B H U T A N

Country Report

on

Natural Disaster Reduction

For Submission to:
International Decade for Natural Disaster Reduction

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Summary

Bhutan is a landlocked Kingdom in the Eastern Himalayas and its terrain is rugged and mountainous. The climate is characterized by dry winter and wet summer monsoon. The consequence of recent geological movements is heavy erosion.

Forest fires is a major threat and susceptible during the dry winter months, with an average of 50 forest fires cases (approximately 12,000 acre) reported annually. Conifer and mixed conifer forests which cover 40% of the total forest area are more prone to forest fires.

In December 1982, a case was reported of spruce epidemic in the western parts of Bhutan between 2859 m - 3250 m above mean sea level. Approximately 6000 ha was estimated to be attacked by Ips longifolia (Bark beetle) and other unidentified pest. in the year 1986. This new species is now described as Ips schmutzenhoferiholz, a new species in science.

The seismotectonic information relating to Bhutan is scarce and in an earthquake hazard context, seismotectonic features described as revelant for areas immediately bordering Bhutan are also revelant for Bhutan. The earthquake symbol in Bhutan at 27 degree North, 1992 acutally represents two major earth quakes of about the same size and location, with a magnitudes of Ms 6.8 and 6.5 respectively.

Natural landslide and erosion processes are mostly because of tectonic uplifting of major mountains ranges and consequent downcutting by the river systems. Severe and irreversible erosion is also a result of the ecological balance that is disturbed by the construction of roads, irrigation facilities and clearing areas for cultivation. Such landslide are often experienced during abnormal heavy monsoon.

Flood is not foreseen, however, during an abnormal heavy monsoon, it is envisaged in the foothills of the country and the neighbouring country. Such cases are faciltated by Emergency Flood relief team.

Bhutan is not considered a disaster prone area, however has established a regional cooperation with SAARC: assistance mechanism for disaster; regional cooperation on the development of modern disaster warning systems, etc.. The Department of Roads, Department of Forests, Department of Agriculture, Department of Health Services, Department of Power and National Environment Commission are also responsible in carrying out preventive measures and rehabilitation relief assistance during an emergency case.

Chapter I

Introduction

1 The kingdom of Bhutan is a small, landlocked country situated on the southern slopes of the Eastern Himalayas, bordering Tibetan region of China in the North and the Indian states of Sikkim, Assam and Arunachal Pradesh in the west, south and east respectively. The country covers an approximately area of 46,500 square kilometers: roughly 150 km north to south and 300 km east to west.

Area, sq km	46,500
Population	600,000
Population density/sq km	13
GNP per capita, US $	425
Economy % of GDP 1990	
Agriculture	46%
Industry	25%
Service Sector	29%
Landuse preliminary survey (1991)	
Grass, river and alpine	25%
Forests	57%
Cultivated	16%

Source: National Environment Commission 1992.

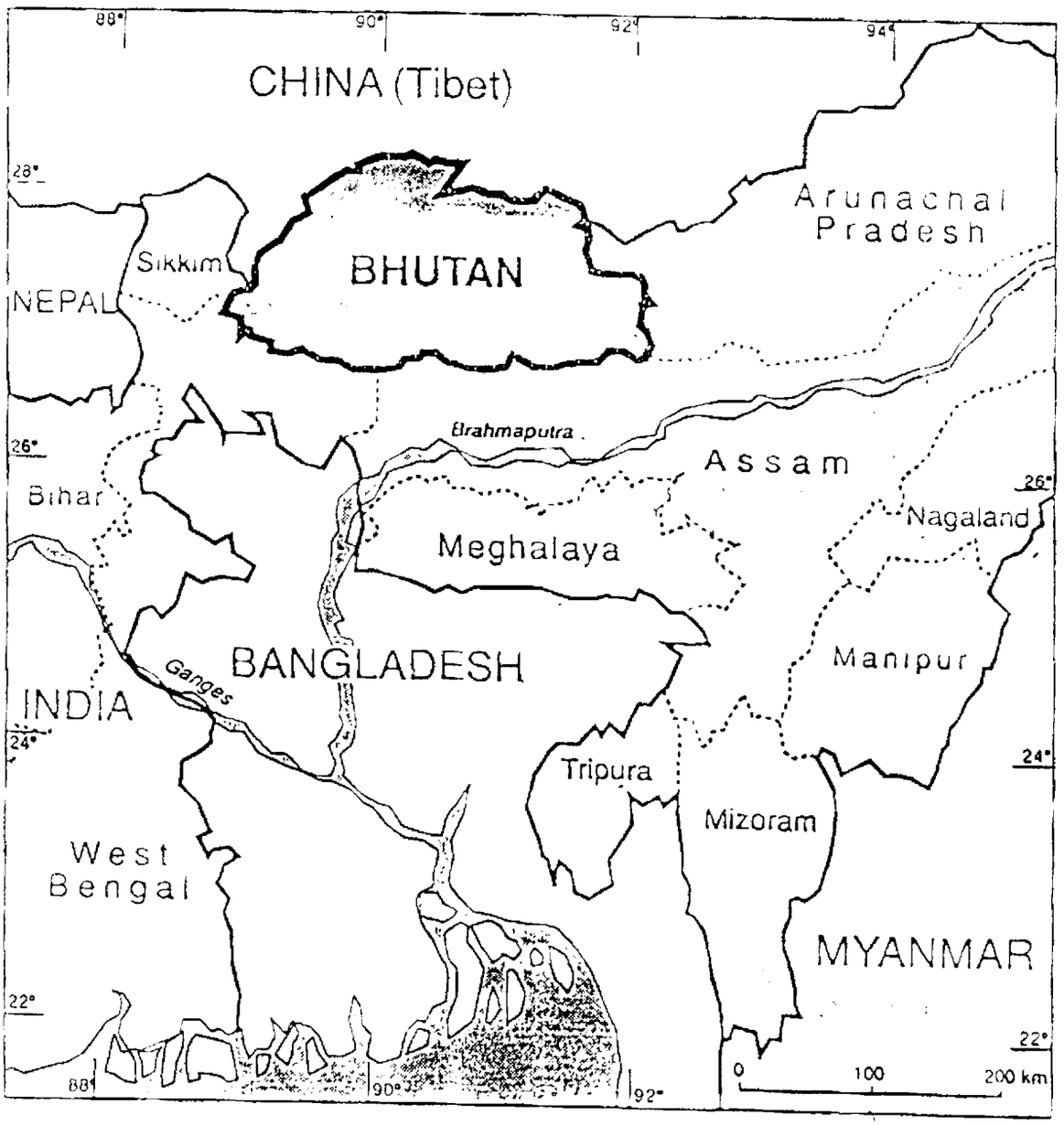
2 The terrain is among the most rugged and mountainous in the world, as most of the country includes part of the Himalayan ranges. The land rises from an elevation of about 160 meters above sea level in the south to more than 7,550 metere above sea level in the north. The variations in climate are correspondingly extreme. Southern Bhutan is generally hot and humid, while the high mountains in the northern border of Bhutan are under perpetual snow. Climate can vary considerabily between valleys and within valleys depending on levels of altitude. Rainfall in particular, can differ within relatively short distance due to rain shadow effects.

3 A consequence of recent geological movements is heavy erosion. Slopes are generally as steep as they can be and are mainly kept stable by vegetation. There is considerable natural erosion which is further exacerbrated by human activities, especially when the soil becomes heavily water-logged during the monsoon. The climate is characterised by a dry winter and a wet summer monsoon. The precipition becomes heavier towards the south, with annual rainfall of up to 5000 mm.

4 The seismotectonic conditions in and around the Kingdom are characterized broadly by the regional Himalayan mountain arc frontal thrust faults along the borders of the country to the south, contrasting a regime of extensional rifting in the north towards Tibet.

5 Forest Fire is another major threat causing land slides within the country. Bhutan's forests that is 40% of the total forest cover area are Blue pine, Chirpine,mixed conifer, broad-leaf with conifer are most susceptible to frequent forest fires. Repeated forest fire combined with heavy grazing pressure are the major reasons of degradation of vegetation cover. Our analysis have revealed that 90% of forest fire incidence are caused by men, will fully or accidently. To prevent man-made forest fire during dry season, prevention and education programme of forest fires are informed through the local radio services and National newspaper yearly.

Figure.1 Map of Bhutan and its neighboring countries.



Chapter II

Risk Assessment

Forest Fire

6 Forest fire is one of the biggest threats to Bhutan's forest resources. Blue pine, Chirpine, mixed conifer, broad leaf with conifer, plantation and degraded forests which covers approximately 40% of the total forest area are most susceptible to frequent forest fires.

7 In Bhutan, forest fire incidence is normally high during the dry winter months. Cool temperate and lack of rainfall are responsible for drying of perennial grasses and increasing wind velocity quicken the drying process thereby making the grass covered area inflammable. Further, land preparation for agricultural, horticultural and shifting cultivation purposes is done during or at the end end of the winter months. Fire is used as the cheapest tool for cleaning such land by the villagers and shifting cultivators. As a result, uncontrolled use of fire in or adjacent to the forest occurs frequently. Often such fires escape to the forest accidentally. The causes of fire is one of the main elements which is studied thoughtfully while planning and designing prevention activities/ programmes.

8 Percentage of forest fire incidence cause-wise in general is given as under:

Table 1. shows the percentage of forest fire incidence

Cause	%
Debris burning(escaping from fields)	40
Cattle grazing(burning for new grass)	30
Uncontrolled campfire, cooking etc.	25
Smokers	5

Source: Ploadpilew, 1980

9 Every year 20 - 75 or on average of 50 forest fire cases are reported in the country. Most forest fire are caused by escaped fires from agricultural land and orchards. Similarly, the number of fire escapeing from camp fire, cooking fire etc. has been reduced by adopting more restrictions through National Forestry Acts.

10 1979, 1981, 1982, 1983 and 1989 were comparatively dry years and in most parts of the country, pre-monsson rain were delayed and very much limited. As a result the number of forest fire cases increased.

11 In order to afford better protection and management of the forest resources, fire risk rating has been classified as:

Total annual rainfall	Fire risk rating zone
Less than 1000 mm	High fires risk zone
1000 mm to 2000 mm	Medium fire risk zone
2001 mm and above	Low fire risk zone

High fire risk zone:

12 Areas with less than 1000 mm annual rainfall are considered high fire risk zone such as, Kurizampa, Tashigang, Tangmachu, Rongtung in the east and Thimphu, Paro, Haa and Wangdi in the west and some rain shadow areas of the central region fall under this zone. Because of little rain, high day-time temperature and afternoon wind forest floor dries slower and higher risk of fire incidence in this low rainfall zone is foreseen. Chirpine growing areas are also included in this zone as these types of forests occur mostly in drier sites.

Medium fire risk zone

13 Areas which receive rainfall between 1000 mm to 2000 mm per annum fall under this zone. Punakha, Hurchi, Langthal, Tongsa, Lama Gompa, Dungkhar, Thrimshing, Khengkhar, Daga Dzong, Dubani, Mangdechu, Dagapela, Shemgang, Chhukha, Tashithang, Yabilabsa and Damphu fall under this zone. Broad-leaved forest floor in this zone is slightly moist and as such forest fires are not frequent however the zone of chir pine forest remains quite dry and therefore, frequent fires may occur.

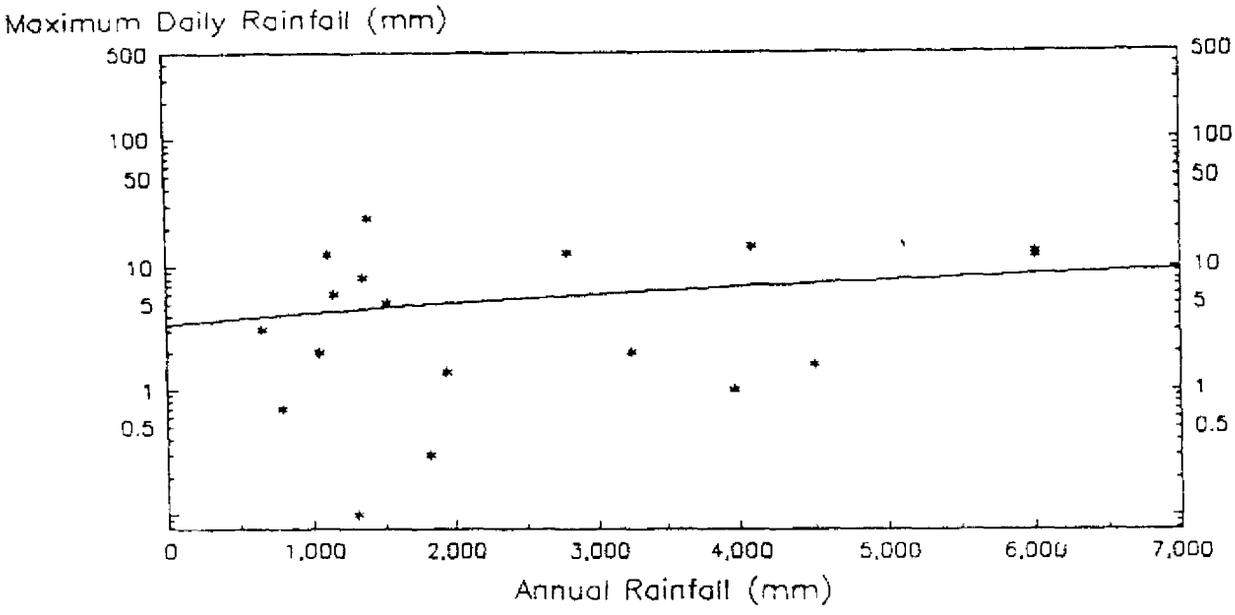
Low Fire Risk Zone

14 Areas with more than 2000 mm annual rainfall are considered as low fire risk zone. All Southern parts of the country like Sarbhang, Samchi, Phuntsholing, Sibsoo, Decheling, Daifam, Samdrupjongkhar, Survey, Deothang, Dungmain and Dorokha fall under this zone. The floor of the evergreen forest is covered throughout the year by green grasses but the floor of deciduous forests is covered by dry fallen leaves and is also prone to catch fire during long drought periods.

Rainfall and Fire Incidence Data Analysis

15 Rainfall and fire incidence data analysis was done to allow determination of forest fire seasons based on average rainfall data of the region and past fire incidence data totalling to 280 cases. Analysis reveals that the forest fire season in the country differs region-wise due to variation in weather patterns. Therefore, the analysis is done regionwise as Eastern Region, Western Region, Central and Interior Belt of Southern Region and Southern Region.

Maximum Daily Rainfall
Driest Month: January



Maximum Daily Rainfall
Wettest Month: July

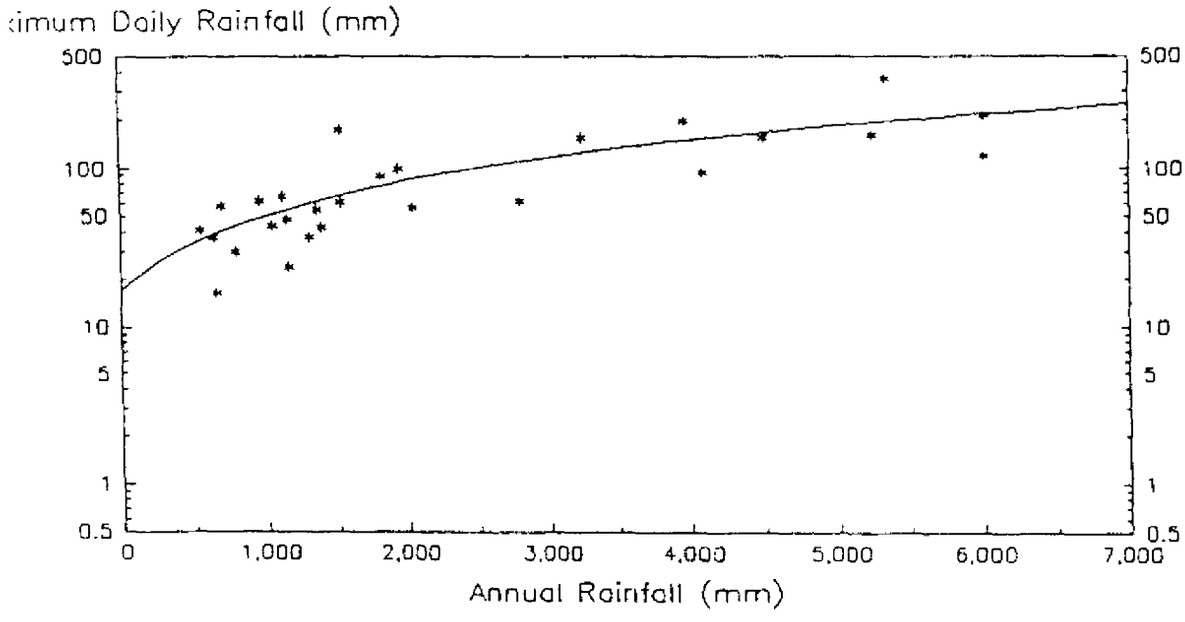


Table 2. Rainfall data

Place	Year 1985(mm)	Year 1986(mm)	Year 1987(mm)	Year 1988(mm)	Year 1989(mm)
Bumthang	940.4	775.3	861.8	683.7	748.6
Chukha	NA	568.0	756.8	1565.6	1668.4
Chirang	NA	NA	1984.8	1817.7	1916.8
Daga Dzong	1236.7	1735.4	1660.4	1911.8	2099.2
Ha	NA	839.9	NA	826.0	1045.6
Luntshi	601.0	873.5	987.3	717.2	927.1
Mongar	1021.1	887.0	998.5	705.4	695.6
Paro	565.6	656.0	824.8	792.4	1127.1
Punakha	2444.1	1673.7	2202.9	1831.7	2352.1
S/Jongkher	NA	1453.9	3241.9	3966.7	2127.0
Samchi	4557.9	2136.9	4402.9	4507.5	4593.1
Gaylegphug	5388.2	4494.5	5873.9	6010.7	4133.2
Sarbhang	NA	2063.0	2778.7	3844.2	2516.6
Shemgang	1670.5	1051.0	1391.1	1923.7	1669.7
Tashigang	NA	805.5	1474.3	1868.0	1531.3
Thimphu	659.3	439.3	495.1	507.4	711.9
Tongsa	1203.2	955.0	1144.6	1042.5	1354.9
Wangdi	NA	981.4	1065.4	894.2	146

Source: Meteorlogy Division, Bhutan

Table 3. shows the forest fire incidence in Bhutan

Dzongkhag	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Haa	-	4	1	1	1	0	0	1	1	1
Paro	3	9	-	5	5	5	4	3	4	3
Thimphu	-	15	8	8	12	12	4	7	9	8
Wangdi	-	-	6	4	6	8	16	1	-	-
Punakha	-	1	6	-	-	-	-	-	-	2
Tongsa	2	-	3	2	-	4	-	-	3	1
Bumthang	-	3	4	7	5	4	3	5	2	2
Mongar	-	-	3	21	2	5	5	-	-	-
Luntshi	-	-	-	-	-	-	-	-	5	11
Tashigang	-	-	-	10	11	20	1	-	9	10
Sarbhang	-	14	-	-	4	-	-	-	-	-
Samchi	-	10	-	-	-	-	1	-	-	-
Chirang	-	-	-	-	-	-	-	-	-	9
Shemgang	-	4	-	-	2	1	-	-	1	-
Chukha	-	-	-	-	-	6	1	-	-	-
Dagana	-	-	-	-	-	-	-	-	-	2
S/Jhongker	-	11	-	13	12	11	5	-	-	-

Source: Bhutan Forest Research Division

Table 3. Continue

Dzongkhag	1988	1989	1990	1991	Average	Total
Haa	3	2	3	2	2	20
Paro	10	-	7	4	5	62
Thimphu	10	11	6	6	9	116
Wangdi	-	-	5	8	7	54
Punakha	4	-	0	1	2	14
Tongsa	-	-	-	-	3	15
Bumthang	-	-	-	-	4	35
Mongar	6	19	4	5	8	70
Luntshi	-	12	6	3	8	50
Tashigang	13	14	19	6	11	113
Sarbhang	-	-	-	-	9	18
Samchi	-	4	-	3	3	18
Chirang	-	-	-	-	9	9
Shemgang	-	-	-	-	2	8
Chukha	-	-	-	-	4	7
Dagana	-	-	-	-	2	2
S/Jhongker	-	-	-	-	10	52

Pest Epidemic[1]

16 In December 1982, a case was reported on Spruce epidemic in the mixed conifer belt between 2859 m 3250 m above sea level at Chailaila and Paro areas. Spreading of this spruce epidemic was identified as Ips longifolia attack and also a new species of longifolia family unknown to science. This analysis was carried out by an Enthomologiest, a consultant from UNDP/FAO. The analysis identified as the species Ipes longifolia and other accompanying species of this family along with Polygraphus bark beetle. During 1986 Febuary and November, trap-log system was carried in all effected spruce belt, and control method was demonstrated for Bumthang Division.This new species is now described as Ips schmutzenhoferi (Holz) a new species in science.

Table 4 Bark beetle survey data.

Area infested		1987	1986	1985	1984
Chailaila	126	37	104	36	52
Haa	436	23	399	35	-
Chamina	1,110	401	269	253	112
Taba Top	-	143	195	116	17
Chamgang	114	95	116	20	-
Total	1786	697	1083	460	181
Percentage		28.79	44.61	19	7.48

Source: Bhutan Research Division

[1] Source: Bhutan Forest Research Institute, Taba

17 July 1987 remarkable decrease in population of bark beetle was reported from the Divisions. I.schmutzenhoferi's (bark beetle) attack survey in areas where control measures such as Trap-log and debarking of felled fresh trees are as follows:

Table 5. Bark beetle attack survey where control measures were carried out.

	Area	1987	1986	1985	1984
	Chailaila	37	104	36	52
	Haa	23	399	35	-
*	Chamgang	95	116	20	-

* (Chamgang : A kind of new patch near epedemic area)

Source: Bhutan Research Division

Table 6 Bark beetle attack in forest where there is no control and preventive measures.

Area	1987	1986	1985	1984 & earlier
Taba Top	143	195	116	17
Chamina	401	269	253	112

Source: Bhutan Research Division

Table 7 Decrease of attck in beetle control.

Areas	1987	1986	1985	1984 & earlier
Chalaila & Haa	60	503	71	52
(%)	8.75	73.32	10.34	7.58

Source: Bhutan Research Division

Table 8. increase of attack in untouched area.

Areas	1987	1986	1985	1984
Chamina & Taba	544	464	396	129
(%)	35.48	30.27	25.83	8.41

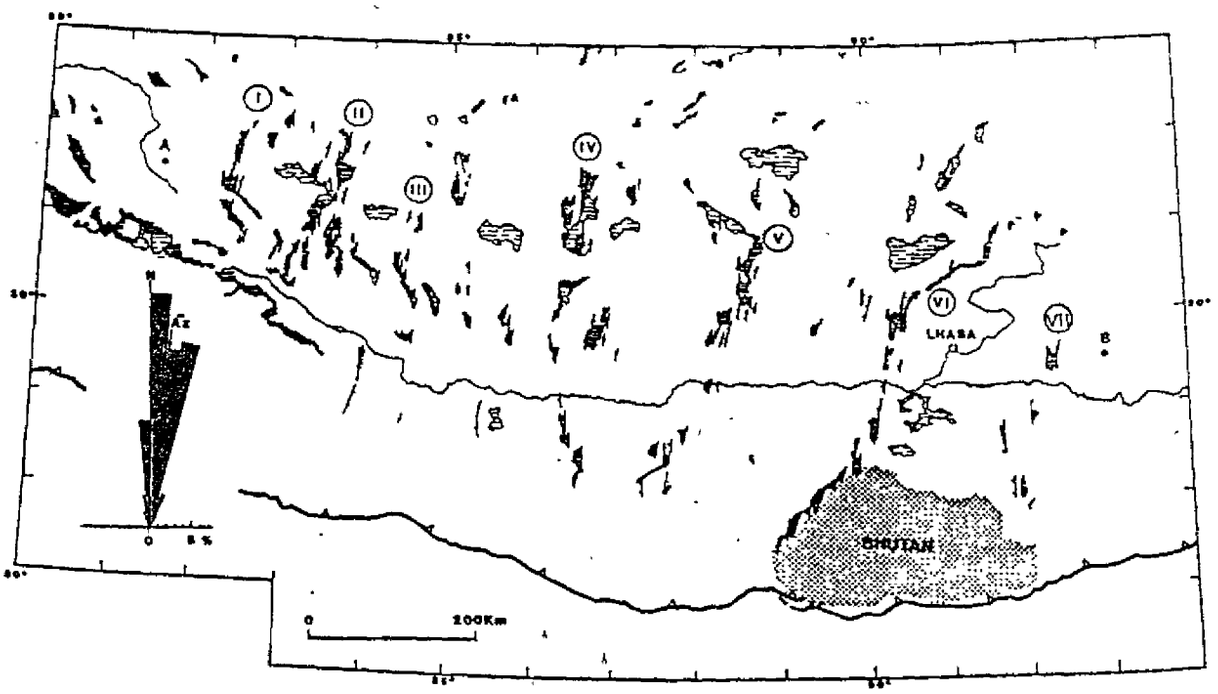
Source: Bhutan Research Division

Seismicity of Bhutan

18 The seismotectonic information directly and particularly relating to Bhutan territory is scare. In an earthquake hazard context, seismotectonic features described as relevant for the areas immediately bordering Bhutan are

also relevant for Bhutan. Very few earthquake reports are available for the Himalayan region prior to the end of 19th century, when the world sciencitfic community's growing interest in the observation of natural phenomena lead to an increasing number also of erathquake reports. But it was not until the beginning of the 1960's, that earthquakes in remote, sparsely populated areas such as the Himalayas could be reliably covered with respect to their spatio-temporal characteristics[2]. The crustal structure beneath the Himalayan collision zone and Tibet is complex, leading to a considerable uncertainity in the location of earthquakes even with a considerable amount of globally recorded instrumental data of good recording accuracy.

Figure.2 Simplified map of Quaternary faults I-VII mapped by the Chinese-French expedition to Tibet, 1980-1982 (modified from Armijo et al., 1986) The Kingdom of Bhutan is here approximately drawn into the figure (shaded area)



19 The Himalayan region has suffered from many large earthquakes during the past 100 years. One of the most significant earthquakes was the August 15, 1950, magnitude 8.6 earthquake in Assam, India, with epicenter at 28.7° N, 96.6° E, abou 450 km east of Bhutan. This earthquake created

[2] Overview of Tectonic Conditions and Earthquake activity in Bhutan, prepared by NTNF/NORSAR May 15, 1992

extensive damage in an area of 50,000 km2, corresponding to an area slightlylarger than Kingdom of Bhutan. The location of earthquakes with surface wave magnitude shows ms above 6.0 during the past 100 years for Bhutan and the surrounding areas. The earthquakes symbol in Bhutan at 27°N, 92 acutally represents two earthquake of about the same size and location. These earthquake occured in 1941, the first one and largest of magnitude MS 6.8 occurred on January 21, and the second largest of magnitude MS 6.5, on January 27.

20 Table 9 gives the key parameters for the 20 earthquakes reported inside the small geographical rectangular enclosing the Kindom of Bhutan during the time interval 1963 - 1991[3].

21 Several earthquakes of magnitude and above 8 have actually occurred in the surroundings of Bhutan, more specifically in the Assam Valley south of Bhutan, in Tibet and near the Nepal-India border. No major damage has been recorded in Bhutan, except for the Tashigang Dzong which had large cracks on the walls of the dzong.

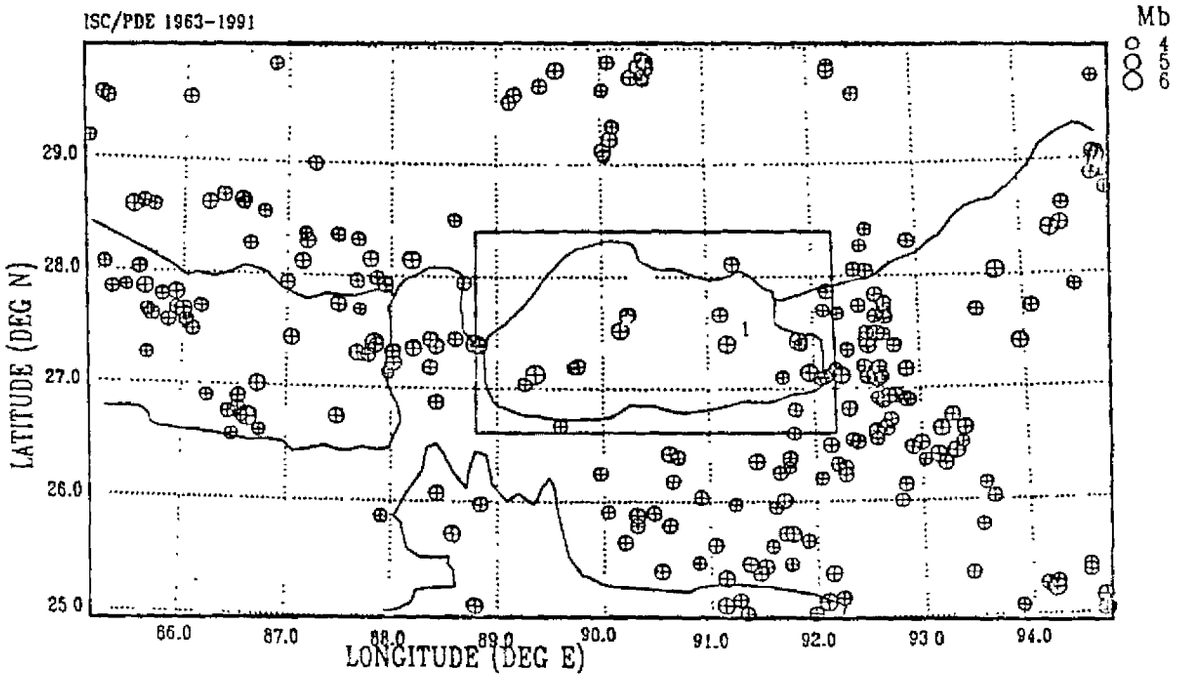
Table 9 key parameters for 20 earthquakes reported in and around Bhutan.

Year	Agency	HMS	Latitude	Longitude	Mb
1963/7/05	PDE	071915.8	27.70	92.10	4.2
1964/2/18	ISC	034834.4	27.40	91.18	5.6
1964/3/27	ISC	230341.1	27.13	89.36	6.3
1964/4/13	ISC	031957.3	27.52	90.17	5.4
1965/11/6	PDE	1600458.9	27.10	91.70	4.3
1967/7/7	ISC	2256630.9	27.87	92.14	4.9
1967/9/15	ISC	103244.2	27.42	91.86	5.8
1969/11/5	ISC	202513.7	27.66	90.24	5.0
1979/1/13	ISC	032715.5	27.39	91.89	4.5
1979/7/29	ISC	141559.3	26.81	91.82	4.6
1980/12/22	ISC	023608.0	26.67	89.59	4.5
1981/2/9	ISC	154921.6	27.20	89.76	5.1
1982/4/5	ISC	021941.2	27.38	88.84	5.1
1982/8/18	ISC	180107.6	27.04	89.26	4.6
1985/1/7	ISC	161305.4	27.14	91.96	5.6
1985/10/2	ISC	163350.3	27.19	89.73	4.4
1985/12/26	ISC	180426.5	27.09	92.07	5.7
1988/2/17	ISC	063007.7	27.11	92.11	4.8
1988/7/5	ISC	073627.4	28.11	91.24	4.9
1988/12/20	ISC	094544.4	27.66	91.12	5.0

Source: Bhutan Power System Master Plan

[3] Compiled by NTNF/NORSAR

Figure.3 ISC/PDE reported earthquakes during the time interval 1963-1991. The small rectangle enclosing Bhutan is used for the determination of the earthquake activity level in Bhutan



Lanslides

22 The topography of Bhutan is characterized by steep to precipitous slopes which descend rapidly into narrow valleys. These conditions give rise to very high soil erosion. 'To avert the global environmental disaster being brought on by soil erosion, it is imperative to take action quickly and on vast scale.....'Noel D.Veitmeyer, Study Director,Vetiver Grass 1993. Severe and irreversible erosion can take place when ecological balance is disturbed by construction of roads, irrigation facilities and clearing areas for arable land. However, the mass wasting which scar the landscapes have not all resulted from the activities of man. Mass wasting, unstable slopes and other natural erosion processes are mostly because of tectonic uplifting of major mountain ranges and consequent downcutting by the river system.

23 Bhutan can be divided into four physiogeographic regions:

i) The sub-Himalayan or Siwaliks
ii) The middle Himalayan or middle mountains
iii) The great Himalayan or high mountains
iv) The trans Himalayan or high Himalayan.

24 From the point of slope instability, the Department of Roads when planning roads construction has considered two

main components that is type of soil i) sheet erosion and ii) landslide prone area; and angle of the deposit. Landslide and other erosion are usually caused by roads, especially during the monsoon seasons. It has a major problem both for transport communication and the forests. The maintenance of existing roads is technically difficult, expensive and labour intensive see Table.10

Table 10[4]. road maintenance cost per annum

Type of road	National Highway(1591 Km)
Routine maintenance	Nu: 23,000 per Km/year
Periodic Maintenance	Nu:240,000 per Km/year
Emergent/Restoration	Nu: 30,000 per Km/year
Unit cost	Nu:1,860,000 per Km
Type of road	District Roads (517 Km)
Routine maintenance	Nu: 17,400 per Km/year
Periodic Maintenance	Nu:222,000 per Km/year
Emergent/Restoration	Nu: 25,000 per Km/year
Unit Cost	Nu:1,644,000 per Km
Type of road	Feeder Roads (461 Km)
Routine maintenance	Nu: 6,778 per Km/year
Periodic Maintenance	Nu: 180,000 per Km/year
Emergent/Restoration	Nu: 20,000 per Km/year
Unit Cost	Nu:1,404.000 per Km

Source. Department of Roads Thimphu

25 Information required for landslide hazard mapping and risk evaluation:

Geological maps	For understanding causes of landslides for predicting density, severity and frequency of landslides in large areas. Aerial photos enable recognition and mapping landslides in large areas.
Topographic maps	Provide a base for plotting landslide information.

[4] Approximate estimated budget figure for 1993/94.

	Topographic forms are used to indentify landslides, etc.
Slope maps	Climatic data based on specific events and annual climates are needed for assessments of influence for case histories and probablistic predictions.
Climate Data	Build up of pore water pressure in the subsurface materials and changes in water level needed for predicting initiation of specific landslides and predicting probability of failure.
Subsurface Water	Enable preparation of maps of susceptability to landsliding.
Vegetation Maps	Vegetation tending to support and stabilze slopes need to depicted in terms of types, density and canopy cover.

26 Statistics concerning the number of landslides occuring each year are not available at a single place and the data is also not collected, since required equipment are not readily available at the sites.

Flashfloods

27 There are four major rivers in Bhutan. The rivers are fed by the melting snow and the glaciers of the greater Himalayan range during spring and summer and also by rains during monsoon. Bhutan is a mountainous country and flood is not foreseen. However, during abnormal monsoon, towns located in the foothills are likely to be affected at a minimum.

28 The Royal government does carry out disaster management operation in these effected area and neighbouring country, during such emergency circumstances. Such as this year few towns located in foothills were affected with a damage estimated upto 31.0 Million Ngultrums approximately.

Facilities/infrastructure

National level

29 The National Environment Commission was established in November 1990, to assist the existing structure of government ministries and departments with an integarted approach to deal with environmental problems in the planning stage in the development.

30 Department of Forests manages the country's forests; regulates access to and utilisation of forest resources; and enforces restrictions and collection of taxes and dues.

31 The Nature Conservation Division does the management of the country's protected and reserves areas and implementation of application on the biological diversity. Database information on flora and fauna.

32 The Department of Agriculture undertakes land development as of their major programmes. The department encourages terracing, contour bunding and drainage activities to ensure proper land and soil management and to improve the productivity of limited agricultural lands. Land Use Division, established in 1992 November has been responsible for mapping, landslide areas, landuse clasification system and database information for environmental planning for Bhutan.

33 Meteorlogy Division in the Department of Power is responsible of organisation, operation and maintenance of the meteorlogical network throughout the country. Dissemination of metoerlogical information and advice including weather forecast, climatological statistics for different department for their application. Correlation of meteorlogical and hydrological data and draw the conclusion for hydropower generation. Promotion of meteorlogical throughout the world by internal co-operation.

34 The Department of Roads is responsible for maintenance of roads in Bhutan and enforce preventive measures to avoid further landslide and erosion.

35 The Department of Health Services is responsible for water quality, surveillance of water supply schemes, and health. The department provides health education through health institutes and family planning schemes.

Legislation and policies

36 Bhutan's legal system is based on age-old traditions. Only recently has a modern system of laws, policies and regulations been developed. As a result the legal means of addressing environmental problems are often inadequate.

37 The administrative infrastructure and legal framework for addressing environmental issues has been outlined in para 38. Since the early 1990s, the Royal Government has paid special attention to the incorporation of environmental concerns such as Environmental Impact Assessment in the planning of major development activities. Environmental Impact Assessment (EIA) procedures was adopted at the Paro Resolution on Environment and Sustainable Development, May 1990.

Population

38 Bhutan's population is 600,000. Dzongkha is the official language of the Kingdom. The country's population growth rate is estimated at 2% per year. There are few major towns

namely Thimphu (the capital city), Phuntsholing, Paro, Samdrup Jhongkher, Gaylegphug and Samtse that are densely populated and in the rural areas the population is sparsely distributed. Population of Thimphu[5] is 30,000 to 32,000 and estimated to be the most densed than any other towns in Bhutan.

39 The population growth is rapid and this although relatively modest by regional standard, is high vis-a-vis arable land i.e. 245 persons per square kilometer. Due to geographical limitations there is little room for expanding acerage under agricultural production which in turn has led the government to prioritize increasing output on existing land through irrigation, improved livestock, seed and the use of fertilizer and pesticides.

40 The last two decades have seen unprecedented rural to urban migration and the development of urban settlements in Bhutan. In modern development, it has brought the promises of greater opportunity to develop proper landuse plans. General problems relating to rapid growth of urban settlements has resulted, such as sanitation, water quality, waste disposal, diesease control etc.

Social and culture

41 In Bhutan, Buddhism plays a central role in people's lives. Both buddhist and pre-buddhist beliefs promote a cautious attitude towards the environment.

42 Bhutan addresses the multi-faceted issue of sustainable development from both environmental, as well as financial and management perspectives. The former refers to the country's environmental carrying capacity and the importance of development activities taking place as par with the country's natural resource base. The latter refers to the country's ability to finance and manage existing infrastructure and services.

Monsoon Restoration Works
Expenditure during 6th Five Year Plan

Wall Type	Nos
B/walls	92
Suasage walls	19
Dry walls	11
Hume pipe culverts	7
Causeways	2
Retaining walls	750

Total cost Nu:25.610 million
Source: Department of roads

[5] Thimphu Dzongkhag's seventh five year plan document.

Chapter III

Mitigation Activities

43 No mitigation activities has been prepared by the Royal Government, since Bhutan is considered not a disaster prone area, except for sporadic landslides during abnormally heavy rainfall during the monsoon. Organisation like Department of Roads and Department of Forests are responsible to carry out the following:

- maintenance of roads drainage system
- emergency landslide clearance along the roadside
- undertake a nation wide tree plantation programme along the road and in severe landslide prone areas
- prevention and monitoring forest fires
- research on pest epidemic and prevention methods

Awareness and training

44 The National Environment Commission coordinates between various departments and is also responsible to collect information on natural disaster and environmental aspects.

Chapter IV

Warning

45 Warning signals for major landslides, forest fire and pest epidemic are sent through the local radio (Bhutan Broadcasting Service), the Weekly National Newspaper (Kuensel).

Chapter V

International Cooperation

49 A South Asian Association Regional Cooperation (SAARC) committee on environment was established during the last SAARC Summit in Dhaka. Bhutan is a member state and the National Environment Commission is the focal point. The following were initiated to evolved specific programmes, activities and modalities to implement by each member states.

- streghtening the environment management programme
- programme on environmentally sound land & water use planning
- research and action programme on mountain development in the Himalayan region
- coastal zone management programme
- SAARC forestry and watershed management
- people's participation in resource management
- information exchange on low cost and environmentally sound habitat related technologies
- funding arragement
- establishment of a SAARC relief and assistance mechanism for disaster
- regional cooperation on the development of modern disaster warning systems

50 The National Environment Commission is the focal point for the International Decade for Natural Disaster Reduction.

Chapter VI

Overall evaluation and future programme closely related to IDNDR activities.

Goal and achievements

51 Bhutan is considered to be non-disaster prone area. However, the Royal Government has adopted a policy of deliberately slowing down the pace of development to safeguard the culture and the environment of the country. Bhutan's long-held policy of respecting forests and life and setting aside areas for special protection; preservation of the beautiful living environment of the Bhutanese society; safegaurding economic options for recreation, toursim, education and research; protection of valuable natural resources used for fodder, medicine, grazing pastures and fuel requirements of the largely rural population. This policy also conserves resources of great value in the fields of medicine, horticulture, silviculture and animal husbandry.

52 Establishment of National Environment Commission to coordinate all environmental issues with related departments and ministries. Its main objectives are to define and establish policies, plans, organisations and action, whereby the sustainability of resources use will be fully integrated with every aspects of the country's social and economic development; institute Environmental Impact Assessment into the planning policy and environmental communications to enhance the knowledge and understanding of environmental matters and of sustainability in the Bhutanese society.

National goals for the decade

53 One of the most significant guiding policies of the Royal Government is conservation of the environment. Recognizing the environmental issues that have already come up and to ensure that development does not come at the cost of undue environmental degardation, the government has taken the following measures:

- Establishment of a National Environment Commission
- Establishment of the Bhutan Environmental Trust Fund
- Environmental Education
- Population Education
- Increasing community and non-government involvement
- Improving existing and introducing new legislation
- Preparation of Master Plans for many sectors of the economy eg.Forestry, Power, Roads.

- Developing National Environmental Strategy
- Strengthening of research institutes on Forestry and Natural resources
- Institutionalizing Environmental Impact Assessment

Environmental Plans for 1993 - 2002

54 Establishment of Forest Management Unit: This management plan is valid for the period of 1993 - 2002 and has been prepared for several confined areas namely: Thumshingla Management Unit; Bumthang Management Unit; Gedu Management Unit; Haa Management Unit; Halila Management Unit; Nai-Wangdi Management Unit; Korila Management Unit; Wangdigang Management Unit; Kotokha Management Unit; Tingtibi Management Unit.

- The goal of these management is to protect the environment and at the same time ensure a sustained supply of wood and non-wood products to meet the needs of the local population.
- In order to achieve the goal, the entire management has been organised into many working circles such as Protection, Watershed management, Community Forestry and etc.

Protection: The forests of the protection circle are permenantly dedicated as protection forests for protection of watershed, fauna and flora, soil and stream flow. Protective management will be practised in this working circle and no form of utilation will be permitted.

Watershed Management: The management prescription for the Watershed circle aims at protecting the environment specially aiming at the watersheds and stream flow. The activities prescribed include conservation measures and also limited utilization to meet the rural wood needs.

Community Forestry: The community Forestry circle aims at transfering the responsibility of managing and protecting the forests close to villages to the local communities.

Adverse environmental impact (landslide etc.) on the forest due to harvesting will be minimized during and after the management plans. Further all harvested areas will be reforested immediatly to bring under forest cover quickly.

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