

# 350 PPM CO2

## THE UPPER LIMIT OF HUMAN HABITATS

**THE RISE OF ATMOSPHERIC CO2 ABOVE 350 PPM AT THE CURRENT RATE OF ABOUT 2 PPM/YEAR IS TRANSCENDING THE CONDITIONS THAT ALLOWED THE DEVELOPMENT OF HUMAN AGRICULTURE AND CIVILIZATION FROM ABOUT 8000 YEARS AGO.**

Life on Earth depends on a delicate balance between the atmosphere, the oceans and the biosphere. The atmosphere acts like the "lungs" of the biosphere, while the ocean currents act as its "vein system", modulating temperatures around the globe. Changes to the chemistry of the atmosphere, including greenhouse gases (CO<sub>2</sub>, methane, nitric oxides, ozone) and aerosols (mainly sulphur dioxide) through Earth's history resulted in climate shifts between greenhouse states and glacial/interglacial states. Such changes were triggered by orbital shifts, solar cycles, volcanic events, asteroid impacts, release of methane from sediments and, on longer time scales, the distribution of oceans, continents and mountain ranges.

Sharp decline in CO<sub>2</sub> 34 million years ago and 15 million years ago to **below 500 ppm** has resulted in the development of the Antarctic ice sheet. About 2.8 million years ago a further decline in CO<sub>2</sub> resulted in formation of the Greenland ice sheet and Arctic Sea ice. The current runaway climate change is a direct result of human emissions and land clearing. The emission of more than **320 billion tons of carbon** (over 50% the original atmospheric inventory) since 1750 raised CO<sub>2</sub> levels from 280 to 388 ppm, or 460 ppm CO<sub>2</sub>-equivalent (a value including the effect of methane).

Acceleration of climate change since the mid-1970s is leading toward a global temperature rise of **+1.5°C** above pre-industrial time, once the masking effects of sulphur aerosols are removed. The polar regions have already warmed by up to 4°C. This results in carbon cycle and ice/water melt feedback processes, with consequent (A) extreme rates of polar ice melting, including the Arctic Sea, Greenland, West and East Antarctica, which threatens accelerated sea level rise above the current rate of 0.35 cm/year; (B) a progressive shift of climate zones toward the poles, which extend the tropics, as indicated by intensified cyclones and floods, and enlarging desert regions as manifested by extreme droughts and fires. Given lag effects, looming threats include (1) ocean acidification, collapse of coral reefs and the marine food chain; (2) mountain snow and glacier melt and availability of freshwater; (3) destruction of native habitats, i.e. the Amazon; (4) ozone depletion; (5) atmospheric aerosol loading and (6) chemical pollution by metals, plastics, radioactive nuclei.

The consequences for human habitats include loss of arable land, fresh water supplies and extreme weather events. The loss of Himalayan snow and thereby decreased river flow, coupled with a failure of the monsoon and sea level rise, threatens more than one billion people in south and south-eastern Asia. As the polar regions warm, a release of methane from the many hundreds of billions of tons of carbon stored in permafrost and shallow lakes and seas, is imminent.

In the view of leading climate scientists there is no alternative to attempts at reducing atmospheric CO<sub>2</sub> levels **to below 350 ppm** as soon as possible. What is urgently required is a combination of (A) urgent deep cuts in carbon emissions; (B) fast-track development of clean renewable energy systems; (C) an intensive global reforestation campaign; (D) application of a range of CO<sub>2</sub> draw-down sequestration measures, including world-wide replantation and reforestation campaigns and chemical capture methods, solar-powered desalination plants, and long-range channel and pipe water transport systems.

### Recent references

Schellnhuber, Oxford meeting, 28-30.10.09 <http://www.eci.ox.ac.uk/4degrees/programme.php>  
British Antarctic Survey [http://www.antarctica.ac.uk/press/press\\_releases/press\\_release.php?id=989](http://www.antarctica.ac.uk/press/press_releases/press_release.php?id=989)  
NASA/GISS). <http://data.giss.nasa.gov/gistemp/>  
Copenhagen Synthesis Report <http://www.anu.edu.au/climatechange/content/news/copenhagen-synthesis-report-released-today/>  
Hansen et al. 2008. Target CO<sub>2</sub>: Where Should humanity aim?  
[http://www.columbia.edu/~jeh1/2008/TargetCO2\\_20080407.pdf](http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf)  
Lenton et al., 2008. Tipping points in the Earth climate system.  
<http://www.sciencedaily.com/releases/2008/02/080204172224.htm>  
Reports by NASA/GISS, Hadley\_Met, Potsdam Ocean Institute, NSIDC, CSIRO, BOM.

Andrew Glikson  
Earth and paleoclimate scientist  
24 October, 2009