Managing the Planet

Woodrow Wilson International Center
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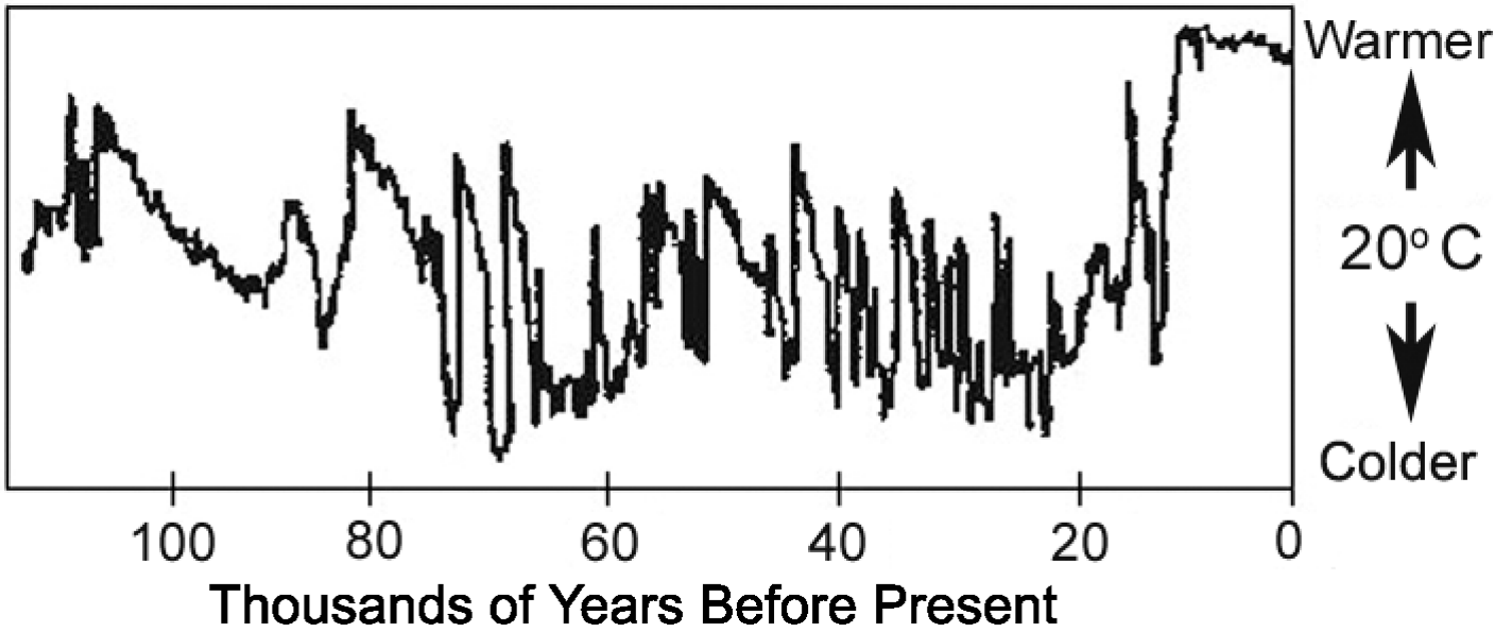
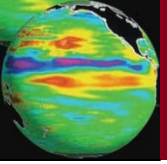
Dr. Svante August Arrhenius

1859-1927

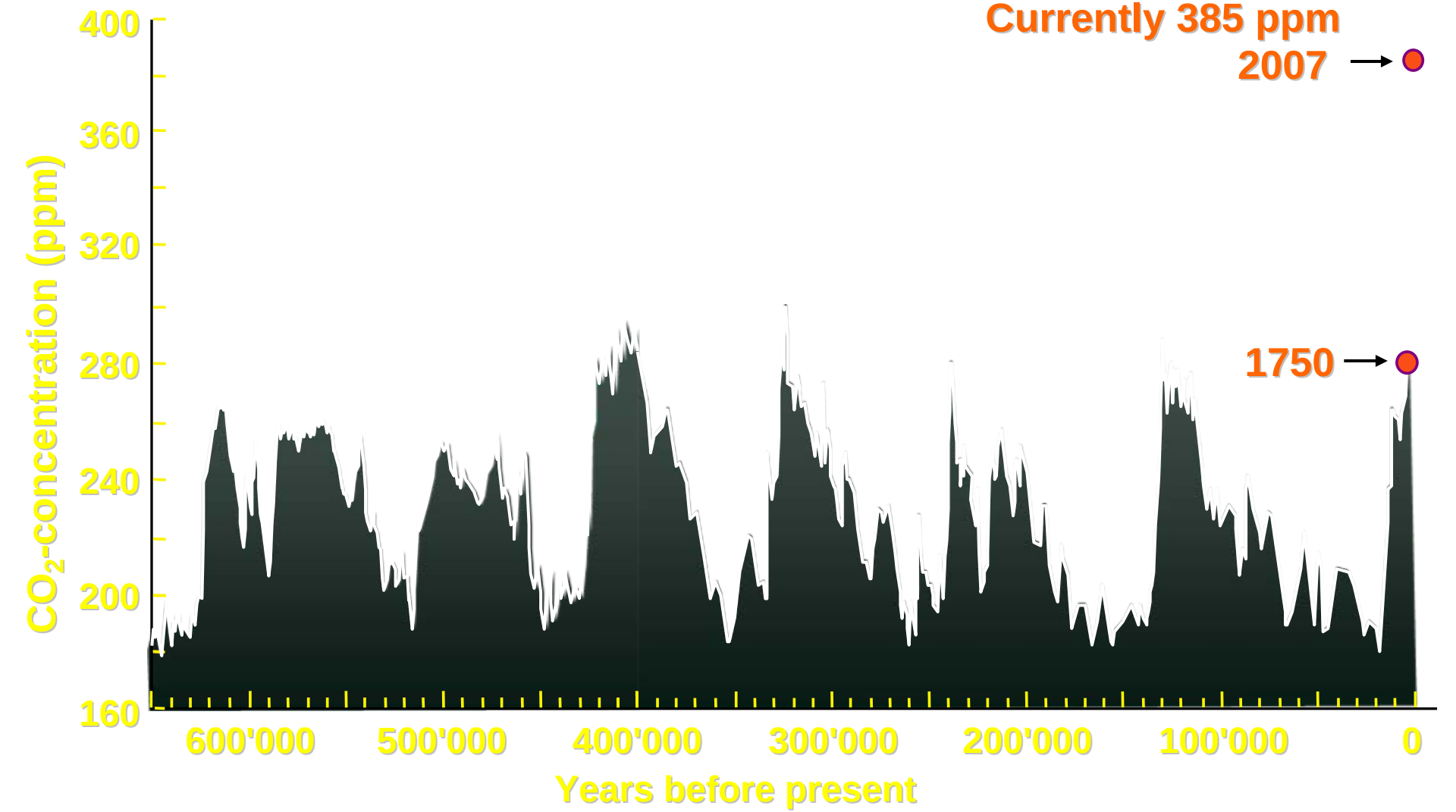
Analysis of a Greenland ice core oxygen isotope proxy



Source: Wallace Broecker



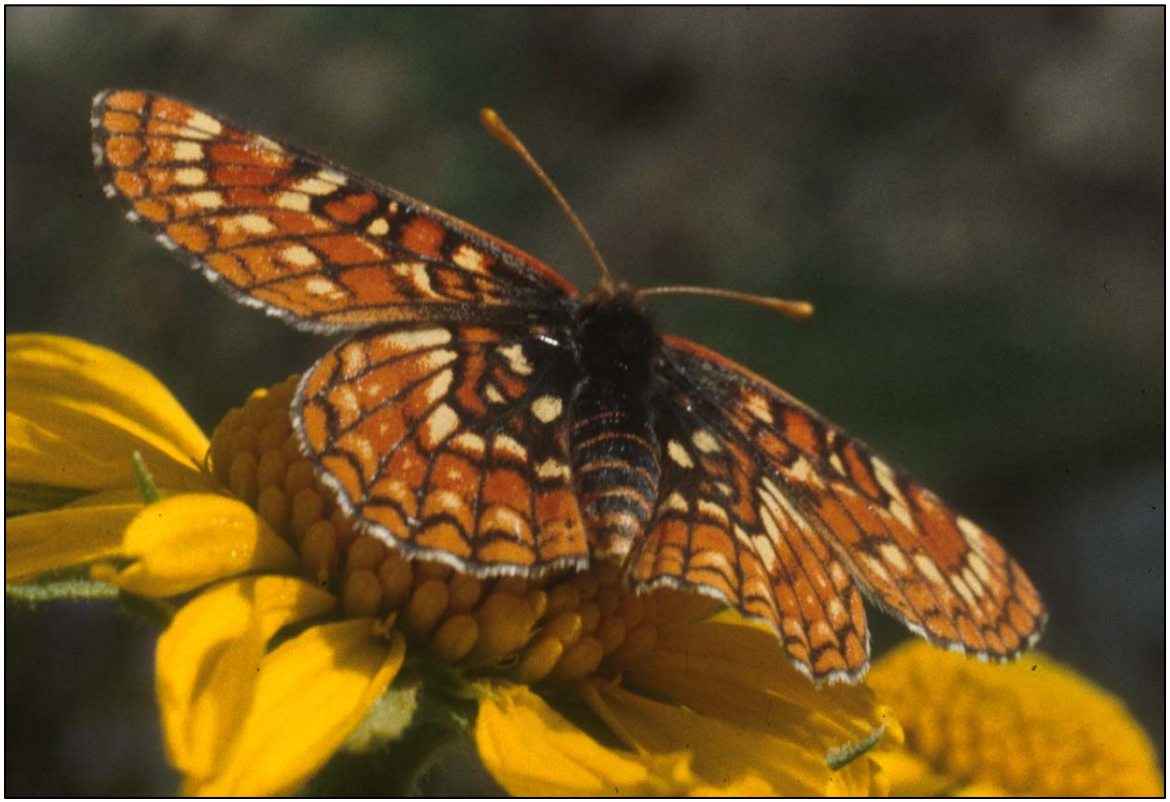
CO_2 for the Last 600,000 Years

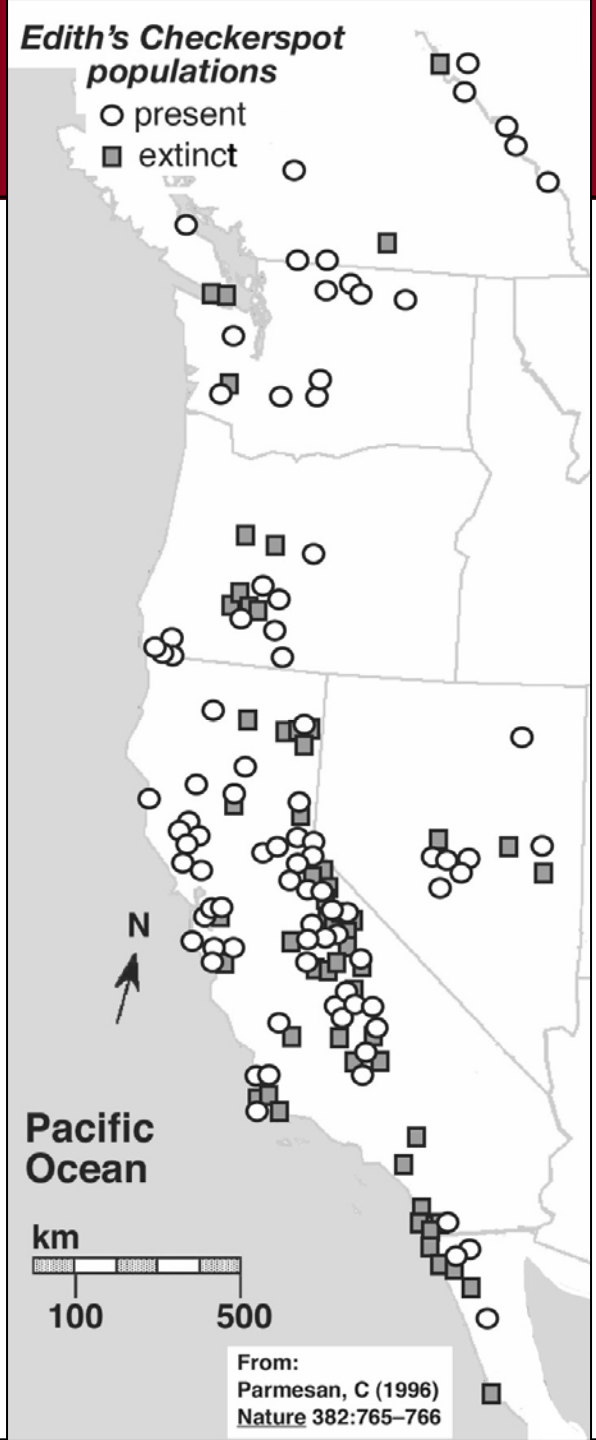


Siegenthaler U *et al.* (2005) Science 310:1313
Petit JR *et al.* (1999) Nature 399:429

Edith's Checkerspot

- **Range shift northward and upward during the 20th century**
- **Most extinctions in south and low elevations**





INTERNATIONAL
Herald Tribune
PUBLISHED BY THE NEW YORK TIMES

Wednesday, June 7, 2006

Oceans II ▪ By Thomas E. Lovejoy

Rising acidity threatens marine life

WASHINGTON

The problems of acid rain and acid lakes, which came to public attention in the 1980s, have been addressed to a considerable degree. Today we face a far more profound challenge: increasingly acid oceans.

It is little known outside of scientific circles that a fundamental change has already taken place in the chemistry of the two thirds of the earth's surface occupied by oceans. The change, of 0.1 of a pH unit, sounds trivial when expressed in the logarithmic scale that science uses, but it translates to the upper layers of the oceans already being 30 percent more acid than in preindustrial times.

The change is being causes by increased atmospheric levels of greenhouse gases, in particular carbon dioxide. In addition to forcing climate change, more carbon dioxide combines with water and produces carbonic acid.

The consequences for marine ecosystems are only beginning to be understood but are bound to be far-reaching.

Tom Ondway/Jean-Michel Cousteau Productions via AP

Why is a CO_2 target of 450ppm too high ?

(1) Arctic sea-ice

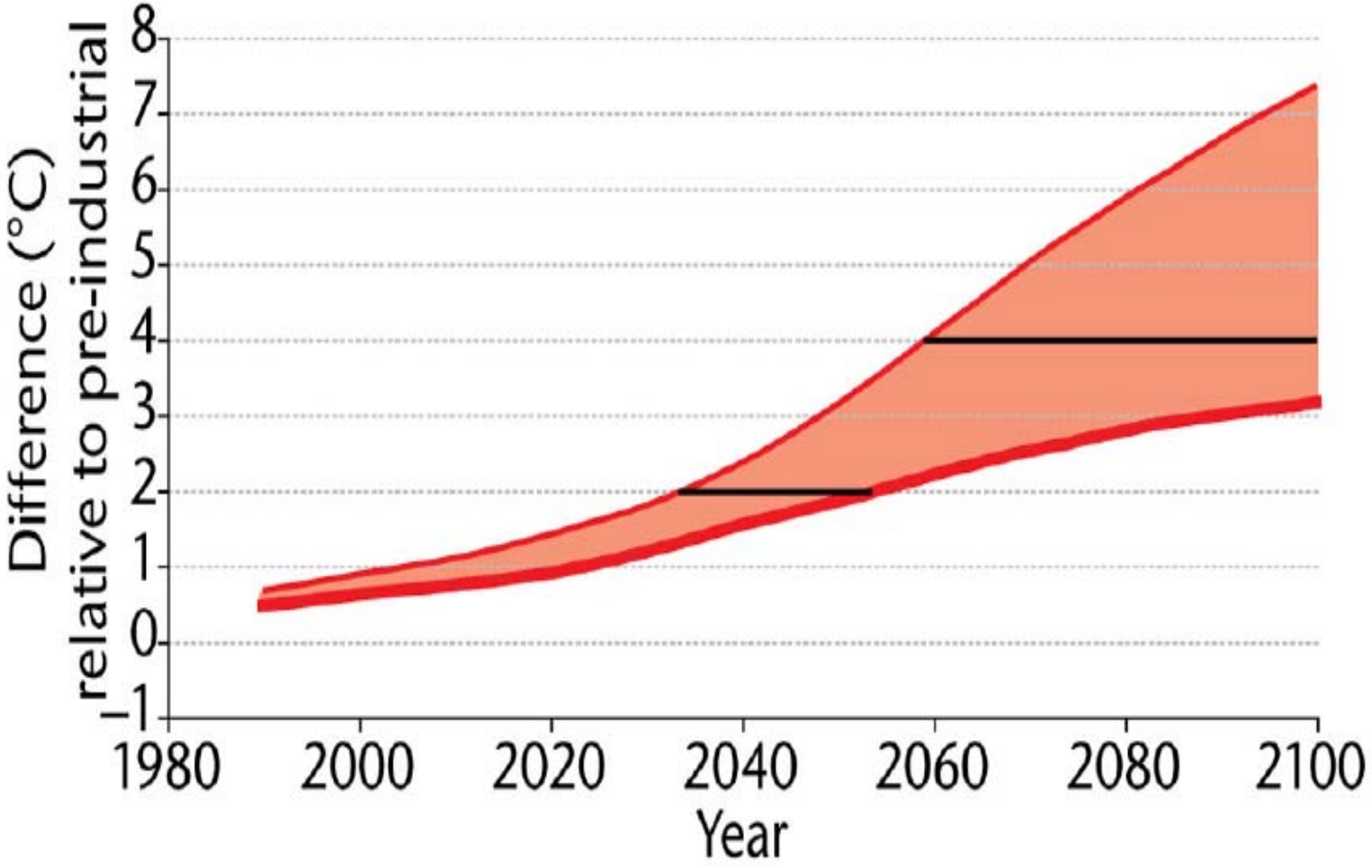
(2) Greenland ice-sheet stability

(3) Antarctic ice-sheet stability

(4) Major ecosystem disruption

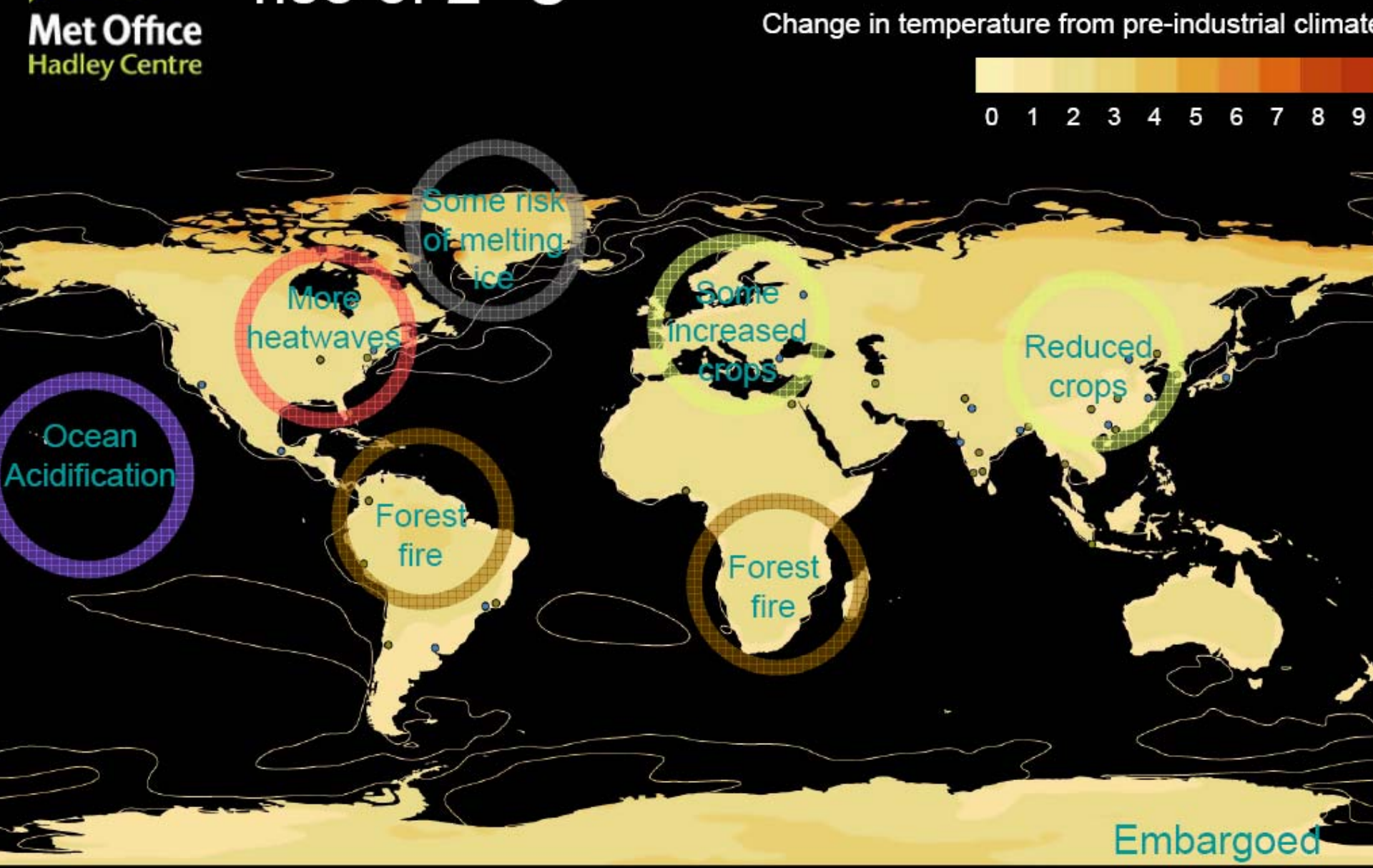
When will the 2^{o}C and 4^{0}C thresholds will be breached?

Projected temperature rise for A1B & A1F1 scenarios (Hadley, 2009)



The impact of a global temperature rise of 2 ºC

Met Office
Hadley Centre



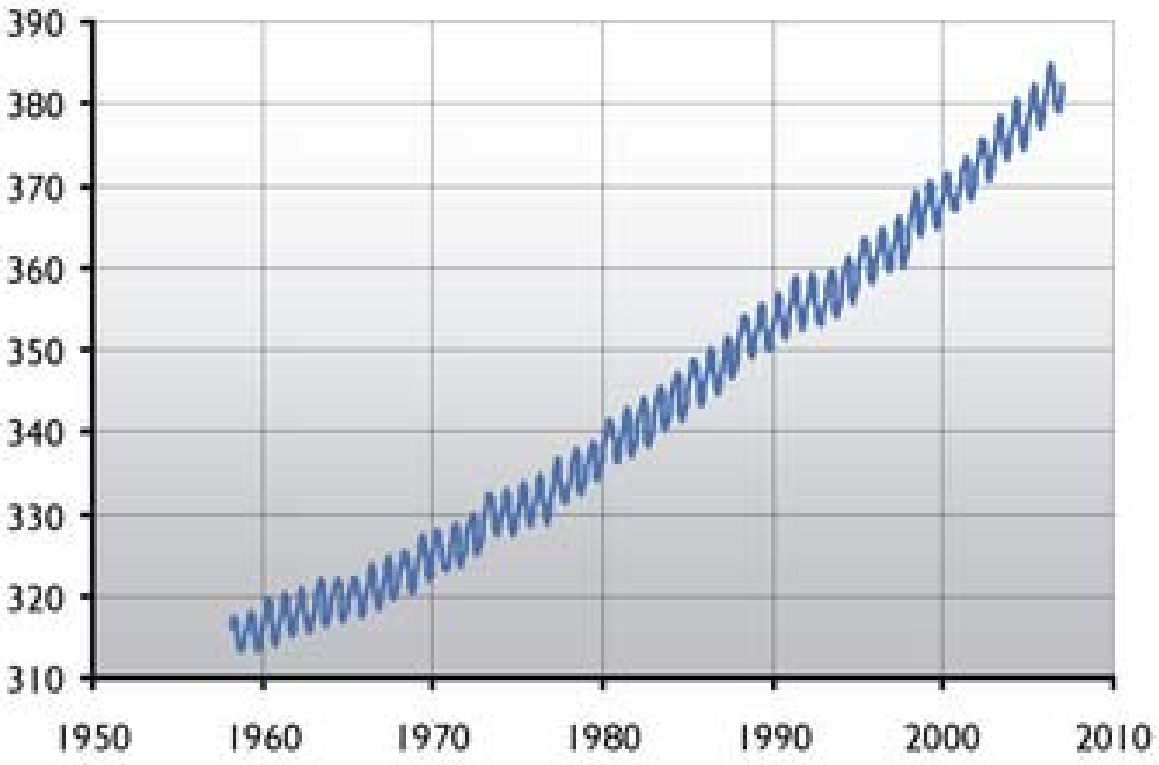
Current City population • 3-10 million • 10-20 million

What is a “safe” level?

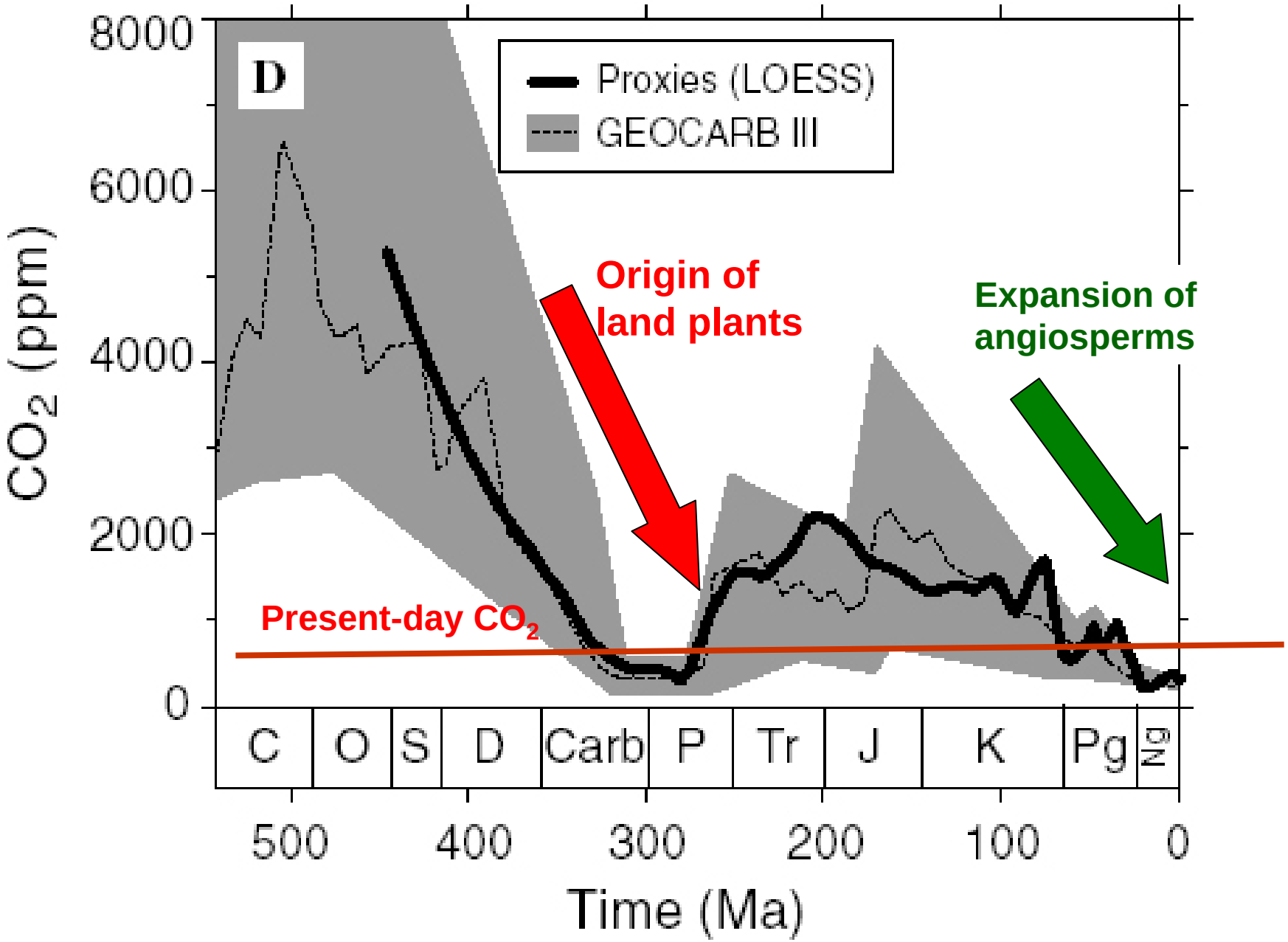
James Hansen,

et al., 2008

350 ppm



The Role of Life Processes



Over the past three centuries, ecosystems have lost 200-250 billion tons of carbon

1.5 Pg C y^{-1}

+

7.5 Pg C y^{-1}

4.2 Pg y^{-1}
Atmosphere
46%

2.6 Pg y^{-1}
Land
29%

2.3 Pg y^{-1}
Oceans
26%

Canadell et al. 2007, PNAS (updated)

Re-Greening the Emerald Planet