

An aerial photograph of a forest with long, dark shadows cast across the green canopy, suggesting a low sun position. The text is overlaid on this image.

# Evidences of impact of Climate Change on forests and wildlife

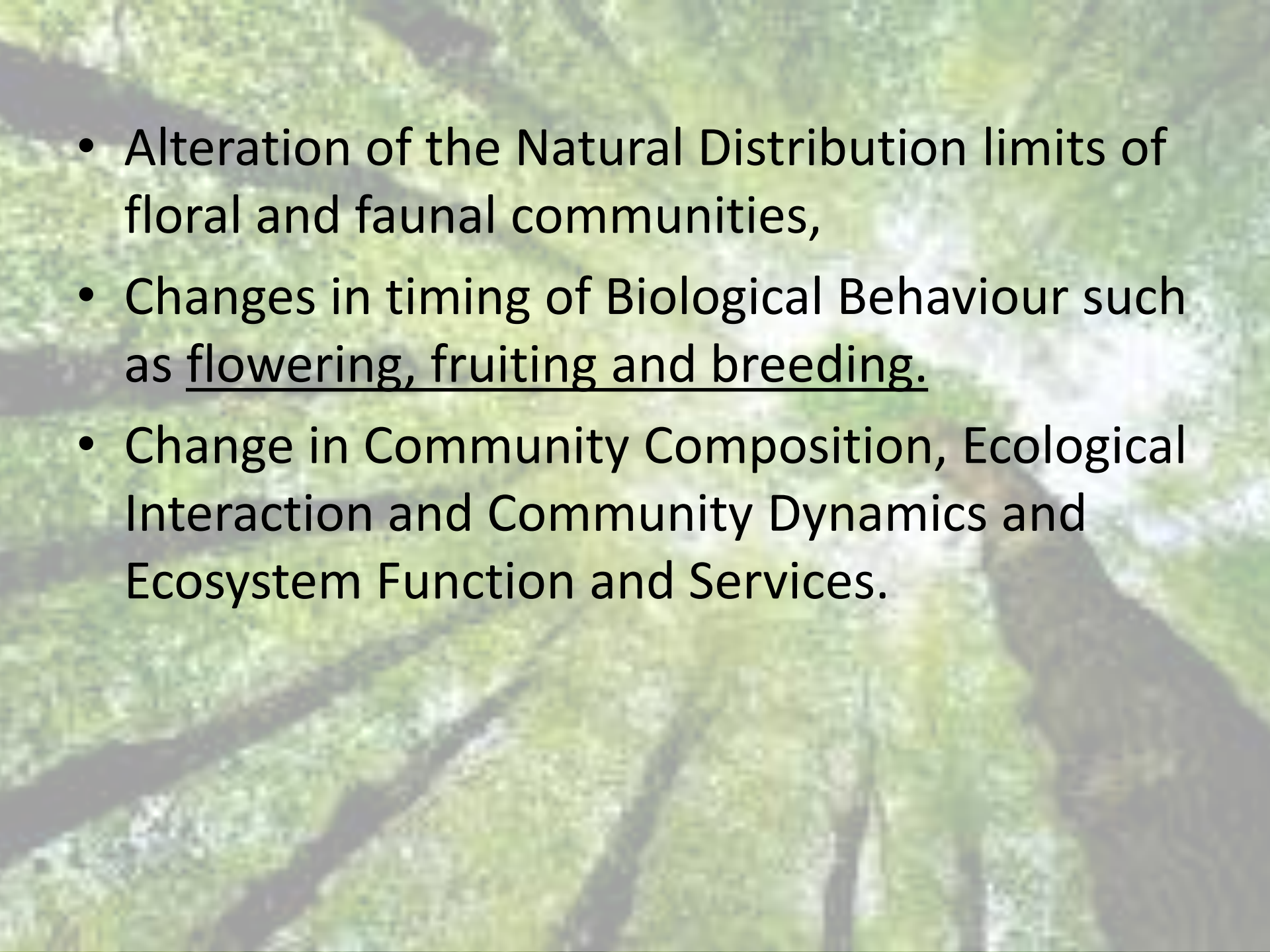
GROUP III

# Climate Change and its effect in general:

1. Temperature rise by 3° C to 4°C towards the end of 21<sup>st</sup> century.
2. Reduction in wheat and rice yields.
3. Rainfall patterns and quantities in periods of drought in some regions, more rainfall in central India and reduced rain in the north-east, leading to changes in forestry and vegetation.
4. Rain spells in the Ganga, Krishna and Godavari more intense.
5. Number of rainy days may be reduced in the western parts of the Gangetic basin.
6. 70% of vegetation vulnerable to change.
7. Adverse impact on wildlife and other biological species.

# Effect of Climate Change on Forests :

- Shift in Vegetation Type Boundaries i.e in Western Ghats the Moist Forest Species are Shifting Eastward.
- Mountain Forests of Western Ghats would Change into Grasslands.
- Increase in Dry Season Length would increase the risk of forest fires in moist and dry deciduous forests.
- Increase in Frequency and Intensity of –
  - a. Outbreaks of Insects and Pathogens
  - b. Extreme Events such as High Winds.

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- Alteration of the Natural Distribution limits of floral and faunal communities,
  - Changes in timing of Biological Behaviour such as flowering, fruiting and breeding.
  - Change in Community Composition, Ecological Interaction and Community Dynamics and Ecosystem Function and Services.

- The destructive beetles have multiplied quickly throughout the mountain range, largely because of warmer temperatures.
- The mountain pine beetle's ability to survive and multiply rapidly is highly sensitive to temperature and precipitation. Warmer average temperatures allow pine beetles to complete their life cycle in just one year instead of two.



Tim Wilsc

**Dead red trees cover the mountainsides in Rocky Mountain National Park. This is just one location in the Rockies where mountain pine beetles have killed millions of trees.**

# IMPACT OF CLIMATE CHANGE ON DIVERSITY OF HIMALAYAN MEDICINAL PLANT

- Most of the medicinal plants have shifted to higher altitudes due to increasing temperature.
- It has been observed that species of higher elevations are projected to shift higher and that a rapidly changing climate might favour species that can extend their ranges quickly or that can tolerate a wide range of climatic conditions, both these traits are shared by many invasive species.



- Climate change may directly alter plant fitness, as well as alter the reproductive success of plants and their interactions through impacts on flowering phenology.
- Early bud break in *Betula utilis* has been recorded in 2010 as compared to earlier years. The changes in phenological behavior of species may be a strong indicator of climate change since many species are highly sensitive even to the smallest change in the long prevailing climate of any ecosystem.
- Generally when plants are stressed, secondary metabolite production may increase because growth is often inhibited more than photosynthesis, and the carbon fixed not allocated to growth is instead allocated to secondary metabolites.

# Impact on Sundarbans

- Sundarbans being affected by Climatic Change conditions such as Floods, Cyclones, Relative Sea-level Rise, and Coastline Erosion.
- Studies\* 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.
- The projected loss of area for 12 of the most vulnerable sea-facing islands by 2020 is between 3 per cent and 32 per cent.
- Such drastic changes in climatic conditions are also leading to frequently occurring cyclonic storms.



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



# I. EFFECT ON BIRDS

## 1. Upward Extension/Shift in Altitudinal Ranges of Species

- Due to temperature increase, Snowline in the Himalayas has Shifted Upwards over the years (Xu et al. 2009).
- Consequently, Birds in the Alpine areas for upward extension in their altitudinal ranges. Thus displaying *Adaptation to Climate Change*.

- Snow Pigeon currently occurs in the sub-alpine and alpine zones far exceeding its historical lower limits of 1600 m (common at 3000 m)



## 2. Change in Breeding Seasonality:

- Warmer temperature, alteration in habitats may alter bird's reproductive strategies.
- Many tropical bird species might start breeding earlier than their usual breeding season or produce lesser offsprings due to reduced reproductive rate resulting in population decline. (Both and Visser 2001; Wormworth and Sekercioğlu 2011).
- Ashy Drongo (*Dicrurus leucophaeus*)  
Breeding activities such as
  - Habitat Selection
  - Nest Building
  - Laying of Eggs
  - Emergence of Hatchlings are supposedly delayed.



### 3. Breeding Failure

- Ali (1962) reported breeding records of 229 species of birds in Sikkim but the number of breeding species decreased in the recent years (Acharya 2008).
- It shows that Breeding period has Shortened in most species  
OR
- They fail to make nests and reproduce due to climate induced changes in
  - Plant Phenology
  - Food Availability
  - Habitat Alteration.

## II. EFFECT ON REPTILES

### 1. Upward Species Migration :

- While warmer temperature seems to be beneficial on a short term basis, its long term impact is detrimental. As observed in other organisms, one of the significant impacts of climate change on reptiles is the shift in altitudinal and latitudinal limits of species (Bickford et al. 2010).
- With the increase of temperature, the animals tend to seek refuge towards higher elevation leading to upward migration.



## 2. 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).
- According to Fisher (1930), natural selection has always favoured equilibrium in sex ratio (1:1) if the expenditure of producing both sexes is equivalent.
- Hence deviation of sex ratio from the normal due to global warming can disrupt population dynamics of reptilian community.

### 3. Influx of Exotic Species

- Climate change has led to the influx of exotic species. Influx might lead to disproportion in prey-predator relationship thereby disturbing the entire food chain (Pianka 2000).
- E.g., in Sikkim, we find Indo-Chinese elements of rat snake *Ptyas korros*, whereas in plain area of West Bengal an Oriental species *Ptyas mucosus* occurs. Due to climate change there is a possibility of *Ptyas mucosus* to penetrate into the hills affecting niche dimension of the native *Ptyas korros*



#### 4. Disappearance of Turtles from Sikkim

- While the occurrence of turtles in Sikkim cannot be completely ruled out (sporadic sightings of turtles was reported in the local media in recent past), they have not been observed within the geographical boundary of Sikkim in the recent years.
- Hence, turtle disappearance is attributed to drying of springs and streams in the lower elevation in Sikkim. Dryness could have pushed the habitat of turtles further down necessitating an area for further research and confirmation.



# III. EFFECT ON AMPHIBIANS

- Amphibians are potentially good bio-indicators due to their highly permeable skin and dual mode of life (Beebee and Griffiths 2005). Climate change affects three major physiological functions of amphibians viz., water balance, thermo-regulation and hormonal regulation of reproduction (Donnelly and Crump 1998).





# IV. 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).
- Since butterflies are the important pollinator component of ecosystem, any affect on them would lead to disruption in pollinator relationships. Less nectar availability, affected by dry spells and drought on plant phenology have negative consequences on butterflies.



# Continued..

- Many species have extended their distribution in response to the changing climate.
- Most butterflies have very narrow elevation ranges. Hence, upward extension has further contracted their ranges making them more vulnerable.
- Upward range shift and contraction of elevational and latitudinal range of butterflies have been observed.

# Olive Ridley Turtles

- Visits some specific beaches of Odisha for mass nesting activity because of the conducive conditions for mating, nesting and hatching.

## ***Effects of Climate Change :***

- Frequent cyclones and extreme weather conditions alternating between floods and droughts.
- Coastline of Orissa is changing drastically and being eroded.
- Creating new river mouths and breaking beach stretches.
- Massive changes in the topography that will eventually impact the nesting behavior of the turtles.
- Destroys the coastal ecosystem that offers with a plenty of food to the mother turtles and their hatchlings

An aerial photograph of a forest. The ground is covered in green grass and small trees. Long, dark shadows of trees are cast across the landscape, indicating a low sun position. The text "Thank You" is centered in the middle of the image.

Thank You