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Climate Change Adaptation and Water Nexus - Country Report: Nepal

Kedar Kumar Shrestha

Senior Divisional Engineer

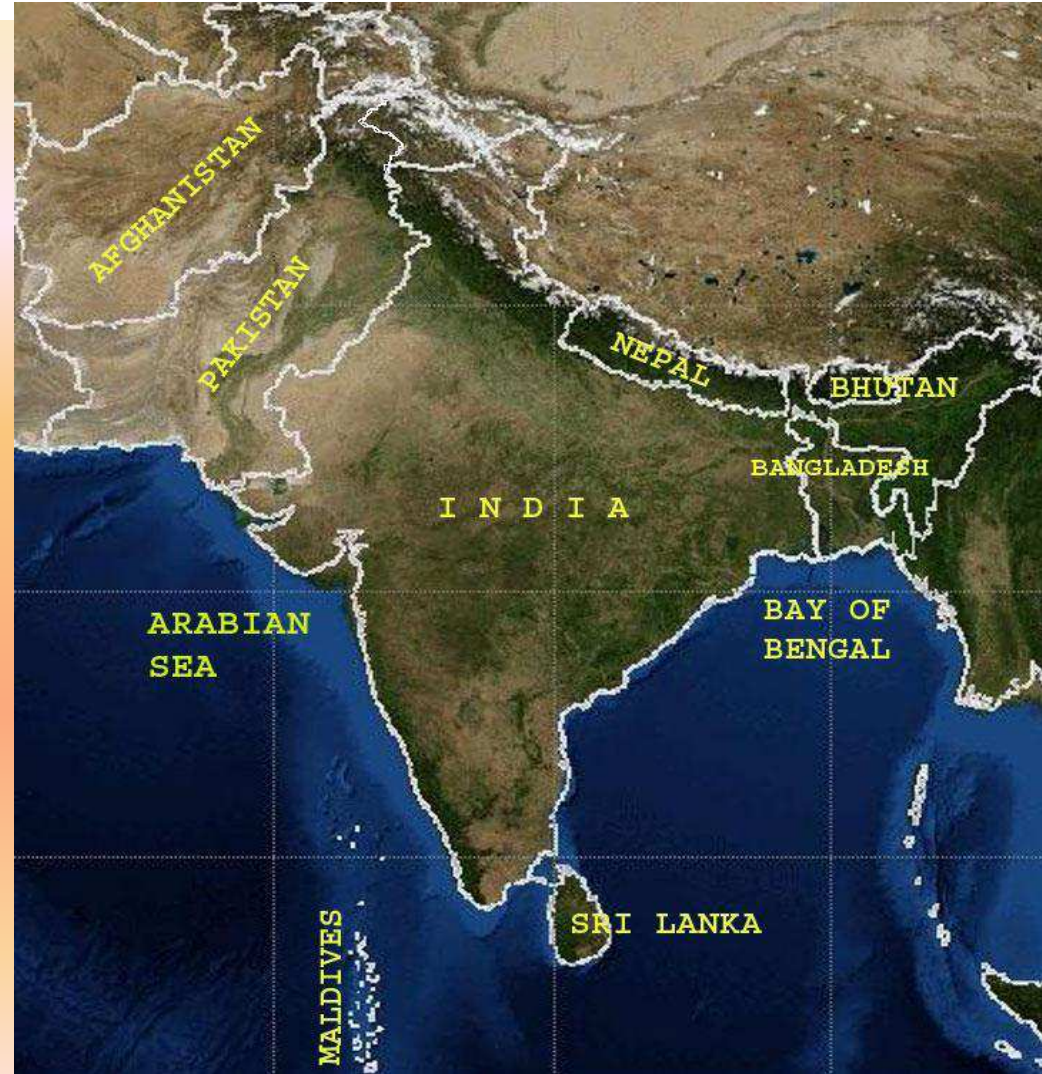
Department of Irrigation

Kathmandu, Nepal

AWCI

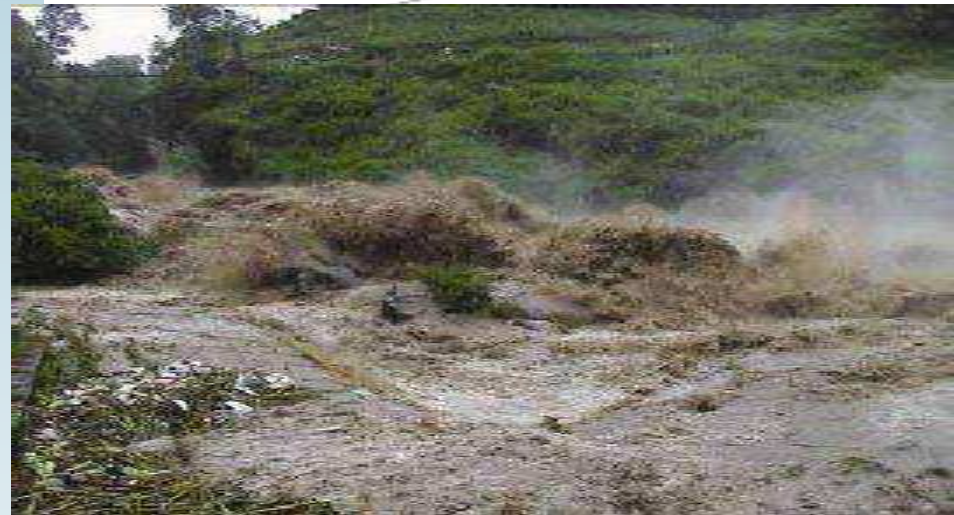
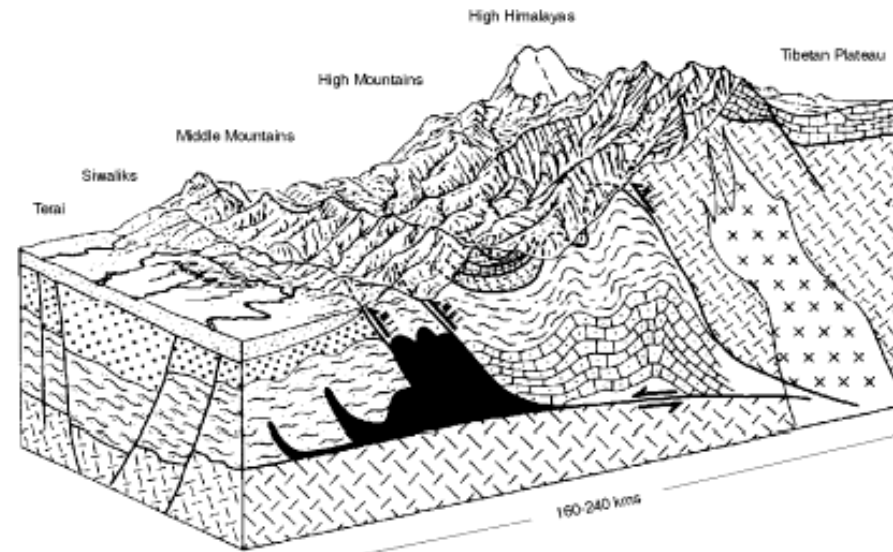
NEPAL : COUNTRY PROFILE

- Total Area – 147,181 Sq. Km
- Located between – Latitudes $26^{\circ} 22'$ and $30^{\circ} 27'$; Longitudes- $80^{\circ} 40'$ and $88^{\circ} 12'$
- Rectangle in Shape – average length in east west direction 885 km and average width – 193 km
- Mountains cover 44 %; Hills – 30% and Terai – 26%
- Population – 23.15 million with growth rate 2.25
- Average per capita GDP \$470
- Agriculture – 40% on national GDP



Nepal: Climate

- Four seasons (spring, summer monsoon, autumn, winter)
- Temperature: 15°C mean – Varies by altitude
- Rainfall: 1875.60mm
- – Uneven distribution
- Most floods in the monsoon season

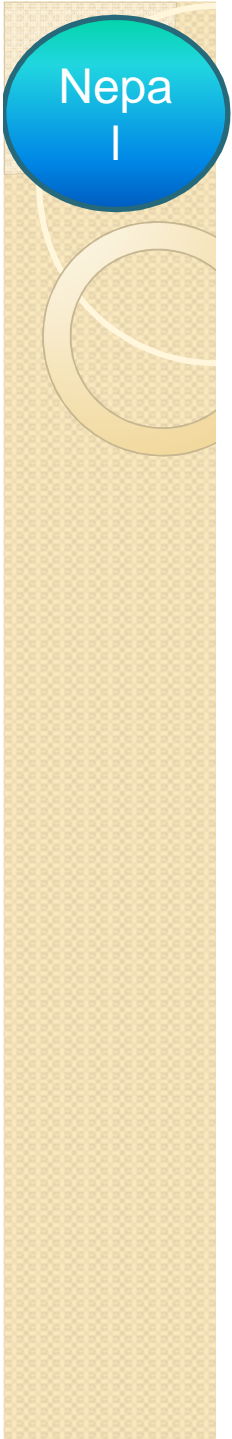


Nepal: Climate

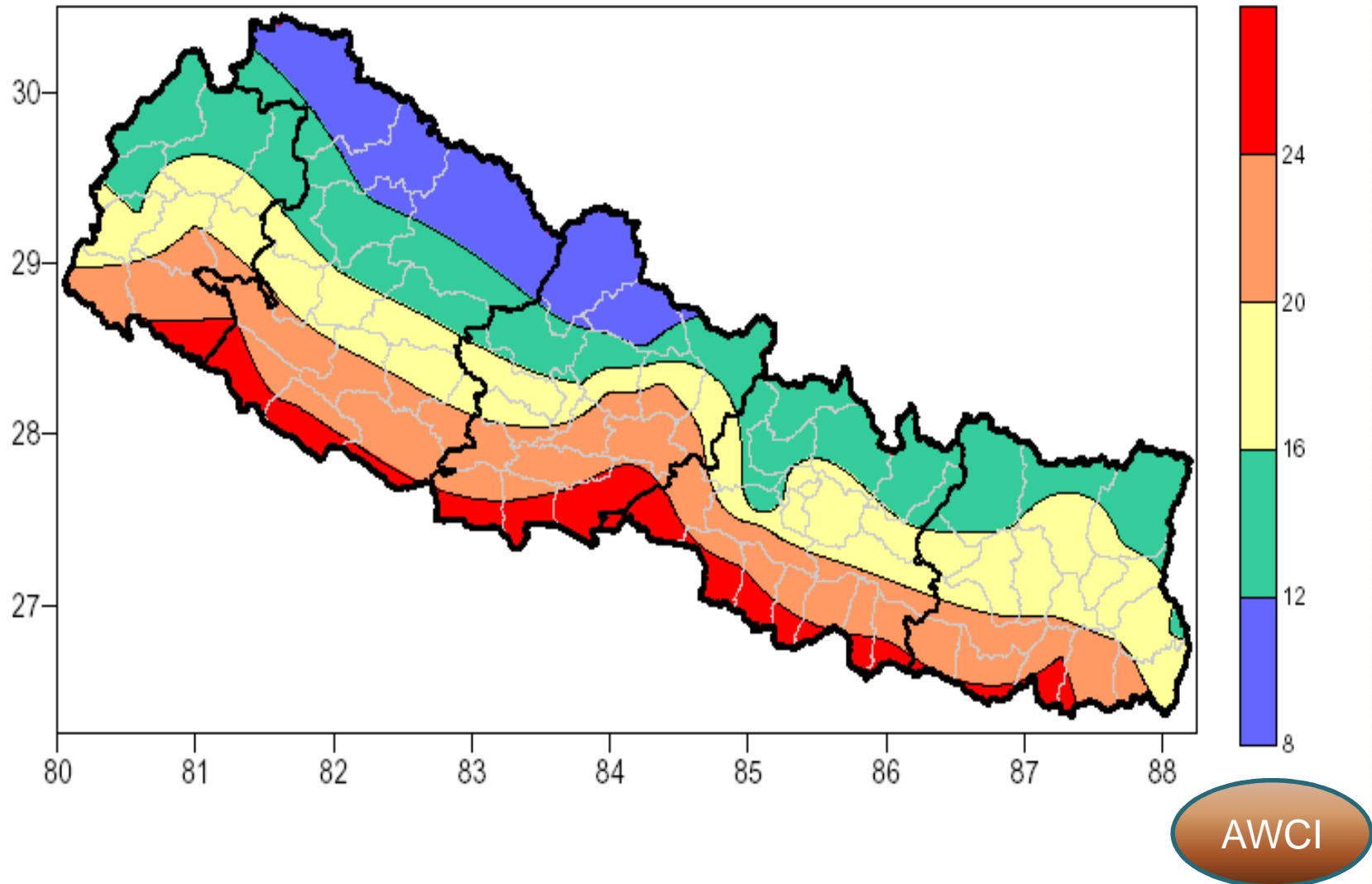
- Rainfall – dominated by south easterly monsoon

Items	Monsoon	Post Mon	Winter	Pre Mon	Annual
Rainfall (mm)	1478.2	79.0	64.9	235.4	1857.6
% Rainfall	79.58	4.25	3.49	12.68	100

- Rainfall contributes 267 MCM of water annually (26.7 MCM – Snow; 240.3 MCM – Rain)

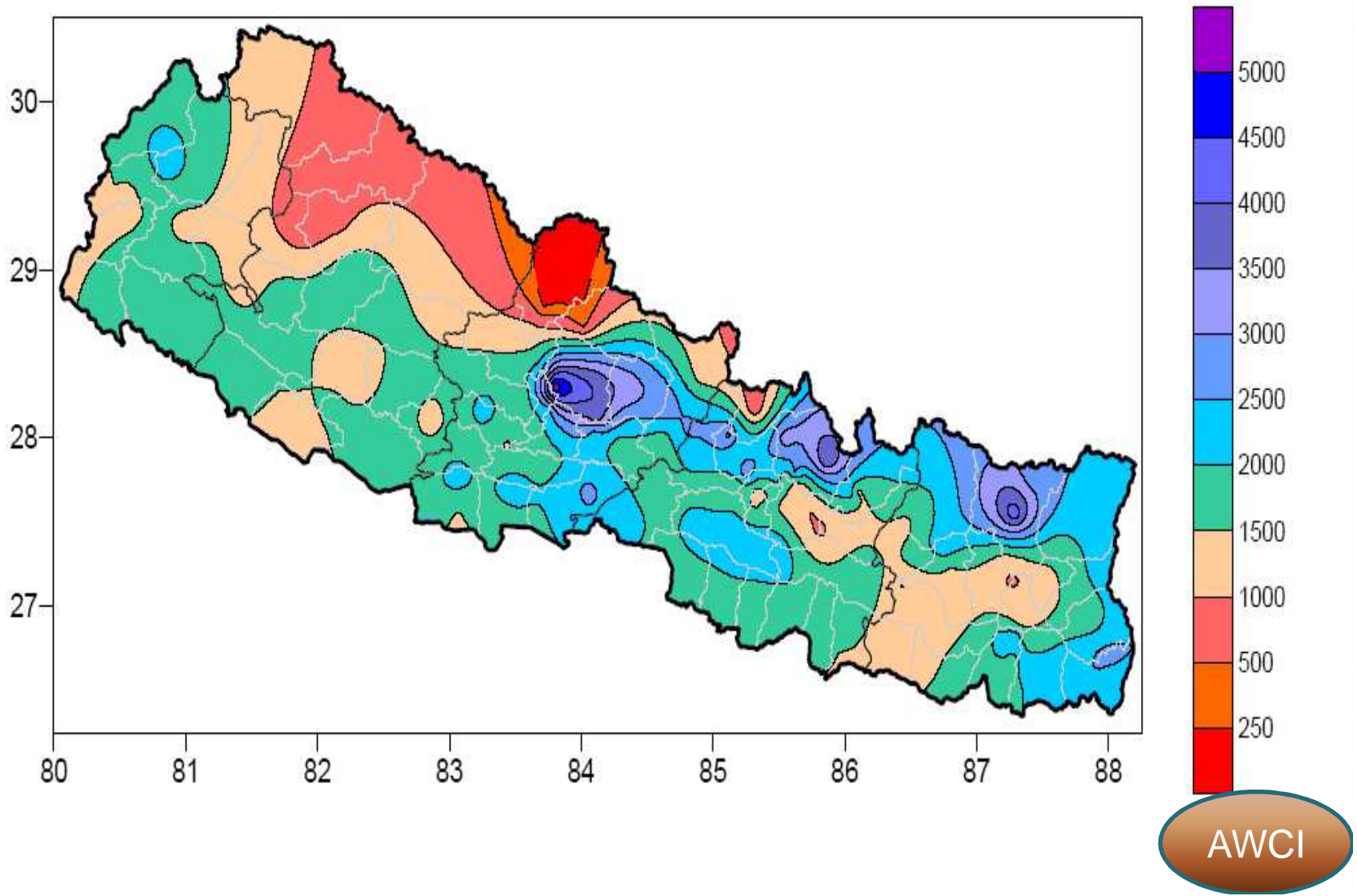


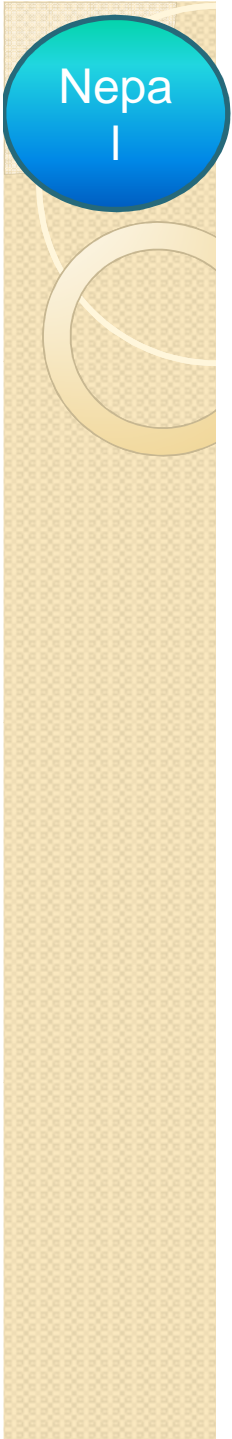
Spatial Variation of mean Annual Temperature





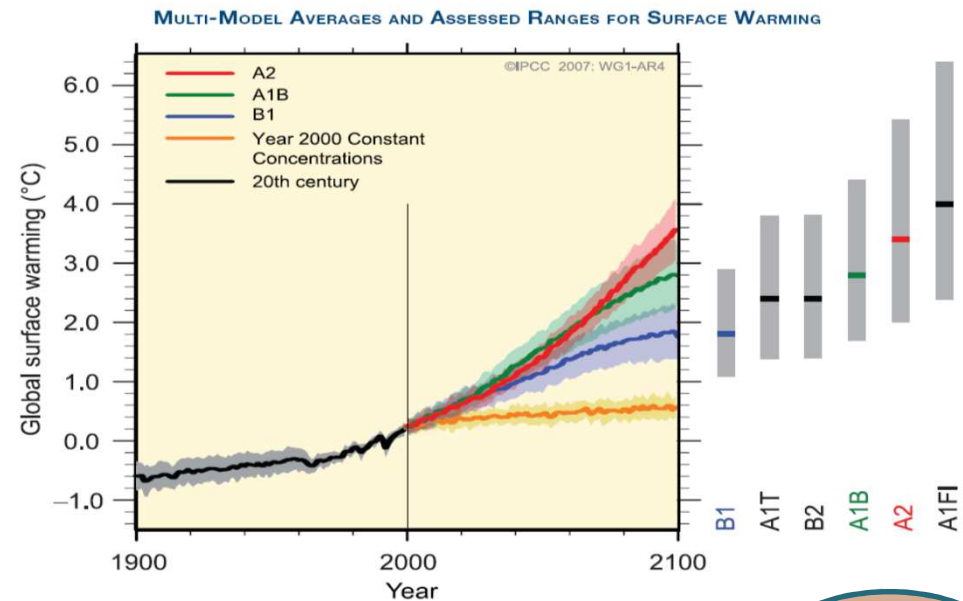
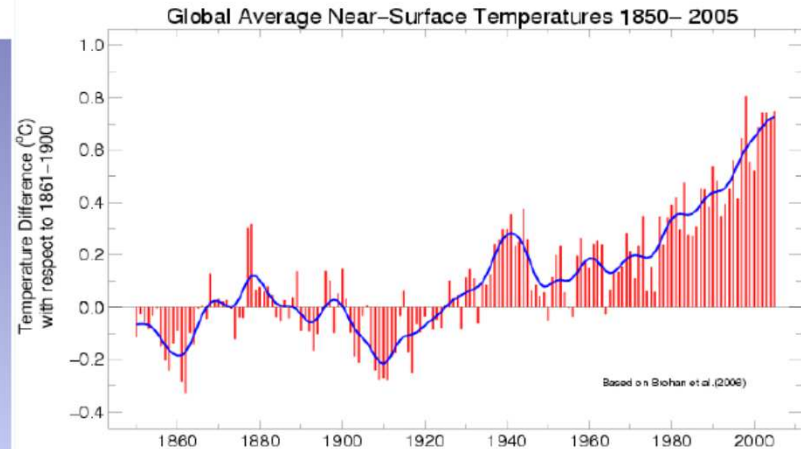
Annual mean Rainfall distribution





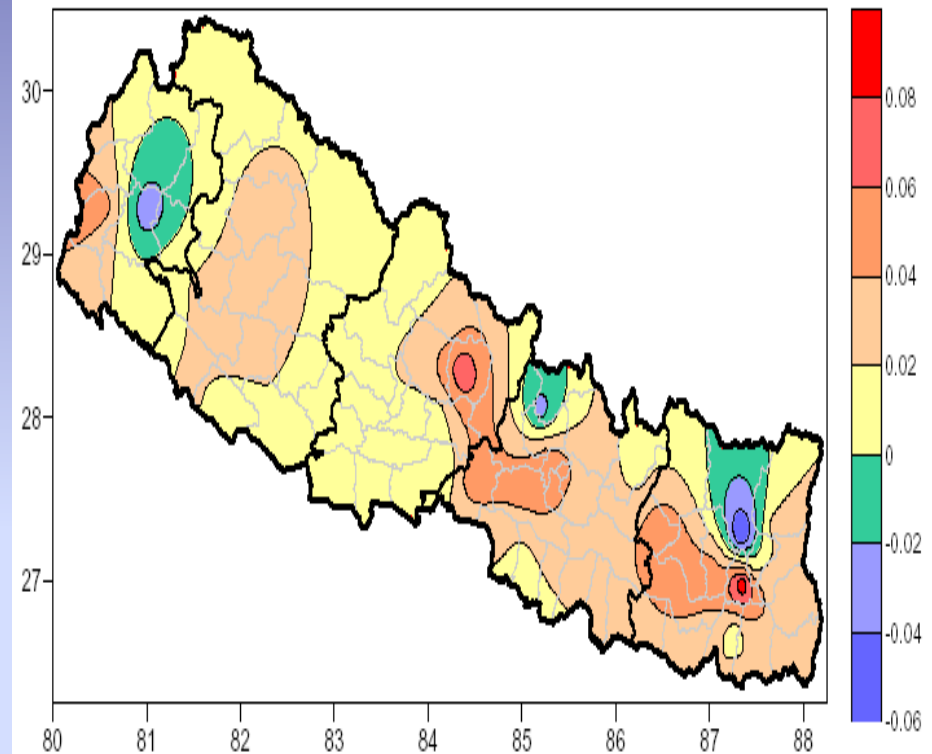
Nepal: Climate Change

- Earth – warmed by 0.7°C since 1900
- Nepal : Temp increase
 - 0.09°C in Hill
 - 0.04°C in Terai
 - Increase air surface temp during winter than in summer
 - No distinct long term trend in precipitation



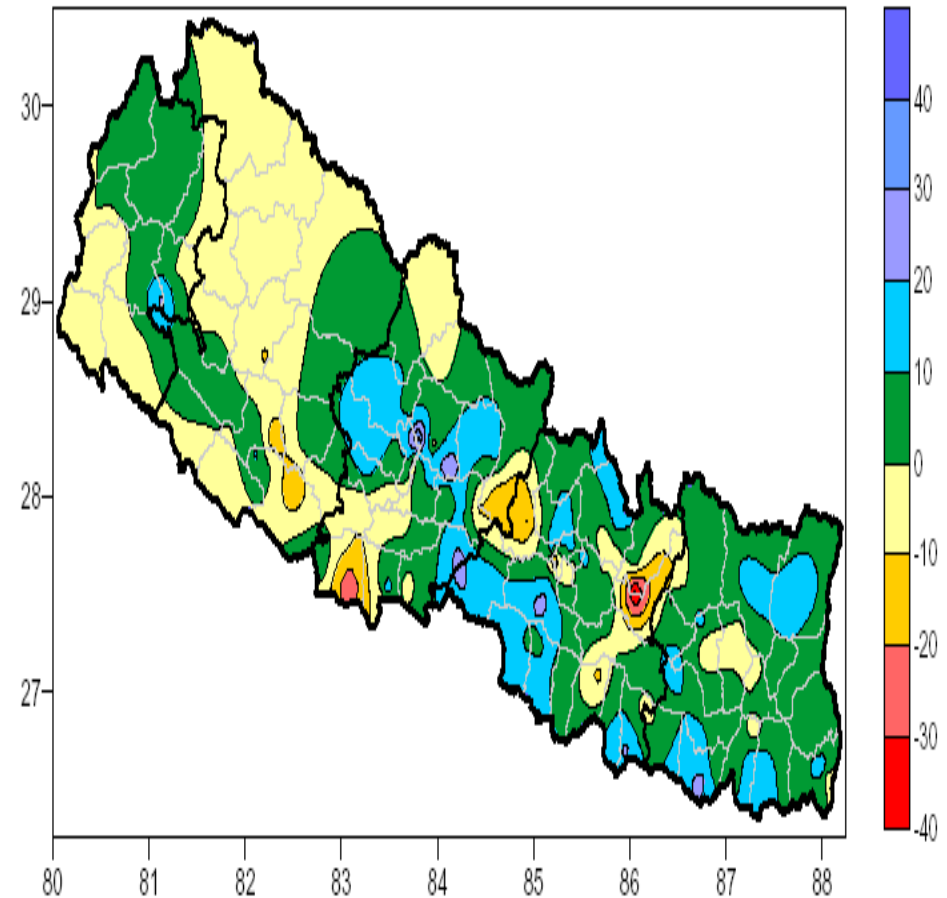
Spatial variation of annual mean temperature trends $^{\circ}\text{C}$ (45 stations 1976 -2005)

- Consistent and continuous warming at annual rate of 0.04° c/yr
- Warming trend all over country but not uniform spatially
- Some part has decreasing trend with $-0.06^{\circ}\text{ c/yr}$



Annual Precipitation Trend (mm/yr)

- No any significant trend
- Overall Increase by 3.6 mm/yr
- Observed even 40 mm/yr increase in Kaski
- Observed even -40 mm/yr decrease in Dolakha

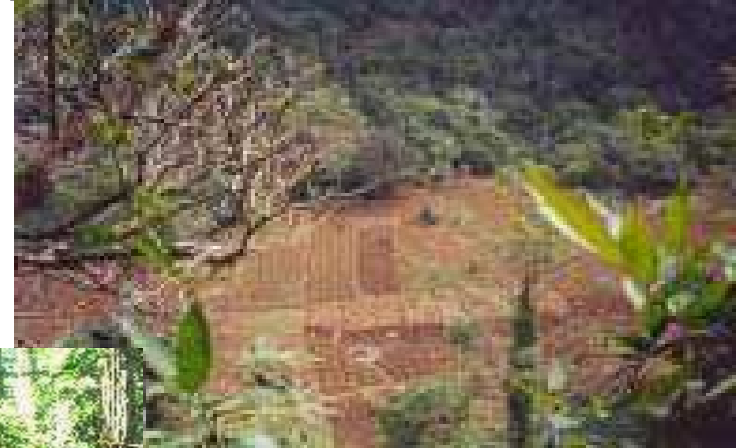
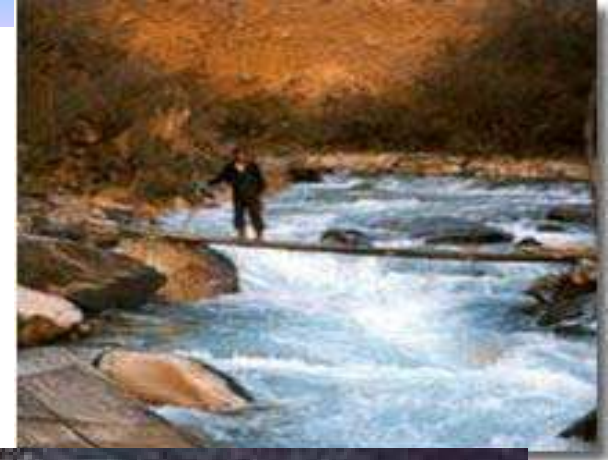


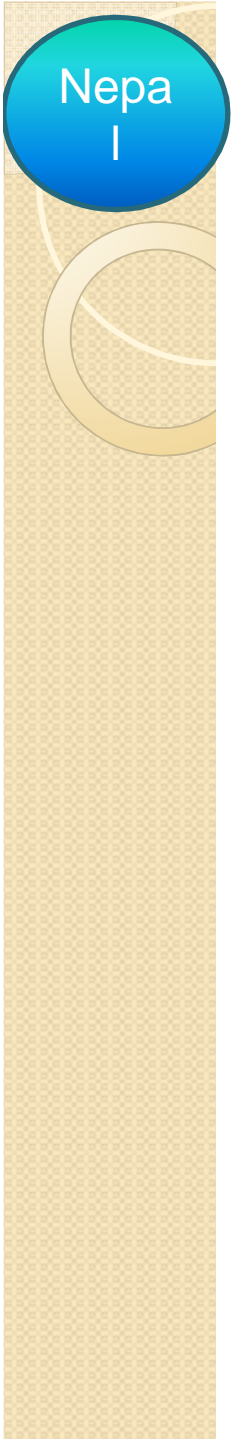
Nepal is Vulnerable to Climate Change

- Fragile mountain ecosystem
- Lack of appropriate mechanisms to response its implications
- Nepal's Mountain highly sensitive to climate change
- Country is the under developed and its economy is entirely based on agriculture

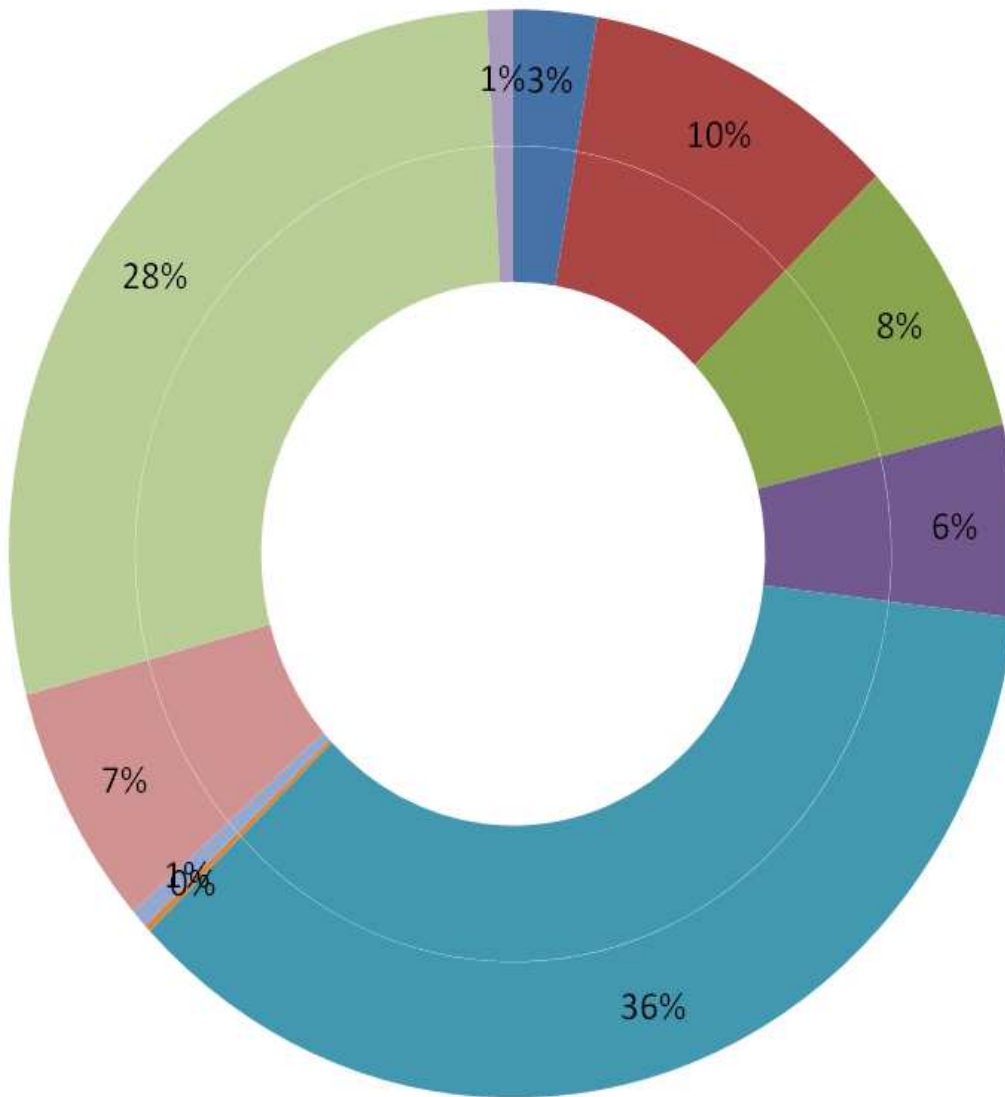
Sectors Vulnerable to Climate Change

- Water resources
- Agriculture and food security
- Natural ecosystem and Biodiversity
- Health
- Energy





Disasters in Nepal (1979 - 2009)



- Drought
- Earthquake (seismic activity)
- Epidemic
- Extreme temperature
- Flood
- Insect infestation
- Mass movement dry
- Mass movement wet
- Storm
- Wildfire

Water induced Disasters in Nepal

- Glacial Lake Outburst Floods
- Floods and Landslides
- Landslide Dam Burst
- Avalanches
- Flashfloods
- Bank Erosio





Glacial Lake Outburst Floods

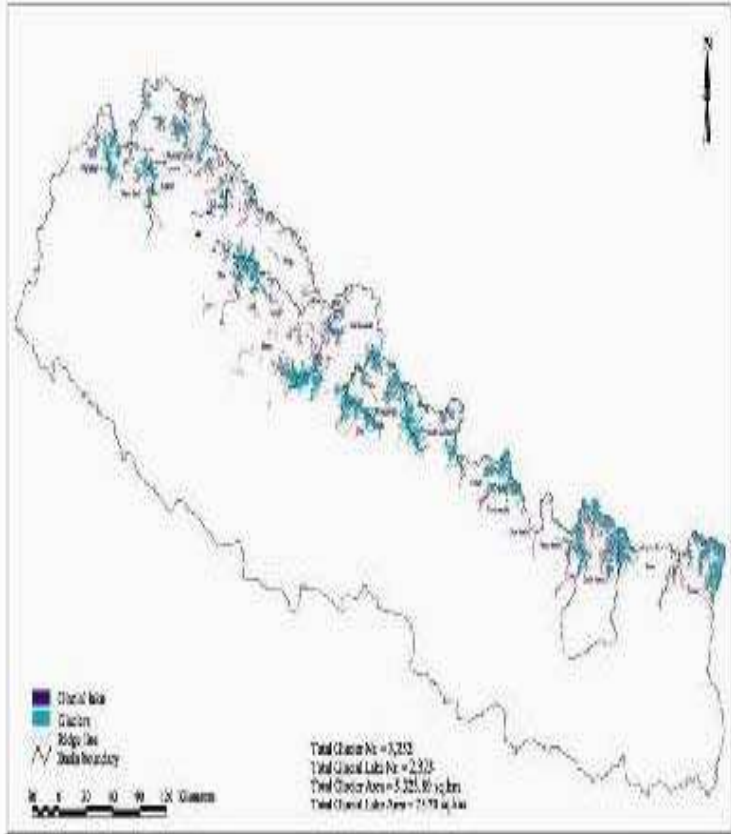
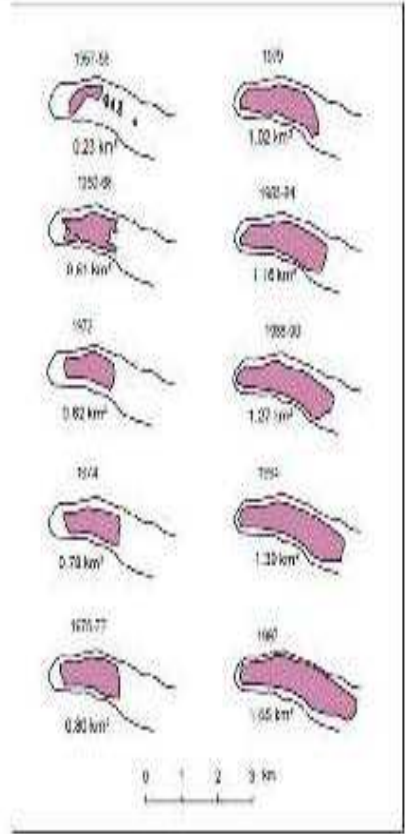
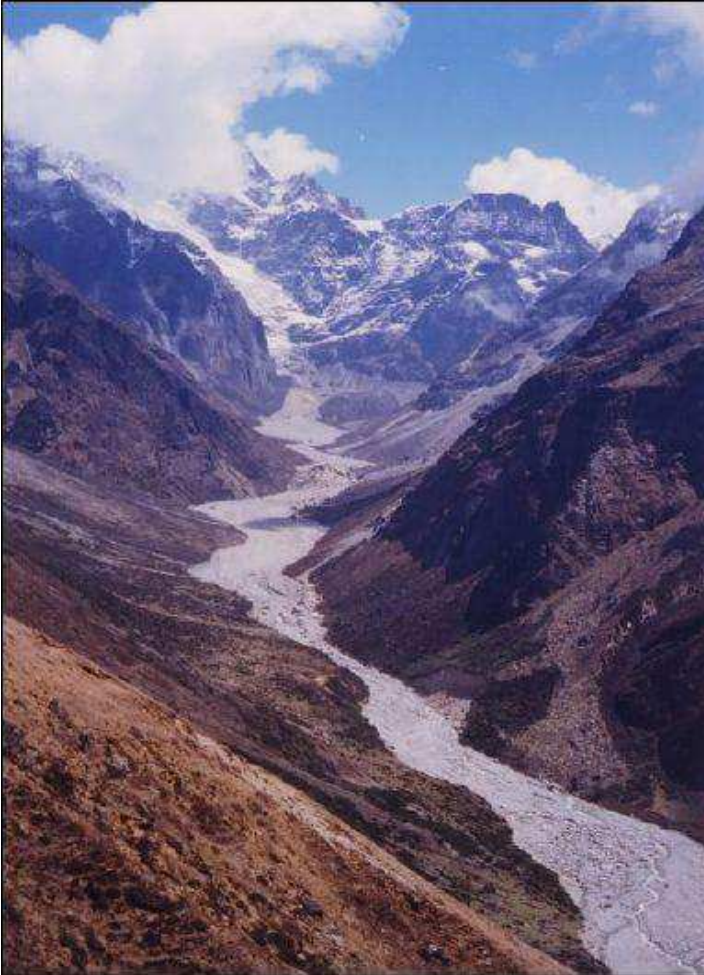


Figure 2

- 3,252 glaciers and 2,323 glacial lakes
- 20 Potential GLOF sites



Landslide Dam Burst Flood in CCAA Basin (5th May 2012)



**-Death Toll : 31 Nos
- Missing : 40 Nos**

Climate Change Impact: Nepal

Change in Cryosphere:

- The enhanced melting causes leading to increased D/S river runoff, while in longer time frame glacier runoff is expected to decrease
- Formation of additional glacier lake/reservoir
- Thawing of buried ice also threatens to destabilize the older moraines, thereby causes on site land degradation, erosion

Hydrology and water Resources:

Surface water:

Climate Change Impact: Nepal

- Increase/decrease, temporal/spatial variability in precipitation is likely to bring changes in river flows trend and effect on the availability of water downstream
- Warming of lakes and rivers is likely to change in the lake and river levels due to increased evaporation.

Ground Water:

- Climate change affects groundwater recharge rates and depths of groundwater tables.

Climate Change Impact: Nepal

- Change in the shallow groundwater table. The impact is on the water availability

Floods:

- Variability in the monsoon rainfall is likely to change in the flooding process resulting in river floods, flash floods, urban floods, glacial lake outburst floods.
- Variability in the monsoon rainfall is likely to increase on the intensity and frequency of floods.

Climate Change Impact: Nepal

Drought:

- Variability in the rainfall in the summer and winter is likely to increase the frequency of draught.
- Decreased land precipitation and increased temperatures, is likely to enhance evapotranspiration and reduce soil moisture.
- Decreased land precipitation and increased temperatures, is likely to enhance forest fires.

Climate Change Impact: Nepal

Water Erosion and Sedimentation:

- Increase in rainfall intensity would lead to greater rates of erosion
- The shift of winter precipitation from less erosive snow to more erosive rainfall is likely to enhance erosion
- Melting of permafrost increases the erosion and sediment in the downstream due to mobilization of the previously non erosive soils.

Some Significant Impacts observed

- Decrease in the river/rivulet discharges in the winter and summer months resulting to closer of water mills, inadequate or no water in the irrigation systems, low energy output of the hydropower
- Decrease in longer and milder precipitation and increase in shorter and intense precipitation resulting to high run off, increased soil erosion debris flows and landslides

Some Significant Impacts observed

- Decrease in soil moisture (due to high evapo transpiration, and decline in rainfall) resulting to reduced agricultural productivity and forest productivity
- Decline spring discharges resulting to water scarcity even for domestic consumption
- Decline in recharge of groundwater
- Increased forest fires
- Increased water induced disaster due to frequent and intense precipitation in monsoon resulting to flash floods

A Glimpse of Adaptation measures practiced

- Traveling longer distance for domestic and livestock water collection
- Roof top rain water harvesting
- Improvement in the household water management
- Use of water filtration system for drinking purpose at household level
- Collection of available snow for irrigation
- Diversion of available run off to agricultural fields for maintaining soil moisture and irrigation

A Glimpse of Adaptation measures practiced

- Use of overhead and underground tanks for domestic water collection
- Use of drip irrigation
- Shift to water stress resistant crops and horticulture
- Plantation of water conserving plant species around water holes
- Use of improved cooking stoves
- Use of solar lantern for lighting and solar water heater for water heating

A Glimpse of Adaptation measures practiced

- Use of residual biomass and animal dung for cooking and household heating
- Use of biogas for cooking and lighting
- Installation of solar home systems for lighting energy
- Installation of dug well, hand pumps, shallow tube well and deep tube well

Adaptation Measures by Government

Government has formulated National Adaptation Programs of Actions (NAPA) under Ministry of Environment

NAPA has envisaged following adaptation measures:

- Investments and subsidies on micro-hydro, improved water mill, and peltric sets
- Investments and subsidies on rural water supply schemes; small irrigation systems ; rainwater harvesting ponds for livestock and irrigation
- Promotion of forest conservation through community, leasehold, and collaborative forestry programs
- Watershed conservation programs

Adaptation Measures by Government

- Establishment of early warning systems for GLOF and floods
- Draining of glacier lakes
- River training works including bio-engineering
- Subsidies for autonomous adaptation programs such as biogas, improved cooking stoves, solar home systems, shallow tube wells, hand pumps, improved seeds, food grain in draught areas

Adaptation Measures by Government

- Water-related Disaster Management Policy and Program
- Risk/Vulnerability Mapping and Zoning Program
- Disaster Networking and Information System Improvement Program
- Community-level disaster preparedness program
- Activation of Inundation Committee

Adaptation Measures by Government

- Flood, Drought, Landslides/Debris Flow, GLOF and Avalanche Mitigation Program
- Integrated Program for Irrigated Agriculture
- Improved Management of Existing Irrigation Schemes
- Improved Planning and Implementation of New Irrigation Systems
- Strengthening of Capacity Building of Local Level Institutions in Planning and Project Implementations

Adaptation Measures by Government

- National Capacity Building of Farmers
- Management of existing hydrological and meteorological network
- Extend hydrological and meteorological networks
- Mainstreaming IWRM and River Basin Concept
- Develop River Basin Plans
- Develop and Implement DSS in water resources programs

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Seti Landslide dam Burst Flood (5th May 2012)



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Thank You

