Climate Change and Fire Emissions

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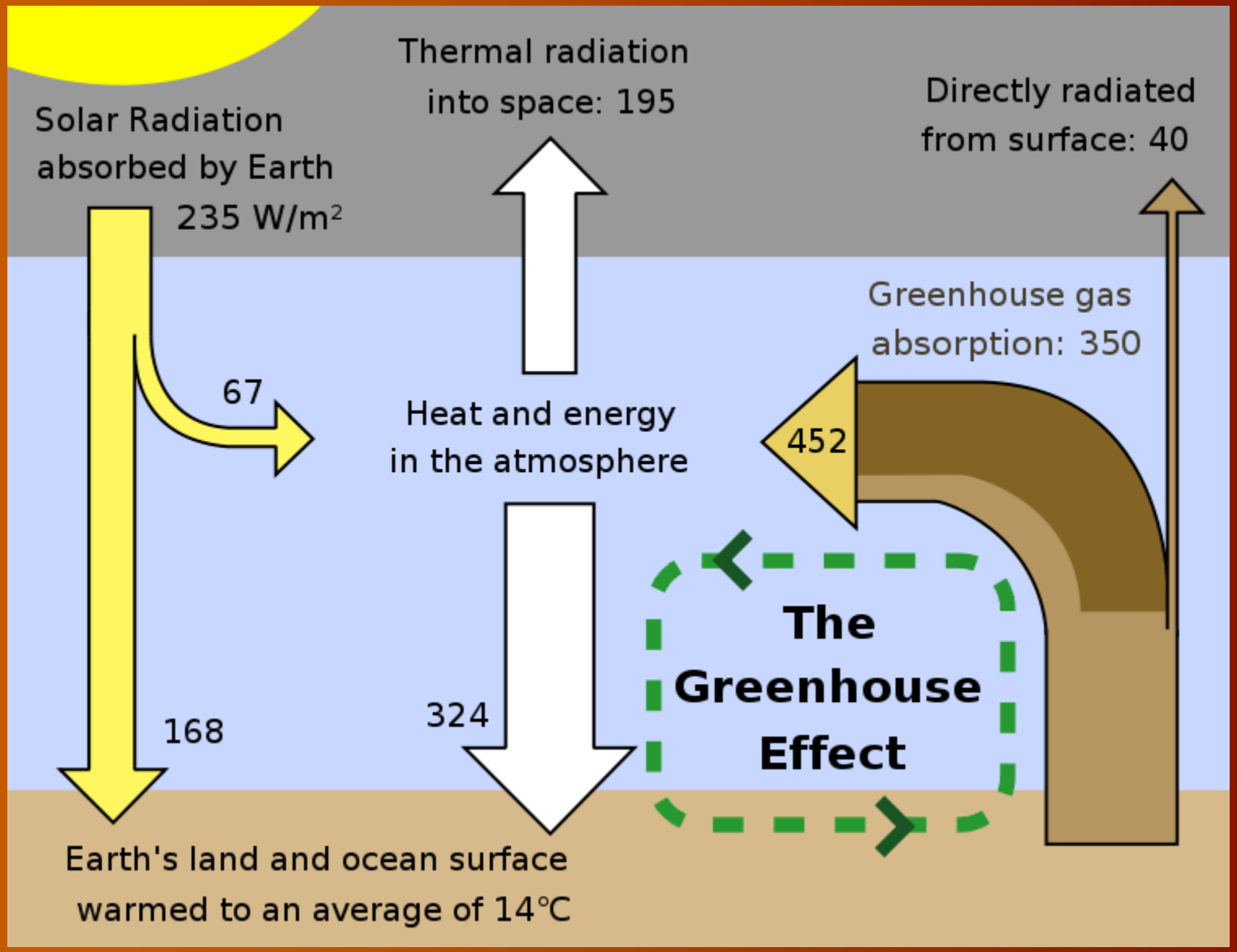
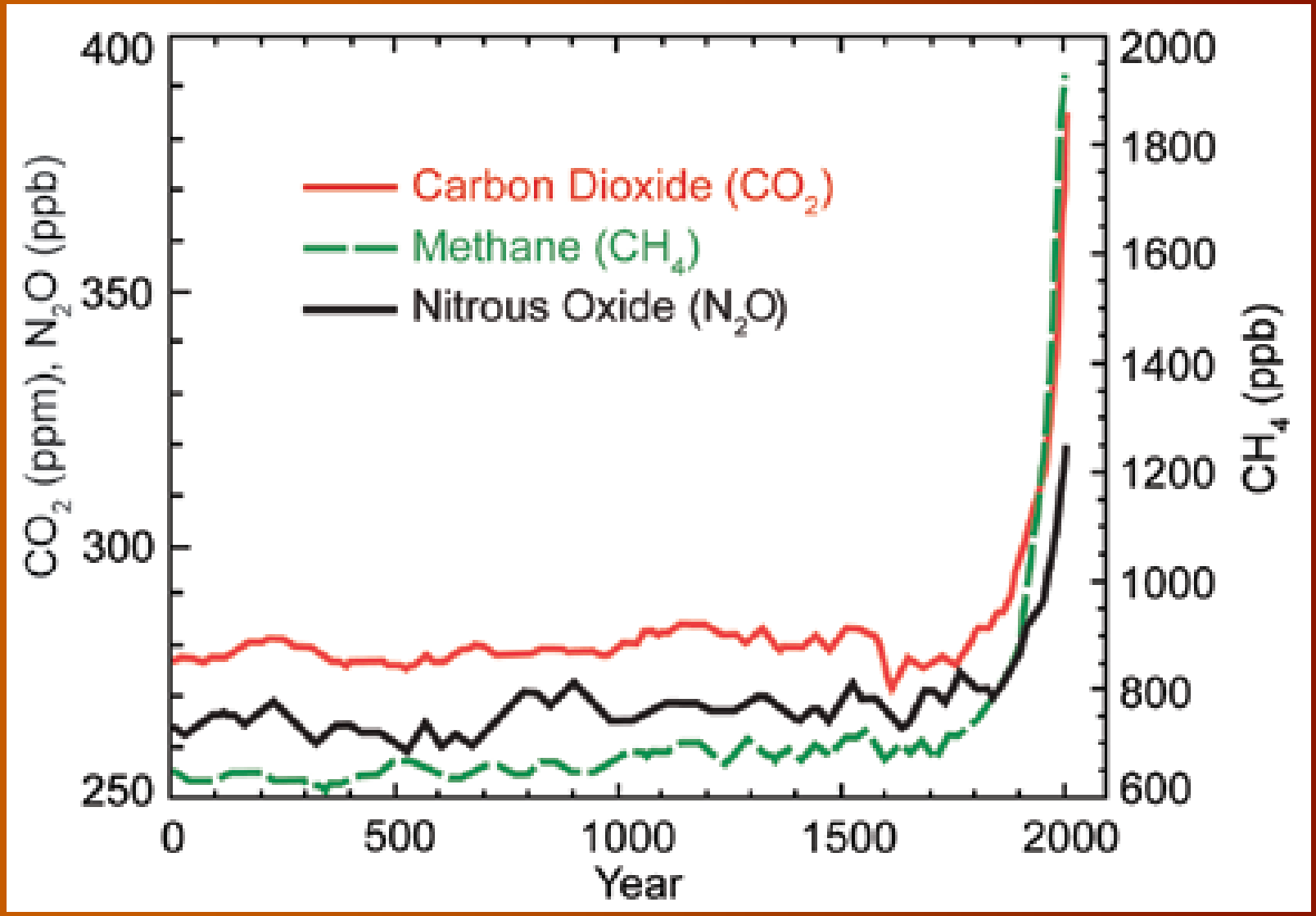
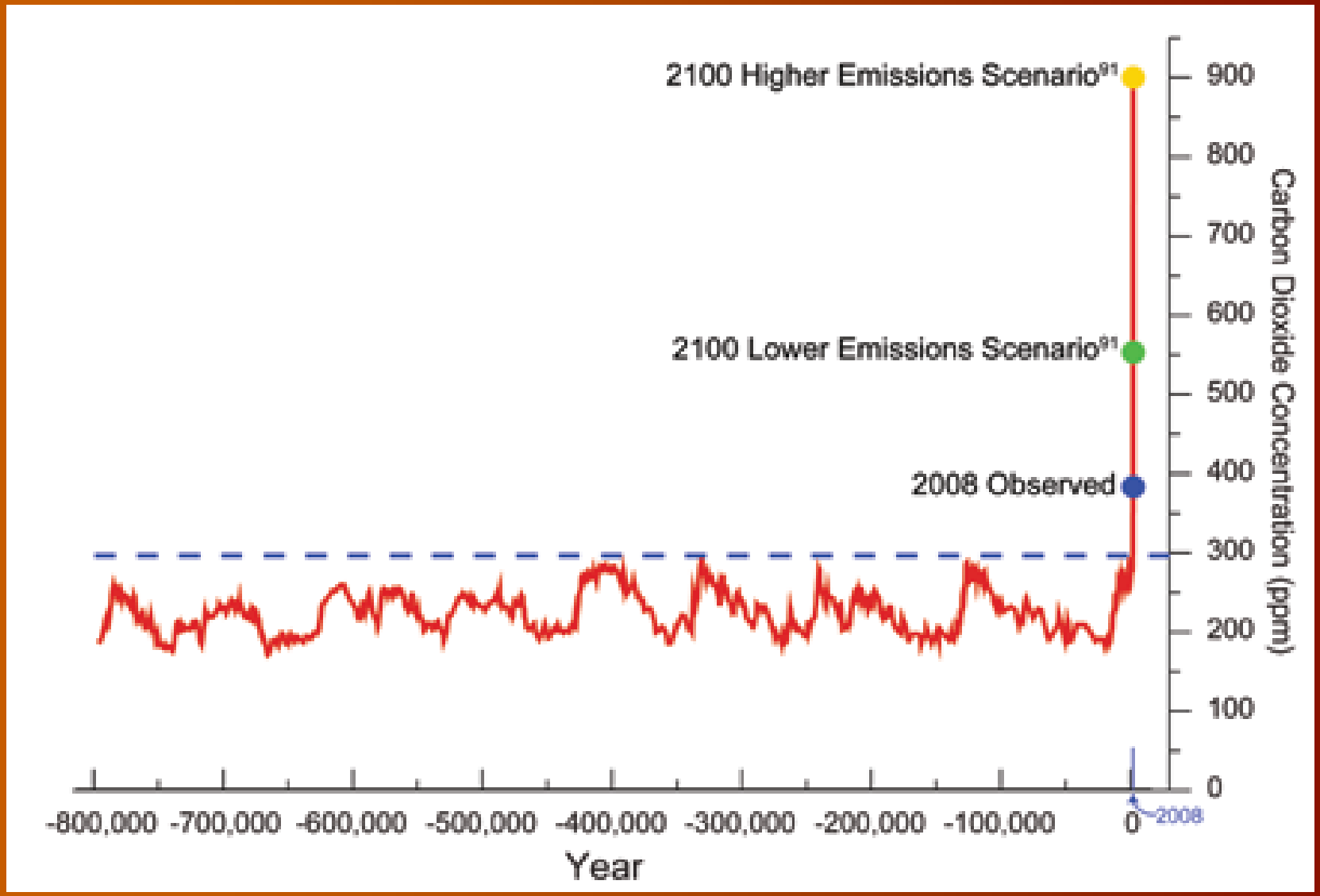
The Greenhouse Effect





Source: Karl, Thomas R., Jerry M. Melillo, and Thomas C. Peterson (eds). 2009. Global Climate Change Impacts in the United States, Cambridge University Press, 196pp.



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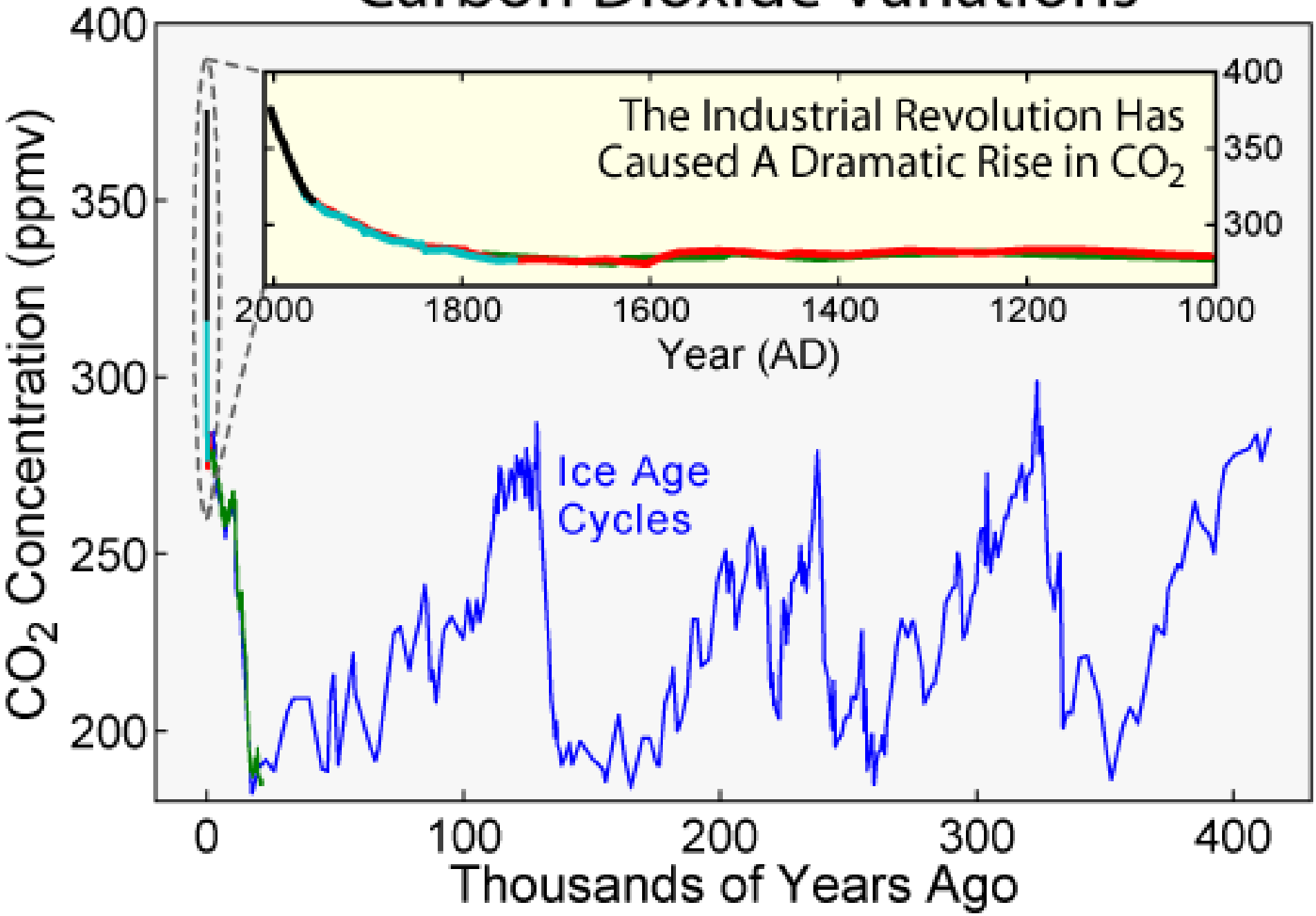
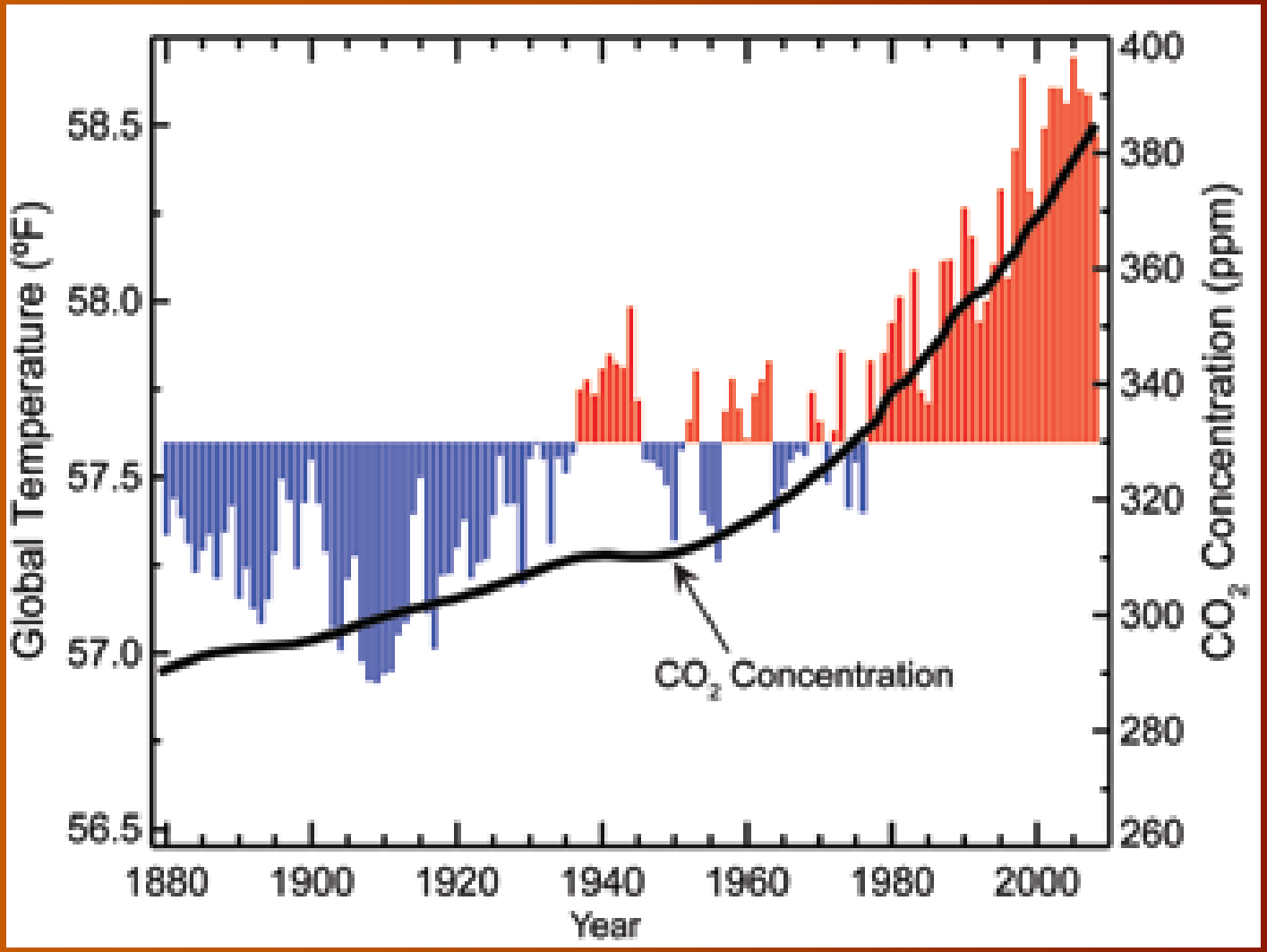
Carbon Dioxide Variations



Deviation from average 1901-2000



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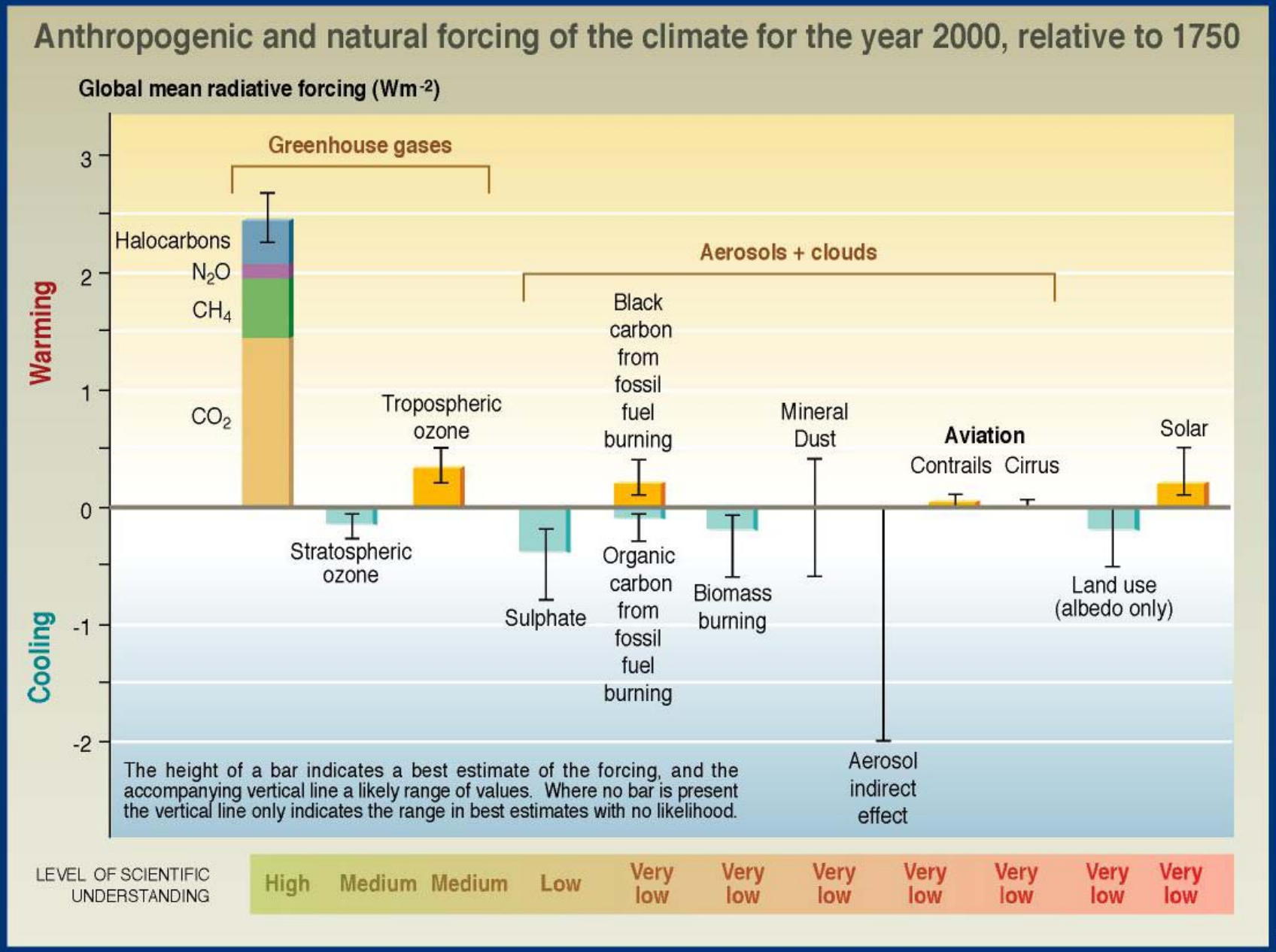
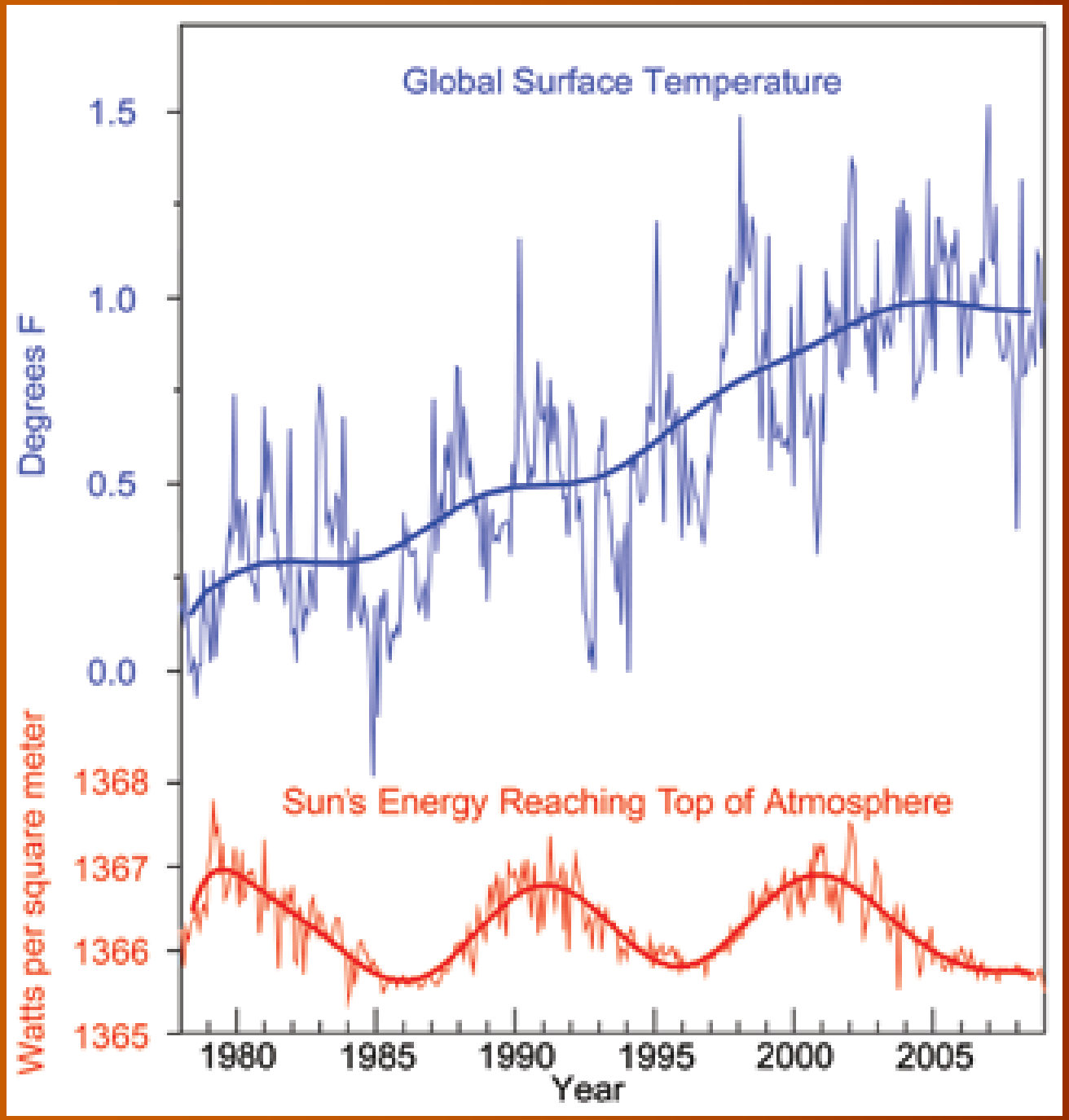

Anthropogenic and natural forcing of the climate for the year 2000, relative to 1750
Global mean radiative forcing (Wm-2)
Warming
Cooling
3
2
1
0
-1
-2
Greenhouse gases
Halocarbons
N2O
CH4
CO2
Stratospheric ozone
Tropospheric ozone
Aerosols + clouds
Sulphate
Black carbon from fossil fuel burning
Organic carbon from fossil fuel burning
Biomass burning
Mineral Dust
Aerosol indirect effect
Aviation
Contrails
Cirrus
Land use (albedo only)
Solar
The height of a bar indicates a best estimate of the forcing, and the accompanying vertical line a likely range of values. Where no bar is present the vertical line only indicates the range in best estimates with no likelihood.
LEVEL OF SCIENTIFIC UNDERSTANDING
High
Medium
Medium
Low
Very low
Very low
Very low
Very low
Very low
Very low
Very low



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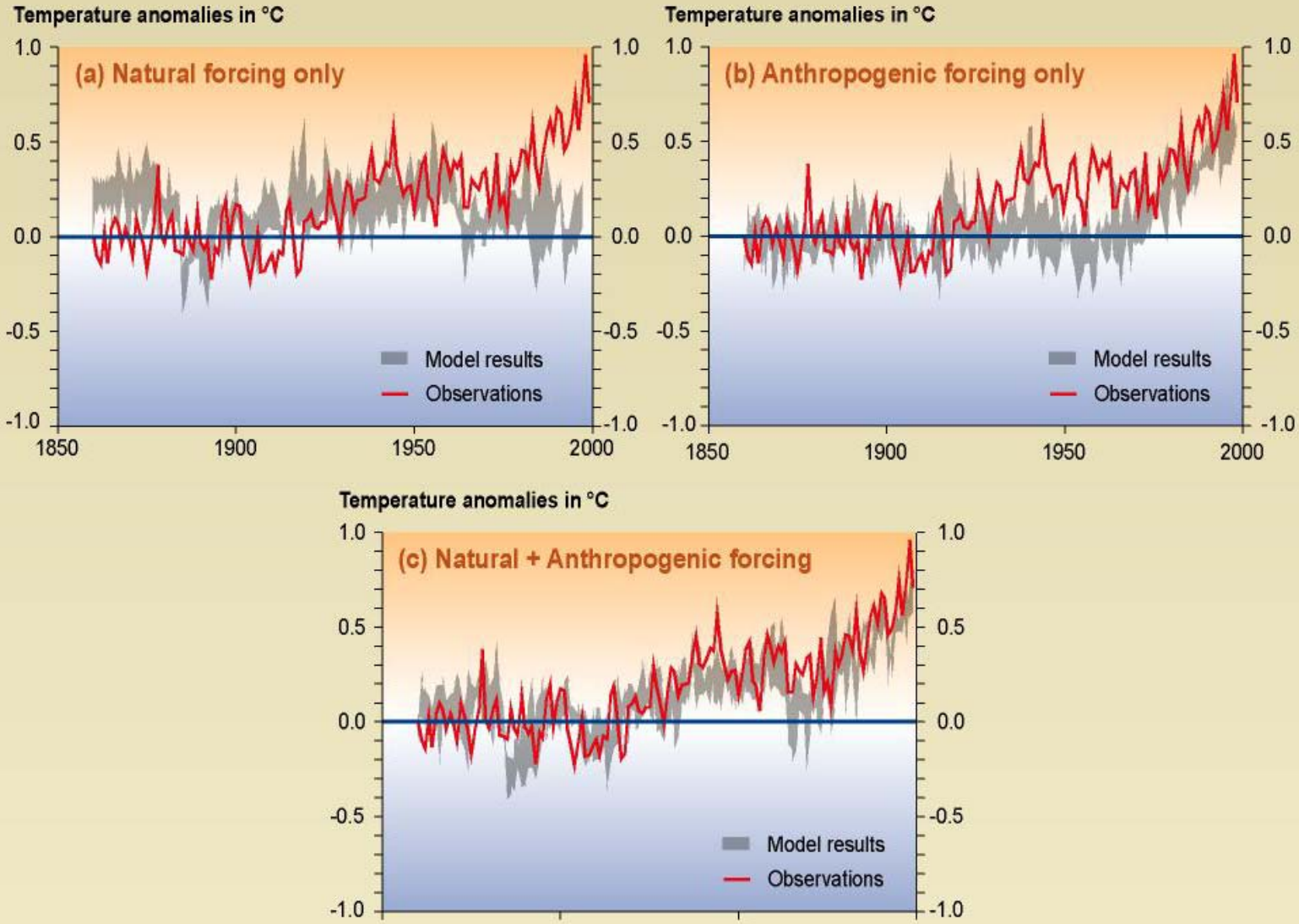
Comparison between modeled and observations of temperature rise since the year 1860



SYR

There is a natural carbon cycle of which fire is a part

How much CO2 does a fire produce?

Emissions vary by fuel type

Emissions vary by intensity of the fire

In general 2500 – 3500 lbs of CO_2 are produced for every ton of fuel consumed

How do you get more than a ton of CO_2 per ton of fuel?

- The Carbon comes from the fuel
- The Oxygen comes from the air

How much Methane (CH_4) does a fire produce?

Emissions vary by fuel type

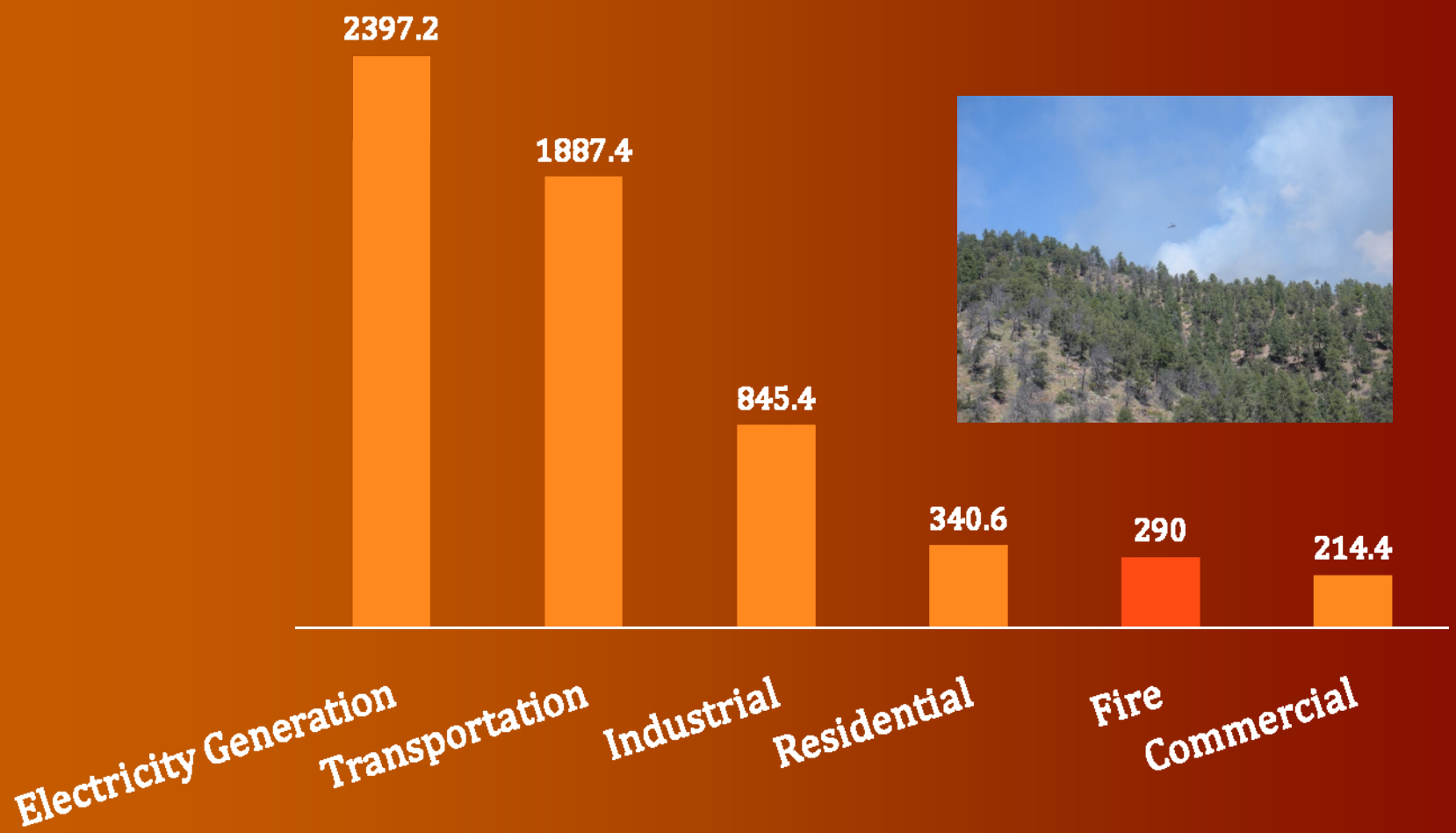
Emissions vary by intensity

In general 8 to 13 lbs / ton

CO_{2e} = 200-325 lbs/ton

Fire Emissions vs Fossil Fuels

U.S. CO_2 Emissions Sources (Tg/yr)



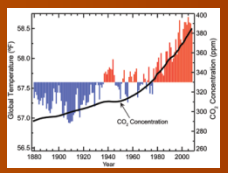
Feedback Loop

Early Snowmelt

Fire

Carbon

Climate Change



Insects

Balancing Act

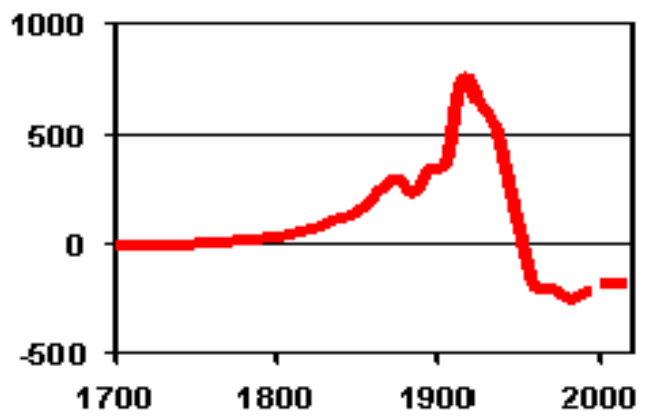
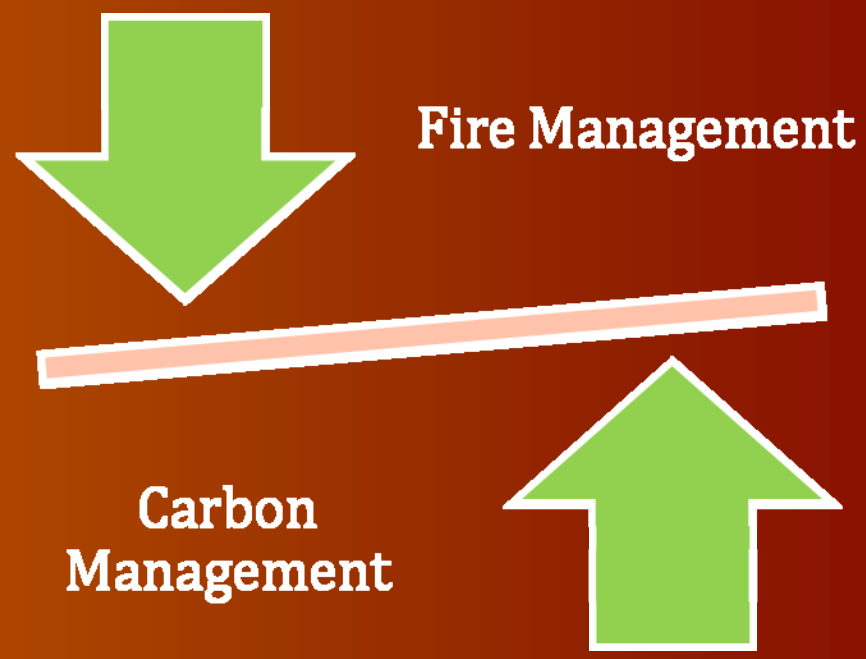
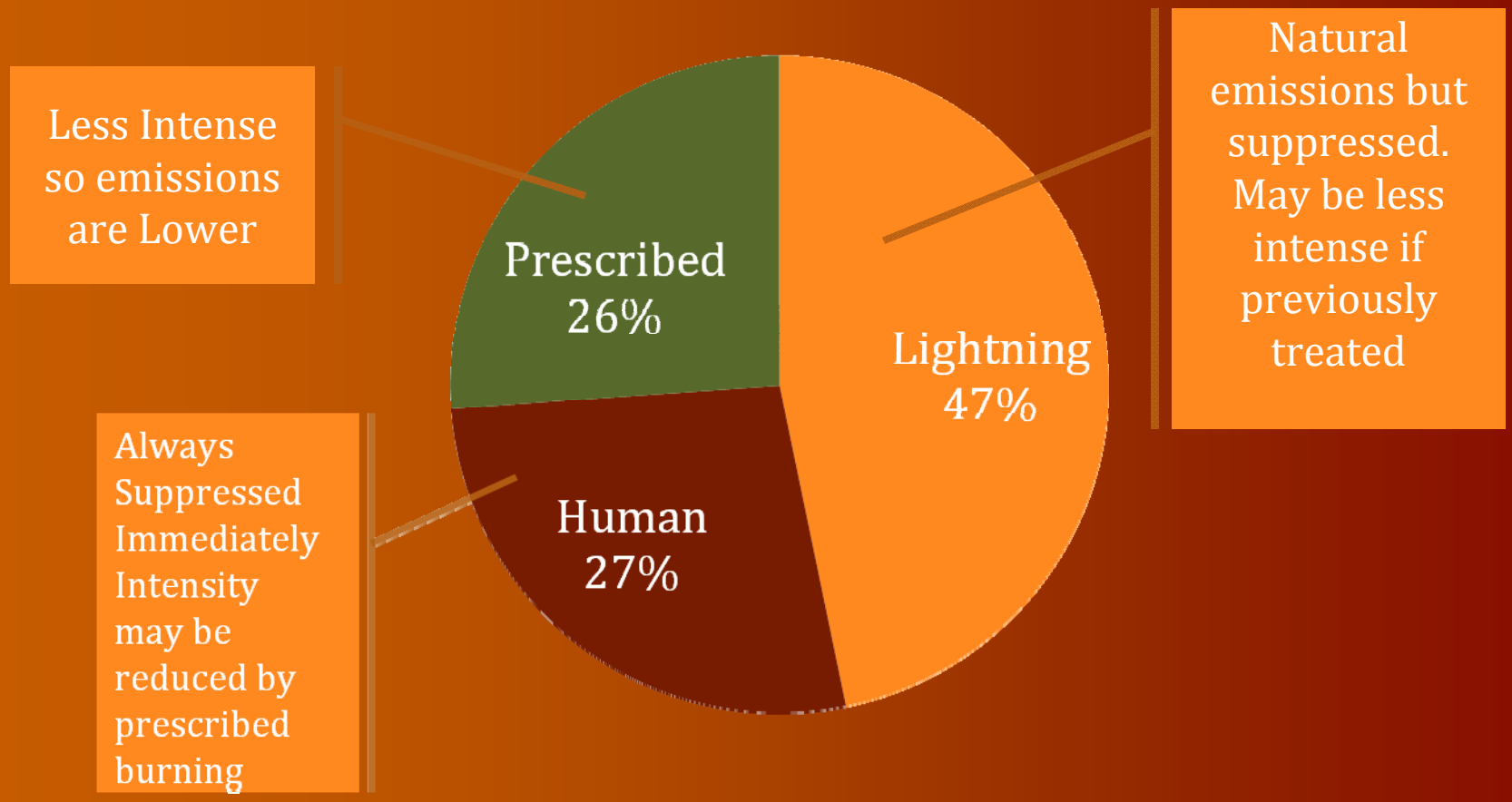


Figure 1—Carbon balance of the U.S. forest sector in millions of metric tons of carbon per year. The large flux of carbon from forests to the atmosphere (from logging and deforestation) peaked in 1915 at 760 million metric tons of carbon per year. Currently forests take up about 250 million metric tons of carbon per year. From Birdsey et al. (2006).



How Much Prescribed Burning Occurs Compared with Wildfire?

US Percent Acres Burned on Average 2001-2008



Why we burn

Reduce risk of large wildfire

- Especially important near communities
- Less net carbon released

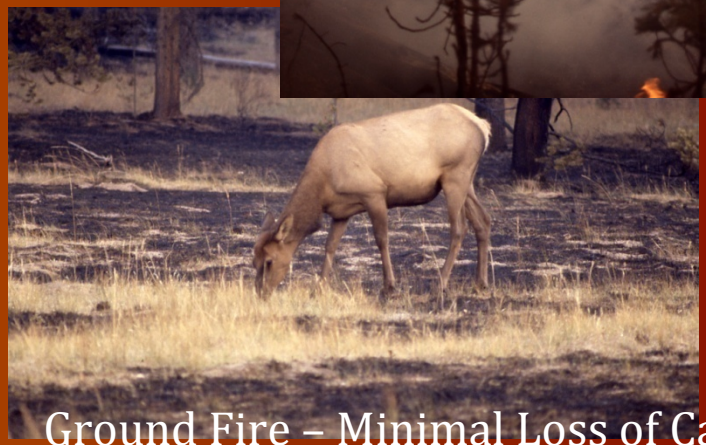
Reduce accumulated fuels

- Unnatural suppression
- May also be due to CO_2 buildup
- Allows for greater long term carbon storage by opening up room for bigger healthier trees

Intensity

White Ash
Extensive Carbon
Loss , slow recovery
due to loss of soil
carbon

Moderate Severity -Carbon preserved
in soil, slow loss as trees decompose
but some returned to soil



Ground Fire – Minimal Loss of Carbon
with quick Recovery and soils may
be enhanced

Carbon will be reabsorbed after a fire or burn

Questions??????