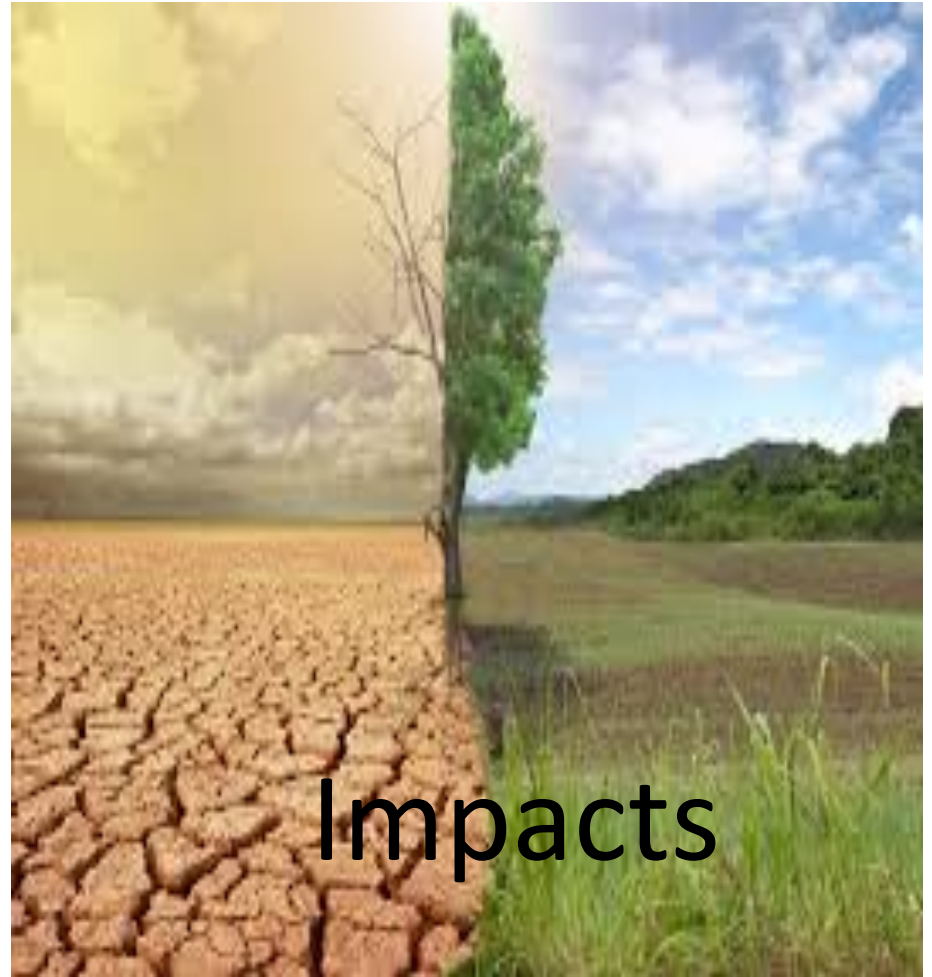


Welcome



Climate change, water resources and agriculture in Nepal

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Nepal Agriculture Research Council , Kathmandu

17-19 October, 2017

Kathmandu, Nepal

(Hotel Himalaya, Kupandol)

Presentation Layout

1. Background
2. Major Problems Associated with Global Climate Change
3. Climate change, water resource and agriculture: Physiographic
4. Land Utilization and Water resources in Nepal
5. Climate Change in the context of Nepalese Farming System
6. Climate change water Resources and Adaptation
7. Water Climate Change and Adaptation to Agriculture
8. Climate Change related Video
9. Climate Change, Mitigation and Adaptation in Agriculture
10. Climate Change concerns Agriculture: Policies
(A Brief History of the Climate Change Concerns): Nepal
11. Institutional Arrangements in Nepal
12. Policy Documents Developed by Nepal
13. Project focusing to addressing the Climate Change Adaptations
14. Way forward
15. Conclusion

Some Picture related CCA.

1. Background

- Agriculture supports the livelihood of the Nepalese people
- Farming system is open and depends of the rain occurred in the country
- Despite of rich in water resources, the use of water to grow agricultural crop and animal farming is difficult (due to difficult terrine)
- In the change context of climate , water resource are getting disappear eg spring, ponds etc.
- Due to the impact of climate change, untimely monsoon, erratic rainfall, dryness, cold wave and flooding is affecting crop and livestock production in the country
- Government policies and plan are made and initiate to execute in the country.

Scientific Data base and Scaling up: Three Core Actions on CCA context

1. Generation of new technology on climate change: International Collaboration

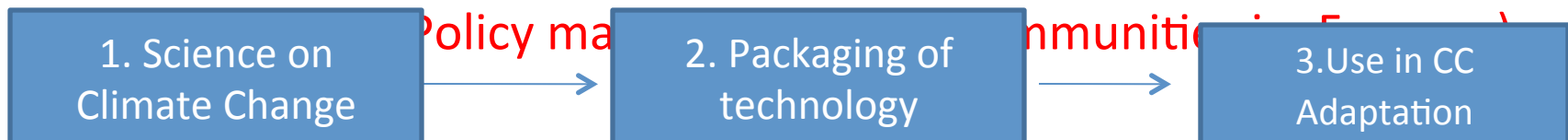
- Several organizations over the world are engaged in generating the database on climatic parameter such as Temperature and precipitations like TPE-GHP, GEWEX and other similar organizations.

2. Packaging of generated technology (for scaling up):

- The generated information should be scaled up to the agricultural farming communities so that user can adapt the new technology in the change context of climate.

3. Use of the technology by the users (farming communities):

- Use of technology to (1) mitigate the Impact of climate Change, and (2) Adaptation to increase the agriculture production

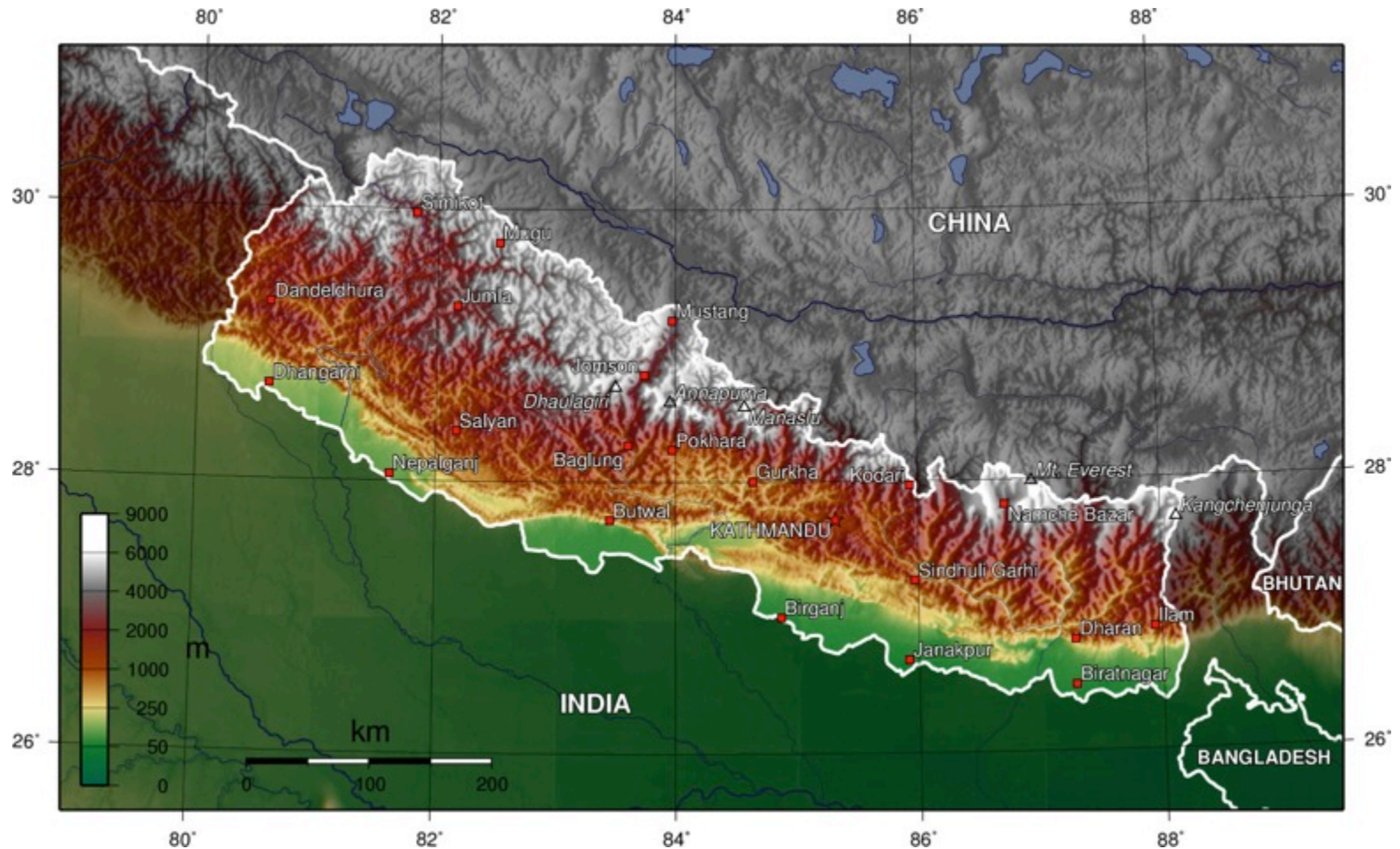


Major Problems Associated with Global Climate Change (Issues)

- Changes in rainfall patterns increase the threat of drought & floods in many regions.
- Melting glaciers & thermal expansion of sea water may raise sea levels, threatening low-lying coastal areas.
- Climate & agricultural zones may shift towards the poles, which would result in reduced crop yields and livestock production.
- The International and national conventions recognizes that climate change has the potential to produce “dramatic negative impacts on human health, food security, economic activity, water resources and physical infrastructure

Climate change, water resource and agriculture:

Physiographic

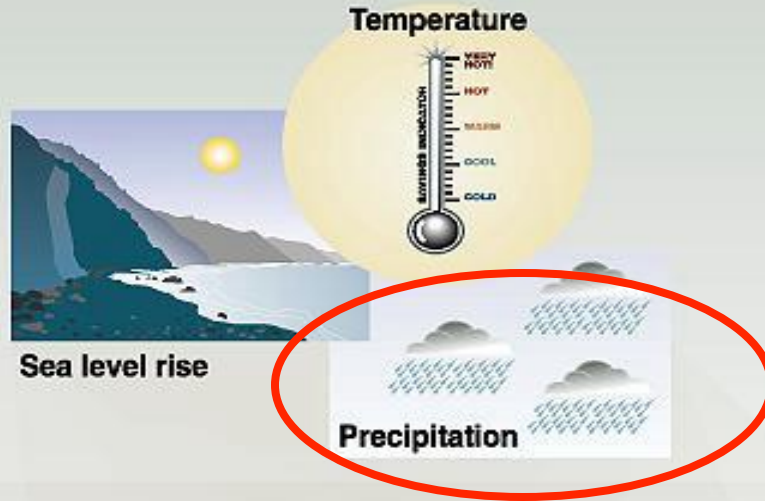


Land Utilization and Water resources in Nepal

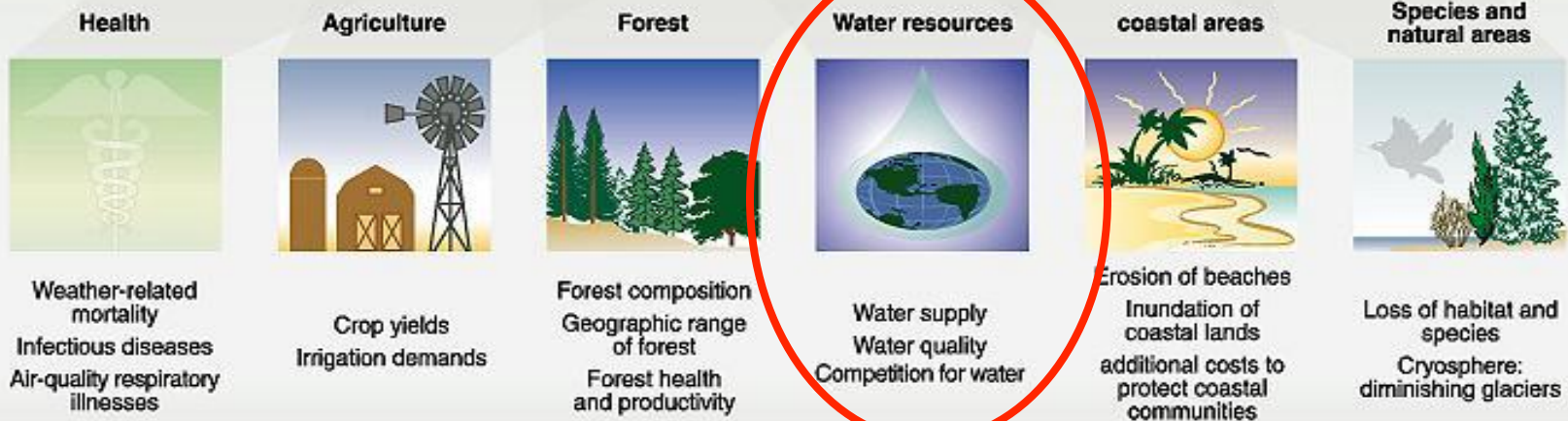
Area	Land Area (000hectare)
1.Cultivated Land	3,091
2.Uncultivated but can be cultivated	1,030
3.Forest and Shrubs	5,828
4.Pasture land	1,766
5Water	382
6 Other	2,620
Total	1,47,181

2.1. Climate Change and Water

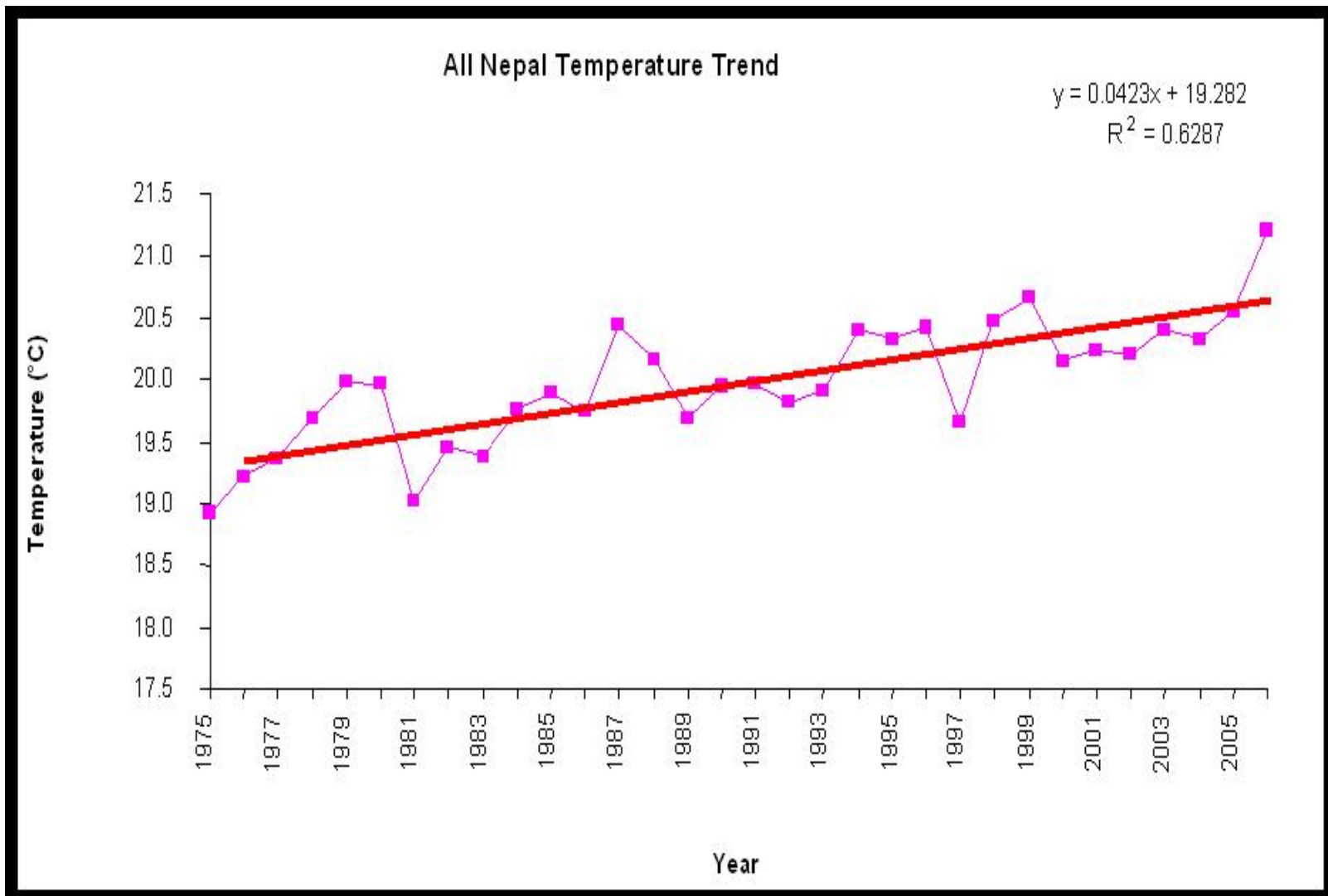
Potential climate changes impact



Impacts on...



2.2 Temperature: Temperature change 1975-2005



Regional mean temperature change trends for the period 1977-94 ($^{\circ}\text{C}/\text{yr}$) in Nepal

Regions	Seasons				Annual Degree C/ year Changed
	W Winter	PrM Pre -Winter	M Monsoon	PoM Post- Monsoon	
Trans-Himalaya	0.12	0.01	0.11	0.10	0.09
Himalaya	0.09	0.05	0.06	0.08	0.06
Middle Mountain	0.06	0.05	0.06	0.09	0.08
Siwaliks	0.02	0.01	0.02	0.08	0.04
Terai	0.01	0.00	0.01	0.07	0.04
All Nepal	0.06	0.03	0.05	0.08	0.06

2. 2. Water Resources in Nepal

1. Precipitations (Rainfall):

- Decreasing, erratic and untimely.

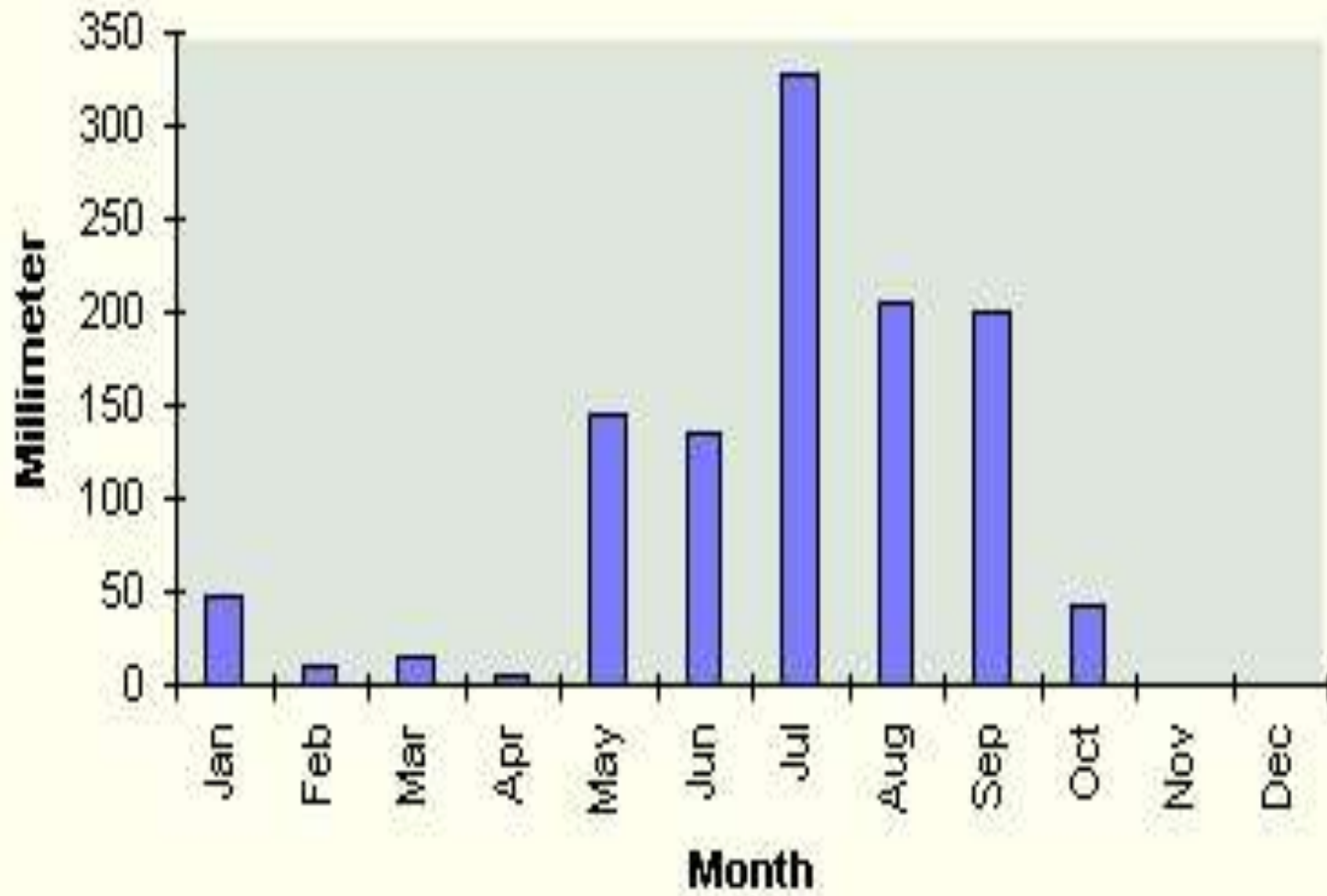
2. Rivers:

- Snow melting and monsoon based
- Summer run off is high

3. Ground water:

- **Water level decreasing**: Urbanization (Land sealed by concreting) : No water discharge to support the ground water level.

Rainfall in Nepal Annual



2.Rivers as water resources of Nepal

Water management

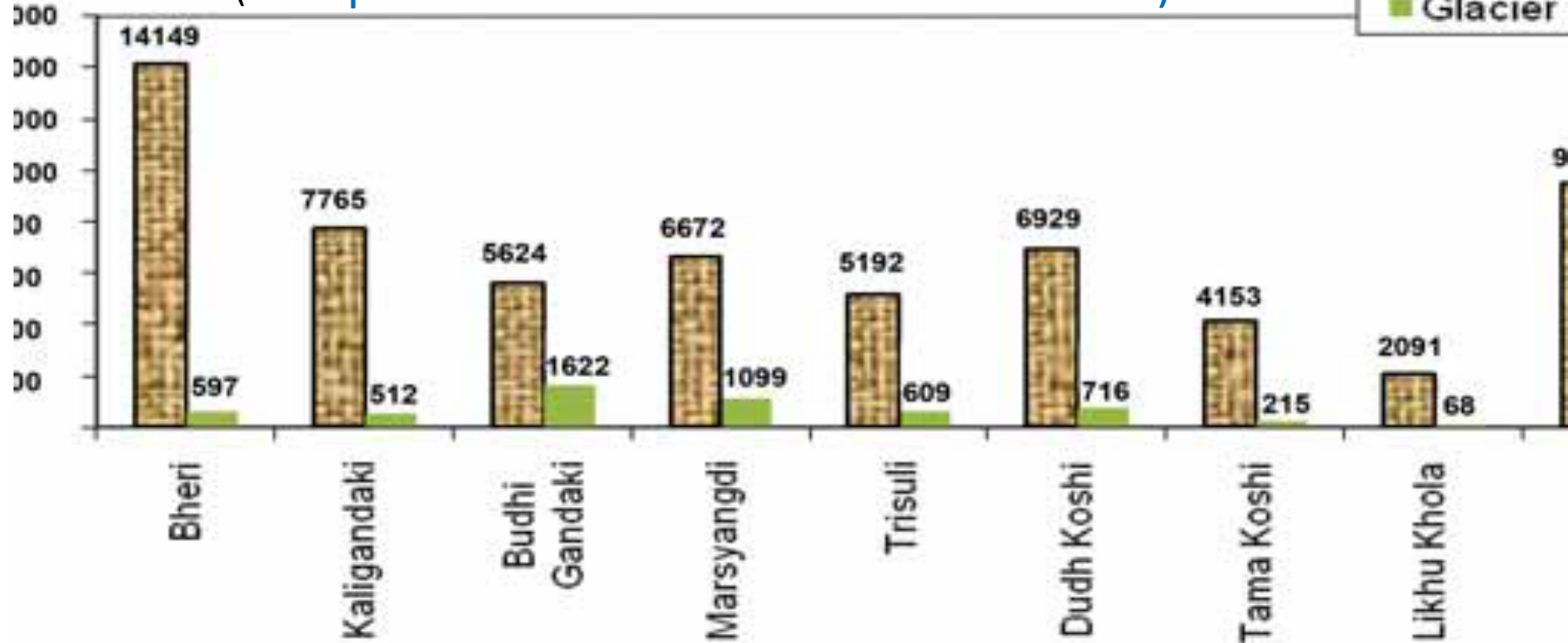
- Good coverage through out the country but needs water management for irrigation like Babai and Bagmati irrigations



- Major water sources for agricultural land irrigation

Comparative Streamflow Volumes. mcm

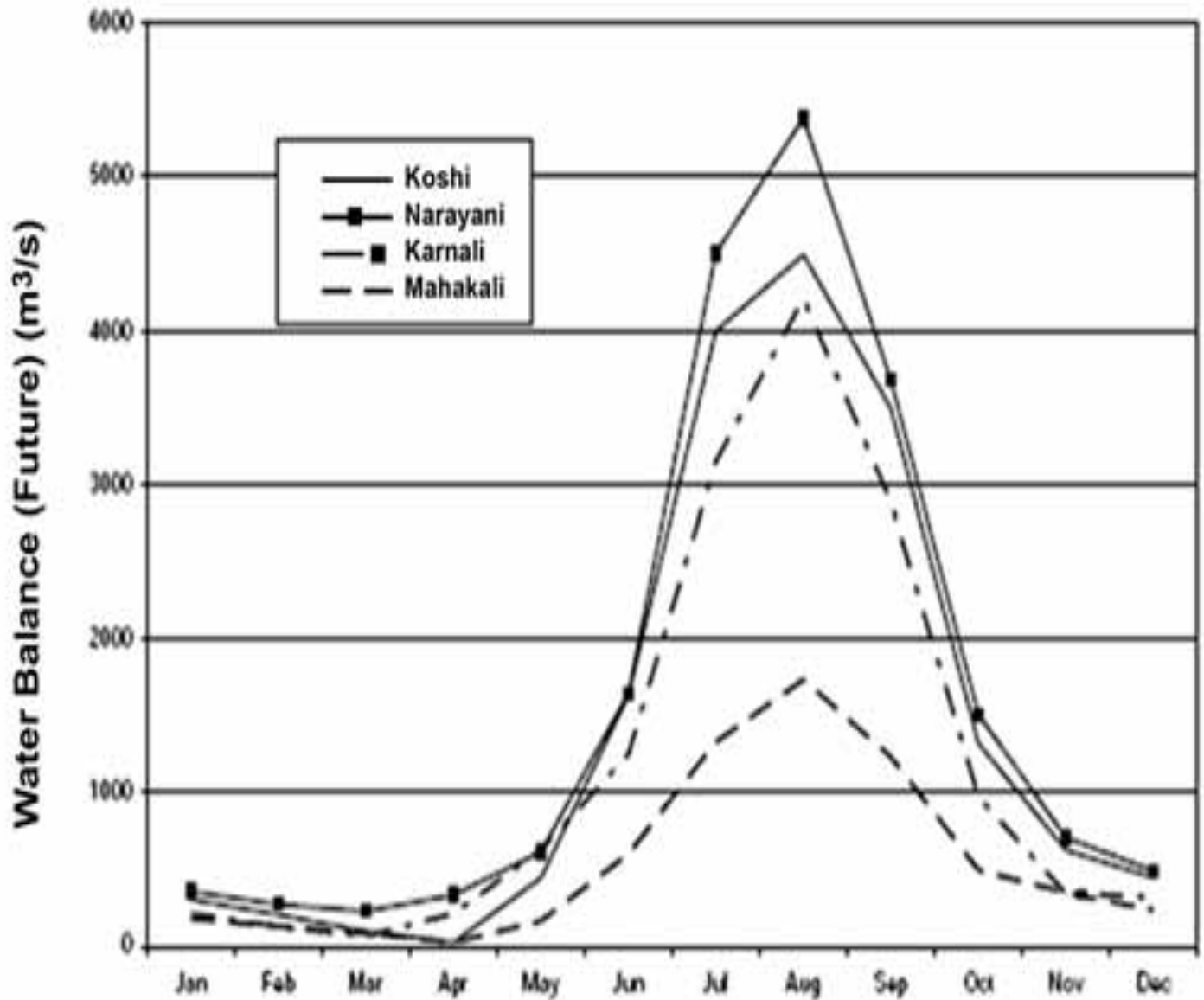
(Comparative Stream flow Volumes. MCM)



Less snow in th peak, less melting and less water for irrigation

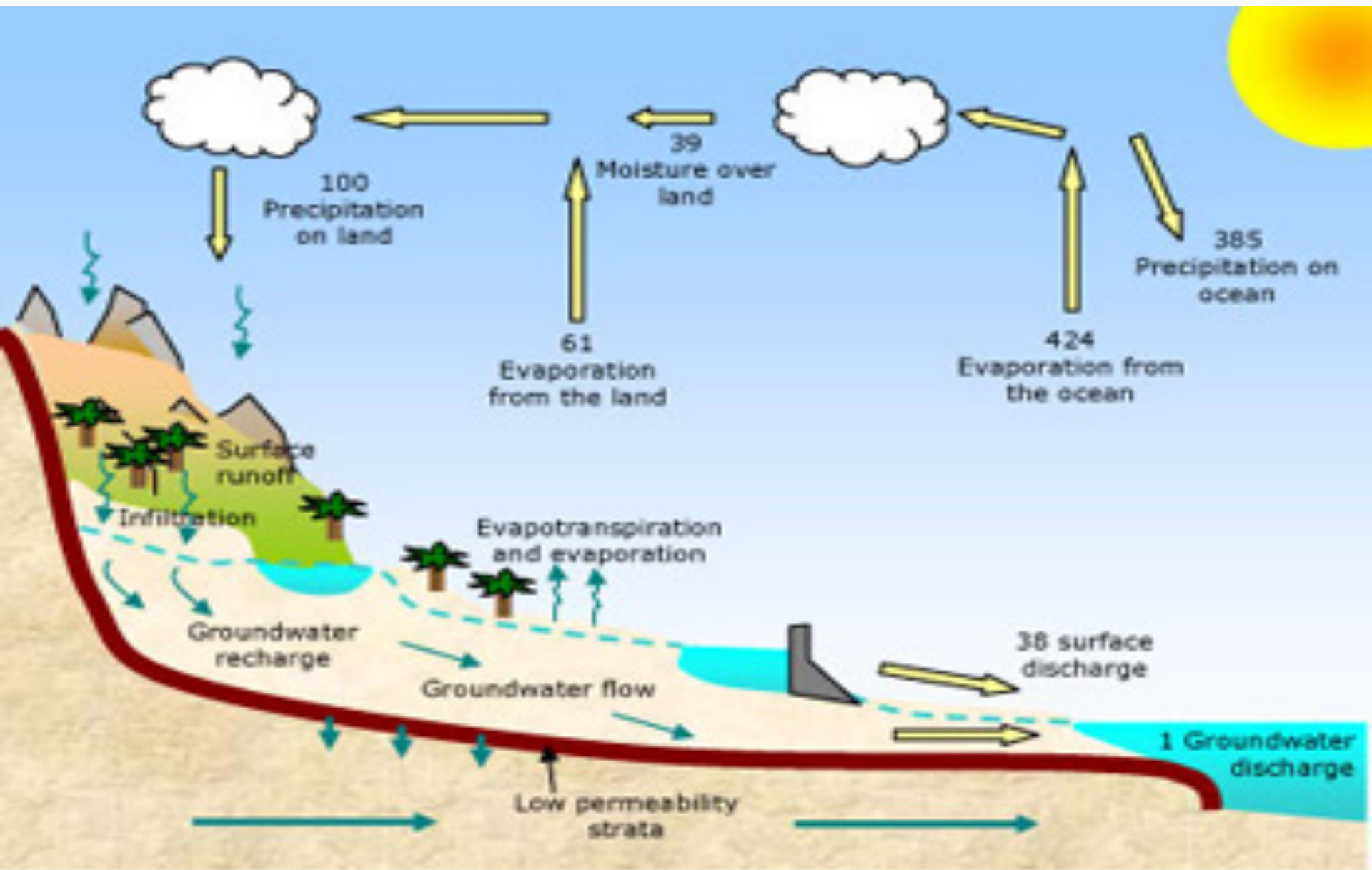
Annual Rainfall distribution

- July and August is having highest rain in the country
- Winter and spring season is dry
- Rainy season badly affects the crop due to flood/ dry



4. Impact of Climate change in water Resources

Hydrological Cycle and Water Budget



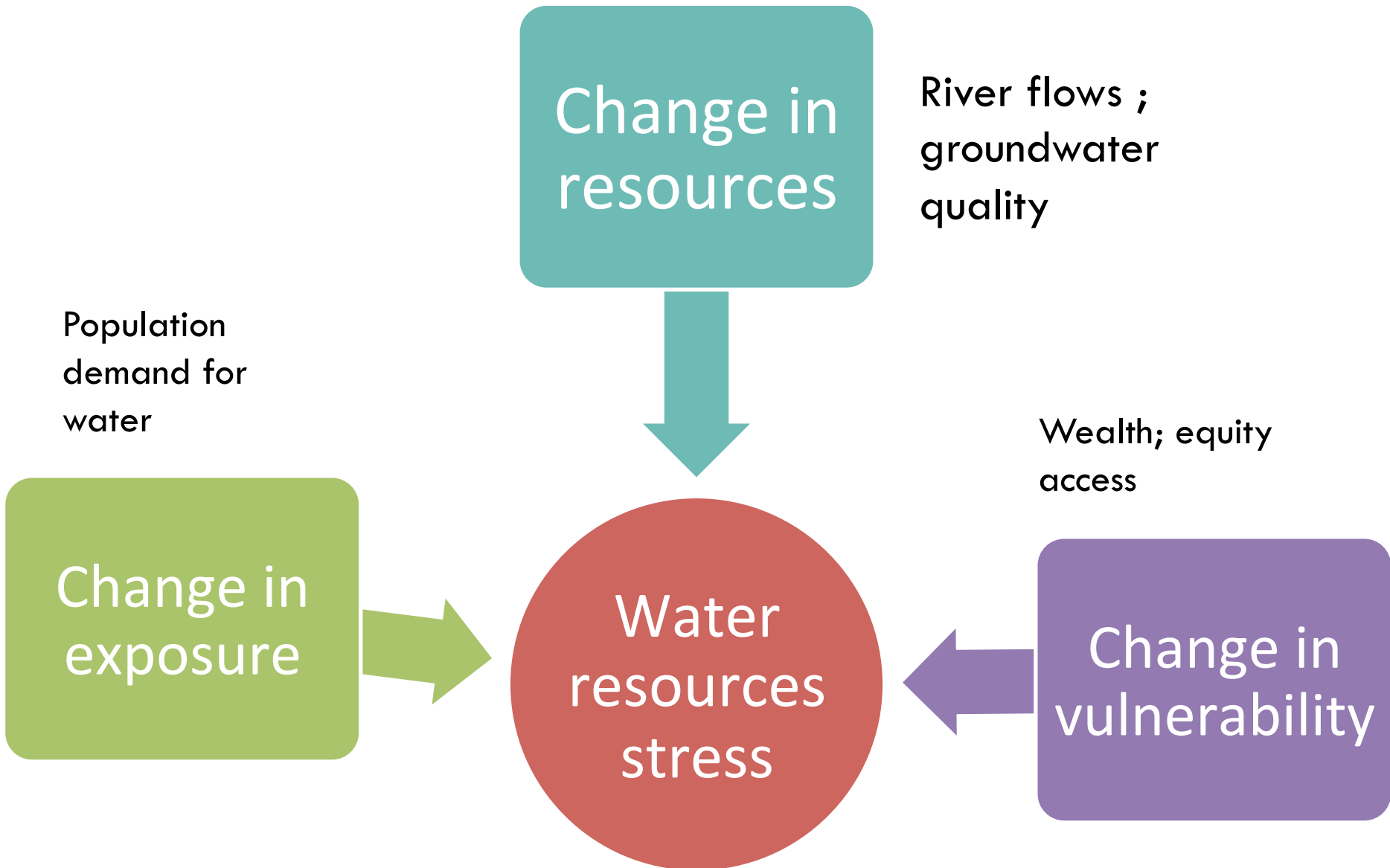
Impact of Climate change in water Resources and agriculture and life of the people



Climate change water Resources and Adaptation

- More/Less precipitation - but also more evaporation
- Changing precipitation patterns will affect how much water can be captured.
- The drier the climate, the more sensitive is the local hydrology.
- High-latitude regions may see more runoff due to greater precipitation and less land coverage.
- Reduced water supplies would place additional stress on people, agriculture, animals and the environment.
- Improved water resource management can help to reduce vulnerabilities that protect natural resources (Crop, Livestock and Fish and Forest)

Climate change and water Resources



Impact of Climate change and water availability human crisis if not managed timely: **For Agriculture ???**

Not enough even for drinking

Many are behind



Natwargad, India

Source: Google Search

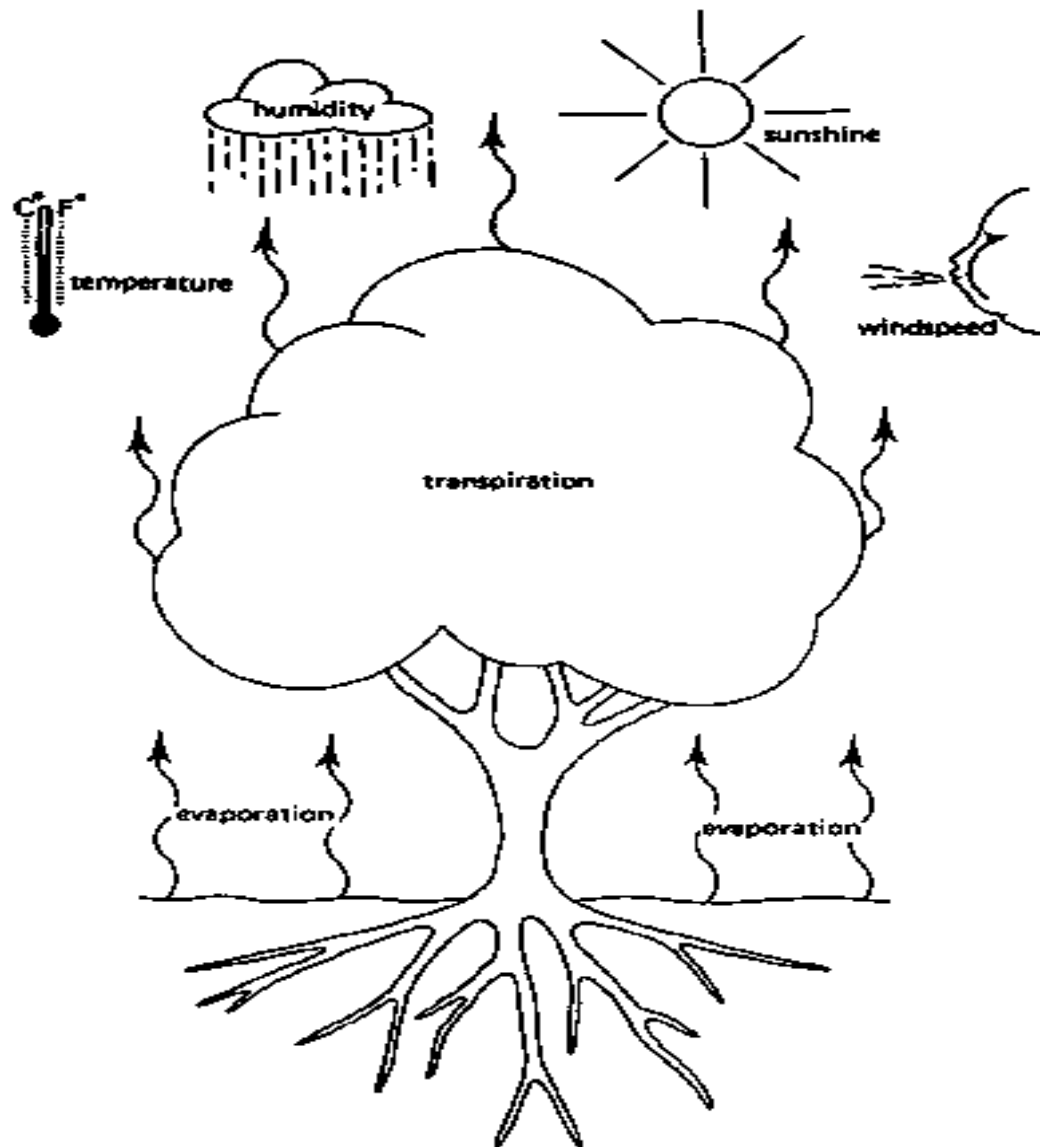
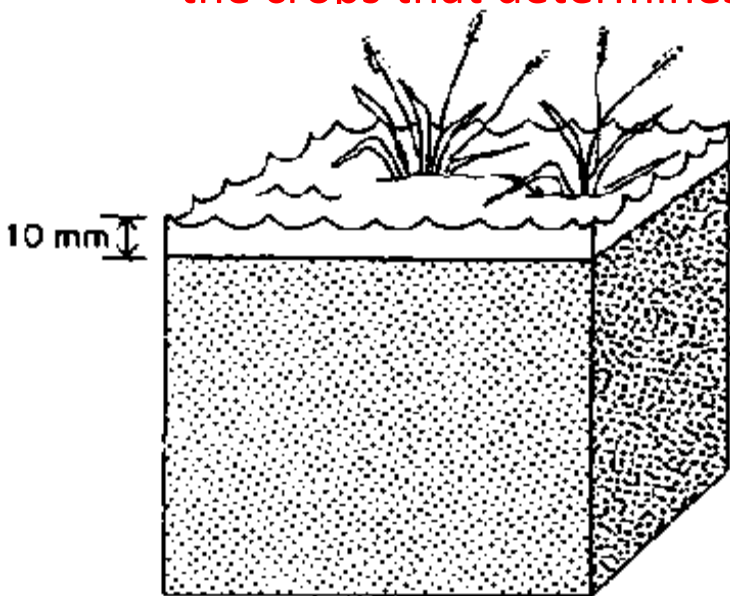
5. Water, Climate Change ,and Adaptation to Agriculture :

Possible Adaptation Measures

- Adaptation strategies in the water include
 - Water exploitation methods
 - Water storage methods +rain harvesting
 - Water management and planning
- Drip Irrigation mainly to horticulture crops.
- Rain Water Harvesting (Storage rain water harvesting system and Direct run-off harvesting system)
- Water Source Conservation and uses. A forestation, use of water as per the requirement of crops and livestock
- Use of **Temperature Humidity Index** (THI) mainly to the Animals to determine the water requirement
- Household-waste water utilization: **for kitchen garden**
- Installation of waste water treatment and sewer systems: **Urban area**

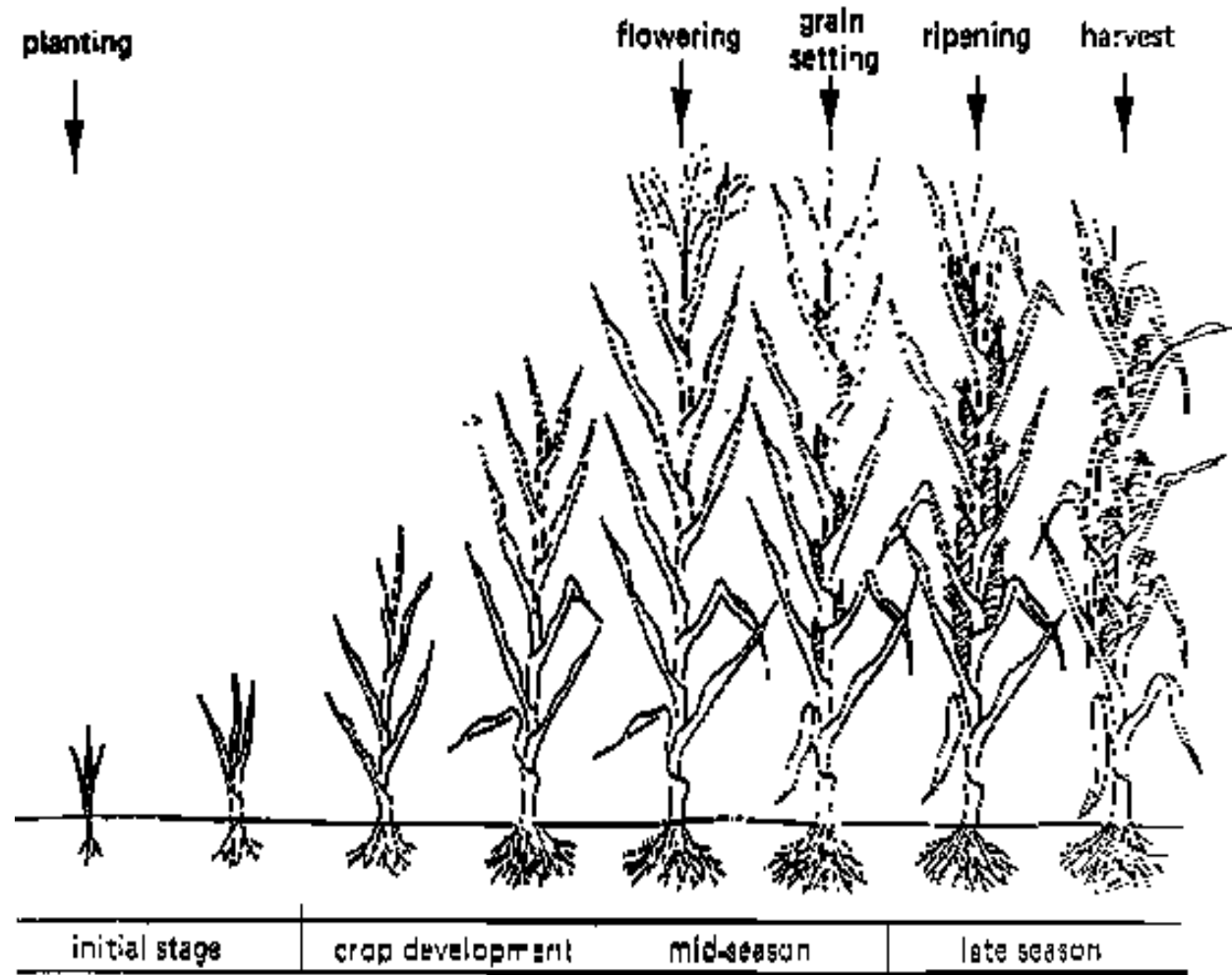
4. Create awareness on Crop and Water Requirement

Water budgeting
considering the root zone of
the crops that determines



Plant Growth stages and Water Requirement

- There are certain critical time where water is needed
- Drought causes the heavy losses in growth
- Drought and flood tolerant varieties have been developed by the Government of Nepal and been used promoting FAO CCA project.



Plant Growth stages and Water Requirement...

Consumptive Values of major crops of Nepal

- Following affects on the Consumptive value

1. Temperature
2. Method of irrigation
3. Length of plant (Maturity)
4. Rainfall (annual)
5. Relative Humidity
6. Wind speed
7. Sunshine hour
8. Growth stage of the plant
9. Types of plant
10. Leaves type (Broad, thin)

Efficient Use of Weather information including water availability in crop production considering the crop type and growth stages in the context of climate change Adaptation

Who generates???, Who Uses???

Scientist

Farmers

Daily water Consumptive flow/hectare

Use of water Consumptive	Equal water flow rate/h	
	Liter/Second	Qubc meter/day
2	0.23	20
3	0.35	30
4	0.46	40
5	0.58	50
6	0.69	60
7	0.81	70
8	0.92	80
9	1.04	90
10	1.15	100

Root Zone depth of some important crops

Crops	Average Root depth (CM)	Amount of Water consumed/day
1.Onion	60	
2.Potato	60	4-6
3.Wheat	60	4-6
4. Cauli Flower	60	4-6
5.Bean	90	4-6
6.Rape seed	105	
7.Maize	120	4-7
8. Rice	120	
9. Rape seed	120	
10 Cotton	120	5-8
11. Citrus	180	

6. Climate Change and Adaptation in Nepalese Agriculture Farming system

Nepalese Farming System

- Mixed farming system: **Cereal crops, Horticulture crops, Fodder crops, animal farming**
- Substance farming that **support the livelihood**
- Heading to commercialization: **Needs more water management**
- Inadequate inputs (water, improved seed, fertilizer and other inputs as pesticide, feed, vet drugs)
- Monsoon based farming system: **due to the lack of water management**
- Suffered by the climate change : **Plans are not effectively in use**

Farming system has been distorted by Climate Change

Difficult terrine do not support the irrigation

Cropping Seasons and Patterns: need of adjustment on need based intensifications

1. Cropping System

- (a) Rice – wheat- quick minor crops
- (b) Maize-Rice-wheat
- (c) Rice – Potato- Other quick minor short crops

Cropping system can be affected by the CC and water shortage

2. Cropping Seasons

- (a) Winter season: Suffers from waters shortage due to CC.
- (b) Spring season
- (c) Summer season

Note:

- With climate change, the cropping system has been getting changed:
- 1. water availability do not supports the requirement in the changed context: Needs capacity building to understand these issues by the Policy makers, Extension worker and farmers.
 - 2. Animal farming is getting affected due to the shortage of water

Climate Change, Mitigation and Adaptation in Agriculture

- Temperature have been increased by 0.04 degree in Terai and 0.08 degree Celsius in high mountain (0.6 degree Celsius).
- Monsoon has been erratic in the country with late or early onset and decreases in number of days.
- Too little or too much of rain is resulting in drought or flood resulting in sever losses in agricultural productivity.
- Number of rainy days with high intensity (>100 mm rain/day) has been increasing in recent past.
- Soil moisture availability has been reduced resulting in early maturing of crop, crop failure and reduction in productivity, Extreme fog conditions and cold wave in the Terai region in winter are affecting winter crops in the country

Efficient use of technologies developed by the scientist is prime important to fight with the Climate Change impact in agriculture

Adaptation technology in Agriculture considering CSA

Adaption of improved technology such as;

- **Multiple cropping:** Inter cropping, mixed cropping, sequential cropping, relay cropping, agro forestry, terrace cultivating in the hills conservation of agro biodiversity,

(in situ and community gene bank, integration of legume in cropping system and utilization of plant and **animal wastage** (crop residue, compost, FYM, Biogas slurry) in agriculture.

- The practices such as **organic and inorganic farming system**, farmers managed irrigation system, crop residue mulching, and indigenous knowledge should be promoted as a part of Climate Smart Agriculture (CSA).

Best Use of drought and flood resistant crop varieties and stress management

Adaptation Methods to climate change in Agriculture... contd

- Protect land from **deforestation and degradation**
- **Conservation of water resources** and efficient uses
- Use of suitable crop varieties, (1) drought tolerance (2) submergence and (3) disease tolerance varieties.
- **Development of high producing and CC adapting livestock breeds to support the livelihood and crop farming.**
- Capacity of human resources to generate and adapt the technology on CSA including livestock and fish.

- Protected land from **deforestation and degradation**
- **Conservation of water resources** and efficient uses are key issue in the recent farming system

Adaptation Methods to climate change in Agriculture... contd

- There is a **need of greater investment on research and development** with favorable policy and institutional mechanism to facilitate promotion of CSA to enhance food and nutritional security of the country.
- **Amalgamation of CSA with the reach indigenous knowledge and practices will enhances wide scale adaption of CSA and help mitigation climate change in Nepal.**

Need of Research, Academics and Extension in CCA to mitigate the impact of CC.

Sensitivity Matrix in Agriculture

Point of Entry	Anticipated impacts												
	Insects/ diseases	Shift in planting flowering time	Soil moisture depletion	Loss of fertility	Loss of forage	Loss of land	Ripening period	Inundation	Weed infestation	Storage loss	Livestock habitat change	Livestock diseases	Others
Temperature													
Sedimentation													
Floods													
Drought													
Mass wasting (debris, landslide, gully)													
Erosion													
Water source depletion													
Humidity													
Frost													
Fog													
Hailstorms													
Any other stresses													

Impact Matrix of Weather parameter with point of entry

Future Climate Change and Economic Cost

- The analysis of the future impacts of climate change on the agriculture crops grown in Nepal, focused on the key sector.
- Water budgeting has been included in the cost estimation.

Government of Nepal, MoSTE has done “ Economic Impact Assessment of Climate Change in Key Sectors in Nepal” that consider the efficient use of water resources

7. Climate Change concerns Agriculture: Policies

(A Brief History of the Climate Change Concerns): Nepal

- 1992: The UNFCCC was signed by 154 states at the Rio de Janeiro Earth Summit.
- 1992 (12 June): Nepal signed UNFCCC
- 1994 (21 March): entered into force
- 1994 (2 May): Nepal ratified, became a member on 31 July
- 1995 Conference of the Parties (COP) became the Convention's ultimate authority/governing body.
- By now 195 parties of UNFCCC

National and International Policies

1. International Policies

- COP 21: Paris Agreement
- COP22: Marrakech Action Proclamation
- COP 23: Just coming

2. National Acts and policies

- Acts on: **Forest Act 1993**, **Environment Act 1997**, **Water Resources Act 1996**, **Land accusations Act 1977**, **Natural Disaster Relief Act** – directly related to CC

Legislative provisions relating to Climate Change

- Forest Act 1993 and National Park and Wildlife Conservation Act 1973
 - No any provision directly related to climate change.
 - However, provisions for Community Forestry and conservation of forests and wildlife provide for measures to mitigate climate change.
- Environmental Act 1997
 - For promoting sustainable development to ensure that the negative impacts of environmental degradation do not have adverse impacts on humans, plants, animals, and other natural and physical resources.
 - However, IEE/EIA can cover CC issues.
- Water Resource Act 1996
 - does not address the potential negative impacts of climate change on water resources.
- Land Acquisition Act 1977
 - No direct mention
 - However, many provisions be associated with the climate change adaptation.
- Natural Disaster Relief Act – directly related to CC

Institutional Arrangements in Nepal

- **Climate Change Council (2009)** -- chaired by the Prime Minister and comprises of members from key national, local and sector ministries.
- **Ministry of Population and Environment (MoPE)** coordinates climate change planning and reports directly to the Climate Change Council.
- **Multi-stakeholder Climate Change Initiatives Coordination Committee (MCCICC)** for regular dialogue and consultations.

Climate change policy 2011

Vision: This policy envisions a country spared from the adverse impacts of climate change, by considering climate justice, through the pursuit of environmental conservation, human development, and sustainable development---all contributing toward a prosperous society.

Policy coverage

- Climate adaptation and disaster risk reduction
- Low carbon development and climate resilience
- Access to financial resources and utilization
- Capacity building, peoples' participation and empowerment
- Study and research
- Technology development, transfer and utilization
- Climate-friendly natural resources management

Targets

- Establishment of a Climate Change Centre **within one year**
- Preparation of a national strategy for carbon trade **by 2012.**
- Formulation & implementation of a lowcarbon economic development strategy .. **by 2014.**
- Assessment of losses and benefits from climate change in various geographical areas and development sectors **by 2013.**



Committing at least 80 % of total funds .. at the

Policy Documents Developed by Nepal

- National Adaptation Programme for Action (NAPA 2010)
- National Framework for Local Adaptation Plans for Action (2011)
- National Climate Change Policy (2011)
- Climate Resilient Planning (2011) -a tool for long-term climate adaptation
- Local Disaster Risk Management Planning Guidelines (2011).

NATIONAL ADAPTATION PROGRAMME OF ACTION...

- Six major areas impacted by climate change – basis for NAPA
 - *Agriculture and food security*
 - *Water resource and energy*
 - *Climate induced disasters*
 - *Forest and Biodiversity*
 - *Public health*
 - *Urban settlement and infrastructure*
- Cross cutting sectors – gender,

NATIONAL ADAPTATION PROGRAMME OF ACTION...

Priority adaptation options for Agriculture and Food Security

Climate Change Effect/Impact	Adaptation Options
Increase in intense rainfall - epidemic	Provision of food/clean drinking water Provision of emergency health care
Reduced rainfall and increased of temperature – drought	Identification of drought prone area Forecasting Livelihoods diversification Drought resistant cross species
Hailstorm, wind storm and thunderbolt	Provision of Insurance Weather forecasting Livelihoods diversification Community based fund (FAO in collaboration of the GOVN is working in this line)

Steps of LAPA Process

1. Climate Change Sensitization
2. Climate vulnerability and adaptation assessment
3. Prioritization of adaptation options
4. Developing LAPA (local adaptation plan for action) in new national context.
5. Integrating the LAPA into planning processes
6. Implementing the LAPA
7. Assessing progress of LAPA

Project focusing to addressing the Climate Change Adaptations

- GEF
- FAO
- DFAID
- GON

GEF is the potential donor to get fund for Climate Change Study

Way forward

- Revision of plan and policies to fit in new governmental structure: focusing to the water use and conservation: rain water harvest, drip irrigations for efficient use of water considering the crops and animal requirement
- Focused program in natural resources conservation and utilization (water, plant and animal resources)
- Execution of the CCA Plan and policies on water conservation
- Capacity development: 

```
graph LR; A[1. Village] --> B[2. Regional]; B --> C[3. National level]
```
- Prioritization and provision of fund:
- Collaborative work to the international agencies to fight against climate impact on the .food production.

Conclusion

- Nepal is rich in water resources but less managed to promote the agriculture
- Climate change is directly affecting in water availability to crop, animal and human being. People are leaving village due to the shortage of water.
- Crops and animals are suffering from drought, erratic and untimely rainfall throughout the country/
- CC adaption work has been initiated in a selected area by international organizations such as FAO, DFAID, USAID and other organization
- Effect ways to conserve water and best utilization to promote the sustainable agriculture system is prime important in the context of climate change in the different agro ecological zone of the country.
- Capacity development, both human an physical resources is prime important to execute the plan and program of Nepal.
- Conservation of mountain region focusing to the land coverage (range land management).
- Farmers Field School (FFS) model could be an effective tools to build CC adapting capacity in water management in agricultural farming community

Land terracing in Nepal and Rain fed condition



Thank You

