

**Vulnerability & Adaptation to  
Climate Change  
–An Integrated Assessment  
Forest Ecosystems, Biodiversity &  
Biomass Production:**

**Prof. N.H. Ravindranath  
Indian Institute of Science**

# Climate Change; V&A

1. Climate change will adversely impact forest and other natural ecosystems (Wetlands, Mangroves, etc)
  - biodiversity, biomass production, regeneration, ecological processes
2. Some impacts are long-term and irreversible
3. Climate impacts will adversely impact livelihoods of forest dependent communities & economy (timber, industrial wood, etc)
4. Forest and natural ecosystems are subjected to human intervention / management / policies
5. Communities depending on the ecosystems and the Govt Depts are also adapting to some of the current stresses, some of which are similar to projected impacts of climate change
6. Socio-eco Impacts and adaptive capacities vary; urban and rural, tribal and agricultural

# Why adaptation

1. Impacts of climate change are long-term and irreversible
  - Inertia in climate and ecological systems
  - Impact on biodiversity of Forests & Natural Ecosystems
2. Adaptation requires long gestation periods – thus long-term planning
3. Large dependence of forest dependent communities for livelihoods
4. Large industrial dependence
5. Large afforestation / conservation programme
6. Requires long-term research; developing varieties / practices

# Multi-sectoral impacts of Climate change; agriculture, forests and water resources

- **Studies using moderate climate change scenarios show adverse impacts**
  - forest area and distribution
  - Grasslands
  - stream flow, ground water recharge and water availability for agriculture
  - Crop productivity
- Need for a full understanding of the linkages of climate impacts on forest ecosystems, grasslands, water resources and agricultural production
- Socio-economic factors and policies - will impact -  
**Agriculture, forests, grasslands and water resources**

## Two approaches and studies are required

1. Case studies of Adaptation in a selected regions – highly vulnerable to climate impacts OR hot-spots of vulnerable forest ecosystems and natural ecosystems
2. **Integrated assessment of climate impacts on Grasslands- forest ecosystems – agriculture – water resources**

# APPROACH

- 1. Assess the impacts of climate change**
  - Physical & biological impacts
  - Socio-economic impacts
- 2. Assess the current policies, practices and programmes**
- 3. Assess the adaptation policies, practices, programmes and adaptive capacities**
  - Forest dependent communities
  - Forest Depts
- 4. Develop alternate adaptation practices, programmes, and policies**
  - investment and institutional capacity

# Case study of Adaptation in a selected region involving climate impacts on forest ecosystems

# Case Study of Adaptation

- 1. Select a location identified as highly vulnerable (HOT SPOT) to climate change – where there is also a large dependence on forests & biodiversity**
  - Western ghats & Central or Western Himalayas
- 2. Assess impact of climate change using dynamic models**
  - biodiversity, biomass production
  - Socio-economic impacts
- 3. Assess current socio-eco dependence on forests**
- 4. Assess the past and projected land use change**
- 5. Assess land use policies and forestry practices**
- 6. Identify policies and practices that are likely to enhance & reduce vulnerability**
- 7. Explore methods and approaches to analyze adaptation**
- 8. Develop potential adaptation policies and practices**

Integrated assessment of climate  
impacts on Grassland & forest  
ecosystems – agriculture – water  
resources

## **Need for integrated assessment of land based sectors**

1. Select a landscape or watershed or river- basin
2. Adopt case study approach - where all FOUR land based sectors could be studied for interdependence;
  - biological and physical & socio-eco
3. Explore integrated assessment models and analyze climate change implications for
  - water resources, crop/grass production & forest ecosystems
4. Develop an understanding of impacts in an integrated way for the selected landscape / watershed

**Hardly any studies & may need methodological & modeling developments**

**Required for developing adaptation strategies**