

United Nations Disaster Management Team

Disaster Management Analysis in Bhutan

FINAL VERSION

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Executive Summary

The **specific objectives of the present analysis** dealing with the disaster management situation in Bhutan are three-fold:

- To analyse the causes and vulnerability to natural hazards in Bhutan as well as their socio-economic impact;
- To provide a clear picture of the organizational mechanisms and related legislative framework currently in place within the country;
- To provide a set of possible organizational options based upon models from other countries.

Apart from providing support to the Royal Government of Bhutan (RGoB) in weighing the merits of a more integrated approach to disaster management, the analysis is also intended to support the United Nations Development Assistance Framework (UNDAF) Country Programme formulation and Common Country Assessment (CCA) processes.

The **main methods used** to undertake the analysis include a review of existing documentation and the conduct of individual interviews with the relevant stakeholders. A half-day working session was also organised with key persons in the relevant departments/agencies to collect preliminary information on vulnerability to natural hazards in Bhutan. **The major limitation of the analysis** is that information has been collected only from key actors at central level.

This report is divided into five main sections. While Section 1 provides information on the background, objectives, methods used and limitations of the analysis, Section 2 presents the **different types of natural hazards in Bhutan** and analyses the **causes, vulnerability and impact** in relation to the major natural hazards identified. Earthquakes, floods including flash floods and glacial lake outburst floods (GLOFs), landslides and forest fires constitute the major types of natural hazards to which Bhutan is prone. The present analysis will therefore mainly focus on these particular types of natural hazards. In addition, Bhutan is prone, though to a lesser extent, to outbreaks of pests and epidemic diseases, droughts, wind, storms, hail and lightning.

Bhutan lies in one of the most seismically active zones of the world primarily attributable to the continent-continent collision of the Eurasian-Indian plates. While there is no detailed seismic micro-zonation of the country, it can reasonably be assumed that Bhutan is either in seismic zone IV or V since the north-eastern parts of India contiguous to Bhutan fall under seismic zone V (seismically most active). Hence, the threat of a significant **earthquake** is ever present.

There are no comprehensive and official historical records tracking earthquakes and damage caused in Bhutan. Some information regarding the impact in Bhutan of past earthquake events could however be compiled based on limited information that is included in different available documents making mention of these events. Mention is made of destruction of/damage to ancient religious buildings, minor cracks in several buildings, and landslides on the highways caused by the tremor as consequences in relation to past earthquake events. Then again, the available documents do not refer to anything on property and human life losses, except for the earthquake in 1980 with epicentre in Gangtok area, Sikkim, India, where it seems that a few human casualties were reported in some parts of the country, and from an account by Shikya-rinchen (1710-1759) that makes mention of a major earthquake that occurred in Western Bhutan in the spring of 1713.

The participants during the half-day working session of which mention has been made earlier identified the high density cities/settlements (e.g. Thimphu, Phuentsholing, Samdrup Jonkhar),

institutions (e.g. schools including school for disabled children, hospitals, Dzongs) and infrastructure (e.g. power, roads, dams) as being the most vulnerable to earthquake in Bhutan.

Under the influence of global warming, the threat of **GLOFs** in Bhutan is increasing. Glacier retreat, which is believed to be possibly accelerating in Bhutan, leads to the formation of numerous glacial lakes that might result in flash floods if the barriers or dams of these lakes fail, causing severe damages downstream in terms of loss of lives, economy and infrastructure.

A recent study carried out by the Department of Geology and Mines (DGM) in collaboration with the International Centre for Integrated Mountain Development (ICIMOD) has identified 24 glacial lakes that could pose a potential threat of a GLOF in the near future. Another study by the DGM along with the Institute of Geology, University of Vienna, Austria, warns of possible danger of Raphstreng and Thorthormi glaciers and GLOF risk potential of their lakes, unless mitigation measures are taken.

Although several cases of GLOFs have been reported over the past few decades, detailed written records of damage exist only for the 1994 GLOF that was due to the outburst of Luge Tsho lake in Eastern Lunana and caused extensive damages to the Punakha-Wangdue valley. It was reported that the GLOF event of 1994 resulted in 17 lives lost, a total of 91 households affected, 12 houses damaged, 5 water mills washed away, 816 acres of dry land and 965 acres of pasture land damaged, 16 yaks carried away, 36 cowsheds and a full year's manure washed away, about 6 tonnes of food grains lost, 2,838 pieces of roof shingles and 68 'champs'/beams washed away, 4 bridges washed away, 2 Chortens destroyed, 1 Temple on Tsojug badly damaged.

Floods -which are mostly flash floods- and landslides -which are closely linked with flooding- are a recurrent phenomenon in Bhutan. The southern foothill region of Bhutan, which has an intensively dissected terrain with deeply eroded, steep and closely-spaced gullies, gorges and river valleys, often experience floods caused by heavy rainfall during the monsoon season (June to September). The tropical monsoon climate also favours faster weathering of rocks becoming very obvious resulting in a greater magnitude of erosion activity, widespread slope instability and mass movements.

The floods in 2000 and 2004 that caused extensive damages in Phuentsholing and Pasakha as well as in other southern cities and in six eastern Dzongkhags respectively represent the major floods that have occurred in Bhutan in recent years. Besides heavy rainfall as the natural cause for the Monsoon 2004 floods and combined landslides, note that other causes related to human activities have been reported: poor water management, forest degradation and over-grazing; intensive land use practices; practice of starting intentional forest fires to promote lemon grass regeneration; lack of proper environmental impact monitoring in the construction of farm roads; population pressure.

Based on a review of Kuensel reports on floods since 1980, the following information in relation to their consequences could be found: loss of life; injury; property loss/damage; vehicles submerged; damage to agricultural land and dry land; loss of crops; damage to infrastructure/public facilities; disruption of transport routes; disruption of communication; and, land erosion.

Disruption of the road transportation network represents the major impact reported in relation to landslides in Bhutan. It seems that they rarely killed people. Landslides have in some cases also created temporary dams with potential for disastrous downstream effects, including potential risk for damage to the hydropower projects (e.g. Tsatichhu lake).

The people living in the valleys and in the low lying plains, industrial infrastructure and hydropower projects were identified by the participants during the half-day working session as being the most vulnerable to (flash) floods, including GLOFs. As far as landslides are concerned,

the foothill and eastern regions of the country are more vulnerable. The urban areas -even if not directly affected- because of the importance of road infrastructure for the despatch of vital goods, all the settlements along the roads, road workers and road users, and farmers on steep slopes were considered the most vulnerable to this type of natural hazard by the participants during the half-day working session.

As we think it is important that vulnerability is analysed in relation to a particular type of natural hazard, we urge the readers to have a look at the three vulnerability models that were developed for different types of natural hazards (namely one for earthquakes, one for floods in general, and one for landslides) by the participants during this working session or based on the factors identified by them (Section 2.2). Nevertheless, some common causes of vulnerability to earthquakes, floods and landslides could be identified and are as follows: dangerous locations (due to urbanisation and population pressure or the absence of proper planning regarding site selection for infrastructural development especially with respect to floods and landslides), lack of hazard zonation map as well as lack of disaster management including lack of preparedness and mitigation were considered to be the immediate causes of vulnerability to these three types of natural hazards. On the other hand, financial constraints figure among the root causes of vulnerability in the three different models. While development pressures and lack of alternatives regarding livelihoods were also cited as root causes of vulnerability to landslides, structural/development inequalities as well as limited access to communication services and lack of economic opportunity figure among the root causes that were cited for vulnerability to floods. Note that vulnerability was also believed to be caused by lack of awareness regarding floods and earthquakes, and by deforestation regarding floods and landslides.

Finally, there have been severe **forest fire outbreaks** in Bhutan during the last decade. These fires damaging acres of land generally occur during the drier winter months (November to April). While for most of the forest fires, the causes remain uncertain, it is believed that they are mainly caused by human behaviour and activities. Note that some forest fire outbreaks have also been associated with short circuits on power transmission lines. Based on the records kept by the Social Forestry Services Division, Ministry of Agriculture (MoA), over the period 1992 to 2004, Thimphu Dzongkhag in the western region has the highest number of incidents followed by Mongar, Trashigang and Samdrup Jongkhar in the eastern region.

Section 2.2.4 of the report deals with the current disaster management system in Bhutan. The **institutional framework for disaster management** that is **currently in place in Bhutan** consists of the Department of Local Governance (DoLG), under the Ministry of Home and Cultural Affairs (MoHCA), being the focal point in disaster management as far as the national level is concerned, and the Disaster Management Group formed in Phuentsholing in January 2005 as far as the local level is concerned. Note that it is only very recently that the newly established DoLG has been designated as the focal agency. Among others, one of the main functions of this department is to coordinate the functions of Dzongkhag administrations and to monitor their activities; it shall therefore also directly coordinate disaster management in all 20 districts. The DoLG, which is expected to be fully functional by June this year, is now still in the process of working on organisational structures and re-organising manpower, and it is good to note here that the establishment of a Disaster Management Division is being considered. Similarly, the department has plans to develop a National Disaster Management Strategy and to establish National Disaster Management Committees at central and local levels.

At the national level, there are other ministries/departments/agencies that deal with disaster related issues as part of their regular activities. Annex 1, which makes an integral part of this report, provides a list of **disaster risk reduction initiatives or supportive projects/programmes/activities undertaken by various key actors**. These include the Department of Geology and Mines (DGM) and the Department of Energy (DoE), under the

Ministry of Trade and Industry (MoTI); the MoA, including the Social Forestry Services Division under its Department of Forest; the National Environment Commission (NEC); the Department of Roads (DoR), the Standards and Quality Control Authority (SQCA), and, the Department of Urban Development and Engineering Services (DUDES), under the Ministry of Works and Human Settlement (MoWHS); and, the Ministry of Health (MoH). While we would strongly recommend the readers willing to get more concrete information for particular sectors on capacity gaps identified during the analysis to refer to the table provided in this Annex -that also contains information on activities that some of the relevant sectors intend to carry out in the future-, a summary of these capacity gaps for the different sectors confounded is given below:

- Constraints in terms of financial resources (e.g. in relation to GLOFs for implementing the mitigation plan on Thorthormi lake prepared by Austrian experts and for putting in place early warning systems; in relation to earthquakes for setting up a local seismic network; no allocated funds in annual budget for possible outbreaks of human diseases);
- Constraints in terms of human resources (e.g. in relation to earthquakes, shortage of structural engineers, and limited capacity in vulnerability assessment and in earthquake-resistant construction; in relation to road construction, lack of capacity in geo-technical engineering, in environmental impact assessment and monitoring, and in risk assessment; in relation to forest fires, lack of skills to assess their causes);
- Constraints in terms of material resources (e.g. in relation to forest fires, lack of facilities and equipment; in relation to road construction planning, lack of instruments for detailed survey, more particularly to determine the type of soil);
- Lack of hazard zonation maps;
- Lack of coordination (e.g. in relation to GLOFs, lack of involvement of DGM in site selection for infrastructural development on the downstream region; in relation to forest fires, absence of set procedures to involve other key actors);
- And, lack of public awareness (e.g. in relation to earthquakes).

Whatever extreme events have occurred in Bhutan so far, it seems that the people affected have been able to receive prompt **response** from the central government, districts, local agencies and armed forces. The existing and usual practice is that the local authorities inform the MoHCA and/or the concerned ministry of any such events that have occurred in their locality.

Arrangements are then made at central level to supply the required relief measures and to support the local authorities in this respect. However, it was observed that in most cases, the concerned agencies had to ask the CCM for approval and release of emergency funds to address such events. The need therefore for all concerned agencies to keep some contingency funds under their annual work plan has been underlined at several occasions.

In a number of cases, a multi-sectoral team has been sent to assess the situation and damages and prepare a report for mitigation measures to be taken (e.g. after the 1994 GLOF event; after the 2000 floods that affected Phuentsholing and Pasakha areas). We refer the readers to the main text of this report (Section 3.3) for case studies analysing the intervention process in relation to different types of natural hazards that have occurred very recently. In this respect, the following important observations could be made:

- in the case of the 2004 Monsoon floods/landslides, no coordination between the concerned sectors at central level has apparently taken place and DGM has not been involved in the immediate response activities;
- the Food Corporation of Bhutan plays an important role in making arrangements to supply food rations to affected families in extreme events;

- while there are no set procedures to involve the armed forces in case of natural disasters, they will generally be there to help, whenever possible, in case of such events.

The **existing ways for compensating the affected people** in case of natural disasters include the compulsory Rural House Insurance Scheme on one hand (which covers damage caused by the major natural hazards occurring in Bhutan to houses in the rural areas all over the country), and, several insurance schemes offered by the Royal Insurance Corporation of Bhutan (RICB) on the other hand. The absence of a culture of insurance and lack of awareness about the risks were said to contribute to the tendency of people consisting of rarely taking up insurance that exists on a voluntary basis (e.g. the fire insurance with extensions possible for other types of natural hazards, the private car/commercial vehicles comprehensive insurance schemes that cover damage caused by the major types of natural hazards). Finally, the '*kidu*' -which is a land grant from His Majesty the King of Bhutan to needy families who directly apply to him for agricultural land- represents another way of compensation in case of natural disasters.

While there is **no legislation/policy in Bhutan dealing specifically with disaster risk management**, elements supportive to disaster reduction can be found in some Acts/Rules & Regulations/Policies existing in other development sectors. A detailed review of the relevant provisions for each of such existing legal/regulatory instruments is provided in the main text of this report (Section 3.4). Here follows just a list of these instruments:

- Draft Constitution of the Kingdom of Bhutan (26th March 2005), which stipulates the responsibility of everyone to provide help in times of natural calamity in addition to have two other relevant articles included, one on environment and the other dealing with emergency;
- A series of instruments pertaining to environment: the National Forestry Policy of 1974; the National Environment Strategy '*The Middle Path*'; the Environmental Assessment Act 2000, the Regulation for the Environmental Clearance of Projects and Regulation on Strategic Environmental Assessment 2002, the sectoral Environmental Assessment guidelines, the Environmental Codes of Practice and the Environmental Discharge Standard (all concerned with the environmental assessment process aimed at mitigating and preventing the undesirable impacts of developmental activities on the country's environment); The Mines and Minerals Management Act, 1995; the Bhutan Water Policy, 2003 that contains important guidelines in relation to flood control and management; the Forest and Nature Conservation Act of Bhutan 1995 and Revised Forest and Nature Conservation Rules of Bhutan 2003, mainly dealing with the users' rights and requirements to government reserve forests, contains also specific provisions on forest fires and fire protection; the Land Act, 1979 where reference to natural calamities is only made when dealing with community grazing land; and, a number of environmental international conventions ratified;
- Bhutan Building Rules 2002 dealing with the process of building permit and Building Code of Bhutan 2003 that lays down a set of minimum standards for the construction of engineering buildings;
- Royal Bhutan Police (RBP) Act, 1979, and Royal Bhutan Police Rules and Regulations that include some provisions dealing with the duties of RBP in cases of outbreak of epidemic diseases and fire.

Section 4 describes the **key components to be considered in the design of a national disaster management system**. These include the following: focal point agency; links between the policy formulating body and the operational agency; links between all levels of government; linkages between mitigation, preparedness, relief and reconstruction; links with NGOs; the establishment

of strategies and plans; and, the development of supporting legislation or other forms of support. To serve as an illustration, examples of other countries such as Nepal, India, Bangladesh, Vietnam, are provided in this section.

The last section (Section 5) concludes providing the readers with a number of **challenges ahead for Bhutan in relation to disaster management**, which is hoped to assist the different stakeholders in determining possible areas of collaboration and in developing a specific and prioritized list of disaster management projects.

The main area of priority concerns institutional development. In this respect, it is considered that work remains to be done to address the following issues:

Organisational structures including consolidation and strengthening of institutional arrangements at national and local levels, clear definition of the roles and responsibilities of the institutional structures in place and key agencies involved at national and local levels, institutionalisation of effective communication and coordination mechanisms;

Policy and planning including the formulation of a National Disaster Management Strategy as well as national and local plans, and the integration of disaster risk management into development planning and sectoral policies;

Legal/regulatory framework including the development of new legislation/policies or other forms of support or the inclusion of relevant provisions in the existing supporting arrangements;

Resources including the allocation at all levels of adequate funds in the yearly budget for relief and recovery activities but also for implementing mitigation and preparedness programmes as well as of adequate and well trained staff.

Other priority areas include:

- Carry out risk assessment studies;
- Develop strategic land-use management and planning based on hazard assessments and risk mapping;
- Establish effective early warning systems;
- Look into the possibility of having a specific institution to take care of the overall management of water resources;
- Increase education and public awareness on disaster risk management;
- Develop a comprehensive system to maintain proper records of disasters.

Other challenges for Bhutan include:

- Find appropriate ways to compensate the affected persons;
- Further strengthen national, regional and international cooperation in research and technology development and continue efforts to support the conduct of scientific studies.

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List of abbreviations and acronyms

ADB	Asian Development Bank
BPC	Bhutan Power Corporation
CCA	Common Country Assessment
EA	Environmental Assessment
FNC	Forest and Nature Conservation
DGM	Department of Geology and Mines
DoA	Department of Agriculture
DoE	Department of Energy
DoLG	Department of Local Governance
DoR	Department of Roads
DUDES	Department of Urban Development and Engineering Services
EFRC	Environmental Friendly Road Construction
EMS	Emergency Medical Services
EMTs	Emergency Medical Technicians
FNC	Forest and Nature Conservation
FWS	Flood Warning Section
FYP	Five Year Plan
GEF	Global environment Facility
GLOF(s)	Glacial Lake Outburst Flood(s)
GoI	Government of India
HPC	High Powered Committee on Disaster Management
ICIMOD	International Centre for Integrated Mountain Development
KHPC	Kurichhu Hydro Power Company
MoA	Ministry of Agriculture
MoH	Ministry of Health
MoHCA	Ministry of Home and Cultural Affairs
MoTI	Ministry of Trade and Industry
MoWHS	Ministry of Works and Human Settlement
NAPA	National Adaptation Program of Action
NDC	National Disaster Committee
NDMO	National Disaster Management Office
NEC	National Environment Commission

NES	National Environment Strategy
NSSC	National Soil Service Centre
RBA	Royal Bhutan Army
RBG	Royal Body Guard
RBP	Royal Bhutan Police
RGoB	Royal Government of Bhutan
RICB	Royal Insurance Corporation of Bhutan
RMMS	Road Maintenance Management System
RNR	Renewable Natural Resources
SQCA	Standards & Quality Control Authority
TVERMP	Thimphu Valley Earthquake Risk Management Project
UNDAF	United Nations Development Assistance Framework
UNDMT	United Nations Disaster Management Team

1. Introduction

1.1 Background

Bhutan is prone to different types of natural hazards that pose varying degrees of threat to the lives and livelihood of its estimated population of 800,000.

Historically, the Ministry of Home and Cultural Affairs (MoHCA) has been the Royal Government of Bhutan's (RGoB) focal point on disaster response operations although a number of other ministries and departments also play a role in addressing the risk of disasters. It is generally agreed that, while disasters in Bhutan have been reasonably well-managed in the past, key stakeholders in disaster management are proactively deliberating whether the time has come for a more holistic and integrated approach.

As part of its mandate, the United Nations Disaster Management Team (UNDMT) in Bhutan is responsible for assuring that planning and preparation for potential disasters in the country on the part of constituent agencies are up to date and fully coordinated with those of the RGoB.

The RGoB and the United Nations in Bhutan have agreed upon a program of preliminary assistance for integrated disaster risk management. It has been also agreed that the first step in the process of improving the collective ability to respond to disasters is stock taking of organizational mechanisms in place, the relevant legislative history, and the existing capacity of disaster management in Bhutan.

Apart from providing support to the RGoB in weighing the merits of a more integrated approach, the present analysis is also intended to support the United Nations Development Assistance Framework (UNDAF) Country Programme formulation and Common Country Assessment (CCA) processes.

1.2 Objectives of the analysis

The main objectives of the analysis are three-fold:

- To analyse the causes and vulnerability to natural hazards in Bhutan as well as their socio-economic impact;
- To provide a clear picture of the organizational mechanisms and related legislative framework currently in place within the country;
- To provide a set of possible organizational options based upon models from other countries.

1.3 Methodology

The main methods used to undertake the present analysis are as follows:

- Review of existing documentation; the list of documents reviewed is included in Annex 2.
- Individual interviews with the relevant stakeholders; a list of the persons met in the relevant departments/agencies can be found in Annex 3.

A half-day working session was also organised with key persons in the relevant departments/agencies to collect preliminary information on vulnerability to natural hazards. After a brief presentation on the concept of vulnerability and the factors determining vulnerability, the

participants were divided into three sub-groups, each sub-group having to brainstorm and develop a model of vulnerability in relation to a specific type of natural hazard. A list of the participants can be found in Annex 4.

1.4 Limitations

The major limitation of the present analysis is that information has been collected only from key actors at central level. The short duration of this consultancy did not allow us to collect information from local authorities and local communities.

2. Natural hazards in Bhutan

2.1 Types of natural hazards, causes and impact

Bhutan is prone to a number of natural hazards¹ due to fragile geological conditions, steep sloping terrain, vulnerable ecosystem, great elevation differences, variable climatic conditions and active tectonic processes taking place in the Himalayas. The following table shows the different types of natural hazards in Bhutan.

Table 1: Types of natural hazards in Bhutan

Major hazards	Minor hazards
<ul style="list-style-type: none"> • Earthquakes; • Floods, including flash floods and glacial lakes outburst floods (GLOFs); • Landslides; • Forest fires. 	<ul style="list-style-type: none"> • Outbreaks of pests and epidemic diseases; • Droughts (local-level water stress); • Wind, storms, hail, lightning.

The present analysis will mainly focus on the major types of natural hazards to which Bhutan is prone.

2.1.1 Earthquakes

Bhutan lies in one of the most seismically active zones of the world primarily attributable to the continent-continent collision of the Eurasian-Indian plates. Over a period of one year, a local temporarily seismic network established in collaboration with the University of Texas at El Paso has detected about 2,100 teleseismic, regional and local events, out of which 900 events (mostly $M \leq 4.0$) are not listed in the global National Earthquake Information Centre catalogue.²

¹ A natural hazard can be defined as a natural phenomenon that may adversely affect human life, property, activity or the environment to the extent of causing a disaster. Examples of such natural events include earthquake, avalanche, drought, flood, landslide, tropical cyclone, volcanic eruption, etc.

² Dowchu Drukpa (2005), "Earthquake studies in the Bhutan Himalaya: A collaborative research work between DGM and University of Texas at El Paso, University of Colorado at Boulder and Dalhousie University", *Bhutan Geology Newsletter*, Sl. N°8, p 47.

There is no detailed seismic micro-zonation of the country. However, since the north-eastern parts of India contiguous to Bhutan fall under seismic zone V (seismically most active), it can reasonably be assumed that Bhutan is either in seismic zone IV or V. Hence, the threat of a significant earthquake is ever present.

Box 1: Likely impact of a major earthquake

A major earthquake event can result in a great number of deaths, injury, and, damage to human-produced structures/loss of property. It can also have a significant impact on economic development due to substantial reconstruction costs and reconstruction competing with development projects for financial and other resources. Moreover, it is not uncommon in the aftermath of an earthquake to see an increase of land invasions, rural-urban migration, and a decline in the number of skilled workers in rural areas. After an earthquake, there is usually also a substantial impact on land (land values, land controls, and sometimes land tenure). Finally, mention should be made of the secondary effects of an earthquake such as landslides, fires, and floods; the risk of fire immediately after an earthquake is often high because of broken electrical lines and gas mains.

There are no comprehensive and official historical records tracking earthquakes and damage caused in Bhutan. The following table presents a list of historical earthquake events in Bhutan for which some information could be found in available documents.³

Table 2: History of earthquakes in Bhutan based on available information

Year	Location of the epicentre	Magnitude (Richter scale)	Impact in Bhutan
1897	Shillong Plateau, India	8.7 (re-evaluated intensity 8.0)	Catastrophic: destroyed Punakha and Lingzhi Dzongs; damaged Wangdi, Trongsa, Jakar and Tashichhodzong.
1906	Bhutan-China-India border	6.5	No information
1910	North of Punakha	5.7	No information
1934	Bihar, India – Nepal border	8.3	No information
1941	West of Trashigang	6.75	No information
1947	Bhutan	7.9	No information
1980	Gangtok area, Sikkim,	6.1	- few human casualties in some

³ Information given in this table was compiled from the following documents: Department of Local Governance, Ministry of Home and Cultural Affairs (2005), *National Report of Bhutan for World Conference on Disaster Reduction (Kobe, Japan 18-22 January 2005)*, Thimphu, p. 27; National Environment Commission, *Bhutan's Country Report on Natural Disaster Reduction*, Thimphu, p. 8; UN agencies (2004), *Bhutan UN Inter-Agency Humanitarian Contingency Plan*, Thimphu, p. 6; UNDP, *Preparatory Assistance for Thimphu Valley Earthquake Risk Management Project (TVERMP)*, Thimphu, p. 1; Multi-sectoral NAPA taskforce (2005), *Draft National Adaptation Programme of Action*, Kuensel reports since 1980, Thimphu.

Year	Location of the epicentre	Magnitude (Richter scale)	Impact in Bhutan
	India		parts of the country; - cracks reported in several buildings in Thimphu, Phuentsholing, Gelephu, Samdrup Jonkhar and Trashigang; - national highway Phuentsholing-Thimphu blocked by landslides caused by the tremor.
1988	Bihar, India – Nepal border	6.4	Several landslides reported on the highways
2003	Gunitsawa, Paro, Bhutan	5.5	Minor cracks in some of the buildings in Thimphu

Note that according to Bhutan’s Country Report on Natural Disaster Reduction, another major earthquake is said to have occurred in 1931, which led to the collapse of the Utse of Jakar Dzong in Bumthang. In the same report, two earthquakes are mentioned for 1941 (January 21 and January 27), with respective magnitudes of 6.8 and 6.5 and their epicentres near the south-eastern border with India.⁴ Note also that in Bhutan UN Inter-Agency Humanitarian Contingency Plan (2004), mention is made of two other earthquakes: one in the year 1954 with a magnitude of 6.5 and located in Bhutan-China-India border region; the other one in the year 1960 with a magnitude of 6.5 and located near Chirang; the latter is reported to have badly damage Pemayangtse Monastery.⁵

There is no information available for the period before 1897, except from an account by Shikyarinchen (1710-1759) that makes mention of a major earthquake, which occurred in Western Bhutan in the spring of 1713 and resulted in the collapse of houses/huts and loss of life.

2.1.2 GLOFs

GLOFs are among the most serious natural hazards in the country. Under the influence of global warming, glaciers in the Himalayas are shrinking remarkably in comparison with other glaciers in the world. It is conceivable that glaciers in Bhutan under strong influence of the summer monsoon are very sensitive to the global warming and the glacier retreat is accelerating.

Glacier retreat leads to the formation of numerous supra-glacial and dangerous moraine-dammed pro-glacial lakes. These moraine dams if unstable could fail and give rise to GLOF events - resultant discharges of huge amounts of water and debris- often having a devastating effect downstream. The most common triggering event for a GLOF is a surge wave caused by mass movements due to large ice falls and avalanches, slope failures of lateral moraines, rock falls or

⁴ National Environment Commission, op.cit., p. 8.

⁵ UN agencies (2004), op.cit., p. 6.

debris flows into the glacial lake, or seismotectonic events. Other triggering effects include overtopping of the dam crest due to lake overflow or intense seepage and piping.

According to the recent study carried out by the Department of Geology and Mines (DGM) in collaboration with the International Centre for Integrated Mountain Development (ICIMOD)⁶, altogether there are 2,674 glacial lakes in Bhutan, among which 562 are associated with glaciers. The study has identified 24 glacial lakes as potentially dangerous lakes, i.e. lakes that could pose a potential threat of a GLOF in the near future.

Table 3: Potentially dangerous glacial lakes in Bhutan

Basin	Number of lakes
Chamkhar Chu Basin	3
Mangde Chu Basin	7
Kuri Chu Basin	1
Mo Chu Basin	5
Poo Chu Basin	8

Another study by the DGM along with the Institute of Geology, University of Vienna, Austria, warns of possible danger of Raphstreng and Thorthormi glaciers and GLOF risk potential of their lakes, unless mitigation measures are taken. The worst case scenario is a combined GLOF of these two lakes, which could result in more than twice the volume of the 1994 GLOF with severe consequences downstream.⁷

Box 2: Likely impact of GLOFs

The impact of GLOF events downstream can be devastating in terms of damage to roads, bridges, hydro-power plants, trekking trails, villages, agricultural land, natural vegetation, as well as the loss of lives, property and infrastructure. Much of the damage created during GLOF events is associated with the large amounts of debris that accompany the floodwaters. Damage to settlements and farmland can take place at very great distances from the outburst source.

The following table presents a list of historical GLOFs events in Bhutan. Although several cases of GLOFs have been reported over the past few decades -for which records are mainly based on verbal information gathered from elderly people-, detailed written records of damage exist only for the 1994 GLOF.

Table 4: History of GLOFs in Bhutan

⁶ Mool P.K., Dorji Wangda, Bajracharya S.R., Karma Kunzang, Deo R. Gurung and Joshi S.P. (2001), *Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods. Monitoring and Early Warning Systems in the Hindu Kush-Himalayan Region, Bhutan*, ICIMOD, Kathmandu, p. 107.

⁷ Department of Local Governance, Ministry of Home and Cultural Affairs (2005), op.cit., p. 7; Multi-sectoral NAPA taskforce (2005), *Draft National Adaptation Programme of Action*, op.cit., p.3.

Year	Origin	Affected areas	Impact
Before 1950	No information but the fact that the end moraines of most glaciers in the high Himalayas of Bhutan are missing indicates that disastrous outwashes have occurred in the past. ⁸		
1957	Western Lunana region	Punakha-Wangdue valley	Part of Punakha Dzong destroyed ⁹
1960	Eastern Lunana area (burst of Tarino Tsho lake)	Punakha	Parts of Punakha Dzong destroyed ¹⁰
1968	No information	Punakha, Thimphu and Paro valleys	<p><u>In Punakha valley</u>: several houses washed away, including Bajo Lakhang; Old traditional bridge of Wangdue Phodrang and a house with 12 people washed away;</p> <p><u>In Thimphu</u>: a few houses, shops and bridges swept away;</p> <p><u>In Paro</u>: great damage to both human and aquatic life (e.g. a major area of paddy fields in Dophu area completely laden with silt, sand and debris);</p> <p>In general, degradation of aquatic life in the rivers of Punakha, Thimphu and Paro valleys.¹¹</p>
1994	Eastern Lunana (burst of Luge Tsho lake)	Punakha -Wangdi valley	<ul style="list-style-type: none"> - 17 lives lost; - total of 91 households affected; - 12 houses damaged; - 5 water mills to grind barley washed away; - 816 acres of dry land and 965 acres of pasture land damaged (washed

⁸ National Environment Commission, *Bhutan's Country Report on Natural Disaster Reduction*, op.cit., p. 7.

⁹ Mool P.K., Dorji Wangda, Bajracharya S.R., Karma Kunzang, Deo R. Gurung and Joshi S.P. (2001), op.cit., p. 88; Multi-sectoral NAPA taskforce (2005), *Draft National Adaptation Programme of Action*, op.cit., p.2.

¹⁰ Mool P.K., Dorji Wangda, Bajracharya S.R., Karma Kunzang, Deo R. Gurung and Joshi S.P. (2001), ibid., p. 88; Multi-sectoral NAPA taskforce (2005), ibid., p.2; Planning and Policy Division, Ministry of Home Affairs, *Draft Guidelines for Disaster Management in Bhutan*, Thimphu, p. 1.

¹¹ National Environment Commission, *Bhutan's Country Report on Natural Disaster Reduction*, op.cit., pp. 7-8. This document mentions that the 1968 floods are thought to have been caused by an outbreak or overtopping of a glacial lake in the upper reaches of the river basin.

Year	Origin	Affected areas	Impact
			away or partially covered with sand and silt); <ul style="list-style-type: none"> - 16 yaks carried away; - 36 cowsheds and a full year's manure washed away; - about 6 tonnes of food grains lost; - 2,838 pieces of roof shingles and 68 'champs'/beams washed away; - 4 bridges washed away; - 2 Chortens destroyed; - 1 Temple on Tsojug badly damaged.¹²

2.1.3 (Flash) floods

Landslides and (flash) floods are a recurrent phenomenon in Bhutan causing extensive damages every year during the monsoon season (June to September). The southern foothill region of Bhutan, which has an intensively dissected terrain with deeply eroded, steep and closely-spaced gullies, gorges and river valleys, often experience floods caused by heavy rainfall. Most flood events are flash floods, which are local floods of great volume and short duration. A flash flood generally results from a torrential rain or 'cloudburst' on relatively small and widely-dispersed streams. Runoff from the intense rainfall results in high flood waves. Discharges quickly reach a maximum and diminish almost as rapidly. Flood flows frequently contain large concentrations of sediment and debris. A flash flood can also result from the failure of a dammed lake caused by a landslide.

Box 3: Likely impact of (flash) floods

Floods can have the following impact on housing or other buildings: houses washed away; flotation of houses; undercutting of houses; damage to houses caused by inundation or by debris. Floods can also cause deaths and injuries, and may create conditions that promote secondary threats of waterborne and vector borne diseases. Possible negative impact on agriculture includes drowning of crops, submersion of crop storage facilities, erosion of topsoil resulting in the reduced productivity of the land and possibly eventual abandonment. Widespread floods can have a significant impact on development: indirect and secondary effects on the local and national economy may include reduction in family income, decline in the production of business and industrial enterprises, inflation, unemployment, increase in income disparities and decline in national income; relief and reconstruction efforts often compete with development programmes for available funds; rural-urban migration due to the loss of crops or extensive damage to agricultural land and the need to find alternate sources of income and employment, which may result in a related housing shortage in urban areas.

¹² Multidisciplinary team (1994), *Preliminary Report on the investigation of glacial lakes at Pho Chhu Source and the assessment of flood affected areas in Lunana*, Thimphu.

Based on a review of Kuensel reports on floods since 1980, the following information in relation to their consequences could be found: loss of life; injury; property loss/damage: shops, houses, huts washed away/damaged, commercial buildings, factories, machineries damaged; vehicles submerged; damage to agricultural land and dry land; loss of crops; damage to infrastructure/public facilities: rural water supplies, power supply plants, hospitals; disruption of transport routes: bridges washed away/damaged, road blocks, roads damaged; disruption of communication: telephone and electricity; and, land erosion.¹³

The following table provides more detailed information regarding two major floods that have occurred in recent years.

Table 5: Major floods in Bhutan in 2000 and 2004

Year	Natural cause	Affected areas	Impact
2000	Heavy rains	Phuentsholing and Pasakha Also other southern cities	<p>- 49 lives lost;¹⁴</p> <p>- Damage in Phuentsholing: 17 huts washed away; BOD fuel station, the market, 1 saw mill; 2 main water supplies and the city's sewage system destroyed; and, several vehicles submerged;¹⁵</p> <p>- Damage to BCCL and BFAL factories: the ADM office of BCCL and the MRSS of BFAL half covered by the debris; retaining wall of the CHPC substation badly damaged; in the residential colony of BCCL and BFAL, 9 buildings completely washed away and 7 buildings damaged; bailey bridge also washed away; and a number of hutments washed away.¹⁶</p> <p>43 people went missing and 400 families have been left homeless;¹⁷</p> <p>- In other southern cities: widespread damage to property and infrastructure;</p> <p>- Hundreds of landslides along the Thimphu-Phuentsholing highway, hampering the delivery of vital goods and fuel to Thimphu for several weeks.¹⁸</p> <p>RGoB released and approved a total of Nu 83.5 million for emergency and recovery.¹⁹</p>

¹³ Multi-sectoral NAPA taskforce (2005), *Draft National Adaptation Programme of Action*, Kuensel reports since 1980, op.cit.

¹⁴ Tshering Phuntsho, Ministry of Home Affairs, *Disaster and Management in Bhutan*, slides of its presentation.

Year	Natural cause	Affected areas	Impact
2004	Heavy rainfall	Six eastern Dzongkhags, Trashigang, Trashiyangste and Samdrupjonkhar being the most affected ones.	<ul style="list-style-type: none"> - 9 lives lost; - 29 houses completely washed away, 26 houses collapsed and about 107 houses partially damaged; - 161 acres of wetland and 503 acres of dry land washed away; - 350 metric tons of maize, 126 metric tons of paddy, 2000 orange trees and 21 metric tons of potatoes estimated to be lost affecting about 1437 households; - livestock heads washed away; - damage to infrastructure and services facilities: 39 irrigation channels damaged, 22 bridges of different types damaged or washed away, farm and feeder roads damaged; damage to power facilities; exposed foundation of Vocational Training Institute in Rangung collapsed; - no outbreak of diseases or serious food shortages was observed.²⁰

Besides heavy rainfall as the natural cause for the 2004 Monsoon floods and landslides and the resulting damages in the East, mention should be made here of the other causes related to human activities that have been reported: poor water management, forest degradation and over-grazing; intensive land use practices; practice of starting intentional forest fires to promote lemon grass regeneration; farm road constructions (lack of proper environmental impact monitoring in the

¹⁵ UNICEF Bhutan (2003), *Protecting and Assisting Children and Women in Extraordinary Circumstances. Emergency Preparedness and Response Plan for Year 2003, Part I: Overview and Summary of Planned Response*, Thimphu, p. 5. See also Multi-sectoral NAPA taskforce, *Draft National Adaptation Programme of Action*, Kuensel reports since 1980, op.cit.

¹⁶ Multi-sectoral team (2001), *Report on the study of the catchment area of Barsa Chhu and its future impact on the downstream industries at Pasakha, in and around Penden Cement Factory and new industrial estate locations*, Thimphu, p. 7.

¹⁷ Multi-sectoral NAPA taskforce, *Draft National Adaptation Programme of Action*, Kuensel reports since 1980, op.cit.

¹⁸ UNICEF Bhutan (2003), op.cit., p. 5.

¹⁹ Tshering Phuntsho, Ministry of Home Affairs, op.cit.

²⁰ Ministry of Agriculture (2004), *Report on the Assessment of Monsoon Related Damages in the Six Eastern Dzongkhags*, Thimphu.

construction of these roads); population pressure (higher population density than the other parts of the country).²¹

2.1.4 Landslides

As mentioned before, landslides -which are closely linked with flooding- are a recurrent phenomenon in Bhutan. The tropical monsoon climate favours faster weathering of rocks becoming very obvious resulting in a greater magnitude of erosion activity, widespread slope instability and mass movements. Slopes in the country are susceptible to landslides, particularly in the rainy season. Most occur from natural causes in the southern foothill belt where the terrain is steep and rocks underlying the soil cover are highly fractured, allowing easy seepage of water. Contributing factors are the undercutting of slopes by high-energy rivers and streams during a period of heavy rainfalls.²² Landslides can also be caused by the tremors of an earthquake.

Disruption of the road transportation network represents the major impact reported in relation to landslides in Bhutan: road blocks have been widely reported mainly in the rainy season on its vital north-south and east-west highways and feeder roads in various Dzongkhags, involving enormous repair and maintenance costs every year and threatening the lives of the travellers and road workers. It should be noted though that the numerous landslides in Bhutan seem to rarely kill people. Landslides can also cause disruption of communication due to damaged life-lines. In addition, landslides leave huge and ugly scars on mountain slopes, destroying forests and eroding soils. Landslides have in some cases also created temporary dams with potential for disastrous downstream effects, including potential risk for damage to the hydropower projects: in July 2004, due to heavy rains, a major part of the Tsatichhu dam failed and a large volume of water including tones of logs and debris was released downstream causing damages to paddy fields along the course and the road between Mongar and Lhuntse; damage to the Kurichhu Hydro Power Company (KHPC) could be minimized due to timely warning.

2.1.5 Forest Fires

Given the rugged and steep topography with tick ground fuels and erratic wind conditions, Bhutan is very prone to forest fires. During the last decade, there have been severe forest fire outbreaks. The fire season is generally over the drier winter months (November to April).

While for most of the forest fires, the causes remain uncertain, it is believed that they are mainly caused by human behaviour and activities such as burning of agricultural debris (particularly burning of apple orchards pruning), agricultural burning for stock feed or for lemon grass regeneration²³, carelessness of school children or herders. Some forest fire outbreaks have also been associated with short circuits on power transmission lines (e.g. fire in Wangdue Phodrang that started on Monday 11/04/05 caused by a short circuit on the power transmission line in Rurichhu when a large pine tree was uprooted on a cliff and fell on the line²⁴).

²¹ Ministry of Agriculture (2004), *ibid*.

²² National Environment Commission, *Bhutan's Country Report on Natural Disaster Reduction*, op.cit., p. 5.

²³ For example, the forest fire in Trashigang Dzongkhag below Drameste, Gongthong and Yangneer geogs in April 2005 where farmers involved in the lemon grass business are suspected to have set the fire intentionally ("Forest fire in Trashigang", *Kuensel*, Thimphu, April 16, 2005)

²⁴ Dema, "Firefighters battle flames in Wangduephodrang", *Kuensel*, Thimphu, April 16, 2005.

A total number of 803 forest fires damaging a total area of 309,181.9 acres were recorded by the Social Forestry Services Division, Ministry of Agriculture (MoA), over the period 1992 to 2004. Based on the records, Thimphu Dzongkhag in the western region has the highest number of incidents (115) followed by Mongar (105), Trashigang (90) and Samdrup Jongkhar (85) in the eastern region.

Box 4: Likely impact of forest fires

Forest fires can have a devastating impact on the environment and the economic viability of communities. They may also threaten or cause the destruction of houses, infrastructure, human life, wildlife and domestic animals.

2.2 Vulnerability analysis

The present section is dealing with vulnerability to natural hazards in Bhutan. It is important to note here that this section is mainly based on the information collected during the half-day working session organized with government officials and various representatives of the donor community, for which more details can be found in Section 1.3. It should be clear that this section does not claim to report on the results of a vulnerability/capacity assessment, which requires a long-term commitment of time and resources and is therefore beyond the scope of the present study. Instead, the information included in this section should be considered as preliminary information in relation to vulnerability.

A well used description is that vulnerability reflects “*the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard*” (Blaikie et al., 1994). This perspective shows that a person or groups’ vulnerability is determined by the conditions in which they are living prior to a natural event. These conditions are determined by physical, socio-economic and environmental factors or processes: while physical factors refer mainly to considerations and susceptibilities of location and the built environment, socio-economic factors refer to the level of well-being and economic status of individuals, communities and society, and, environmental factors refer mainly to the extent of natural resource depletion and the state of resource degradation.

The framework suggested by Blaikie et al. (the ‘*Pressure and Release Model*’) was presented to the participants during the workshop to enhance their understanding with respect to the need for distinguishing between levels of factors that generate vulnerability. In the Pressure and Release Model, there are three such levels of factors: *root causes* refer to the set of well-established processes within a society which affect the allocation and control of power and resources between different groups of people; *dynamic pressures* are processes and activities that translate the effects of root causes into particular forms of insecurity that must be considered in relation to a specific hazard, which Blaikie et al. has called *unsafe conditions*. The model is based on the idea that the vulnerability that arises from unsafe conditions generated by dynamic pressures and root causes intersects with a physical hazard to create a disaster²⁵.

While initially it was planned to divide the participants into four sub-groups to work on vulnerability in relation to the different types of major natural hazards in Bhutan (earthquakes, GLOFs, floods, and, landslides), three sub-groups were formed with one group working on vulnerability to floods, including GLOFs, due to the limited number of participants for forming two separate groups for those hazards.

²⁵ A natural disaster can be defined as an occurrence of widespread severe human, material, economic or environmental losses with which a community or society cannot cope and during which the community or society undergoes severe disruption.

The aim of the working session was to obtain some answer to the three following main questions:

1. What/Which locations/groups of people are the most vulnerable?
2. To what particular hazard(s) are they vulnerable?
3. What makes them vulnerable?

The results of the half-day working session are presented below.

2.2.1 Vulnerability to earthquake

Box 5: What/Who is the most vulnerable to earthquake?

- High density cities/settlements (e.g. Phuentsholing, Thimphu, Samdrup Jonkhar);
- Institutions (schools including school for disabled children, hospitals, Dzongs, etc.);
- Infrastructure (e.g. power, roads, dams, etc.)

Table 6: Vulnerability model in relation to earthquakes developed by the participants

Vulnerability to earthquake		
Root causes	Intermediate causes	Immediate causes
<ul style="list-style-type: none"> • Financial constraints • Ideological problem • Low enforcement • No legal backing • No proper management system 	<ul style="list-style-type: none"> • Lack of awareness programme • Lack of coordination • Lack of capacity (<i>financial resources as well as skilled professionals</i>)* • Lack of investment • No budget provision for disaster response 	<ul style="list-style-type: none"> • Unsafe buildings (<i>use of new construction materials and techniques; no fire protection; late entry of building codes</i>)* • Unsafe locations (<i>due to rapid socio-economic development and urbanization caused mainly by rural-urban migration</i>)* • No disaster management plan

* The information given in italic in this table did not appear in the model as presented by the participants. However, factors that were identified during the brainstorming session as determining vulnerability have been included in the present table where relevant for a better understanding of the model.

Under ideological problem, participants meant that with the socio-economic development involving investment in buildings, people are interested in a fast rate of return but are not willing to invest in structural safety: they tend to construct high buildings with multi-apartments and tend to neglect quality.

The fact that the existing Building Code and Rules are not backed up by legal instruments ('no legal backing') was said to contribute to low enforcement, which was identified as a root cause. Another factor that was cited as making enforcement sometimes difficult was the fact that Bhutan is a small hierarchical society where everyone knows everybody.

Delay in information dissemination to the public was also considered to be a factor determining vulnerability.

While not appearing in their model, the absence of seismic hazard zonation map for the country was cited by the participants as a major cause of vulnerability.

2.2.2 Vulnerability to (flash) floods, including GLOFs

Box 6: What/Who is the most vulnerable to floods, including GLOFs?

- The people living in the valleys (e.g. Punakha-Wangdi valley vulnerable to GLOFs, Pasakha and Kurichu vulnerable to flash floods, Rangjung);
- The people living in the low lying plains (near the rivers);
- Industrial infrastructure; hydropower projects

The vulnerability model in relation to floods presented by the participants has been somewhat reorganised here for the purpose of more adequate categorisation. Nevertheless, it should be noted that the model below is merely based on the list of factors identified during the brainstorming and on the explanations given by the participants during their presentation and the discussion that followed.

Box 7: Vulnerability model in relation to floods based on the factors identified by the participants

Vulnerability to floods
<p>Root causes:</p> <ul style="list-style-type: none"> • Inadequate resources (e.g. regarding application of environmental-friendly road construction techniques for farm roads) • Structural/development inequalities (e.g. less attention was given for basic infrastructure in some parts of Eastern Bhutan) • Limited access to communication services (which also renders accessibility to these areas difficult in case of disasters) and lack of economic opportunity, both making the people to settle in low lying plains • No proper watershed management • Leadership (strong local leadership important for taking preventive adequate action as well as responding adequately in case of floods) <p>Dynamic pressures:</p> <ul style="list-style-type: none"> • Literacy/education (lack of awareness) • Urbanisation (relatively populated border towns in the foothills that are expanding with increasing trade and commercial activities) • Deforestation/inappropriate planning in road construction/over-grazing <p>Unsafe conditions:</p> <ul style="list-style-type: none"> • Dangerous locations (e.g. in some cases, no proper planning regarding site selection for infrastructural development) • No hazard zonation map (especially for floods and flash floods)

- Lack of mitigation measures & inadequate disaster preparedness (lack of early warning systems, lack of coordination)

2.2.3 Vulnerability to landslides

Box 8: What/Who is the most vulnerable to landslides?

- Urban areas -even if not directly affected- because of the importance of road infrastructure for the despatch of vital goods;
- Ribbon development (all the settlements along the roads); Road workers; Road users;
- Farmers on steep slopes;
- Foothill and eastern regions.

As this was the case regarding vulnerability to floods, the vulnerability model in relation to landslides presented by the participants has been somewhat reorganised here.

Box 9: Vulnerability model in relation to landslides based on the factors identified by the participants

Vulnerability to landslides
<p>Root causes:</p> <ul style="list-style-type: none"> • Financial constraints regarding road construction • Economic systems: Development pressures (road construction, big infrastructure) • Lack of alternatives regarding livelihoods • Level of risk accepted by the society <p>Dynamic pressures:</p> <ul style="list-style-type: none"> • Deforestation (use of wood for house construction, fire wood collection, over-grazing, forest fires e.g. set up intentionally for lemon grass regeneration) • Urbanisation • Population pressure <p>Unsafe conditions:</p> <ul style="list-style-type: none"> • Dangerous locations (e.g. because lack of suitable alternatives due to land pressure caused by population pressure; inadequate site selection for infrastructural development) • Lack of risk mapping

- Lack of natural disaster management and preparedness

2.2.4 Summary

While we think it is important that vulnerability is analysed in relation to a particular type of natural hazard, some common causes of vulnerability can be found in the three different models developed for earthquakes, floods and landslides. Dangerous locations (due to urbanisation and population pressure or the absence of proper planning regarding site selection for infrastructural development especially with respect to floods and landslides), lack of hazard zonation map as well as lack of disaster management including lack of preparedness and mitigation, were considered to be the immediate causes of vulnerability to these three types of natural hazards. On the other hand, financial constraints figure among the root causes of vulnerability in the three different models. While development pressures and lack of alternatives regarding livelihoods were also cited as root causes of vulnerability to landslides, structural/development inequalities as well as limited access to communication services and lack of economic opportunity figure among the root causes that were cited for vulnerability to floods. Vulnerability was also believed to be caused by lack of awareness regarding floods and earthquakes, and by deforestation regarding floods and landslides.

3. Current disaster management system in Bhutan

3.1 Institutional Framework

The following table provides an overview of the institutional framework for disaster management that is currently in place in Bhutan.

Table 7: Current institutional framework for disaster management in Bhutan

Focal Point for disaster management	National action plan(s)	Disaster Management Plans at local level
Department of Local Governance (DoLG), under the MoHCA	<ul style="list-style-type: none"> • National Disaster Management Plan/Strategy yet to be developed; • No legislation/policy dealing specifically with disaster risk management; 	Phuentsholing City Corporation: Disaster Management Plan under development

Focal Point for disaster management	National action plan(s)	Disaster Management Plans at local level
	however, elements supportive to disaster reduction included in some Acts/Rules & Regulations/Policies existing in other development sectors. ²⁶	

Very recently, the new DoLG, under the MoHCA, which was recently established in January 2005, has been designated as the focal agency in disaster management by Executive Order from the Cabinet of Ministers. This indicates a political commitment to disaster management in the country.

Included in the MoHCA's mandate is to administer the 20 Dzongkhags and co-ordinate with relevant agencies in staffing the Dzongkhag administration. The MoHCA is further responsible for (i) efficient management of the civil administration, (ii) support and co-ordinate peoples' participation and (iii) facilitate and enhance the decentralisation process.

Among others, one of the main functions of the DoLG is to coordinate the functions of Dzongkhag administrations and to monitor their activities. The department shall therefore also directly coordinate disaster management in all 20 districts.

Although it should be noted that these will need to be further refined, we think it is worth mentioning here the following functions that the DoLG is planning to undertake in relation to disaster management:

- Plan and coordinate responses to disaster in any part of the country in cooperation with concerned sectors;
- Be the agency to coordinate all external assistance/collaboration in disaster management including trainings and formulation of projects;
- Develop rapid reaction strategies for all types of disasters in collaboration with respective sectors without requiring separate establishments;
- Develop annual budgets in the centre and also ensure procurement of essential equipment and other logistical needs;
- Raise public awareness, caution and preparedness with special focus on the vulnerable groups;
- Include civil society in all its disaster management plans and strategies;
- All Dzongkhag disaster management committees shall report directly to the department, which in turn shall inform all participating agencies;
- A fund raised through (i) government allocation, (ii) public contribution, (iii) external support and other sources shall be named 'His Majesty's Relief Fund';

²⁶ For a review of existing legislation/regulations/policies relevant to natural disaster management, see Section 3.4.

- There shall be a disaster reduction/prevention and management committee in the centre with members from relevant sectors.²⁷

The recently established DoLG is now still in the process of working on organisational structures and re-organising manpower. Note in this respect that the DoLG is considering the establishment of a Disaster Management Division. The department is expected to be fully functional by June.

At local level, the initiative taken in Phuentsholing is important to mention here. A Disaster Management Group, chaired by the Drungpa, Dungkha Administration, and including the Thrompon, City Corporation, as well as representatives from various agencies (health, education, telecommunication, power, transport, commerce and armed forces), was formed in January 2005. This group meets regularly and have already discussed and agreed upon the goals and objectives and terms of reference for the Disaster Management Group; the members also discussed on the types of hazards faced in Phuentsholing and have identified emergency services and lifeline organisations and defined the responsibilities of the relevant agencies for response in case of disaster.

3.2 Disaster risk reduction initiatives or supportive projects/programmes/activities undertaken by key actors

Different sectors and organisations in Bhutan are dealing with disaster related issues as part of their regular activities. A list of disaster risk reduction initiatives or projects/programmes/activities supportive to disaster risk reduction²⁸ undertaken by various ministries/departments/agencies can be found in Annex 1, which makes an integral part of this report. The table provided in this Annex also contains information on capacity gaps that were identified in relation to particular sectors following the review of documents and our discussions with relevant stakeholders; the third column provides information on activities that some of the relevant sectors intend to carry out in the future.

3.3 Existing response mechanisms

Whatever extreme events have occurred in Bhutan so far, it seems that the people affected have been able to receive prompt response from the central government, districts, local agencies and armed forces. The existing and usual practice is that the local authorities inform the MoHCA and/or the concerned ministry of any such events that have occurred in their locality. Arrangements are then made at central level to supply the required relief measures and to support the local authorities in this respect.

It was observed that in most cases, the concerned agencies had to ask the CCM for approval and release of emergency funds to address such events. The need therefore for all concerned agencies to keep some contingency funds under their annual work plan has been underlined at several occasions. Note that while DoR for example does have a provisional sum included under its annual work plan for restoration works, this sum seems to be rarely sufficient to cover the damages caused annually to the road infrastructures by floods and landslides during the Monsoon season.

²⁷ Department of Local Governance, Ministry of Home and Cultural Affairs (2005), op.cit., pp. 6-7.

²⁸ Disaster risk reduction refers to the conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development (UN/ISDR (2004), *Living with Risk: A global review of disaster reduction initiatives*, New York, Geneva, UN, Volume I, p. 17).

In a number of cases, a multi-sectoral team has been sent to assess the situation and damages and prepare a report for mitigation measures to be taken. This was the case for example after the GLOF event in 1994²⁹; the floods in 2000 that had severely hit Phuentsholing and Pasakha³⁰; and, in relation to Tsatichhu lake.

Case studies are provided below analysing the intervention process for different types of natural hazards that have occurred very recently.

Box 10: Existing response mechanisms - Case study regarding the 2004 Monsoon floods/landslides

Following the 2004 Monsoon floods combined with landslides, His Majesty the King commanded His Excellency, Lyonpo Sangay Ngedup, the Honorable Minister of Agriculture, to visit the affected areas in the East to assess the damages caused and to initiate mitigation measures. The Minister led a small team comprising of different officials from MoA; Dzongkhag officials of every affected Dzongkhag and other members from relevant agencies in the region were also involved in the assessment. The team found that the DoR and Dzongkhags had responded very well within their available resources. Measures found taken at Dzongkhag and Geog level included the visit to all the affected areas in their respective locality, preparation of a detailed report and undertaking of further assessments, evacuation and relocation to safer places of people in risk prone areas, and at the Geog level, initiation of basic measures such as replacement of bridges and footpaths through make-shift arrangements. Immediate evacuation and relocation initiated in high risk zones as well as awareness-raising on the importance of proper watershed and catchment areas management and of forest cover in preventing flash floods and landslides were among the actions taken by the team during their field visit.³¹

For its part, DoR, and more particularly its Director, also undertook a tour to almost all the flood affected Dzongkhags to assess the damage and recommend measures to restore the road communication facilities.

It is interesting to note that apparently no coordination between the concerned sectors has taken place at central level and that DGM has not been involved in the immediate response activities.

Box 11: Existing response mechanisms - Case study regarding the dengue outbreak in Phuentsholing in 2004

A good illustration of prompt action taken by the MoH in cases of outbreaks of epidemic diseases is provided by the case of the dengue outbreak in Phuentsholing in 2004. After having been informed in the first week of July about the increase in cases of fever at Phuentsholing hospital, the national health authorities took immediate action by sending a team of medical specialists and public health laboratory officials from Thimphu as well as a team of the Vector borne Diseases Control Programme based at Gelephu to Phuentsholing to assist local health officials in managing the outbreak. In addition to blood samples of suspected cases sent to Kolkata, Bangkok and Delhi, a series of measures were initiated in the second week of July to control the outbreak:

²⁹ Multidisciplinary team (1994), *Preliminary Report on the investigation of glacial lakes at Pho Chhu Source and the assessment of flood affected areas in Lunana*, op.cit.

³⁰ Multi-sectoral team (2001), *Report on the study of the catchment area of Barsa Chhu and its future impact on the downstream industries at Pasakha, in and around Penden Cement Factory and new industrial estate locations*, op.cit.

³¹ Ministry of Agriculture (2004), op.cit.

- awareness-raising activities aimed at informing the public about the occurrence of the outbreak of the dengue fever, its mode of transmission and its control measures (e.g. notification, health education messages through local television, development of IEC material and campaigns held in schools, organisations such as Royal Bhutan Army (RBA) and Royal Bhutan Police (RBP) and villages near Phuentsholing town);

- briefing of the Dasho Dungpa and doctors from the nearby border towns and multi-sectoral meeting;

- control measures such as thermal fogging, anti-larval measures, and, cleaning-up campaign in Phuentsholing town involving other sectors and business community.

While case load started to decrease in the third week of July and the team from Thimphu went back, control measures continued and a Mission was sent by WHO to further assist the national authorities in the investigation and control of the outbreak and to recommend necessary measures to prevent and control future outbreak.³²

Similarly, when there is an outbreak of pests and diseases in the agricultural fields, MoA provides technical expertise and measures to control the outbreak. If the situation becomes worse and if there are severe food shortages then it also provides direct food aid to the affected group of people for a limited duration as a temporary measure. The Dzongkhags also provide small amounts of free inputs such as seeds and fertilizers to the affected farmers.³³

Note that the Food Corporation of Bhutan plays an important role in making arrangements to supply food rations to affected families in extreme events.

Box 12: Existing response mechanisms - Case study regarding the forest fire in Wangdue Phodrang in April 2005

In relation to the forest fire that started on the 11th of April, 2005 in Rurichhu in Wangdue Phodrang, the Kuensel³⁴ reported that “*Volunteers, forestry officials, soldiers, students and employees of various institutions in the dzongkhag are fighting the blaze with twigs ... Farmers from upper and lower Gaselo, forestry officials, soldiers, and dzongkhag staff spread across the area fought the blaze as it moved towards Gaselo village on April 13 and saved house properties. Trainees of the Natural Resource Training Institute (NRTI), soldiers, project staff, forest officials, and village volunteers saved the powerhouse and Theckchen Ugyen Dra monastery in Hebesa on April 12 ... For future safety the Bhutan Power Corporation Limited cut down four or five big trees near transmission tower on April 12.*”

It is interesting to note here that while there are no set procedures to involve the armed forces in case of natural disasters, RBP, RBA and Royal Body Guard (RBG), whenever possible, will generally be there to help in case of such events. The important role that the national medias can play in addressing disasters is also worth mentioning at this point.

³² WHO Mission (2004), *Report on assistance to the national authorities for control of dengue outbreak 5-19 August 2004*, Thimphu.

³³ Department of Local Governance, Ministry of Home and Cultural Affairs (2005), *op.cit.*, p. 12.

³⁴ Dema, *op.cit.*

The following box provides information on the existing ways for compensating the affected people in case of natural disasters.

Box 13: Existing ways to compensate the affected people in case of natural disasters

Rural House Insurance Scheme: the scheme covers damage caused by (i) accidental fire, (ii) earthquake, (iii) flood/landslide, (iv) storm -with the exclusion of hail storm- to houses in the rural areas. It covers all the Dzongkhags and it is compulsory for all rural houses to be insured. The annual premium, the amount of which depending on whether it concerns a '*semi-permanent*' or '*permanent*' house, is very reasonable ranging from Nu. 60 to Nu. 150, respectively. The scheme while managed by the Royal Insurance Corporation of Bhutan (RICB) is subsidised by the Ministry of Finance.

Insurance schemes offered by RICB:

- Fire insurance that covers loss of/damage to the insured property (any building or any part thereof and any property contained in any building) caused by fire and/or lightning. Extensions to include loss of/damage to the insured property directly caused by storm, cyclone, typhoon, tempest, hurricane or tornado on one hand, and by or through or in consequence of earthquake on the other hand are made possible under payment of an additional premium.

- Private car comprehensive insurance and commercial vehicles comprehensive insurance both covering loss of/damage to the insured vehicle and/or its accessories caused by fire explosion self-ignition or lightning, earthquake (fire and shock damage), flood, typhoon, hurricane, storm, tempest, inundation, cyclone and hailstorm among other risks.

People subscribe to these two schemes on a voluntary basis. In this respect, it should be noted that people tend rarely to do so unless they are asked to by financial institutions in connection with the application for a loan. The absence of a culture of insurance and lack of awareness about the risks were said to contribute to this fact.

- Contractor's all risks insurance including loss/damage to the contract works caused by all types of natural hazards that occur during the construction period -with extension possible for the maintenance period under payment of an additional premium. Contractors have an obligation to be insured if construction works concern government projects and outside funded projects (e.g. hydropower, bridges, dams). A similar insurance also exists for all erection works (Erection all risks insurance).

'*Kidu*' which is a land grant from His Majesty the King of Bhutan to needy families who directly apply to him for agricultural land. Note that His Majesty the King has in some cases also provided a financial grant to the affected families (e.g. fire disaster in Yangthang village in Haa in 2002 where His Majesty granted Nu. 50,000 condolences to each family and commanded the district authorities to provide immediate relief to the people and free ration for three months³⁵).

3.4 Existing legislation/regulations/policies relevant to natural disaster management

The present section will review some legislation/regulations/policies existing in Bhutan that are considered relevant in the context of disaster management.

³⁵ Tshering Phuntsho, Ministry of Home Affairs, op.cit.

3.4.1 Draft Constitution of the Kingdom of Bhutan (26th March 2005)

The Draft Constitution includes an article on environment reaffirming the country's commitment to sustainable development. Article 5, § 1 and 2, outlines the responsibilities of every citizen and the government in relation to environment. Paragraph 3 provides that a minimum of 60% of the country's total land shall remain under forest cover for all time. Paragraphs 4 and 5 allow the Parliament to enact environmental legislation and implement environmental standards and instruments, and to declare any part of the country to be a protected area.

In its article 8 dealing with the fundamental duties, § 6, the Draft Constitution stipulates that *“A person shall have the responsibility to provide help, to the greatest possible extent, to victims of accidents and in times of natural calamity”*.

Article 33, dealing with emergency, gives the authority to His Majesty the King of Bhutan to *“proclaim that a public emergency or calamity, which threatens or affects the nation as a whole or part thereof, exists in which case the Government may take measures derogating from the provisions of this Constitution to the extent strictly required by the exigencies of the situation”* (§2).

3.4.2 Legislation/regulations/policies pertaining to environment

Bhutan has always been lauded by the international community for its sound environmental policies. Environmental conservation is one of the four pillars of *Gross National Happiness*, which represents the development approach followed by the country.

The **National Forestry Policy** of 1974 sets out the objective of maintaining at least 60% of the country's area under forest cover and lays strong emphasis on forest conservation rather than economic exploitation and on conservation of the country's rich flora and fauna diversity. It is said that at present, 72,5% of the country's land is covered by forest based on the definition of forest provided in the Forest and Nature Conservation Act of Bhutan, 1995: *“any land and water body, whether or not under vegetative cover, in which no person has acquired a permanent and transferable right of use and occupancy, whether such land is located inside or outside the forest boundary pillars, and includes land registered in a person's name as Tsamdog (grazing land) or Sokshing (woodlot for collection of leaf litter)”*.

The **National Environment Strategy** (NES) *'The Middle Path'* is the main policy document for the environment sector. Designed to guide environmental conservation in Bhutan, the Middle Path aims at minimizing or mitigating the impacts likely to result from the development process.

The **Environmental Assessment Act** (EA Act) was passed by the National Assembly in **2000**. Pursuant to the EA Act, the **Regulation for the Environmental Clearance of Projects** (later referred to as the Regulation) and **Regulation on Strategic Environmental Assessment** was adopted in **2002**. The Environmental Assessment process endeavours to mitigate and prevent the undesirable impacts of developmental activities on the country's environment.

Under this Act and the Regulation, any person who seeks to carry out a project (i.e. *“an activity which may have significant effects on the environment”*) that requires a development consent (e.g. trade licence) shall submit an application for an environmental clearance, such clearance being a prerequisite to the issuance of the development consent (article 8 EA Act and section 16 Regulation). The same applies to any agency (Ministry, Department, Municipality or any autonomous public body of RGoB) that seeks to carry out a project that does not require a development consent. Depending on whether or not the project concerns an activity that is listed in Annex 2 of the Regulation, the Competent Authority being empowered to issue the

development consent or the NEC Secretariat shall issue the environmental clearance. In its article 18, the EA Act 2000 sets out the conditions to be met for issuance of an environmental clearance:

“18.1 The effects of the project on the environment are foreseeable and acceptable;

18.2 The applicant is capable of carrying out the terms of the environmental clearance;

18.3 The project, alone or in connection with other programs or activities, contributes to the sustainable development of the Kingdom and the conservation of its natural and cultural heritage;

18.4 Adequate attention has been paid to the interests of concerned people; and,

18.5 The project is consistent with the environmental commitments of the Kingdom.”

The clearance will be issued for a maximum period of 5 years and will contain terms and conditions which the project must comply with to ensure that it is managed in an environmentally sound and sustainable way. Compliance monitoring is the responsibility of the Competent Authority or the NEC Secretariat depending on whether or not it concerns an activity for which a development consent is required/a listed activity under Annex 2 of the Regulation. The NEC Secretariat may also conduct spot checks for listed activities (article 44 EAA and section 33 of the Regulation). Note also that NEC conducts environmental monitoring of all existing industries and mines at least annually.

Sanctions for offences committed under the EA Act and the Regulation such as the establishment of a project without an environmental clearance or non-compliance with the terms of the environmental clearance include suspension or revocation of the clearance, in part or in whole, and payment of a fine.

The EA Act also provides that environmental aspects and consequences should be taken into account by all government agencies when formulating, renewing, modifying and implementing any policy, plan or programme including Five Year plans (article 7). Requirements in this respect are defined in the Regulation on Strategic Environmental Assessment.

The 8 following **sectoral Environmental Assessment guidelines** were developed with the intention to guide different project proponents through the process of acquiring an environmental clearance for their projects by specifying what information is required for preparing an application to attain such clearance: (i) Mines, (ii) Hydropower, (iii) Transmission and Distribution Lines, (iv) the preparation of Industrial Project Reports, (v) Highways and Roads, (vi) Forestry activities, (vii) Urban Development, (viii) Tourism.

In addition, several **Environmental Codes of Practice** have been produced to support the environmental assessment guidelines (Environmental Codes of Practice for Storm Water Drainage Systems, Installation of Underground and Overhead Utilities, Tourism Activities, Urban Roads and Traffic Management, Hazardous Waste Management, Solid Waste Management, and Sewage and Sanitation Management).

Environmental standards for water, air and noise can be found in the **Environmental Discharge Standard**.

The **Mines and Minerals Management Act, 1995** stipulates in its section 8 that *“All minerals shall be developed in accordance with the policies of the Royal Government of Bhutan, with due respect for efficient use of the resources, protection of the environment, and worker and public health and safety.”* The Environment Management Plan, which is part of the Final Mine Feasibility Study that needs to be prepared and submitted prior to the granting of a mining lease, shall include: *“the size and sensitivity of the proposed mine, but shall contain, in as detailed a manner as deemed sufficient by the Head of Division the following site-specific environmental*

impact assessment :

- i. *base-line sampling and analysis of soils, surface and sub-surface waters, air quality and noise levels, plant and animal life, and*
- ii. *analysis of the effects that mining, possible processing, worker activities, transport of workers and mine products, will have on existing human habitation and current uses of land, water, plant and animal resources.”*
(Section 24)

Bhutan Water Policy, 2003

The Water Policy underlines the need “*to develop a national adaptation strategy for climate change, including a national flood management and mitigation strategy*” (section 3.5) and stresses the importance of an integrated approach in water resources management in general, and in monitoring, early warning and mitigation measures in relation to GLOFs in particular (section 6.2.4).

Section 6.5 deals particularly with flood control and management:

- “6.5.1 Integrated and coordinated approach in flood control and management is essential. Action plans and programmes shall be developed for monitoring, early warning of flood hazards and disaster management caused by different forms of water. Particular attention shall be given to threats from glacial lake outburst.*
- 6.5.2 Disaster management plan including forecasting, preventing, evacuating and mitigating measures shall be developed for flood prone basins. Sound watershed management through extensive soil conservation, watershed area treatment, conservation of forests shall be promoted to reduce the incidence and intensity of floods. Flood forecasting system shall be established for timely warning along with the regulations for human settlements, construction of physical flood protection works to minimize the loss of life and properties due to floods.*
- 6.5.3 Flood protection and damage prevention shall be strengthened. In particular, flood zoning shall be carried out as an important disaster prevention measure. Measures to reduce the threats from glacial lake outburst floods shall be taken.”*

The NEC is made responsible for effective coordination of water resources management at the national level, including coordination -in collaboration with relevant sectors- of emergency preparedness, and, of flood and disaster management related to water resources (section 7.1.1).

The importance of national, regional and international cooperation is recognised in section 8.1.1:

“Cooperation in information sharing and exchange, appropriate technology in water resources development and management, flood warning and disaster management shall be initiated at the national, regional and global levels.”

Finally, according to section 7.5.2, flood control and mitigation, together with soil erosion and bio-engineering, figure among the areas that need special attention.

Note that a **Water Act** is currently **under drafting process** and is scheduled to be adopted within next year, with the NEC taking the lead role in this process.

Forest and Nature Conservation Act of Bhutan 1995 (FNC Act)

Revised Forest and Nature Conservation Rules of Bhutan 2003 (FNC Rules)

The FNC Act, aimed to provide for the protection and sustainable use of forests, wildlife and related natural resources of the country, deals with a series of land management issues. Section 9 of the FNC Act provides that RGoB *“may declare any private registered land to be Government Reserved Forest ... where it considers such action necessary to protect public health and safety, to prevent land slides on highways, to maintain critical watersheds, to conserve wild animals and plants ...”*. Section 10 contains a list of activities that are prohibited in Government Reserved Forests, except pursuant to a permit. According to Section 12, (b), a permit may be issued to take forest produce for own domestic use from nearby areas of Government Reserved Forests if *“... the taking will not increase the danger of landslides, soil erosion or other environmental damage ...”*. Section 14 does not allow the issuance of a permit to fell and take any timber *“(i) within 600 feet uphill or 300 feet downhill of a motorable road except forest roads; (ii) within 100 feet of the bank or edge of any river, stream, water course, or water source, or; (iii) on any place where the slope is greater than 45 degrees unless authorised under an approved management plan or by the head of the Department”*. The FNC Act gives MoA the power to make rules for the establishment of community forests (Section 17), for controlling breaking or clearing of land in private registered lands (Section 29, (a)), and, for regulating grazing in Government Reserved Forests (Section 30, (a)). Section 30, (b), reads as follows: *“Where the head of the department determines that land located in Government Reserved Forests is suffering from soil erosion or other environmental degradation, he may, after consulting with the appropriate local authority, order that grazing on such land be stopped for a specified time or be permitted only under specified conditions”*.

Any land in the country may be declared a protected area for the protection of biological diversity, management of wildlife, conservation of soil and water and related purposes (Section 21, (a)).

A number of provisions included in the FNC Act and Rules deal specifically with forest fires and fire protection. Among other activities, *“setting of fire, except controlled campfires, or leaving any fire including a campfire burning in such manner as to destroy, damage or endanger trees, any forest produce or wildlife”* in or near Government Reserved Forests is prohibited (Section 10, (a), (ii), FNC Act and Rule 74, (2), FNC Rules). The FNC Act and Rules underline the responsibility of every person in reporting, in helping prevent and put out any forest fires as well as in identifying those who have caused the forest fire (Section 31, (a), FNC Act and Rule 74, (1), FNC Rules). If the culprit is apprehended, he will be punishable with imprisonment of a maximum period of 5 years, or a fine of minimum Nu. 300 to maximum Nu. 1,000 per acre, or both (Section 10, (b), FNC Act and Rule 84, (8), (g) FNC Rules). If the culprit is not apprehended, the relevant village community will be required to re-plant the burnt area and to maintain those plantings (Section 31, (a), FNC Act and Rule 74, (5), FNC Rules).

Enforcement power of the FNC Act is given to the Department of Forest, MoA, through its Forest Officers. However, enforcement of the FNC Act and Rules seems difficult for the following reasons:

- there are not enough Forest Guards to patrol all areas;
- people in rural areas need to use fire for herd management or increasing agricultural yield and any viable alternatives have been proposed so far to their current practices;
- there are some existing constraints in relation to reforestation: difficulties in planning budget for seedlings, staffing shortages, availability of land for propagation.

The **Land Act, 1979** is very silent regarding sustainable land use and management. The government is in the process of reviewing this Act; it will probably include provision(s) related to a National Land Use Plan but no provisions regarding land management. The only reference made to natural calamities in the Land Act is when dealing with community grazing land, of which allotment can be done “...if the people of that village suffer from natural calamities and allotment of such land becomes necessary ...” (KA 8.1).

International Conventions

The following International Conventions have been ratified by Bhutan:

- United Nations Convention to Combat Desertification, 1994;
- United Nations Framework Convention on Climate Change, 1992;
- Convention on Biological Diversity, 1992;
- Vienna Convention for the Protection of the Ozone Layer, 1985;
- Montreal Protocol on Substances that Deplete the Ozone Layer, 1987 and its Amendments;
- Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention), 1972;
- International Plant Protection Convention, 1951.

3.4.3 Others

Bhutan Building Rules 2002

These rules, which apply to all declared urban areas, were elaborated with the hope of facilitating the property owners to plan and build their construction according to the prescribed technical specifications and expedite the process of approval by the implementing authorities. The purpose is to ensure minimum quality standards of construction and promote a healthy living environment for the safety of all occupants and properties.

Under the Bhutan Building Rules 2002, a person shall not erect any building or carry out any additions and alterations without obtaining a building permit from the Municipal/City Corporation (section 4.1.1). The application for a building permit shall be accompanied with a complete set of drawings (architectural drawings, structural drawings, details on electrical connections, additions and/or alterations to existing installation, compound electrification work, telephone connections, drainage and sanitation, and water supply – Annex 4) that have to comply with all requirements of the Building Rules, urban development plan, architectural guidelines and other requirements of the municipal authorities (section 4.2.2). Section 4.7 dealing with inspection states that site layout shall be verified and approved by the authorized Engineer/Building Inspector from the Municipal/City Corporation, and stipulates further that building constructions shall be subject to routine/periodic inspections by the same authorities. Note that the Municipal/City Corporation shall be held responsible for non-compliance of Bhutan Building Rules (section 17). Among other responsibilities (section 14), the applicant shall ensure that close supervision is exercised over the construction by an experienced Supervisor/Engineer. The rules require also the issuance of an occupancy certificate that certifies that the work has been completed as per the approved building drawings (section 4.8). The sanctions provided for by the rules include cancellation of the building permit if the construction is not as per the

approved building drawings and demolition of unauthorized building or additional floor(s) in the absence of a building permit.

Building Code of Bhutan 2003

The building code lays down a set of minimum provisions designed to protect the safety of the public with regard to structural sufficiency (Part I: Structural design) and with regard to fire hazards as well as different services such as electrical installations, installation of lifts, lighting and ventilation, etc. (Part II: Building Services). This code refers to relevant Indian Standards and Codes of Practices, among which the application of the Indian Code IS:1893 for seismic Zone V with regard to design for loads caused by earthquake is worth mentioning here.

Difficulties in enforcement of the building code and rules have been discussed earlier (see Sections 2.2.1 and 3.2)

Two **Draft Acts**, the **Urban Planning and Development Act** and the **Building Act**, are planned for submission to the National Assembly this year. While it seems that the former is dealing mainly with managerial and administrative issues related to urban planning, the latter is said to encompass the building code and rules and to institutionalize SQCA. SQCA has been operating so far under an Executive Order with its primary responsibility being to develop codes and standards for construction. It seems that under the Draft Building Act, SQCA could have a similar role as the one that NEC has in the Environmental Assessment Act with regard to enforcement. Note also that the need to frame an **Urbanization Strategy** is being discussed.

Royal Bhutan Police Act, 1979, and Royal Bhutan Police Rules and Regulations

Sections 34 and 36 of RBP Act deal with the duties of RBP in case of outbreak of epidemic diseases and fire respectively. In case of outbreak of epidemic diseases, the Officer-in-Charge of Police Station shall record information related to the event (“...*date and time of occurrence, place of occurrence, number of persons effected, number of serious patients, number of deaths...* ”), shall inform the nearest medical authority, and in consultation with the medical officer “... *shall make all efforts to prevent further spread of disease and render all possible aid to the public*” (Section 34, (a)). The police shall disseminate warning information about epidemics to the public dealing with vegetable and fruits at market places and encourage immunization; the Officer-in-Charge shall issue instructions on preventive and precautionary measures (Section 34, (b)). In case of fire outbreak, it is the duty of all the police personnel to promptly proceed together to the place of occurrence for preventing further spread of fire and extinguishing the fire (Section 36, (i) and (ii)).

Finally note the **key policies directives of the 9th FYP for the agriculture sector**: to intensify and diversify adopting an integrated approach in nutrient and pest management and achieve at least 70% self sufficiency in food grains.

4. Key components in the design of a national disaster management system with examples of other countries

This section describes the key components to be considered in the design of a disaster management model. To serve as an illustration, examples of some other countries are provided for each of these components.

4.1 Institutional structure and institutional linkages

4.1.1 Disaster management structures at the national level

Countries that have established disaster management structures often operate a dual system comprising of a National Disaster Committee (NDC) and a National Disaster Management Office (NDMO). The NDC, which is often the policy formulating body and may also be concerned with operational affairs, is typically composed of representatives from different ministries/departments/agencies and the Red Cross/Red Crescent and possibly representatives of donor agencies, NGOs and the private sector. The NDMO usually acts as the executive arm of the NDC; it may or may not be responsible for operations. The location of the NDMO has major implications for effective horizontal connections across ministries: it is either located in the Prime's Minister Office -which offers the advantage of providing the NDMO with greater authority in coordinating and integrating the inputs from various line ministries- or in a line ministry.

In Nepal, the Ministry of Home Affairs is the nodal agency for natural hazard management: it formulates and implements emergency preparedness and disaster management policies; it also carries out immediate rescue and relief in the event of disasters through the Department of Narcotics Control & Disaster Management and in collaboration with districts offices in all 75 districts in the country. The Central Disaster Relief Committee is the apex body of the disaster response system in the country. This committee, headed by the Minister of Home Affairs, consists of the Minister of Health, the Minister of Physical Planning and Works, secretaries of other ministries, representatives from the armed forces, the Director Generals from the Departments of Mines and Geology and of Hydrology and Meteorology, as well as representatives from the Social Welfare Council, the Nepal Red Cross Society and the Nepal Scouts. Three sectoral working groups, which include representatives from the government, the UN, donors and NGOs, were also established to provide complementary support to the government's own on-going relief efforts in the sectors of food and agriculture, health, and, logistics.³⁶ The Disaster Health Working Group came up with a health sector emergency preparedness and disaster response plan.³⁷

In 2002, the GoI decided to relocate all disaster management issues, with the sole exception of drought concerns, from the Ministry of Agriculture to the Ministry of Home Affairs, which is directly responsible for the coordination of the operational aspects of government. A National Committee on Disaster Management, under the Chairmanship of the Prime Minister, has been constituted with members of major political parties to suggest the necessary institutional and legislative measures needed for a mutually agreed national strategy for effective and long-term disaster management. The creation of the national committee was based on the recommendations made by the High Powered Committee on Disaster Management (HPC) that was earlier constituted in 1999 to recommend measures for strengthening existing arrangements as well as to propose comprehensive models for all aspects of disaster management responsibilities at national, state and district levels. Other recommendations of the HPC included: constitute a Cabinet Committee on Disaster Management; establish a National Centre for Calamity Management for

³⁶ United Nations Disaster Management Team (2001), *Nepal – UN Disaster Response Preparedness Plan Part I*, Kathmandu, pp. 33-35.

³⁷ UN/ISDR (2004), *op.cit.*, p. 90.

strategic and policy formulation; establish a National Institute for Disaster Management as a national centre for the creation of knowledge and its dissemination.³⁸

The Department of Dyke Management and Flood Control under the Ministry of Agriculture and Rural Development is the focal point for disaster management in Vietnam. This department acts as the secretariat of the Central Committee for Flood and Storm Control, chaired by the Minister of Agriculture and Rural Development and including Vice-Ministers from 13 line ministries, which is responsible for emergency responses to disastrous events.³⁹

Another existing model from other countries is not having a central NDMO but disaster units/departments established in different ministries, similar to Turkey's structure.

4.1.2 Links from the Centre to Local Government

Arrangements made at central level for the organisation of disaster management are usually replicated at local levels.

In Nepal, the District Disaster Relief Committee is the active agency for coordinating the district level relief efforts; this committee, chaired by the Chief District Officer, consists of representatives from public sector organisations such as the District Health Office, the Nepal Red Cross Society and similar agencies.⁴⁰

In Bangladesh, the creation of Disaster Management Committees at district, upazilla and union levels in disaster high-risk areas was among the main outcomes of the 'Support for Disaster Management' project supported by UNDP and UNICEF.⁴¹

In India, disaster management is deemed to be a 'state subject'; State Disaster Management Authorities (e.g. in Orissa and Gujarat) and Emergency Operation Centres have been set up in some States. Emergency Operation Centres also exist at District level. Disaster Management Committees are being formed at District, Block/Urban local body, Gram Panchayat and Village levels.

The operation of disaster management structures is often problematic at local levels. Difficulties in cooperation between different levels of government often constitute a major problem. Links are critical between national, regional, district and community levels to facilitate implementation and ensure effective vertical communication between different levels of government. An option that is however debatable if resources are scarce is the appointment of specialized staff to coordinate between the national government and the regional and local governments, which some countries consider or which is the case in Zimbabwe for example.

³⁸ UN/ISDR (2004), op.cit., pp. 85-87. See also GoI/UNDP (2002), *Disaster Risk Management Programme [2002-07]: Community Based Disaster Reduction and Recovery Through Participation of Communities and Local Self Governments*, Malhotra Publishing House, New Delhi, pp. 4-5.

³⁹ UN/ISDR (2004), ibid, p. 91. See also Kishore K. (2004), *Disaster Risk Management: experiences and good practices*, slides of the presentation done by the consultant during his mission to Bhutan.

⁴⁰ United Nations Disaster Management Team (2001), op.cit, p. 34.

⁴¹ GoI/UNDP/Confederation of Indian Industry (2002), *International Seminar on Disaster Preparedness and Mitigation - Report*, New Delhi, p. 21.

4.1.3 Coordination of mitigation, preparedness, relief and reconstruction

A problem often encountered is that national and local plans tend to address only relief, with little priority given to mitigation and preparedness. At local levels especially, this may be due to lack of executive power, lack of awareness or lack of political will to implement mitigation and preparedness programmes. If disaster risks are to be reduced, it is essential to adopt a more proactive approach of disaster preparedness and mitigation.

Various strategies and institutional arrangements need to be considered to ensure linkages between mitigation, preparedness, relief and reconstruction programmes. In Trinidad and Tobago, the NDMO has been divided into two sections: the Operations and Relief Section and the Mitigation Section. A key feature of Ethiopia's National Policy on Disaster Prevention and Management is the linkage of relief issues to development activities enlisting the involvement of all line ministries in incorporating disaster reduction measures into development programmes and development goals into relief operations.

4.1.4 Links with NGOs

Disaster management structures should provide for the participation of NGOs; a key means of involving NGOs is through representation on government committees at national and local levels.

The linkages between NDMOs and NGOs are of vital importance to effective disaster management. NGOs serve three essential roles in this respect: first, national NGOs can help communication between government and local communities; second, they can assist to promote community awareness and preparedness; and third, effective integration of NGOs has become imperative with the recent trend for the donor community to channel funds for relief activities through international and national NGOs rather than directly through national governments. Equally important is the coordination of NGOs inputs so as to reduce duplicity of efforts and to more effectively meet needs of the population to reduce vulnerability.

4.2 Support for the operation of a formal system of disaster management

To support disaster management, plans and strategies should be established, and policies, legislation and agreements should be developed or revised.

4.2.1 National Disaster Management Strategy/Plan

The concepts of planning and strategizing are usually used interchangeably while the products of each process may actually differ. The strategy can be considered as a broad exercise defining the roles of key agencies in vital functions, assessing their capacity responses and promoting improvements and activities to minimize the impact of disasters. A national contingency plan provides a description of a systematic approach to disaster preparedness. Typical contents of a disaster plan may include:

- A policy statement;
- Legislative authority for the design and implementation of the disaster plan;
- Objectives and conditions under which it will come into force;
- Assessment of disaster risks;
- Disaster scenarios;

- Roles and relationships with each level of government, especially emergency related bodies;
- Organisation chart of lines of authority;
- List of all relevant agencies and their heads and deputies with contact details;
- Operations of warning systems;
- Preparedness preparations;
- Communications arrangements and telecommunications equipment and procedures;
- Public information programme;
- Recovery and reconstruction resources and mechanisms;
- Disaster assessment plan;
- Agreements and linkages with other regions and countries.

Disaster plans must be constantly revised and updated.

Countries vary in their usage of a national disaster plan. In India, for example, besides the National Contingency Action Plan, a nationally applicable hazard specific plan has been developed (the Drought Contingency Plan 2000); plans have also been developed by state government authorities (e.g. Contingency plan for floods and cyclones in Chennai, Action Plan for reconstruction in earthquake-affected State of Gujarat). The advantages of having plans developed at local level are that each area can focus on the problems it is likely to encounter rather than use a very generalised national plan; such area specific plans also allow local officials to act quickly in a disaster without the need for long consultations with other levels of government.

Regardless of whether regional or local levels are expected to develop their own plans, it is recommended to establish a national plan so as to reduce the risk of erratic response. Besides providing a systematic approach to disaster preparedness, national disaster plans can support and enhance the local planning process. Regional or local plans need to be interlocked with the national plan in a consistent and complementary manner.

Besides the Standing Orders on Disaster, Bangladesh has also developed a Flood Action Plan following the 1988 floods. The objectives of this Plan are to safeguard lives and livelihoods, improve agro-ecological conditions to increase crop production, enhance development of public facilities, commerce and industry, minimize potential flood damage, create flood-free land to accommodate the increasing population, and meet the needs of fisheries, navigation, communication and public health. Note also that the ‘Support for Disaster Management’ project resulted in the development of a draft copy of an “Act, Policy and Plan on Disaster Management” and the formation of Local Disaster Action Plans in the most disaster prone districts, upazillas, pourashavas and unions.⁴²

The objectives of the National Strategy for Disaster Management in Vietnam are reduction in loss of property, reduction in loss of human life, reduction in economic losses caused by reduced production, reducing the incidence of poverty, ensuring sustainable development, providing equitable development, and, protecting the environment.⁴³

⁴² GoI/UNDP/Confederation of Indian Industry (2002), *ibid*, p. 21. See also UN/ISDR (2004), *op.cit.*, p. 88; Haan N., *WFP’s Role in Natural Disaster Mitigation – The Case of Bangladesh*, Dacca, p. 14.

⁴³ Kishore K. (2004), *op.cit.*

4.2.2 Supporting legislation and policy

The implementation of a national disaster management strategy/plan should be backed up by adequate legislation or other supporting arrangements, which can take the forms of policies, agreements (e.g. Memorandum of Understanding between two agencies), codes (e.g. building codes for earthquake resistance, codes of conduct) or others such as acts and decrees. Legislation or other forms of support should cover such issues as the authority delegated to the involved institutions, allocation of national resources to disaster management, specific procedures for implementation of mitigation, preparedness and response activities with assigned responsibilities, procedures for including the use of the military or civil defence agencies to address the disasters.

Among others, the most prominent act formulated by the government in Nepal is the Natural Calamity (Relief) Act, 1982. This act defines the official disaster management system at central, regional, district and local levels.⁴⁴

The Civil Defence Law, Law on environmental protection, Law on Water, Law on Air, Law on hydro meteorological and environmental monitoring, and, the State policy towards ecological issues, together with a few relevant articles in the Constitution, provide the legislative background to disaster management in Mongolia. A shortcoming in those laws is that there are no provisions delineating clearly the particular areas of responsibilities and functions in relation to natural disasters of a number of organisations with similar powers and responsibilities including the Ministry of Nature and Environment, the State Civil Defence Department and local authorities.⁴⁵

Key legislation supporting disaster management in Vietnam include the Law on Water Resources (which addresses issues of reservoir operation, flood diversion and retention, mobilization of manpower for emergency response, drainage of flooded areas and drought management) and the Environmental Protection Law (which lays emphasis on improving the environment, ensuring ecological balance, preventing and overcoming adverse impacts of man and nature on the environment); in addition to these laws, decrees provide the authorities with the necessary legal backing to carry out state management functions for flood and other disaster mitigation activities.⁴⁶

5. Conclusion and challenges

Past experience indicates that the government has been able to respond quite effectively to extreme events. However given the threat of a significant earthquake, the increasing risk of GLOFs and the annual occurrence of floods and landslides, the existing mechanisms and capacities may prove to be inadequate in dealing with large scale disasters and the predicted increase in occurrences of some natural hazards as a result of global warming and climate change.

While some elements of disaster management do exist in Bhutan, the country does not have a clearly defined institutional and legal system for disaster management. Poor communication between and lack of coordination among the different agencies dealing with disaster related/relevant issues are often cited among the major shortcomings. The need for a comprehensive national disaster management system was underlined at several occasions.

⁴⁴ United Nations Disaster Management Team (2001), op.cit, p. 33.

⁴⁵ Ministry of Nature and Environment, *Country Report on Natural Disasters in Mongolia*, Ulaanbaatar.

⁴⁶ Kishore K. (2004), op.cit.

The government has already taken an important step by designating the DoLG, MoHCA, as the agency with overall responsibility for disaster management in Bhutan. Included in the DoLG's future plans are the establishment of Disaster Management Committees at central and local levels and the development of a National Disaster Management Strategy. Note in this respect that a Preparatory Assistance Project supported by UNDMT-Bhutan is currently under draft process; this project would include the provision of technical assistance for the development and pilot testing of such national strategy.

Therefore the **main area of priority** concerns institutional development. In this respect, work remains to be done to address the following issues:

Organisational structures

- Strengthening the capacity of the DoLG in disaster risk management;
- Consolidating and strengthening institutional arrangements at national and local levels, for example creation of National, District and Block Disaster Management Committees, and providing them with adequate training as well as financial and material resources;
- Defining clearly the roles and responsibilities of the institutional structures in place and key agencies involved at national and local levels (it became clear during the present study that there was a need for clear roles and responsibilities regarding the conduct of awareness-raising activities in relation to different types of natural hazards for example);
- Institutionalising effective communication and coordination mechanisms (vertical communication between all levels of government as well as horizontal communication between different stakeholders);
- Establishing ways to involve civil society, NGOs, private sector and the communities in disaster management.

Policy and planning

- Formulating a National Disaster Management Strategy as well as national and local plans;
- Integrating disaster risk management into development planning and sectoral policies;

Legal/regulatory framework

- Developing new legislation/policies/other forms of support or reviewing existing ones to include relevant provisions dealing with issues such as (i) the definition of clear roles and responsibilities of the involved institutions and agencies, (ii) allocation of resources, (iii) specific procedures and guidelines for implementation of mitigation, preparedness and response activities, and (iv) procedures to involve the armed forces in addressing disaster situations.

Resources

- Allocating adequate funds at all levels in the yearly budget not only for relief and recovery activities in case of disasters, but also for implementing mitigation and preparedness programmes;
- Allocating adequate and well trained staff at all levels (capacity-building needed not only on technical skills -e.g. structural engineering, fire investigation, search and rescue operations- but also on management, planning and knowledge management skills).

Other priority areas include:

- Carry out risk assessment studies, which include the following elements: hazard mapping, resource assessment, loss estimation, deciding on levels of protection as well as vulnerability assessment. Indeed, risk assessment is a necessary first step for any serious consideration of disaster reduction strategies;
- Develop strategic land-use management and planning based on hazard assessments and risk mapping;
- Establish effective early warning systems;
- Look into the possibility of having a specific institution to take care of the overall management of water resources;
- Increase education and public awareness on disaster risk management through inclusion in educational programmes at all levels, public awareness and information campaigns, the use of the medias, and community training programmes;
- Develop a comprehensive system to maintain proper records of disasters.

Other challenges for Bhutan include:

- Find appropriate ways to compensate/provide relief to the affected persons that at the same time take care of not developing any relief-dependency behaviour (e.g. for farmers in case of loss of land and crops);
- Further strengthen national, regional and international cooperation in research and technology development and continue efforts to support the conduct of scientific studies (e.g. need for an analysis of traditional knowledge and practices).

Annex 1: Disaster risk reduction initiatives or supportive projects/programmes/activities undertaken by various ministries/departments/agencies

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
<p>Department of Geology and Mines (DGM), Ministry of Trade and Industry (MoTI)</p>	<p><u>In relation to GLOFs:</u></p> <ul style="list-style-type: none"> • Apart from several joint expeditions to the Lunana area carried out before and just after the 1994 GLOF, numerous studies have been undertaken by DGM during the recent years to monitor the developments in glaciers and glacial lakes and to assess the risk of GLOFs. This was done mainly in collaboration with organisations in other countries: <p>Nagoya University, Tokyo Metropolitan University, Japan - Geological Survey of Bhutan joint research programme between 1998 and 2003;</p> <p>Institute of Geology, University of Vienna, Austria - Geological Survey of Bhutan joint project between 1998 and 2001;</p> <p>Collaboration with ICIMOD for the creation of an inventory of glaciers and glacial lakes,</p>	<ul style="list-style-type: none"> • Lack of financial resources (e.g. to implement the mitigation plan prepared by the Austrian experts for Thorthormi Tsho; to put in place early warning systems such as sirens in Lunana region and in Punakha-Wangdue valley); • Lack of involvement of DGM in site selection for infrastructural development on the downstream region 	<ul style="list-style-type: none"> • DGM plans to suggest mitigatory measures and early warning systems for the flood prone areas based on the regular monitoring of the glacial lakes; the department plans to incorporate implementation into the 10th FYP;

⁴⁷ Now called the International Institute for Geo Information Science and Earth Observation.

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>of GLOF events and potential GLOF sites in Bhutan, and, the establishment of an early warning system for GLOF hazard monitoring;</p> <ul style="list-style-type: none"> • Mitigation measures (excavation of a channel) on Raphstreng Tsho were carried out in collaboration with the Government of India (GoI) from 1996-1998; • One of the results of the three year joint Austria-Bhutan project has been the design of hazard zonation maps along Pho Chhu up to Kuruthang (4 plans for Thanza, Denji, Tshojo, and, Lhedi, Shangsa and Tasho) for hazardous processes such as water flood, debris flow, slides, rock fall and side slope erosion, which consist of a red prohibition zone, yellow and blue regulation zones and a brown information zone. On basis of these maps, it becomes clear that some houses, particularly those identified as falling in the red zone, should be relocated; • Sensitization/awareness-raising during the various field trips to local communities in Lunana on the risk of GLOF and measures to be taken in case of GLOF; • Monitoring activities of a number of glacial lakes are carried out yearly and reflected in the annual budget. 	<p>of the glacial lakes;</p>	

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p><u>In relation to earthquake:</u></p> <ul style="list-style-type: none"> • DGM installed five temporary seismic stations for a period of one year (2002-2003) in collaboration with the University of Texas at El Paso to collect information on the seismicity of Bhutan; this collaboration has also resulted in training of one Bhutanese national in the field of geophysics and another one in the field of Remote Sensing/GIS and neo-tectonics; • DGM also collaborates with the University of Colorado at Boulder to better understand the characteristics of tectonic deformation of the Bhutan Himalaya region and the mechanics of the monsoon. Numerous GPS points were measured in November 2003 along Thimphu-Phuentsholing highway, Punakha-Laya, and Bumthang-Zhemgang highway, and will be measured again in the near future. Besides, two permanent GPS stations have been installed at Thimphu and Phuentsholing in November 2003 to monitor the rate of convergence in the region with the highest possible accuracy. Some results from the analysis of the GPS data collected are expected in 2006; • DGM is also collaborating with the Dalhousie University, Canada, to unravel the tectonics and the structural setting of the 	<ul style="list-style-type: none"> • Financial constraints to set up a local seismic network; 	<ul style="list-style-type: none"> • DGM plans to set up a permanent seismic network for the entire country (project proposals submitted to UNESCO and JICA); • The department plans to develop a seismic hazard zonation map for the country;

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>Bhutan Himalaya region.</p> <p><u>In relation to (flash) floods and landslides:</u></p> <ul style="list-style-type: none"> • DGM has been carrying out the geological risk assessment along the national highway. A landslide hazard map for the stretches already covered is being prepared. On the Thimphu-Phuenstholing highway, such studies were also carried out and instruments have been installed at Kharbandi slide to monitor the movement of the slide in collaboration with the Norwegian Geotechnical Institute; • DGM is also carrying out a project through the Sustainable Development Secretariat fund on slope stability and environment assessment in collaboration with the International Training Centre⁴⁷, Netherlands. In this project, three batches of foresters and engineers have been trained in the field of engineering geology, especially addressing issues of slope stability and environment; • Over the years, and especially since last year, DGM has been actively involved in foundation studies for various infrastructural development and landslide hazard assessments; the Department has also been providing geo-technical advice 		<ul style="list-style-type: none"> • DGM plans to prepare a landslide hazard zonation map for the country; • The department plans to continue providing geo-technical services for infrastructure development and slope stability among other subsurface stability related problems; • It also plans to incorporate hazard assessment for urban centres into the 10th FYP.

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>and laboratory services to both private and public sectors (e.g. hazard assessments for several Hospitals, for schools, for renovation of Dzongs; slope stability studies for town planning);</p> <ul style="list-style-type: none"> • DGM is also involved in assessing and carrying out mitigatory measures for flash floods and the stability of artificial lakes formed by landslides (e.g. MoTI coordinating the river training works and riverbed dredging at Pasakha following the flash flood in 2000; DGM involved in relation to mitigation works for Tsatichhu and Wabbranchhu Lakes). 		
<p>Department of Energy (DoE), MoTI</p>	<ul style="list-style-type: none"> • The Flood Warning Section (FWS), presently with the Hydromet Services Division, has 10 hydrological stations spread across the country that are equipped with wireless transmission sets. Based on a fixed schedule, river level data of the main rivers flowing to India is transmitted to stations of Central Water Commission in Cooch Behar, Jalpaiguri, Nalbari and Barpeta in India. The flood warning activities are funded by the GoI and are reviewed every six months through the Joint Expert Team meetings. • The FWS has also one radio station at Thanza to monitor water levels of the 		

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>glacial lakes at Lunana. A charter of duties defines the times to be followed by the staff at Thanza for gauge observations and for transmission of the data to Wangdue and Sunkosh Dubani stations. This charter also includes a list of the officers at district level and at headquarters to whom alert shall be given immediately in case of emergency following the outburst of glacial lakes. The operation of Thanza station is funded by RGoB.</p> <ul style="list-style-type: none"> • Tsatichhu Lake, mitigation works and early warning system: <p>The DoE was made responsible for the overall coordination of the mitigation activities aimed at minimizing the impact of a possible outburst of the landslide dammed lake, which was formed on the Tsatichhu in September 2003. The joint effort of activities has contributed to better understanding of the landslide dams and lakes and the threat that they pose; it has also shown the importance of early warning system and the need for a coordinated approach.</p> <p>In accordance with the recommendations submitted by the multidisciplinary team - consisting of experts from various agencies</p>		

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>including the DGM, the Hydromet Services Division and the Kurichhu Hydro Power Company (KHPC)- who visited the site in December 2003, the Hydromet Services Division installed a water level recorder to monitor the level of the lake and to calculate the inflow, and a flood warning station was set up at Ladrong; the DGM carried out a downstream hazard assessment; and, the KHPC dug a channel.</p> <p>A second wireless station was set up in Autsho after the occurrence of a large slide in May 2004, which created a second lake on the Wabbranchhu.</p> <p>Thanks to timely warning, damage to the KHPC could be minimized as the spillway gates could be opened when a major part of the Tsatichhu dam failed in July 2004.</p> <p>To follow up on the recommendations made by a team -comprising of officials from Bhutan Power Corporation (BPC), KHPC and DoE- who visited both lakes in December 2004, the following measures were undertaken during the last joint DoE-DGM field visit end of January 2005: bathymetric survey conducted of both lakes to determine the volume of water in the</p>		

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>lakes; breached outlets deepened and widened.</p> <p>The flood warning section will continue to monitor the water level of both lakes and the seepage as well as the downstream areas for another monsoon season.</p> <ul style="list-style-type: none"> • A Joint Group of Experts on Flood Management has been formed between the RGoB (from which the Director General, DoE, was asked to lead the team) and the GoI to <i>“discuss and assess the probable causes and effects of the recurring floods and erosion in the southern foothills of Bhutan and adjoining plains of India and recommend to both Governments appropriate and mutually acceptable remedial measures”</i>. A set of flood mitigatory studies to be done by both Bhutanese and Indian Experts was decided upon during the first meeting that was held in November 2004. • The Hydromet Services Division is collaborating with ICIMOD for the establishment of a flood information network in the Hindu Kush Himalayan region. 		
Department of Forest (MoA)	<ul style="list-style-type: none"> • As part of the decentralisation process, a community forest development programme 	<ul style="list-style-type: none"> • lack of trained manpower, 	<ul style="list-style-type: none"> • The Department of Forest plans to

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
<p>Social Forestry Services Division</p>	<p>was initiated: at present, 23 communities participate in the programme where they have been handed over the right to manage and use the forest areas within the vicinity of their community;</p> <ul style="list-style-type: none"> • A Memorandum of Understanding was signed in 2001 with Rural Fire Service Australia that provided technical assistance regarding training in forest fire management: training of officials from Department of Forestry in fire fighting and, in December 2002, of all Dzongkhag Forest Officers, officials from the armed forces, Bhutan Forestry Institute and Natural Resources Training Institute; development of two training manuals in 2003 ‘Standard operating procedures and forest fire fighting training manual for crew leaders’ and ‘Forest fire fighting training manual for basic firefighters and advanced firefighters’; • Emphasis is put on forest fire prevention activities, for which provision is made in the annual budget: awareness-raising campaigns with financial assistance from Bhutan Trust Fund for Environmental Conservation conducted through the use of the national medias (Kuensel and BBS); also awareness-raising through the Dzongkhag Forest Officers by organizing 	<p>facilities and equipment;</p> <ul style="list-style-type: none"> • lack of skills and knowledge in assessing the causes of forest fires (2 persons have been sent for training in forest fire science but have not come back yet); • Absence of an institutionalized coordination mechanism in case of forest fires, including fixed procedures to involve other key actors such as RBP, RBA, BPC and MoH; • no emergency telephone number. 	<p>carry out a fire hazard mapping in the East;</p> <ul style="list-style-type: none"> • The department is also in the process of drafting terms of reference for forest fire committees to be formed at village level.

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>on a regular basis workshops and training to local communities on the prevention and suppression of forest fire;</p> <ul style="list-style-type: none"> • Forest fire hazard reduction measures: establishment of forest fire lines particularly in fire-prone areas and on plantation areas; on a trial basis, use of the ‘prescribed burning’ method, which involves burning of particular patches of forest area to reduce fuel load in fire-prone areas. 		
<p>MoA</p>	<p>Department of Agriculture (DoA):</p> <p>Resource management is one of the programmes under which DoA emphasizes more on land management programmes such as land development, soil conservation, soil fertility development and cultivation practices.</p> <ul style="list-style-type: none"> • Demonstration of suitable land management technologies at 8 pilot sites; • Capacity-building of Extension Agents on resource management in collaboration with the National Soil Service Centre (NSSC) through trainings. <p>Involved in environmental assessment and forest clearances for Geog Renewable Natural Resources (RNR) infrastructure development such as farm roads, irrigation channels, power tiller tracks and RNR offices construction.</p>		<ul style="list-style-type: none"> • Land Management Campaign for mass awareness is planned commencing from July 2005 at Trashigang Dzongkhag led by His Excellency, the Honorable Minister, MoA

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>Land use change and/or conversion strictly assessed based on technical guidelines.</p> <p>Riverbank protection works such as construction of gabion walls are carried out on an ad-hoc basis for example after the occurrence of an event (e.g. in Gelephu following the 2004 Monsoon floods) or integrated in the design of a project if revealed needed already at that stage.</p> <p>Council for RNR Research of Bhutan:</p> <ul style="list-style-type: none"> • Soil management/conservation/fertility studies; • Land management studies/campaign; • Watershed management activities in Lingmetechu and Radi; • Community-Based Natural Resource Management activities. <p>Second Eastern Zone Agricultural Programme:</p> <ul style="list-style-type: none"> • Community participation in natural resource management through sensitization, trainings, resource mapping, and development of a digital database for critical watershed management for all 	<ul style="list-style-type: none"> • Poor communication and collaboration between relevant departments of line ministries. 	<ul style="list-style-type: none"> • Multi-sectoral project sponsored by World Bank/Global Environment Facility (GEF) is under preparatory phase led by NSSC; the project is expected to extend support on land management programmes.

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>eastern regions on degraded land;</p> <ul style="list-style-type: none"> • Demonstration and training in soil and water conservation techniques. <p>Wang Watershed Management Project:</p> <ul style="list-style-type: none"> • Increased awareness on watershed management among teachers, students, and local communities; • Increased awareness on sustainable agricultural production among school children; • Improve Dzongkhags' land-use planning capacity; • Forest operational planning, management and implementation; • Private forestry; • Community forest management; • Improved soil and water conservation on agricultural lands. 	<p>In relation to watershed management in general:</p> <ul style="list-style-type: none"> • Lack of basin-wide approach; • Lack of institutional and financial resources for effective implementation of watershed management; • Need to move from token community participation to real participation; • Need to identify local level partners. 	
<p>National Environment Commission (NEC)</p>	<ul style="list-style-type: none"> • NEC has the overall authority for monitoring the Environmental Assessment process of projects; • NEC is implementing a National Adaptation Program of Action (NAPA) project funded by GEF through UNDP, which is aimed to 		

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>assess the most urgent adaptation needs to climate change. A list of adaptation strategies has been proposed in relation to natural disaster and infrastructure to address the impacts of climate change, among which prioritization will further be done. Project proposals will be developed for the priority activities and implementation will be undertaken by the relevant organisations.</p>		
<p>Department of Roads (DoR), Ministry of Works and Human Settlement (MoWHS)</p>	<ul style="list-style-type: none"> • As part of the Environmental Friendly Road Construction (EFRC) support programme, DoR has adopted since a few years ago the EFRC technique for all road infrastructures development in the country: detailed geological, socio-economic and environment assessment studies are carried out to minimize the negative impact of road construction on the society, economy and environment. Since about one year ago, involvement of DGM in assessing the geological hazards for the proposed road alignment is part of a fixed procedure during the planning process. • Bio-engineering is carried out as part of the regular activities and reflected in the annual budget; • Other mitigation measures such as drainage system are undertaken on a case by case basis for example after the occurrence of an 	<ul style="list-style-type: none"> • lack of capacity in geo-technical engineering; • lack of capacity in environmental impact assessment and monitoring; • lack of instruments for detailed survey, more particularly to determine the type of soil; • further strengthening needed for the collection and analysis of data for landslide risk assessment; 	<ul style="list-style-type: none"> • DoR plans to create an Investigation and Development Division, which will include people from various fields (planning, geo-technical engineers, environmental unit, research, Road Maintenance Management System (RMMS), and, technical taskforce unit).

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>event or during the construction stage whenever revealed necessary; note also that some slope protection works (construction of retaining walls and breast walls, bio-engineering) were undertaken on the East-West highway during the last financial year with part of ADB loan;</p> <ul style="list-style-type: none"> • The seismic Indian Standard is followed for the construction of bridges and protection walls; • A Landslide Risk Assessment Project was carried out in 2001-2002 by the Scott Wilson Company, funded by the Department of International Development, UK, in three pilot areas (Mongar-Trashigang road, Sunkosh-Dagana road and Chukha-Damchu road) with the aim of developing rapid, low cost methods of landslide hazards and risk mapping; • Data is being collected on road structure, landslide sites, slope and quarries along the roads with the objective to assess landslide risk for the entire road network (data already collected for 6 of the 8 divisions). 		
<p>Standards and Quality Control Authority (SQCA), MoWHS</p>	<p>SQCA is implementing the Thimphu Valley Earthquake Risk Management Project (TVRMP) funded by UNDP as a preparatory assistance in the field of earthquake related disaster. The objectives</p>	<ul style="list-style-type: none"> • No earthquake zonation map for the country; • Application of 	<p>The importance to carry out the following activities has been underlined by SQCA:</p> <ul style="list-style-type: none"> • Conduct seismic

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>of this project are as follows:</p> <ul style="list-style-type: none"> • To formulate an earthquake scenario (through vulnerability and capacity assessment) of Thimphu Valley and Action Plan (with short medium and long term recommendations); • To understand seismic risk reduction needs of critical buildings in Thimphu valley and to offer user-friendly guidance for reducing seismic risks of these buildings and other prominent building types in Thimphu. 	<p>interpolated Indian Standard seismic code provision for Zone V (the severest zone) to all engineering buildings uniformly throughout the country has considerable impact on the cost of construction;</p> <ul style="list-style-type: none"> • Limited in-house technical facilities and human expertise (shortage of structural engineers). 	<p>study and develop a seismic zoning map for Bhutan;</p> <ul style="list-style-type: none"> • Review and revise the Building Code for seismic structural standards based on the seismic zoning map; • Additional technical and financial support to continue with similar project as TVERMP for other towns and cities (e.g. Phuentsholing, S'Jonkhar, Gelephu); • Technical and human capacity-building in seismic vulnerability assessment and in earthquake-resistant construction, including in the

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
			design of retrofitting system and implementation of retrofitting techniques.
Department of Urban Development and Engineering Services (DUDES), MoWHS	<ul style="list-style-type: none"> • DUDES provides technical backstopping to the Municipal/City Corporations, which are responsible for enforcement of the building code and rules, i.e. verifying compliance of the drawings with minimum standards and conducting routine/periodic inspection to the construction sites to ensure compliance. 	<ul style="list-style-type: none"> • Lack of capacity in structural engineering (assessing structural safety of existing buildings and in the design and construction of new buildings); • Lack of awareness of the public on the importance of investing in quality and safe buildings; • Application of minimum standards, including anti-seismic design, resulting in high cost of construction. 	
Ministry of Health (MoH)	<ul style="list-style-type: none"> • In 1999, Emergency Medical Services 	<ul style="list-style-type: none"> • Need for training 	<ul style="list-style-type: none"> • MoH, with EMS,

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	<p>(EMS) was instituted and a National Policy on Emergency Medical Response was developed, which was further refined in November 2003 as Policy Directive on Disaster Management and Internal Displacement.</p> <p>244 Emergency Medical Technicians (EMTs) from throughout the country and about 94 hospital-based personnel for trauma care (mainly in hospitals along the border areas and some hospitals along the national highway) from among various categories of health workers were trained to back up the armed forces during the operation against the militants in December 2003. While EMS was instituted for the country to be prepared in case of military conflict, EMTs are still retained for any activity in the future if need arises such as in case of a disaster (note that EMT have been actively involved during the Monsoon floods in 2004). Focal points have been designated: the Director, Department of Medical Services, is the focal point for any matters related to disaster; the Division of Health Care & Diagnostic Services is the focal division; there is also a focal person in the Hospital.</p> <ul style="list-style-type: none"> As part of the regular activities, prevention measures are undertaken (such as health 	<p>and retraining of EMTs in trauma and other specific areas;</p> <ul style="list-style-type: none"> Development of infrastructure for trauma care; No allocated funds in annual budget for possible outbreak of diseases. 	<p>plans to focus towards addressing both natural and manmade disasters.</p>

Ministry/Department/Agency	Disaster risk reduction initiatives undertaken or projects/programmes/activities supportive of disaster risk reduction	Capacity gaps	Future plans of RGoB
	education and monitoring) under malaria programme and diarrhoeal disease control programme.		

Annex 2: Bibliography

- Department of Local Governance, Ministry of Home and Cultural Affairs (2005), *National Report of Bhutan for World Conference on Disaster Reduction (Kobe, Japan 18-22 January 2005)*, Thimphu.
- National Environment Commission, Royal Government of Bhutan, *Bhutan's Country Report on Natural Disaster Reduction*, Thimphu.
- Planning and Policy Division, Ministry of Home Affairs, *Draft Guidelines for Disaster Management in Bhutan*, Thimphu.
- Tshering Phuntsho, Ministry of Home Affairs, *Disaster and Management in Bhutan*, slides of its presentation.
- Konagaya Y. (2005), "Characteristics of disasters in Bhutan", *Bhutan Geology Newsletter*, Sl. N°8, pp. 26-39.
- Kishore K. (2004), *Draft Mission Report*, Thimphu.
- Kishore K. (2004), *Disaster Risk Management: experiences and good practices*, slides of the presentation done by the consultant during his mission to Bhutan.
- Ministry of Agriculture and Ministry of Home and Cultural Affairs (2005), *Report on land damaged by the flood during 2004 in Chuzangang geog*, Thimphu.
- Ministry of Agriculture (2004), *Report on the Assessment of Monsoon Related Damages in the Six Eastern Dzongkhags*, Thimphu.
- Multi-sectoral team (2001), *Report on the study of the catchment area of Barsa Chhu and its future impact on the downstream industries at Pasakha, in and around Penden Cement Factory and new industrial estate locations*, Thimphu.
- Multidisciplinary team (1994), *Preliminary Report on the investigation of glacial lakes at Pho Chhu Source and the assessment of flood affected areas in Lunana*, Thimphu.
- UN agencies (2004), *Bhutan UN Inter-Agency Humanitarian Contingency Plan*, Thimphu.
- UNDP, *Preparatory Assistance for Thimphu Valley Earthquake Risk Management Project (TVERMP)*, Thimphu.
- Multi-sectoral NAPA taskforce (2005), *Draft National Adaptation Programme of Action*, Kuensel reports since 1980, Thimphu.
- UNICEF Bhutan (2003), *Protecting and Assisting Children and Women in Extraordinary Circumstances. Emergency Preparedness and Response Plan for Year 2003, Part I: Overview and Summary of Planned Response*, Thimphu.
- WHO Mission (2004), *Report on assistance to the national authorities for control of dengue outbreak 5-19 August 2004*, Thimphu.
- Dowchu Drukpa (2005), "Earthquake studies in the Bhutan Himalaya: A collaborative research work between DGM and University of Texas at El Paso, University of Colorado at Boulder and Dalhousie University", *Bhutan Geology Newsletter*, Sl. N°8, pp. 46-49.
- Ageta Y. and Kohshima S. (2004), *Report of Japan-Bhutan Joint Research 2003 on the assessment of Glacier Lake Outburst Flood (GLOF) in Bhutan*, Institute of Hydrospheric-

Atmospheric Sciences of Nagoya University, Department of Geography of Tokyo Metropolitan University, Tokyo, Geological Survey of Bhutan, Thimphu.

Ageta Y. and Iwata S. (1999), *Report of Japan-Bhutan Joint Research 1998 on the assessment of Glacier Lake Outburst Flood (GLOF) in Bhutan*, Institute of Hydrospheric-Atmospheric Sciences of Nagoya University, Department of Geography of Tokyo Metropolitan University, Tokyo, Geological Survey of Bhutan, Thimphu.

Brauner M., Häusler H., Leber D. and Dorji Wangda (2002), *Implementation of a Hazard-Zonation Concept for Land-Use Planning of Gasa Dzongkhag in the Eastern Pho Chhu Watershed of Bhutan*, Institute of Geology, University of Vienna, Vienna, Department of Geology and Mines, Thimphu.

Häusler H., Leber D. et al. (2000), *Final Report of Raphstreng Tsho Outburst Flood Mitigatory Project (Lunana; Northwestern Bhutan): Phase II*, Institute of Geology, University of Vienna, Vienna.

Häusler H. and Leber D. (1998), *Final Report of Raphstreng Tsho Outburst Flood Mitigatory Project (Lunana, Northwestern Bhutan): Phase I*, Institute of Geology, University of Vienna, Vienna.

Mool P.K., Dorji Wangda, Bajracharya S.R., Karma Kunzang, Deo R. Gurung and Joshi S.P. (2001), *Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods. Monitoring and Early Warning Systems in the Hindu Kush-Himalayan Region, Bhutan*, ICIMOD, Kathmandu.

Shrestha M.S. and Karma Chhophel (2005), *Disasters in the Hindu Kush Himalayan Region – A case study of Tsatichhu Lake in Bhutan*. Paper prepared for the International Conference on Headwater Control VI: Hydrology, Ecology and Water Resources in Headwaters (20-23 June 2005, Bergen, Norway).

Hydromet Services Division, Department of Energy, Ministry of Trade and Industry (2005), *Survey report of Tsatichhu and Wabragchhu lakes*, Thimphu.

Dema, “Firefighters battle flames in Wangduephodrang”, *Kuensel*, Thimphu, April 16, 2005.

---, “Forest fire in Trashigang”, *Kuensel*, Thimphu, April 16, 2005

National Environment Commission, Royal Government of Bhutan (2004), *Brief Report on State of the Environment*, Thimphu.

National Environment Commission, Royal Government of Bhutan (2000), *First Greenhouse Gas Inventory*, Thimphu.

National Environment Commission, Royal Government of Bhutan (2000), *Initial National Communication under the United Nations Framework Convention on Climate Change*, Thimphu.

Draft Constitution of the Kingdom of Bhutan (26th March 2005)

National Environment Commission, Royal Government of Bhutan (2000), *Environmental Assessment Act*, Thimphu.

National Environment Commission Secretariat, Royal Government of Bhutan (2002), *Regulation for the Environmental Clearance of Projects and Regulation on Strategic Environmental Assessment*, Thimphu.

National Environment Commission, Royal Government of Bhutan (2004), *Environmental Guideline, Environmental Codes of Practice, Environmental Standard*, Thimphu (CD).

National Environment Commission, Royal Government of Bhutan (2002), *Environmental Codes of Practice for Hazardous Waste Management*, Thimphu.

National Environment Commission, Royal Government of Bhutan (2000), *Environmental Codes of Practice for Urban Roads and Traffic Management*, Thimphu.

National Environment Commission, Royal Government of Bhutan (1998), *'The Middle Path' National Environmental Strategy for Bhutan*, Thimphu.

Bhutan Water Policy, 2003

National Forestry Policy, 1974

Forest and Nature Conservation Act of Bhutan, 1995

Revised Forest and Nature Conservation Rules of Bhutan, 2003

Land Act, 1979

Department of Urban Development & Housing, Ministry of Communications, Royal Government of Bhutan (2002), *Bhutan Building Rules 2002*, Thimphu.

National Authority for Construction Standards and Quality Control, Ministry of Communications, Royal Government of Bhutan (2003), *Building Code of Bhutan 2003*, Thimphu.

Ministry of Communications, Royal Government of Bhutan (2003), *Urban area and property regulations 2003*, Thimphu.

Ministry of Communications, Royal Government of Bhutan (2002), *National Housing Policy 2002*, Thimphu.

Royal Bhutan Police Act, 1979, and Royal Bhutan Police Rules and Regulations

UN/ISDR (2004), *Living with Risk: A global review of disaster reduction initiatives*, New York, Geneva, UN, Volumes I and II.

GoI/UNDP (2002), *Disaster Risk Management Programme [2002-07]: Community Based Disaster Reduction and Recovery Through Participation of Communities and Local Self Governments*, Malhotra Publishing House, New Delhi.

GoI/UNDP/Confederation of Indian Industry (2002), *International Seminar on Disaster Preparedness and Mitigation - Report*, New Delhi.

United Nations Disaster Management Team (2001), *Nepal – UN Disaster Response Preparedness Plan Part I*, Kathmandu.

Haan N., *WFP's Role in Natural Disaster Mitigation – The Case of Bangladesh*, Dakha.

Ministry of Nature and Environment, *Country Report on Natural Disasters in Mongolia*, Ulaanbaatar.

Annex 3: List of persons met

Ministry of Home and Cultural Affairs, Department of Local Governance

- Dasho Dr. Sonam Tenzin, Director
- Ms. Sonam Deki, focal point natural disasters

Ministry of Trade and Industry

Department of Geology and Mines

- Mr. Yeshe Dorji, Head Geological Survey of Bhutan
- Mr. Karma, Glaciologist
- Mr. Dowchu Drukpa, Geophysicist

Department of Energy

Mr. Karma Chhophel, Head of Hydromet Services Division

Ministry of Agriculture

Policy and Planning Division

- Mr. Sonam Lhundrup, legal officer
- Mr. Kezang Jamtsho, Head of Policy and Legal Section
- Mr. Dungkar Drukpa, GIS officer

Department of Forest

Mr. Karma Thinley, Social Forestry Services Division

Ministry of Works and Human Settlement

- Am Dorji Choden, Director, Standards & Quality Control Authority
- Mr. Tshering Wangdi B, Superintending Engineer, Road Division, Department of Roads
- Mr. Meghraj Adhikari, Chief town planner, Urban Planning and Development Division, Department of Urban Development and Engineering Services

Ministry of Health

Dr. Tapas, Joint Director Health Care Services

Royal Insurance Corporation of Bhutan

Mr. Damdi Dorji, Manager, Insurance Department

National Environment Commission

Mr. Karma C Nyedrup, Deputy Director

Royal Bhutan Police

Captain Tashi Phuntsho, Officer-in-Charge, Thimphu City Police Station

WHO

Dr. Kunzang Jigmi, National Medical Officer

Annex 4: List of persons who have attended the half-day working session on vulnerability

Ministry of Home and Cultural Affairs, Department of Local Governance

Ms. Sonam Deki, Focal Point Natural Disasters (sub-group earthquake)

Ministry of Trade and Industry, Department of Geology and Mines

- Mr. Yeshi Dorji, Head Geological Survey of Bhutan (sub-group floods)

- Mr. Karma, Glaciologist (sub-group floods)

- Mr. Dowchu Drukpa, Geophysicist (sub-group earthquake)

Ministry of Works and Human Settlement

Department of Roads

- Mr. N.P. Katel , Executive Engineer (sub-group landslides)

- Mr. N.K. Giri, Engineering geologist (sub-group landslides)

Department of Urban Development and Engineering Services

Mr. Meghraj Adhikari, Chief town planner, Urban Planning and Development Division (sub-group earthquake)

Standards and Quality Control Authority

- Mr. Rinzin Namgyel, Executive Engineer (sub-group earthquake)

- Mr. Pema Dorji, Assistant Environment Officer (sub-group earthquake)

Ministry of Agriculture

Mr. Kezang Jamtsho, Head of Policy and Legal Section, PPD

National Environment Commission

Mr. Tshering Tashi, Joint Director, Head of Technical Division (sub-group floods)

WFP

- Mr. Bhanu Bhakta Acharya, Programme Assistant (sub-group landslides)

- Ms. Naoe Yakiya, Chairperson UNDMT (sub-group floods)

UNDP

- Ms. Seeta Giri, Environment Specialist (sub-group landslides)

- Mr. Karma Chogyal, Field Security Coordination Assistant (sub-group earthquake)

UNICEF

- Mr. Pema Dhendup, Water & Sanitation Project Officer (sub-group earthquake)

- Ms. Khandu Om, Education Assistant Project Officer (sub-group floods)

WHO

Dr. Kunzang Jigmi, National Medical Officer (sub-group landslides)

Helvetas

Ms. Sangeeta Koenig (sub-group landslides)

JICA

Ms. Emi Doyle, Project Formulation Advisor (sub-group earthquake)

Departments/agencies invited but that were not able to participate:

Ministry of Health

Department of Energy, Ministry of Trade and Industry

Thimphu City Corporation

UNFPA

SNV

Austrian Coordination Bureau

Annex 5: Terms of Reference – Disaster Management Analysis

1- Background:

Bhutan is vulnerable to several different types of natural disasters including earthquakes, flash floods, landslides, and glacial lake outburst flooding which pose varying degrees of threat to the lives and livelihood of its estimated population of 800,000.

Historically, the Ministry of Home and Cultural Affairs has been the Royal Government of Bhutan's (RGoB) focal point on disaster response operations although a number of other ministries and departments also play a role in addressing the risk of disasters. It is generally agreed that, while disasters in Bhutan have been reasonably well-managed in the past, the current "loose" institutional mechanism may not be adequate to deal with a catastrophic earthquake or other large-scale disaster. Key stakeholders in disaster management are proactively deliberating whether the time has come for a more holistic and integrated approach.

As part of its mandate, the United Nations Disaster Management Team (UNDMT) in Bhutan is responsible for assuring that planning and preparation for potential disasters in the country on the part of constituent agencies are up to date and fully coordinated with those of the RGoB.

The RGoB and the United Nations in Bhutan have agreed upon a program of preliminary assistance for integrated disaster risk management. It has been also agreed that the first step in the process of improving the collective ability to respond to disasters is stock taking of organizational mechanisms in place, the relevant legislative history, and the existing capacity of disaster management in Bhutan.

The analysis will not only support the RGoB in weighing the merits of a more integrated approach but is also intended to support the United Nations Development Assistance Framework (UNDAF) Country Programme formulation and Common Country Assessment (CCA) processes.

2. The main objectives of the Analysis

The main objectives of the analysis are three-fold. First, the analysis should provide a clear picture of the organizational mechanisms and related legislative framework currently in place within Bhutan. Second, the analysis should provide a set of possible organizational options based upon models from other countries. Third, the report should also include sections on causal analysis related to the various types of disasters and vulnerability analysis of disasters including potential loss of life and property and impacts on economic status and livelihood, based upon research and interviews.

3. Output:

The key output will be a Disaster Management Analysis Report which will include five major sections:

1. Causal analysis of the various types of disaster threats in Bhutan
2. Vulnerability and impact analysis of disasters
3. Matrix or chart showing current disaster management mechanisms (policy and planning, legal and regulatory framework, organizational structures, and resources and capacities) among the key stakeholders;

4. Review of existing legislation pertaining to the environment, human settlements, and land use to assess the need for disaster specific legislation
5. 3-4 organizational models of disaster management from other countries appropriate to the Bhutanese context.

4- Activities:

The key task is to consolidate the information gathered from a review of existing documentation and consultation with relevant stakeholders. The information must be compiled in such a way that it can be used by all relevant stakeholders including the RGoB at the national and district level, NGOs and donors to discuss possible disaster management options and to make related recommendations, as part of national and district consultative workshops.

A second task will be the collection of models of disaster management from other countries identified as relevant to the context and risks in Bhutan.

The consultant will be assisted by UN disaster management team (UNDMT).

5- Time frame:

The analysis is expected to be completed in 20 working days.

6- Qualifications and experience required

The consultant should be a highly experienced written communicator. He/she should be knowledgeable about disaster management in the Himalayas and in Bhutan and have a general idea about the RGoB system. He/she should be able to work proactively and independently and should be highly responsible about meeting deadlines. Experience in developing similar analytic documents is an asset.