



Use of climate information in Nepal for water and food security

Rijan Bhakta Kayastha, D. Sc.

Associate Professor and Coordinator

**Himalayan Cryosphere, Climate and Disaster Research Center
(HiCCDRC), Kathmandu University**

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Main Contents

Country Background:

Use of climate information in Water:

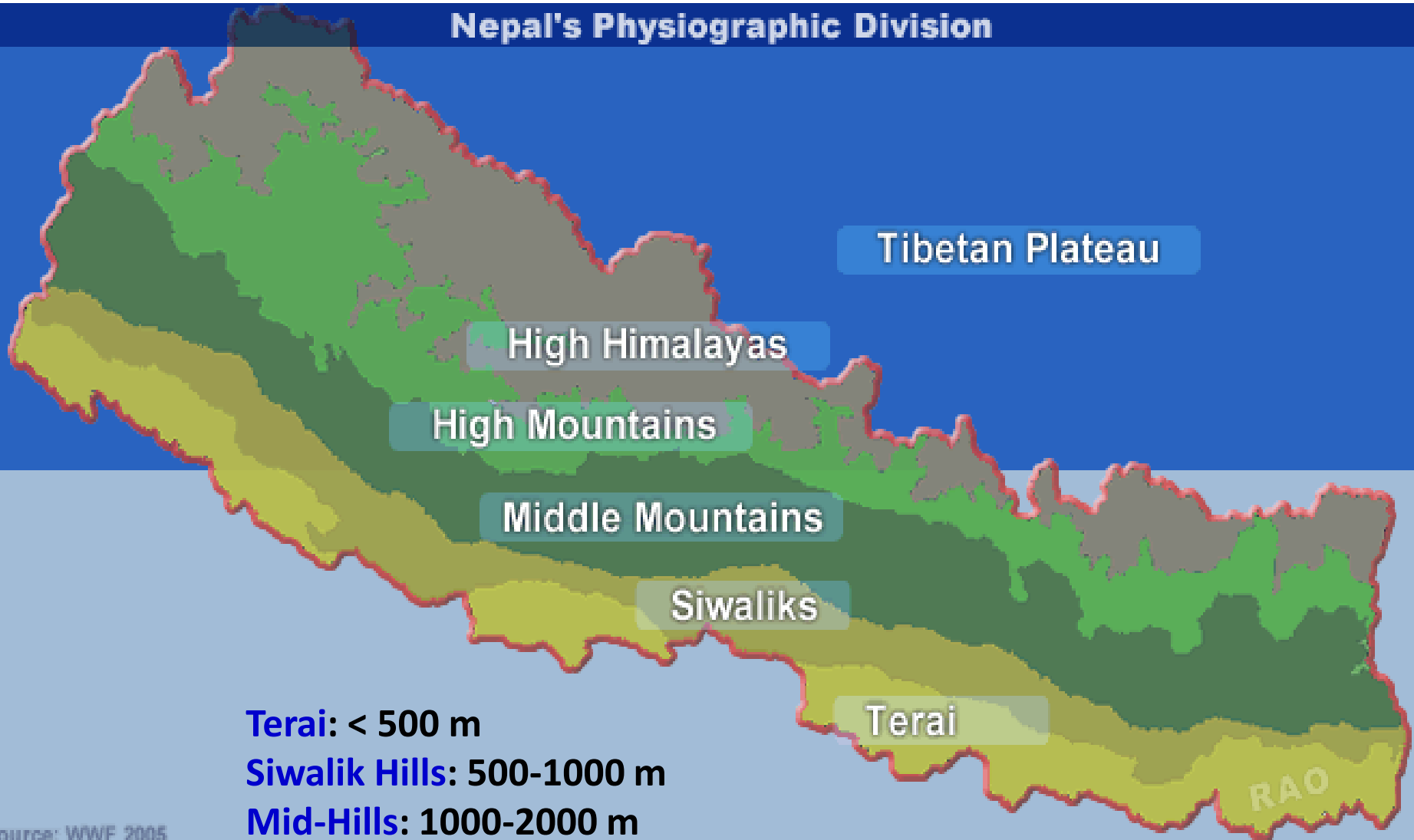
- 1. Flood early warning system**
- 2. Assessing water in glacierized river basin using glacio-hydrological model for hydro power production and fisheries**

Food:

- 1. Nepal Agriculture Management Information System**

Country Background - Nepal

Nepal's Physiographic Division



Terai: < 500 m

Siwalik Hills: 500-1000 m

Mid-Hills: 1000-2000 m

High Mountains: 2000-5000 m

High Himalaya: > 5000 m

(Source: LRMP, 1986)

- **Altitude range:** 64 m to 8848 m asl
- **East-west length:** about 850 km
- **North-south span:** less than 200 km
- **Climates:** From subtropical to Alpine types
- **Monsoon:** June to Sept. accounts 80 % ppt.
More ppt. in the east than in the west

Climatic Conditions of Nepal

Ecological Belt	Climate	Avg. Annual Ppt. (mm)	Mean Annual Temp. (°C)
Mountain	Arctic/Alpine	Snow/150-200	<0 - 10
Hill	Cool/warm temperate	275-2300	10 - 20
Terai	Sub-tropical	1100-3000	20 - 25

Avg. annual ppt. of Nepal: 1530 mm

Forest area: 39.6 % (18 % protected areas) (NWP, 2005)

Biodiversity: Very rich (5833: flowering plants, 185: mammals, 645: butterflies, 170: fishes)

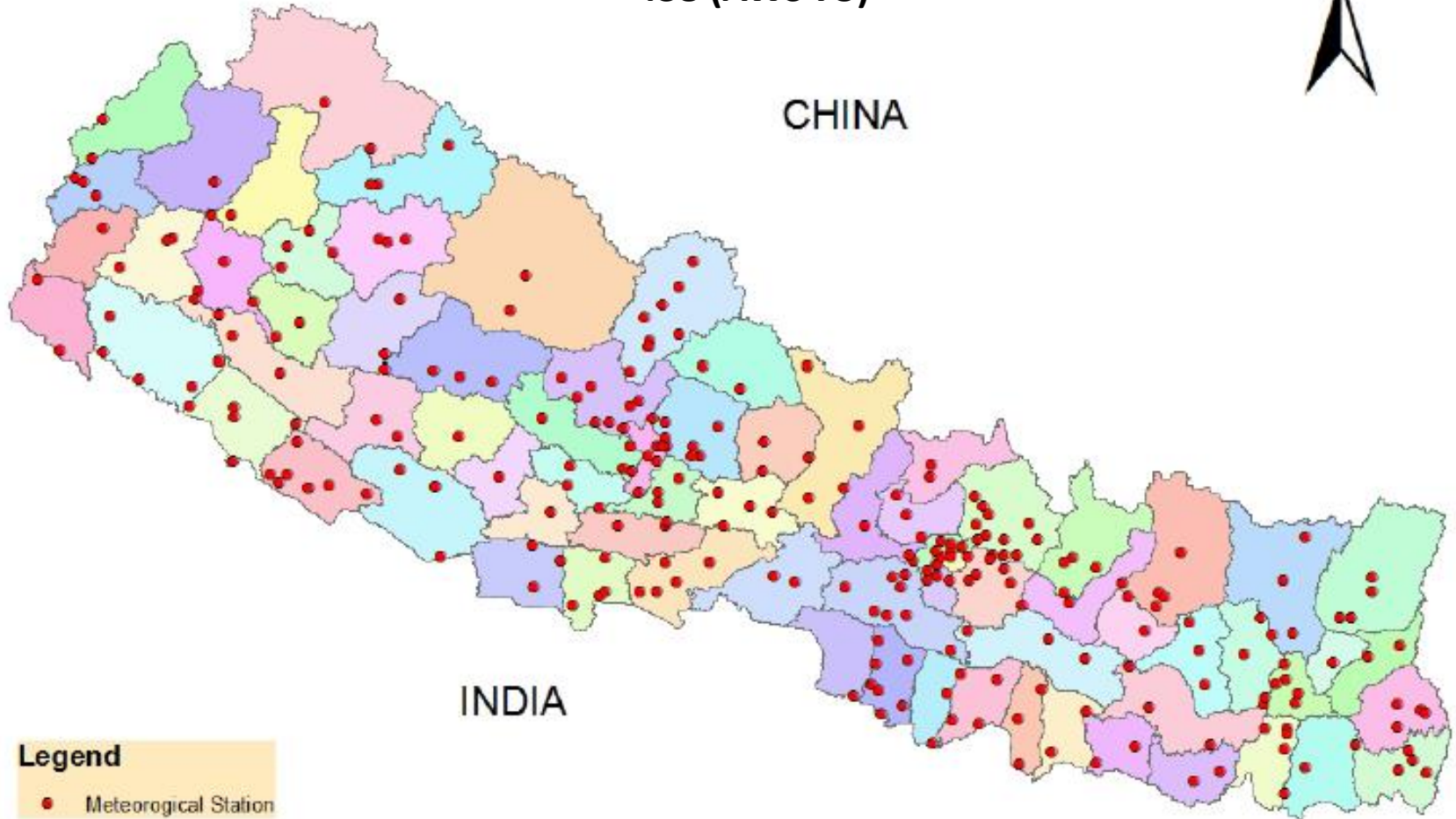
- **Rivers: more than 6000 (north to south flowing)**
(Saptakoshi, Gandaki, Karnali and Mahakali)
- **Total avg. annual runoff: 225 billion cubic meters (BCM)**
Only 15 BCM has been utilized (NWP, 2005)
- **Poverty: 25.2 % of the population (26.5 million in 2011, CBS, 2018)**
- **per capita GDP: US \$ 1004 in 2017/18 (CBS, 2018)**
- **Livelihood: Agriculture 35 % in GDP (65 % population)**
 - **Industry: 20 %**
 - **Services: 45 %** (CIA World Fact Book, 2018)

Network of Meteorological Station

438 (AWS 75)



CHINA



INDIA

Legend

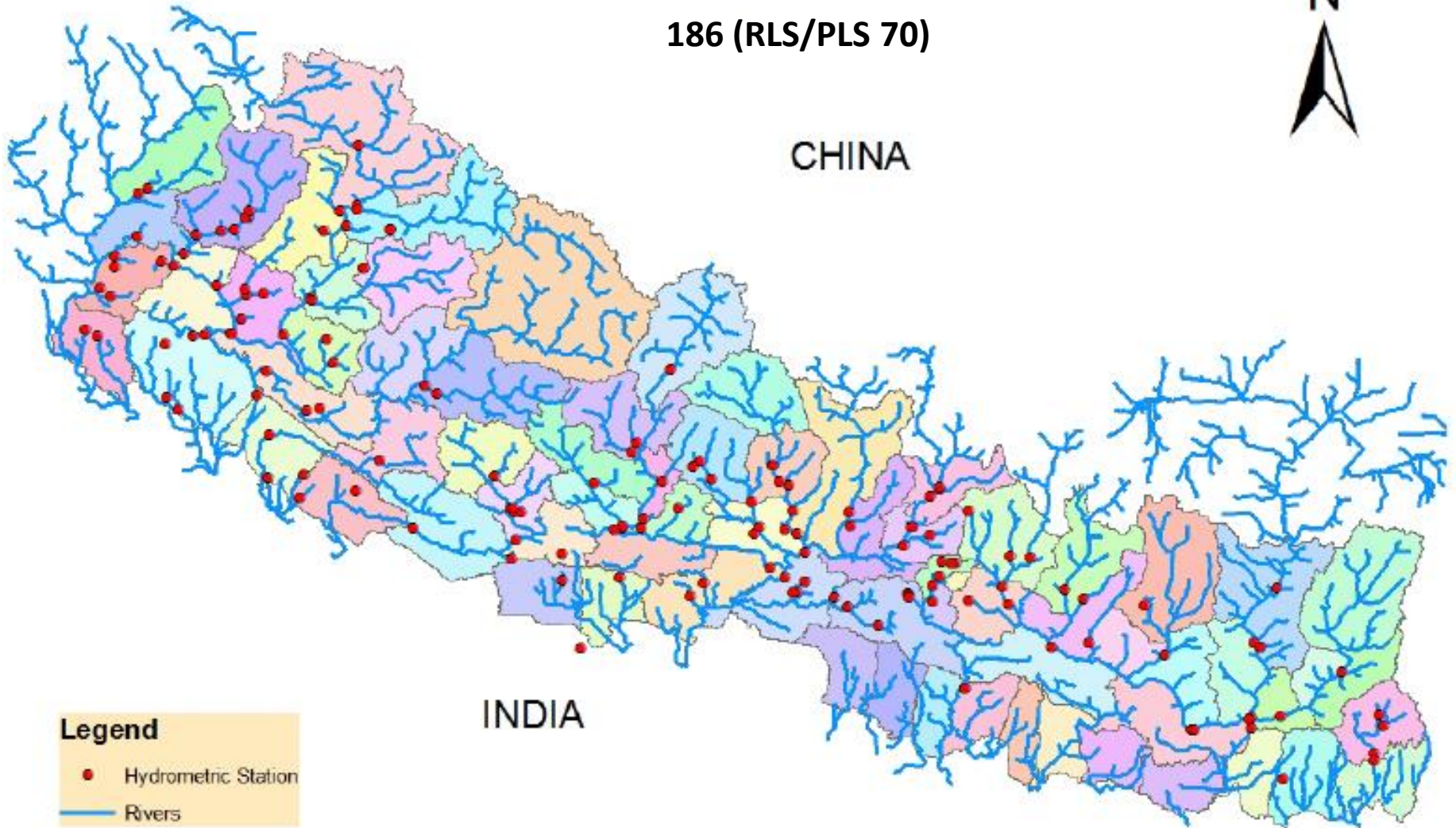
- Meteorological Station

Network of Hydrometric Station

186 (RLS/PLS 70)



CHINA

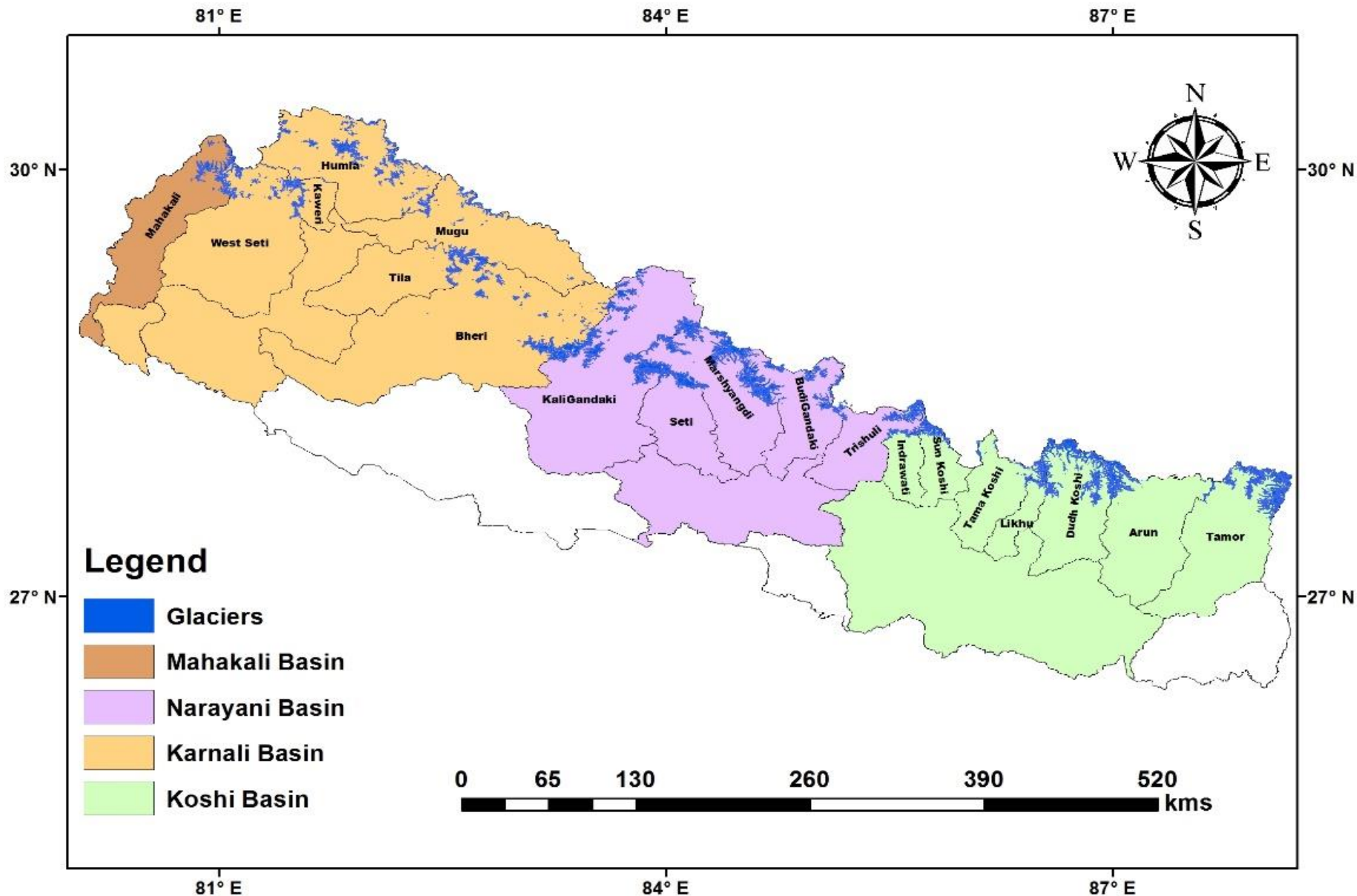


INDIA

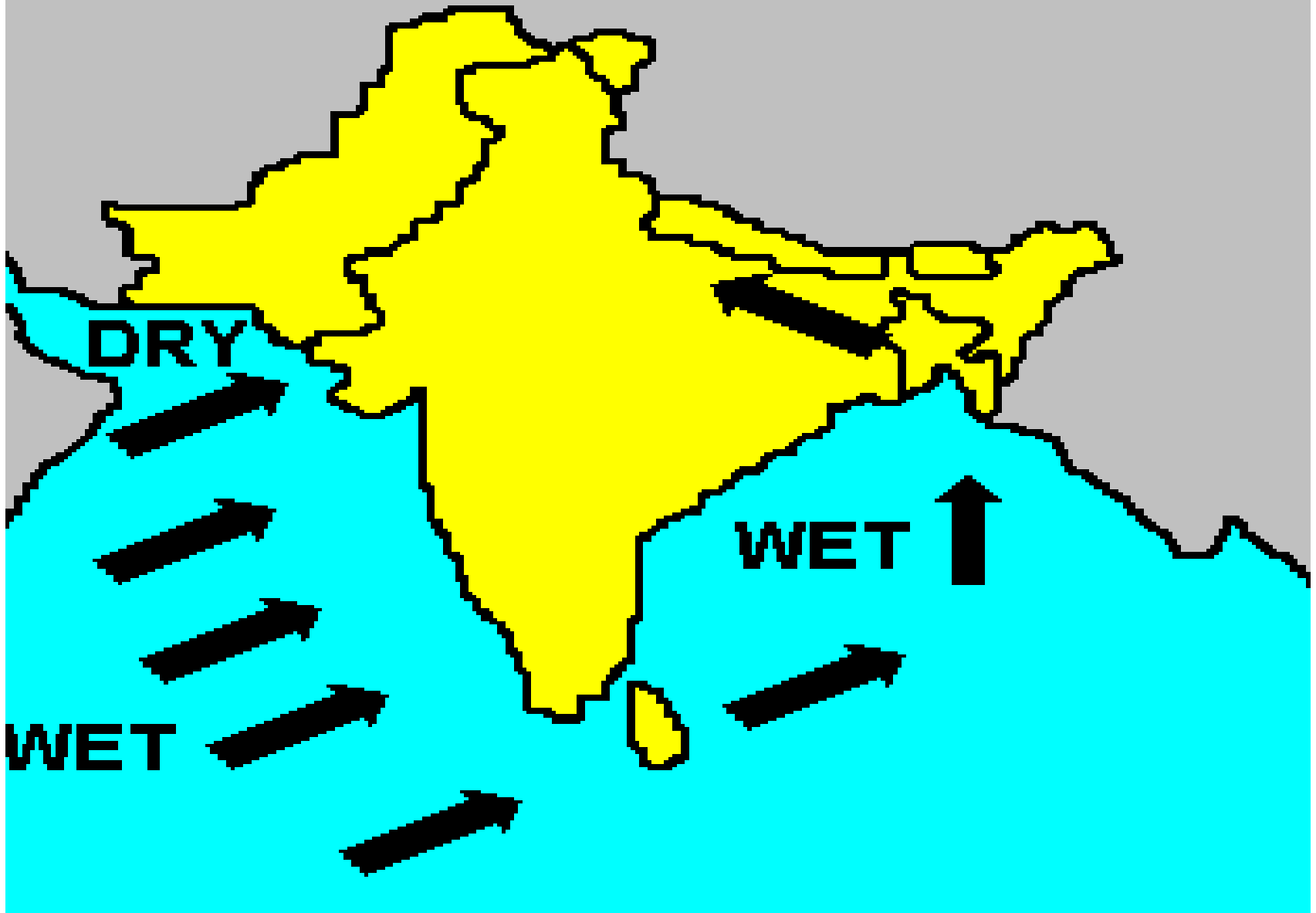
Legend

- Hydrometric Station
- Rivers

Glacierized-sub river basins of Nepal



WET MONSOONS (June-Sept.)



Climate Change in Nepal

All Nepal Climate Trend (1971-2014)

- Annual maximum temperature trend: +0.056 °C/yr
- Annual minimum temperature trend: + 0.002 °C/yr

(DHM, 2018)

During a period from 1977 to 2010

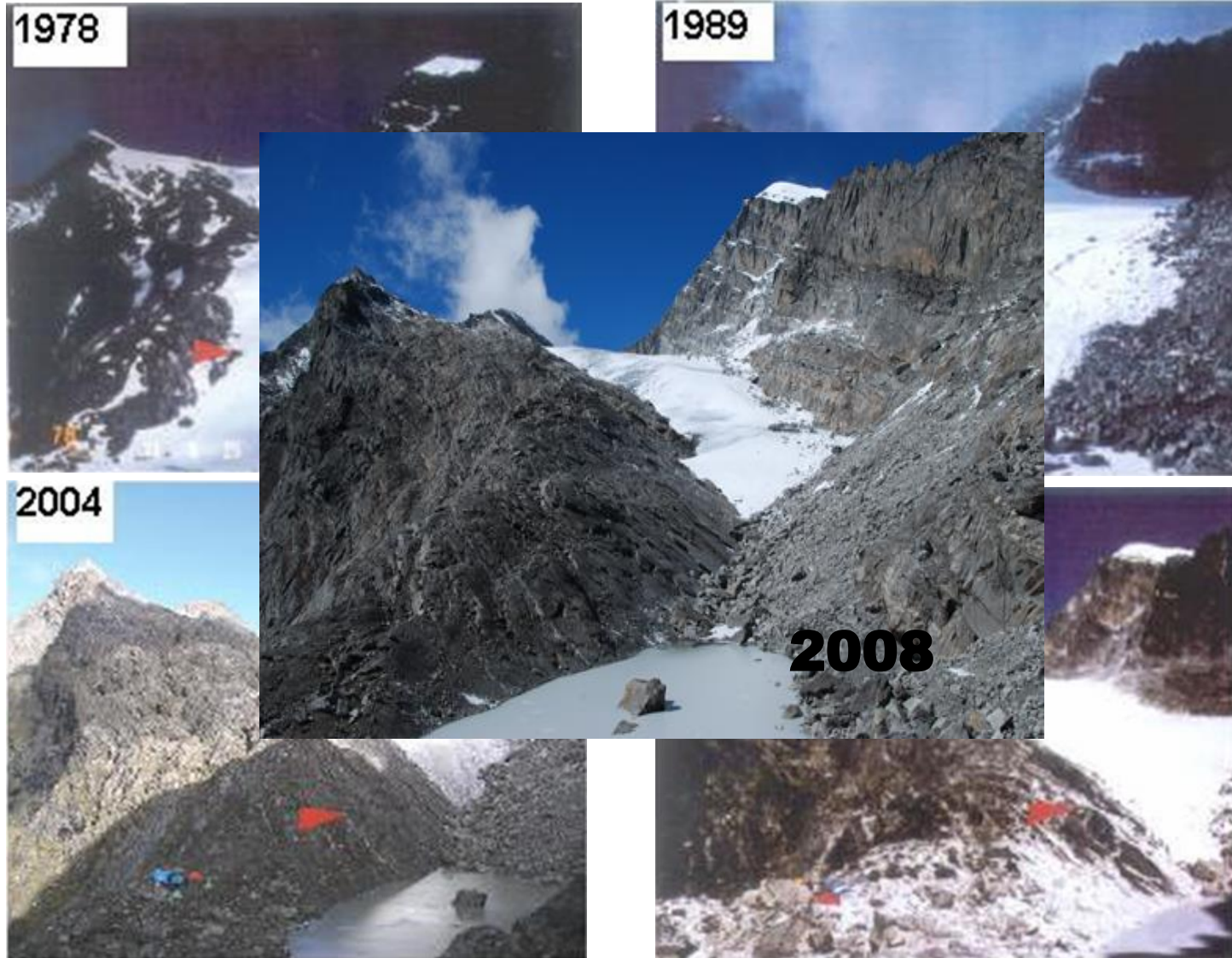
24 % of glacier area (**38 km²/yr**) decreased

29 % ice reserve decreased

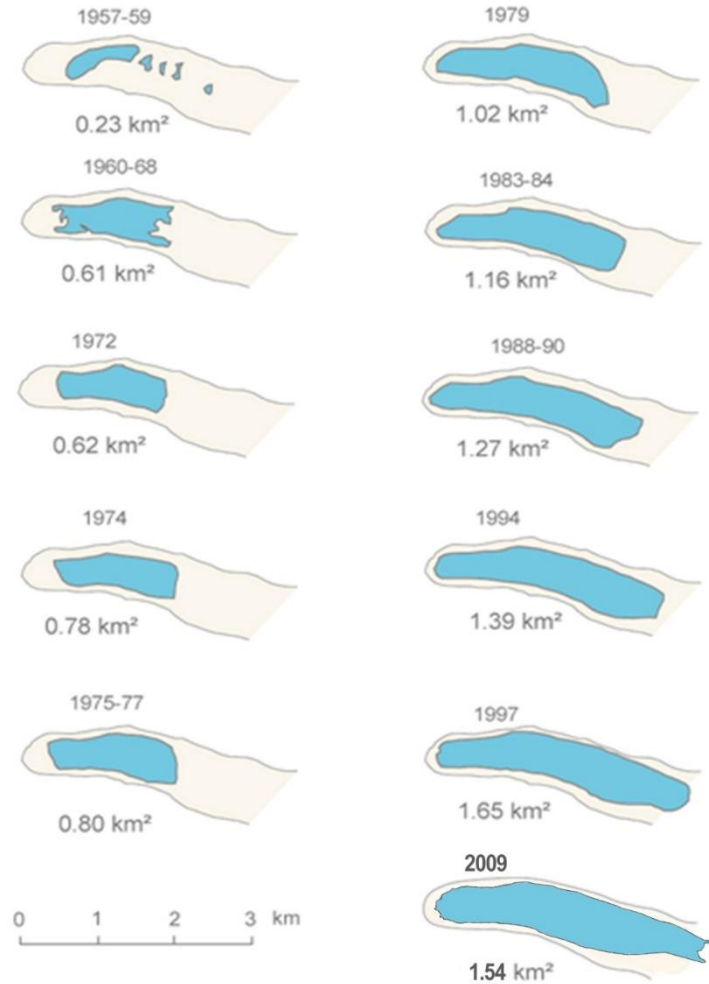
(Bajracharya et al. 2014-ICIMOD)

Glaciers are retreating

Glacier AX010 in Shorong Himal, east Nepal

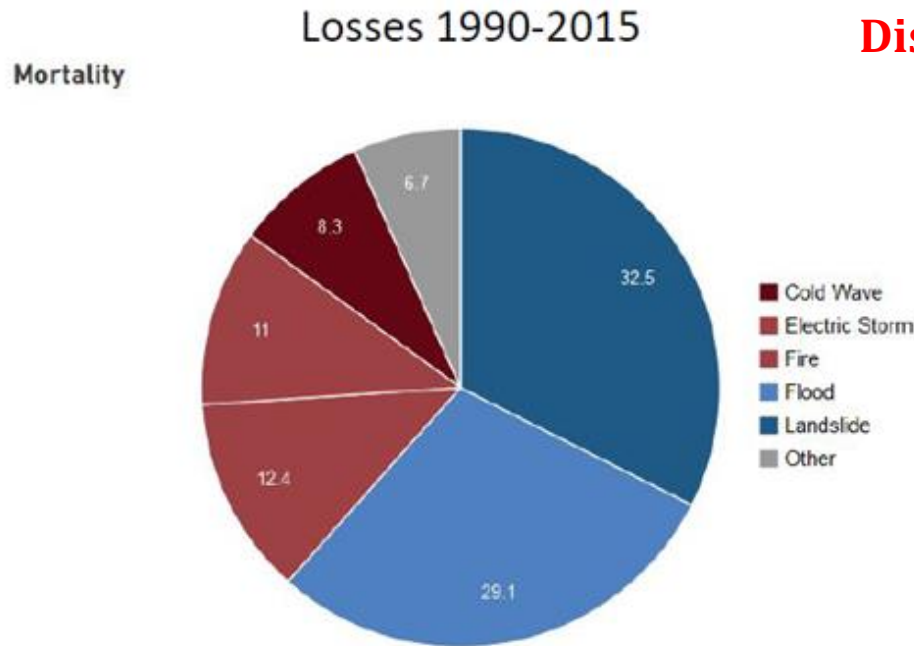


Tsho Rolpa Glacial Lake (Dolakha)



Use of Climate Information in Water

- Flood early warning system



among the top weather-related hazards, Flash
Floods have the highest mortality rate globally ...

Source:
www.preventionweb.net

Major works of Flood Forecasting Section, DHM



Station

Communication/ Media



National Emergency Operation Center

DEOC

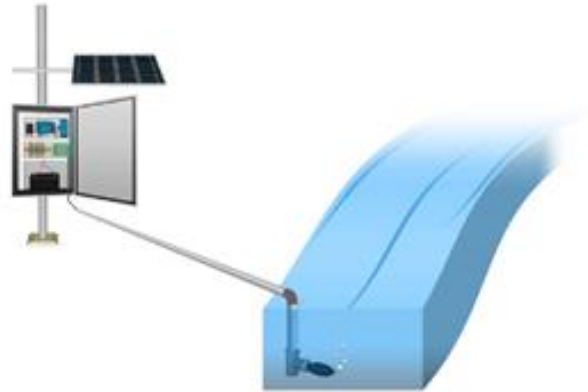
LDMC/CDMC



Office

Stake
Holders

Flood Station





RAINFALL WATCH

Last updated on 2014-07-07 10:02:55

S.N	Basin Name	Station Index	Station Name	RAINFALL IN mm					Status ^{***}
				1 hour (09-10)	3 hour (07-10)	6 hour (04-10)	12 hour (22-10)	24 hour (10-10)	
1	Karnali	280	Karnali at Chisapani	13.40	27.40	39.00	39.40	77.20	Below Warning Level
2	Karnali	402	Dallekh	6.00	19.20	20.80	21.00	31.00	Below Warning Level
3	Karnali	404	Jajarkot	2.00	4.60	4.60	4.60	7.00	Below Warning Level
4	Babai	289.95	Babai at Chepang	7.20	56.20	116.60	122.40	151.20	Above Warning Level
5	Babai	417	Ranjaruwa	8.00	26.80	78.60	82.60	109.20	Below Warning Level
6	Babai	508	Tulsipur	5.00	29.00	130.60	130.80	133.20	Above Warning Level
7	Babai	515	Ghorahi	9.60	28.20	145.60	145.80	148.60	Above Warning Level
8	Babai	515	Ghorahi	6.05	16.01	94.83	95.12	96.11	Below Warning Level
9	Babai	519	Thamsare	10.40	22.80	34.60	34.60	44.40	Below Warning Level
10	Babai	525	Rampur-Kalimati	N/A	N/A	N/A	N/A	2.20	Below Warning Level
11	Babai	529	Padampur	0.40	15.20	85.80	86.80	92.40	Below Warning Level

Note: warning level for rainfall :60mm in 1 hr,80 mm in 3 hour, 100 mm in 6 hr, 120mm in 12 hr,140 mm in 24 hr

RIVER WATCH

S.N	Station Index	Station Name	Water Level (m)	Flow (m ³ /sec)	Warning Level (m)	Danger Level (m)	Trend	Status
1	259.5	Seti at Dipayal 2013-08-27 13:15:00	6.70	-	-	-	Rising	-
2	289.95	Babai at Chepang 2013-08-27 13:15:00	4.18	777.80	6.50	7.00	Rising	Below Warning Level
3	339.3	Jhimruk at Cherneta 2013-08-27 13:00:00	2.85	-	-	-	Steady	-
4	375	West Rapti at Kusum 2013-08-27 13:15:00	5.75	2414.00	5.00	5.40	Rising	Above Danger Level
5	425	Seti 2013-08-27 13:00:00	2.05	-	-	-	Steady	-
6	550.05	Bagmati at Khokana 2013-08-27 13:15:00	1.28	24.05	3.50	4.00	Falling	Below Warning Level
7	610	Bhote Koshi at Bahrabise 2013-08-27 13:00:00	2.02	-	-	-	Steady	-
8	630	Sunkoshi at Pachuwarghat 2013-08-27 13:00:00	2.04	-	-	-	Falling	-
9	647	Tamakoshi at Busi 2013-08-27 13:00:00	3.29	-	-	-	Falling	-
10	690	Tamor at Mulghat 2013-08-27 13:20:00	4.45	-	-	-	Falling	-

Early warning system: Case study of Banke District



Display board at DAO, Banke showing water level of Rapti River at Kusum (above danger level)



Source:
www.hydrology.gov.np

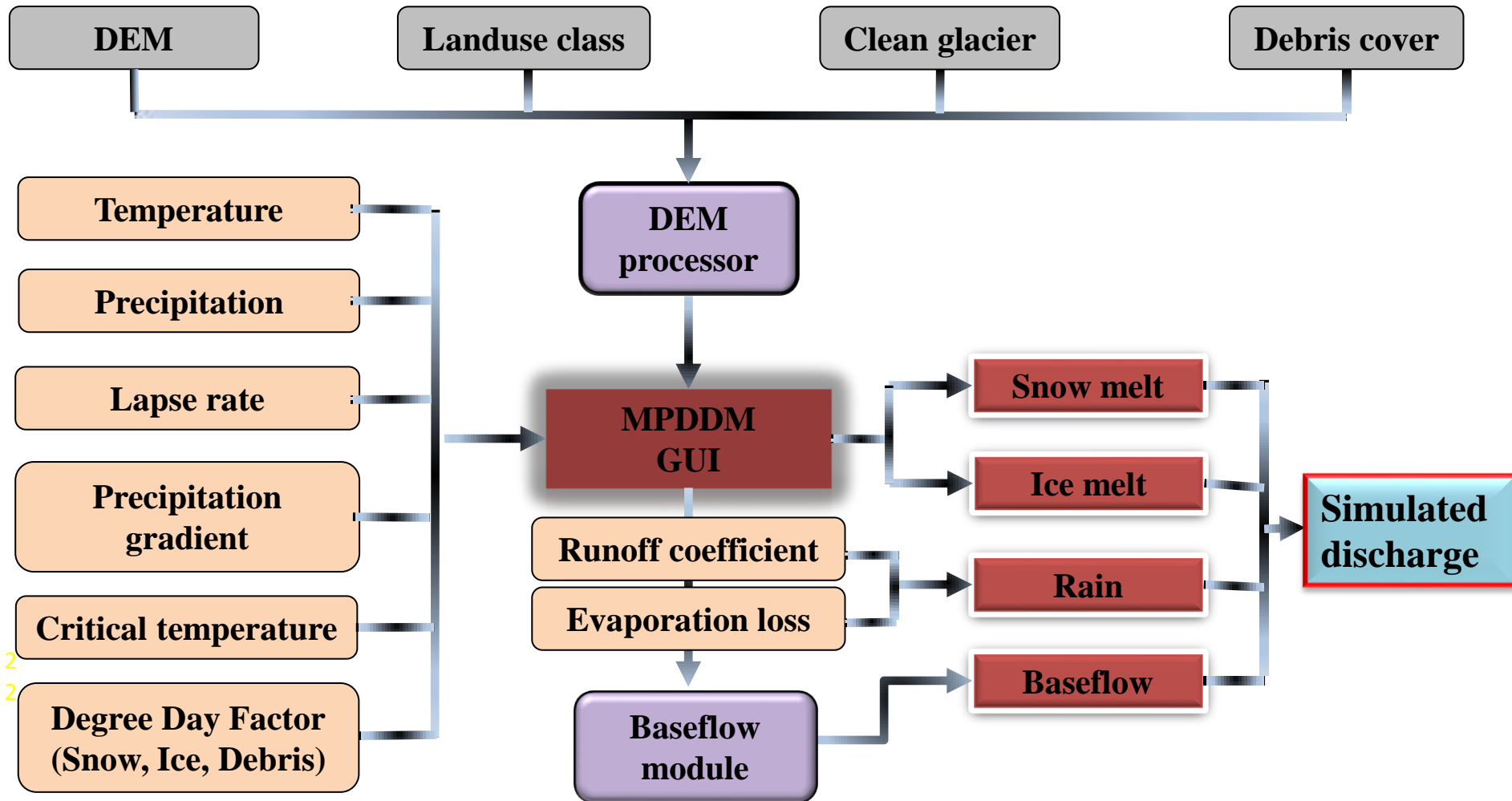


CDO, Banke taking flood level information



Photo: Community people shifting their belongings to safe place

Assessing water in glacierized river basin using a glacio-hydrological degree-day model for hydro power production and fisheries



Trishuli River basin



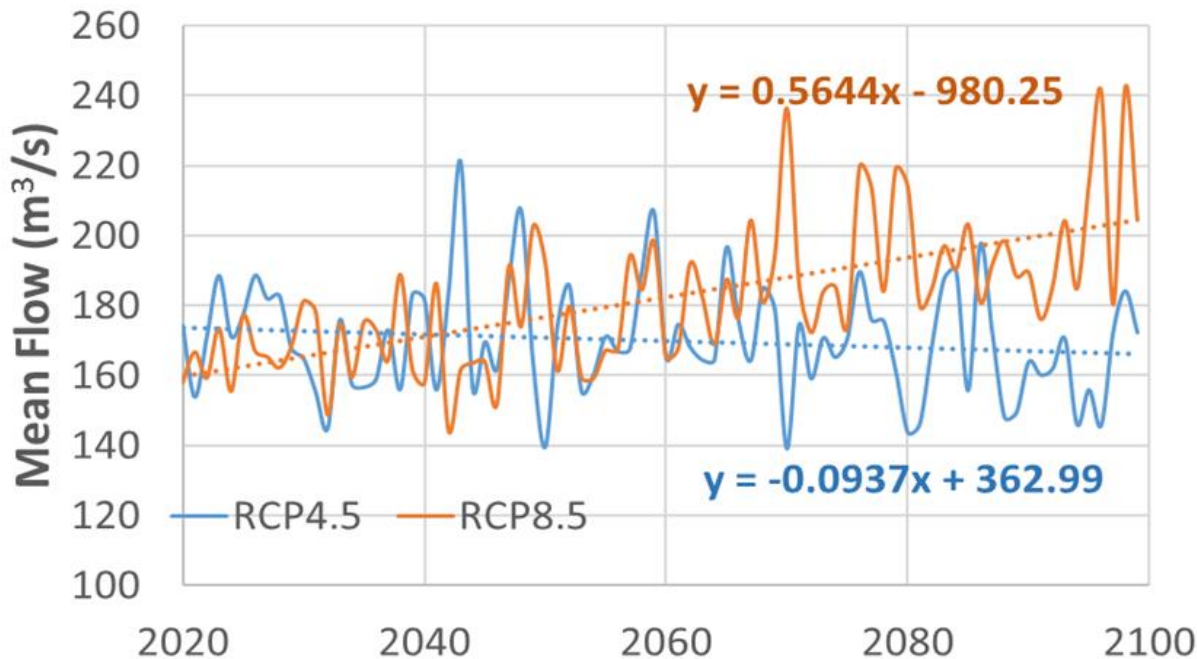
70.1 MW

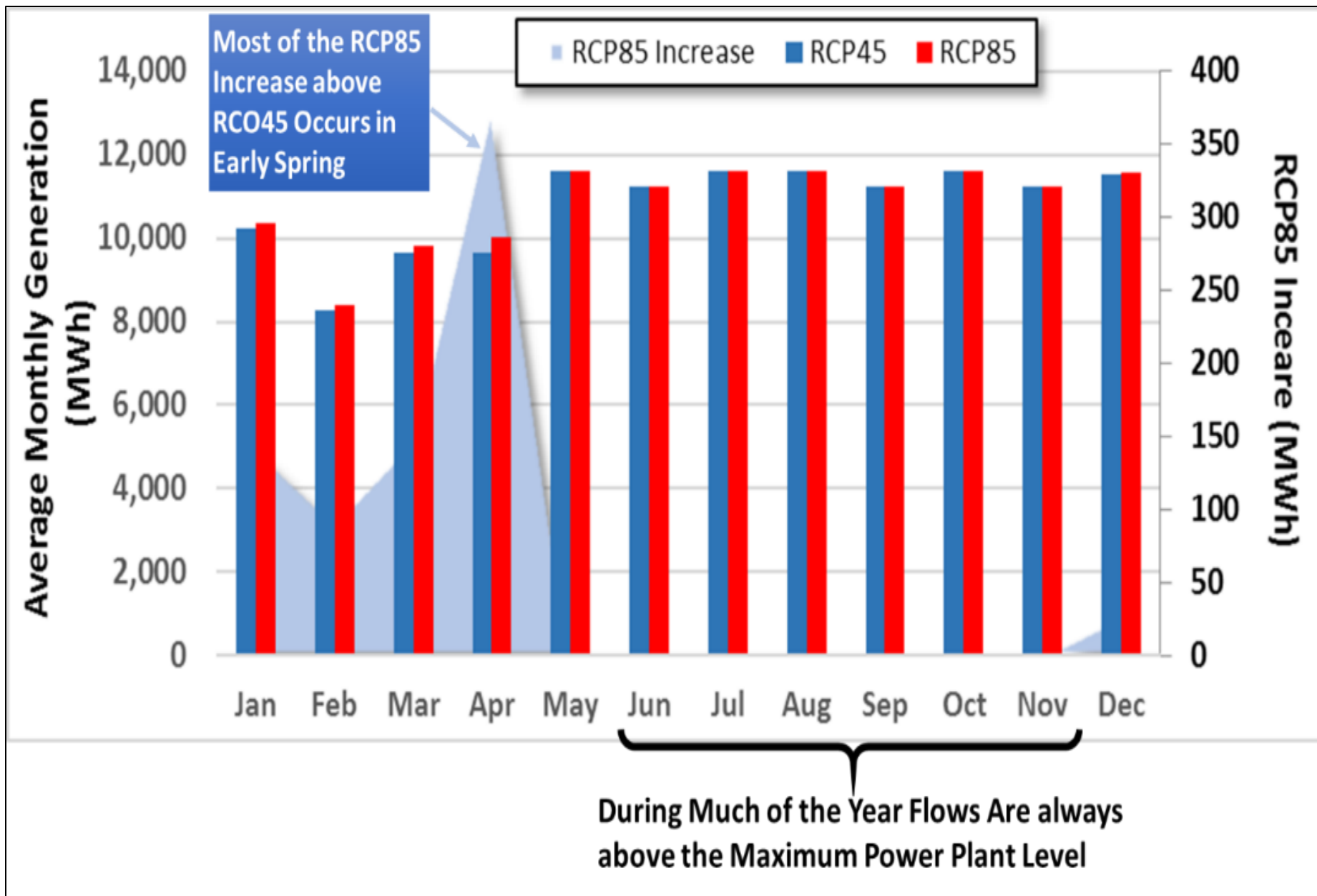
Recent paper

An Integrated Assessment Approach for Estimating the Economic Value of Climate-led Change on energy water nexus: An Application in a Himalayan River, Trishuli

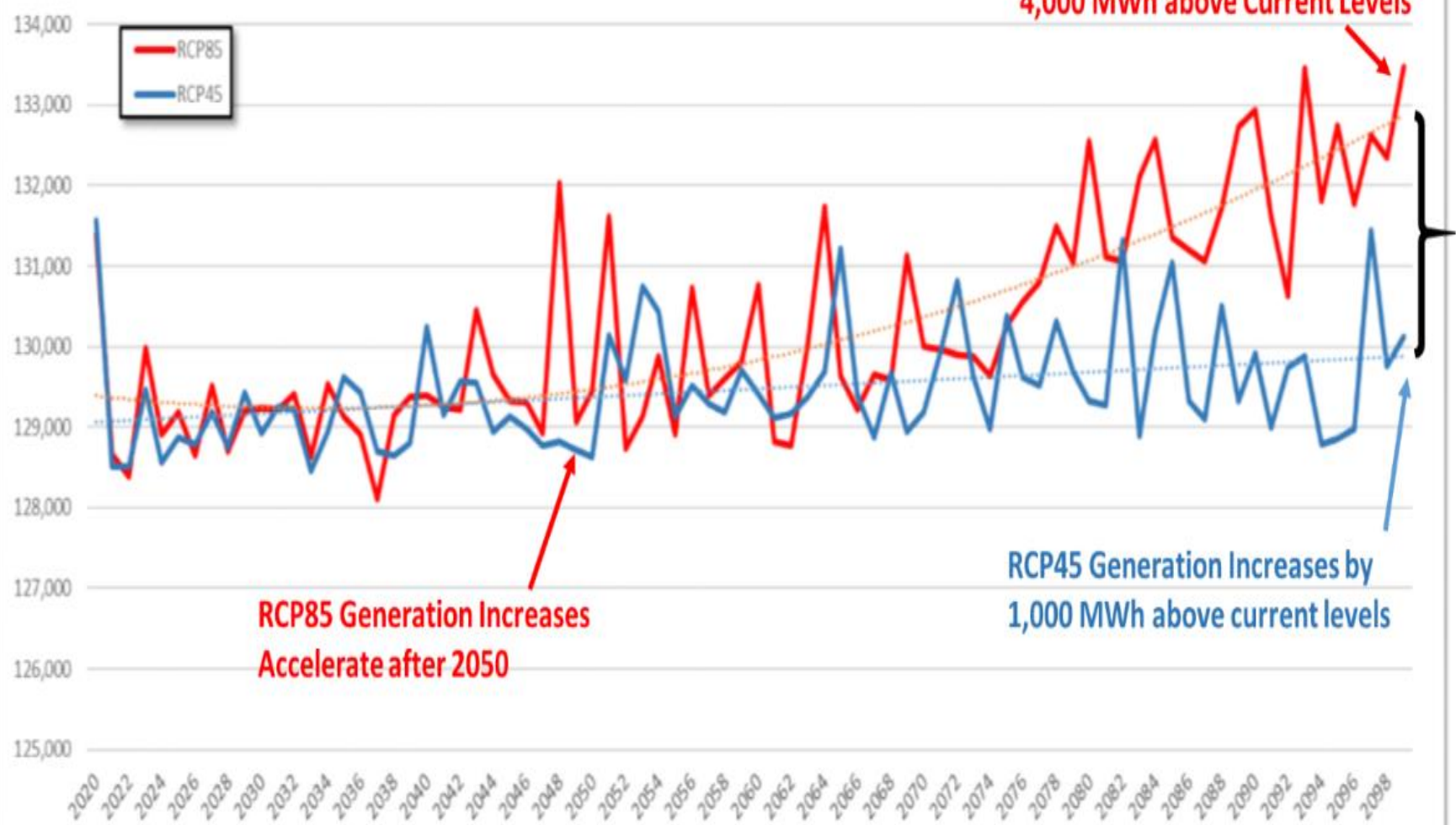
Shruti Khadka Mishra, John Hayse, Thomas Veselka, Eugene Yan, Rijan Bhakta Kayastha, Kirk LaGory, Kyle McDonald, Nicholas Steiner

[\(Environmental Science and Policy, 2018\)](#)





Annual Generation (MWh)



- **The estimated economic value of electricity generated from the Trishuli hydropower plant under RCP 4.5 and RCP 8.5 was projected to be 3.7% to 7.5% higher for the month of March, while for the months of April and May the values were 1.5% to 9.4% lower.**
- **As compared to the estimated total mean annual fisheries revenue for 1977–2014, the projected average annual revenue for 2020–2050 is higher by 0.1% to 6.1% under RCP 4.5 and RCP 8.5.**
- **The framework can be applied to support decisions on investment and designs of hydropower infrastructure as well as fisheries conservation in the upstream of High Mountain Asia basins from Afghanistan through Bhutan.**

Use of climate information in Nepal Agriculture Management Information System



Climatic Hazards in Agriculture



- ❖ Drought
- ❖ Floods
- ❖ Landslides
- ❖ Windstorms
- ❖ Hailstorms
- ❖ Hot wave/ Cold wave

Blocked huge river
Bhotekoshi by recent
landslide

Bhotekoshi river





Agriculture Management Information System (AMIS)

Provide open data access for information and web portals



Build ICT assisted communication opportunities to strengthen the voice of the farmer on agricultural issues





Information Generation Modality (Institutional level)

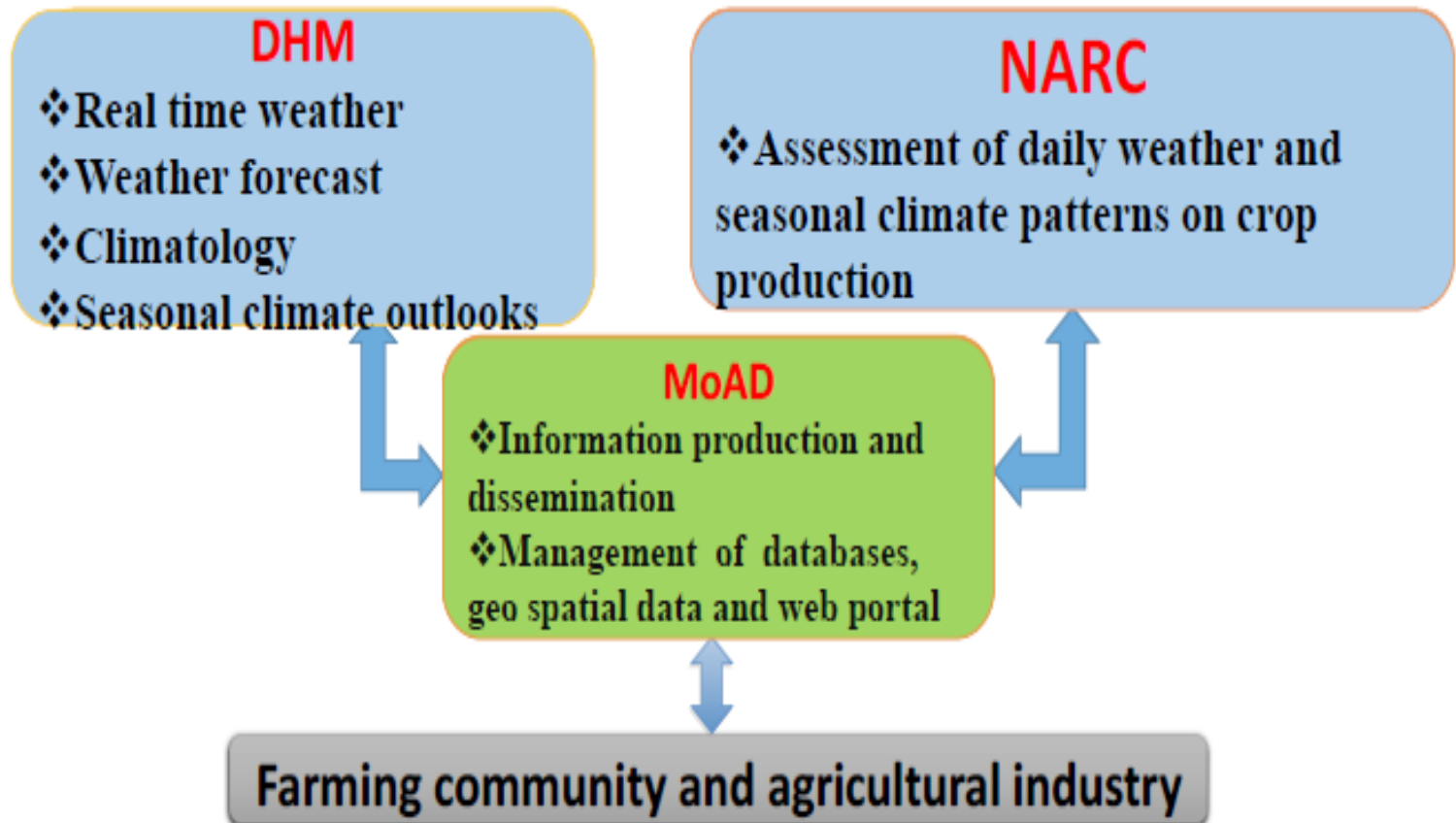
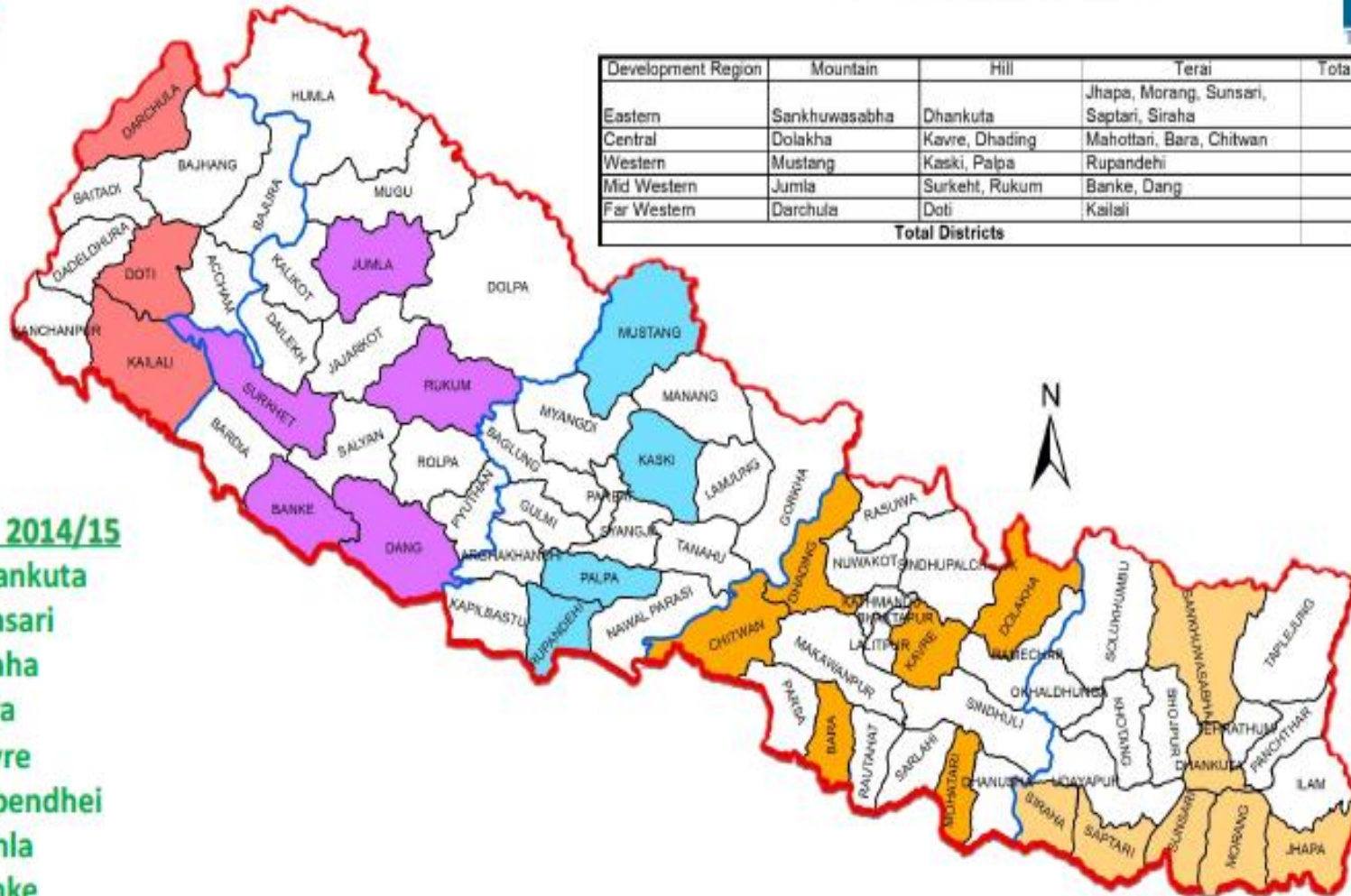


Figure: An integrated information system composed of the meteorological (DHM), agricultural research (NARC) & agricultural planning and extension (MoAD) institutions working together to develop and provide relevant weather & climate information to farmers in Nepal



AMIS Pilot Districts



Development Region	Mountain	Hill	Terai	Total Districts
Eastern	Sankhuwasabha	Dhankuta	Jhapa, Morang, Sunsari, Saptari, Siraha	7
Central	Dolakha	Kavre, Dhading	Mahottari, Bara, Chitwan	6
Western	Mustang	Kaski, Palpa	Rupandehi	4
Mid Western	Jumla	Surkeht, Rukum	Banke, Dang	5
Far Western	Darchula	Doti	Kailali	3
Total Districts				25

For FY 2014/15

1. Dhankuta
2. Sunsari
3. Siraha
4. Bara
5. Kavre
6. Rupendhehi
7. Jumla
8. Banke



AMIS Infrastructure

- Mobile (Smart Phone)
- Climate Smart Agriculture (Mobile Application)
- SIM Card
- Rain gauge
- Thermometer

Farmer
Community





Agromet Advisories(Products)



I. Agriculture Data Digitizing & Archiving

A satellite image based digital agriculture area map, Crop production parameters, Optimal crop advisory package

II. Weather & Climate Informed Agriculture Crop Map

III. Crop/Livestock Monitoring System

Seasonal cultivated area assessment, Crop growth assessment, Monitoring & assessment of natural disasters in agriculture, Livestock disease assessment)

IV. Climate Information Products

- ❖ ENSO based climatology-to detect expected rainfall and temperature during different phases including expected anomalies in rainfall & temperatures
- ❖ Seasonal climate projections
- ❖ Seasonal climate outlooks- highlighting expected climate for the season & potential impacts on crops



Agromet Advisories(Products)



V. Weather Information Products - depend on the availability of real time information from the proposed upgrading of the monitoring system.

➤ Study on “agriculture insurance” schemes and “risk transfer” instruments for Nepal

➤ Early Warning System for Drought & Floods

Early weather forecasts

Mostly used for tactical or operational decisions e.g **planting** when adequate soil moisture is present or forecast; **harvesting** before damaging rainfall, or hailstorms, **crop protection measures** when risk of pests is elevated; planning of perishable produce **transportation** to markets.

THANK YOU!

