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Climate Change & Health: vulnerability and adaptation assessment for Nepal

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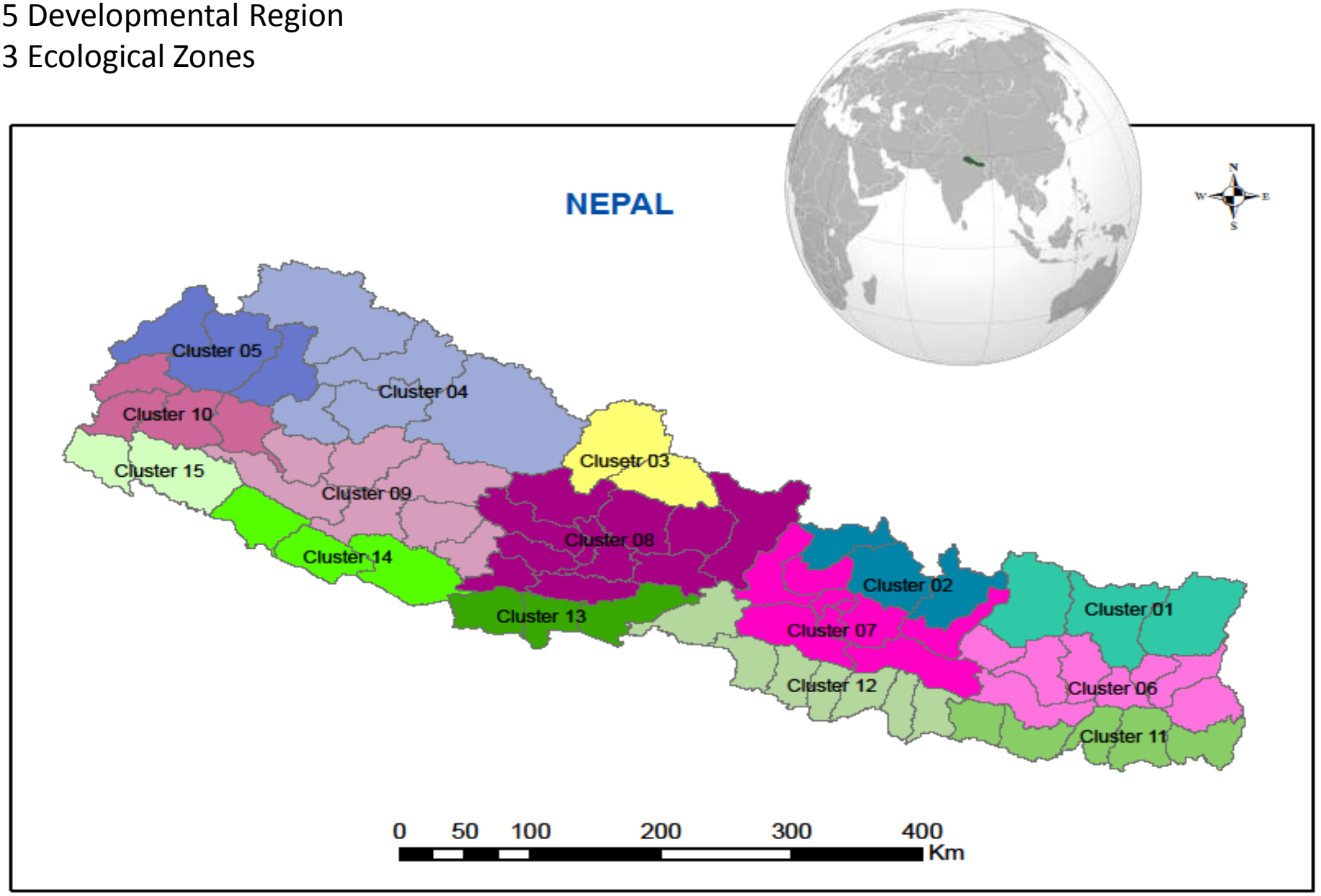
Population: 26,494,504
Density: 180/km^2
5 Developmental Region
3 Ecological Zones



Climate & Health Dynamics

- **Temperature Increase:**
  - Pathogens like bacteria favor warmer temperature
  - Favor parasites to grow in vector
- **Precipitation increase/extreme rainfall:**
  - Increase rainfall or snowmelt raises the risk of sewer overflows which might lead to water supply contamination
  - Runoff of human and animal excreta on soil and subsurface will increase, leading to higher concentrations of pathogens in surface waters
  - Increased precipitation causes turbulences and lead to sediment re-suspension, which disperse accumulated pathogens

Climate & Health Dynamics

- **Decreased precipitation/droughts:**
  - Decreased precipitation coupled to water scarcity limits dilution and , thus, increase the concentration level of pathogens in water and communities relying on these contaminated sources experiences increased outbreaks of water-borne diseases
  - Interrupted water availability contributes to poor hygiene - an important factor causing diarrhea
- **Humidity:**
  - Least evidences with unclear mechanisms
  - Plays role in survival and dissemination of viruses
  - Rotavirus can be aerosolized and exits and the respiratory route has been suggested as an additional pathway (Bishop, 1996; D'souza et al., 2008; Hashizume et al., 2008; Levy et al., 2009)

Objective

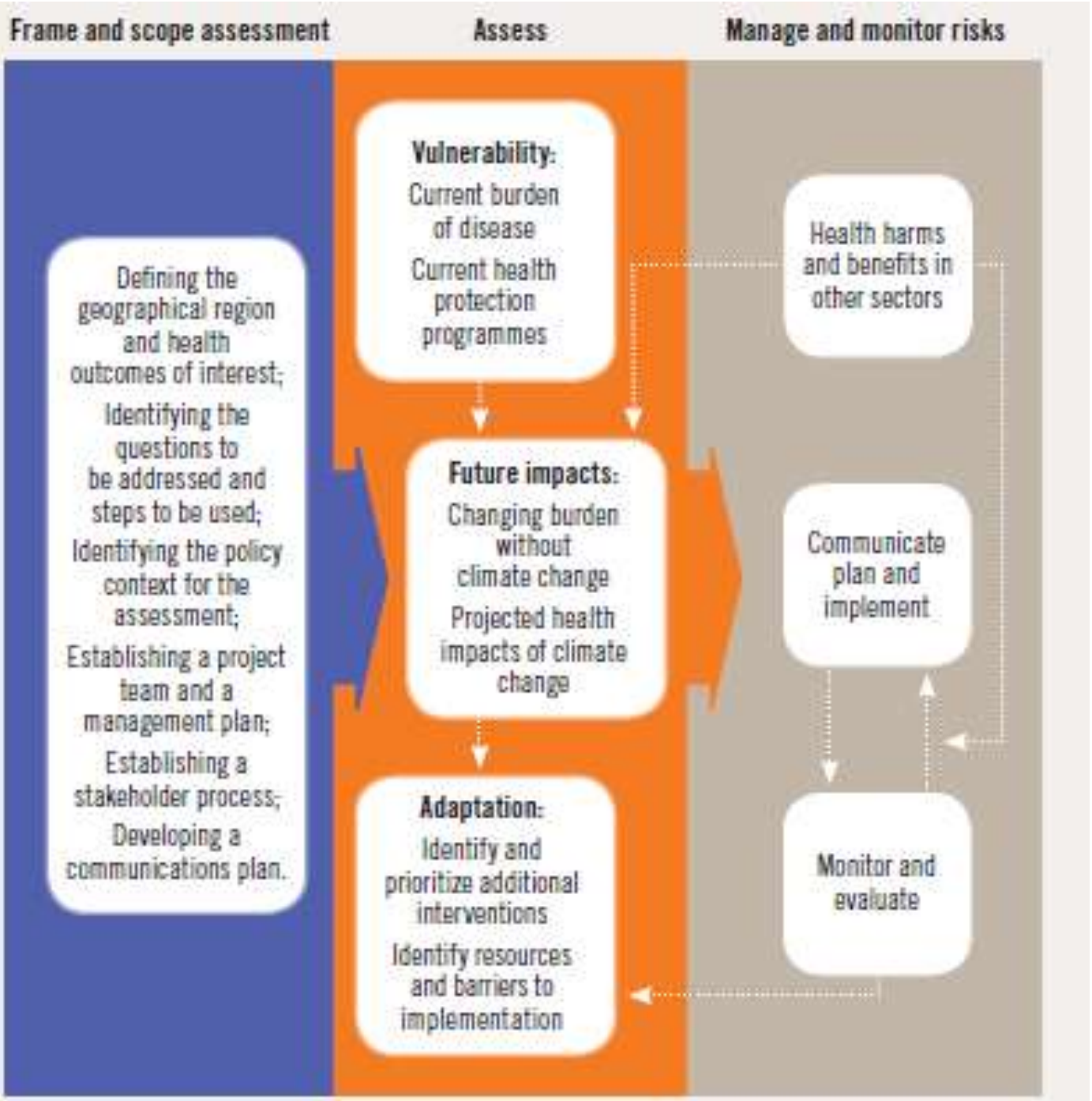
- To conduct vulnerability and adaptation assessment as evidence on how climate variability and climate change affects the health that will help to develop Nepal's Country Strategy for protecting health from climate change.

Methodology

- Followed WHO (PAHO) guidance:
- **2.2 Conducting the vulnerability and adaptation assessment**
  - 2.2.1 Establish baseline conditions by describing the human health risks of current climate variability and recent climate change, and the public health policies and programs to address the risks
  - 2.2.2 Describe current risks of climate-sensitive health outcomes, including the most vulnerable populations and regions
    - *2.2.2.1 Identify vulnerable populations and regions*
    - *2.2.2.2 Describe risk distribution using spatial*

Methodology

- 2.2.3 Analyse the relationships between current and past weather/climate conditions and health outcomes
- 2.2.4 Identify trends in climate change-related exposures
- 2.2.5 Take account of interactions between environmental and socioeconomic determinants of health
- 2.2.6 Describe the current capacity of health and other sectors to manage the risks of climate-sensitive health outcomes
  - *2.2.6.1 Considering health system adaptive capacity and resilience*


Frame and scope assessment
Assess
Manage and monitor risks
Defining the geographical region and health outcomes of interest;
Identifying the questions to be addressed and steps to be used;
Identifying the policy context for the assessment;
Establishing a project team and a management plan;
Establishing a stakeholder process;
Developing a communications plan.
Vulnerability:
Current burden of disease
Current health protection programmes
Future impacts:
Changing burden without climate change
Projected health impacts of climate change
Adaptation:
Identify and prioritize additional interventions
Identify resources and barriers to implementation
Health harms and benefits in other sectors
Communicate plan and implement
Monitor and evaluate

Steps in Vulnerability and Adaptation Assessment

- Determine the scope of the assessment
  - Communicable diseases (diarrhoea, vector borne disease)
  - Food and water security, malnutrition
  - Effects of extreme events (floods, heatwaves)
  - Assess vulnerable populations
- Identify the burden of climate sensitive diseases
- Evaluate current strategies, policies, and measures to reduce these (adaptation baseline)

Diseases and socio-economic status

- Incidence of diarrheal diseases and ARI are in increasing trend
- Malnutrition still remains a major problem
- Trend of child mortality is decreasing except for neonatal mortality
- Larger population of mid and far western region are without education
- Significant gain in poverty reduction

Vulnerability

Cluster region	Mean	SD	Cluster region	Mean	SD
ME	0.63	0.06	HMW	0.55	0.20
MC	0.55	0.06	HFW	0.50	0.35
MW	0.76	0.16	TE	0.68	0.23
MMW	0.56	0.31	TC	0.25	0.17
MFW	0.71	0.20	TW	0.61	0.12
HE	0.51	0.21	TMW	0.73	0.23
HC	0.59	0.13	TFW	0.47	0.39
HW	0.48	0.21	**Country**	**0.57**	**0.20**

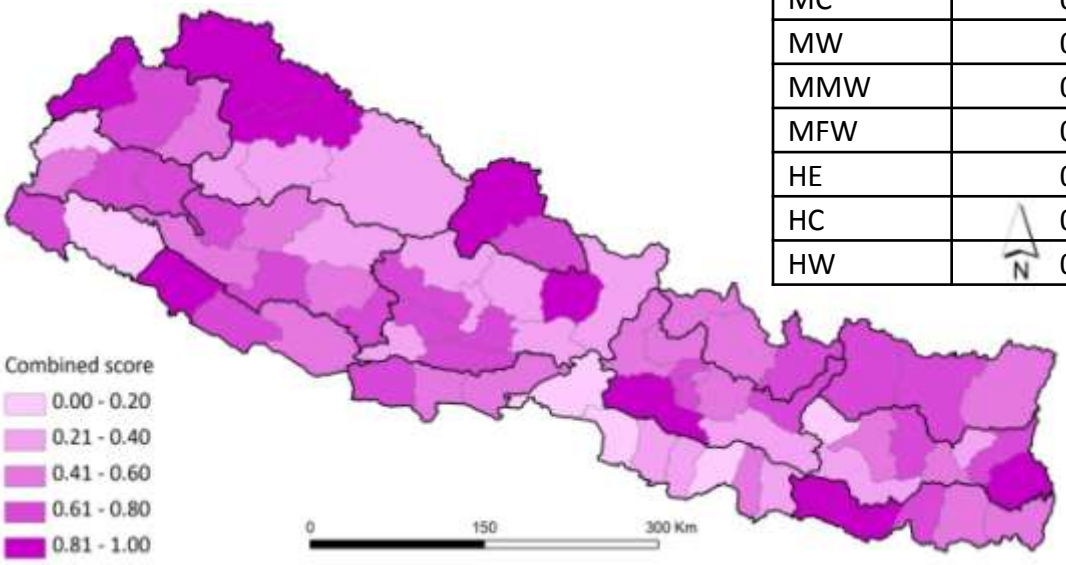


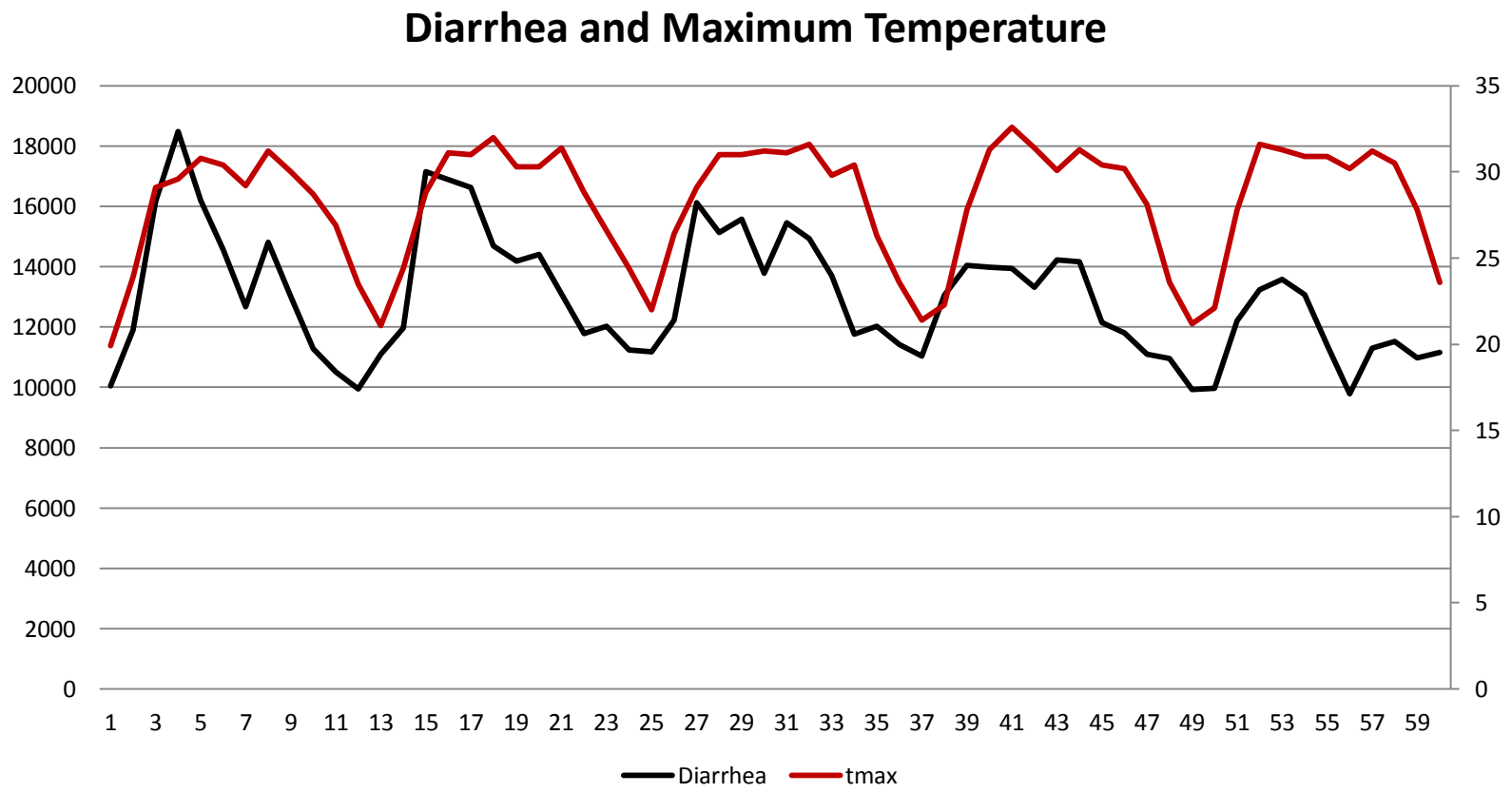
Figure : Spatial distribution of aggregate vulnerable values by district, Nepal

- There are 38 districts above the mean value, signifying more vulnerable and the rest 37 districts are less vulnerable.

- In terms of score, Rupandehi (WT) with 0.63 is the highest vulnerable district, which is followed by two districts such as Dang (MWT) and Kailali (FWT) with score 0.61.

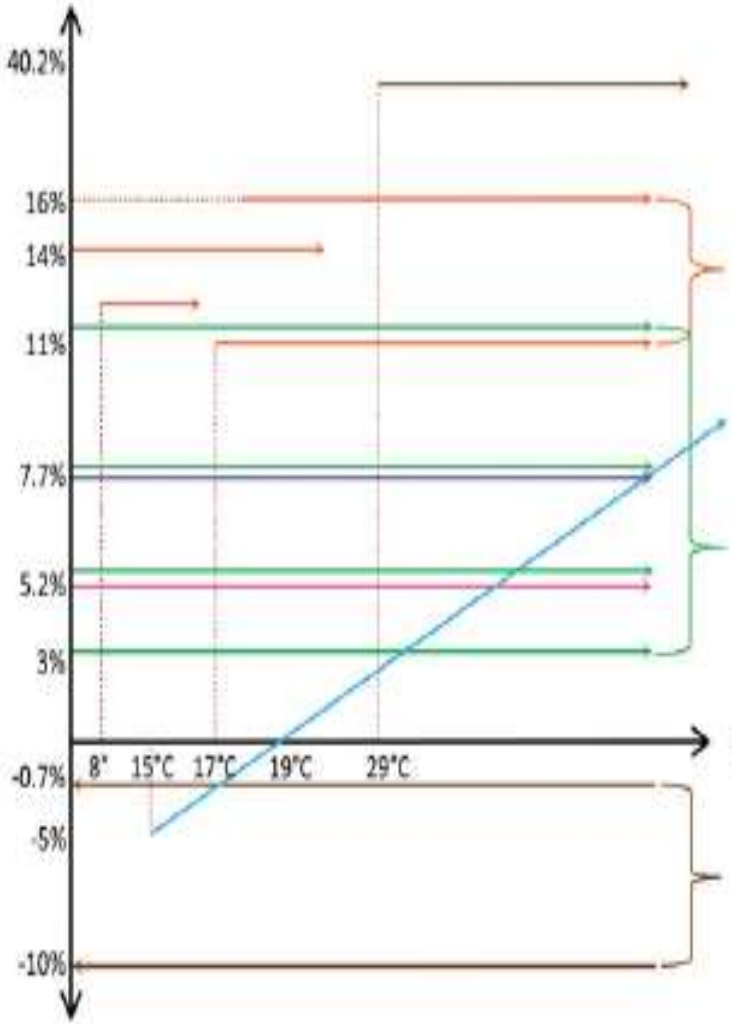
- It means the Tarai districts are relatively more vulnerable to health. Lalitpur (CH) with 0.11 is the least vulnerable district.

Relationship between climate change and health outcome



A) Temperature increase

Change in diarrhoea incidences in % per 1 degree change in temperature



For every increase of 1 °C above 29 °C, a 40.2% increase in incidences (d)

In one Chinese city, a 1°C rise in maximum temperature led to a 16% increase in incidences, while a 1 °C rise in minimum temperature led to a 14% increase. In another city, a 1 °C rise in maximum temperature (17 °C) led to an 11% increase, while a 1 °C increase in minimum temperature (8 °C) led to a 12% increase (j)

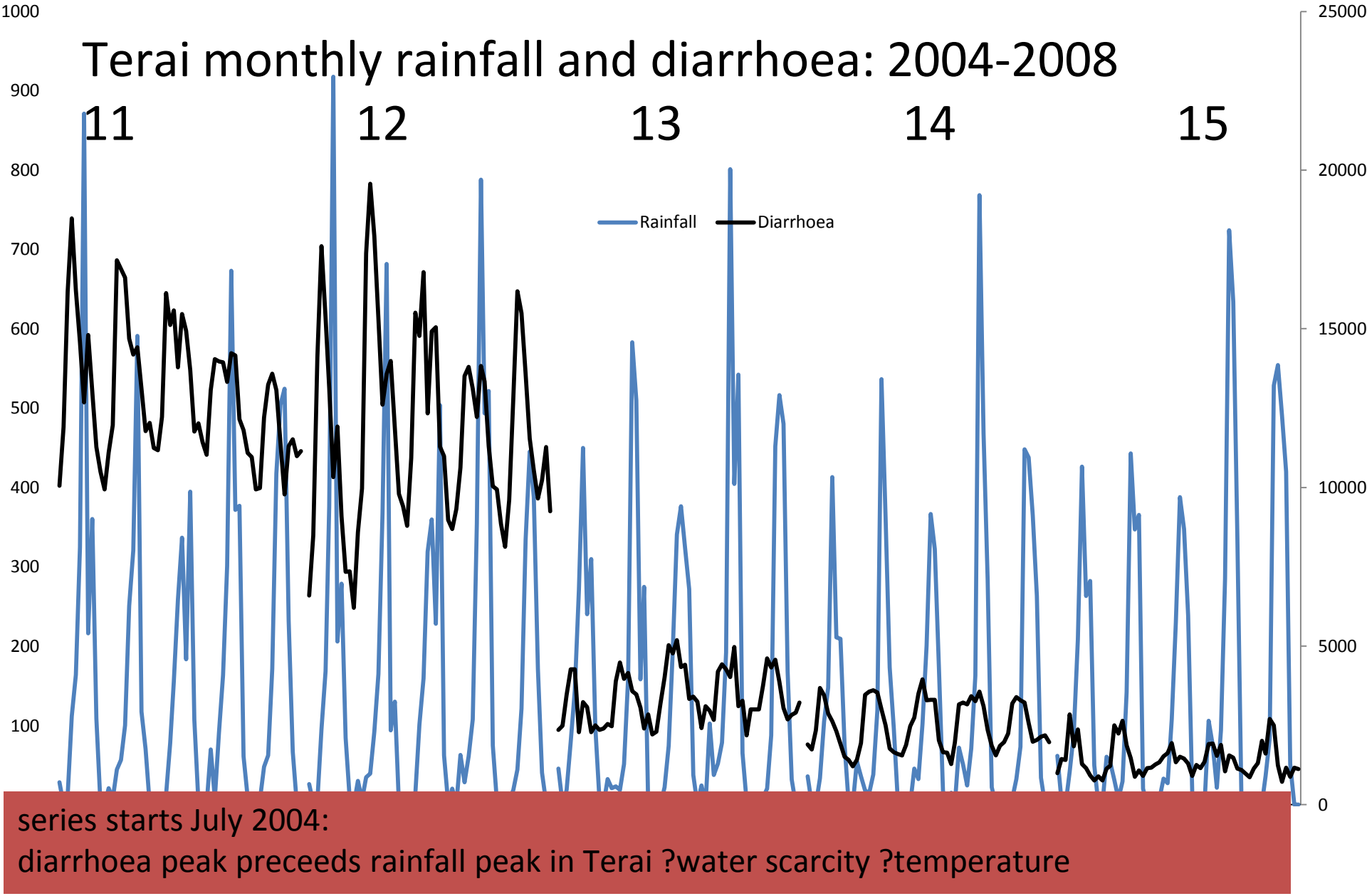
Nonlinear relationship: increase of 1 °C below the threshold of 19 °C decreases incidence rates, but 1 °C above 19 °C increases them (e)

For every increase of 1 °C an increase of 7.7% (i)

For every increase of 1°C, an increase of 3% (a); 5.6% (b); 8% (c), 11.3% (k)

An increase of 1 °C six weeks before onset of the outbreak explained a 5.2% increase in incidences (n)

For every increase of 1°C, a decrease of 1.3% [0.7%-2.2%, differs per climate region] (g); 2% - 5% [differs per city] (f); 10% (h)



series starts July 2004:
diarrhoea peak preceeds rainfall peak in Terai ?water scarcity ?temperature

Conclusion

- Magnitude of the health problem and climate pattern assessed
  - Some diseases are in increasing trend while others are not in decreasing trend
  - Climate is changing
- Vulnerability assessment
  - Many areas and population are vulnerable
- Relationship between climate and disease
  - It exists

Recommendations

Exposure	Health issue	Health Impact/CC effect	Ability to affect outcome by public health adaptation?	Policy recommendations
1. Water supplies, quantity and quality threatened by changing rainfall patterns, glacial melting	Water borne diseases	+++/++	+++Improve water supply, treatment, sanitation Strengthen surveillance, integrated water resource management, WSP	Water quality enforcement, integrate testing with climate forecasts, Vector control in water tanks, EWS, Climate resilient technology Ecosan, Biogas ?focus on sanitation (public health expertise)

Exposure	Health issue	Health Impact/ CC effect	Ability to affect outcome by public health adaptation?	Policy recommendations
2. Progressive temperature increase	Communicable disease (VBD, foodborne)	+++/+++	Surveillance Food safety	Regulation: veterinary, urban standards (standing water/vector breeding sites) Training, awareness

Exposure	Health issue	Health Impact/CC effect	Ability to affect outcome by public health adaptation?	Policy recommendations
3.Heatwave/ coldwave, air pollution	Heatstroke, heat stress Cardio-respiratory mortality, ARI, COAD Reduction in cold stress?	++/+++	Urban policies	Occupational standards, community awareness Co benefits (air pollution, transport, cooking fuel)

Exposure	Health issue	Health Impact/CC effect	Ability to affect outcome by public health adaptation?	Policy recommendations
4.Riverine floods, landslides, GLOF	Drowning, injury, population displacement	++/++	+ DRR/DRM + EWS, location of settlements, resettlement	Location of settlements, hazard mapping + forecasts/projections

Exposure	Health issue	Health Impact/CC effect	Ability to affect outcome by public health adaptation?	Policy recommendations
5.Drought/food security	Malnutrition, child mortality	++/+-	New crop/livestock location and methods General measures, targeted to vulnerable.	Land use, prioritise public health benefits (food/subsistence rather than urbanisation) Climate resilient crops Home gardening Food banking
Generic issues, ecological impacts				“mainstreaming of CC in public policy”

Adaptation Options

- Reactive Actions (rely on awareness)
  - Treatment of diarrhea by ORS is known
  - Adding zinc reduce the severity
  - Early and exclusive breastfeeding and Vit A supplementation reduce risk of severe diarrhea

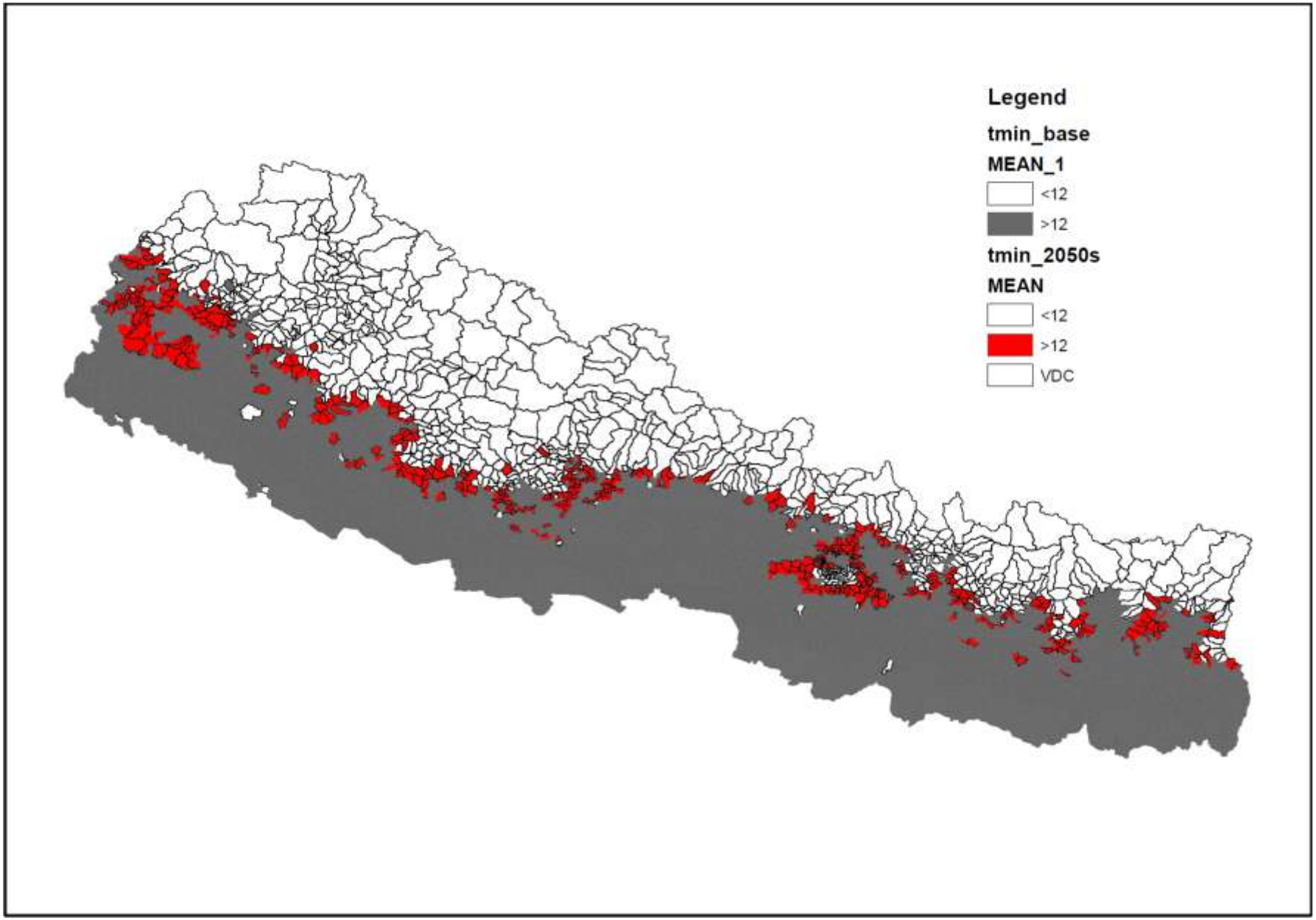
Ref: Eddy Moors et al: climate change and water borne diarrhea in northern India: impacts and adaptation strategies

- Preventive actions:
  - Hand washing with soap, improving water quality and safe excreta disposal
  - Rotavirus vaccination

- Policy choices:
  - NAPA enlist specific mission targeting human health

Future impacts

- Projected future health impacts of climate change (analysis is in process)
  - Qualitative methods
  - Quantitative methods



Malaria risk area will be increased

Challenges

- We know from IPCC report that:
  - Effective adaptation planning requires reliable and high quality data
  - And stakeholder engagement

Health Data

- Underestimation of diseases due to less access and unavailability of services
- Poor quality of health data
- Old data stored in different format
- Difficulties accessing the data

Data analysis

- Lack of experts at local level to analyze the quantitative and qualitative data and run modeling

Stakeholder engagement

- Lack of interest due to less knowledge on the impact of climate change
- Lack of fund to include all stakeholders
- Lack of interest at higher level - wait for many years to get the desired outcome

Further

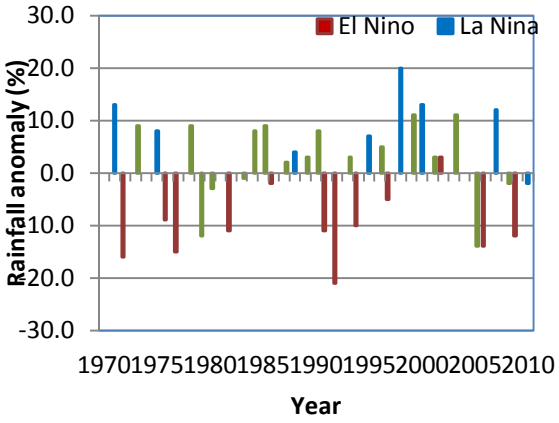
- Draft final report is in the process
  - Along with DLN Modeling
  - Analysis of temperature and daily mortality
- MoHP Strategic working group will meet and discuss on the recommendations
- Stakeholders meeting
- Development of draft strategy
- Strategy Finalization workshop

Acknowledgement

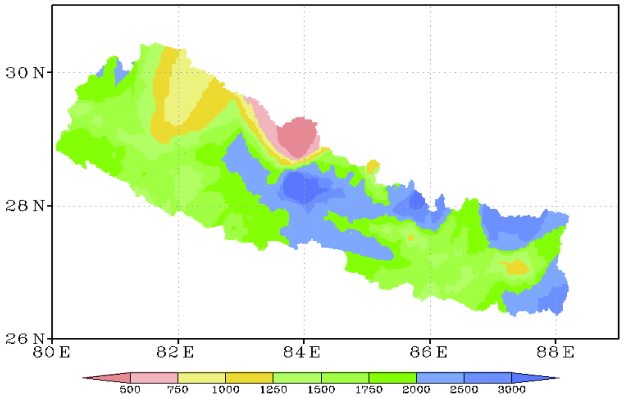
- MoHP
- WHO
- Dr. Simon Hales
- Consultants
  - Gajananda Prakash Bhandari
  - L N Thakur
  - Bandana Pradhan
  - Rupak Rajbhandari
  - Dhruba Gautam

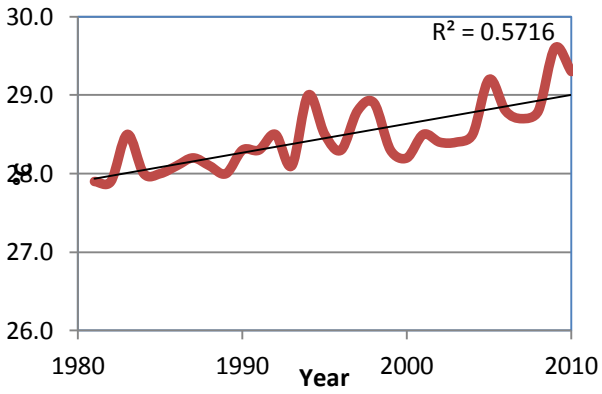
Thank you

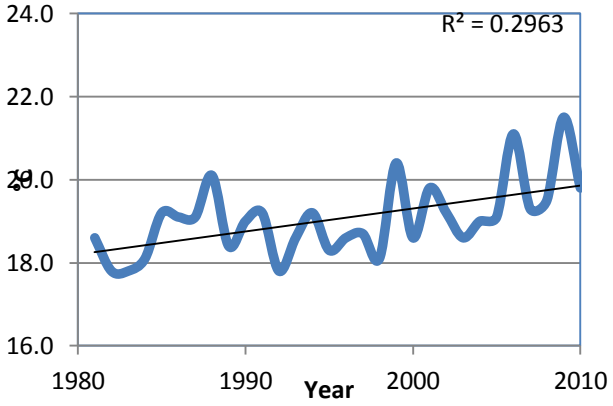
Recent climate trends in Nepal



Average distribution of annual rainfall



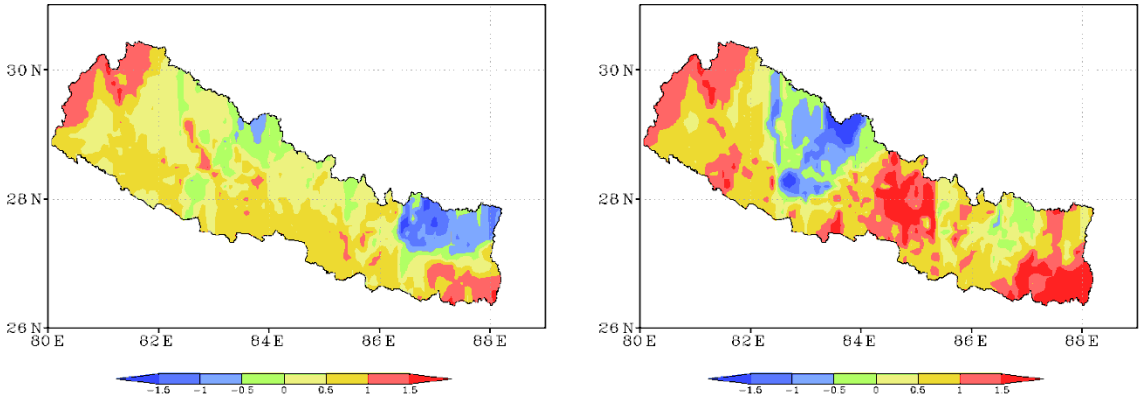




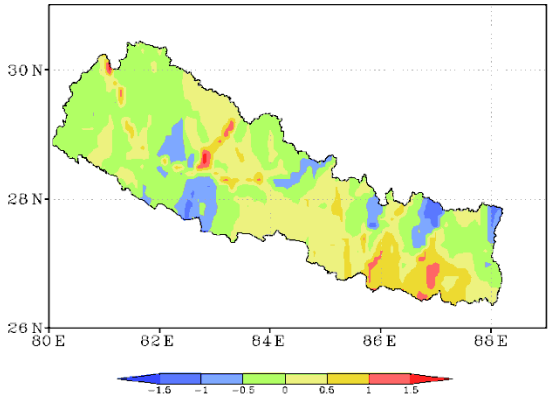
Variation in Maximum and Minimum T

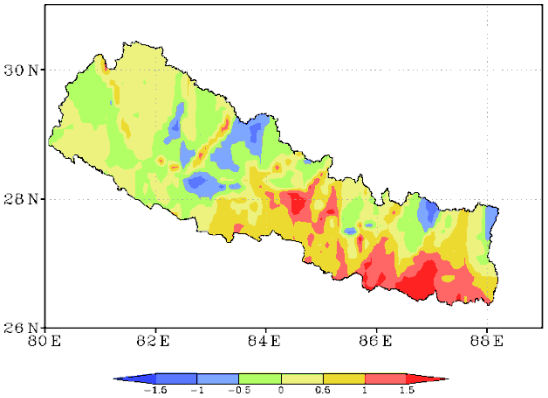
Trend in Climate Change in Nepal

Changes in maximum temperature from baseline period of 1981-1990
1991-2000 and 2001-2010.



Minimum Temperature

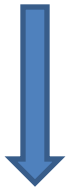




Extreme Events – Heat Waves

Year	Events (no.)	Deaths (no.)	Injured (no.)	Affected (no.)
2001	0	0	0	0
2002	1	1	0	0
2003	2	3	0	0
2004	3	2	0	0
2005	1	1	0	0
2006	3	1	8	0
2007	2	1	0	160
2008	0	0	0	0
2009	6	9	0	100
2010	7	7	0	20
Grand Total	**25**	**25**	**8**	**280**

Impact of Heat Waves 2001-2010



Health Impact

- **Increase in vector-borne diseases**
- **Heat stroke**
- **Hyperthermia**
- **Eye-related diseases**
- **Water-borne communicable diseases**
- **Mental health problems**