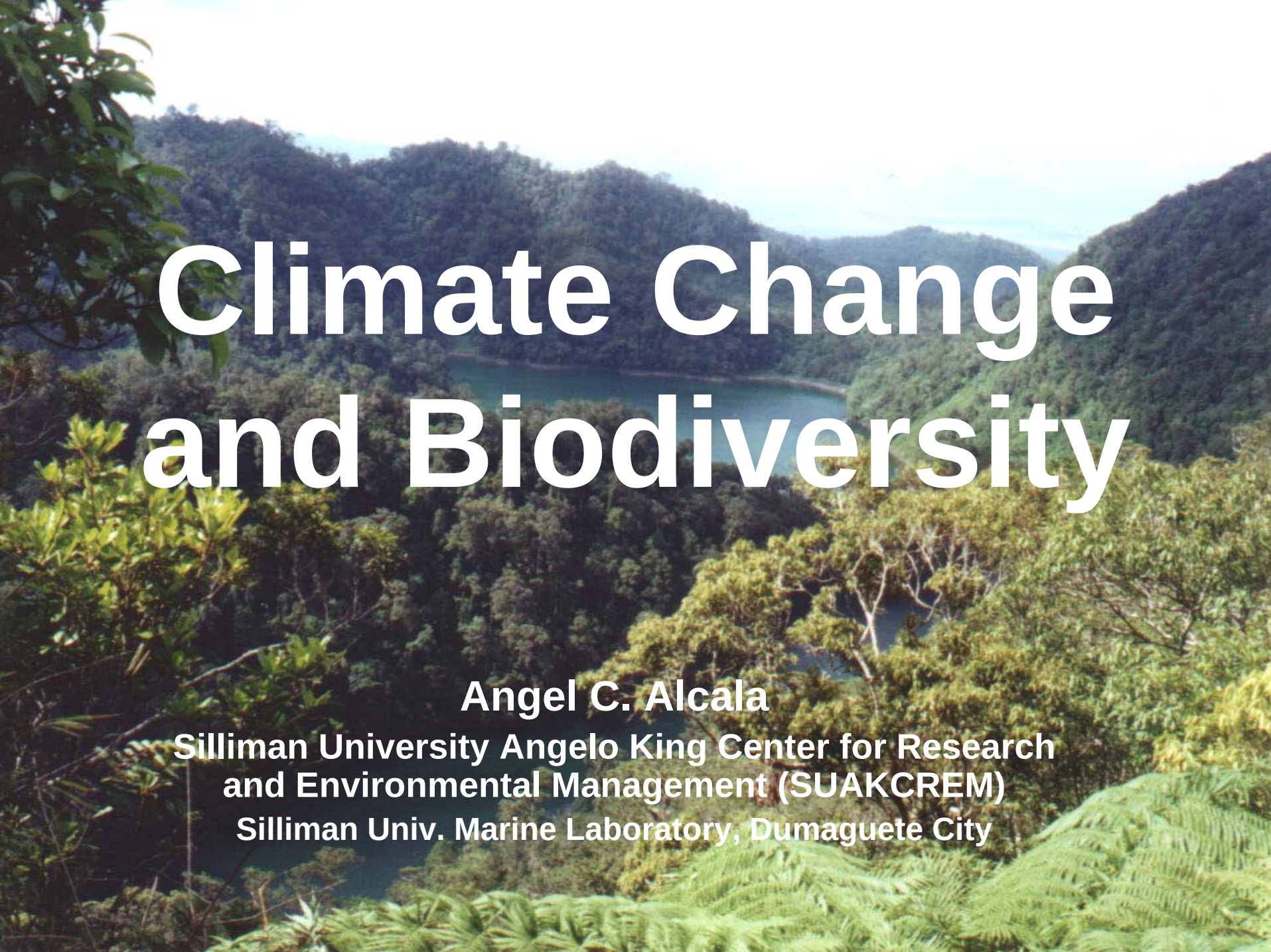

Climate Change and Biodiversity

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Climate change is not a new phenomenon

- Climate change has been with us for a long time
- Has accelerated since the 20th century (1900)
- In the past, cold periods alternated with warm periods

- **The earth gradually warmed up resulting in:**
  - Melting of some of the ice
  - Rise in sea level
  - Present sea level reached about 6,000 years ago
- **During this period of sea level adjustment, biodiversity adapted to the changes:**
  - coral reefs gradually occupied shallower depths (down to 50m) of the tropical seas

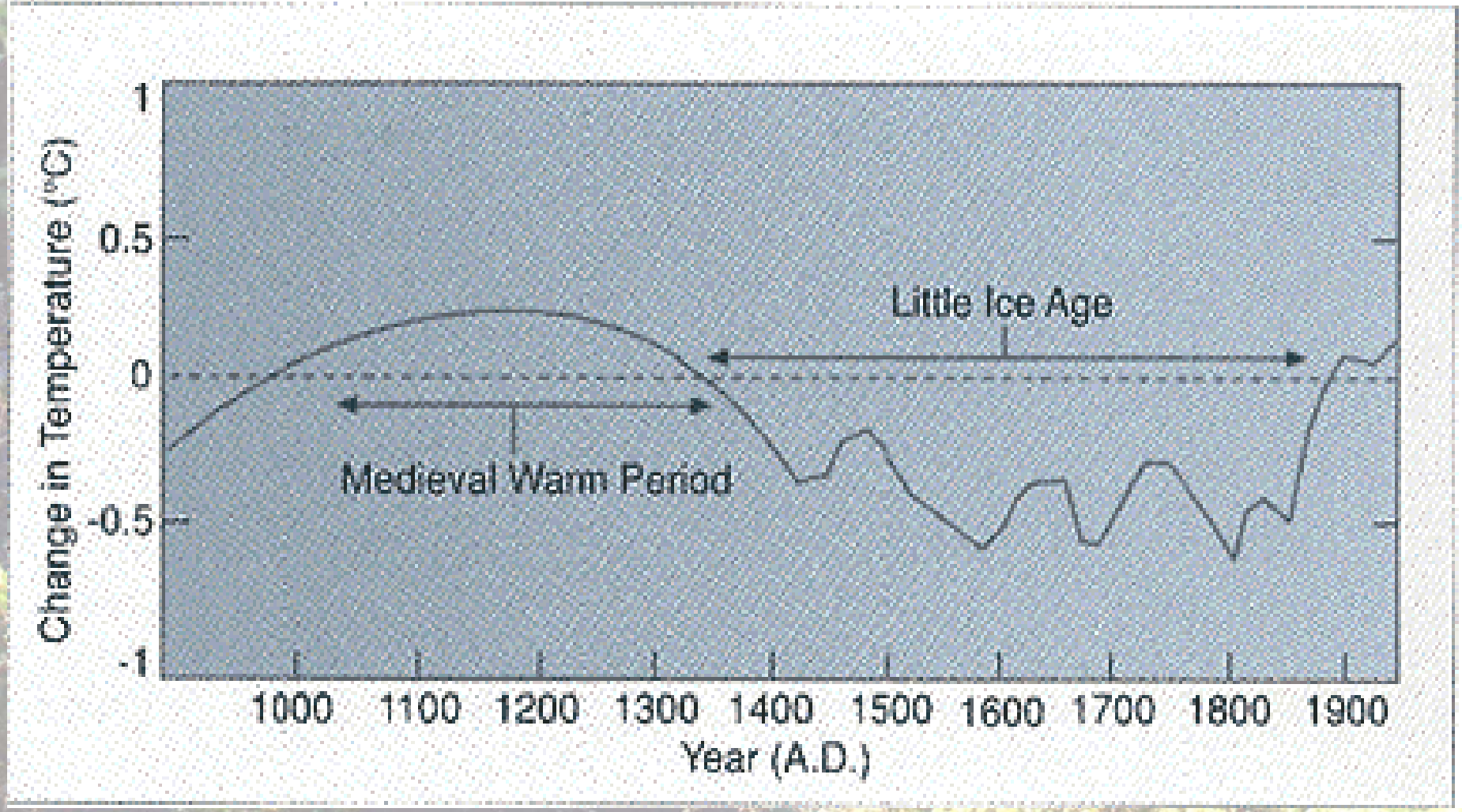


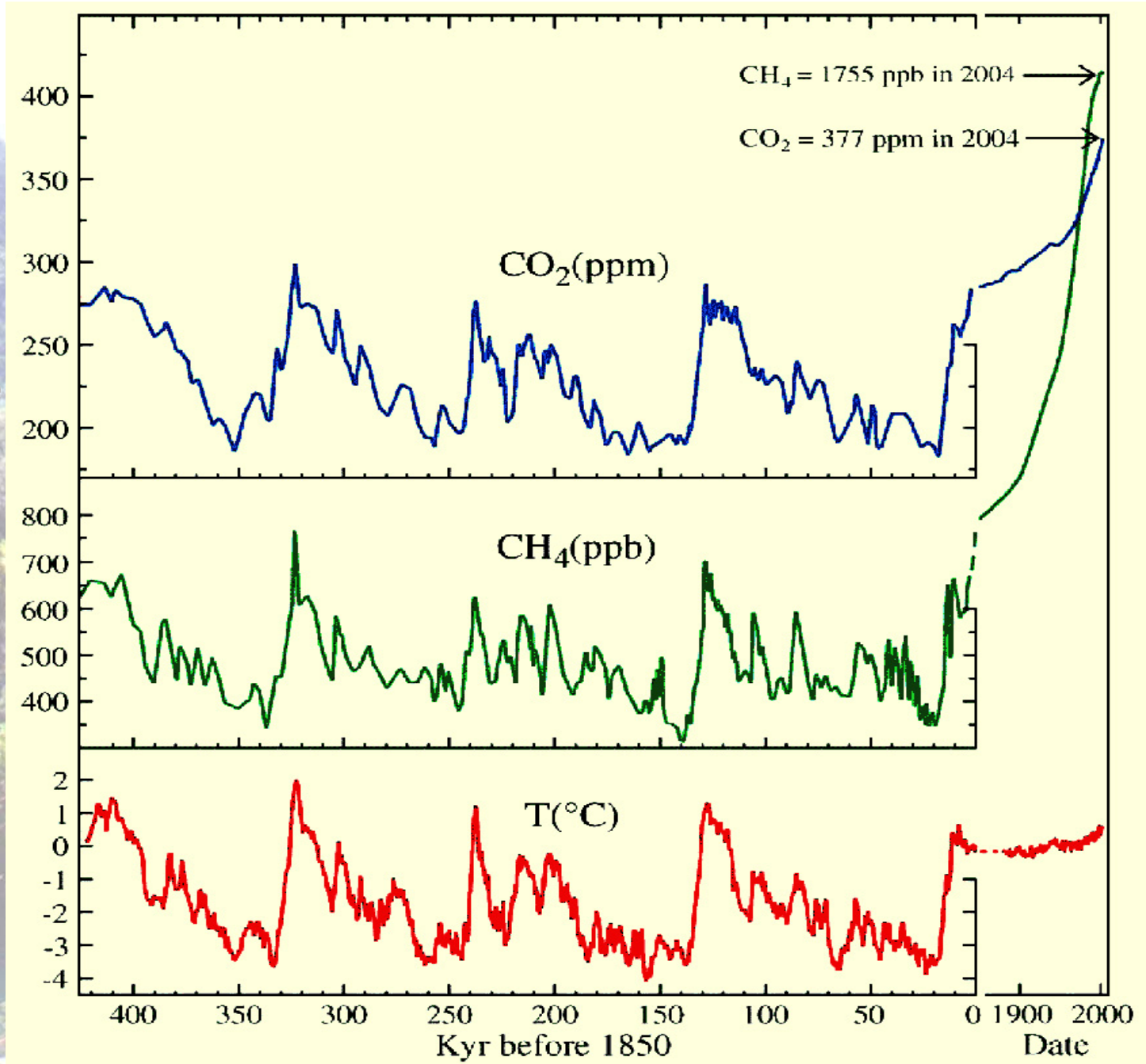
Fig. 1. Temperature changes from A.D. 1000 to A.D. 1900

- **Climate change also involves changes in the concentrations** of **some chemical compounds e.g.:**
  - **Carbon dioxide**
  - **Methane**

- **Changes in the concentrations fluctuated in the past**

- **Trend in rise has been dramatic from 1900 to 2000 A.D.**

Fig. 2. $CO2, CH_4$ and estimated global temperature (Antarctic $\Delta T/2$ in ice core era) 0 = 1880-1899 mean.



Source: Hansen, *Climate Change*, **68**, 269, 2005.

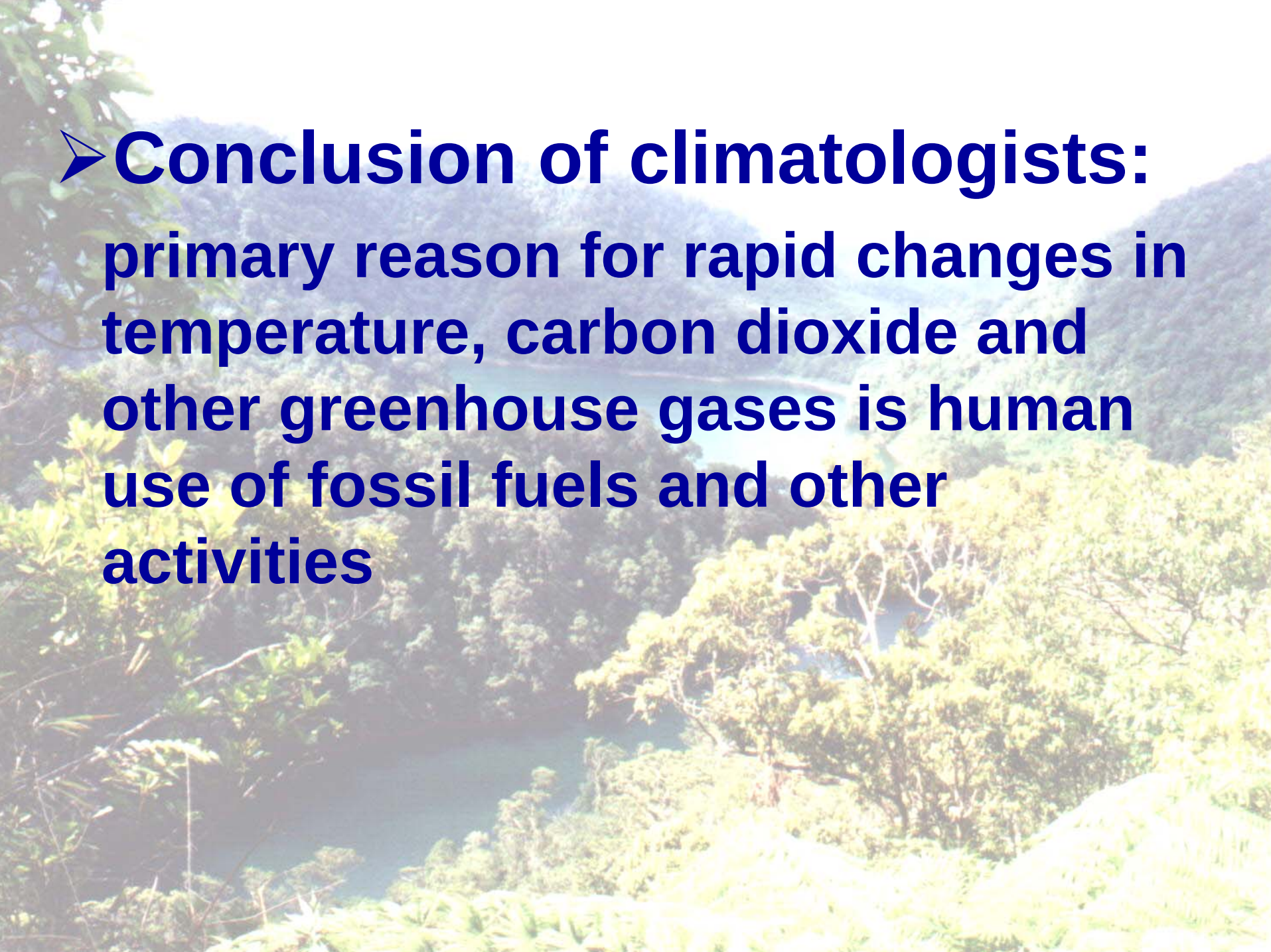
Natural Causes of Climate Change:

- Global factors include:
  - continental drift (break up of continents)
  - volcanic eruptions
  - earth's tilt (responsible for the earth's four seasons)
  - comets and meteorites

- **Regional factors include:**
  - **ocean currents bringing heat to more northern areas such as the Japan Current in the eastern Pacific Ocean**

Human-induced Causes:

- Use of fossil fuels
- Deforestation
- Human activities that increase production of greenhouse gases
  - ex. burning large amounts of oil, gas, and coal



- **Conclusion of climatologists:**

  primary reason for rapid changes in temperature, carbon dioxide and other greenhouse gases is human use of fossil fuels and other activities

Effects/Manifestations of Climate Change

1. Trapped heat from the sun and increased temperatures on ground and in oceans
2. Heavy rainfalls in some areas and droughts in others
3. Glaciers melt and spring comes earlier
4. Rise in sea levels, salt water intrusion
5. Changes in ocean circulation (stratification of ocean water)
6. Changes in weather patterns
7. Direct & indirect effects on biodiversity

Quantitative Measurements of Changes

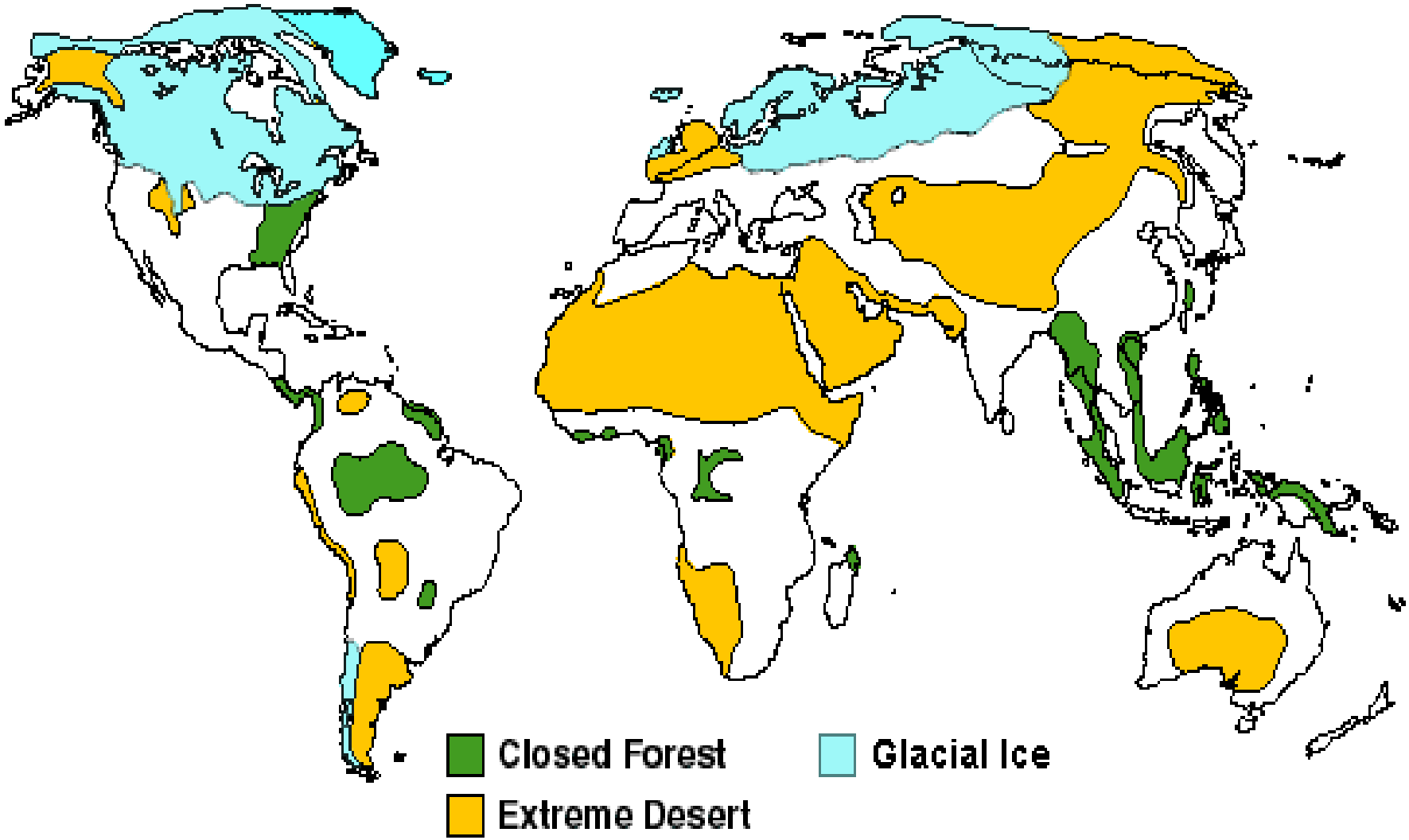
1. Total global temperature change since late 19th century is 0.6^0C
2. CO^2 concentration in atmosphere before industrial era (1750) was 280 ppm +/-10 ppm
3. CO^2 concentration was 367 ppm in 1999, 377 ppm in 2004
4. 280 ppm was not exceeded during the past 420,000 yrs and not within the past 20 million years
5. Oceans absorb about 1/3 of human-induced CO^2 emissions, uptake declines with absorption

Experts' Prediction/Conclusions

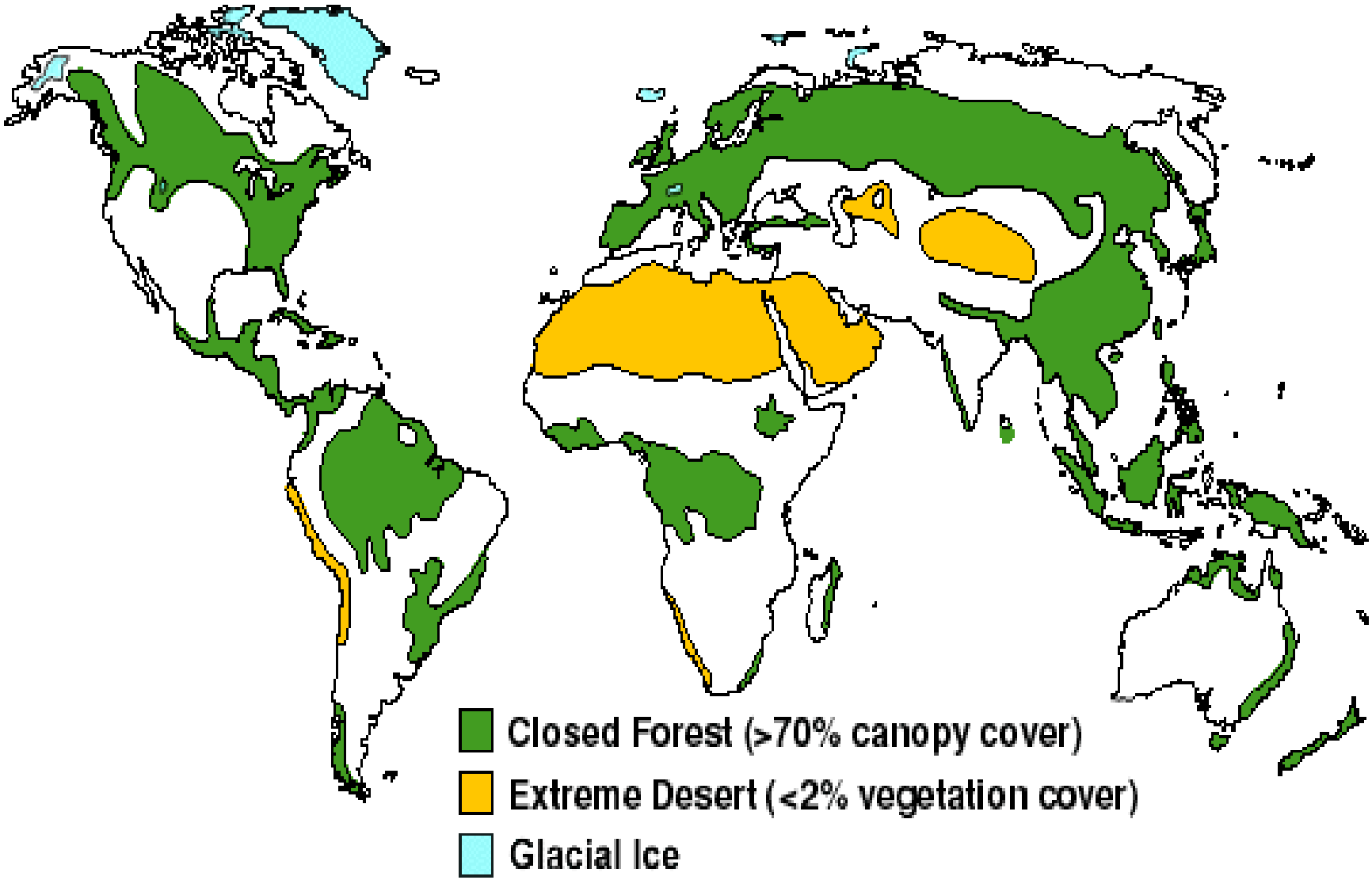
1. Possible rise in global temperature could be from 1.4^{0}C to 5.8^{0}C by 2100
2. Climate related impacts predicted

   eg. hurricanes and typhoons would increase in severity
3. UV radiations increased (population die-offs, e.g. frogs in s. hemisphere)
4. End of Ice Age, the disappearance of Glacial Ice in the North Pole.

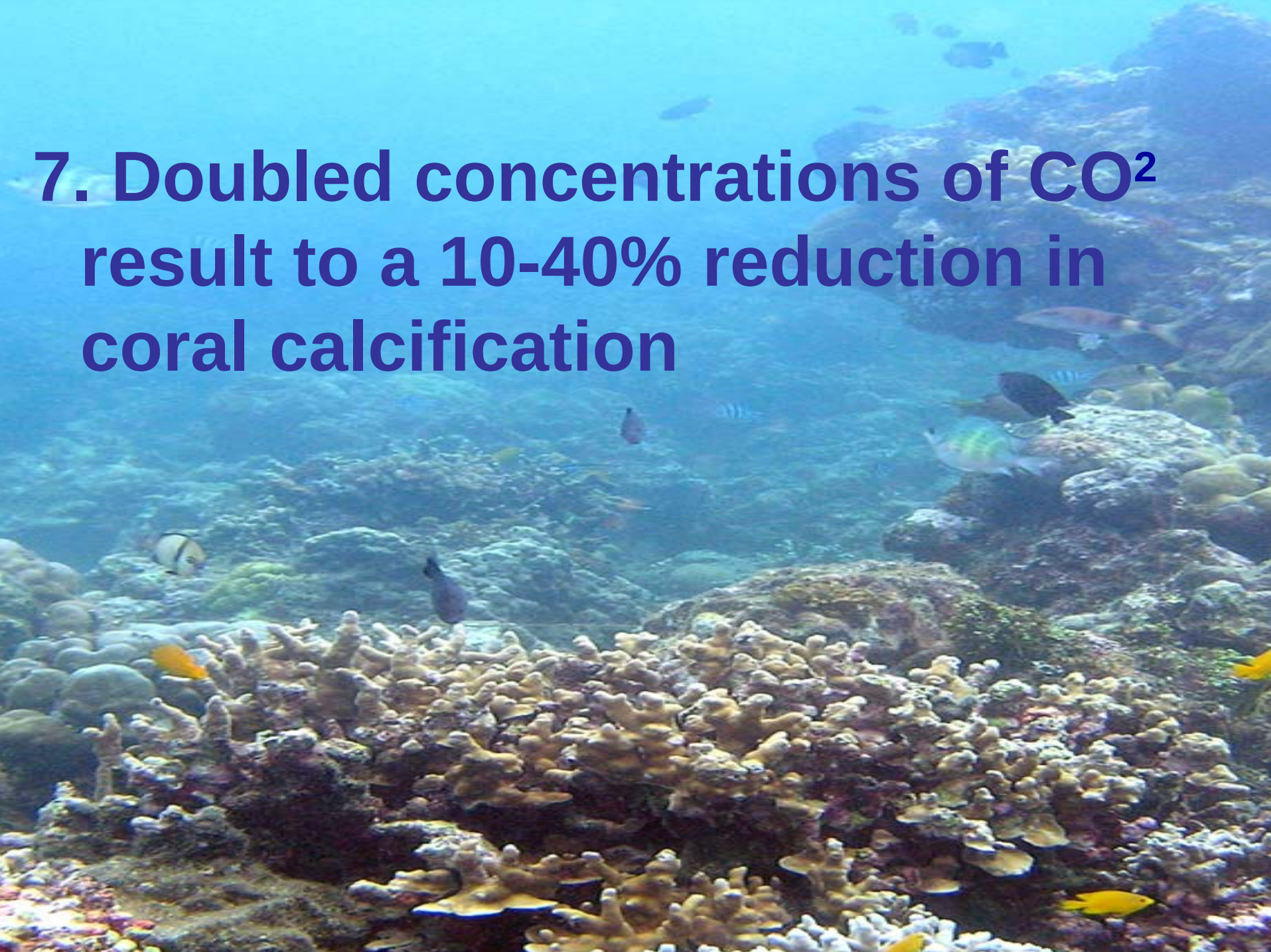
Last Glacial Maximum (18,000 ^{14}C years ago)



Present Potential Vegetation



4. It will take centuries for the present CO^2 level to come down to the pre-industrial level
5. Much of global warming is caused by increase in man-induced greenhouse gas emissions, especially CO^2 and methane
6. Increased CO^2 absorbed by oceans prevents/lessens efficiency of marine organisms to build calcium carbonate skeletons



7. Doubled concentrations of CO^2 result to a 10-40% reduction in coral calcification

8. If all of CO^2 released by land use changes could be restored to terrestrial biosphere, CO^2 at end of 21st century would be 40-70 ppm less with no intervention
9. Global deforestation would add 2-4 times more CO^2 than reforestation of cleared areas would subtract





8. CO^2 stabilized at 450, 650, and 1000 ppm would require global CO^2 emissions to drop below the 1990 levels, within a few decades, a century, and two centuries, respectively
9. Increase in atmospheric temperatures would harm tropical biodiversity more than temperate biodiversity since tropical species have a narrow range of tolerance limit at the upper end of the temperature scale

What are we to do?

- The Philippines contributes relatively little to climate change
- However, we are affected by climate change
- Some parts of our country are especially vulnerable because of our archipelagic status
- As member of the community of nations we have to do our part

- **Our responses would require actions at the level of individuals and community groups:**
  - changes in behavior
  - local governments through specific actions
  - national government agencies through national policies and programs intended to combat climate change.

➢ Suggested areas of action:

1. IEC on climate change
2. Change energy consumption patterns:
   - ✓ reduce consumption of and dependence on bio-fuels and fossil fuels
   - ✓ shift to energy generated by wind, water, sun, tides etc., thus reducing production of CO_2 and other greenhouse gases
   - ✓ these require change in human behavior

3. Increase sequestration of CO_2 already in the atmosphere by:

- ✓ implementing the Kyoto Protocol
- ✓ reforestation of denuded lands with indigenous tree species
- ✓ protection of the 20,000 sq km coral reefs of the Philippines
- ✓ bring back the half a million ha of mangrove forest along coastal areas

4. Protect all remaining natural forests including mossy forests (that store H2O)
5. Adopt measures to increase soil storage of rain water during the raining season
6. Conserve natural marshes in lowlands to maintain/increase water storage capacity
7. Protect deep coral reefs of the country to serve as sources of marine propagules

8. Identify using modern tools (e.g. satellite imageries) and protect upwelling areas of Philippine seas that serve as areas of high primary productivity and fishery production
9. Avoid reclamation in coastal areas and building structures on reclaimed areas, and
10. Strengthen foundations of buildings already existing in reclaimed areas to decrease risk to sea level rise and coastal erosion

Lake Balinsasayao, Negros Oriental. 900m ASL