# Protected Areas and Climate Change in Asia

Contributed to Asia Parks Congress

By
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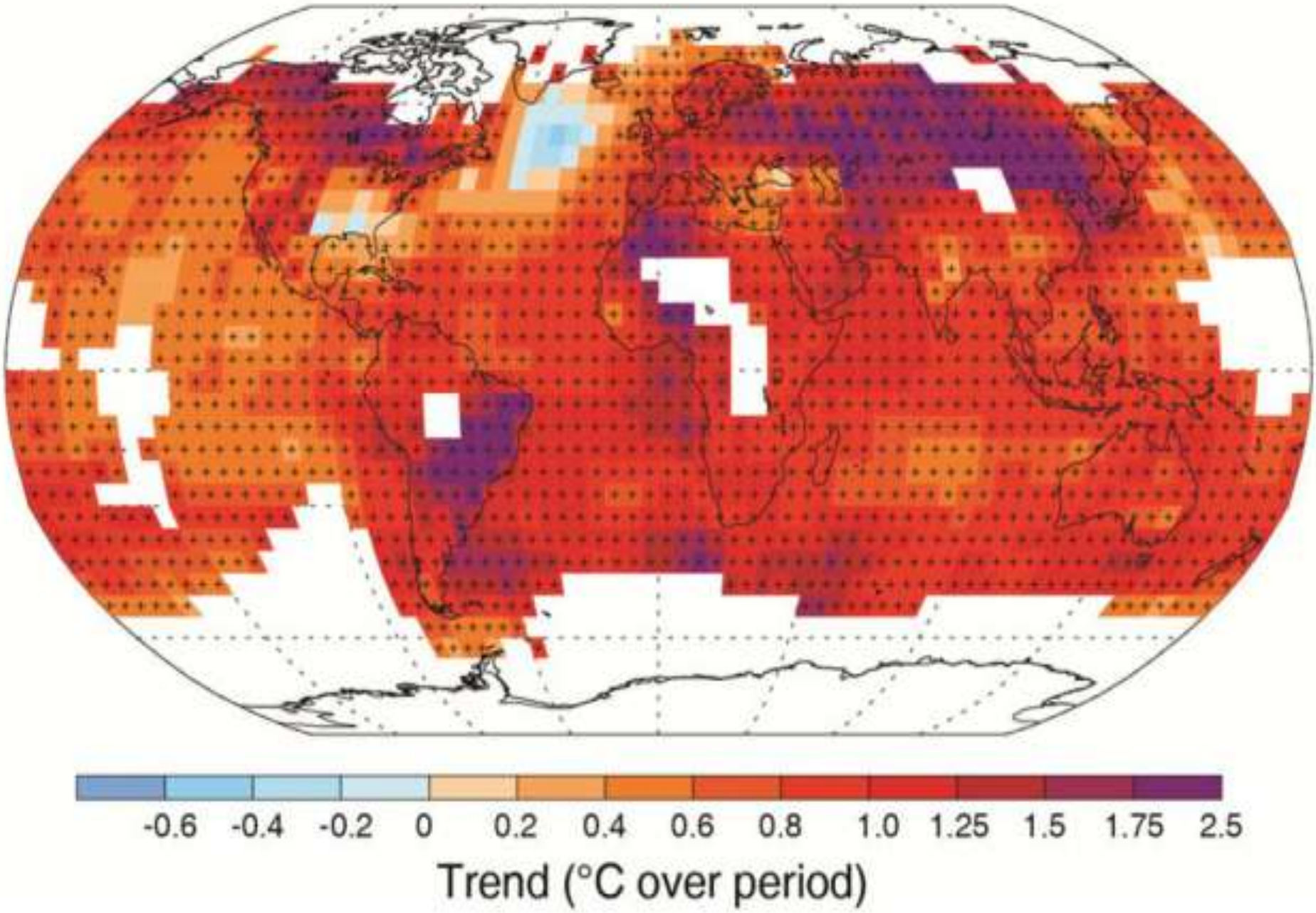
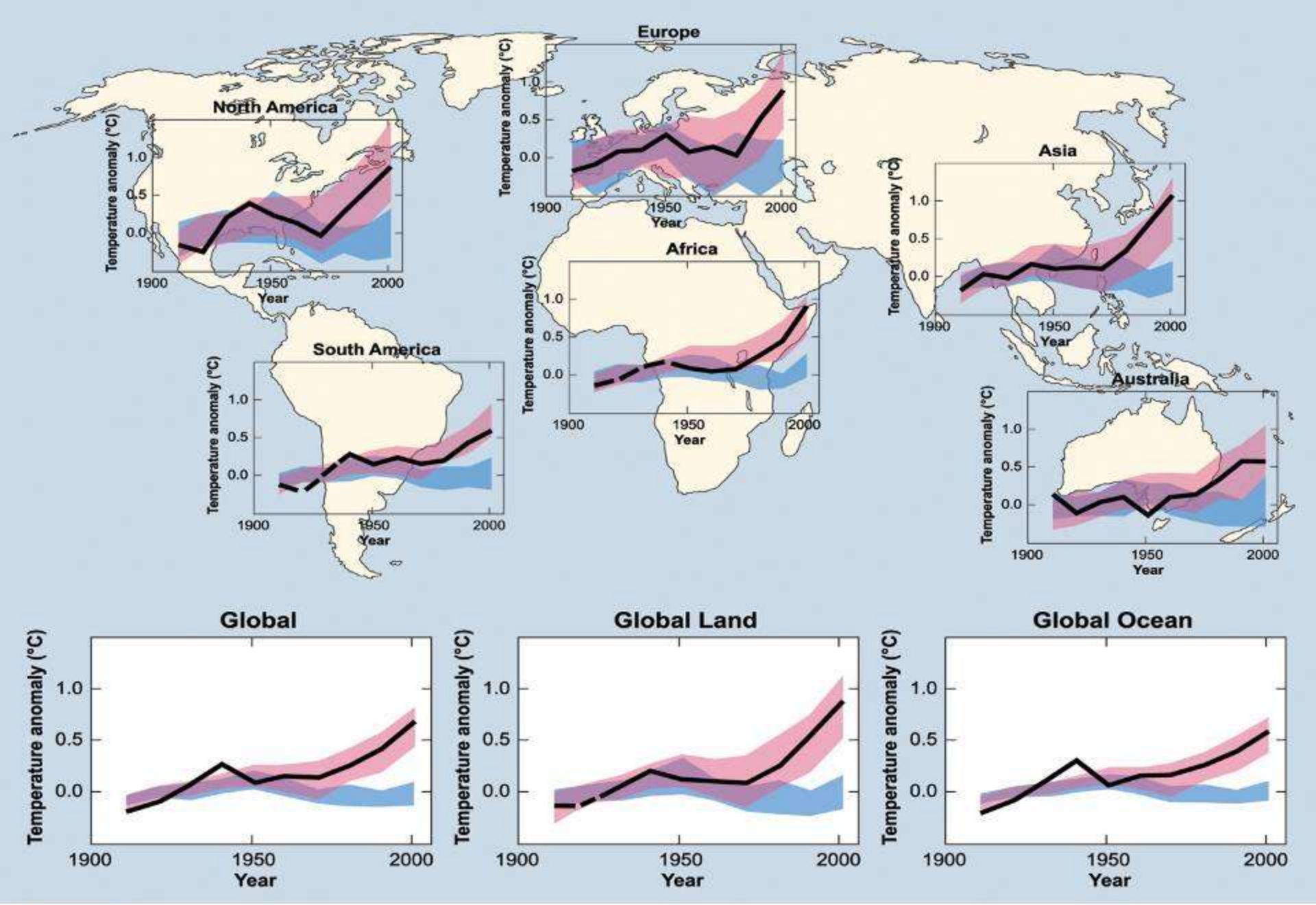
A

# Observed change in average surface temperature 1901–2012









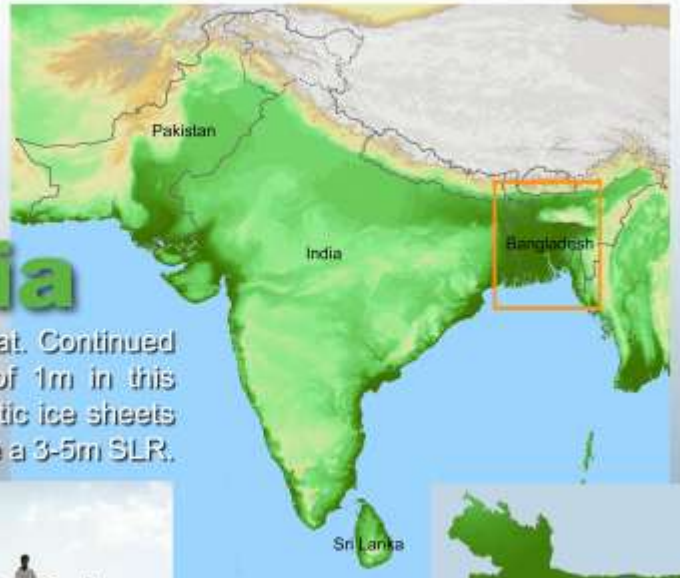
models using only natural forcings

models using both natural and anthropogenic forcings

observations

# Sea Level Rise from Global Warming

## Potential Impact on South Asia




Sea Level Rise (SLR) due to climate change is a serious global threat. Continued growth of Green House Gas emissions could well promote SLR of 1m in this century. Recent scientific evidence indicates Greenland & West Antartic ice sheets are melting faster than predicted. rapid breakup of which might produce a 3-5m SLR.

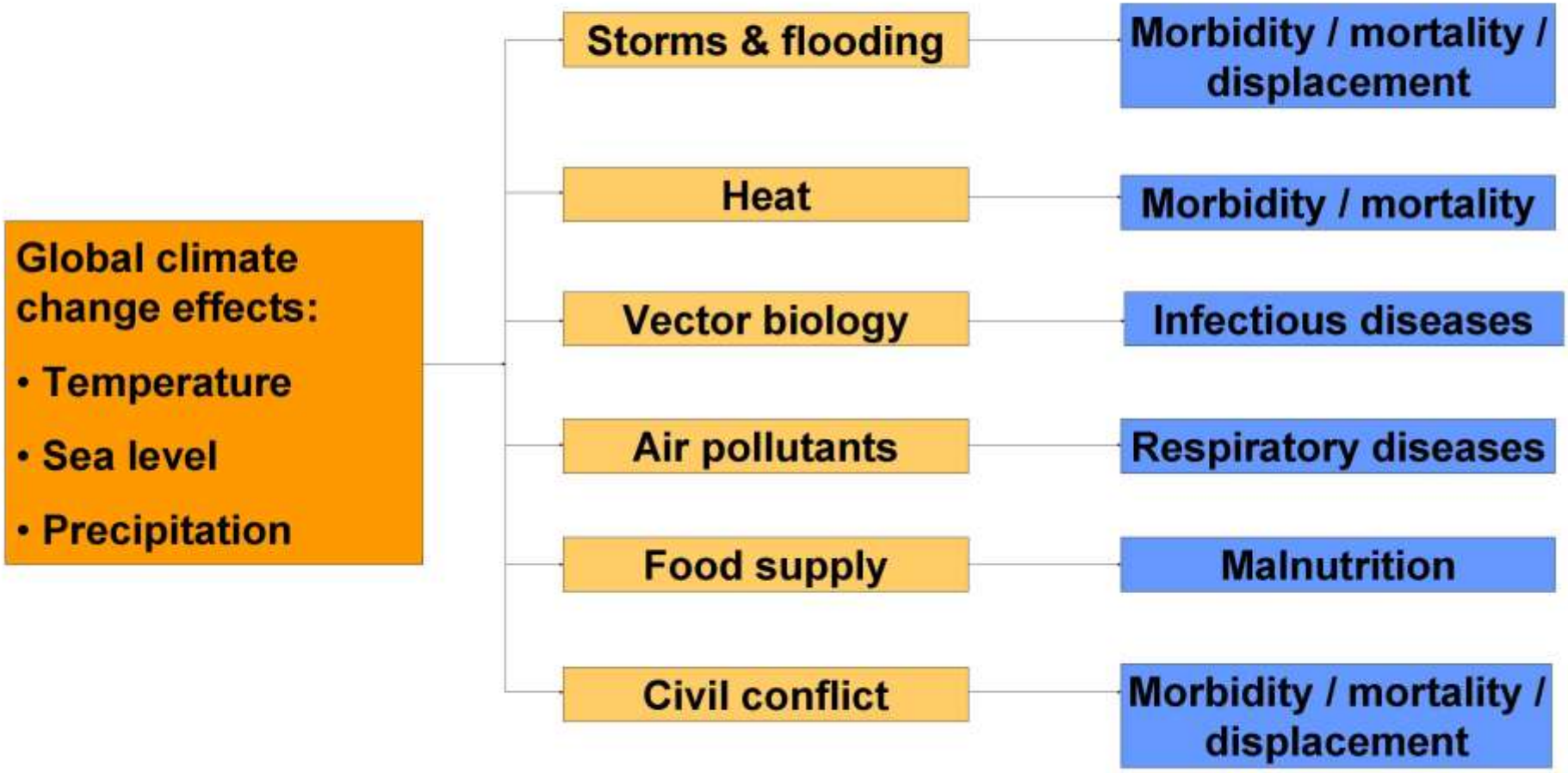
Millions of people in the South Asia region would be displaced, and accompanying economic and ecological damage will be severe. Even a 1m SLR would turn at least 6.4 million people into environmental refugees. An estimated 19 billion US$ of GDP would be lost. Among the countries, Bangladesh will be most severly affected.

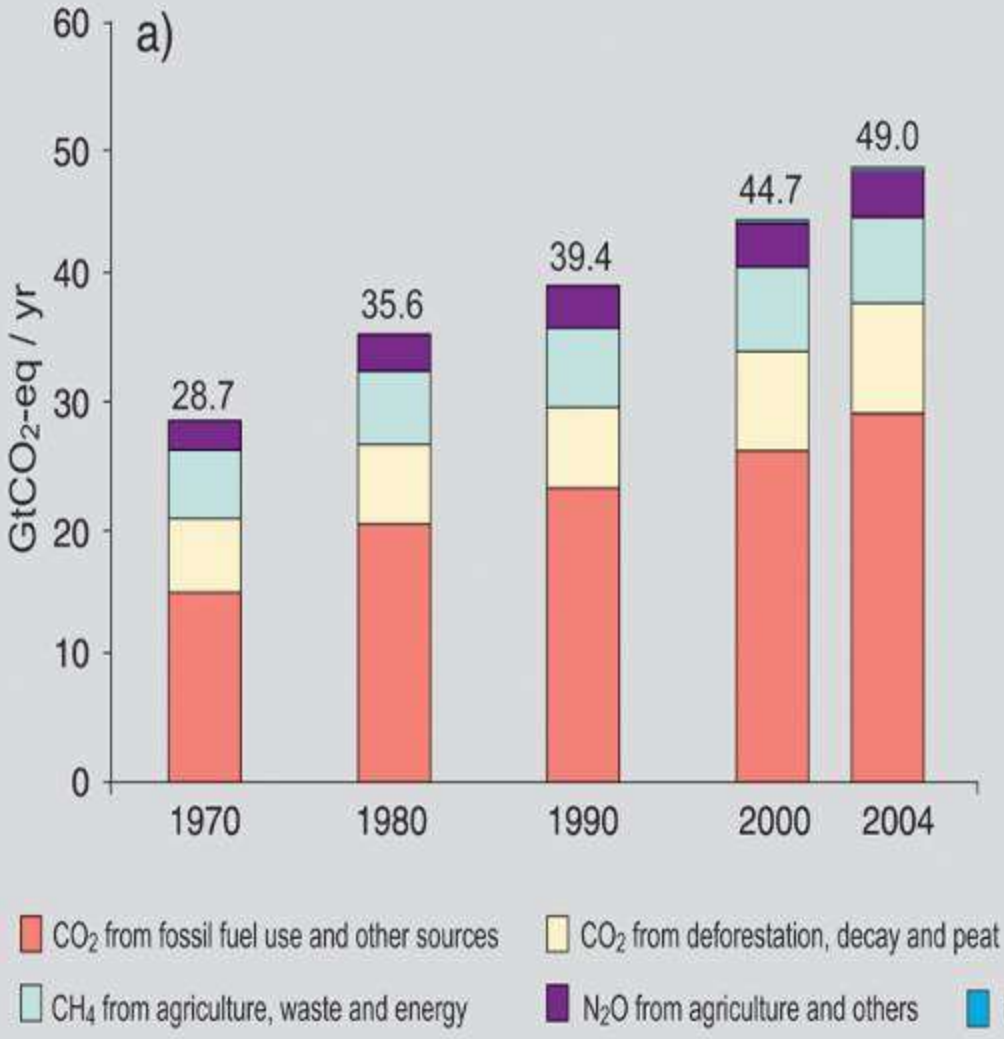
## Bangladesh

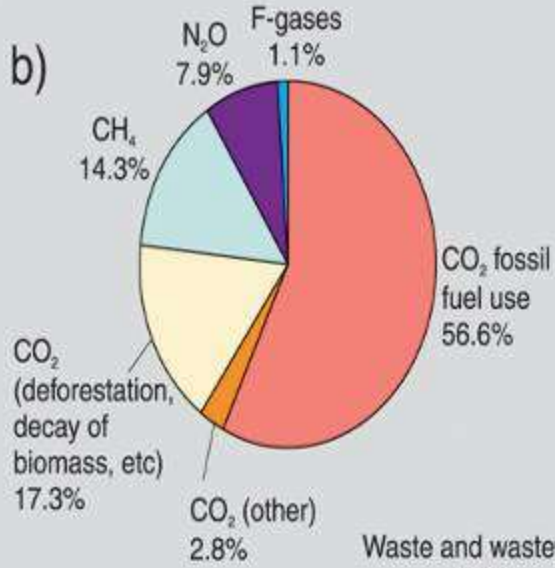
| SLR | Impacted Population | Impacted GDP |
|---|---|---|
| 1 meter | 1.5 million | 1.9 billion US$ |
| 3 meter | 5.4 million | 7.8 billion US$ |
| 5 meter | 16.7 million | 22.8 billion US$ |

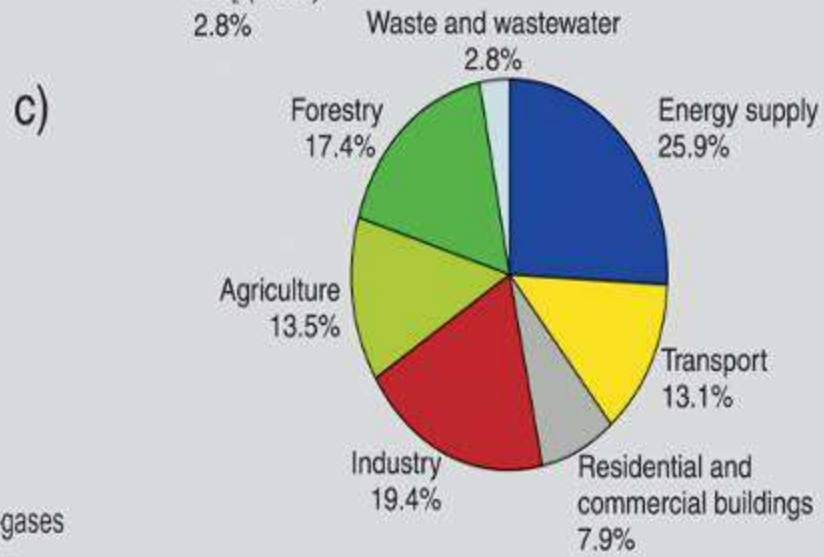
DECRG-RU, The World Bank : For more information contact Susmita Dasgupta : sdasgupta@worldbank.org

# Potential Impacts of Global Climate Change on Human Health

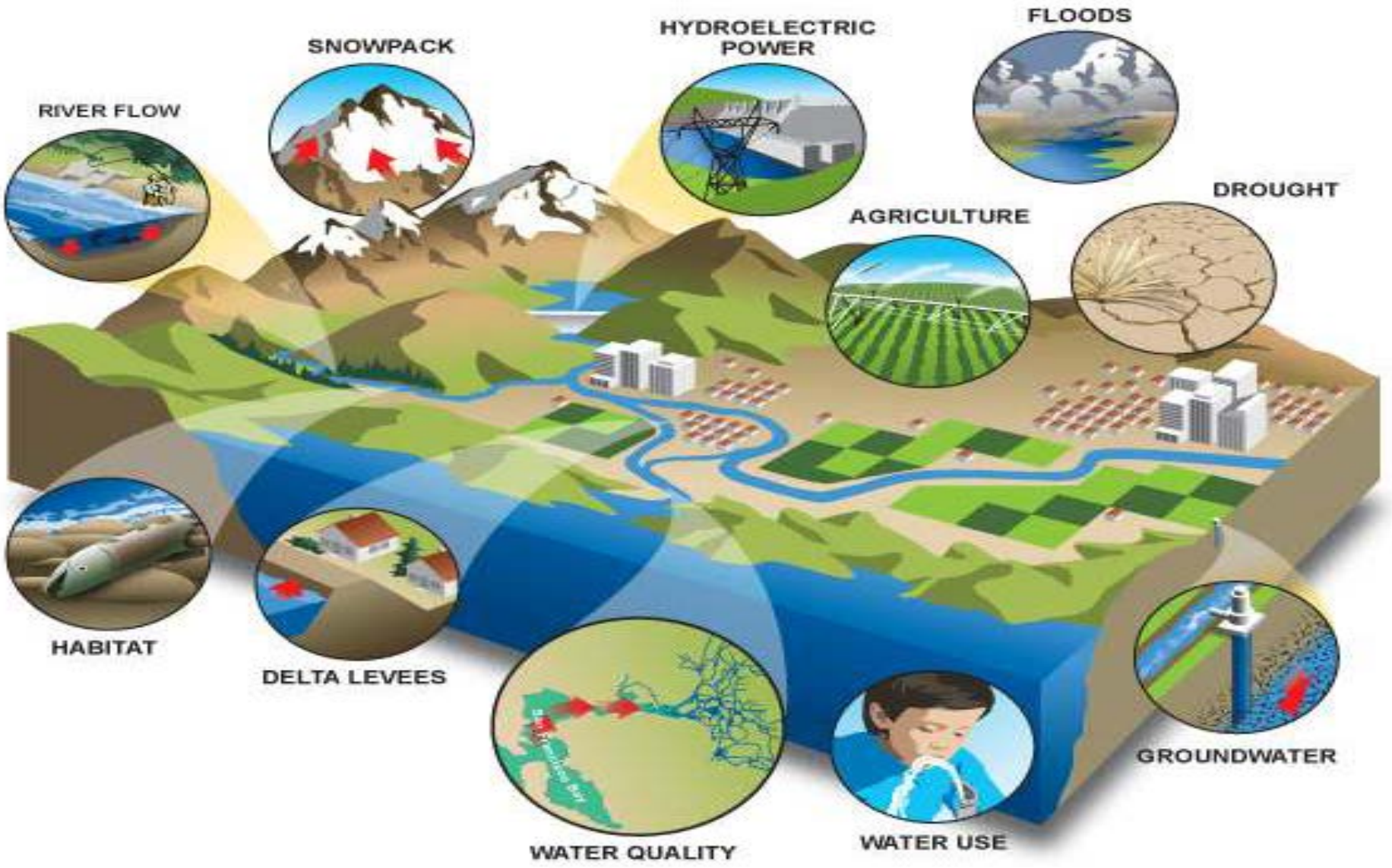




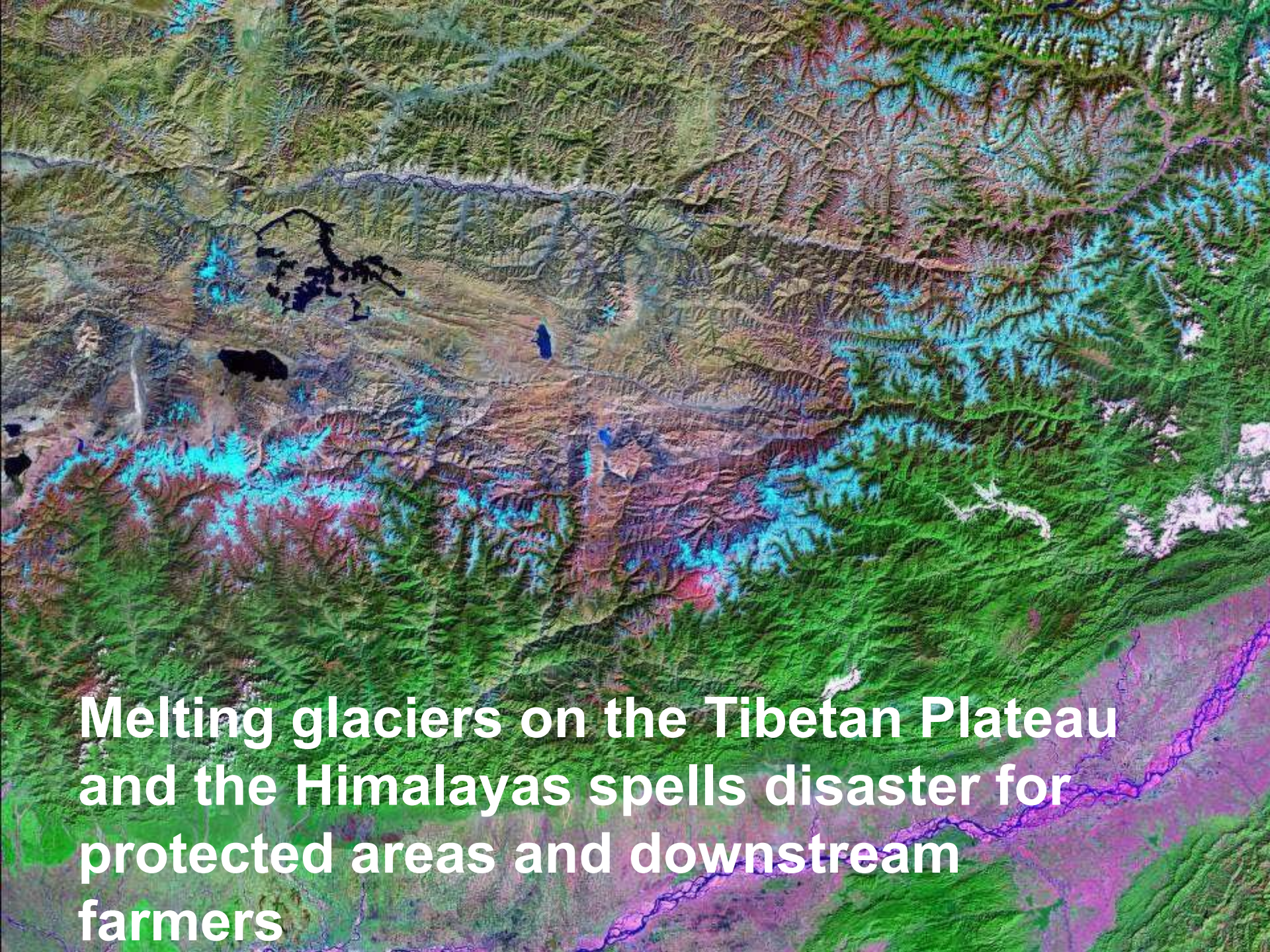




# Annual greenhouse gas emissions by sector

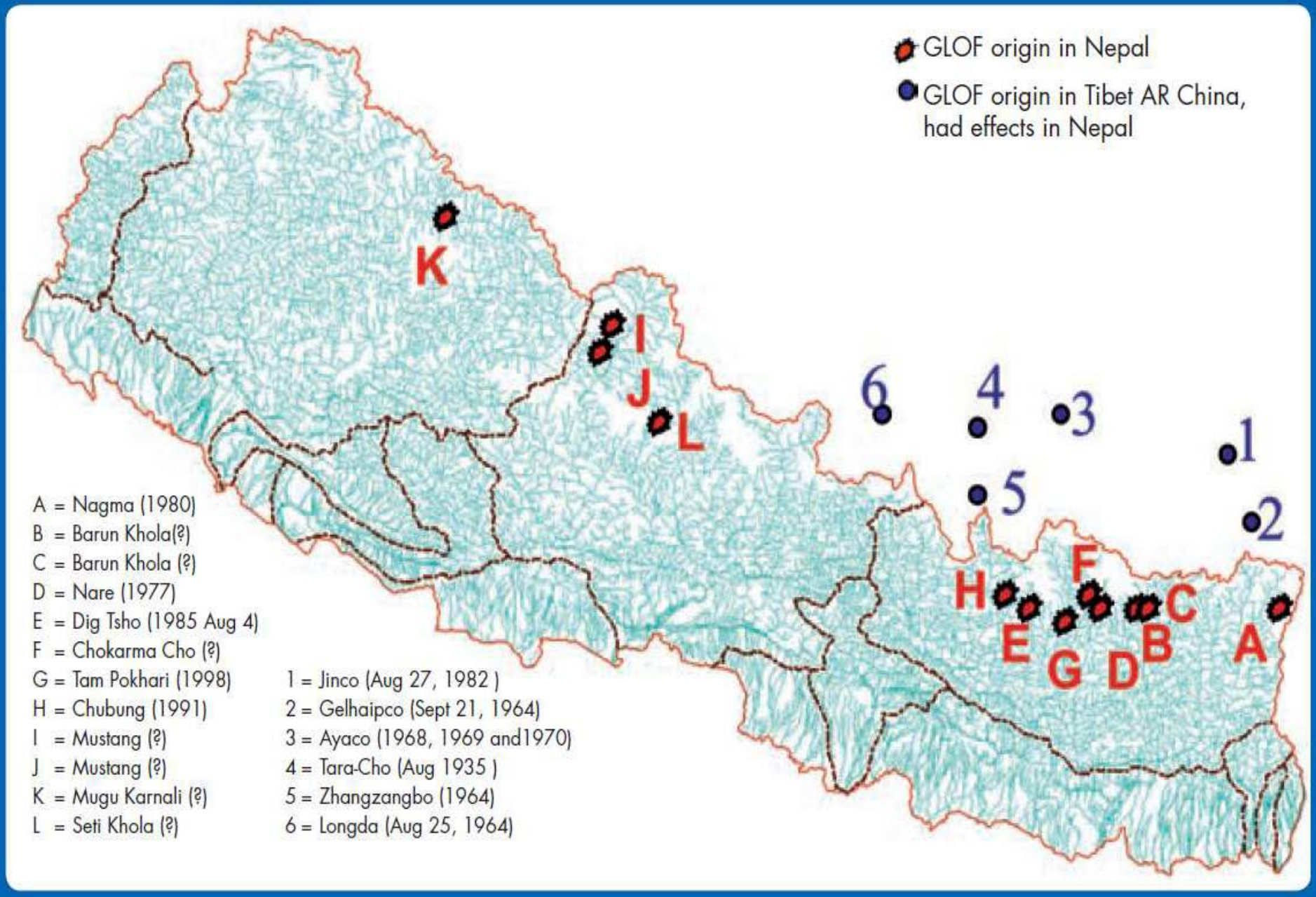



**The impact of climate change on humans is felt through changes in ecosystems and biodiversity**



Melting glaciers on the Tibetan Plateau and the Himalayas spells disaster for protected areas and downstream farmers

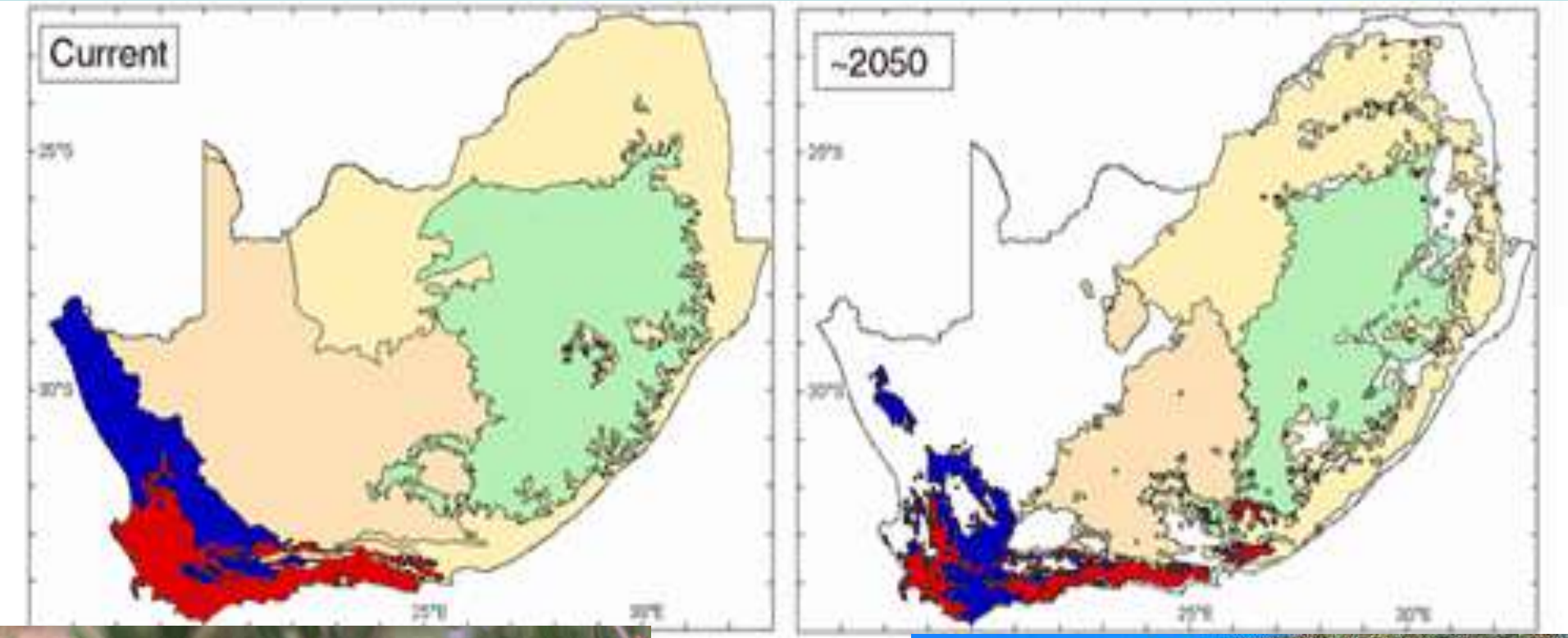
Figure 1: **Recorded glacial lake outburst events in the central Himalayan region that have affected Nepal and TAR/China**



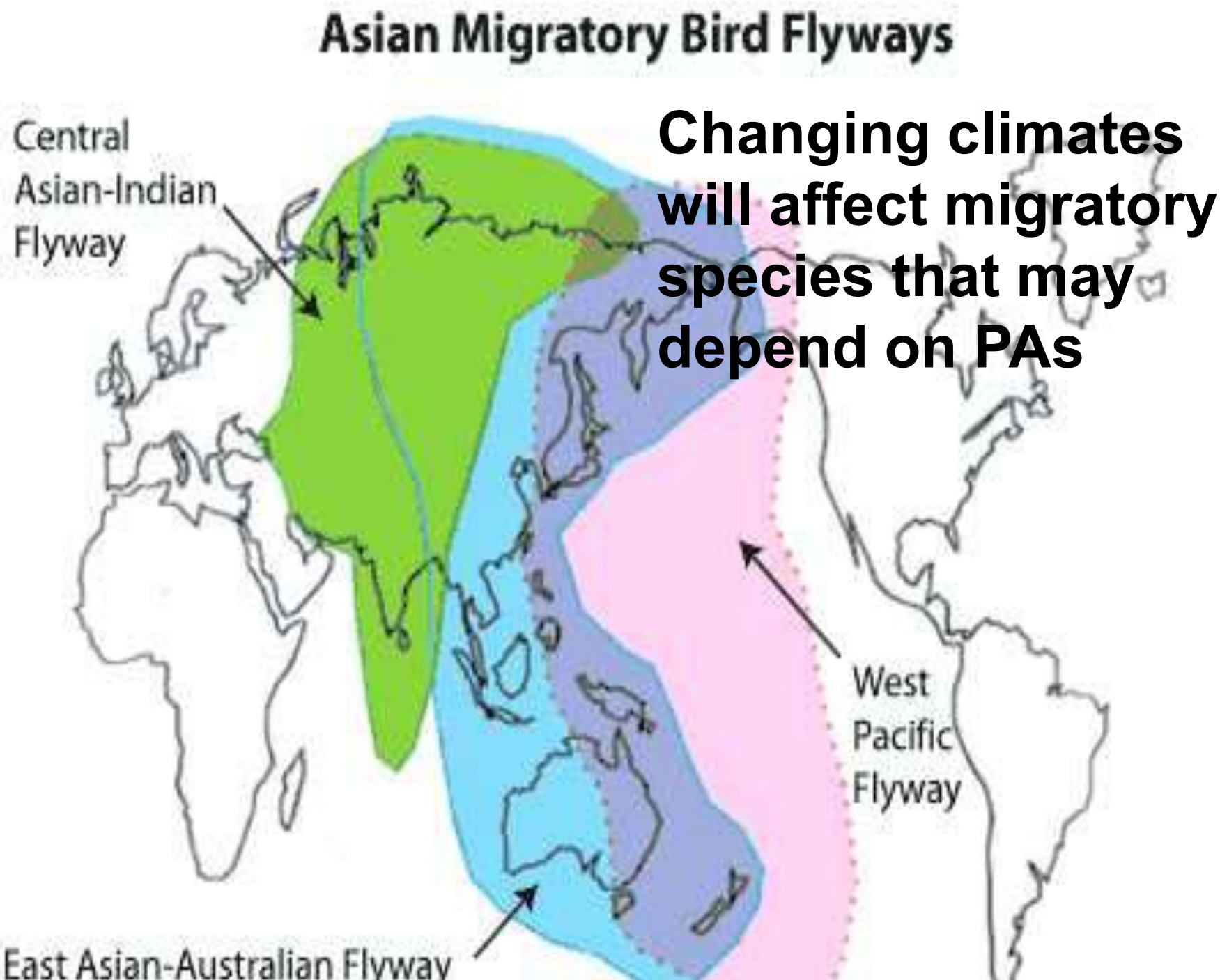

Source: Mool et al. (2001a)

**Dig Tsho glacier lake burst in Sagarmatha NP released up to 10 million cubic meters of water in 4 hours,  destroyed farms, bridges, trails, and the Namche hydroelectric station.**

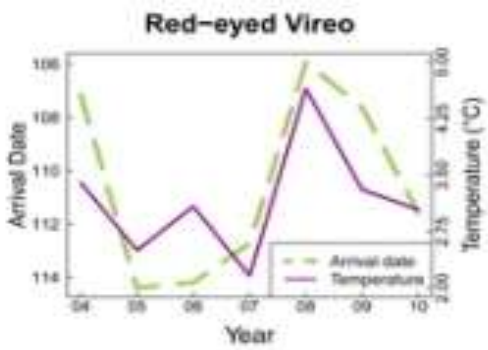
# Climate change will affect the distribution of species, and the areas designed to protect them.

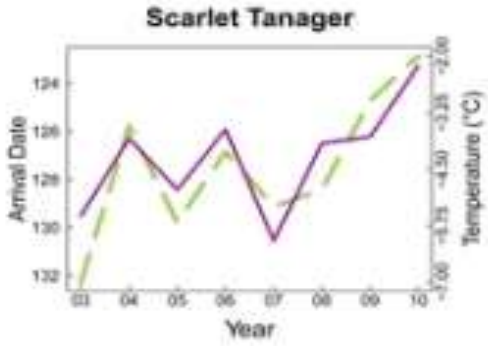


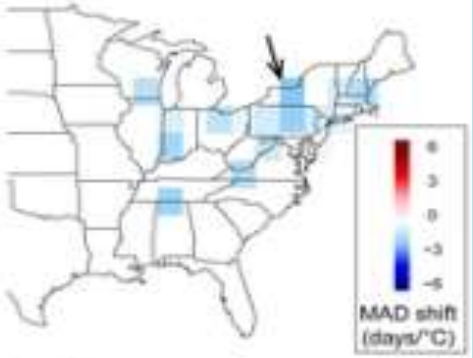

South African Biomes
- Desert
- Forest
- Fynbos
- Grassland
- Nama-Karoo
- Savanna
- Succulent Karoo
- Undefined

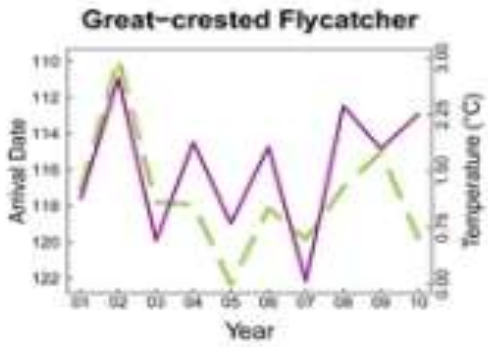



**Changing climates will affect migratory species that may depend on PAs**





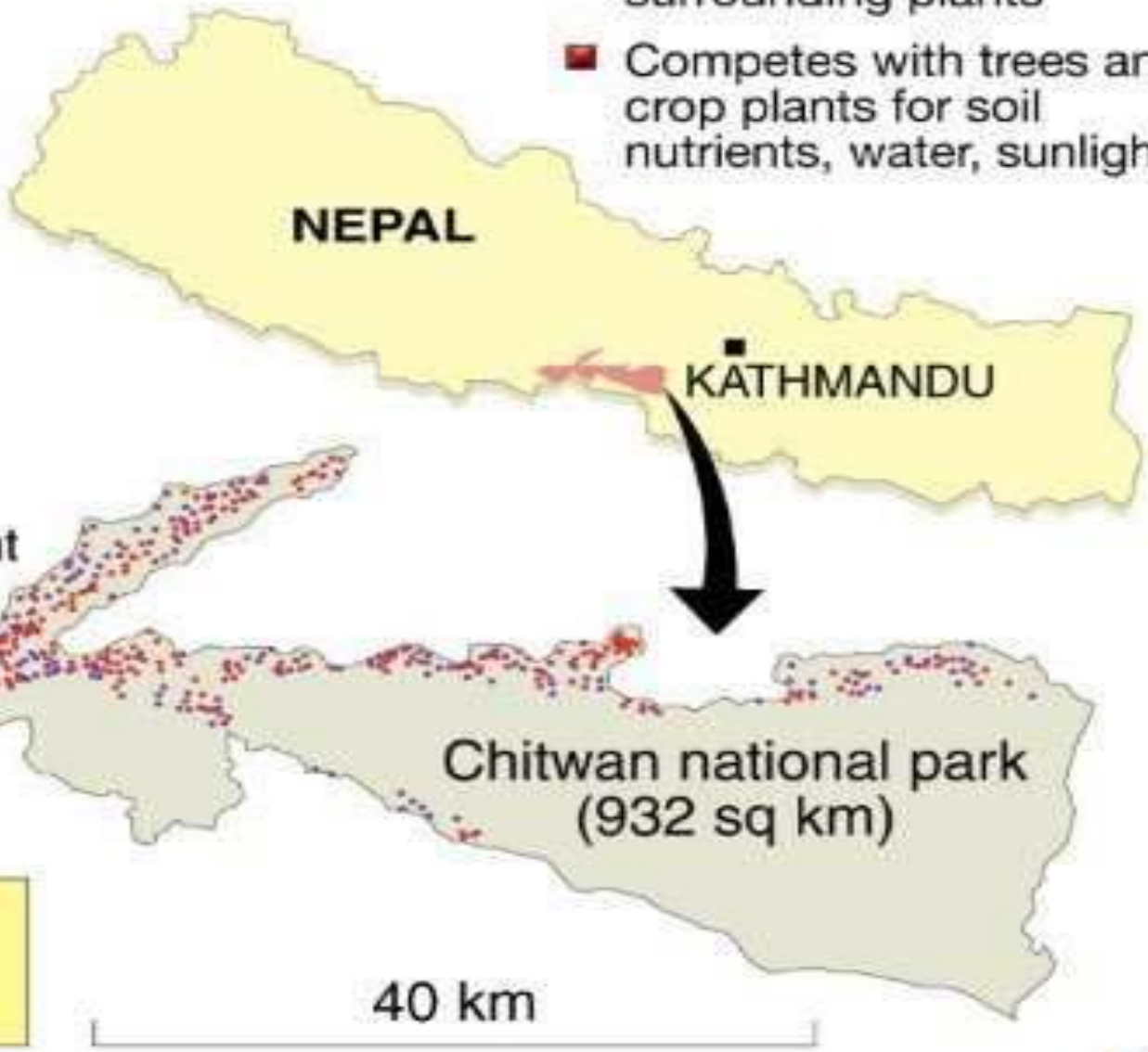
**Climate change affects breeding times of many Species, and can promote invasion of non-native species of plants and animals.**

# Plant invasion

Nepalese wildlife park under threat from invasive species

*Micania microantha*

- Creeper plant, smothers and chokes surrounding plants
- Competes with trees and crop plants for soil nutrients, water, sunlight



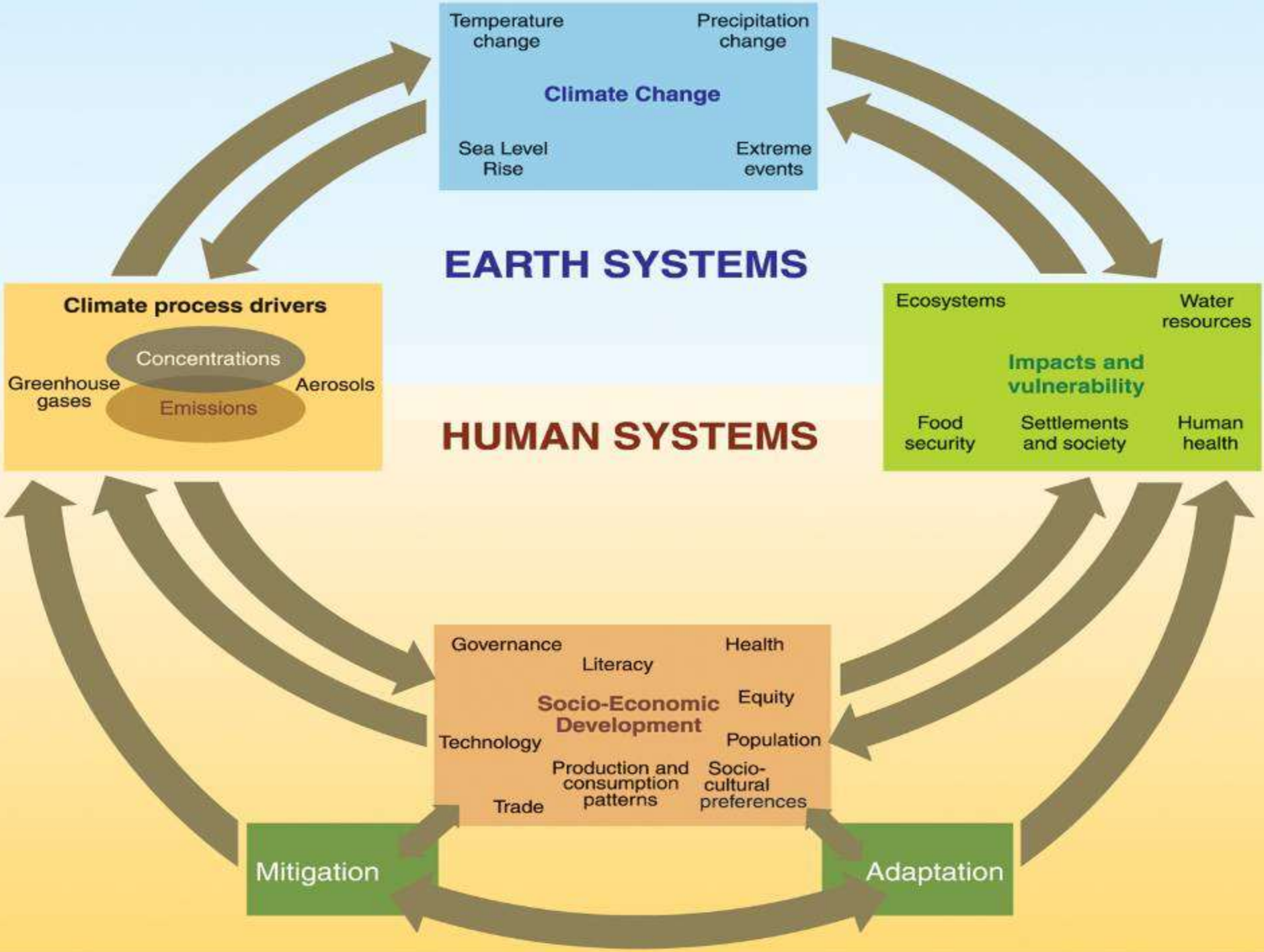

Source: CNP

AFP

Invasive plant species threaten the population of Asian rhinos In Chitwan. Other invasive species threaten many other native species throughout Asia's protected areas.


Climate change will affect flowering
and fruiting of plants in protected areas.
PA managers should monitor such changes.


Changing fruit
production will affect
fruit-eating species


Temperature change
Precipitation change
Climate Change
Sea Level Rise
Extreme events
EARTH SYSTEMS
Climate process drivers
Concentrations
Greenhouse gases
Aerosols
Emissions
Ecosystems
Water resources
Impacts and vulnerability
Food security
Settlements and society
Human health
HUMAN SYSTEMS
Governance
Health
Literacy
Socio-Economic Development
Equity
Technology
Population
Production and consumption patterns
Socio-cultural preferences
Trade
Mitigation
Adaptation

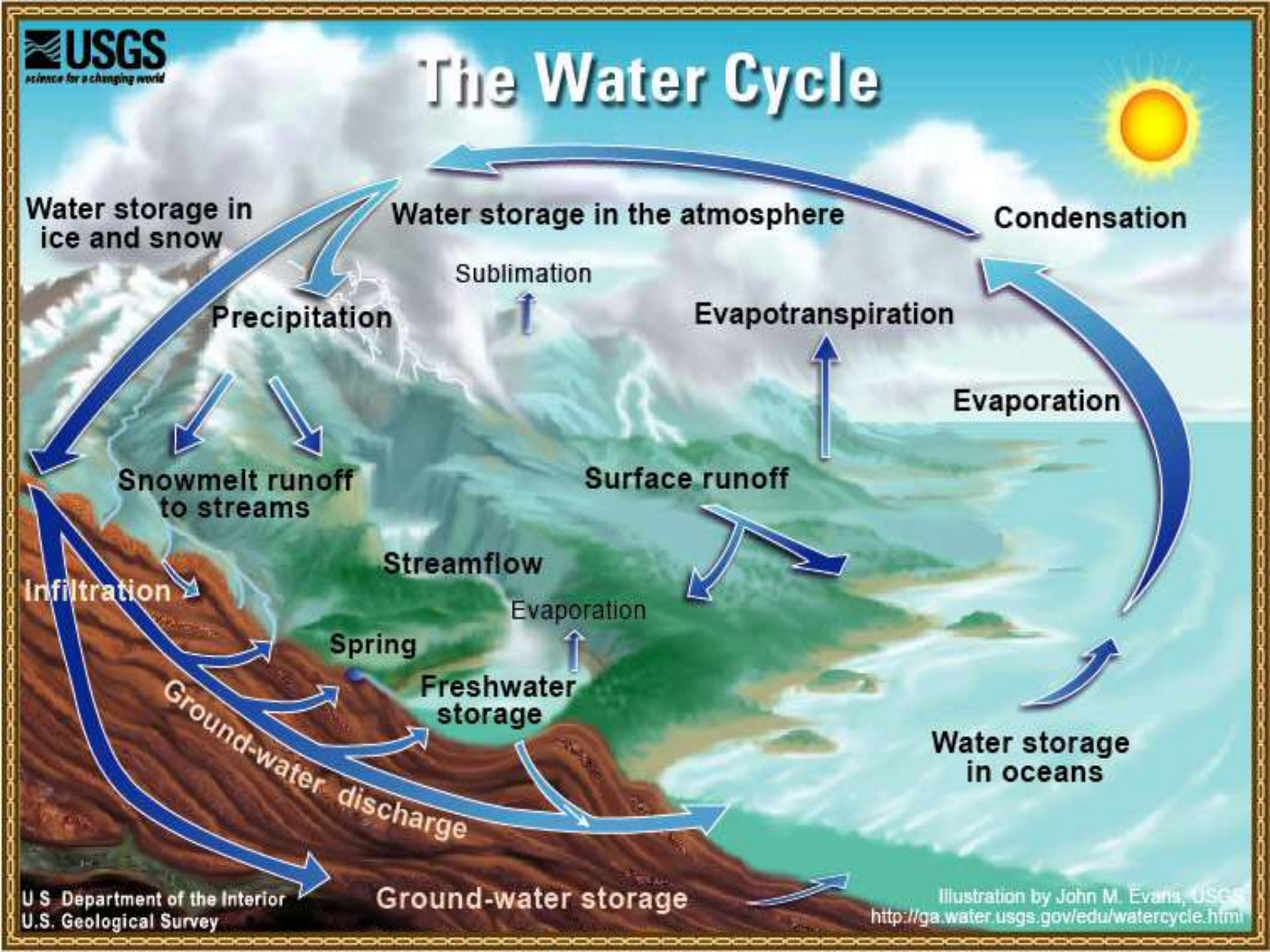
# Ecosystem Services (ES) related to Wetlands

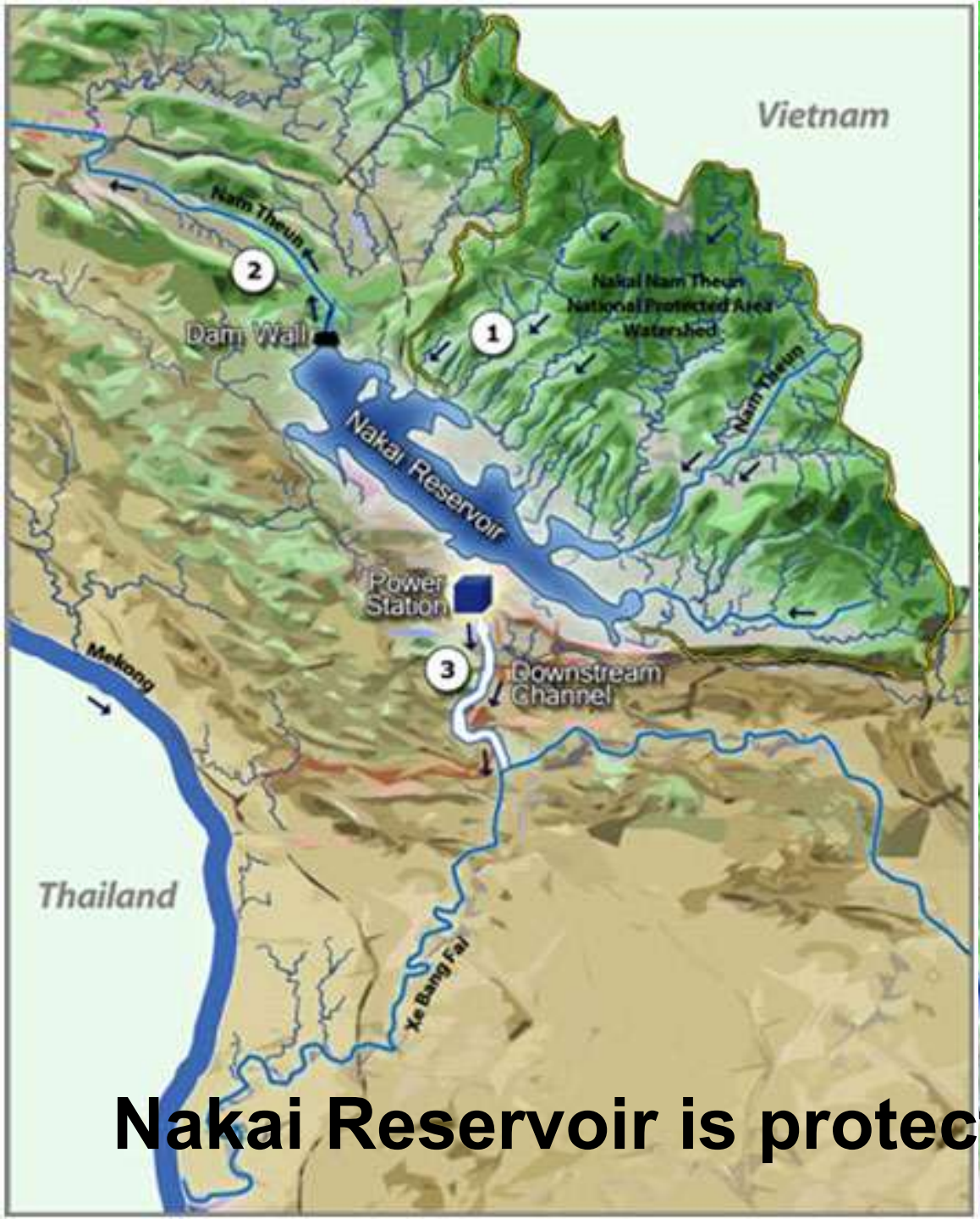
| Provisioning | Regulating | Cultural | Supporting |
|---|---|---|---|
| ▪ Floodplain recession agriculture<br>▪ Fresh water supply<br>▪ Food source (fishery, birds, wildlife)<br>▪ Grazing area for cattle | ▪ Flood attenuation and protection<br>▪ River flow regulation<br>▪ Improvement of water quality<br>▪ Nutrient cycling and sediment retention | ▪ Ecotourism<br>▪ Services meeting aesthetic, emotional, ethnic or spiritual needs | ▪ Biodiversity<br>▪ Carbon sequestration and storage<br>▪ Groundwater recharge |

Protected Area Certificates + Management Plan for Development

Benefit sharing, Conservation of Nature and Sustainable Use of Resources

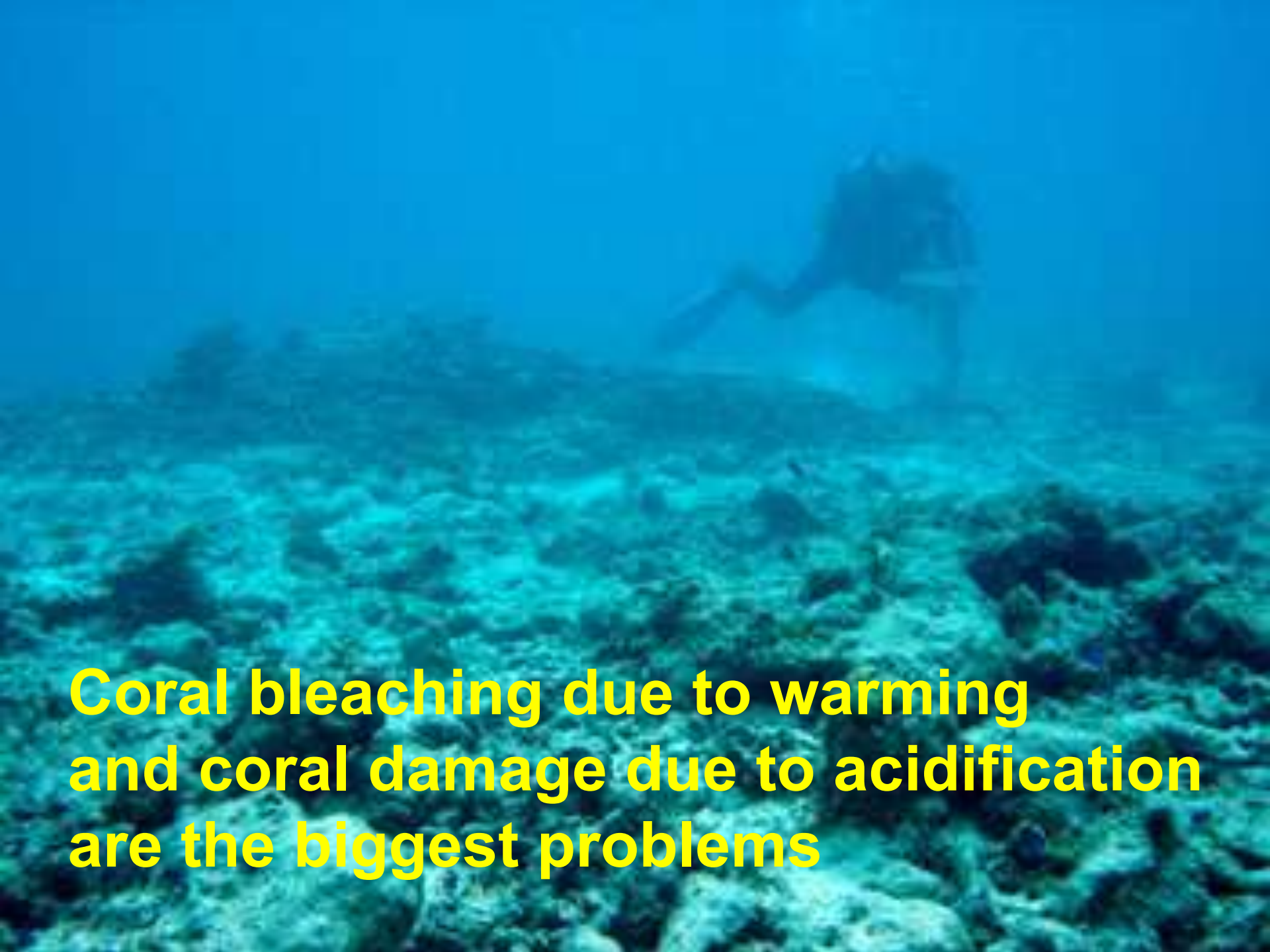

Air quality
Pest & disease control
Watershed protection and regulation
Forest products
Conservation of biodiversity
Plant pollination
Carbon sequestration and storage
Soil formation and fertility
Decomposition of wastes
Landscape beauty

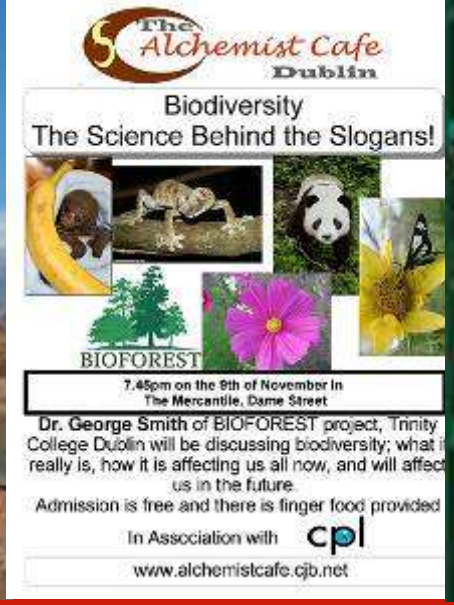

USGS
science for a changing world
The Water Cycle
Water storage in ice and snow
Water storage in the atmosphere
Condensation
Sublimation
Precipitation
Evapotranspiration
Evaporation
Snowmelt runoff to streams
Surface runoff
Streamflow
Infiltration
Evaporation
Spring
Freshwater storage
Ground-water discharge
Water storage in oceans
Ground-water storage
U S Department of the Interior
U.S. Geological Survey
Illustration by John M. Evans, USGS
http://ga.water.usgs.gov/edu/watercycle.html

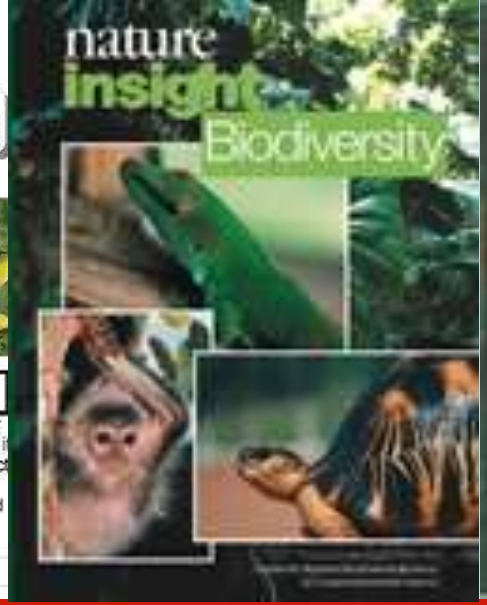


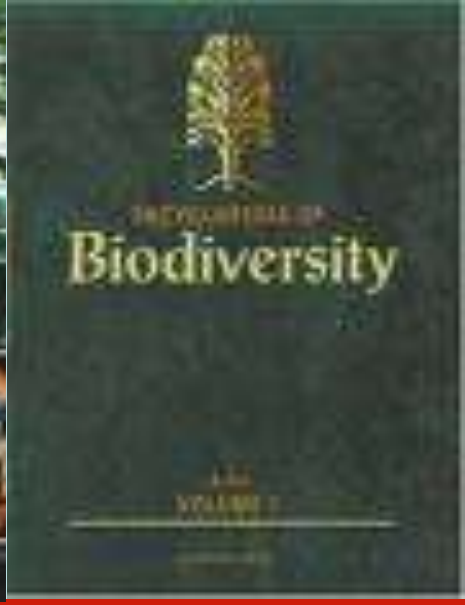

**Nakai Reservoir is protected by the PA**


Coral Reefs are already being affected by climate change

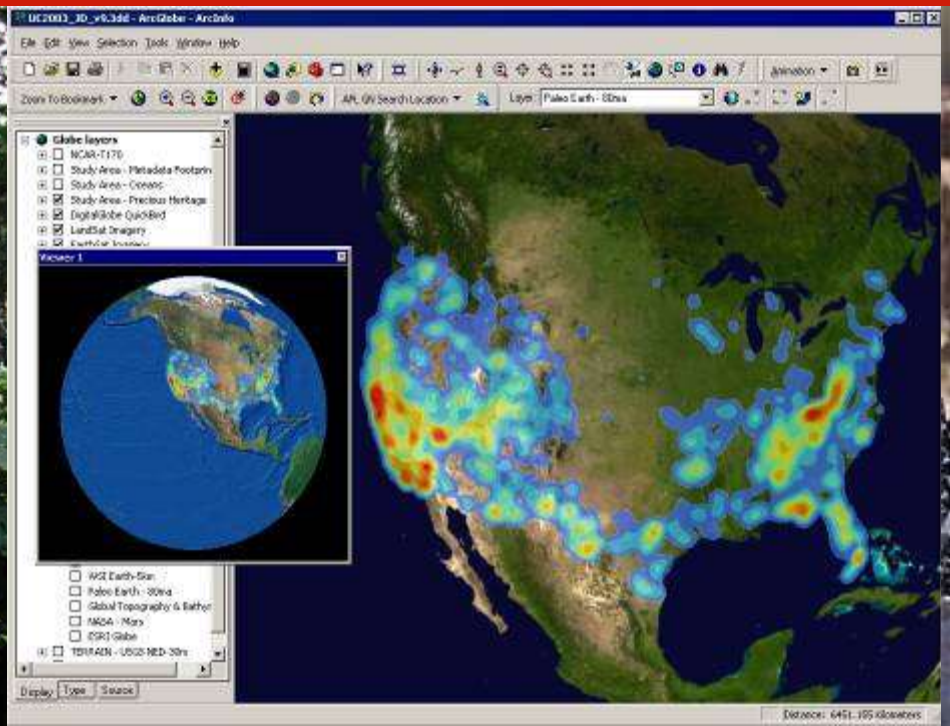

Coral bleaching due to warming
and coral damage due to acidification
are the biggest problems




# Conclusion 1: Build strong scientific support



# Climate Change Susceptibility Traits

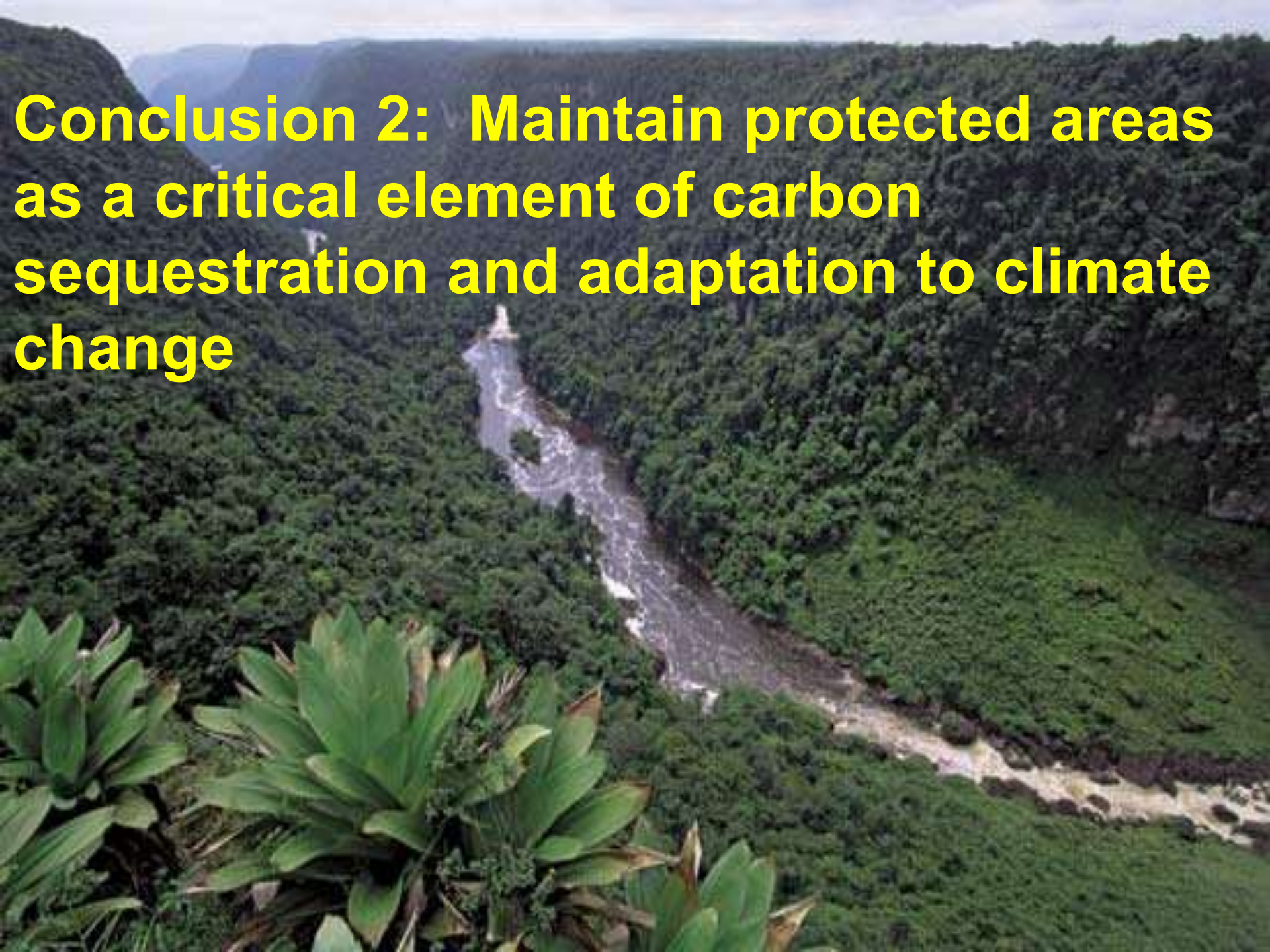
>90 detailed traits identified by IUCN's Species Survival Commission

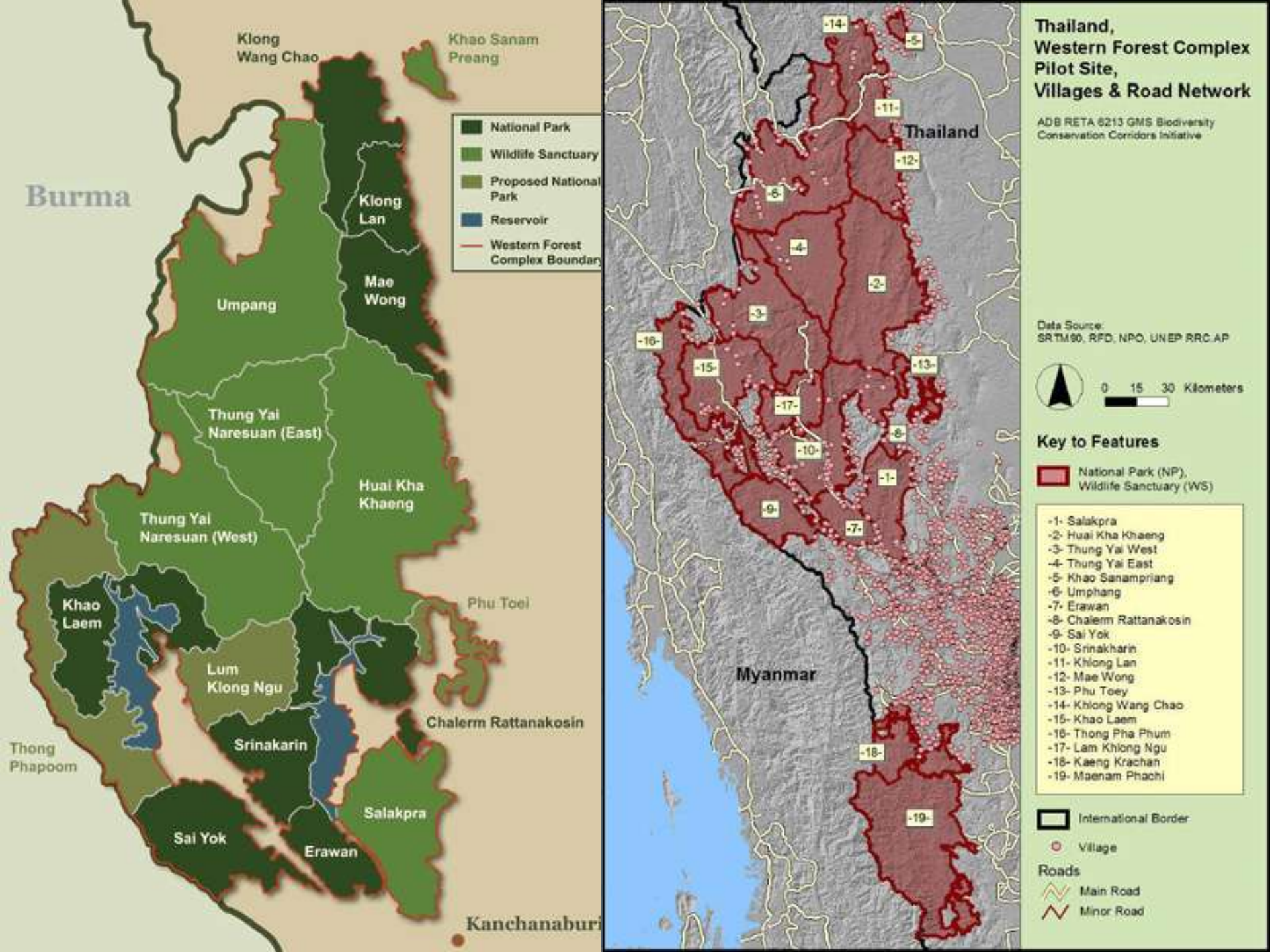
| |
|---|
| **A. Specialised habitat and/or microhabitat requirements** |
| **B. Narrow environmental tolerances or thresholds** that are likely to be exceeded due to climate change at any stage in the life cycle |
| **C. Dependence on specific environmental triggers or cues** that are likely to be disrupted by climate change |
| **D. Dependence on interspecific interactions** which are likely to be disrupted by climate change |
| **E. Poor ability or limited opportunity to disperse to or colonise** a new or more suitable range |

MacArthur

# Research priorities:

- **Establish a monitoring system for tracking the change in species distributions in response to climate change**
- **Explore possibilities for linking protected areas into larger landscapes that would enable species and ecosystems to adapt to climate change**
- **Improve understanding of the relationship between biodiversity and ecosystem services in protected areas**


Conclusion 2: Maintain protected areas as a critical element of carbon sequestration and adaptation to climate change


Klong
Wang Chao
Khao Sanam
Preang
Burma
National Park
Wildlife Sanctuary
Proposed National
Park
Reservoir
Western Forest
Complex Boundary
Klong
Lan
Mae
Wong
Umpang
Thung Yai
Naresuan (East)
Huai Kha
Khaeng
Thung Yai
Naresuan (West)
Khao
Laem
Phu Toei
Lum
Klong Ngu
Chalerm Rattanakosin
Srinakarin
Thong
Phapoom
Salakpra
Sai Yok
Erawan
Kanchanaburi
Thailand,
Western Forest Complex
Pilot Site,
Villages & Road Network
ADB RETA 6213 GMS Biodiversity
Conservation Corridors Initiative
Thailand
Myanmar
-14-
-5-
-11-
-12-
-6-
-4-
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-16-
-15-
-13-
-17-
-8-
-10-
-1-
-9-
-7-
-18-
-19-
Data Source:
SRTM90, RFD, NPO, UNEP RRC.AP
0 15 30 Kilometers
Key to Features
National Park (NP),
Wildlife Sanctuary (WS)
-1- Salakpra
-2- Huai Kha Khaeng
-3- Thung Yai West
-4- Thung Yai East
-5- Khao Sanampriang
-6- Umphang
-7- Erawan
-8- Chalerm Rattanakosin
-9- Sai Yok
-10- Srinakharin
-11- Khlong Lan
-12- Mae Wong
-13- Phu Toey
-14- Khlong Wang Chao
-15- Khao Laem
-16- Thong Pha Phum
-17- Lam Khlong Ngu
-18- Kaeng Krachan
-19- Maenam Phachi
International Border
Village
Roads
Main Road
Minor Road

**Definition of REDD**

**“Reducing Emissions from Deforestation and forest degradation in Developing countries.”**

**Definition of REDD+**

**Adds the role of conservation, sustainable management of forests and enhancement of forest carbon stocks**

# REDD+

REDD+ helps to mitigate climate change through forests, and provides social and environmental benefits. It includes these essential components: creating incentives for not clearing standing forests, maintaining and expanding forest cover, sustainably managing forest and recovering degraded lands.

# Conclusion 3. Promote regional cooperation to adapt to climate change

# Recommendation: Manage protected areas to adapt to climate change

- Monitor changes to species and ecosystems, and modify management accordingly;
- Build links to surrounding lands through corridors that will enable species movement;
- Give greater attention to the problems of invasive species, and emerging infectious diseases;
- Enhance financial support for PAs through payment for ecosystem services such carbon sequestration, provision of water supplies, and conservation of biodiversity