Climate Change and The Himalayan Ecosystem

Conserving Now, Preserving Future
Himalayan Region: Source of ten river basins- the water tower of Asia

- Himalayan glaciers: 17% of the global glacial area (>15,000 glaciers)
- Largest body of ice outside the Polar caps;
- Store about 12,000 km$^3$ of freshwater

Himalayan glaciers are sources of freshwater reserves which provide headwaters for major river systems in Asia – a lifeline for almost half of humanity.
The region is rich in biodiversity

...Himalayas due to high altitudinal variations...are rich in biodiversity

...hosts 4 of the 34 Global Biodiversity Hotspots;
488 protected areas and
330 Important Bird Areas

...has a large number of water retaining wetlands, 28 of them are Ramsar sites
Research and Development Thrusts

Environment Change & Ecosystem Services:
- Transboundary landscape conservation and management
- Monitoring of land use changes and sustainable management of natural resources
- Community and livelihood forestry

Sustainable Livelihood & Poverty Reduction:
- Rewarding poor for eco-system services
- Value chain development of high value products
- Community adaptation and resilience

Integrated Water & Hazards Management:
- Monitoring of snow, ice and water for long-term water management
- Regional flood information and management
Climate Change Challenges and its issues

1. Rapid rate of glacier melting & its impact on region’s water resources
Snow Cover in 2006
## Estimated Contribution of Glaciers in water resource of the HKH rivers

<table>
<thead>
<tr>
<th>River basin</th>
<th>Mean discharge (m³/s)</th>
<th>Contribution of glacial melt in river flow (%)</th>
<th>Water availability per person (m³/person/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indus</td>
<td>5,553</td>
<td>44.8</td>
<td>978</td>
</tr>
<tr>
<td>Ganges</td>
<td>18,691</td>
<td>9.1</td>
<td>1,447</td>
</tr>
<tr>
<td>Brahmaputra</td>
<td>19,824</td>
<td>12.3</td>
<td>5,274</td>
</tr>
<tr>
<td>Irrawaddy</td>
<td>13,565</td>
<td>Unknown</td>
<td>13,089</td>
</tr>
<tr>
<td>Salween</td>
<td>1,494</td>
<td>8.8</td>
<td>7,876</td>
</tr>
<tr>
<td>Mekong</td>
<td>11,048</td>
<td>6.6</td>
<td>6,091</td>
</tr>
<tr>
<td>Yangtze</td>
<td>34,000</td>
<td>18.5</td>
<td>2,909</td>
</tr>
<tr>
<td>Yellow</td>
<td>1,365</td>
<td>1.3</td>
<td>292</td>
</tr>
<tr>
<td>Tarim</td>
<td>146</td>
<td>40.2</td>
<td>571</td>
</tr>
</tbody>
</table>
IPCC (2007) Forecast

- Glaciers in the Himalayas are receding faster than in any other parts of the world;
- At the current trends, 80% of Himalayan glaciers will be gone in 30 years (although this is questioned);
- In Northwest China, 27% of the glacier area will decline by 2050;
- Likely water shortages for downstream agriculture in dry season
- Up to 750 million people in the region are vulnerable
Climate Change Challenges and its issues

2. Flood disaster due high intensity rainfall, land slide and glacial lake outburst floods (GLOF)
Increased risk of flash flood (Imja Glacier Everest Area Nepal)

1956 photograph of Imja glacier

2006 photograph of Imja glacier

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Climate Change Challenges and its issues

3. Environment Change & Forest/ Biodiversity Conservation
Increased Vulnerability of the Ecosystem service

- Himalayan countries are facing unexpected risks due to degradation of forests, biodiversity, rangelands and pasture;

- People’s high dependence on these ecosystems make them vulnerable and exposed to various risks and uncertainties.
Climate Change Impact Scenario on Vegetation

Large change in natural vegetation pattern is predicted: a) a northward shift of vegetation types; b) occurrence of invasive species.

Key research questions:

• What will be the impact on forests and biodiversity species composition?

• What will be the impact of increased moisture stress on forest and agriculture ecosystem services?

• Degree of community’s vulnerability to the impact on supply of ecosystem goods and services.
Climate Change Challenges and its issues

4. Livelihoods and food security
Climate Change Challenges and its issues

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- Climate change > water stress, reducing water availability for irrigation
- Climate change may further reinforce the pressure on available resources & ecosystem services > trigger the spiral of resource degradation, poverty, social unrest

Expected Impact of Climate Change on cereal production.

<table>
<thead>
<tr>
<th>Region</th>
<th>1990-2080 (% of change)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>0.6 to -0.9</td>
</tr>
<tr>
<td>Developed Countries</td>
<td>2.7 to 9.0</td>
</tr>
<tr>
<td>Developing Countries</td>
<td>-3.3 to -7.2</td>
</tr>
<tr>
<td>Southeast Asia</td>
<td>-2.5 to -7.8</td>
</tr>
<tr>
<td>South Asia</td>
<td>-18.2 to -22.1</td>
</tr>
<tr>
<td>Sub-Saharan</td>
<td>-3.9 to -7.5</td>
</tr>
<tr>
<td>Latin America</td>
<td>5.2 to 12.5</td>
</tr>
</tbody>
</table>
Conclusions

- Climate change is one of the most complex and difficult challenges for the Himalayan countries.

- Academic collaboration is needed to reduce the scientific uncertainty and knowledge gap.

- Scientific data to monitor and climate and environment change are lacking; IPCC has identified HKH region as the `data deficient';

- Long-term research and comprehensive data are needed to plan adaptation and mitigation program to deal with future changes;
Thankyou...