REPORT
ON
DISASTER PREVENTION
IN
THE KINGDOM OF NEPAL

May 1977

JAPAN INTERNATIONAL COOPERATION AGENCY
THE GOVERNMENT OF JAPAN

Preface

I have the pleasure of presenting a preliminary survey report on disaster prevention in the Kingdom of Nepal by the survey team dispatched by the Japan International Cooperation Agency at the request of UNDRO from April 8 to 20 in 1977.

While in Nepal, the team held discussions with the authorities concerned as well as the UNDP office there and conducted study tours in the field in order to grasp the actual disaster conditions in that country.

I take this opportunity to express our sincere gratitude to His Majesty's Government of Nepal and the UNDP office in Nepal for their whole-hearted assistance rendered to the team during their stay there.

May 9, 1977

Shinsaku Hogen
President
Japan International
Cooperation Agency

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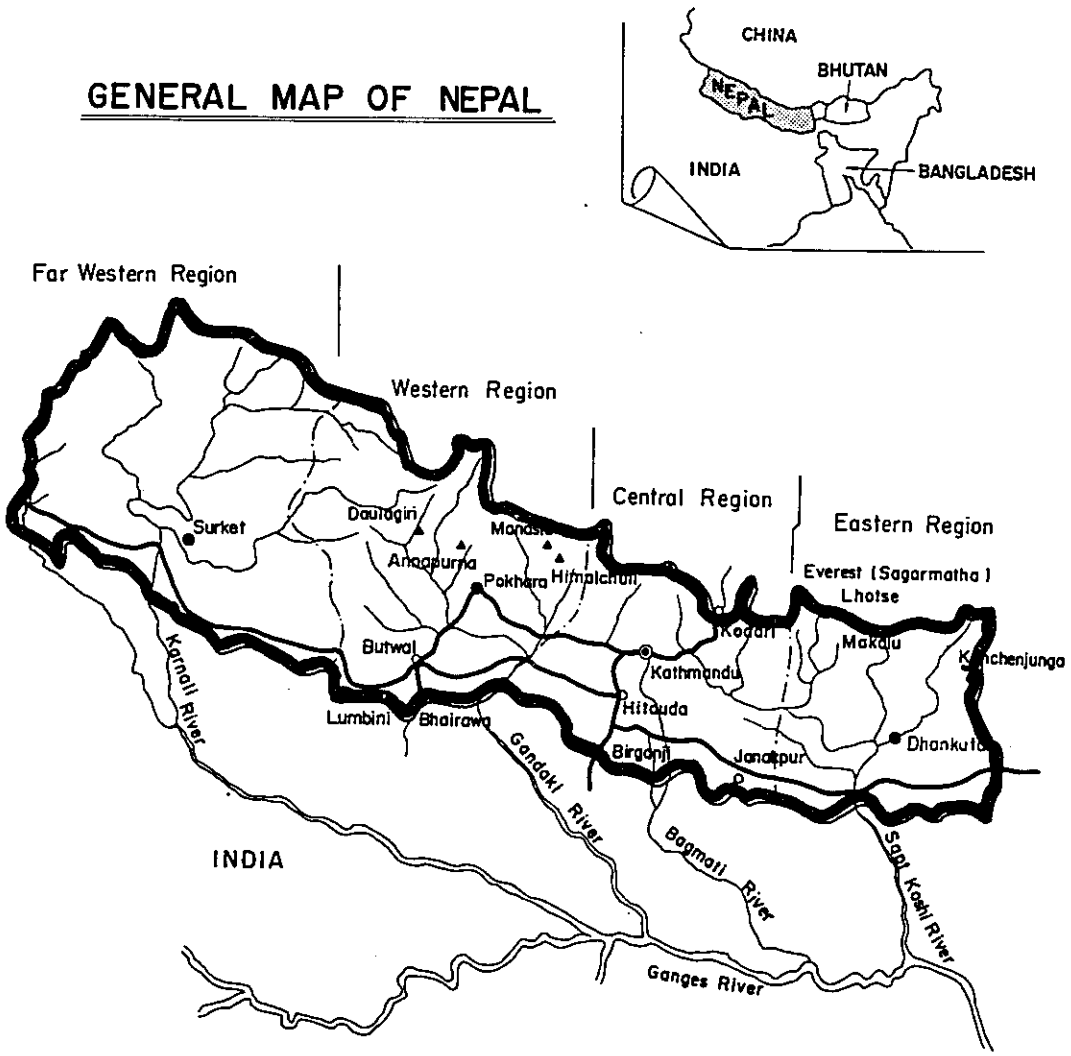
GENERAL MAP OF NEPAL



I. Introduction and Summary of Recommendations

1. Introduction

1) The United Nations Office of Disaster Relief Coordinator (UNDRO) requested the Government of Japan to send a six month mission to assist His Majesty's Government of Nepal in establishing policies in the area of desaster prevention.

2) In response to the request made by UNDRO, the Government of Japan sent a preliminary survey mission prior to the six month mission to study the overall situation concerning disaster prevention and preparedness in the Kingdom of Nepal.

3) The preliminary survey mission consists of two experts, Mr. H. Tamamitsu, Chief of the Technical Staff, Planning Division, Mr. T. Matsushita, Assistant Director, Sand Control Division, River Bureau, Ministry of Construction, Japanese Government.

4) The preliminary survey mission stayed in the Kingdom of Nepal from April 8 to April 20, 1977. Through the arrangement made by the UNDP office (Mr. B. Hausner, Assistant Resident Representative in charge), the team visited relevant Departments of H.M. Government and held discussions on disaster prevention.

5) During the mission's stay, the mission made a 1500 Km field trip by vehicle to observe the sites of landslides and floods in Hills, Terai, Inner Terai Area.

2. Schedule of Preliminary Survey Mission

The schedule and activities of the preliminary survey mission is shown below.

April 7 (Thu) Left Tokyo for Bangkok by JAL 767
(8:20 - 17:30) Stayed in Bangkok

8 (Fri) Visited Embassy of Japan and JICA office in Bangkok in the morning.
Left Bangkok for Kathmandu by RN 402
(13:00 - 16:15)
Visited Embassy of Japan and UNDP office.
Embassy of Japan
Mr. Noboru YABATA (Counsellor)
Mr. Hojun Kikuchi (First Secretary)
UNDP office
Mr. Klessa
(Representative of the Office)
Mr. Raheem
(Assistant Resident Representative)
Mr. B. Hausner
(Assistant Resident Representative)
Collected statistical data and history of Nepal. Stayed in Kathmandu

9 (Sat) Visited Nippon Koei office in Kathmandu and surveyed Bagmati River and land use situation in and around Kathmandu Basin.
Stayed in Kathmandu

10 (Sun) Visited Nepal Red Cross Society with Mr. B. Hausner and talked with Mr. Carl Naucler (adviser to Nepal Red Cross Society from the International League of Red Cross Societies) and Mr. T.R. Onta (Chief Executive Officer of Nepal Red Cross Society) concerning the activities of the Society on Natural Disaster Preparedness and Prevention.
Collected Map of Nepal

Stayed in Kathmandu

11 (Mon) Visited UNDP office and discussed the schedule of the week with Mr. B. Hausner.
Visited the Ministry of Home and Panchayat, in the morning with Mr. B. Hausner and discussed with Mr. Shahi (the Secretary of the Ministry) the background of the request to dispatch experts in the field of Natural Disaster Prevention to the Kingdom of Nepal.
Visited the Department of Soil and Water Conservation, in the afternoon, and discussed and exchanged opinions with Mr. M.E. Stevens (Manager of Integrated Watershed Management Programme from FAO of the United Nations) who is assisting the staff of the Department through this programme.
Visited the Embassy of Japan and made a courtesy call on the Ambassador.
Asked JICA to finance expenses of the field observation and survey trip.

Stayed in Kathmandu

12 (Tue) Visited UNDP office.
Mr. Tamamitsu visited the Ministry of Home and Panchayat again in the morning and talked with Mr. M.P. Kafle (Joint Secretary of the Ministry) concerning the upcoming expert mission.and, in the afternoon, visited the Department of Meteorology and Hydrology to collect data.
Talked with Mr. G.L. SHAK (hydrological specialist with UNDP) on the present situation of data collection and meteorological and hydrological analysis.
Mr. Matsushita visited the Department of Mines and Geology in the morning to collect geological information on Nepal and confirm the present situation of arrangement of geological maps.
Talked with Mr. J.M. Tater (Deputy Director General of the Department) regarding this matter.
Visited the Department of Soil and Water Conservation again in the afternoon and exchanged opinions on Landslide prevention with Mr. K.B. Malla (Deputy Director General of the Department).
Stayed in Kathmandu

13 (Wed) New Year's Holiday in Nepal
Preparation for field observation trip and arrangement of data and information collected.
Stayed in Kathmandu

14 (Thu) Left Kathmandu for Birganj by Toyota Land Cruiser with a staff member of Ministry of Home and Panchayat, Mr. B.N. SHARMA.
Kathmandu - Naubise - Hitauda - Amlekhganj - Bagmati River - Simra - Birganj
Survey 1 Intensively cultivated land use up to mountain top along the road to Hitauda.
2 Landslide and collapse of mountain slope along the mountain road.
3 Sporadic debris-flow deteriorating roads and cultivated fields.
4 Flood inundation in Terai plain.
(310 Km trip) Stayed in Birganj

15 (Fri) Left Birganj for Bhairawa
Birganj - Hitauda - Bharatpur - Narayangad - Narayani River (Gandaki River) - Ferry boat - Butwal - Bhairawa - Lumbini - Bhairawa
Survey of landslide (collapse of mountain slope) of Siwalik range,
Mahabharat range,
Narayani river gorge and
Ganges plain (Terai) formed by Gandaki River.
(350 Km trip) Stayed in Bhairawa

16 (Sat) Left Bhairawa for Pokhara

Bhairawa - Butwal - Tansen - Syangja - Pokhara.

Survey 1 Intensively cultivated land use

2 Collapse of mountain slope along road and river.

3 Sporadic debris flow on small alluvial fan.

Many persons were killed and houses were destroyed, cultivated fields and slopes were lost.

4 Flood in relatively lower river terrace caused by running water and sand materials at the time of the flood.

5 Phewa Tal and destroyed barrage

Talked with Gandaki Zonal Commissioner at his office.

(250 Km trip) Stayed in Pokhara

17 (Sun) Left Pokhara for Kathmandu

Pokhara - Seti River - Damauli - Mugling Phant - Trisuli River - Naubise - Kathmandu

Survey 1 Collapse of mountain slope along river and road

2 Debris-flow on small alluvial fan

3 Flood inundation and erosion of relatively lower river terrace caused by running water.

(300 Km trip) Stayed in Kathmandu

18 (Mon) Visited UNDP office and reported the results and impressions of our field trip to Mr. B. Hausner.
Visited the Department of Irrigation and talked with Mr. N.K. Agrawal (Deputy Director General of the Department) on irrigation projects in Nepal and trouble and damage caused by the flood.
Visited Department of Roads and talked with Mr. B.P. Shah on the problem of road maintenance and trouble and damage caused by the landslide (collapse of mountain slope) and debris-flow.
Visited the Ministry of Home and Panchayat and reported the results of the field trip to Mr. M.P. Kafle and Mr. B.N. Sharma.
Visited the Embassy of Japan.
Stayed in Kathmandu

19 (Tue) Visited the Embassy of Japan and reported the results of the Preliminary Survey and the future direction of disaster prevention in Nepal.
In the afternoon, visited Mr. Klessa and Mr. Hausner at the residence of Mr. Klessa and reported the results of the survey and the future direction of disaster prevention in Nepal.
Visited the Ministry of Home and Panchayat and held final talks with Mr. M.P. Kafle concerning the upcoming expert mission on disaster prevention.

20 (Wed) Left Kathmandu for Bangkok by TG 312 at 11:30.
Stayed in Bangkok

21 (Thu) Left Bangkok for Tokyo by JAL 464 at 13:00.
Arrived in Tokyo at 21:30.

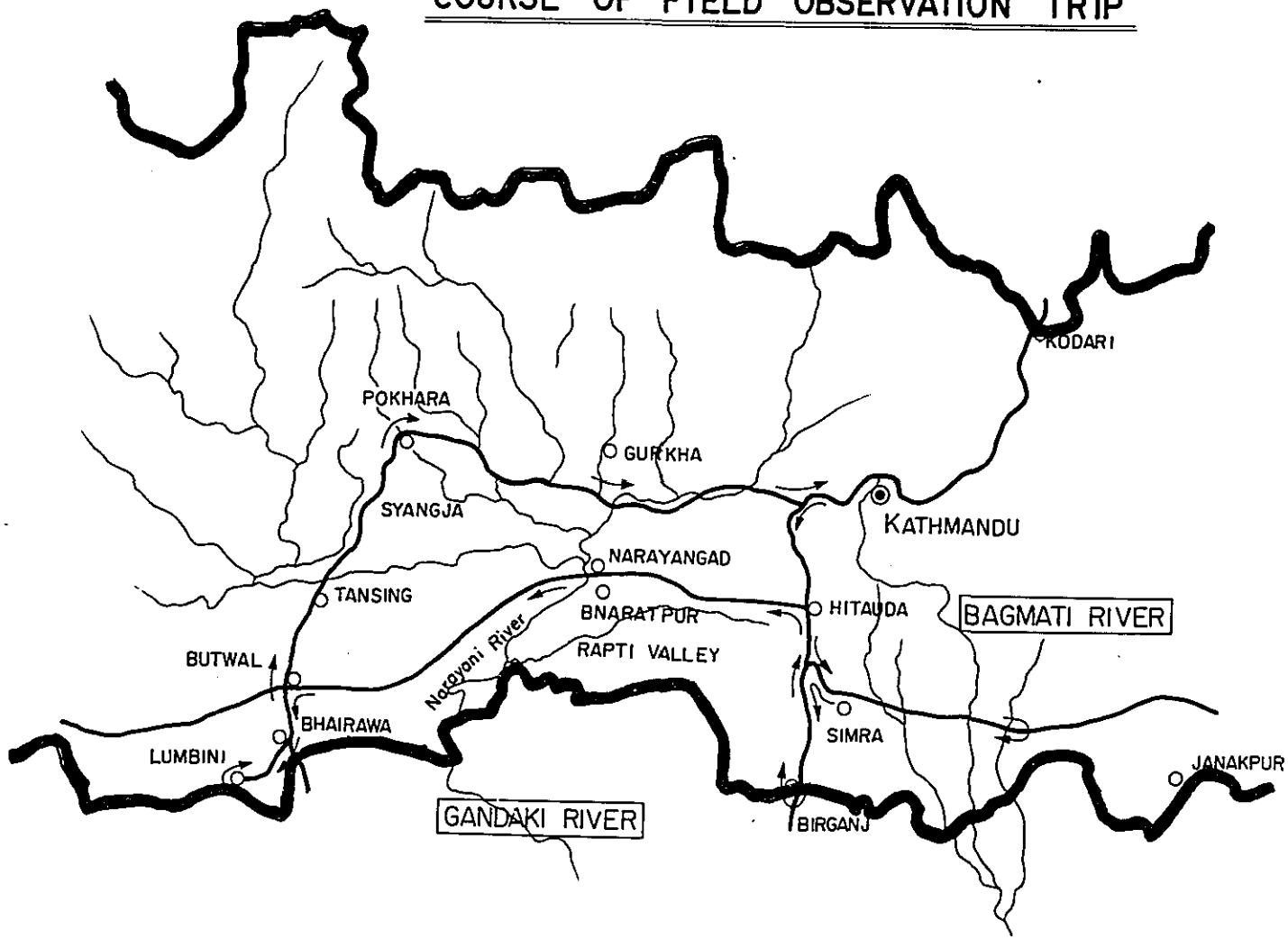
3. Summary of Recommendations

1) The mission obtained fruitful results with the kind cooperation of His Majesty's Government of Nepal and the UNDP office, in spite of a short term survey, in appraising the existing situation of natural disaster from which the Kingdom of Nepal has suffered for a long time. The mission was able to get useful information for study of the direction of future technical cooperation with Nepal concerning natural disaster prevention.

2) It is an urgent matter for the Kingdom of Nepal to tackle the establishment of policies, systems and measures for prevention of natural disasters caused by floods and landslides including collapse of mountain slope and debris-flow.
The mission, therefore, felt strongly that a long term mission of disaster prevention to study the situation in more detail and to give proper advice to the concerned Departments of H.M's Government is definitely necessary.

3) As to the long term mission, it is recommended that, at first, one(1) expert who is a hydrologist and at the same time a river control and sand control (erosion and debris-flow control) engineer be sent to H.M's Government of Nepal. He should also have a knowledge of geology and experience in administrative matters involved in disaster prevention.

COURSE OF FIELD OBSERVATION TRIP



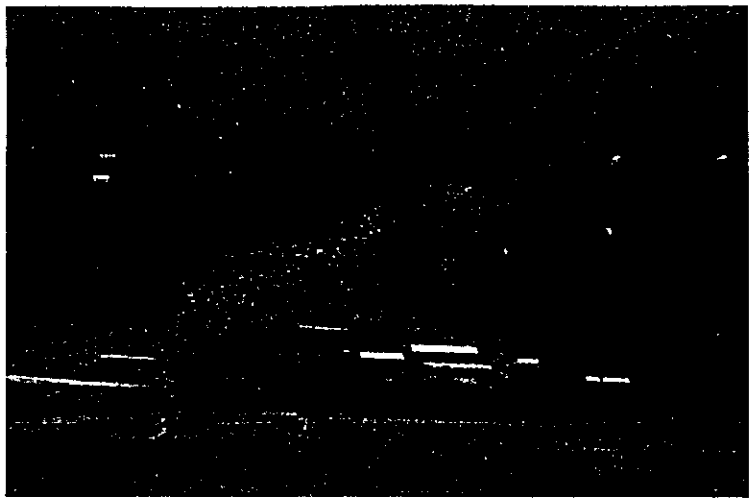
Because of the importance of the experts duties, it is recommended that the expert continue his duty for at least one(1) year.
The expert will study and collect necessary information and give advice concerning policies, systems and technical measures for disaster prevention.

4) Some additional experts or project survey missions might be necessary according to the expert's study and activities. However, these judgements will be the responsibility of the expert.

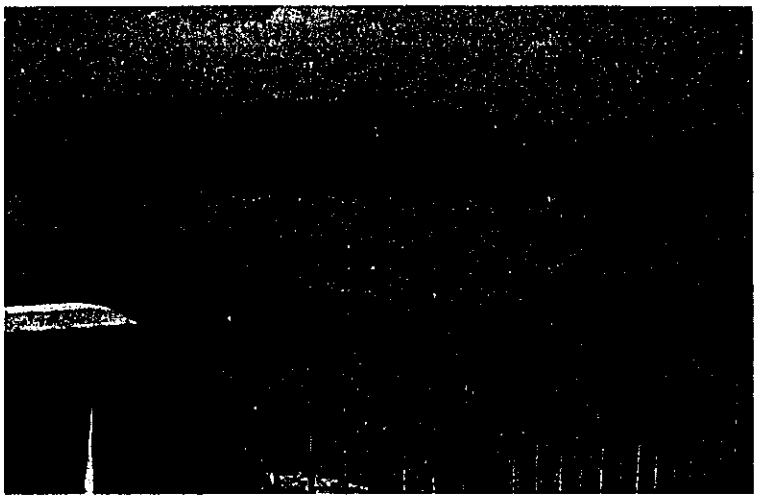
5) The expert is expected to implement his assignment actively and effectively as a UN expert cooperating with his counterparts of the Ministry of Home and Panchayat.
The expert's activities should be closely connected with the activities of the Central Disaster Relief Committee under the Chairmanship of the Minister of Home and Panchayat.

Intensively cultivated hills along the road from Kathmandu to Naubise

Landslides along the road from Kathmandu to Pokhara



Debris-flow to a village in a small alluvial fan in Syangja area

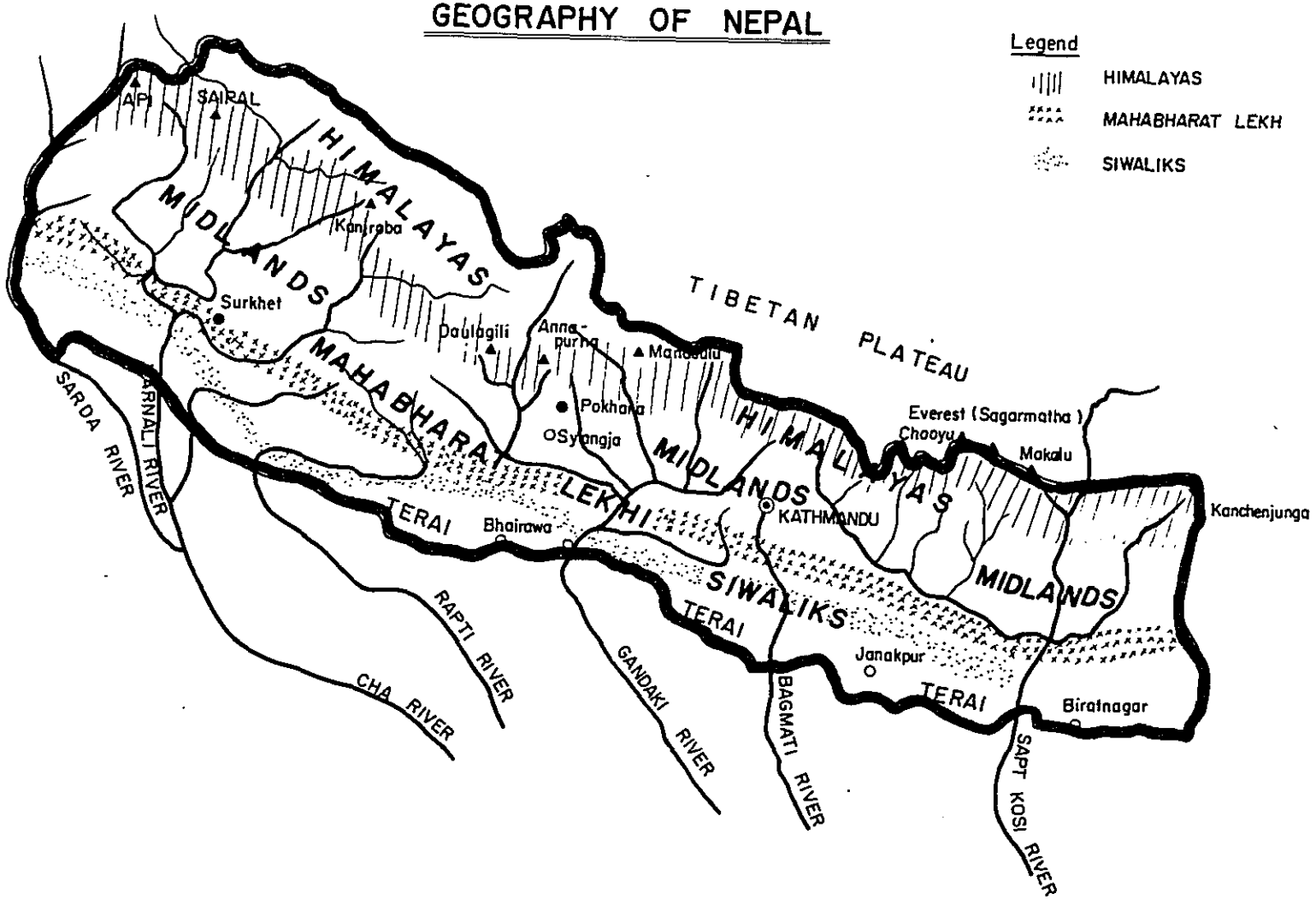


A river covered with sand materials in Terai area

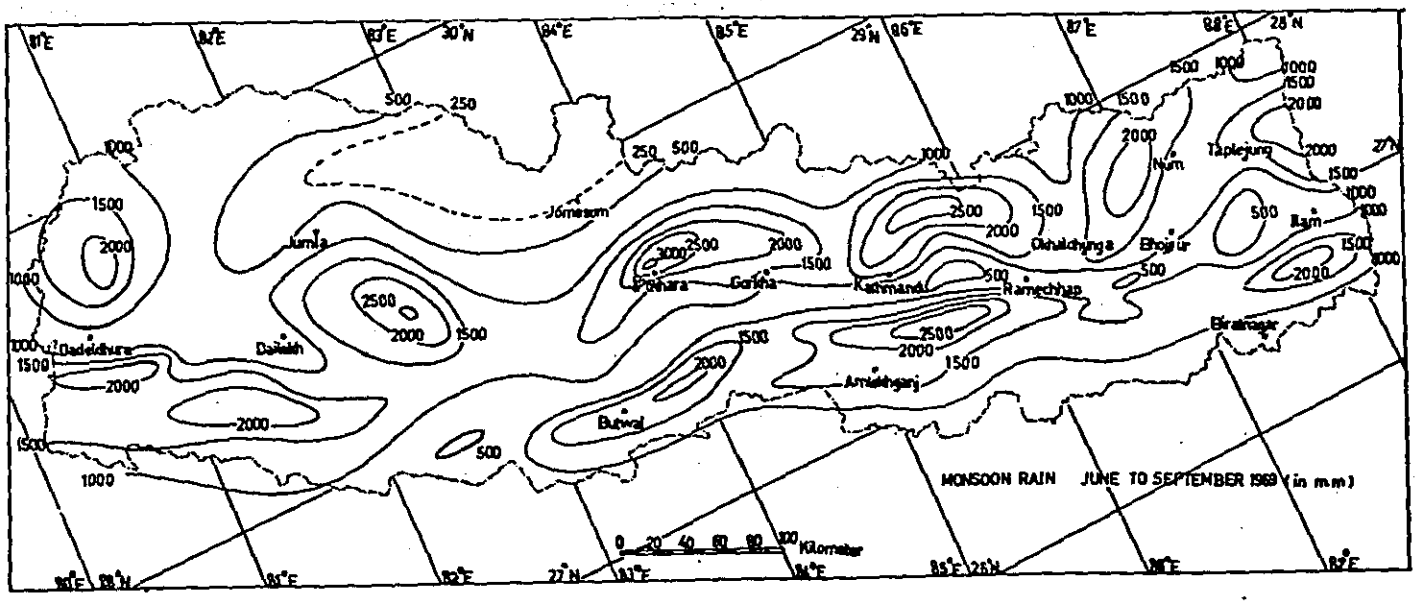
II. Background

1. The Kingdom of Nepal extends from 26.30 to 30.30 degrees North latitude and from 80 to 88 degree East longitude. The length of the country (from east to west) is approximately 800 Km, the width of which is 150 to 250 Km. Total area of the country is 141,000 Km^2.

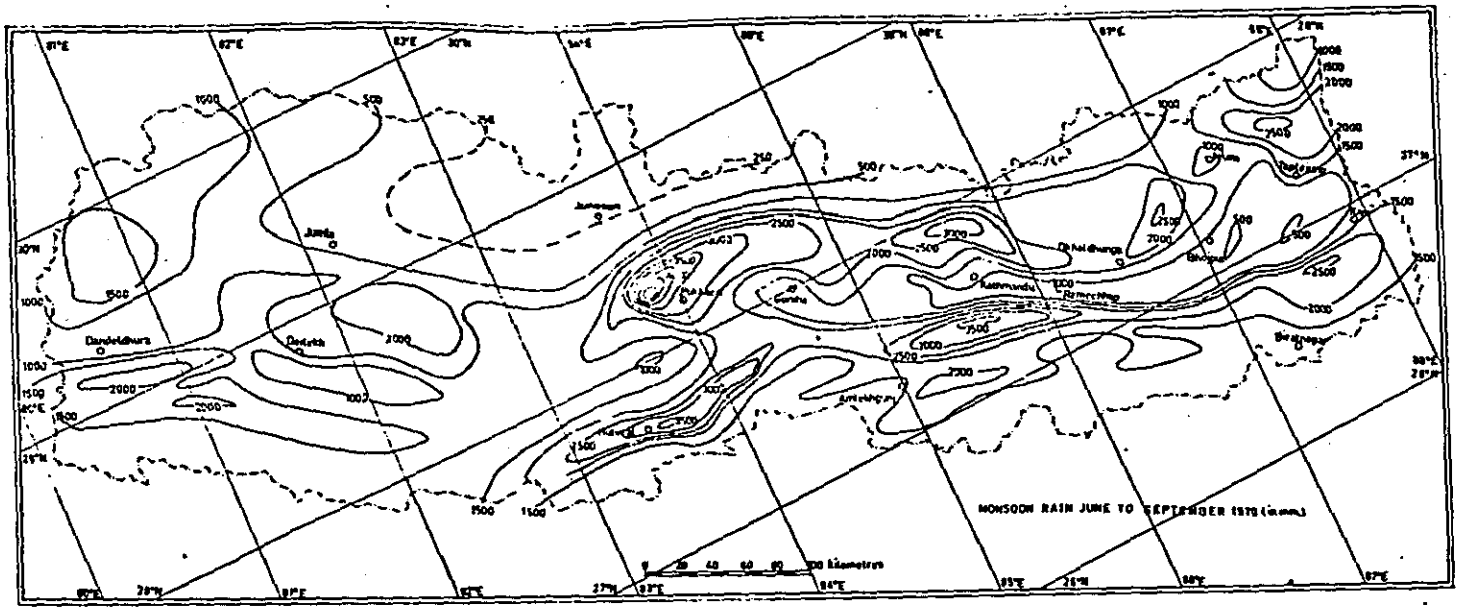
2. The Himalaya range is situated in the northern part of the country, near the border with China. Mountains in this range have heights of from 5000 to more than 8000 meters above sea level.
   From the center to the southern part of country lies the Mahabharat range 1500-5000 m high, and in the Southern part, the Chure or Siwalik range 600-1500 m high.
   The country is roughly divided into 3 zones according to topography, geology and climate; the Himalayan Midland zone, the Inner Terai zone and the Terai zone. The first zone is a hilly area between the Himalaya and Mahabhara ranges. The second is the area between the Mahabharat and Siwalik ranges, 600-900 m high. The third is flat land lying south of the Siwalik range with a maximum height of 300 m, extending from east to west through the country.


GEOGRAPHY OF NEPAL
Legend
HIMALAYAS
MAHABHARAT LEKH
SIWALIKS
API
SAIPAL
HIMALAYAS
MIDLANDS
Kanjraba
Surkhet
MAHABHARAT LEKH
Daulagili
Anna-purna
Manaslu
TIBETAN PLATEAU
Pokhara
Syangja
Everest (Sagarmatha)
Chooyu
Makalu
MIDLANDS
KATHMANDU
HIMALAYAS
Kanchenjunga
TERAI
Bhairawa
SIWALIKS
MIDLANDS
TERAI
Janakpur
TERAI
Biratnagar
SARDA RIVER
KARNALI RIVER
RAPTI RIVER
CHA RIVER
GANDAKI RIVER
BAGMATI RIVER
SAPT KOSI RIVER

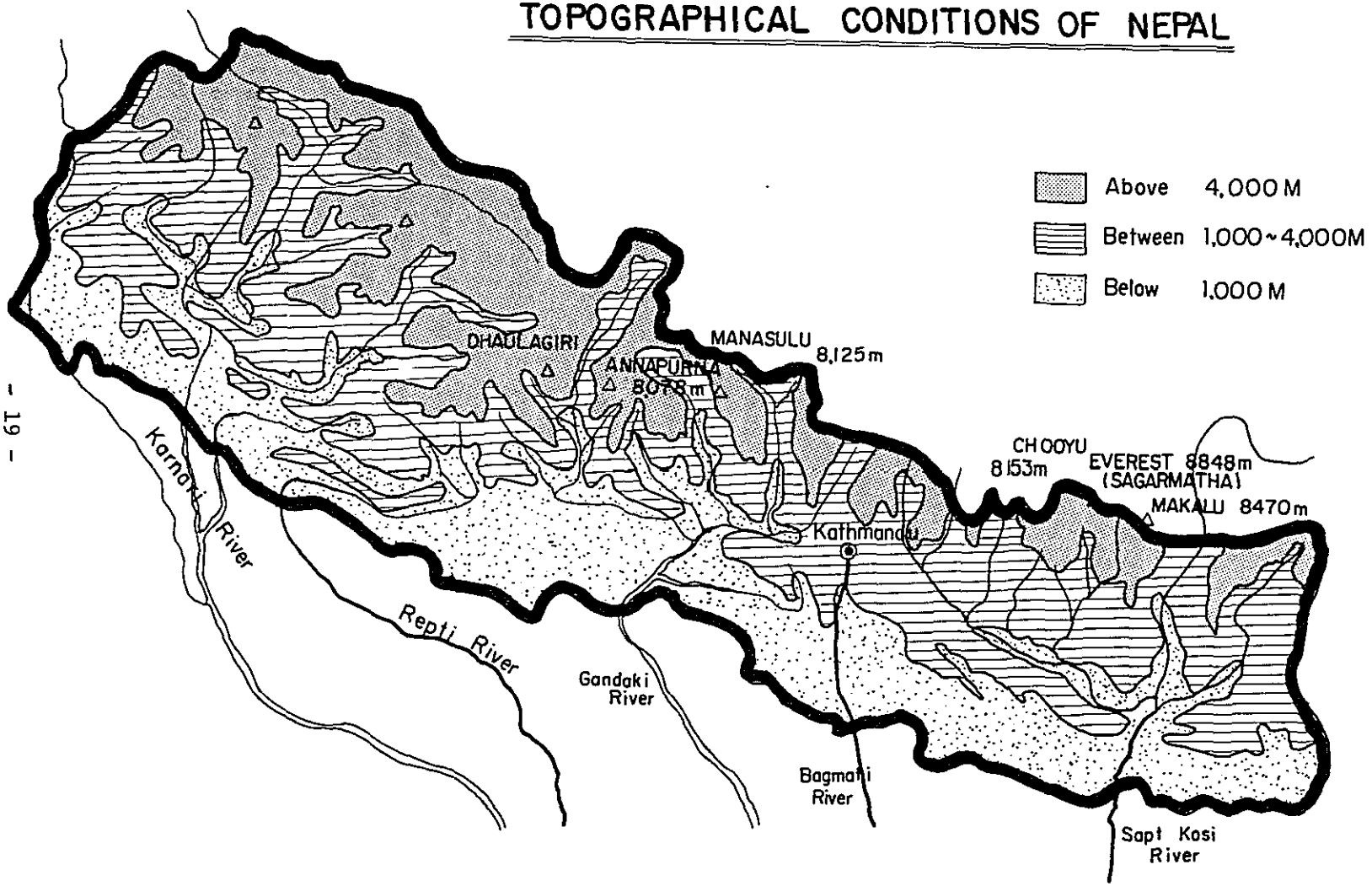
1969.


MONSOON RAIN JUNE TO SEPTEMBER 1969 (in mm)
Jomsom
Jumla
Dadeldhura
Dailekh
Pokhara
Gorkha
Kathmandu
Ramechhap
Okhaldhunga
Khotang
Num
Taplejung
Ilam
Biratnagar
Amalekhganj
Butwal
0 20 40 60 80 100 Kilometer

1972



TOPOGRAPHICAL CONDITIONS OF NEPAL



3. In the Terai zone, the annual rainfall amounts to from 2000 t 2500 mm.
This area has a semitropical climate, the maximum temperature 40°C in April or May, the minimum is 4°C.
The Inner Terai zone has an annual rainfall of 1500 to 2500 mm, and has an average temperature 6 to 7°C lower the than the Terai zone.
In Himalayan Midland zone rainfall varies from place to place. South of the Himalayan peaks, such as in Annapurna or Everest, annual rainfall amounts to from 2000 to 3500 mm.
Temperatures in this zone are low and moderate.
Most of the annual rainfall occurs during the monsoon from June to September.

4. The geology of this country is complicated and several structural zones lie parallel to the Himalaya range.
The southernmost structural zone, Siwalik, is the youngest, belonging to the Middle Miocene - Pleistocene age (1-10 million years ago).
This zone consists of weathered sandstone, mudstone, shale and conglomerato.
Most of the Himalaya area consists of accumulated rocks, such as sandstone, shale, etc., and the geologists recognize that this area was formerly under water between the Chinese and Indian continents.

5. The Terai area (including the Inner Terai) covering 1/3 of the total area of the country, has 1/3 of the total population of 12.3 million (1974). Two thirds of the national population is scattered all over hilly area.

The annual rate of population increase is a little less than 2 percent.

6. Almost 93% of the population lives on agriculture. Principal crops include rice, maize, sugarcane and wheat. Of the Gross Domestic Product 13,128 million Rupees (approximately $1,050 million U.S.) in 1974, 70% was from agriculture, 10% was from manufacturing.
The Terai area is the most productive area and covers nearly 70% of cultivated area in the country. People are cultivating hilly area up to the top of the hills, where they cannot expect high productivity.
Many cattle, goats and sheep are fed in hilly area.

7. Government revenue amounts to 774 million Rupees ($65 million U.S.) and expenditures amount to 992 million Rupees ($80 million U.S.) in 1974, resulting in a 218 million Rupee deficit.
International trade in 1974 amounted to total exports of $33 million U.S., imports of $82 million U.S., resulting in a trade deficit of $50 million U.S.

8. The Kingdom of Nepal is administratively devided into 14 zones and 75 districts. Each zone has a zonal commission and each district a district director nominated from H.M's Government.

III. Findings

1. Disasters in the Kingdom of Nepal are caused by floods, landslides, earthquakes and fires. Floods and landslide are among the most serious cause of disaster. Statistics since 1975 show that roughly 200 lives are lost and 1500 houses are destroyed every year, mostly by floods and landslides.

2. The recently established Central Disaster Relief Committee, with the Minister of Home and Panchayat as its chairman, has indicated its activities in the area of disaster prevention and preparedness. Besides the above national committee, subcommittees on the district and village level are also set up for hospital services.

3. The Nepal Red Cross Society has been conducting remarkable activities throughout the country in the area of disaster preparedness, building store houses in regions and districts to stock materials for emergency use in case of disaster.
   The Red Cross Society is also giving training in emergency relief to local staff members.

4. The Department of Soil and Water Conservation has also been carrying out effective service is the area of "Integrated Watershed Management" with the support of the United Nations Food and Agriculture Organization. The FAO started its program in 1967.
   In its second phase activities starting in 1975, the FAO enphasizes surveys on land conditions for forest restoration and land use. The FAO also put forward a program

for a demonstration basin and a program for the Pewatal and Bagmati food basin.

5. The Department of Irrigation, Hydrology and Meteorology is active in undertaking irrigation projects in the Terai area.
   In connection with these projects, the fixing and stabilization of river channels are under consideration.

6. Hydrologists of the Department have compiled hydrological data in different basins for more than 10 years. Those data are useful for the estimation of floods.

7. Meteorological data are also available for the past 10 years.
   From the file of recorded rain gauge stations, daily and hourly precipitations were obtained for the purpose of flood estimation. Some observatory stations are connected with central office by wireless, relaying the amount of rainfall five times a day.

8. The Geological survey Department also presented satisfactory geological data which have been compiled by many geologists. UNDP is also conducting a geological survey for mineral resources.

9. The Road Department has an important role in maintaining the existing paved roads that stretch over 2000 Km. Because of the rugged topography and unfavourable geological and meteorological conditions, road maintenance in Nepal is very difficult, especially in the monsoon season. Officials of the Department have continuous

patrols and are prepared to take emergency action.

10. As regards geological maps of Nepal, it is possible to obtain a colour separated map of one-five hundred thousands (1:500,000) scale compiled by Dr. ARITA, Hokkaido University of Japan, in 1973. This map may be obtained in Tokyo.
This geological map covers the whole land area of Nepal except the Terai area.
In addition, the Department of Mines has the original of a one inch-eight miles scale geological map compiled by a geologist of the USSR in 1972.
According to information of the Department, it is, at present, arranging and compiling a one inch-one mile scale geological map of the midlands area.

11. As regards topographical maps, a one inch-one mile scale topographical map may be obtained in Kathmandu.

IV. Recommendations

1. Disaster prevention and disaster preparedness are closely connected to the objective of mitigating the damage caused by disasters.
   In the Kingdom of Nepal, disaster preparedness activities have progressed in satisfactory steps. Disaster prevention activities, however, are in the biginning stage. Development of prevention policies and measures to cope with mounting disaster damage in this country is strongly desired.

2. Damage in the Kingdom of Nepal is caused by floods, landslides, earthquakes and fire. Because of the physical differences of the above disasters, prevention measures should be considered separately by the type of disasters. Floods and landslides caused by rainfall will be the first category, earthquakes the second category, and fire the third category. It is recommended that disaster prevention measures should be started for floods and landslides, since most fatalities and serious damage have been caused by those types of disasters.

3. Generally, in order to mitigate flood or landslide damage, following measures have to be emplayed.

   i) Watershed management to reduce water and sand discharge from the sources of rivers and valleys.

   ii) Protection structures to cope with flood innundation or the collapse of slopes.

iii) Flood plain or damage susceptible land management to modify susceptibility by means of proper land use.

iv) Structural change and floodproofing to avoid serious damage by reinforcing or reforming the houses, buildings and other structure in damage-prone areas.

v) Emergency measures such as flood warnings, flood fighting, evacuation, etc. to minimize the losses of residents.

The above mentioned measures should ideally be employed in combination for the purpose of achievement of the most effective disaster prevention policy.

4. Those measures of disaster prevention are the responsibility of many different departments.
Therefore, close cooperation and coordination amoung the different departments are essencial to eliminating the duplication of efforts of the departments.

5. Effective prevention policies can be accomplished only by continuous efforts. Therefore, steps should be taken one by one. To choose the first step several natural and social conditions must be considered. Generally, fatalities and other personal damage should be prevented at first, then cattle, property and farm land. Protection structures take most of the budget, being employed only if justifiable from the economical and financial viewpoints.

6. In evaluating disaster prevention measures, preparatory basic systems should be formed in the beginning. Collection of data on past disaster damage and on meteorological, hydrological and geological conditions in connection with the damage, should be made systematically and promptly.

7. According to the information collected above, annalysis of the damage susceptibility of each area or each block, preferablly by small or medium size catchment area, should be made from the viewpoints of topography, meteorology and geology. Consequently, the priority of disaster prevention policies for each different area will be considered.

8. Where the population is concentrated protection structures may be justified economically, while in less populated areas resettlement might be the preferable solution. Protection structures for flood and landslide should be deviced so as to be most economical using local material such as gravel, rock, and timber lying on the river bed. At the same time, the construction method of the structure should be simple and easy enough to allow the people to participate in the operation.

9. A warning system for floods and landslides will, in any case, be the most useful measure for disaster prevention. Even after constructing protection structures or resettlement, people are not completely free of the disaster danger. A warning system will also be useful for these protected areas. A warning system covers weather, amount

of rainfall, floods and landslides. Natural conditions must be analyzed in relation to the damage which has occurred in the past.
Telecommunications systems should be developed in the future to provide effective warning. An administructive service system or organization must also be developed.

10. An evacuation system for emergencies is also considered necessary in connection with the warning system. Refuge located in safe areas must be designated beforehand. Disaster prevention and disaster preparedness are not clearly delineated. Of course, it is not necessary to divide them, since those two functions should always be combined for the purpose of damage mitigation. Local administrative systems will be reformed to work for disaster prevention as well as for disaster preparedness.

11. Natural disaster caused by heavy rainfall in the Kingdom of Nepal can be typically classified as follows:

    i) Landslides of steep slopes which destroy land and houses on top and at the foot of slopes.

    ii) Flush floods or torrents in steep valleys which destroy land and houses along the valleys and on the past soil desposit fan area at the mouth of the valley.

    iii) Innundated floods with sand and gravel in relatively open valleys, which mainly destroy cultivated land along rivers.

iv) Floods in plain land such as the Terai, which wash away the land and houses with sand and gravel.

In order to control these floods, torrents and landslides, heavy capital investment will be necessary as well as technical experience. To find the physically and economically appropriate method of control some demonstration projects are recommended.
In these demonstration areas, comprehensive disaster prevention measures, including not only protection works but also warning systems, proper land use, etc., should be studied.

12. During the preliminary mission's field trip, the mission felt that the Kari Anam valley near Syangja may be a suitable demonstration area, since this area has heavy precipitation as well as unfavorable geological conditions and is populated. This valley might well to be economically developed by means of flood prevention measures.
Other demonstration sites will be somewhere in the Terai.. The mission heard that near the outlet of the Bagmati river to the Terai area, irrigation projects or "Integrated Watershed Management" programs are to be promoted. Demonstrations of controlling the rivers are recommended in the Terai area in connection with irrigation or other programs. Most of the sediment transported to the Terai area seems to have come from the errosion of the Siwalik Range. Flood control in the Terai area could be achieved by means of controlling sand and gravel outflow from the Siwalik Range.

13. The preliminary mission had only a brief glance over the problems of disaster prevention and preparedness which the Kingdom of Nepal is facing. Recognizing that there are a lot of difficult problems to be solved for the development and welfare of the people of the Kingdom, the mission felt that a long-term mission of disaster prevention to study the situation in more detail and to give proper advice to the Departments of H.M's Government is definitely necessary.

14. As to the long term mission, it is recommended that, at first, one expert who is a hydrologist and at the same time a river control and sand control engineer be send to H.M's Government of Nepal. He should also have a knowledge of geology and also have experience in disaster prevention administration.
Because of the heavy responsibilities on the expert, it is recommended that he continue his work for at least one year.
The expert will study and collect necessary information; and give advice concerning policies, systems and technical measures for disaster prevention.
According to the expert's study some additional experts or project survey missions might be necessary.
These judgements will be left up to the expert.

15. The expert is expected to implement his assignment actively and effectively as a UN Expert, cooperating with his counterparts of the Ministry of Home and Panchayat. Secretary and/or Joint Secretary of the Ministry of Home and Panchayat should fully cooperate with and give support to the expert.

The expert's activities should be closely connected with the activities of the Central Disaster Relief Committee presided by the Chairmanship of the Minister of Home and Panchayat.

Attached Tables and Data

1. Departments and other Authorities concerned of His Majesty's Government of Nepal and UNDP office we met and held talks with in Nepal.

   1) Ministry of Home and Panchayat

Mr. Shahi	Secretary
Mr. M.P. Kafle	Joint Secretary
Mr. B.N. Sharma	Staff of Secretariat

   2) Department of Soil and Water Conservation (Ministry of Forests)

Mr. K.B. Malla	Deputy Director General
Mr. M.E. Stevens	FAO Project Manager of Integrated Watershed Management, Torrent Control and Land Use Development Project

   3) Department of Meteorology and Hydrology (Ministry of Food, Agriculture and Irrigation)

Mr. G.L. Shak	Hydrologist from UNDP

   4) Department of Mines and Geology

Mr. J.M. Tater	Deputy Director General

   5) Department of Irrigation (Ministry of Food, Agriculture and Irrigation)

Mr. N.K. Agrawal	Deputy Director General

6) Department of Roads (Ministry of Public Works)

Mr. B.P. Shah	Chief Engineer

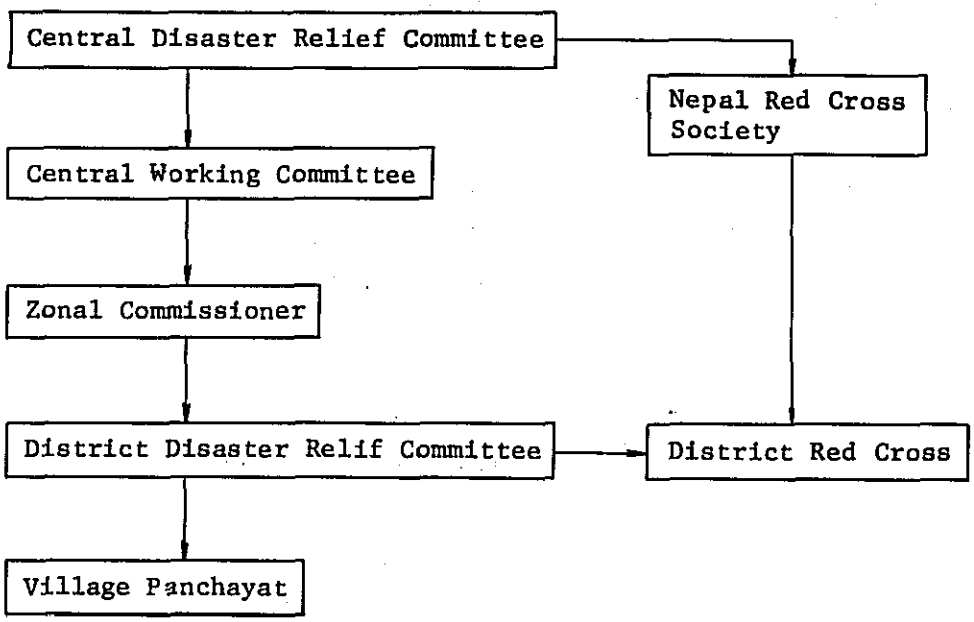
7) Nepal Red Cross Society

Mr. T.R. Onta	Chief Executive Officer
Mr. Carl Naucler	Adviser from International League of Red Cross Socities

8) UNDP office

Mr. Kiessa	Resident Representative of the office
Mr. Raheem	Assistant Resident Representative
Mr. B. Hausner	Assistant Resident Representative

2. Disaster Relief organization in Nepal



Members of Central Disaster Relief Committee

Chairman	Minister of Home and Panchayat
Members	Minister of Forests, Vice Minister of Forests
	Minister of Health,
	Secretary of Finance Ministry
	" Home and Panchayat Ministry
	" Forest Ministry
	" Food, Agriculture Ministry
	General Secretary of Red Cross Society

Chairman of Industry and Commerce Association
Joint Secretary of Home and Panchayat Ministry

Members of District Disaster Relief Committee

Chairman	Chief District Officer
Members	Chairman of District Red Cross Society
	Chairman of District Panchayat
	Chairman of Class Organization
	Chairman of Village Panchayat

3. General Statistics in Nepal

(U.N. Statistical Year Book) 1. US.$ ≒ 12.5 Rupees

Population (in million)

	1970	1971	1972	1973	1974
Population	11.23	11.56	11.81	12.07	12.32

Trade (in million Rupees)

Import	855	703	870	1031	-
Export	489	462	617	487	-

National Accounts GDP (in million Rupees)

Agriculture, Forestry Fishing	5,927	6,040	7,095	7,704	9,068
Manufacture	788	819	995	1,082	1,304
Construction	192	213	149	153	219
Wholesale, Retail, Trade, Restaurant, Hotel	363	372	381	390	399
Transportation, Communication	192	234	285	347	422
Finance, Insurance, Real estate	857	884	907	942	979
G.D.P Total	8,796	9,077	10,399	11,260	13,128

Government Revenue and Expenditure (in million Rs.)

	1970	1971	1972	1973	1974
Total Revenue	464	459	553	612	774
Tax Revenue	411	397	466	518	646
Income,wealth tax	20	21	22	23	33
Land tax	88	76	83	71	110
Custom duty	194	159	199	239	276
Transaction Consumption	95	126	144	166	199
Total Expenditure	684	765	889	886	992
Defence	50	57	63	71	83
Economic service	34	39	43	57	67
Social Service	33	62	69	79	92
Other current expenditure	102	142	149	173	236
Development expenditure	465	465	565	505	514
Total Balance	-219	-305	-336	-273	-218

Agricultural Production and Cultivated Area

(in thousands of tons and ha.)

	1970	1971	1972	1973	1974
Production of Rice	2,305	2,680	2,010	2,402	2,200
Wheat	265	193	223	225	225
Maize	833	761	810	800	800
Cultivated area of Rice	1,182	1,300	1,104	1,200	1,200
Wheat	195	228	239	240	240
Maize	446	437	434	440	440

Livestocks (in thousands)

Cattle	6,300	6,350	6,400	6,450	6,535
Pigs	320	300	300	300	324
Sheet	2,200	2,200	2,220	2,250	2,266
Goats	2,260	2,300	2,300	2,300	2,348
Buffaloes	3,460	3,622	3,692	3,760	3,831

4. Damages caused by floods and land slides in Nepal

Zone	District	1975					1976				
		People killed	Damaged houses	Damaged land (Bighas)	Cattle killed		People killed	Damaged houses	Damaged land (Bighas)	Cattle killed	Property damaged (Rupees)
Mechi	Jhapa	13	4	50	-						
	Taplejung	-	1	5	-		29	17		128	
Kosi	Dhankuta	-	1	1	4		2			1	
	Sankha-wasaba						2	3		9	
	Sunsari						2				
Sagarma-tha	Okhal-dunga						15	72			
	Sivaha						1	36	200		3,521,245
	Solukhu-mbu						2	15			
Jankpur	Dhanusa	2	1,306	2,500	-		6				
	Sarlahi	1	200	2,000					2,000		
	Dolakha							11		8	
	Mahottari	3	500	100	-						
	Ramechhap	-	5	-	-						

Zone	District	1975					1976				
		People killed	Damaged houses	Damaged land (Bighas)	Cattle killed		People killed	Damaged houses	Damaged land (Bighas)	Cattle killed	Property damaged (Rupees)
Bagmati	Sludhup -alchok		2		5		14	1	64 Ropanies	7	
	Dhading	5	1	1							
	Nuwakot	2	1	1							
	Kathmandu	1	10	50							
	Lapitpur		4	5							
	Bhakta -pur	1	10	10							
	Kabrepa -lanchok		15	20	20						
Narayani	Rauthaut	6	250	2,000				37			
	Makawan -pur	2	2	4							
	Parsa	2	5	500							
	Chitwan	5	9	50							
	Bara		30	760							
Gandaki	Syangja	6	5	5			68				
	Parbat	2	1	1							
	Kaski		2	2			74	18		70	
	Lamjung		4	50							
	Gokkha		1				2	1			

Zone	District	1975					1976				
		People killed	Damaged houses	Damaged land (Bighas)	Cattle killed	Property damaged	People killed	Damaged houses	Damaged land (Bighas)	Cattle killed	Properties Damaged (Rupees)
Lumbini	Palpa	9	18	10				5	50 Ropani		
	Gulmi	19	30	5	3		4	20		2	
	Augrakh-achi	3	3	5	5						
	Parsha		2	100							
	Rupande-hi			7							
Dhaula-giri	Baglung	2	1	1			38	46	300 Ropani	109	
	Myagdi	13	4	1			3	1		12	
	Mustang		1								
	Parbat						4	14		4	
Rapti	Rolpa	3	5		6		2	29		6	50,000
	Sayllan		3	12							
	Rukum		1					29	119 Ropani		

Zone	District	1975					1976				
		People killed	Damaged houses	Damaged land (Bighas)	Cattle killed	Property damaged	People killed	Damaged houses	Damaged land (Bighas)	Cattle killed	Properties damaged (Rupees)
Karna -li	Jumla	3	3		256						
	Humla			1	90						
	Mugu				47						
	Dolpa										250,000
Bheri	Surket		1	10							26,100
	Banke		66	146							
	Bardia		20	150							
Seti	Accham		5	1	19						
	Doti	3	3		32						
	Bajura	2					2				
	Bhajhang							1			
	Kailali						5			1	
Mahaka -li	Baitadi	2	2				10	21		67	
	Dhanga -dhi	2	2		9						
	Kanchan -pur		18	50	31						
	Darchula		3	20			25	106	1,512 Ropani	151	1,616,000
Total		112	2,553		527		310	483		575	

5. Temperature in Nepal

(Mean value and Absolute extreme value)

Upper: maximum value

Lower: minimum value

in degree centigrade

Kathmandu Elevation 1288 m Lat. 27°42' Long. 85°20'

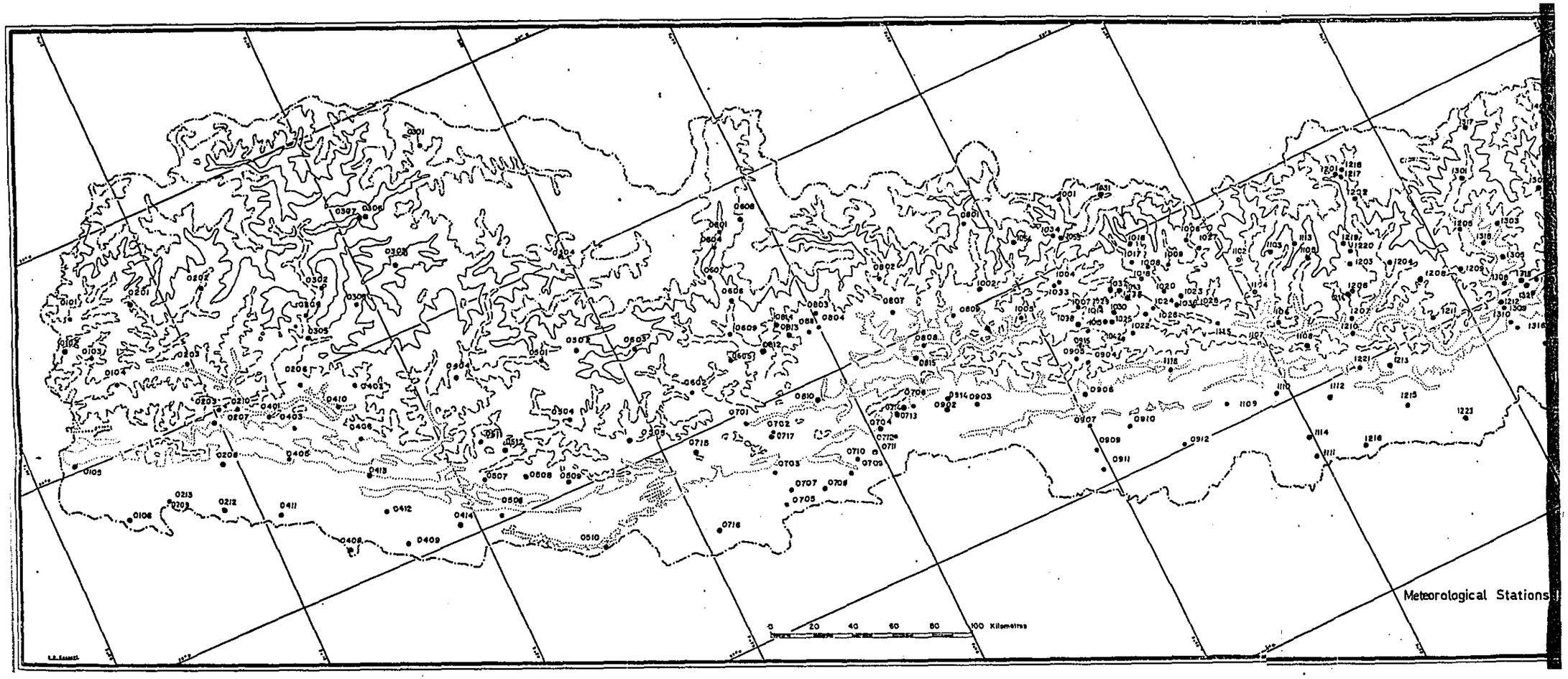
Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
1968	19.2 -1.0	23.0 2.9	22.5 6.1	26.6 10.4	30.9 14.1	29.5 18.5	27.7 19.9	28.1 19.8	28.0 18.3	26.7 10.2	21.8 4.7	19.7 3.2	25.3 10.5
Absolute extreme	21.6 -3.2	25.8 0.0	26.2 2.9	29.2 4.0	31.5 9.3	36.0 16.2	30.5 18.0	30.4 18.2	29.9 15.4	29.0 6.4	24.9 2.0	22.0 0.3	36.0 -3.2
1969	18.8 1.6	22.8 2.8	26.7 8.7	29.7 11.1	28.8 15.8	29.8 19.4	28.5 20.3	27.9 19.9	27.9 18.7	27.2 12.7	24.0 8.7	21.0 3.0	26.0 11.9
Absolute extreme	22.4 -1.1	26.9 -2.0	29.7 3.5	33.1 7.7	35.8 8.7	33.2 17.4	31.2 18.8	31.0 18.4	- -	30.0 8.3	27.3 4.1	23.3 0.2	35.8 -1.1
1970	18.5 2.3	20.7 3.4	25.8 6.6	29.1 11.7	30.5 16.1	28.0 19.6	27.7 20.6	28.3 20.2	28.1 19.2	27.7 14.0	23.8 6.9	21.5 1.2	25.8 11.8
Absolute extreme	20.9 -1.4	25.0 0.7	30.6 2.8	32.3 4.9	34.8 12.8	30.6 17.7	30.7 19.4	31.0 18.0	31.0 17.8	30.2 10.3	27.4 1.2	24.3 -0.3	34.8 -1.4

Pokhara Elevation 833 m Lat. 28°11' Long. 84°00'

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
1968	19.6 6.2	22.9 10.1	24.1 12.3	28.5 16.5	30.3 18.9	29.6 21.0	28.6 21.9	29.3 21.8	28.6 20.7	26.3 15.0	21.7 10.1	19.3 9.1	25.7 15.3
Absolute extreme	21.8 2.7	26.9 5.6	27.7 8.1	31.5 12.7	33.3 13.4	34.9 18.5	31.7 20.7	31.8 20.1	30.4 18.4	28.8 12.3	24.2 5.8	21.2 5.0	34.9 2.7
1969	18.8 7.8	22.4 9.6	27.4 15.1	30.7 18.0	30.1 19.8	30.2 21.5	29.6 22.0	28.8 21.8	27.8 20.7	26.4 16.2	23.7 12.9	20.5 9.1	26.3 16.2
Absolute extreme	21.5 3.2	27.5 6.7	31.2 11.1	34.3 13.6	35.3 13.6	33.2 20.0	32.0 20.4	31.4 20.4	30.2 17.7	28.3 13.9	26.8 8.3	23.0 6.6	35.3 3.2
1970	20.4 9.0	18.3 7.5	26.0 13.3	30.5 17.9	31.0 20.2	29.0 21.2	29.1 22.2	29.4 21.8	28.9 21.3	27.1 17.5	23.5 11.6	20.3 7.5	26.1 15.9
Absolute extreme	20.2 4.8	23.8 5.7	31.7 7.7	33.5 13.8	34.6 16.8	31.7 18.8	31.8 20.7	32.4 20.4	30.7 19.8	28.7 14.3	26.4 6.3	22.2 5.3	34.6 4.8

Butwal Elevation 263 m Lat. 27°42' Long. 83°28'

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
1968	24.1 12.0	27.2 14.5	29.0 16.9	33.9 20.9	37.0 24.9	35.3 25.5	32.0 25.5	32.7 25.3	32.1 24.1	31.1 20.6	27.1 16.3	24.0 13.7	30.5 20.0
Absolute extreme	25.9 7.4	33.4 9.4	32.4 14.4	36.9 15.9	40.9 20.9	42.9 22.9	35.4 23.9	35.4 24.4	33.9 22.4	32.9 16.9	29.4 14.4	26.9 9.4	42.9 7.4
1969	22.6 11.4	25.9 13.6	33.1 20.2	36.9 23.8	36.2 24.8	34.7 23.5	32.5 24.7	31.8 23.8	31.7 24.7	31.2 21.8	28.3 17.9	25.0 14.2	30.8 20.4
Absolute extreme	25.2 5.4	32.4 7.4	36.9 15.9	40.9 15.9	41.4 17.1	40.4 17.9	35.4 22.9	34.9 22.9	33.9 21.9	32.9 19.4	31.4 13.9	26.9 11.9	41.4 5.4
1970	22.7 12.5	24.4 13.7	30.6 17.7	35.8 23.9	37.0 25.8	32.6 24.9	30.8 25.7	31.1 25.2	30.1 24.6	28.6 22.3	23.3 17.1	20.0 13.6	28.9 20.5
Absolute extreme	30.9 7.7	27.9 8.9	35.4 12.4	39.9 17.9	41.4 19.4	36.2 21.9	33.7 23.9	34.4 22.9	32.9 22.9	- 19.9	- 12.9	23.9 9.9	41.4 7.7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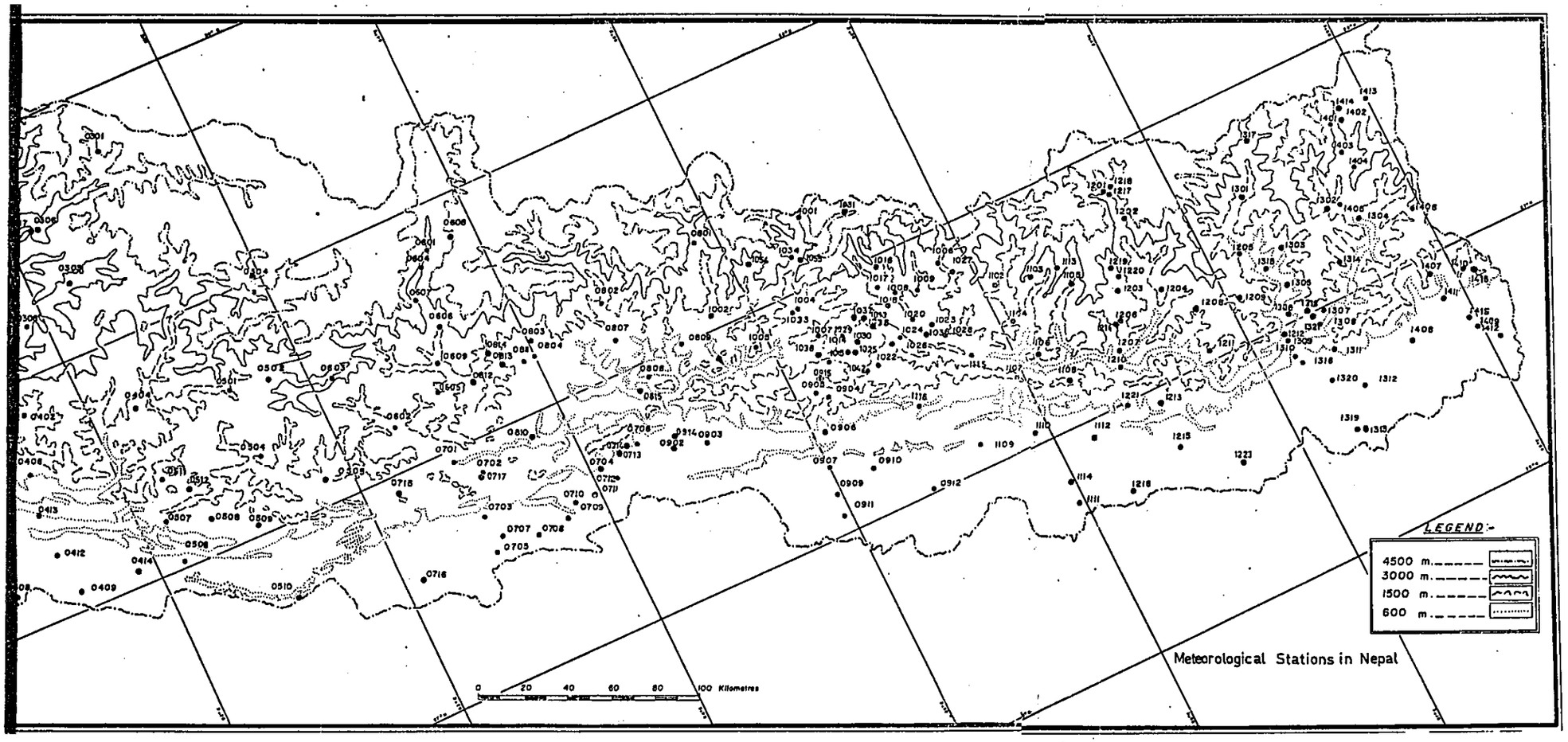
Meteorological Stations



Meteorological Stations in Nepal

6. Precipitations in Nepal (in m.m.)

Kathmandu

Month / Year	1	2	3	4	5	6	7	8	9	10	11	12	Total	Max in 24 hr.and date
1968	31	9	45	29	130	332	442	279	83	139	0	0	1,519	75 Oct. 5
69	10	2	45	31	61	115	316	341	123	65	2	0	1,110	
70	24	23	25	42	86	236	458	311	197	21	4	0	1,426	68 Jul.16

Pokhara

Month / Year	1	2	3	4	5	6	7	8	9	10	11	12	Total	Max.in 24 hr.
1968	43	13	108	24	221	734	951	430	828	237	0	1	3,591	129 Jul. 8
69	10	7	81	65	159	296	773	702	582	70	8	0	2,753	111 Aug.11
70	28	56	26	52	174	677	1385	909	529	45	0	0	3,880	204 Aug. 7

Butwal

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12	Total	Max. in 24 hr.
1968	48	0	13	7	25	403	612	428	400	204	0	36	2,176	108 Jul.23
69	7	0	2	73	108	295	550	495	356	10	0	0	1,816	95 Jul.29
70	26	16	21	35	62	970	1188	622	675	77	0	0	3,693	338 Jul.20

Rainfall intensity at Pokhara in 1973 (in mm)

Date		Time	Duration	Rainfall
June	5	2:38 - 3:43	1 h 05 min	27.3
	26	4:00 - 5:00	1 : 00	37.0
July	2	19:10 -20:00	0 : 50	42.0
	11	17:15 -18:00	0 : 45	39.0
	14	24:45 -02:00	1 : 15	46.0
	15	1:35 - 2:40	1 : 05	52.0
	17	20:50 -21:30	0 : 40	23.0
	25	16:50 -17:30	0 : 40	33.5
	30	1:30 - 2:35	1. : 05	29.5
August	3	20:25 -21:00	0 : 35	23.0
	4	22:30 -23:40	1 : 10	30.0
	9	24:58 - 1:43	0 : 45	31.0
	13	21:16 -22:16	1 : 00	24.5
	17	2:00 - 3:30	1 : 30	64.0
	21	21:45 -22:15	0 : 30	46.5
	25	19:15 -20:00	0 : 45	20.0
	24	18:10 -18:45	0 : 35	29.0
	28	20:50 -21:15	0 : 25	23.0
	31	24:10 -01:15	1 : 05	41.0
		24:00 -2:00	2 : 00	60.0
Sept.	10	24:15 - 1:15	1 : 00	47.0
	16	18:40 -20:55	2 : 15	77.0
		5:45 - 7:37	1 : 52	31.0
	23	18:50 -20:00	1 : 10	46.5
		24:35 -2:15	1 : 40	42.0
	30	19:15 -21:00	1 : 45	32.5

7. Discharge of main rivers in Nepal

(in m^3/sec)

No.170 Sarda River, Mahakli R. surnaged at Patan near Baitadi A = 188 km^2

	1966	1967	1968	1969	1970	1971	1972	Average	Extreme
Max. discharge	121 Aug. 2	37 Jul. 5	42 Jul.22	99 Sep.22	373 Jul.20	173 Jun.13	197 Sep.15	6.9	373
Min. discharge	0.2	0.3	0.4	0.2	0.4	0.8	0.6	(1966 - 72)	(1966 - 72) Jul.20 '70
Mean	10.4	4.0	5.1	4.0	5.4	12.3	4.9		

No.280 Kavnali R. Chisapani near Dondajari A = 42,890 km^2

Max.	7,230 Jul.26	10,190 Jul.5	11,290 Jul.22	11,000 Sep.23	15,800 Jul.21	16,400 Sep.10	11,600 Sep.15	1.3	16,400
Min.	236	214	308	284	272	323	392	(1962 - 72)	(1962 - 72)
Mean	1,090	1,172	1,311	1,384	1,345	1,721	1,201		Sep.10 '71

No.360 West Rapti R. Jalkundi near Amile A = 5,150 km^2

Max.	1,120 Jul. 2	1,020 Jul.18	1,530 Aug.22	2,500 Aug.20	1,720 Jul.21	1,020 Aug. 8	1,300 Jul.18	99.7	2,500
Min.	2.5	1.5	1.1	3.6	3.5	14.0	3.6	(1964 - 72)	(1964 - 72)
Mean	75	85	111	107	123	127	71		Aug.20 '69

No.420 Narayani R. Kali ganki R. Kotagaon near Shnga A = 11,400 km^2

Max.	3,210 Aug.24	2,490 Jul.15	6,720 Oct. 5	2,300 Aug.24	5,650 Jun.18	2,600 Aug. 8	3,730 Jul.18	503	6,720
Min.	85	60	52	77	38	63	55	(1964 - 72)	(1964 - 72)
Mean	558	472	613	408	519	485	370		

No.550 Bagmati R. Chobhar near Kathmandu A = 585 km^2

Max.	634 Aug.24	680 Jul.10	497 Oct. 4	431 Aug.19	582 Jul.16	617 Jun.12	876 Jul.28	14.2	876
Min.	0.2	0.6	0.3	0.5	0.3	0.4	0.1	(1963 - 72)	(1962 - 72)
Mean	12	12	15	9.4	17	19	18		Jul.28 '72

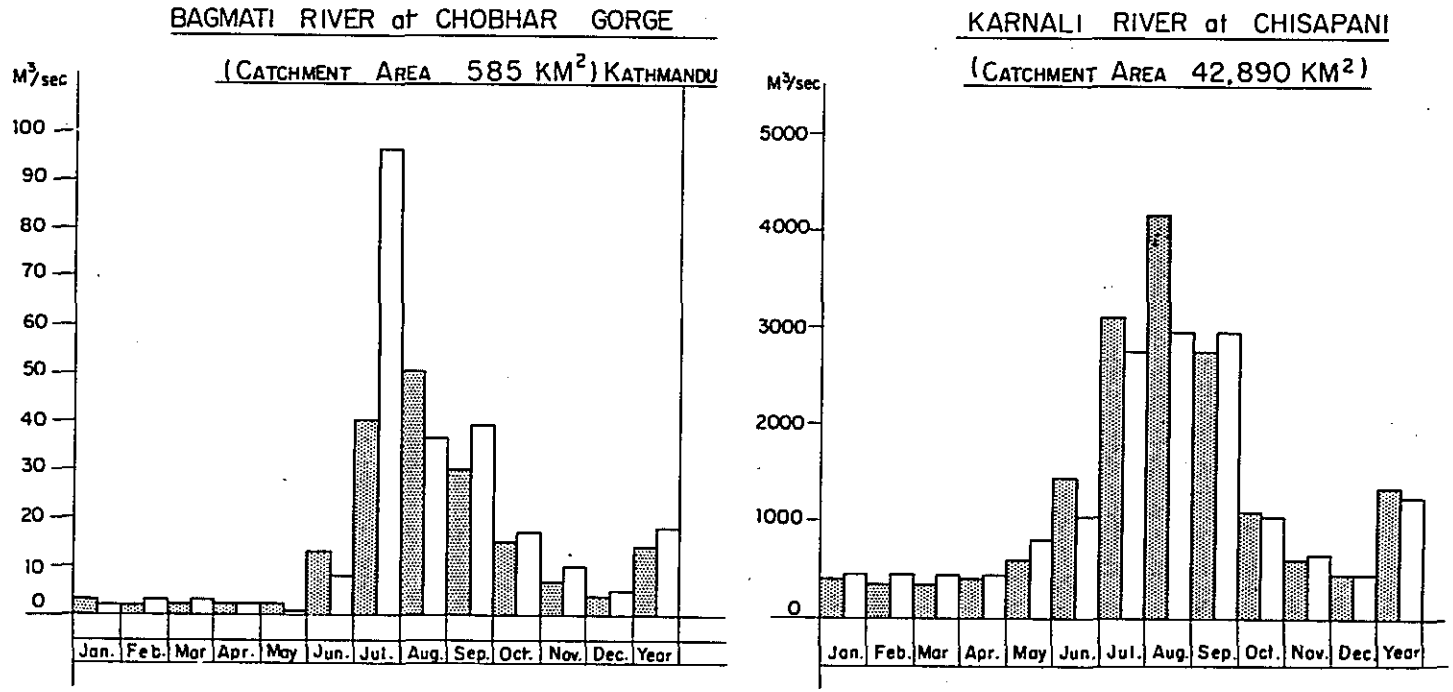
No.570 Bagmati R. Kulikhani R. at Kulikani A =126 km^2

Max.	202 Aug.24	277 Jul.10	141 Oct. 4	32 Aug.21	572 Jul.16	305 Jun.13	251 Jul.24	3.9	572
Min.	0.3	0.1	0.6	0.3	0.2	1.0	1.1	(1963 - 72)	(1963 - 72)
Mean	4.7	3.4	2.9	2.0	4.2	4.5	5.0		Jul.16 '70

No.680 Sapt Kosi R. Sunkosi R., at Kampughat near Udaypur A = 17,600 km^2

Max.	5,940 Aug.24	4,280 Jul.10	9,390 Oct. 5	3,460 Jul.28	7,360 Aug. 9	5,500 Jun.13	4,600 Jul.28	710	9,390
Min.	137	123	127	134	174	148	116	(1966 - 72)	(1966 - 72)
Mean	745	595	882	608	763	785	590		

AVERAGE MONTHLY AND YEARLY MEAN DISCHARGE



Average Monthly and Yearly Mean Discharge (1963 - 72)

Average Monthly and Yearly Mean Discharge in 1972.

Extreme discharge of the rivers in Nepal

(1964 - 72) (in m^3/sec)

No. of Station	River	Tributary	Station	Town near by	Catch-ment(km^2)	Discharge (m^3/sec)	Unit Dis-charge(m^3 /sec/km^2)	Date of Discharge
170	Mahakali	Surna gat		Baitadi	188	373	1.98	Jul.20 '70
240	Karnali	Asaragat		Sirkot	12,260	5,050	0.42	Sep.10 '71
250	Karnali	Benigat		Belgan	21,240	9,600	0.45	Sep.10 '71
260	Karnali	Seti	Bangga	Belgan	7,460	7,030	0.95	Sep.10 '71
270	Karnali	Bheri	Jama	Chaukle	12,290	5,610	0.46	Jul.21 '70
280	Karnali		Chisapani	Doudajari	42,890	16,400	0.38	Sep.10 '71
290	Karnali	Bahainadi	Bargadaha	Kumaragaon	3,000	2,120	0.71	Aug.20 '69
330	West Repti	Kalikhola	Nayaon	Piuthum	1,980	880	0.45	Aug.22 '64
360	West Repti		Jalkundi	Amile	5,150	2,500	0.49	Aug.20 '69
410	Narayani	Kaligandaki	Stibeni	Dumrichur	6,630	2,240	0.34	Jul.13 '70
415	Narayani	Andhikola	Dumrichaur	Tansing	476	1,590	3.35	Jun.17 '70
420	Narayani	Kali Gandaki	Kotagaon	Shringa	11,400	6,720	0.59	Oct. 5 '68
430	Narayani	Seti Khola	Phool bari	Pokhara	582	711	1.22	Aug. 7 '70
440	Narayani	Chepakhola	Palungtar	Gorkha	308	556	1.80	Jul.10 '67
445	Narayani	Burki Gandaki	Arung hat Bazaar	Gorkha	4,270	5,210	1.22	Aug. 2 '68

No. of Station	River	Tributary	Station	Town near by	Catch-ment(km^2)	Discharge (m^3/sec)	Unit Dis-charge(m^3 /sec/km^2)	Date of Discharge
446	Narayani	Phalanku Khola	Betrawati	Trisuli	162	510	3.15	Sep.10 '71
460	Narayani	Rapti	Rajaya	Hitaura	579	1,050	1.81	Aug.26 '68
470	Narayani	Lothar	Lothar	Debichaur	169	464	2.75	Jun.13 '71
485	Narayani	Burki Rapti	Chirasaari		184	400	2.20	Jul.17 '70
540	Bagmati	Nakhu Kola	Bhairab	Patan	52.5	181	3.45	Aug.24 '66
550	Bagmati	Bagmati	Chobhar	Kathumandu	585	876	1.50	Jul.28 '72
560	Bagmati	Thado Kola	Darkot	Marku	13.8	98.2	7.15	Jul.28 '72
570	Bagmati	Kulikani	Kulikani		126	572	4.55	Jul.16 '70
610	Sept Kosi	Bhote Kosi	Bahrabise	Gumthang	2,410	446	0.19	Aug. 1 '66
620	Sept Kosi	Balephi kola	Phalame Sangu	Chantara	629	1,125	1.77	Aug. 9 '70
630	Sept Kosi	Sun Kosi	Pachuwar chat	Chantara	4,920	3,410	0.70	Jul.28 '72
640	Sept Kosi	Rosik Khola	Panauti	Dhulikhel	87.2	117	1.35	Aug.24 '66
650	Sept Kosi	Khimti Khola	Rasunalu	Those	313	420	1.37	Jul. 3 '71
660	Sept Kosi	Likhu Khola	Sangutar	Ramechap	823	428	0.52	Jul.22 '64
670	Sept Kosi	Duda Kosi	Ptabuwa	Okhaldhung	4,100	2,450	0.60	Jul.20 '70
680	Sept Kosi	Sunkosi	Kampughet	Udaypur	17,600	9,390	0.53	Oct. 5 '68
690	Sept Kosi	Tamur	Mulghat	Dhankuta	5,640	4,100	0.73	Sep.26 '72