Climate Change and its Implications for Conservation

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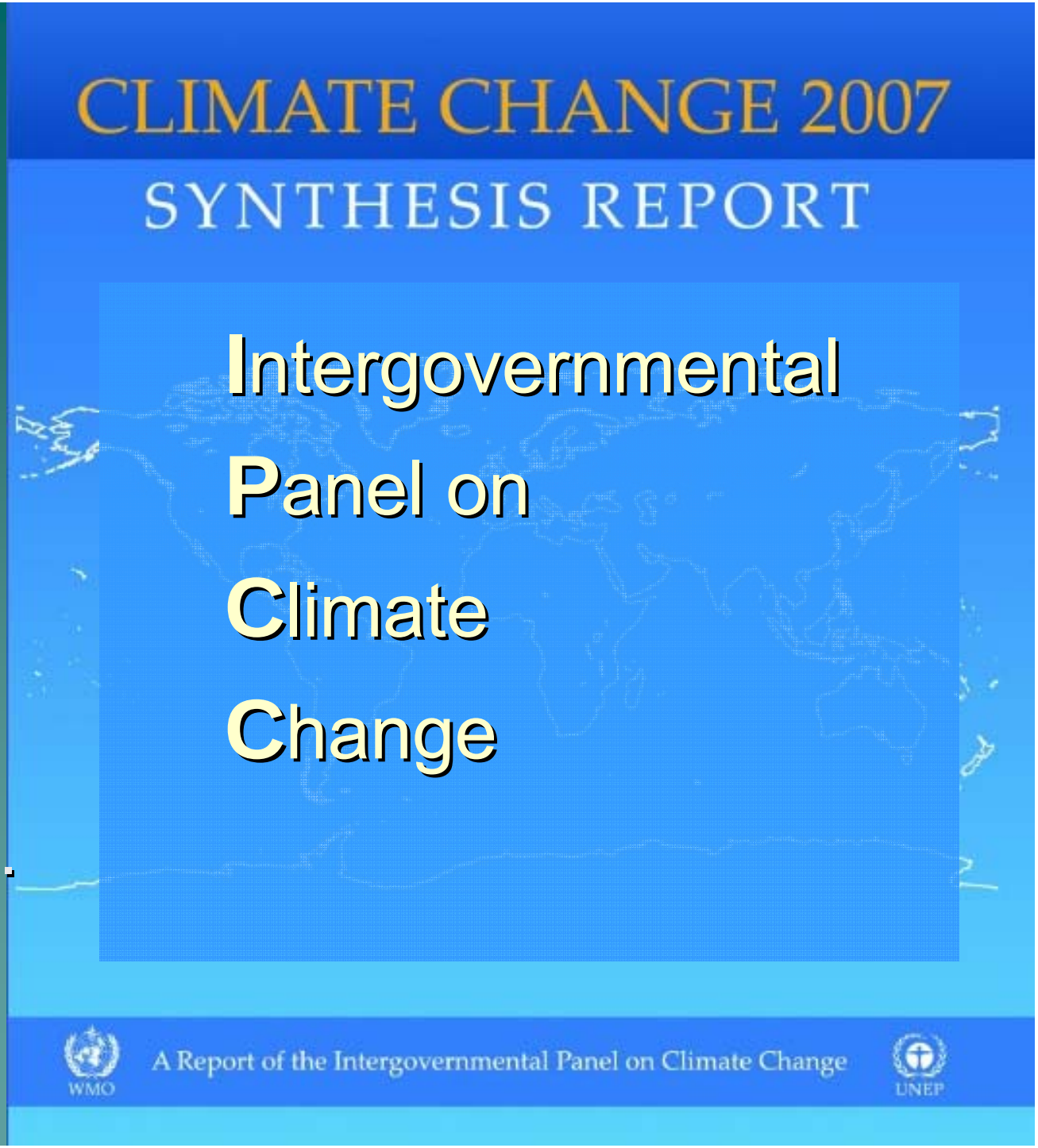
U.S. Fish and Wildlife Service
Pacific Islands Office

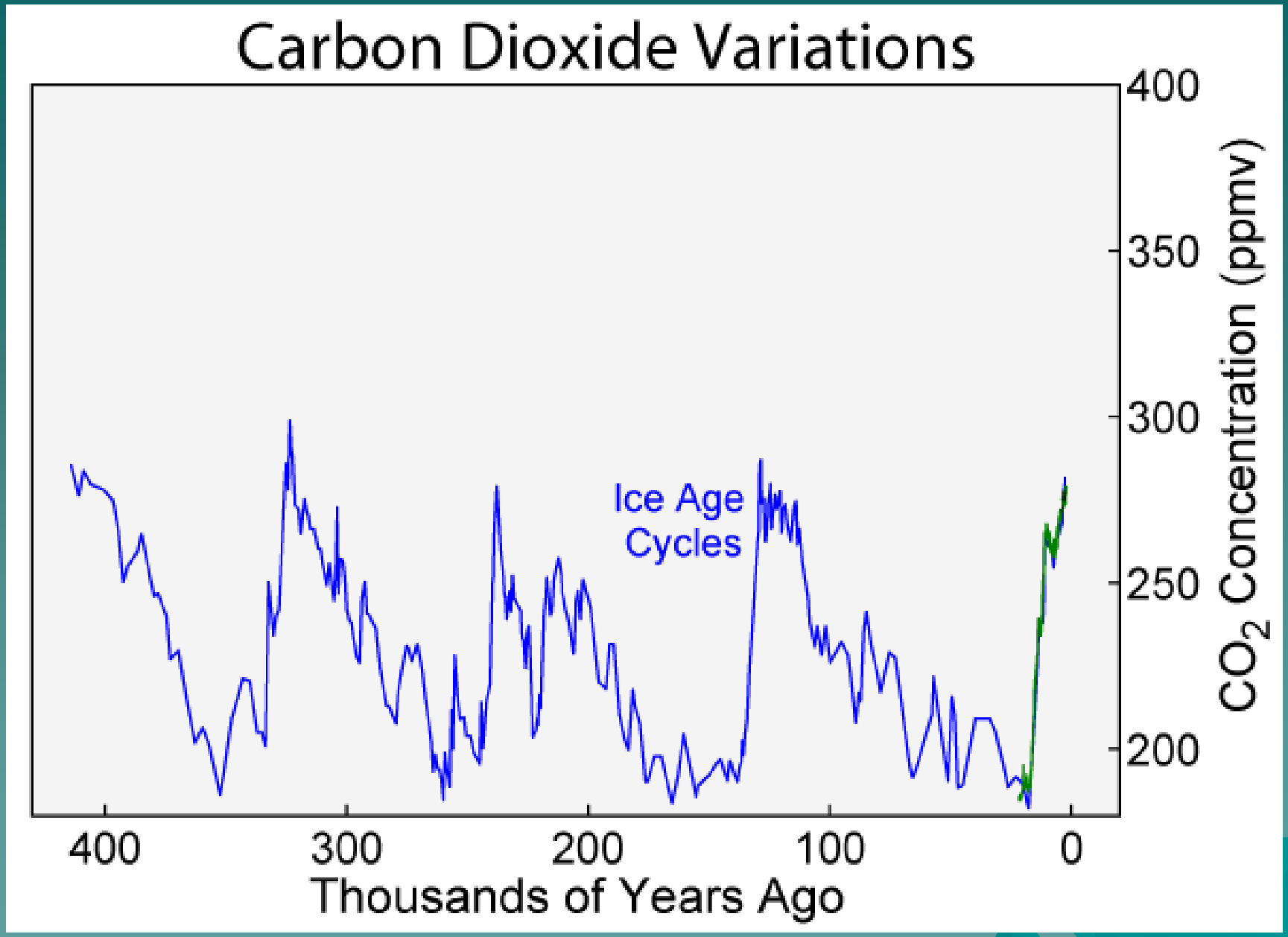
Nobel Peace Prize

Hundreds of authors

Adopted by U.S. Government

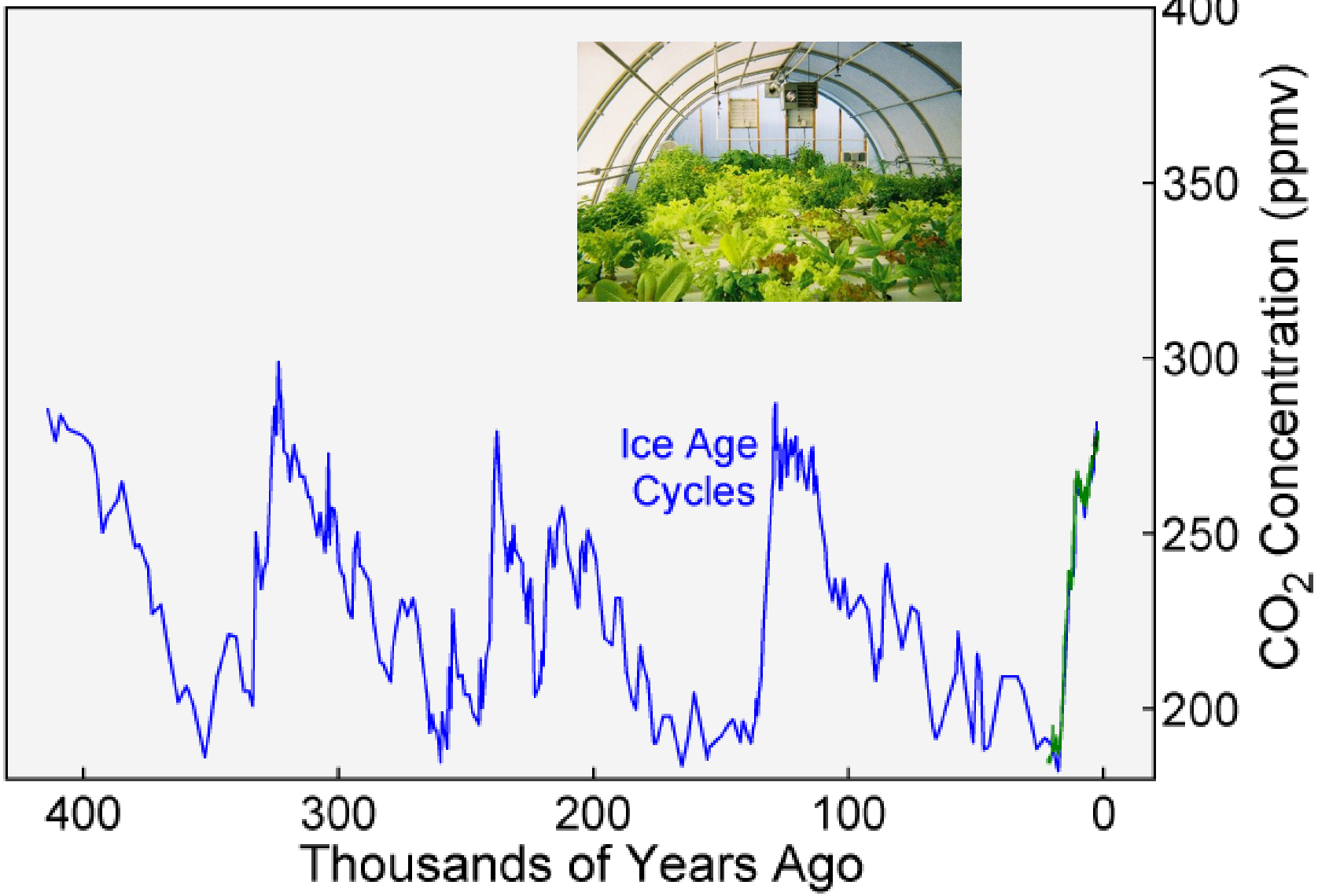


“Climate is what we expect, and weather is what we get”



Globalwarmingart.com

Carbon Dioxide Variations



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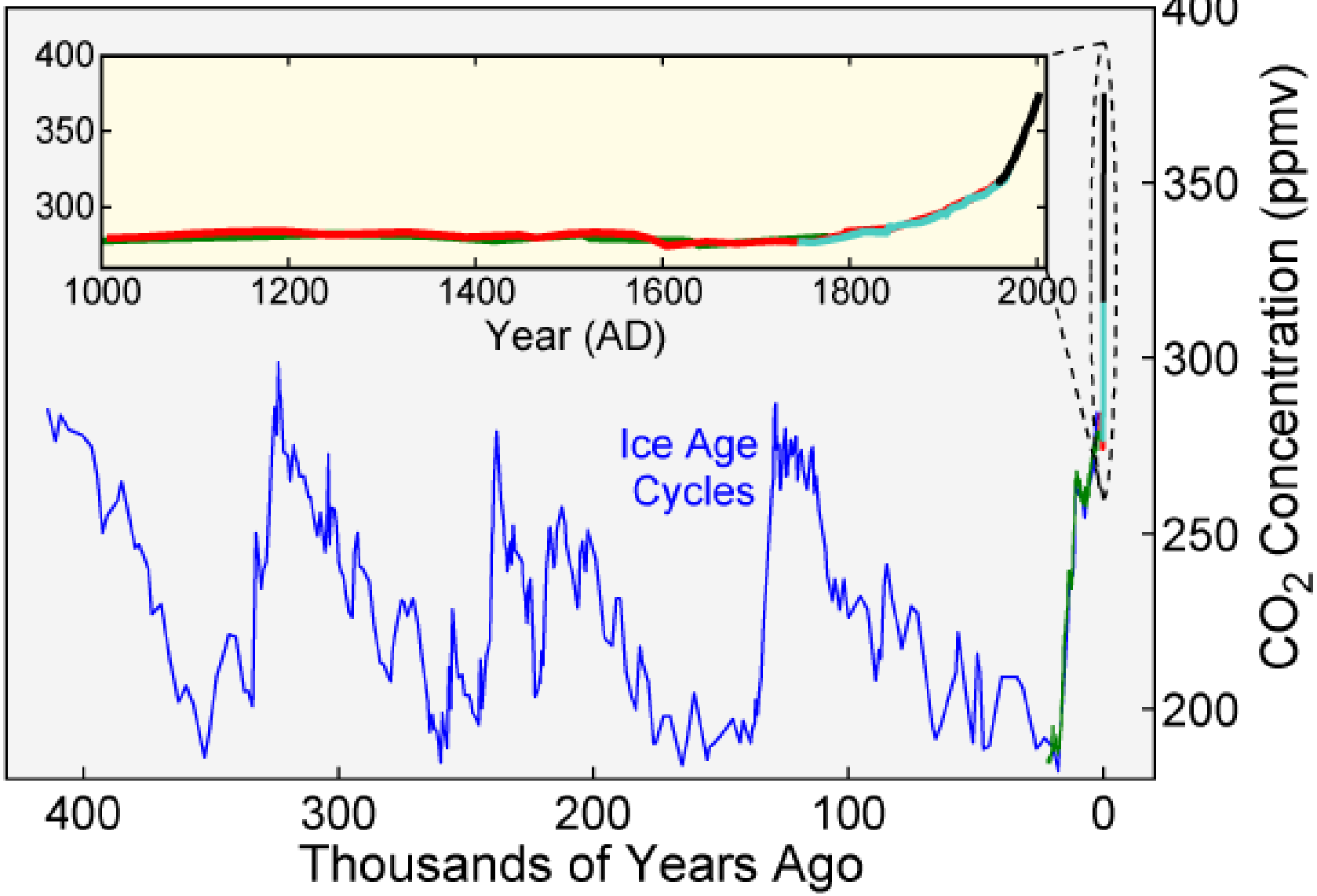

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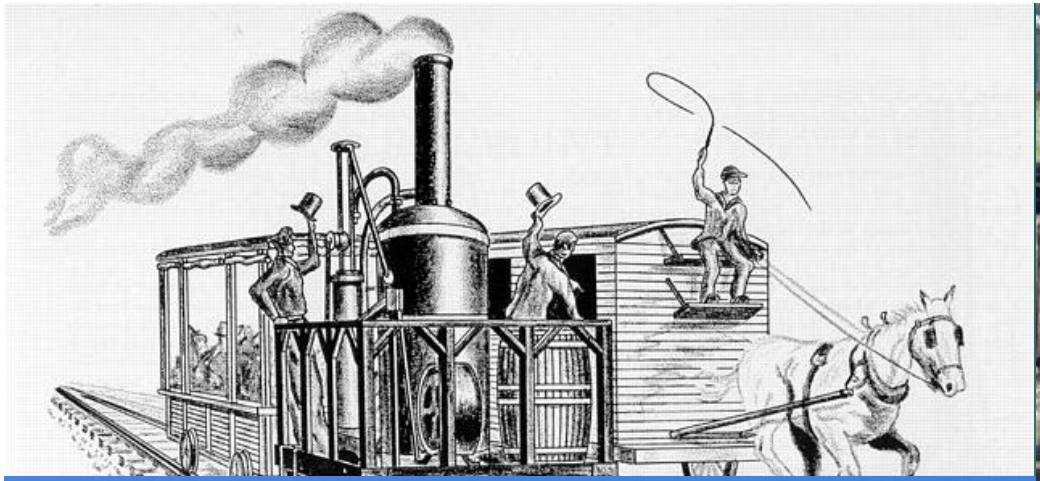
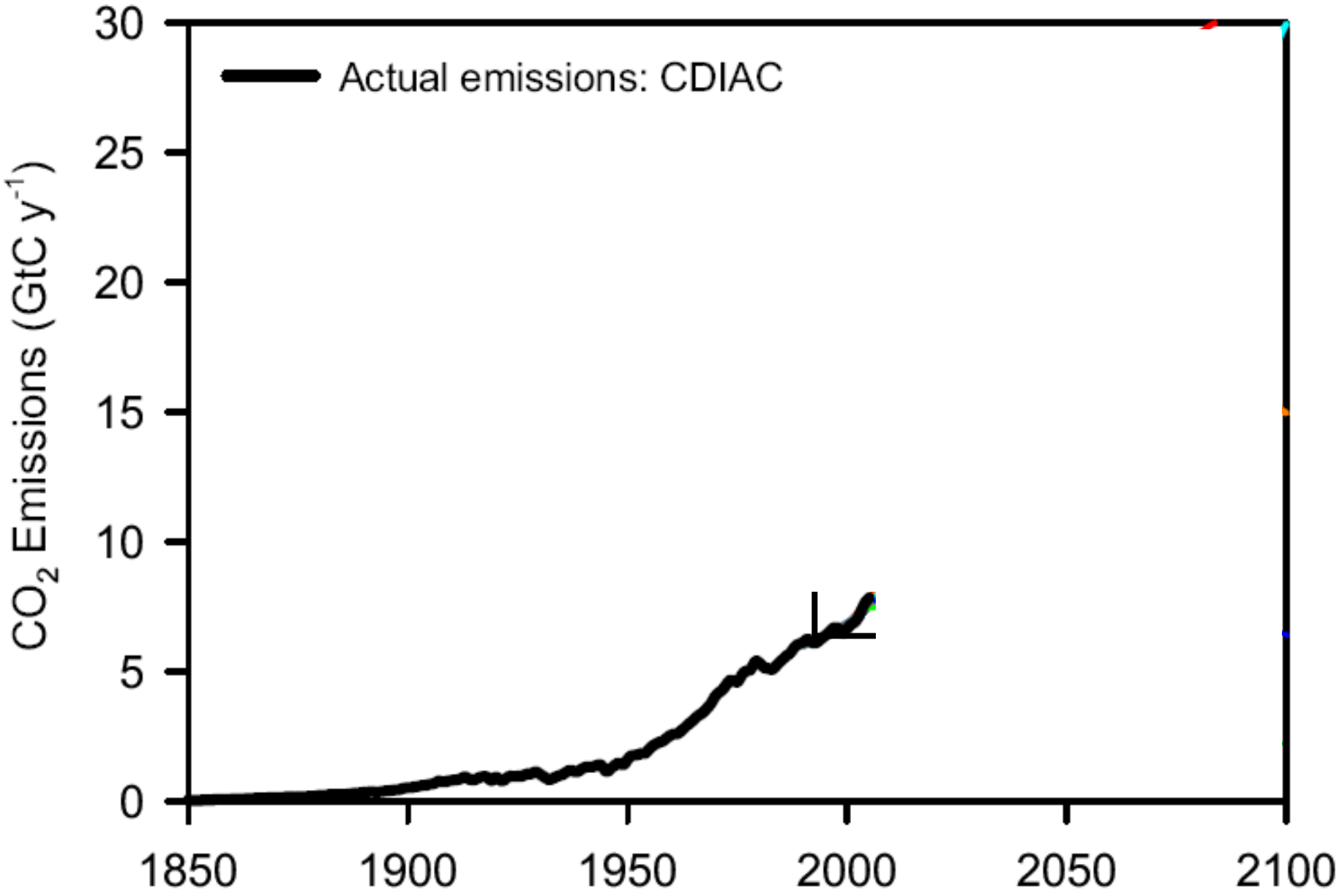
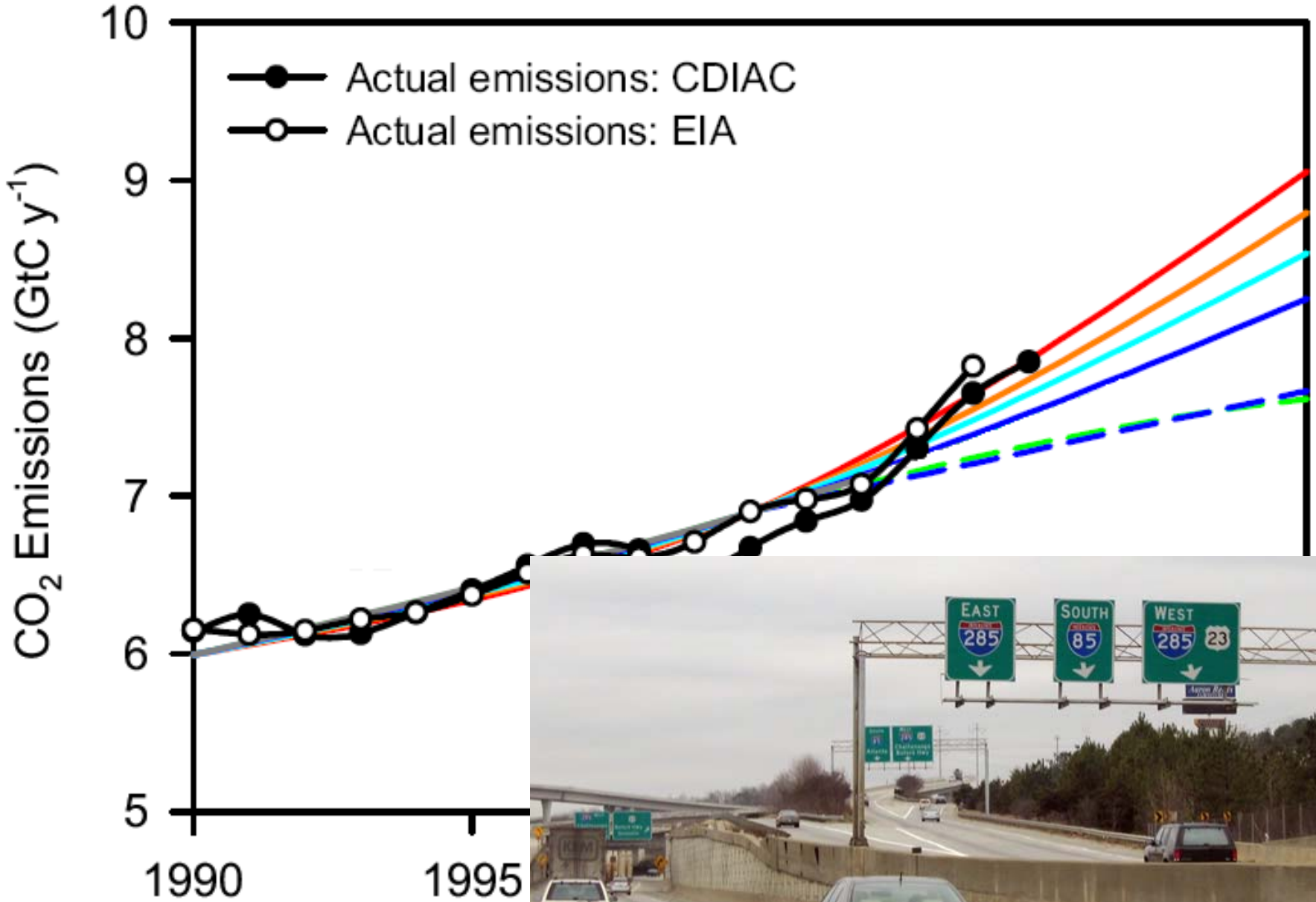


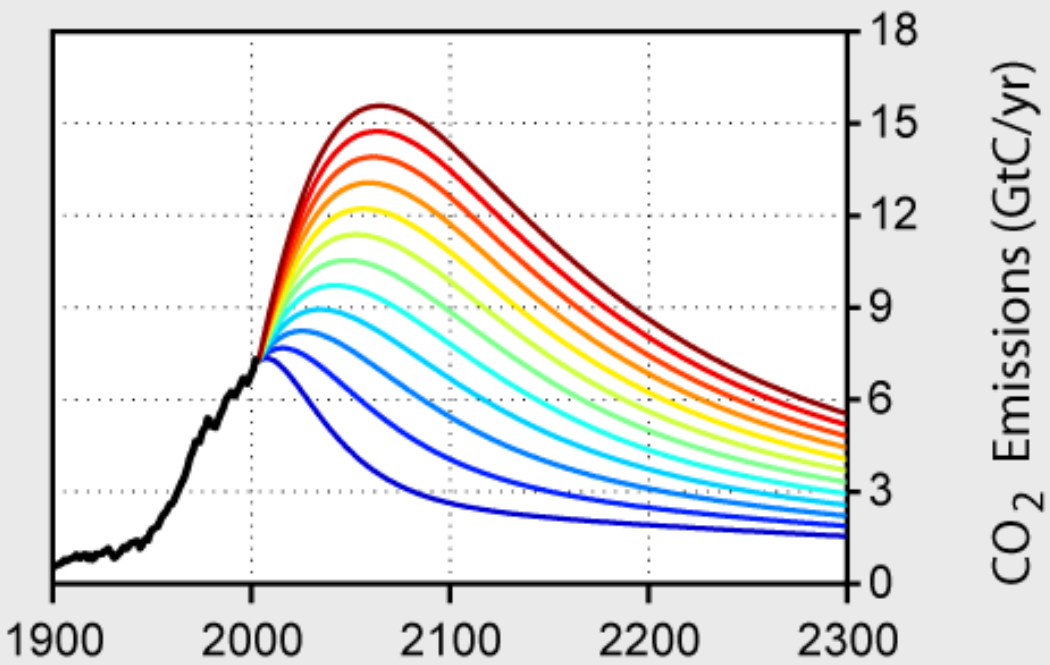


Raupach et al. 2007


Actual emissions: CDIAC
Actual emissions: EIA
CO_2 Emissions (GtC y^{-1})
10
9
8
7
6
5
1990
1995

EAST
285
SOUTH
85
WEST
285
23

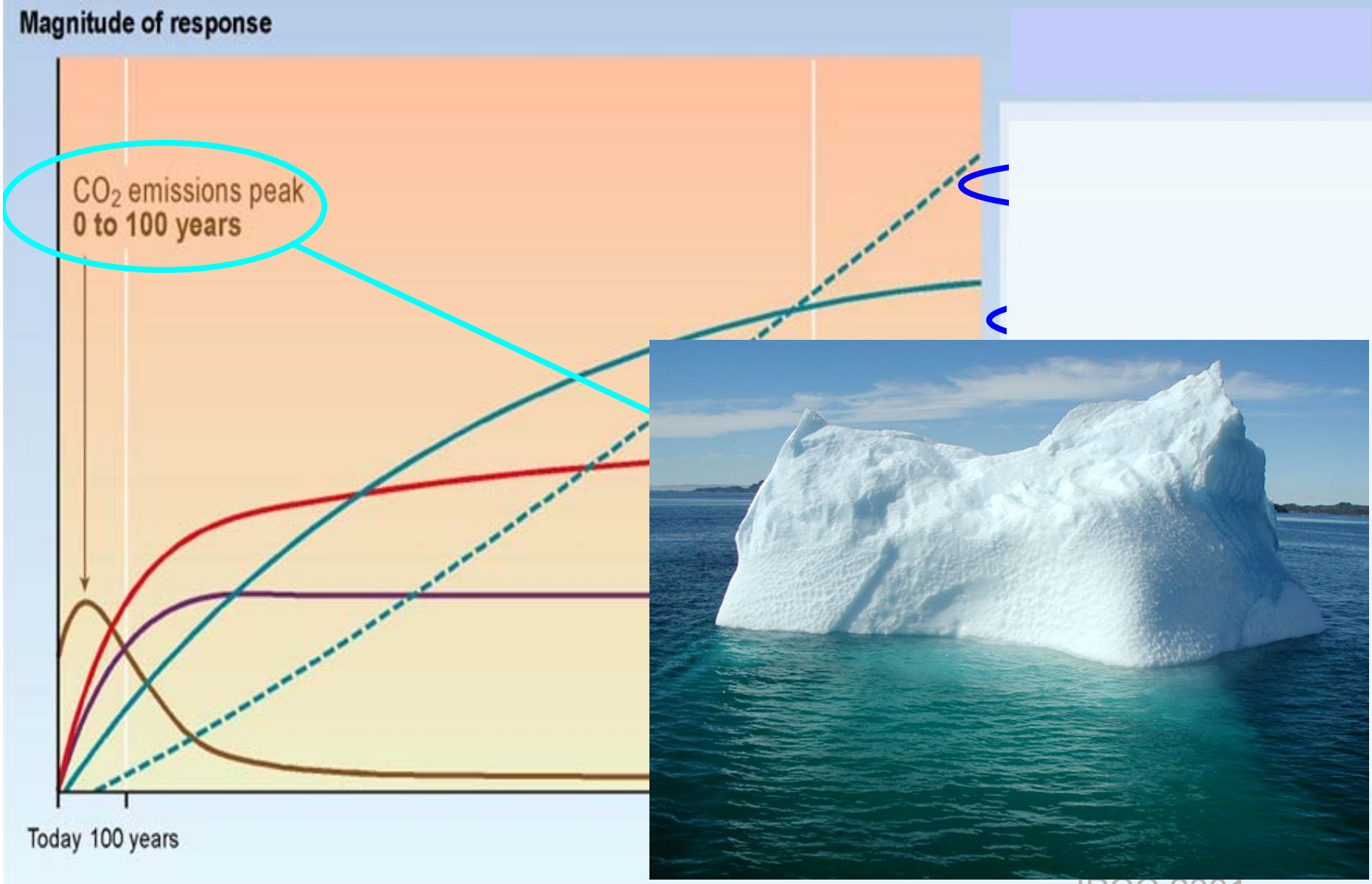
Carbon Dioxide Stabilization



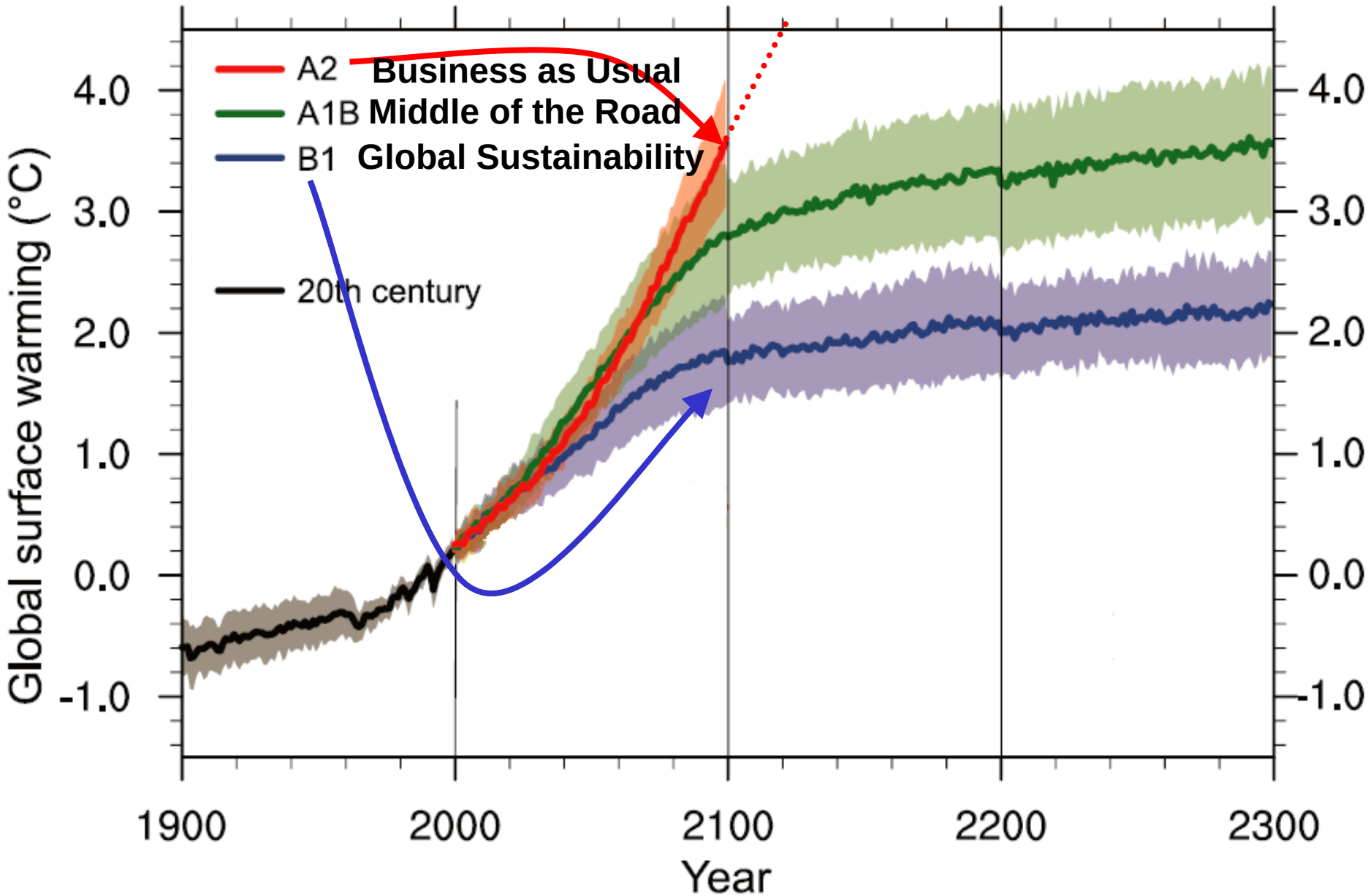
Carbon is Forever

Globalwarmingart.com

Long Term Responses to Higher CO_2

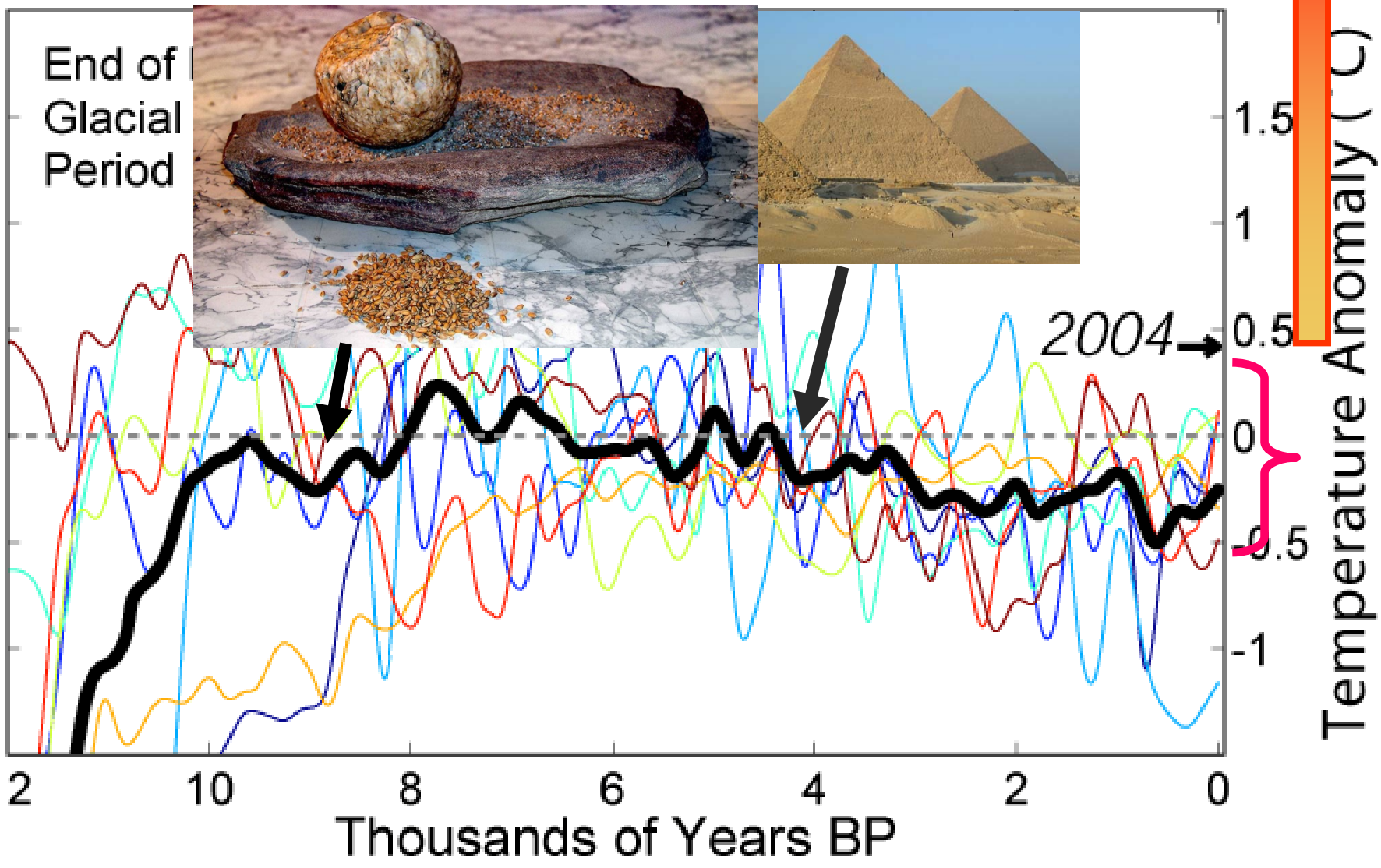


IPCC 2001


A2 Business as Usual
A1B Middle of the Road
B1 Global Sustainability
20th century
Global surface warming (°C)
4.0
3.0
2.0
1.0
0.0
-1.0
1900
2000
2100
2200
2300
Year

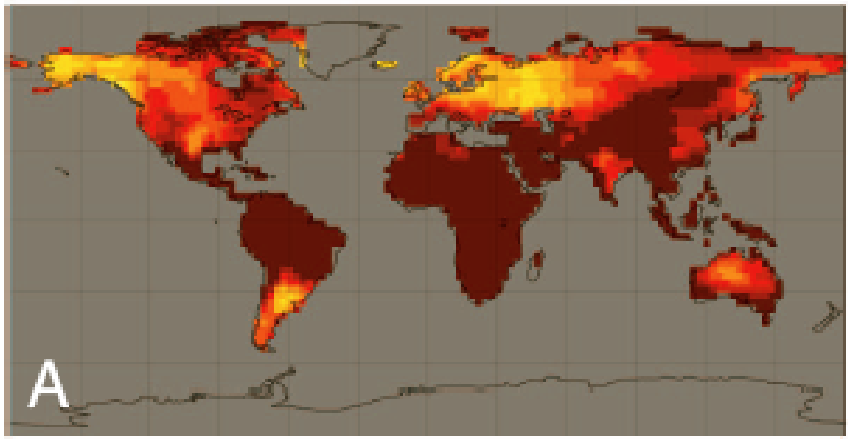
IPCC 2007

Holocene Temperature Variations

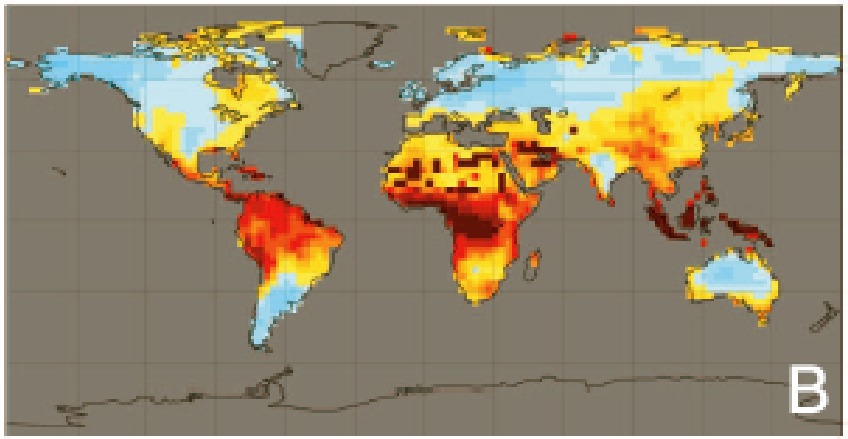


Globalwarmingart.com

A2 Business as Usual

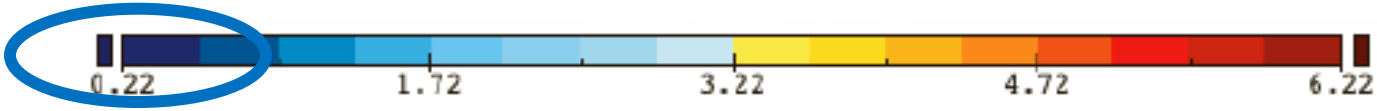


B1 Global Sustainability



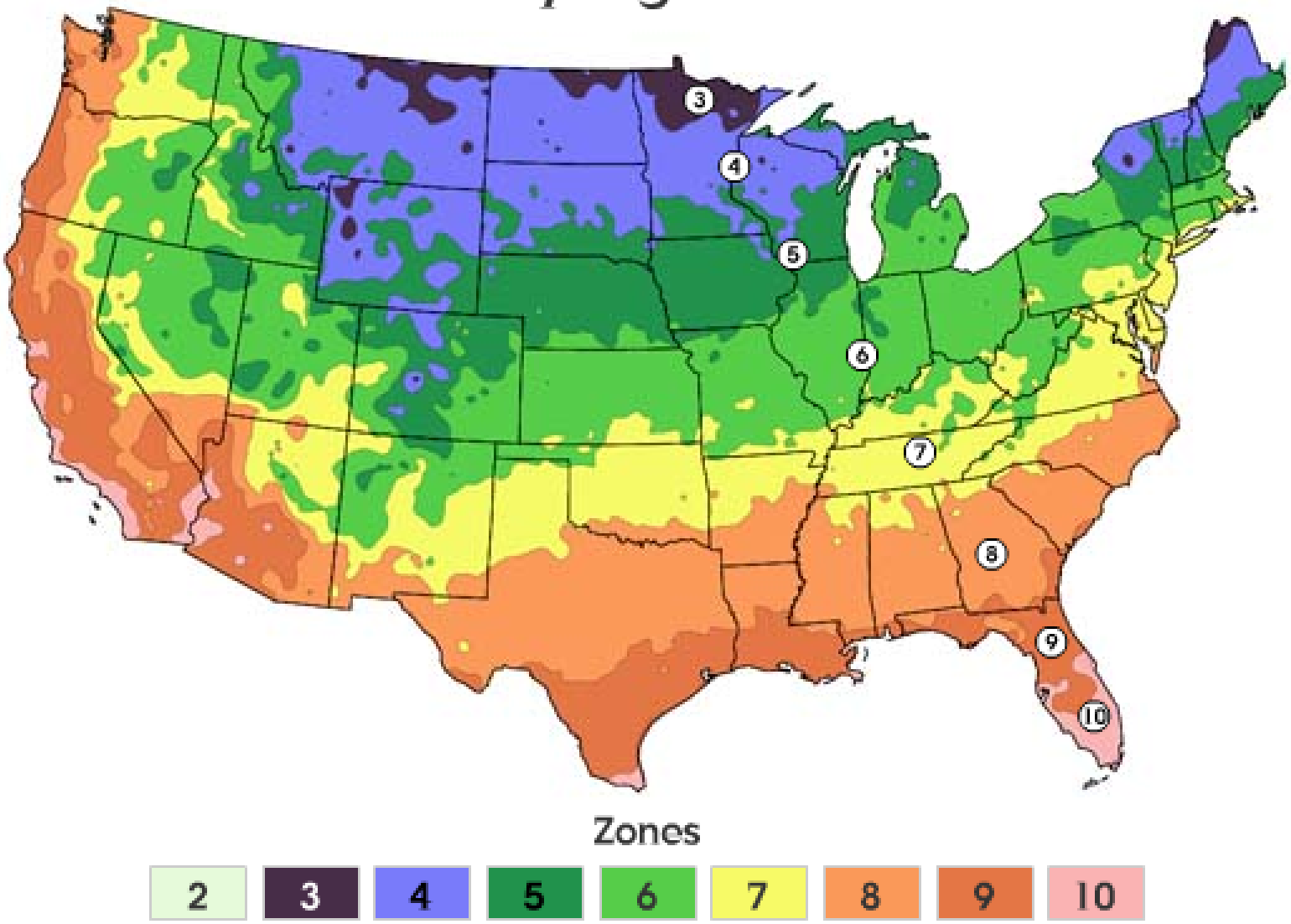
21st Century ≈ 20th Century

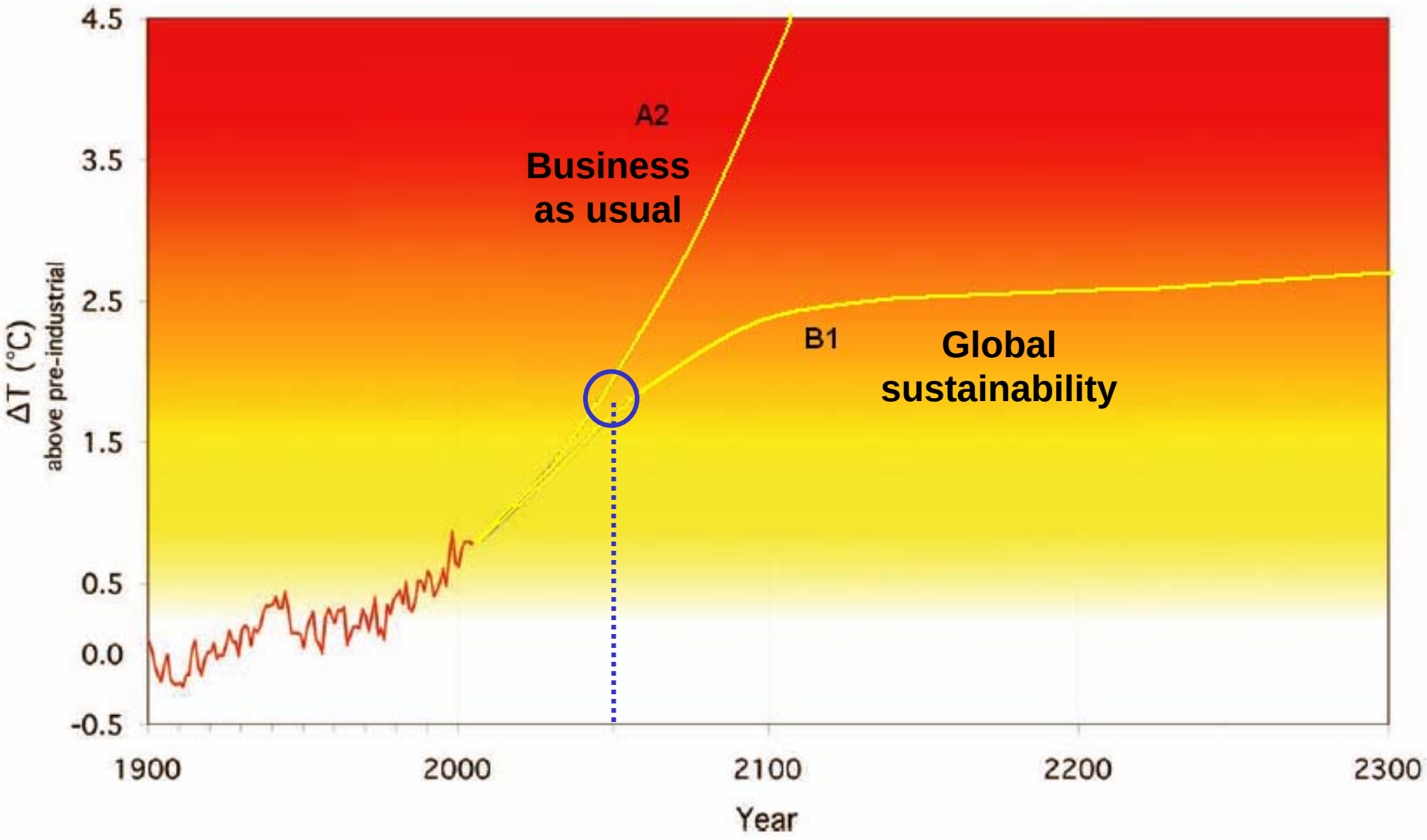
21st Century very different



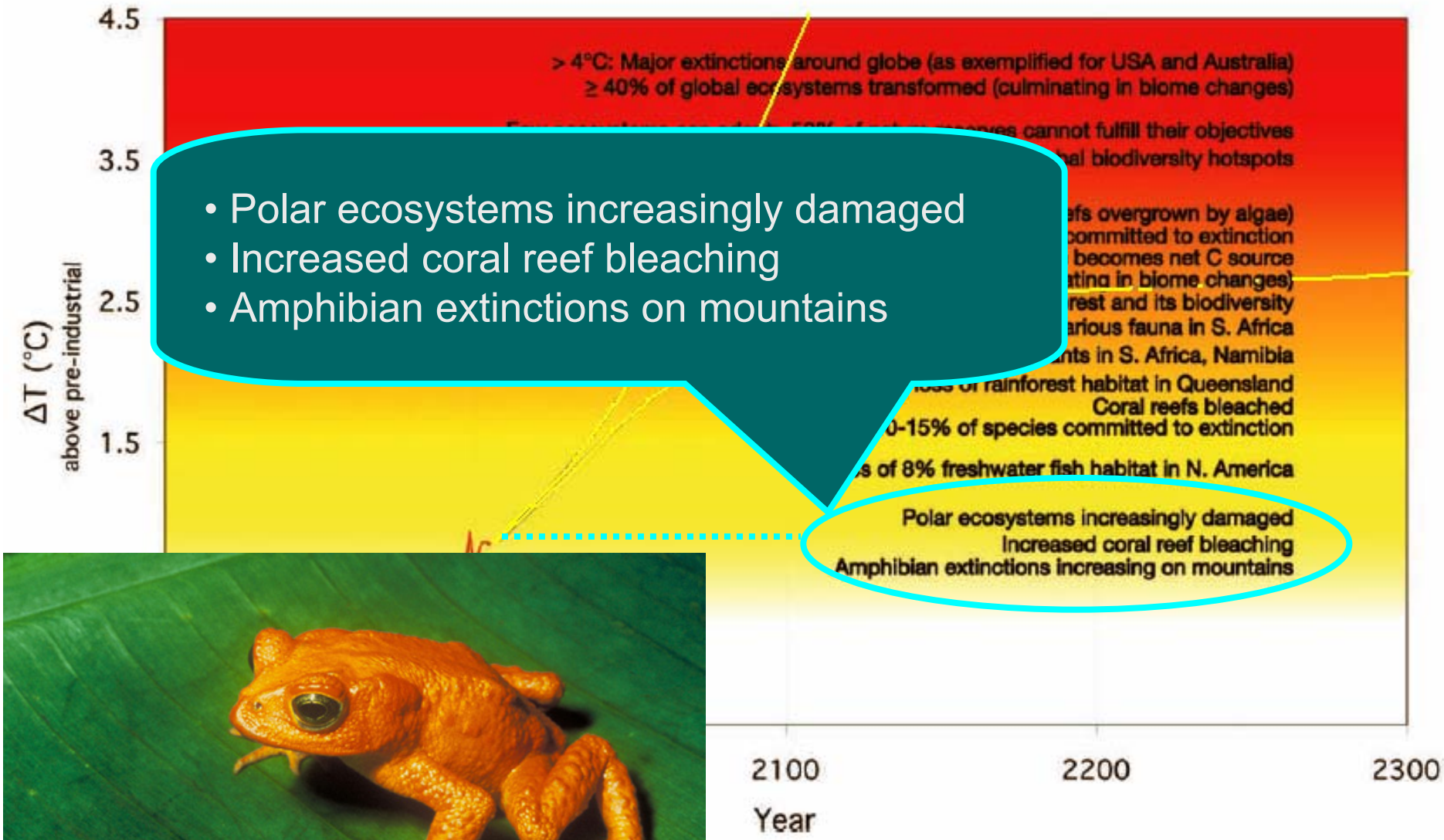
Williams et al. 2007

2006 arborday.org hardiness zones




4.5
3.5
2.5
1.5
0.5
0.0
-0.5
ΔT (°C)
above pre-industrial
A2
Business
as usual
B1
Global
sustainability
1900
2000
2100
2200
2300
Year

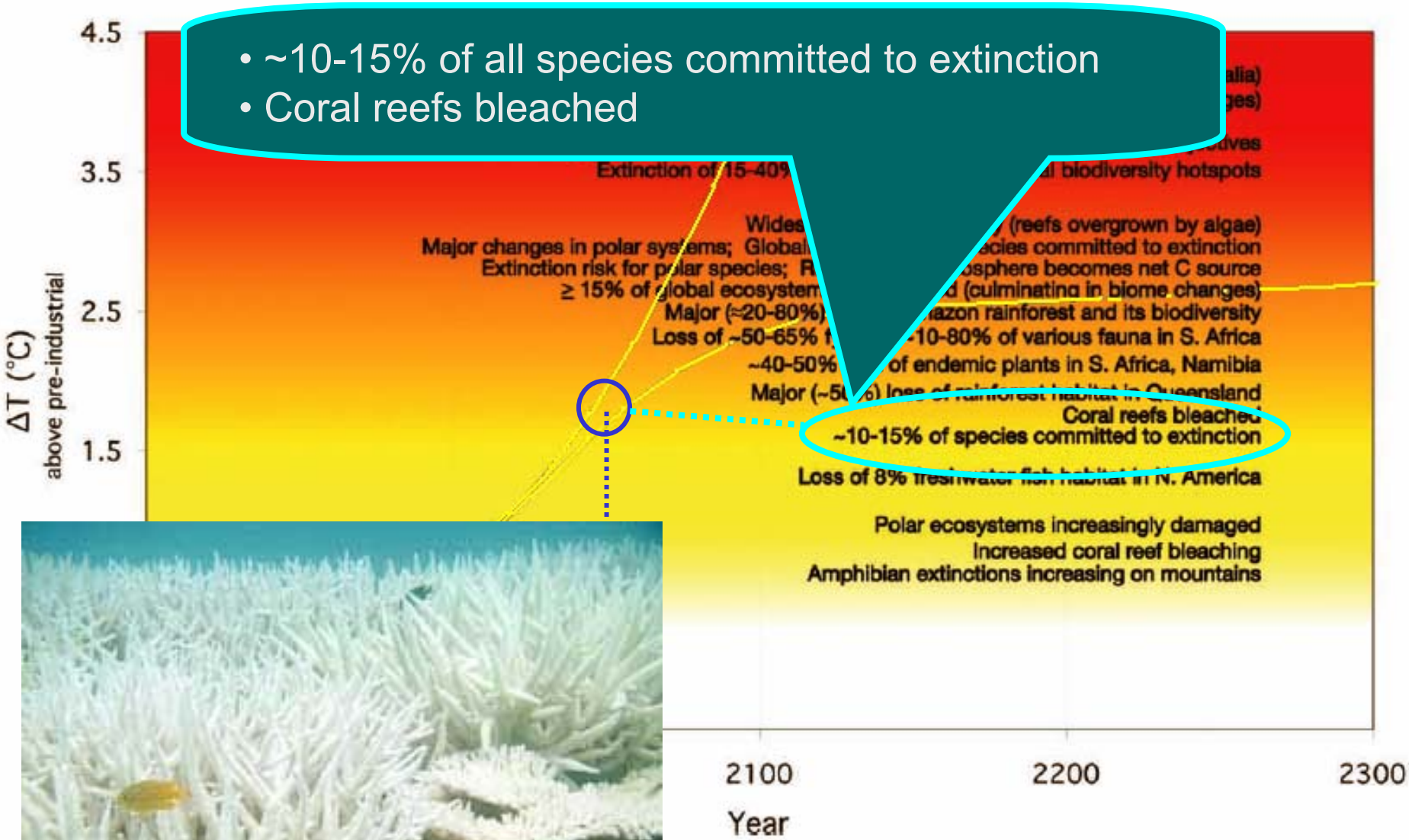
IPCC 2007



- Polar ecosystems increasingly damaged
- Increased coral reef bleaching
- Amphibian extinctions on mountains

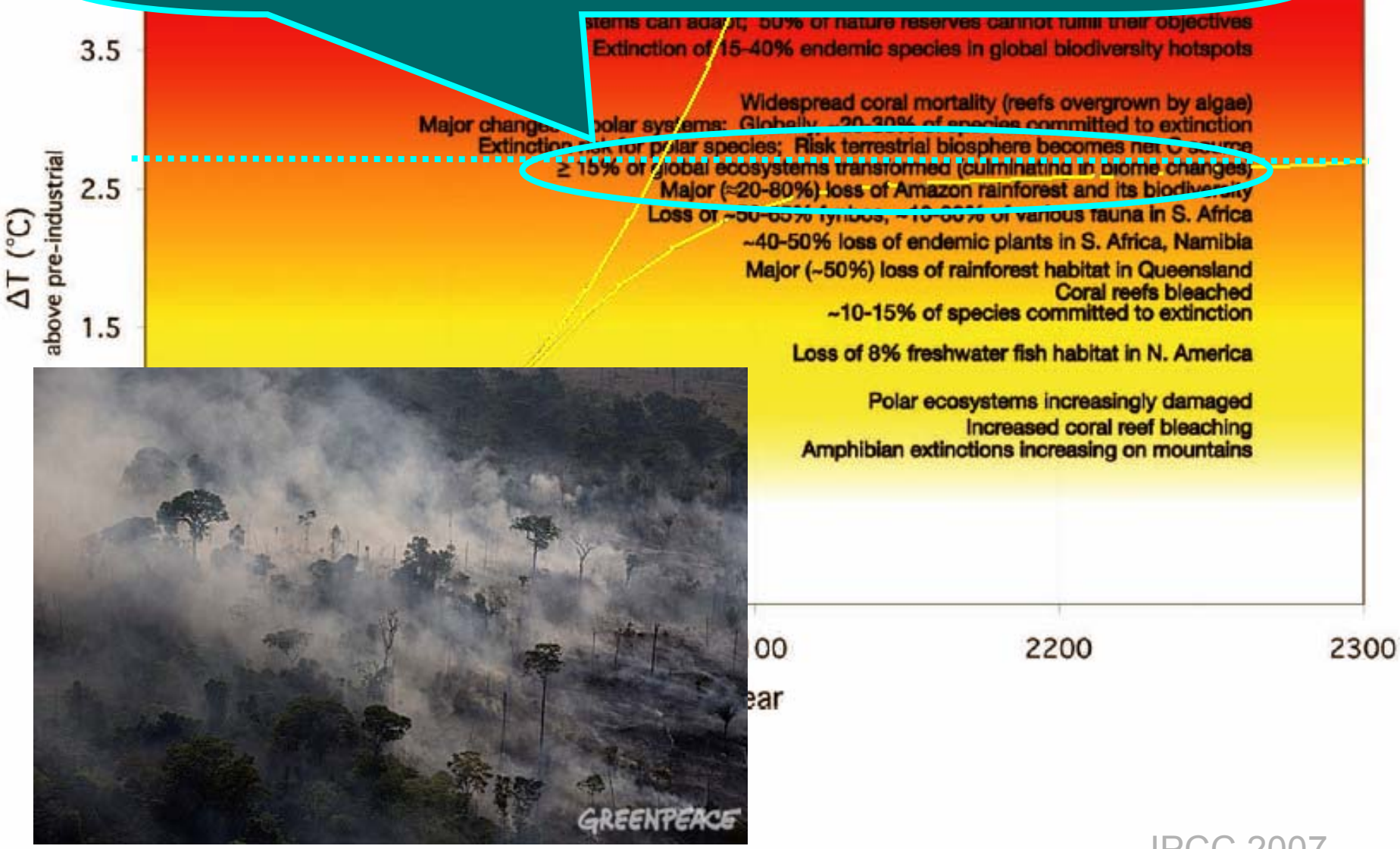
IPCC 2007

- ~10-15% of all species committed to extinction
- Coral reefs bleached

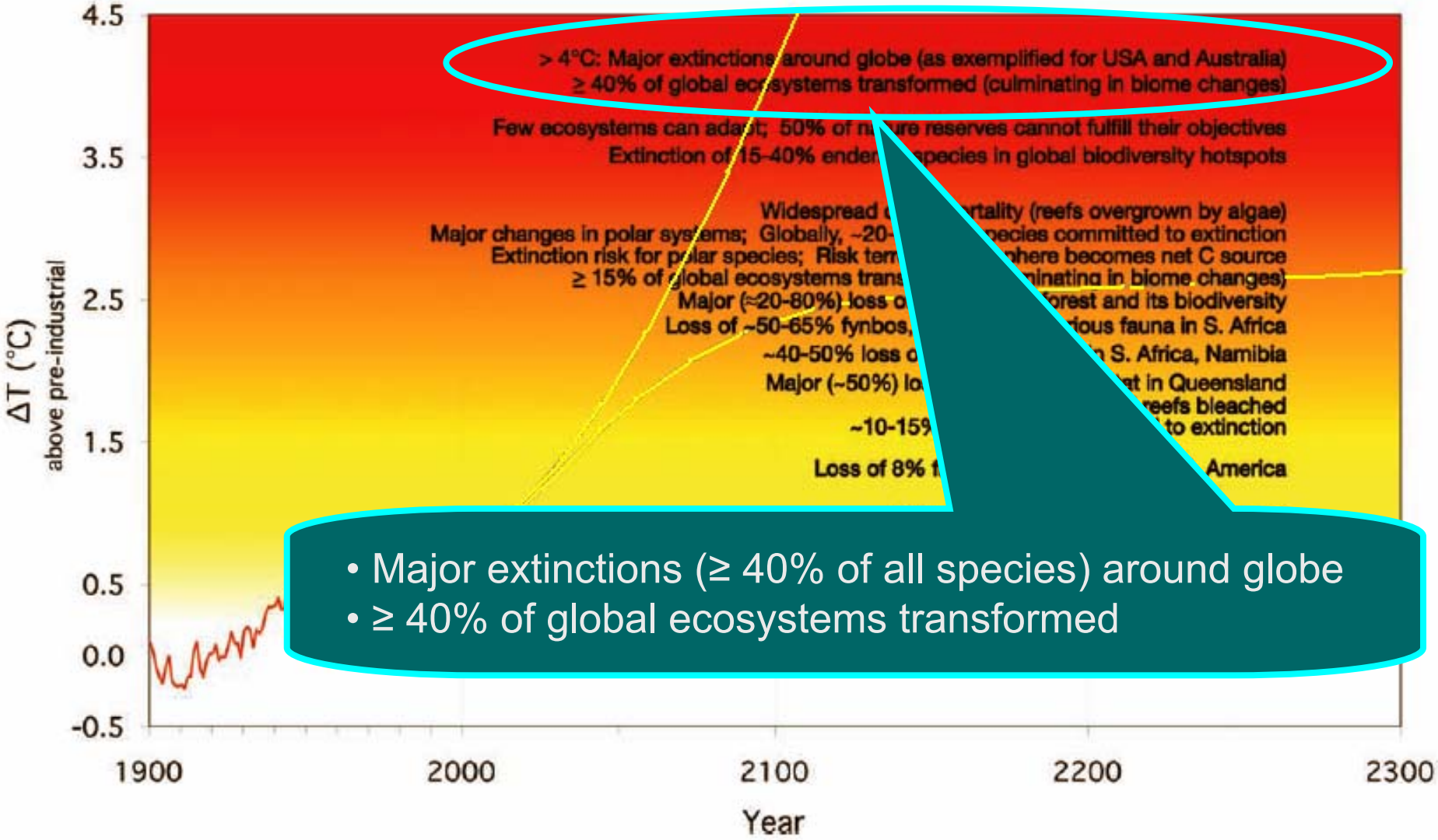


IPCC 2007

- ≥ 15% of global ecosystems transformed (biome changes)
- 20-80% loss of the Amazon rainforest



IPCC 2007


4.5
3.5
2.5
1.5
0.5
0.0
-0.5
ΔT (°C)
above pre-industrial
1900
2000
2100
2200
2300
Year
> 4°C: Major extinctions around globe (as exemplified for USA and Australia)
≥ 40% of global ecosystems transformed (culminating in biome changes)
Few ecosystems can adapt; 50% of nature reserves cannot fulfill their objectives
Extinction of 15-40% ende species in global biodiversity hotspots
Widespread tality (reefs overgrown by algae)
Major changes in polar systems; Globally, ~20- pecies committed to extinction
Extinction risk for polar species; Risk ter here becomes net C source
≥ 15% of global ecosystems trans inating in biome changes)
Major (≈20-80%) loss o orest and its biodiversity
Loss of ~50-65% fynbos, ious fauna in S. Africa
~40-50% loss o S. Africa, Namibia
Major (~50%) lo t in Queensland
reefs bleached
~10-15 to extinction
Loss of 8% f America
• Major extinctions (≥ 40% of all species) around globe
• ≥ 40% of global ecosystems transformed

IPCC 2007

Conservation is…

- Saving habitat for species
- Controlling threats

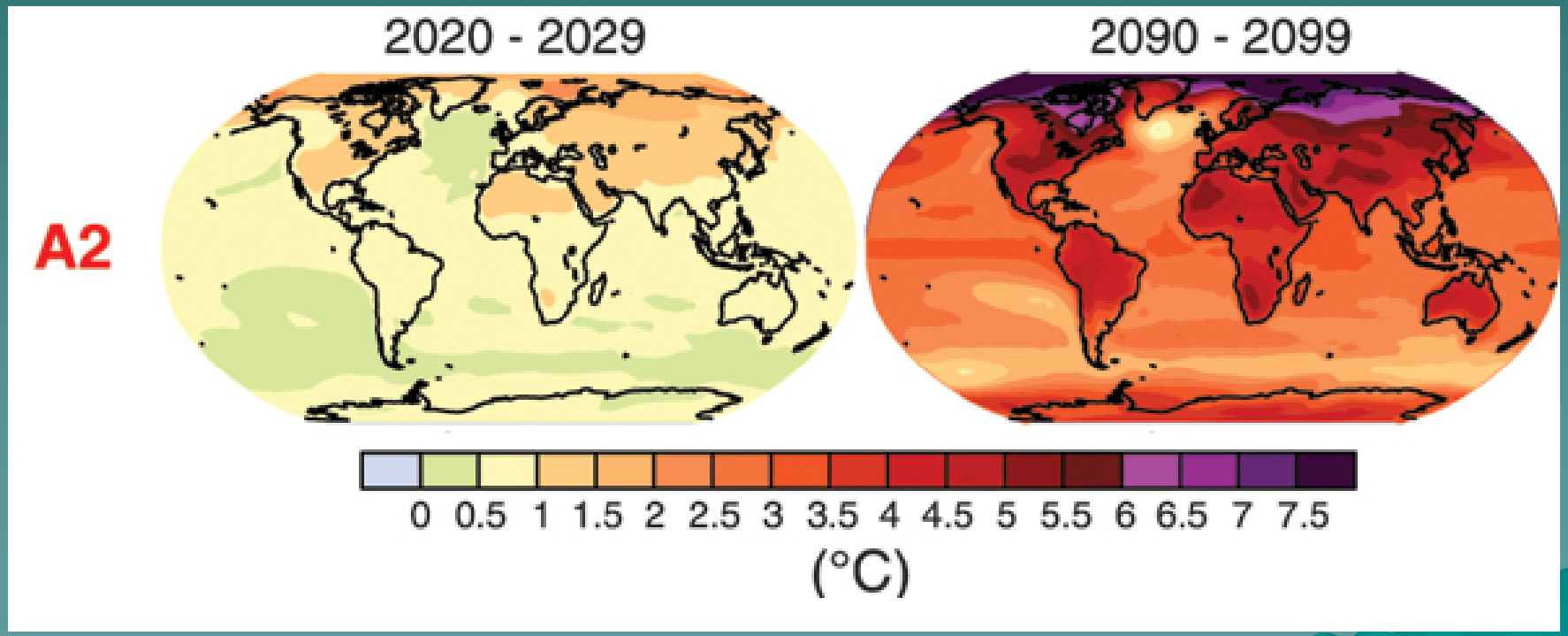
Assumes… But

- "Natural" future will resemble past
  - Communities, historical range, habitats
- Threats can be controlled locally
  - Management, restoration, regulation

Where will the wild things go?

Species Modeling Issues

- "Where" also means "when?"



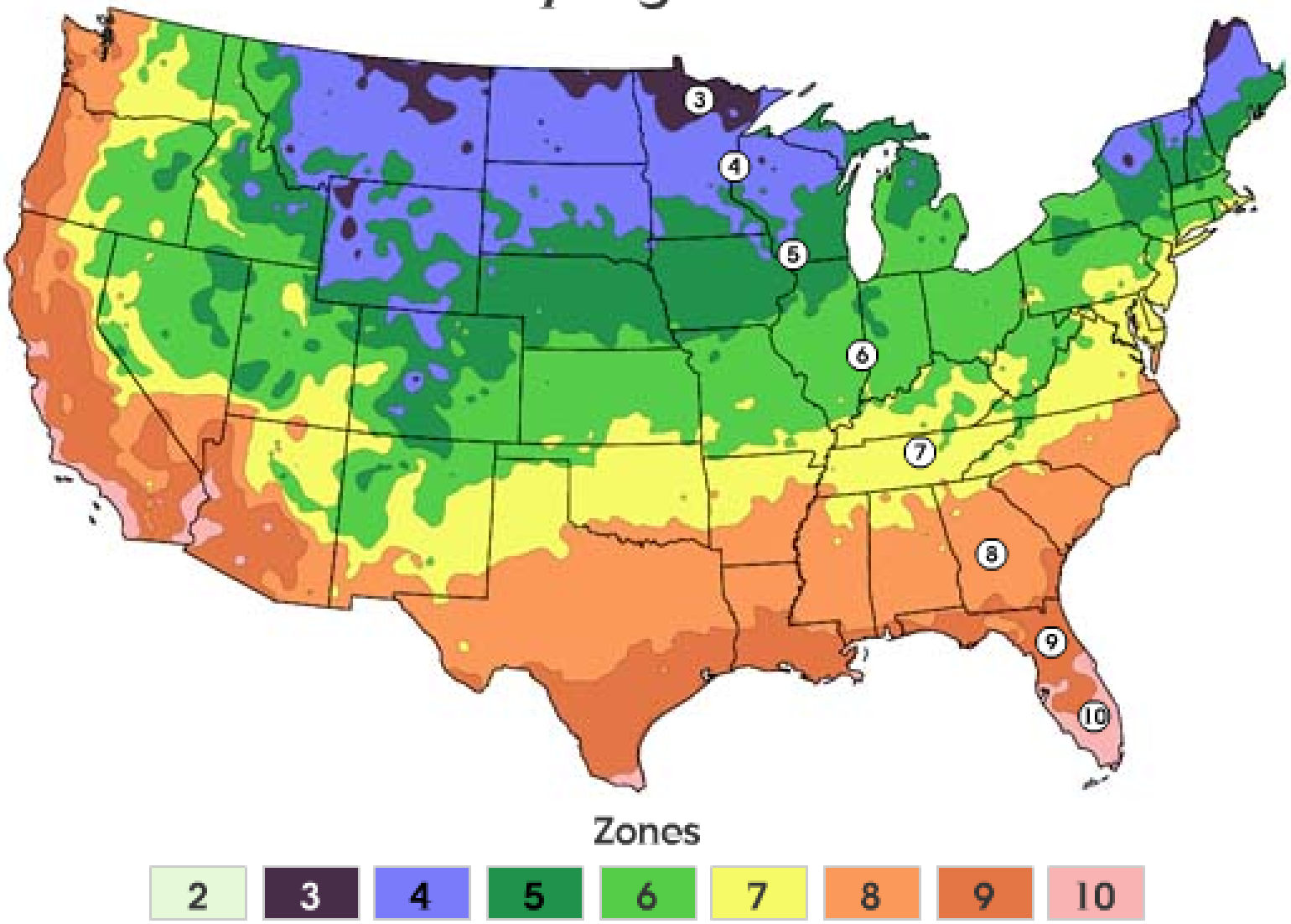
Species Modeling Issues

- Development needed

Species Modeling Issues

- "Where" also means "when?"
- Development needed
- Collaboration

2006 arborday.org hardiness zones



How will they get there?

- Corridors?

How will they get there?

- Corridors?
- Assisted Colonization?

New home, or no home?

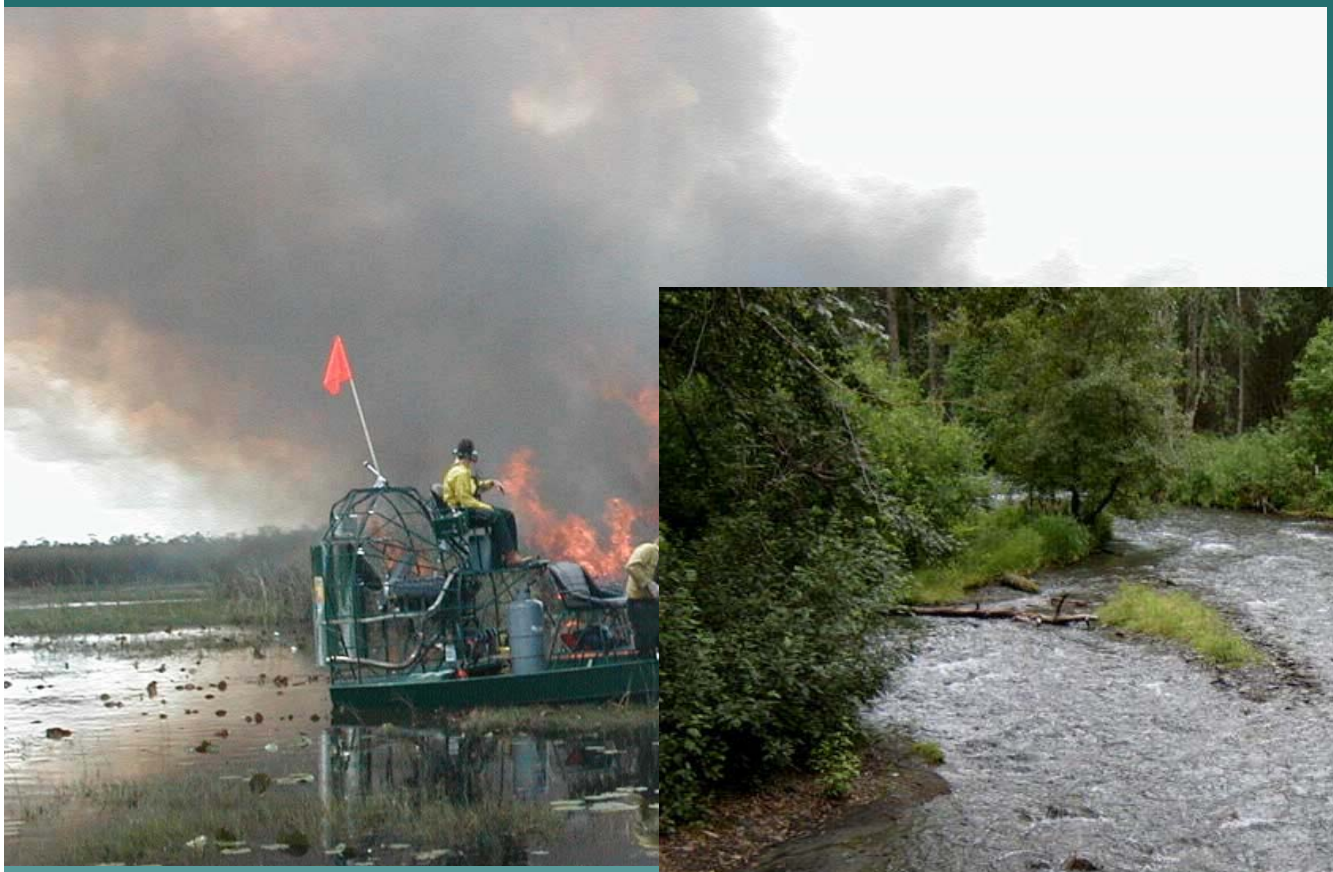
New home, or no home?

California Condor to Arizona

Laysan Duck to Midway Island

Change on the ground

Robust management



Robust management

In the end we will conserve only what we love,
we will love only what we understand,
and we will understand only what we are taught.

-Baba Dioum

The People vs. Nature

- Climate stresses
- Nature is essential

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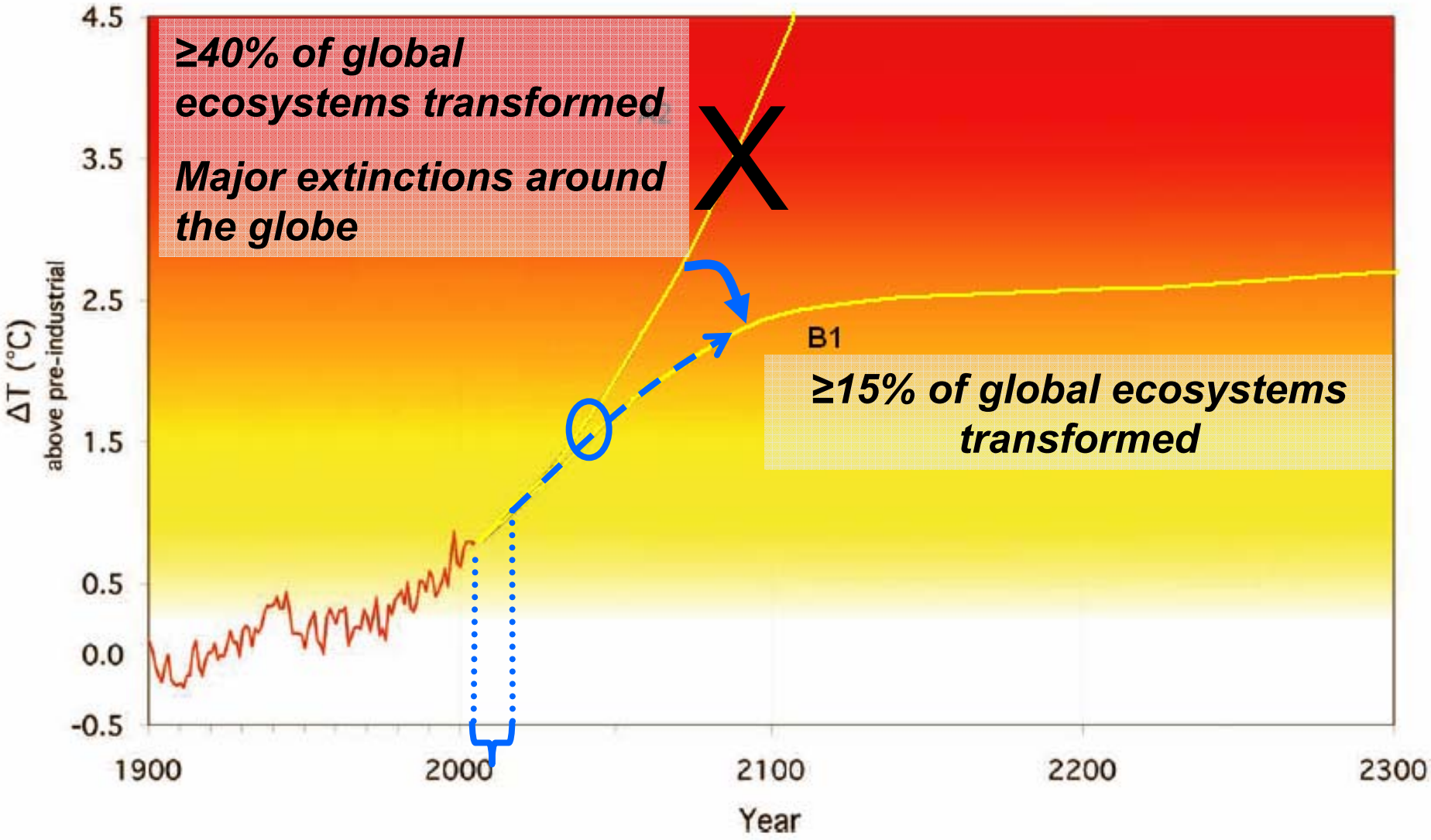
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X
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4.5
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0.0
-0.5
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2100
2200
2300
Year

"Environmental leadership means being able to describe, compellingly, the world you want to get to. Only then will people find a way to get there."

-*Larry Selzer, The Conservation Fund*