LAND TENURE IN DISASTER RISK MANAGEMENT: CASE OF FLOODING IN NEPAL

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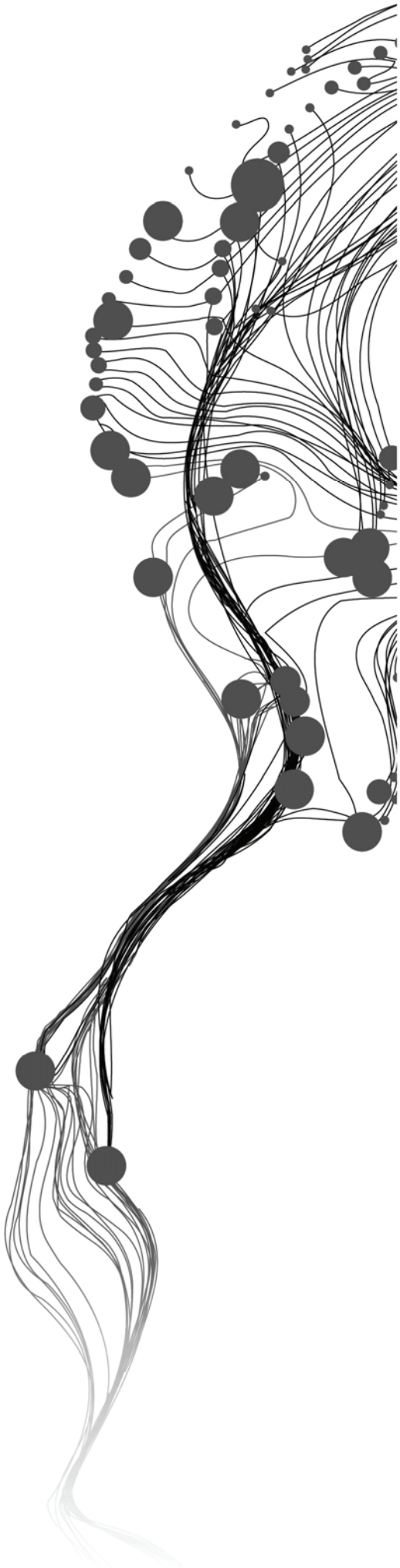

LAND TENURE IN DISASTER RISK MANAGEMENT: CASE OF FLOODING IN NEPAL

CHINNAPAN CHAROENKALUNYUTA
Enschede, The Netherlands, February, 2011

Thesis submitted to the Faculty of Geo-Information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements for the degree of Master of Science in Geo-information Science and Earth Observation.
Specialization: Land Administration

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ABSTRACT

The effect of a disaster is increasingly becoming serious problem worldwide. After the disaster, people in the community often become landless either due to demise of family member(s), inability to prove land ownership or the land being unusable. In such situation, most vulnerable people are those who depend upon access to land with insecure land rights for their livelihood. Addressing land issues in a broad context promotes disaster resilience by providing secure land tenure access for shelter and land use, and it reduces the vulnerability of community. Land tenure plays an important role in the disaster prone areas in pre and post disaster phase for the implementation of Disaster Risk Management (DRM) plan effectively and efficiently. On the other hand, if land tenure security is enhanced, it also improves the resilience of the people or community at large. This research focuses on the resilience of people in the community from land tenure perspective in the case of disaster caused by the flood.

The literature study from several countries indicates four most prominent elements that are needed for increasing resilience of the people in a community. These are; land tenure security, well-planned DRM activities, a reliable land registration system and stakeholders' interaction. In order to look deeper on these elements, primary and secondary data were collected from the field study area, a village called Dibyanagar of Chitwan district in Nepal. This area usually gets affected by the disaster caused due to flooding from the river flowing alongside the village, and affects shelter and livelihood of the people in the communities. Household surveys, stakeholder interviews and field survey observation were carried out to collect primary data, while the relevant documents, local DRM plans and sets of spatial data (digital cadastral data, GeoEye images, and aerial photographs) were collected as secondary data for the study.

The result of data processing indicates that 94% of the land parcels have private ownership hold by the people/landowners, while only 6% of land belongs to the government. The study also shows that about 11 % of land area was swapped away by the flood and 52% of land area is still falls under hazardous zone while 37% of land area is found completely safe from the disaster. Despite all these land parcels are registered and land disputes are not the major issues in the area, the analysis reveals that land tenure security is weak. The results of the household surveys and stakeholder interviews reveal that the DRM activities are well managed in practice on the response (emergency time), recovery (post-disaster) and prevention, but the organisations involved do not often share the available data such as hazard map. It is also found that because of their experiences, the people in community can respond the disaster risk very well by following the procedure to be taken during emergency time.

This research finally reveals the responsible organisations need to improve a) land tenure security in broader context by bringing land policy into implementation, and b) interaction with the organizations involved to complement the DRM activities by sharing timely relevant data for increasing the disaster resilience of the people in the community.

Keywords: *Land tenure, Disaster Risk Management, Resilience, Vulnerability, Flood*

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ขอบคุณทุกคำแนะนำ ความร่วมมือ ความช่วยเหลือ และกำลังใจ

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LIST OF ABBREVIATIONS AND ACRONYMS

ADPC	Asian Disaster Preparedness Center
ADRC-AIT	Asian Disaster Reduction Center in Thailand
DAO	District Administrative Office
DDC	District Development Council
DDMC	District Disaster Management Committee
DNDRC	District Natural Disaster Relief Committee
DoLRM	Department of Land Reform and Management
DoS	Survey Department
DPnet	Disaster Preparedness Network-Nepal
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DWIDP	Department of Water Induced Disaster Prevention
ICIMOD	International Centre for Integrated Mountain Development
INGO	International Non-Government Organization
LRO	Land Revenue Office
LUP	Land Use Plan
NCDM	Nepal Centre for Disaster Management
NGO	Non-Government Organization
PDMP	Participatory Disaster Management Program
PEP	People's Embankment Program
SO	Survey Office
VDC	Village Development Committee

1. INTRODUCTION

1.1. General

The influential factors in disaster are caused by human activities and changes in global climate. Global warming is an important cause of serious natural disasters (IPCC, 2001) such as typhoons, sea levels rise, droughts, floods etc. The disaster risk is the probability of losses occurring that depends on hazard and vulnerability (UNU-ITC DGIM, 2009). The hazard factors occur by natural phenomena and also socio-natural hazards. Simultaneously, the vulnerability refers to political-institution, economic and socio-cultural and environmental factors (GTZ, 2002). Referring to the framework of disaster risk management (DRM) elements, the disaster risk reduction (DRR) or minimizing the vulnerability is possible by averting (prevention) or limiting (mitigation and preparedness) the effects of hazards (UNU-ITC DGIM, 2009). This also depends on the resilience of people or the communities living in the disaster areas.

Presently, the numbers of vulnerable groups in disaster areas are increasing due to urban population growth, environmental degradation, improper or no land use planning. In order to prevent and mitigate the effects of the environmental risks, spatial data instrument of land information system is required, which supports essential functions (Kotter, 2003) such as:

- Early warning system: the monitoring information system of natural and environment risk.
- Risk assessment and mapping: disaster assessment and mapping system based on geological and hydrological information.
- Prevention and reduction: spatial planning analysis of environmental disaster based on spatial model development.
- Risk Management: infrastructure of environmental disaster
- Reconstruction: provide innovation models to eliminate the damages and priority prevent

Land policy is a key component to take appropriate measures with due condition of land tenure issues in the disaster areas (Quan & Dyer, 2008). Land tenure policy plays an important role in the disaster prone areas in pre and post disaster phase for the implementation of Disaster Risk Management (DRM) plan effectively and efficiently. In other words, land tenure policies not only support the security of land ownership, but also provide the right to access land for recovery after a disaster takes place. Therefore, this research aims to explore the resilience elements for supporting people or community that reduces the vulnerabilities of disaster risk areas.

1.2. Background

Nowadays, the damage caused by unexpected natural disasters has increased worldwide with manifold damages such as South East Asia Tsunami in 2004 that took lives of almost 230,000 people, Hurricane Katrina in North America in 2005 with a loss of more than $75 billion of economic damage (FIG, 2006), and the Haiti earthquake in January 2010, where more than 200,000 lives were lost and over 100,000 have been rendered homeless (PDNA, 2010). The latest example is the Pakistan flooding in August 2010, over 14 million people have been affected by this disaster (BBC, 2010). These disaster events not only destroy lives and resources, but also reduce liquidity of economic and social development (GTZ, 2002).

The climate change caused by human intervention also increases natural disaster (GTZ, 2002). Every year, out of about 250,000 people are killed by disasters around the world, 95% live in developing countries (UN-HABITAT, 2008). As a developing country, Nepal suffers from severe disaster as it has a unique landscape and climate change. Geography of Nepal and surrounding increases vulnerability to the poor people, with over 500 million alone living in the Himalayan area (Zurick, Pacheco, Shrestha, &

Bajracharya, 2005). The Nepali people residing in the mountainous areas depends on agriculture but they still have food insufficiency (UN-HABITAT, 2010b). They depend on land and livestock for their living (Oxfam International, 2009). During the past decade, the poverty in Nepal has increased to 42% (UN-HABITAT, 2010b). They live in condition of low education, low income and also less government services (Oxfam International, 2009).

Due to the geographical location and circumstances of the people, Nepal is a country vulnerable to disaster. Nepal suffers from several losses due to earthquakes, fire, epidemics, windstorm, hailstorms, avalanches, landslides and flood. As an average, around 951 lives and NRs 1,242 million ($17.5 million) loss every year (Oxfam International, 2009).

The average of annual precipitation in Nepal is about 1,630 mm. If the rainfall is more than 300 mm in a day, river channels will lose their balance leading to severe flooding. In addition, due to global warming, the melting snow from the Himalayas is increasing water levels (R. Khanal, Shrestha, & Ghimire, 2007). The climate change models in 21st Century show that intense summer monsoon is increasing rainfall events. As the impacts, melting of glaciers will cross the peaks period at 150 - 170% between 2030 -2050 in Nepal (Oxfam International, 2009).

Due to this fact, flooding is a serious annual phenomenon in Nepal. The management of flood risk areas to reduce the vulnerability and strengthen the resilience or the ability of a community to prevent and to recover from the impact of the disaster, hazard and vulnerability including associated elements require tenure arrangement and use of land to be considered in Nepal. Very often, vulnerable groups or communities usually have no other options and still stay in the risk areas.

1.3. Research Problem

One of the causes in increasing people's vulnerability is poverty. Oxfam International (Oxfam International, 2008) shows that flood in 2007 has severely affected poor people in India, Nepal (Terai) and Bangladesh.

Natural catastrophes are often linked closely with poverty. That poverty causes informal settlements, especially in dangerous areas and unsafe places. The number of people who live in informal zone is rapidly growing in poor countries. They can survive without any facilities and concentrated in the risk areas (Basyal, 2010). Nepal is a disaster risk country area, with over 90 percent of country vulnerable to natural disaster risk zone (District Development Committee, 2005). Majority of income and employment in Nepal come from "Land", especially in rural areas where 90 % of land use for livelihood is through agriculture. The poor farming groups in Nepal are the most vulnerable group from the impact of climate change. In addition to natural disaster issues, poor people of Nepal have problems with land issues for those who are landless and have limited land holdings for life (Sharma, 1999). As a result, the poor farmers often informally settle in disaster risk areas, such as along the river banks where flood occurs annually, and landslide prone areas. Certainly, it is the cause of increased risk and vulnerability to them.

Unclear or uncertain land tenure in disaster areas makes negative effects to communities. On the other hand, secure land tenure is a key factor in terms of allocation of assistance and reinstate the land to response catastrophe (Mitchell, 2009). The more security of land tenure is conditions for mitigation measures.

Therefore, the land tenure in that risk areas needs strategies and measures to manage the land and also needs the implementation of land policy as an important tool in reducing people's risk during prevention, preparedness, recovery and risk assessment periods. The land tenure security can support the resilience of community to cope with the disasters. On the other word, improving land tenure is a strategy to increase the resilience and to reduce the vulnerability of community from natural hazard.

1.4. Justification

Enemark (2010) stated that "By combining the disaster risk information with the relevant information on land tenure, land value, and land use, the necessary risk prevention and mitigation measures can be identified and assessed in relation to legal, economic, physical, and social consequences" (Enemark, 2009). Therefore the information about land issues is needed in recovery and response phase of natural disasters.

Mitchell (Mitchell, 2009) supports the view saying that "Responses to natural disasters need to consider land issues in the preparation for early recovery. Secure land tenure is important in responding to natural disasters in terms of allocating assistance and retribution in reinstating homes and livelihoods". In addition, he states that "Improvements to tenure security require a long-term commitment and should be based on the development of comprehensive land policies and legal frameworks. Understanding the land tenure issues that may arise following a natural disaster provides an opportunity to minimize the impact during the emergency response, recovery and reconstruction stages. Where recognition of potential and existing land issues are incorporated into national land policies as part of the DRM process, the most vulnerable members of the community are more likely to be protected from loss of land and livelihoods." (Mitchell, 2010)

Accordingly, security of land is a critical issue to be responded in natural disasters areas. Unclear land tenure leads to uncertainty of decisions that should be taken with regards to DRM activities before, during and after disaster.

Brown and Crawford (Brown & Crawford, 2006) have put their opinion that lack of land use planning increases vulnerability and tension in disaster areas. The land issues always appear during recovery in disaster area. The relationship between people and their land are significant to sustainable land development. Example in case of flooding, Ministry of Water Land and Air Protection, Province of British Columbia (Ministry of Water Land and Air Protection, 2004) guide that "Local governments should consider broad flood hazard management tools to ensure that future land use will be planned and buildings constructed in a manner that will reduce or prevent injury, human trauma and loss of life, and to minimize property damage during flood events." These expressions indicate that land use planning also play an important role in reducing vulnerability and preventing losses in the future.

After a disaster takes place, it destroys both land and buildings including infrastructures, and breaks down the humankind to land relationship in the areas. Such relationship is usually constructed by land tenure arrangement in which property rights are arranged in private, state, common or customary and open access tenure. When the disaster hits, there are varieties of effects to the people, families and communities living and working in such areas depending upon the bundle of rights that they held. As an example, Mokan is the indigenous community in PhangNga province of the Southern Thailand who live on state land and private coastal lands with tourist areas. After the tsunami in 2004 they have to leave the areas, and later during post-tsunami, these vulnerable groups try to reconstruct houses in their land. After many arguments on conflict, the land is finally allocated to two-third of original villagers on a long-term lease and allowed building a hospital (Brown & Crawford, 2006).

Furthermore, in case study area, in Chitwan district, Sixteen hazards occur with flooding being the most severe (DDC, 2004). Over RS 10.62 billon was lost by disaster annually in last 49 years. The disaster vulnerability of Chitwan contributes to landslide because of flooding. The consequence is the debris from the hill of Chitwan and Makwanpur to Narayani River and Rapti River. During the last couple of years, almost 1,000 people were killed in landslides and flooding. The dam developed by Asian Development Bank, East Rapti Project (ERP) protects floods in agricultural areas, but now the water level of river has increased significantly causing concerns that the dam could not prevent flooding in the near future. Accordingly, the study of hazard and vulnerability is one of the most important elements to reduce and prevent the effects of flooding in Chitwan.

These examples demonstrate the necessity of well-arranged land tenure system with its associated bundle of property rights to reduce vulnerability of the poor and marginalized people and communities. Therefore, land tenure in disaster risk areas is relevant and important to be studied.

1.5. Research Objectives

1.5.1. Main Objective

To study the resilience of community in disaster risk areas from the land tenure perspective

1.5.2. Sub-Objectives

1. To identify the resilience elements required to increase resilience of community in disaster risk areas.
2. To analyse resilience elements from land tenure perspective using spatial and non-spatial data in disaster risk areas

1.6. Research Questions

The questions concerns to the sub-objectives are following:

Sub Objective 1:

a) What are the experiences/lessons learned in disaster areas in term of land tenure?
b) What are the resilience elements from land tenure perspective to be considered in disaster risk areas?
c) How to measure the efficacy of land tenure for resilience?

Sub Objective 2:

d) What spatial and non-spatial data are required for land tenure with flood affected mapping in disaster area?
e) What are the results of resilience elements in disaster areas?

1.7. Research Framework

Conceptual framework of this research is based on the elements of land policy and disaster risk management. The land policy consist of land tenure, land value, land use and land development. But the resilience elements in this research focuses on land tenure and land use only. On the other hand, disaster risk management elements discuss in this research are risk assessment, prevention/mitigation, and preparedness planning as Figure 1-1:

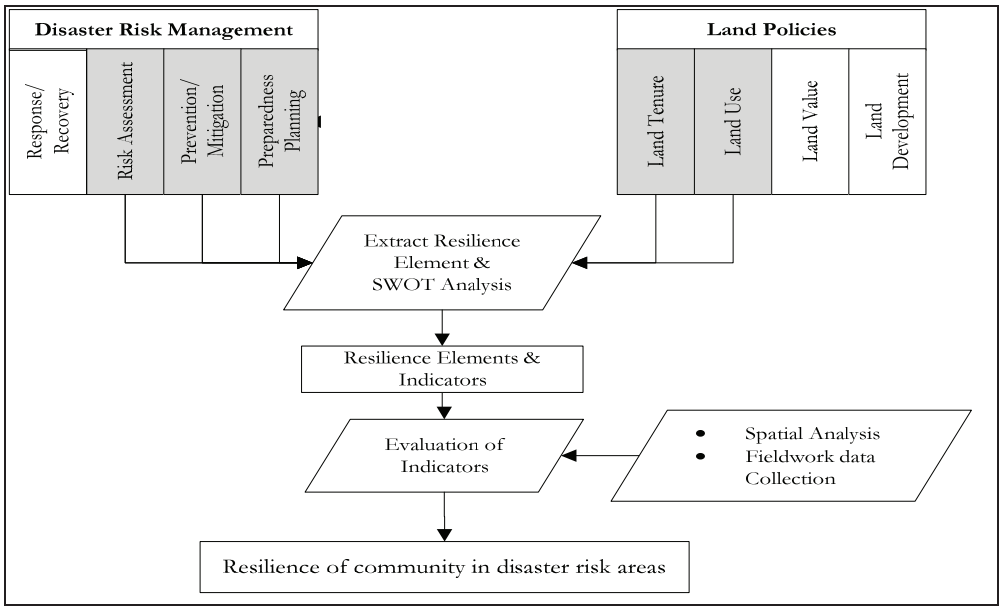

Figure 1-1: Research Framework

1.8. Research Design

The following Table 1-1 gives the design of the research.

Table 1-1: Research Design

Research Objective	**Main**	To study the resilience of community in disaster risk areas from the land tenure perspective				
	Sub	1. To identify the resilience elements required to increase resilience of community in disaster risk areas			2. To analyse resilience elements from land tenure perspective using spatial and non-spatial data in disaster risk areas	
Research Question		a) What are the experiences/ lessons learned in disaster areas in term of land tenure?	b) What are the resilience elements from land tenure perspective to be considered in disaster risk areas?	c) How to measure the efficacy of land tenure for resilience?	d) What spatial and non-spatial data are required for land tenure with flood affected mapping in disaster area?	e) What are the results of resilience elements in disaster areas?
Data Source		**Secondary Data** - Literature (short cases and long case study in The Netherlands and Thailand)	**Secondary Data** - Literature (find out resilience elements from result of a))	**Secondary Data** - Literature (find out indicator from result of a) and b))	**Primary Data** • Household Survey • Open and close interviews of stakeholders • Survey observation **Secondary Data** • Land policy documents • Topographic map • Cadastral map • Flood hazard map • Image/ ortho-photo • Land use map • etc.	Evaluate the indicators from c) to case study in Nepal
Expected Output		- Result from the verified land tenure elements from short and long case studies.	- Resilience elements of community from land tenure perspective to be considered in disaster risk areas	- Indicators to measure efficacy of land tenure perspective for resilience	- List of spatial and non-spatial data for land tenure with flood affected mapping - Land tenure with flood affected map of case study in Nepal	- Table of result from evaluation based on indicators of case study in Nepal - Discussion the resilience of community in disaster risk areas from the land tenure perspective in Nepal

1.8.1. Methodology

The methodology of this research is to answer the research question a), b) and c) using literature reviews and desk research are given as follows:

- For answer a), in this research applied desk research on experience and lessons obtained on disaster and flooding that happened in The Netherlands and Thailand as long case studies. And also reviewed short case study in other countries as short case studies. The sources information of those case studies retrieved from journals, papers, reports and other documents.
- For answer b), finding out resilience elements by the results from a).
- For answer c), extracted land tenure arrangement situation in disaster risk areas from answer a). Then identified indicators by using SWOT analysis as well as defined reason for each indicator.

To answers the research question d) and e), it used the case study data of Chitwan, Nepal, as follows:

- For answer d), used the spatial and non-spatial data collection from fieldwork for mapping "land tenure with flood affected". And also applied spatial analysis to identified land tenure and land use in case study.
- For answer e), was done by evaluating the indicators from c) and analysing the resilience of community due to land tenure in the case study with spatial and non-spatial data collection, continually with conclusion and recommendation of this research.

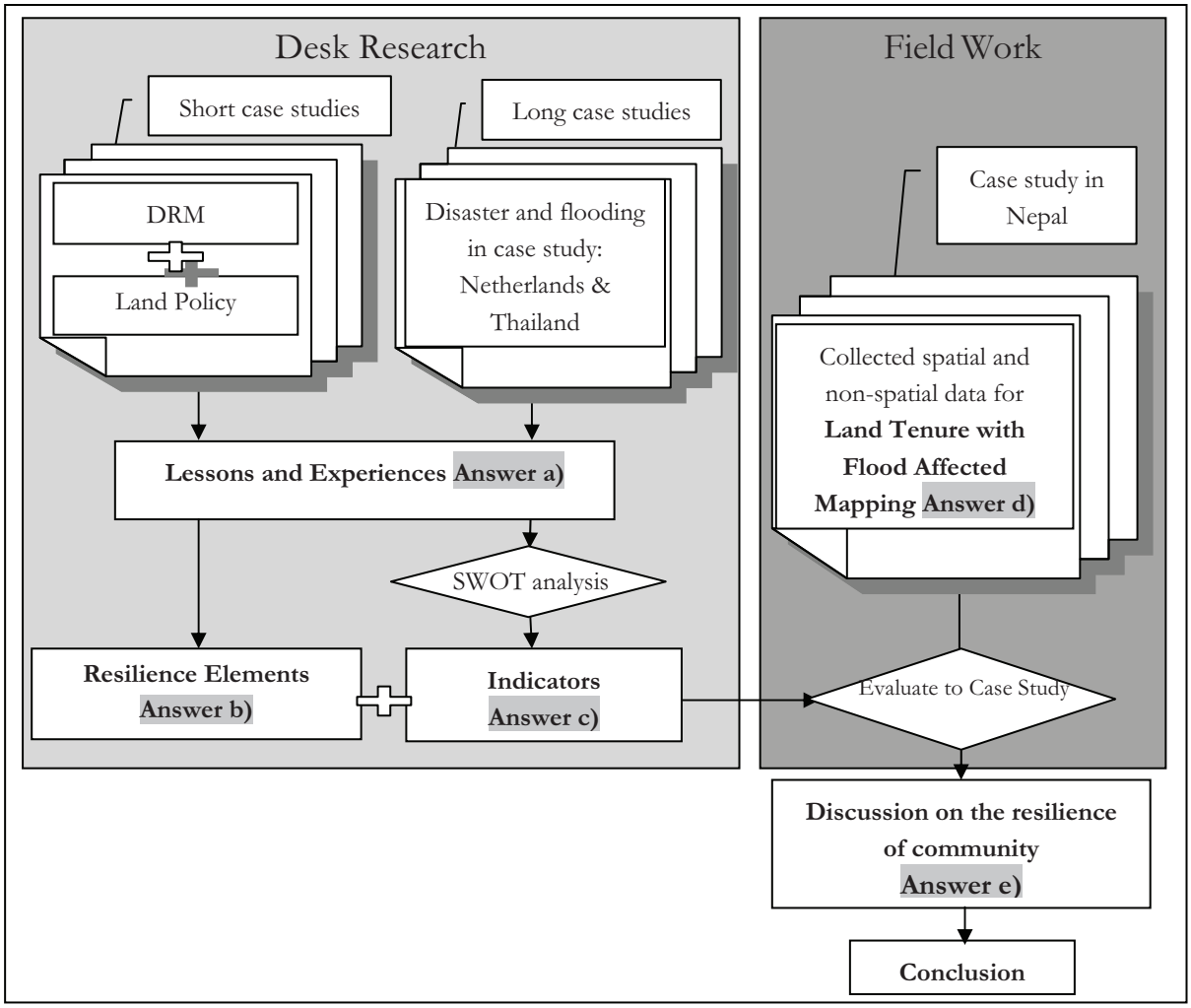

Figure 1-2: Research Methodology

1.8.2. Study Area

Nepal is the country in natural disaster risk zone. Every year, over hundreds of people are being killed and millions of properties are being damaged by catastrophes. The flooding is the one of the serious and most common problem in Nepal. Therefore, this study takes into account the hazards caused by flooding in the Chitwan district. The place was affected by flooding and became a centre of preparing of action plan that supported by several agencies, especially by United Nations (UNOCHA and UNDP) (DDC, 2004).

Chitwan District is situated in the south western district of Bharatpur in Narayani Zone. It covers of 2,218 km^2 area with a population of 472,048 people and 92,863 households (Central Bureau of Statistics, 2008). Chitwan is a famous district of flora and fauna. Royal Chitwan National Park, the largest in Nepal is located here. Therefore, Chitwan has an area of biodiversity and an important nature conservation area of the country.

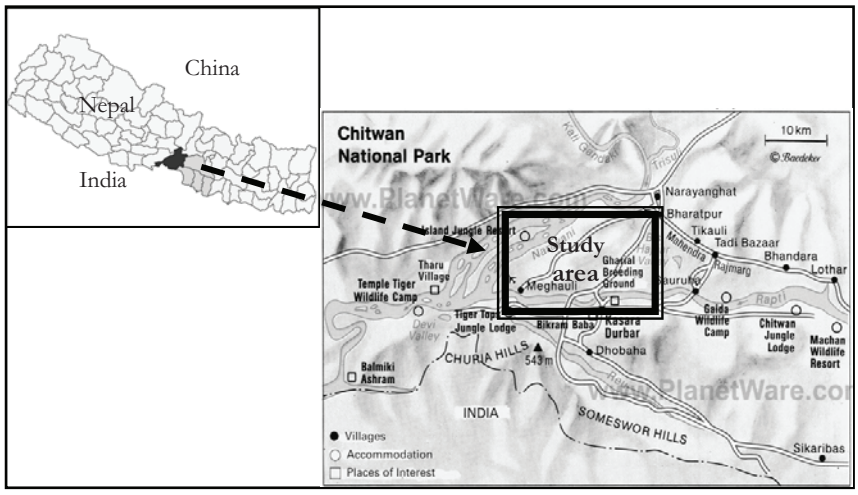

Figure 1-3: Case Study Areas: Chitwan District, Nepal

1.8.3. Research Phase

The research activities are divided in three phases: pre-field work, field work and post field work. The details of each phase are given below:

Pre-Field Work Phase: In this phase, resilience elements, strategies and indicators were found out using SWOT analysis based on literature review. Furthermore, necessary preparation was done for data collection from the case study area, Chitwan, Nepal. The preparation included designing questionnaire for data collection, preparing fieldwork schedule, calculating the number of samples, and requesting for appointments with the personalities to be interviewed etc.

Field Work Phase: The main activities of this phase are data collections by carrying out field visits. The data were collected from the primary as well as secondary sources.

- Primary data were collected from household surveys, interviews and field observations.
- Secondary data were collected from the document on land policy documents, topographic maps, land use plans, cadastral maps, flooding risk maps, image/orthophoto, relevance map, Etc.

Post Field Work Phase: After the field work, data analysis and assessment were done by evaluating the indicators and land tenure with flood affected mapping in order to measure the resilience of community due to land tenure arrangement in disaster risk areas, which was a part of discussion stages.
To complete the above three phases, the next step written the thesis as a report.

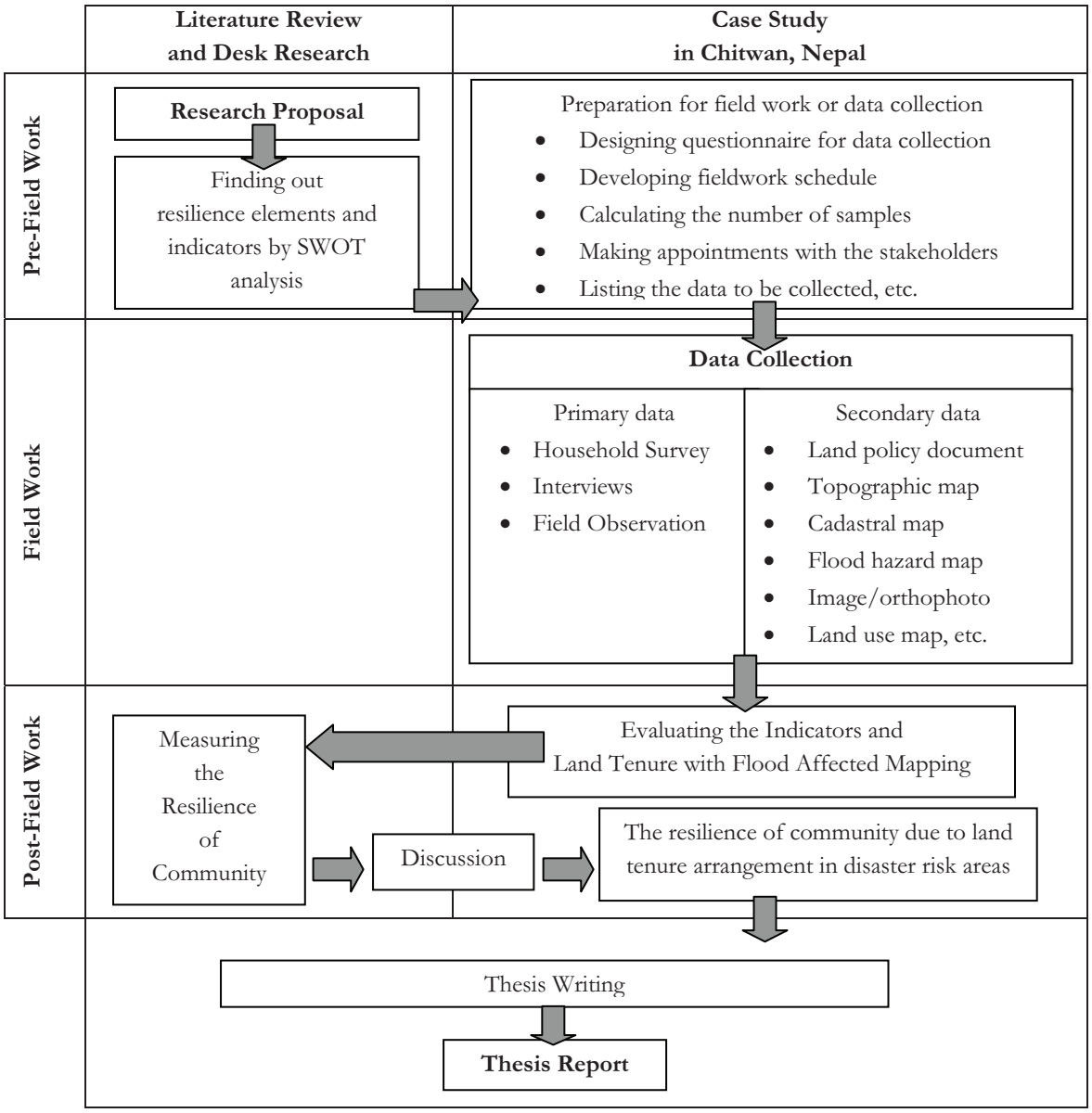

Figure 1-4: Research Phases

1.9. Resources Used

Hardware

- Digital and video camera for survey observation
- Computer PC and laptop
- GPS for identifying the coordinates of the location of household surveys during the field survey
- Voice recorder for recording the interviews

Software

- ArcGIS for spatial data processing and analysis
- Erdas Imagine for digital image processing
- Microsoft office (Word, Excel, PowerPoint, Access. etc) for managing non-spatial and interview data, report and thesis writing, etc.
- SPSS for statistical analysis

Manpower Used during the Field Work

- Driver guide: 1
- Data collection assistants: 2
- KU supervisors

1.10. Thesis Structure

Chapter 1: Introduction

This chapter provides the general background to the research followed by research problem and justification, objectives, research questions, hypotheses, research design, resources used, and thesis structure.

Chapter 2: Theory and Lessons Learnt in Disaster Risk Management and Land Policy

This chapter reviews different scientific literatures to build the foundation for the research. The literatures are basically based on the concept of land policy and disaster risk management, and also experiences/lessons learnt in disaster and flood; Cases of The Netherlands and Thailand have been studied. This chapter aims to answer the research question a).

Chapter 3: Resilience Elements from Land Tenure Perspective

This chapter deals with the classification of the elements of resilience in disaster risk areas to answer the research question b) and analysing the strategies and indicators with SWOT analysis to answer the research question c).

Chapter 4: Case Study and Data Collection in Nepal

This chapter provides designs, methodology and output of data collection from fieldwork in Nepal, as well as spatial and non-spatial data collection for Land Tenure with Flood Affected in disaster areas to answer the research question d).

Chapter 5: Spatial Data Analysis and Evaluation of Indicators

This chapter deals with Land Tenure with Flood Effected mapping, spatial data analysis process by using the data collection from field work and the evaluation process for comparing indicators and in addition, discussion of the resilience of community due to land tenure arrangement in disaster risk areas to answer the research question e).

Chapter 6: Conclusion and Recommendation

This chapter concludes the research results and puts forward some recommendations for further research.

2. THEORY AND LESSONS LEARNT IN DISASTER RISK MANAGEMENT AND LAND POLICY

2.1. Introduction

In order to measure the resilience of community in disaster risk areas from the land tenure perspective, this chapter reviews the theory and lessons learned from several country concerning the disaster risk management (DRM) which focuses on factors and cycles of DRM including the resilience of the community (section 2.2). In this thesis, the definition of "Resilience" is refers to terminology based on Disaster Risk Reduction (UNISDR, 2009) which states that resilience is "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions". On the other word, good resilience of a community can reduce vulnerability level as coping pre and post disaster phase. The ability to recover an area depends on the resilience of the community.

This chapter is started by reviewing the theory of DRM (section 2.2). Since land policy has important role in promoting land tenure in disaster risk areas, this chapter elaborates the policy, which focuses on land tenure and land use (section 2.3). Similarly, the concepts of land management and land policy with resilience of community in disaster areas are also elaborated. Moreover, this chapter also provides the experiences and lessons learnt from the cases of land tenure arrangement in disaster risk management with short case studies. Those cases are derived from Germany (flood), Turkey (flood), USA (hurricane), Honduras (hurricane), Iran (earthquake) and Indonesia (earthquake and tsunami) (section 2.4). Review of long case studies from The Netherlands and Thailand (regarding to land management, land policy, landownership, disaster risk management and resilience of community in case of floods and others hazards) was done in order to know the situation about resilience of community in disaster risk areas (section 2.5). Finally, the chapter has been summarised in the section 2.6.

2.2. Disaster Risk Management (DRM)

The damage caused by unexpected natural disasters has increased worldwide; such as tsunami disaster in 2004 in South East Asia that took the lives of almost 230,000 people; Hurricane Katrina in North America in 2005 which caused more than $75 billion of economic damages (FIG, 2006); the earthquake in January 2010 in Haiti, where more than 200,000 people died and over 100,000 people have been rendered homeless (PDNA, 2010); the recent example is the Pakistan flooding in August 2010, where over 14 million people have been affected (BBC, 2010). All of these are natural disasters phenomena, which gave adverse impact to the affected people. Such natural disasters are beyond the control of human beings. However, the risk of the disasters can be minimized through its proper management. In this section, as components of disaster risk management, major factors of disaster risk, cycle of disaster risk management, and community resilience of community in disaster risk management have been illustrated.

2.2.1. Factors of Disaster Risk

Risk, in the term of hazard, means the probability of harmful effects and damage of life and property that depends on hazard and vulnerability (UNU-ITC DGIM, 2009) as Figure 2-1.

Basically, **Hazard** is "a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation" (ISDR, 2010).

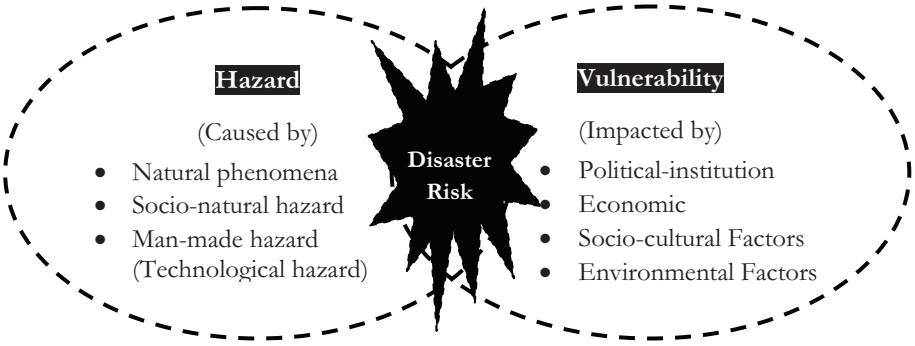

Figure 2-1: Factors of Disaster Risk
(Adapted from (UNU-ITC DGIM, 2009)

The causes of hazard can be classified in three ways; those may occur by natural phenomena, or socio-natural phenomena, or men-made hazards. The natural hazard comes from the system of the earth without human involvement. Socio-natural hazard is caused by human activities that interfere or modify the natural process such as nuclear or chemical accident. While, men-made hazard or technological hazard is caused by human activities, such as the firework explosion in Enschede, the Netherland in 2000 that started with small fire, and then the fire grew up and continues with two major explosions in firework containers. As result, large firestorm covered many industrial and residential buildings surround by (UNU-ITC DGIM, 2009).

Vulnerability relates to inadequate ability to protect against the natural disasters and insufficient ability to recover quickly from its effects. The factors of vulnerability comprise political-institutional, economic, socio-culture and environmental factors. Basically, political-institution factor is caused by lack of legislation, unclear role/responsibility of stakeholders and lack of political support. Meanwhile, economic factor comes from lack of financial resources, poverty of people and low level of diversification of products (such as the economic system which depend on a few products only). Socio-cultural factor includes poor education/knowledge, superstitious belief and tradition of people (GTZ, 2002). The environmental factors relate with the impact resulted from the interaction of natural, political-institutional, economic and socio-cultural factors.

2.2.2. Cycle of Disaster Risk Management (DRM)

"Disaster risk management is a cyclical, dynamic process that requires continuous adjustments, decision making and interaction at different yet interrelated levels and among a variety of institutions and actors, including individuals, households, communities, non-governmental organizations, market institutions, and government" (Pantoja, 2002).

According to the definition above, all the stakeholders in DRM including government, NGO, private sector and communities, can involve in the implementation of all the components of the DRM cycle. According to the UN/ISDR(2004), the key elements of the DRM processes are prevention/mitigation, preparedness planning, response, recovery and risk assessment, and the cycle of DRM is as shown in the Figure 2-2.

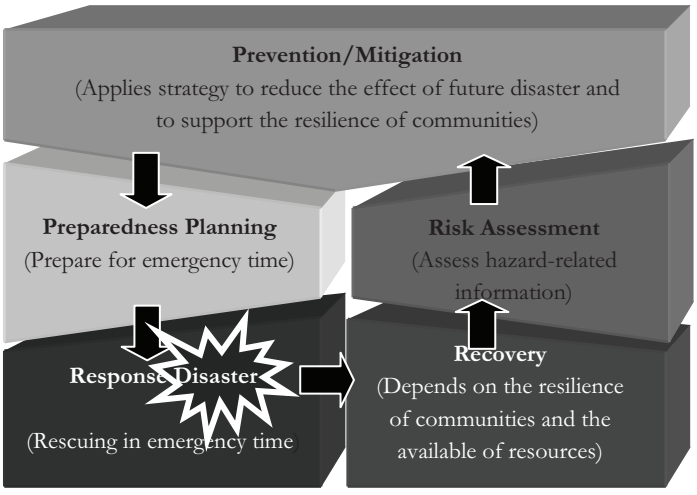

Figure 2-2: Cycle of Disaster Risk Management

Soon after disaster takes place, rescuing the victims is needed as **response** to safe the victims and remaining property. After that, the process is continued by **recovery** to return back to the normal condition as

pre-disaster stage. In order to protect the vulnerable group in future, **risk assessment** concerning related hazard needs to be carried out, The assessment can be useful to manage the damage in case of similar kind of disaster that might in the future. Meanwhile, the **prevention/mitigation** and **preparedness planning** stages are the main stages for improving the resilience of community. In details, each stage is described as follows:

- **Response** This stage is the actions in emergency time after a disaster take place to rescues lives and reduce the damage of property, and also to prevent the physical impacts and new risk factors (Pantoja, 2002). As an example, in case of earthquake hit, the government is responsible to save the life of victims from collapsed buildings immediately. This action is also needed to protect the victim from new risk factors generated by the earthquake such as fire or gas explosion.
- **Recovery:** This is the stage when short term and long term activities are performed to bring the life back to the normal condition. The recovery period depends on the resilience of communities and the available of resources. Efficiency of recovery also depends on the availability in the process of prevention and mitigation stages (Pantoja, 2002). As an example, after tsunami took place, the recovery ensured the victims whether they can get/reconstruct their houses and bring their life back to normal.
- **Risk Assessment** is defined as "a methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend" (ISDR, 2010). In this step, the information related to the hazard is assessed. The results of the assessment may be made public depending upon the situation but not always. The stakeholders can make strategies (e.g. through risk-based land use plan) for reducing the loss and damage in similar cases of disasters in future.
- **Prevention/Mitigation** is the pre disaster stage. These activities apply the strategies or measures and policies in disaster risk areas to reduce the effects of the disaster and vulnerability. In other words, this stage is to minimize casualties and damage of economy by applying both of the structural and non-structure measure in disaster risk areas(Pantoja, 2002).
- **Preparedness Planning.** This is the stage where activities are focused on minimizing the effects of any future hazards. It also helps respond during the emergency period (Pantoja, 2002). Preparedness planning is a measure that can increase the resilience of community. As an example, awareness program on potential future hazards conducted for local people can be considered as an activity of preparedness planning. Such activities educate the people about the procedures to be followed in emergency time ultimately to save their lives and properties.

2.2.3. Resilience of Community in Disaster Risk Management

According to the cycle of DRM as explained above, the risk assessment stage can provide information to the community to reduce the vulnerability. Reducing vulnerability is possible by enhancing and improving the resilience the community as in prevention/mitigation and preparedness stages. Better resilience of the community ensures that the community can recover soon. The local community is the foremost party impacted by the natural disasters. Therefore, it needs to be aware in coping with disasters. Disaster risk reduction (DRR) is an initial way to make step for reducing vulnerability. Many countries around the world are developing the strategy to improve the resilience of their local communities. According to the United Nations International Strategy for Disaster Risk Reduction (UN/ISDR) (2007), it was reported that the practices for promoting the resilience of community are found in the following cases.

- In Afghanistan: *Tearfund* broadcasts dramas, and stories in order to raise disaster risk awareness in the communities. This helps understand the ways of coping in case of any disaster and enhance the capacities of the communities, especially for the communities in remote areas. The reason is, if people in communities are trained and get adequate information about DDR, they can prepare in pre-disaster stage and know the tips for surviving during emergency time.

- In El Salvador: *Plan International* agency is implementing "School Protection Plan" project. It brings children and youths forward for creating the emergency plan and other disaster risk reduction activities. It also stimulates the schools and communities to participate in emergency time and give the understanding of the importance of DRR to young generation.
- In Haiti: *Oxfam UK* developed "Community Based Disaster Preparedness Project" by creating 22 Local Civil Protection Committees (LCPCs). Each LCPC makes its own campaigns to stimulate communities' participation in disaster prevention in order to empower the members of the community. Inviting local dancers and singers to join in rescue demonstration or presenting relevant information to the members of a community are examples of the LCPCs activities.
- In Namibia: *Desert Research Foundation of Namibia (DRFN)* supports local decision making and local-level monitoring from the drought hazard. The foundation has developed a local level monitoring system such that local community can provide the information about draught to national level for supporting DRR. This program is not only supporting the information supply of drought to the government but also enabling the communities to keep capable enough to cope with the disaster situation.

All the cases presented above are practical examples of the involvement of local community, local and international NGOs. The good practices reflect the understanding and implementation among different level of stakeholders. Therefore, local, national, and international efforts are required for improving their resilience and resistance from natural disaster.

2.3. Land Policy

"Land policy aims to achieve certain objectives relating to the security and distribution of land rights, land use and land management, and access to land, including the forms of tenure under which it is held. It defines the principles and rules governing property rights over land and the natural resources it bears as well as the legal methods of access and use, and validation and transfer of these rights." (IFAD & FAO, 2004). Land policy expresses the political alternatives and decentralization of the land interests between the state and people, and also determines the sustainable management and utilization of land (Bell, 2008).

2.3.1. Land Management and Land Administration as Tool for Implementing Land Policy

The land management focuses use and maintenance of land. Meanwhile, Land administration refer to the process of recording and disseminating the ownership, use, value and information of land at individual or in parcel level (Enemark, 2005). Both are supporting the implementation of the land policy for good governance. The success of implementation of land policy not only depends on the effectiveness of legal framework but also requires the coordination among all the involved stakeholders (UNECE, 2005). The legal framework of land policy is particularly related to right of land and allocation of land resources. Good government system can guarantee and increase the security of land as well as can reduce the land disputes.

According to the (IFAD & FAO, 2004), "a land administration system is a set of structures and institutions which implements the land policy, affects rights, delivers titles and deeds, and manages information systems. The structures can be state or local government institutions. Sometimes, customary institutions perform land administration functions. Proximity, accessibility and accountability of land administration institutions are key issues, which are also relevant for traditional authorities".

here are four components of land administration, namely(Enemark, 2004):

- **Land Tenure.** It provides the security and right on land; demarcate the boundaries of parcel; transfer the land and property (such as sale and lease) and adjudicate the land right and land boundaries conflict.

- **Land Use**. Land use planning regulation at national, regional and local levels controls the uses of land and resolve conflicts of land use interests.
- **Land Value**. This component is meant for valuation of land and property in order to implement the land management, taxation and supports open land market and the property tax disputes.
- **Land Development.** It focuses on building the new construction including the regulation and implementation to change land use planning.

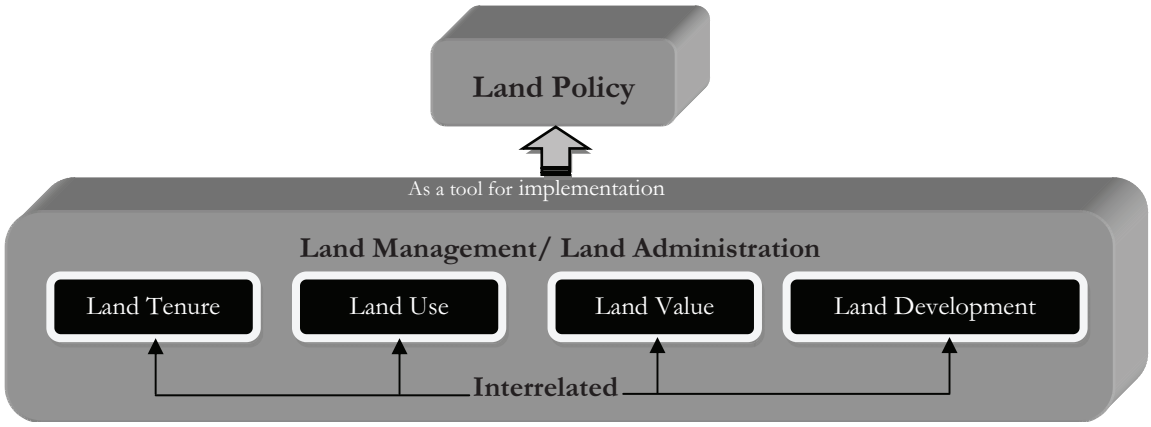

Figure 2-3: Land Management/ Land Administration as Tool for Implementation Land Policy (Extracted from (Enemark, 2004))

As mentioned in the Figure 2-3, these four components are interrelated. Land value is influenced by the economic and physical use of land. On the other hand, the land value is also influenced by the zoning in land use planning and the regulations, which includes granting permit processes. The land use planning and policies define and control the future of land development. These systems support the administration of land for ensuring the sustainable development (Enemark, 2004).

The effective and efficient use of land can support sustainable development. This condition could be achieved through good land use planning. Land use planning (LUP) is a tool to find certain and the best use of land based on its suitability and desirability in particular space of land to meet with the demand of environment, society and economy of the country in present as well as in the future. LUP provides a means of legal control over changes in land use and provides the opportunity to allocate land use of the areas which best suits to particular activity. In practice, LUP relies on the rights of land owners, the role of government at different levels to set direction and policy, and the right of community to be involved in decision making to develop the responses to natural resource degradation (Beinat & Nijkamp, 1997).

One of the causes of natural resources degradation comes from natural disasters. As a tool to achieve sustainable development, LUP, which incorporates the danger of potential hazard in the future, could be used to prevent the adverse impact of natural disaster. In disaster prone areas, sustainable development can prevent the disaster-resistance of the community and can utilize the resources efficiently to ensure for the future generations (Smart Communities Network, 2010).

In order to guarantee the ownership and right of land, cadastre is the individual land parcel registration. It certain purposes to provide security of tenure as land right as established in Torrens system (such as in Australia). It also supports taxation as established in European cadastre or both land taxation and legal right purposes (Enemark, 2004). Moreover, the cadastral system can provide interrelations of land tenure, land use and land value, including the other services to public (World Bank, 2003).

Land registration is a means to identify ownership, status and the right on particular land parcel. Deed System and Title system are the basic of land registration systems. Deed system, which is common in Latin America, Europe and some of Asian countries, and exist in different forms as well as variety of the role of surveyors. On the other hand, title system could be found in central and eastern of European

countries. This system relates with organization, property concept and the role of surveyors. As an example, the system in United Kingdom applies the general boundary concept and identified in a large-scale map. Meanwhile, title registration developed by Sir Robert Torrens, so-called as Torrens System, introduced land tenure security which could be found in some countries in Africa, Asia, Australia and Canada (Enemark, 2004).

Generally, Land Administration Systems are the basis for managing rights, restrictions and responsibilities of land and property. Property rights are usually owned and occupied either by private, public or state. The restrictions control the activities and use on the land. While the responsibilities are related to ethical or socially responsible attitude and commitment of land management (Enemark, 2009). These rights, restrictions and responsibilities manage the relationship between people and their land. That relationship, together with land policies, is an important aspect which supports sustainable development (Enemark, 2009).

Presently, accountability and transparency have got serious concern from civil society and non-government organizations. The concern has also influenced the governance sector. Good governance plays essential role to administer land issues. Basically, good governance is responsible to protect property rights of land and enhance the efficacy of land market as well as to protect the environment and land resource. Land administration can support the good governance by providing effective, transparent, efficient and accountable land services. Since, land is the main capital resource, the consistent investment on land is needed to achieve effective and sustaining outcome (Bell, 2007).

2.3.2. Land Tenure for Sustainable Development

Land tenure can support economic and environmental benefits. The relationship between individual or group and bundle of rights to land is a key of land tenure as well as its administration (Tuladhar, 2004). Analysis of land tenure and land rights is needed in order to identify the right of either registered or unregistered parcel. Basically, the land tenure security requires generalized registration or certificate (Title or Deed). It can prevent, depose and guarantee land transaction and provide access to the land (UN-HABITAT, 2003). Registration of land is an instrument to improve the land tenure security. It supports not only security of land tenure but also promotes the effective and sustainable development. As land tenure can identify the relationship between people and land, the government can define conservation zone, residential zone and other land use zones according to land policy of the country. The implementation is regulated by land related legal system of the country.

Basically, land related legal framework considers land rights, restrictions and responsibilities which are regulated by written and/or unwritten laws. Written Law consists of common Law based on court decisions related with the norms and values of societies; civil/Roman Law based on norms of the Roman Empire and after French Revolution time, and religious Law based on religious beliefs. While un-written laws are the customary Law of the traditional and religious beliefs which exist in old communities or indigenous communities such as American Indians, Aboriginal and others ethnic groups in Africa (Paul van Asperen, 2007).

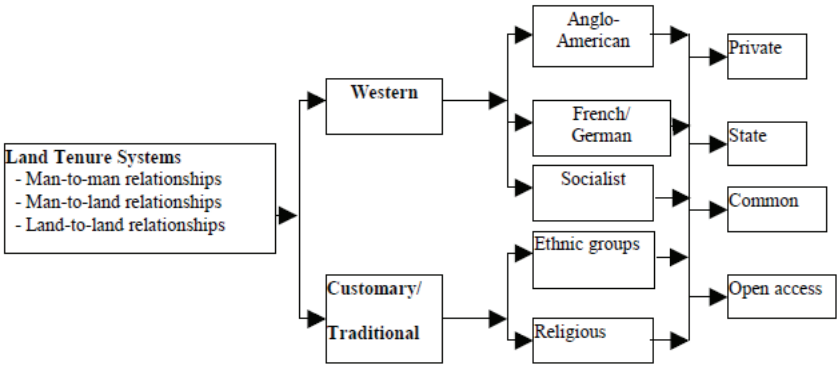

Figure 2-4: Taxonomy of Land Tenure and Property Rights (Tuladhar, 2004)

The concept of land tenure systems widely varies according to evolution of each country. Many factors have influenced to land tenure systems such as colonial administration, western legal system or religious system. Thereby, analysis of the land tenure brings clarity of overlapping

of rights, restrictions and responsibilities between people and land. According to the GTZ (1998), the land tenure can be categorised in four types such as private land, state land, common land and open access land. It was also described by the idealistic taxonomy of land tenure systems by Tuladhar (2004), as shown in the Figure 2.4 explanation.

Private property: FAO (2002) defines private property as "The assignment of rights to a private party who may be an individual, a married couple, a group of people, or a corporate body such as a commercial entity or non-profit organization. For example, within a community, individual families may have exclusive rights to residential parcels, agricultural parcels and certain trees. Other members of the community can be excluded from using these resources without the consent of those who hold the rights." Clearly defined rights on private property guarantees landowners to harvest as well as use the land based on the legal framework such as to sell, bequeath and lease.

State property: is the property in which "property rights are assigned to some authority in the public sector. For example, in some countries, forest lands may fall under the mandate of the state, whether at a central or decentralised level of government." (FAO, 2002). It is usually used by the government for social objective. Government can manage the land such as expropriation, purchase (with or without compensation). Basically, to occupy the state land for special purposes such as pump site, and advertising signs on roads the permission is required (Department of Environment and Resource Management, 2010).

Common or Communal property: it is "a right of commons may exist within a community where each member has a right to use independently under the holdings of the community. For example, members of a community may have the right to graze cattle on a common pasture" (FAO, 2002). This types of land regardless the individual use. It is the land for livelihood of community and use for sustainable development with social controlling.

Open access property: FAO (2002) defines that open access property is the property in which "specific rights are not assigned to anyone and no-one can be excluded. This typically includes marine tenure where access to the high seas is generally open to anyone; it may include rangelands, forests, etc, where there may be free access to the resources for all. (An important difference between open access and communal systems is that under a communal system non-members of the community are excluded from using the common areas.)" In property system, it is not owned individually but allows for public to get access without any incentives for individual who invest in, usually, conservation area.

The explanation above provides the basic knowledge in order to understand each type of land tenure. These types of tenures might exist in flood prone areas. The security level of land tenure within the community areas has impact of the resilience of community members.

2.4. Land Management in Disaster Risk Area

Addressing the land issues in disaster areas are needed specifically in post disasters. Security of land right is critical issues in responding to natural disasters for allocating and reinstating the land. If the land right is unclear after disaster took place, the decision is difficult to be obtained and may cause serious events affecting peace and destroy the harmonized condition in the community.

2.4.1. Resilience of Community in Land Tenure Perspective

According to the survey results about expert opinion and international awareness on land issues after natural disasters, undertaken by the International Institute on Sustainable Development (IISD) in 2005, the respondents rated the importance of land to disaster vulnerability at 4.5 on a scale from 1 to 5 (Brown & Crawford, 2006). The right of the citizens on land could improve planning and guarantee of investment. It decreases vulnerability in disaster areas (Daniel Fitzpatrick, 2008). Conversely, unsafe, unconvinced and unclear land tenure systems will increase the vulnerability of communities.

As an example, in India's Orissa case in 1999, cyclone disaster destroyed land and properties. Victims constructed their houses along shorelines. After that, a storm surge ripped and killed thousands of people in the communities within minutes (Brown & Crawford, 2006). Government must also play primary role in restoring and reconstructing infrastructures including the housing for their people in post disaster phase, and also should solve possible land disputes caused by unclear parcel boundaries. The government together with humanitarian organization needs to cooperate and collaborate in implementing DRM. Lack of good land management, lack of good land use planning, lack of infrastructure and lack of DRM's implementation in disaster risk areas lead to the poor resilience of communities (Daniel Fitzpatrick, 2008).

The causes of vulnerability from natural disaster occur at different level. These are: global level (e.g. climate change and demographic change), National level (e.g. poor governance and tenure insecurity) and Community level (e.g. unsustainable land use and poor of land use plan) (UN-HABITAT, 2010a). The security of land tenure and effective land use planning promote resilience of the community from natural disasters (such as resist and recovery). On the other hand, the impact of natural disasters on land and people are related with the volume of vulnerability. The interaction among land tenure, land use, natural disasters and vulnerability including the resilience of the community can be illustrated as Figure 2-5.

Figure 2-5: The Relationship of Land Management/Administration, Vulnerability and Resilience in Disaster Risk Management

Lack of tenure security and inadequate access to the land for the affected people by disaster increase the vulnerability of the community. This conclusion is also supported by the results of the survey undertaken by IISD in 2005 (Brown & Crawford, 2006) which conclude as follows:

- Extra-legal or informal settlements might not be included in disaster risk assessments.
- Lack of land record systems or land registration will inhibit re-establishment of tenure security in post-disaster.
- Lack of land tenure security will increase vulnerabilities. Some people in disaster risk unwilling to escape from their land during emergency time because they fear to loss the property.
- The eligibilities of land can be proved by land documents/certificate, and it is also needed in reconstruction process and to improve the secondary rights-holders (such as mortgage and tenants).
- Insufficient information of woman-land right, informal right, secondary right and customary right which may not available in pre-disaster records will lead to hardly informed decision, sufficient participation and consultation in regarding to their land and housing.
- Shelter and foods in temporary place may be joined by poor or non-victim people.

2.4.2. Land Policy in Disaster Risk Area

Land policy plays important role in disaster risk management. Van Der Molen (2009) mentioned that land management/administration, land use, land tenure and land reform need to incorporate climate change issues into land policies for land administration which could be implemented through cadastre. Cadastre is

applicable to increase the resilience of vulnerable people who live in risk prone areas. As an example, in flood prone area, when the flooding takes place, the boundary of parcel may be destroyed or even the parcel itself may disappear. Land registers and cadastres should provide information about the boundary of parcels in order to avoid disputes between the adjacent parcel and information about right holders to be compensated in case of losing parcel due to any disaster.

The strategies and policy of land use and land management are required to combine the processes of land administration, cadastral and land development in order to support the implementation of disaster risk management activities. Security of land rights and proper land use in hazard areas including creating and adopting the comprehensive policy in order to prevent, mitigate and to develop the sustainability on land are also keynote to minimize the vulnerability. Good land management system can support disaster risk management to reduce the vulnerability and damage in future. As shown in the Figure 2-6, land management activities play important role in DRM cycle.

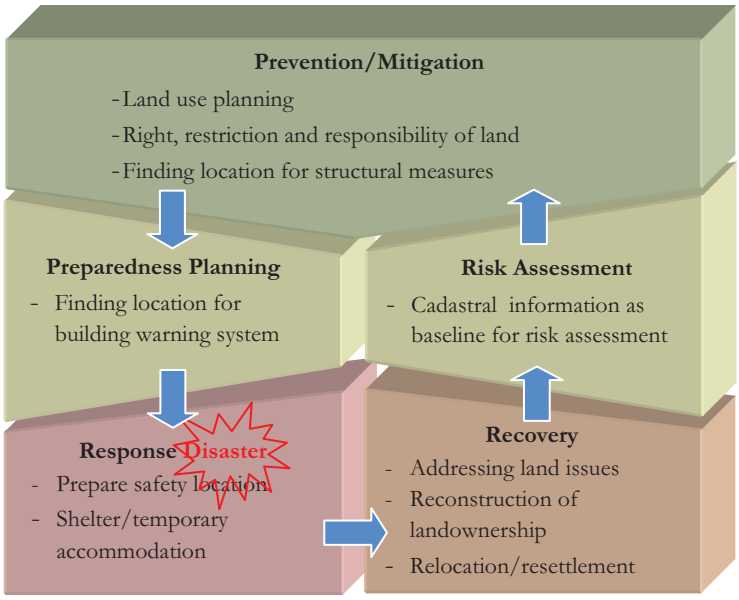

Figure 2-6: Role of Land Management/Administration in Cycle of Disaster Risk Management

In case of disaster "Response" or emergency time, government must provide temporary accommodation at safe locations. Good land management can help finding a safe location for protecting the victims in emergency time. The safe places or shelters must be provided to all the vulnerable people in the communities.

"Recovery" is the period for addressing and reconstructing infrastructures including the housing that it also depends on resilience of each community. Good land administration can provide the records of land ownership in order to identify the land tenure after disaster takes place. Landowners must claim the right of their land based on the type of their land tenure. Moreover, land management/administration can support by providing data related to land so that it could be allocated to the right person before reconstruction of housing. It will have effect to expedite the ability of victims for taking their normal livelihood back. In case the old location of victims is in the risk zone, land management/administration can find safe location for resettling and relocating of victims.

"Risk Assessment" can be conducted based on the cadastral information to estimate the loss of land property in future. Cadastral records, including records of land use and infrastructure information can support assessing the value and use of land. It is important information for estimating expected value of loss in case of any disaster in future. The information resulted from risk assessment can identify the risk zones, which may impact the use and value of land. The government needs land use plan and specific regulation in each risk zone in order to protect people and conserve resource in community.

The activities of "Prevention/Mitigation" related to land issues are applied with non-structural measures. Land administration can provides specific right, restriction and responsibility of land based on land use planning and risk assessment information, such as the government can imposing a responsibility to the landowners in risk zone to insure their house from natural hazards damage. Moreover, land management/administration can also provide the information in order to find the suitable location to dikes, dams, canals and pump stations in flood risk areas, etc.

"Preparedness Planning" is the period for building the warning system and training people to cope with disaster during emergency. Land management/administration can support to fine suitable location to build infrastructures of early warning system and provide information for making procedure of preparedness planning in order to inform vulnerable groups.

As explained above, good land management/administration can support in entire steps of DRM. It also enhances the resilience and relieves the vulnerability of community.

2.4.3. Example Cases: Land Management in Disaster Risk Areas

This subsection demonstrates strategic aspects related to the resilience from the perspectives of land policy and tenure in different hazard situations using six short case studies.

Germany: Flood

More than 100,000 people live along the bank of Rhine River in Germany. The rising water level was affecting their daily life. One of the important strategies that was applied for damage and risk reduction was by spatial planning for flood preventions measures such as by **relocating existing dikes**, **changing the land utilization**, consolidating the land as part of flood risk management and changing the uses of land to conforming use. **Re-arrange of land use and land tenure** by land consolidation enables to reduce the land use conflicts, make required land available and secure the result of risk reduction permanently. Figure 2-7 shows the example of parcel before and after the land consolidation for the parcel beside the creek. The landowner together with spatial planning authorities are involved in enabling the program successfully done (Friesecke, 2005).

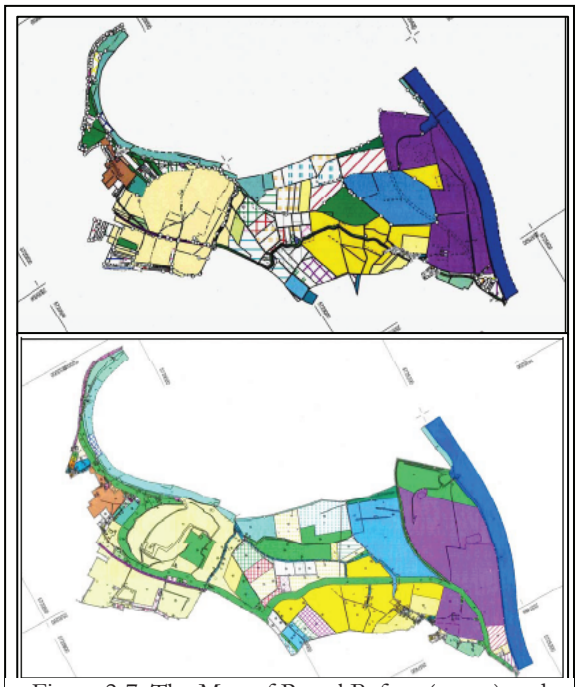

Figure 2-7: The Map of Parcel Before (upper) and after (lower) Land Consolidation Program in the Part of Rhine River Bank

Turkey: Flood

This is the case of the north-western part of Back Sea River basins in Turkey. In this case, one of the flood management strategies applied is use of structural and non-structural measures as solutions. These measures are implemented by slanting structures for river training, flood forecasting and early warning, flood-proofing, land-use modification, building public awareness of the floods, and obligatory natural disaster (including floods) insurance. Use of satellite images and GIS has been done to facilitate these activities. The information related with flood disaster are provided based on: 1) developing data base of flood inventory; 2) giving the clear mandates and responsibility to each organization, especially during emergency time; and 3) **Enabling the participation as an obligatory for all stakeholders**, including local communities in the planning and decision-making process (Gurer & Ozguler, 2004).

USA: Hurricane

In 2005, hurricane named Katrina killed around 1,500 persons and over 800,000 persons were displaced from Missisippi, Alabana and Louisisna in USA. Early recovery plan was reconstructed by compulsory purchase of land from nearby areas. Later plan was aimed to mitigate the flood risk by implementing safety standards and motivating the people to re-build their houses in safe areas with financial incentives. In Louisiana, the Recovery Authority adopted a strategy relating with land tenure element such as **paying the compensation** to re-build and buy a new house in Louisiana or sell their property and move out from Louisiana (Daniel Fitzpatrick, 2008).

Honduras: Hurricane

Hurricane named Mitch, in 1998, killed over 11,000 people and destroyed around 10,000 homes in Central American country Honduras. In post disaster, land tenure is an important issue to manage the conflict and poverty. Private ownership covers around 50% total parcels, Community ownership around 25% (rented to private) and government land covers around 25% in Honduras. 800,000 of farmers have 0.5 hectare or smaller farmland and around 250,000 have no land. These conditions were compounded by deforestation and poor land use planning. After Hurricane Mitch took place, **people tried to occupy vacated land in high-risk areas illegally**. The Government of Honduras reconstructed and developed recover strategies. One of the program was registering the purchase of housing with subsidy in the name of both spouse (Daniel Fitzpatrick, 2008).

Iran: Earthquake

Earthquake in 2003, in Bam, killed 30,000 people, destroyed 85% of the houses, and 75,000 became homeless. Some land issues arose caused by destroyed boundary markers, loss of land records and identity documents. It seemed that the widows could not get their rights of land belonging to their deceased husband. During the emergency response time around 30,000 tents were built along the city streets. But, the victims moved these tents to their land with the reason to protect their property rights and to get close to their livelihood. The government of Iran prepared the legislation which **prohibited land transaction (buying-selling)** in order to minimize the ownership disputes during the reconstruction (Daniel Fitzpatrick, 2008).

Indonesia: Earthquake and Tsunami

This is the case of earthquake and tsunami that took place in 2004 in Ache and Nias of Indonesia. Around 667.000 ha of land including 300.000 parcels of private land and 74.000 ha of agricultural land were affected by mud, salt and sand resulted by tsunami waves (Daniel Fitzpatrick, 2007). In 2005, the Government of Indonesia published the Master Plan which identifies that **land rights as a key element during reconstruction phase.** auditing to the physical condition of land (obscured, unsafe and submerged land) and replacement of lost land records were proposed (Indonesian Government, 2005). In early 2005, the land title certification based on community-driven adjudication were implemented under The Reconstruction of Aceh Land Administration System in Aceh and Nias (RALAS) project by Indonesian National Land Agency to guarantee the tenure security and to support the housing providers during reconstruction period (Daniel Fitzpatrick, 2008). This is the case where land policy has played important role in protecting right of vulnerable groups (orphans, women, and poor), during the reconstruction phase.

The short case studies as explained above are used to extract the elements of community's resilience from land tenure perspective which is described in Chapter 3.

2.5. Experiences and Lessons learnt

In this section, two long case studies are reviewed from the Netherlands and Thailand in order to get the overview of the experiences and lessons learned from the cases. These two cases are chosen because they are relevant for the purpose of this research, especially about communities' resilience in DRM activities. These cases describe the experiences gained and lessons learned from the cases of flooding, and include the strategies that were applied for enhancing the resilience of community.

2.5.1. Disaster Risk Management in the Netherlands

a) Background on DRM

The Netherlands is a country which has a very good example of adequate planning and investment to assess, prevent, prepare, response and recover from disaster in order to prevent disaster risk and reduce vulnerability of communities. The measures used are land use planning, safety zoning and transportation

controlling. Responsible organizations coordinate and share responsibilities not only in implementing the strategies but also in making the policies in disaster areas (Diehl, Neuvel, Zlatanova, & Scholten, 2007). The example can be given as follows: during emergency time, response in the Netherlands has been divided into four levels according to magnitude of the hazard as follows: GRIP 0: routine operations, GRIP 1: limited proportion, need coordination, GRIP 2: surround effect, GRIP 3: within one municipality and GRIP 4: more than one municipality (Captijn, 2010).

There must be exchange of information and sharing of geo-information among different administrative levels in order to support "decision-making teams". The response sector needs training to the actors such as Police and Fire Department. The principle to response is the time and capacity of public/vital facilities such as hospitals to treat patients and road to access the locals (Diehl, et al., 2007).

b) Disaster Risk Management of Flooding

Netherlands Environmental Assessment Agency (PBL), and Institute of Strategic Policy in the Netherlands are the responsible organisations to improve flood policy and spatial planning, and implementing strategies in Flood Risk Areas in the Netherlands. (Kingma, 2010).

The Flood Protection Act (1996) dictates the safety standard of dike ring area, and safety assessment of flood defences should be reviewed for every 5 years (prescribed in guidelines), and responsibility should be shared among stakeholders (Pieterse, Knoop, Nabielek, Pols, & Tennekes, 2009). The Netherland still needs investment for new approach to deal with flooding in the future. The Ministry of Transport & Water Management introduced Multi-layer safety as follows: Level 1: prevention of flood as the core policy, Level 2: making spatial plan for limited effect of flood and Level 3: response in emergency time for limited effect to victims (Kingma, 2010).

According to the National Water Plan, the Netherlands has issued a State Water Policy Plan in 2008, which indicates water policy and water management as their planning, and also it incorporates the spatial planning in new water law. The water management subjects are water safety, water quality, and lack of water, freshwater supply and flooding problem.

In order to make a plan to protect and prevent flooding hazard, the spatial data is required for flood mapping and formulating the non-structural measures. Example, *Hoekse worth*, *IJsselmonde* and *Dordrecht* are three southwest delta islands where the flood management and spatial planning are being implemented. The information of the plan consists of the location of risk area and victims, perspective of different areas and possible land use measures. Introducing Flood Risk Zonation is the program to give extra security to the people living in flood prone areas. In flooding risk assessment, three variables are applied that are probability of affected flood area, exposure to flooding and vulnerability of the area (Kingma, 2010).

Dutch Government has policy/strategies and measures as prevention and mitigation of flood hazard. They consider four factors of flood risk that are incorporated into spatial planning as follows (Neuvel & van den Brink, 2008):

- Making clear about the flood conceptually which sometimes it is considered in spatial planning practices,
- Applying scientific data as well as public concern for decision making in flood risk management implementation,
- Applying additional measures by local government. For example by implementing spatial planning measures in the dike-ring area,
- Cooperation among the involved agencies to consider and integrate the mitigation measures into their spatial planning.

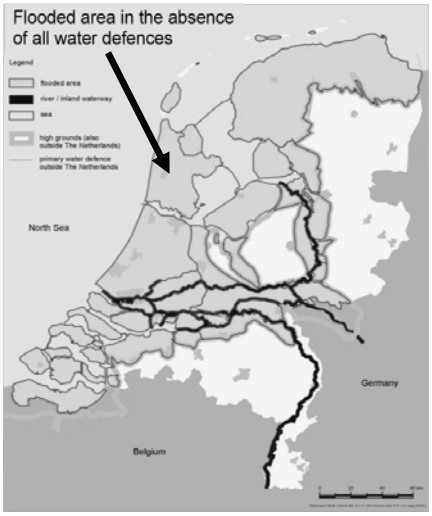

Figure 2-8: The Netherlands Flood Area in Case without Protection Systems (Kingma, 2010)

Around 34,000 km²of area is covered by artificial land. Water land and wetland were drained and changed to cultivated areas. Rhine, Mease, Ems and Sahedt are four rivers as major delta in The Netherland. The annual disaster in densely populated areas is flood hazard. The lowest point in the Netherland is "Nieuwerkerkaan de LJssel" at 6.74 m below sea-level (Pieterse, et al., 2009).

1000 years ago, The Netherland exposed with serious river floods. In order to solve the problem, in 13th century, the first dikes system was created in Utrecht areas. However, the river floods are still a serious problem in The Netherland. During 1314-1347 several floods killed 5-10% of the population. In 17th century Dutch Government created prevention contracture system and draining system, continuous construction and maintenance of many pump stations, canals, ditches, locks and dikes. The height of dike was not enough to protect people. So, the government have increased the height of dike more and more.

Figure 2-9: The North Sea Flood Over the Dikes of the Netherlands in 1953 (Hughes, 2010)

The Figure 2-9 is a picture of flood over the Netherland dike in 1953. It occurred coverkng 40,000 households killing 2,100 people and a loss of more than $500 million dollars (Hughes, 2010). Before 1953, 66% of area was flooded and 70% of GNP or around US$ 600 billion loss occurred due to floods annually. After 1953, in order to save 9 million Dutch in flood risk areas and recovery of the economy, Dutch Government has **raised the dike level for controlling flood problem**(Kingma, 2010). During 1995-2000, dikes and levees were built along river around 240 kilometers. Presently, the flood control regulations has been forced and taken into account for securing the communities in the future.

c) Land Tenure on DRM

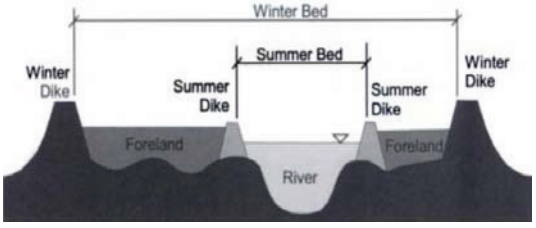

Figure 2-10: Cross Section of Dike in the Netherlands (Hoeksema, 2006)

Dutch civil law is the law to be considered in the real property such as the doctrines of ownership and limits of right. The right of land according to the Dutch Civil Code consists of the role of ownership, building lease, usufruct, apartment ownership, easement and mortgage (Ploeger, Velten, & Zevenbergen, 2005). The information of land registration of the Netherland (Kadaster) can support good governance which provides information on land tenure, land value and land use, as well as public properties and restrictions for the environment (Van Der Molen, 2009). Cadastral information plays role as database for assessing risk damage and also for supporting preparedness plan, such as in providing the route to escape for survivor in emergency time. Land management/administration involves in the other steps of cycle of DRM as explains in previous part. Enhancing resilience of community implies the efficacy DRM strategies by good land management support.

The history of river flood in the Netherlands, reveals that after the Dutch government created dikes to protect communities in hazard prone area, the **landowners felt aware** to protect their community from the flood. Then, they realized to have a responsibility to contribute the costs of dike restoration and maintenance. The "Dike role" is the right between landowners and dike maintenance. Then land was implied in dike role as well as dike building also was implied with land (Tol & Langen, 2000).

To protect the community, in 1964 landowners agreed with land consolidation program to solve river flood problem. Dutch government has designed the program to reduce parcel from 2,415 to 718 with average of the size is 1.2 – 6.5 hectares. 29 farms were relocated and changed became the area for dike and protecting nature areas (planted 395,000 shrubs and 12,000 trees). After that, the Dutch government created level controls and drainage tiles. The program was completed in 1975 (Hoeksema, 2006).

d) Resilience of the Communities in Term of Land Tenure

Resilience of Community in Flooding Risk Areas in the Netherlands, is the ability of system to persist in case of exposes disaster. After the construction of dikes, dams and other structural measures, people felt safer to live in hazard prone areas. Resilience of flooding in the Netherlands focuses on prevention/Mitigation strategies as well as avoids the damage and sudden recovery. After flooding takes place, Dutch government pays compensation of damage to the affected people; reconstruct the house; and making the warming system. The people who live outside hazard areas together with the government will help the victims. **A new strategy of resilience are managing land use by spatial planning** to control and manage flood areas, protect the life of vulnerable group and implement recovery program after the event (Bruijn & Klijn, 2002).

2.5.2. Disaster Risk Management in Thailand

a) Background on DRM

Topography of each region in Thailand encounters different kind of hazard. The Northern region is mountainous and has steep slopes, so this region faces floods, landslides and debris flow. The North-eastern region frequently encounters droughts and flash floods. The Central region often faces river floods. The Southern Region's topography is mountainous and it has coastal areas. This region encounters tropical storms, mudslides, floods and tsunami (Thomalla, Metusela, Naruchaikusol, Larsen, & Tepa, 2009).

The legal framework (the Civil Defence Act of 1997) of Thailand classifies 3 categories of disasters. Those are mad-made and natural disaster, disasters caused by air raids during wartime, and disaster arisen from sabotage/terrorist attack. The Natural Civil Defence Committee (NCDC) is the organization which is responsible for making policy on disaster issues. National Disaster Warning Center is an organization responsible for detecting and publishing notices or massages about disasters to the public. While the coordination and management of disasters are under the responsibility of Department of Disaster Prevention and Mitigation (DDPM). The disaster management systems of the country has prioritized following programs: 1)making and improving public Awareness and Education, 2)materializing early warning Systems, 3)establishing More International Disaster Management Networks, 4)making effective damage assessment, 5)making application of Community-Centered Approach, 6)focusing on Preventive Approach, 7)supporting prevention, 8)supporting public participation, 9)supporting unity in management, 10)focusing on efficient communication, 11)focusing on Human Resource Development, and 12)supporting livelihood rehabilitation.

After tsunamis took place in the southern part of the country in 2004, government and local administration recognized the importance of disaster preparedness, and alarm systems were installed around disaster risk areas. In 2010, Patong Municipality in Phuket Province received award of disaster risk management from UN (United Nation) as a "role model city". The municipality has clear strategies for preparedness of disaster such as tsunamis, flooding and landslides (Phuket Gazette, 2010). Presently, Thailand enhances the awareness of disasters to public and all relevant organizations. Disaster warning system has been made with the plan according to National Disaster Warning guidelines. In implementation, it is involving Television Channel 5, Television Pool of Thailand and cooperate with National Telecommunications Commission. 76 warning towers were installed in tsunami risk zones (Ranong, Krabi, Phang-nge, Phuket, Trang and Satun province), 48 warning towers were installed in the Gulf of Thailand, and 144 warning towers will be installed in Central, Northern and Northeast of Thailand in the days to come (PRD, 2010).

Figure 2-11: Thailand Flooding in 2010 (Source: News-Story Thailand, 2010)

b) Disaster Risk Management of Flooding

Flooding problem in Thailand usually happens during the rainy season between June to October. The effects of floods lead to soil erosions, landslides, property and farm land damages (Wisitwong & McMillan, 2010). The latest event of flood in 2010 can be given as an example (Figure 2-11). The Federation of Thai Industries (FTI) has estimated that this flood has caused an economic loss of more than $1.6 billion in flood area. 39 provinces or around 50% of country were flooded, killing 110 persons, damaging many houses, and destroying thousands of hectors of agricultural land, which has greatly impacted economic growth (Royal Thai Government, 2010).

Chao Pharaya River is a main river of Thailand. In the Thai history, this river has caused heavy losses during flood time. Presently, rapid land development along the river has been taking place wildly and the area is much more vulnerable to the flood. The causes of floods are both natural and men made. The natural causes include heavy rain falls, tides and overbank flow. On the other hand, man-made causes of floods are deforestation, uncontrolled urban development, destruction of flood embankments and excessive groundwater abstraction (Hungspreug, Khao-uppatum, & Thanopanuwat, 2000).

In the past, the measure of flood in the Chao Pharaya River, was taken by constructing dykes along the river bank around 300 km in 7 municipalities, which consists of polder system (such as embankments, retaining wall and pumping station), flood control for protecting the capital city (Bangkok) and agricultural area. One of flood damage mitigation plan is called "Monkey Cheeks". This Master Plan has been designed with a safety expected to last for 100 years in urban areas and 10-25 years in agriculture areas. (Hungspreug, et al., 2000).

c) Land Tenure on DRM

Thailand is a constitutional monarchy and agricultural country. In principle, all the land belongs to the king. However, people can occupy, utilize and cultivate the land privately. Landownership and land heritage are important land issues in Thailand (Yano, 1968). In "The Fifth National Economic and Social Development Plan (1982-1966)", the Thai government has addressed the issue of productivity and poverty problems. According to which, "Land Titling Program" was introduced to solve the prevailing problems in order to provide land tenure security and credit facilities on farmland to the people (Nanthanontry & Rakyao, 2007). Land Titling Program is a 20-year program and achieved the target by issuing over nine million "Title Deed" or certificate of land rights. Improved income from agriculture sector is a positive result of this program.

After disaster takes place, people having Title Deed or certificate of land rights can easily access to their land and do the reconstruction, although their parcel are located in the hazard zone and in some cases, difficult to identifies their boundary (the case of tsunami). Example case **(Thailand: Tsunami)**, Mokan is the indigenous community in PhangNga province of the Southern Thailand who live on state land and private coastal lands as tourist areas. All their lands were not registered in cadastral. After the tsunami in 2004 they had to leave the areas, and later during post-tsunami, these vulnerable groups try to reconstruct houses in their land (private land). After many arguments on conflict, the land is finally allocated to two-three of original villagers on a long-term lease and allowed building a hospital (Brown & Crawford, 2006).

d) Resilience of the Communities in Term of Land Tenure

As a good example of resilience of community in Flood Risk Areas in Thailand, the case of Chitnat Province can be interesting. In this province, some local people from a community could predict

occurrence of disaster by using their experiences such as by observing changes in environment/climatic condition, migration of animals or change in the colour of leaves, before flood took place. As they felt the possibility of flood, as prevention, they moved their belongings to higher land. Meanwhile, some groups could not determine that condition. As a result, during the emergency time, they faced lack of shelters, toilets, drinking water and, also, many people fell sick. Damages due to flood can cause both direct and indirect effect. Damage of property and agricultural products can be considered as examples of direct effect. These direct effects are also causing indirect impacts to the people such as lack of money to pay the debts. During the occurrence of flood, people travelled by boats, had no electricity system and moved to temporary shelters. The flood caused their homes and farmlands covered with lots of garbage and mud. Water was contaminated with dirt and stench (Wisitwong & McMillan, 2010). The actions that were taken by the government in flood situation as follows: 1) shutting down the electrical service; 2) supporting food and drinking water to victims; 3) arranging public toilets; 4) providing health service station; 5) draining water; and 6) **Paying the compensation to victims.**

2.6. Summary

According to the theory of DRM, the factors of risk are hazard and vulnerability. The natural hazard cannot be controlled but the vulnerability which can reduce the adverse impact of disasters could be increased by improving the resilience of community. In this regards, land policy plays an important role to manage the land. Therefore, the land management in disaster risk area is the key factor to increase the resilience of community.

Based on the experience/lessons as explained above, it can be concluded it needs good land management system in disaster risk areas to reduce vulnerability and damage in future. Land management is involved in the entire period of disaster risk management. Appropriate land policy strategies such as improving the land tenure security, land records, and spatial data are required in all cycle of DRM. In other words, good land management and land administration are required to support the resilience of communities.

The experiences and lessons learned in this chapter provide resilience elements of the community based on land tenure perspective which will be presented in details in following chapters. These situations are used in SWOT analysis. It is used to find out the strategy and indicators as elaborated in the next chapter.

3. RESILIENCE ELEMENTS FROM LAND TENURE PERSPECTIVE

3.1. Introduction

This chapter aims to summarise communities' resilience from land tenure perspective. The summary is extracted from the experiences and lessons learnt from case studies in several countries as explained in Chapter 2 (in section 2.3 and 2.4). Section 3.2 describes the resilience elements in order to answer the research question b). Section 3.3 provides the SWOT analysis concerning the strategies for resilience of community. The indicators of each strategy are described in section 3.4. Finally, section 3.5 summarises the chapter.

3.2. Resilience Elements from Experiences and Lessons Learnt

According to the experiences and lessons learnt from communities' resilience in land tenure perspective, as described in Chapter 2 (section 2.4), the governments of **Germany** and **Netherland** have been implementing the strategy for preventing and planning of disaster risk reduction. As developed countries, the Germany and Netherland have been attempting to ensure the security of land tenure for their people in risk areas. They consider some proper measures. One of those measures is land consolidation project activity for reducing the adverse impact of flooding hazard. These project aims to re-arrange the land based on the conforming uses and to relocate the structural measures (e.g. dike and dam) for increasing the retention capacity of the land. Accordingly, the author argues that providing the specific policy in hazard risk areas is a strategy to increase the resilience of community.

Furthermore, from the Netherland case, the landowners have responsibility to support structural measures by bearing the cost for restoration and maintenance of dike to protect their communities. Accordingly, the participation of communities is the main factor to success of the project as well. If they are aware that they are living in hazard risk areas and perceive the damage to land and property in future, they will collaborate to find the strategy that fits with their communities. The other strategy to increase the resilience of the community in flood risk areas is not only by enabling the participation but also by clear mandate and responsibility among the involved stakeholders and the involvement of the communities in decision-making. This strategy, as an example, is applied in the **Turkey** case. The Community plays the role for decision-making and planning process. The government respects and considers the opinion of local people with their local knowledge based on their experiences in facing the flood.

Presently, the DRM technology is improving rapidly. This becomes an opportunity for increasing the level of community's resilience. From the case study in **Thailand**, the early warning system project was created as one of the preparedness planning in emergency time. The spatial data analysis is an important strategy in several countries such as in Turkey as well as in the Netherland. Turkey uses the spatial data in forecasting analysis of the flood disasters. The Netherlands use the spatial data for planning the water management to reduce the adverse effects of floods.

The effectiveness of the policies depends on the appropriate actions for supporting social and economic aspect for the affected people as in case of **USA** where the compensation is the most important to the victim in post disaster scenario. The people of Mississippi have freedom to re-build or move to other areas if they feel unsafe in the old location. This strategy is also fitted in social way of America that emphasizes on freedom.

Providing and enabling the victims for accessing the land is also one of the strategies for increasing the resilience of the community. As an example case is in **Honduras**, many of victims are landless, homeless and moneyless. The victims try to occupy vacant land. Although, they realize that all those lands were located in the high risk area. It is one of the causes that increase the informal settlement and also vulnerable group in disaster risk areas. This condition also brought the land disputes regarding the boundary that were destroyed by Hurricane. The same case also was happened in **Iran**. The government has solution by prohibiting the land transaction during recovery process.

In hazard areas, land registration also plays the key role to increase the resilience of the community. As the example case is coming from **Indonesia**. Land rights are as a key element during reconstruction phase. Land disputes (e.g. boundary disputes) can be reduced by reconstructing the boundary of the affected parcel by tsunami. Moreover, the other impact of land registration is increasing the economic level of the community. This is happen in Thailand where the Land Titling Program provides land tenure security and also increases the agriculture sector activities. The people who got the "Title Deed" can get the credit by mortgages and invest the money for their business. Indirectly, that money could also affect the acceleration of the economy growth of the country.

According to the explanation above, in disaster situation, the resilience element of the community from land tenure perspective can be classified as follows:

Firstly, in case of Germany and Netherland, the consolidation projects were carried out to re-arrange the land and to relocate the people in risk areas in order to ensure the security of land tenure. In USA case, government provides the compensation of the damage of the land and property in post-disaster. The feelings of insecurity are common in disaster condition even though they perceived the danger of risk disaster. The need of land for living and surviving shows in Honduras cases. Victims occupy the land in high risk area in post-disaster. And from the Thailand case, The Land Titling Program has purposes to support the security of land tenure as well. Accordingly, the resilience element of all those cases, namely: **"Land Tenure Security"** is the first element of resilience of the community.

Secondly, In Germany and Netherlands cases, land consolidation project, and structural measure were applied as prevention strategy of DRM activity. In case of USA, Honduras, Iran, and Indonesia cases were focused on post disaster or **Recovery Step** of DRM. Therefore, this element called as **"Disaster Risk management Activities"**

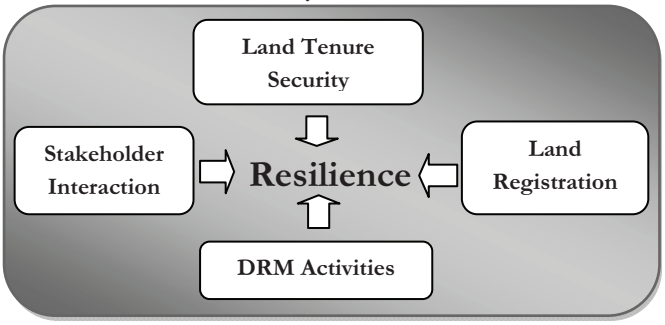

Figure 3-1: Resilience Elements from Land Tenure Perspective in Disaster Risk Areas

The third element deals with land record and land registration in order to support land tenure security. It comes from the lessons learnt from Thailand case by the Land Titling Program and from Indonesia case by RALAS project which aims to reduce land dispute in post-disaster. Hence, the element namely as **"Land Registration"** is important element to increase land tenure security.

The fourth element focuses at the implementation of all stakeholders' activities for improving and promoting the resilience in the community. The participation and data sharing among stakeholder can support the efficacy of all elements as explained above. The participation of local community play important role in **"Stakeholder Interaction"** as shown in the Turkey case.

3.3. SWOT analysis of Communities's Resilience

SWOT analysis is a technique to incur the strategy from business or organization context. It enhances the understanding of Strengths and Weakness as internal condition. And it also identifies the Opportunity and

Threats related to the external influence (MindTools, 2010). The Strengths consists of the advantage of organization. The Weakness is the point that is needed to avoid the problem from internal organization. On the other hand, Opportunities obtains the interesting trends. And the Threats obtain the obstacles that the organization faces. The SWOT analysis can get the comprehensive view of situation of organization deal with, (Groenendijk, 2001; Houben, Lenie, & Vanhoof, 1999).

In order to find out the strategy and indicators of community's resilience, the SWOT was applied for this research. Because the experiences and lessons learnt from Chapter 2 shows that resilience of the community is influenced internal and external condition of those communities. Moreover, these situations of resilience have both negative and positive impact to the community. Those impacts can be identified by SWOT as well. Therefore, the SWOT matrix could find out the suitable strategy for improving the resilience. After that, the indicators could be identified based on the strategies resulted from SWOT analysis.

3.3.1. Analysis based on Experiences and lessons learnt

According to the experience and lessons summarized as above, regarding to SWOT analysis, this part determined external and internal factors influencing communities. The external factors come from outside communities, while internal factors come from inside communities. The external factors are divided into **Opportunity** and **Threat** situation and internal factors are **Strength** and **Weakness** situation. Those are distributing according to the cycle of DRM. The results are showing in a SWOT Matrix Table 3-1.

a) Response/Recovery

Post-disaster situations (Cyclone in India, Tsunami in Thailand: Earthquake followed by Tsunami in Indonesia) shows that after disaster took place, people try to occupy and live in disaster risk areas again. Land issues become major problem that need to be solved. Some parcels were lost and the boundaries of remaining parcels were difficult to be identified. In cases of Hurricane in Honduras, landless and homeless are serious land issue problem after disaster occurred. It has increased the informal settlement. From those entire situations, it relates to SWOT analysis and can be summarized into: (1) People re-occupy and return back to live in disaster areas; (2) Land boundaries conflict and (3) Landless and homeless problem as Weakness within community. It reflects the negative result and increase vulnerability of community. Other finding is (4) Increment of informal settlement can be called as Threat because the legal framework or activity to avoid the informal settlement is not effective enough. It means the factor outside influence the resilience of community.

b) Risk Assessment

During the risk assessment period, government estimate the damage caused by disasters that might be happen in future. Experiences and lessons from all case studies show that government understand and perceives the importance of assuring land tenure and reducing the potential risk in disaster prone areas. Beside the government, people also perceive the disaster risk as well as aware of the importance of land tenure security. From the case studies of flooding in Germany; The Netherlands and Thailand, The communities agree to do land consolidation in river flood areas in Germany and The Netherland as the prevention/mitigation from the disasters. Regarding to the SWOT analysis, it could be that: (1) Government understands and perceives the importance of assuring land tenure security and (2) Government understands and perceives the importance of reducing risk in the disaster area. Both are as the Opportunity from the government side and can be seen outside factor from community's side which can provide the benefits for the community in future. Meanwhile, (3) People perceive the disaster risk and (4) People aware of the importance of land tenure security are Strength point. Both are the starting point for participation of community to improve the resilience in future.

c) Prevention/Mitigation

During prevention and mitigation in disaster risk areas, all case studies show that stakeholders must have clear mandates and responsibilities/roles. Land issues which might happen in this period are lack of land records or land registration to make a good land use plan. It happened in Iran: Earthquake, Honduras:

Hurricane and Indonesia: Earthquake followed by Tsunami. Therefore, disaster risk prone areas required the security of land tenure. Besides that, education and poverty of people is also problem in this period. Regarding to the SWOT analysis, it can be summarized that: (1) Clear mandates and responsibilities/roles for land management as Opportunity because they would not have any conflict in implementation of resilience. (2) Lack of land records or land registration and (3) No security of land tenure classified as Threat. The reasons are because the poor land registration system cannot provide benefit to community and the government cannot provide the security of land tenure. Meanwhile, (4) Low education and poverty of people is the factors which come from the community itself as Weakness point.

d) Preparedness Planning

The people's participation for preparing and training are important during this period because people who lived in risk areas commonly have the experiences during emergency time. On the other hand, the government also realized to implement land policy/strategies/measures in risk areas. The new technology could be applied for developing early warning system to reduce the vulnerability of the community. Those are shown from the case studies in Turkey, The Netherland, and in Thailand: Tsunami. Based on those situations, it can be summarized that: (1) Public participation and (2) People's experience of the disaster as positive point from inside community called as Strength points. The people within community exchange the local knowledge for promoting their resilience. The (3) Increment of technology for communication and effective construction in disaster areas could be classified as Opportunity where the government has several alternatives for choosing the proper technology to support the resilience. Meanwhile, (4) No appropriate land policy in the disaster area is as Threat because it can reflect the negative impact comes from outside of the community. The government cannot provide effective strategy to reduce the vulnerability of community.

Table 3-1: SWOT Matrix of Communities' Resilience in Land Tenure Perspective

External Factors (Outside communities) / **Internal Factors** (Inside communities)	**Opportunity (O)** 1. Clear mandates and responsibilities/roles for land management 2. Government is understood and perceives the importance for assuring tenure security. 3. Government is understood and perceives the importance of reducing risk in the disaster area 4. Increment the technology for communication and effective construction in disaster areas	**Threat (T)** 1. No security of land tenure 2. No appropriate land policy in the disaster prone areas 3. Lack of land records or land registration 4. Increment of informal settlement
Strength (S) 1. People aware the importance of land tenure security 2. Public participation 3. People's experience from the previous disaster 4. People perceives the risk of disaster	SO Strategies: • Guaranteeing the land tenure in disaster risk areas • Defining the role and responsibility of stakeholders clearly • Sharing data between stakeholders with all administration level • Involving among stakeholders and communities in prevention/mitigation and preparedness project	ST Strategies: • Making people feel secure in hazard prone area • Improving land security in case of relocation/resettlement of people from disaster risk areas. • People perceive the importance of land registration in order to support land tenure security
Weakness (W) 1. People re-occupy and return back to live in disaster prone areas 2. Conflict of land boundaries 3. Landless and homeless problem 4. Low education and poverty of people	WO Strategies: • Defining appropriate right, responsibility and restriction in disaster risk areas • Making hazard map • Relocating /applying the resettlement of people from disaster risk areas • Applying the structural measures (such as: building dikes, dam, canal, etc.) to protect community and preparing temporary shelter • Required organization which has responsibility for disaster management for the community	WT Strategies: • Increasing the efficiency of land registration • Implementing land registration after re-settlement • Solving land dispute with land registration • Making education program (e.g by training, pamphlet and brochure)

3.3.2. Resilience Elements and Strategies

The SWOT Matrix of communities' resilience in land tenure perspective as explained above shows the Strength (S), Weakness (W), Opportunity (O) and Threat (T). Moreover, the SWOT Matrix not only helps to formulate strategies but also obtain the resilience elements of land tenure arrangement in disaster risk management. Those can be analysed from each match of SWOT analysis. The results from the analysis are show below.

a) SO Strategies provides four strategies as follow:

- Guaranteeing the land tenure in disaster risk areas;

This strategy comes from O2-S1. The people aware and the government perceive the importance of land tenure security. Therefore, government plays vital role to legislate the land tenure guarantee.

- Defining the role and responsibility of stakeholders clearly;
- Sharing data between stakeholders with all administration level

These both strategise are carried out from O1- 2 and S1- 4. Basically, clear role and responsibility of stakeholder involved would affect the efficacy of implementation in both land tenure security and DRM. Therefore, the involved stakeholder must have clear task and cooperation and have the policy for sharing data as well as in implementing activities.

- Involvement among stakeholders and communities in prevention/mitigation and preparedness project

It was carried out from O3-4 and S3-4. The government can support resilience of the community by using the experience of people. The participation of community can make the government to provide the proper strategy in order to protect community. The experience and local knowledge can rely on through prevention/mitigation and preparedness program. Stakeholder can apply the new technology for communication as well.

b) ST Strategies provides three strategies as follow:

- Making people feel secure in hazard prone area;

This strategy carried out from T1-2 and S 1-2. The awareness of the importance of land tenure security is the strength that can overcome the outside community's threat by guaranteeing the security and making the people feel secure of their rights on land.

- Improving land security in case of relocation/resettlement of people from disaster risk areas.

This strategy is found out by T4 and S3. The strength point can overcome the threat by improving land security. In case of relocation of community in hazard areas, government should provide the guarantee of the land tenure to the people.

- People perceive the importance of land registration in order to support land tenure security;

It is come from T3 and S4. The problem coming from outside and inside communities are lack of land record and people perceives the risk in disaster areas. In this regards, the land registration could be as the solution of this problem and allows the people to be participated to land registration as well.

c) WO Strategies provides five strategies as follow:

- Defining appropriate right, responsibility and restriction in disaster risk areas;

It was carried out from O2-3 and W1-3. The opportunity can overcome the weak point. The government can define the appropriate specific regulation in disaster risk area which can reduce the adverse impact of the future disaster.

- Making hazard map;
- Relocating /applying the resettlement of people from disaster risk areas;
- Applying the structural measures (such as: building dikes, dam, canal, etc.) to protect community and preparing temporary shelter;

The three strategies above are carried out from O1-3 and W1-3. As the first, making hazard map is the first step to identify the vulnerable group and the affected areas within community that might be affected by the future hazard. Then, as second step, it is continued by relocating the people from hazard zone. In

line with these actions, the government also should apply the structural measures to protect the community.

- Required organization which has responsibility for disaster management for the community.

This strategy is carried out from O1-4 and W1-4. One of strategy is that government should provide an organization directly responsible of DRM in local community in order to solve the problem in disaster risk areas.

d) WT Strategies provides four strategies as follow:

- Increasing the efficiency of land registration;

Supporting the efficiency of land registration is a strategy to accelerate the land registration in pervious strategy. This strategy is found out from T2 and W2.

- Implementing land registration after re-settlement;

This strategy can improve land records (T3) as a database for managing the problem of landless and homeless in post disaster (W3).

- Solving land dispute with land registration.

This strategy carries out from T 3-4 and W4. The land registration can solve the land dispute and informal settlement in community. Furthermore the land certificate can be used as collateral through mortgage. It can overcome problem of poverty in W4

- Making education program (e.g. by training, pamphlet, and brochure).

It is found out by T1-4 and W1-4. The government should support the training programme to overcome the low education and poverty of people. By providing the education to community, they would know the personal preparedness plan in pre-disaster including the procedures to survive during an emergency time. Moreover, government can also introduce their regulation at the same time in disaster risk area.

Four resilience elements including 16 strategies resulted from SWOT analysis which is mentioned above are the key factors for improving the resilience in community from the land tenure perspective. All those indicators can be rearranged based on each resilience element as follows:

Land Tenure Security Element: This element is focused on the land tenure and the security of people lived in risk areas during pre and post disaster which can improve the resilience of community. The strategies which are suitable to relate with this element are as follows:

a. Making people feel secure in hazard prone area:
b. Guaranteeing the land tenure in disaster risk areas:

In both strategies which are related directly to the land tenure security, the people need guarantee or feel secure in hazard prone area.

c. Defining appropriate right, responsibility and restriction in disaster risk areas. As this strategy defines the relationship between people and land according to the type of land tenure.
d. Improving land security in case of relocation/resettlement of people from disaster risk areas. This strategy demonstrates the efficacy of the land tenure security after resettlement.

Disaster Risk Management Activities Element: The strategies in this element are as follow:

e. Making hazard map. As output of risk assessment step, this map provides the information related hazard level in risk area for planning in prevention/mitigation stage.
f. Relocating/resettlement for people from disaster risk areas. This is also part of prevention/mitigation stage.
g. Applying the structural measures (such as: dikes, dam, canal, etc.) to protect community and preparing temporary shelter. Because the structural measure is a strategy in Prevention/Mitigation step.
h. Providing the education program (e.g. by training, pamphlet and brochure). This is part of Preparedness Planning step.

Land Registration Element: This element is emphasizing the support of the land tenure security by the land registration. All of the following strategies directly related to land registration:

i. People perceive the importance of land registration in order to support land tenure security
j. Increasing the efficiency of land registration
k. Implementing land registration after re-settlement
l. Solving land dispute with land registration

Stakeholder Interaction Element: This element underlines the role and responsibility of each stakeholder. And also emphasize the exchange of data among stakeholder. The strategies below are part of Stakeholder Interaction Element:

m. Defining the role and responsibility of stakeholders clearly
n. Sharing data between stakeholders with all administration level
o. Involvement among stakeholders and communities in prevention/mitigation and preparedness project
p. Required organization which has responsibility for disaster management for the community need to be establish

3.4. Indicators of Communities's Resilience

In order to measure the resilience of community in disaster risk areas from the land tenure perspective, the Indicators extracted from Resilience Elements and Strategies is shown in Table 3-2.

Table 3-2: Resilience Elements, Strategies and Indicators of Land Tenure Perspective

Strategies	Indicators
Land tenure security	
a) Making people feel secure in hazard prone area	1. Percentage of people feeling insecure due to loss of their land in hazard prone area
b) Guaranteeing the land tenure in disaster risk areas	2. Availability of the compensation regulation for the people who lose the land after disaster
c) Defining appropriate right, responsibility and restriction in disaster risk areas	3. Availability of additional regulation in hazard prone areas
	4. Clear right, responsibility and restriction of each type of land tenure
d) Improving land security in case of relocation/resettlement of people from disaster risk areas	5. After relocation/resettlement, people stay in safe place and have the right of land in new location
DRM Activities	
e) Making hazard map	6. Availability of hazard map
f) Relocating /resettlement of people from disaster risk areas	7. Availability of relocation/resettlement program from hazard prone areas
g) Applying the structural measures (such as: building dikes, dam, canal, etc.) to protect community and preparing temporary shelter	8. Availability of structural measures to protect communities
	9. Availability of sufficient temporary shelter for community
h) Making education program (e.g. by training, pamphlet, and brochure).	10. Percentage of the people having prior knowledge that they are living in flood risk zone or not
	11. Percentage of the people aware of the procedures and practices during emergency times
Land Registration	
i) People perceive the importance of land registration in order to support land tenure security	12. Percentage of unregistered parcels in the community
j) Increasing the efficiency of land registration	13. Percentage of backlog parcels waiting for registration
k) Implementing land registration after re-settlement	14. Availability of registration of parcels in resettlement locations
l) Solving land dispute by land registration.	15. Percentage of land disputes after registration
Stakeholders Interaction	
m) Defining the role and responsibility of stakeholders clearly	16. Law/policy/regulation, roles and responsibilities among stakeholders are not overlapping
n) Sharing data between stakeholders with all administration level	17. Availability of the regulation and activity for sharing data
o) Involvement among stakeholders and communities in prevention/mitigation and preparedness project	18. Availability of coordination and collaboration among the stakeholders, including international stakeholder
	19. Availability of prevention/mitigation and preparedness project/program which are involving local stakeholders and/or community
p) Required organization which has responsibility for disaster management for the community	20. Availability of organization which has responsibility of disaster risk management for community

As a result of the SWOT Matrix analysis, the four resilience elements are defined. These elements are used to measure communities' resilience in land tenure perspective. Table 3.2 shows 16 strategies and 20 indicators.

In Land Tenure Security Element, The strategy a) is used to identify the indicator No 2 "Percentage of people feeling insecure due to loss of their land in hazard prone area" because since the people feel secure about their land/property, it is assumed that they willing to invest in their land. They are confident regarding the guarantee of land tenure. The strategy b) is used to find out the indicator No 1. "Availability of the compensation regulation for the people who lose the land after disaster". The compensation is to guarantee the security of land tenure by government. The government can ensure the right of land by providing the compensation of damage The strategy c) assessed by the indicators No 3 and 4 "Availability of additional regulation in hazard prone areas" (e.g. obligate to people to have an insurance) and "Clear right, responsibility and restriction of each type of land tenure". Because the additional regulation, including the restriction and responsibility can reduce the vulnerability of the community such as by making the insurance of the damage in disaster risk area is compulsory for the people. In case of flooding, the victim can get compensation of the damage individually. The compensation makes they can rebuild or choose relocation options to avoid the next hazard. The strategy d) is used to define the indicator No 5 "After relocation/resettlement, people stay in safe place and have the right of land in new location" by having ownership in new location, the resilience of people is increase. On the other hand, after resettlement, people are still living in risk areas. It means that they have no security of life and land as well.

In DRM Activities, from the strategy e) the indicator No 6 "Availability of hazard map" is found out. Hazard map could be used to inform the community to be aware and government can use hazard map as input data in decision-making (risk assessment). The strategy f) is used to find out the indicator No 7 "Availability of relocation/resettlement program from hazard prone areas" because resettlement as an alternative way to protect vulnerable groups as measure in Recovery step. The strategy g) is used to find out indicator No 8 "Availability of structural measures to protect communities" (e.g. dike, dam, canal, etc.) because structural measures as an evidence of implementation of government program for community as measure in Prevention step. And this strategy also used to find out the indicator No 9. "Availability of sufficient temporary shelter for community" in order to measuring the implementation of government preparation for emergency time as a measure in Response step. The strategy h) is used to find out the indicator No. 10 and 11 "Percentage of the people having prior knowledge that they are living in flood risk zone or not" and "Percentage of the people aware of the procedures and practices during emergency times". The Awareness of people can increase the participation to the mitigation program.

In Land Tenure Element, The strategy i) is carried out to identify the indicator No 12 "Percentage of unregistered parcels in the community" because Unregistered parcel could bring to uncertainty boundary and unclear the land ownership. The strategy j) resulting the indicator No 13 "Percentage of backlog parcels waiting for registration". Due to the backlog is representation of inefficient land registration to guarantee land tenure of community. The strategy k) is used to identify the indicator No 14 "Availability of registration of parcels in resettlement locations". Registered parcel can guarantee the people in new location. The strategy l) is carried out to identify the indicator No 15 "Percentage of land disputes after registration" due to less land dispute is representation of efficient of land registration.

The Stakeholders Interaction, The strategy m) resulting the indicator No 16 "Law/policy/regulation, roles and responsibilities among stakeholders are not overlapping" due to overlap role and responsibility lead to ambiguities in decision-making in implementing DRM. The strategy n) is used to find out the indicator No 17 "Availability of the regulation and activity for sharing data". It shows the efficiency of the cooperation among stakeholders and the more complete and comprehensive information is obtained, the better the decision are resulted by stakeholders for DRM. The strategy o) is used to define the indicator No 18 "Availability of coordination and collaboration among the stakeholders, including international stakeholder" because the collaboration among different level of stakeholders can provide the complete

data/information to the community. This strategy also is used to find out the indicator No 19 "Availability of prevention/mitigation and preparedness project/program which are involving local stakeholders and/or community". The participation of local stakeholders and community can ensure the prevention/mitigation and preparedness program could work well. The strategy p) is used to define the indicator No 20 "Availability of organization which has responsibility of disaster risk management for community". Direct interaction between stakeholders in charge in DRM and community can keep the information and response in time.

3.5. Summary

The experiences and lessons learnt in Chapter 2 were carried out from the several case studies in pre, during and post disaster. All those cases are not only deal with land policies in different country but also imply the resilience of communities of each situation. In this chapter, all those cases were carried out to find out the resilience elements by using SWOT matrix. The four resilience elements were found out, those are: Land Tenure Security, Disaster Risk Management Activities, Land Registration and Stakeholder Interaction.

16 strategies were carried out from SWOT analysis. All those strategies are grouped into four resilience elements. In order to evaluate the resilience of community, 20 indicators are defined based on each strategy. All those indicators are required to evaluate the resilience of the community based on the data collected from study areas. Therefore, field work need to be applied. Accordingly, the designing and data collection need to be conducted. All of the data collection will be explained in the next following chapter 4.

4. CASE STUDY AND DATA COLLECTION IN NEPAL

4.1. Introduction

In order to evaluate the indicators which have been defined in the previous chapter and to analyze the spatial data, it is required to collect appropriate data from field. The primary dataset used in this research were collected by conducting household survey, field observation, and interviews whereas secondary data has been obtained from concerned stakeholders. These data are required to evaluate the indicators that was explained the previous chapter. The first step of data collection is pre-fieldwork phase in which preparation has been done. The various stages that have been done are as follows:

1. Designing data collection approach;
2. Making a fieldwork schedule;
3. Making a household survey and stakeholder questionnaires and prepare the specific questions for each stakeholder (base on indicators from Chapter 3;
4. Selecting case study location and calculating sample size;
5. Discussing with KU supervisors by e-mail to adjust the schedule, questionnaires and specific question;
6. Making an appointment with the stakeholders;
7. Making reservation for accommodation in Nepal;
8. Making list of data to be collected.

This chapter has been started by the explanation regarding DRM, land policy and land tenure in national context in Nepal. Then, it is continued by the description of the case study area: Dibyanagar village-Chitwan District (section 4.2). The explanation of designing of data collection for both primary and secondary data is presented in section 4.3. Further, it is followed by the explanation concerning data collection methodology (including primary and secondary data) and list of collected data including the interviewed stakeholders in section 4.4. In order to answer the research question d), this chapter also explains the spatial and non-spatial data collected that are required for mapping and analyzing land tenure in flood areas (section 4.5). The techniques used in data analysis of the spatial and non-spatial data are explained in section 4.6. Finally, the barriers faced during fieldwork data collection are also presented at the end of this chapter (section 4.6).

4.2. Study Areas and National Context

Nepal is considered as a disaster risk country where various disasters take place frequently. The cause for the disaster is not only the topography condition and extreme climate but also exacerbate by rapid population growth. Floods and landslides are the major natural hazard in Nepal. Regarding with the disasters, the poor construction and lack of public awareness of the community in disaster risk area makes the cope for emergency time in Nepal is very weak (Pokharel, 2004). Consequently, it is increasing the vulnerability group in Nepal more and more (NADRM, 2008).

4.2.1. Disaster Risk Management in Nepal

In Nepal, the 10th National Development Plan is the first plan of government for adding Disaster Development Programs into their national plan. While, 11th National Development Plan during 2007-2010 has separate chapter for strategies and program for implementing DRM (Marasini, 2008).

The land management strategy in disaster risk areas in Nepal is distributed according to the different hazard in order to provide a new approach of DRM which need legal framework and policy mechanisms. The National Strategy for Disaster Risk Management in Nepal (NSDRM) has made five priority strategic actions.

The Priority Action 1 is ensuring the DRR that could be implemented in national and local level. Priority Action 2 are assessing, monitoring and enhancing the early warning system. Priority Action 3 is providing the knowledge for secure building. Priority Action 4 is reducing the risk factors. And finally, Priority Action 5 is promoting the efficacy response. The five Priority Action have been considering agriculture (food security), health, education, shelter, livelihood, water, communication, rescue and assessment (NADRM, 2008).

The structure of DRM in Nepal is divided based on the administration level as follows (NADRM, 2008): ***National commission for DRM***: chaired by Prime Minister. This agency has responsibilities to endorse, approve, arrange and to provide national DRM policy which is operated by National Authority for DRM.

National Authority for DRM plays the role as secretariat of National commission for DRM. The tasks of this organization are developing, implementing, coordinating, monitoring and facilitating national DRR plan.

District Authority for DRM: The responsibilities of this level are monitoring DRM in local level, developing the local DRR plan, training staff to promote disaster-resistant, supporting the insurance and financial for increasing disaster-resistant, conducting the public awareness, maintaining early warning system in community level and etc.

Municipal Authority for DRM: This agency is deal with formulating a municipal emergency response plan, assessing the risk, making local DRM master plan, implementing DRM in municipal level and etc.

Village Development Committee (VDC): is the lowest governance administration level. The main tasks are preparing the inventory and information as database source to district level, developing the local DRM preparedness plan, collaborating local stakeholders and community and etc.

In order to support DRM in Nepal, Disaster Management Plans provide the information concerning national action plan on Disaster management and make several plans in disaster risk areas. As an examples, by legislating the implementation of disaster plan, assessing the disaster risk of community, defining the role and relationship of each government stakeholder, preparing emergency procedures and shelters, operating the warning systems, Reconstructing (recovery), making disaster assessment plan, linking and making agreement among different administration level of stakeholders, revising and distributing of the plan and etc. (Pokharel, 2004).

4.2.2. Land Policy in Disaster Risk Area in Nepal

According to the Nepal constitution, the compensation for disaster victims has not mandated yet. However, regarding land issues , in the case of complete loss of land and crops the victims are provided the support of minimum finance Rs 500 during immediate relief (Pokharel, 2004)

Some plans relates with land use planning in Nepal are described as follows:

Land and Water Base Protection, 1982 (section 10) states that the areas identified by Land and Water Base Protection Officer are categorized as vulnerable area from disaster such as flood and landslide. Government empower the resettlement for the people from land and water base protection area but must give the compensation to the victims (Pokharel, 2004).

National Action Plan on Disaster Management in Nepal, 1996 provides the plan as follows (Pokharel, 2004): 1) Disaster Preparedness: measures relate to national planning, arrange institutional, awareness rising and establish DRM information. 2) Disaster Response: this period has the activities to build the capability of DRM. Those are evacuation/search/rescue, communication and transport, temporary settlement and health/nutrition. 3) Reconstruction and Rehabilitation: this plan is implemented to support sustainable development. It needs standard damage assessment and cooperation at various levels, including NGOs and local community. 4) Disaster Mitigation: this plan focuses on multi-sectoral activities and allocates proper financial within each disaster actor. The activities in this plan are such as formulating building code and establishing National Land Use Cover Plan and National Disaster Reduction Programs and making action plan of earthquake, fire, drought, flood, and landslide hazards.

Agricultural Perspective Plan, 1995: which has purposes to increase the agriculture growth (basically focuses on land use), make conservation practices. In the same time it is aimed to avoid natural resource pollution. This plan also relates on analyzing impact in poverty and environment but regardless to disaster risk management.

Nepal Environmental Policy and Action Plan, 1993: The aim of this plan is to manage and conserve the areas to sustainable natural that could have an impact to DRM.

Shelter Policy, 1996: which formulate and implement the land use planning and building code. It also adopts the technologies of anti-disaster shelter construction.

4.2.3. Land Tenure and Land Use in Nepal

In Nepal, land is the main property that is used for supporting livelihoods. Especially it happens in rural areas where about ninety per cent (90%) of population rely on farm land. Moreover, landless and small land holders are the main land problem which increases the informal land tenure. These condition is also exacerbated by the poverty which are caused by limited education and health in community (Sharma, 1999).

a) Land Tenure System in Nepal:

A forms of land tenure system in Nepal comprises into two, those are: *Raikar* (state retain under individuals taxing ownership) and the *Gathi* as the rights for protecting cultural and religious traditions. The *Raikar* is divided into three types, those are: private, public and government land as it is shown in Figure 4-1 (Tuladhar, 2004):

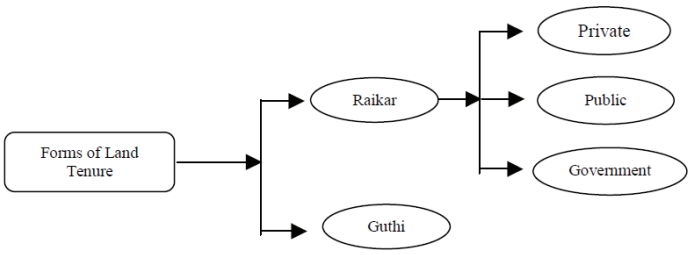

Figure 4-1: Land Tenure System in Nepal (Tuladhar, 2004)

The ownership of *Raikar* tenure system allows the land owners to use, hold, inherit and get the benefits as long as they pay the annual tax to the state. The right of each type of tenure are as follows (Tuladhar, 2004):

Private Land: the possible owners are individual, private companies and institution withholds.

Public Land: it is not allowed for individual uses but the persons which is allowed to use this land is according to general consensus such as for playgrounds, ponds and temples.

Government Land: it is land that is used for public benefit such as for roads, government office, forest, river and canal. The citizens cannot claim the rights on this type of lands.

b) Land Use in Nepal:

in order to manage the natural resources, the utility of land becomes a central component in present strategies (National Land Use Project, 2010). The changing of land use/land cover can be used to evaluate the influence of human to natural resources such as in forest and grassland areas.

According to the Central Bureau of Statistics (2008) report, the land use pattern in Nepal consist of forest areas around 29%, cultivated land 21% , non-cultivate 7%, grass/pasture land 12% and other (such as snow area and barren land) is 29%. The percentage of residence in rural areas is around 98% with 134 people/km2 population density. Meanwhile the residential urban area is around 2% with 985 people/km2 population's density.

Unplanned settlements and building in hazard risk areas is increasing the vulnerability level of that area. Presently, almost all areas in Nepal do not have land use plan yet. Some areas located around Kathmandu have been started to develop the land use planning (EMI, 2010). According to information from The National Land Use Project, the important purposes of this project are to provide the spatial data for land use

planning. Land Use Planning Project requires spatial data as database such as topographical, land use and land capability (Oli, 2001). Land Use Planning Project in Nepal is established to support sustainable development.

Figure 4-2: Typical Bank Erosion by Riverine Flooding

4.2.4. Resilience of Community in Nepal

Resilience of community in disaster risk areas requires constant vigilance, especially in hazard risk country like Nepal. *Practical Action* as an organization for reducing the impact to disaster creates programs that focus in Narayani and Karnali watersheds area. They developed disaster management plan, applied the strategy for reducing vulnerability, and supported livelihood strategies. The livelihood strategy is a key indicator for resilience of communities which can be done by increasing the productivity of farming with planting on summer season. By doing so, the community has much more income and has enough food in disaster period (Practical Action, 2010).

One of the good practices on DRR program in Nepal is the existence of agreements among three organizations: Action Aid Nepal, CARE Nepal, and Oxfam GB Nepal. According to DPNet- Nepal the program that are implemented are a) constructing shelter house b) mobilization of young group for disaster preparing c) creating embankment for facing the flood river d) building concrete bridge (DPNet-Nepal, 2009). As an example, Resilience of Riverine Floods in Nepal, Riverine Floods are regular phenomenon in Nepal, it occurs during monsoon season between June and September. In several case, it is followed with bank erosion and landslide (ICIMOD, 2007a).

Riverine floods are the main cause for property and crops damages. Commonly, people who live in riverine flood risk areas have the managing strategies such as by elevating house and consolidating the house's walls. Generally, their houses are made up of mud, straw, wood, and bamboo. The people keep their belongings and prepare food in elevated place. They use local materials to create embankments such as sand bag, bamboo, and grass at the top of embankment. They get drinking water by manual water pumps. Apart from this, local people communicate their experience to next generation through local stories, proverbs, and songs. These methods are the way to make the next generation aware to the disasters as their local strategies (ICIMOD, 2007b).

4.2.5. Hazard and Vulnerability in Chitwan District

Chitwan is one of the districts in Nepal which lies in Narayani river zone. It covers an area of 2,218 km2 with a population of 472,048 and 92,863 households (Central Bureau of Statistics, 2008). Chitwan is a famous district of flora and fauna. Royal Chitwan National Park, the largest in Nepal is also located here. Therefore, Chitwan is an area of biodiversity and as an important nature conservation spot of the country. The

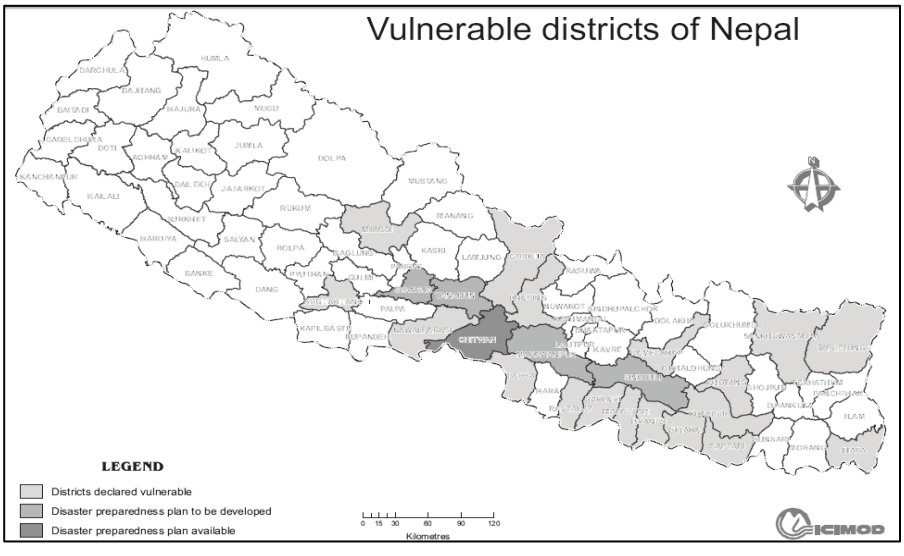

Figure 4-3: Vulnerable Districts in Nepal (ICIMOD, 2007a)

Nepal government has declared 23 districts (as in Figure 4-3) as vulnerable areas for natural disaster. District Relief Committee (DDRC) of each district has to prepare annual plan of district disaster preparedness. Presently, Chitwan is the first district that has made a district disaster management plan (ICIMOD, 2007a).

"During the 1993 flood which significantly affected five tarai and hill district. Chitwan was one of the worst affected districts." (DDC, 2004). According to the result of hazard and vulnerability assessment shows that flood hazard is the most serious hazard in Chitwan. Then, it is followed by several hazards such as landslide and river bank cutting. According to this description, Chitwan have several vulnerable groups due to flooding. Hence, this research selected Chitwan district as the case study areas.

4.2.6. Location of Dibyanagar Village, Chitwan District

According to the information from *DWIDP* and *DAO,* flooding hazard areas of Chitwan always take place annually in Dibyanagar Village/VDC. All the areas in Dibyanager village located along Narayani River are riverine flood risk area. Same as information of Chitwan District Disaster Management Action Plan (2004) shows that Dibyanagar village is in the very high flood hazard status of Chitwan. Therefore, this research has selected Dibyanagar as case study area. The figure below shows the location of Dibyanagar village which consists around 1,785 households (National Land Use Project, 2010) with 8,088 (Central Bureau of Statistics, 2008).

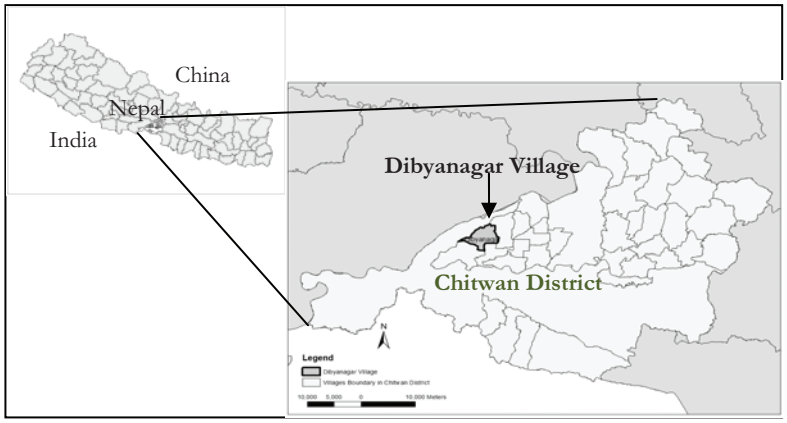

Figure 4-4: Location of Dibyanagar Village (Case Study)

4.3. Designing Data Collection Approach

In order to measure the resilience of community based on the indicators as defined in Chapter 3, primary and secondary data for evaluation processes are required. Some of those indicators of resilience of the community require the opinion of community members. Accordingly, household survey information is required for assessing the indicators. The interview is also required. Stakeholders' interaction element is focused on investigation of the role and data sharing among stakeholders involved. The role and data sharing provides the implemented information of land tenure security, DRM and land registration in study areas. The survey observation was carried out to obtain the topographic information including the affected areas by flood or by river erosion and to obtain the information regarding the DRM such as the implementation of the structural measure (e.g. dikes, dam, etc). Thereby, in this thesis, designed of data collection which consists of households' survey, interviews and field survey observation for primary data was applied. The secondary data is other information required for supporting the answer of indicators as well. The related document and spatial data as secondary data can enhance the understanding of the information obtained from the interview of stakeholder. Primary and Secondary data are collected in the following way:

4.3.1. Primary Data

The questions to obtain the required data and information were developed based on the indicators that were determined in the previous Chapter 3 above. Each question in every questionnaire was defined to answer the indicators. The interviews were conducted for completing the data and information that were not acquired on questionnaires. In summary, the relation and method in designing the method of data collection is shown in the Table 4-1. While, all those methods that were used are describe in the next following part.

Table 4-1: Designing the Method for Primary Data Collection

Resilience elements	No. of Indicators	Households Survey	Interviews	Survey Observation
Land tenure security	1.	✓	✓	
	2.	✓		
	3.	✓	✓	
	4.	✓	✓	
	5.	✓	✓	
Disaster Risk Management Activities	6.		✓	
	7.		✓	
	8.	✓	✓	✓
	9.	✓	✓	✓
	10.	✓	✓	
	11.	✓	✓	
Land Registration	12.	✓	✓	
	13.	✓	✓	
	14.		✓	
	15.	✓	✓	
Stakeholders Interaction	16.		✓	
	17.		✓	
	18.	✓		
	19.	✓	✓	
	20.		✓	

✓ = method was used to obtain the information based on indicators.

Table 4-2: Distribution of Sample

Distance from the Narayani River	% of Sample Surveyed	Number of Group	Number of Sample Surveyed
0 m – 500 m	50%	1	17 households
		2	17 households
		3	16 households
> 500 m – 1000 m	25%	4	13 households
		5	12 households
> 1000 m – 2000 m	15%	6	15 households
Over than 2000 m	10%	7	10 households

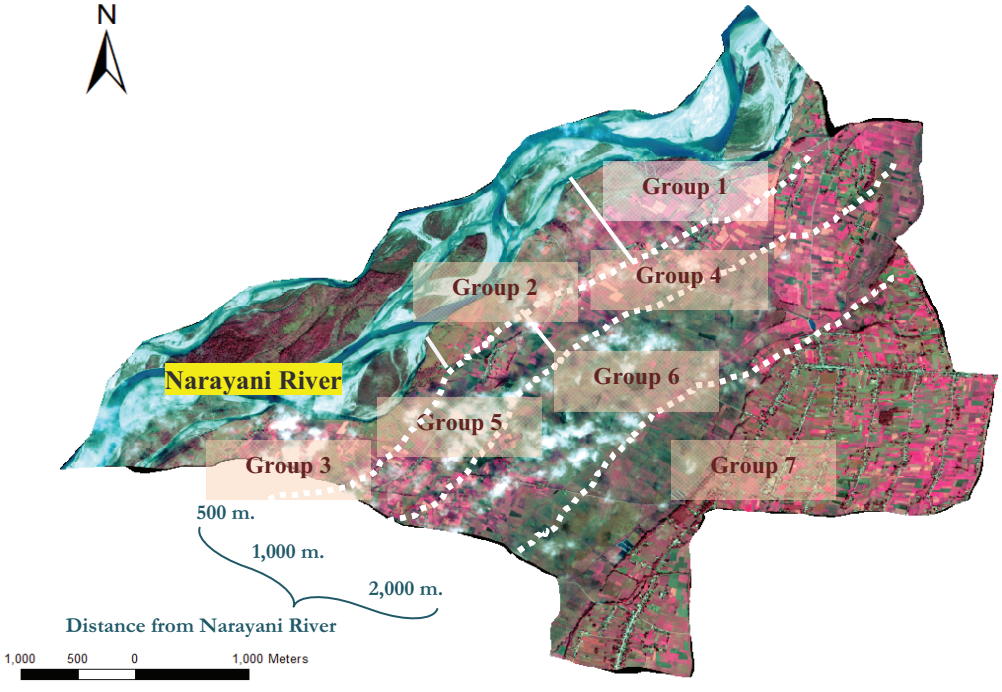

Figure 4-5: Household Survey Sample in Dibyanagar Village

a) Households Survey

Sample Size and Sample Strategy : In order to find out the sample size for households survey in Dibyanager Village , this research use the Slovin's formula methods (Guilford & Fruchter, 1973) as follows:

$$n = N / (1 + (N*e^2))$$

Where: n = number of sample, N = total population, e = margin of error (The smaller the margin error, the bigger the number population needed and the better the result will be more credible). In this research, margin error has settled for a 10%. So, n of Household is

= 1,785 / (1 + (1,785 *.1^2)) = 95

In order to prevent the incompleteness information of the surveyed sample, the sample size is increased into 100 households.

According to the experience/lessons learnt as explained in Chapter 2 and literature review. The resilience in Nepal is affected by the flood which usually occurred along river. Therefore, in this research, survey has been carried out focusing on the community along the Narayani River. The respondents were distributed into seven groups in such a way that it covers the entire village area. The distance from riverside and location of the respondents/house-holds have been considered as an important parameter while distributing the sample. The distribution of sample is shown in Table 4-2 and Figure 4-5:

Questionnaire Design: Household Survey Questionnaire is a main tool to find out the answers of research questions. The questions of this questionnaire has been developed which is based upon the elements and indicators that were explained in the previous chapter. The questionnaire for household survey consists of four parts which are explained below:

Part 1: General information of household: This part of the questionnaire has been developed in order to identify the location (address and coordinate) check the sample group and to make sure that distribution of respondent covers the entire village.

Part 2: Household Information: This part of the questionnaire consists of the information concerning the educational and financial background such as the level of education, occupation, migration and house condition. This part has been developed to obtain the information for evaluating in land tenure security and DRM activities elements. Moreover this part also provide the information to estimate the education and financial of the community. The level of education must be concern with the knowledge and awareness of the community in disaster risk as well as concern with the level of financial. This information could be depicted and related with the ability of people to find strategy for preventing the disaster risk.

Part 3: Risk of Flooding: In this part the questions concerning the flood hazard which has been experienced by the local people losing their land and property has been included. Further, the questions also concerns with the strategy for prevention of the flood and the response during emergency time. This part was carried out in order to answer and to evaluate the indicators in land tenure security, DRM activities, and stakeholder interaction elements.

Part 4: Land Right and Land tenure arrangement: this part has been developed in order to find the answer of land tenure security and land registration element. The questions in this part have been related with the land tenure, land registration, land right and land dispute.

Detail questions for household are presented in Appendix 1.

b) Interviews

As described before, interviews are the method that was chosen for completing the data. Such as for the interactions among the involved organization in DRM in Nepal which could not be obtained by using the questionnaires comprehensively. All those organizations have been implemented the programme related with land issues and DRM in Nepal, either by directly or indirectly program. The list of organizations that interviewed is shown Appendix 2. In order to select the respondent of the organization, this research focuses on the person who have the knowledge not only in policy aspect but also can explain the implementation relate with land and DRM aspect.

The questions for the interview of each involved stakeholders were determined based on the required information to answer the related indicators. The questions were grouped into four parts which is given below and the list of the questionnaire has been attached in the appendix 1:

Part 1: General Information of Organization Interviewed,

Part 2: Respondent Information,

Part 3: Role and Responsibility of Organizations including the information of data sharing with the other stakeholders,

Part 4: Specific Questions which are depend upon the role and responsibility of each organization.

c) Field Survey Observation

The main objectives of Survey Observation are to evaluate the indicators No. 8 and 9 (DRM activities element), to observe the structural measures either personal and community protection as well as to check the temporary shelter for emergency time. Thereby, the survey observation is required to take photos and identify the location in a map. The following information is obtained from the field observation: 1) structural measure 2) temporary shelter 3) river bank erosion 4) land use/cover of community 5) boundary of parcel 6) material and style of house and 7) the transportation in village.

4.3.2. Secondary Data

The secondary data collection covers both spatial and non-spatial data. The objectives of secondary data collection are not only for evaluating indicators but also for mapping the land tenure in the areas that are affected by flooding. The list of the secondary data collected is given follow: 1) land use plan document 2) land policy in disaster risk area 3) specific regulation in disaster risk areas 4) DRM information in study areas 5) topographic map 6) cadastral map 7) image on aerial photo and 8) land use/cover.

4.4. Methodology of Data Collection

The method adopted for collecting primary data is household survey, survey observation and close/open interview with relevant stakeholders. Similarly, the secondary data (spatial and non-spatial) are collected from organizations involved in land management and disaster risk management.

4.4.1. Primary Data

a) Household Survey

After making household survey questionnaire, calculating the sample size and making a plan of sample distribution in study area, the methodologies adopted for household survey are as follows:1) Translating the questionnaire into Nepali language helped by KU supervisors as shown in Appendices; 2) Contacting the local assistant and arranging the transportation to get access to the location; 3) Making an appointment with chief and secretary of village; 4) Training the 10 assistants for collecting the data by KU supervisors; 5) Collecting the data in Dibyanagar Village, Chitwan, Nepal (case study); 6) Checking the answers in the questionnaires and 7) completing the missing data.

b) Interview

After finalizing the relevant stakeholders, and designing question for each stakeholder, next step is the making an appointment with each stakeholder, then, finally interviewing to conduct interview with stakeholders.

c) Field Survey Observation

The field observation was carried out in the selected area of study area. The local assistance was appointed as a guide to the study area. The vehicles were arranged and the surveying was carried out according to survey plan.

4.4.2. Secondary Data

Non spatial data that were collected from fieldwork are mainly focused on land policy whereas spatial data are focused on disaster area. The collected spatial data includes topographic data and map of flood affected area which is required to investigate the land tenure and to answer research question d) and to analyze the resilience of community i.e. to answer research question e).The secondary data was collected by requesting data from stakeholder at the same time when the interview was conducted.

4.5. Output of Data Collection

The aim of data collection in this research is not only for measuring the resilience of community but also for analysing land tenure pattern with flood affected in study area. This part describes the output of primary and secondary data that were collected including spatial and non-spatial data.

4.5.1. Primary Data

The output of primary data collection of fieldwork in Nepal as follows:

a) Household Survey

The total 100 household has been surveyed with the help of local supervisors and two assistants as well as support from officers in Survey Office (SO) of Chitwan. The photos are attached in Appendix 3.

b) Interview

The stakeholders who were interviewed during field work as follows. The fieldwork diary is attached in Appendix 2 and the photos during the interview shows in Appendix 3: 1) 3 interviews of organization in international level; 2) 2 interviews of organizations which has the role in international, national and local levels; 3) 5 interviews of central government organization; 4) 8 interviews of government organization in districts level; and 5) 2 interviews of head and secretary of village.

c) Field Survey Observation

Field Survey Observation has been carried out by surveying 15 locations within study area, the details and photos in Appendix 3.

4.5.2. Secondary Data

As mention above, the data required in this research are divided into primary and secondary data. The secondary information is important in order to map land tenure in flood affected areas and also answering research question d).data collection was carried out by collecting and compiling spatial and non-spatial data which is required for assessing indicator and mapping land tenure within flood affected area. The detail of non-spatial data collected is given in Appendix 3:

4.6. Data Analysis Techniques

The techniques applied in data analysis comprise spatial and non-spatial data processing. Both techniques are described in the next subsection below.

4.6.1. Spatial Data

Spatial data collected, as mentioned in Chapter 4 (section 4.5), were image processed by software Erdas Imagine and ArcGIS. Analyzing spatial data requires the preparation of data in digital format. Data collected in hard copy is the map of flood hazard area of scale 1:25,000; obtained from DWIDP, flood affected area in cadastral map and Aerial Photo in 1992 from SO. The first step is digitalization which followed by geo-referencing process. In geo-referencing process, the coordinate of the map is specified using Universal Transfer Mercator projection and WGS 84 datum (WGS 1984 UTM Zone 44N). The data collected in digital copy without geo-reference are Cadastral digital map; from *SO* and *Genesis Consultant (P) LTD*, topographic maps from *DoS* which is managed by provided coordinate and mosaic has been done.

Similarly, other spatial data collected in different coordinate system are processed by changing the co-ordinate system, the techniques applied is cadastral mapping to classify the type of land tenure and to identify the areas of floods affected by cadastral surveying along Narayani River. The zoning of risk areas is defined by hazard map. Satellite image (geo-eye) and aerial photo 1992 are used for supporting the appearance and changes of the River. The data analysis of this part was done in ArcGIS and support graphing and calculation by Microsoft Office (Excel). The obtained results are shows in section 5.3.

The spatial data analysis not only classifies the land tenure that affected by flood but also presents the land use and land cover in case study. The majority of data results are shown in percentage of whole area of Dibyanager Village.

4.6.2. Non-Spatial Data

The result of non-spatial data is arranged according to element and indicators which is given in section 3.4. In order to evaluate the indicators, findings of household survey, interviews and field survey observation has been used. The techniques for visualization of results used are graphs, charts, maps, photos and descriptive text.

In this research qualitative and quantitative approach are used for analysis of non-spatial data. Quantitative analysis for household survey is performed in SPSS software. The data collected from questioner was processed by using appropriate tools available in this software. Microsoft Excel was used to process the

graph and chart. The data results are shown by percentage or number of sample group. These sample groups are comparing with four sample group based upon distant from Narayani River which is already described in section 4.3. The first sample group consists of respondents living between distant 0-500 m. From Narayani River, the second group consists of respondents living in distant between 500-1,000 m, the third group between 1,000-2,000 m. and the last group is the people living far from the river more than 2,000 m.

Qualitative data analysis technique was applied to analyze the data that collected from semi-structured and open ended questionnaires, open interviews from stakeholders and from related reports and documents collected during the fieldwork. All these data were processed manually since the volume of the data collected is manageable.

4.7. Barriers During Fieldwork Data Collection

Some barriers during the fieldwork data collection are:

The language: Interviewees in state and private organization can communicate in English but difficult for communication with the local people in study area. Hence in order use local language, we need the assistance for data collection. Besides that, some of the materials are available in Nepali language only, so translation is required.

The weather/climate: Since the data collection is done in monsoon season. It is difficult to travel into study area. One has also needed to be aware of the risk of some communicable diseases.

Travelling: For data collection in Kathmandu and Chitwan, we (including KU supervisors) were travelled by taxi. Travelling from Kathmandu to Chitwan district was done by air plane due to the road blockade by landslides. Data collection in village was done on foot due to non-accessibility of vehicular routes.

The accommodation: The accommodation in study areas is much more expensive than any other places in Nepal. This condition happens because the study area is located near by the famous tourist place (Royal Chitwan National Park).

4.8. Summary

Nepal already has National Development Plan of DRM. Meanwhile, the Land Use Plan program is in initial stage. Chitwan is a vulnerable district in Nepal with natural disasters, especially from flooding due to topography and terrain condition. Dibyanagar is a village which is affected by river flood. The most hazardous areas in Dibyanagar are located along the riverbank. The people who stay along riverbank would be affected by flood according to the distant of river. People living near the river bank are much more vulnerable. Therefore, in this research, the sample case of household survey was focused on vulnerable group along river.

The implementation of DRM, government can decrease the vulnerability and support the resilience of community at the same time. The assessment of indicators was done by field work data collection. The secondary data from stakeholders are the essential information for spatial and non-spatial data analysis.
In the fieldwork both primary and secondary data are collected. However, there is some limitations in acquiring data such as land use planning which is not available in the study areas. As the consequence, the information concerning land policy and specific regulation in disaster risk area are difficult to obtain. The land policy in case study area was obtained from several sources such as law and regulation framework of ministry or organization. However most of them are in Nepali language. The data collected need to be processed by applying the software. In spatial data processing, the Erdas Imagine and ArcGIS software were used. While non-spatial data were processed by SPSS and MS excel software. The results of spatial and non-spatial data are presented in the next following section.

5. SPATIAL DATA ANALYSIS AND EVALUATION OF INDICATORS

5.1. Introduction

This chapter describes the results of the data collected. The results of the data analysis are explained in the section 5.2 followed by the evaluation of the results in section 5.3. The spatial data analysis demonstrates the state of land use and land tenure in the flood affected or the case study area. Meanwhile, the non-spatial data analysis shows the findings of evaluation of each indicator as defined in previous Chapter 3. Moreover, non-spatial data analysis also provides the information obtained from interviews, survey observation and household surveys. Maps, graphs, charts, and tables are used to show the results of non-spatial data analysis. The next section 5.4 is the synthesis and discussion of the resilience based on each element as defined in previous section 3.4. The contents of the chapter are summarized in the section 5.5.

5.2. Results of Spatial Data Analysis

In this section, the land use of flood affected area is analyzed spatially by using secondary data obtained from field data collection. The land use of flood affected area provides the information of land use zoning and land cover of each area affected by flood. Meanwhile, the land tenure situation of flood affected area is formulated from hazard map and cadastral information of land tenure type in study areas. The assessment of non-spatial data analysis was carried out based on the information acquired from primary and secondary data that was collected based on the defined indicators.

The case study area is divided into three categories. Firstly, the land area that was swept away by flood in the past has been named as "Flood area". This area is a part of Dibyanager Village, which was affected by embank erosion during the flooding along Narayani River. Many of the privately owned land parcels, roads, and drainages were swept away and became a part of Narayani River. Secondly, the area that is vulnerable due to flood and potential zone for the floods in future has been named as "Hazard area". The people living in this area can be considered as vulnerable group. The government should apply adequate measures for improving resilience of this group of people. Thirdly, the area which is safe from any impact of flood has been named as "Non-hazards area". Relatively, this area is in higher location and safe from annual flood. This area was used as temporary shelters during the floods in the past.

5.2.1. Land Use with Flood Affected

In order to assess the resilience of people in case study area, this section describes the land use pattern as the background condition.

Large part of land in the case study area is covered with cultivation (around 68 % out of 1,973 hectares of total areas). The rest part includes sand 12 %, water bodies 6% and others land covers such as forest and shrub around 14%. The cultivation is mainly located in wetland (around 81.8%). During monsoon, the average rainfall is around 468 mm per month while in other season the average rainfall is around 175 mm per month (National Land Use Project, 2010). The crop during monsoon/rainy season (June- September) is commonly rice or maize. In winter time (December-February), the crops are usually buckwheat, mustard, fallow or wheat. While in dry season, the majority of cultivation is maize. The present condition of land use including soil type and land capacity of the case study area (Diyanagar Village area) is shown in the Appendix 4. Present land use map shows that existing land use is classified based on the type of

vegetation and soil, and land capacity is classified based on land characteristics and soil type for the suitability of use of land.

The Figure 5-1 shows the present land use condition overlaid with flood affected areas (Flooded Area, Hazard Area and Non-Hazard Area).

According to the figure above, more than 90% of land falls both in Hazard and Non-Hazard Area and the use is for crops. Details of land use classes are shown in the Figure 5-1.

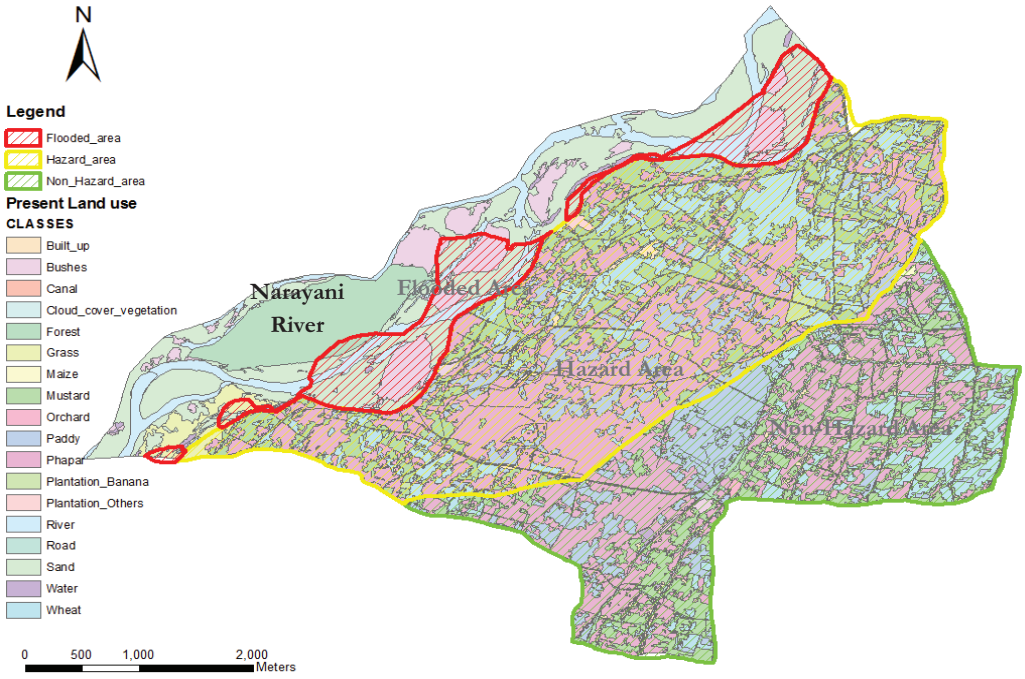

Figure 5-1: Present Land Use Condition with Flood Affected Zone in Case Study Area

Table 5-1: Land Use with Flood Affected in Case Study

Land Use	Flooded Area (%)	Hazard Area (%)	Non-Hazard Area (%)
Build up	-	0.78	2.58
Forest, Bushes and Grass	29.52	1.18	1.45
Maize, Mustard, Phapar, Wheat, Paddy and Orchard	-	94.47	92.24
Road	-	1.70	2.75
River, Canal and Sand	70.48	1.87	0.97
Total	**100.00**	**100.00**	**100.00**

From this Table 5-1 it can be derived that land is the main source for community's livelihood.

5.2.2. Land Tenure with Flood Affected

In the case study area, around 94% of land is privately owned, while state land is around 6%. The state land consists of the parcel including canals, rivers and roads. The extent of land tenure type in the case study area is as mentioned in the following (Error! Reference source not found.

Table 5-2: Land Tenure Type within Flood Affected Area

Type of Tenure	Flooded Area (%)	Hazard Area (%)	Non-Hazard Area(%)
Private Land	95.30	94.30	93.50
State Land	4.70	5.70	6.50
Total	**100.00**	**100.00**	**100.00**

Presently, the shape of Narayani River has been changed due to the effects of flood as shows in the Figure 5-2. The comparison of the shape is done based on the imagery (GeoEye) of present time (2010) with Aerial Photo of 1992. The comparison shows that the shape of Narayani River is significantly changed and it also shows that some land parcels were swept away even before 1992

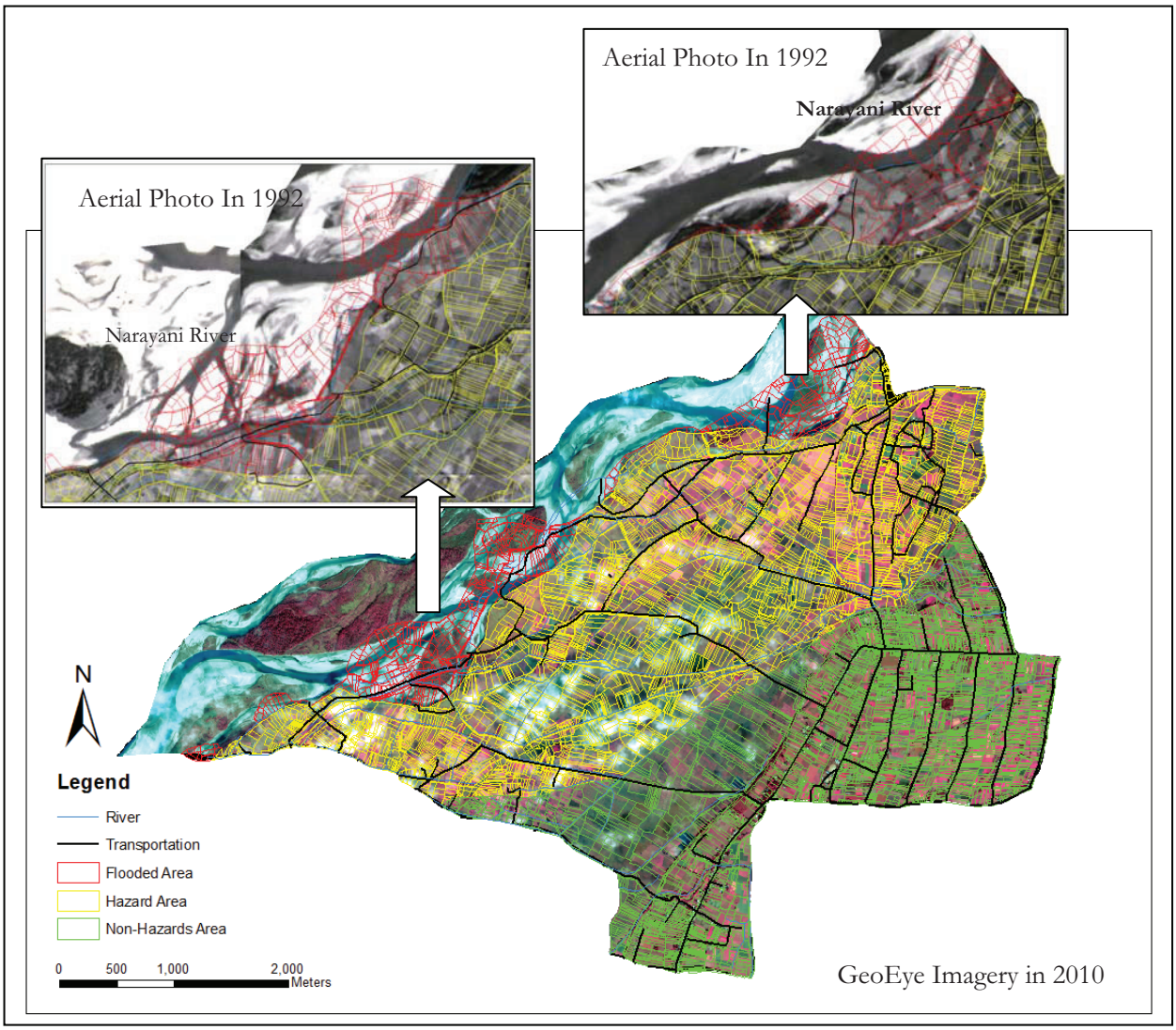

Figure 5-2: The Land Tenure with Floods Affected in Study Area

According to Figure 5-2, the spatial data analysis indicates that average size of private land parcel is around 0.23 Ha. 11% or around 692 parcels in the case study area, once a part of Dibyanagar Village, fall within Narayani River (Flooded Area). This area is now under the responsibility of Chitwan National Park Authority. To reduce loss of land, and in order to conserve the environment of the area, Chitwan National Park Authority has cultivated forest. About 3,973 (around) parcels fall within flood prone zone, while remaining parcels (around 37 % or around 3,900 parcels) are located in safe area of flooding (Non-Hazard Area).

5.3. Evaluation of the Results

This section begins with present socio-economic condition of the case study area that is Divyanagar Village. This information helps the evaluation of the results of each element.

According to households' survey results, 89 % of the respondents are living in the village for more than 10 years, whereas the rest for less than 10 years. The source of income for 48% of the respondents is based on self-employment or farm produce, 35% of the respondents are unemployed, and 17% of them are employed either in public or private organisations. Regarding the incomes level of sample population of the village, the result shows that 42% of the respondents feel that they have enough income, while 56% of the respondents feel they do not have enough income, and only 2% of the respondents answered that they have no idea. Regarding the use of fuel for cooking, around 84% of the surveyed households are using firewood and the rest are using gas (some of them are also using electricity and gas together). Regarding the use of material the construction of house, 49% of the respondents use brick in cement, 39% use adobe, and 12 % use reinforced cement, straw and thatched.

Regarding the knowledge level about the cause of disaster (e.g. flood), majority of the respondents (92%) believe that it is a natural phenomena, 6% believe that the disaster is caused by human activity, and the rest 2% believe that the disaster occurs from God's willing.

5.3.1. Land Tenure Security

Land Tenure Security elements consist of five indicators that focus in the security of people related with their land and their property. The security level of land tenure is measured in terms of security level based on legal framework and the feeling of security of the land and property for the land that falls within hazardous areas. The results of each indicator are explained as follows:

Indicator 1: Percentage of people feeling insecure due to loss of their land in hazard prone area

According to the household survey results, majority of respondents feel secure concerning their land tenure. However, they feel insecure from losing their land/property due to flood (Figure 5-3). According to the graph, not only people living within 0-500 m along the Narayani River feel insecure but also the people who are living within 1,000-2,000 m from the Narayani river bank feel insecure. The reason is that those people, even though they live far from the Narayani River, they have farm land located within 0-500 m zone. Therefore, they are afraid of losing their land because of flood.

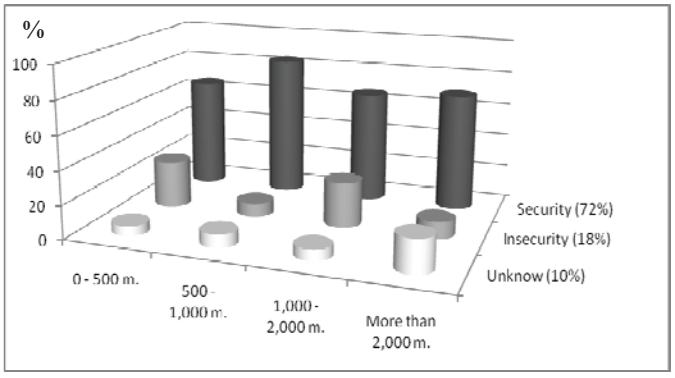

Figure 5-3: Land Tenure Security Feeling in Study Areas

Indicator 2: Availability of the compensation regulation for the people who lose the land after disaster

Household survey and stakeholders interviews (Chitwan National Park Authority), in case study area, revealed that there is no any compensation regulation. However, there exists a provision of nominal financial support to the affected people by flood from the government.

Some private lands affected/lost by flood are located in Chitwan National Park buffer zone areas. Those landowners get compensation from Chitwan National Park Authority. The Chitwan National Park is also responsible to provide the relief to the victims. The northern part of Dibyanagar Village, along Narayani River, is a part of the buffer zone of Chitwan National Park. The victims in that area also get financial support in case of any damage to support the immediate need of their livelihood. Basically, the compensation from Chitwan National Park Authority is allocated to a whole community, which is managed through a committee to improve the community's welfare living within the buffer zone areas. A committee comprises 22 sub-committees, which are coming from different villages around Chitwan National Park and has the authority to use the budget as their own plans and programmes. 50% of annual income of Chitwan National Park Authority is used for the development and cultivation programme in these buffer zone areas. 20% part out of the 50% is allocated for improving the community welfare and the rest 30% is used for supporting cultivation. The example of

cultivation programme is building the embankment activity along the Narayani River to protect farming areas from the flood. Therefore, this cultivation programme is indirectly supporting the mitigation of flood effect in the district.

In addition, in post-disaster DDR committee in Chitwan provides relief for the damage of house and cattle by providing the money around 2,000-5,000 Rs depending on the level of damage of each households.

Indicator 3: Availability of additional regulation in hazard prone areas

According to the household survey and stakeholders' interview, the result reveals that additional regulation does not exist in hazard prone areas. The land regulation in Nepal is never considering the location of the land either located in non-hazard or in hazard area. In this area, the land use plan is not available. Therefore, the people never get information about the zoning of hazard for government. The right and limitation based on land use plan do not exists in this area.

Indicator 4: Clear right, responsibility and restriction of each type of land tenure

According to literature review, household survey and stakeholder's interviews, the land owners have right to use as described previously in section 4.2.3. According to the results of spatial data analysis, around 94% of the land is private land and only 6% of land belongs to the state. Commonly, the people in this village can use, hold, inherit their private land and get benefits from state land by paying annual tax to the state. Almost all of the government lands in this area are used for public interest such as: the roads, government office, river and canal. The right, responsibility and restriction of each type of land tenure in study areas are clear as regulated on the legal framework of the country.

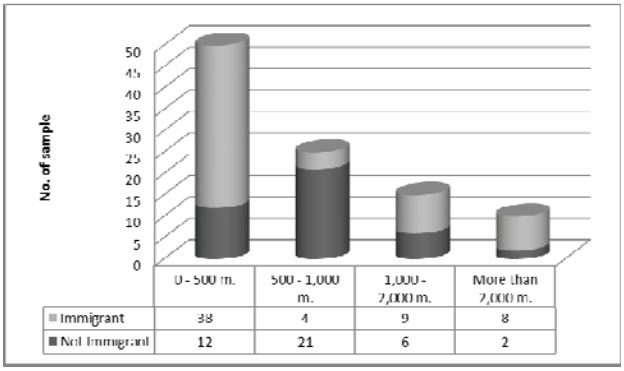

Figure 5-4: The Number of Sample Group Who Immigrant of Each Zone

Indicator 5: After relocation/resettlement, people stay in safe place and have the right of land in new location

From household survey and stakeholder's interviews, all the surveyed households that were relocated / resettled due to flooding are still living in hazardous zone (around 0-2,000 from Narayani River bank). However, they have already the titles of the land where they were relocated or rehabilitated.

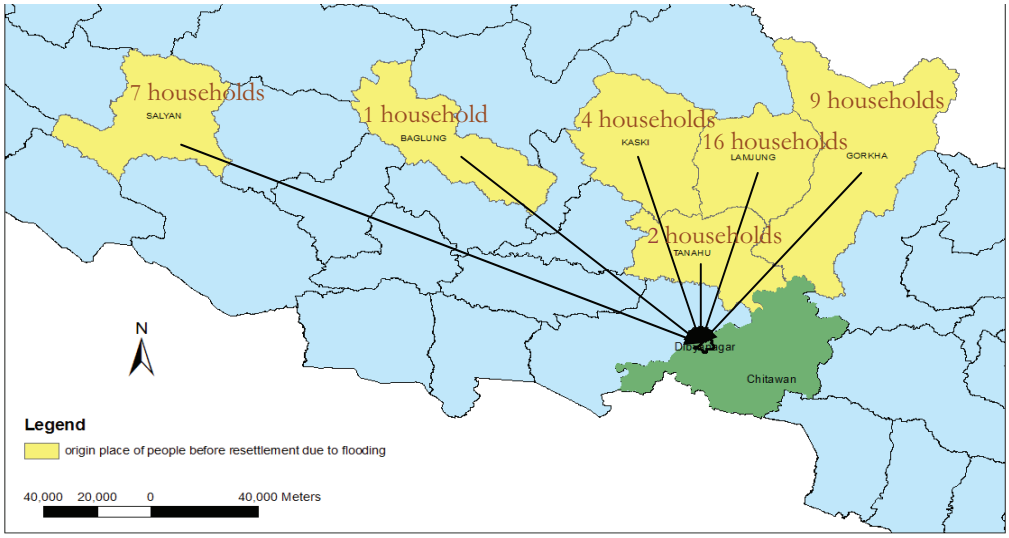

Figure 5-5: Origin of the Households Prior to the Resettlement in Dibyanagar Village

Around 59% of sample population is either immigrant or re-settled from other part of the village. The number of immigrant and non-immigrant people in detail of each zone is shown in Figure 5-4.

According to the household surveyed, 39 households or around 66 % of immigrants' in this village have been re-settled from different places due to flooding. The origin of the households prior to the resettlement is as shown in Figure 5-5, whereas only 20 households or 34% of the respondents migrated to this village due to occupation, marriages and other reasons.

5.3.2. Disaster Risk Management Activities

This element has five indicators. Each of the indicators is explained as follows:

Indicator 6: Availability of hazard map

According to the information from the Chief District Officer, the hazard map of Chitwan District is available and published through internet in small scale (1:100,000) by Chitwan District Disaster Management Action Plan (as show in Appendix 4). Moreover, DWIDP has also flood hazard area in demarcated topographic map of scale 1:25,000 (as show in Appendix 4). This map is a database for planning structural measures in Narayani River. Unfortunately, the map is neither published nor shared to the other organizations.

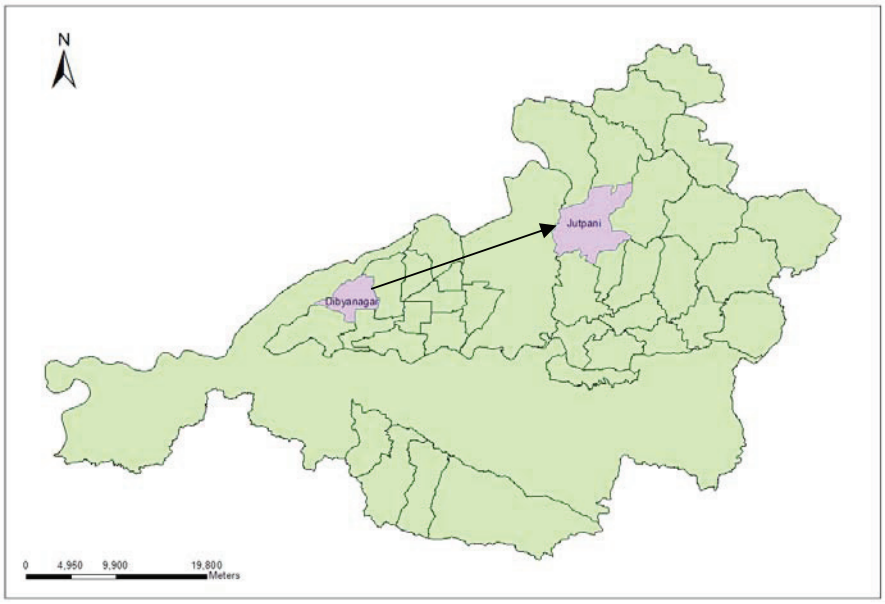

Figure 5-6: The Location of Jupani Village Where People Moved due to Flood from Dibyanagar Village in 1968

Indicator 7: Availability of relocation/resettlement program from hazard prone areas

According to the household survey and stakeholder's interview DoLRM and DAO, both organizations indicate that there is no program related with the relocation/resettlement activities in risk areas. And none of the organizations is responsible for relocating people from risk areas.

However, according to the information from former Chairman of Divyanage Village Development Committee, in 1968 government had a resettlement program for the households in flood risk areas. The households were resettled from Dibyanagar to Jutpani village in Chitwan District as shows in Figure 5-6. They have right for living and using the land without holding the land certificate.

Indicator 8: Availability of structural measures to protect communities (e.g. dike, dam, canal, etc.)

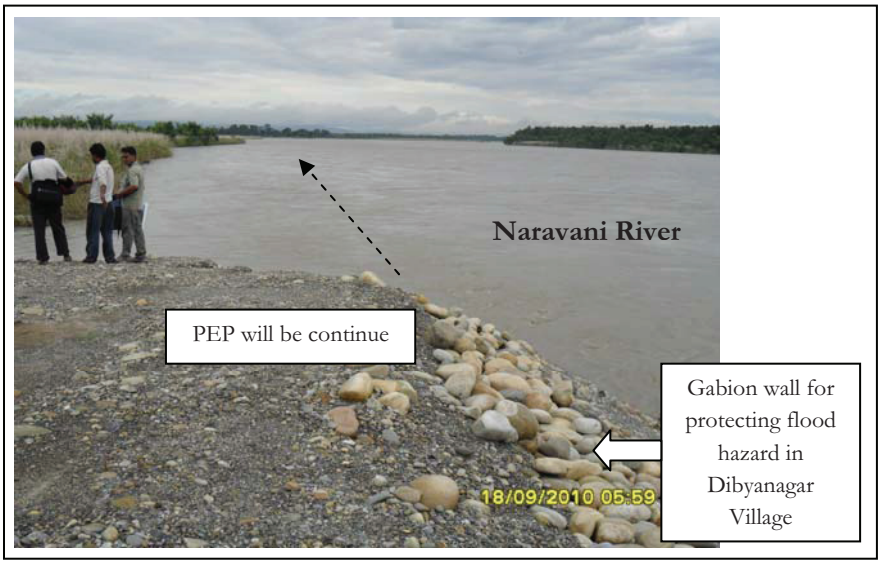

Figure 5-7: People's Embankment Programme in Dibyanager Village

According to the household survey, survey observation and stakeholders' interviews, there exists a structural measures programme in the study area such as People's Embankment Program (PEP) under the DWIDP authority.

This program is in accordance with the national development objectives of the Government of Nepal concerning with the disaster management. PEP provides mitigation measures of flood disaster by involving the affected communities. At the same time, this programme is also generating opportunities of employment for the people from local community. In order to prevent inundation, avulsion and back erosion of 4 villages (including Dibyanagar) and 1 municipality, the embankment is under construction along the high flood areas of Narayani River (as shown in Figure 5-7).

The PEP has expected tangible and intangible benefits. Expected tangible benefits are direct benefits such as protection of land, agriculture products, infrastructures, livestock, and other properties, whereas the expected intangible benefits are indirect benefits like saving transportation system, business disruption, and flood risk expenditure. Moreover, expected intangible benefits are preventing people's life, improving people's health, and preventing social inconvenience and distress losses (DWIDP, 2009).

Indicator 9: Availability of sufficient temporary shelter for community

The household survey, survey observation and stakeholders' interview show that primary and high schools located in non-hazard area are potential locations for temporary shelter during emergency time, as these locations were used in the past. As an example, Shree Adarsh Higher Secondary School located in high land (Figure 5-8) is used as temporary shelter for the community during emergency time. However, the capacity of those schools for accommodating the entire mass of the people during emergency time is not sufficient.

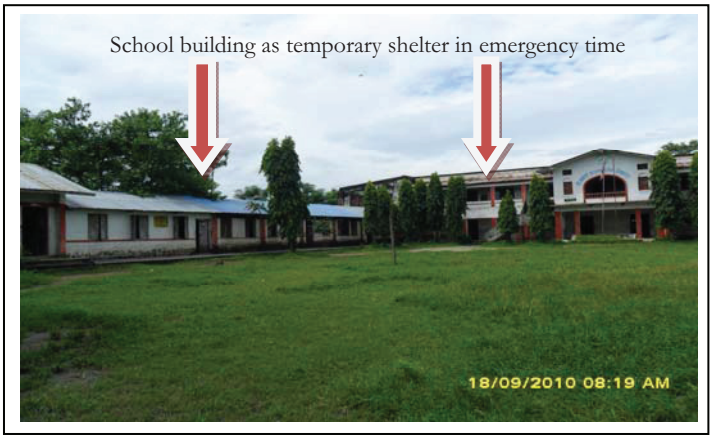

Figure 5-8: Temporary Shelter of in Dibyanagar Village

Indicator 10: Percentage of the people having prior knowledge that they are living in flood risk zone or not

The results of the household survey and stakeholder's interviews indicate that almost 100% of the respondents living within 1-500 m from Narayani River are already aware that they are living in flood risk areas. Around 77% of the respondents in Dibyanagar village have already perceived that they are living in risk areas (Figure 5-9).

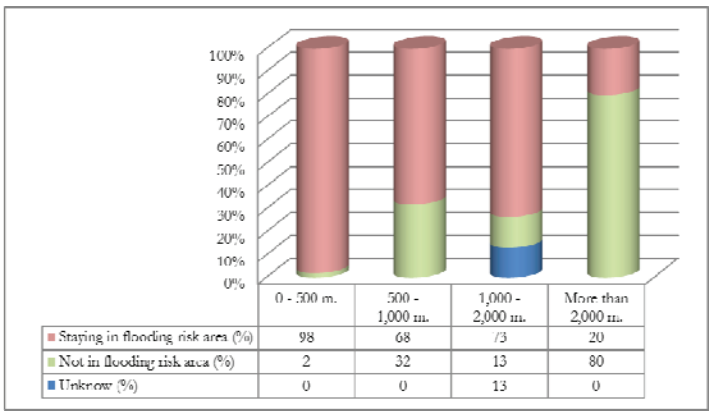

Figure 5-9: The Graph Shows Perceives of People that Their Area in the Flooding Risk Areas or Not

Indicator 11: Percentage of the people aware of the procedures and practices during emergency times

The results of the stakeholder's interviews show that District Disaster Management Committee has been distributing a booklet entitled "Work Plan for District Disaster Risk Management". It provides information about the procedures that have to be followed and responsible authorities to be contacted during emergency time. However, the household survey reveals that this booklet is not publically available and most of them have

never seen it. Around 86% of the respondents have experienced pervious flood events. According to the interviews, the local people escape to temporary shelters during the emergency time (Figure 5-10).

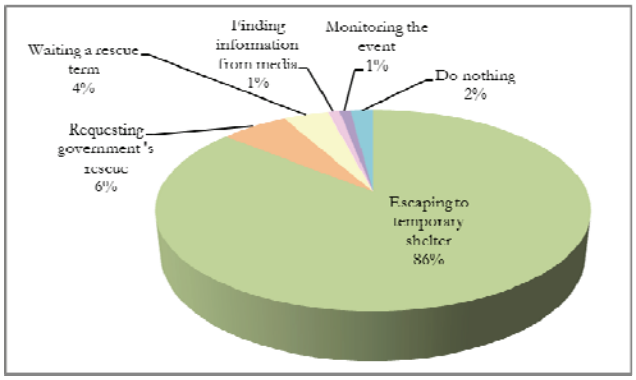

Figure 5-10: The Responding of Respondents in Case Emergency Time of Flood

5.3.3. Land Registration

Based on this element, fours indicators have been evaluated. The result of the evaluation is as follows:

Indicator 12: Percentage of unregistered parcels in the community

As informed by the Survey Office of Chitwan, the organisation responsible for building cadastre of the district, almost all the land parcels in the case study area are registered. According to the household survey, around 7 % of the respondents occupy private land without title. 3% of the respondents hold registered land distributed by Commissions in the past.

Indicator 13: Percentage of backlog parcels waiting for registration

According to the Land Revenue Office or Chitwan, the organisation responsible for registering the land in support of Survey Office in the district, there was no any backlog parcel waiting for registration, within the case study area. Land registration (such as boundary survey, registration of ownership, and issuing title or certificate of land ownership) supports in improving land tenure security, which is found in good position in the case study area. According to the household survey results, land disputes are not seen as major problems within the case study area.

Indicator 14: Availability of registration of parcels in resettlement locations

The household survey shows that 72% out of 39 people, who were resettled due to flood, have got their land registered as described in indicator Indication no. 5, and around 26% of the respondents (10 people) are yet to get their land registered. According to the results of the indicator no.7, acquired from interviewing Former chairman of the VDC/village, the households that were resettled under the government's program in Juntpani village are yet to get titles to their land. Thereby, according to this, it can be concluded that even though the land registration of parcel in relocated area exists but it is not evenly yet.

Indicator 15: Percentage of land disputes after registration

In study area, around 96% of the respondents use "Terrace" as a parcel boundary, which is made of soil rib as shown in Figure 5-11. According to the household survey, around 7% of the respondents, who have already got their land registered, claimed that they have faced conflict on their land boundary. However, according to the Stakeholders interviewed, land dispute and boundary conflict in Diyanagar village are not major issues.

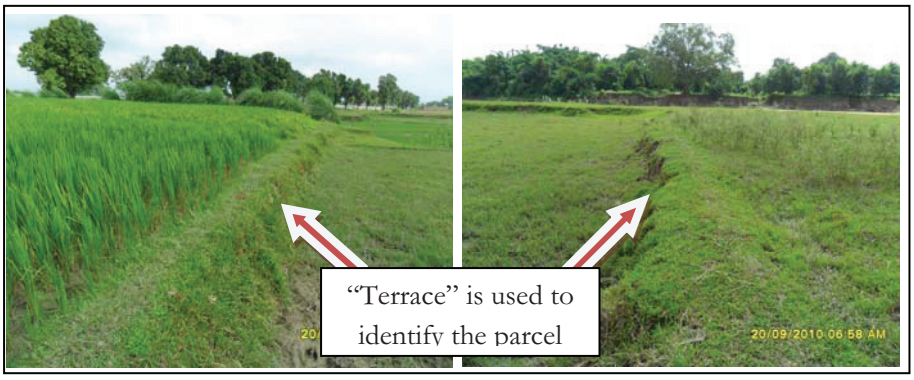

Figure 5-11: Boundary of Parcel in Study Area

5.3.4. Stakeholders Interactions

The stakeholder's interactions elements are discussed based on the result of the indicators as follows:

Indicator 16: Law/policy/regulation, roles and responsibilities among stakeholders are not overlapping.

According to the stakeholders interviewed, the roles and responsibilities of stakeholders are not overlapping. The roles/responsibilities among stakeholders involved in DRM in Chitwan village (DDC, 2004) are as follows:

Making policy and legislating are the responsibilities of DDC, DAO and Municipalities. While going into implementation, these organisations seek cooperation from NGOs through PDMP.

Development Organizations: DDC, DRO and DNDRC are responsible organizations for implementing development related activities in disaster areas. These organisations implement their tasks in cooperation with Municipalities, VDCs, NGOs, and Line Agencies.

Formulation of Plan and Implementation is under the responsibility of DDC, DNDRC, Local Authorities and Line Agencies. These organisations perform their responsibilities in cooperation with NGOs, municipalities, Line Agencies, Red Cross and civil society.

Development of Human resources is under the responsibility of DNDRC, DDC, District Municipalities, Red Cross and NGOs. Line Agencies, Private sector and volunteers are the cooperating organization of these activities.

Preparing and rescuing are the responsibilities of DDC, DAO and municipalities in cooperation with NGOs, Red Cross, civic society, Line agencies, Private sector and Human right groups.

Studying of documents (such as assessing the disaster risk and vulnerability in community) is an activity of DRM of Chitwan district. DDC, DNDRC, Line Agencies and Local Authorities have the responsibility of this task. These organisations implement their task in cooperation with NGOs, Red Cross, and Private sectors.

Indicator 17: Availability of the regulation and activity for sharing data **and Indicator 18:** Availability of coordination and collaboration among the stakeholders, including international stakeholder

According to the household survey and stakeholder's interviews, there is no any meeting for community members in the case study area. The regulation for sharing data about the disasters is also not available. However, cooperation among stakeholders is found in practice. The cooperation among the organizations involved is as follows:

International Level ADPC*,* ADRT-AIT in Thailand and ICIMOD in Nepal share the data related to disaster and share their knowledge through training, seminars, and publications. These organizations do not have any direct contact with the community in Chitwan. All of them play a role of preparedness in international Level.

International-National-Local Level Action Aid Nepal and Practical Action are the NGOs located in Nepal working in the sector of community resilience during disasters. Both of them are involving in all the levels of DRM activities in Nepal. Their roles/responsibilities are similar to those of INGOs like ICIMOD, the difference is that these organizations directly share knowledge through interaction with affected community. However, the missions of both organizations are different; Action Aid Nepal more focuses on developing communities and eradicating the poverty and injustice. While Practical Action more focuses on preparedness activity and building the resilience capacity of the community. Hence, both organizations involve in prevention/mitigation, preparedness, and risk assessment. They have regular schedule to have a meeting and cooperation with others stakeholders such as government agencies, other NGOs, donors agencies and local communities.

Central Level Government Organization: DOS, DoLRM, NCDM and DPnet, DWIDP and Nation Land Use Project are the central level government organisastions those are contributing in DRM activities in a way or another. DOS, DoLRM, NCDM, DPnet and DEIDP have their central office in the capital city, Kathmandu, with their district level offices in each district of the country. Central level organisations are responsible for making policy and framework to be implemented by local offices. National Land Use Project is an organization that creates and updates database of land use/cover and also capacity of soil in the village. Regarding the data sharing, there does not exist any regulation for data sharing among the organizations involved in improving the resilience in case study area yet.

District Level Government Organisations such as LRO, The Royal Chitwan National Park Authority, Buffer Zone Management Committee, DAO, DWIDP in Chitwan, SO, District NGOs, DDC are involving in DRM activities. They share the data upon request. However, they do not have any legal framework for exchange of the data. However, they have frequent meetings among some stakeholders. As an example, DAO have 15 regular meeting and 20 non-regular meeting with District Development Committee, Nepal Police, Red Cross and other responsible organizations available at the district. NGOs have monthly meeting with DDC, DNDRC, District Health Office and etc.

According to the results revealed from local stakeholders interviews, Disaster Risk Committee of Chitwan District (in cooperation with Nepal Government, Practical Action and European Union (EU)) have been enhancing awareness and the procedures to be followed during the emergency time in case of disaster (including flooding) to the people in risk areas, including Diyanager Village. The relevant information is distributed through a booklet "The Work Plan for District Disaster Risk Management" in Nepalese language before monsoon season (around June-September). However, most of the respondents were not aware of the booklet in the case study area

Village Level: Former Chairman of Dibyanager Village Development Committee and VDC Secretary in Dibyanager have been interviewed during the field work. In principle, the chairman of the VDC is the first contact person in case of any disaster. However, as there is no any elected body at VDC level currently in Nepal, the VDC secretary is the contact person. As per the results of household survey, the former chairman of the VDC is still contacted in the emergency time. .

Indicator 19: Availability of prevention/mitigation and preparedness project/program which are involving local stakeholders and/or community

Household surveyed and stakeholders interviewed indicate that People's Embankment Program (PEP) as explained in the results of indicator No. 8, is being carried out by DWIDP together with local people as beneficiaries groups and local stakeholders. The process of this programme in general as follows:

Firstly, PEP form a committee at local level. The committee begins to contact the beneficiary group and assess the capability of them in order to participate in the program. Then, PEP chooses a suitable beneficiary group and makes agreement with them to carry out the program activities at local level. At the completion of the work, PEP, with proper evaluation, accepts their work and provides a certificate of acceptance of the work done and their participation.

PEP committee coordinates with local landowners to get land free of charge for the construction of embankment. Usually, it is done by involving local political leaders.

This program also focuses on the interaction with local government and other districts involved agencies. After the construction completed, the responsibilities of maintenance and repairing will be belong to the local government and other related agencies. (DWIDP, 2009).

Indicator 20: Availability of organization which has responsibility of disaster risk management for community

The result form stakeholder's interview shows that DWIDP has a responsible organization in PEP as described previously. Another agency is DDC, which is responsible for making the Chitwan District

Disaster Management Action Plan. It provides the information of the vulnerability assessment, district capability analysis including the ways to implement their strategies.

The results that have been elaborated above can be summarized as given in the Table 5-3 below.

Table 5-3: Summary the Result of Indicators

Indicators	Result
Land Tenure Security Elements	
1. Percentage of people feeling insecure due to loss of their land in hazard prone area	• 72 % of people feel secure
2. Availability of the compensation regulation for the people who lose the land after disaster	• The compensation regulation does not exist but there exist the relief in case when disaster occurs.
3. Availability of additional regulation in hazard prone areas	• Not exist
4. Clear right, responsibility and restriction of each type of land tenure	• Clear right, responsibility and restriction of each type of land tenure
5. After relocation/resettlement, people stay in safe place and have the right of land in new location	• 90 % of people who did the resettlement have land owner certificate but they are not live in safe location
Disaster Risk Management Activities Element	
6. Availability of hazard map	• Hazard map exists
7. Availability of relocation/resettlement program from hazard prone areas	• The program is not exist
8. Availability of structural measures to protect communities	• Structural measure exists: People's Embankment Programs as an example
9. Availability of sufficient temporary shelter for community	• Temporary shelter is not sufficient in emergency time
10. Percentage of the people having prior knowledge that they are living in flood risk zone or not	• 77% of respondents know that they live in risk areas
21. Percentage of the people aware of the procedures and practices during emergency times	• Almost 100% of respondents know the procedures based on their experience
Land Registration Element	
11. Percentage of unregistered parcels in the community	• 93% of parcels have been registered
12. Percentage of backlog parcels waiting for registration	• Backlog does not exist
13. Availability of registration of parcels in resettlement locations	• Registration programme is not evenly
14. Percentage of land disputes after registration	• 7% of sample group have land boundary conflict
Stakeholders Interaction Element	
15. Law/policy/regulation, roles and responsibilities among stakeholders are not overlapping	• The regulation does not exist. the role and responsibility of stakeholders are not overlap
16. Availability of the regulation and activity for sharing data	• The regulation and activity for sharing data are not exist but there is exist procedure to cooperate among stakeholders
17. Availability of coordination and collaboration among the stakeholders, including international stakeholder	• Regular and non-regular meeting for communities are not exist
18. Availability of prevention/mitigation and preparedness project/program which are involving local stakeholders and/or community	• Prevention/mitigation and preparedness project/program which are involving local stakeholders and/or community is exist. People's Embankment Program (PEP) is as example.
19. Availability of organization which has responsibility of disaster risk management for community	• DWIDP and DDC are organizations responsible in DRM in study areas.

5.4. Synthesis/Discussion on Community Resilience

This section discusses each element of community resilience in the case study area along with the synthesis of land tenure in DRM.

5.4.1. Resilience of Community in Disaster Risk Area

a) Land Tenure Security

Basically, land tenure system in Nepal consists of three main types of land rights, such as private, trust (guthi) and state (public and government land) as described in section 4.2.3. According to the spatial data

analysis, 94% of the land in the case study area falls within privately owned land. The landowners pay the land tax to the local government. Only 6% of the land belongs to the government which includes roads, canals and river for public purposes. The community has already perceived the importance of land ownership. Therefore, the land disputes are not major issues in the case study area since they have clear understanding concerning the right, restriction, and responsibilities over their land.

The legal framework of the rights, restrictions, and responsibility of land tenure are clearly defined in Nepal. However, specific regulations in hazard prone areas do not exist in case study area. There is no land use plan available. Specific regulations, such as the regulation to elevate a house through building permits and compulsion of insuring land and property could reduce vulnerability and enhance the resilience of community in hazard zone.

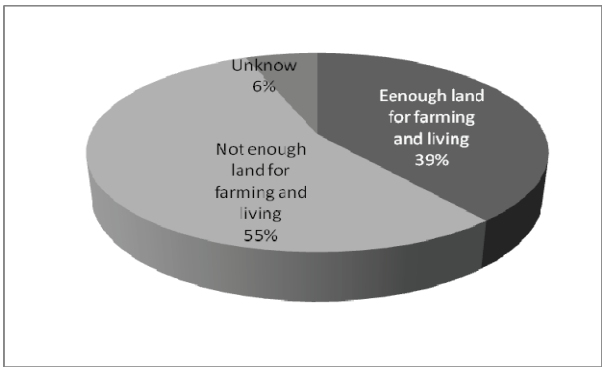

Figure 5-12: The Opinion of People Regarding the Land for Farming and Living

The result of spatial data analysis shows that 11% of land was swept away by floods and became a part of Nayarani River. Based on Nepalese legal system, there is no any compensation for those who lost their land due to flood. Therefore, the victims cannot buy land at new location as happened in the USA case (see section 2.3). Consequently, many of the victims are homeless and landless. Such a situation can increase informal settlements, poverty problem and vulnerability level in hazard area. The people who lost their land are vulnerable group in this village. Regarding the financial level as described in section 5.3, majority of the people in this village are suffering with poverty. Cultivation is the main land use and it is essential for the people in this village. The average size of a parcel for each family is only around 0.23 ha. Therefore, more than 50% of respondents expressed that they need more land for living and farming (Figure 5-12).

According to household survey information, 72% of respondents feel secure concerning their land tenure, while 18% of people feel insecure from losing their house and land due to flooding. Almost 40% of respondents have got experience of losing their land due to flood (Figure 5-13).

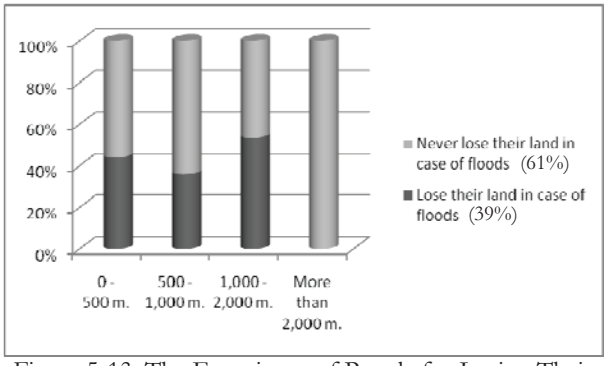

Figure 5-13: The Experience of People for Losing Their Land in Flooding

All the respondents who were relocated in the past are still living in hazard, prone areas that is within 0-2,000 m of the river and 82% of them are living within 0-500 m from the River. Actually, the purpose of resettlement is to bring the vulnerable group out from hazard prone area, but in this case, these people are still living in hazard prone area.

Presently, there is no any resettlement programs from the government for the people who are living in the risk areas. This condition is exacerbated by unclear responsibility of the organizations involved for relocation and resettlement. According to the background information of Nepal, as explained in section 4.2, Nepal is an agricultural country which encounters several disasters and has limited land for living and farming. Furthermore, there is lack of open space at safe location that can be used to rehabilitate the vulnerable groups during disasters in the case study area. Majority of landowners in Nepal have small parcels, which are not enough for farming. Moreover, land consolidation, as explained previously in section 2.3-2.4 about the experiences from Germany and The Netherlands, is not feasible in the case study area. According to the discussion above, the resilience of community based on land tenure security element is weak. It needs to be improved in broad context by bringing land policy into operation.

b) Disaster Risk Management Activities

The Nepalese government understands and perceives the importance of disaster risk reduction (DRR). The policy of DRM in Nepal exists and has already incorporated into present National Development Plan. Several DRR plans have been created to provide the resilience and to reduce the vulnerability for the communities. The starting step of the activities in National Development Plan is to provide the legislation of DRM. After that, it is continued by assessing the damage of risk in community and by defining the role and responsibilities of each stakeholder involved in "Risk Assessment". The cooperation among stakeholders for making early warning system is a strategy of "Preparedness Planning" period. The emergency procedure and reconstructing planning are the strategies of "Response" and "Recovery" activities. According to the DRM plan in Nepal, the prevention and mitigation activities are not involving the land tenure security issues yet.

In Nepal, roles and responsibilities among the organizations involving in DRM activities are clearly defined to support in enhancing resilience of community, as explained in section 4.2.1. However, in the case study area, no hazard map is publicly available. Demarcation of risk zone on a topographic map for official purpose is available though. The local people or other organizations cannot get appropriate information about the location of hazard precisely. A structural measure namely "People's Embankment Program" is an important community prevention project from flooding. However, majority of the people in this community have not adopted any personal measure for prevention from flooding. Rather have a feeling that even with the personal measures they will lose their land during flood in the future.

According to the results of household survey, more than 50% of the respondents in the risk area (the zone between 0-2,000 m from Narayani River) agree to elevate their house in case the government implements such a policy and provides necessary support. The respondents living within 0-500 m from Narayani River and disagree with this idea give a reason that elevating house will not help in case the flood occurs. Meanwhile, around 45% of the respondents living in Non-Hazard Areas (living farther than 2,000 from Narayani River) disagree with the idea of elevating their house because they are already living in safety area (Figure 5-14). Moreover, 77 % of the people who are living within 0-2,000 m from Narayani river are already aware of the fact that they are living in hazard areas based on their experiences in the past or as informed by their neighbours. Such information is helpful for implementing DRM activities in the community. The resilience based on this element still needs to be improved especially in the programs implemented in the recovery (lack of resettlement program) and response (insufficient of temporary shelter) stage.

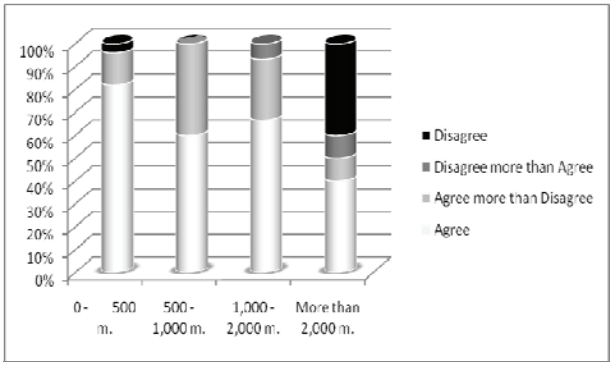

Figure 5-14: The Graph Shows the Opinions of Respondents to Elevate Their House

c) Land Registration

Land registration, in Nepal, is as a tool to ensure land tenure security to the people, which can be revealed from the evaluation of land tenure such as percentage of registered parcels and the number of land disputes in post disaster stage. In this element, three out of four indicators have positive results. In the case study area, 93% of the respondents have already registered their land. The backlog problem does not exist in this area. The average size of a family in this village is around 8 persons per family and majority of the population is engaged with farming. Regarding ownership of land, around 82% of the respondents own and cultivate their land. Only 2% of the respondents cultivate the land that belong to their relatives, about 9% of the respondents cultivate the land with sharing crops, and about 7% of the respondents occupy the other type of land without any agreement and permission.

The information obtained from household survey reveals that 90% of the respondents who were resettled from other places to Dibyanagar Village have got their land registered, and therefore, they own private land. On the other hand, according to the former Chairman of the Village, the people who were relocated from Dibyanigar

Village in 1968 to Jutpani Village own private land but without registration. It means the implementation of resettlement program in the new location still lacks guarantee of land tenure. They have right for using and living on the land but they cannot sell or mortgage it. Therefore, they cannot get the benefit from mortgaging their land. By mortgaging, they could improve their livelihood by improving their economy as shown in Thailand case (section 2.5.2). Thus, it can be concluded that the element land registration is not in the state to support land tenure security in the resettled area. Land dispute is not a major issue for parcels that have already got registered in the case study area. Only about 7% cases of boundary disputes were found from the household survey. It shows that the registration of land is effective in Nepal.

As described in the section 4.2, and the results acquired from data analysis, small landholders and landlessness are challenging issues in Nepal. In rural area, people are living with their traditional agricultural based life style. The households having large plots of land are richer compared to those having small plots, which is evident as large plots yield more. At the same time, the vulnerable people are becoming poorer day by day. This condition is fueling the vulnerability of the community. It is difficult for the vulnerable people to return back to the normal life as they lost their land and do not have alternative source of income. In order to reduce poverty and improve resilience of people, the Government of Nepal is implementing land reform program. Implementation of land reform program would enhance the productivity and employment (Lumsalee, 2002). By this program, the government allocates state land and government land to landless people. The allocation is made by the Commissions constituted by the government time to time. The land allocated by the commissions becomes private as soon as it gets registered. The cycle of poverty due to landlessness cannot be solved as long as this area remains vulnerable from the damage due to flooding.

d) Stakeholders Interactions

In Nepal, the DRM agencies are structurally divided into National, District, Municipal and Village level. Each level has clear role and responsibility. The government organization and NGOs involved have clear mandates (section 4.2.1). Therefore, the stakeholders of each level must share the information and involve the communities in decision-making concerning DRM plan.

This element focuses the implementation any DRM plan with the participation of stakeholders in order to support the community's resilience. The international stakeholders participate through national level by providing knowledge and training the staff in central organizational level. The central organization level later provides policy to local office. Stakeholders in district and village level can implement DRM activities affectively as they have direct interaction with the community. The local condition could be identified in order to implement appropriate measures. In principle, the roles and responsibilities among stakeholders should be clearly defined, but in practice, the regulation of data sharing does not exist. The available data are not used for improving the resilience of the community yet. For example, the flood hazard map prepared by DWIDP is not publicly available. This map could be used as a major data source for risk assessment. It could be used to make prevention and preparedness plans effective.

The benefit of people's participation can be seen from the People's Embankment Program that is under implementation in the case study area. This program makes the participation of local community in implementation phase. Such participation is not only supporting effective implementation of this program but also benefiting the local community by increasing land tenure security and improving awareness about risk of hazard.

According to the information revealed from interviews, the important organizations involving in DRM activities in district level are DDC and DNDRC, which are available in every district of the country. These organizations play important roles in DRM activities. DNDRC mobilizes national army, police force, political parties, NGOs (major line agency), including water supply agency, and agency which in charge in electricity, telephone in an integrated way for the effective implementation of DRM activities. DNDRC has five different subcommittees to look after different issues during the disaster such as Recues and Relief Committee is one of them. Whenever disasters occur, these committees get activated to provide the rescue in cooperation with police, doctors, nurses etc. As an example, in case of flooding, this committee provides the

foods, water by involving government offices and using school as temporary shelter. Chitwan National Park Authority provides elephants to rescue the victims. After emergency time, the committee provides relief to each household and cattle by providing the financial support of around NRs 2,000-5,000 depending upon the level of damage. In case of any death victims, the committee provides money around NRs 25,000 to the concerned family. This committee also focuses on response and recovery stage. The member organizations of this committee should have good interaction among themselves and victims during and after disaster takes place. Meanwhile, DWIDP is responsible agency in providing structural measures during prevention/mitigation stage. Despite the availability of such a mechanism, risk assessment and preparedness planning still need to be improved especially in sharing data and collaboration among stakeholders involved. Regarding the enhancement of the local participation, it could be done by improving awareness of the local community through training for emergency time and involving the local community in decision making.

According to the discussion above, vulnerable groups in case study areas can be classified as follows: 1) the households that lost their land by flooding; 2) the households relocated due to flooding but are still living in hazard risk area; 3) the households relocated due to flooding but without land ownership certificate in their new location; and 4) the poor households living and farming in hazard risk area. They need proper support from the governments as well as from the NGOs to improve their livelihoods and resilience for preventing their land due to flooding.

5.4.2. Land Tenure in Disaster Risk Management

This section explains the role of land tenure in DRM activities which could support the resilience of community.

a) During Emergency Time (Response)

In emergency time, stakeholders' involvement is required to save the life of victims and minimize the damage of property. Victims have to leave their land and house temporally. Good land management/administration can support in finding the suitable location of shelter.

Government needs the data of damage caused by disaster as basic information for planning the activities of rescuing victims and protecting land and property. The preliminary evaluation of risk is an important tool in response stage. This tool helps prioritizing the activities in emergency time, which focuses on food, accommodation, livelihood and vulnerability (FAO & ILO, 2009). The purpose of rapid assessment is not only to provide the information of the loss of land, property, and life but also to find the location where the vulnerable groups can be resettled. The government can use the result of rapid assessments to identify the effect of adverse disaster to the land tenure. Government can plan strategy in order to avoid the land disputes in post disaster stage. As lessons learnt from the case of Iran (see section 2.4.3), the victims moved away the tents provided by the government as temporary shelter and started to acquired others land. At the same time, the government prevented the land dispute by prohibiting land transaction in post-disaster stage.

b) Bringing the Livelihoods Back (Recovery)

After the occurrence of any disaster, the government has the responsibility of recovering the affected community. The recovery is effective, if carried out with the cooperation from other stakeholders involved. Depending upon the scale of vulnerability and damages, risk area is declared restricted during the occurrence of the disaster. Many buildings may need reconstruction, and many dwellings may need to be relocated to safe place from disasters. In many cases, after the disaster takes place, people try to return back to their home in hazard areas. Commonly, the government restricts the landowners to return back in such situation to protect them from the next disaster. As an example, the Haitian government is prohibiting its people to rebuild or restore their property without expert control and permission from local authorities (PDNA, 2010). The government tries to protect people from new generated risk due to collapse of building. As learnt from the Turkey case, the victims who could not access to their land tried to occupy others land despite its location within hazard area (see section 2.4.3).

In recovery stage, land registration is a tool to prove land ownership. In the case of landowners death, land records can support to claim the right of heirs. The land records could also be destroyed by disaster, as shown by the 2004 tsunami in Indonesia (see section 2.4.3). The disaster also causes the disappearance of land parcel boundaries. In this case, Community-Driven Adjudication is an effective strategy during reconstruction period. Earthquake 2001 in Bhuj of India is another example, victims lost their land title certificate and electronic register system was not available. However, the government accepted other documents as an evidence to prove their ownership such as by telephone bills, electronic bills and etc. (Daniel Fitzpatrick, 2008). These solutions can also be used to reduce the land disputes in post-disaster situation.

Even though there exists complete record of land in the case study area, the victims still do not have access to their land. They lost farming which is essential for their livelihood. In this context, the compensation policy could be a solution to the existing situation. The compensation should be provided in such a way the owner can buy a piece of land at any safe place. By doing so, it will improve the resilience of the community. In fact, such compensation policy does not exist in Nepal. The vulnerable groups are trying to find the solution by themselves such as by sharing crop or cultivation in their relative's land. Consequently, they are still vulnerable from poverty.

c) Predicted Damage (Risk Assessment)

The information of risk assessment can be used as database for planning in prevention and preparedness stage. The risk assessment provides the information of hazard prone area. The sharing of data and cooperation among stakeholders involved are the key elements for achieving the prevention and preparedness measures. However, publishing risk assessment information will have impacts on land tenure, land value and land use. As an example, in Switzerland, flood hazard maps influence local land use plan. Based on the hazard maps, the hazard levels are classified in four zones. The first is red zone as high hazard zone, where the construction activities are prohibited. The second is blue zone as moderately hazard zone. The construction is allowed within this zone with enforcing restrictive regulation. The third is yellow zone as slight hazard zone as warning area in which damage of buildings is still possible. In this zone, there is no restriction however people who live in this zone must be aware to the flood hazard. The forth is yellow-white hatched. This zone is warning zone which is indicating a residual hazard. This zone is danger free zone. All these zones have direct consequences for land use planning (Loat, 2010).

Dibyanagar village does not have land use plan yet. The village has a typical pattern of housing and farming, surprisingly, the most dense settlement falls along the riverbank, which is usually affected by flood. Although the people have already perceived the risk of flooding, they are not aware of the exact coverage of flood prone area. Even though some of them have relocated themselves, they still live in hazard area. Therefore, the risk assessment information needs to be published officially as essential information for the vulnerable group living in hazard area. There is no any regulation concerning hazard area. However, most of the people are aware that they are living in hazard prone area based on their experiences in the past.

d) Improving the Resilience (Prevention/Mitigation and Preparedness Planning)

The resilience of people in community can be improved by implementing prevention and mitigation strategy. Land use plan with hazard information incorporated can be a tool for government to make risk-based building codes. The Hurricane 1998 in Honduras case indicated that "Poor land use planning and ineffective public administration has led to poor quality land management. Malfunctioning urban land and housing markets, largely a result of inadequate regulations, has led to a rapid increase in informal settlements in hazardous areas" (Daniel Fitzpatrick, 2008).

According to "The Pinheiro Principles", a book published by COHRE (COHRE, 2003) that contains the international standard of right of refugees and displaced persons, a government should establish multipurpose cadastral system. The registration of land and property is a tool for restitution program and guarantee the right of refugees and displaced persons related with land. As described in recovery stage

above, the land records are evidences to prove landownership. Thereby, good land registration system should be developed in pre-disaster in order to avoid land dispute in post-disaster.

In this stage, the resilience of community can be improved by structural and non-structural measures. The example case as explained in the section 2.2.3, people in communities participate to promote their resilience. The participations of people are an important factor in achieving the goal for improving the resilience of community. However, the applied program must appropriate with their culture and environment. The relocation/resettlement of people from hazard area is an example strategy in this case. From the cases in Germany and the Netherland, land consolidation program was applied to relocate people from hazardous area. It means the structural measure can also improve the resilience of communities. Meanwhile, the lessons learnt from cases of the Netherland and Thailand (in section 2.5), both country have been applying structural measures to protect the adverse effects from flooding. Similarly, the People's Embankment Program is a structural measure to protect the adverse effects from flooding has been applying with participation of community in Dibyanagar Village. Local people involved in embankment construction. This program also generates the advantage in increasing their land tenure security.

In addition, the early warning system of disaster can save the life and property in emergency time, such as by the towers warning system of tsunami in Thailand as explained in section 2.5.2. The people who stay in hazard prone area can prepare themselves to fact with disasters through preparedness training program.

According to the explanation above, it can be conclude that land policy, land use planning, land records, structural and non-structural program play important role in improving the resilience of community and reducing vulnerability of community as well.

5.5. Summary

The result from spatial data shows that in Dibyanagar Village, the land use is dominated by cultivation both in hazard and non-hazard area. Hazard area is located along the Narayani River with the distant around 0-2,000 m. The Land Tenure with Flood Affected demonstrates that around 11% of the areas have already gone by flood and around 52% of the area located in hazard area. Dibynagar Village is categorized as high risk area from flooding caused by topography condition.

The result of non-spatial data analysis shows that 12 indicators have a positive result, while the 8 indicators show a negative result. The comparison among the elements, land tenure security element was found more negative result. Meanwhile, the land registration element was found more positive result than other elements. This element can support increasing land tenure effectively as described in section 5.3.

The data analysis shows that the resilience of the vulnerable groups needs to be improved by bringing land policy into operation such as by relocation program and promotion of preparedness to cope with the disaster. After relocation, government should provide certificates for guaranteeing land tenure of people such as by land ownership or long lease certificate. The stakeholder interaction element should also be improved with sharing timely relevant data and enhancing local participation in decision-making. These strategies can not only increase the resilience of community but also can support the economy of country by protecting farming productivity and in broader sense it can save the costs of recovering for the victims.

6. CONCLUSION AND RECOMMENDATION

6.1. Introduction

This chapter comprises of the conclusion of the research and some recommendations for future research.

6.2. Conclusion

The conclusion of the research is presented based on each sub-objective. The main objective of this research is to study the resilience of community in disaster risk areas from the land tenure perspective. Two sub-objectives were defined to achieve the main objective. The research resulted into following conclusions:

1st sub-objective: To identify the resilience elements required to increase resilience of community in disaster risk areas.

a) What are the experiences/lessons learned in disaster areas in term of land tenure?

Experience and lessons learnt from the cases of disasters from several countries around the world were used to achieve this sub-objective. The case studies have been focused on land tenure and land policy issues in disaster areas. This research undertook six short case studies and two long case studies (Chapter 2). Six short case studies include the flooding in Germany and Turkey, Hurricane in USA and Honduras, Earthquake in Iran and Earthquake followed by Tsunami in Indonesia, whereas the two long case studies belong to DRM and flood hazards management in The Netherlands and Thailand.

From the case studies it is found that the countries have already understood and taken necessary efforts for improving resilience of communities in disaster risk areas by applying appropriate land policy. For examples, the countries modernized technology of communication, supported land tenure by land registration, and implemented the risk assessment in hazards prone areas. The resettlement and land consolidation used for protecting life and property of people in risk areas. Meanwhile, the people in communities are aware of the importance of land tenure and the risk of disaster by their experiences, and they have meaningful participation in the prevention and preparedness programs. In post-disaster, the victims can become landless, homeless, and moneyless. In such situation, the victims may occupy risk areas again and it increases their vulnerability. Good resilience of community can resist the effects of disaster and helps in rapid recovery in post disaster.

b) What are the resilience elements from land tenure perspective to be considered in disaster risk areas?

Essential elements needed to measure the resilience of communities were acquired from the experiences and lessons learnt as described in section 2.4-2.5. Four resilience elements including Land Tenure Security, Disaster Risk Management Activities, Land Registration, and Stakeholder Interaction were identified. **The Land Tenure Security** attends the land policy in order to guarantee the land tenure by defining appropriate right, responsibilities, and restrictions in hazard prone areas and also by resettling the affected people from risk areas. **Disaster Risk Management Activities** deals with the land policy for DRM such as by making hazards map, applying the structural measures and organizing awareness programs related with disaster risk reduction. **Land Registration** concerns with the guarantee of land tenure and solves land dispute**. Stakeholders Interaction** focuses on the roles/responsibilities and involvement of each stakeholder in decision making. Sharing of data and interaction among stakeholders involved are major indicators of implementation of land policy and DRM.

c) How to measure the efficacy of land tenure for resilience?

In order to answer this question, firstly indicators to measure community's resilience in land tenure perspective were extracted from the experiences gained and lessons learnt from the case studies. The indicators were found by applying SWOT analysis (Chapter 3). The results of SWOT analysis consist with 16 strategies. Later, from those strategies, 20 indicators were found. All these steps are shown in Figure 6-1.

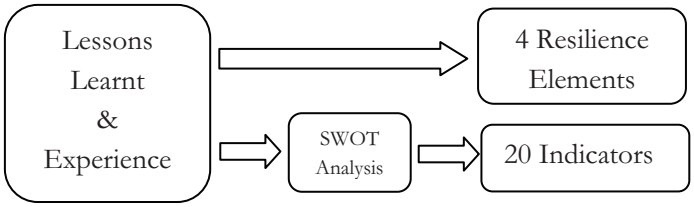

Figure 6-1: The Steps for Finding out the Resilience Element, Strategies and Indicators

By applying this technique, following indicators for measuring the efficacy of land tenure for resilience of the community have been found:

1) Five indicators of land tenure security element can help find the weaknesses of land policy in supporting land tenure security. Even though the land tenure system in Nepal has clearly defined the issues of rights, restrictions and responsibilities, this element needs to be improved more than the other elements.
2) Six indicators of DRM activities can be used to see the ability of the DRM from international to village level. The result shows that DRM activities are involved in almost all stages of DRM cycle. However, some activities should to be improved for improving resilience of communities such as by providing shelter in emergency time.
3) Four indicators of land registration can show the ability of land registration in providing security of land tenure to the people of affected communities. The result shows that this element has more positive results more than the other ones.
4) Five indicators of stakeholder's interaction can indicate the level of integration between stakeholders involved, which may affect the communities' resilience. The research found that data sharing and active participation of communities in DRM activities need to be improved.

Furthermore, the indicators can measure the quality of each element. The weaknesses and the strength of each element can be identified including the indicators of each element inside. Therefore, this technique is appropriate and sufficient for measuring the resilience of the community based on the purpose of this research as mentioned in Chapter 1.

2nd Sub-Objective: To analyse resilience elements from land tenure perspective using spatial and non-spatial data in disaster risk areas.

d) What spatial and non-spatial data are required for land tenure with flood affected mapping in disaster area?

The Land Tenure with Flood Affected mapping was done by the spatial and non-spatial data collected from the field work (Chapter 4). Primary and secondary data were collected from the case study area, Diyanagar Village, Chitwan District, Nepal. This village is one of the seriously hazardous and vulnerable areas in Nepal. The spatial data and non-spatial data for mapping the land tenure with flood affected used are 1) political boundary layer 2) topographic map layer 3) GeoEye imagery acquired in 2010 4) flood hazard areas 5) cadastral map layer showing flood effects 6) cadastral maps and 7) land records

e) What are the results of resilience elements in disaster areas?

The spatial data analysis shows that 94% of the land in study area is private land and only 6% of the land belongs to the state. 11 % of the area has been swept away by floods, 52% of the land is located in hazardous area and 37% is located in non-hazardous area. Analysis of non-spatial data shows that the land tenure security element in the case study area needs to be improved. The regulation for compensation does not exist. However, the government provides nominal financial support for immediate relief. Due to the lack of land use planning, the hazardous zone has not been defined yet in Nepal. The additional regulations for hazard prone areas also do not exist. The resilience from land tenure security perspective is

the weakest element, whereas that based on the land registration element is strong in the case study area. In addition, the land dispute or land conflict is not a major issue in the study area. Meanwhile, the DRM activity element has been focused on the stage of response (emergency time), recovery (post-disaster) and prevention. A hazard map exists to support implementation of risk Assessment stage but it is not shared for its use in preparedness planning stage. Moreover, the people in case study area have perceived the potentiality of disaster risk and are aware of the procedures to be followed during emergency time by their experiences in the past. It means that to make the implementation of DRM activities by the government for the vulnerable group and community effective and efficient, participation and Stakeholder Interaction element need to be improved.

6.3. Recommendation

6.3.1. Resilience of Communities

The recommendations for improving the resilience of community are given as following:

- The government needs to implement land use planning in hazard prone areas. Land use planning is an effective tool of land policy, which can reduce the vulnerability of community.
- The government should provide a certificate (e.g. ownership or long lease certificate) to the vulnerable people who are provided land under relocation or resettlement programs to ensure the guarantee of land tenure so that they can freely invest on the land for their livelihood. . Further, they can get benefit of certificate such as by mortgaging, which can stimulate the economy and reduce the poverty level.
- In implementing DRM activities, the government should make the communities' participation active. The community is a key factor for effective management of DRM activities.
- Risk assessment needs to be implemented in order to build risk data base as an input for making DRM planning better and effective, and share it with other involved agencies. By integrating the information between the organizations involved can enable better decision-making of DRM strategy and land policy.

6.3.2. Future Research

In order to enhance the resilience and reduce the vulnerability of communities, some of the recommendations are expected to be useful for research in future.

- The comparison of land use and land tenure in different type of tenure is not undertaken in this research. The differences of land tenure in different hazard are interesting issues to be studied in the future research. The result of these indicators in section 3.2 can be applied to measure resilience in other communities in Nepal or in other countries. The results of those indicators can be used as the guideline for reducing the vulnerability in other communities.
- In case of land use plan already available in the future, the resilience of these communities may change. After risk based zoning is published, it may affect the resilience and the value of land within community. Theoretically, the land use plan will define the land use pattern and has an impact to land tenure in the future as well. The specific regulation which is enforced to landowners influences the resilience level of community. Therefore, it is interesting to study such affects by using the same indication and compare it before and after land use plan is created.
- This research mainly focused on the resilience of the community in disaster areas on land tenure perspective. The insecurity of land tenure and poor crop in disaster areas can impact the land value and land development. Therefore, the perspective of land development and land value can be interesting topics for further research.
- In order to improve the resilience of a community, local knowledge and participation of local people are found as the key elements of successfulness of DRM and land tenure activities in implementation level. Therefore, the actual role of local knowledge and local participation in this regard can be a topic for further research.

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APPENDICES

Appendix 1: Questionnaire for Household Survey and Question for Stakeholder Interview

Part 1:

Household Survey Questionnaire

"Land Tenure in Disaster Risk Management"
In Case of Flooding in Chitwan, Nepal (10 September - 3 October 2010)

Household address:..... Ward number:.....

Street's name.....Village's name.....~~Meghauli~~.....

Date of interview.....

Coordinate GPS reading: X:..... Y:..... Elevation.....

Part 2:

1. Household information

1.1 Name..... Age.....

1.2 Household head: ☐ Male ☐ Female

1.3 Number of family member: Male.....Female..... Children.....

1.4 Number and level of education:

Non-education..... Primary completed.....

Secondary completed..... University.....

1.5 Occupation: ☐ self jobs ☐ government/business agency

☐ no jobs ☐ other.....

1.6 Length of stay in current place:

☐ 0-5 years ☐ 6-10year ☐ over 10 years

1.7 Are you immigrant: ☐ Yes ☐ No

If yes, from where: District's name.....~~Ward's~~ VDC name.....

- Reason of migration: ☐ Marriage ☐ Occupation

☐ Forced evictions or resettlement due to the flooding ☐ Other.....

1.8 Energy of cooking: ☐ Wood ☐ Gas ☐ Manure ☐ Electricity ☐ Other.....

1.9 How much is your income in a month?.....

Is the income enough for livelihood of your household? ☐ Yes ☐ No ☐ Unknown

1.10 Physical indicators (base on observation)

Number of Floors	Height of floors (m)	Materials used ★)	Age of building	area of house(m 2)	Visible conditions/ observation

Code ★): Adobe (AD), Brick in mud (BM), Brick in cement (BC), Reinforced concrete<3stories (RC3), Reinforced concrete > 4 stories (RC4), Thatched (TH), Straw (ST)

1

Part 3:

2.1+* Did you loose your land due to flooding?
☐ Yes ☐ No
If yes, When .... Year
Area .... Sqm / bigha.

2. Risk of Flooding

2.1 Do you live in flooding area? ☐ Yes ☐ No ☐ Unknown
If you know, who provide you the information?
☐ Neighbor ☐ Head of village ☐ Government ☐ Other.................

2.2 How often the flooding happen in your experienced? And when it happens?

No.	Event (Date/Year)	Damage loss experienced? (House, land, persons)	How high was the flood?	Other remarks

2.3 Distance form river/stream (in meters):..m.

2.4 Do you agree if the government relocate your house to other place?
☐ agree ☐ agree more than disagree ☐ disagree more than agree ☐ disagree

2.5 Do you need to elevate your house? ☐ Yes ☐ No ☐ Unknown
Why...

2.6 Do you have personal effort to reduce the impact of flooding? ☐ Yes ☐ No
If yes, by what: ☐ elevating the house ☐ dike ☐ canals ☐other............

2.7 Do you have physical structures to protect the impact of flooding by your community?
☐ Yes ☐ No ☐ Unknown
What is it ☐ dike ☐ canals ☐other...

2.8 What is the cause the flooding? बाढीको कारण के होला?
☐ natural disaster ☐ by human ☐ from God ☐ other.......................
प्राकृतिक विपत्ति दैवीय अन्य

2.9 In case of flooding occurs, what is usually you do?
☐ request the rescue from of Government's Organization
☐ wait until the rescue team comes to help you
☐ escape from your house temporarily
☐ Other...
- Who will you contact the first?
  ☐ Head of village ☐ Local Government ☐ Other...............................
- In case you will escape from your house, to where will you go?
  ☐ open area ☐ school ☐ temple ☐ other.................................
- How many clinic or hospitals nearby your house (in village)?
  ☐ 1 ☐ 2 ☐ more..........What is the name and how far? ....&......(km)

2.10 Personal participation in disaster preparedness program:

Name of Program	Date/years	Which organization/community

2

Part 4:

3. Land right and land tenure arrangement

3.1 Size of land:.....m^2 enough space for your family: ☐ Yes ☐ No ☐ Unknown

3.2 Ownership of land: ☐ Owned by you ☐ Renting ☐ Other.....
If renting, how much do you rent per month.....

3.3 Do your land already registered : ☐ Yes ☐ No ☐ Unknown
[If yes, what kind of certificate/registered:] मोहियानी (Tenancy) / आयोगका प्रमाणपत्र (Commission) / लाल (Land certificate)
If no, why.....

3.4 Have you used your certificate as collateral? ☐ Yes ☐ No ☐ Unknown
If yes, for how much and long do you use it as a collateral: (NPR) .....&.....years

3.5 Type of Land tenure:

☐ Public land ☐ Private land ☐ Government land ☐ Trust land ☐ Other.....

3.6 Type of boundary: ☐ Fixed boundary ☑ General boundary ☐ other.....

3.7 What is the boundary marker do you use in your land?

☐ Concrete Block ☐ wood ☐ plant ☐ natural futures/others..... ☐ गहराको आली

3.8 Do you have conflict of your land boundary: ☐ Yes ☐ No
If yes, what kind of dispute do you have:
☐ unclear boundary ☐ unclear type of land right ☐ Other.....

3.9 For what do you use your land:
☐ rice field ☐ subsistence ☐ cash crops ☐ grazing ☐ other.....

3.10 Do you already felt secure with your property? ☐ Yes ☐ No ☐ Unknown
Why .....

3.11 Are there any barrier on accessing your land during flooding?
☐ Yes ☐ No ☐ Unknown

3.12 What kind of restriction or responsibility of your land/house given by community/the government do you have?

Restriction:	By whom:
Responsibility:	By whom:

Signature of interviewer.....Date.....

Stakeholder Interview Questions
"Land Tenure in Disaster Risk Management"
In Case of Flooding in Chitwan, Nepal (10 September - 3 October 2010)

Part 1:

Organization's name……..…..Date of interview:……

Administration level: ☐ International ☐ Central ☐ District ☐ Village

Part 2:

1. Respondent Information

1.1 Respondent's name……..
Position……
Gender: ☐ Male ☐ Female

1.2 What is your responsibility?
☐ Decision making☐Policy making☐ Managing ☐ Implementation
☐ Others: please, specify……

1.3 How long have you been involved with this organization?.....years

Part 3:

2. Role and Responsibilities of the organization

2.1 Does your organization have the policy to support disaster management?

☐ Yes ☐ No

2.2 What is the main role and responsibilities of you organization?

a…… b……..

c…… d……..

e…… f……..

2.3 Are the role and responsibilities of your organization is/are clear and not overlap with other stakeholders? ☐ Yes ☐ No

If yes, please specify……..…….....

And with which organization?…….

2.4 Does your organization have regular and non-regular meeting with other stakeholders?

☐ Yes ☐ No

If yes, how often? Regular meeting……..……/month/year

Non-regular meeting……../month/year

2.5 What is the implementation of your organization involved in Disaster Risk Management?(you can select more than one)

☐ Prevention/Mitigation ☐Preparedness ☐Risk assessment

☐ Recovery ☐ Respond ☐ other……

What is the name of your program?……..

2.6 Do you have a program to improve your organization's ability to help the vulnerable people from impact of disaster? ☐ Yes ☐ No

What is the name of your program ?.....

2.7 Do you have barriers or challenges implementing your program?
☐ Yes ☐ No If yes, please specify ……..…….....

2.8 Does your organization have regulation and program for sharing data of disaster risk information with other stakeholders? ☐ Yes ☐ No

Part 3:

If yes, by what?

☐ Personal connection ☐ Official processing ☐Other.....

What are the names of the stakeholders which are cooperate?

1.....

2.....

3.....

4.....

5.....

2.9 What kind of problem(s) have you experienced during sharing data between stakeholders?
☐No response ☐Data delay

☐ Incomplete information ☐ other.....

2.10 Does your organization have participation with local stakeholder and communities in decision making? ☐ Yes ☐ No

If yes, what is the name of the local stakeholders or community?

.....

2.11 Does your organization have cooperation with international organization?

☐ Yes ☐ No

If yes, with which organization?.....

what is the project/program?.....

3. Specific Questions

Part 4:

I hereby certify that to the best of my knowledge and belief the facts that I have stated are true.

Signature .....Date.....

Appendix 2: The List of Organizations and Field Works Data Collection Diary

a) The List of Organizations

International Level: According to defined indicators in Chapter 3, it requires the information concerning the coordination and collaboration among local, national and international stakeholders related with the DRM in Nepal. In this research various international organizations have been contacted for the data collection and interview. The list of these organizations is mentioned below. These organizations have mission and responsibility which is concern with DRM in order to support the resilience in the study area.

- Asian Disaster Preparedness Center (ADPC): involve in providing hazard map in Nepal and as the expert in disaster preparedness in Asia.
- Asian Disaster Reduction Center(ADRC-AIT) in Thailand: involve in providing and training about knowledge of DRM.
- International Centre for Integrated Mountain Development (ICIMOD): involve in supporting the resilience in Nepal.
- Action Aid Nepal: involve in developing community in Chitwan District
- Practical Action: involve in supporting the resilience of community in Chitwan.

Central Government Level: The list below describes the names of main organizations and its involvement in central government level. The responsibilities of them are directly related to the land ownership, land use and DRM in Nepal.

- Survey Department (DoS): as in charged organization to provide the policy and guidelines for surveying the land and producing the topographic map.
- Department of Land Reform and Management (DoLRM): as in charged organization to provide the policy and guidelines for registering of landownership.
- Nepal Centre for Disaster Management (NCDM) and Disaster Preparedness Network-Nepal (DPnet): as in charged organization to responsibility of DRM in Nepal.
- Department of Water Induced Disaster Prevention (DWIDP): as in charged organization to provide the master plan for preventing the flood disaster along Narayari River.
- National Land Use Project: in charged organization to produce the land use map.

District Government Level: District Government level is the local government who plays the main role to support DRM activities during disaster emergency time because this level has direct contact with community. They are responsible for implementing the appropriate land policy and DRM in local hazard risk situation. This level can provide the useful information for assessing the indicators, especially the indicator of land registration element. The names and the role of each organization involved in Chitwan district are as follow:

- Survey Office (SO): as in charged organization to provide surveying the land in study area. This organisation is as a local office of DoS
- Land Revenue Office (LRO): as in charged organization for registering landownership. This organisation is as a local office of DoLRM.
- People's Embankment Program (DWIDP Office in Chitwan): as organizations in charged in providing the structural and non-structural measures for preventing the flood disaster along Narayani River.
- Royal Chitwan National Park Authority: involved in managing and controlling the conservation area along Narayani River in the study area.
- Buffer Zone Management Committee: as organization involve in managing and controlling the conservation area along Narayani River in the study area.
- District Administration Office (DAO): as public administration organizations in study area.
- District NGO.Co Ordination committees and Common Forum of NGOs on Natural Disaster Management as local NGO dealing with DRM in study area.

- District Development Commitee: as in charged organization in preparedness activities in Chitwan District.

Village Level: Village level is another local government level which is very important level as it provides the information to assess the indicators of land tenure security element and DRM activity. The lists of interviewee in village level are as follows:

- Formal Chief of Dibyanager village: as in charged representative of people in study areas
- VDC Secretary in Dibyanager Village: as in charged representative of people in study areas
- People in Dibyanagar Village, Chitwan, Nepal though household survey questionnaire

b) Field Works Data Collection Diary (10 September – 3 October 2010)

Date	Place	Activities	Primary/Secondary Data	Transport ation
10 Sep	Enschede, The Netherlands	• Travelling from The Netherlands to Nepal	-	By train and airplane
11 Sep	Kathmandu, Nepal	• Arrival to Kathmandu, Nepal at 8.15 am • Traveling from airport to International Guest Home • Meeting with KU Supervisors - Mr.Ganesh PraSad Bhatta - Mr.Reshma Shrestha • Preparing data for meeting with Kathmandu University (KU)	-	KU supervisor's car
12 Sep	KU (School of Management) Kathmandu, Nepal	• Meeting with KU Dean and KU supervisors for support in fieldwork data collection. List of name in the meeting are following: - Prof. Dr.Bhola Thapa (Dean, School of Engineering) - Prof. Dr.Ramesh Kumar Maskey - Mr.Genesh Prasad Bhatta - Mr.Janak Raj Joshi - Mr.Arun Kr. Pratihast - Ms.Reshma Shrestha - Mr.Subash Ghimire - Ms.Chinnapan Charoenkalunyuta - Mr.Ratnayake, M.S.B.R. • Preparing data for interviewing stakeholders	-	By taxi

13 Sep	Survey Department Kathmandu, Nepal	• Collecting secondary data	Spatial Data • Topographic Maps scale 1:25,000 (Dibyanagar village, case study cover 4 sheets: 2784-05B, 2784-05D, 2784-06A, and 2784-06C) • Aerial Photo in 1992 scale 1:50,000 (Dibyanagar village, case study cover 3 photos)	By taxi
	International Center for Integrated Mountain Development (ICIMOD) Kathmandu, Nepal	• Interviewing to: - Dr.Giriraj Amarnath: RS Specialist - Mr.Basanta Shrestha: Division Head/Geoinformation Specialist - Mr.Sagar Ratna Bajracharya: Land and Water Analyst - Mr.RajeshThapa: Land and Water Analysis	• Close and open interview • Disaster risk management in Nepal	KU supervisor's car
14 Sep	KU (School of Management) Kathmandu, Nepal	• Presenting the thesis proposal and discussion with: - Prof. Dr.Ramesh Kumar Maskey - Mr.Genesh Prasad Bhatta - Mr.Janak Raj Joshi - Mr.Arun Kr. Pratihasi - Mr.Subush Ghilnire - Ms.Chinnapan Charoenkalunyuta - Mr.Ratnayake, M.S.B.R.	-	By taxi
	Department of water Induced Disaster Pervention (DWIDP) Kathmandu, Nepal	• Interviewing to Mr.Pradeep Thapa: Project Manager of People's Embankment Program, Narayani River-Chitwan, Nepal	• Close and open interview	KU supervisor's car
15 Sep	Bharatpur Kathmandu, Nepal	• Preparing data for interviewing stakeholders in Chitwan District • Traveling from International Guest House, Kathmandu to Chitwan, Nepal	-	By taxi and airplane
	Land Revenue Office (LRO) Chitwan, Nepal	• Interviewing to Mr.Keshab P.Ghimire: Office Manager	• Close and open interview	-

16 Sep	Royal Chitwan Nation Park Authority Chitwan, Nepal	• Interviewing to Mr.Jagannath Singh: Under Secretary and Mr.Ganesh Pant: Assistance conservation officer	• Close and open interview	By taxi
	Buffer Zone Management Committee Chitwan, Nepal	• Interviewing to Mr.Bishnu Dhakal: Staffs of Management Committee and Mr.Laxman Paudel: Assistance warder.	• Close and open interview	
	District Administration Office (DAO) Chitwan, Nepal	• Interviewing to Mr.Basant Rai Gautam: Chief District Officer	• Close and open interview	
	Department of Water Induced Disaster Pervention (DWIDP) Chitwan, Nepal	• Interviewing to Mr.Punya Prorkarel: Irrigation Engineer in Narayani River (People's Embankment Program) Project and collecting data: - Flood risk area • Master Plan of Narayani River Training Works (Chitwan&Nawalparasi)	• Close and open interview • Master Plan of Narayani River Training Works (Chitwan&Nawalparasi) <u>Spatial Data</u> • Flood hazard area scale 1;25,000	
	Survey Office (SO) Bharatpur (Head of Chitwan District), Chitwan, Nepal	• Interviewing to Mr.P.R.Joshi: Head of Survey office(SO), Chitwan and collecting data: • Cadastral Map with registration records in risk area in Dibyanagar Village(case study) • Discussion with KU Supervisors and Head of Survey Office to revise and translate Household Survey Questionnaire to be fit with case study • Training assistant for household surveying	• Close and open interview <u>Spatial Data</u> • Flood effected in cadastral map with registration records	
17 Sep	Dibyanagar village Chitwan, Nepal	• Surveying and interviewing households by hiring 2 local assistants(collected 30 households) • Interviewing to village's stakeholders: • Mr.Budhi Bahadur Gurung: Formal Chief of Dibyanager village • Padma Pr.Dhakal: V.D.C. Secretary in Dibyanager Village	• Close and open interview • Household Survey	

18 Sep	Dibyanagar village Chitwan, Nepal	• Surveying and interviewing households by hiring 2 local assistants (collected 40 households)	• Household Survey	
19 Sep	Dibyanagar village Chitwan, Nepal	• Surveying and interviewing households by hiring 2 local assistants (collected 30 households)	• Household Survey	
20 Sep	Dibyanagar village Chitwan, Nepal	• Survey observation	• Survey observation	
	Lumpini - Chitwan, Nepal	• Visit holy place, the place of Lord Buddha	-	
21 Sep	District NGO.Co Ordination committees and Common Forum of HGOs on Natural Disaster Management Chitwan, Nepal	• Interviewing to Mr.Dipak Lamichhane: Field Coordinator	• Close and open interview	
	District preparedness plans (DDRCs) Chitwan, Nepal	• Interviewing to Mr.Balram Luitel: Information Officer and data collecting secondary data	• Close and open interview • Chitwan District Disaster Management Action Plan	
	Bharatpur Chitwan, Nepal	• Traveling from Chitwan to Kathmandu , Nepal	-	By airplane
22 Sep	Genesis Consultancy (P) LTD. Kathmandu, Nepal	• Interviewing to Mr.Anish Joshi: Managing Director and collecting data	<u>Spatial Data</u> • Boundary of Nepal • Boundary of Districts in Nepal • Boundary of Village(VDC) in Chitwan • Boundary of Dibyanagar Village Digital GeoEye imagery in 18th February 2010 resolution 2.0 m. for MSS and in 26th February 2010 for Panchromatic resolution 50 cm. • Cadastral digital map	By taxi

23 Sep	Nepal Centre for Disaster Management (NCDM) and Disaster Preparedness Network-Nepal(DPnet) Kathmandu, Nepal	• Interviewing to Dr.Meen B. Poudyal Chhetri: Chairman and data collecting secondary data	• Close and open interview • Disaster Preparedness Network Nepal • Good Practices on Disaster Risk Reduction in Nepal • DPnet-Nepal Strategy, 2009-2013	By taxi
	Action Aid Nepal Kathmandu, Nepal	• Interviewing to Mr.ShyamSundarJnavaly: Senior Theme Leader Human Security Emergency and Disaster	• Close and open interview	By taxi
24 Sep	Survey Department (DoS) Kathmandu, Nepal	• Interview and courtesy visits to Mr.Raja Ram Chhatkuli: Director General	• Close and open interview	By taxi
	Department of Land Reform and Management (DoLRM) Kathmandu, Nepal	• Interview and courtesy visits to Mr.JeetBahadurThapa: Director General	• Close and open interview	By taxi
	Practical Action Kathmandu, Nepal	• Interviewing Mr.DinanathRhhandar: Project manage and data collecting secondary data	• Close and open interview • Understanding Disaster Management in Practice with reference to Nepal • Approaches to disaster risk reduction	By taxi
25 Sep	Kathmandu, Nepal	• Preparing the presentation to KU	-	-
26 Sep	National Land Use Project Kathmandu, Nepal	• Interviewing to Mr.H.M.Mishra: Project Chief and Mr.PremB.Mahariar:Survey Officer data collecting secondary data	• Close and open interview • Present Land Use Map of DibyanagarVDC of Chitwan district Report <u>Spatial Data</u> • Digital GeoEye imagery in 18th February 2010 resolution 2.0 m. for MSS and in 26th February 2010 for Panchromatic resolution 50 cm. • Present Land Use map, Land capability, Land Use Zoning and Soil Map	By taxi
	Kathmandu, Nepal	• Preparing the presentation to KU	-	
27 Sep	KU (School of Management) Kathmandu, Nepal	• Presenting field work report to KU Dean, KU supervisors and KU/Land Management Training center(LMTC) staffs	-	By KU bus

28 Sep	Kathmandu, Nepal	• Travelling from Kathmandu, Nepal to Bangkok, Thailand	-	By airplane
29 Sep	Bangkok, Thailand	• Arrival to Bangkok, Thailand • Preparing visits to ADPC and ADRC-AIT	-	-
30 Sep	Asian Disaster Preparedness Center (ADPC) Bangkok, Thailand	• Interviewing to • Ms. Gabrielle Iglesias: Information and Networking, Urban Disaster Risk Management • Mr.KittiphongPhongsapan: Research (GIS) Coordinator, Urban Disaster Risk Management and collecting secondary data	• Close and open interview • The experience/lesson of disasters and flooding in Thailand Spatial Data • Nepal hazard risk assessment map	-
1 Oct	Asian Disaster Reduction Center (ADRC-AIT) Bangkok, Thailand	• Interviewing to Dr.Lal Samarakoon: Director, Geoinformatics Center	• Close and open interview	-
2 Oct	Bangkok, Thailand	• Preparing returns to The Netherlands • Travelling from Thailand to The Netherlands	-	By airplane
3 Oct	Enschede, The Netherlands	• Arrival to Amsterdam, The Netherland • Travelling from Schipol Airport (Amsterdam) to Enschede	-	By train

Appendix 3: Data Collection and Photos during Field Work in Nepal

The non-spatial data collected as follows:

- Cadastral record from SO (for mapping)
- Information concerning disaster risk management: from ICIMOD
- The experience/lesson learnt of disasters and flooding in Thailand; from ADPC
- Document concerning disaster risk management in Nepal; from ICIMOD
- Book with title "Understanding Disaster Management in practice with reference to Nepal" ; from Practical Action
- Approaches for disaster risk reduction; from ICIMOD
- Disaster Preparedness Network Nepal; from ICIMOD
- Good Practices on Disaster Risk Reduction in Nepal; from DPnet
- DPnet-Nepal Strategy, 2009-2013; from NCDM and DPnet
- Master Plan of Narayani River Training Works (Chitwan&Nawalparasi); from DWIDP
- Chitwan District Disaster Management Action Plan; from District Development Committee
- Present Land Use Map of DibyanagarVDC of Chitwan district Report; from National Land Use Project

The spatial data collected as follows:

- The administrative boundary map of the country, district and Dibyanagar village from DoS (for mapping)
- Topographic Maps scale 1:25,000 (Dibyanagar village, case study is covered by 4 sheets: 2784-05B, 2784-05D, 2784-06A, and 2784-06C); from DoS (for mapping)
- Digital GeoEye imagery in 18th February 2010 resolution 2.0 m. for MSS and in 26th February 2010 for Panchromatic resolution 50 cm; from National Land Use Project and Genesis Consultancy (P) LTD. (for mapping)
- Flood hazard area scale 1:25,000; from DWIDP (for mapping)
- Flood effected in cadastral map with registration records; from SO (for mapping)
- Cadastral digital map; from SO and Genesis Consultant (P) LTD. (for mapping)
- Present Land Use map, Land capability, Land Use Zoning and Soil Map; from National Land Use Project
- Aerial Photo in 1992 scale 1:50,000 (Dibyanagar village, case study cover 3 photos); DoS
- Nepal hazard risk assessment map; from ADPC

Figure A-1: Training Process Given to the Assistants for Collecting the Data by KU Supervisors.

Figure A-2: Collecting the Data in Dibyanagar Village, Chitwan, Nepal

Figure A-3: Supporting Household Survey Data Collection by Officer from Survey Office (SO), Chitwan

Figure A-4: Interviewing Stakeholders

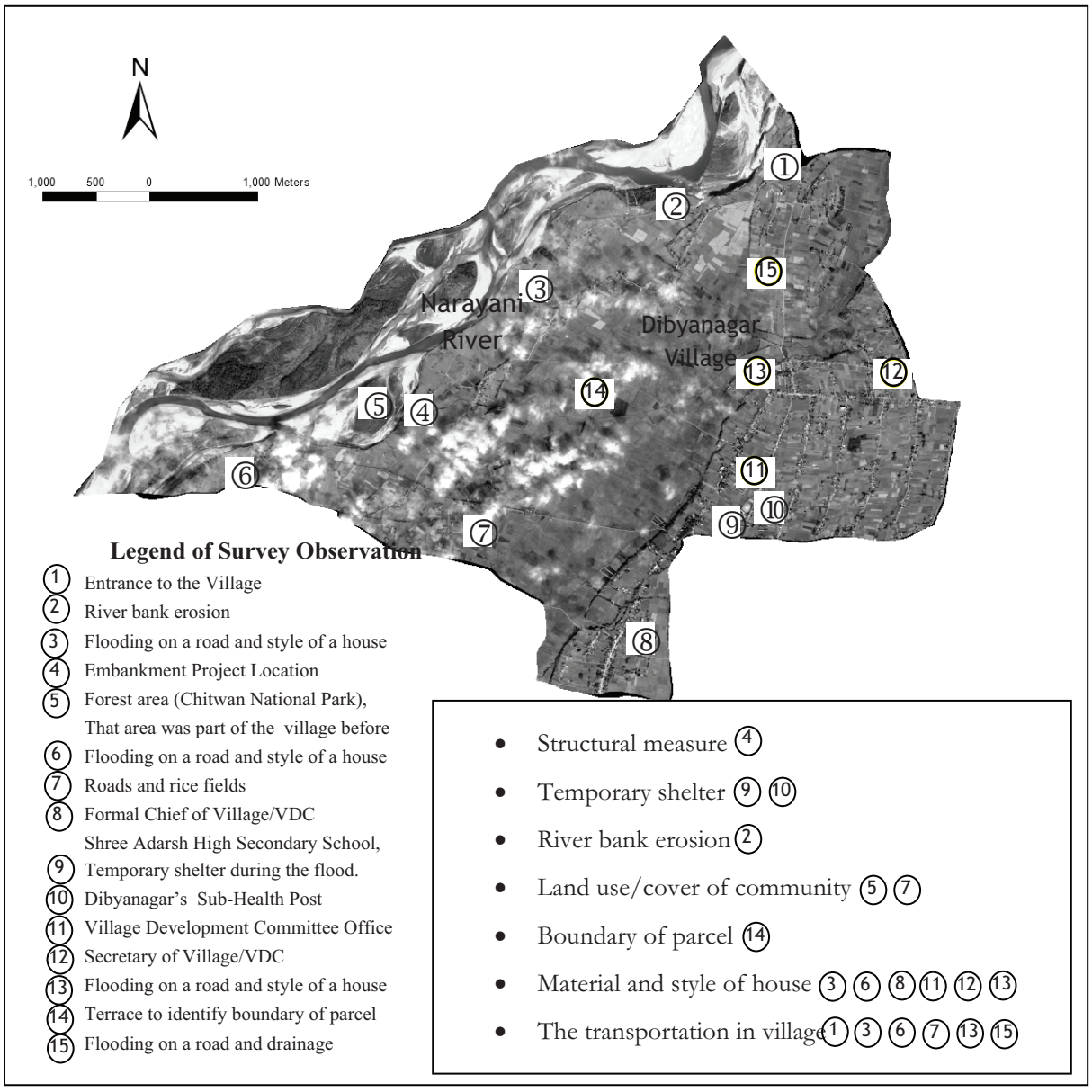

Figure A-5: Survey Observation Points

Figure A-6: Survey Observation Photos

Figure A-7: Secondary Data Collection

Appendix 4: Spatial Data Collection

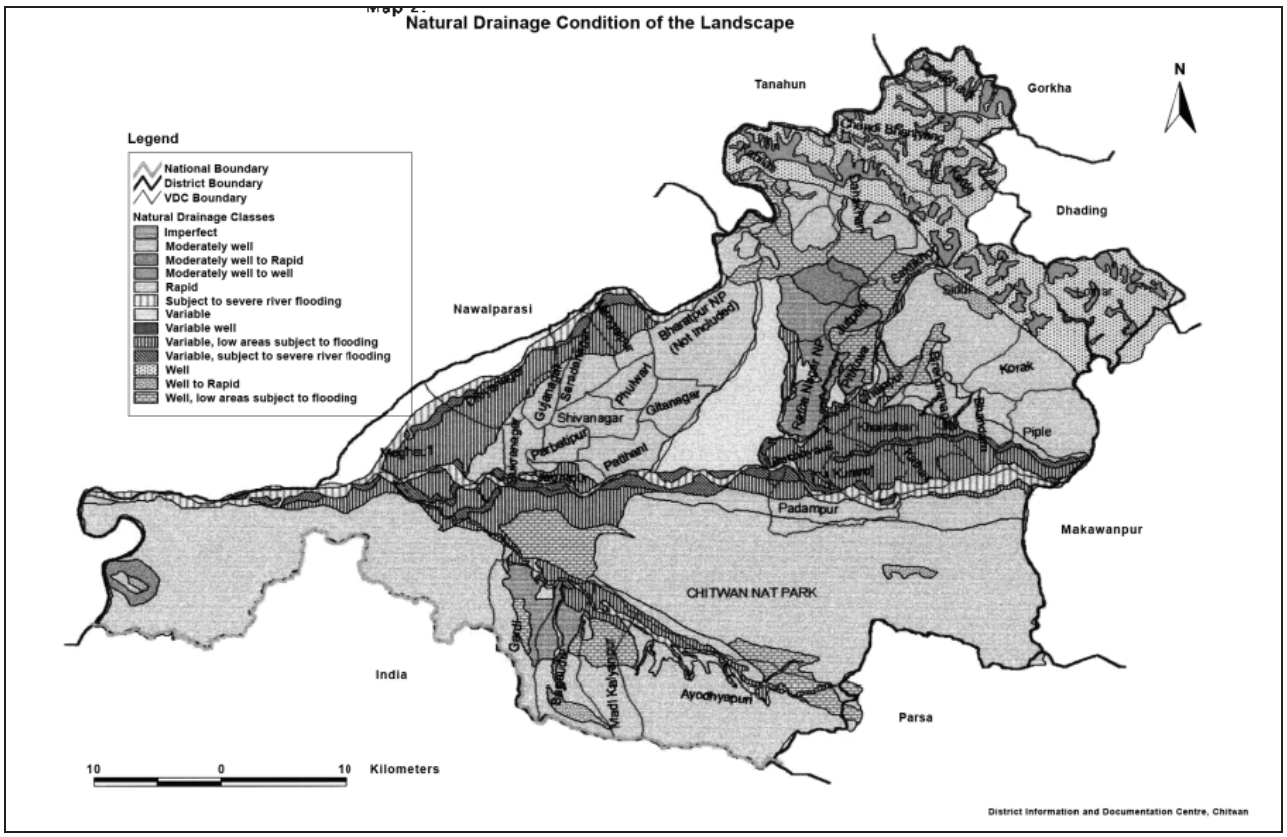

Figure A-8: Flood Hazard Map from Chitwan District Disaster Management Action Plan

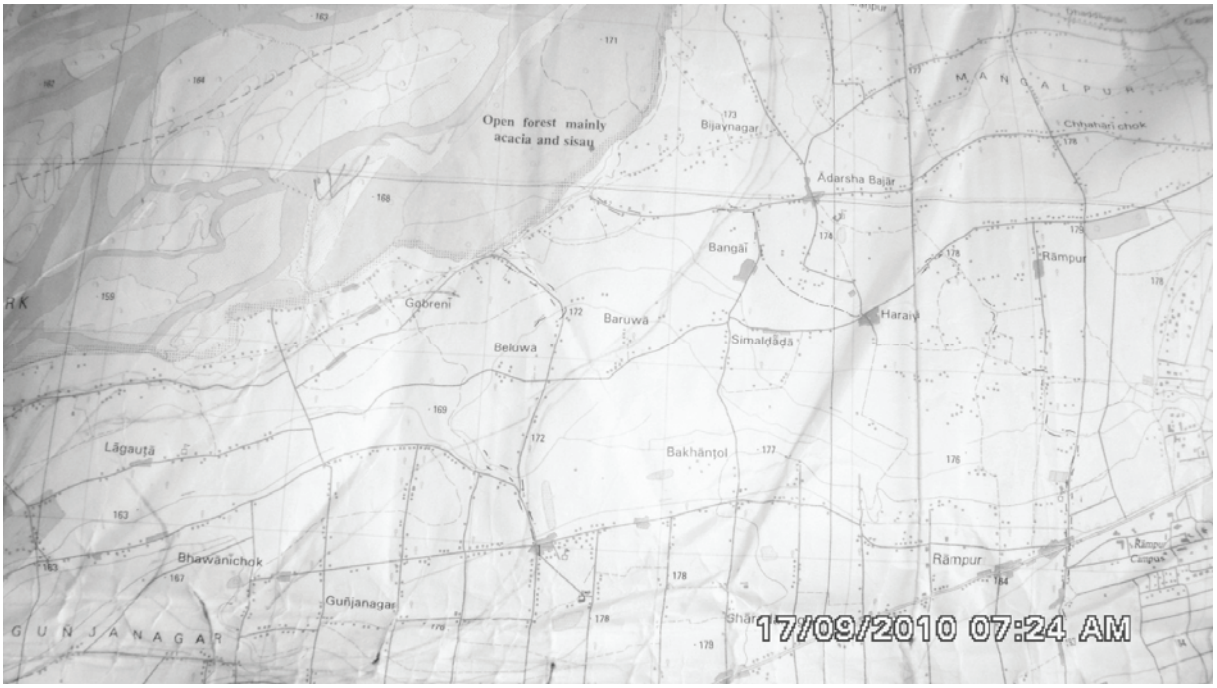

Figure A-9: Flood Hazard Area from DWIDP scale 1:25,000

Figure A-10: Example of Flood Effected in Cadastre Map in Dibyanagar, Chitwan, Nepal

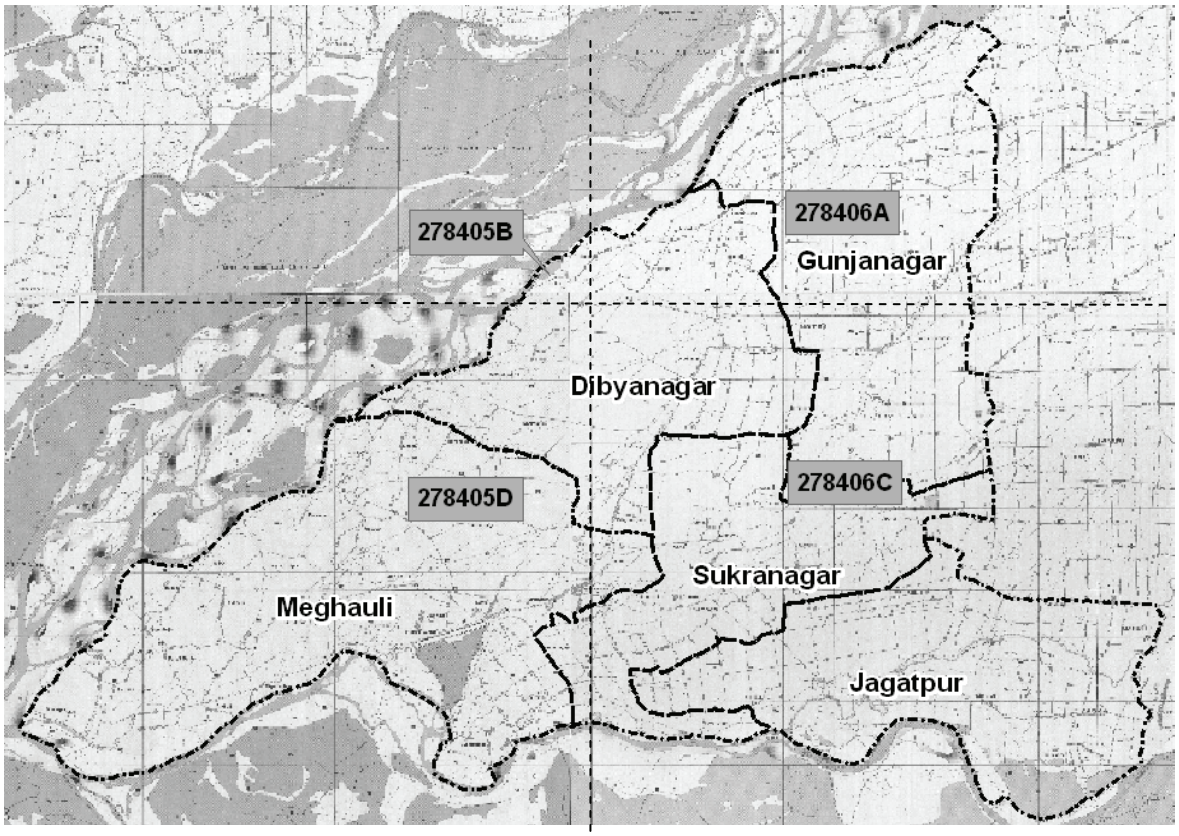

Figure A-11: Topographical Map scale 1:25,000 (Dibyanagar village, case study cover 4 sheets: 2784-05B, 2784-05D, 2784-06A, and 2784-06C)

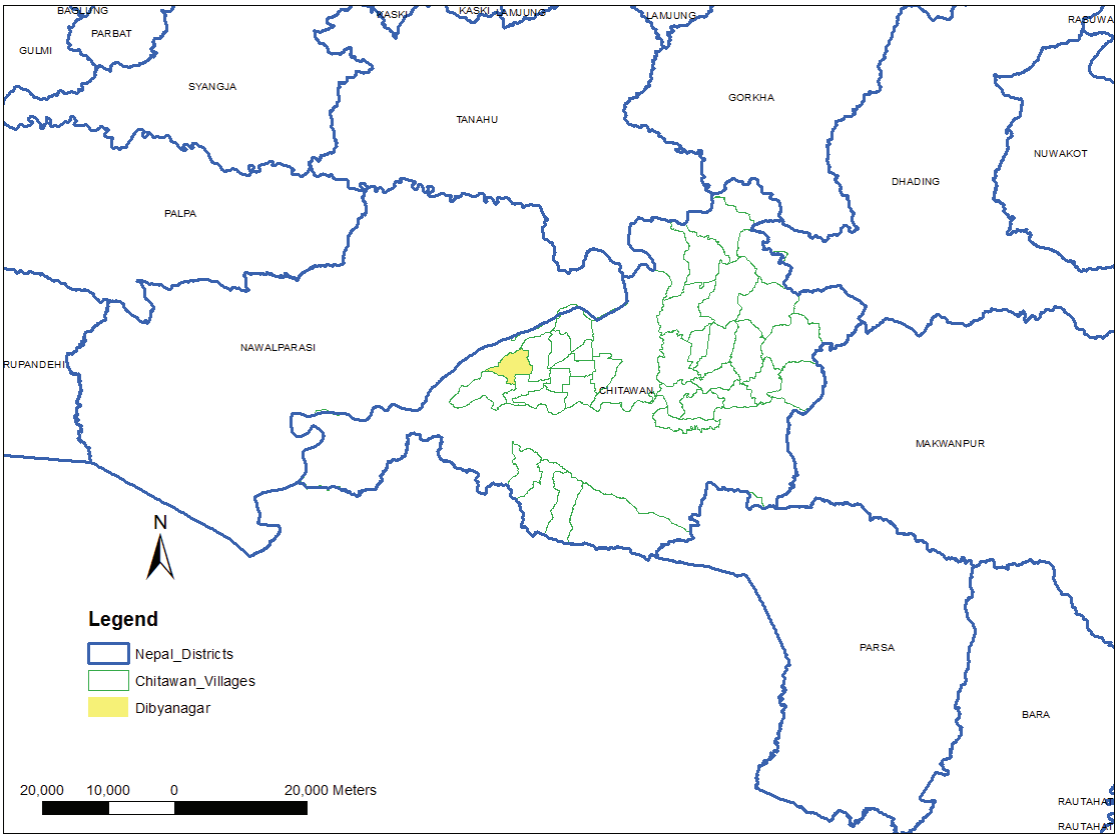

Figure A-12: Boundary of DibyanagarVallage, Chitwan, Nepal

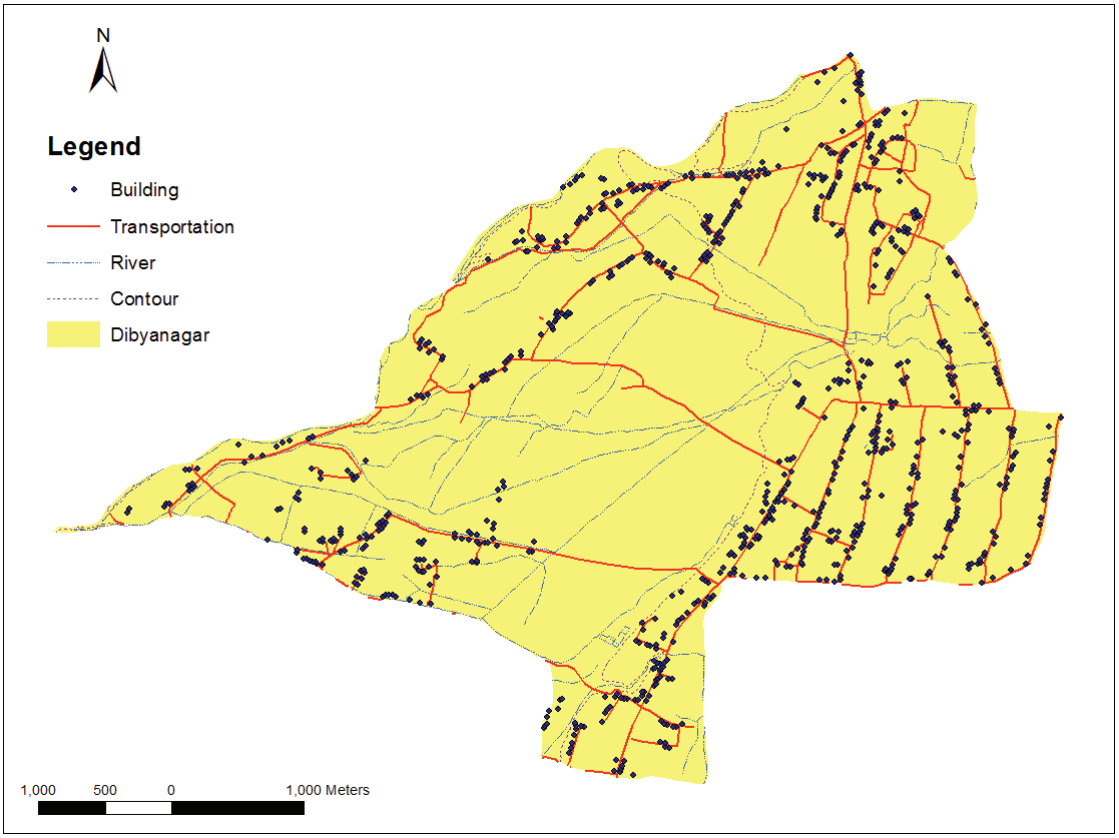

Figure A-13: Building, Transportation, River and Contour of DibyanagarVallage, Chitwan, Nepal

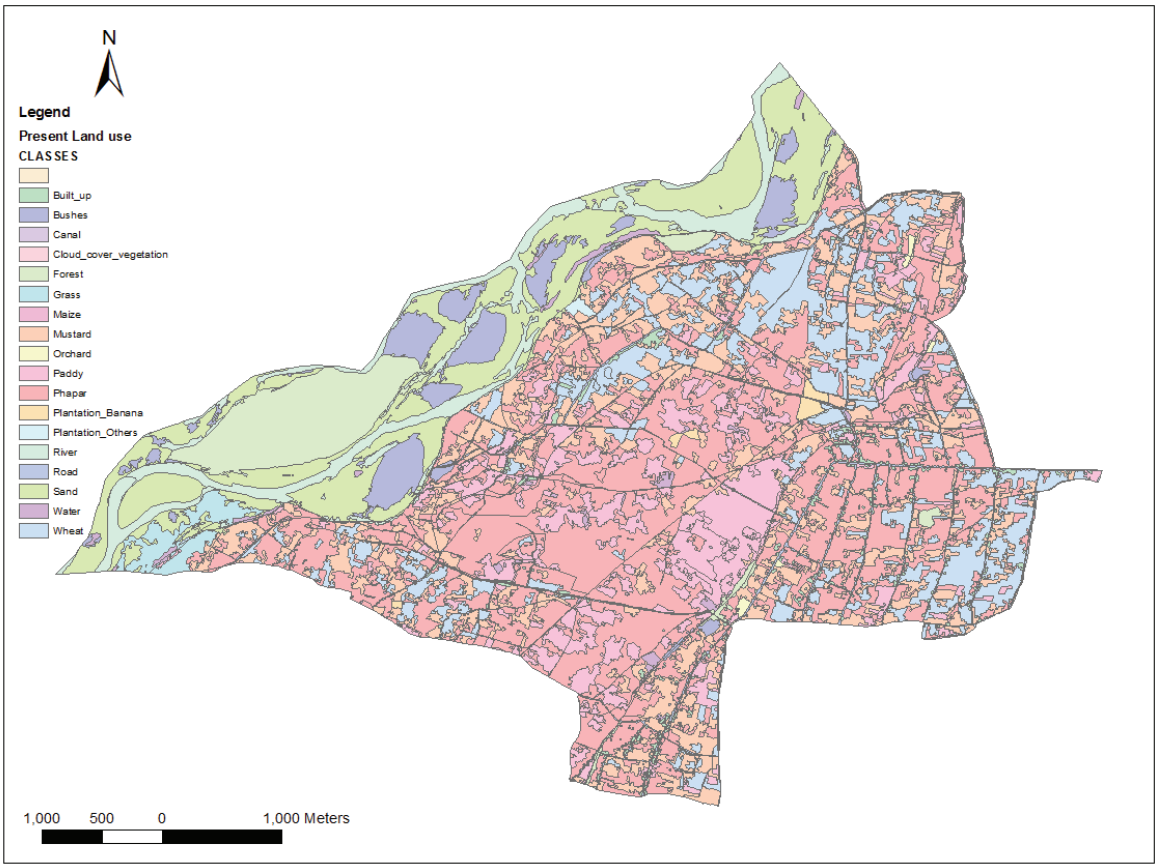

Figure A-14: Present Land Use of Dibyanagar Village, Chitwan, Nepal

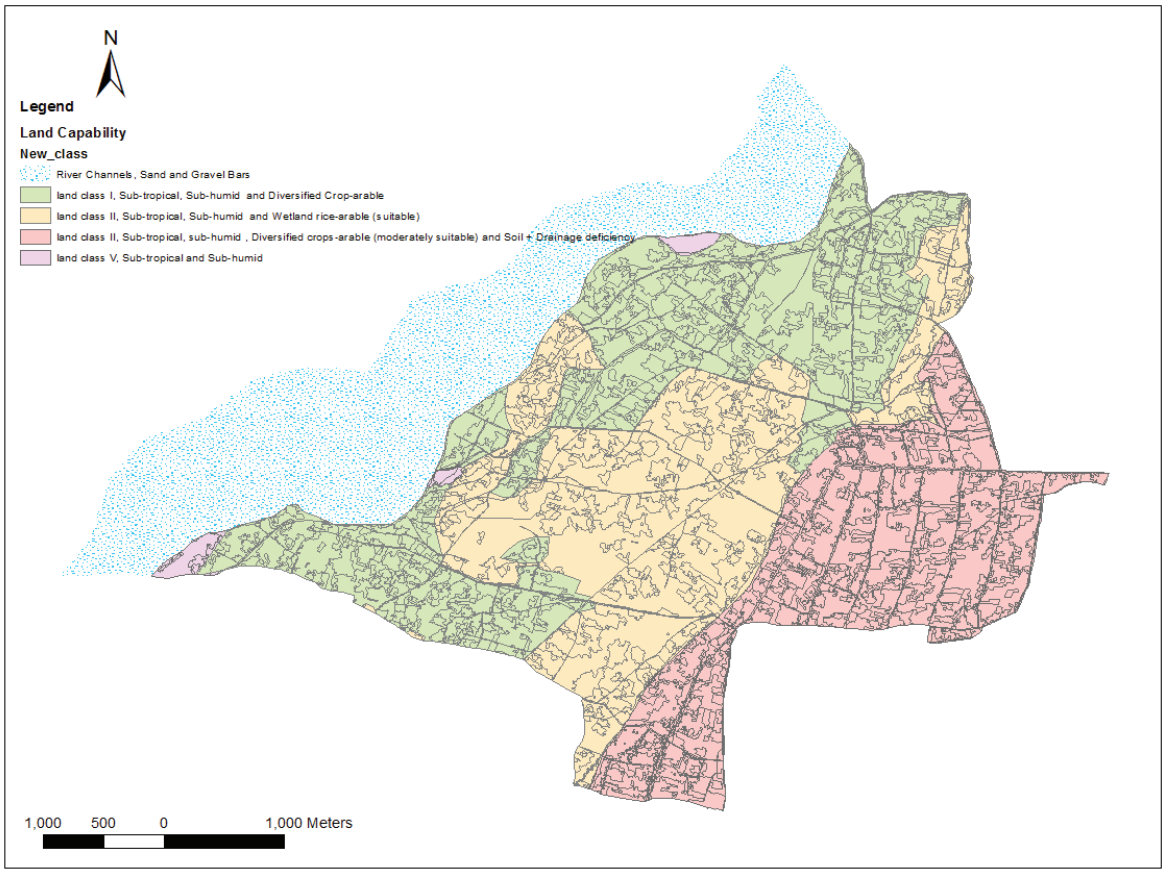

Figure A-15: Land Capability of Dibyanagar Village, Chitwan, Nepal

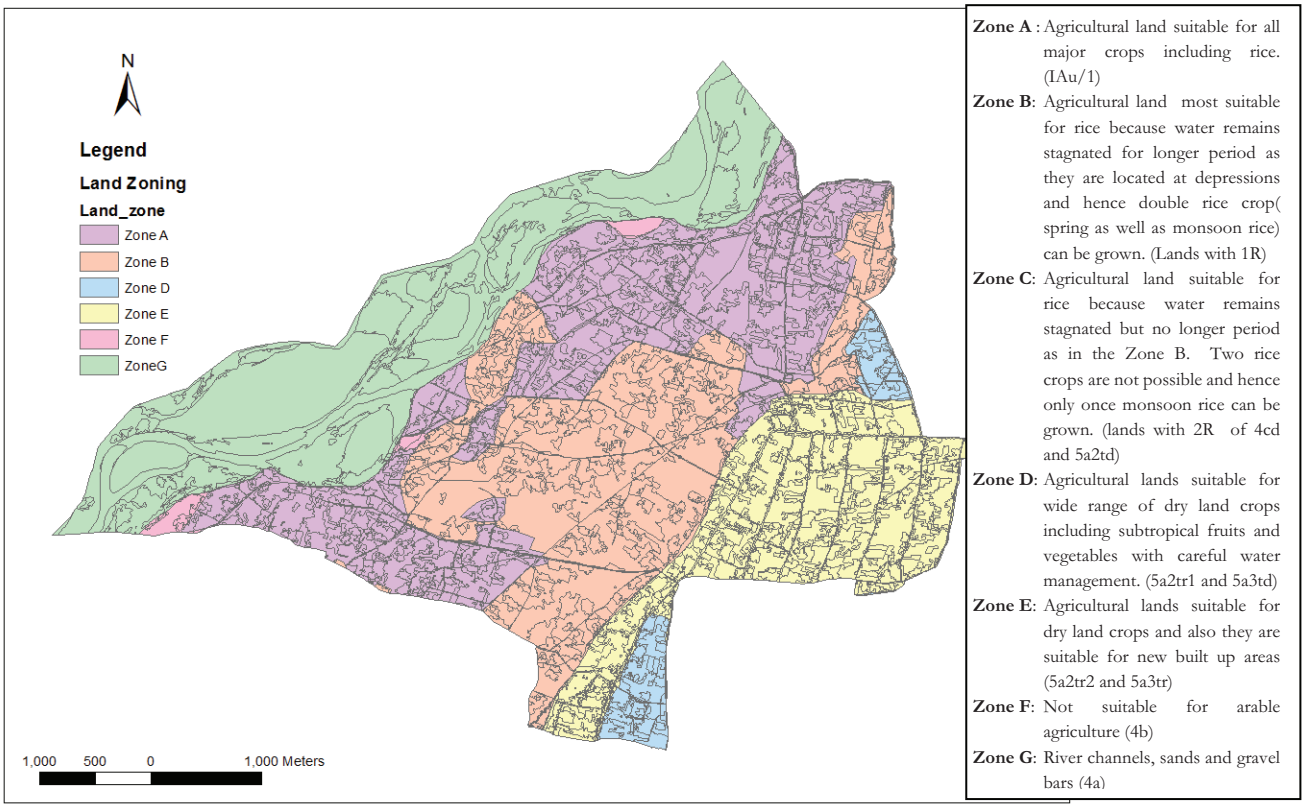

Figure A-16: Land Use Zoning of Dibyanagar Village, Chitwan, Nepal

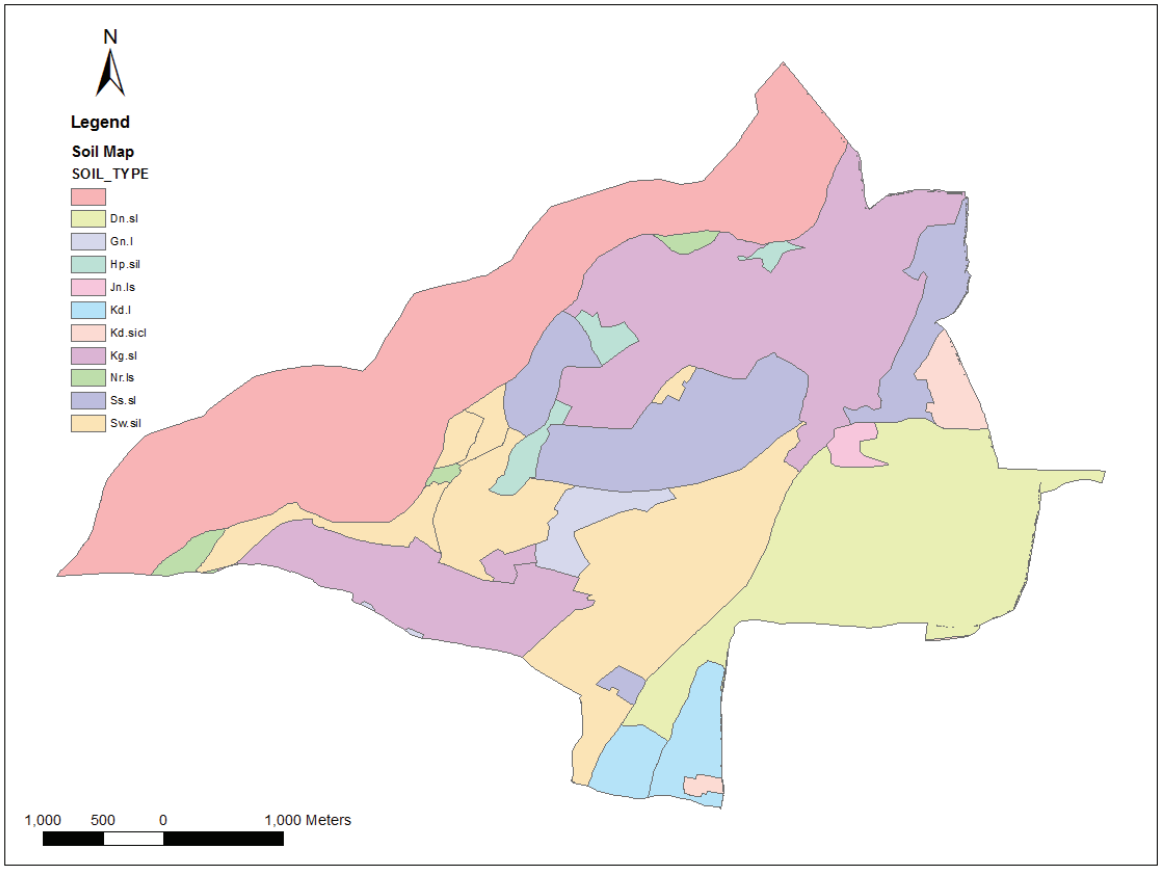

Figure A-17: Soil Map of Dibyanagar Village, Chitwan, Nepal

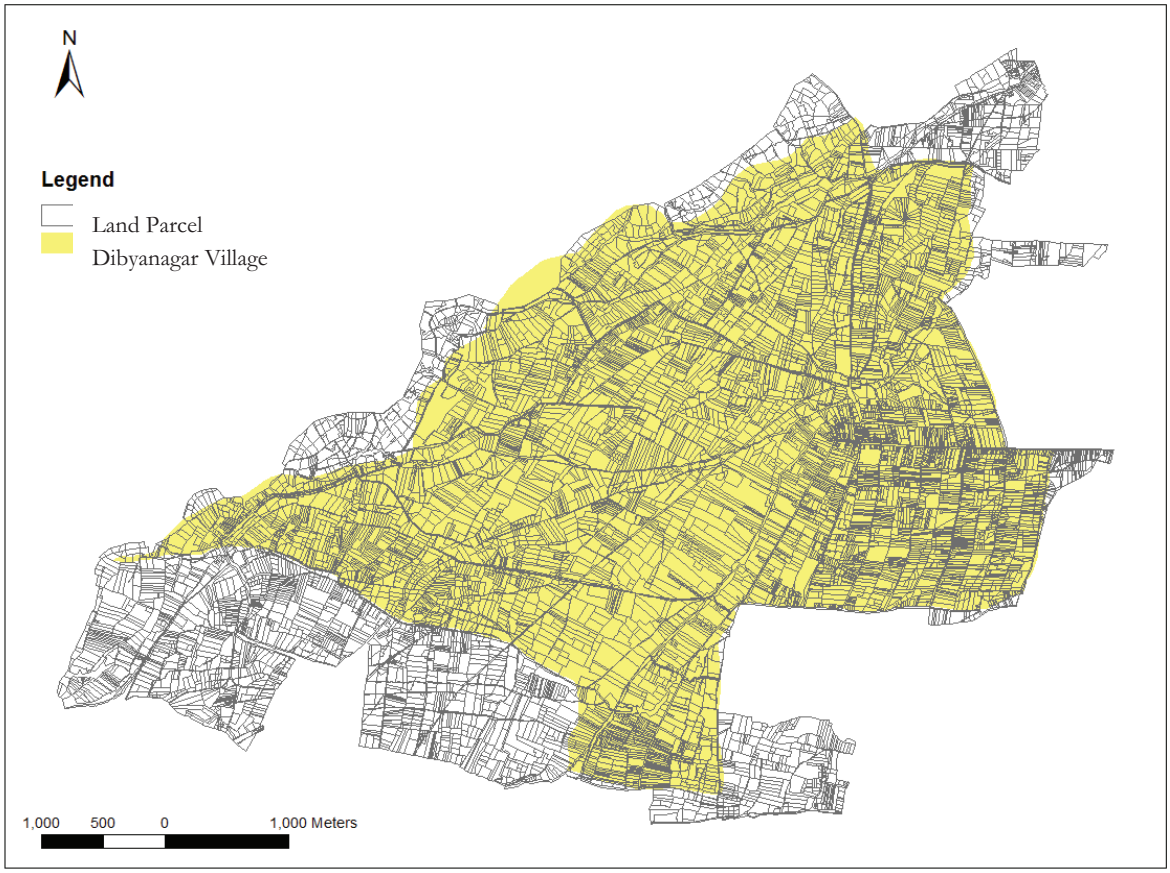

Figure A-18: Cadastral Digital Map

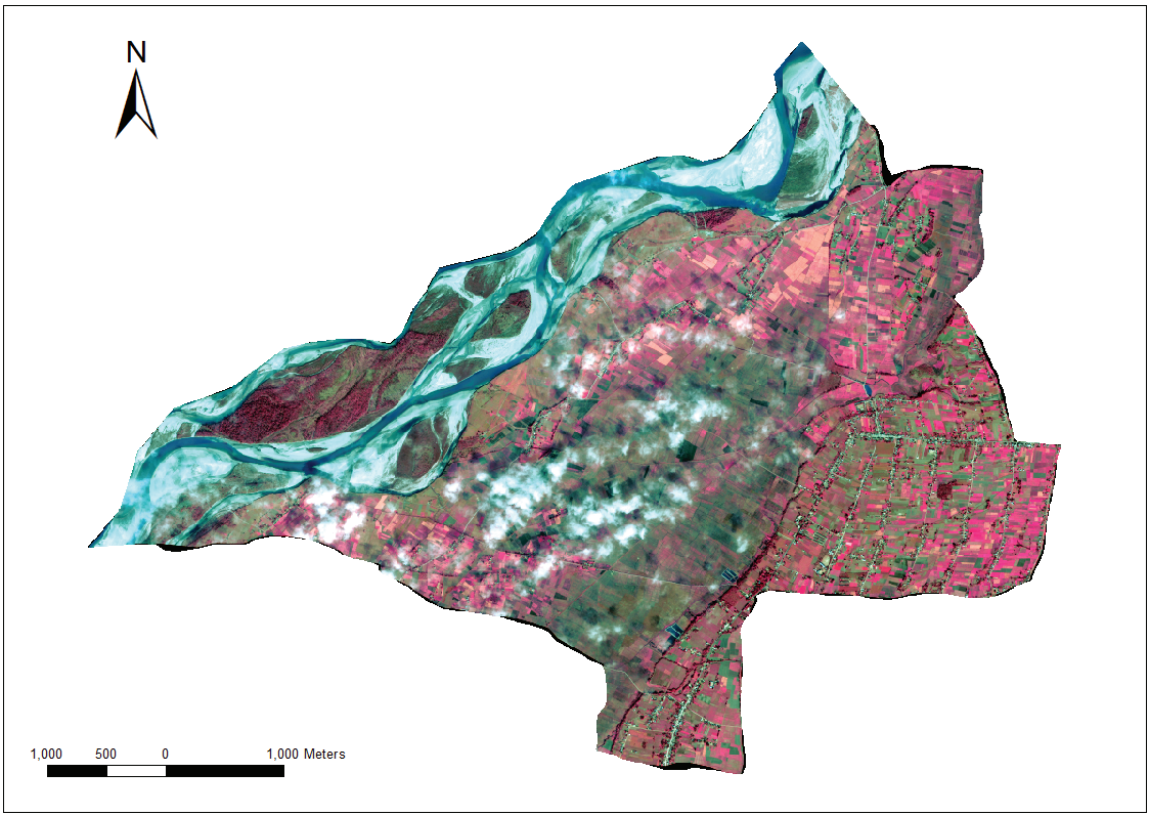

Figure A-19: Digital GeoEye imagery in 18th February 2010 resolution 2.0 m. for MSS and in 26th February 2010 for Panchromatic Resolution 50 cm.

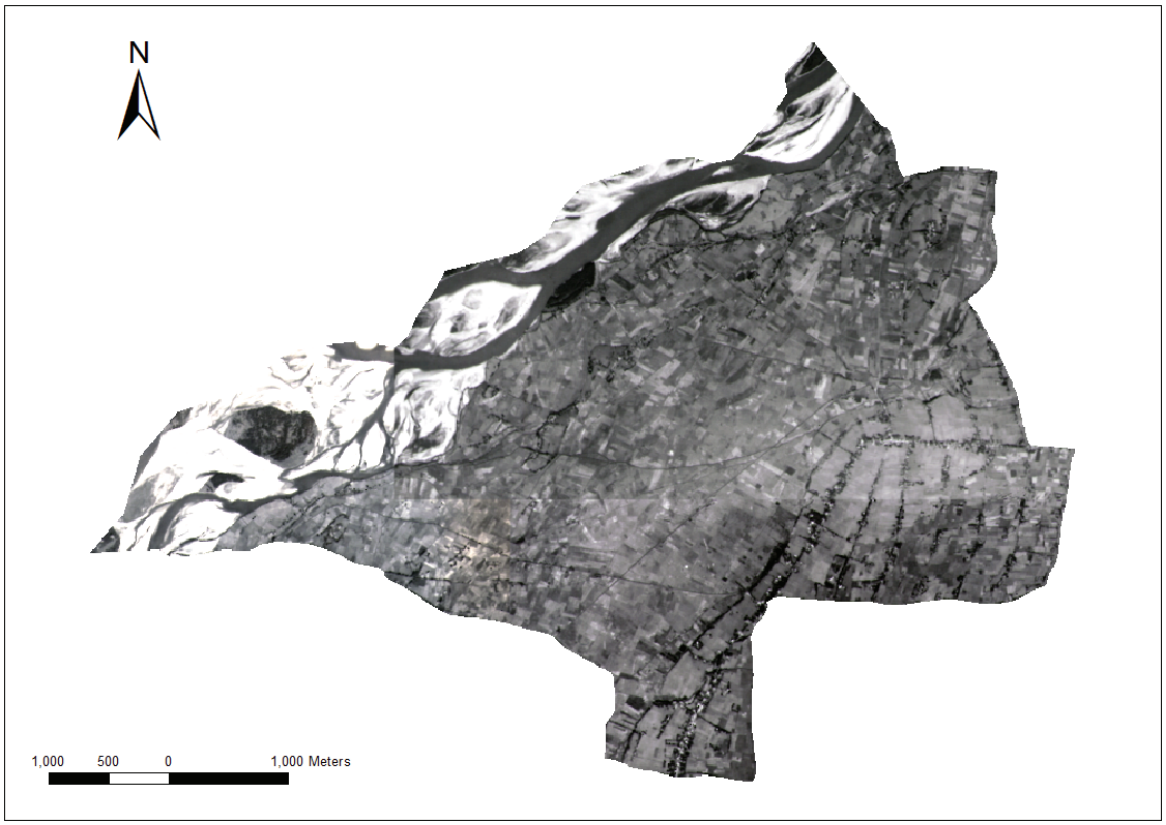

Figure A-20: Aerial Photo in 1992 Scale 1:50,000 (Dibyanagar village, case study cover 3 photos)