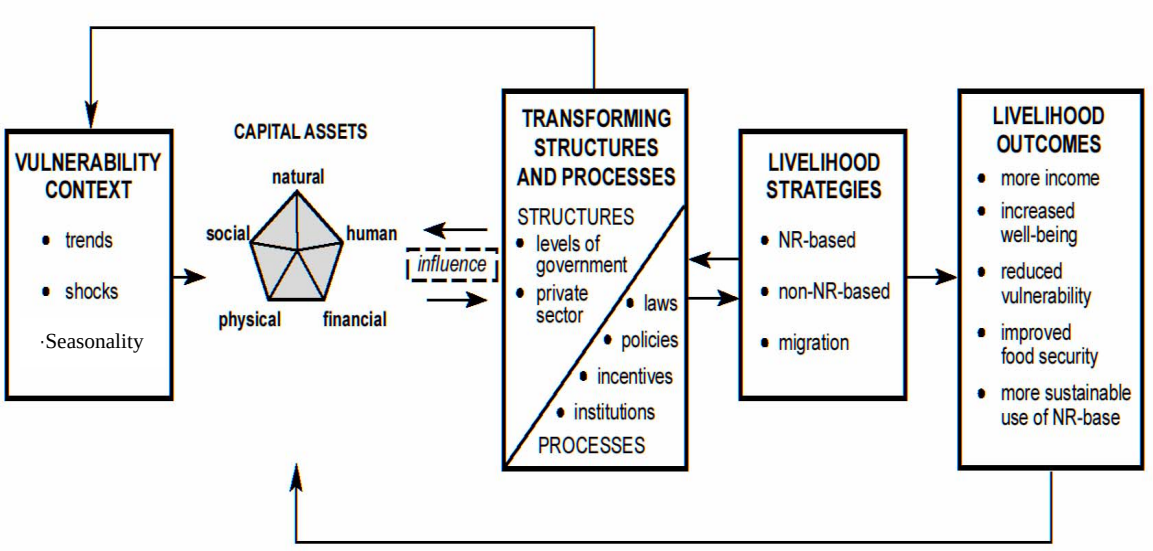
2.2 Sustainable Livelihoods Approach:

Sustainable livelihood approach (SLA): Livelihood framework (diagram 2.1) is a tool to improve our understanding of livelihood, particularly livelihood of the poor. A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover

from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, and which contribute net benefits to other livelihoods at local global levels in the long and short term (Chambers. and Conway, 1992) and (Carney and Scoones 1998).

The SL approach was not developed specifically for the analysis of disaster, but more generally for a wide range of (usually agrarian) policies. None the less it is implied that the occurrences of a disaster (or in livelihood terminology by shocks or stress) implies vulnerability context for the affected households. After all, disaster can be prevented or palliated, and recovery achieved, without necessarily reducing the reproduction of sustainable livelihoods (Wisner et.al, 2004).

Diagram 2.1: Sustainable rural livelihoods Framework:



(Adapted from Chambers and Conway, 1992; Carney, 1998 and scoones, 1998).

The Vulnerability context frames the external environment in which the people exist. People livelihoods and the wider availability of assets are fundamentally affected by critical trends as well as by shocks and seasonality. **Shocks:** A shocks is a short time act or stress such as disaster and destroy assets directly in the case of flood, storm etc. They can also force people to abandon their homes areas and dispose of assets such as land as a part of coping strategies. The affect may be more or less which ultimately depends on the household's ability to defense the stress. Unless and until, there will be no effective coping strategies against to resist the shocks, the sustainability of livelihoods will always be questionable. **Trends:** various trends like population trends, agricultural growth and productivity trends etc. They have a particularly important influence on rates of return to choose the livelihood strategies. **Seasonality**: Seasonal shifts in prices, employment opportunities and food availability are one

of the greatest and most enduring hardships that create and adverse effects in the lives of the poor people. Seasonality effect the disadvantages in a number of ways as seasonality is central concern of poverty in the least developed country, where agricultural and rural livelihoods depends on seasonal fluctuation in access to food. “In general poor and more powerless people are, the more they tend to suffer during the season of hunger and sickness” (Gill, 1991). In the context of my study area due to the impact of flood many people have lost their employment, income and the properties and they are suffering a major problem in their daily earning and adopting various coping strategies to improve the situation and to survive.

Livelihood analysis seeks to explain how a person obtains a livelihood by drawing upon and combining five types of ‘capital’ i.e. human capita (skills, knowledge, health, and energy); social capital(networks, groups, institutions); physical capital(infrastructure, technology and equipment); financial capital (saving, credit); and natural capital (natural resources, land, water etc.).

2.2.1 Vulnerability Context:

Vulnerability occurs because livelihoods and social systems are exposed to stress and unable to cope effectively with that stress. Vulnerability is the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of natural hazards (Wisner, et.al, 2004).

Blaikie, et.al. (1994) From Natural Hazard perspective, defines vulnerability as “the characteristics of a person or group in terms of their capacity to anticipate, cope with resist and recover from the impact of natural hazards”. They also argue that household that has access to resources and social networks are less vulnerable than the household who does not have access to resources and social network.

Vulnerability and the extent of ability of an individual or household to recover from shocks are linked to the resources or assets that a household holds, so the relationships between vulnerability, assets and poverty are important to understand. Vulnerability is not a synonymous with poverty is important but means defenselessness, insecurity, and exposure to risk, shocks and stress. It is linked with assets such as human investment in health and education, and also productive assets such as houses, domestic equipment, access to community infrastructure, stores of money, jewellery and gold and claims on other household, patron, governments and the international community for resources at times of need (Chambers, 1989; Swift, 1989 cited in Pryer, 2000).

The access to resources is always based on social and economic relation including social relation of production gender, ethnicity, status and age, it varies greatly between individual and groups and this affects their relative resilience to disaster. Those with better access to information, cash, and means of production, equipment and social network are less vulnerable and are generally able to recover quickly, crisis and insecure conditions put the life of people into more risk and vulnerability so, each household may have experience to different type and nature of risks depending upon their livelihood strategies, and their resources. (Blaikie, et.al.(1994). Some households structure their income opportunities in such a way as to avert the risk of threatening events such as flood. They also employ survival strategies and coping mechanisms once that event has occurred, though this usually involves an element of physical or institutional preparation.

A household is in a vulnerable state if there is a high probability of suffering loss or damage to life or property from which there is a high probability of it not recovering quickly or fully because the effect are either irreversible or opportunities of recovering losses are negligible (Wichester, 1986, p 112 cited by ibid.).Vulnerability measures the resilience against the shock, and the likelihood that a shock will result in a decline in well-being. Vulnerability is primarily a function of a household 'assets, endowments and exchange, and the insurance mechanisms, and the true characteristics (severity, frequency) of the shocks. If the household has low income this means that they are less able to save and accumulate assets, which ultimately restrict the ability to deal with a crisis. Households mitigate risk through income diversification, from wage income, self employed income, investments in physical and human capital (Pryer, 2000).

Poor people have to rely largely on self insurance. Household insure themselves by collecting assets in normal times, and then drawing on them in bad times. So the household who does not have any assets are vulnerable, so such household rely on mutual support network of members of a community or extended household, among members of same occupation. When a shock occurs the poor household must obtains immediate increases in income or cut spending, but in doing this they incur a high long – term cost by jeopardizing their economic and human development prospects. These are situations that lead to child labour and malnourishments, with lasting damage to children and breakdown of families. In the lean season in Bangladesh children work on farm, tend cattle or carry out household task in exchange for food (ibid).

The poorest people have fewest assets, so in general the poorest households reach the threshold of collapse much faster than other (Chambers, 1989).
Sen, (1981) discuss the vulnerability of people involved in informal serviced sector or landless labourer, in the Asian context. Such group of people don't have the opportunity to undertake second stage coping strategies of selling assets nor have they opportunities too make short term adjustment to livelihoods such as changing cropping pattern. (Adger, 1996).

2.2.2 Livelihood Assets:

Household characteristic represent various forms of assets, which ensure entitlement, that will determine whether the household shall cope or not. Household are vulnerable to hazards in varying degree when a household is confronted with a certain hazard, this can result in hunger. Livelihoods strategies are the key to understand the way the people cope with hazard. Livelihood assets, Physical, natural, social capital, human financial: these assets are dynamic and very among household. Supporting the range of assets of poor people – human, material, financial, and social – can help them to manage the risk they face (Chambers, 1989, scones, 1998).

Different livelihood activities have different requirement, but the general principal is that those who are amply endowed with assets are more likely to be able to make positive livelihood choices, what combination of livelihood resources (different types of capital) result in the ability to follow what combination of livelihood strategies (agricultural intensification / extensification, livelihood diversification and migration with what outcome? (Scoones, 1998). I would like to see what strategies the flood victims are adopting to cope in the time of crisis.

Within a particular vulnerability context defined for example by shifting seasonal constraints, short term economic shocks and longer term trends of change, people deploy five types of livelihood assets or capital in variable combinations, within the circumstances influenced by institutional structures and processes, in order to pursue diverse livelihood strategies with more or less measurable livelihood outcomes. The five capitals or assets are discussed individually below.

i) Human Capital:

Human capital represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives

(Carney, 1998). At a household level human capital is a factor of the amount and quantity of labour available; this varies according to household sizes, skill levels, health status etc. Household human capital plays a major role in earning the income for the household, which can affect the food security of a household. Human capital appears in the generic framework as a livelihood assets. The total number of people in a household will increase the ability of household, in a household if there are more grown children above 15 means more labour than a household with children less than 15 years, so the household who has more children are vulnerable. The ability of labour contributes to growth and growth contributes better livelihoods. Similarly if a household member is educated, may increase the ability of household to access information, will also be important members in the community. Good nutrition and better health provides quality for the individual member of the household to undertake all sort of activities as for e.g. off- farm activities and non- farm activities at their disposal. Hence, in a household, human capital is a factor of the amount and quality of labour available.

ii) Natural Capital:

Natural capital refers to a stock (of natural assets) that yields flows, of valuable goods and services from where the livelihood is derived. Natural capital could be tangible such as land, forest, water, wild resources, biodiversity, mineral etc. and intangible such as air, solar energy etc. Farm household members are heavily dependent on natural capital, those farmers who has access to land of various qualities, land holding sizes, and common pull resources, these type of household farmers will l improve their consumption and income both in the normal times as well as in the crisis period, as for e.g. flood that destroy agricultural land. Natural capital is very important to those who derive all or part of their livelihoods from resource based activities like agricultural production, fishing, gathering of forest product etc. Those farmers who are natural resource poor have to face many challenges in sustaining their livelihoods.

iii) Social Capital:

In the context of sustainable livelihood framework, social capital is the resources upon which people search their livelihood objective. The social capital includes network and connectedness, membership of groups, relationships of trust, reciprocity and exchanges, upon which people draw in pursuit of livelihoods. As in the case of Nepal, political patronage, Aphno Manche (own man); existence of these trend in a community influence a great deal in building and using social capital. Household with higher amount of social capital may be

particularly important as a resource of last resort for the poor and vulnerable people. Social capital provides a buffer that helps them to cope with shocks, act as an informal safety net to ensure survival during the period of crisis, it also compensate for a lack of other types of capital.

iv) Financial capital:

Financial capital tends to be quite versatile of all the other capital. The capital include, cash, credit/debt, saving and other economic assets. These capitals can be converted to various degrees of ease, depending upon transforming structures and process in to other types of capital (scones, 1998). The financial capital which is available to people may be savings, livestock's, sale of food stuffs, remittance, pension, credit and other income generating activities, all this capital will provide them with different livelihoods options.

v) Physical capital:

Physical capital which include privately owned assets such as farm, animals, tools and other machinery as for example agricultural tools; and public own economic infrastructure such as roads, electricity, school, irrigation etc. These infrastructure and producer goods needed to support the livelihoods. Producer goods are the tools and equipment that people use this tool for more productivity such as irrigation systems would enable farmers to increase the productivity, good network and transport will access the markets. According to Scoones, 1998, physical capital provides opportunities for making some livelihoods opportunities.

2.2.3 Structure and process:

Transforming structure and process will influence and shape behavioral pattern of people. Within the livelihoods framework are the institutions, organizations, policies and laws that affect rural households and help them to determine the access (to various types of capital, to livelihood strategies and decision – making bodies and source of influence); the term of exchange between different types of capital and returns economic opportunities open to them thereby shaping livelihoods. Now there are lots effort put by INGO and NGO to help farmers organize and form cooperative, helping them sources outsides markets. They are also giving credit to increase the wellbeing g of the rural poor.

2.2.4 Livelihood Strategies:

Livelihood strategies within sustainable livelihoods approach mainly consist of three broad clusters of livelihood strategies they are as follows: Intensification or more intensive use of the natural resources; diversification or expanding of the share non farm income in the household income portfolio; migration, either temporarily or permanently, from village to town or other areas. Different livelihood activities have different requirements, but in general principle is that those who are more endowed with capital are in the better position than the one who does not. The combination of activities that are pursued can be seen as a 'livelihood portfolio' the degree of diversification may relate to the resource endowments available and the level of risk associated with alternatives options. "Livelihood strategies are composed of activates that generate the means of household survival" Ellis, 2000:40). Livelihood resources may be accumulated so that reserves and buffers are created for times when stresses and shocks are felt. Capital accumulation would lead to transformation of assets, which would turn influence the livelihood strategies to achieve livelihood outcomes which are sustainable in the long run.

2.2.5 Livelihood Outcomes:

Livelihood outcomes are the achievement or outputs of livelihood strategies. These are the objectives that a household seek to achieve by the end of the day. Sustainable livelihoods outcomes lead to sustainable utilization of resources at both household and village level.

1. More income: the income derives from off farm on farm and through skills work, wages labour migration etc. Increased income also relates to the idea of the economic sustainability of livelihoods.

2. Increased well being: when a house hold will have ample food and opportunity of employment, this type of household will be in the stage of well being.
3. Reduced vulnerability: resilience in the face of stress and shocks is both key coping and adaptation strategies. Reducing vulnerability which means more resilience.
4. Improved food security: any household has to be food secure based on the earning from on farm or off farm activities and this is the core objectives of the household.
5. More sustainable uses of the natural resources will provides security at the time of shocks and stresses.

In any livelihood strategies, there will be trade- offs and possibly conflicts between different outcomes e.g. increase income for some groups damages the natural resources base, different household members have different priorities.

The livelihood approach extends over the Sen Entitlement approach (1981). The major strength of livelihood approach id it does not perceived people as vulnerable victims; rather as dynamic actors, they adapt to trend and cope with shocks, based on external condition, their vulnerability context. Vulnerability context includes five capitals which determine the life of people whether they will sustain or not. The transferring structure and process will influence and shape behavioral pattern of people. The endowments sets or resources have been clearly specified in the context of SLA approach. They have represented the resources by a model (pentagon) which comprises five capital or assets. Similarly outcomes are also broadly defined such as natural based, non natural based sustainability, income, well being etc. Heterogeneity of actors plays a key role in SLA for e.g. caste, gendered and the issue of inclusion and exclusion become a central part of the analysis.

The Sustainable approach is the approach which seeks to 'investigate how a person or community gains a sustainable livelihood using a range of resources with in given institutional rules and social norms, devises livelihoods strategies. However livelihoods outcomes are not always sustainable or positive' (Yaro, 2004.)

2.3 Coping Strategies:

Coping is the manner in which people act within the limits of existing resources and range of expectations to achieve various ends. In general this involves no more than 'managing resources', but usually it means how it is done in unusual, abnormal and adverse situation. Thus coping can include defense mechanisms, active ways of solving problems and methods for handling stress (Murphy and Moriarty 1976, as cited by Wisner and Blaikie 2004).

When a shocks hits, household cope by changing work pattern – moving more members in to the labour force, or working more hours – or by reducing expenditure, taking loans, leasing assets, or in the extreme they sell assets. Members of households may migrate to the village, or families may move together. If this also does not work than member will beg or ask for help (Pryer, 2000).

Households with good economic status will buy a land or house in safer place so that they can live there in time of crisis. As self protection is also a one of the strategy adopted by the affordable household. The other aspect of safety – social protection is the function of non monetary social relations as for example, mutual aid in a community, neighborhood, or extended kin. Besides this provision of preventive measure by government and other institution who supply and support the victims at the time of crisis (Wisner et.al, 2004).

Depending on the endowments, entitlements and other factors coping strategies will be vary by region to region, community to community, social classes, household, age , gender and season.

Mountain people face hazards on a regular basis, as they have developed many ways of coping, but they are vulnerable nonetheless, and many copes as long as possible, and are then force to abandon their homes (Dahal, 1998).

The coping strategies reported from various parts of semi arid rural India do not differs significantly: these include growing a mix crops and rearing a variety of livestock, earning the labour and tenancy market as needed, drawing down stored goods or fixed assets adjusting consumption, borrowing and drawing upon traditional security: what differs from region to and over times in the pattern who adopt which strategies, in what sequence and under what circumstances (Chen, 1991).

In a study in Rohini and Bagmati Nepal (Moench and Dixit, 2004), found that, household adopted a variety of coping mechanisms and strategies. When flood occurs, priorities tend to break down as follows: first of all the victim try to save themselves and will try to save the valuable goods for example jewelery and important paper. Secondly, they try to save their food supplies; thirdly they attempt to save their animals and fodder for them, in the time of severe flooding family's release their livestock's and they try to move them in the higher elevated parts, "how much can be save is viewed on their 'karma' as well as on the type and duration of flood"

When flooding cause crops to fail, families must look for other employment in order to sustain themselves until the next crop is harvested, if that is not damaged. After the floods people cannot mortgage their land to get money because it has little value and at the same time no body wants to buy the affected land. Thus, the incentives to invest further in farming declines sharply, families generally have two options to restore income sources following major floods losses. If they have access to irrigation and can count on growing a winter crop,

they borrow food from neighbors to meet their needs for a few months until harvestings time. If they lack access to irrigation most people attempts to find jobs within the village, or at a viable commuting distance. In the time of crisis it has also seen that most of the victims work in the relief actives which are one of the coping mechanisms. If the above said jobs are not available locally they migrate to nearby town and cities. For those who cannot move to other places or find jobs, selling land and gold ornaments and begging is the last resort (ibid.)

Crisis events occur from time to time in people lives, as well as in the lives of whole communities and societies, in which case they are often called disaster. Such events call for the mobilization of resources at various levels to cope with their impact. When people know an event may occur in the future because it has happened in the past, they often set up ways of coping with it. (Douglas, 1985 cited by Wisner, 2004).

"Poor households often cope by reducing consumption, removing children from school and seeking off-farm employment (at low wages)… Some studies concludes that an appropriate policy is needed to assist vulnerable household in this "diversification process".. However, support of coping behaviour can keep household locked in the vicious cycles of poverty… Concern exists that poor people have less ability to smooth consumption and this inability may lead to behaviour such as shifting to less risky portfolios that exacerbates income inequality" (Alwang and Sigel (1999: 20 – 21).

So, I would like to apply the above said approaches to see how the flood victims are coping, and how they were using the different available resources or the capital to sustain their livelihoods at the time of crisis, and what their livelihoods outcomes whether they are intensifying; Diversifying or migrating and what are there livelihoods outcomes sustainable or unsustainable.

Chapter III

Methodological Approach

This chapter discusses the strategy, plan, process or design adopted for this study.

3.1 Selection of Study Area:

The idea behind selecting this VDC for my study was due to the fact that this VDC has been affecting by floods since 1974. As already shown Nepal is very prone to water induced disaster but little research has been done in this field in my country. When I was planning to think what and where I should focus my study, suddenly I happen to see the news papers. Many newspapers highlighted the floods in Jagatpur as “***Jagatpur flood Victims seeks help”.*** (photo.3.1). The news stated that due to flood of 2002 and 2003 in Jagatpur VDC many people became homeless; and lost almost all their properties, due to which flood victims livelihood was disrupted. This news inspired me to work on this VDC mostly focusing on how flood victims are surviving what means of strategy they have been adopting to cope with this disastrous flood. Good transportation facility to reach Jagatpur VDC from Kathmandu and its high population density also made me stimulate to select this.


वर्षा हुन थालेपछि जगतपुरबासी टेलिफोनको घन्टी सुन्न पुग्छन्

THE HIMALAYAN TIMES 30 MAY (JESTHA 17)

Jagatpur flood victims seek help

Tika R Pradhan

Chitwan, May 29

This is the third time the residents of Ghailaghari of Jagatpur VDC-1, Chitwan, have tried to protect themselves from floods. Their efforts in the last two years went vain as floods from Rapti river washed away their houses, livestock and paddy, destroying around five-meter high embankment constructed to avert the disaster.

The victims used trees and roof tops to save their lives. This year they have been trying to receive help from all concerned including the government. Hundreds of families were affected by the floods that turned the paddy farms to sands. The flood, last year, destroyed 190 ha of forest and 150-m-long embankment among others. Six people lost their lives.

This year, they are working to construct at least seven-meter high embankment to remain secure. They have collected Rs 1 million from various sources including Participatory Disaster Man-

A house at Ghailabari, constructed by Caritas Nepal, for emergency use during floods.

agement Programme of UNDP and various fund-raising programmes like folk duet competitions. The Buffer Zone Development Council and Kerung Consumers Committee have also contributed to the construction of the embankments.

The locals seek refuge in their relatives' land or elsewhere for three months every year. "We are preparing to shift to safer places," says Parwati Pasta. Last year, her

shop worth some Rs 0.3 million was washed away by the flood. Now she sells home-made liquor to earn bread for the family.

The Nepal Red Cross Society and Caritas Nepal have constructed about a hundred houses for the flood victims but they, too, are not safe. The Caritas Nepal has made a two-storey building that can accommodate hundreds of people in emergency situations. "We will bring all our children, disabled

people, and senior citizens here as soon as people from Sauraha inform us about the impending flood," says Khem Lal Bhusal.

According to locals, the Kasara bridge constructed over Rapti river a few years ago was the cause of flooding. "The bridge has blocked flow of water, as it has been made narrowing the edges of the river to minimise the cost of construction. The bridge is very low and the distance of pillars is very near that diverts the flow to the village," said Leela Raj Bhusal, president of the Rapti River Control and Conservation Committee. "We are in need of some 1,000 nets to construct embankments." People have now started making liquor illegally, as their fields have turned to sands. "We are forced to make wine to survive though the district has been declared alcohol-free zone," said Kumari Thapa.

CDO Jagannath Sharma Poudel said the people who were victimised in the previous years should be shifted to safer places. "They should not be made the victims again in the name of constructing embankments," he said.

Photo 3.1: The Himalayan Times, 30 May, 2003.

This VDC`s are divided into nine Wards on the basis of population size. A Ward is the smallest administrative unit consisting of one village or groups of villages. Since my study was on the impact of flood and coping strategies, out of 9 Wards only three Wards i.e. Ward number 1, 2 and 7 which are more vulnerable to flood hazards were studied. The rest of the

Wards fall in Tadi (high elevated part) and these Wards are safe from flood hazards. Even the Ward number seven too fall in Tadi but the people who live there are mostly the flood victims who moved from Ward number 2 to Ward number 7 and most of their land is in Ward number 2. Among the nine Wards, 1 and 2 are most densely populated, mainly because of fertile lands and irrigation system and occupied the larger area of the total VDC.

3.2 Qualitative and Quantitative Data:

The research design of the present study includes mostly qualitative, besides this I have collected household information, as for e.g. landholding size, family size, age groups, food sufficiency, livestock etc have been collected in a quantitative manner by using semi structured interviews.

Qualitative research is a field of inquiry in its own right. The word qualitative implies an emphasis on the qualities of entities and on process and meanings that are not experimentally examined or measured in terms of quantity, amounts, intensity or frequency. Qualitative researchers stress the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape inquiry such researchers emphasize the value laden nature of inquiry. They seek answers to the questions that stress how social experience is created and given meaning (Denzin and Lincoln, 2003).

Quantitative studies emphasize the measurement and analysis of causal relationships between variables not processes proponents of such studies claims that their work is done from within a value free framework (Denzin and Lincoln, 2003). Quantitative research on the other hand can be constructed as a research strategy that emphasizes quantification in the collection and analysis of data (Salkind, 2000). It is possible to use both qualitative and Quantitative methods in one piece of research (Crotty, 1998), as he said in my present research was done by applying both qualitative and quantitative methods, besides this I have also used Geographical Information Systems and Remote Sensing (GIS/RS) to fulfill my all research questions.

Qualitative researcher uses ethnographic prose, historical narratives, first person accounts, still photographs, life histories, fictionalized facts and biographical and autobiographical materials among others. Quantitative researchers use statistical tables, and graphs and usually write about their research in impersonal, third person prose (Becker, 1986, P.P. 134 cited in (Denzin and Lincoln, 2003). Using map is both qualitative and quantitative, since

qualitatively I have generated by focus group discussion and quantitative was in the sense after the analysis map gives us the statistical information which we can compare.

3.2.1 Use of Geographic Information System and Remote Sensing:

GIS/RS is an integrated tool for handling, processing and analyzing geographic data. This tool has been widely used for the assessment of risk and management of natural hazards. These types of system make it possible for the users to collect, manage, analyze and display large volumes of spatially referenced data and be very effective in integrating and manipulating information of different sources. This tool also has been used for land use planning, flood management etc. We can delineate the different flood Risk Zonation by applying these techniques; such kind of maps will help the civil authorities for quick assessment of potential impact of a natural hazard and initiation of appropriate measures for reducing the impact.

In the context of my studies I have tried to use GIS/RS together with people participation more like a social mapping. And I have test the result of social hazard mapping instead of using different statistical modeling in GIS. To do this exercise I have used a simple social hazard maps prepared in the field together with the help of key informants. Besides this I have also made a Geomorphic hazard map based on geomorphic terrain feature. Finally I have cross the results comes from social hazard map and the results from terrain maps. But in the context of my study I have given more emphasis to social hazard maps as I think is more accurate than the geomorphic hazard mapping, since my geomorphic spatial data were limited.

Data for the GIS/RS analysis were collected from two different sources: A) focus group discussion and community mapping b) GIS/RS lab work. The community mapping is mainly done because of unavailability of discharge data in the vicinity of the study area, due to which I could not calculate the discharge volume and its affect, as how much volume of water would affect the area, such type of analysis could have been done if there were historical discharge data at least for past 50 years. To fulfill this gap I have used community GIS focus group mapping, and this mapping is very much practiced this days. In the current researches visual sociology and anthropologist use photography, motion, pictures, the World Wide Web, Interactive CDs, and CD –ROM, and virtual reality to see the connections between human existence and visual perception. This form of visual representation constitutes different ways of recording and documenting (Denzin and Lincoln, 2003).

Geographic information systems are being integrated in communities to serve many purposes, and with various degrees of effectiveness. (Craig et al. 2002), has given many referenced in his paper about the uses of GIS/RS widely. Some communities use PPGIS to administer and manage territory under their control, and to make informed input in to local planning processes. There are also cases where PPGIS has helped communities to develop their own spatial strategies and policies.

One of the most direct applications of GIS in developing countries is participatory mapping or community mapping, where for example, GIS/RS specialist interact with farming communities to create spatial inventories (digital data) of natural resources, property status, land-use rights, and perceived problems. Such inventories feed into a consultative process that aimed at building consensus on more equitable and sustainable resource-management arrangements.

Experience has also shown that villagers, local farmers can quickly relate to geographic representations of their surroundings due to their attachment of the place. Community mapping can also help to encourage the process of transferring greater decision making power and economic and financial responsibility to local levels of government (Deichmann, & Wood, 2001).

I have also adopted Community Mapping approach instead of doing other statistical modeling.

The social maps are the factual map about the flood affected areas. As the magnitude of loss is not the same in all the flood affected areas, social maps helps in identifying the most prone areas, which are often left out or neglected by the relief workers or policy makers. So, with the help of community, I have done the micro analysis of terrain of the VDC, as well as data on elevation was not that accurate, due to plain lands there were no much altitude differences in the study area. So I found community mapping as the best way to delineate the hazard level together with geomorphic mapping.

3.2.2 Photo Elicitation:

Photo elicitation is a powerful tool for researchers, local community to understand the particular views and also it offers an insightful opportunity for farmers to consider how to change their landscape practices (Beilin, 2001). Visual sociology community mapping, based on ethnographic foundation, encourages the integration of photograph and interpretation. The process of qualitative interview and narrative explanation is called “photo elicitation”. In my

present studies I have not used photo elicitation exactly as I did not use photographs but instead of that I have used two different date aerial photographs of the same area and two different date colorful large scales topographical maps of the same area (1:25,000), together with the poster which I prepared from the latest Land sat Imagery (some of the poster and maps are attached in Annex- 1) in which I have merged, administrative units, settlement and printed in A1 size. Villagers especially the flood victims and other key person react differently by seeing the maps, topographical sheet they could easily recognize the information on it. But the key person did not able to read the aerial photographs and the poster (satellite imagery), they could only recognize the main features on those maps. Due to which I need to teach them the basis about how we handle and where are we, and the direction in the aerial photographs, though all my respondents who have come for groups discussion at least know the direction (Purba, pachim…i.e. east and west) based on this they recognize their place easily but mostly through the identification of the main features in those maps and they even compare it in the other maps and aerial photo those information, in the process of seeing some feature I have obtain some more results from them, as they have added some new features in the maps, which were not present in all the maps which was the positive aspect of doing social mapping.

Besides, by looking at the different dates photographs and maps, they were confidently telling the story of changing Rapti river course in the area, and how their landscape are change in different period, based on this it was easier for me to map the different years floods and their flood level, and which floods was the destructive one. When they see the areas visually with their infrastructure, services, together with their farmland, it was easier for them to recall their past days and to see the changes in their landscape. So, photo elicitation method and community mapping has helps me to map the social hazards maps based on their visual information.

3.3 Secondary Data:

To answer the research question, I have used both secondary data and primary sources of data. Secondary data on annual rainfall, total losses from flood disaster in the country in different time period were collected, together with this Topographical map, Aerial photographs and satellite imagery were collected from different organization to maps the community hazards mapping were given below. Other secondary information was collected from variety of books, articles, reports, newspaper etc. about the study area.

However secondary data (Aerial photographs, Satellite Imagery and Topographical maps were compared and updated with the views, memories of the informants.

For the first research question the secondary information were most important and in other research questions, survey and in depth interview were dominants. In all the research questions both secondary and primary sources of data collection is followed.

The main data sources of information for the study are as follows.

- Tgraphical sheets (scale: 1:25000) published by the Topographical Survey Department, HMG/Nepal, 1998.
- Indian Survey one-inch-one mile, Topographical sheet scale 1:63,360 of 1958 published by Indian Survey Department.
- Aerial photographs at a (scale of 1:50,000) of 1978/79 and 1994, available from the Topographical Survey Department, HMG/Nepal.
- Digital version of Geo-coded LANDSAT Imagery (Thematic Mapper) acquired in November 2000. Digital copies of imageries were provided by MENRIS –ICIMOD 2004.
- Past flood hazard record were collected from (Ministry of Home Affairs, Nepal Red Cross Society, and Disaster preparedness center (DPTC). Besides this local news paper were also consulted to collect relevant information.
- Annual precipitation data since 1967 were collected from Department of Hydrology & Meteorology, HMG-Nepal.

3.4 Data Collection:

3.4.1 Before Field work:

After arriving in Kathmandu for my M. Phil thesis field work in the months of April, 2004, I have checked all the necessary information about my study area. Besides that my major task was to check the security situation in the field about the safety ness to work in Jagatpur, due to Maoist insurgency in the country, since my supervisor has given me second option to work. So I have decided first to go and visit the study site, to see the real situation, whether the area is safe or not, with one of my Geography Department friend from Kathmandu who is a native of Chitwan district and reside close to my study area.

When I reached the study area Jagatpur, I heard some rumor that recently Maoist have capture many hectares of agricultural land which belong to Mercantile Communication Private Limited, in the adjacent VDC, and few minor incidence of burning vehicles in the Jagatpur itself. By this news I was little upset, but when I have talked with the few local people and

guest house owner regarding the safety ness to work in the VDC, they have told me that, due to the National Park Headquarter and the army headquarter which lies in the southern boarder of the same VDC, they did not face much problem besides some minor incidences, and they suggest me that it is safe to work in this VDC as compared to the other VDC of Chitwan District. Besides this VDC is one of the worst affected VDC by the continuous flood of 2002, 2003 and 2004.

After finalizing lodging in the field I have gone back to Kathmandu and prepared for my field work. My first work was to gather other information needed for my field work so I have also prepared a short household questionnaire and a checklist (attached in Appendix), since one of the major objective was to see the impact of flood hazard to the livelihood of different floods victim and how the victim coping against the destructive flood hazard. Besides this my other research question was to map the area, and to delineate the flood hazards maps based on focus group discussion and secondary maps as for example, topographical sheets, aerial photographs and satellite imagery were used.

3.4.2 Participation and Observation:

After finalizing everything, together with poster, maps, aerial photographs, household questionnaire and checklist I went for my final fieldwork. After reaching the VDC it was really hard for me to start my field work. Since VDC office was inactive because Maoist has locked the door of the VDC office so I have to rely for secondary information with local Red Cross office and Buffer Zone office, firstly I get the general information from the local Red Cross office and Buffer zone office about VDC the impact of flood and which are the most affected Wards in the VDC, and the population distribution in the VDC. From local Red Cross office and buffer zone office I came to know that most affected Wards are 1, 2 and 7, I asked them why other VDC are not affected so they told me that the other Wards mostly lies in the upper elevated area of the VDC which they called Tadi. I decided to observe whole of my study areas myself to be sure with all the maps. In three days by bicycle I have finished observing all 9 Wards in the VDC. During observation I enquired with the local people whom I met on the way in their farm land as well as with the local people who were grazing their animals, from my observation as well as from the local people I came to know that the other Wards were not that affected by floods, only in some major floods they have faced the flood but not that destructive.

From the local people also I came to know that Ward number 1, 2 and 7 were the most affected Wards in the VDC, and most of the populations are also concentrated in those Wards. I also came to know that Wards number 7 which fall in the Tadi so it is safe from floods, but the people who live in Wards number 7 has mostly the lands in Ward number 2, so their houses are in safe but their farm was not. Since most of the people of the Ward number 7 have moved from Ward number 2 during the different times of flood. Since 1974 they have moved to this 7 Ward by clearing the forest and settle in those areas which I have discussed in the following chapter, below. According to the villagers I came to know that in 1974 around 84 household of Ward number 2 were rehabilitated by His Majesty Government to Banke and Bardia district of Nepal, rest of the household did not move to Banke and Bardia, since they don't want to move as they were attached to the place very much, and some of respondent told me that, after malaria eradication program during 1960s they have moved to this VDC from other parts of the country, and now again they don't want to move to other part of the country, rather they will die there, so they captured the upper elevated part by clearing the dense sal (S*horea robusta*)forest and settled there.

Finally I agree to work only in those affected Wards which suggested by local Red Cross office and Buffer zone office. My first task is to give my personal identity to the Army headquarter because, army used to come and check every person who resides in hotel and guest house in their patrolling time and asked personal identity to the people who resides in hotel and guest houses. So to clarify them I have fixed an appointment with the major general of army headquarter and submitted the letter which I brought from Norway from my supervisor, during the visit with army chief I have to give other details about my family background as well as I need to give him the details of my district and where I belong from originally. Finally the army chief gave me a permission to work in the village. But I had to report my work every week to the army personal. Being and outsider my other major task is to build my rapport with my informants, while moving in bicycle and asking about the impact of flood, and observing how they are coping against floods, most of the local thought of me as a army personal or I am a Maoist because they have seen a new face in the village, so every body was curious about me, why I am there, it takes me more than a week to clarify them that I was a student and had come there to do research in flood hazards. Still it was very difficult to convince them; slowly they were convinced with me.

One day VDC representatives were having meeting with the donor agency management committee, about the building of embankment in there areas, on the very day I have also taken

permission from the president of Rapti river management committee Mr.Lilla Bhusal to participate in their meeting. During the meeting fortunately I found some of the staffs of the donor agency especially from UNDP, who knew me when I was working in International Centre for Integrated Mountain Development (ICIMOD), where we did a joint project on flood hazard mapping of Bhandara VDC of Chitwan district in 2001. So the chief of UNDP Disaster management project introduce me to the rest of VDC members and other local residents who were present that day. From that day people recognized me as a member of donor agency and work in big project, so when they came to know that I have come from Norway they think that I have come there for some project, so my status was changes from a stranger to a staff of donor agent who have come for project development. So they think me as a Thulo Manche and give me a title Project ko Hakim which means a high ranking staff in INGO. But my status was not Hakim; it was hard to convince them that I am just a student who has come there for the research for the partial fulfillment of my M.Phil degree. Slowly when they see me everyday with an old bicycle and talking and taking picture, and takes notes in a small field diary they think me that I am not a hakims (big person), Hakim does not move regularly in a bicycle, they usually travel in blue plate vehicle. So after two weeks times some of the household member and the people in the main Jagatpur Bazar (market), given me a status as a Bidharti (student), who came from Norway to write a book about their area slowly local people of the village recognized me a student who has come there to study there place and to write about their place. After this it was easier for me to work in the VDC, still some of the household member told me to bring project from Norway, because they knew Norway is financing Nepal in development work. I have told them that I can't promise you in this matter as you all know now that I am a Bidharti (student) and not a Hakim, and come to your village to study about your place and write a book. In this way I have change my status from a donor agency staff to a Bidharthi (student) who came from Norway.

During the process of my different role people, answering of research question was different. When my position was stranger everybody talks less to me, but when I have change my status from strange to Hakim they react me differently, some of the household member exaggerate the things I asked as for example what you have lost different times of flood in the village, i.e. livestock, land, valuable goods, they seems that I have come there to check their loss and to compensate those losses, so after getting result from them I used to cross checked the data which I got from Buffer zone office. Some times I even asked to the neighbor household to get the factual information. But when my status changed from Hakim

to student researcher they did not accept much from me, so their response was different that the response which they gave me earlier. To the best of my knowledge I have tried to get the factual information as far as possible from my informants.

The above experience of my field work is found similar to what (Aase[1] ,2005) told us in his lecture on research methodology status building is the first and major task while doing field work, without entering to the local set of status it is very hard to collect information in the field.

3.4.3 Categories of Information:

When doing research we observe things based on that we sense and feel. While observing, our minds consists of thousands of million of categories from where we ascribed meanings. Categorise are a kind of cognitive container where we put our observation and there by we give meaning to it. The exact observation of anything is similar in the world but during the process of cognition we categories based on our own culture, experiences and education, etc as for example in rural areas of Nepal cats are like a guard to rats to save the store grain, where in western culture they resemble a pet not as a guard to store grain. To every concept we possesses, there belongs a set of categories. Aase, (1997) warns us not to put our own concept when conceptualizing the observed world. So we have to put away our own categories to be able to interpret other people understanding of an event. Observation is objective (fact), when we locate in one or categories, we describe with meaning. People belonging to the same culture do not posses same categories; they have different meaning about the same object. So it varies from group to group, and from person to person.

In my research study, I had to be aware about the local people's indigenous knowledge concerning coping with floods. As one of my research objectives is how the flood victims coping with the flood hazards, in my study areas there are different groups with different socio cultural background and their way of coping is different than others, as for example they stores there grains in Chota (first floor of the house), they keep fencing around their houses, and some of there house were open in the basement, so I have tried to learn there way of categorizing things in the case of coping against destructive floods.

3.4.4 Observing Events:

In different time period in a society any particular activity takes place that activity is defined as events. Each event has some effect it may be bigger or smaller in their daily lives. The

field analysis is process of discovering and understanding of those events taken place and what impact it has made to the society as a whole. In any society there lives different groups of people with different assets, based on their asset we categories them to different classes. The extent of effect of such events can directly be observed on certain group of people. In the context of my study I have tried to observe the flood hazards events which has contributed to change in the socio, economic aspect of the different livelihood of the effected victims. As from the field work I came to know that they could remember the destructive floods and river cutting of 1974, onwards since most the people had migrated to Jagatpur only after malaria eradication progarmme of 1960's.

Due to the flood and river bank cutting government has rehabilitated 84 household to Banke and Bardia district of Nepal. Also due to the establishment of Royal Chitwan National Park and the Park headquarter, which has contributed in changing the socio economic activity of the local people. Observing the flood hazards events in different time period and the establishment of National park and headquarter in the southern boarder of the VDC, from the observation, I have tried to see the impact of those destructive floods hazards and establishment of National Park to the society as a whole and how the people are changing their social, economic and environmental impact in the study areas.

3.4.5 Focus Group Discussion and Community Mapping:

Focus group discussion was held with local elder people, past and present VDC chairman, Ward chairman, local leaders, teachers, member of Red Cross Society, members of saving group and social workers. Information on magnitude, reoccurrence interval and damages made by the different floods were collected during focus group discussion.

While doing community mapping first of all I had collected the Maps, Aerial photographs and Satellite Imagery (LANDSAT) of my study areas, before going to field data collection. First of all I have geometrically corrected the images which I got from secondary sources. By doing geometric correction it removes geometric distortions in an image based on knowledge of the satellite and sensor, and remaps the image to a regular grid in a standard map projection. This is accomplished by constructing a mapping between pixel coordinates in the image and geographic coordinates on the surface of the earth. After this process I have overlays the Administrative units (Wards boundary), roads, and major settlements to those Images and printed in an A1 size sheets (21 inch by 36 inch), so that my informants can visualize there area clearly on the printed poster. I have also collected the two different dates Aerial photographs one of 1978/79 and other of 1992 from Nepal Survey Department and the

Topographical map sheets of the area, to get more picture of the areas and the informants can visualize there area more clearly as well as they can see the change in the land use land cover since Topographical maps are in color and they are in large scale.
First of all I had explained them about their location, settlement, roads etc which are marked on the Topographical sheets, by seeing their houses, infrastructure, services, key informants become curious, to know more and started going in depth, side by side had asked them which are the years the flood came in the VDC, different members given different dates, also marked the hazard level i.e. High, Medium and Low and marked those level in the Topographical and Aerial photographs as well as I also marked the level of flood water which came in different years, they have recalled those days with their past and present knowledge.

From this I got a clear picture about the different years of flood occurrence, hazards level and their impact in those printed maps, aerial photographs and topographical maps. I have also encounter some problem in the process mapping the level of flood hazard in the group discussion. As the different people were given different height information for the level of water, so to be more clear in this respect I have taken, main feature, as houses, trees, terraces of the farm and the road, by taking those reference point I have delineated the level of flood water in the prepared maps and poster. I have also encounter the problem in reading aerial photographs and reading topographical maps especially they could not identify the different colors and their reference, beside this elevation for example contour line and spot height were hard to recognize by my informants. So to make them more clear on aerial photographs, I have given general concept of aerial photographs, about the date of photographs, centre point, and the reorganization of important feature in the aerial photographs, together this I also given a general information about reading topographical maps, and which colors identify what features. The information which I have overlay in the aerial photographs has helps me a lot in explaining the people about the location.

After finalizing the different years of floods and the level of water, hence, the social map showing different levels of hazard was prepared in field. After this the results have been re-transferred in other new topographical maps for more accuracy for digitization. The information regarding social and economic impact of flood was also collected from the key person present at that time, by doing this I had got the information about which was the most destructive flood in the Jagatpur, till this date and what impact it has done to the society as a well.

3.4.6 Sampling Method:

It was very difficult for me to choose my sample, as I was interested only with the flood victims in the three Wards. Also difficult to choose the targeted population for household interview; to fulfill my research question I need my informants to be more experience one who has seen all floods in his life time as well as I need the different groups of flood victims who were affected in different times of floods in the VDC and how they were coping, what strategies they have adopted. To get the good sample framework I have thought many sample frameworks but among them **"Snowball"** sampling methods was most suited for my study.

From the local people I came to know that Padam lal Bastola was the oldest settlers and the most affected person in the VDC. Based on this I have started my household survey from him. After interviewing him I have asked him to give me the name of the person which is affected like him based on his suggestion I moved it to second person than to third, finally I have gone to 114 households based on the relational sample. After the 114 household surveyed the results were repeated and it was very hard for me to fine the new answer of my question, I was at the saturated level of getting my answer. So after this I have stopped my household survey. The 114 household has a population of 662 people and the total numbers of prone household were 795 with a total population of 3741 peoples.

3.4.7 Interview Method:

Interview is and data gathering methods in which there is a spoken exchange of information. It is a method which requires some form of direct access to the person being interviewed (Hay, 2000).There are many types of interview as such structured, unstructured and semi structured. In the present study I have used unstructured and semi-structured form of Interview, in unstructured interview the conversation in this form of interview is directed by the informant rather than by set of question (ibid.), this type of interview does not follow the standard list of question. Where as semi structured interview is done for household survey, this type of interview has certain flexibility the researcher can use a set of predetermined questionnaire in a flexible manner.

Since my research objectives was to know the impact of flood to the livelihood of different group of people and how they are coping against those destructive floods. Besides this I also need to know the different floods events took place in the VDC, and what impact it has made to the society as a whole how the socio economic status is changing in the village, and their local knowledge and experiences about the different flood hazards events. I did unstructured

interviews with many flood victims, and how they are coping how they are managing, whether they have some saving or credit groups, and how the social network, Government, NGO and INGO helps in the different time of disaster. Different roles play by the people at the time of disaster in the case of household and what are the livelihood strategies they do in different times of flood hazards as pre flood disaster, during disaster and past disaster is asked with informants. Special attention was given to the way people had dealt the destructive flood events coping strategies. To know the answers about the past flood hazards events was difficult for me, as they did not much remember the past days easily. So to get the proper result I used to ask them by joining different events, as what was your son or daughter age at that time of destructive floods, or their marriage years. This has help me to get my research question answer easily about the past flood hazards and their impact, and their local knowledge to cope with the destructive flood hazards. Besides this I have also colleted information from other key person as for e.g. oldest person in the village, school teacher, past and present VDC, Ward chairman, social activist, and local businessmen.

3.5 Data processing Analysis:

Data processing and analysis began from the very first day of my field work. Everyday after returning from my field work, I used to check and corrected all the information provided to me by my informants. The row data collected from field work were than processed mostly after the filed work in Kathmandu. The quantitative information data were mostly entered in Microsoft excel. The output tables were prepared as per the need of my research objectives based on which analysis and interpretation were made. The main analyses were follows based on the five capitals as shown in the Sustainable Livelihoods approach. Vulnerabilities and capacities were analyses based on those five resources. The qualitative data were mostly translated edited in to english after the field work in the process of writing my impact and coping chapters.

3.5.1 Unit of Analysis:

In most studies of coping strategies household is taken as the unit of analysis. Household is frequently viewed as single entity and treated as a unit of analysis. In the context of my study I have also taken households as the main factor in coping with disaster, it is mostly depend on the household economic and social situation to cope with hazard. Those household who has more assets, like human capital e.g. family size, age structure, skill, education all depends in taking strategy to cope with disaster, similarly, natural capital in the form of land, financial

capital in the form of saving and insurance, social capital, e.g. social network, and physical capital, like infrastructure which all together run the livelihood of rural people, and based on this assets they cope, those with more assets are more secure than with less assets. Based on this they diversify their livelihood so, I have collected information like, average family size, education, skill, landholding sizes, food sufficiency, livestock, social network, government and donor agency policy and other assets which household have etc. from the flood affected victim by using quantitative methods, semi structured interview with the household. For the selection of sample I have used snow ball methods as said earlier.

3.6 GIS/RS lab work

GIS/RS tool (ARC View 3.2, ERDAS Imagine 8.4 and ArcGIS software) were used to capture different nature of spatial data regarding terrain, channel course, flooding from satellite imagery and aerial photos as well as from topographical sheets.

Different spatial layers like spot height (altitude), services, land use land cover, drainage, contour, VDC and Ward boundary, road/trails etc were extracted from topographical sheet (1994) through screen digitizing process. Some data were also acquired from secondary sources (ICIMOD). Screen digitization methods was used to enter the features from the geo-reference maps and aerial photographs and satellite imageries using the same projection system as described in the Nepal Topographical maps 1:25,000 by Department of Survey His Majesty Government of Nepal. The aerial photographs of 1978 – 79 and 1992 and LANDSAT TM images of 2000 were used for the study. Both satellite as well as aerial photo images were processed and interpreted in digital image processing environment in ERDAS 8.4. Feature like river morphology, old channels, flood affected areas, river traces, fans, lakes, and the other terrain classes in the study area were extracted from these images.

3.6.1 GIS/RS Data Analysis:

By overlaying channel course maps of 1958 and 1996 channel shifting pattern of Rapti river was extracted. Geomorphologic technique of flood hazard mapping was used to prepare flood hazard map. Geomorphic terrains map (annex- 1) of study area was prepared based on Digital Elevation Model (DEM) multi temporal satellite data and aerial photos. Geomorphic terrain map was classified in to different flood hazards classes (table, 3.1.) and assigned different ranking accordingly.

Table: 3.1: Hazard level raking scheme for terrain feature.

Terrain features	Ranking
Flood plain 1 meter high from natural levee	very high
Low terraces 2-3 meter high from natural levee	high
Middle terraces 3- 4meter high from natural levee	moderate
High terraces above 4 meter high from natural levee	low to safe
Temporary lake (low depression area with high moisture content and water logging during flooding period)	high
Active channel (water body)	very high
Old course (remarkable features)	moderate
Oxbow lake, sand bars and depression area (water logged)	high
Cut front (concave)	high
Depositional front(convex)	high

Source: ICIMOD/UNDP 2001

Table: 3. 2: Hazard level ranking scheme for flood frequency

Flood frequency	Ranking
Never flooded area	safe
Major flood	low
After 1993 continuous, prior to that only in major flood: moderate	moderate
Earlier above average but continuous after 1993	high
Yearly flooding	Very high

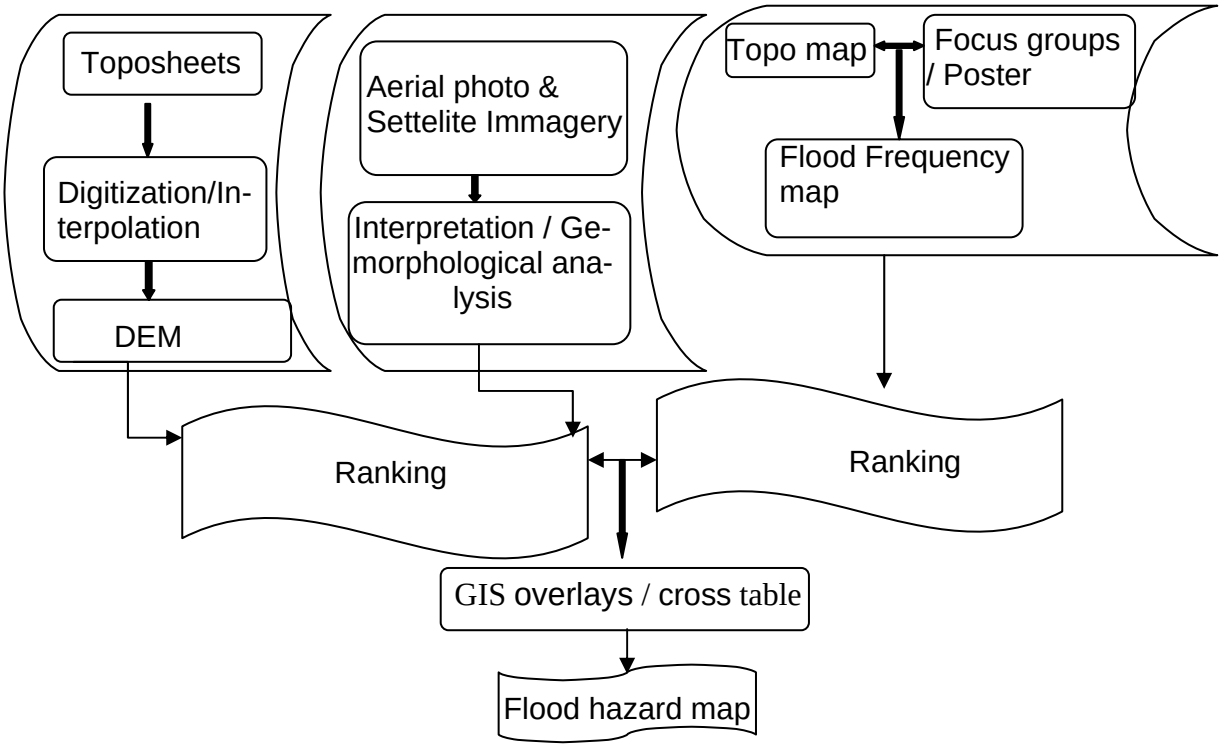
Source: Field survey 2004

Social flood hazard map (Annex - 1) prepared during focus groups discussion also classified in to different hazard classes (table, 3.2) and assigned different ranking value accordingly. Final flood hazard map of study area was prepared combining these two weight maps. The details flow chart is shown in (diagram. 3.1.)

The ranking has been given based on the expert knowledge, as well as based on the found literature, especially for geomorphic mapping and assigned different hazards level to different

terrain features. The flood plain 1 meter high from natural levee is the most hazardous areas, so I have ranked this as very high hazard. Similarly for high terraces which is more than 4 meters from the natural levee I have assigned those areas as low to safe area since this area are less hazardous, the slope are relatively high in this type of land. I have assigned active channel also a very high hazard, where as oxbow lake, low depression areas, lake etc as high hazards rank, based on this ranking of the geomorphic feature.

Diagram 3.1: Conceptual flow chart of flood hazard mapping



Like wise I have also assigned different raking to the flood frequency maps which was prepared with the help of focus groups discussion in the field.

Similarly in the social hazard map too I have assigned frequently or yearly flooding areas as very high hazards, like wise never flooded areas I have given different ranked as low to safe. Form this I have generated a flood frequency maps indicating very high, high, and medium and low to safe hazards areas.

Table 3.3: GIS based two dimensional tables:

Flood frequency / Geomorphic map	Very high V.H	High H	Moderate M	Low	Safe
High	V.H	V.H	H	M	Low to safe
Moderate	V.H	H	M	Low to safe	Low to safe
Low	H	M	M	Low to safe	Low to safe
Safe	M	M	Low to safe	Low to safe	Low to safe

After getting the two different flood hazards map one is flood frequency and another one is geomorphic hazard map, finally I have calculated these two maps in GIS map calculator and assigned different ranking or value by using the cross table as shown in (table 3.3).

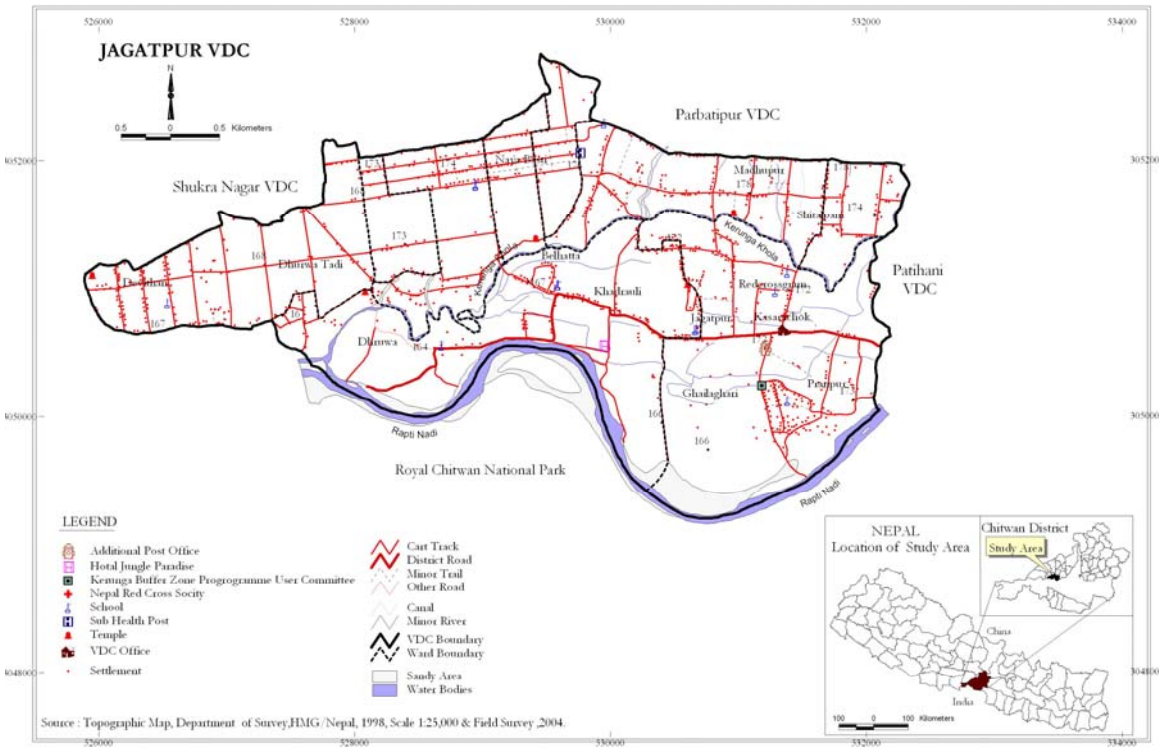
CHAPTER IV

An overview of study area

4.1 Location:

Jagatpur Village Development committee (VDC) lies in the Chitwan district, Inner Terai Region of Nepal. This VDC is border by Royal Chitwan National Park in the south, Sukranagar VDC in the west, Parbatipur VDC in the North and Pathihani VDC in the east. Royal Chitwan National park is located south of the Rapti river. North of Rapti river there is dense settlement and fields of intensive agriculture. The VDC has a good transportation facility. The altitude ranges from 155 meter to 185 meter above the mean sea level (masl). It has a total area of 1911 hectares (fig.4.1) from the map of land resources mapping report (LRMP) of Chitwan district 2002. In the district as a whole, about 80 percent of the land is flat < 1 º slope and mostly such lands are used for arable agriculture. The soil is well drained. About 15 % of land is under 5º to 30º slope category which are used for agriculture and the remaining 5 % of the land is steep with slopes > 30º. This land is mostly suitable for fuel wood, fodder and timber prc

Figure 4.1: Location map of the study area

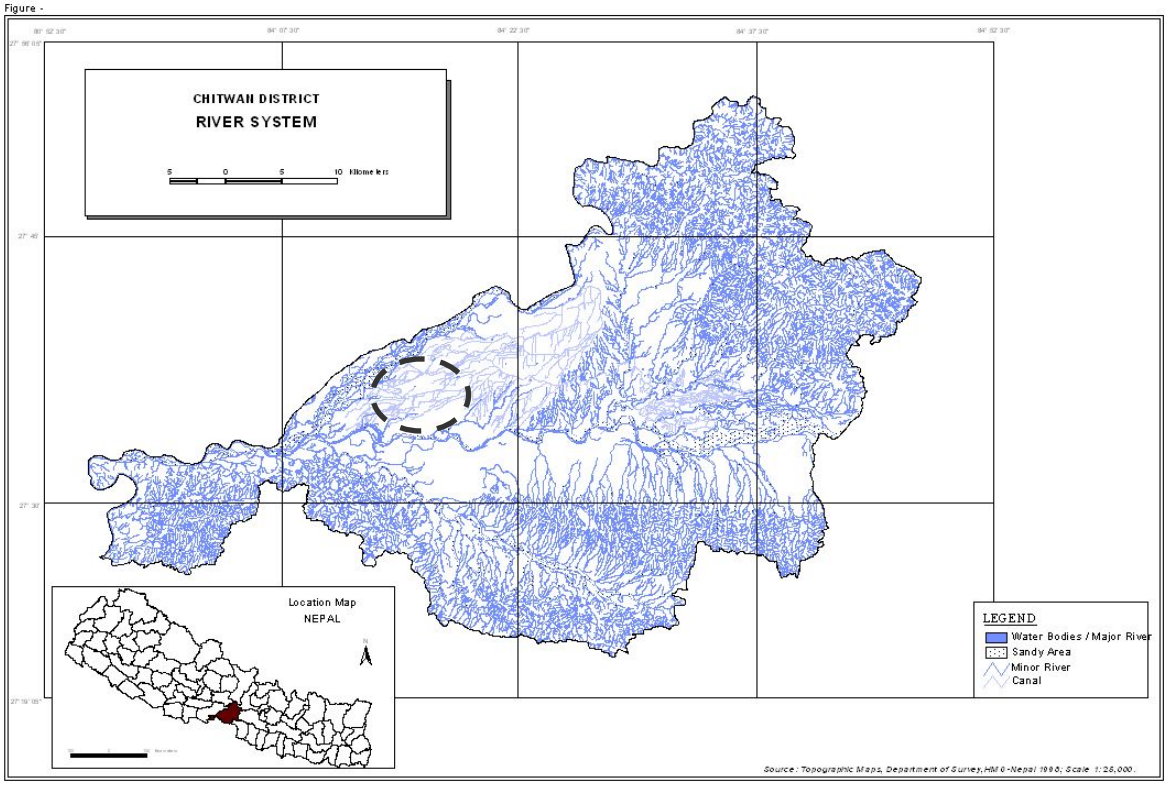


Soils in this area are deep and rich alluvial with a content of high fine sand and silt from seasonal flooding. Erosion, flooding and deposition of sedimentary materials are the primary sources of depth and richness of the soil.

4.2 Drainage Network:

The Rapti river is the largest river draining the VDC, it flows from east to west meandering through the valleys, and near Meghauli (149 m.a.sl.) It joins with the river Narayani, which than cuts through the Churiya range in a transverse valley toWards the south. This is a non-snow fed river that originates from the southern slopes of the Mahabharat range. However, as it traverses Eastern Chitwan the flow is from east to West and the gradients are gentle. Among the rivers of Eastern Chitwan this is the longest as well as the largest river and is a perennial river. The mean monthly wet season discharge (August) lies in the range between 90-500 m3/s and the mean monthly dry season discharge (April) ranges between 7-29 m3/s. Water released from the Kulekhani power plant also supplements the natural runoff from this river. During the monsoon the river transports large boulders and loose aggregates. As results there has been an increase in the riverbed

Figure 4.2: Drainage Network



Other river and stream joining Rapti are as follows. Lothar originates from the Mahabharat ranges, flows North to South, has a steep gradient and ultimately drains into Rapti river about Km below Lothar Bazaar (fig 4.2.) Streams such as Kerunga originate from the hills immediately located in the northern part of this VDC, which flows east to west, and joins with

Rapti River near Dhruwa village of the VDC. *(Note: The dotted circles in the drainage network map represent the present study area.).*

4.3 Climatic Condition:

The study area lies within the subtropical monsoon climate where winter remains cool and summer is hot. It is hot and rainy from June to September and remains cool and dry condition from December to January. The months from February to May are relatively dry and hot months. Nearly 80 percent of rainfall occurs in the summer monsoon season between June to September and these months are the catastrophic months in terms of flooding. About 15 percent rain occurs during the post monsoon (October) and pre-monsoon seasons (April to May) and the remaining 5 percent during the winter (November to February).

The mean annual rainfall is 2400mm with about 90% falling in the monsoon from June to September. Monsoon rains cause dramatic floods and changes in the character and courses of rivers. The maximum temperature in the summer rises to above 35ºC, while the winter night temperature drops to just above freezing. The discharge in Rapti river during peak flow it surpasses over 80 cumec (cubic meter per second) and sometimes over 110 cumec (recorded) where as during dry period it remains below 10 (cumec).

4.4 Land Cover:

The area was once covered with dense forest, providing shelter for a large number of various wild animals until 1950. But after the resettlement program launched by his Majesty Government the area was widely deforested and converted to the human settlement and cultivated farming plots. According to Gurung 1984, in the whole Chitwan district 49 % of the forest land had been converted to agriculture during the period of 1961 – 1977. At present most of the lands are under cultivation, which is clear from the (table 4.1) below.

Table.4.1: Land Cover (1994)

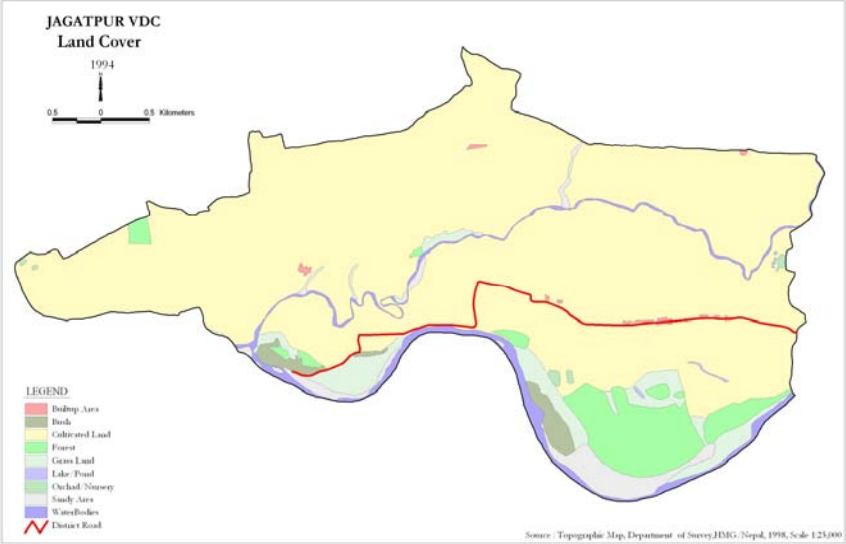
Cover types	Area ha	Percentage
Agricultural Land	1562.7100	81.8
Bush/Scrub Land	25.2600	1.3
Forest Land	118.1700	6
Grazing Land	85.3100	4.5
Urban/Built Up Land	4.9600	0.3
Waste Land	52.5300	2.8
Water Bodies	62.1600	3.3
Total Area	1911	100

Source: Computed from the land use/cover map 1994 Department of Survey Topographical branch, HMG/Nepal 1994

According to the analysis of the map of 1994 based on digital database depicted from topographic map of 1:25000 published by Department of Survey His Majesty Government of Nepal (fig 4.3). 81.8 percent of land is covered by Agriculture, since this VDC lies under the most fertile land. Forest covers 6 percent, grazing land 4.5 and the remaining area is covered by other covers including bush/shrub, built-up, wasteland and water bodies.

Major crops cultivated are paddy, corn, mustard and different varieties of beans. Paddy is planted in the monsoon and harvested in November – December, and in the flood plain area rice is grown twice a year (monsoon and spring)

Figure 4.3: Land Cover (1994)



4.5 Demographic condition:

i) Historical background of migration:

Since this area lies in the Inner Tarai plain, the area was prone to malaria before the implementation of malaria eradication program in the early 1950. Only few ethnic caste groups such as Darai, Tharu and Bote/Maji used to live in this area. After the eradication program launched by the government large number of people from hills and mountains especially from Baglung, Dhading, Syangja, Kaski, Parbat, Makwanpur, Tanahun migrated to this VDC. After the establishment of Royal Chitwan National Park in 1973 more people inmigrated mostly form Chitwan, Makwanpur, and even few household from Kathmandu Valley to this VDC after 1980 for tourism related jobs.

ii) Population size and ethnicity:

Jagatpur VDC is one of the most densely populated VDCs in Chitwan district. There are altogether 2210 households with a total of 10117 inhabitants in the VDC. The density of population is 529 persons/sqkm in 2004. Among these 795 households with a population of 3741 resides within areas prone to flood hazard prone area (Field Survey 2004, Kerunga Buffer zone user committee and local Red Cross office 2004). The overall literacy rate of the VDC is 61 percent (District Profile 2002).

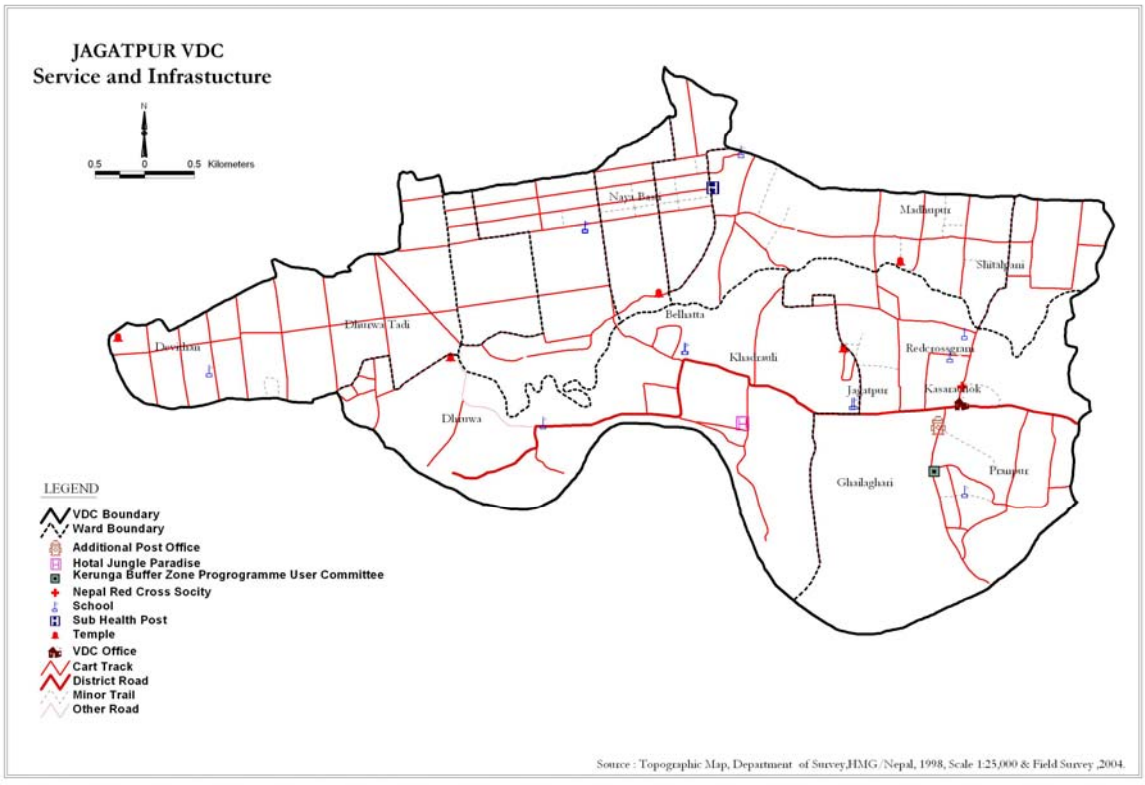
There are altogether 18 ethnic/caste groups in the VDC. Among them Brahmins constitute about 22 percent followed by Tamang 14 percent, Kami (blacksmith) 14 percent Chhettri 11 percent, Darai 7 percent. Other caste and ethnic groups in these VDCs are Tharu, Magar, Gurung, Newar, Damai, Syanyasi, Sarki, Sunwar, Gharti, Bote, Darai, Muslim and Thakuri.

4.6 Services and Infrastructure:

i) Services:

According to the record of district profile, this VDC rank first in terms of the availability of service and infrastructures. The VDC is connected by a motorable road from Kathmandu District headquarters Bharatpur district headquarters.

Figure 4.4: Service and Infrastucture



Other services available in the VDC include post office, sub health post, veterinary, red cross, buffer zone user committee, rural community communication and technology centre, cooperatives/ saving groups, family planning weekly office, and hotels (fig:4.4) Beside these currently some NGO and INGO are also working in this VDC for the benefit of the flood victims.

ii) Infrastructure:

From the (district profile 2002) 85 percent of the total populations have access to purified drinking water and 75 percent of the total populations have electricity. There are various service institutions in the VDC. There are altogether 10 schools offering different level of education. Among the 10 different schools there is only one secondary school which is located in Jagatpur, besides this there is one orphanage school run by the Korean family in Dhrubwa village of Jagatpur VDC and rest of the school are primary level school. The other infrastructures include bridges, cannel, stone net, embankment etc.

CHAPTER V

Flood Disaster History and Causes

This chapter addresses mainly the flood disaster at global, national and local level with local history of flood in my study area, and its causes and the people's perception about the flood hazard has been discussed in this chapter. In addition flood hazard map and channel course change is delineated with the help of Geographic Information system and Remote Sensing (GIS/RS).

5.1 Flood Hazard:

Globally, floods are widely distributed natural hazard and bring devastation to human lives and infrastructures. Flooding is the most common of all the environmental hazards. It regularly claims more than 20,000 lives per year and adversely affects around 75 million people worldwide (smith, 1996).

Flood hazard has two components. 1: Increasing flood events and its causes; 2: Increasing exposure to hazard prone areas. The first one is associated with the increase in the probability of flood events and the second one is associated with the increasing exposure to hazard prone areas.

Abundant rainfall causes very serious floods in which people loose their houses, harvests, grain stores, livestock or even their lives. The analysis of world-wide loss events since 1900 to 2004 shows that there are distinct increases in respect of the economic losses, among them Asia ranks the first in economic and other losses. (table 5.1).

World-wide, flooding is a leading cause of losses from natural disasters and is responsible for a greater number of damaging events than most other types of disaster. At least one third of all losses due to nature's forces can be attributed to flooding. *"Flood damage has been extremely severe in recent decades and it is evident that both the frequency and intensity of floods are increasing"* (Kron, W., 2002). No populated area in the world is safe from being flooded. However, the range of vulnerability to the flood hazard is very wide, in fact wider than for most other hazards. World wide since 1900 a total number of peoples, 6880420 have been killed by flood. According to statistical evidence, there have been three times as many losses resulting from disaster events in the past ten years than was the case in the 1960s. As a consequence, economic losses have been nine times greater during this decade, currently

exceeding US $90 billion a year, (Extracted from, Centre for research on the Epidemiology of Disaster, CRED 2000).

Table 5.1: Continent wise losses due to flood hazards (1900 to 2004)

Continent	Killed (no.)	Injured (no.)	Affected (no.)	Homeless (no.)	Total affected (no.)	Damage in US$
Africa	18004	21483	17028741	3040045	20090269	2356494
Americas	98686	39293	33758006	2582976	36380275	39290561
Asia	6754420	1191369	2501452020	122333607	2624976996	164008750
Europe	9035	6239	5730647	290558	6027444	39432262
Oceania	275	NA	249000	1000	250000	127272
Grand Total	6880420	1258384	2558218414	128248186	2687724984	245215339

Source: (OEDA/CRED EM-DAT International Disaster database, http://www.cred.be)

South Asia is among the world's most vulnerable region to both natural and human-made disasters. In the world Asia rank the highest flood affecting country since 1900 a total number of 6754420 people were killed by the flood, and the total affected number were 2624976996 (*http://www.cred.be*).

Due to its rugged topography and intense rainfall, Nepal is very prone to water induced disaster among them flood and landslide are the most destructive types of water induced disaster in Nepal. Every year flood disaster causes heavy losses of lives, vast damages to agricultural land, crops and property. In July 1993, Nepal experiences a devastating flood in the Tarai region, which took the lives of 1336 people and left 487,534 people homeless. In 1999 flood and landslide killed 209 while 47 people were reported missing and 91 seriously injured. 8844 families were affected, 3507 houses and cattle sheds were destroyed and 17732 ha of agricultural land and crops were ruined in that year floods and landslide. About 367 kilometers of road connecting the capital with the Tarai was damaged with their retaining structure, six major bridges and 25 culverts, which were damaged. The disaster also caused a total loss of NRs.3.6 million. In July and August 2002, Nepal experience another flood in eastern and central Nepal which took the life of 458 people and left near about 55,000 families affected (Pokharel, 2002).

Jagatpur VDC is one of the worst affected VDC in Chitwan district. The data on past flood hazard could be found mostly after 1974, as I have explained earlier most of the people were new to this area who came mostly after 1950 and 1960s.The upper part of the VDC has been mostly affected by flooding whereas the lower part in the west by river shifting and river

bank cutting. During the flood of 1974, around 100 house hold were severely affected by the river shifting. Out of this 84 household were rehabilitated to Banke and Bardia district by His Majesty Government (HMG). And rest settled in the northern part of the same VDC. The level of water was around 2 meter from the river bed. After 1974 the people face another flood in 1975 but this time it did not loss much only some portion of the Durbha village was washed away by the flood of 1975. After this flood came in 1990 and 1993 respectively and those year's flood gave more silt and soil nutrients the year after these floods the production was very high because of the deposits of thin layer of fine soils according to the villagers some years they produce more than 158 kg. in one kattha of land (0.03387ha.) The people of the study area face a devastating flood in 2002 and in 2003 which affected more to the VDC economically. The flood lasted for more than 17 hr. in both of the years; level of water was 4 meter from the bed of the river. As flood came in the midnight due to which flood victims could not take any thing from their house. The flood mostly affected the 3 Wards of Jagatpur VDC.

After the flood of 2002 people again the flood victims have started building embankment, stone net, houses, shed, and improve their silted farmland by selling different assets by taking loan and mortgaging of land and other valuable good and the through outside relief. But again the flood came in 2003 too with same magnitude which too was destructive, but not as of 2002, because it mostly passed from the earlier gully made in 2002. The flood of 2003 mostly ruined crops and more than 20 houses constructed by Annurag (NGO) and King Mahendra Trsut after the effect of 2002 flood. Besides this 2003 floods did not harm much to the infrastructure because flood passed from earlier gully making the gully wider. But affect the same amount of land and crop by 2003 flood too. After this flood people of Ghailaghari, and Dhruwa village become almost squatters mentally and psychically they were nervous. Now they had nothing thing left and had become more vulnerable. At present they have to totally depend on the outside relief. Similarly again flood has affected this VDC in 2004 but this time it did not harm much to Ward number 1 but Ward number 2 Dhruwa village was totally inaccessible. The orphan school was highly affected by 2004 flood, around 200 ha. of agricultural land and crop in it was ruined by the flood. Due to this flood the 260 student of orphan school were forced to move to another part of the district, and thousands rupees of infrastructure were damaged.

More than any other environmental hazard, floods bring benefits as well as losses. Flood maintains the fertility of soils by depositing layers of silts and flushing salts from the surface

layers in one side where as in other side it destroys the fertility of the land by depositing sand and boulders on it. In the context of my study area it was found that flood has a more negative impact than a positive one, it has deposited sand and boulders more than 4 feet's, due to which the flood affected victims left their fertile farm land abandoned since 2002.

5.2 Increasing Flood Events and its Causes:

A river flood is caused when water discharge exceeds the channel capacity whereas sheet flooding is associated with improper drainage of water during and after the heavy rainfall in the catchments. So the inadequate capacity of rivers to carry the high flood discharge, inadequate drainage to carry away the rainwater quickly to streams/ rivers are the main causes of floods other causes of floods. So both heavy precipitation and terrain condition (the hydraulic geometry of the channel, topography of the flood plain terraces) are responsible for generating floods with different magnitude. Other causes of floods is snowmelt, GLOF etc. the Mahabharat and Chure hills regularly experience intense rainfall and also cloudbursts, lowland areas as these regions are prone to flooding.

In the Himalayan region of Nepal glacier lakes are common. A total of 159 glacier lakes have been found in Koshi basin and 229 in Tibetan Arun basin. Among them 24 are potentially dangerous. About 14 such Glaciers Lake Outburst Floods (GLOFs) have been experienced between 1935 and 1991 in the country (Chettri & Bhattaria, 2001).

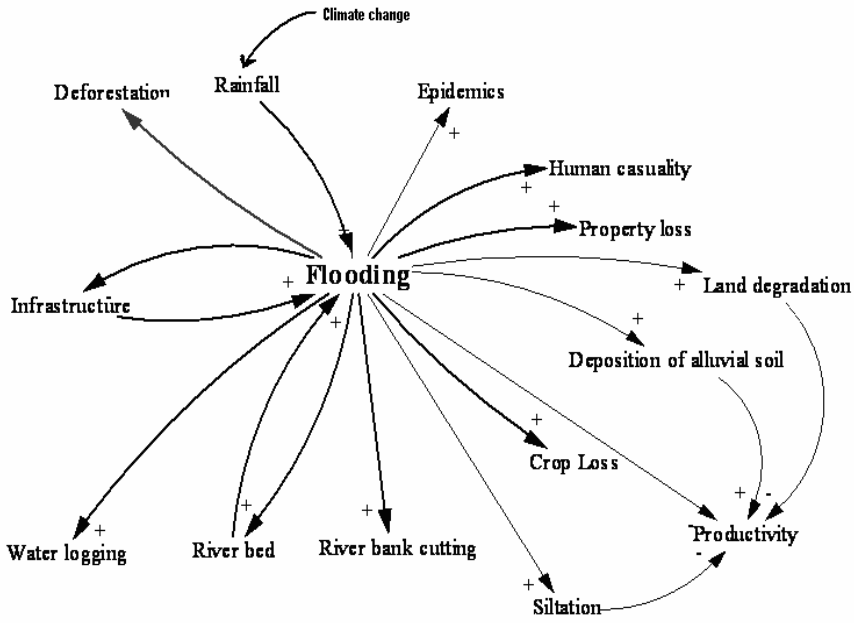
The climate changes predicted in south Asia regions are likely to intensify both floods and droughts. Changes in stream flow due to increased snowmelt and changes in the form and pattern of precipitation in mountain region could affect both flood and drought. On the one hand, more summer snowmelt combined with increased precipitation is likely to increase the intensity and number of flood events. (Moench and Dixit, 2004).
Still it is contradictory to know the causes behind the occurrence of intense rainfall precisely; combined effect of the factors given below is supposed to be responsible for intense rainfall in the Himalayan region (Dixit, 2004). The meteorological factors are listed as follows.

- Severe thunderstorms due to the atmospheric unsteadiness caused by the surface heating.
- The occurrence of series of low pressure systems (depressions) or cyclonic storms,
- The shift of the axis of monsoon channel close to the foothills of Himalaya during the monsoon and ,

- The passage of western disturbances across the western Himalaya during the monsoon period.

In the context of Nepal, Inherently fragile geophysical landscape leading to high rate of erosion and mass wasting; streams carrying flows in excess of the carrying capacity within the banks; thus overflowing the adjoining land and heavy rain and cloudburst; Glacial lake outburst floods; landslide dam breach floods and change of river course, lateral shifting of

Diagram 5.1: Cause and effect of flood



The different causes and affect of flood in the study areas is given below in the cause and effect (diagram 5.1). The different cause of flood hazards has been described within this chapter; among the major cause of flood in the case of Jagatpur is heavy monsoonal rain as a direct cause, besides this other causes are climate change, river bed rise, and infrastructure. Where as the major effects were losses of human lives, property, crop, siltation, etc.

5.2.1 Heavy Monsoonal Rain:

The VDC lies within the subtropical monsoon climate where winter remains cool and summer is hot, monsoon rainfall is high which results flooding. Abnormally heavy precipitations in the Tarai and Himalaya foothills often accompany a 'break' in the summer monsoon. Daily rainfall exceeding 400 mm has been recorded at several localities in Nepal

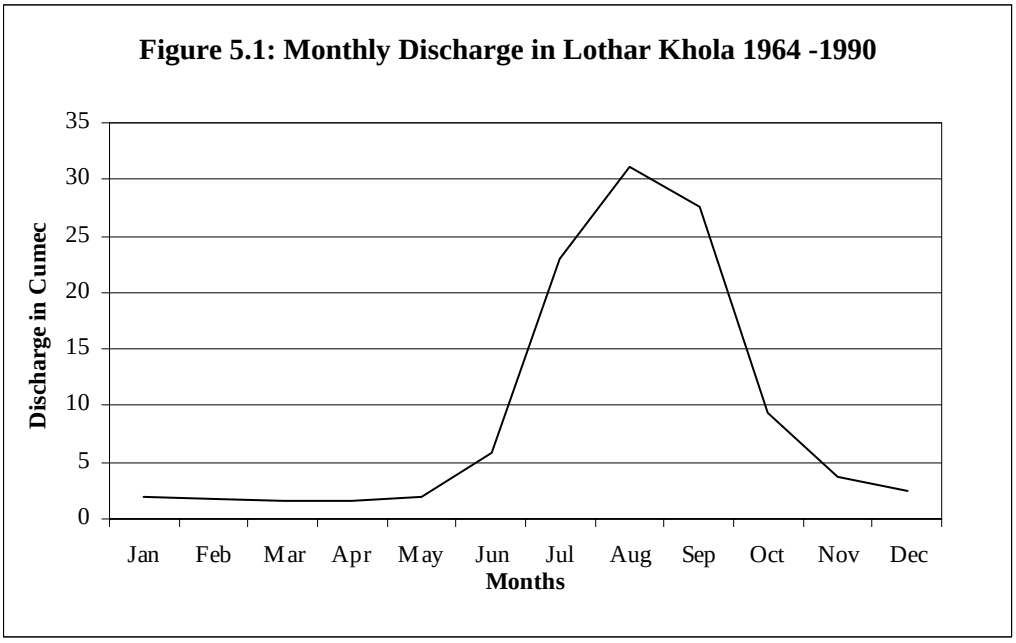
and rainfalls exceeding 300 mm are not uncommon for station located elevations of 2,000 meter. (Chettri and Bhattarai, 2001). Floods in Nepal are closely related with storm rainfall during the summer monsoon. Due to its rugged topography, generally steep river slopes, floods in Nepal are characterized by the rapid speed of the flood wave (ibid.).

The average monthly precipitation in the month of July recorded in Jhawani, since 1967 to 2001 (Annex - 2) was 636mm. A long duration of heavy rainfall associated with thunderstorm is very common. The highest rainfall recorded ever in Central development region of Nepal was 540mm in 24 hours duration was in July 1993 at Tistung. Besides this Jagatpur VDC is drained by Rapti river originated from Mahabharat and other major tributaries, join Rapti river are Lothar and Kayar khola and this rivers seasonally fluctuate on volume but perennial with high volume of water.

Several other streams originate at the plain area but they have very slow flow due to low land and confined like water logging channels, which are also called Ghol, Gitanagar Ghol is one of the Ghol. These are also active during monsoon and water logging hazards result. All this factors account for flooding in the study areas.

From the recorded database on monthly discharge in Lothar Khola between 1964 – 1990 shows that nearly 90 percent rainfall occurs between June to September (Annex- 2, fig 5.1). March to June remains partially dry and hot. Many water related or water-induced hazards occurred in the months of July to August which is more than 30 cumec discharge of water.

Figure 5.1: Monthly Discharge in Lothar Khola 1964 -1990



*Source: Department of Hydrology and Meteorology HMG/Nepal 2004***.**

5.2.2 Flood and Climate Change:

There is still a controversy whether climate change is the main cause for flooding. It may be due to Climate change the frequency and intensity of rainfall is increasing, ultimately that support in flooding. So recent times increase in flood disaster might be the due to climate change but it is not yet confirmed.

The impact of climate changes on flood will further increase the vulnerability of rural south Asian population which, are already plagued by extreme of nature. (Moench and Dixit, 2004). The Green house effect – Global Climate change, not enough research has been done on the probable consequences of the green house effect and the gradual rise in global temperature to predict with certainty the relationship with flood events in Nepal (Chettri & Bhattaria, 2001).

There is much debate going on how global warming will affect pattern in monsoon rainfall. A number of studies using Global Circulation Models (GCMs) show that rainfall intensity may increase, while other study shows a decline in rainfall. Climate change is likely to result in greater annual variability of daily precipitation (Kitoh et al. 1997 cited by Moench and Dixit 2004). According to Lal et al. 2000 the variability in intra seasonal precipitation will also increase. The intensity of extreme rainfall events is projected to be higher in warmer atmosphere, suggesting a higher frequency of extreme precipitation events, which in turn, will increase the possibility of more frequent flash floods in parts of India, Nepal and Bangladesh. According to Chase et al. 2000 as cited in (Moench and Dixit 2004), they predict that differences between land and ocean surface temperature will increase and therefore rainfall will also increase. Increased precipitation intensity particularly during summer monsoon could increase flood.

The intergovernmental panel on Climate Change (IPCC) Third Assessment Report estimates a projected global warming of 1.4 – 5.8 ºC and concomitant sea level rise of 9 – 88 cm, by 2100. Such changes would imply an increase in flood risk in terms of both frequency and duration in temperate and tropical Asia. These areas include the Hindu Kush Himalayan (HKH) Region in general, and the Gnages – Brahmaputra – Meghna (GBM) particular. The eastern Himalayan countries of Bangladesh, India, Nepal and Bhutan are likely to be particularly affected. Thus, the Hindu Kush Himalayan (HKH) Regional countries have been periodically suffering from major losses and damages due to flooding; it would appear that they may face yet more hazardous and frequent flooding than up to now. (Ahamad, 2003).

5.2.3 River bed rise:

Due to heavy soil erosion and landslide in the Makwanpur district, that result in high sedimentation in the river course. River bed rise is not the direct cause of loss of life and properties. It is not considered as individual disaster. However, the magnitude of events and losses from flood, river bank cutting and channel shifting is triggered due to rise in river bed.

The Nepalese Tarai receives on average 1cm of sediment per year (Carson, 1985). As well as according to the field survey, made by Carson 1985 found that, in past 45 years the deposition of sediments on farmland was over 2 meters in the Tarai, Ratu Khola Mahotari district. During the field survey 90 % of the respondent says the magnitude of events and losses from floods, river bank cutting and channel shifting is triggered due to rise in river bed. It is one of the major problems triggering those geomorphic processes and threatening livelihood of the people living nearby areas in the VDC. The gradual siltation of many channels results in flood, erosion and siltation going on continuously with increase and decrease of flows.

'There are many believes that the cause of flooding is the rise s of the river beds, which has been caused by excessive silt deposition, and which become part of a positive feedback system, since aggrading river beds will drop more load, causing further aggradations' (Chapman and Thompson, 1995).

In the context of my study may be because of the huge boulders and gravels brought by the rivers mainly from Hetouda industrial (cement factory blasting) and Makwanpur district landslide, which help in deposition of boulders and sand particles in the river, and yearly accumulation of these boulders helps in raising the bed of the rivers.

Another cause of increasing floods in the VDC is due to inter basin change in water and land use change. Inter basin change in water may also be the cause of increasing flood events in Jagatpur. As the high discharge, Lothar khola, Kulekhani khola, Kyer khola, Manahari khola etc. These rivers are in the high slope the accumulation of discharge from this khola , brings large and huge number of boulders but when they reach in the plain the channel slope decrease tremendously , due to which there might be high deposition rate which ultimately increase in the flood intensity in the plain areas.

Land Use changes also may cause in increasing events of floods. Since the study area fall under the Buffer zone, the National park authority did not allow the local to collect the sand and boulders from the rivers due to which the bed level was increasing according to the survey it was found that after 1970 the bed of the river has been raised by 10 to 12 feet. The

old inhabitants of the VDC says that before they use to cross this river by long jump, since the river was deep and narrow, but now the Rapti river has spread due to the deposits of sand and boulders. The wide of the Rapti river was 0.18km in 1958 where as in 1994 the same river width is almost double that is 0.35km (based on the two date Topo sheet 1958 and 1994). So, indirectly the Royal Chitwan National park headquarter and the Palace in it supporting for the cause of flood and disaster to the people living closer to the park so called buffer zones. Kans (thatching grass), sand, and other vegetation inside the park is growing up which ultimately blocks and function as a natural check dam resulting flood and river shifting to the settlement side, since the area is becoming low due to accumulation of this sand and boulders and the settlement side northern part are weak, the soils are loose so due to which they are facing floods. Where as national park side is becoming dense day by day and functioning as a natural check dam.

5.2.4 Inappropriate Design of Infrastructure:

Drainage congestion due to development of interventions; improperly built flood control (eg. embankment and dikes built without analyzing long term effects); The design and construction of infrastructure such as bridge, culverts, and irrigation structures with out the consideration of the frequency and magnitude of floods and their recurrence interval lead to flood hazards. Similarly, haphazard growth of Human settlements could lead to drainage congestion, thereby increasing the probability of floods. Construction without proper understanding of geohydrological processes, particularly the discharge of water and sediment and discharge type, has also led to hazardous activities (Dhital, Khanal and Thapa, 1993). According to Chettri and Bhattarai, 2001, a recent case of cross border inundation and drainage congestion causing adversity to the Nepalese side is the afflux bund constructed in March 2000 by India on the right bank of the Rapti river ten kilometers upstream of the Laxmanpur barrage. The afflux bund of height 2 to 5 meters is located at a distance ranging from 200 meters to 650 meters from the international boarder. As a result, five village Development Committees (VDCs) of Banke district of Nepal become vulnerable to inundation and 1723 houses, 9951 families and over 1,600ha of land were being affected in the monsoon season.

In the study area too due to the construction of bridge which joins National Park headquarter to Madi VDC from the study area has increased floods hazard. According to the field survey nearly 90 percent of the respondent opinion was, the flood in Jagatpur is mainly due to improperly recent constructed bridge, which resulted in serious flooding since 2002. As the

victims express their views as “the bridge has blocked flow of water, as it has been made narrowing the edges of the river to minimize the cost of construction” Parbati Panta, flood victims) (The Bridge which was build without the proper consultation with the local and which was build to join National park headquarter to Madi VDC.

The design of the bridge was inappropriate (photo. 5.1) by seeing the pillars of the bridge; we can assume that this bridge is some way helping to increase flood hazard in the VDC. The sizes of the pillars are very thick and the distance between the pillars is just 36 feet’s as well the height of the bridge of comparatively less. Since the plain area has Sal tree (*shorea robusta*) which are around 30 to 50 feet’s tall ultimately the trunk of this huge tree brought by the flood blocked the bridge, which will be further blocked by smaller trees, big boulders and bushes finally this block the flow of rivers and act as a dam, consequently the water will flow to the low area as a flood.

Photo No 5.1: The structure of Jagatpur Bridge

The other cause of floods is soil erosion as cited by Chettri and Bhattrai 2001; it is estimated that Nepal loses 240 million cubic meters of soil annually. Such a rate of soil erosion causes heavy sedimentation in the rivers, increasing the incidence of floods and damaging life and properties every year. There is also a hot debate regarding deforestation causes and downstream flooding. It is therefore a need to investigate the extent to which the depletion of forest in the uplands might contribute to increase runoff, soil erosion and sediment load.

According to (United Nation 1999:79), the loss of forest cover is also affecting river flow, exacerbating the severity of flooding and increasing variability in flow.

According to WECS 1994/1995, Nepal has lost about 57,000ha of natural forest area. The rate of deforestation is high in the Tarai, from 1978 to 1991 about 90,000 hectares of tropical Sal forest (*Shorea robusta*) was cleared in the Tarai. As a result, from 6 million hectares of forest covers in in 1964 it has now shrunk to 4.2 million hectares. The average annual rate of deforestation is 1.3 % in Tarai as compared to average deforestation 1.7 percent per annum in the country as a whole (Choudhary, R.P. 2000), due to which helps in increase the run-off, formation of gullies and occurrence of debris flow, increase in peak flow and decrease in minimum flow helps in landslides and flooding. The decline of forest in Tarai is continuous even today, this loss of forest in Churia has directly affected the productivity of agricultural lands of the Tarai because of ground water cannot be fully recharge and the increased sand deposits and rising of river bed have created an unfavorable situation for farming. But recent day's development of community forestry in middle Hills region of Nepal has resulted in increase of forest lands in the country as a whole.

According to (Chapman and Thompson, 1995) they have concluded by saying: 'Forest cutting followed by abusive agriculture and grazing may aggravate flooding, forest cutting followed by conservation farming should not aggravate flooding'.

However, several sources agree that natural factors are dominants, e.g.: *'Deforestation of the Himalayas is not likely to have a significant effect on the extent of flood in the plains and delta below. The high monsoon rains in the mountain, combined with steep slopes and seismically unstable terrain, ensure that this zone will have rapid run – runoff and high sedimentation what ever the land cover may be, as was true before human settlement in the region'.* (Rogers et. al. 1989, cited by Chapman and Thompson, 1995).

5.2.5 Government Policy in Flood Relief:

Government policy is also one of the causes of floods. The Natural Calamity (Relief) Act was first formulated in 1982. The Act has given importance to relief and preparedness. It also made provisions for establishing the Central Disaster Relief Committee under the Ministry of Home Ministry of Home. The act was amended last time in 1992, which broadens the scope of the previous instrument to include all disasters. The act has been extended beyond natural disaster to include man-made calamities such as industrial accidents.

Until the 1980, most of the government activities were mainly directed towards post disaster activities, for example rescue, relief and rehabilitation. But with the start of Natural Calamity Act of 1982 and its amendments in later years, pre-disaster activities also started to be recognized as important activities in the overall context of disaster (Intermediate Technology Development Group, ITDG, 2001).

In the context of my study, most of the respondent complains about government policy in building embankment. Poor land use management policy is also the major cause of every year disaster. In the village sine 1974 they have received many funds to build embankment and spur to control flood. But those funds were directly controlled from the Center government, and they assigned a contractor to build the structure to control the floods. But mostly those contractor works were unsatisfactory in the village, before monsoon they start the jobs, but after monsoon all those structure which are builds to protect flood swept away by the floods, again new funds come but never control the flood and riverbank cutting in the village. The informants also told that funds are insufficient, not in timing, without local people participation, and impact assessment were hardly done before implementing any policy.

Also, the policy of the Royal Chitwan National Park in some way helps in creating floods in the village as I discussed in my earlier chapter. Most of the respondent said that due to the National Park Headquarter and the Palace in the southern part of VDC, in the National Park side, due to long grass, and stone embankment, is becoming a natural check dam where as in the village side it is loose soil and yearly deposit of sand and boulders, creating floods in a yearly basis also the Government policy in the construction of bridge joining the headquarter is also helping the floods, because the bridge was constructed without proper impact assessment. And the policy of National Park is, the local cannot collect sand and boulders from the river which is also another major cause of flooding in the Village.

5.3 Increasing Exposure to Hazard Prone Areas:

Encroachment in the flood prone area by building the costly infrastructure, as for example: School, health post, irrigation canal, roads bridges etc has increased the vulnerability. Also cropping in the flood prone areas, settlement and encroachment of river bank, by the in migrated people and building the house over it. As I have already said in my earlier chapter that, the population density in the Jagatpur VDC is 529 persons per sqkm. And this VDC is one of the densely populated. Soon after the malaria eradication program large numbers of people from hills migrate to this place in search of agricultural land so these people

encroachment of the flood plain and started cultivation, and settled in a haphazard manner which might be also the result of more damage and loss in the village, besides this excessive irrigation resulting in rise of water table causing floods. It has been found from many other literatures, 9 meters of permanent lowering of groundwater table cause 30 cm of land subsidence contributing to increase flood depth. (Khalequzaman, not dated).

The socio economic and demographic factors also contribute to increase the vulnerability of people's life's and properties to flood. The linkages between land use practices and Human settlement encroachment on to the flood plains create conflicts between resources and environment (Chettri and Bhattarai, 2001).

More than 300 household in the study areas falls under different hazard level. The two schools one is in Dhruwa VDC (orphan school), fall under very high hazard areas. This school was inaccessible by all three floods. The school has more than 250 children. And the other school was in Ghailaghari Ward number 1, which also falls under high flood prone areas. Besides this the other infrastructure is the Hotel jungle paradise which also lies in the flood prone areas. The other infrastructure are the canal, road and bridges in both the village (Ghailaghari as well as in Dhruwa) which are build in the hazard prone areas has increases the vulnerability in the areas.

5.4 Hazard Prone Area Risk Identification and Mapping:

From the social and geomorphic flood hazard map prepared based on GIS/RS (fig 5.4) depicted that out of 1560ha of agricultural land in the VDC, 26ha of agricultural land fall under very high hazard level, which is followed by 93ha in high hazard and 473 ha under moderate hazard and rest of the agricultural land falls in low to safe hazard areas (table 5.2.). Similarly when I checked which areas in the VDC is more vulnerable to flood, from the analysis hazard map I have found that Ward number 1 and 2 are the most vulnerable Ward in my study areas as most of the area of this Wards fall under different hazard level, and this two Wards are the most densely populated and high land use land cover areas are concentrated in this two Wards. The result of my finding based on GIS/RS is same as the local people perception of the prone areas. Out of 521ha of total area in Ward number 1, 55ha of the area fall under very high hazard followed by 110ha in high hazard and 318 ha in moderate hazard. Similarly Ward number 2 cover a total of 468 ha out total area of the VDC, of this 152 ha lies under very high hazard, followed by 71ha in high hazard, 102 ha in moderate hazard

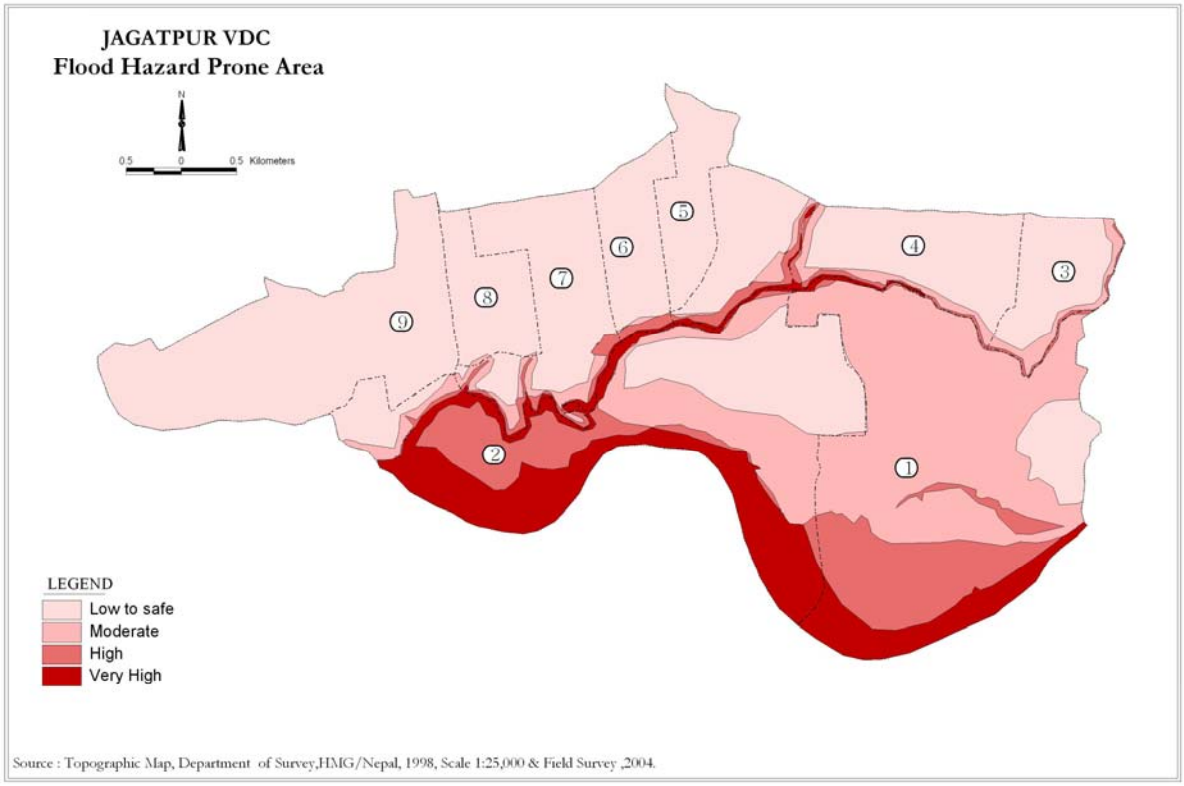
respectively. So, this shows that these Wards are the most vulnerable Wards in terms of areas as well as by population.

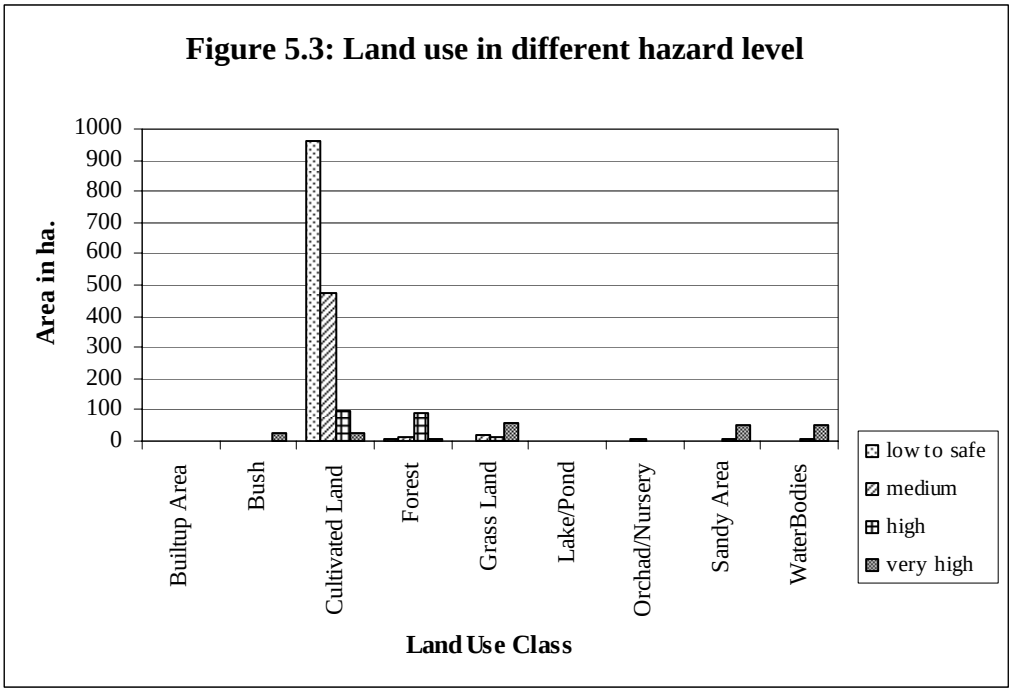
Table 5.2: Land Use/Land cover fall under different hazard level

Land Use in ha.	Low to safe	Percent	medium	Percent	high	Percent	very high	Percent
Builtup Area	2.3	0.2	2.7	0.5	0.0	0.0	0.0	0.0
Bush	0.0	0.0	0.0	0.0	0.1	0.0	25.2	11.4
Cultivated Land	963.8	99.1	473.5	92.4	93.8	45.8	26.3	12.0
Forest	5.3	0.5	13.9	2.7	89.9	43.9	9.1	4.2
Grass Land	0.4	0.0	17.1	3.3	10.1	5.0	57.7	26.2
Lake/Pond	0.0	0.0	1.1	0.2	0.5	0.3	0.0	0.0
Orchad/Nursery	0.6	0.1	3.4	0.7	0.1	0.0	0.0	0.0
Sandy Area	0.0	0.0	0.2	0.0	4.0	2.0	48.2	21.9
WaterBodies	0.0	0.0	0.5	0.1	6.1	3.0	53.5	24.3
Grand Total	**972.4**	**100**	**512.3**	**100**	**204.6**	**100**	**220**	**100**

Source: Computed from GIS based on Topographical sheets 1:25,000

Figure 5.2: Flood Hazard Prone Area





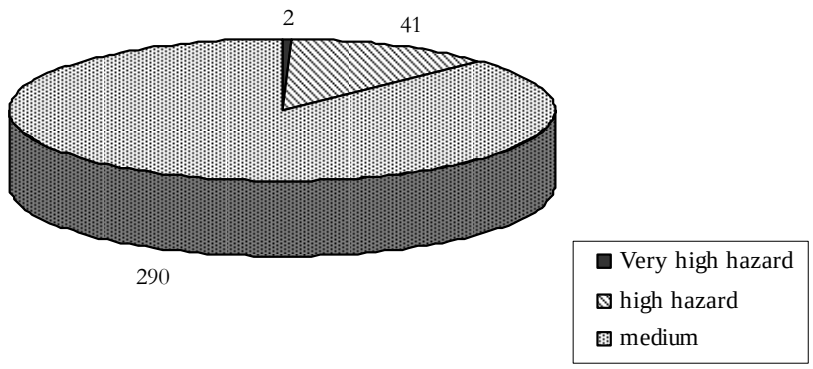
Source: Computed from GIS based on Topographical sheets 1:25,000

Likewise the total forest land in the VDC is 118 ha out of this 92 ha fall under high hazard, followed by 9 in very high, 11ha in moderate hazard (fig 5.3). But most of the forest has been swept away by the flood of 2002 and 2003, and this is the results from Topographical land cover maps of 1996.

Out of 85ha of total grazing land in the VDC, 58ha falls under very high hazard, 15 in moderate hazards and 12ha in high hazards, by seeing the results it shows that most of the natural resources in the study area fall under the hazards areas.

When I cross tabulated the settlement data with hazard map it was found that 2 houses falls in the very high hazards, followed by 60 in high, 254 in medium hazards out of 2210 settlement (fig 5.4). Where as rest of the settlement houses are in the safe areas but their land are in the hazards level so they too are vulnerable to flood hazards. Most of the settlement who are vulnerable are of Ward number 1, 2 and Ward numbers 7 rest are not that affected as they resides in Tadi (high elevated areas where the land is not that fertile and scarcity of irrigation), so the people who

Figure 5.4: Number of settlement in different level

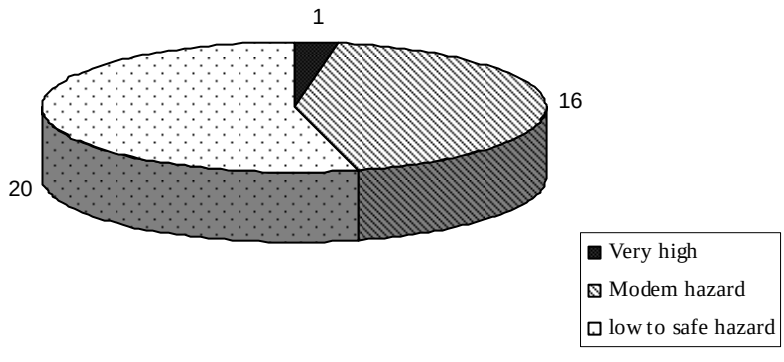


Source: Computed from GIS based on Topographical sheets 1:25,000, and field survey, 2004

live in Tadi mostly cultivate other crops than paddy, only very few household family who have access of well and generator cultivate paddy but that too only one season.

Like wise the total services in the study areas were 37, only one school fall under very high hazard that is the Orphan school in Dhruba village Ward number 2 of Jagatpur VDC, followed by 15 services in moderate hazards and rest falls under low to safe floods hazards (fig 5.5).

Figure 5.5: Differenet service under different hazard levels



Source: Computed from GIS based on Topographical sheets 1:25,000 and field survey, 2004

The infrastructure and services too fall under the different hazards level. When I calculated the lengths of different types of roads falls under different hazards level. I have found that out

of 84.513 km of total road in the VDCs, 4.8km lies in the very high hazard areas, followed by 6km of road in high hazard, besides this rest of the roads are in the low to safe hazard areas.

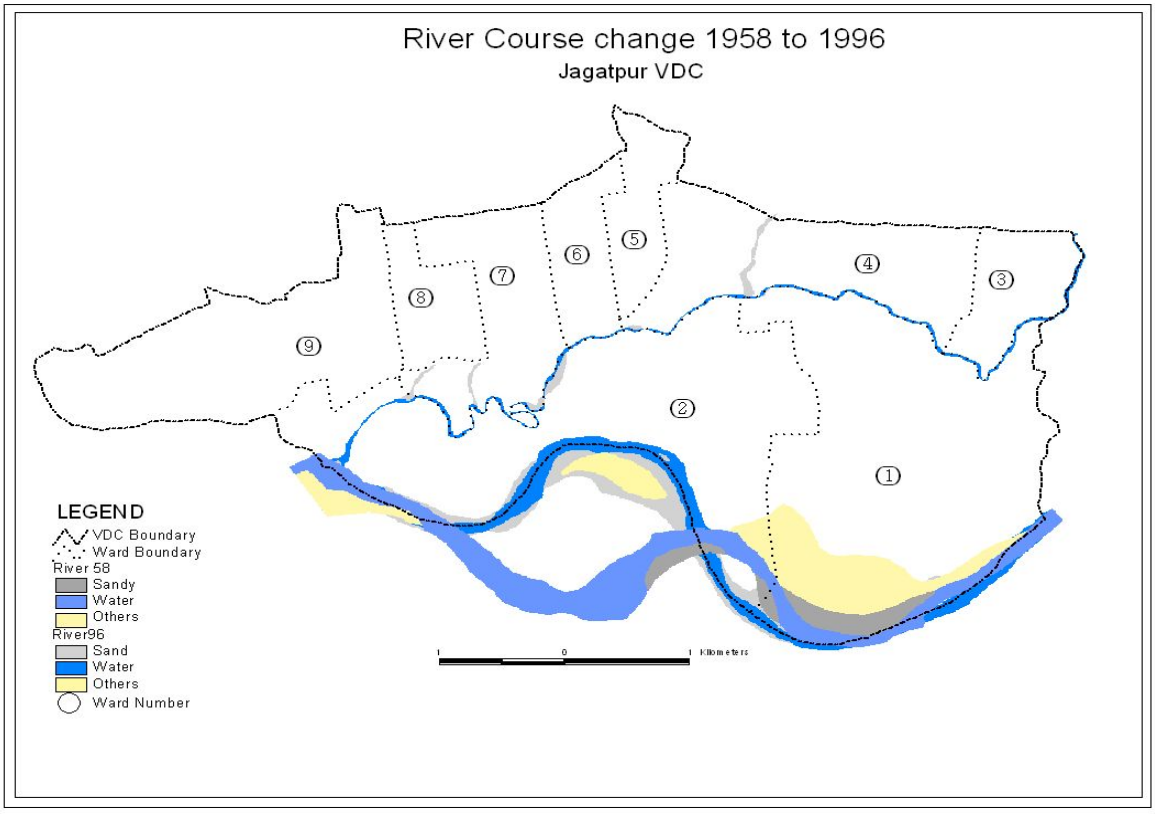
5.5 River Channel Course Change (1958 to 2004):

The shift of river course, river bank cutting, siltation, and inundation etc. are creating problems to the people living near by the flood prone area, for an example, the Koshi river has shifted about 100 km west since 1736 in a period of 250 years (Ives and Messerli, 1989). So due to this drastic change in river course, it has made direct livelihood disruption of the local people and to most fertile agricultural land and extensive damage to crops near by the flood prone areas.

The river course change has been detected of the study areas since 1958. By seeing the river course pattern in 1958 and 1996 there has been a tremendous shift in the river course. From the change analysis it was found that river has shifted more than 2 kilometer since 1958. The shift is mostly to the northern part of VDC which we can see in the map (fig 5.6.) The largest areas of shifting have been seen in the Ward number 2 of Dhruwa village as compared to other part of the same VDC.

From the map below, this it is clear that this VDC is not only suffering from flooding but also the river course shifting is a major problem in the VDC as I have earlier discussed because of river bank cutting and flooding 84 households have been rehabilitated to other districts of the country and rest to the same VDC. Due to its shifting nature the people of Ward No. 2, (Dhruba village) mostly migrated to northern part of same village. Most of the forest has been cleared in the northern part of the VDC and change to cultivated and settlement area. We can see the change in cover pattern with the help of two date's aerial photographs (1978 – 1992), (photo 5.1) and (photo 5.2). As I have already discussed in earlier chapter the main cause of river shifting to the northern part of the VDC is the Chitwan National Park which is supporting for this shifting. As well 90 percent of the respondent blames that Royal Chitwan National Park Headquarter and palace on it is supporting in the shifting of river course which is mainly due to huge accumulation of sand and boulders and tall grass in the stone net which has build to protect flood and river bank cutting. Ultimately those stone nets have the growth of Kans and accumulation of sand course, helping the stone net as a natural check dam to the national park side.

Figure 5.6: River course change (1958 – 1996)



Source: Computed from GIS based on Topographical sheets 1:25,000

The Local have loss 2 kilometer of fertile agricultural lands already during 30 years time frame. The policy of National Park is Rapti river is taken as the boundary of National Park. If the River shift to the settlement side, than those land will be automatically belongs to National park and vice versa, based on this they give some compensation to the victims, who has lost their land.

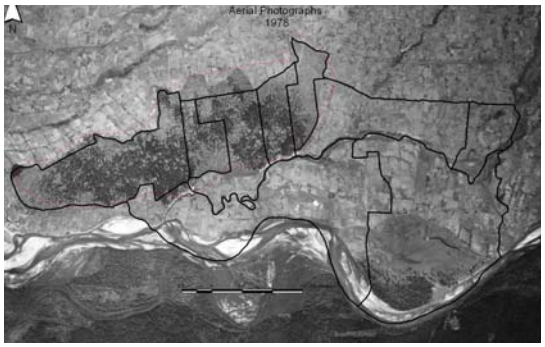


Photo 5.2: Aerial photo 1978

Photo 5.3: Aerial photo 1992

From the above aerial photographs it is clear that in 1978 the north western part of the VDC was full of dense forest which is also marked by dotted lines, but this patch of dense forest has disappeared in the photographs of 1992. This is mainly due to the resettlement program launched by the Government, for the people working in Hetouda Industrial area mostly in the northern part of the VDC. Besides this mostly the western parts of dense forest land were

deforested and change to settlement and farmland by the victims of flood disaster and riverbank cuttings since 1974. The flood victim as well the other local people has also started some afforestation in the bank of Rapti river in Ward number 1 and in the VDC to be protect from flood and river bank cutting, which we can see in the above aerial photographs of 1992 there were more new patches of forest in the Rapti river bank mostly in the southern part of the VDC, where as very less or no forest patch can be seen in the same area in the photographs of 1978. But those patches of forest were swept away by the flood 2002, 2003 and 2004.

From this it is clear that the VDC is seriously affected by flooding and river shifting. Also other important factor is due to inter basin change in water, as for example the Hetouda cement factory mining site, from where huge amount of sand boulders which come with the Manahari rivers. Since in the upper catchments the slope is high enough so rivers brings large number of boulders, Where as when it reaches in the lower catchments the slope as well as the flow of river decreases highly. By the decrease of slope and the decreases in river flow, the boulders accumulate and spread in the plains which may help in shifting of river course in very short time.

Chapter VI

Impact of flood

This chapter mainly deals with the socio economic and environmental impact of flood. The people of the study area were well off before the flood. However after the flood the economic situation of the people has been worsening due to which there livelihood has been disrupted.

6.1 Impact:

The impact of flood in the study area is devastating. The northern part of the study area is little safe from the flood, villages like Ghailaghari and Dhruwa are the most affected in the area. For three consecutive years, i.e. 2002 to 2004 the excessive rainfalls during the months of July and August have cause devastating flood. Almost the whole villages of Ward number 1 and Ward number 2 were inundated.

Not only the rare and high magnitude floods events are associated with severe damages, but the more frequent flood events of a lower magnitude can still bring serious damage and disruption in the form ruining crops and causing food scarcities, disrupting infrastructure and access to services, suspending business activities, and exacerbating health risks in the home and local environment (Blaikie et al., 1994; Smith, 1996; Parker, 1999). Similarly to their finding, my study village was severely affected by the flood, when In the middle of night of 22nd July 2002; the Rapti River was suddenly over flooded which ultimately broke the embankment that was build at a cost of NRS 30, 0000/- (field survey 2004). The riverbed raised up to 6 meter and severe flood lasted for 20 hours. Most of the people were unable to take any thing from their houses as the flood came in the middle of the night. Some people saved their life by climbing trees or the roof of the houses, while other families saved their lives by sailing in traditional water boat and the rest ran to the safer place of the VDC. The house shown in (photo.6.1) represents the living symbol of that event where about 36 people saved their lives by staying on top of the roof. We can still see the level of flood mark on the wall of the house.

Photo 6.1: Flood Level mark

Note: This house was saved from the flood of 2002. The flood reached the mark above window in right side a 6 feet deep gully was developed in the yard of the house near the ladder.

The most serious direct effect of this flood was the loss of lives and damages of houses and sheds. It made many villagers homeless. In the study area most of the people lived in nearby school for several days. Such strategies are quite common in other areas too as for example a study of the devastating flood in Mozambique in 2000 shows that most of the flood victims were accommodated in local schools (Christie and Hanlon, 2001). In the case of my studies, some of them had to find shelter in their neighbor, relative's houses; whereas most of them settled in tents in the nearby school compound. A year later on after a year 40 household were rehabilitated by Nepal Red Cross Society in other safe area of same VDC in Ward number 1 Red Crossgram, while other household families were supported by CARITAS to 54 households, King Mahendra Trust, 26 households and local NGO (ANUGRAH, 27 households). Besides this some of the well-off families moved to the northern part of the same VDC. And those families, who become landless as well as home less and were not properly rehabilitated moved to other parts of the district and settled by encroaching the public land illegally.

Apart from lives of the people and housing the flood of 2002 caused serious damage to the property, number of livestock, poultry and infrastructure. More than 500 ha of fertile land with planted paddy have been silted. The impact of flooding on women, old people and children were severe in the study area. The local people attributed many of their health related problems to the recurrence of flood. Due to the flood the local people are facing the problem of drinking water. 95 % of the people had their own hand pump in Ghailaghari village earlier but now they share one hand pump by two to three houses but the quality of water is very poor after the floods still people do not have any option so they were drinking unhealthy water.

6.2 Losses of Existing Farmland and Settlement:

This is one of the serious environmental, economic and social issues commonly observed in flood affected areas. In the study areas it was found that large amounts of sand and boulders were deposited in the farmland mostly in Ward number 1 and 2 making it useless for more than 5 years. Similarly, due to bank erosion considerable numbers of houses in Ward number 2 Dhruwa village have been destroyed and the people have moved to new location mostly in the same VDC i.e. northern part. Some houses have not been rehabilitated and resource poor people and those with fewer networks are still in the high hazard areas which might damage in near future. Similar type of destruction are also found in other areas according to Lyngdoh,(1988) (in Wisner et.al 2004), found that when the Kosi river flooded in north Bihar (north India), it also normally deposits a layers of sand over the agricultural land, rendering it useless for up to 50 years.

The orphan school in Ward number 2 Dhruwa with 260 orphan students (photo 6.2), run by the Korean family was mostly affected by the three continuous floods (2002 to 2004). Due to development of a new channel in the western part of VDC near Shukaranagar, the school was surrounded by river channels and became inaccessible. The Orphan children (260 students) living in school were totally isolated from surrounding villages, at present they are in the stage to move permanently to other part of district. Many new gullies and rills were developed by the flood in Ghailaghari as well as in Dhruwa village.

The severity of flood disaster depends primarily on the interaction between the magnitude of the flood and the vulnerability of the human settlements. The most serious direct effect of the 2002 and 2003 floods was the loss of life, livestock, and house damage and to agriculture land and crop on it. The flood that has killed 11 persons, injured 17, and affected 795 household

families, among them 199 houses and 65 shades were totally swept by the flood (field survey, 2004).

Photo 6.2: The orphan students in queue to change their dress.

6.3 Permanent flooding or Stagnation in the Farmland:

Water logging and stagnation in the farmland is another major impact as well as environmental problem being face by the inhabitants, especially in Ghailaghari Ward number 1 of the study area. Due to heavy rain in the monsoon months, the Rapti rivers carries a large flood discharge with heavy sedimentation and it causes the aggravation of river bed due to which flood height become more than the river banks. In such situation the flood water spills over the cultivated land by spilling through the banks of river. In some part the river has changed its course itself and formed a new course. The land owned by 40 house hold in Ward number 1 of Jagatpur VDC is totally water logged (photo 6.3) and the victim of these lake formatted areas of Ghailaghari village were rehabilitated to new area in same VDC by Nepal Red Cross Society after a year.

Photo 6.3: Water logged area in Ghailaghari after the flood of 2002.

Besides this other 20 household, whose only land were formatted to a lake, but their houses and shades were in safe place were not rehabilitated by the Red Cross, so these family members ultimately moved to Ganeshthan of Chitwan district where thy illegally captured the wasteland, as they could not sustain in their village as they have roof to stay but nothing can be grown. Besides this 6 household of Bote caste has been displace no one knows where they have gone. Similar to my finding there are also other cases, household that has less capital or assets, choose the different livelihood option and among them one is migration or moved to other areas in search of land and food. (Blaikie et al.1994, Scones, 1998).

6.4 Loss of Road and Infrastructure:

Apart from this flood of 2002 destroyed infrastructure including 5 pavements, 10 kilometer of canal, and 180 meters embankment worth of 3 million Nepalese rupees. Besides this, dike 50 by 50 meter, stone net 4 stone net of 50 X 50 meter, 10 kilometer of trail more than 200 water pump and electricity transmission line and 10 kilometers of strong wire and concrete fencing of National Park were all destroyed by this flood. So, due to the loss of National Park fencing, people have now become more vulnerable to flood and wildlife.

Again the people in this area have started building the embankment, stone net, houses, sheds, and improve their silted farmland, by selling different assets, by taking loans and mortgaging land and other valuable goods. Poor structural measures as one of the major supporting

facture of embankment failure and poor maintenance of some have even exacerbated flood hazards. (Blaikie et al., 1994. Smith, 1996 ;) In the context of my study area, poor structural measures are also one of the major causes of yearly floods. The improper construction of bridge and embankment contribute flood hazards. Due to which again in 2003 and 2004 too same magnitude of flood came to the VDC at that time only three person loss their life those build infrastructures were again destroyed by the flood. The flood of 2003 again swept away the 17 houses which were build by the (ANUGRAHA) for the shelter of 2002 flood victims. The Flood also destroyed 160 ha of community forest, out of that 10ha of forest land were totally swept by the floods. After this flood people become very weak economically and psychologically. Similar to my finding there are also other cases where they have found.

6.5 Economic Loss:

6.5.1 Agriculture

Agriculture is a major vulnerable area, because of the dependence of majority of population on it. In the study area more than 500 ha of fertile agricultural land with paddy have been silted by the flood (photo 6.4.). More than 90 percent of the total respondent reported that their summer crops were completely destroyed. The productivity of the land, usually in this area to be very high, they used to produce 3 Muri (157.5 kg.) per kattha (0.03387ha.) But at present farmer's household of Ward number 1, 2 and 7 have abandoned the land since the floods of 2002. Except some families, have planted paddy not by transplanting but by throwing the seeds Agriculture is the major impact area, because of the dependence on it of majority of population, according (NPC, 1991), around 12000 to 15000 ha. of arable lands washes away every year in Nepal by floods and landslide.

Photo 6.4: Fertile land left abandoned due to sedimentation of boulders and gully formation.

The flood of 2002 swept away of National park fencing. As a result, many wild animals such wild boar and rhinos have been continuously visited the cultivated land and destroyed the crops in northern part of the same VDC, where the land is not affected by the flood. This part of the land is slightly elevated, and called Tadi; where maize, potato, oilseed, beans, and vegetables are cultivated. Due to wildlife encroachment after the flood they are not intensifying cultivation; this has affected the livelihoods of the people of the study area. At present the victims are basically engaged in non farm activities.

6.5.2 Decline in Land Value:

The land value has declined tremendously after the flood. The village Jagatpur was developing as a tourist centre. Due to the arrivals of more tourists, the agricultural land was sold to develop hotels and lodges in higher prices after 1990s. Besides this the villagers were diversifying their livelihood from subsistence agriculture to tourism related jobs. The prices of land prior to flood was NRS 400000 per Bigha (0.68ha) of land but now the value of same plot of land value is around 50,000 to 100000 . And still it is difficult to sell the land in these areas now. People of the study area had demanded land compensation from the Government in the safe area. Till this date neither the government nor the National park authority has given compensation. Hence, the life of local people is becoming harder day by day. Even the bank does not provide loan to such land, mortgaging of the land too is not possible. The insurance

policy for land is not yet introduced in our country. So the local people are adopting different ways to cope with the hard situation.

6.5.3 Livestock:

Livestock's are inseparable part of agriculture in the VDC. Large number of people own livestock mainly because of availability of grass and water. Major types of livestock in the VDC are buffalo, cattle goat, sheep and chicken. Local people used to rear water buffalo and cow for dairying. Oxen were reared for plaguing. Prior to flood there are around 2660 water buffalo, 1410 cattle, 3491 goat, 37410 chicken and 124 sheep and others.

But the flood of 2002 killed around 220 heads of livestock including water buffalo, cow, oxen and goats. More than 1500 chicken were swept by the flood (field survey, 2004). They have sold the remaining livestock sustain their family income. From the household surveyed it was found 5 household did not have any livestock at all, where as 19 household has more than 4 livestock and rest of the surveyed household have 1 – 3 livestock mostly she water buffalo. Apart from this there were increasing number of poultry farm and people were increasing number of goats in their houses, to do this At present some INGO like CARITAS, a donor based project, has given 2500 NRS to each flood affected household to purchase goats.

Every house engaged in subsistence farming has agricultural equipments and some trees they plant in their land for fruits and fodder. Besides livestock, other sources of income in the VDC are from the wage labour, trade/ business, services, labour migration mostly abroad.

6.6 Socio Economic Impact:

Prior to the flood the people in the VDC had a good income through agriculture, livestock and tourism. Agriculture is by far the most important economic activity of most of the households in the VDC Nearly 3 percent of the total household in the VDC is landless.

Sen (1981) argues that one cannot predict without the detail analysis of the victims that which groups within the community will suffer most or least. To carry out the such an analysis, Sen recommends that four parameters of each groups be measured; firstly the bundle of commodities owned by the each unit of analysis, what Sen, refers to as endowment; secondly the alternative set of commodities owned by each unit of analysis which he refers to entitlement mapping. These basis parameters enable each groups to generate varying degrees of direct entitlement (i.e production for own consumption), trade based entitlements (i.e.

exchange of commodity bundles for food. Conversely, unfavorable shifts in either basic parameters due to flood or other factors, can lead to varying degree of direct entitlement or trade entitlement failure (Chen, 1991).

In the context of my study area the landless household and the some marginal land holding household have faced the direct entitlement failure, as these families were mostly doing wage labourer work in agricultural land and the household who rented the land, because of siltation and loss of agricultural land their earnings of wage labour is loss, as well as the production is loss as some of the household members were growing food in others lands as trade based entitlements. The details of landholding sizes of the household are; Households with marginal size of land holding (<0 .5 ha) comprise about 43 percent of the total households in the VDC. Small farm households comprise about 49 percent whereas large farm households comprise about one percent of the total household in the VDC (table 6.1).

Table 6.1: Number and percentage of household by farm size, 2001

Farm size	Household	Percent
Land less	62	2.81
Marginal (< 0.5 ha)	950	42.99
Small (0.5-2 ha)	1078	48.78
Medium (2-4 ha)	88	3.98
Large (> 4 ha)	32	1.45
Total	2210	100.00

Source: Buffer zone user committee, 2004.

6.6.1 Food Sufficiency:

Food deficiency is considered as a major indicator of poverty status of the household. Prior to the flood of 2002, 2003 and 2004, 20 percent of the families in the VDC were producing surplus food from their own production in different seasons. Nearly 15 percent of the families have their own production sufficient only for less than 3 months. The percentages of families with food sufficiency for 3-6, 6-9 and 9-12 months is 16, 23 and 26 percent (table 6.2)

Table: 6.2: Food sufficiency and percentage in the VDC, 2001

Months	Household	Percent
< 3 months	331	14.98
3-6 months	361	16.33
6-9 months	509	23.03
9-12 months	567	25.66
Well off (surplus)	442	20.00
Total	2210	100.00

Source: Buffer zone user committee, 2004

After the floods of 2002, 2003 and 2004, the majority of household in the Ward 1, 2 and 7 are reduced to less than 3 months with food sufficient. There were a few households did not produce any food continuously for three years. Out of surveyed households 21 households were not producing any food, similarly 31 households produce food 1 - 4 months, where as 31 household produced food for 5 – 9 months, and 32 households were find producing food for more than 9 months and few household produced for whole year with surplus.

The people's livelihood was mostly disrupted by the disastrous floods. They have faced many problems after the flood disaster. The people of the study area were mostly of mixed ethnic and caste groups. It was very hard for the people to live together in a school compound after the post disaster period due to cultural conflicts.

'Ethnicity affects the livelihood strategies as there are some taboos and cultural because of restriction and cultural practice, which permits some households and forbid others, to engage in certain occupation. Occupational caste households are particularly vulnerable as they face discrimination not only in adopting occupations involving food preparations but also in their access to resources' (Adhikari and Bhole, 1999).

In Nepal, every one is equal by law but practical life people still follow their own rules and customs and with such practices as for eg. Untouchability, higher and lower classes create a major difficulty in the relief camp to manage the people from different groups. As higher class people regard people like Sarki, and Kami as untouchable, so this group of people entitlements has been forbidden by the cultural norms though they are equally affected and skillful. Similarly, among the disaster affected household, poverty has uncertain role in maintaining social relations. The flood victims of Ghailaghari and Red Cross gram reported that they are facing establishing marital relations due to their economic conditions.

Among the ethnic and caste groups the most affected were the occupational groups and Bote. Bote were the most marginalized groups in the VDC as they have lost mostly all their assets. Besides this it was very hard for them to adjust in a very compact place due to unavailability of space.

Also the families faced insecurity in the camp for other resources as well. Some of the people went out and drank at night and harassed the other residents by using dirty words. The women and children (girls) felt it uncomfortable to hear such words particularly when they were

together with their elderly family members present with them. Many of them were forced to live in tents for more than 6 months.

The flood did not only cause substantial destruction of physical infrastructure and land, but it also caused massive uprooting of the people. Many of the villagers became poor almost overnight after the flood. Only small portions of the household were able to save their assets such as cattle and some valuable household goods. Most of the households on the other hand were not able to take along any thing but themselves. After the floods the people have had problem of shelter, food and pure drinking water and health problems. The impact was different to the different socio economic groups and to different households. Some were severely affected while others were partly affected. The people of Ghailaghari Ward number one and the people of Dhruba village were severely affected due to the loss of land and other household properties.

Many houses swept away, their properties including livestock, trees, agricultural equipments, household utensils, and grain stocks were mostly drowned or swept away and 40 houses has to rehabilitated to nearby VDC because of waterlogged in their land (lake formation). But the people of Ward number 7 Dhurba Tadi, and Belhatta village in Ward number 2, have lost only their fertile lands this two village houses and sheds were in the safe place. Where as the village Ghailaghari was severely affected by the flood of 2002, and 2002, by the flood of 2002, about 162 houses were swept away and many hectares of agricultural land. The family members of 199 households had to stay in tents for more than 6 months. They had to sell their assets in very cheap prices, while discussing with them they have said that they have given freely not sold, because the prices was very low which they got from one buffalo or goat, due to which some economic class family has been profited as they have accumulated the assets at depressed price.

The other impact is when any body in the victims family born or death, customarily death rituals such as (Kriya) and naming ceremony (Naran), needs huge financial resources to perform this ceremonies, as one has to invite and feed a large number of people/ guest. Such rituals eventually lead a family to a more uncertain condition; it has also found that some of the household of Bote caste in Ghailaghari had face such problem due to which they become worse.

I have also found some families, who have sold there wife's jewelry. For instance one family had to sell Mangal sutra (marital symbols) which has a great symbolic and cultural meaning

for the Hindus women. It means they are married and their husband is still alive. Selling this asset is a serious issue many had to take loan and sold others assets to be able to maintain the farmland and plant crops on it. After the second flood which again swept away the rebuild things and ruined the crops and silted the agricultural land by huge boulders and gravels people were discouraged. After the flood they had started building their houses and shades, and borrowed money and sold their other households assets to purchase utensils cloths etc. Unfortunately the second flood the year after destroyed all their newly constructed houses, buildings, shade, land and crop on it.

According to Wisner et.al , 2004, the impact of flood on many people's livelihoods causes at least a medium – term disruption and will entail hunger for some group of people. The International Food Policy Research Institutes (IFPRI, 1995) study provides evidence that people in lower income groups mostly reduce their food intake considerably. It was also seen in my study area the people's food consumption among affected families had declined, as they could not afford, mainly due to unemployment and due to their low purchasing power. At present the victims have to totally depend on market, while earlier they use to produce food in their farmland. Most of the households were self sufficient for more than 6 months. Besides this rest of the year they used to get food from neighbor by exchange of goods or labour. The 40 household, who were rehabilitated by Nepal Red Cross Society, got a root to stay under but had nothing to eat.

Photo 6..5: Rehabilitated flood victim shelter

The photograph (photo 6.5) above illustrates how bad their situation is. Some families have planted maize, and beans in their garden. A few households have sheds and oxen. The toilet reflects the condition of the lives of these households. The rests of the households in this rehabilitated area are living under similar conditions.

6.6.2 Impact on Women, Children and Elderly:

Women, children and the elderly people were most severely affected by the flood. The children, the elderly and women might be the most vulnerable groups we need to focus them while studying the impact of natural calamities as flood. It has long been established that the poor are the most vulnerable groups when it comes to the disastrous events. (Blaikie et.al.1994).

Among those affected by the flood, women children and old were most severely effected by the flood among them also it is found that occupational and Bote caste groups children and women were more effected. As I came to know during my field work that five women were pregnant when the flood struck. Three out of them, gave birth at the school camp which was the worst situation they had to face. One of the occupational class families (Bote) lost a 3 months old child while fleeing from the flood. The elderly persons were found to have insisted not to leave their homes and properties at or after the time of disaster. This could be attributed to their emotional attachment to the land they were grown up/earned. In Ghailaghari, four people lost their lives because an old woman insisted not to living the house.

The schooling of children was particularly affected during the floods, it became impossible to run the schools during this period. The Ghailaghari School was closed for longer than 6 months because the school building was damaged, furthermore wherever the schools buildings were not submerged and damaged, those schools buildings were made into the shelter for the flood victims. In an area which is still waterlogged, such as in Ghailaghari, 40 household of this waterlogged areas have been rehabilitated by Red Cross Society only after a year. Now these families have a roof to stay under but nothing else to further survive, most of the children, women and old people of these household were force to work outside their houses to sustain their family members.

The primary school in Ghilaghari was also severely affected by the flood. There were 220 students attending the school, mostly coming from the same More than 50 students especially those staying at Red Cross Gram rehabilitee centre dropped out of the school because their parents no longer can afford them to go to school. Kumari Thapa, a single parent, of

Ghailaghari explained that once her son once could not maintain school uniform and, he was scolded by his teachers and had to leave the class room. For Kumari, it was a heartbreaking moment and sometimes recalls her happy days before she faced the flood disaster. Now many school children have left school and are forced to work for earning livelihood (eg. domestic servants, child labor in hotels, in carpet factories and transport sector etc.)

According to (Blaikie, 1994), as well as in other flood literature, it is often observed that the elderly persons workload is increased in the post disaster times. In the study area too I have similar an example from Ghaliaghari and Dhruwa these elderly people were more than 70 years of age, who had lost their entire savings and they were separated from their sons. They are now forced to do wage labor. They are sometime begging for their survival. Another impact of the flood was of the psychological nature especially with the children. It was found that two children of Parbati from Ghailaghari village Ward number 1 did not want to go back to their house again, as they had shown the dead bodies of human and other domestic animals as well as wild animals lying around in these areas after the flood. These children were traumatized. They think that there may be ghost in that area so they do not want to go to that place any more. Now they are staying with their grandfather in another part of the VDC.

6.6.3 Health and Nutrition:

According to Blaikie et al. (1994) the flood disaster is destructive of life not only through drowning and directs injury, but also because of associated disease and famine. In the context of my study, local people attribute many of their health related problem after the flood. They reported diarrhea, and skin diseases, also I contracted skin disease on my legs and hands during my field study. More than 90 % percent of the people of Ward number 1 and 2 suffered by different kind of diseases. This followed contagious affecting other people in other areas as well. The environment of Ward number 1 and 2 was unhealthy because of dead corpses, cadaver and dead insects polluting the surrounding area with smell bacterial dispersal. The water has been contaminated. The people did not have any other options than to drink the contaminated water. During the very first week of the post flood time, they got very good relief from outside. Gradually the outsides aids were decreased. Now people have to sell their assets to purchase medicine and to treat their illness.

6.6.4 Change in Economic Structure:

Prior to the flood the VDC was self sustained. Mostly the people of the study area generating their income through trade, tourism and as wage laborers. New hotels and lodges were

established in the area. The Hotel Jungle Paradise is still there but there were no tourists visiting this during and after the flood. The road was damaged, and the newly build hotel and lodge were all swept away by the flood, instead there is sand and boulders which once was a recreation place, earlier picnic spot is today nowhere to be seen. This has directly impacted the local people's livelihoods. Earlier people were employed in those hotels, and were engaged in activities as by selling handicraft. Now they have to look for the other options. Now the tourism and agriculture related employment opportunities are reduced to the minimum in the study area, and people who were employed in this sectors prior to the floods have now turned unemployed. Now it is hard even to get a wage labour engagement. Often people are getting jobs in the National Park but this is also a limited source. Some people are getting jobs in the neighborhood VDC. They need to pay extra money to work in the agricultural field to those who arrange jobs to them. As a wage laborer, they used to earn around 150 NRS per day at the time of rice transplanting. Out of that, they need to pay 10 NRS to the middleman who arranges jobs and these are mainly due to the scarcity of jobs.

The women mostly used to work mainly inside the house before the floods. They are now forced to work outside the house to sustain their family. The School children were forced to take domestic labor or as a helper, helper in the transport sector, in carpet factories.

From rich to poor:

> *An old Tamang family of Red Cross Grams, rehabilitated flood victim explained his case. He explains in 2002, a devastating flood in Rapti river washed away all of his property including, homes, shades, livestock and the land was silted rendering it useless for more than 5 years and the crops on it was ruined. Prior to floods he was one of the well-known person as his economic condition was better he owned good number of milking buffalos and a good production from agricultural field. Most of the renowned people of the VDC used to come to visit his house to drink milk and lashi (skimmed milk). But after the flood his social status has been changed drastically, those people who used to come to his house for fresh milk and lashi, at present they neglect him, and they hesitate him to give even a glass of water, because of hierarchical problem (Full kumar Tamang, filed survey 2004).*

CHAPTER VII

Coping strategies

This chapter examines the strategies developed by the flood victim households of Jagatpur VDC to cope with the extreme flood hazard and how they are sustainable in running their livelihood. The discussion focuses mostly on the strategies applied by the household member to mitigate the impact of floods at the time of crisis. Among the surveyed household although the flood has equally affected all, but through their coping strategies were different some are able to sustain whereas other becoming more vulnerable. The finding in this chapter is mostly based on the results from the field work. However the first paragraphs discuss about the coping concept on the basis of scholars work.

7.1 Introduction:

The shock or stress and seasonality challenge the basis of a livelihood, then the livelihood moves into so-called 'coping' strategies. From Natural Hazard perspective, defines vulnerability as "the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazards". Blaikie, et.al.(1994). Coping is a mechanism that a household or a community employs to handle the stress situation by mobilizing the assets or capital resources (human, capital, natural, physical and social). Resources also include land, tool, cash, jewellery, livestock or other items as for example storable food items and the skills which can be sold at the crisis to cope in a sustainable manner (ibid).

In response to external shocks such as flood, different vulnerable houses engaged different coping strategies. 'The implication of coping strategies is that the portfolio of activities of these people changes to cope with unusual stress' (Davis, 1996a: 238 cited by Husain and Nelson, 1998). A shock is relatively short stress, such as flood, drought or fall in output prices, affect the people in sustaining their livelihoods. These effects are most affecting to particularly livelihoods groups and socio economic classes. The decline in common property resources is likely to affect the land less class.

To be able to cope with recover from shocks and stresses is a critical component of sustainable livelihoods. Sustainable livelihood, 'a livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A

livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, and which contribute net benefits to other livelihoods at local global levels in the long and short term' (Chambers, and Conway, 1992).

Coping strategies mostly consist of the action taken before, during and after the event. So this can be categories in to three main types: 1) pre disaster; 2) during disaster; 3) post disaster.

7.2 Pre Disaster Coping Strategies:

Pre disaster coping strategies is the strategy taken before the disaster occurrences. This kind of strategies are designed on the bases of past flood disaster experience, based on those experience different group of people takes the preventive strategies, as moving the valuable in safer place, early warning system, communication, shelter management, keeping the food stuff in higher elevated parts etc, the role of government, NGO/INGO in structure development. Fencing their homes, change in the structure of the house has also seen in some households. Improving more social network and based on the household socio economic condition they choose different option to diversify their income sources as for example natural based and non natural based income sources. In the contest of Jagatpur village, though the most of the inhabitants of this VDC are new to flood but in the very short period of time they have adopted different pre coping strategies mostly after the floods of 1993 and this strategies varies form household to household based on their capability.

Besides this Government, NGO/INGO are also giving assistance in building embankment, training on how to mitigate flood. As I have already discussed in my earlier chapter, most of the people in this VDC came after the Malaria eradication programme of 1958 and 1960s. The original inhabitants were Tharu, Darai and Bote and they become a minority. Once the hill migrants (mostly Brahmans and Chettri), move to this VDC, they have slowly captured the most fertile lands of the VDC from Tharu, and Darai, as I came to know from some Tharu and Darai family that their father has given the khet land (paddy farm) to Brahmans and Chettri for a liter of Raksi (alcohol) Slowly the Tharus, and Darai they have exchanged their lands at a nominal price from most fertile to less fertile land toWards the northern part of the VDC which is called Tadi. At present we could see mostly the Brahmans and Chettri lands in lower elevated parts of the VDC. Only 10 Darai and 20 Tharu households are in Ghailaghari village but they also sold out most of their land and now they have below 10 kathha (0.3387ha.) of land. And rest of the Tharu and Darai are in the Ward number 2, higher elevated parts and are

relatively safer. The Bote (fisherman) family has less land as their main occupation was fishing so these families mostly resides in the lower elevated parts of the VDC near the river bank and are mostly concentrated in Ghailaghari village.

Since the families who live in the lower elevated parts were from hills, they did know much about floods in their past days, because they did not face flood in hill mostly they face landslide. When I enquire with the Brahmans and Chettri household families members why they had chosen to live in the risky areas, they replied that, when they came to this VDC, at that time the wide of river course was very small, they could not think of flood at that time, they mostly look at the fertile Khet lands and the grass in the areas, due to which they reside in the flood plain. They have also inquired about the flood with the Tharu, Bhote and Darai people and they too, had said that they had not faced destructive floods in their earlier days. They did have floods in the earlier days but those floods were not destructive as of these days, rather those floods brings soil nutrients in the farms lands, due to which productivity was high in earlier days.

So the new people who knew nothing about floods faced the first destructive flood but mostly riverbank cutting in 1974 that had impacted most of the area of Ward number 2 of the VDC where as Ward number 1 was little affected. Prior to this flood they have also face flood in 1965, 1966 and in 1970 but those flood were not destructive. After this they have face flood in 1974, followed by 1990, 1993 but not as destructive as of 2002 and these floods were the most destructive floods in the VDC followed by 2003 and 2004. In the context of Nepal 1993 was the most destructive floods in the country which has impacted much to the national economy, but this flood did not harm much in Jagatpur VDC. Most of the victims in Jagatpur were in the stage of learning to cope with the floods. But during the short period of time this village people has adopted various coping mechanism among them some are the example, from them the other part of the country flood victims even the policy makers have learned, the technique of early warning system. The details of the pre disaster strategies taken by the flood victims of Jagatpur are as follows.

7.2.1 Early Warning Systems:

The local people have adopted different early warning system in the village against the flood. As there is a saying that "***Jagatpur basi barsa huna thalepachi telephone ko ghanti sunna pugchan"*** (Jagatpur villagers, listen to the rings of telephone after heavy rainfall in monsoon). This has happened because, some of the household members of this village work in Sauraha

(Sanichari hotel), when they see a destructive flood in Sauraha, they make a telephone call to the Jagatpur village to take necessary precaution. If the telephone does not work some time they even come themselves. Based on the telephone they react and move, their valuables to a safer place, usually it takes more than 4 hours to reach flood from Sauraha Bachouli VDC to Jagatpur VDC. In this four hour time people move their valuable belonging to the safer place as shown in the (Photo 7.1. and 7.1)

Photo 7.1: Taking precaution against the flood of July 2004 Photo 7.2: Transferring their valuable to safe place

Due to this early warning system the loss of lives is less in this VDC. This type of early warning system is very rarely practices in the context of Nepal. At present some of the donor funded project implementing this type of pre warning system to the other flood victims in the country, I think this is the first VDC who has this system in the context of Nepal. Besides this currently with the assistance from CARITAS Nepal they have also built a danger **warning pillars** of different height. If the flood level riches to the danger level the volunteer people "rings the Bell" to alarm the people. This precaution measure is implemented after the flood of 2003. Based on this people react and try to save their belonging as far as they can. Also CARITAS has supported by building a flood resistance house that can accommodate more than 200 people at the time of crises (Photo: 7.3).

Photo 7.3: Flood resistance house

When I have enquired about the rescue house, people said me that, they will use the house at the time of crisis, those family members who do not have good assets, who cant afford to rent a land outside the flood prone areas, such families members will stay in their own house and move their children and other valuable in the flood rescue house. So this strategy has helped a lot to the household who are poor and who can't afford to rent a land or room outside the flood hazard prone areas.

7.2.2 Policy and Institutional Support:

Various institutions supported in building embankment, spur, and gabion wall. Besides this other training and precaution measures to mitigate the flood, were given by the educated people of the VDC as well as from the donor funded project as for example CARITAS – Nepal. Flood of 2002 destroyed the embankment, gabion wall spur in Ghailaghari and spur and gabion wall in Dhruwa village. After this the Government, local NGO/INGO, Royal Nepal army's and King Mahendra Trust supported the development of Embankment and they have given assistance to building houses. After the floods of 2002, institutions that supported structure development are District development Committee, Water Induced Disaster Section (provided wire to build gabion wall), CARITAS- Nepal, Village Development Committee Office, Save the Children, and Buffer Zone. They supported the villagers in building embankment in Ghailaghari village. They have collected and spend an amount of NRs. 21, 00000 from the above said organization to build an embankment in Ghailaghari (*Lila Raj Bhusal, President Rapti river training groups, field survey, 2004*). But again the flood came in the VDC

in 2003 and destroyed the built embankment, since the embankment height was low due to unavailability of financial support from government side, as well as due to unavailability of wires from Water Induced Disaster Section. They could not complete the work after the 2002 floods, due to which this VDC had to face another disastrous flood in 2003. After 2003 flood, again various local, Governmental, NGO/INGO (UNDP, CARITAS- Nepal), Royal Nepal Army, District Development Committee (DDC) and Village Development Committee (VDC), support from neighbors, social groups, teacher's fund, youth's clubs, saving groups, cooperatives and the local residents supported an estimated amount of NRs.25,00000/- to construct the embankment. Local are fighting yearly against the floods and applying various pre coping strategies.

Photo7.4: Royal Nepal Army participates in plantation

Photo7.5: Under construction of embankment

The photographs (photo 7.4) is showing the Royal Nepal Army men is supporting the local in planting *Kans grass* (tall grass) also they have planted *Asuro (Adhatoda Vesica), Bakaino (Melia azedarach)*, in the embankment prior to the floods of 2004, and (photo 7.5) is showing the under construction of embankment. According to the villagers, Kans grass, Bakaino, Asuro, and Bamboos are planted in the embankment to control floods, according to the villagers the roots of this grass and tree goes very deep inside the soil and they help the soil to be more compact, and help against erosion of soil.

7.2.3 Social Organization and Groups:

Most of the people in the VDC were new settlers who have migrated from Hills and Mountains as I have said in my earlier chapter. But the villagers are trying to build strong social network to fight against the floods. After the floods of 2003, the villagers did not get much support from the government and donor's agency since they have already supported them for two consecutive years. So local people are raising money from each household to cope against the destructive floods by helping in the extension of embankment as well as they

were increasing number of gabion wall. The villager's key person made a standard format to collect money, and they have divided the house holds in different categories as for example (Ka, Kha, Gha ….).

Table 7.1: Local funds (Bigati) collected to build embankment

Household categories	Type of households	Amount collected
Ka (A)	wealthy household (businessmen, landlords and the household who owns truck, tractor, bus etc)	1000 and above
Kha (B)	RCC building	500 above
Ga (C)	Slabs household with cemented pillars (pakki house)	300 above
Gha (D)	Household who has tin roof and cemented wall (pakki house)	200 above
Nga (E)	Household with tin roof and stone wall	100 above
Cha (F)	Household with straw roof and mud wall (katchi house)	50
Chha (G)	Serviceman including teacher and pension holder, remittance etc.	10% of their one months salary
Ja (H)	Poor household who cannot support by cash (mostly the rehabilitated victims and other more effected victims of the VDC	1 day labour and above
Jha (I)	Household who has only old people and who could not and could not give even 1 day labour	they help in monitoring the relief work or they are set free

Source: field survey, 2004.

From the above (table7.1) it shows that the community is well functioning. Among the household who cannot pay the cash they give their labour for 1 or 2 days depending their family size status.

7.2.4 Fund Raising by Performing Dohori Gheet (Folk duets):

It was also found that in Jagatpur VDC the local youth club and mother groups have participate actively in performing (Dohari Gheet (folk duets) in various hotels, lodge, public area, bus station, market area etc. By performing Dohari Gheet they have accumulated more than NRs. 200000/- for the flood victims and in strengthening the build embankment. This shows that Jagatpur village local people are trying to build a good social network with each other to fight against the destructive floods. This activity is one of the pre coping strategies adopted by the Jagatpur people after the floods of 2003.

7.2.5 Sale of Logs Brought by floods:

The positive aspect of floods in the Jagatpur VDC is the logs and sand which flood brings together with it form the upper catchments; slowly deposit to the flat lands because the current of the water gets slower in the plains. In law this are the properties of National park, but it is seen that few poor people of the village illegally steal the logs brought the floods as a coping strategies, which can be seen in (photo 7.6)

Photo 7.6: People gathering the logs brought by flood.

At present the Rapti River User Control groups has requested the National park to use the logs and sand for the purpose of strengthening the embankment as well as the gabion wall in different place of Ghailaghari and Dhruwa by selling the logs and sand. This year the village committee members got the permission from National Park Authority to collect and sell the logs and sands brought by flood. The price per cubic feet of logs is NRs. 500 to 900 for Sissoo (Dalbergia Sissoo) and Sal (Shorea Robusta).

7.2.5 Change of Settlement Temporarily:

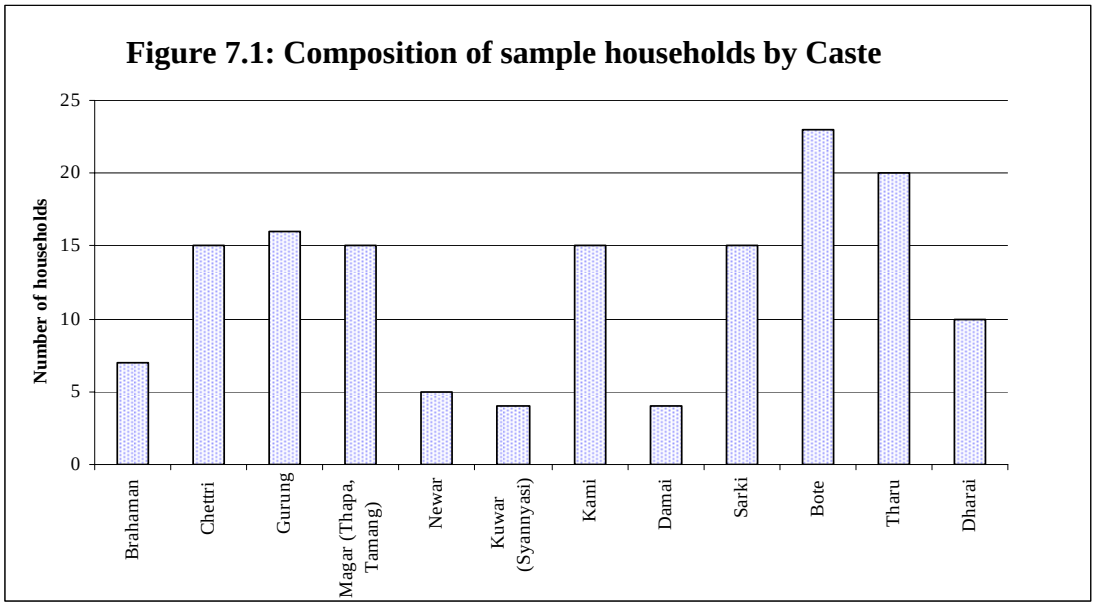
The flood victims of Jagatpur change their settlement, and moved to the safest place for three months during monsoon period to Pranpur village in Jagatpur VDC. This pre coping mechanism is different among the groups of people. Those who has more capital as for example (human resources, natural capital, financial capital) they are moving to safe place but those who can't afford they live in the same house. Only at of the time of crisis they ran to safer place or to the rescue house which has been shown in earlier page.

The practice of temporarily settlement has been increasing in the case of Jagatpur VDC because of yearly destructive floods. Each household has to pay a monthly rent of NRs. 500 to NRs1500/- to rent a room together with part of land to keep their cattle. There are also family members who can't afford paying rent stayed in their own houses. At the time of crisis they ran to safer place with their belonging as shown in above photographs. Those who take a temporary shelter for three months, they only moves their other household members, and the household heads used to stay in their own house, to take the precaution from theft.

At present in Ghailaghari Ward number 1, in flood affected areas, after the assistance from various organizations such as (CARITAS – Nepal, Annugrah, Buffer zone (King Mahendra Trust) constructed a house to the victims families whose land and properties were lost. At present there are altogether 149 household of different cast and ethnics groups residing in the flood hazard areas in Ghailaghari where as in Dhruwa village only six houses are now left and those houses mostly belongs to Brahman and Chettri (fig 7.1) and they too are in the process of moving to the northern part of the VDC.

Besides this 36 household of Ghailaghari and 4 of Dhruwa live in the rehabilitated house build by Nepal Red Cross Society. These houses are the one who has lost everything both land, house and shades, what ever assets they save that also used to buy the newer household goods, as for e.g. Utensils, furniture and cloths. Some of the household members are still using the cloths which they get as a relief.

Figure 7.1: Composition of sample households by Caste



Source: Field survey, 2004

It was found that in households belonging to Brahman, Chettri, Magar, Kuwar, Newar and Gurung, some family members took the shelter outside the hazard prone areas during the monsoon season after the floods of 2002. Where as the occupational caste groups, Kami Damai, Sarki mostly stay in their own house, only at the time of flood they ran to safer place with their belonging. Because of caste hierarchy and untouchable, it is difficult for them to find accommodations besides this most of them are economically incapable.

The Bote caste groups are the most marginalized groups in the study areas. Out of survey household they are in largest groups, because of floods they have lost their properties, besides this entitlement to fishing has been cut down due to the policy of National Park. Earlier they used to fish in the Rapti river mostly at night illegally to sustain their household income (1 kg. of fish they sell for NRs 100/-) but because of Maoist insurgency, they could not go at night for fishing because of army's patrolling. There have been incidences where a Bote were killed by the army's in the riverbank mistakenly suspecting them to be Maoist. Only two to three Bote families are using their skills and traditional knowledge and they are capitalizing those skills to sustain their families. Those with more skills are found more secured than the other. Few Tharu and Dharai, household's member used to take a temporary settlement in the safe place prior to floods mostly with their kin and in the Dharai comunity (Belhatta) in Dhruwa village and rest of them they stay in their own house only at the time of crisis they ran to the safer place. When I see the overall scenario in Ghailaghari village, most of the household members move only during the crisis period due to resources constraints. The above shown household had lost their properties and their land was silted rendering it useless for more than five years by the floods of 2002 and 2003. Among these household it has also found that indigenous ethnic groups like Gurung, Magars, Tharu, have strong attachment to the ancestral land, and this group has relatively homogeneous , belongingness so they function as a safety nets. In the study areas it was also found that few household members of Brahmans, Chettri family used to take shelter in their kin members land areas in the other Wards of the VDC.

The family members who mostly change their settlement mostly depend on their available resources, those household who has more natural resources, large active family size and financial resources mostly take shelter in the nearby village Pranpur which is in the higher elevated areas in the eastern part of Jagatpur VDC. This practice has been increasing in the case of Jagatpur VDC because of yearly floods the results of the different resources are as follows.

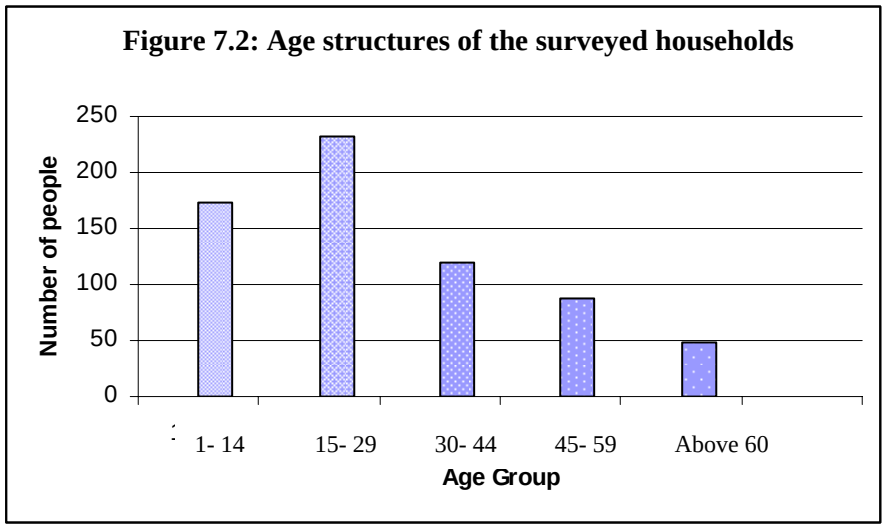
i) Family Size:

The average family size of the household surveyed was 5.8, who live and eat together. Many of the scholars consider large family size as one of the factors for a household vulnerability. But in the context of my study it was found that a large household family member who has grown up children are more secure economically than the house who has less number of households family size. Only those household which has small children, disables and old people are more vulnerable as they do not have able bodied person to take care the households during the time of crisis, this family has to rely on others and they have to diversify the income sources. In the case of my study, the household who has large family size above 15 years of age had found an opportunity to distribute their family members in different income earning opportunities. But due to the scarcity of jobs not all the household members are getting the income earning opportunities.

ii) Age Structure:

The age structures of the respondent in the sample were of different groups. I have divided the age group mainly to five groups as 1 – 14, 15- 29, 30 – 45, 46 – 59, and 60 above is shown (fig. 7.2)

Figure 7.2: Age structures of the surveyed households



From the result it has seen that most of the respondent in my study areas were found in two age groups at the age of 16 – 30, and other at the age of 1 – 15 years of age.

This shows that the flood affected victims family members were mostly young, children and of middle age. There are all together four household in which only old couple are residing and they are above 70 years of age. Theoretically people within the age groups of below 15 years and above 60 years of age are economically inactive population. But in the case of my study

areas it has been found that the work load of children and elderly people has risen due to the impact of flood.

At a household level human capital is a factor of the amount and quantity of labour available; Household human capital plays a major role in earning the income for the household, which can affect the food security of a household. Human capital represents the skills, knowledge, ability to work and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives (Carney, 1998) I have found that out of total 114 household surveyed there are a total of 662 population out of this population 160 are children, 56 old and 446 economically active population.

In the context of my sample household it has found that both active and inactive populations are found. The ability of labour contributes to growth and growth contributes better livelihoods in one hands where is other more children below 15 years of ages and above 60 years of ages are the vulnerable groups, but this groups people are playing a significant role in the economic life of their household.

The change of settlement is mainly based on the human, financial, natural and social resources. The household who has more young and active population who are mostly doing wage labour work to sustain their families members and these people were mostly shifting their houses temporarily for 3 months in the safer place, as they save some money prior to monsoon for renting a land and a room in safer place. It was also found that young family members are in the process of going abroad in search of jobs mostly to India, Malaysia and Middle East countries. Due to the financial constraints only few household members are going abroad in search of jobs. Before the floods the land value was high and they used to get loan by mortgaging the land in bank. Even the landlord used to give them loan in interest but due to the siltation of fertile agricultural land nobody wants to give them money, neither the bank nor the government. Due to this, active population is also not able to find productive work and at present many is found drinking Raksi and playing cards.

iii) Education:

Education is the key factor to bring development and social change as well it plays a great role in pre coping strategies. In the context of my study areas most of the people are literate due to the help of social organization. There are different social organizations in the VDC who give adult education (prod sichha). In (table 7.2), Out of 662 of the total population 42 are not included here since they are below 5 years of age, besides this 203 person are literate,

who could write their names and some numerical. Likewise, 151 are illiterate they are mostly from the occupational caste group and from Bote, Taru and Darai family. However, there are very few in higher education. Around 45 household out of 114 surveyed household families children are going to school, but they are in the process of dropping the school because of financial constraints. Around 18 household whose children are above class 10 were mostly involved in different services instead of continuing there education. They are mostly from Ghailaghari and Dhruwa among those students some of them have join the police and army to support their family members, as these days it is very easy to get enrollment in police and army due to the Maoist insurgency.

Table 7.2: Educational statuses of the surveyed household members

Education status	Total Number of population
High school	163
BA (Bachelor degree)	12
IA (class 12 +)	18
Illiterate	151
Literate (prod sichha), adult education	203
MA (Master)	3
SLC (High school pass)	70

Source: Field survey, 2004.

The table below shows the involvement of people in different occupation in the context of my study areas (table 7.3). Out of 203 literate 137 persons involved in agriculture and wage labour. Only 4 to five household members are involved in different services from the literate family members and they are mostly working in the hotels in Sauraha Bachouli VDC and in National park. The household members who have education above 10 were found 103 out of this 25 of such person were involve in agriculture and wage labour work to sustain their family members and rest are involved in services mostly teaching, National Park, trade and rest are student.

Table 7.3: Education wise occupation

Education	Agri.	Service	Student	Wage labour	Trade	Others	Grand Total
Below 10		1	162				163
SLC and above	18	35	35	7	8		103
Literate	82	44		55	22		203
Illiterate	69	3		64	5	10	151
Grand Total	169	83	197	126	35	10	662

Source: Field Survey, 2004

This shows that most of the student above class 10 has quit their studies and supported their family members by taking different occupation as for example service, agricultural and wage labour, trade etc.

iv) Land holding size:

In the context of my study areas the landholding size plays a major role in pre coping strategies against the floods. The landholding sizes of the surveyed household family vary from one household to another in the Ghailaghari village. It has found that only few household rented in the khet land which is around 449.3 kattha (15.2 ha.), in other Wards of the VDC. The rented landholding size is comparatively less in the case of Inner Tarai. The main reason is due to the financial constraints, as well as due to the fear of wild animal's encroachment (table No. 7.4) shows the landholding size of the flood victims.

Table 7.4: Land holding size of surveyed household

Land holding size in (kattha)	Household no
0 - 5	25
6 - 10	21
11 - 20	22
20 - 60	35
60 +	11
Grand Total	114

Note: 1 kattha = 0.03387ha, *Source field survey, 2004.*

From the above table it is clear that 35 household of the total surveyed household have 20 – 60 kattha registered land, where as 25 household who has land less than 0 – 5 kattha, and 21 house hold has land 6 – 10 kattha. Similarly 22 household has land 11 – 20 kattha and only 11 household who has land above 60 kattha. But after the floods those lands were mostly silted. Only few household who have land outside the hazard areas are cultivating paddy, wheat, maize, mustard and sesame, due to the high elevated part there is a scarcity of irrigation and the soil is also not much favorable for paddy cultivation.

The household who has land above 11 kattha are the household who has their house in safer place, but their land is in the high hazard areas. But those household, whose land is below 11 kattha, are the household whose land and house both fall under the flood prone areas and they are more vulnerable. Where as those household who owns land less than 11 kattha are the people whose land, houses are mostly in the flood prone areas and they are hardest hit by the three floods and lost almost all their properties. The rehabilitated 40 household by Nepal Red Cross society are the most affected groups in the VDC since their land was formed to lake, till

this date neither government nor the National park authority has given compensation of their land. The house which they got from Nepal Red Cross society is also not register in their names. So their main coping strategies are wage labour mostly in relief works and as an agricultural labourer. Besides this, few household members migrate to other part of district in the town in search of jobs.

Those household who has land outside the hazard prone areas are still cultivating paddy, wheat, mustard maize, sesame in rotation but the productivity is quite less than the land in low land areas. In addition wild animal encroachment is growing day by day. Some of the wealthy farmers who have their own tractor or water buffalo pulling carrier, these houses are planting paddy in the waste land not by transplanting but by spreading the rice seeds above the ground, in the sandy areas they are mostly growing ***Makarkodo*** (thick rice), as they told that this rice need less water and it can grow even in sands and ***Radha4*** rice harvesting time is 90 days so they mainly produce this two variety of rice in the affected land. And rest of the household has left the agriculture land abandoned since 2002 floods, only some household are trying to cultivate in their kitchen garden by removing the layers of sand, and mostly cultivating, maize, sweet potato, banana, even some household have started cultivating water melon.

v) Livestock:

Livestock is one of the important household capitals, which can be used at the time of crisis. After the floods of 2003, CARITAS – Nepal has provided each affected household worth of NRs. 2500 to purchase a goat, to sustain their livelihood. The people are rearing mostly water buffalo in the study areas mainly for dairy purposes. They sell the ghee (purified butter) for NRs. 150 per mana (0.454 kg). Due to the availability of grass and water people are mostly keeping buffalo in Jagatpur VDC. Instead of buffalo people rear goats by the poor household who does not have access to land. The price for one improved variety of male goats is above NRs. 4000 in a year some of the household member they sold 4 to 5 male goats. The money which they earn by selling goats can help the household members to purchase food and cloths as well as they keep some money for crisis period. At present VDC people has started a milk collection centre (Jana Shamjik) due to the good transportation network.

Table 7.5: Total number of livestock of the surveyed household

Animals	Numbers
Cow	25
Ox	15
Buffalo	144
Goat	63
others	11
Total	258

Source: Field survey, 2004

People diversifying their income sources by keeping more livestock's as shown in (table 7.5). Mostly the occupational group's people Kami and Sarki own oxen that are mostly used for plaguing the terraced fields. If a person takes his own oxen and he plough himself they get NRs. 400 - 500 a day, which is also a good source of income to run their daily needs of the family members. But very few occupational caste families own oxen in plain areas, it is because most of the farm plaguing is done by tractor, only in the terrace farms in elevated land used oxen. It has also found that improved varieties of cows are rear in the VDC. Other household members who has less access to agricultural land have started the poultry business, due to the access of road local people were found involved in poultry business and most of the people are adopting this strategies as a pre coping strategies after the flood of 2002 and the number of poultry farm are increasing in the Jagatpur VDC.

7.2.7 Local knowledge Used to Protect Belonging and Food Grains:

In the study areas the local knowledge of pre flood coping strategies were rarely seen, may be because of new settlers. The original inhabitants of the study areas people as for example, Tharu, Darai mostly live in the high elevated parts only those household who are living in the low land areas have some pre coping local knowledge which they used, has been shown in the below photographs. It has been found that they keep their food grains mostly in the upper floor of there house. As shown in the (photo7.7) old women standing is from Thapa caste and they are using a wooden grain box, where as the maize is stored by the Darai household in the Chotta (top floor of the house) making a Machhan (joining bamboo poles and even the wall is made of bamboo), By doing this, if flood come they can save the maize, to their knowledge they said that Machhan will not drown in water but it will float in water. The other grain storage is of Tharu family they too have made this grain storage box in the upper room of the house, to be safe from water and rats.

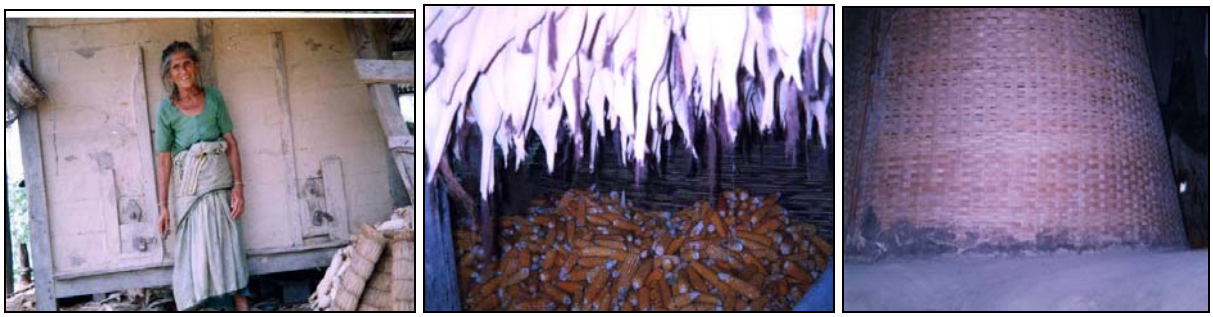


Photo 7.8: Local people knowledge used to protect food grains.

Besides this some of the house holds at present changing their house structure, by building in the higher elevated areas and increasing the plinth of the houses. Some of the household has found of growing dense bush fencing (fig. 7.8), in front of their house to protect the house from snake and dead animals during the time of flood.

Photo 7.8: Bush fencing in front of the houses

It has also seen in Ghailaghari the people were using plastic drum where they put the valuable documents money, citizenship certificate and other, when they hear the danger sound first of al it was seen that they carry the drum with them.

7.2.8 Cooperatives and Saving Groups:

The majority of the people in rural as well as in urban areas in Nepal have no insurances. Their savings are mostly the assets as livestock, land and jewelry and other household equipments which they keep in normal surplus times. And recently in the rural areas, groups and community concept has been reestablished or introduced. There are different groups such as local saving groups, mother groups, community forest groups, river control groups, buffer zone management control groups etc. has been emerging, in the study area too particularly after the floods of 2003. And now the people are now saving certain amount of their earned

money in the saving groups as insurance for the future and these investments in social groups will repaid in the bad times, and this will be the strong assets. They save the amount according to their income. Some save weekly an amount of 100 to 200 NRs. where as other save just 20 rupees a week. Its all depends on the level of income of the households. The house which has more income found that they keep monthly more than NRs. 500 in the saving groups. At the time of crisis or in any period they can borrow twice their deposit amounts at an intrest. Suppose if they save NRs. 2000 than they can take out 4000 at an interest. This is helping very much the local people in time of crisis, such as in sickness, marriage, education, shelter, building infrastructure, houses etc.

7.3 During Disasters Copping Strategies:

Households in the study areas affected by flooding adopted various coping strategies to save themselves from flood. As I have already told in my earlier chapter the house which has saved 36 people was a living symbol. It has found that when flood occurs first they save themselves and valuable. If they have time than they save food grains, and livestock, in a sequential order to be safe from floods. The livestock used to be released in emergency, other wise they take them to safer place since they are one of the strong assets at the time of crisis. Almost all of my informants said that they released the livestock during the time of floods.

The flood of 2000 killed many livestock because the flood was sudden and it came in night, people did not get much time to loosen those animals due to which the livestock's causality was high. At the time of flood different person in the household do the different role, among them women, children and old are the one who are mostly affected during the floods. Women have more burdens than man, because they are the one who save, their children first and than valuables, food stuffs as much as they can, by keeping the food stuffs in the roof of the house if the roof is flat other wise every household members carry something with them. The male member mostly does the outside activities as for example checking the level of water and releasing the livestock's. Besides this if the time is short they climb the tree or in the roof of the house. In the context of my study 36 people saved their lives by staying in a roof of the house, where as 11 people saved their lives by climbing a tree and few household members they save their lives by staying in the roof of Ghailaghari School. In the context of Dhruwa it was found that 12 people they save their lives by staying in a traditional boat by tightening the boat to the tree. The person who has saved their lives by climbing tree, staying in roof of the house and in traditional boats had to spend more than 17 hours in floodwater.

After that they have been rescued by the villagers to the school compound and in the tents. As I have already said in my earlier chapter the total houses that were swept by flood was 199. The people were not at the stage of building new houses by themselves so they were waiting for the assistance from Government and non Government organization and support from the neighbors and social groups. The process was very slow, so which they had to live in a tent for more than six months, where as some household members were found that they have to live in a tent for a year.

7.4 Post Disaster Coping Strategies:

Post disaster coping strategies is usually done after the flood disaster. In the context of my study it was seen that all most all the household members were affected by the flood in Ghailaghari village and in Dhruwa village. As I have said in my earlier chapter the floods of 2002 swept away 199 houses. The affected victims who were rescued and who were in the safer place all return back to see to see their houses and other properties once the flood water recedes. Those houses that were not swept away too were found with the accumulation of 3 to 4 feet of sand and mud insides their houses. The first step they do is clearing the deposited sand and mud and cleaning house and they try to manage the dismantle houses.

7.4.1 Rehabilitation and Relief:

From the interview it was found that after the post disaster period there were many relief's given to the flood victims. Sen (1981) has argued that famines rarely occurred in societies in which there is freedom of press. In the context of my study after the floods of 2002 many media had highlighted this VDC as "Jagatpur VDC seeks help" due to the effect of press, the relief aids was adequate in the first disaster than the next relief of 2003. The relief food was distributed to each effected household by checking on their family size. The people who stayed in tent and school compound for more than six months had to fully depend on the relief food. In the first year of flood various governmental, donor funded project, social groups, missionary, business man, clubs, local people etc. has supported the flood victims with food ,cloths, medicine and others basic necessary things. The relief of 2002 was much better as the food supply was enough but the relief of 2003 was not sufficient. Many flood victims have also criticized the distribution of relief food and other necessary items. There were cases where the victims did not get all the relief which they are suppose to get from different sources, the middle person who works on the distribution of relief were mostly from the well being households, and there were partiality in distribution and not distribution of all the goods

to the real victims. During my field work the flood victims have shown me that tents which were supposed to be for flood victims were seen in a wealthy household member's house and who was not affected by both floods.

Besides these various organizations supported and given assistance in building the flood victims house. Those organization that were involved in given assistance were CARITAS – Nepal, Red Cross Society, Annugrah (Local NGO), Buffer zone (King Mahendra Trust for Nature Conservation) has supported in building a house to the flood victims the details are as follows. Nepal Red Cross society has rehabilitated 40 Household of Ghailaghari and Dhruwa village whose lands turned in to a lake and build them 40 blocks of houses with two rooms and a kitchen per household family handed over to the flood victims after a year but those blocks of houses are not given permanently to the flood victims. Similarly CARITAS Nepal supported by building another 54 household. These houses were constructed in the victim's lands and CARITAS supported with cement, brick, tin (for roof), and the victims has given their labour to build their own house. Likewise, Annugrah and King Mahaendra Trsut for Nature Conservation have also supported building of houses to 27 and 24 household family members. Those household which were building after the floods of 2002 were handed over prior to the flood of 2003 to the victims, but again the destructive floods of 2003 swept away 17 houses which were supported by Annugrah. The other support mainly come from neighbors, kin, different members of social groups, clubs has supported the flood victims one way or others.

After the flood of 2003 the flood victims of Jagatpur, as I have told in my earlier chapter that most of the people of this VDC were agricultural subsistence, due to the effect of flood after six months the local people have face various problem in sustaining their livelihood since the agricultural land was useless because of siltation, to run their daily households needs different groups of people adopted various posts coping mechanism, and these post strategies were discussed and are divided in to different headings and sub heading.

7.4.2 Livelihood Diversification

Livelihood diversification involving rural – urban links, remittances and artisan activities is an important process and which is increasing most of the area day by day in the e developing world (Ellis, 2000).

According to the sustainable livelihood framework three broad clusters of livelihood strategies are identifies as, intensification or more extensive use of natural resources;

diversification or expanding the share of non farm income in the household income portfolio; and lastly migration, either seasonal or permanent migration from village to cities. But in the context of my studies the intensification /extensification of land does not exist due to siltation of agricultural land as well as the farmers does not want to take the risk, as now they have scared due to yearly floods. Besides this due to the more wildlife encroachment in the other safe land too they are not doing intensification. Some of the household members have cultivated paddy in the waste land just not to leave the land abandoned, and two household members have planted banana instead of paddy as banana grows well in sandy area too. Besides this different occupation groups diversified their regular activities in response to flood. It has also found that around 26 household has temporarily move to other part of cities (Ganeshthan in Narayanghat) by capturing the public land illegally. Among the 26 household 6 household of Bote caste left the areas permanently and no one knows where they have gone because they could not sustain in the village. Rest of the effected household are mostly sustaining their livelihood base changing occupation mostly to non natural based livelihood option, below I have discusses in detail different coping strategies adopted by the different occupation and households groups as an alternative means of earning to sustain their livelihoods.

i) Raksi (alcohol) making: Around 50% percent of the household of Ghailaghari are in the process of preparing and selling local home made Raski, which they made from molasses and this business is in increasing rate in Ghailaghari village. Not all the flood victims are adopting this strategy, as for example the occupational groups though they have skill, but due to untouchability, their market is less as compared to the Tamang, Magar and Gurung. As well as Brahaman and Chettri family too are not adopting this strategies though they are skillful, but because of hierarchy they are adopting different strategies rather than Raksi making. Raski making is very common in the case of Nepal to the different caste such as , Tamang, Magar, Gurung, Newar, and Rai for home consumption but it is illegal to make Raksi for business propose. In Ghailaghari village more than 50 percent of the households, a livelihood strategy is selling of Raksi. They sell to the neighborhood village and VDC, per household prepared 12 to 15 bottles a day and they sell the home made Raksi at the rate of NRs 12 per 750ml. of bottle to the neighborhood VDC and to the local villager (photo 7.9).

Photo 7.9: Tamang lady making Raksi.

It has also found even the army men from the National Park Headquarter come and buy home made Raksi from the people of Ghailaghari. Since the Raksi making business is illegal and if the government closes this business of the poor people it might effect negatively. Due to the unavailability of jobs and other alternatives the people Ghailaghari village and Red Cross gram might involved in other illegal activities due to worsening situation.

ii) Child and old labour:

In the case of Jagatpur many children are in the process of dropping the school and were forced to contribute for earning livelihoods for e.g. domestic servant, working in hotel, in carpet factories and in transport sector and collecting fuel wood and wild food. The case of child labour has been multiplied after the disaster.

As I said earlier out of 220 students 85 are from Ghailaghari village among them 22 student has left the school. Similarly more than 50 student of Red Cross Rehabilitated victim's family left the school among them some are supporting their parents in earning some household income. As I told in my earlier chapter, the son of Kumari Thapa a single parent household whose son now does not want to go to school since, her mother could not effort her school uniform, and school fees in time. This is not only the case of Kumari Thapa there are many other household family members like Kumari Thapa. Regarding the child labour, and drop out ratio, it is the girl child whose number are more. As the case of Parbati Daughter, who has left

the boarding school because their parents could not able to support the two children in boarding school. So she has sacrificed her good education for her brother. Still many of the household family members of Ghailaghari especially from occupational and Bote, Tharu and Darai family members the girl child are not attending the school and those who have been admitted too left the school after the impact of disaster. As well as there are also some cases found that few children from the Bote, Tamang and occupational groups has shifted to children's home SOS children home, because their parents could not feed them mostly from Rehabilitated household and Ghailaghari.

Other people suffering are the old people of the affected families. From the surveyed household four of the household are found who has only old couples more than 70 years of age and who has lost all their properties and now they are mostly relying on the kin and some are involved as a domestic workers as well as one of the old couple of Ghailaghari is found begging as a strategies to cope with the crisis. Since this old couple does not have their kin to support them. So these couples move VDC to VDC to collect food grains, because their old days fund given by government is not enough as well as it is not timely.

iii) Wage labourer in relief work:

Participation in a relief work is also a one of the important coping strategies adopted by the flood victims. Those victims who have loss their land as well as houses are at present working in the relief work in expanding the embankment. The people of Red Cross Gram rehabilitated victims and the people from Ghailaghari were mostly depending on the relief work due to the unavailability of other jobs. Among the people who were working in relief work the largest number is of female (photo 7.10). Previously, women used to work mostly inside the houses and mostly in their farmland and as an exchange labourer. Now they are engaged in working together with male in relief work. They are also found in working as domestic labour in the well being houses. Most of the labourers working in relief work are from the occupational caste groups, the Bote and Tharu caste, are also mostly involved in relief work and carpentry work.

Normaly, Brahman and Chettri hardly used to engage in the relief work, though they are equally sufferer, due to hierarchical order this people need to search some other jobs besides wage labour and comparatively they are found more educated than the other caste in the VDC.

Photo7.10: Flood victims working in the relief work as one of strategies to cope

iv) Modifying the consumption pattern:

It was found mostly in the case of Jagatpur VDC, the flood victims consumptions have been decreased at present after the flood disaster of 2003. As I have described in my impact chapter, the Ful Kumar Tamang who own many water buffalo, before most of the people used to come to his place to drink lashi (skimmed milk). But now even he not gets a glass of lashi everyday to drink. This is not only the case of Full Kumar Tamang but there are many other flood victims whose food consumption has been decreased as compared to earlier days. It was also found that people of Ghailaghari, and Red Cross gram that they also cut of the expenditure which they used to do in festival. At present they are mostly depending on the least quality food. Prior to flood they used to consume mostly rice but now due to financial constraints mostly change their food habits from rice to maize, wheat and potatoes and other roots crops. The frequency of taking food is also reduced at present they mostly take two meals a day, as before most of the household family members used to take three meals a day. Besides it was also found that some of the poor household members as for e.g. Bote, Tamang, Magar and occupational groups mostly depend on the wild food such as Sisno, Unio, and Kandamul (***species of dioscoria, urtica and fern***). They are mostly sending children to collect the wild plant and wild roots from the nearest jungle by dropping them from school.

v) Drawing down assets:

In the time of disaster and food shortage, disposal of sell of assets is the most important means of coping strategies adopted by the flood victims of Jagatpur, as I have mention in my

earlier chapter some of the household members were found the selling of Mangal sutra (sign of married and which resemble long life to their husband). Thus disposal of mainly depends on the different groups of households based on their previous year saving. It was found that among the assets first they sell the less economic and productive value, in the context of my study areas it was found that first they sell poultry and livestock secondly they sell jewelry to cope with the crisis situation. But the sales of assets mostly depend on the household size. Mostly the mother headed household members, and the large inactive family size households were found selling of their jewelry to feed the household members.

vi) Social capital using kinship ties:

A social and kinship tie plays a crucial role in minimizing vulnerability, especially at the time of crop failure and loss of all properties. From the interview I also came to know that many household members had sought help from relatives. As the case of Parbati, a Brahman lady from Ghailaghari and Pitambar Poudel from Dhruwa was supported by their kin to settle the new life after the flood of 2003. Like wise many children of the flood victims mostly live their parent's house and staying with their grandfather and with uncle and aunts. It was also found that some of the family members has given the land in the safer place to build a house and also help the flood victims in finding labour or others jobs. This is totally depends on the household family background and their kinship. As in the case of occupational and Bote caste not a single family has been found who are supported by their kin, because their kin too are in the vulnerable stage so they could not support their other family members.

vii) Migration

After the three years of consecutive floods few household members migrate permanently among them the six Bote families who could not sustain in the VDC and left the place, no one knows where they are now. Besides this 20 household of Gahilaghari village and Dhruwa village move temporarily by capturing the illegal lands in Ganeshthan Chitwan district. The largest number of movement was of Orphan student. Due to the inaccessibility the orphan school including (figure 7.11a and 7.11b), 6 household had to leave the Dhruwa village. Among the six household four household moves to the Red Cross Rehabilitated homes where as other move in the safer place of the VDC by taking the land in lease.

The school has a capacity of more than 300 students, and currently 260 students used to live in the orphan school and among them some are the flood victims sons and daughter not from Jagatpur VDC but from other part of Chitwan district. Now they are in the process of moving

permanently to Naraynaghat Chitwan district and already shifted there lower class student around 200 to the new building at a congested place.

Photo 7.11a & 7.11b: Rapti river making inaccessible to Dhruwa village and the school.

Note: The orphan school is in the process of inundation, since Rapti River split in two directions making the school and other 6 household in the centre of the river**.**

And those 6 households also do not want to stay in the place, but they do not have second option to move to a safer place due to financial constraints. At present they are fully depending on the National Park Authority and Government authority to compensate their land or move them to other safer place. Most of the rehabilitated flood victims of Red Cross Gram are in the process of migrating as a wage labourer to Narayanghat in Chitwan district.

viii) Depending on NGO/INGO and charity:

The people of Ghailaghari and the rehabilitated household were found depending on the NGO/INGO and different charity. As I said in my earlier chapter that different NGO/INGO supported the flood victims by building their houses, among them CARITAS and Anurang, still the people of Ghailaghari depends on them if they fall sick. Top man Gurung of Ghailaghari who is of poor health, fully depends on the CARITAS management committee members for his medicine, since he could not treat his disease by himself. Similar to him there are many household members from Occupational, and Bote caste group who depend on the charity. Mostly the Church people help them with food, due to unavailability of jobs, as well as due to ill health and disability they are depending on them. Besides this these organization has supported the flood victims with skill, and also provided different crops and tress which can grows in sandy areas. CARITAS has brought a new strategy to support the flood victims by providing improved varieties of goats to the affected families, due to the availability of grasses and this will be the important assets during their crisis period.

CHAPTER VIII

Summary and conclusion

8.1 Summary:

Jagatpur VDC has experienced substantial changes over the past 30 years. Large scale immigration of people took place in this VDC after implementation of malaria eradication programme in the 1950s. Before there were few of Darai, Tharu and Bote ethnic groups who were immunized from malaria. At present this VDC is densely populated (529 person/sqkm). The main livelihood option of these people is agriculture.

The Royal Chitwan National Park was established in 1973. Because of this and the change in the national political system in the early 1990s the economic base of the people living in this area has changed from subsistence agriculture to tourism related activities. This contributed to the price rise of the land tremendously within a short span of time in this area. Many new hotels, lodges and recreational places were constructed to attract tourist during this period. This too attracted new settlers, mostly from the Chitwan, Makwanpur, and even from Kathmandu. Along with the transportation facilities were rapidly improved. Most of the people of this VDC were self sustaining prior to the floods. Even the landless people were engaged in different activities within the VDC, and the problem of employment was not so.

The sudden flood incidence of August 2002 followed by the floods of 2003 and 2004 disrupted the livelihood options of the local people. The most affected areas were areas of the Wards 1 and 2. These areas were most densely populated. In addition to these, quite a few households in Ward 7 were also partly affected because most of them had their land in the Wards 1 and 2. The floods of 2002 and 2003 has taken the lives of 11 people, injured 17 people and affected 795 households. The flood swept away 199 houses, 65 sheds, 220 animals and more than 1500 chicken. It damaged more than 500 ha of agricultural land. The land was silted more than 5 feet ruining the crop on it and making the land useless for more than 4 years. At present most of the land is being abandoned. Only the wellbeing families who have access to tractor and puling carts are being able to cultivate the land by spreading the seeds. Besides this, the flood has made new gullies were formed and a lake was created affecting 40 households and their land. The floods also affected the services and destroyed other infrastructures, such as 10 km of canal, 180 meters embankment transmission line and the 10

km of National Park fencing. All the newly established hotels, lodges, recreational places too were swept away.

Social hazard map prepared during the field investigation shows that out of a total of 1560ha of agricultural land in the study area, 26 ha. Lie in very high risk zone, followed by 93ha in high risk zone and 473 ha. in moderately risk area. Rests of the agricultural lands are in the low to safe hazard zone. Similarly out of 1911 ha of the total land, 521ha. is in Ward number 1, out of this land 55 ha falls in the very high hazard zone, followed by 110ha in high hazard and 318 ha in moderate hazard zone. Similarly Ward number 2 covers a total area of 468 ha. out of this 152 ha. lies under very high hazard zone, followed by 71 ha. in high hazard and 102 ha. in moderate hazard area, respectively.

Likewise out of total forest land of 118 ha. 92 ha. fall under high hazard zone, followed by 9 ha. in very high hazard zone and 11 ha. in moderately hazard zone. This shows that most of the natural resources in the VDC are located in high hazard zone. When I have cross tabulated the settlement data with the hazard map it was found that 2 houses fall under very high hazard zone, followed by 60 other houses falling under high risk zone, and 254 houses in moderately hazards zone. Similarly the service and infrastructures are also located in high hazard zone. Out of 37 different services, infrastructures and institutions the orphan school with more than 260 students is located in very high hazard zone followed by 15 other different services and infrastructure in moderate hazard zone and rest falls under low to safe areas. Besides this 2 bridges, embankment and 4.8 km of road are located in very high hazard area. The total distance created by the shifting course of the river was more than 2km and the widths of the river course have changed rapidly.

The reasons for the increasing number of flood events in the present study are heavy monsoonal rain, rise in river bed, inappropriate design of infrastructure and lack of government policies and programme to control the occupation of people and their investment in flood prone area.

The major impacts of the floods in the VDC were the losses of agricultural land, settlement, and infrastructure on the one hand and in the other hand socio economic losses such as agricultural crops, decline in land value, and loss of purchasing capacity. The most severe impact was mostly on the people belonging to the occupational ethnic groups such as Damai, Kami, Sarki, and the Bote caste group. Similarly the children, the elderly people and women were the most vulnerable demographic groups.

The flood has made many homeless and turned them poor overnight. The livelihoods have been disrupted and they are left with few options. They are very dependent on the help they receive from different social support institutions, such as the public aid, NGO, INGO, kins and neighbors and different social organizations. The affected local people have used the local school buildings and tents to shelter themselves. In the aftermaths, every one who was directly affected by the floods struggled to sustain their livelihood one way or the other. The people who had more capitals assets/resources were the ones who were in a better position to mobilize their resources and maintain sustainable coping strategies.

8.2 Conclusion:

The main objectives of this study are to develop the social hazard maps and to examine the coping strategies of local people and its sustainability.
The methods which I used to delineate the flood hazard community based mapping was found to be useful than the other methods. If the high accuracy altitude data and discharge data are not available, the social hazard mapping is the best way to supplement this data gaps. And this method is also very useful to update the available maps information, through the help of local knowledge.

Theoretically the livelihood strategies are achieved through access to a range of livelihoods resources (natural, economic, human and social capitals) which are combined and mobilized to pursuit different livelihood strategies such as intensification or extensification (natural resource base), diversification (non natural resource base) and migration further using a range of resources within given institutional rules and social norms, devises livelihood strategies for achieving sustainable livelihood. However livelihood outcomes are not always positive.

Though the effect of the flood might have been more or less equal to the local people, the degree of vulnerability seemed to vary among the different groups of people. The people with more resources and forms of capitals were found more secured than the people with fewer resources.

In the context of my study the occupational groups and the Bote people were the most vulnerable groups. They have limited access to resources and low educational skills. These groups of people were mostly depending on their human capital resources to sustain their

livelihood, but due to the loss of entitlement of wage labor and the exchange entitlement they became the most marginalized groups. Because these groups were facing the shortage of food (or lack of accessibility to food), they were modifying their consumption pattern as well, and becoming physically weaker. They were heavily relying on the social and institutional support for the livelihood maintenance. This finding is in agreement with the findings of Sen (1991), who pointed out that famine in Bangladesh was due to the consequences of loss of paid employment for the families who relied largely on paid labor. These people suffered most, as Sen claimed, as they lost their source of income and along with this the loss of capacity to earn livelihood leading to famine.

In the context of Jagatpur Village people in the age groups between 1 – 15 and the age group above 60 years are found actively participating in the income generating activity to support their family members. As in the context of Nepal child labour is legally forbidden, in everyday practice and cultural norms allow the child to pursue a livelihood earning activity. Though in common literature the age groups between 1 – 15 and the age groups above 60 years are considered the inactive population. Besides this the work load of elderly seems to have increased in a similar manner. The workload for women was seen to have increased in the post disaster period. Prior to the flood events, they were mostly engaged in the in-door and exchange work. After the disaster they have to work working outdoor together with the male members in the relief work and as the domestic laborer. This finding is found similar to the findings of Blaikie et. al (1994) as well as in other flood literature, it is often observed that the workload of elderly, women and children increases in the post disaster times.

The choices and opportunities of livelihood strategies also depend on the ethnicity of local people. Some cultural practices and norms allow some groups to pursue some activities, while others are forbidden to take up the same activities or occupation. In the post disaster period the Tamang, Gurung, Newar and Rai people turned to producing Raksi (alcohol) as a way making living and earning their livelihood. Whereas the other occupational caste groups and the higher caste groups were not able to take this business because their cultural norms and customs do not allow them to do such activities. However, the Brahman and Chettri caste groups were found with more educated and they were could pursued remunerative jobs, or started their own business. The Bote people on the other hand, were mostly found working in relief work and as the wage laborer in order to earn their livelihood. And some of these families were depending on charity.

Sen (1981) has emphasized on the people's ability to command food, which he called 'entitlement'. Some groups do not have the power to acquire food through production, trade, social, political relations, leading to the stage of starvation and famine. The people with more access to financial and social capitals are found more secure than the ones without such access. People who has tractor, puling cart, access to road, and their kin are able to recover and are less vulnerable to flood disaster. Households not having kinship relations are found to be more vulnerable. In the extreme situation this relationship plays a vital role. The people with large family sizes with large number of active population are found to be more secured as they could easily transport their property temporarily to safer places. The people from the lower caste faced difficulty for them to find a place to settle in other places. In some cases they could afford to settle in a new place, but they were not socially accepted. And their kinship and relatives were also found poor, and are not in the stage to be able to render assistance to them in need. On the whole the most vulnerable groups seemed to be the occupational and the Bote caste groups.

In this study area agricultural extensification is practiced in a less intensive manner by some well being families and those who have access to tractor and puling cart. Because the land was destroyed heavily and made useless for more than 4 years, this ruled out the possibility of cultivating it. In addition, the encroachment of the wild animals after the destruction of the fences around the National Park poses a real risk in growing crops in these areas. Because of the loss of endowments, the local people have lost their entitlement to the resources they possessed or commanded before the disaster. They have both lost their properties, basis of production and the capacity to exchange resources and goods and facilities.

As seen in the study areas, different households have evolved different strategies based on the available resources they had access to. In the different phases of crises, different strategies were found to have been applied. For instance, flood protection levees, embankment, early warning system etc. gives some protection against the major losses. In recent years it has become more common to build embankment to stop 'flooding', which seemed to be the case in my case study area as well.

In my case study area, the early warning system, institutional norms, prevented from reducing the loss of lives and properties in times of floods. The embankment failure effected the whole village during the flood of 2002. When the height and width of the embankment were increased in the subsequent years, the village of Ghailaghari was saved in the flood of 2004. Similarly, the

village Dhruwa was severely affected by the flood of 2004, and most of the areas in this village were inundated due to the lack of embankment and other flood protection measures.

In the case of my study area, only a few people had saved some money in different saving funds. Those who had these saving were found less vulnerable than the ones who were not insured. The families with large active family members could save more and save other valuable assets, and they were in the better stage of recovering in such time of crises than those who had less savings and other valuable assets.

In the case of Bote families two to three household were using their traditional skills in capitalization; those with more skills and knowledge were found in better position than the one who does not have such skills. The Bote, the occupational groups seem to have less of such valuable savings and assets, and they were found settling mainly on the margin of the main settlement areas, and they seemed more vulnerable in this disaster.

During the post disaster period the timely relief and rehabilitation was very important. In the context of my study area after the floods of 2002 the media had highlighted this VDC as "Jagatpur VDC seeks help". Due to this publicity, the relief aids were adequate in the first disaster event compared to the next one of 2003. Similar to my finding, Sen (1981) has also argued that famines rarely occurred in societies in which there is freedom of press. In the case of the flood of 2003 the media did not focus and highlight the event. This led to not adequate attention to the disaster, and the support from different organizations was not mobilized compared to the year before.

Finally, the main livelihood options and strategies of the affected people in the study area in the post disaster period, were the non-farm activities such as, Raski making, and wage labor, domestic labor and child labor in different sectors. And very few households were engaged in agricultural wage labor. The food entitlement was found to have declined after the floods of 2002. Due to which the livelihoods of the flood victims were found disrupted and they were modifying their consumption patterns, such as from three meals to two meals and cut down their expenses during the festival times. It was also found that people were drawing down their assets and some were found fully depending on their kin, or neighbors. While others depended entirely on the aids given by different NGO/INGO and charity organisations. Only 6 households of the Bote people were found permanently migrated to the unknown area in search of land and food. Whereas 20 households were found to have temporarily migrated within the district.

To conclude this thesis, overall it is found that economic conditions of the people living in Jagatpur village Ward number 1 and 2 have changed in very short period. The self sufficient families also became food deficit. At present the affected households are trying to cope with the situation on the survival level, and they are trying to come out of this to a more sustainable livelihood conditions by employing different coping strategies.

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Questionnaire:

Household survey Questionnaire:

1. Background information

Name of respondent…….

Ethnicity……

Village……..

Ward…….

2. House type and ownership including mobile sheds

3. Utilities /facilities attached with the house

4. History of migration: native/immigrants (if immigrants, place of origin, district and year of migration. And what is the cause behind immigration if inmigrated

5. Family size:

S.no.	Relation to head	age	sex	martial status	education	occupation	Income per months

6. Livestock type and number:

Types of livestock	Local or improved
cow	
oxen	
buffalo	
goat	
chicken	
others	

7. Size and type of land holding (bigha /katha)

Type of ownership	Own land	Land rented in	Land rented out	Unregistered land
khet				
Abandoned land				
forest				
others				

8. Food sufficiency with own production (if not how you manage)

9. Source of annual income

Source	Annual income
agriculture	
livestock	
service	
wage	
trade	
remittances	
pension	
others	

10. Loss of life due to flood hazard

year	Below 10 years				10 - 59			Above 60		
	male	female	total		male	female	total	male	female	total

11. Losses of properties:

Year	type of loss	unit in (katha or bigha)	quantity	value

12. If losses of life and properties in the past are reported, how many years it took or will take to recover normal condition? And what are the strategies adopted to recover normal condition (migration, extensification or intensification, outside aid, kinship, neighbor or others, give details as far as possible.

13. Perception regarding the trends (increasing, decreasing and constant) of the frequency and losses and causes.

14. Type of emergency measures (evacuation, medical, food, shelter provision adopted and its effectiveness and the problem faced

15. Emergency measures recommended.

16. Types of mitigation measures (structural and non structural measures such as retaining wall, drainage, aforestation, resettlement etc. implemented

17. Type of locally available materials and its use and effectiveness for mitigation measures.

18. What are the local and central level institutions available to administer emergency and mitigation measures? How effective are they. What type of institution are needed, its form right, duties, rules and regulation, sources of financial resources and types of training needed.

19. In the last big events do you invest either cash or labour for coping the flood (rebuild of houses, sheds, farmland, livestock or others.)

20. How much money did you invest for the following activities in the last events (food, cloths, medicine, reconstruction, rehabilitation? What are the sources of expenditure and relief? (Own saving, loan. Loan from bank, landowners, cooperatives, mortgage land, sale of household assets, kinship, neighbor, and others.

21. For what purpose do you use your land, which is highly prone, moderately prone, or less prone.

22. What is the percentage of the income from these flood prone categories of land?

23. How do you manage the livestock during the floods? Set them free, keep less numbers etc.

24. What are the particular coping activities of women, man, children, sick and disables?

26. What type of assistance do you get from Govt., NGO/INGO, community, neighbourhood, kinship or others (food, shelter, livestock, crops, evacuation?) did you face any problem in getting shelter?

27. What type of flood resistance crops do you grow?

28. What do you think for the flood insurance policy?

29. What special strategies do you and your family adopts to cope with the uncertainties of flood?

30. How you perceived the floods, and events that destroy your property or and events that enrich your fertility of your land in the long run or brings poverty or causes of epidemics or loss of social economic status or causes social status such as marriage of your family members, decline of land value or any others.

31. Kind of risk and vulnerability faced by women, men and children and your family

32. Do you have any possible future coping strategies related to livelihood, agriculture, insurance, etc.

33. What are the coping strategies during different crisis period? Individual, community, organization etc.)

34. What are the perceived causes of the occurrences of floods, (heavy rainfall, structure, drainage destruction, failure of embankment or any others?

35. Do you have any perception about the frequency of floods occurrence of the comparable magnitude?

36. What are the other coping strategies you have adopted? Did you adopt to cope with the last flood?

37. What was your food intake and diets during and after the crisis period?

Checklist for VDC level information
(Focus groups)

1. Households and Population

Ethnicity	Total		Within flood prone area	
	Household	Population	Household	Population
Brahaman				
Chettri				
Gurung				
Magar				
Tamang				
Newar				
Bote				
Darai				
Kumal				
Tharu				
Muslim				
Damai				
Kami				
Sarki				
Others				

2. Migration

Type	Status	Total	
		Household	Population
Inmigration	Permanent		
	Seasonal		
	Temporary		
	Permanent		
Outmigration	Seasonal		
	Temporary		

3. Literacy

Literacy status	Sex	Total
Literate	Male	
Illiterate	Female	
% of school going children	Male	
	Female	

5. Sources of family income (number of household)

Sources	Total	Within Hazard prone area
Agriculture		
Service		
Trade & business		
Industry		
Wage		
Porterage		
Others		

6. Farm Size (number of household)

Farm size	Total	Within Hazard prone area
Land less		
Marginal (< 0.5 ha)		
Small (0.5-2 ha)		
Medium (2-4 ha)		
Large (> 4 ha)		
Total		

7. Number of livestock by types

Types	Total	Within Hazard prone area
Cattle		
Buffalo		
Goat		
Sheep		
Pig		
Chicken		
Other		

8. Number of households with food sufficiency

	Total	Within Hazard prone area
< 3 months		
3-6 months		
6-9 months		
9-12 months		
Well off (surplus)		
Total		

9. Number and location of service institutions (school, non-formal educational centre, health centre, post office, banks, cooperatives, cinema halls, nurseries, agricultural centre, veterinary, police station, NGO, INGO, community forests, farmers groups etc)

Type of institutions	Location		Remarks
	Place	Ward	

10. Coverage of drinking water, sanitation and other (number of Household)

11. Tree and other species commonly found in the VDC area (please note if there are any rear and endangered species

12. Wage rates (Rs. per person/day)

Type of activities	Average		Seasonal range	
	Male	Female	Male	Female
Agriculture				
Construction				
Other specify				

13. Calendar of agricultural activities (use symbol: P = Ploughing, S = Sowing, T = Transplantation, W = Weeding, H = Harvesting if others specify).

Crops	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

14. Major festivals and religious activities

Festivals/activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

15. What is the situation of the families affected by the natural hazards in the past in terms of livelihood (agriculture, business, migration etc and the time taken to be normal socio-economic condition at household level).

16. Perception regarding the trends (increasing, decreasing and constant) of the frequency and losses and its reason

17. Community perception regarding the impacts of the flood (types: positive/negative; magnitude: high/low). Ways how to minimize the negative impact of flood.

19. Types of emergency measures (evacuation, distribution of food, clothes, medicine, tent etc) Implemented

Year	Type of measures	Location	Total cost	Local contribution	Outside contribution	Remarks

20. Are there public areas which can be used for emergency evacuation of people?

Sno.	Loction		Area (ha)
	Place	Ward	

21. Flood (recur:=recurrence: every year, 5 year, 10 year etc.; losses: M=male, F=female, C= children, D=disabled, I = Injured, Ani=animal, Hou=house, Cro=crop (mt), Lan=land(ha), Inf= infrastructures (no), Oth= other, value in Rs)

Year	Place	Recur	Time	Duration	Water level (m)	Area flooded (ha)	Damages and losses											
							People					Ani	Hou	Crop	Lan	Inf	Oth	Value
							M	F	C	D	I							

22. Total number of household within the flood hazard zone

		House, land and properties				Only land and other properties			
Ethnicity	Ward/s	100%	50-99%	25-49%	< 25 %	100%	50-99%	25-49%	< 25 %

23. Type and number of assets and infrastructures at present within flood hazard zone
Note the name of rare and endangered species of flora and fauna and their importance

23. Describe the types and magnitude of positive and negative impact of floods/landslides and other hazards

Positive impacts	Negative impacts

24. What is the situation of affected people in terms of their livelihood ((agriculture, business, migration etc and the time taken to be normal socio-economic condition at household level).

25. Perception regarding the trends (increasing, decreasing and constant) of the frequency and losses and its reasons

26. Are there any awareness and preparedness programme. If yes mention

27. Types of emergency measures (evacuation, distribution of food, clothes, medicine, tent etc) implemented in different years and in different crisis period.

Year	Types of hazard	Type of measures	Total cost	Local contribution	Outside contribution	Remarks

28. Types of mitigation measures (structural and non-structural measures such as retaining walls, drainage, afforestation, resettlement etc) implemented.

Year	Types of hazard	Type of measures	Total cost	Local contribution	Outside contribution	Remarks Short terms/long terms

29. Types of mitigation measures (structural and non-structural measures such as retaining walls, drainage, afforestation, resettlement etc) recommended

Types of measures	Types of hazard	Location	Total cost	Local contribution	Outside contribution	Remarks Short terms/long terms

30. Types of locally available materials and its use and effectiveness for mitigation measures recommended above.

31. Are there any central level institutions if any to administer emergency and mitigation measures and make assessment of its effectiveness? Are there any recommended institutions in terms of type of institutions, its form, right and duties, rules and regulation,
sources of financial resources and types of training needed?

32. During the past years, what was the productivity of land, decreased, increased constant, and the reason behind that?

33. What are the different coping strategies developed by different socio economic groups.

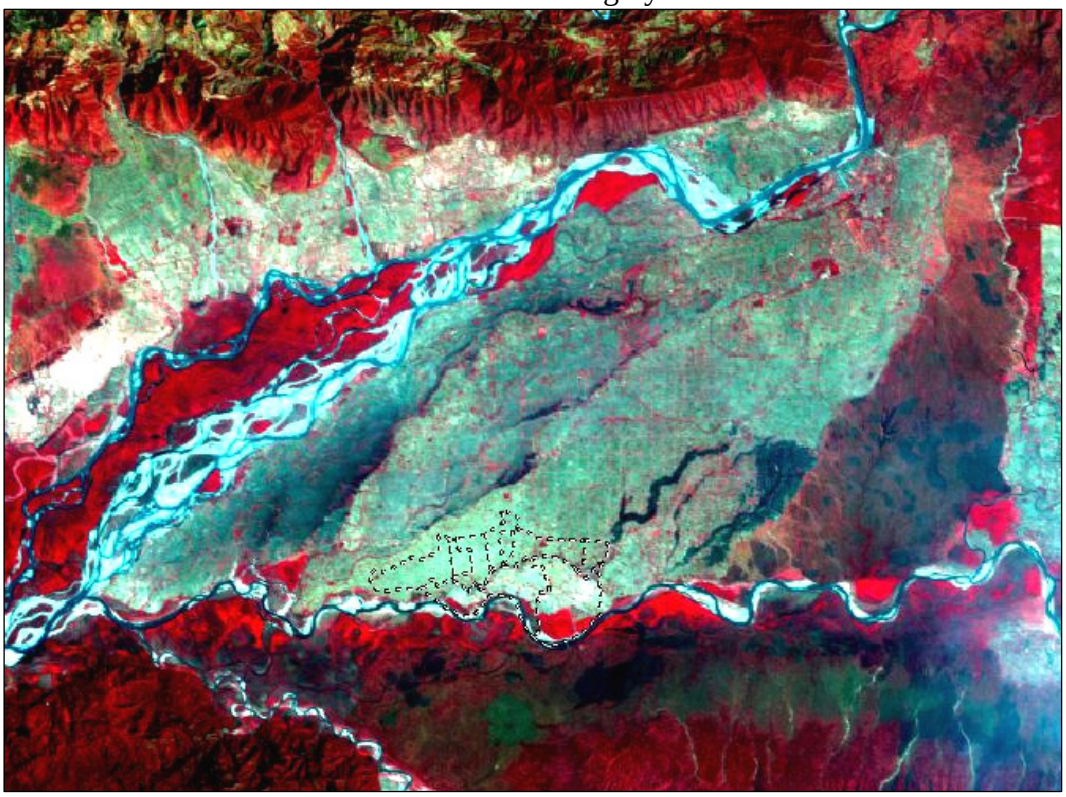
34. What are the safety nets are there during the crisis period (Exchange, social network, community institution, kinship etc)

35. What are the off farm and non farm activities done during the crisis period.

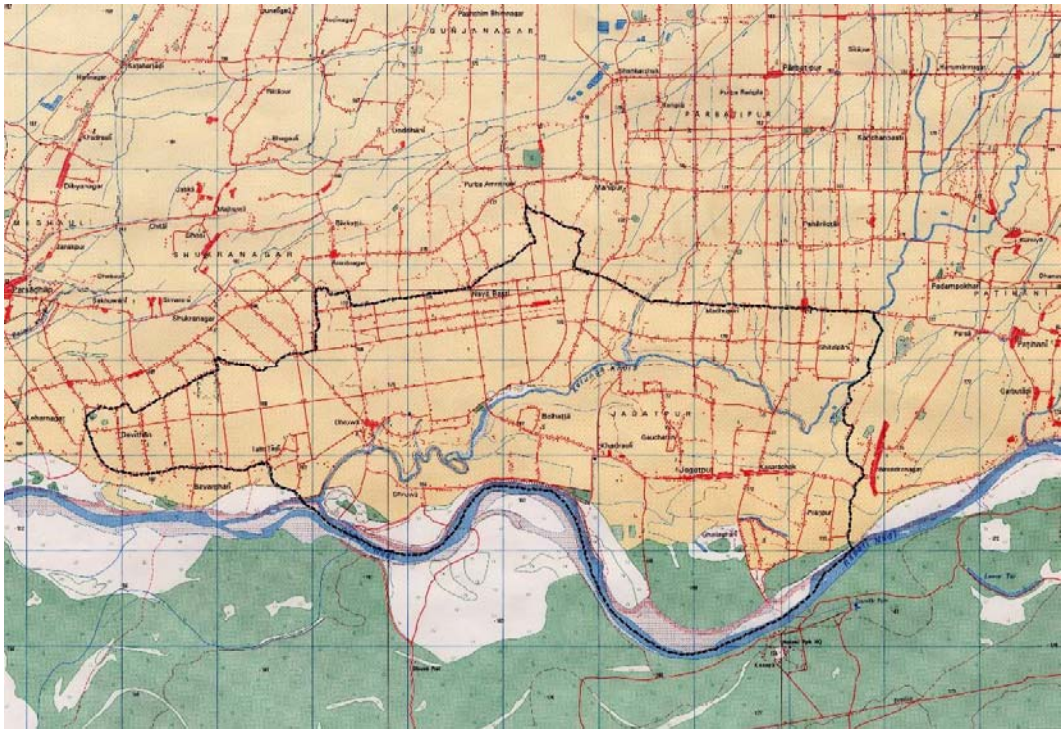
36. Any other suggestions for minimizing the risk of natural hazard.

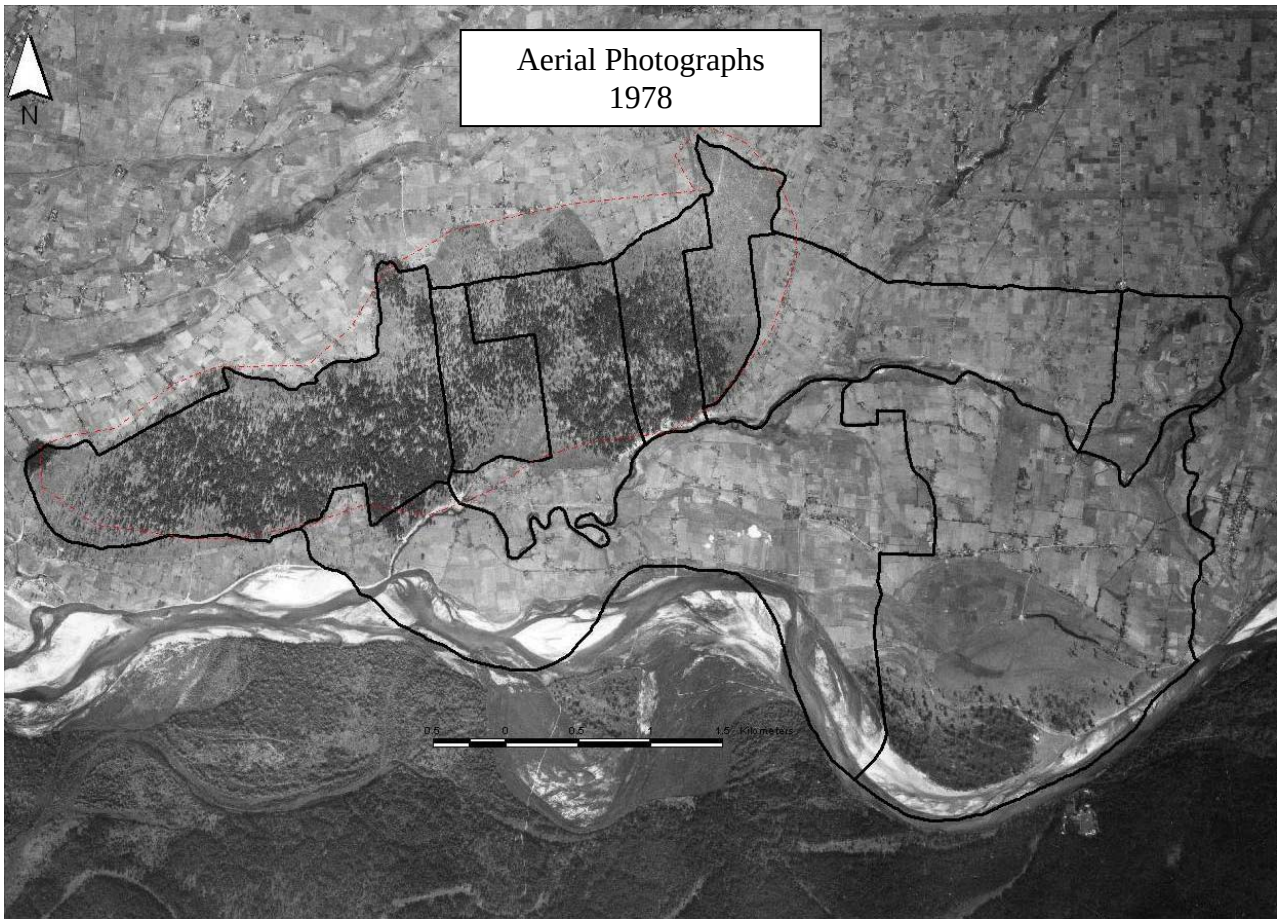
ANNEX I

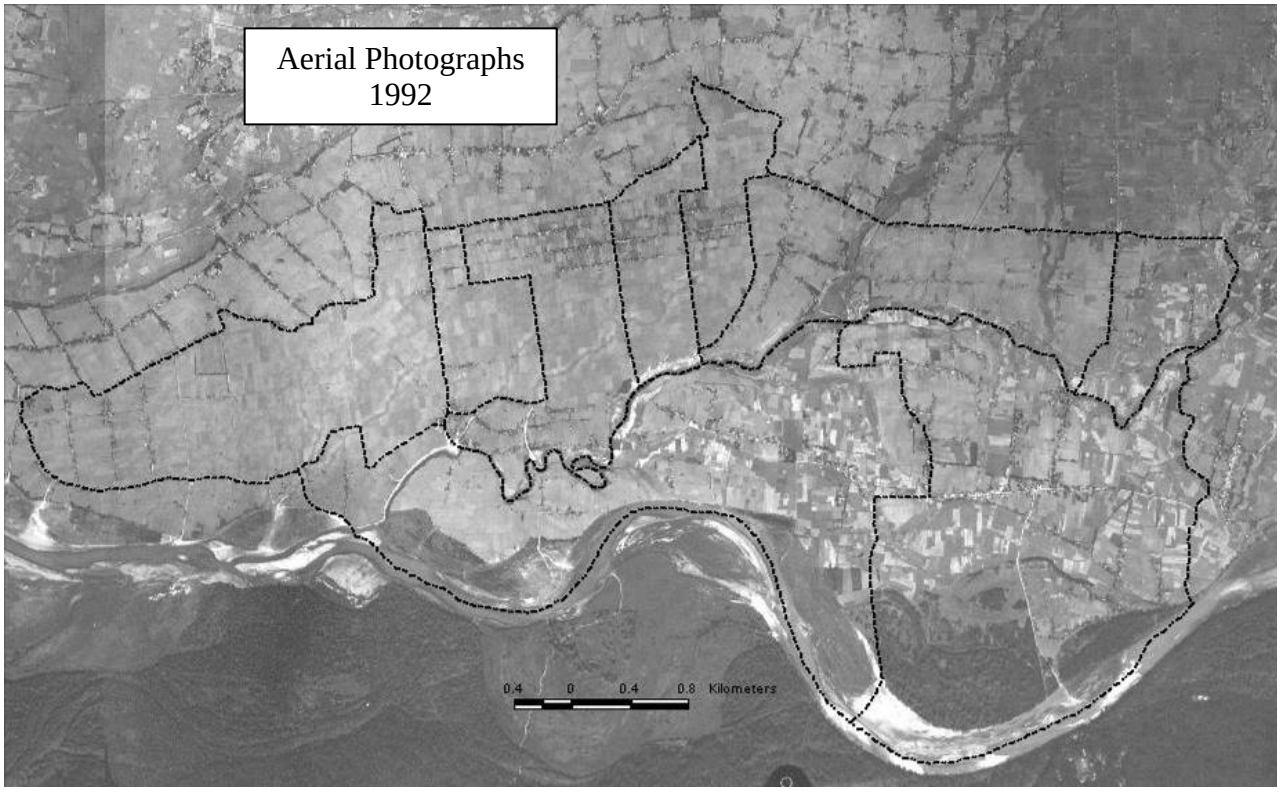
Land sat TM satellite imagery 2000



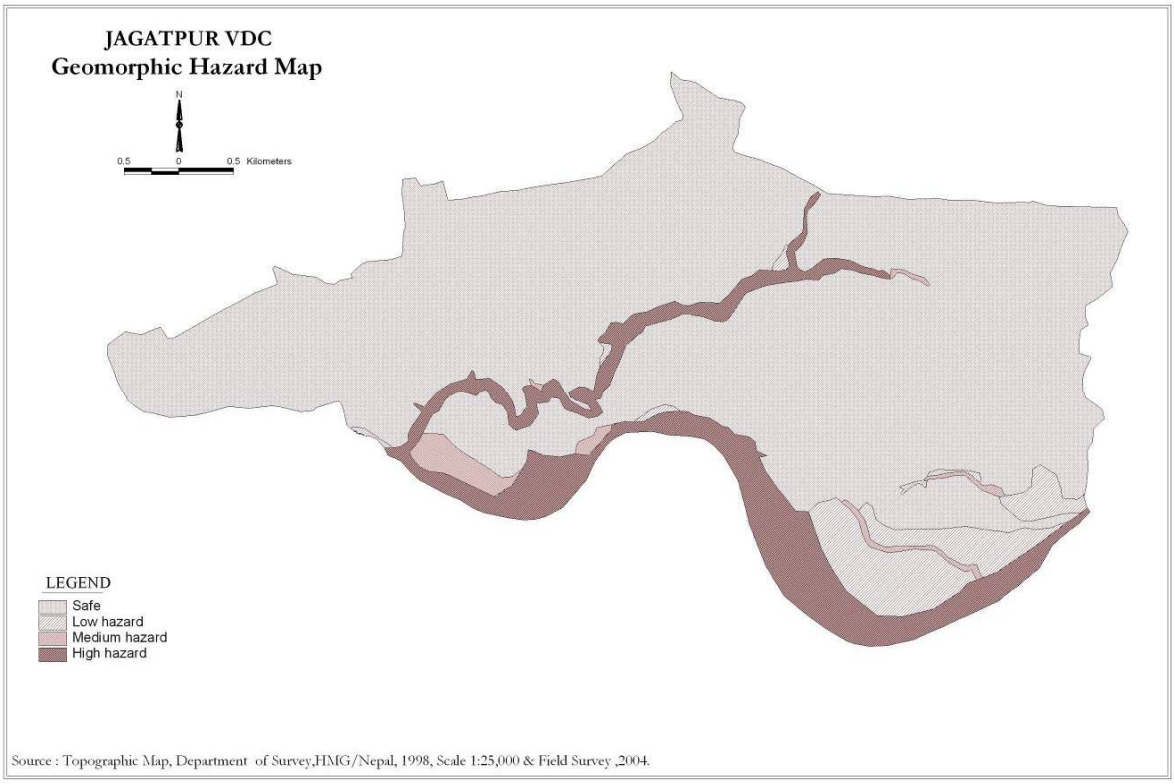
Topographical Map, 1994. Scale 1: 25,000



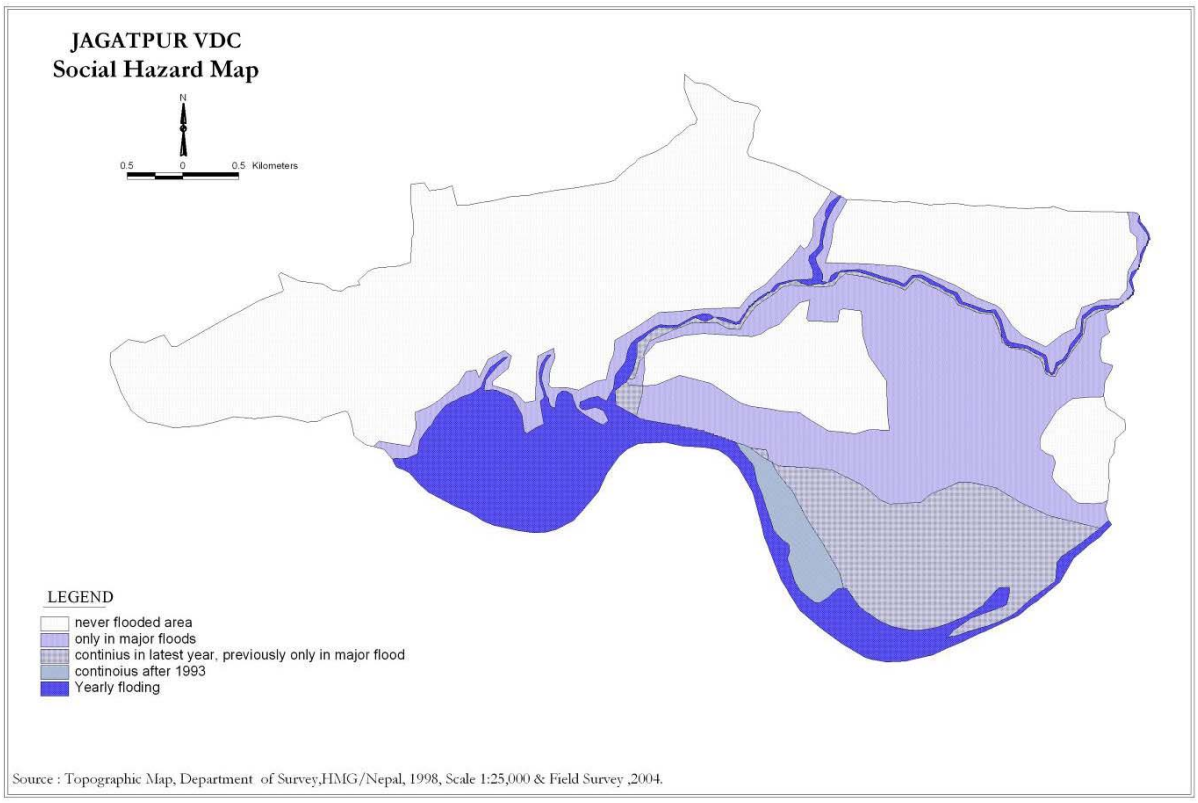

Aerial Photographs
1978
N
0.5 0 0.5 1 1.5 Kilometers


Aerial Photographs
1992
0.4 0 0.4 0.8 Kilometers

Geomorphic Flood Hazard Map



Community based Social Hazard Map



Annex II

Monthly and Annual Discharge in Lothar Khola at Lothar (In Cumec) 1967 - 2001

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1964	1.9	1.49	1.13	1.02	1.61	2.36	18.5	20.7	19.8	7.71	3.5	2.53	6.88
1965	2.15	1.86	1	0.99	0.91	3.98	25.5	61.2	30.6	11.8	5.96	2.97	12.5
1966	2.07	1.67	1.2	0.9	0.85	3.84	21.8	46.9	28.4	8.25	3.74	2.5	10.3
1967	1.96	1.66	1.28	1	1.17	8.79	35.9	28.5	35.5	8.98	3.31	2.12	10.9
1968	1.77	1.37	1.59	1.09	1.02	6.05	17.3	38.3	17.1	13.3	4.4	2.53	8.9
1969	1.92	1.43	1.36	1.51	1.75	2.52	7.41	36.6	14.4	5.5	2.94	2.12	6.68
1970	1.66	1.44	1.32	1.14	1.21	4.59	29	25.8	6.67	5.82	2.99	2.08	7.06
1971	1.82	1.52	1.43	1.23	1.72	24.9	30	18.3	16.9	5.82	3.75	2.75	9.21
1972	1.36	1.69	2.28	2.7	2.68	4.54	32.1	27.2	27.1	4.69	2.61	2.05	9.46
1973	1.99	1.69	1.51	1.34	1.71	15.3	18.5	16.6	21.5	14.2	5.01	2.97	8.55
1974	1.64	2.61	2.4	2.38	2.56	3.77	11.4	26.6	29.1	10.1	3.43	2.34	8.32
1975	1.74	1.63	1.82	1.46	1.44	8.49	55.1	87.4	92.3	11.6	4.03	2.87	22.6
1976	2.26	1.82	1.49	1.45	2.75	3.02	38.3	25	23.7	8.57	3.82	2.29	9.6
1977	1.84	1.48	1.2	2.43	3.65	6.37	22.6	27.8	10.8	5.05	3.57	2.98	7.55
1978	2.4	2.06	1.89	2.25	4.43	11.5	42.6	46.5	26.5	9.88	3.78	2.09	13.1
1979	1.24	1.01	1.02	1.27	1.02	2.71	25.7	37.7	14.8	5.5	3.65	2.93	8.3
1980	2.29	2.03	1.74	1.41	1.83	6.16	6.71	15.3	12.2	6.5	3.88	2.9	5.26
1981	2.58	2.08	2.16	2.2	2.49	3.41	16	35.3	28.2	6.1	3.38	2.17	8.89
1982	1.85	1.55	1.44	1.28	1.06	2.68	10.3	21.3	20.9	4.73	2.86	2.74	6.09
1983	2.75	2.61	1.95	1.98	3.71	3.37	21.8	12.5	13.9	7.72	3.78	2.53	6.59
1984	2.49	2.45	1.85	1.36	1.52	5.09	15.1	14.5	33.8	12.8	2.18	1.23	7.86
1985	1.14	1.2	1.24	1.43	3.58	4.17	24	49.4	71	32.6	4.41	2.23	16.5
1986	NA	NA	NA	NA	NA	NA	NA	35.8	52	14.1	3.5	2.63	NA
1987	1.57	1.33	1.33	1.06	1.03	1.32	22.8	19.9	8.24	2.63	2.07	1.78	5.48
1988	1.2	0.96	1.34	0.94	1.05	1.59	11.6	16	12.5	4.99	2.65	2.08	4.77
1989	1.96	1.49	1.49	1.04	1.91	3.06	10.9	14.2	47.7	10.7	2.57	3.88	8.66
1990	2.56	2.11	2.87	2.35	NA	7.44	25.4	34.3	28.2	15.5	5.98	4.1	NA
Average	2	1.74	1.59	1.51	1.95	5.81	22.9	31.1	27.5	9.45	3.71	2.53	9.2

Source: Hydrological Records of Nepal, Stream flow Summary. Department of Hydrology and Meteorology, HMG, Ministry of Science and Technology, April 1998 (Baisakha 2055)

Monthly Precipitation Recorded at Jhawani (1967-1999)

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
1967	4	0	18.1	16.8	58.2	339.7	195.7	418.1	189.1	0	8	0	1247.7
1968	54	6.3	0	3	9.1	308.7	488.6	488.3	162.2	101.2	0	0	1616.4
1969	0	0	7	45	83.8	248.1	379.1	556.2	304	33.1	0	0	1656.3
1970	19	0	16.8	31.6	69.7	406.3	413.4	350.5	141	64	0	0	1512.3
1971	0	6.2	0	273.7	153.6	766.9	611.6	604.2	194.3	101	60	0	2771.5
1972	0	32	27.6	14.8	62.4	176.1	511.1	251.9	307.3	52.4	10	0	1445.6
1973	71.5	32	7.8	13.2	115.8	437.8	305.6	363	345.4	4167	6.4	0	1865.5
1974	22.4	5.8	12.2	21.6	81.8	372.2	555	690	457.6	68	0	6.3	2297.9
1975	19	65.4	13.2	0	93	249.3	712.7	362.1	471.5	37.2	0	0	2023.4
1976	16.2	26.4	0	69.6	140.1	299.3	449.5	259.8	220.8	78.6	0	0	1560.3
1977	3	9	6	132.4	127.7	123.3	371	457.5	186.4	65.5	41	48	1571.1
1978	5	29	35.9	54.4	240.1	273.4	636.4	332.7	392.6	66.3	4.5	13.1	2083.5
1979	3.5	15.4	1	15.9	25.4	459.4	734.1	776.5	121.2	107.7	23	40.2	2323.1
1980	0	3.5	54.4	4.5	117.5	409.7	339.7	392.7	313	98.6	0	6.5	1740.1
1981	45	0	0	149.8	105.3	272	472.3	577.5	355.2	0	24	0	2001.1
1982	11.6	7.5	92	124.5	24.9	247.1	329.5	463.3	399.1	0	8.4	3.4	1711.3
1983	92	0	11.2	41.1	237.3	135.8	721.7	339.1	327.2	94.2	0	21.5	1944.1
1984	39	0	5.4	3.4	83.9	541.3	580.1	396.3	676.4	49.9	0	15.4	2391.1
1985	0.2	12	17	21	206.5	260.9	593	457.7	389.6	357	20	88.6	2422.6
1986	0	23.4	12	54.9	161.6	250.4	537.3	321.8	492.6	98.1	0	49	2001.1
1987	0.1	38.2	31.7	39.3	50.4	179.2	750.9	328.9	198.9	175.4	0	0	1793
1988	0.1	22.1	139.5	54.6	165.8	355	408.6	507.7	233	14.4	12	91.1	2004
1989	62.3	28.3	38.1	7	237.1	232.6	686.4	277.2	377.6	19.3	3	2.1	1971
1990	0	68.3	105.4	175.1	325.3	230.7	127.5	425.1	247.9	88.5	0	2	1795.8
1991	7	90	18.4	15	103.5	257.3	96.9	173.7	119.5	0	0	13.9	895.2
1992	0	8.5	0	4.3	67.1	84	397.5	253.2	142.1	66	8.7	4.5	1035.9
1993	2.3	17.2	39	30.6	152.3	119.4	187.8	403.3	98.4	15	0	0	1065.3
1994	29.3	46.5	24	20	139	415	547	479.9	505.4	16	0	3	2225.1
1995	2	23	12	38	142.8	426.4	389.1	465.2	238.5	109.1	63	7.3	1911.2
1996	69.1	36	0	3.3	106	238.7	416.1	457.3	193.5	93.4	0	0	1613.4
1997	13.3	5.5	5.1	149.6	120.2	371.5	439.3	369.8	176.3	159.5	12	170	1992.2
1998	2.4	15.6	80.2	57.5	118.91	203.6	571	1002	252.4	61.6	0	0	2365.5
1999	0.1	0	0	6	322.4	613.3	878.2	598.9	277	198.2	0	0	2894.1
2000	1.8	7.4	9	75.8	189.6	408.1	584.1	488.9	329.9	31.2	0	0.2	2126
2001	2.1	7	3	78.1	295.7	338.7	640.5	685.6	358	13.4	5.6	0	2427.7

Source : Ministry of Hydrology and Meteorology, HMG, 2003