

Climate change & the Role of Forests to Climate Change

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Climate change & the Role of Forests to Climate Change



What are the signs that climate change is occurring?



What causes climate change?



What is the role of forests in climate change?

What is Climate Change?

What are the signs of Climate Change?



What is Climate Change?

- **Climate Change** = Any significant change in measures of climate (such as temperature or precipitation) lasting for an extended period of time (typically decades)
- **United Nations Forum Convention on Climate Change (UNFCCC)** defines Climate Change as 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere'

Climate Change is happening

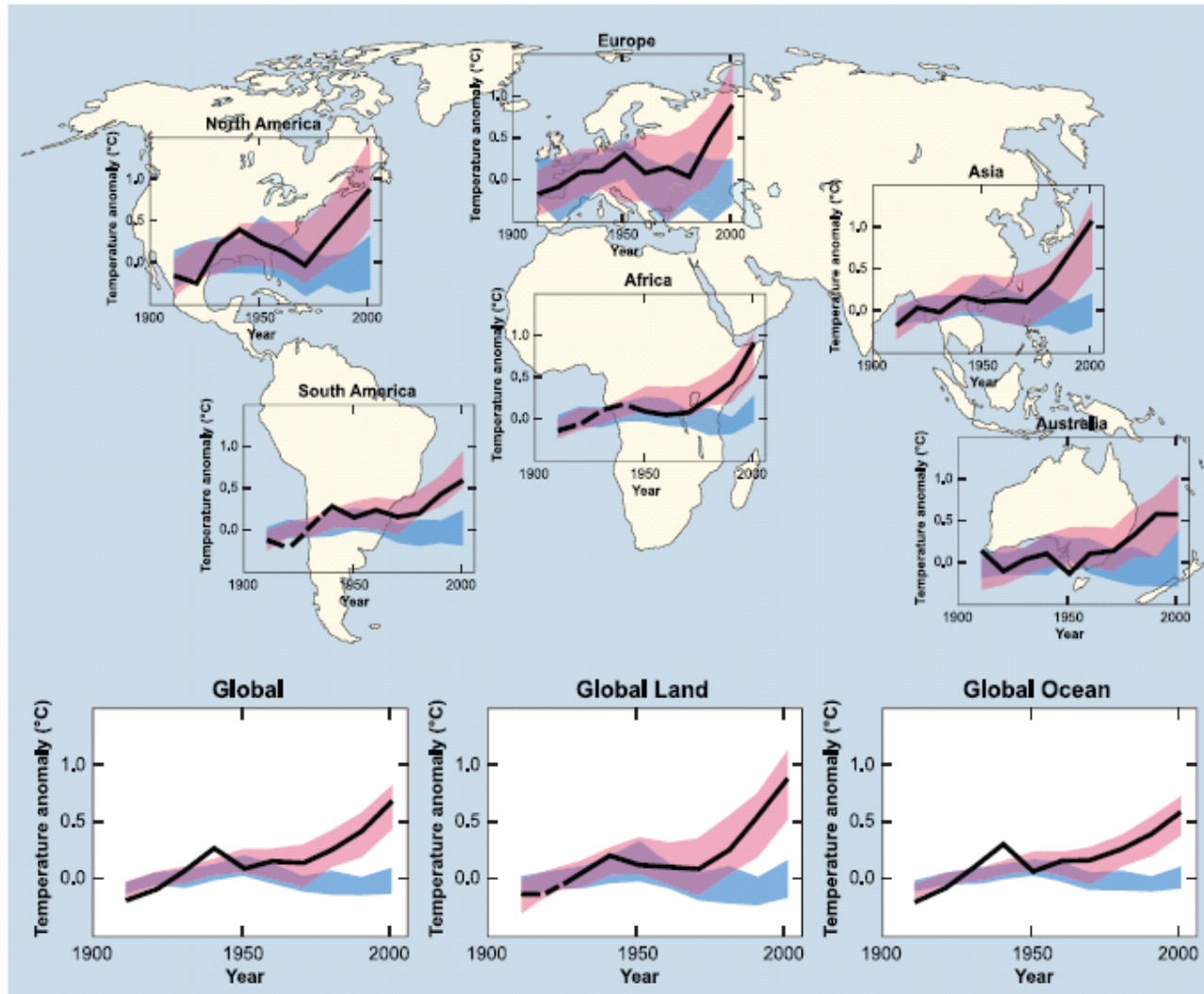
“Warming of the climate system is **unequivocal**, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level” (IPCC Fourth Assessment Report, 2007)



“Most of the observed increase in global average temperatures since the mid 20th century is very likely **due to observed increases in anthropogenic greenhouse gas concentrations**” (IPCC, 2007)

Global and continental temperature change

Global and continental temperature change

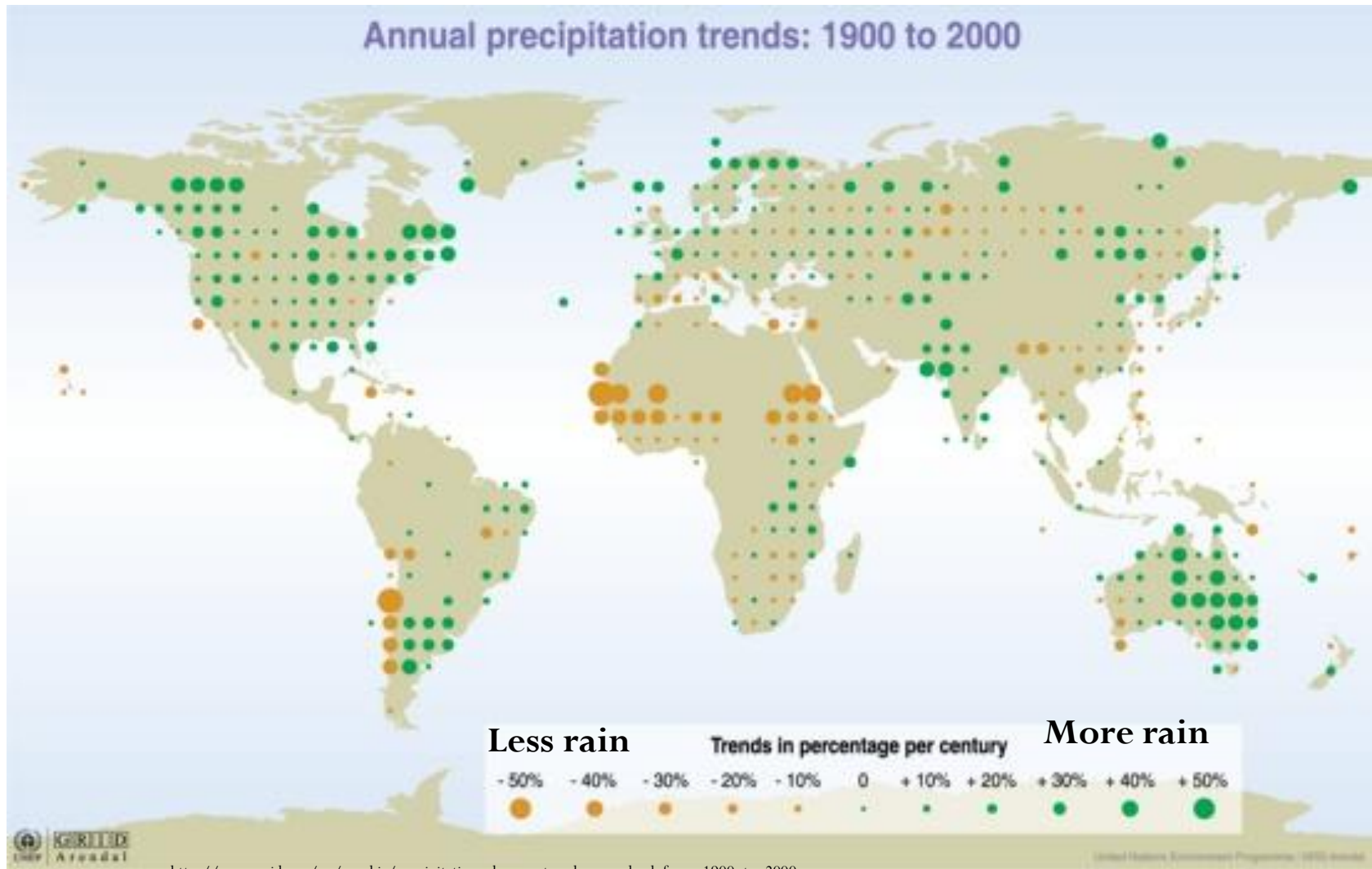


—
Observed
temperatures

Model predictions
(including natural
and human drivers)

Model
predictions
(including only
natural drivers)

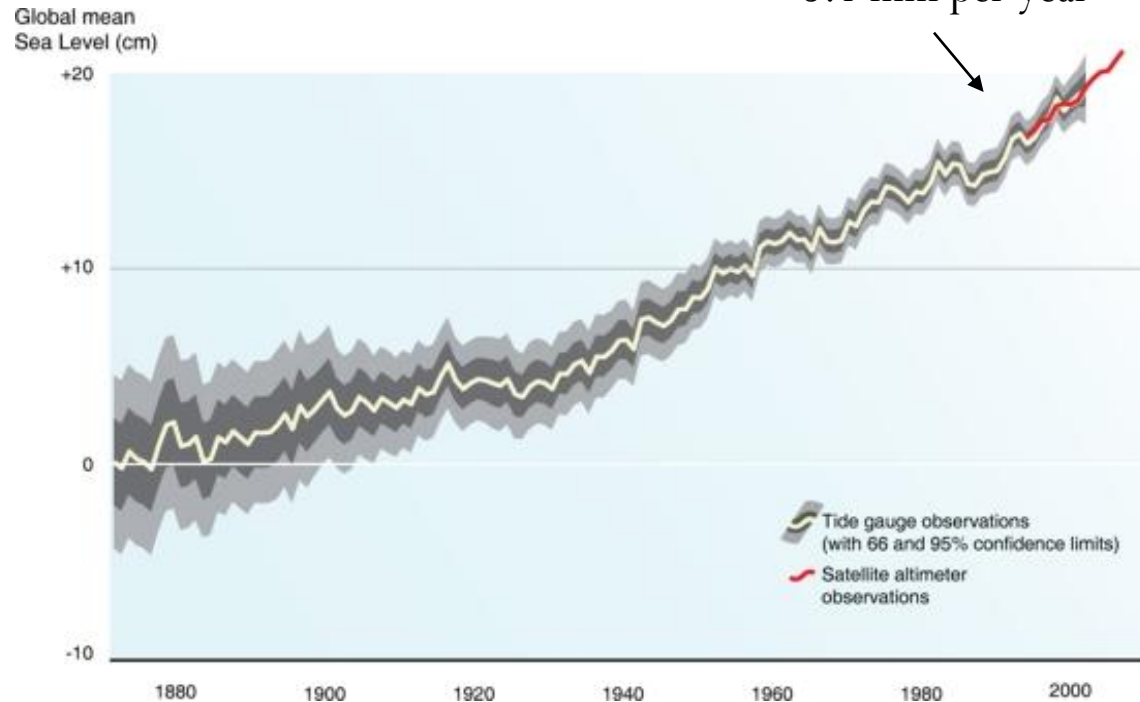
Changes in precipitation patterns



http://maps.grida.no/go/graphic/precipitation_changes_trends_over_land_from_1900_to_2000

Rising sea levels

+ 3.1 mm per year



<http://maps.grida.no/go/graphic/trends-in-sea-level-1870-2006>

Global mean sea level rise from 1870 - 2006



- Sea levels are rising due to thermal expansion and melting glaciers and ice caps
- Average global sea levels have risen 17 cm during 20th century and may rise 28-58 cm by 2100

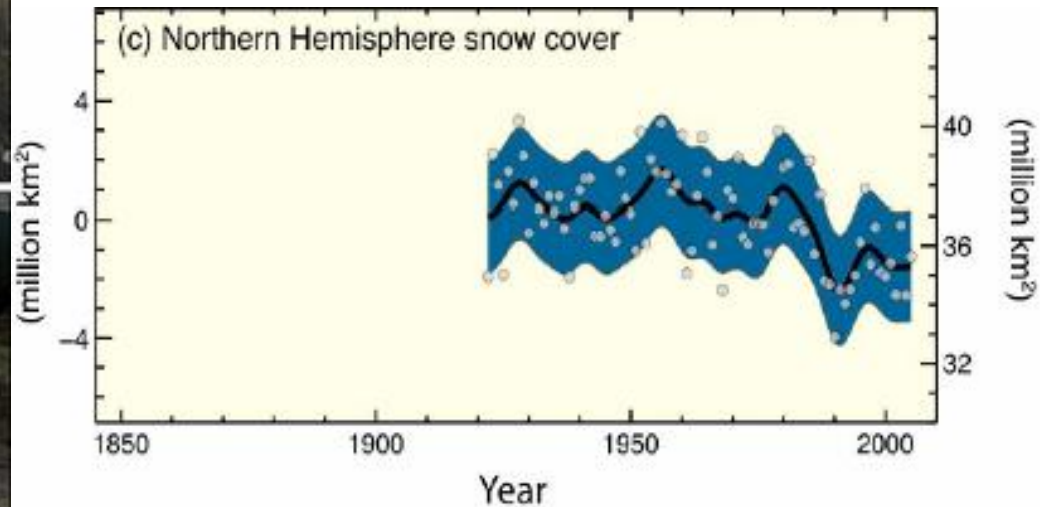
More extreme weather events



Decreasing snow cover and melting glaciers



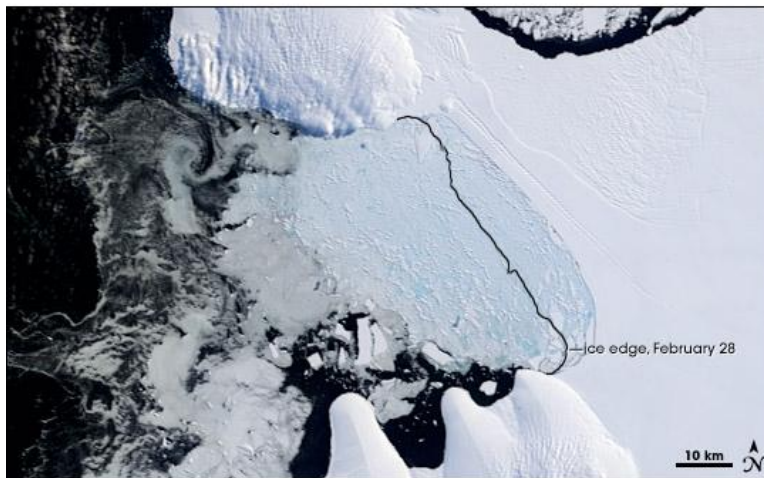
Decreasing snow cover



Warming of poles and loss of sea ice

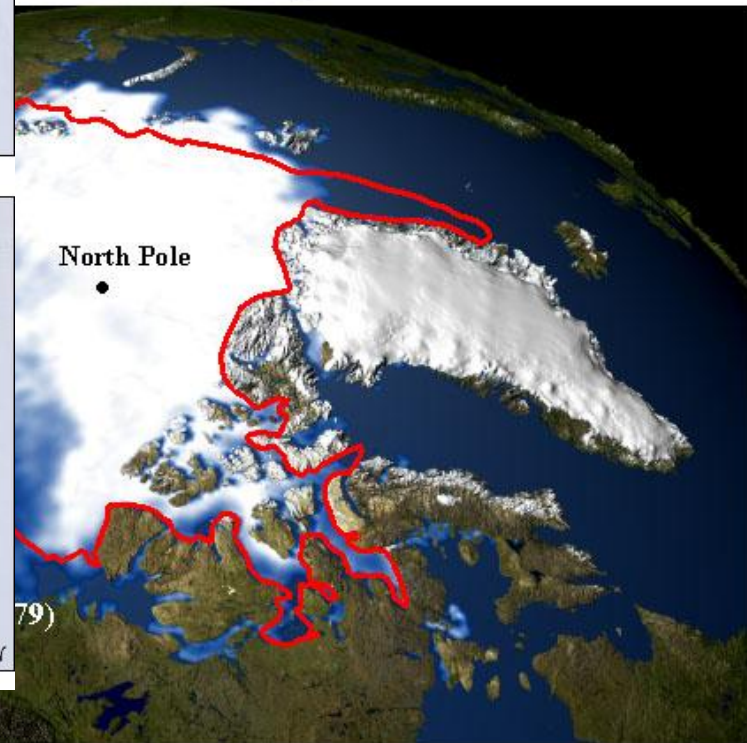


February 28, 2008



March 17, 2008

ss: Greater than Land Area of
ia, and Maryland Combined
03 vs. 1979 Comparison

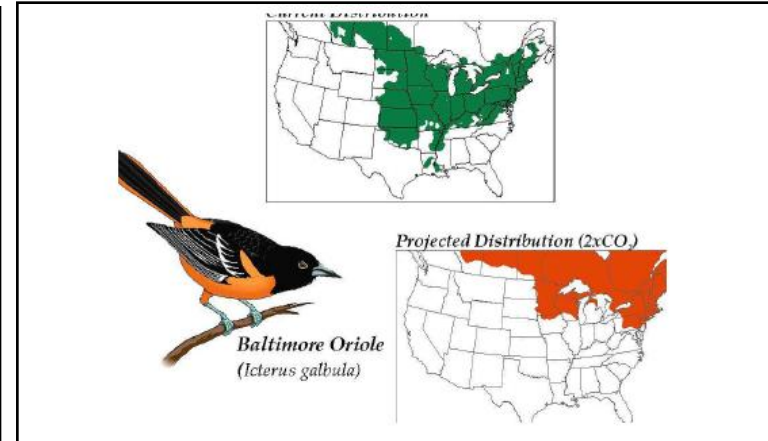


Collapse of Wilkins Ice Shelf, Antarctica

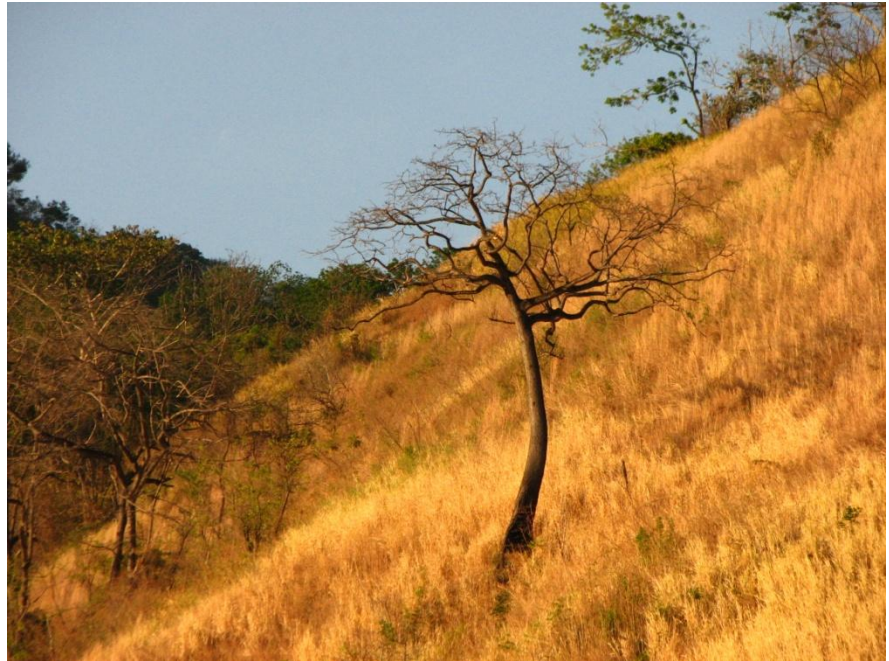
<http://earthobservatory.nasa.gov/Study/WilkinsIceSheet/>

Changes in ecosystems

- Earlier timing of spring events
- Poleward and upward shifts in plant and animal communities
- Loss of polar and montane habitats

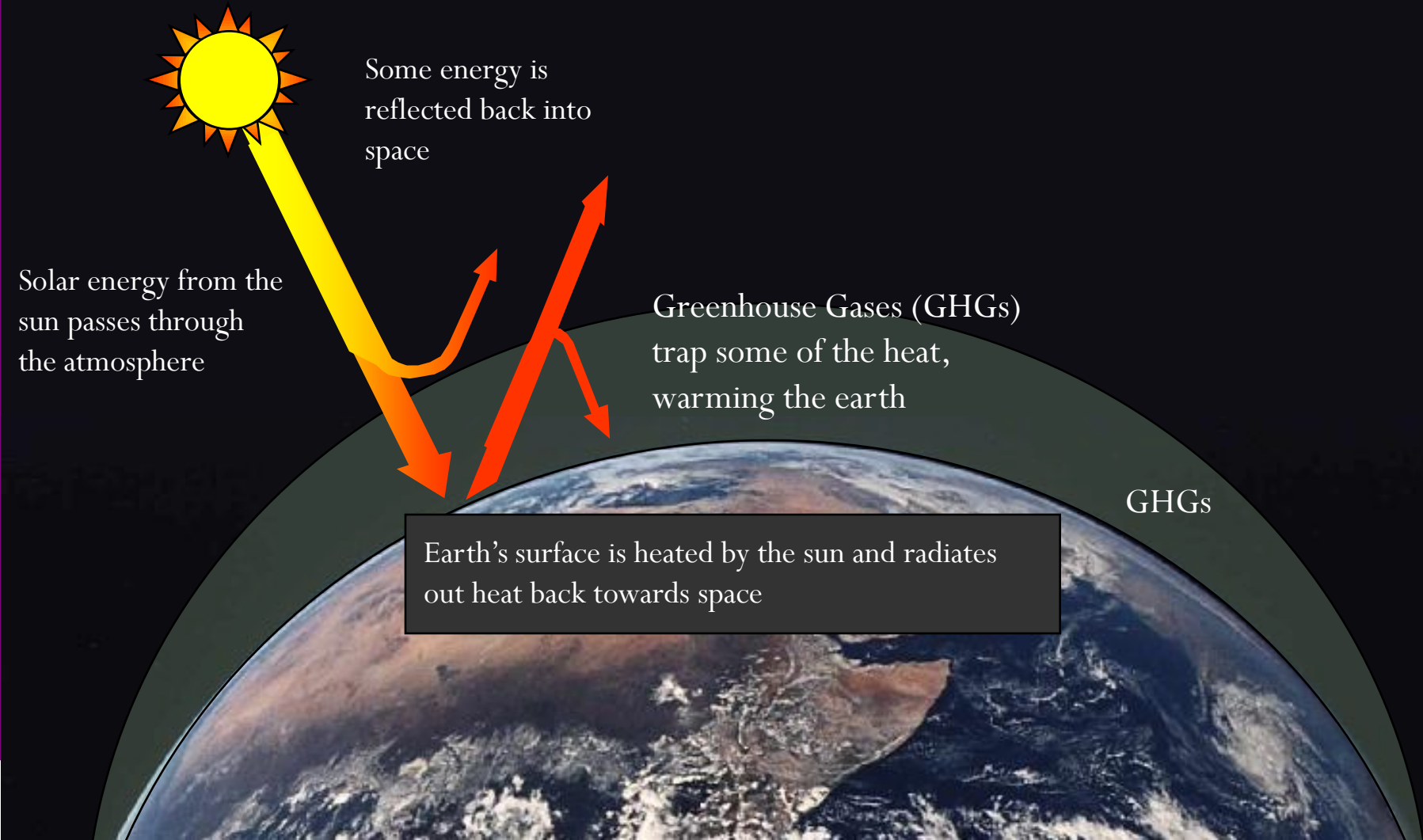


What causes climate change and where are greenhouse gas emissions occurring?

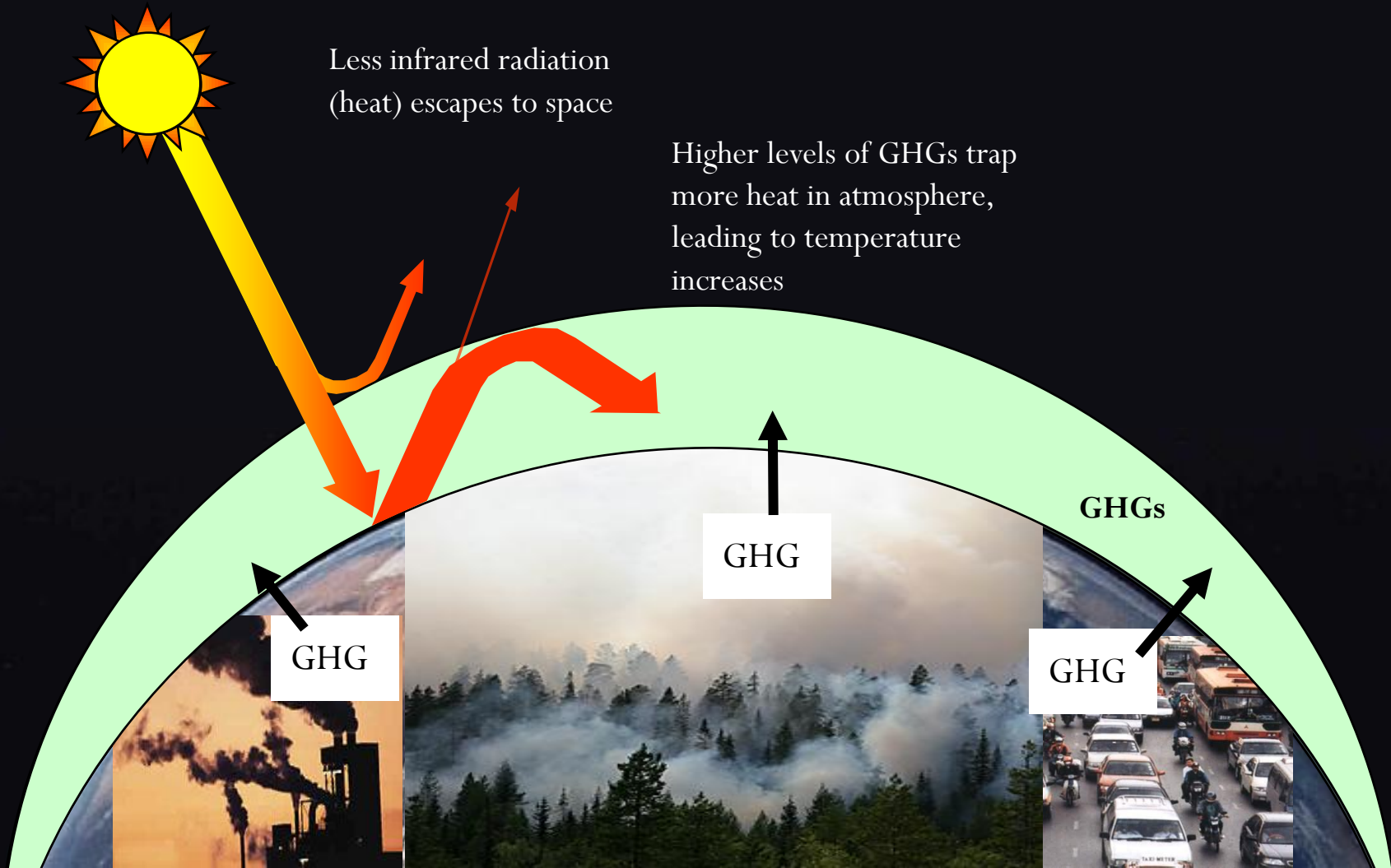


What is causing climate change?

The natural greenhouse effect



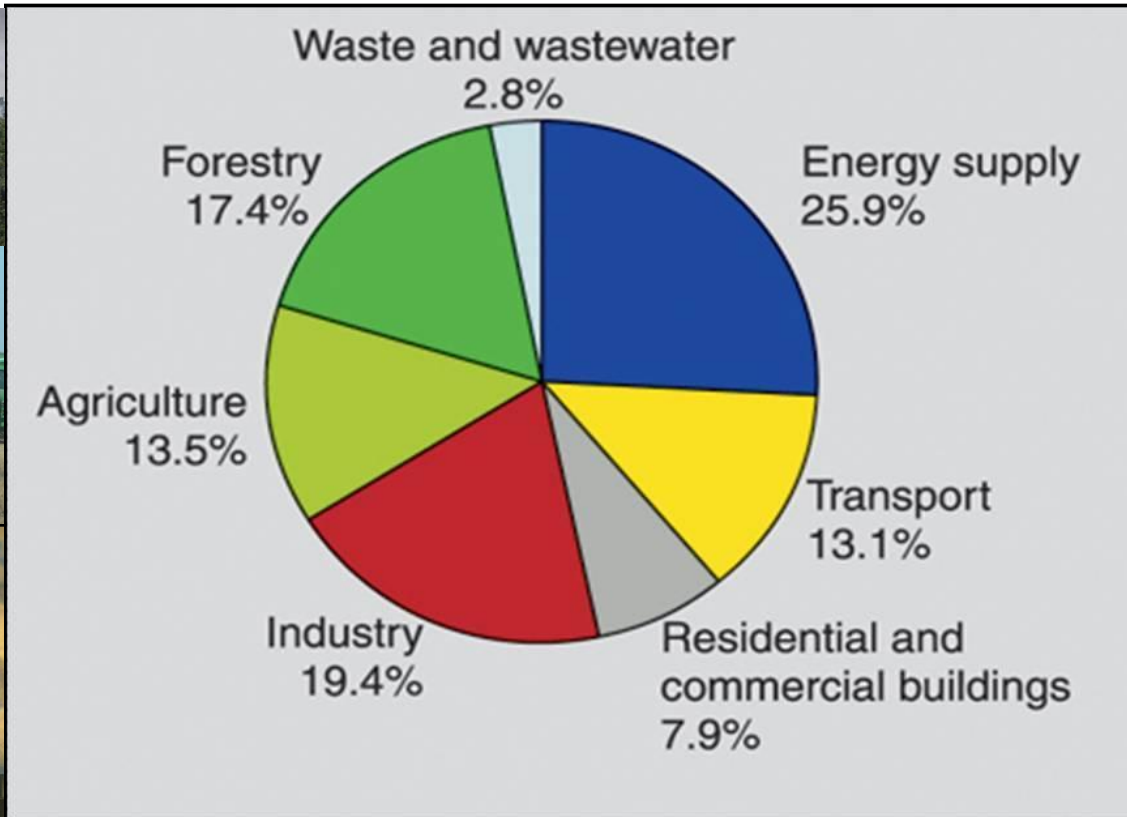
The enhanced greenhouse effect



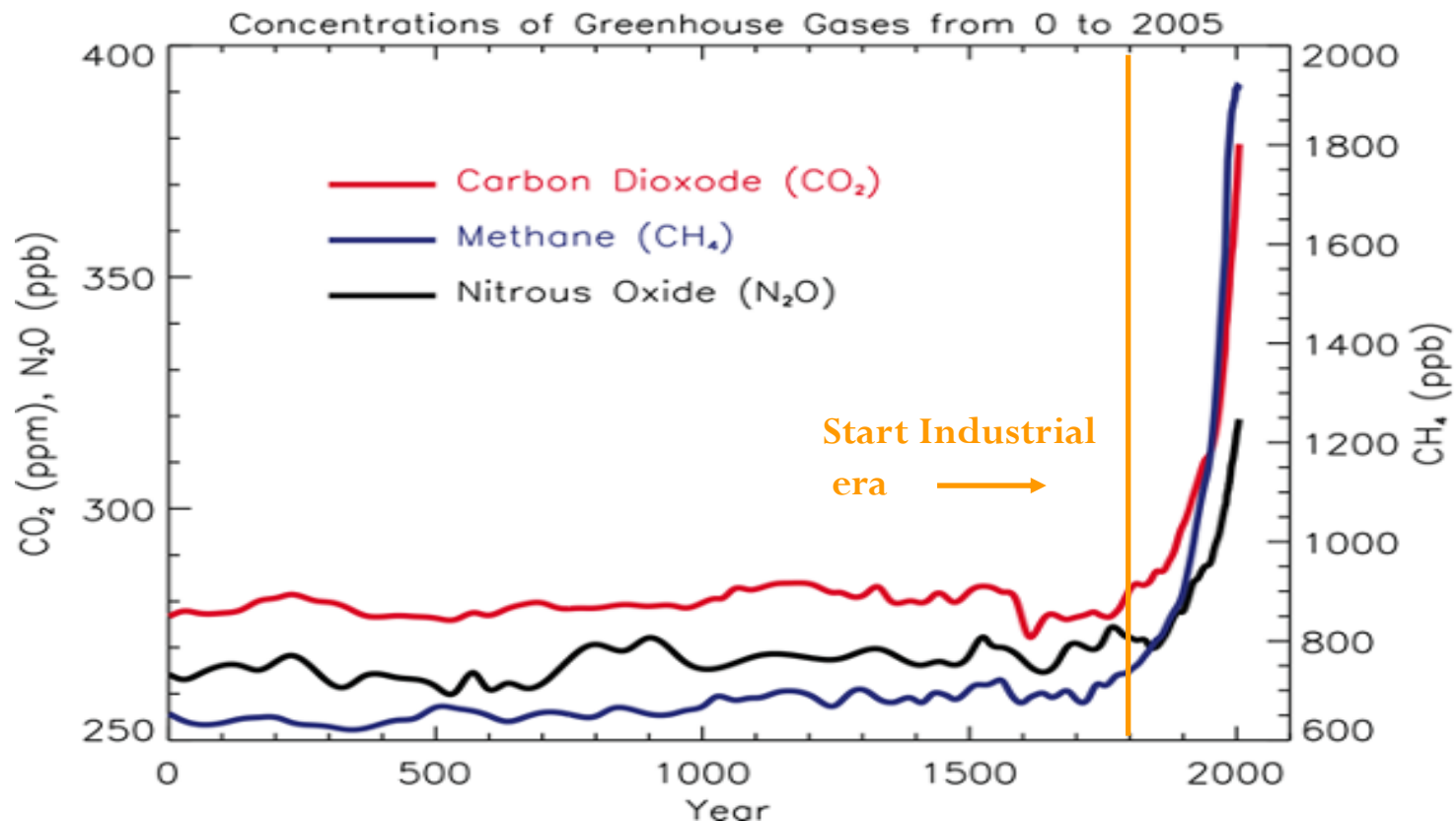
What human activities generate GHGs?

Greenhouse Gas	Industrial Sources	Land Use Sources
Carbon dioxide (CO ₂)	fossil fuel combustion and cement manufacturing	Deforestation and burning of forests
Methane (CH ₄)	Landfills, coal mining, natural gas production	Conversion of wetlands Rice paddies Livestock production
Nitrous oxide (N ₂ O)	Fossil fuel combustion Nitric acid production	Fertilizer use Burning of biomass
Hydrofluorocarbons (HFCs)	Industrial processes Manufacturing	---
Perfluorocarbons (PFCs)	Industrial processes Manufacturing	---
Sulphur hexafluoride (SF ₆)	Electrical transmission and distribution systems	----

Which sectors produce greenhouse gases?



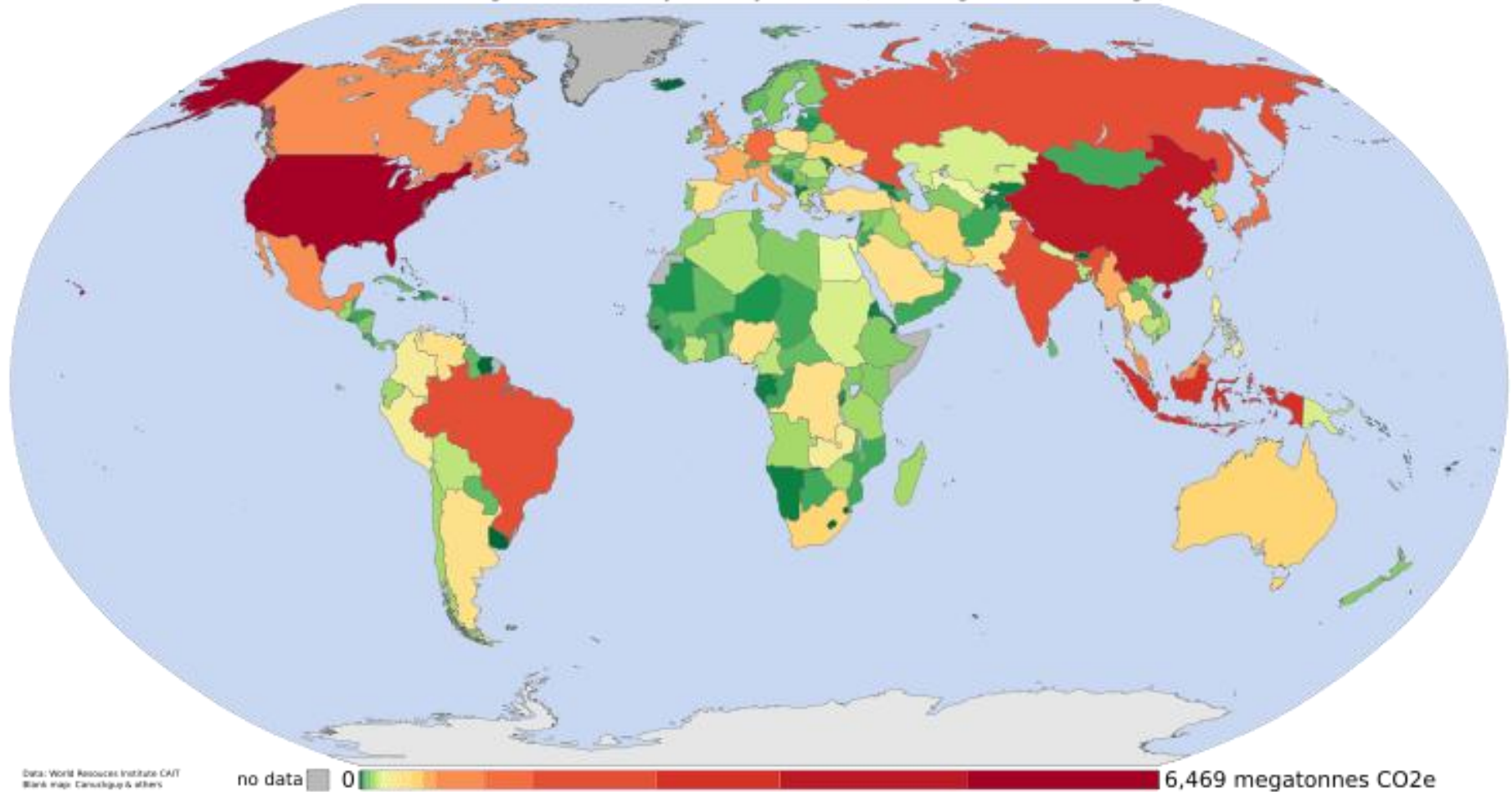
How rapidly are GHG concentrations rising?



- CO₂ levels are the highest in last 650,000 years
- In the last 50 yrs, CO₂ levels have grown more rapidly than ever before
- CO₂ levels are increasing 1.5- 2 ppm/yr

Where are greenhouse gases being emitted?

Greenhouse gas emissions by country in 2000 (including land-use change)

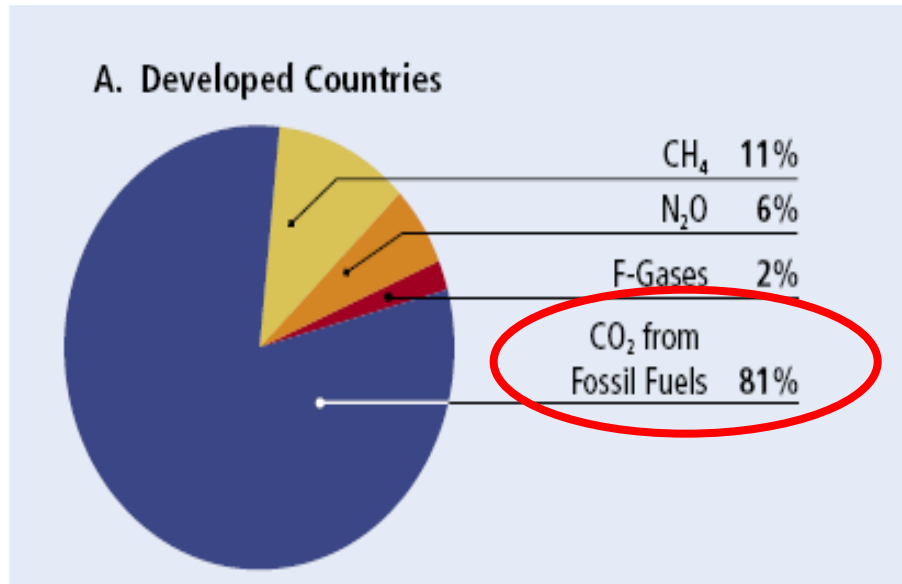


Low
emissions

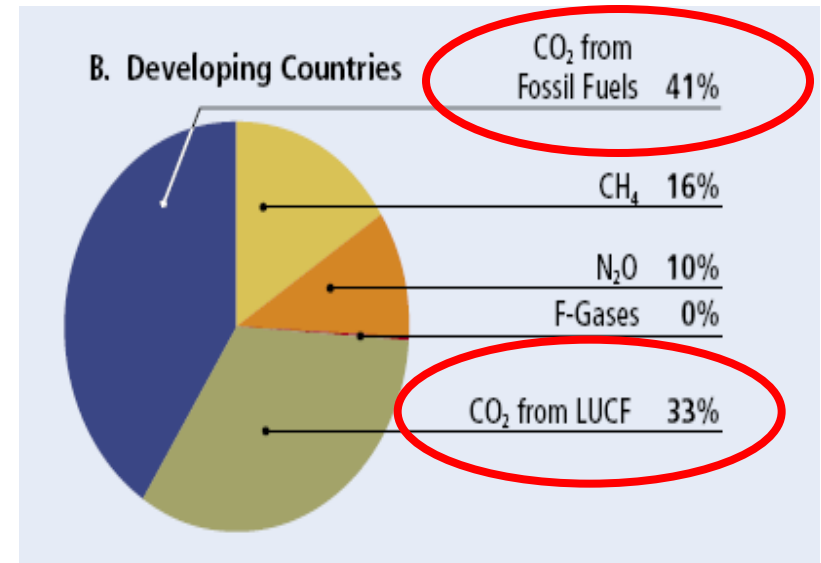
High
emissions

Sources of emissions

The sources of emissions differ across developing versus developed countries



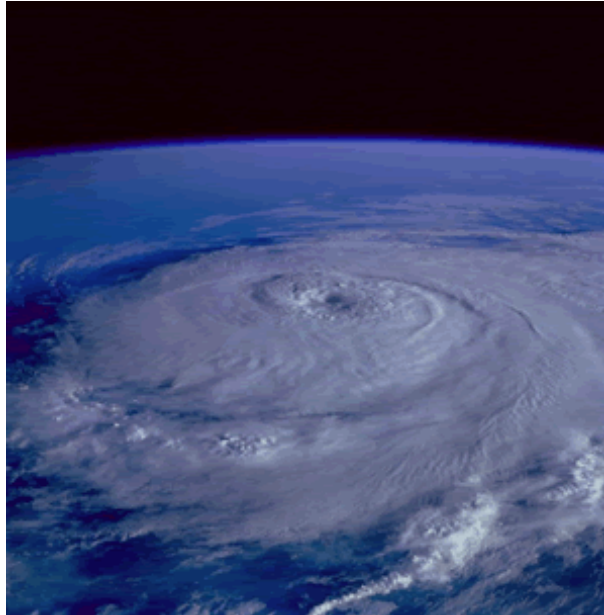
Greatest source of GHG = fossil fuels



Land use change (deforestation) is a major source (second only to fossil fuels)

Source: World Resource Institute (Navigating the numbers)

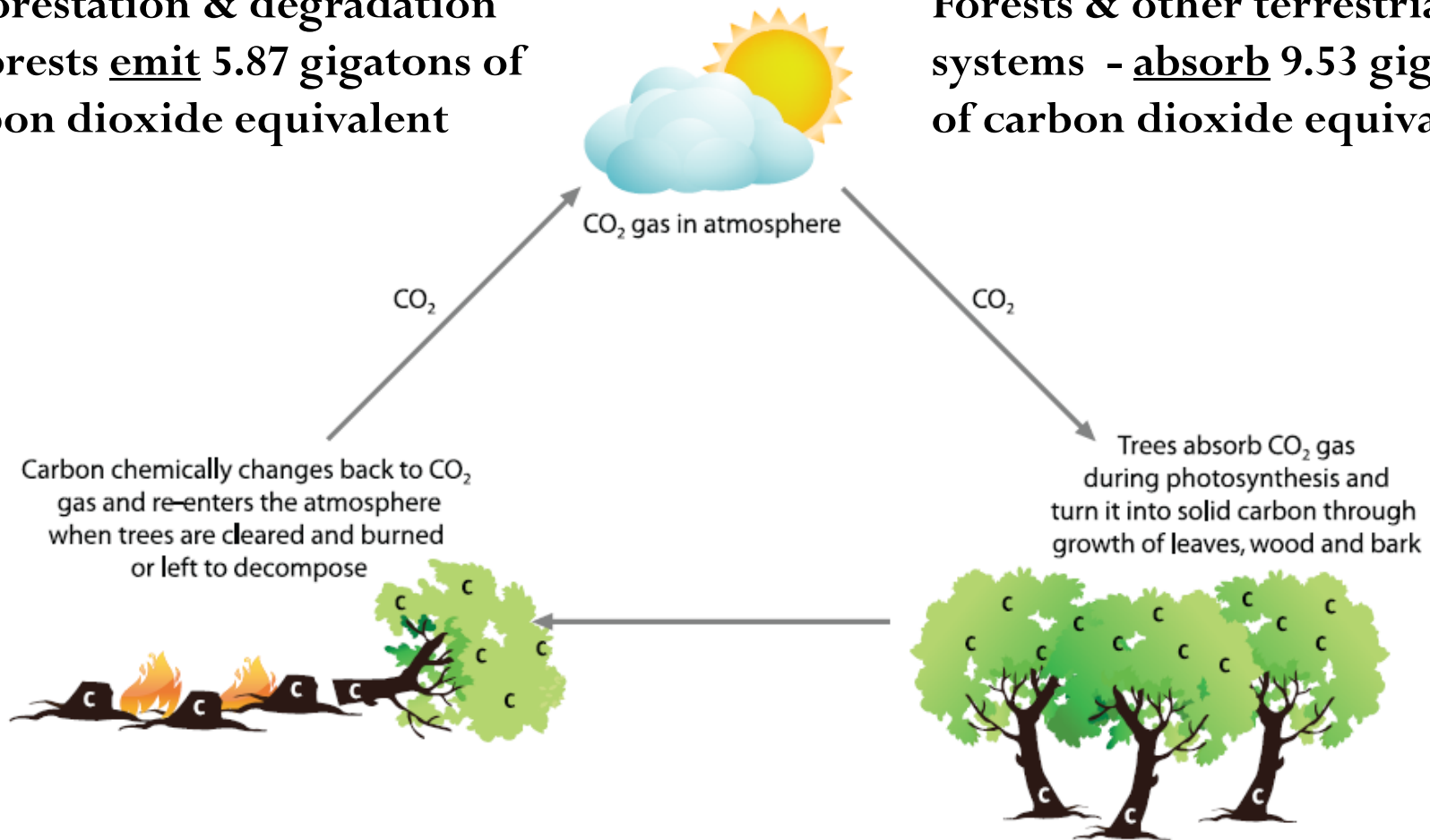
Forests in the global carbon cycle



Forests Store and Emit Carbon

Deforestation & degradation of forests emit 5.87 gigatons of carbon dioxide equivalent

Forests & other terrestrial systems - absorb 9.53 gigatons of carbon dioxide equivalent



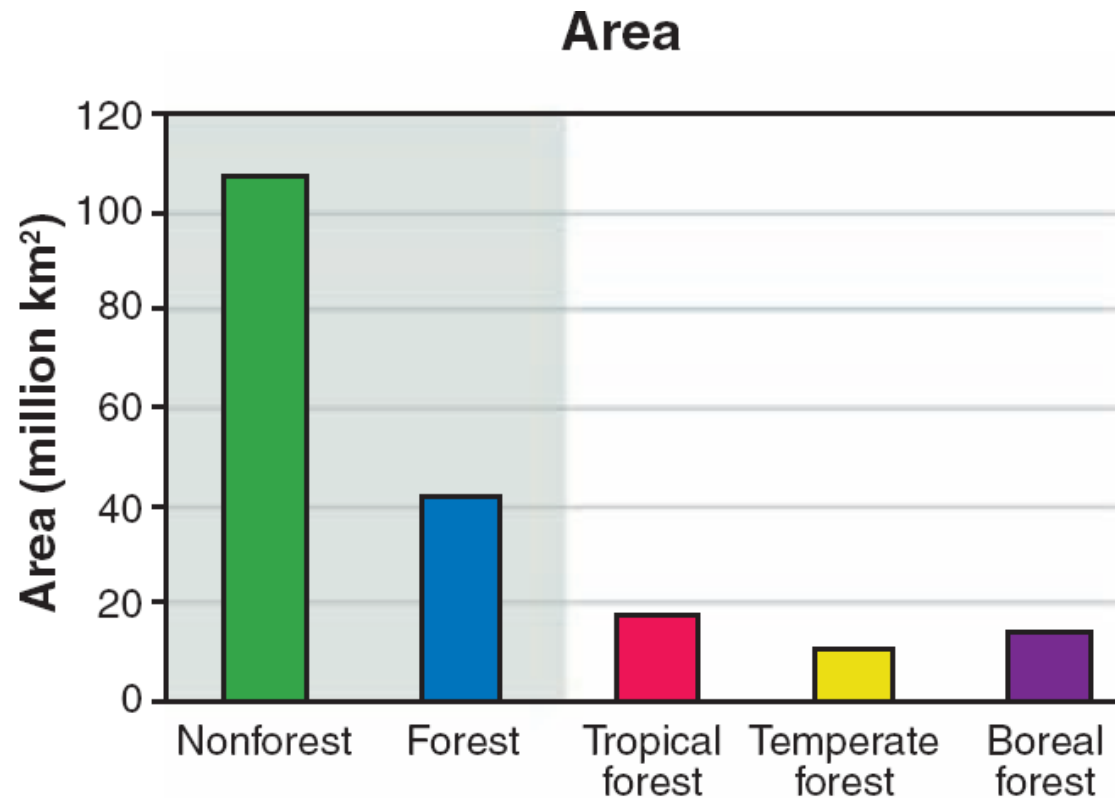
Extent of forests globally



30% of earth's land surface is forest (4 billion hectares)

Forest area by biome

Area forest cover



Tropical	16~17 M km2
Temperate	9~10 M km2
Boreal	15~16 M km2

Forest carbon globally

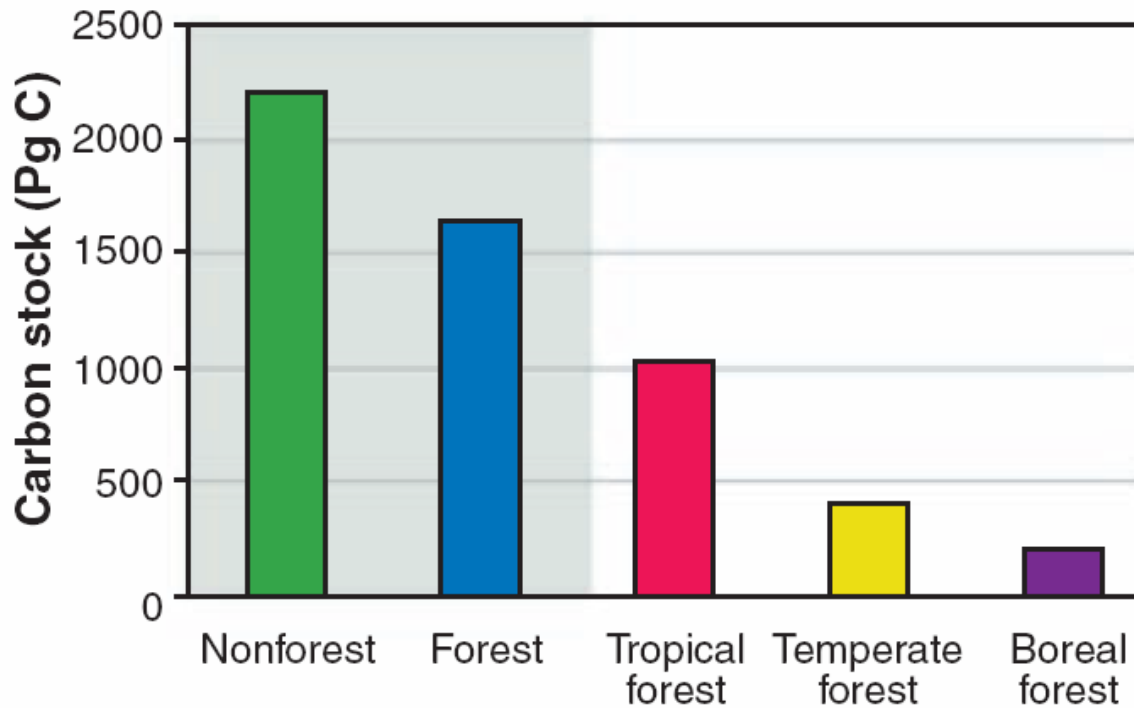


45% of terrestrial carbon is stored
in earth's forests

Carbon stock by biome

% terrestrial C

Global carbon



Tropical ~25%

Temperate ~10%

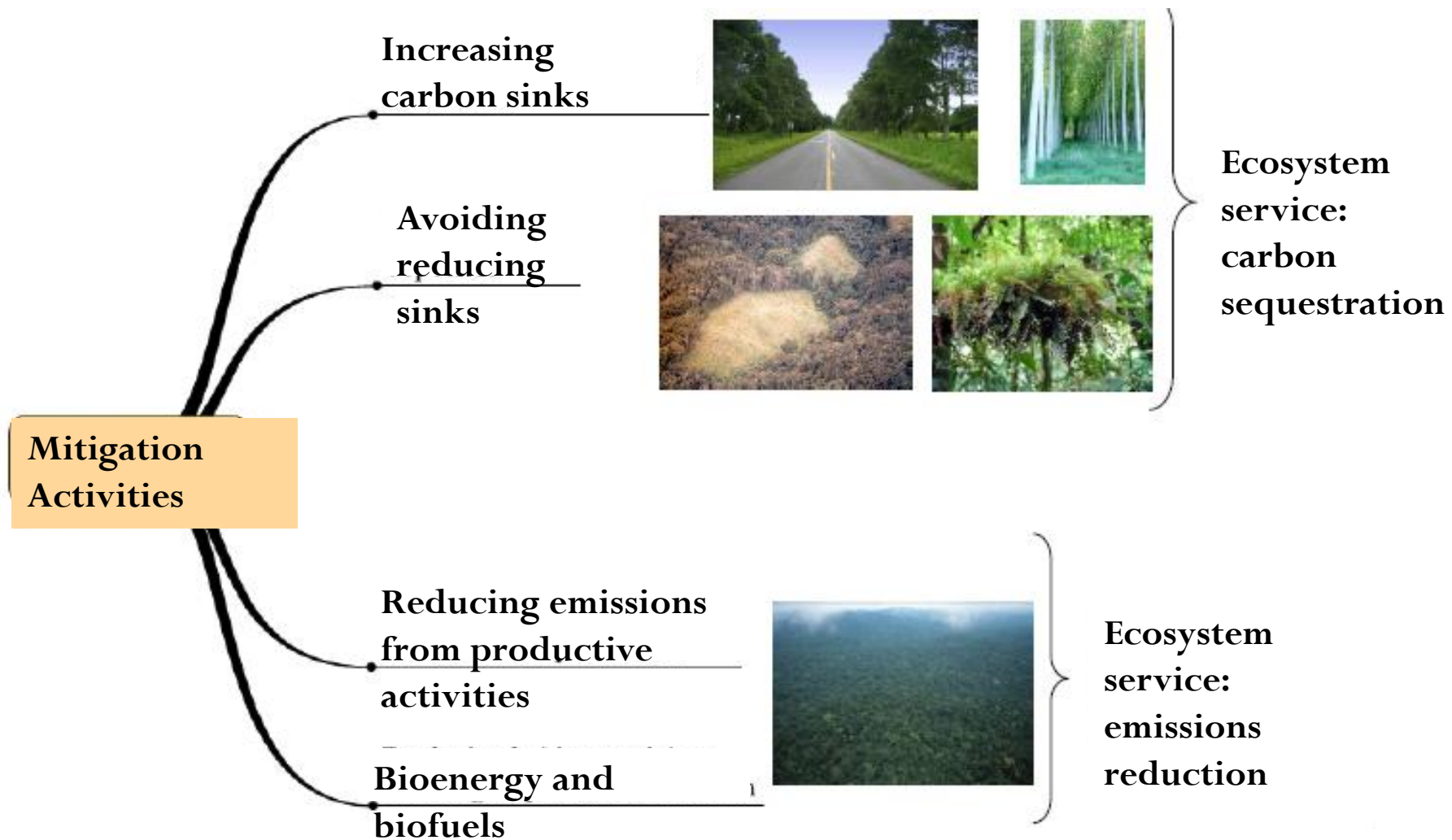
Boreal ~5%

- Forests absorb 2.6 gigatons C (9.5 gT CO₂) per year
- Emissions from tropical deforestation 1.5 gigatons C per year

Climate change
mitigation through
forestry



Options for mitigating climate change



Rates of carbon sequestration: Afforestation/Reforestation



Planted Forest Type	t C/ha/yr Captured	t CO₂/ha/yr captured
Boreal – 60 year rotation	½ - 2	2 - 7
Temperate – 15 to 60 year rotation	2 – 7	7 - 26
Tropics – Eucalyptus, 5 – 16 year old	4 - 14	15 – 51
Tropics – Teak, 25 – 75 years old	2 – 4	7 - 15
Tropics – Pine, 5 – 30 years old	3 - 12	11 - 44