NATIONAL INSTITUTE OF DISASTER MANAGEMENT
(Ministry of Home Affairs; Government of India)

Format for preparation of abridged Report of the Course by the Course Coordinator for uploading in the website of NIDM.

1. Name of the course: National Programme on **“Extreme Weather Events”**

2. Duration : **6 - 10 August 2018**

3. Venue : **APHRDI, Bapatla**

4. Objectives :
   At the end of the programme, the participants will be able to
   i. To develop better understanding about extreme weather events
   ii. To assess the needs and gaps in understanding and management of extreme weather events
   iii. To promote linkages among stakeholders from disaster management authorities, government functionaries and communities
   iv. To explore possibilities for disaster risk reduction and resilience against extreme weather events including adaptation to changing weather conditions
   v. To promote efficient, safe and resilient communities for climate change adaptation and disaster risk reduction

5. Methodology : Lectures, Presentations, Videos, Group Exercise, Discussions, Field visits to disaster affected sites and Institute Visit to AP SDMA, SEOC and NDRF

6. Schedule : Copy attached at the end of this report.

Participant's profile : The participants had varying academic background with most of them being post-graduates. The sponsoring departments included SDMAs, ATIs, Drainage and Irrigation Departments, Administration and Revenue Officers, AIR, DDMAs, NDRF, and DPOs etc.

List of Nominations/Participants for the National Level Training Course on “Extreme Weather Events” from 06 to 10 August 2018, at NIDM South Campus

List of Nomination

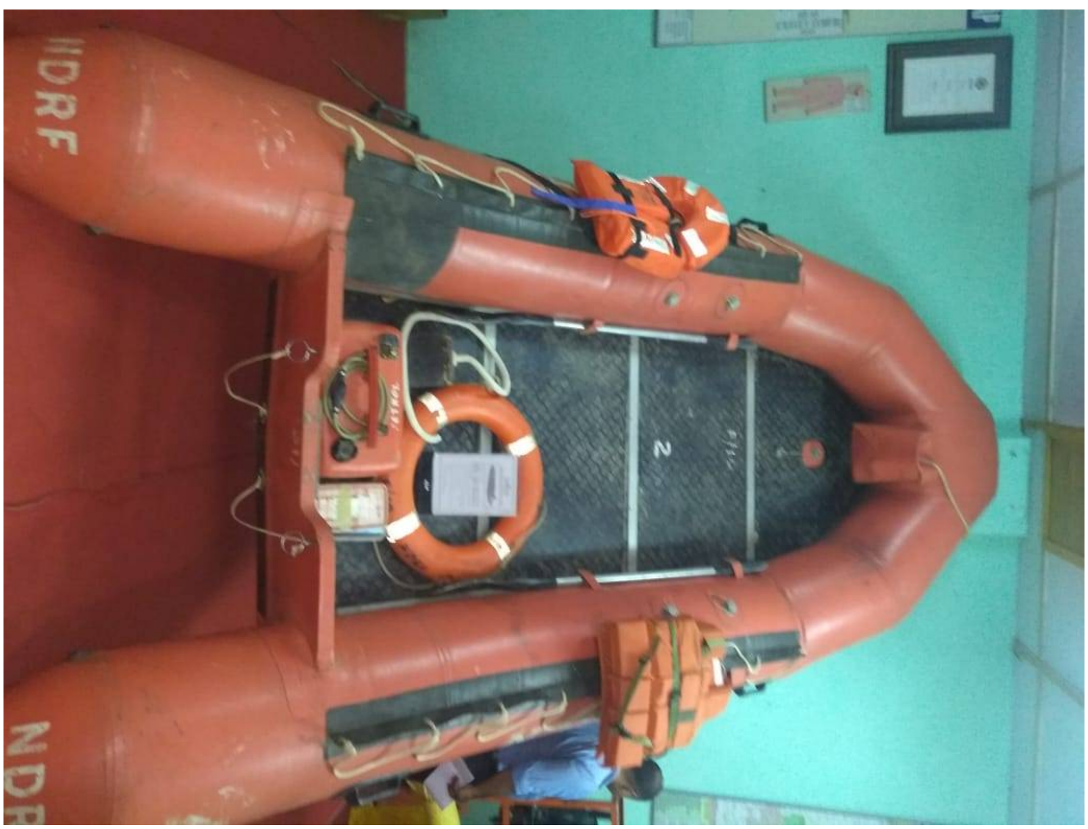
S.No.	Name, Designation and address	Contact Details	State / UT
1.	Sh. Madhusudhana Reddy M, Dy. Commandant, 10th BN	Tel. 0863-2293050, Email. mdhreddy6@gmail.com,	Andhra Pradesh
2.	Sh. Saranka Sekhar Mishra, Assistant Collector, Collectorate, Dhenkanal	Tel. 06762-226507, Email. mishrasasanka71@gmail.com	Andhra Pradesh
3.	Sh. NimainCharan Das, District Project Officer (DPO), OSDMA, Collectorate, Dhenkanal	Tel. 06762-226507, Email. dnimain@gmail.com	Andhra Pradesh
4.	Sh. Vigin Lal, Scientist-B, IMD Meteorological Centre, Near Supi Airport, Ahmedabad -382475	Tel. 079-22858020, Fax. 079-22865449, Email. viginlal@gmail.com	Gujarat
5.	Sh. Amit Mehra, SDM Joginder Nagar, Sub Divisional Magistrate Joginder Nagar, District Mandi	Tel. 01908-223095, Fax. 01908-223895, Email. sdmmanjnr@gmail.com	Himachal Pradesh
6.	Sh. Rahul Chauhan, SDM Sunder Nagar, Sub Divisional Magistrate, Sundernagar District Mandi	Tel. 01907-266001, Fax. 01907-266001, Email. sdmmansor@gmail.com	Himachal Pradesh
7.	Sh. Fayez Ahmad Nika, Professor, Central University of Kashmir, National High Way Srinagar, Tulmulla Road, Ganderbal, Jammu and Kashmir - 191201	Email. n-fayez2004@yahoo.co.in	Jammu & Kashmir
8.	Sh. Anil Kumar, Assistant Professor, Central University of Kashmir, National High Way Srinagar, Tulmulla Road, Ganderbal, Jammu and Kashmir -191201	Email. vipanil@yahoo.co.in ,vipanil@gmail.com	Jammu & Kashmir

9.	Sh. H. N. Gopinath, Transmission Executive, Bangaluru	Email. hngopinath2005@yahoo.com	Karnataka
10.	Sh. Sandeep. S, Transmission Executive, AIR, Vazhgthacago, Thiruvanathapuram- 14 Kerala Pin- 695014	Tel. 2826340, Email. air.sandeep@hotmail.com	Kerala
11.	Sh. Fahad Marzoor T U, Hazahd Analyst, Kerala State Disaster Management Authority, Observatory Bills, Vikas Bhavan (PO). Thiruvananthapuram, Kerala. – 673003	Tel. 0471-2331345, Fax. 0471-2364424, Email. fahadmarzook@gmail.com	Kerala
12.	Sh. G. Santhosh Kumar, Programme Executive, Trivandrum,	Tel. 0471-2325061, Email. santhoshgair@gmail.com	Kerala
13	Sh. Anurag Chaurasia, Research Scholar, Department of Anthropology Vishwaridyalaya Sagar - 470003	Email. anurag.chaurasia6@gmail.com	Madhya Pradesh
14	Sh. Shiv Kumar, Assistant Commandant, 5th BN , NDRF District Pune	Email. shheevv@gmail.com	Maharashtra
15	Smt. Geetanjali Sa, District Project Officer, Collector kalahandi, Emergency Section AT/PO-Bhawanipatna Dist. Kalahandi Pin - 752011	Tel. 06670-250455, Email. sddma.kalahandi@gmail.com	Odisha
16	Sh. Jitesh T M, Assistant Commandant, 4th BN	Email. tn04_ndrf@nic.in	Tamil Nadu
17	Sh. M. Renaasamy, Assistant Project Officer, District Rural Development Agency, Sivagangai	Tel. 04575-240388, Email. mrsamy2211@gmail.com	Tamil Nadu

18	Sh. Prashant Kumar, Disaster Expert, DDMA Moradabad Collectorate Moradabad	Email. s.prashant4@gmail.com	Uttar Pradesh
19	Sh. Vidhan Jaiswal, ADM (F/R), CEO, DDMA, District Disaster Management Authority, Gorakhpur	Tel. 0551-2337792, Email. askvidhan@gmail.com	Uttar Pradesh
20	Ms. Palak Nidhi Nayak, Senior Assistant, Revenue Department, JalaunOrai,	Tel. 05162-255518, Fax. 05162-252390, Email. cra.orai@gmail.com	Uttar Pradesh
21	Sh. Primil Kumar Singh, ADM, (F/R), Revenue Department, JalaunOrai	Tel. 05162-253357, Fax. 05162252390, Email. admjalaun2012@gmail.com	Uttar Pradesh
22	Sh. Vinay Kumar Yadav, District Horticulture Officer, Officer, Room No- 218, IInd Floor, Vikas Bhawan, Civil Line, Dabrai, District Firozabad (U.P)	Tel. 05612-285092, Email. frzbddho@gmail.com	Uttar Pradesh
23	Sh.Mandira Bura Gomain Project Officer Assam Disaster Management Authority,Under Revenue & DM Department. 9650093292	Mandima.asdma@gov.in	Assam
24	Sh.A.Vijay Bhaskar Reddy All India Radio Kadapa	kadaparadio@gmail.com	Andhrapradesh
25	Smt.D.Rathna IAS Sub Collector Tiruvallur Government of Tamilnadu	Rathna_2018@yahoo.com	Tamilnadu

26	Ms.Saraayu.K.M IAS Sub Collector Cuddalone Government of Tamilnadu	Sarayumohan.mace@gmail.com	Tamilnadu
27	Sh.N.Vishnu Vardhan Reddy Programme Executive,A.I.R Nizamabad	Vishnuair1992@gmail.com	Telangana

7. Photo gallery



Tentative Schedule for the National Level Training Course on
EXTREME WEATHER EVENTS
during 6 – 10 August 2018 at NIDM South Campus, APHRD Institute, Bapatla, District Guntur, Andhra Pradesh – 522101
Web address of venue: www.aphrdi.ap.gov.in, NIDM website: www.nidm.gov.in

<table>
<tr><th rowspan="2">Day / Date</th><th colspan="4">Pre-Lunch Session (Time in hours)</th><th rowspan="7">LUNCH BREAK (1300 – 1400 Hrs.)</th><th colspan="4">Post-Lunch Session (Time in hours)</th></tr>
<tr><th>9:00 – 10:00</th><th>10:00-11:30</th><th rowspan="6">Tea (1130 – 1145 Hrs.)</th><th>1145-1300</th><th>1400-1515</th><th rowspan="6">Tea (1515 – 1530 Hrs.)</th><th>1530-1630</th><th>1630-1730</th></tr>
<tr><td>Monday,
6 August 2018</td><td>Registration of Participants
DEO</td><td>Welcome
Intro by participants
Course Intro
Ground Rules
Inaugural Address
Vote of Thanks</td><td>SFDRR, SDG and COP on DRR, Development and Climate Change
Dr. Surya Parkash</td><td>Video on Climate Change
Dr. Surya Parkash</td><td colspan="2">DMS Network of ISRO (DSSP), Satellite Imageries and Bhuvan Portal for monitoring and forecasting extreme weather events
Resource Person from NRSC</td></tr>
<tr><td>Tuesday,
7 August 2018</td><td>Recapitulation</td><td>Trends and Variability in Weather Parameters – Issues and Strategies
Dr. K. Nagaratna, IMD</td><td>Cyclones and Storms in Changing Climatic Conditions
Dr. K. Nagaratna, IMD</td><td>Case Study on Chennai Floods – A Discussion based on Documentary
Dr. Surya Parkash</td><td colspan="2">Case Study on Leh Flash Flood and Case Study on Uttarakhand Flash Floods
Dr. Surya Parkash</td></tr>
<tr><td>Wednesday,
8 August 2018</td><td>Recapitulation & Group Photograph</td><td>Drought Contingency Plans and Management in Changing Climatic Conditions
Dr Surya Parkash</td><td>Case Study on Heat Waves in Southern India
Sh Amal Krishna</td><td>Thunderstorm and Lightning Studies
Sh. Amal Krishna</td><td colspan="2">Orientation for Group Exercise and Conduct of TTE by participants
Dr. Surya Parkash</td></tr>
<tr><td>Thursday,
9 August 2018</td><td>Recapitulation and Exercise</td><td>Field Visit to Cyclone Affected Areas in Andhra Pradesh
Sh. C R Kamalanathan and Dr. Surya Parkash</td><td>Field Visit to Cyclone Affected Areas in Andhra Pradesh
Sh. C R Kamalanathan and Dr. Surya Parkash</td><td>Visit to SEOC
Dr. Surya Parkash and AP SDMA</td><td>Satellite based Communication & Networks, VSAT, Satellite Phones,
Commdt, NDRF10</td><td>Visit to NDRF Control Room
10th Bn, NDRF</td></tr>
<tr><td>Friday,
10 August 2018</td><td>Recapitulation</td><td>Presentation of Group Exercise by participants
Participants and
Dr. Surya Parkash</td><td>Feedback and Evaluation
Participants</td><td>Valediction &
Certification,
Vote of Thanks
NIDM</td><td colspan="2"></td></tr>
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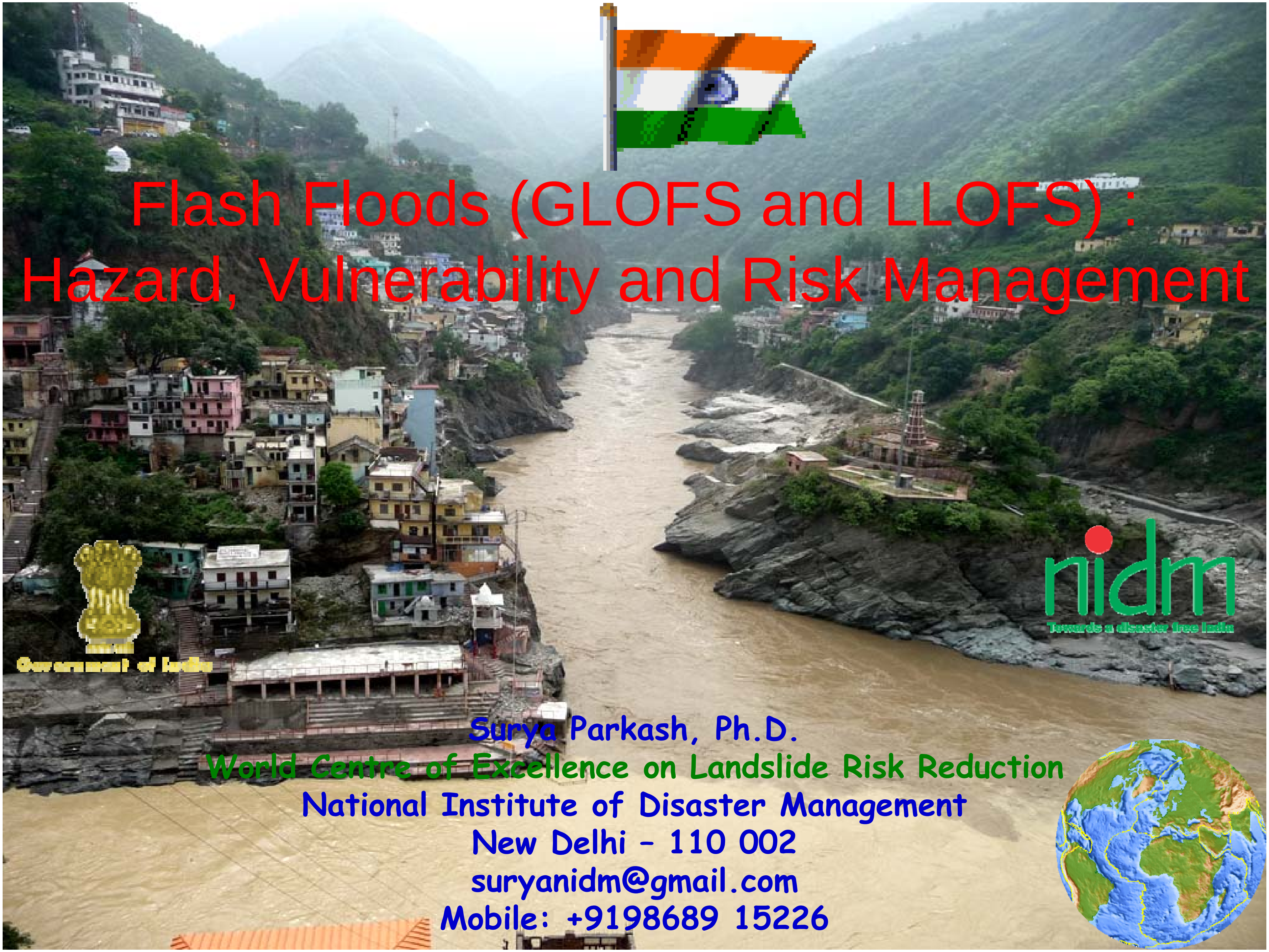
Flash Floods (GLOFS and LLOFS) : Hazard, Vulnerability and Risk Management



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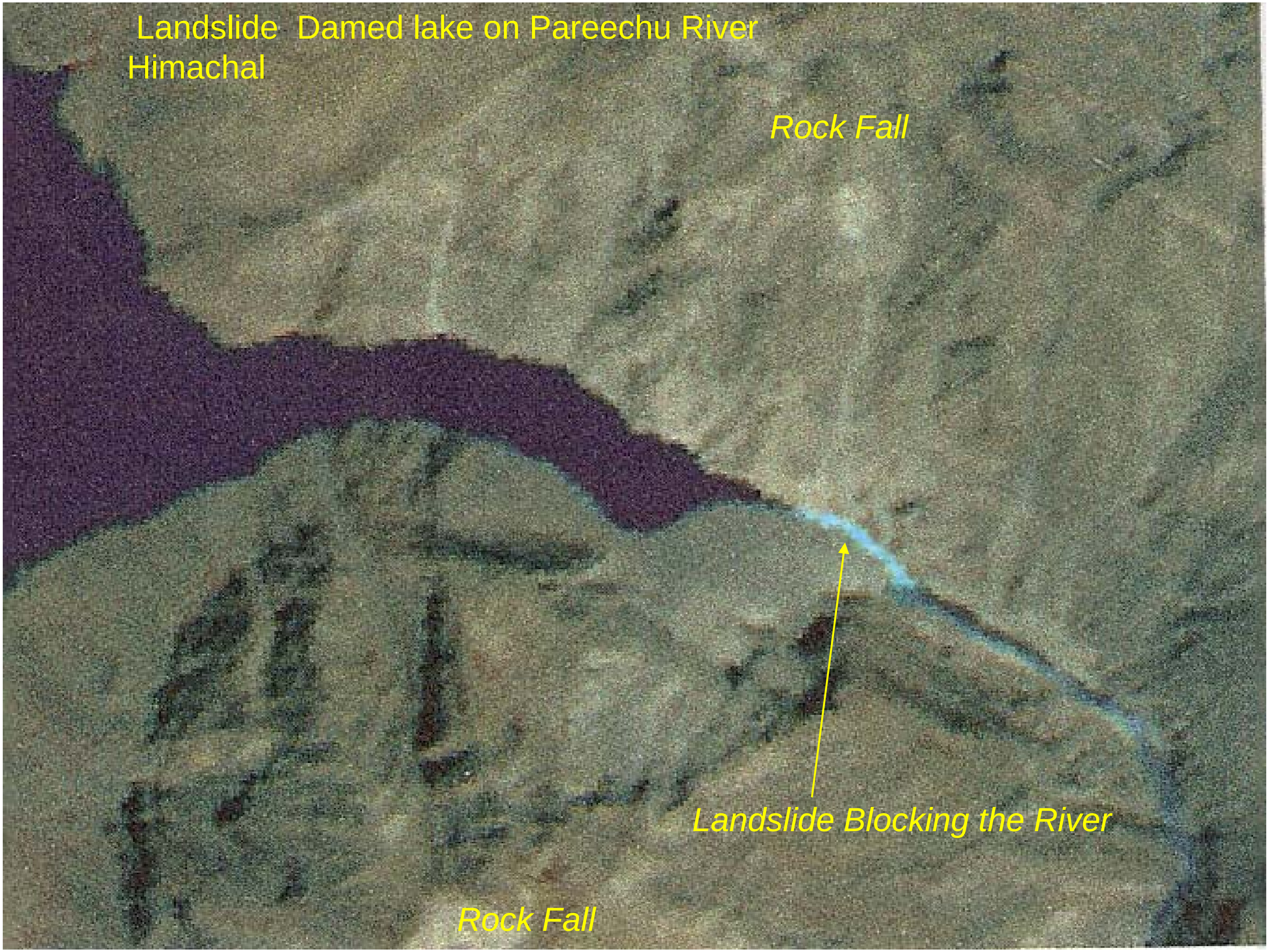
suryanidm@gmail.com
Mobile: +9198689 15226

Examples of Flash Flood Incidences and Impacts


Landslide Damed lake on Pareechu River
Himachal
Rock Fall
Landslide Blocking the River
Rock Fall

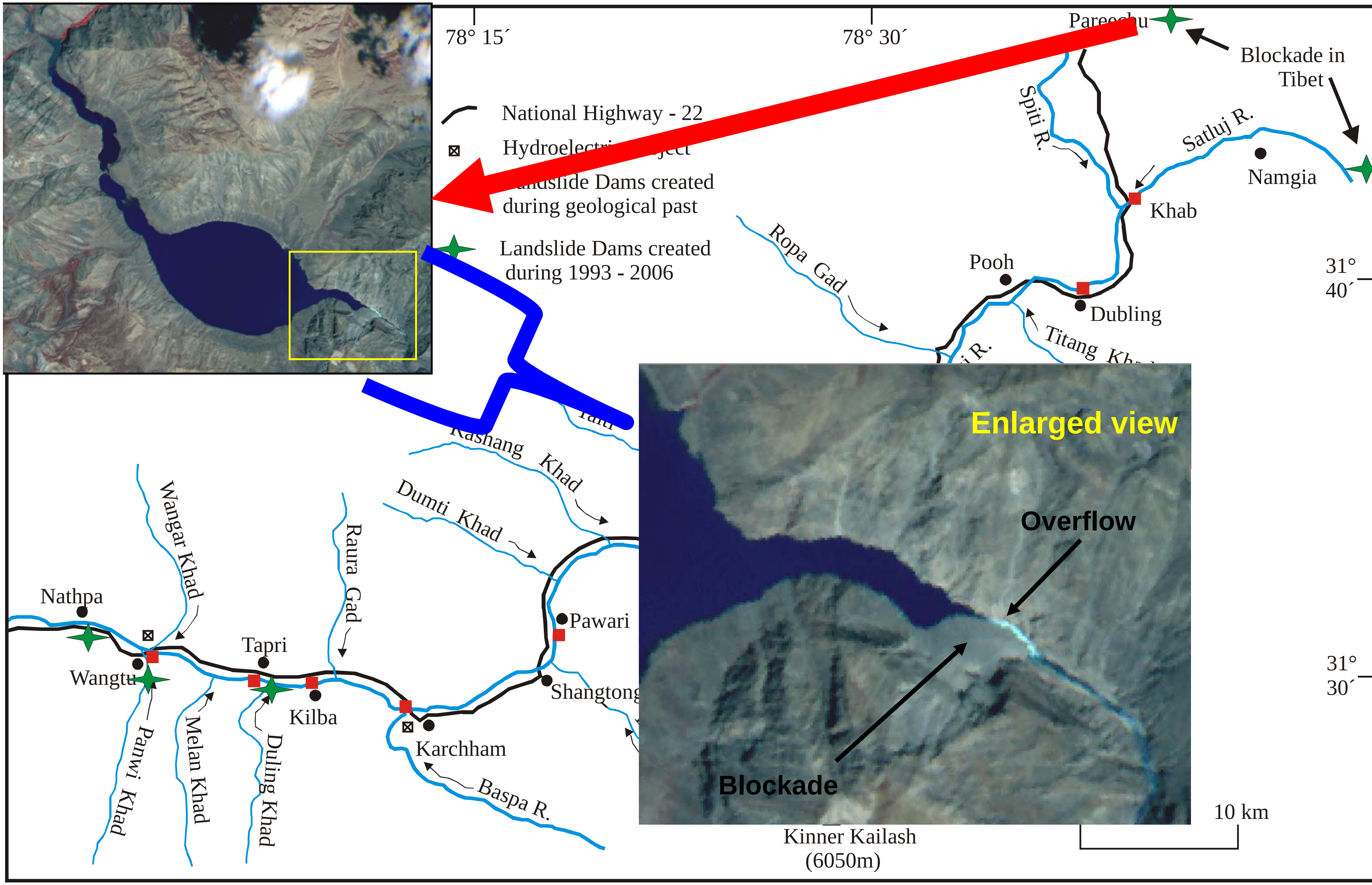
July 2, 2005

September 1, 2004

PARECHU LAKE FORMED BY LANDSLIDE POSED STRATEGIC, SOCIO-ECONOMIC & ENVIRONMENTAL RISKS;

AFTER BURSTING LEAD TO LOSS OF ABOUT 8 BILLION RUPEES AND DAMAGES TO SEVERAL PROJECTS, STRUCTURES & INFRA-STRUCTURES

Flash Floods



H-T FLOOD 26 JUNE 2005

360 FT BSB AKPA BRIDGE HANGING ON ROPE

Typical example of Toe erosion by the 2005 Flash flood

Total Damage caused by the recent LLOFs

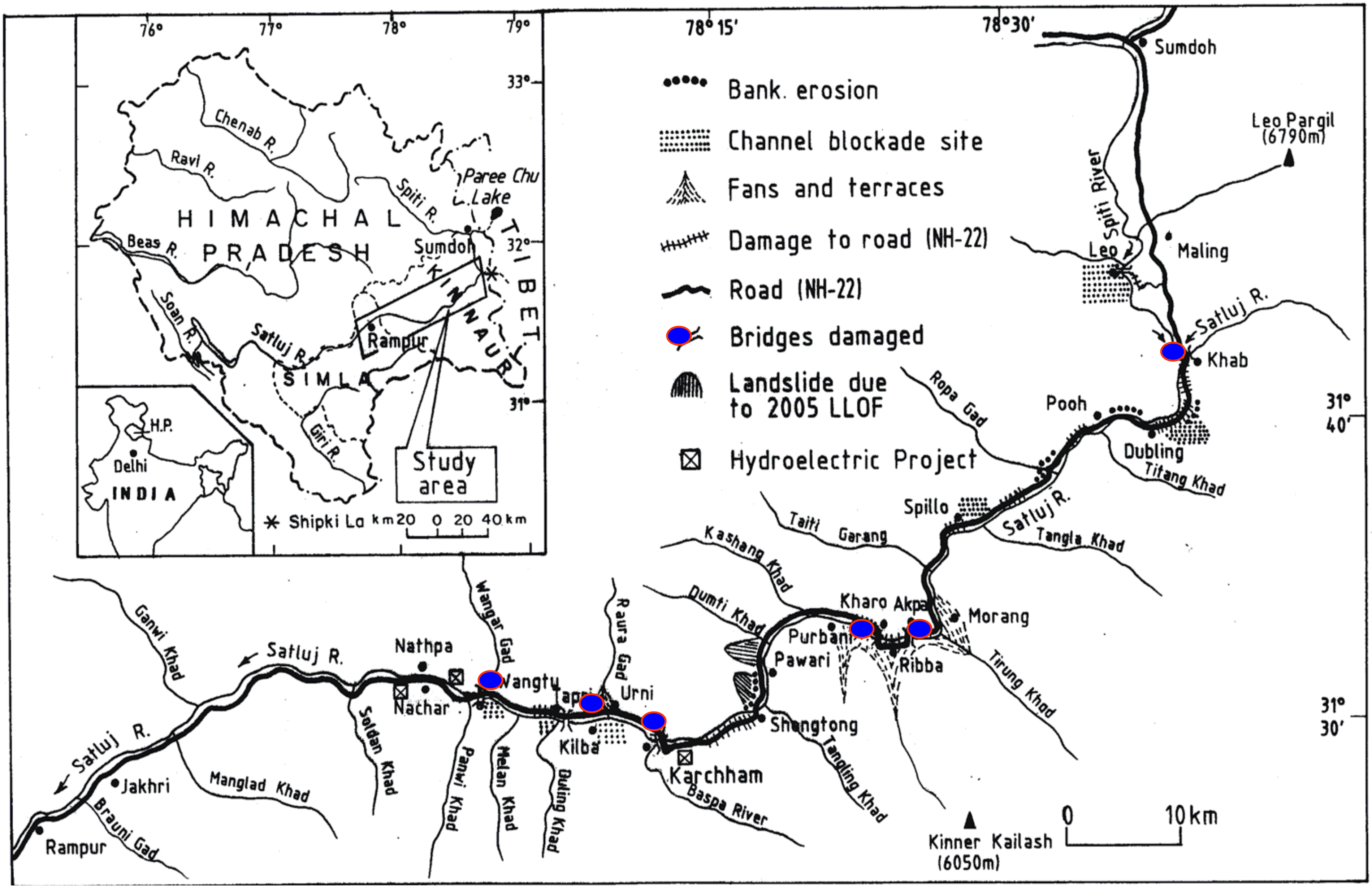
- **31st July 2000**
  - **156 people washed away**
  - **250 houses washed away**
  - **20 km NH-22 washed away**
  - **Hydel Power projects damaged**

Total Loss = Rs 10 b

- **26th June 2005**
  - **No lives lost**
  - **Six bridges washed away**
  - **12 km road (NH-22) damaged in sections**
  - **Hydel Power projects damaged**

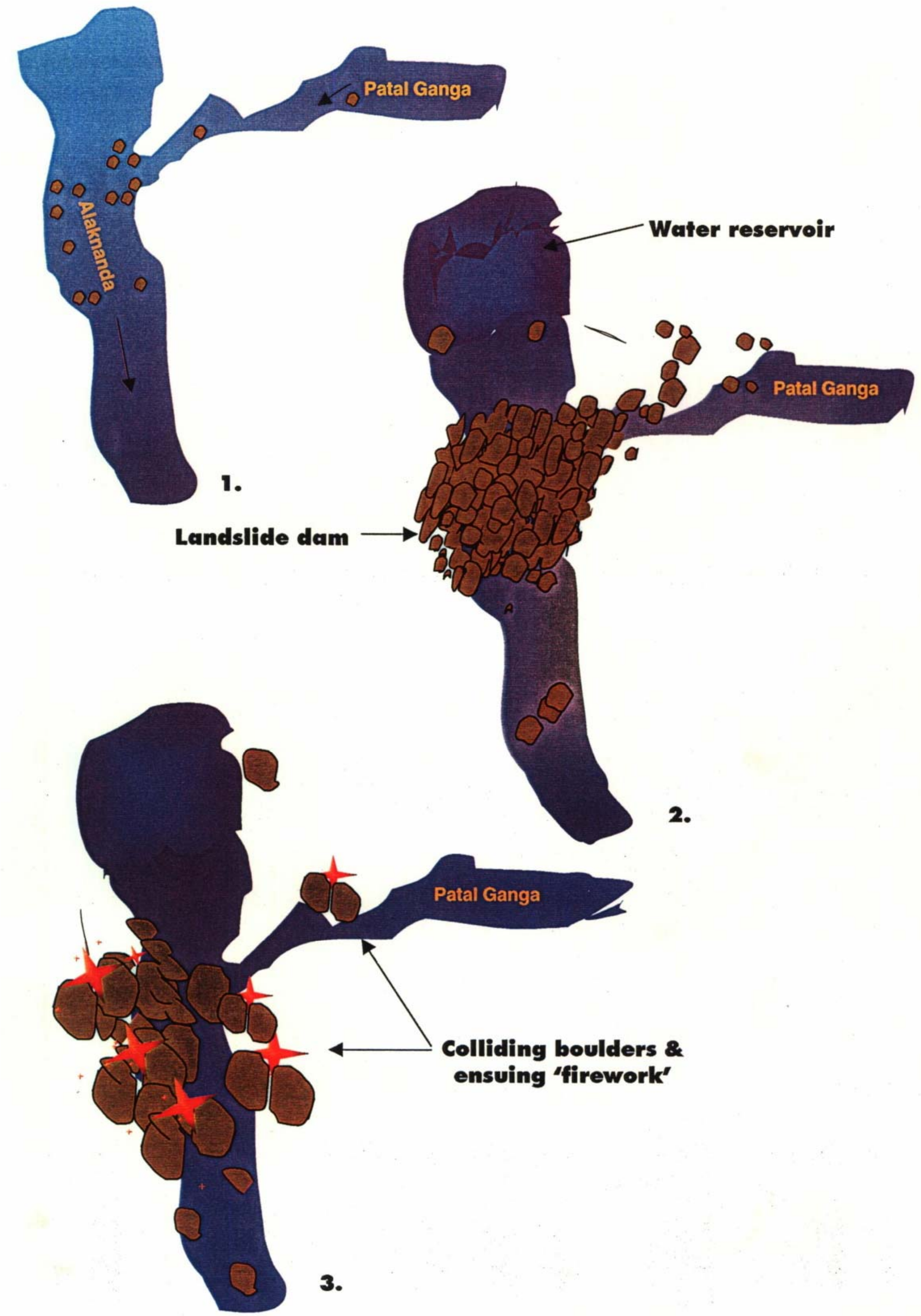
Total Loss = Rs 8 b

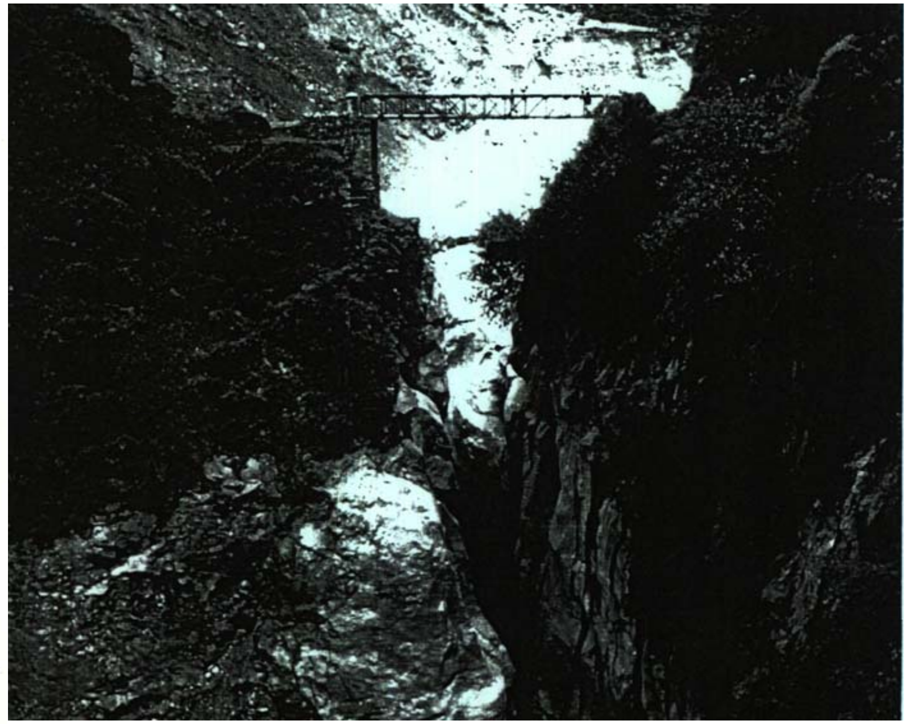
Damages due to 2005 outburst flood in the valley




SONAPUR LANDSLIDE
28 12:23PM

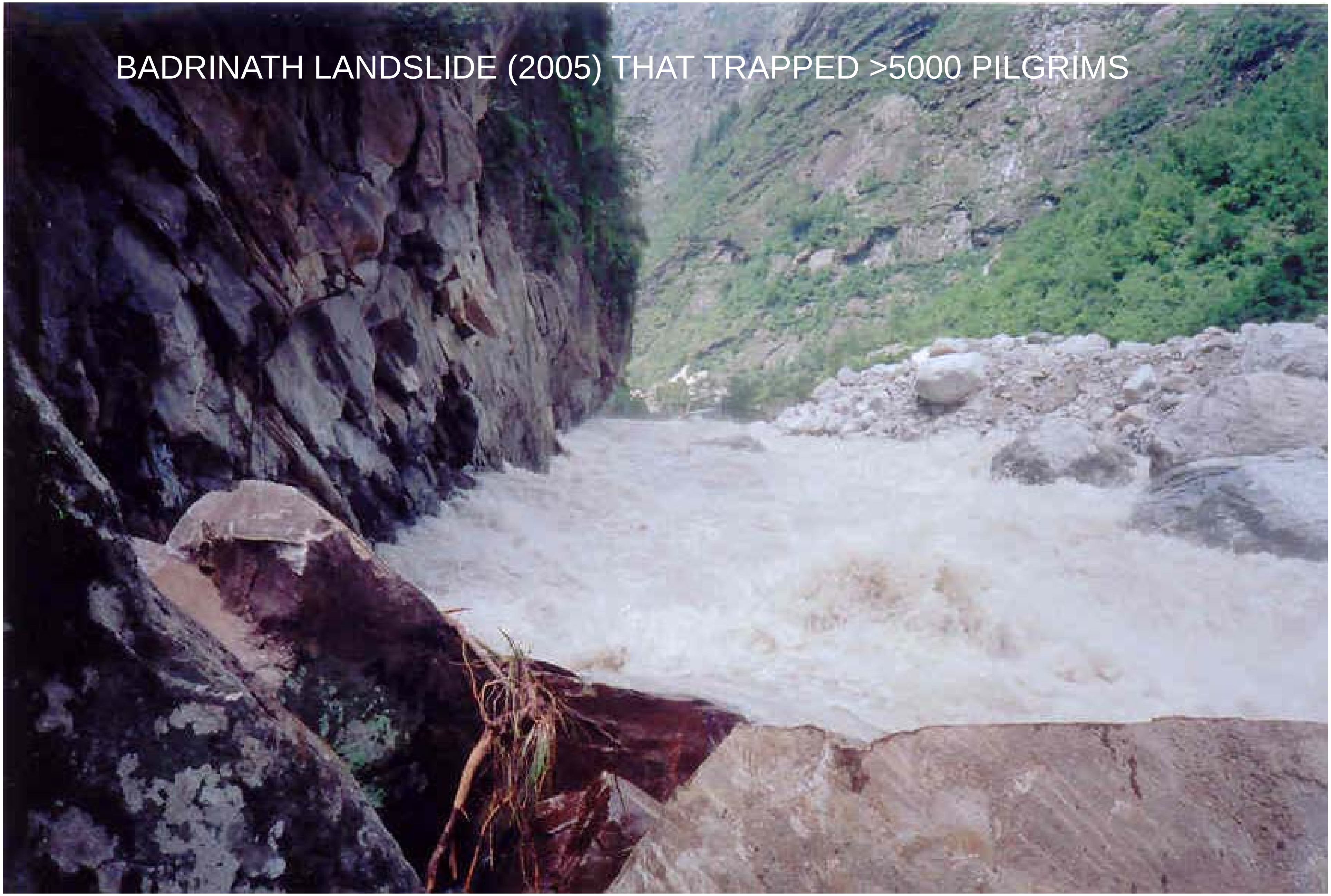

SONAPUR LANDSLIDE





A rare Catastrophe in Himalayan Region
20 August 1970

Khanera


BADRINATH LANDSLIDE (2005) THAT TRAPPED >5000 PILGRIMS


National
Highway to
Srinagar


UNIVERSAL


STATIONERY
M/S JYOTI MEDIC
CHEMIST
DAIRY FRESH
ICE CREAM

BEFORE

AFTER


BEFORE
AFTER

Kedarnath pre and post disaster

Srinagar

Human lives

Dead: 680

Missing: 4,117

Loss of dwelling units

Totally damaged: 1,940
Severely damaged: 1,575
Partially damaged: 5,647

Total damaged dwellings: 9,162

The loss of public infrastructure and assets is assessed to be Rs. 13,844 crore

This does not include loss incurred to personal assets and property

Flash Floods: Hazard, Vulnerability and Risk Management

- Definition of Flash Floods
- Differentiation from Debris Flows and Riverine Floods
- Potential Triggers
- Vulnerability to Flash Floods
- What makes a Flash Flood?
- Natural Factors contributing to Flash Floods
- Anthropogenic Factors
- LDOF / LLOF, GLOFs, Dam Bursts
- Risk Management Options

Flash Floods:

Sudden, severe, short lived flood events often triggered by extreme cloudbursts that occur with little warning in a small catchment and lead to rapid rise in river water level (especially where water courses are narrow), glacial lake outbursts, failure of artificial dams or landslide dams;

FF allow very less time to react and can have impacts hundreds of kilometers downstream, although the warning time available is counted in minutes, or at the most hours

Debris Flow:

A rapid mass movement of loose soil, rocks and organic materials along with entrapped air and water forming a slurry that flows downslope under the influence of gravity

FF differ from riverine floods in terms of their rapid onset and decline, high intensity and unpredictability as well as their usually more localized impact in hills rather than plains. FF moves at high velocity, often loaded with huge debris that washes, damages or destroys whatever comes in its way, besides causing loss of lives.

Potential Triggers of Flash Floods

FF can be triggered by

- intense rain,
- extremely rapid snow-melt,
- failure of natural or artificial dams,
- GLOFs and
- LLOFs

Vulnerability to Flash Floods

FF poses serious threat to lives, livelihood and infrastructure, both in hills and d/s

FF carry much higher debris than normal floods and as a result cause more damage to roads, bridges, buildings, dams, hydel projects & Infrastructure

Vulnerable groups are poor, women, children, elderly and disabled/handicaps

What makes a flood a flash flood?

Intense short-lived precipitation or sudden release of huge amount of water by:

- increased impervious cover
- increased stream density
- increased slope and
- decreased channel length
- decreased surface roughness
- decreased vegetation

Natural Factors contributing to FF

- Meteorological
- Geological
- Hydrological ort hydraulic

FF occurs after cloudburst, compounded with high and rapid run-off over steep slopes, an impermeable surface, saturated and/or compacted top soil, and lack of vegetation cover.

Landslides and debris flows can also form unstable dams across drains/rivers, leading to formation of temporary lakes and development of flash flood when the dam collapses.

Bridges can also trap debris and obstruct flow, leading to inundation upstream followed by the collapse of debris accumulation and a flash flood as a result.

Similarly development of glacial lake behind unstable moraine dams poses a threat of GLOF – when the moraine dam collapses.

All these can be compounded by factors related to people use of landscape – anthropogenic factors – which increase the intensity and impact of FF.

Anthropogenic Factors

Besides natural factors, anthropogenic factors either contribute to creating the conditions that favor the development of flashfloods or increase the associated risk, in particular settlements, urbanization, deforestation and failure to maintain or manage drainage systems.

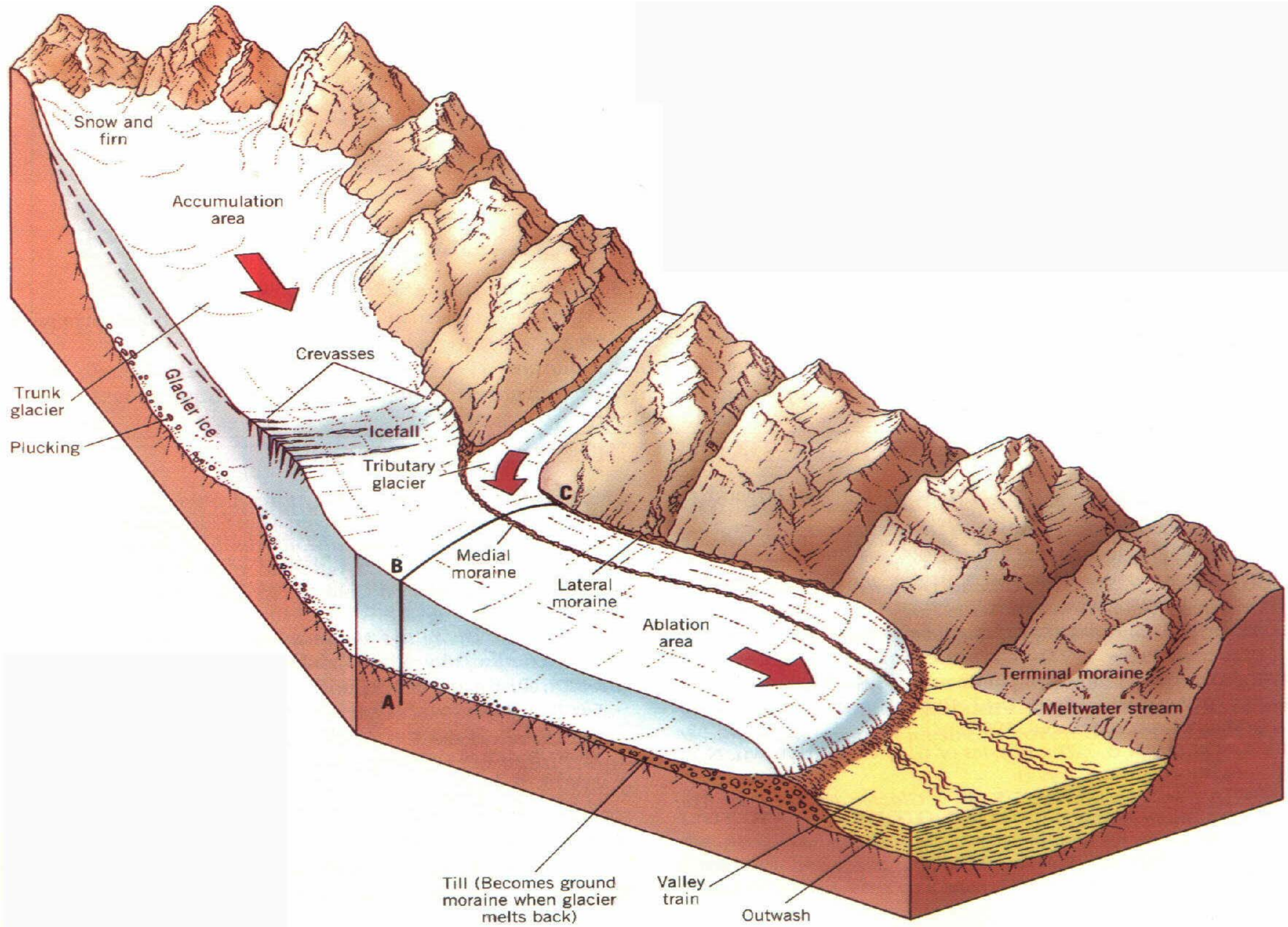
Many of these are the direct result of population growth and the associated pressure on natural resources for development, e.g. deforestation and soil erosion as a result of increased farming on marginal lands, demand for fuel and poor construction of roads, increase landslides and associated potential for creation of landslide dams.

Similarly poor management of watershed, introduction of intensive agricultural practices, poor landuse practices leading to deforestation, degradation and soil compaction or loss, as well as building footprints that reduce infiltration and failure to maintain drainage system, can lead decreased retention of precipitation and higher run-off, directly contribute to FF.

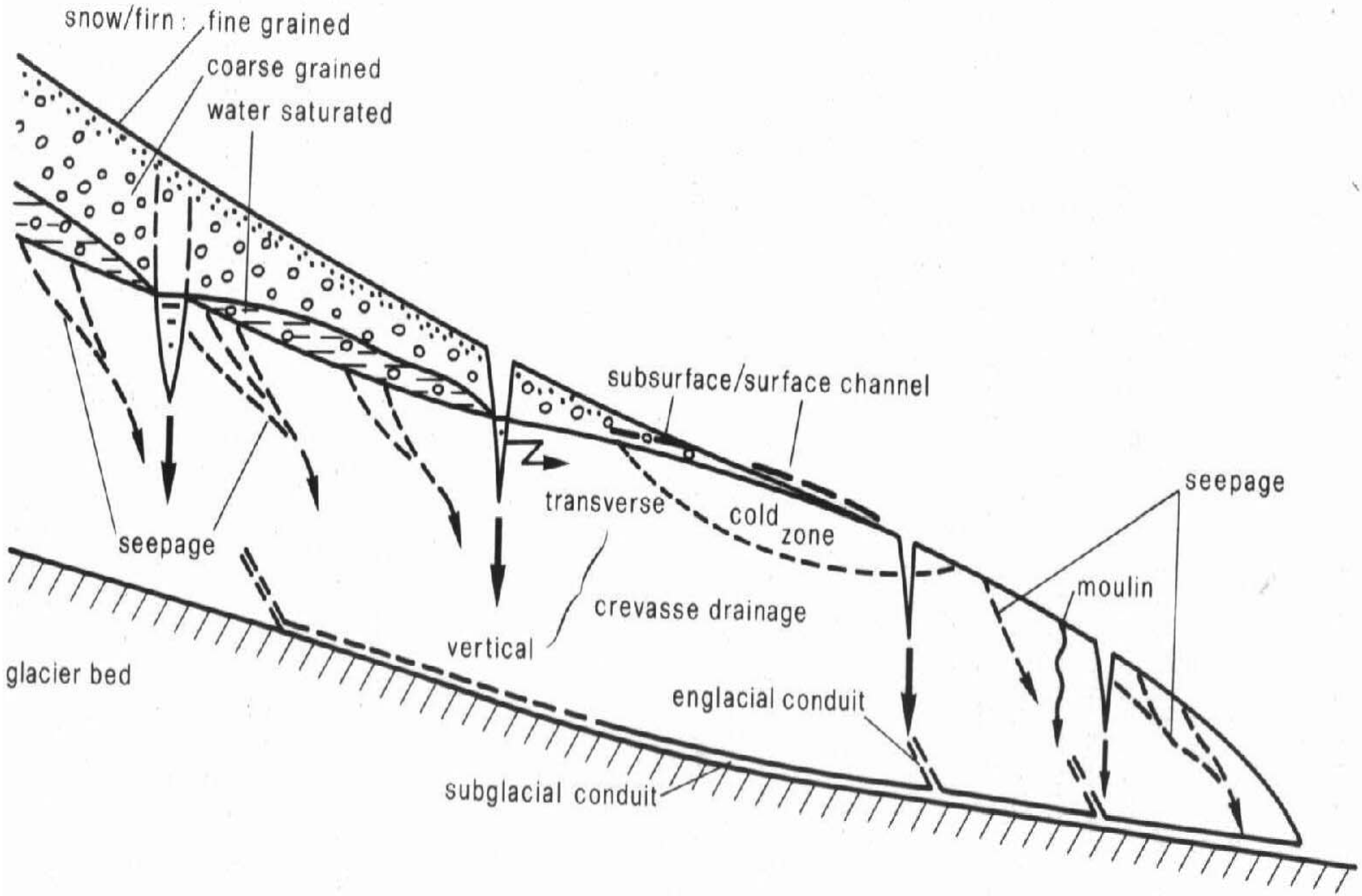
Poorly planned construction (e.g bridges) across narrow channels and altering of water channels can lead to FF, hindering free flow of water and debris, causing blockages which can burst.
Lack of awareness of migrant population of local risk factors

GLACIERS

- **Are the product of climate and climate change**
- **Grow when the climate is cool and shrink when the climate is warm**
- **More than five thousands glaciers (5221) are in the Indian Himalaya**
- **Uttarakhand bears the potential of 917 glacier**



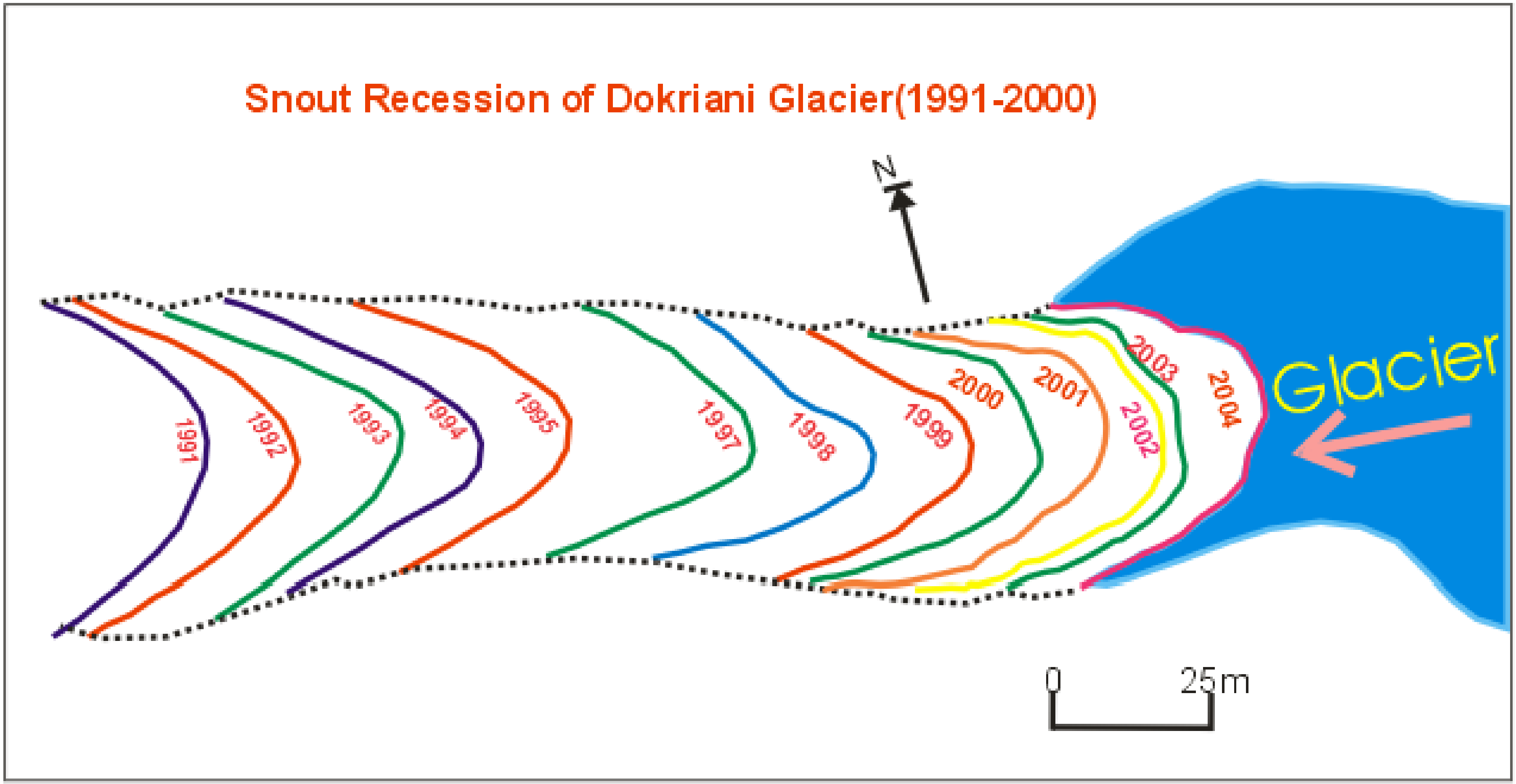
Snow and firn
Accumulation area
Crevasses
Trunk glacier
Glacier ice
Plucking
Icefall
Tributary glacier
C
B
A
Medial moraine
Lateral moraine
Ablation area
Terminal moraine
Meltwater stream
Till (Becomes ground moraine when glacier melts back)
Valley train
Outwash


snow/firn : fine grained
coarse grained
water saturated
subsurface/surface channel
transverse
cold
zone
seepage
seepage
moulin
crevasse drainage
vertical
glacier bed
englacial conduit
subglacial conduit


93 11 14

Recession of Dokriani glacier over the period 1962-1995

Recession of Dokriani Glaciers



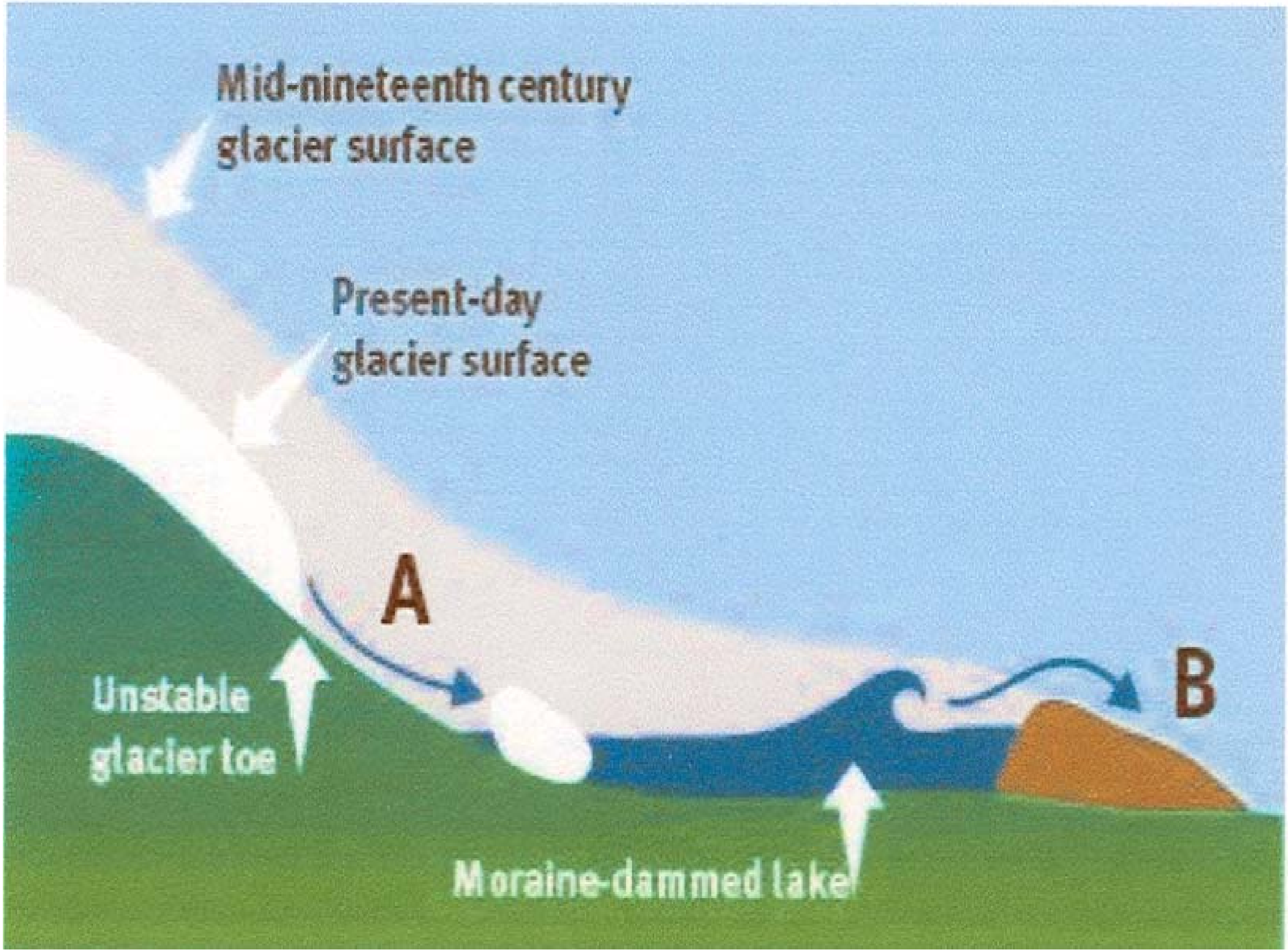
Recession of glaciers in the Himalaya

Name of glacier	Period of measuring	Period (in years)	Recession (in m)	Average rate (m/yr.)
Milam glacier	1849-1957	108	1350	12.50
Pindari glacier	1845-1966	121	2840	23.40
Gangotri glacier	1962-1991	29	580	20.00
Tipra bank glacier	1960-1986	26	325	12.50
Dokriani glacier	1962-1991 1991-2000	29 09	480 161.15	16.5 18.0
Chorabari	1962-2003	41	196	4.8
Shankulpa	1881-1957	76	518	6.8
Poting	1906-1957	51	262	5.13
Glacier No-3Arwa	1932-56	24	198	8.25
Bara Shigri	1956-1963	07	219	31.28
Chhota Shigri	1987-1989	03	54	18.5
Sonapani	1909-1961	52	899	17.2
Kolai	1912-1961	49	800	16.3
Zemu	1977-1984	07	193	27.5

Glacial Lake Outburst Flood (GLOF)

Glacial lakes are formed behind the end moraines / moraine dams composed of unconsolidated boulder, gravel, sands and silt, and are thus, structurally fragile and potentially subject to catastrophic failures.

The collapse of a moraine dam can result in sudden release of a large amount of water and debris – a glacial lake outburst flood


Mid-nineteenth century
glacier surface
Present-day
glacier surface
A
Unstable
glacier toe
B
Moraine-dammed lake

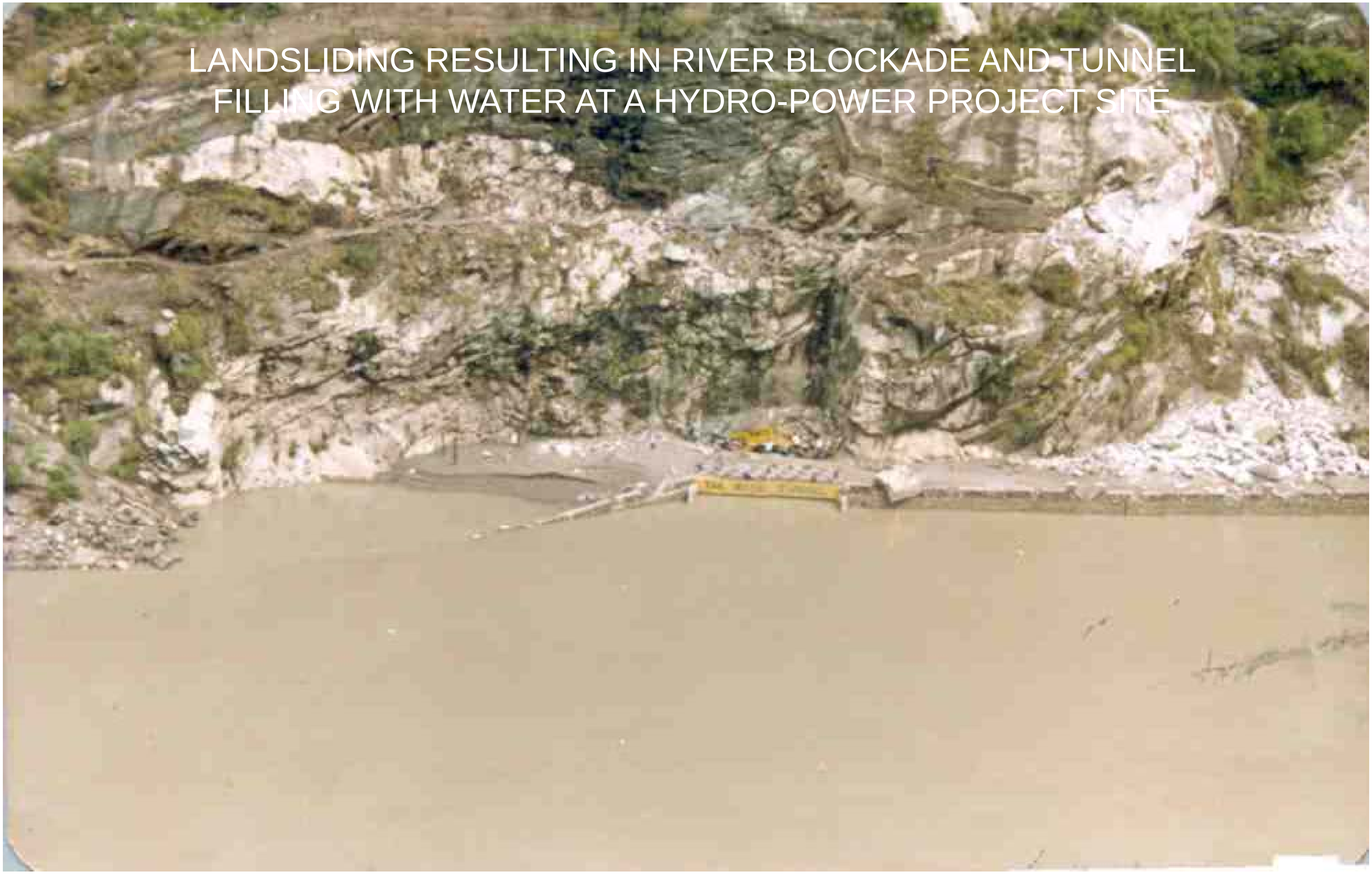

1
2

Landslide Dam Outburst

Weak geological structures, active tectonic forces, steep and fragile topography, heavy seasonal rainfall and river bank erosion are major responsible factors.

Deposits from landslides and debris flows can block a narrow river course to create a natural dam resulting in the formation of a temporary reservoir upstream.

The water level in the reservoir will rise due to the continuous inflow from the river. When the water overtops the dam, or its weight exceeds the holding capacity of the dam, the dam can burst resulting in a sudden torrent of water downstream – a landslide dam outburst flood (LDOF)



LANDSLIDING RESULTING IN RIVER BLOCKADE AND TUNNEL FILLING WITH WATER AT A HYDRO-POWER PROJECT SITE

A disaster happening that you’ve never heard of….

- Six months ago, on January 4th, 2010 in the remote Hunza River Valley of northern Pakistan, a massive landslide buried the village of Attabad, destroying 26 homes, killing 20 people, and damming up the Hunza River.
- As the newly-formed lake grew, authorities rushed to evacuate and supply those affected in the landslide area and upstream. The lake is now over 300 feet deep and 16km (10 mi) long, submerging miles of highway, farms and homes.
- Earlier this week, the lake reached the top of the natural dam, and began to spill out - rapid erosion of the landslide debris has authorities worried about a potential breach, and locals have been evacuated as officials monitor the developing situation.

Another view of the growing lake formed behind the landslide, seen from the ruins of Attabad village on February 1, 2010.

Risk Management

Preventive Measures

Strengthening of embankments of potential damage centers such as

- human inhabitations along the river side
- sites of bridges,
- low lying roads
- and important installations along the river sides so as to impact of huge water mass

Physical Methods for Slope Stabilization and Erosion Control

These include measures to reduce runoff (terracing, diversions, grassed waterways, conservation ponds), methods to stabilize slopes and reduce erosion (retaining walls, drop structures, sabo dams) and integrated methods to address specific problems (gully control, trail improvement) etc.

Terracing

It is technique of converting slope into a series of horizontal step-like structures to

- Control the flow of surface runoff by guiding runoff across the slope and conveying it to a suitable outlet at a non-erosive velocity
- Reduce soil erosion by trapping the soil on the terrace
- Create flat land suitable for cultivation

Terracing prevents formation of rills, improves soil fertility through reduced erosion and help water conservation. The 3 main types of terracing are bench terraces, Contour or level terraces and parallel or channel terraces

Diversions

Diversions are ridges of soil or channels with a supporting ridge on the lower side. They are built across the slope to intercept runoff and dispose it at a selected location. They are used to break up long slopes, to direct water away from active erosion sites, to direct water around agricultural fields or other sites, and to channel surface runoff to suitable outlet locations. Safe passage of the runoff to prevent slope failures can be achieved by drainage ditches or by cross drainage work for road structures.

Slope drainage – open ditch/drains, side drain, culvert, pipe drains (The most common type of drain are stone or gravel filled drain with or without pipes)

Grassed Waterways

are natural or artificially constructed water courses shaped or graded to the required dimensions and planted with suitable vegetation. The channel helps water to flow without causing erosion.

Grassed waterways are used as

- Outlets for diversions and emergency spillways
- To safely convey runoff from contour and graded bunds and bench terraces
- As outlets for surface and sub-surface drainage systems on sloping lands
- To carry runoff from natural drains and prevent formation of rills/gullies
- To dispose water collected in road ditches through culverts

Conservation Ponds / Farm ponds, Dugout ponds, Embankment type ponds are small reservoirs constructed for the purpose of collecting and storing water from runoff, to reduce peak flow and erosion, and thus probability of FF. It also help ground water recharge.

Mitigation Measures

NSM include risk assessment, planning measures to reduce exposure and vulnerability, raising awareness and preparedness, education, training, monitoring, warning and evacuation

SM aim to reduce the volume of water as well as the hydrostatic pressure on the dam. The 4 main approaches are i) controlled breaching/blasting of the moraine dam, ii) construction of an outlet control structure / construction of spillway or open channel, iii) pumping or siphoning the water from lake and iv) drilling and tunneling under the moraine or ice dam

Non-structural Measures (NSM)

Any measure that does not involve physical construction but instead uses awareness, knowledge, education, training, practices, policies, laws, and/or agreements etc. to reduce the impacts.

NSM measures can be cost effective and sustainable alternative to traditional engineering solutions. NSM are only efficient with participation of a responsive population and an organized institutional work

Structural Measures (SM)

Any physical construction designed to intervene, control or mitigate the potential impacts.

SM for FF can be grouped in 4 groups based on overall focus; i) Activities in the whole catchment area, ii) Activities in shape retention, iii) regulating rivers and streams, iv) river conservation

Bioengineering Measures

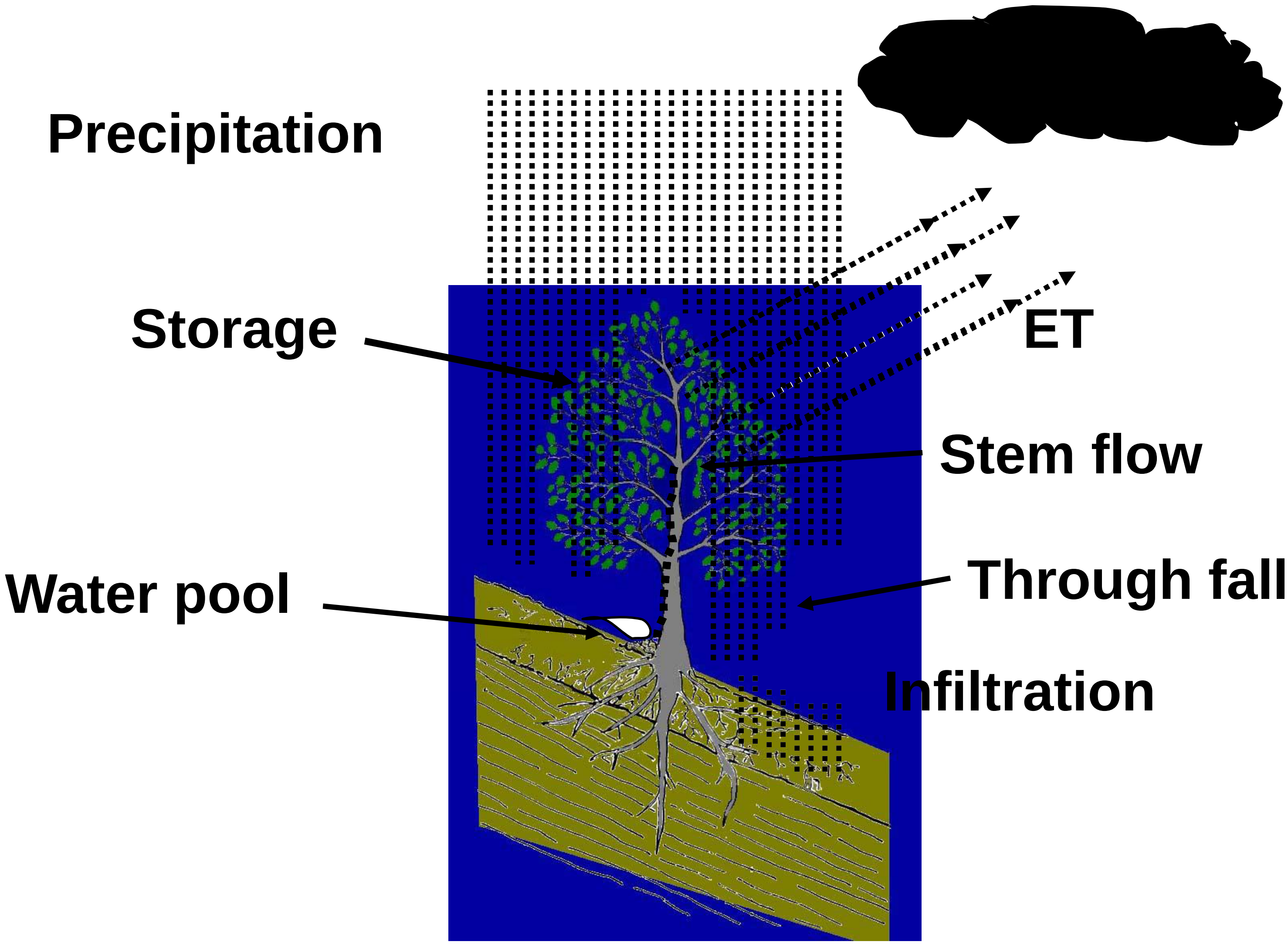
Bioengg is the application of engineering design and technology to living systems. It refers to the combination of biological, mechanical and ecological concepts to reduce or control erosion, protect soil, and stabilize slopes using vegetation or a combination of vegetation and construction materials.

BM used in combination with civil and social engineering offers environmentally friendly, economical and efficient solution to minimize the FF & their impacts

Hydrological Functions of Vegetation include

- Interception
- Restraint
- Absorption
- Infiltration
- Evapotranspiration
- Surface Runoff Reduction
- Stem Flow

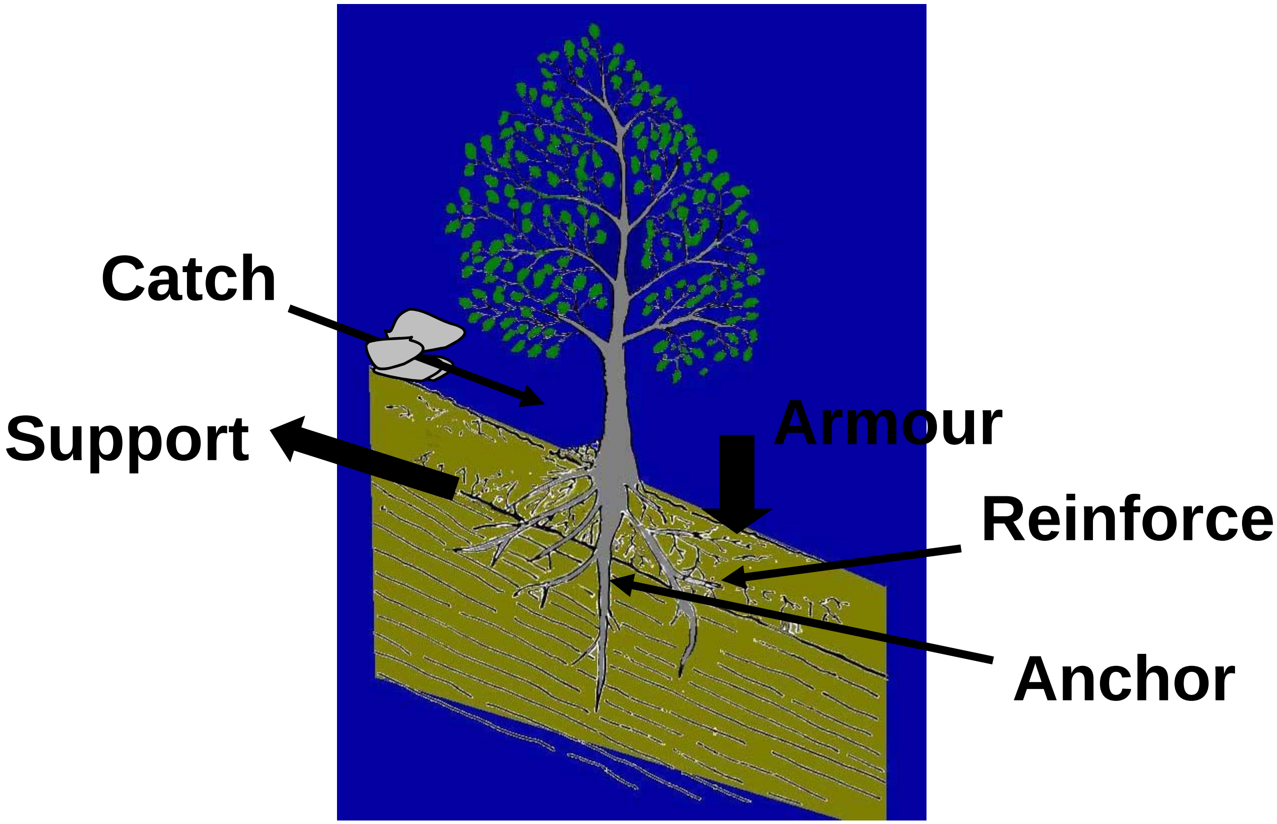
HYDROLOGICAL EFFECTS



Engineering Functions of Vegetation include

- Catching
- Armouring
- Reinforcing
- Supporting
- Anchoring
- Draining

PHYSICAL EFFECTS



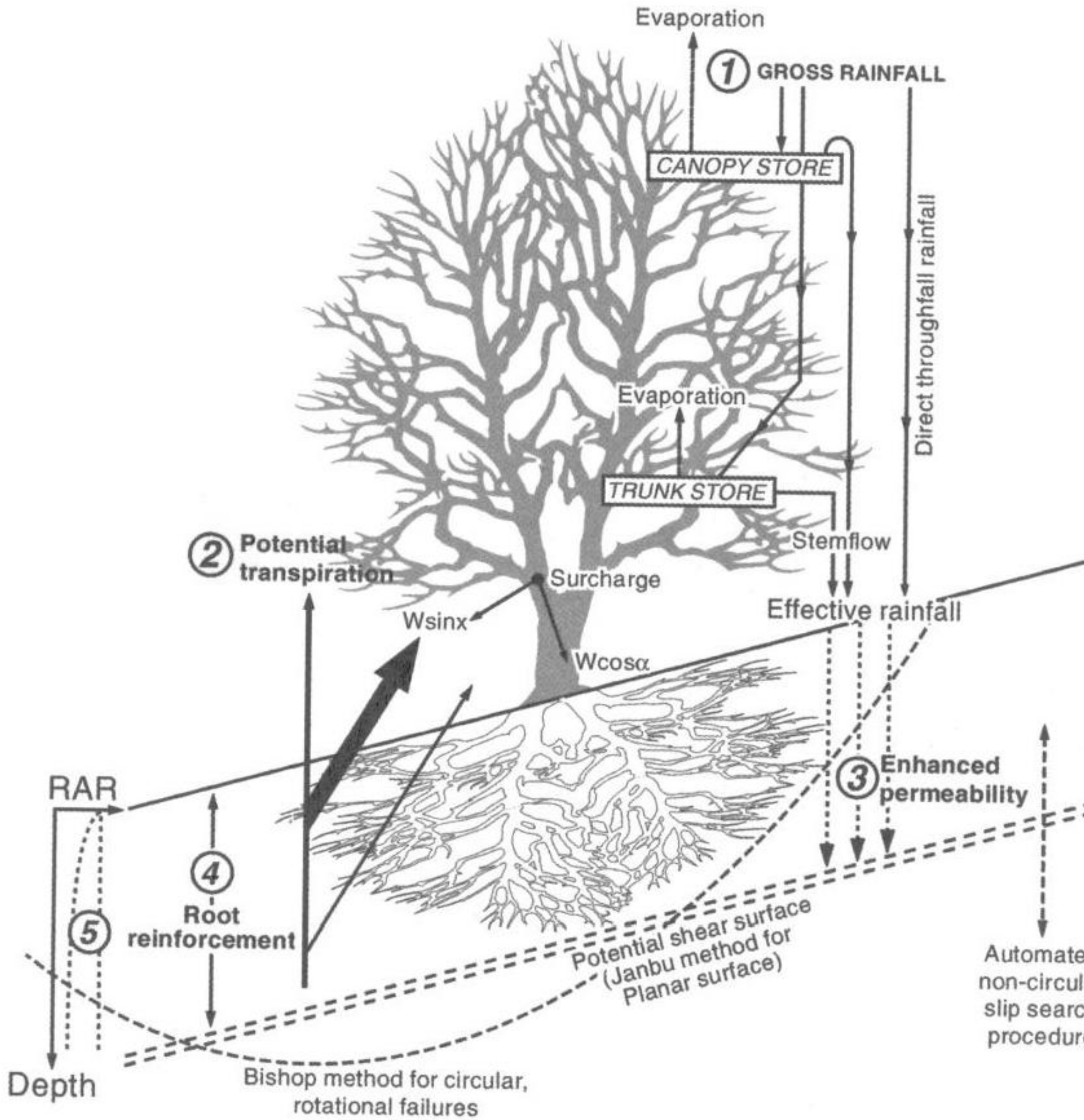


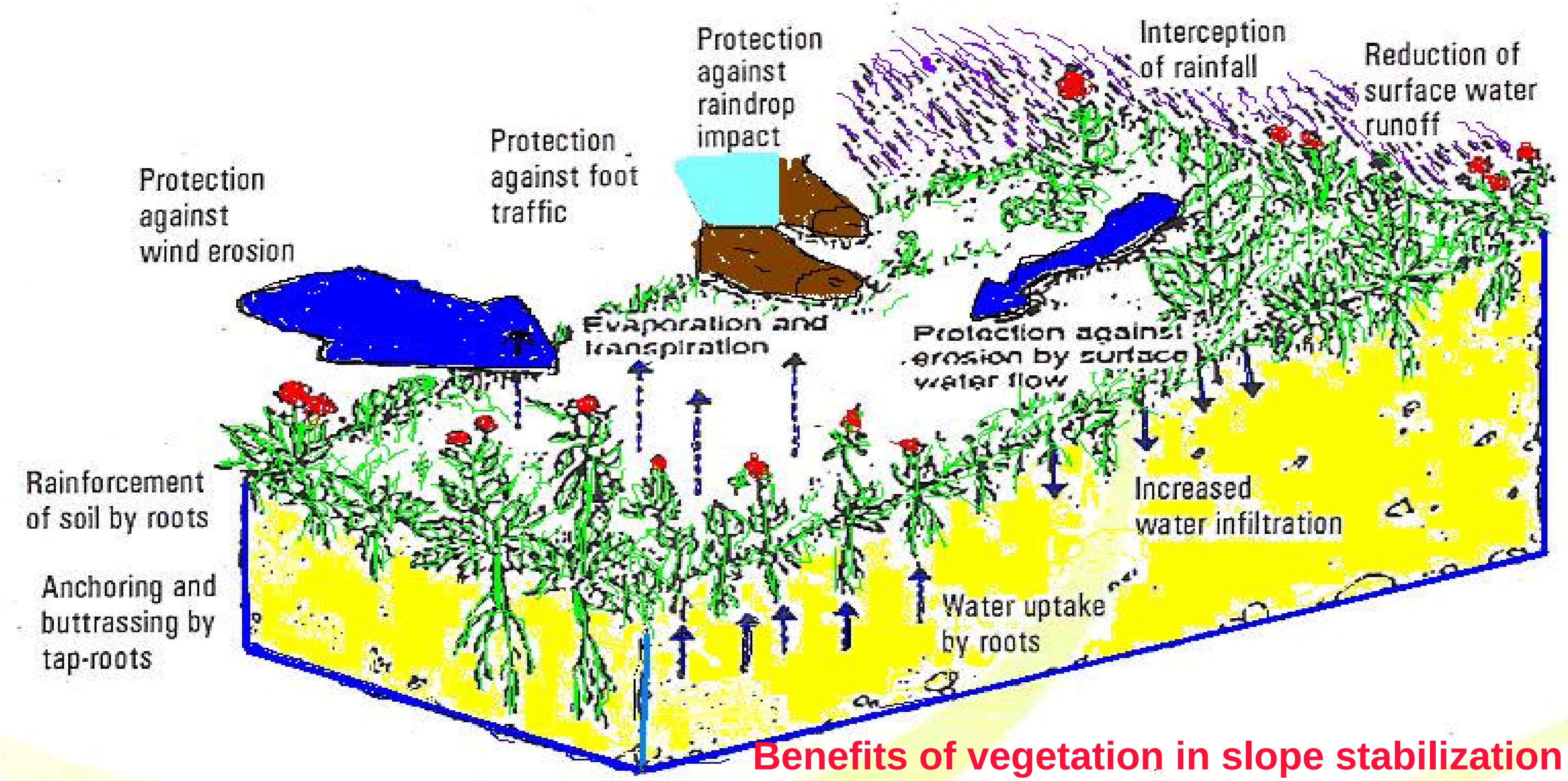
Figure 25.5b *Schematic representation of the integrated vegetation–slope model (1 Rutter model: Rutter* et al., *1971; 2 Penman–Monteith: Monteith, 1973; 3 Permeability model: Collison, 1993; 4 Root reinforcement: Wu* et al., *1979; 5 Water uptake model: Feddes* et al., *1978)*

Bioengineering Techniques can control slope failures through

- Mechanical Reinforcement
- Controlling Erosion
- Increasing the Infiltration Ratio / Soil Infiltration
- Reducing Runoff
- Soil Moisture Adjustment

Bio-Engineering

Use of vegetation (live plant or plant part) in conjugation with small engineering measures to revegetate and stabilize the degraded slopes.



Benefits of vegetation in slope stabilization

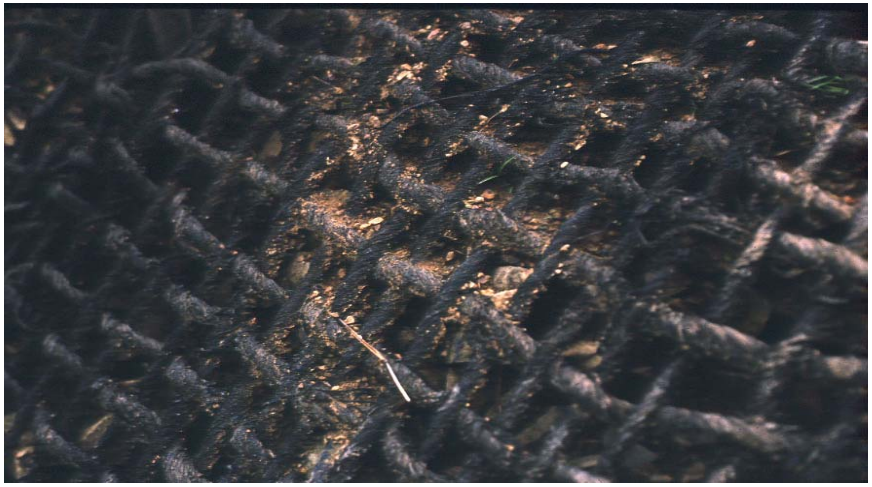
Common Bioengineering Techniques

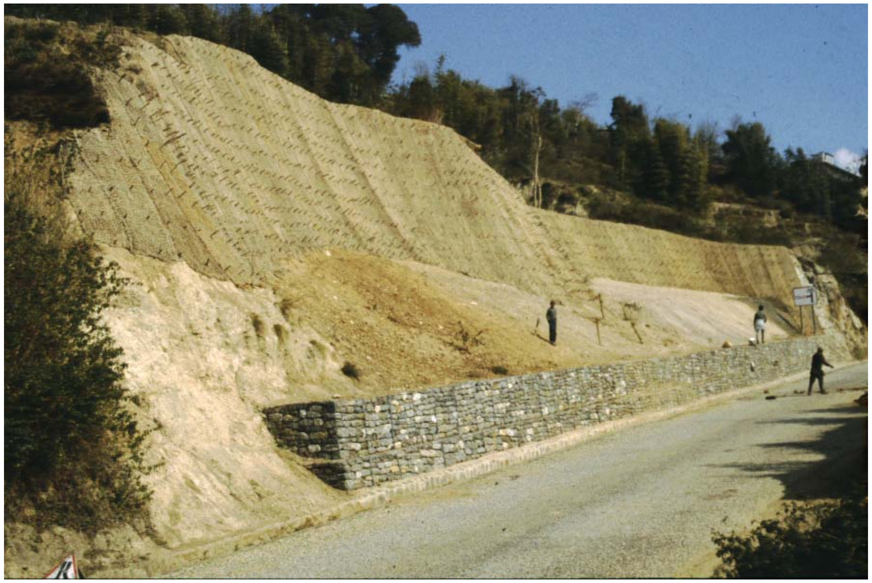
The selection of appropriate bioengineering treatment for a particular area depends on the site conditions and requirements.

- Bamboo Fencing
- Brush Layering
- Brush Mattress
- Fiberschine
- Jute Netting
- Live Crib Wall
- Live Fascines
- Palisades
- Wattle Fence


2006

Jute Netting





Gully Plugging/Bamboo check dams

Slope protection with vetiver and forward slope toe protected with caged boulder

Landslide Stretches - Probable Solution shall be…..

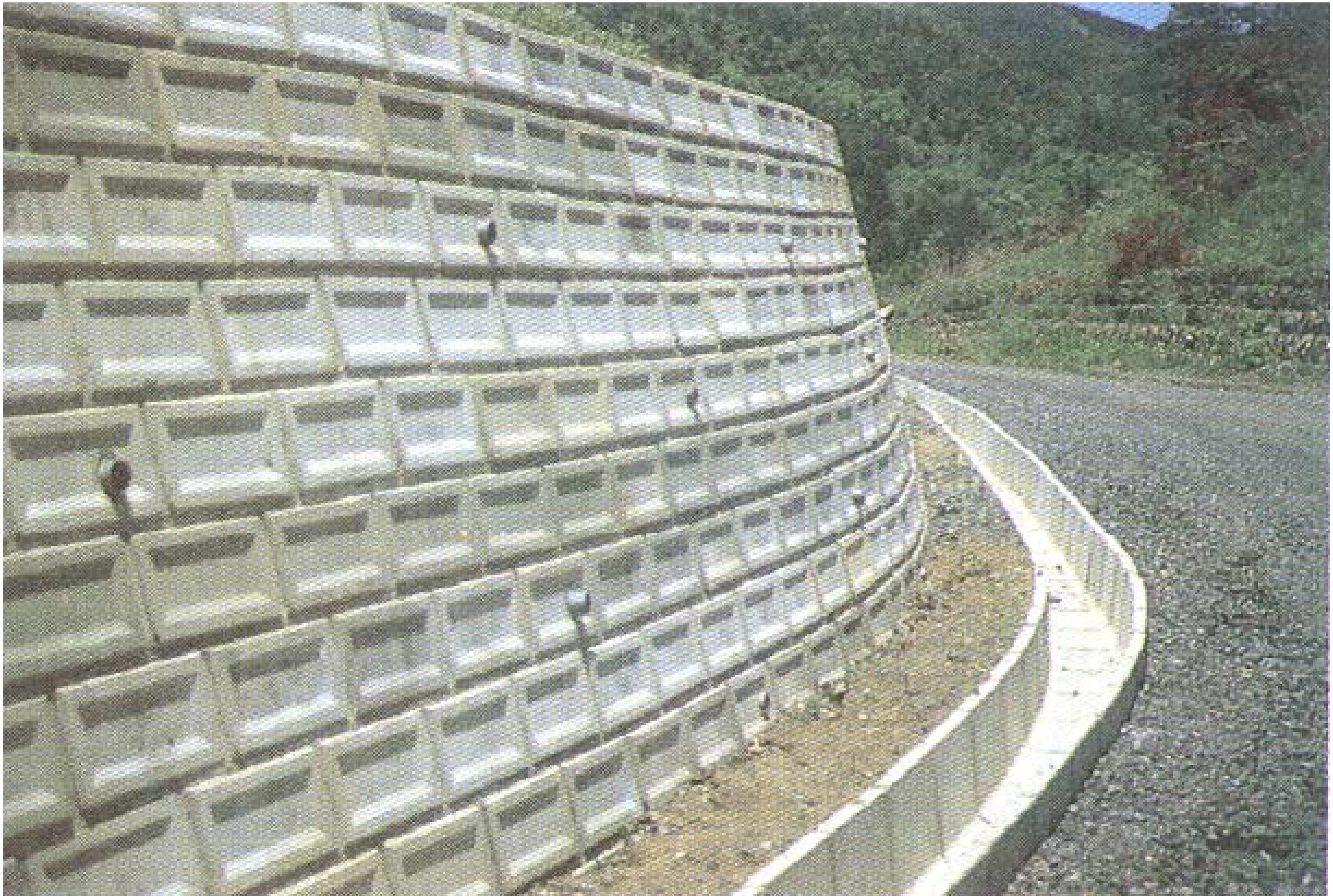
Retaining Walls

are artificial structures that hold back soil, rock, or water from a building, structure or area. RW prevents downslope movement and soil erosion, and provide support for vertical or near-vertical changes in gradient. The walls are generally made from timber, masonry, stone, brick, concrete, vinyl steel, or a combination of these. RW act to support lateral pressure which may cause slope failure.

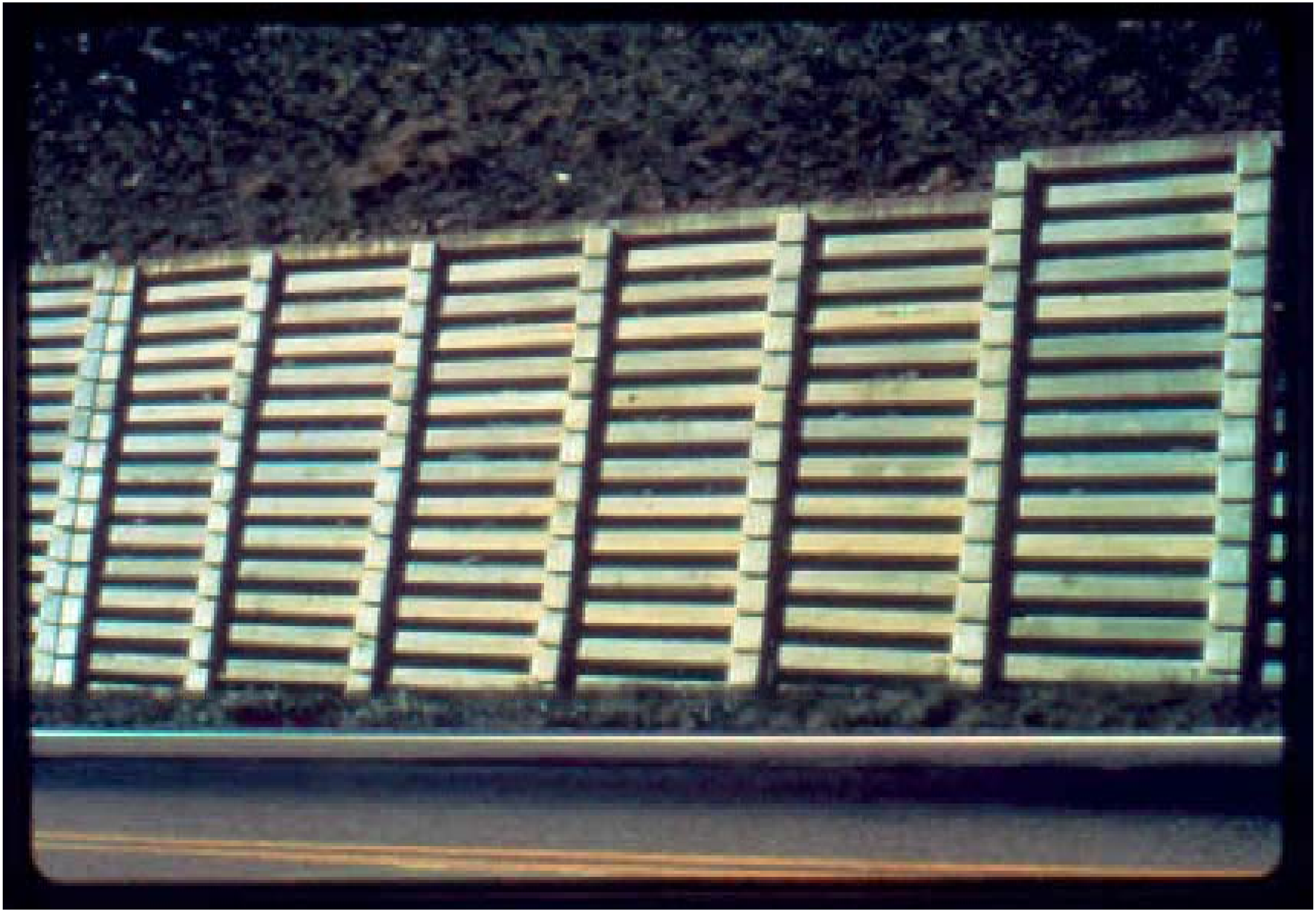
Types of RW based on construction material

- Dry Stone Masonry
- Gabion Wall
- Cement Masonry Wall
- Composite Masonry Wall
- Cement Concrete Wall
- Crib Wall


18/08/2003




Timber crib wall



A pre-cast concrete crib wall

Drop Structures / Grade Control Structures

are the structures placed at intervals along a channel to change a continuous steep slope into a series of gentle slopes and vertical (or steep and roughened) drops, like a series of steps. They control erosion and degradation by reducing the slope of the channel and prevent development of high erosive flow velocities, and allow water to drop safely without gouging out gullies.

Drop structures include sills, weirs, chute spillways, drop pipes, and check dams.

Drop structures can be made of concrete, timber, sloping riprap sills, and soil-cement or gabions. Drop structures made from timber or logs are more appropriate in small streams and gullies.

Physical Methods for River Training

FF mitigation in the u/s part is aimed at reducing the occurrence of FF and focuses on reducing slope instability, reducing amount and velocity of runoff, preventing erosion. The morphology of river is a strong determinant of flow, and can thus serve to intensify or mitigate flood waves and torrents. When the river becomes meandered or braided, it leads to excessive bank cutting and causes damages to agricultural fields and human settlements.

River training refers to structural measures which are taken to improve a river and its banks, for prevention, mitigation and control of FF.

River training structures are classified in 2 categories: i) Transversal protection structures ii) Longitudinal Protection Structures

Transversal Protection Structures

- Check Dams
- Spurs
- Sills
- Screen dams and Beam dams
- Porcupines

Channel stabilization measures

- Through construction of check dams
- Gabion check dams

Check Dams and Trench to break velocity of runoff and store part of the runoff

Longitudinal Protection Structures

- Levees or Earth Fill Embankments
- Guide banks and other approach embankments
- Concrete Embankments
- Revetments and rock riprap
- Porcupines used as embankment protection


14 12 2005

Other Protection Structures

- Sandbagging
- Channel Lining
- Bamboo Piles

Structural Measures for FFM in context of Integrated Water Resources Management

- Integrated Flood Management
- Passive Flood Control Measures
- Flood Storage Reservoirs
- River Corridor Rehabilitation and Restoration

Preparedness

- Forecasting/ Warning to the extent possible
- Setting up control room at district headquarter, District collector as Incident Commander
- Identification of area of damage i.e. Low lying roads, Human Settlements, Army installations and important bridges
- Sectoral division of entire river basin prone to flash flood
- Sector wise storage of food grains LPG, kerosene , petrol, firewood & life saving drugs.
- Army, BRO & paramilitary forces sounded for taking of rescue and relief operation
- Identification of buildings for setting of relief camps.
- Establishing an alert system for affected community

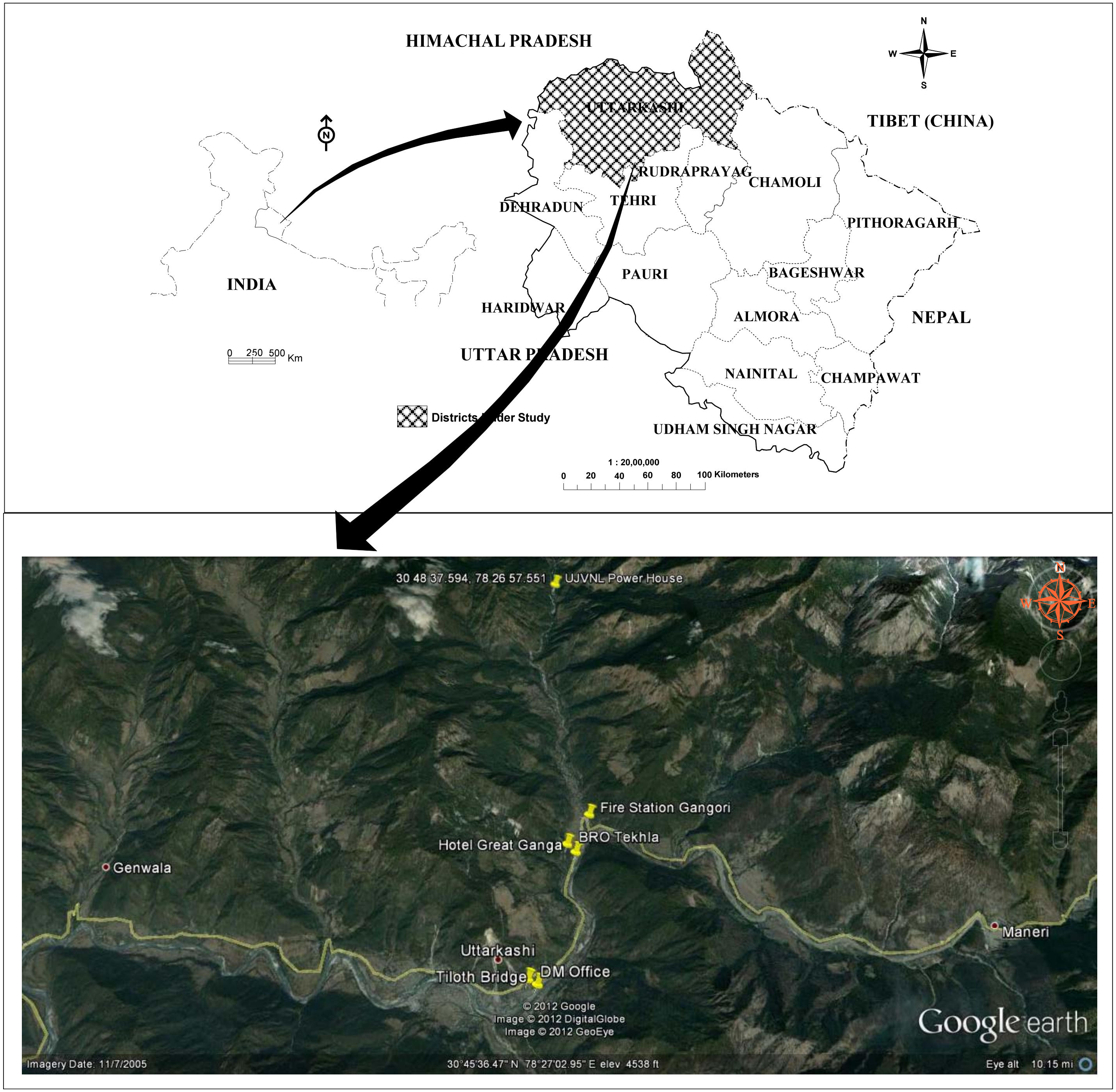
Response Preparedness

- Evacuation of inhabitants from the villages under potential risk of damage
- Deployment of rescue teams & restoration machinery at critical points in different sectors
- Delaunching of all Bailey Bridges
- Erection of safety walls along strategic & important installations
- Alternative routes of transportation
- Realignment & construction of roads at a reasonable distance from river belt

Response

- Quick reporting and assessment of losses in sector wise manner
- Provision of adequate shelter, food, clothing, firewood, medicine and school to the displaced families
- Provision of relief to the farmers and orchidst and restoration means of transportation of their produce
- Reconstruction of damage roads stretches and relaying of bridges
- Identification of land for building alternative house at safer places

A Case Study on Uttarkashi Flash Floods


HIMACHAL PRADESH
TIBET (CHINA)
UTTARKASHI
RUDRAPRAYAG
CHAMOLI
DEHRADUN
TEHRI
PITHORAGARH
INDIA
PAURI
BAGESHWAR
HARIDWAR
ALMORA
NEPAL
UTTAR PRADESH
NAINITAL
CHAMPAWAT
UDHAM SINGH NAGAR
0 250 500 Km
Districts Under Study
1 : 20,00,000
0 20 40 60 80 100 Kilometers
30 48 37.594, 78 26 57.551 UJVNL Power House
Fire Station Gangori
BRO Tekhla
Hotel Great Ganga
Genwala
Maneri
Uttarkashi
Tiloth Bridge
DM Office
© 2012 Google
Image © 2012 DigitalGlobe
Image © 2012 GeoEye
Google earth
Imagery Date: 11/7/2005
30°45'36.47" N 78°27'02.95" E elev 4538 ft
Eye alt 10.15 mi

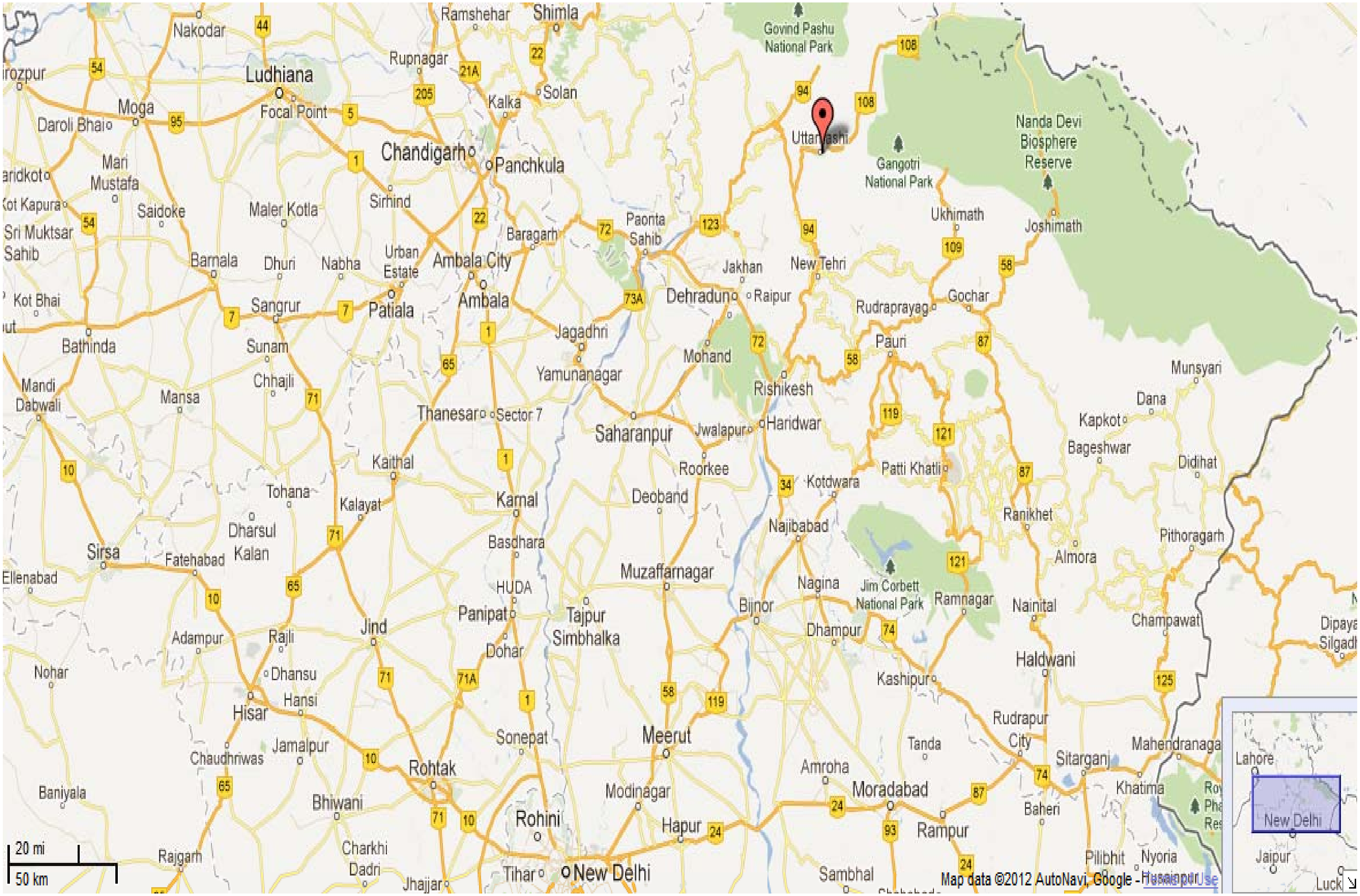


Figure 1.2: Access Route Map from New Delhi to Uttarkashi

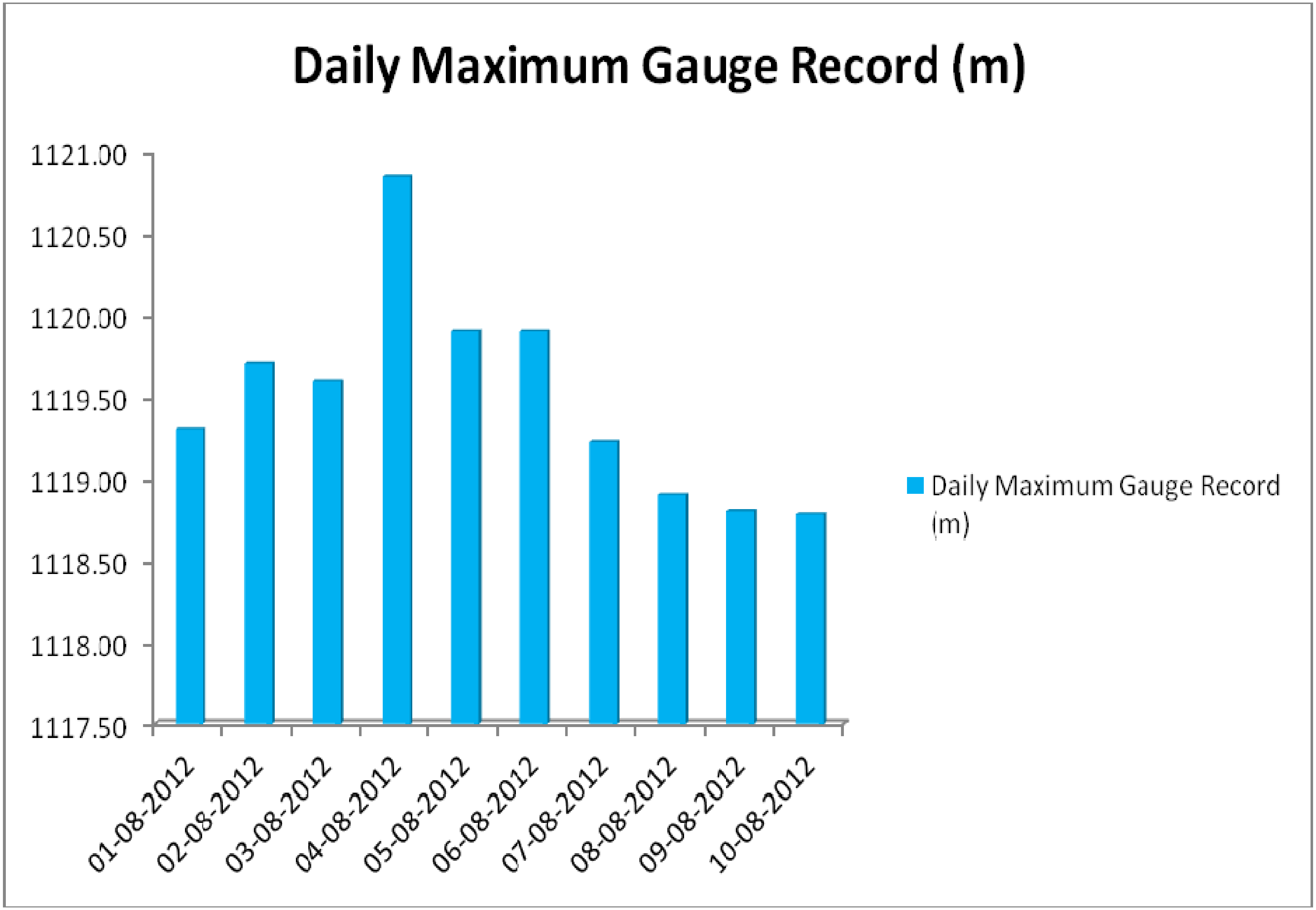


Fig. 1.5: Daily Gauge Records indicating maximum water level in the Bhagirathi river durng 1-10 August 2012

Fig 1.63: Automated Weather Station for recording rainfall, temperature and pressure at DGBR office, Tekhla

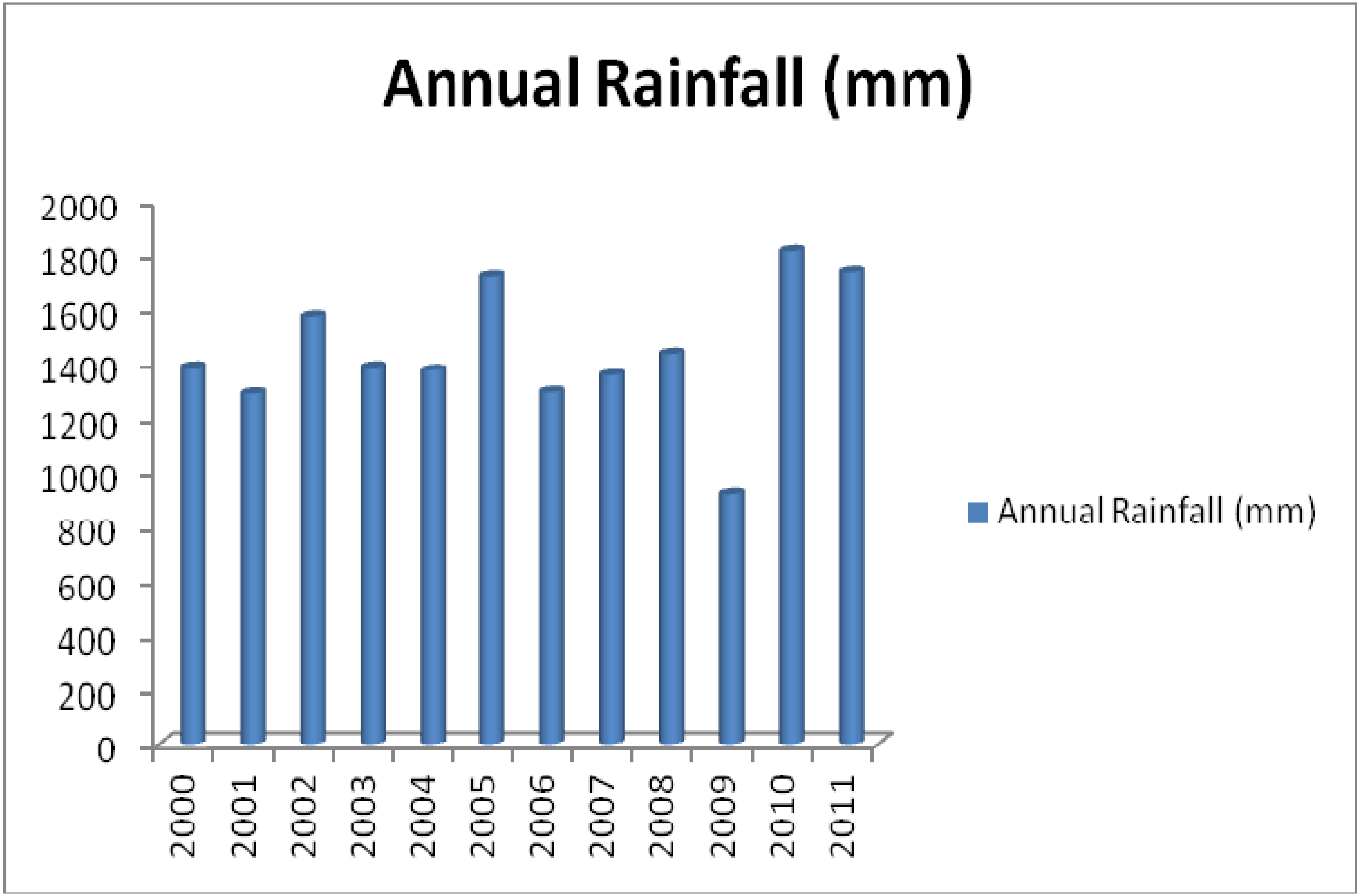


Fig. 1.67: Average Cumulative Annual Rainfall in the Uttarkashi district during the period between the years 2000 and 2012

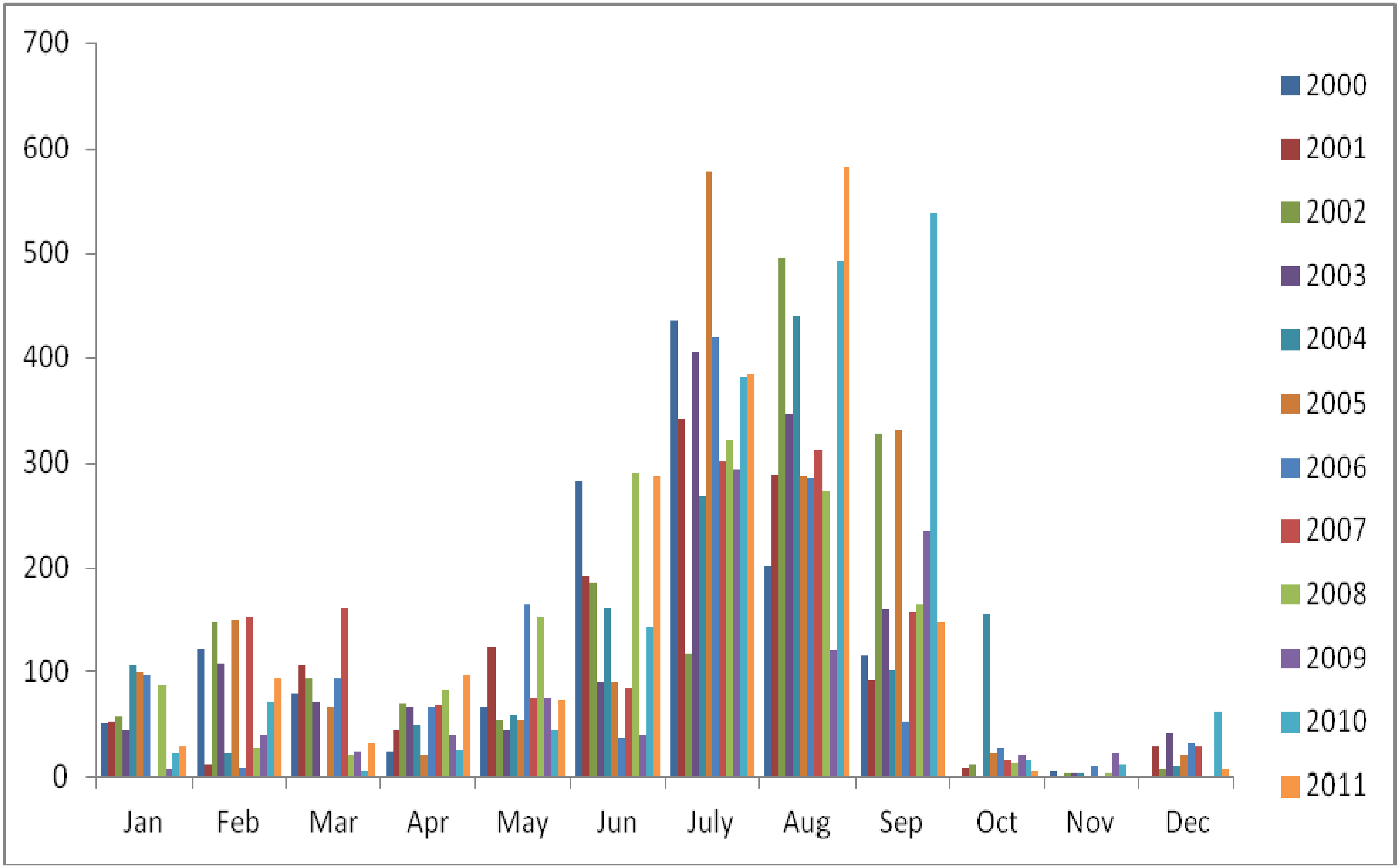


Fig. 1.65: Average Monthly Cumulative Rainfall in the Uttarkashi district during the period between the years 2000 and 2011

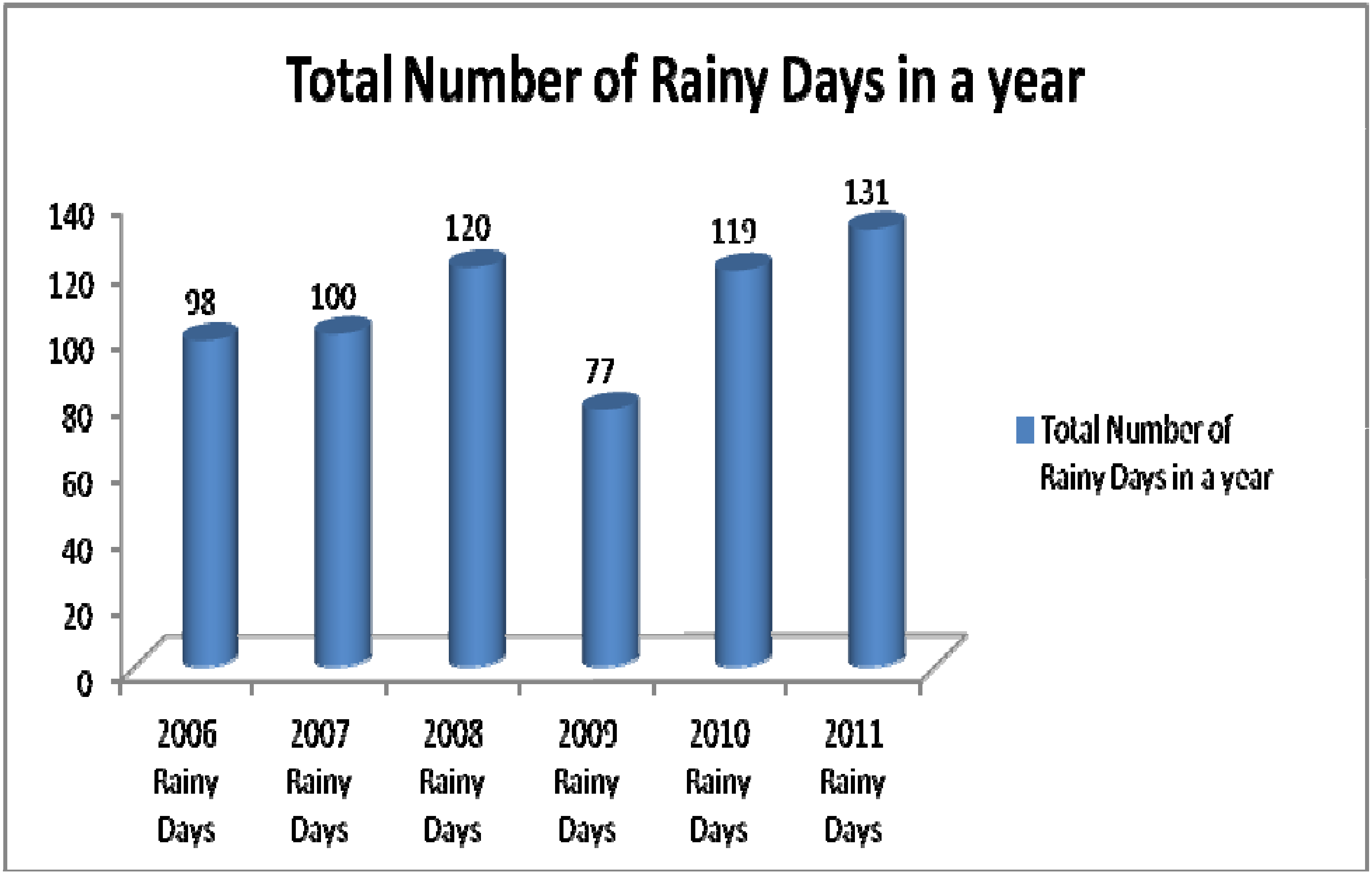


Fig. 1.68: Cumulative Number of Rainy Days per year in the study area during the period between the years 2006 and 2011

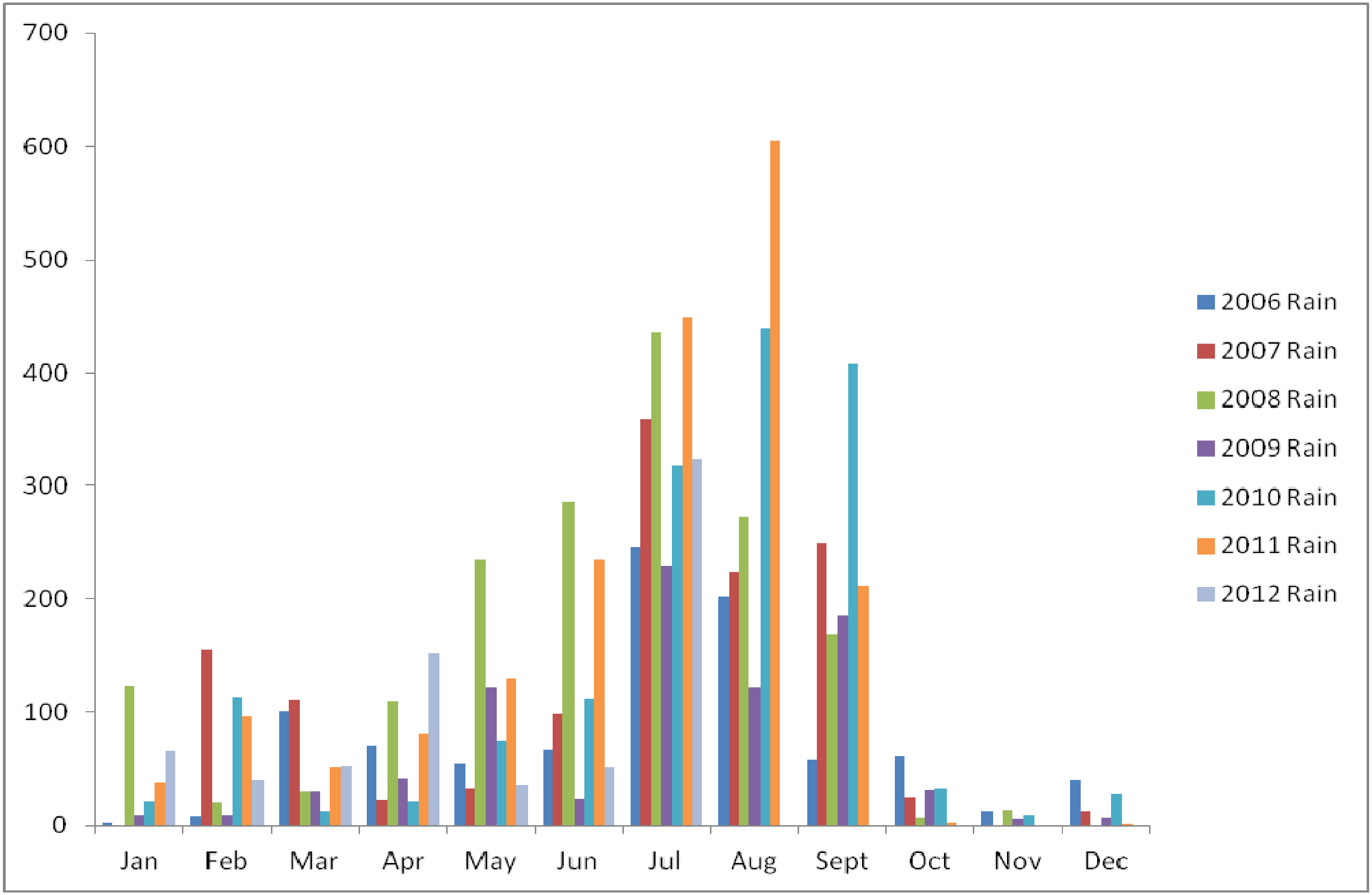


Fig. 1.64: Average Monthly Cumulative Rainfall in the study area during the period between the years 2006 and 2012


6/21/2005 5 am
N
© 2012 Google
Image © 2012 DigitalGlobe
Google earth
Imagery Date: 6/21/2005
2005
30°43'48.16" N 78°25'46.92" E elev 3672 ft
Eye alt 8729 ft


30 48 37.594, 78 26 57.551
UJVNL Power House
Sangamchatti Rd
© 2012 Google
Image © 2012 DigitalGlobe
Google earth
Imagery Date: 10/25/2005
2005
30°48'32.37" N 78°26'58.61" E elev 4799 ft
Eye alt 7430 ft

Fig.11: Transmission Tower location affected adversely after the flashfloods in Asi Ganga Valley


airtel


ACC

Fig.22: Remnants of plants and sand deposits seen in eddy areas of Asi Ganga River


जनपद आपातकालीन परिचालन केन्द्र
उत्तरकाशी
भारत सरकार - संयुक्त राष्ट्र
विकास कार्यक्रम के अन्तर्गत निर्मित
जनपद आपातकालीन परिचालन केन्द्र
का उद्घाटन
मा० विजयपाल सिंह सजवाण जी
अध्यक्ष, राज्य आपदा राहत समिति, उत्तरांचल शासन

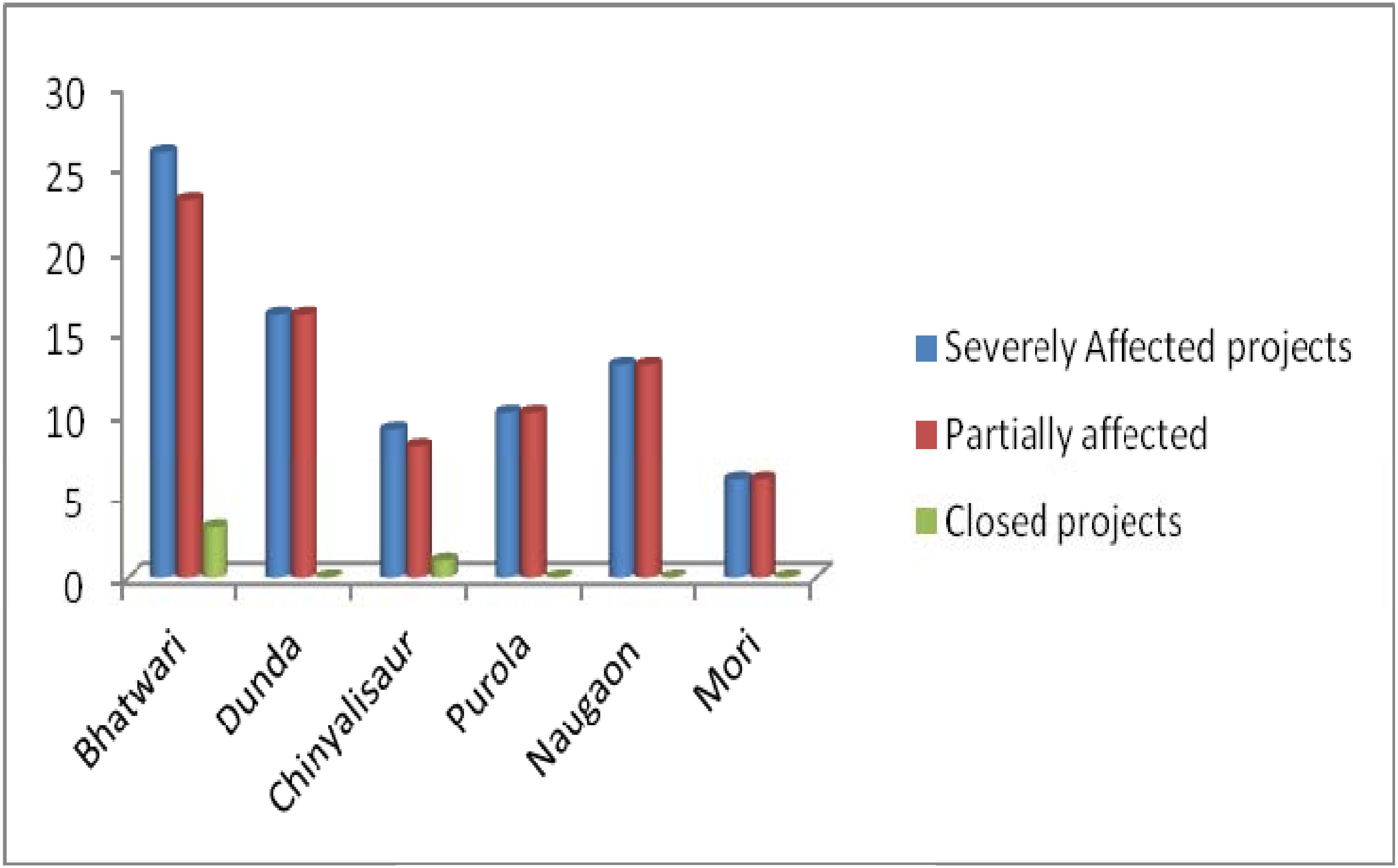

30
25
20
15
10
5
0
Bhatwari
Dunda
Chinyalisaur
Purola
Naugaon
Mori
Severely Affected projects
Partially affected
Closed projects

Figure 5.2:

Fig.5.4: Relief Services rendered by volunteers from Shantikunj, Haridwar


40 PAC


7 8 2012


SEARCH AND RESCUE COURSE
UTTARAKHAND
7 8 2012


स्वावलम्बन
स्वाभिमान
उत्तरकाशी बाढ़ पीड़ितों के लिए सहायतार्थ
राष्ट्रीय स्वयँसेवक संघ
द्वारा प्रेरित
उत्तराञ्चल दैवी आपदा पीड़ित सहायता समिति (पंजी०)
सेवा आश्रम, केशवपुरम मनेरी, उत्तरकाशी
Electrical
Electronics
Frontline
RUPA


DEDICATED ACADEMY

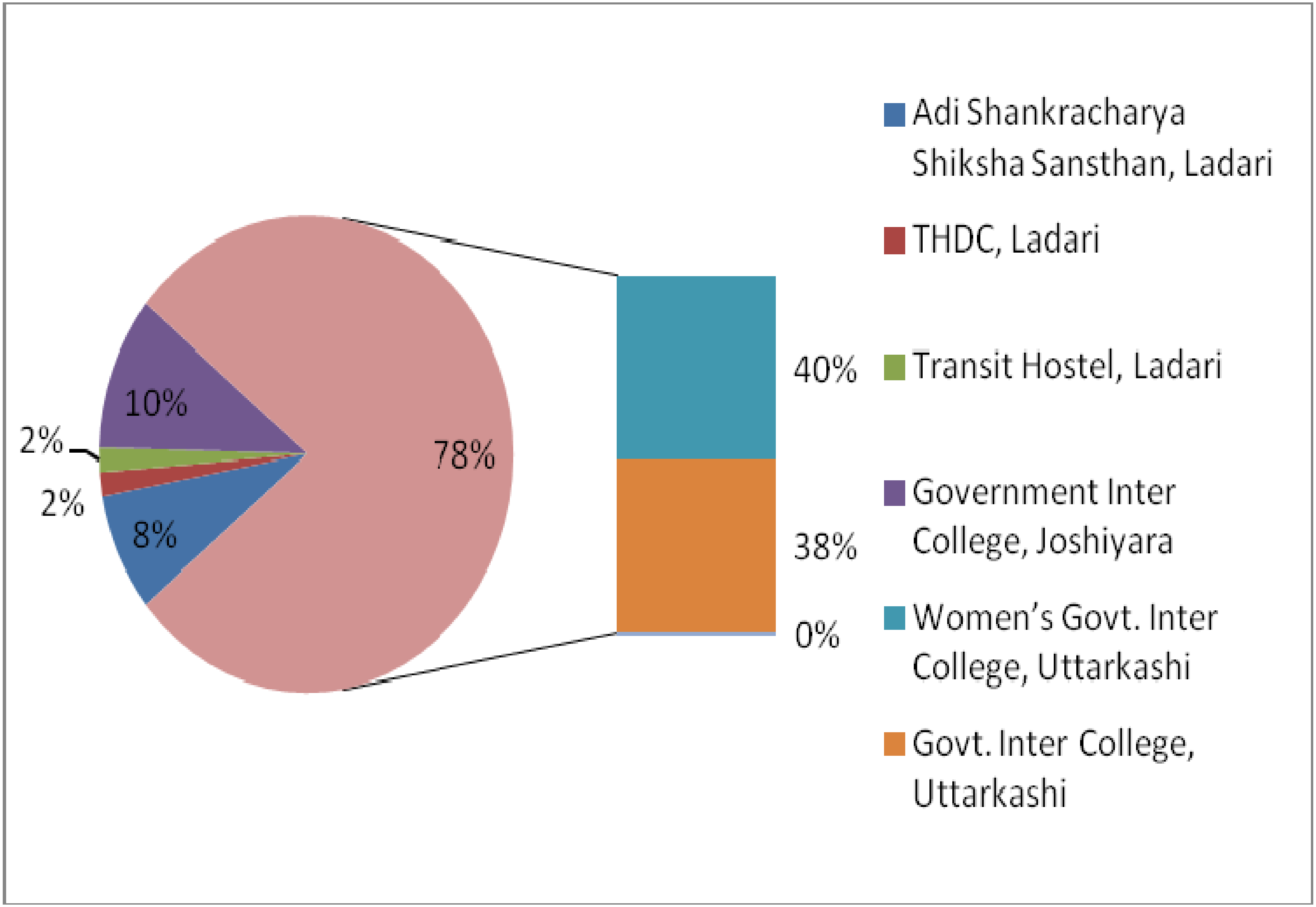
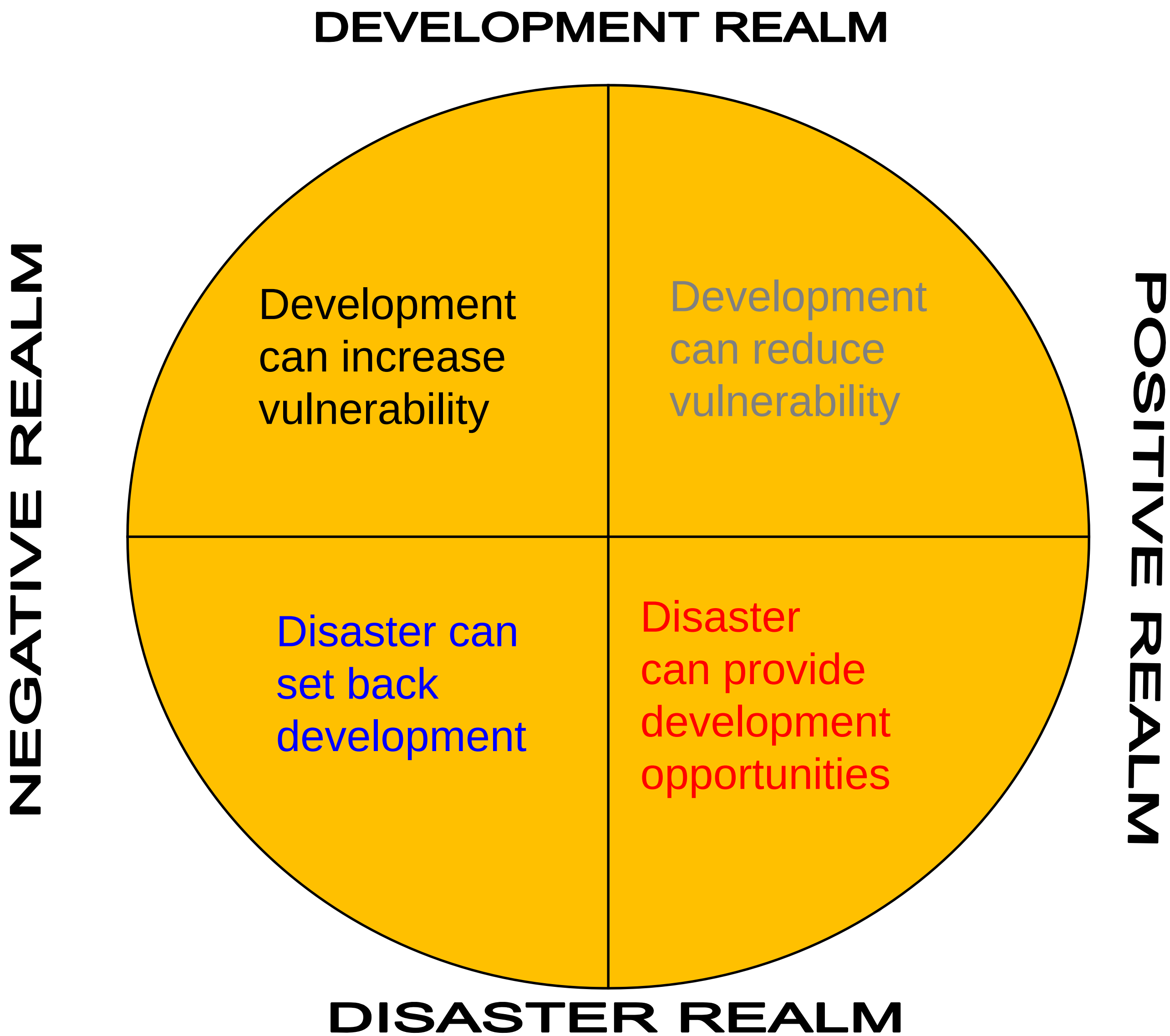

Adi Shankracharya Shiksha Sansthan, Ladari
THDC, Ladari
Transit Hostel, Ladari
Government Inter College, Joshiyara
Women's Govt. Inter College, Uttarkashi
Govt. Inter College, Uttarkashi
10%
2%
2%
8%
78%
40%
38%
0%

Figure 5.1:

Relationship Between Disasters and Development



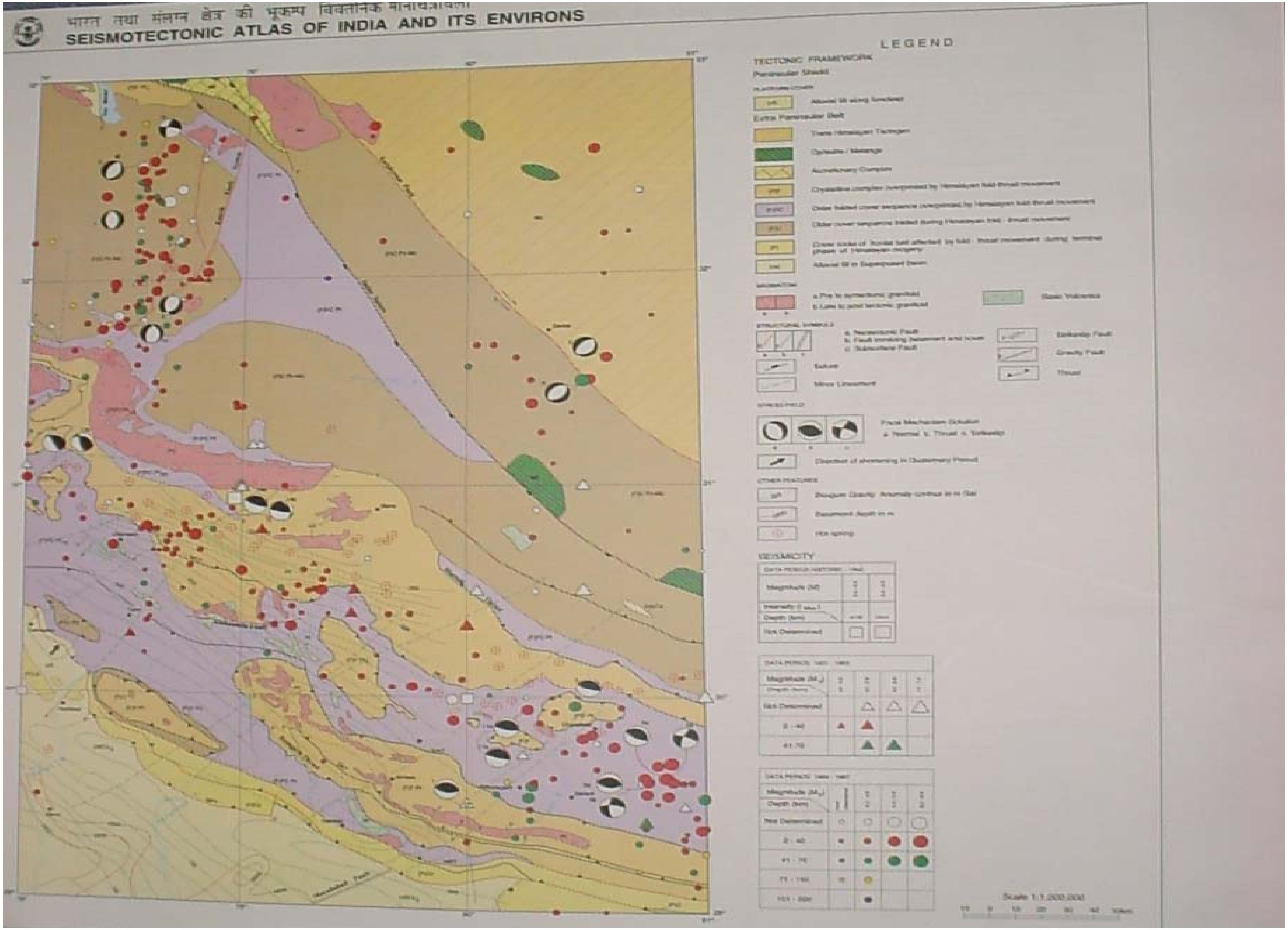
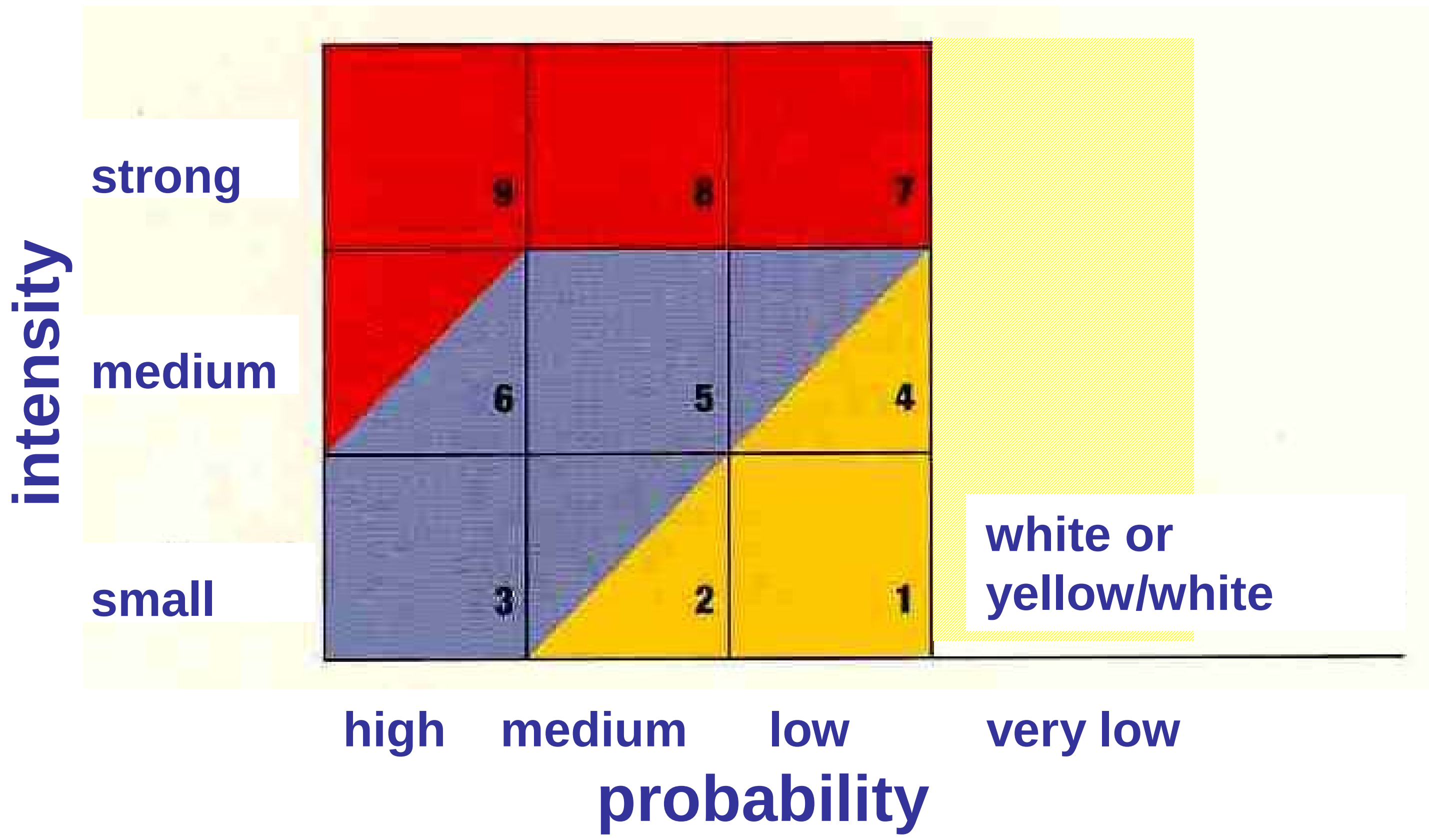


Fig. 1.12. : A view of the seismotectonic map of the study area (source: Seismotectonic Atlas of India and its environs, GSI, 2000)

Fig. 2.2 : An example of the Landslide Hazard Zonation Map prepared by NRSC

Classification of hazard zones



Classification of hazard zones

red zone

high risk for constructions and people inside houses

- no new constructions allowed

blue zone

medium risk

- constructions allowed with restrictions

yellow zone

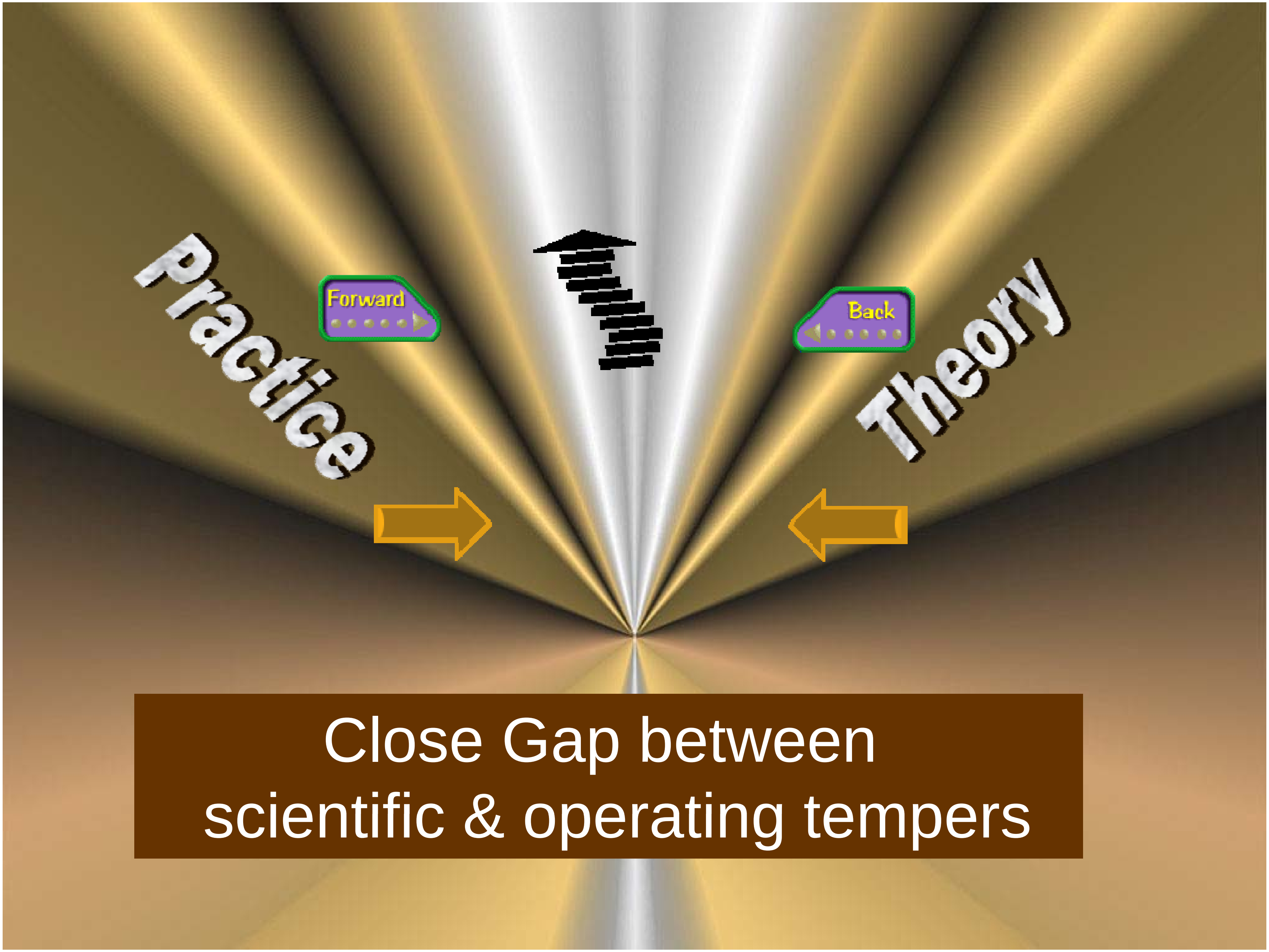
low risk

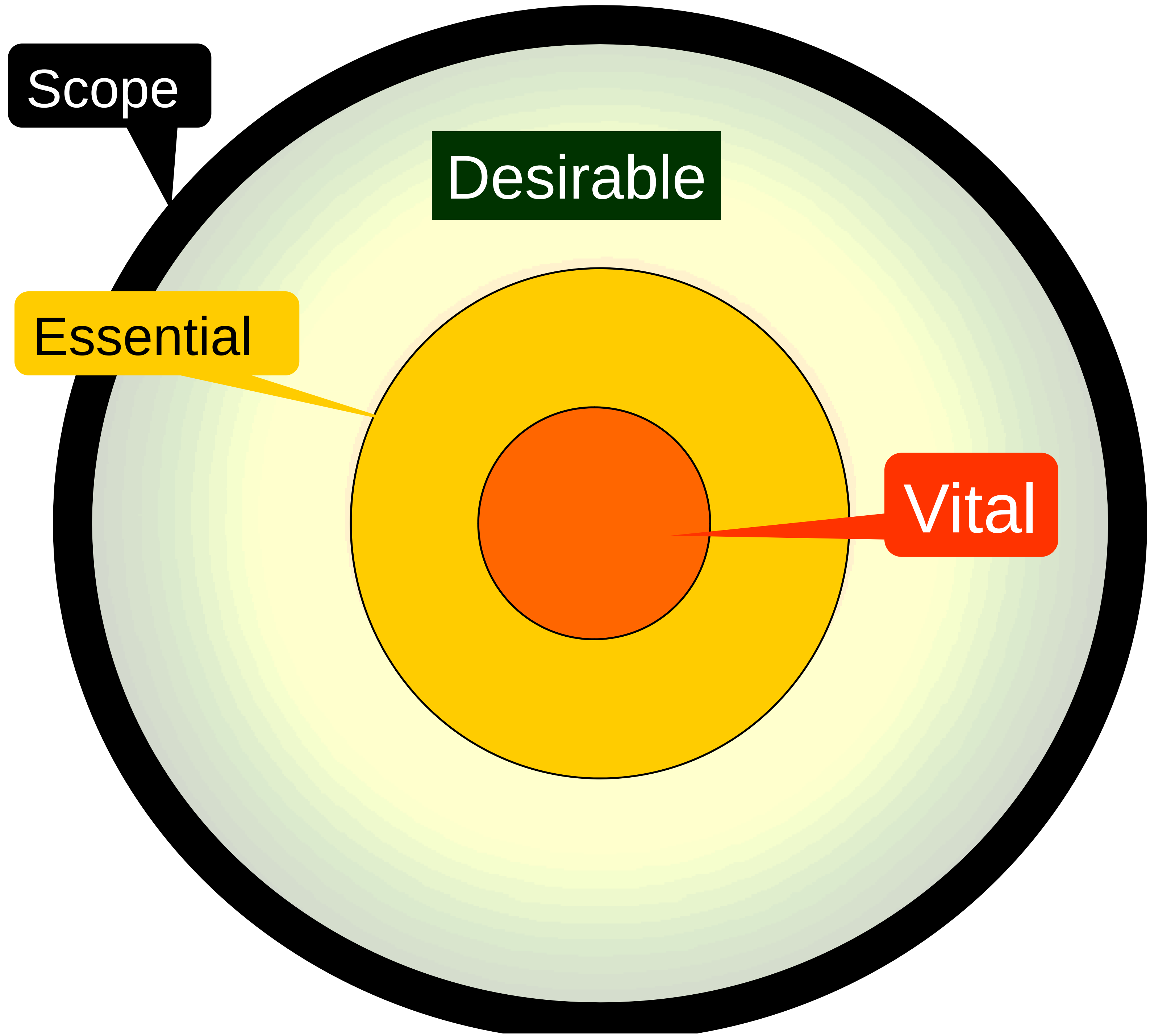
- informations for the ground-owners

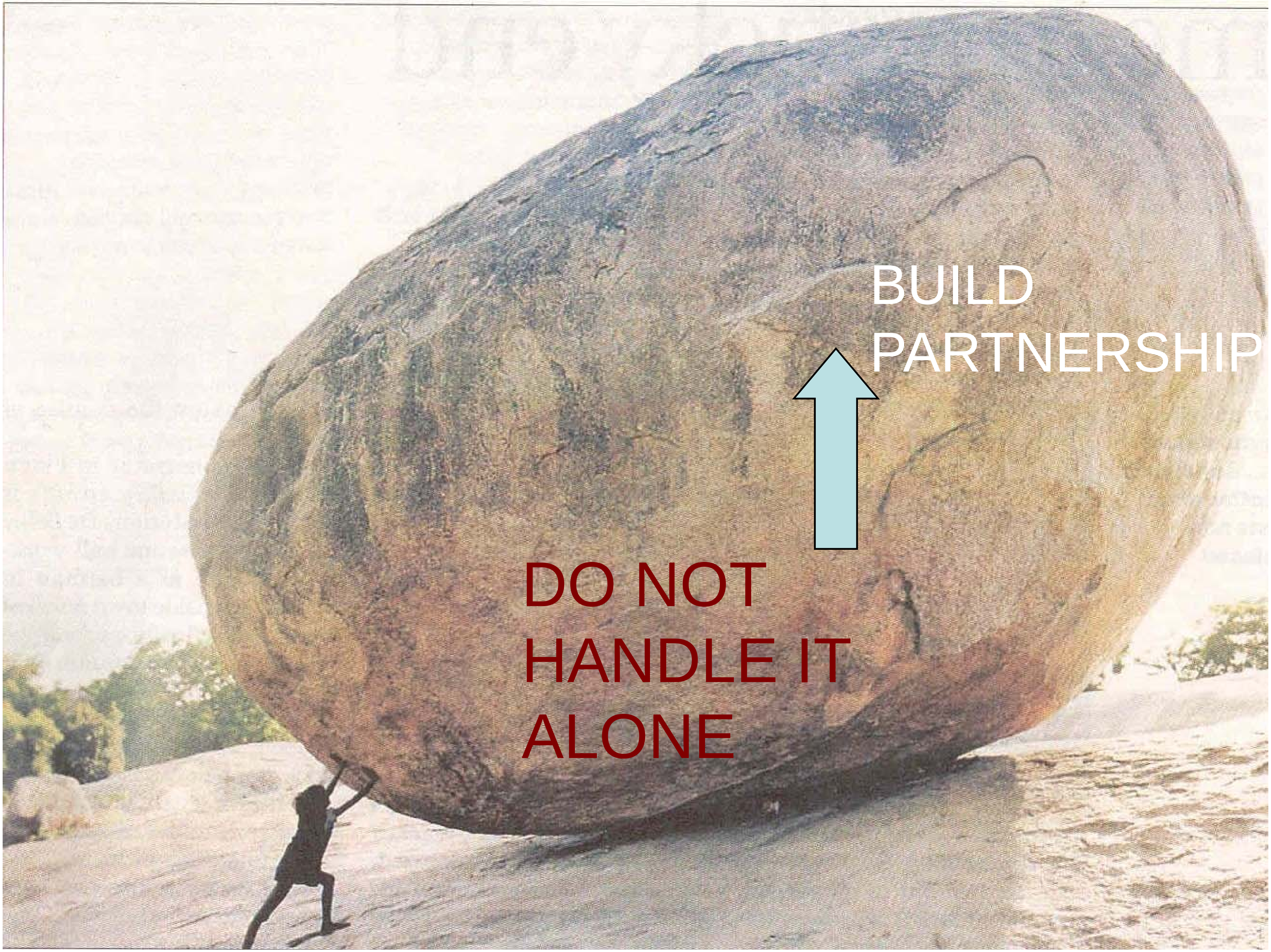
yellow / white zone

residual risk

- pay attention in case of special objects / planning of emergencies


Practice
Forward
Back
Theory
Close Gap between
scientific & operating tempers


Scope
Desirable
Essential
Vital


BUILD PARTNERSHIP
DO NOT HANDLE IT ALONE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Call: +919868915226

nidm
Towards a disaster free India

Thanks……