

Evidences of Impact of Climate Change on forest and wildlife

GROUP-3

• Forest

- Shifting vegetation belts
- Invasive Alien Species
- Pests
- Fire
- Productivity - increasing and decreasing
- Mangroves

• Wildlife

Shifting Vegetation Belts

- Change in temperature and precipitation regime is causing alteration of the Natural Distribution limits of floral and faunal communities
- Species are expected to migrate pole ward in latitude or upward in elevations and eventually run out of habitat

- For example - Decline in species like Deodar, Fir and spruce and increase in Blue Pine in Kashmir Valley and Chir Pine in Jammu
- Marked expansion (11%) in Temperate deciduous, cool mixed and conifer forests at the cost of alpine pastures which are likely to shrink.
- Loss of habitat (sea-ice) of Polar Bear in Arctic region

Invasive Alien Species

- Rapidly changing climate favor species that can tolerate a wide range of climatic conditions, favoring spread of many invasive species.
- For Example - The spread of invasive alien species like *Parthenium*, *Lantana*, *Ageratum*, *Xanthium*, *Anthemis*, etc. in J&K

Pest and pathogen

- Normally controlled by intense cold snaps in the winter, but warmer winters have been one factor enabling the infestation to grow into an epidemic
- For example - Devastation caused by Mountain Pine beetle in forests of Rocky mountains/ British Columbia/Alaska which multiplied quickly , largely because of warmer temperatures (winter warming).

Forest Fire

- Increase in Dry Season Length would increase the risk of forest fires in moist and dry deciduous forests.
- The last two decades demonstrated increasing burned areas in Canada, the western United States, and Russia
- In the United States, the 2003 forest fires resulted in a \$337 million loss in wood.

Forest Productivity

- Studies show high potential for CO₂ induced growth enhancement, such as an 80% increase in wood production for orange trees according to a study
- The change in frequency of extreme events, such as strong winds, winter storms, droughts, etc. can bring massive loss to forestry sector.
- For example, in January 2005 Hurricane Gudrun with maximum gusts of 43 m/s damaged >60 million m of timber in Sweden.

Phenology

- Changes in timing of Biological Behaviour such as flowering, fruiting and breeding.
- Climate change may directly alter plant fitness, as well as alter the reproductive success of plants and their interactions through impacts on flowering phenology.
- For Example - Early bud break in *Betula utilis* has been recorded in 2010 as compared to earlier years

Coastal Ecosystems

- Studies done in Sundarbans suggest that Climate Change is leading to
 1. Increased Salinity
 2. Higher Tidal Surges
 3. Permanent submergence of land mass.
 4. Loss of critical habitat for biodiversity, both fauna and flora.
- Relative Mean Sea Level (MSL) in Sagar Island (Sundarbans) and adjoining areas of the Bay of Bengal is rising at the rate of 12 mm per year, as compared to the global average of 2 mm per year.

* (<http://www.wwfindia.org>)

Wildlife

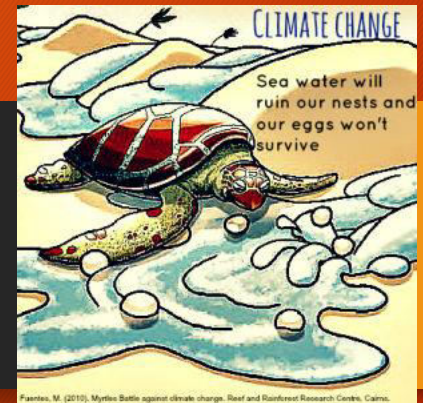


(Effect on Birds)

- Upward Extension/Shift in Altitudinal Ranges of Species. For example Snow Pigeon currently occurs in the sub-alpine and alpine zones far exceeding its historical lower limits of 1600 m (common at 3000 m)
- Change in Breeding Seasonality
 - Ashy Drongo (*Dicrurus leucophaeus*)
 - Emergence of Hatchlings are supposedly delayed



Effect on Reptiles



- With the increase of temperature, the animals tend to seek refuge towards higher elevation leading to upward migration
- Biased Sex Ratio: In Sikkim, *Trachischium guentheri* a high altitude snake in Sikkim, showed skewed sex ratio (M:F=1:1.6; Chettri et al. 2009)
- Disappearance of Turtles from Sikkim

Effect on Butterflies



- Studies have found early migration, northward shift in latitudinal ranges, upward shift in elevational ranges, population decline and species extinction as climate induced effect among butterflies (Parmesan et al. 1999; Walther et al. 2002; Hickling et al. 2006; Forister et al. 2010).
- It would lead to **disruption in pollination**

Wildlife Evidences

- Species that are highly specialized (Koala)
- North Atlantic Cod
- Orange-spotted filefish
- Quiver tree
- Adélie penguin
- Marmots

Wildlife Evidences



Future studies..

- Identifying problems(Map Vulnerability)
- Research on Key systems & Critical Geographical area
- Participatory Processes for Mitigation and Adaptation Scenarios
- Integrated Impact Model
- Decision Theory
- Risk Perception, Climate Knowledge and Behaviour