PRESERVING BIODIVERSITY: ANY MESSAGES FOR CLIMATE POLICY MAKING? First, complex systems are never fully understood--especially coupled human-natural systems--thus we will have aspects of knowledge that are well established, others best categorized as competing explanations and yet others in the speculative realm. We have all three present in our estimation of climate changes, and I will briefly highlight a few in each category. Second, the impacts of climate on biodiversity is a synergistic interaction of the rate and magnitude of climate changes along with other disturbances like land fragmentation and invasives, which together determine the threatened status of some species. Third, to adapt to such threats takes action on several fronts: habitat restoration, sufficient reserves, migration corridors and, yes, more controversially, some managed relocation of priority species--the latter being a very divisive normative debate. Finally, there is mitigation, the reduction of exposure of species to climatic changes, and these can be complementary to adaptation activities. Unlike some of my economist friends who see adaptation and mitigation as tradeoffs, I see them as complements. That is, we must adapt to what we can't mitigate and mitigate what we can't adapt to. To define the latter we need bottom up studies of individual systems to define "dangerous thresholds", which in turn can help to define needed levels of mitigatioin. I think that is about all I'll possibly be able to squeeze into 20 minutes--though I talk fast! Let me know if any of you have suggestions to modify any of this. Cheers, Steve

Stephen H. Schneider*

Melvin and Joan Lane Professor for Interdisciplinary Environmental Studies,
Professor, Department of Biology
Senior Fellow, Woods Institute for the Environment
Stanford University

PRESERVING BIODIVERSITY: ANY MESSAGES FOR CLIMATE POLICY MAKING?

*[Website for more info: climatechange.net.]

Is the Science “Settled”?

Is The Science “Settled”?

-Well-established components

Is The Science “Settled”?

-Well-established components

-Competing Explanations

Is The Science “Settled”?

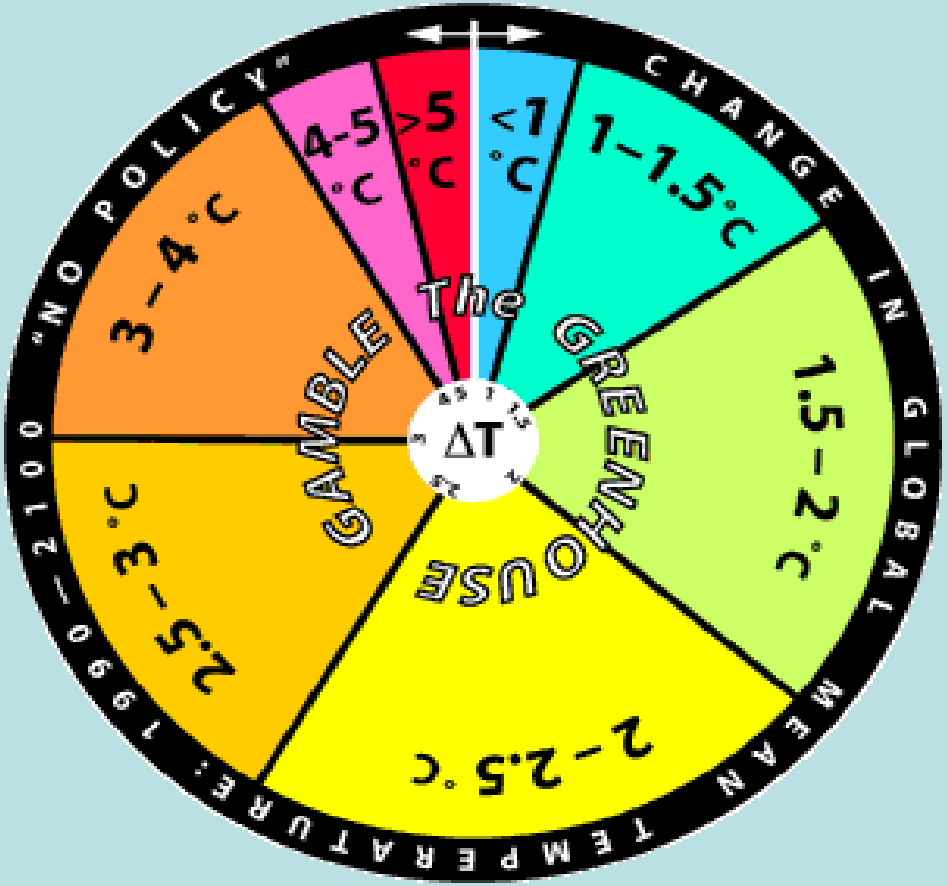
-Well-established components

-Competing Explanations

-Speculative components

The great “greenhouse gamble”…

<1 C	(4.1%; 1 in 24 odds)
1 to 1.5 C	(11.4%; 1 in 9 odds)
1.5 to 2 C	(20.6%; 1 in 5 odds)
2 to 2.5 C	(22.5%; 1 in 4 odds)
2.5 to 3 C	(16.8%; 1 in 6 odds)
3 to 4 C	(16.2%; 1 in 6 odds)
4 to 5 C	(4.6%; 1 in 22 odds)
>5 C	(3.8%; 1 in 26 odds)



Source: MIT Joint Program on the Science and Policy of Climate Change

Little adaptive capacity

<1 C	(4.1%; 1 in 24 odds)
1 to 1.5 C	(11.4%; 1 in 9 odds)
1.5 to 2 C	(20.6%; 1 in 5 odds)
2 to 2.5 C	(22.5%; 1 in 4 odds)
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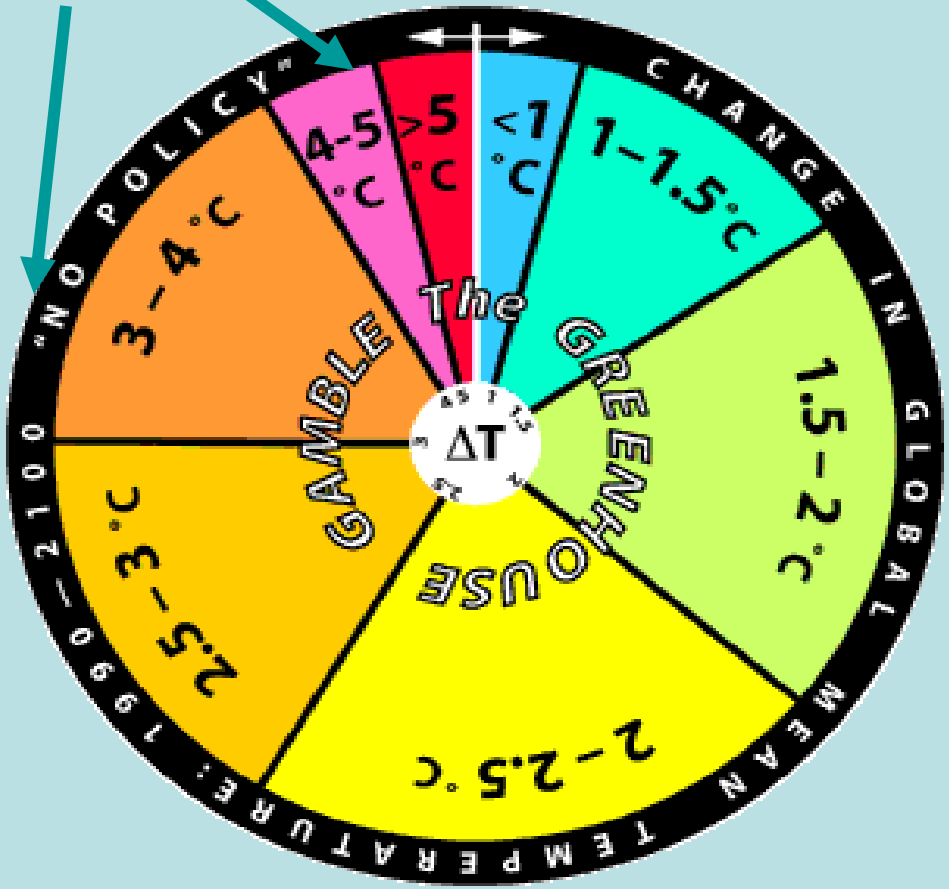

Source: MIT Joint Program on the Science and Policy of Climate Change

Little adaptive capacity

Some adaptive capacity

<1 C	(4.1%; 1 in 24 odds)
1 to 1.5 C	(11.4%; 1 in 9 odds)
1.5 to 2 C	(20.6%; 1 in 5 odds)
2 to 2.5 C	(22.5%; 1 in 4 odds)
2.5 to 3 C	(16.8%; 1 in 6 odds)
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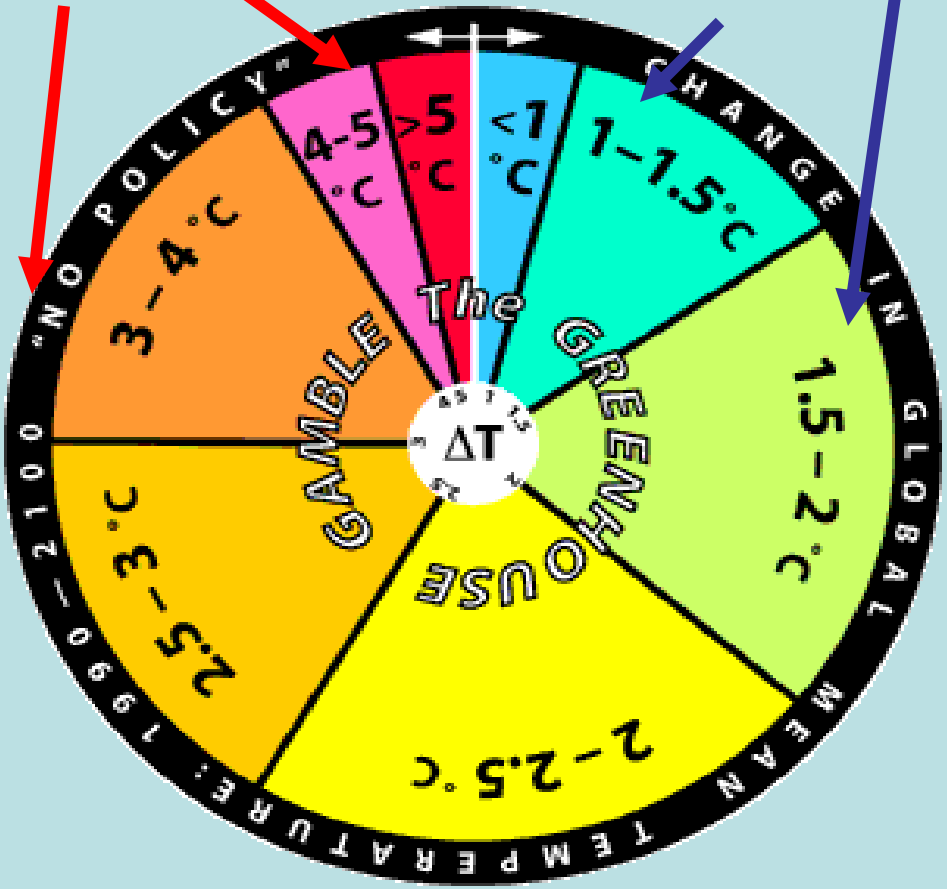
>5 C	(3.8%; 1 in 26 odds)



Source: MIT Joint Program on the Science and Policy of Climate Change

Adaptation and Mitigation are Complements, not Trade-offs!

Adaptation and Mitigation are Complements, not Trade-offs!

-Adaptation to unavoidable climate changes

Adaptation and Mitigation are Complements, not Trade-offs!

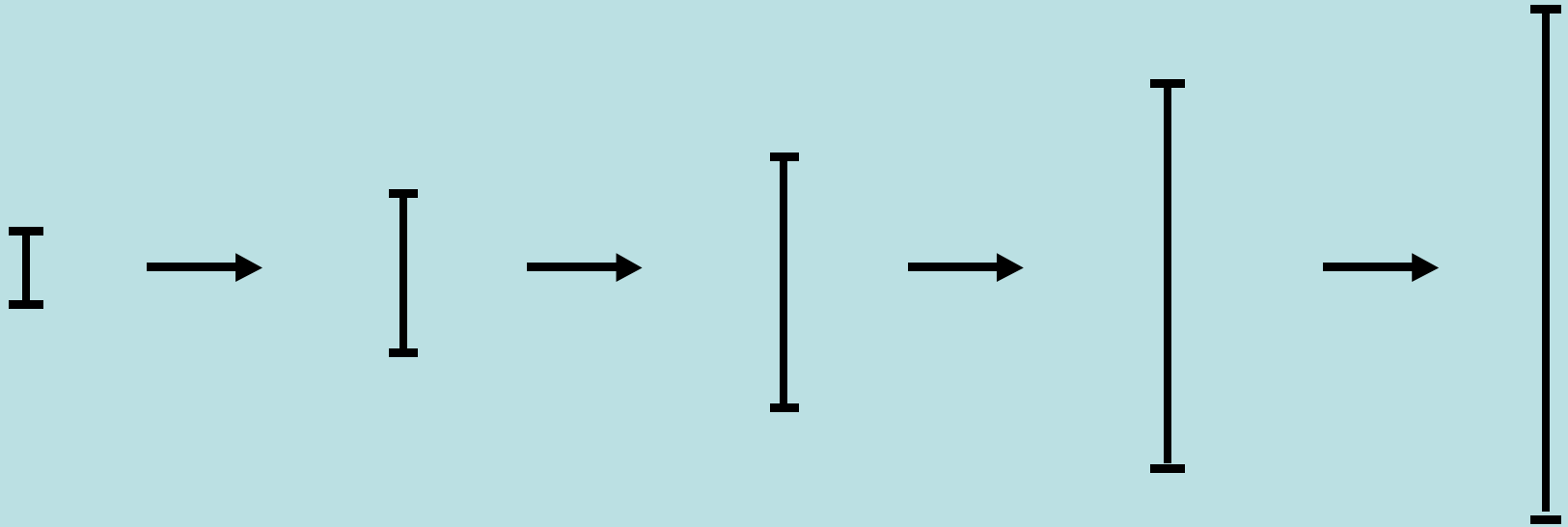
-Adaptation to unavoidable climate changes

-Mitigation of changes that are too difficult to adapt to

Hundreds Gather to Protest Global Warming

Hundreds Gather to Protest Global Warming

Top ➔ Down ➔



emission scenarios ? carbon cycle response ? global climate sensitivity ? regional climate change scenarios ? range of possible impacts

Cascade of Uncertainties

[Schneider, 1983]

Need Additional Research Paradigm:

Not just top down—linear cascade

NEED ADDITIONAL RESEARCH PARADIGM:

Not just top down—linear cascade

but bottom up: regional, sectoral and groups' vulnerability analysis **mapped** to top down analyses

NEED ADDITIONAL RESEARCH PARADIGM:

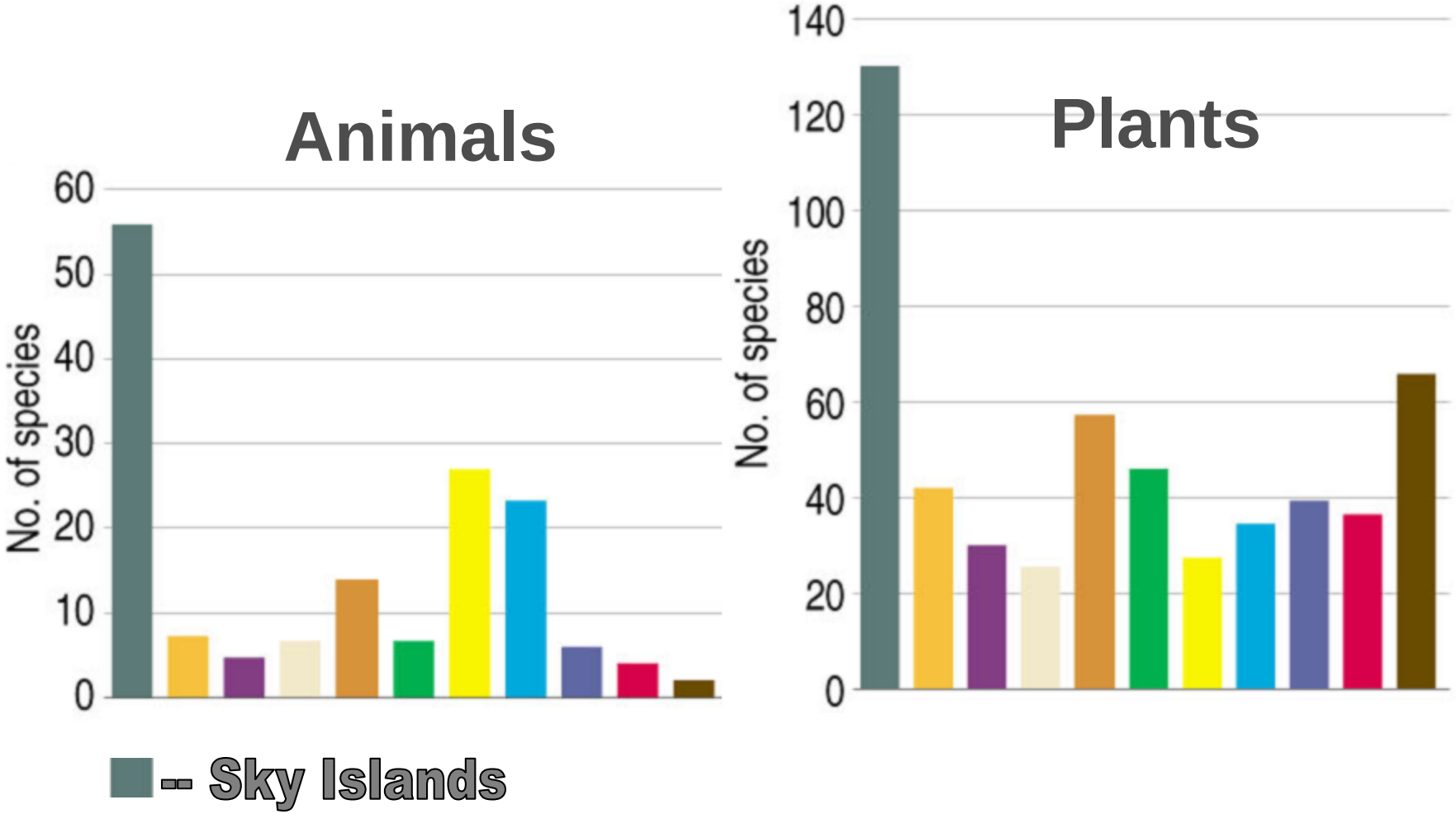
Not just top down—linear cascade

but bottom up: regional, sectoral and groups' vulnerability analysis **mapped** to top down analyses

[all in development pathways context]


Sky Islands in NM & AZ

Threatened, Endangered & Sensitive Species in SW National Forests




2004
9,500 ft
1900
7,800 ft
Pika
Managed
Relocation?

To adapt to such threats takes action on several fronts:

To adapt to such threats takes action on several fronts:

-habitat restoration

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-and, yes, more controversially, some managed relocation of "priority species" (a very divisive normative debate)

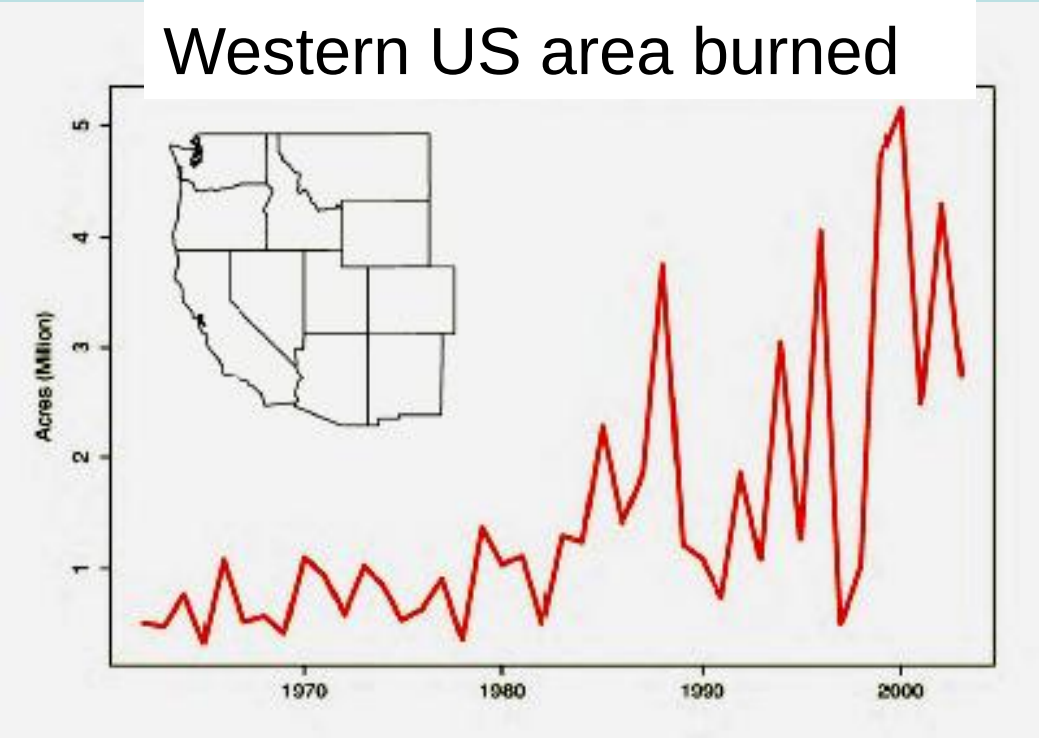
IMPACTS:
A Brief Litany

"Very High Confidence" Global Warming Impacts

- North American Impacts Projected (cont'd)
  - Fire & Pest Impacts: "Disturbances from pests, diseases, and fire are projected to have increasing impacts on forests, with an extended period of high fire risk and large increases in area burned. "

IPCC, Summary for Policymakers, Working Group II Contribution to the Fourth Assessment Report, April, 2007

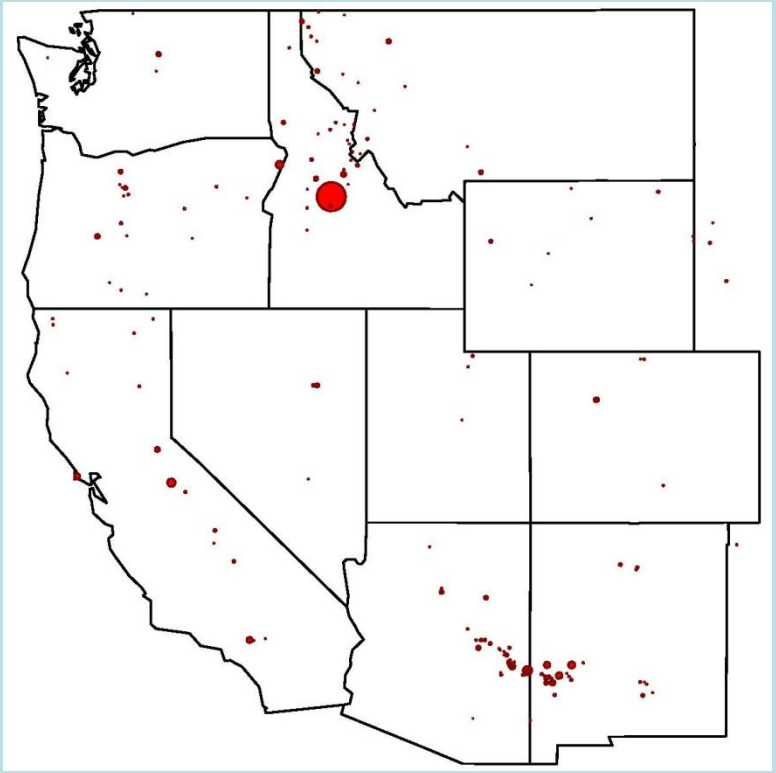
Wildfires Frequency increased four fold in last 30 years.



Source: Westerling et al. 2006

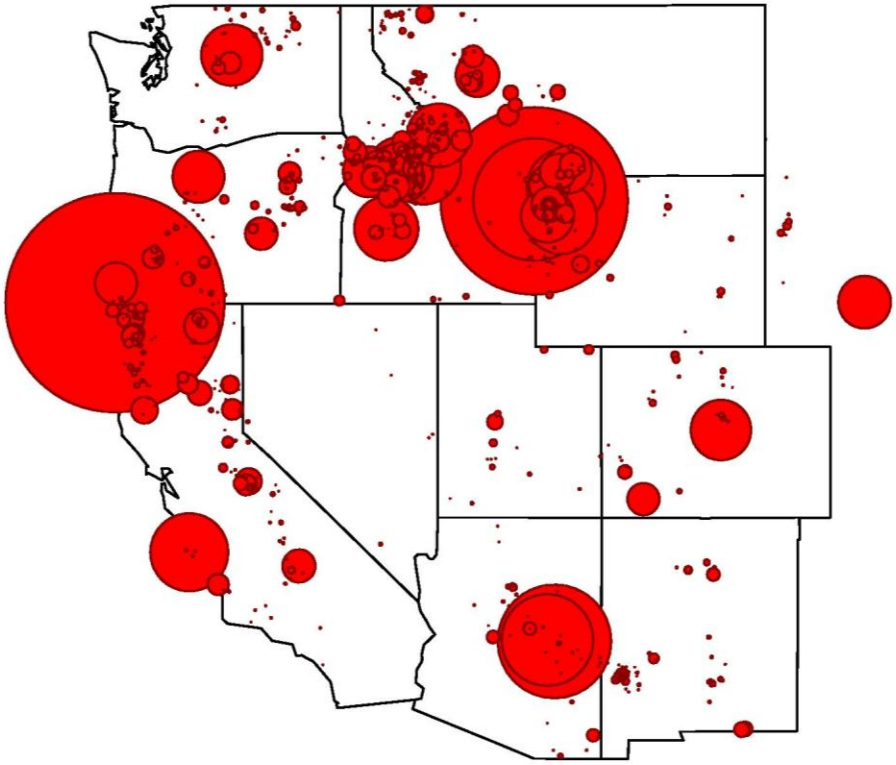
Extreme Events: Wildfires

Fewer, smaller fires



Late Snowmelt Years

More, larger fires

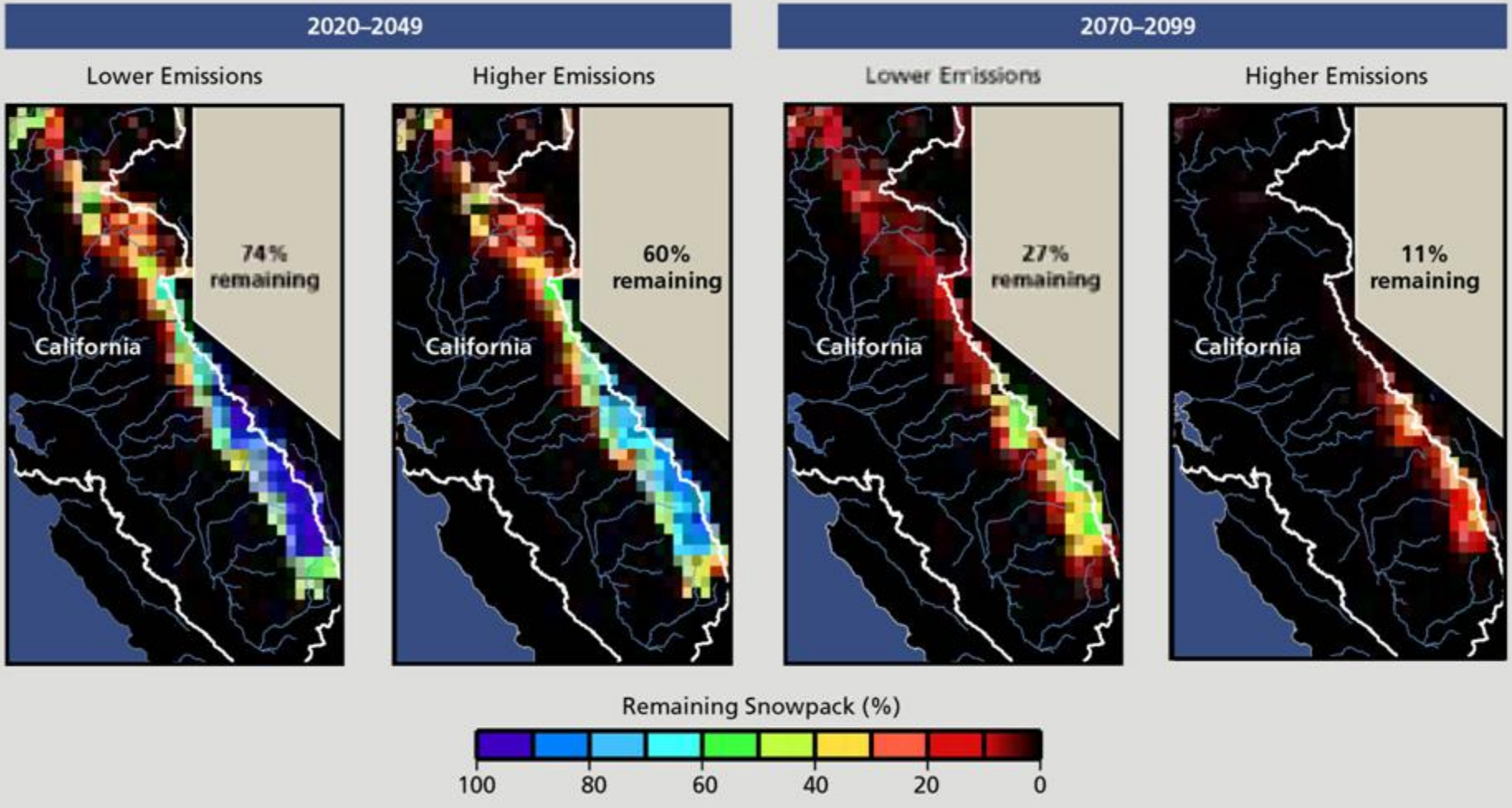


Early Snowmelt Years

Westerling

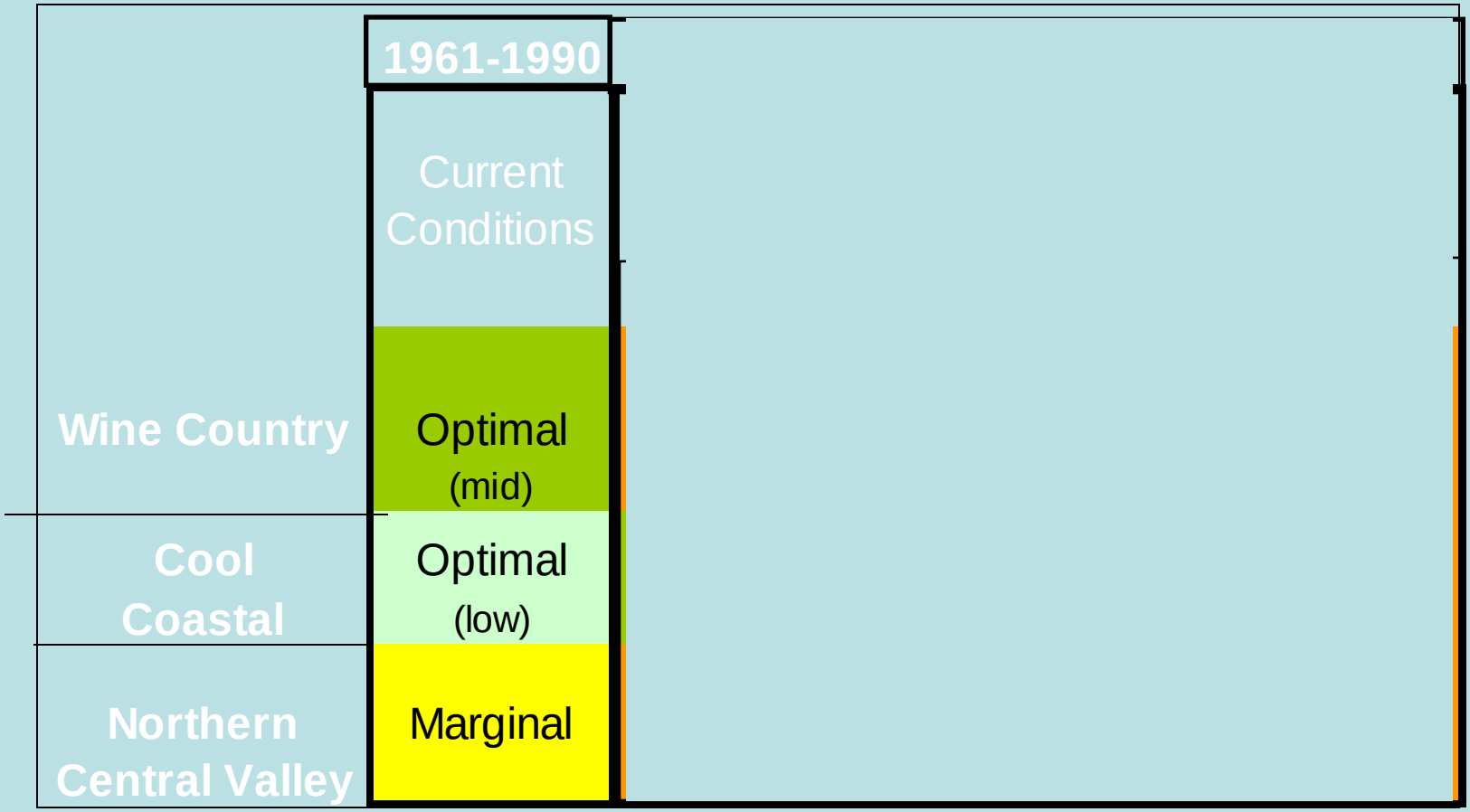
Diminishing Sierra Snowpack

% Remaining, Relative to 1961-1990



Wine Grape Quality

Temperature Impacts



Wine Country (Sonoma, Napa Counties)
Cool Coastal (Mendocino, Monterey Counties)
Northern Central Valley (San Joaquin, Sacramento Counties)

Decreasing Wine Grape Quality

Temperature Impacts

	1961-1990	2070-2099	
	Current Conditions	Lower Emissions (B1)	
		PCM	HadCM3
Wine Country	Optimal (mid)	Impaired	Marginal
Cool Coastal	Optimal (low)	Optimal (mid-high)	Optimal (mid-high)
Northern Central Valley	Marginal	Impaired	Impaired

Wine Country (Sonoma, Napa Counties)
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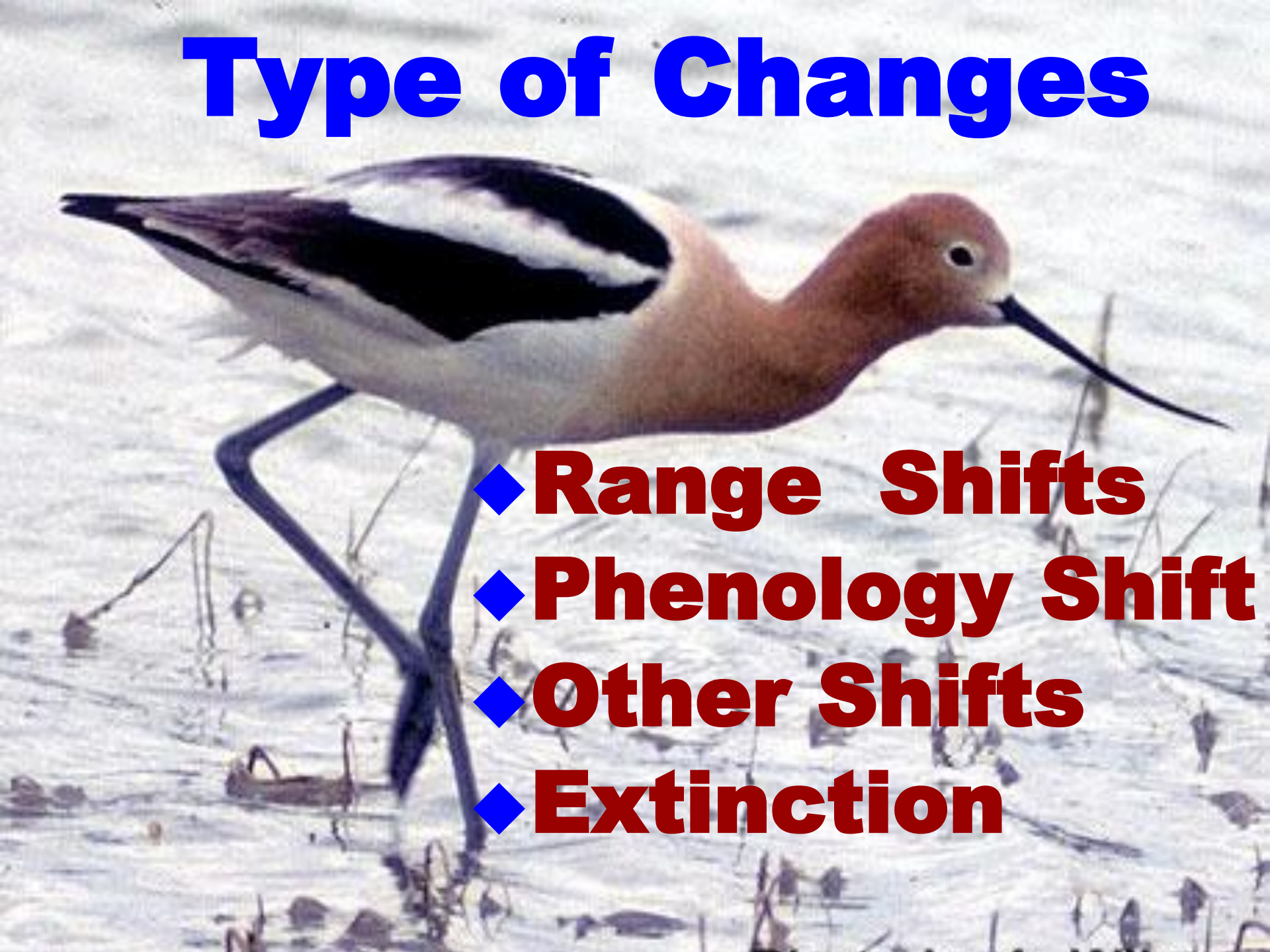
Decreasing Wine Grape Quality

Temperature Impacts

	1961-1990	2070-2099			
	Current Conditions	Lower Emissions (B1)		Higher Emissions (A1fi)	
		PCM	HadCM3	PCM	HadCM3
Wine Country	Optimal (mid)	Impaired	Marginal	Impared	Impaired
Cool Coastal	Optimal (low)	Optimal (mid-high)	Optimal (mid-high)	Optimal (high)	Impaired
Northern Central Valley	Marginal	Impaired	Impaired	Impaired	Impaired

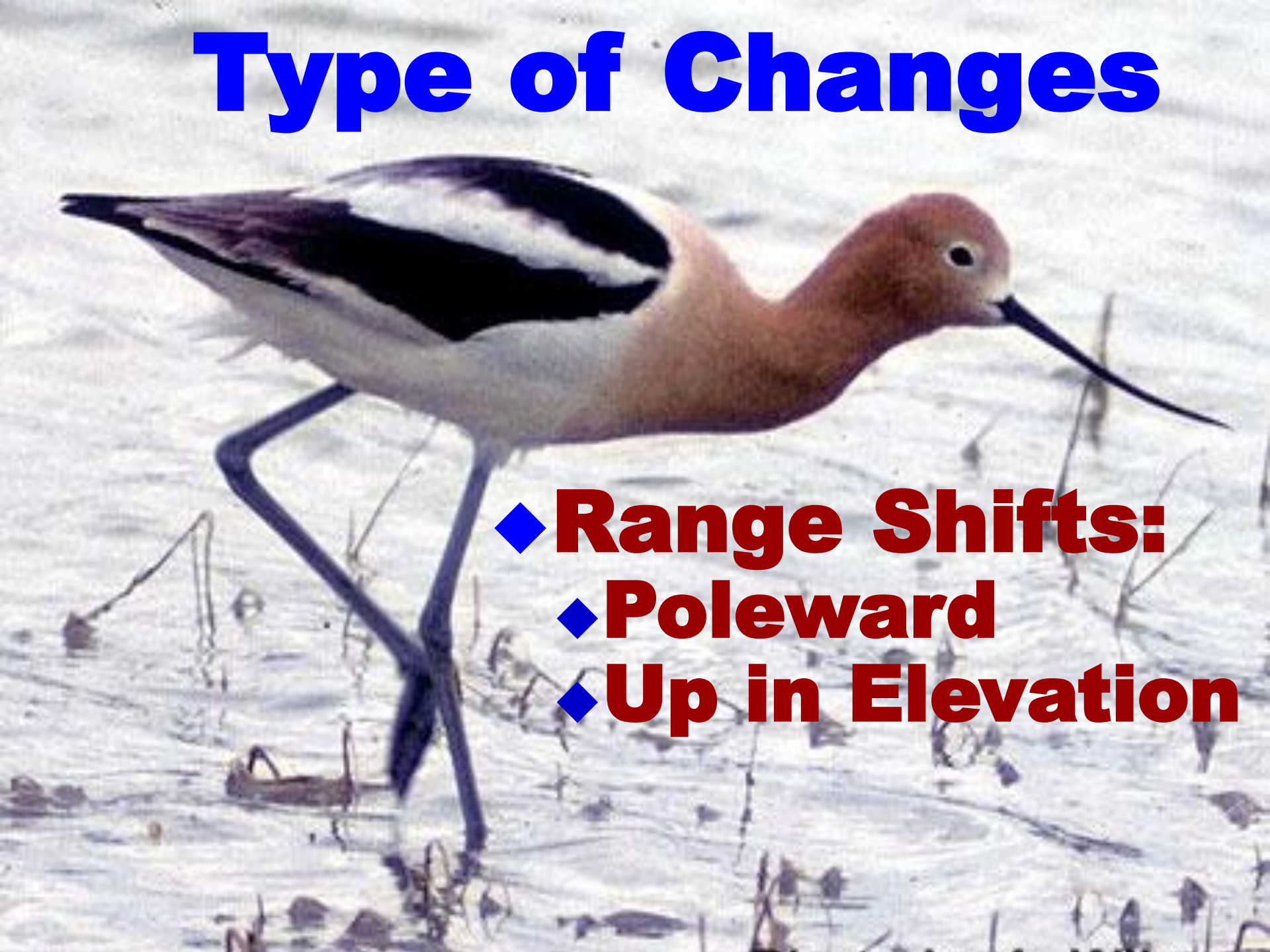
Wine Country (Sonoma, Napa Counties)
Cool Coastal (Mendocino, Monterey Counties)
Northern Central Valley (San Joaquin, Sacramento Counties)

Type of Changes



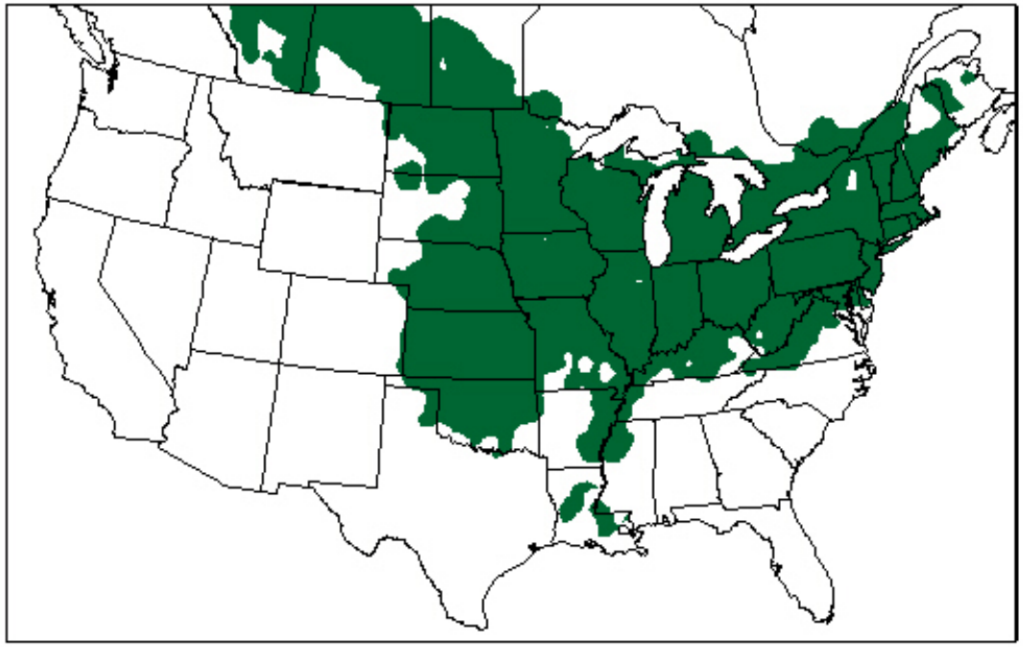
- Range Shifts
- Phenology Shift
- Other Shifts
- Extinction

Type of Changes



- Range Shifts:
  - Poleward
  - Up in Elevation

Current Distribution

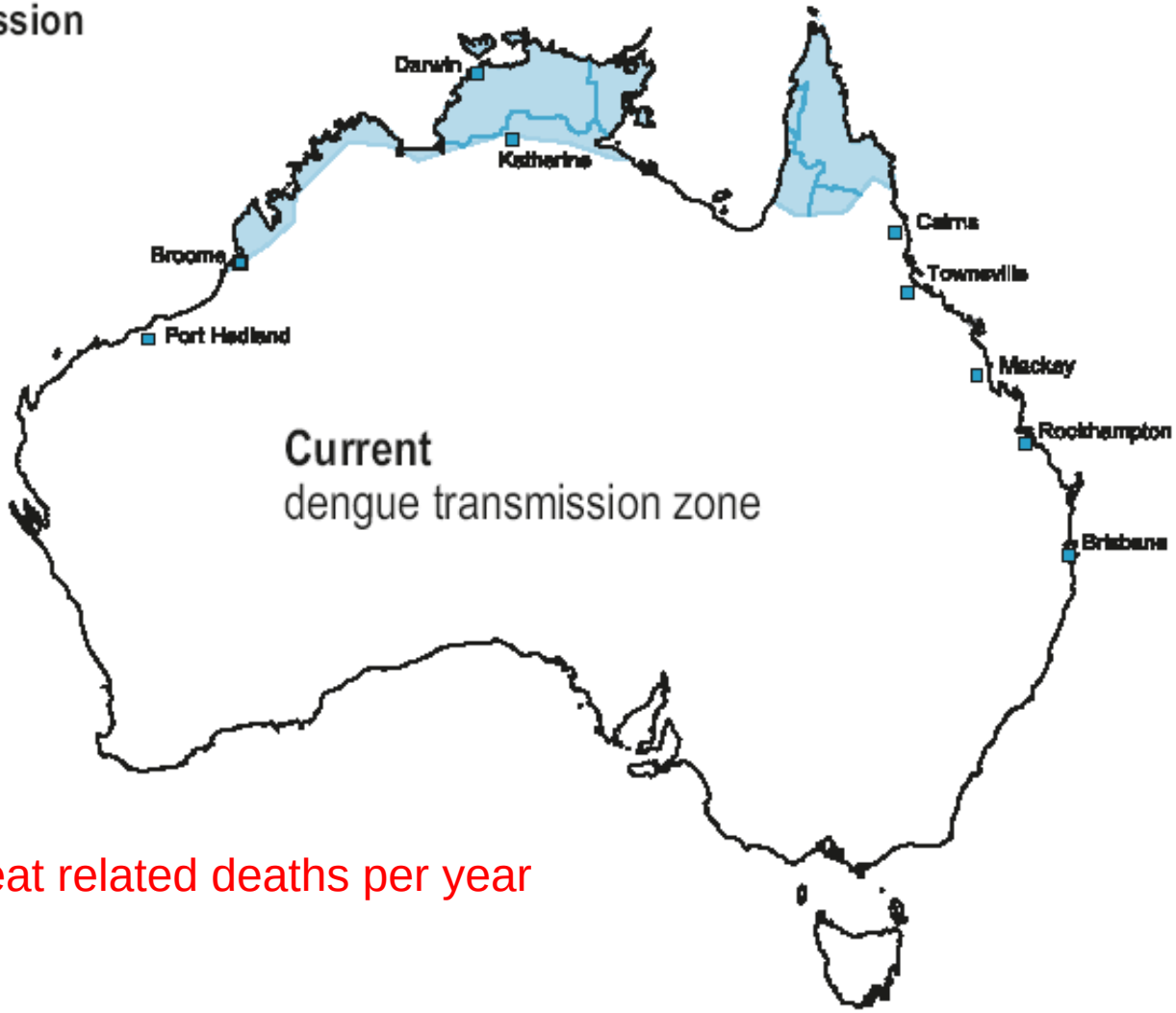


Baltimore Oriole

(Icterus galbula)

Projected Distribution ($2xCO_2$)

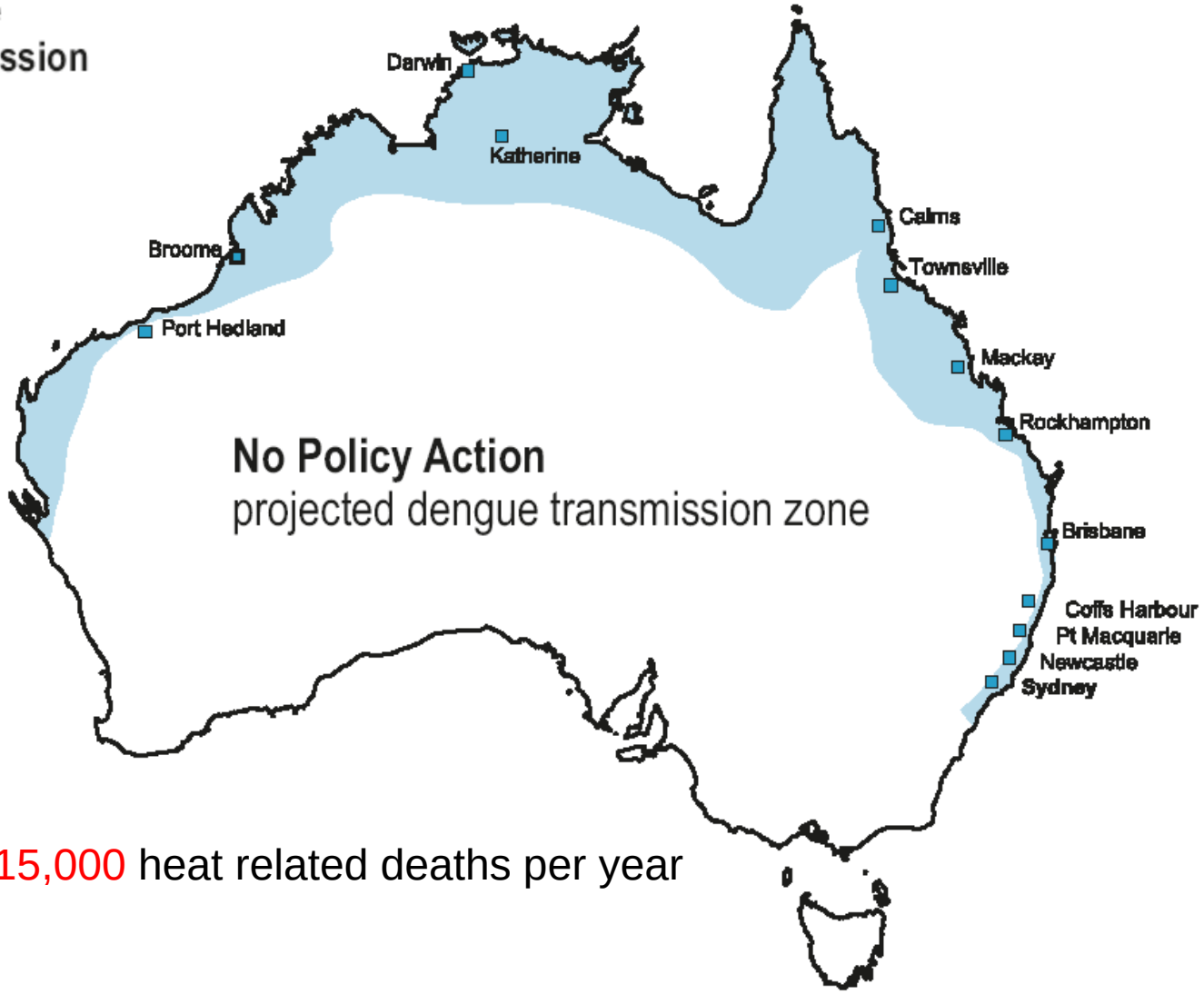
Dengue transmission zone



- and 1,100 heat related deaths per year

Source: ***Climate Change Health Impacts in Australia,*** **ACF & AMA**

Dengue transmission zone

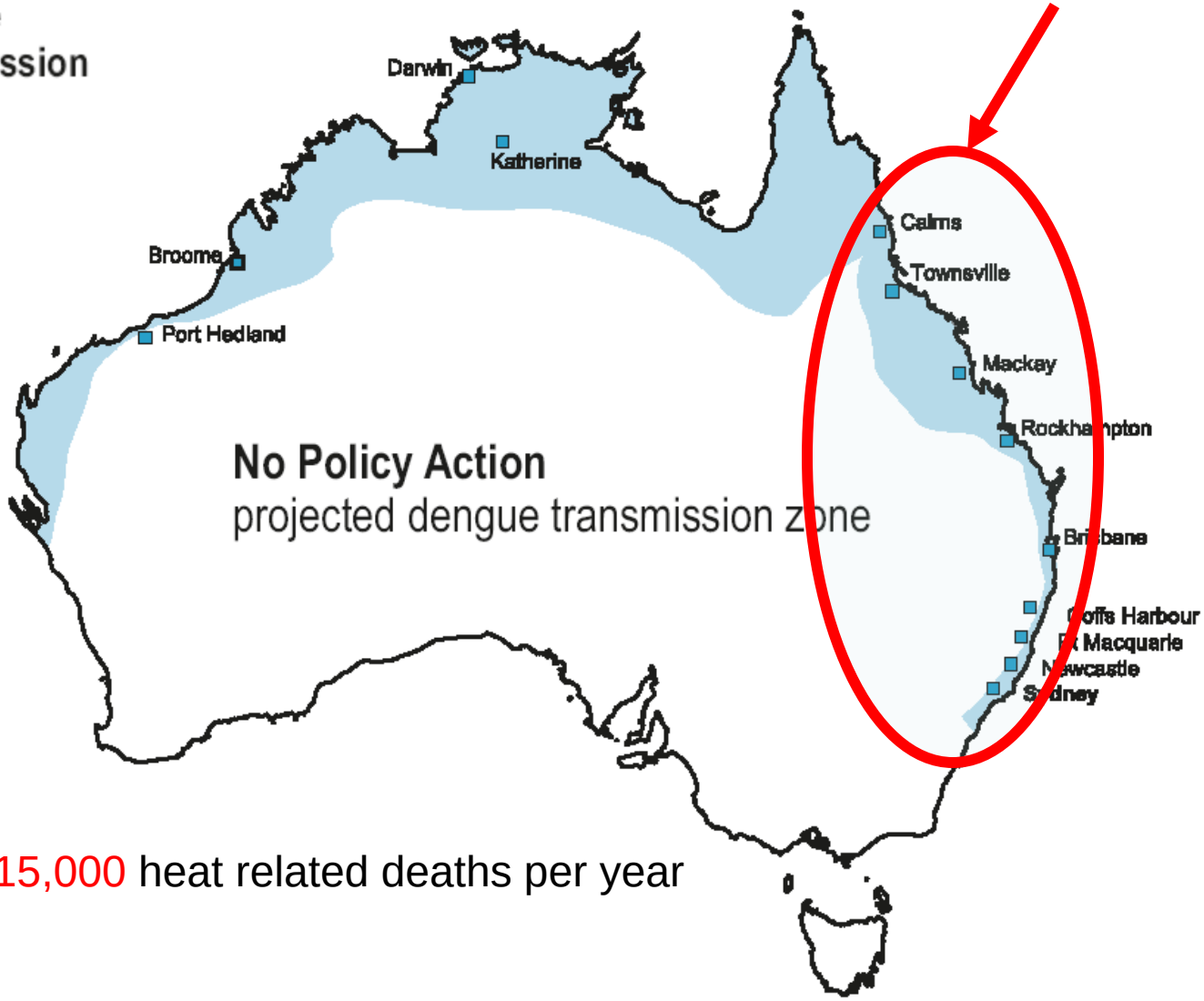


- and 8,000 - 15,000 heat related deaths per year

Source: ***Climate Change Health Impacts in Australia,*** **ACF & AMA**

Vulnerability

Dengue transmission zone



- and 8,000 - 15,000 heat related deaths per year

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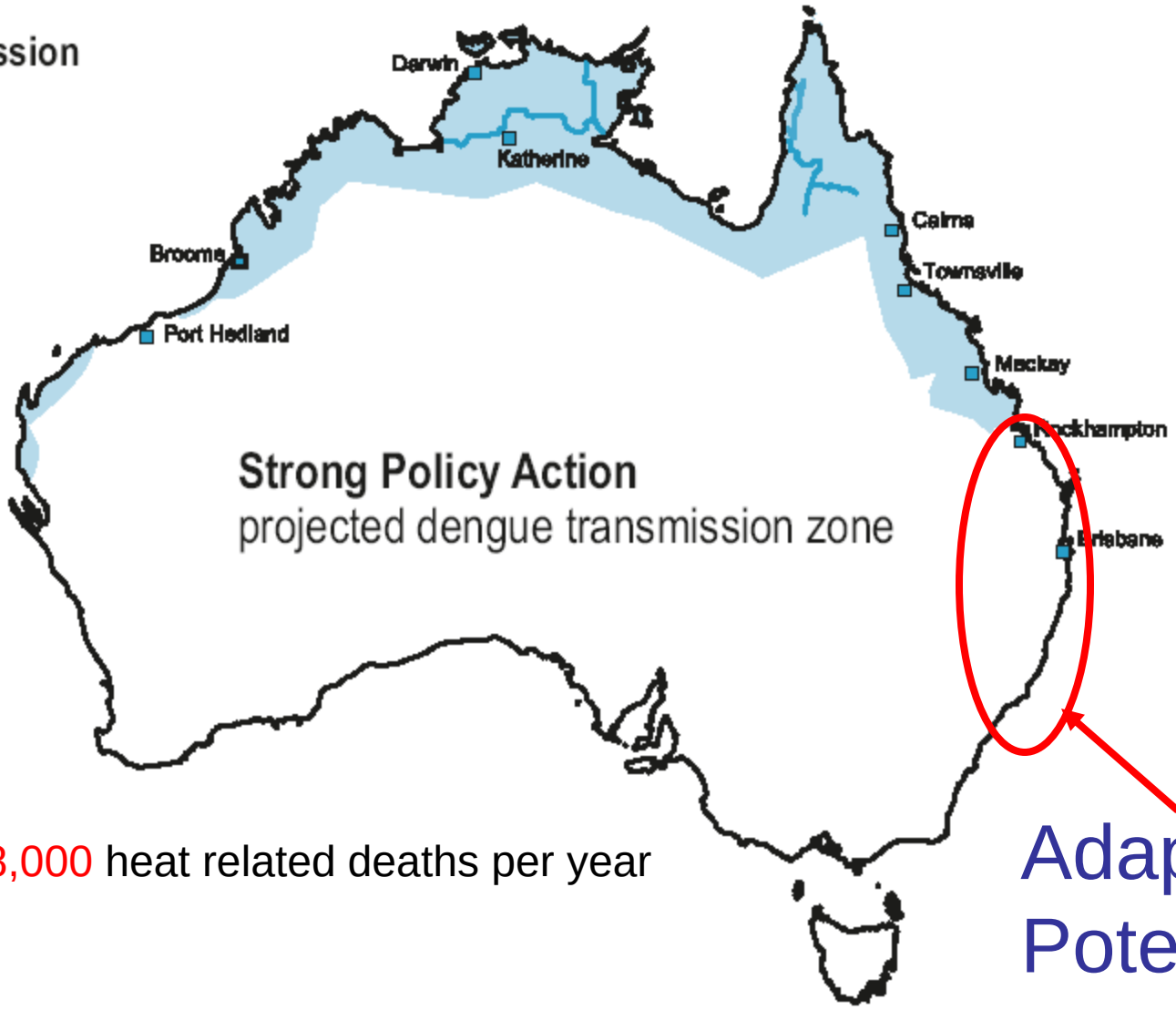


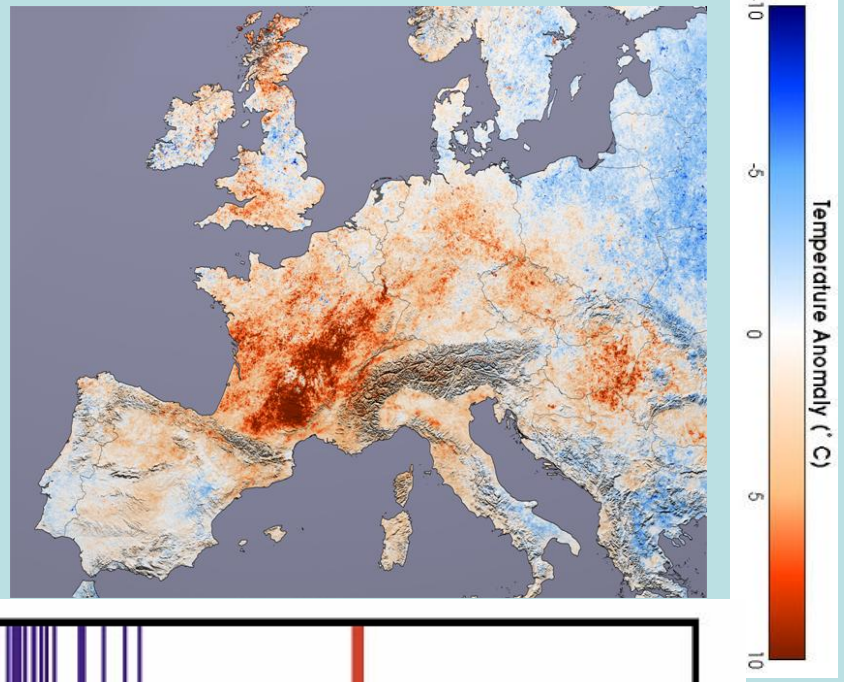
- and 4,000 - 8,000 heat related deaths per year

Adaptation Potential

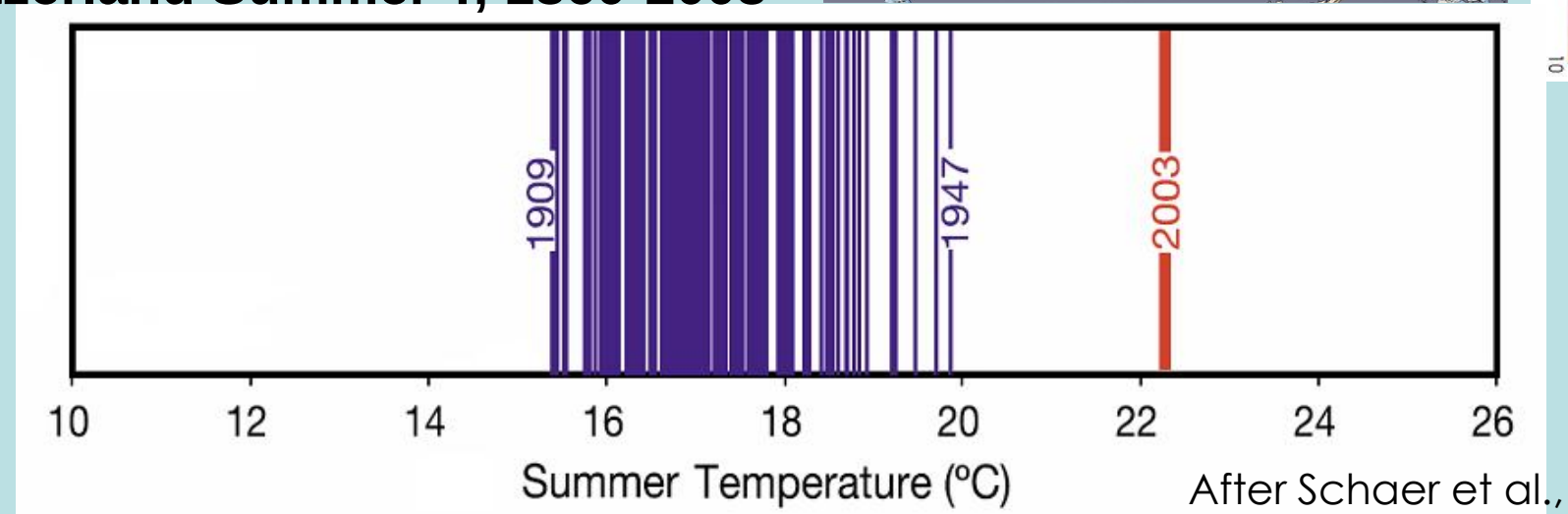
Source: ***Climate Change Health Impacts in Australia,*** **ACF & AMA**

Extreme Events: Heat

NASA

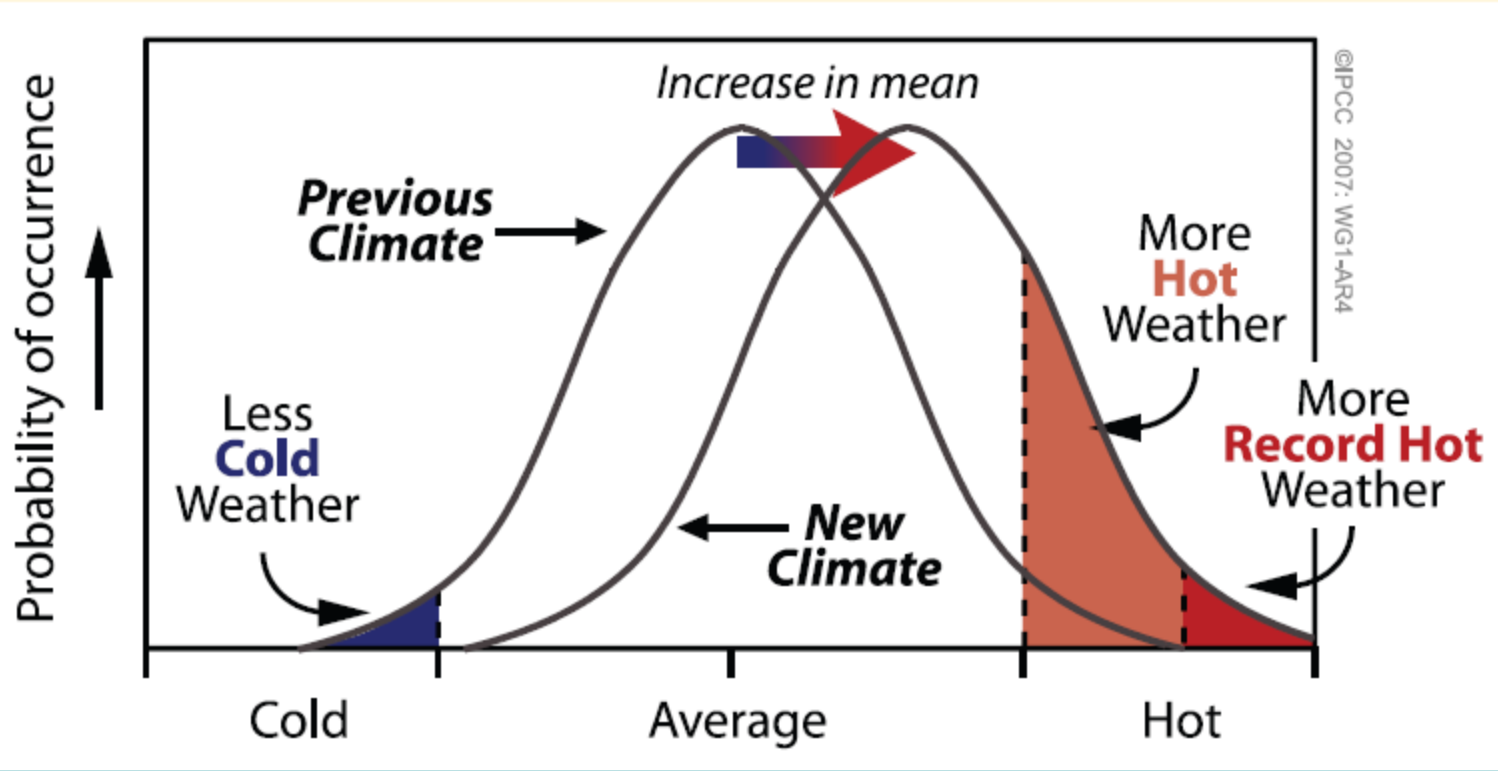


Switzerland Summer T, 1860-2003



After Schaer et al., 2004

Extreme Events: Heat



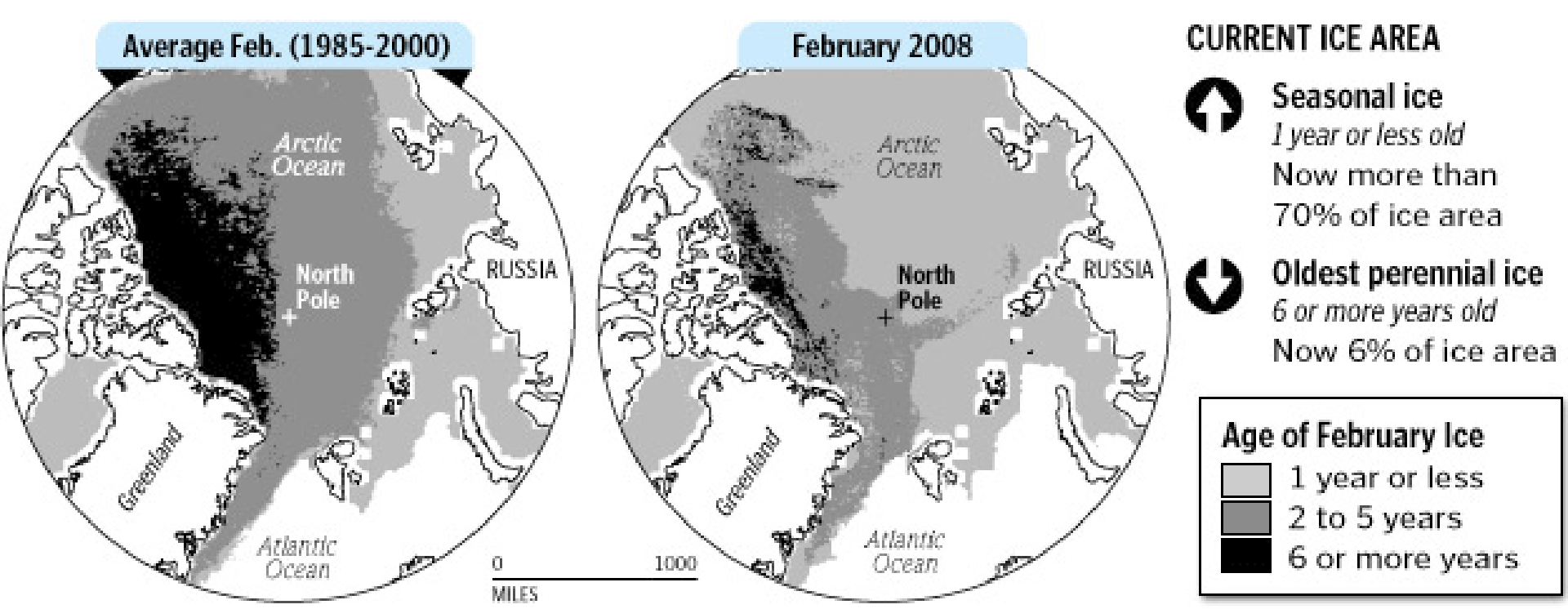
IPCC, 2007

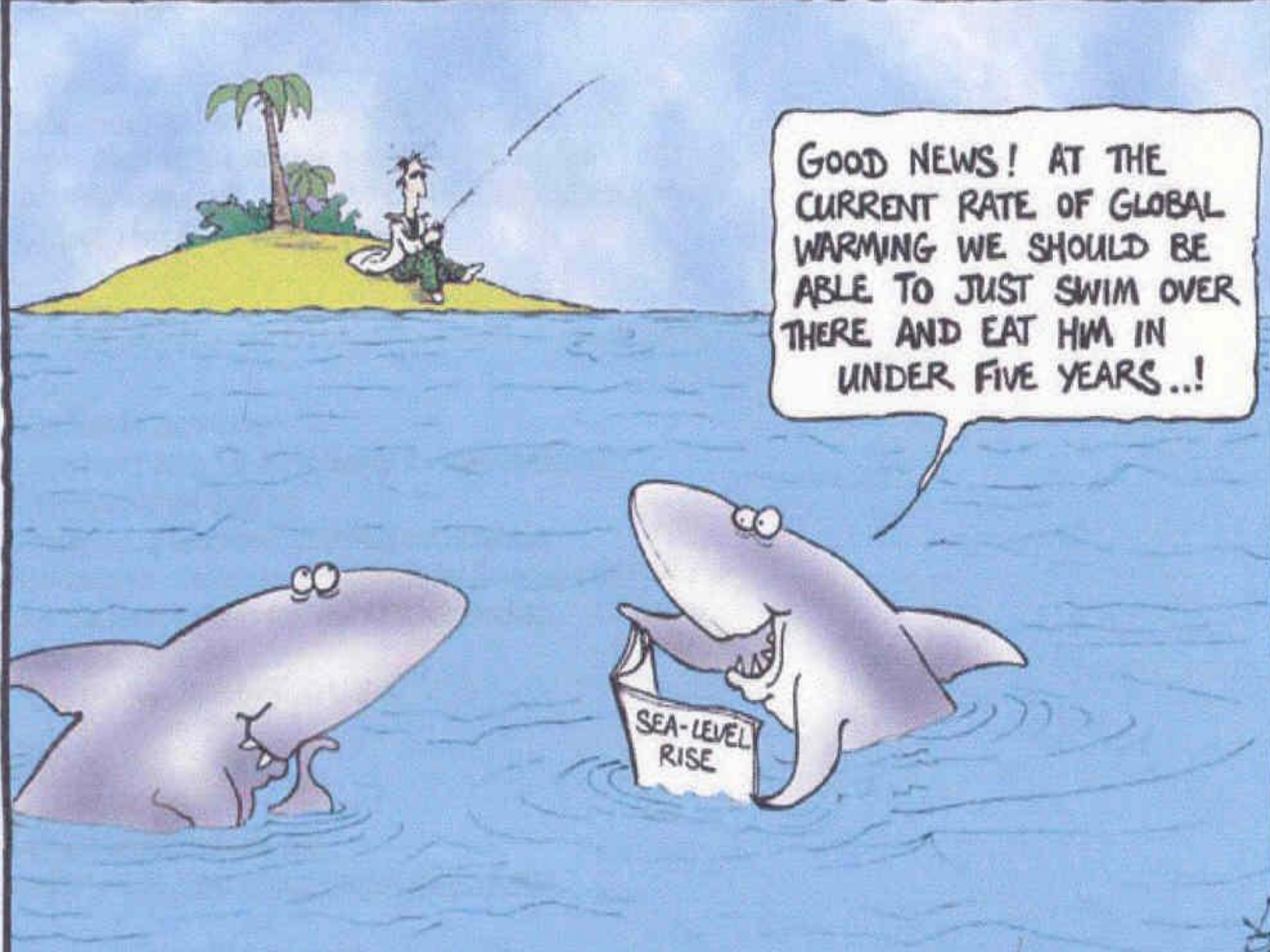
Graphic:

http://www.washingtonpost.com/wp-dyn/content/article/2008/03/18/AR2008031802903.html

Thinner and Newer

A cool Arctic winter has brought sea ice back to broad expanses that melted clear during last summer's unusual warmth. However, the amount of thick "perennial ice" has declined sharply across the Arctic, and climate experts say that global warming is the cause.




GOOD NEWS! AT THE CURRENT RATE OF GLOBAL WARMING WE SHOULD BE ABLE TO JUST SWIM OVER THERE AND EAT HIM IN UNDER FIVE YEARS..!
SEA-LEVEL RISE


Pacific
Sun

Inuit to file anti-U.S. climate petition
Wed Jun 15, 2005 11:09 AM

OSLO (Reuters) - Inuit hunters threatened by a melting of the Arctic ice plan to file a petition accusing Washington of violating their human rights by fueling global warming, an Inuit leader said Wednesday.

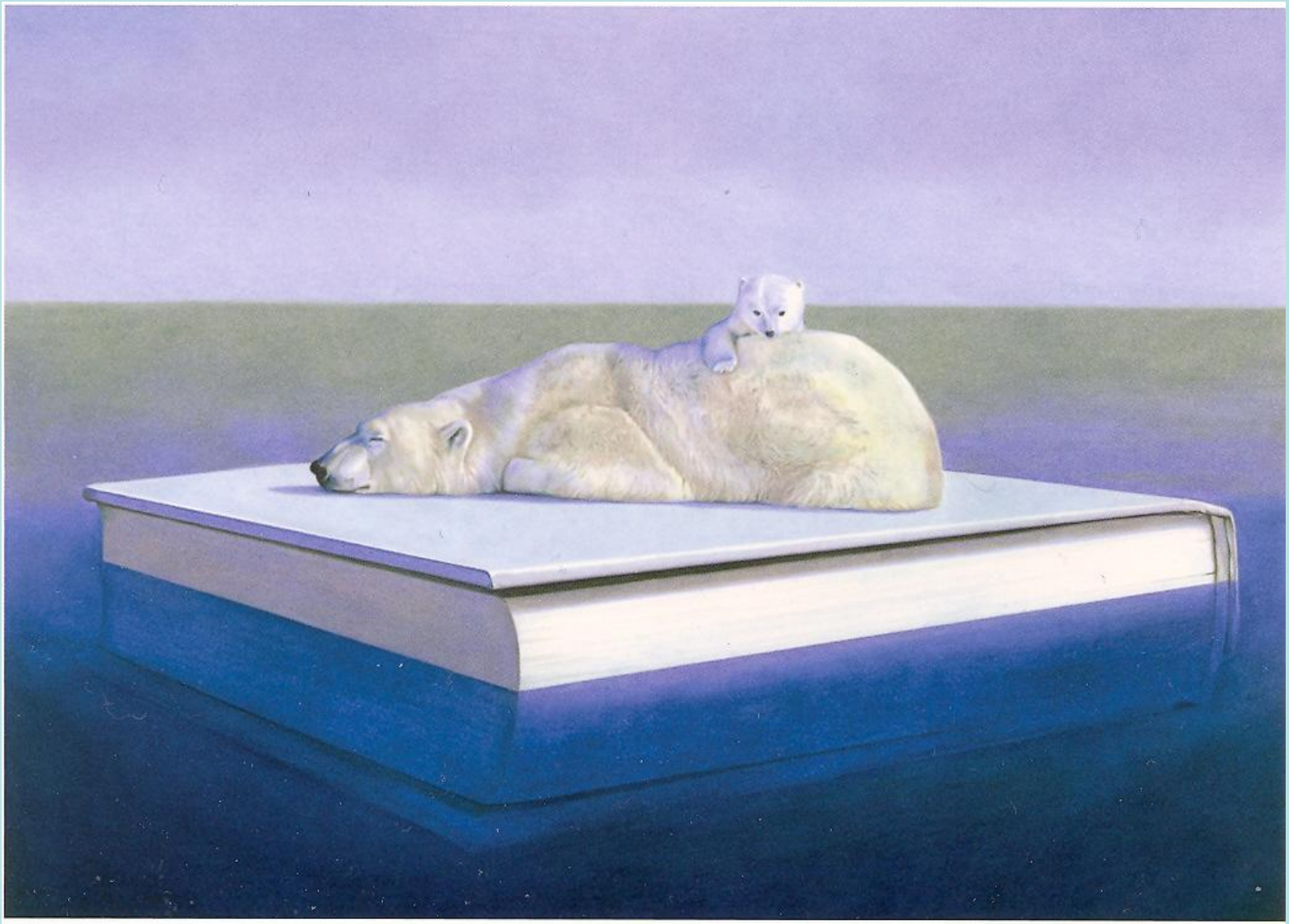
Sheila Watt-Cloutier, chair of the Inuit Circumpolar Conference (ICC), also said Washington was hindering work to follow up a 2004 report by 250 scientists that said the thaw could make the Arctic Ocean ice-free in summer by 2100.

Watt-Cloutier, in Oslo to receive an environmental prize, said the inuits' planned petition to the 34-member Organization of American States (OAS) could put pressure on the United States to do more to cut industrial emissions of heat-trapping gases.

"It's still in the works, the drafting is still going on," she said of a long-planned petition to the OAS' human rights arm, the Inter-

American Commission on Human Rights.

A young male walrus rests on the beach near Barrow, Alaska, in September, 2007.



"PASSAGE 2" DON SIMON 2006

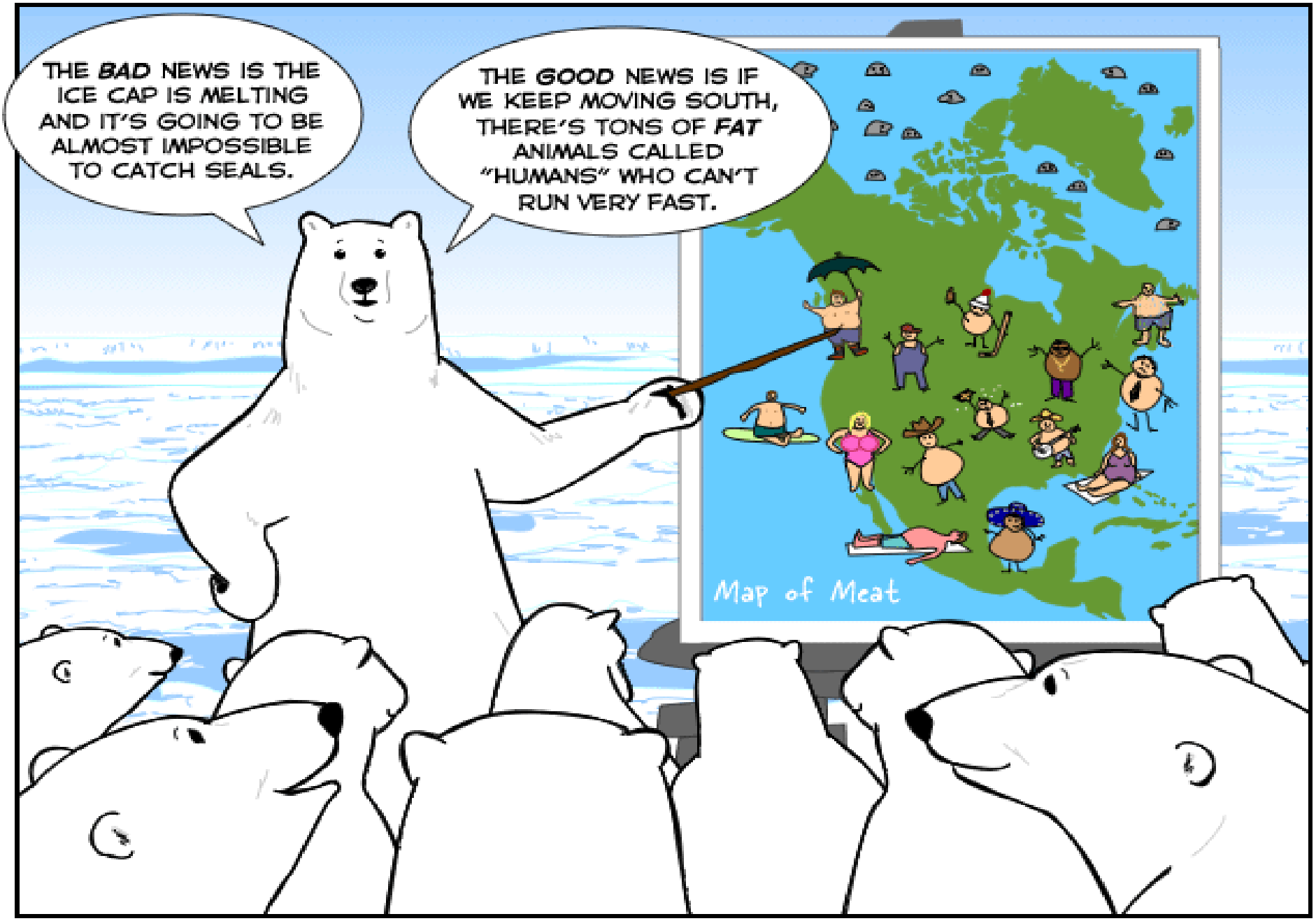
The “Real” Cause of Global Warming

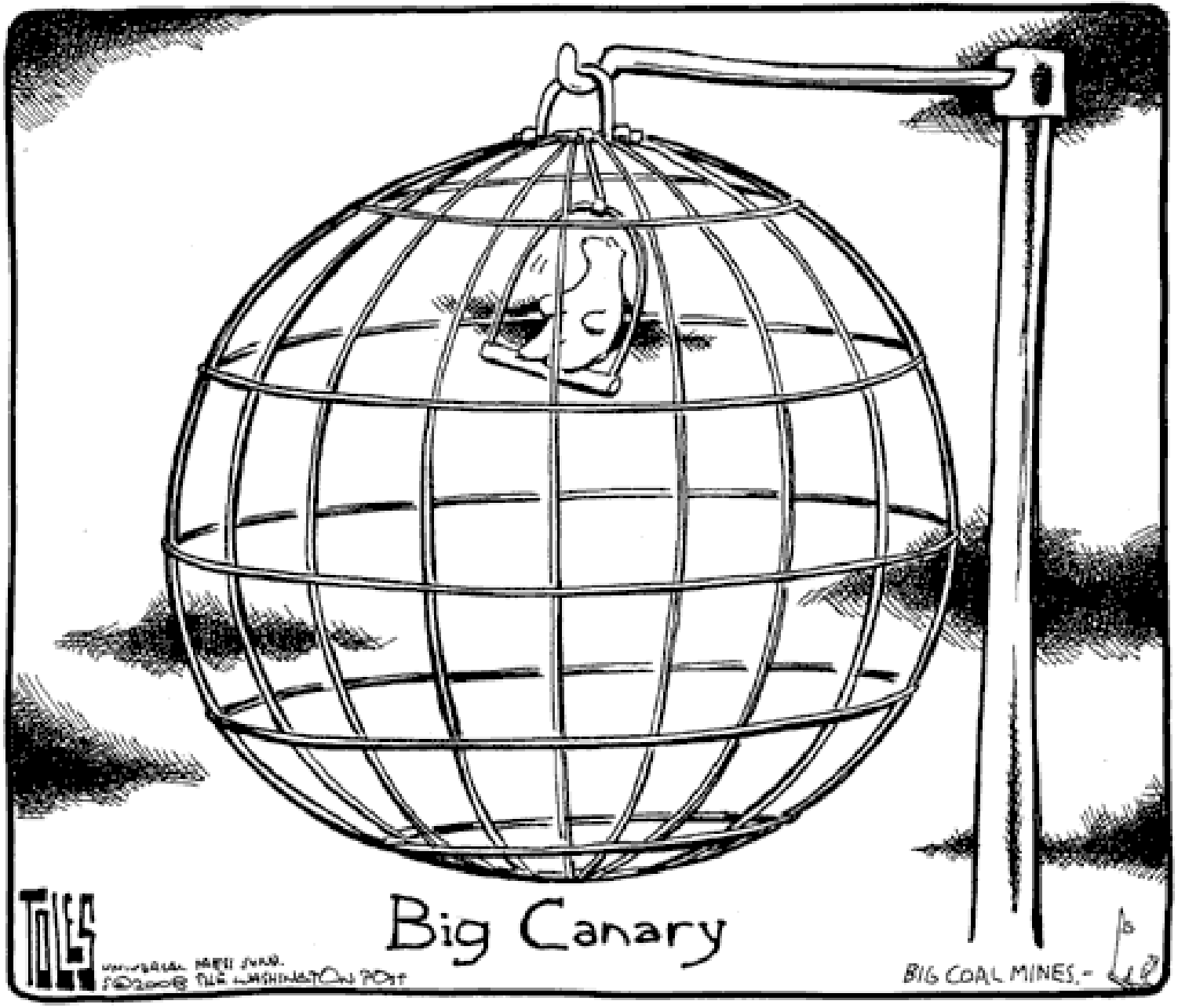

CAUTION

The “Real” Cause of Global Warming

Victims As Villains

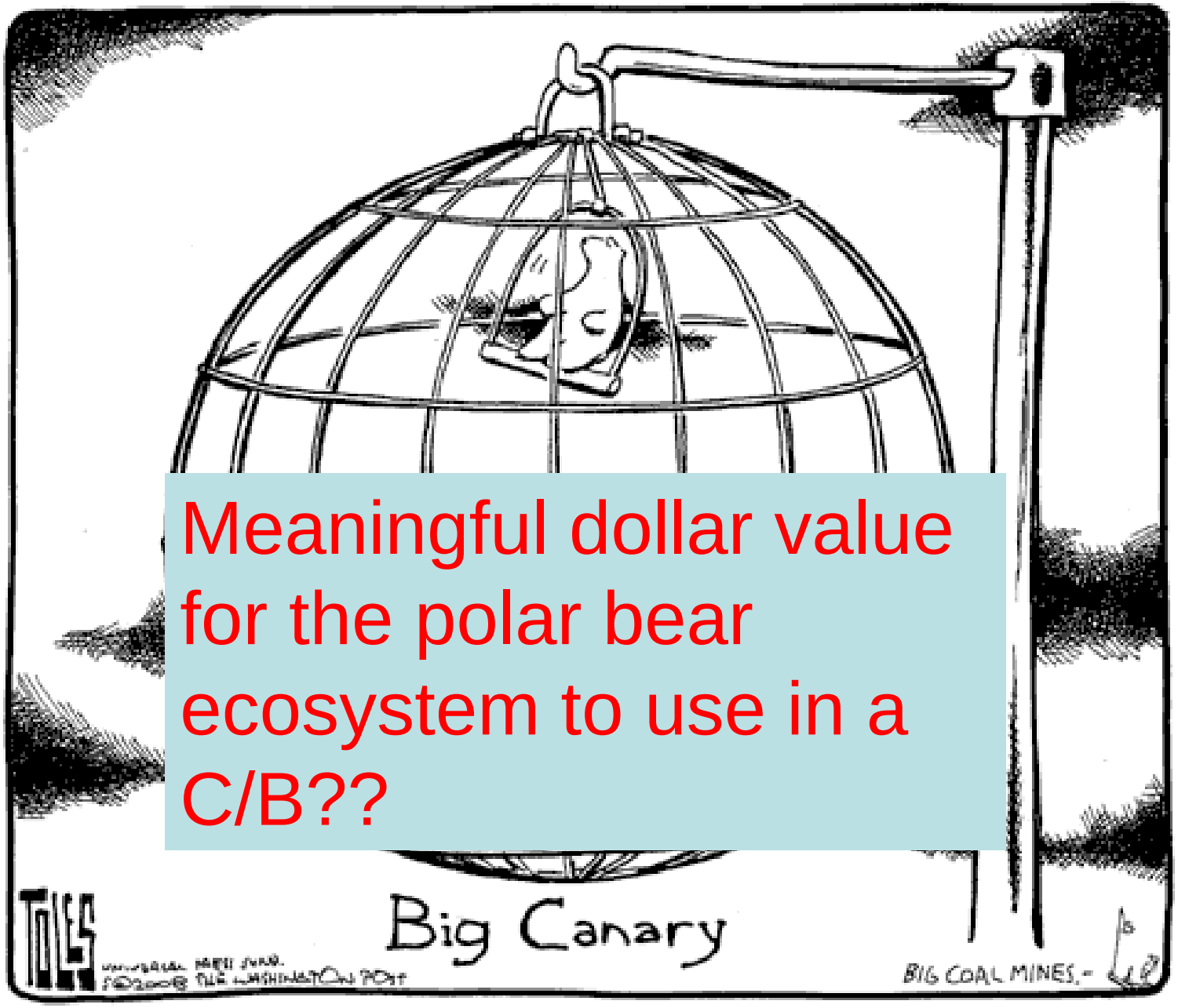
by Nitrozac & Snaggy





Big Canary

5·19·08



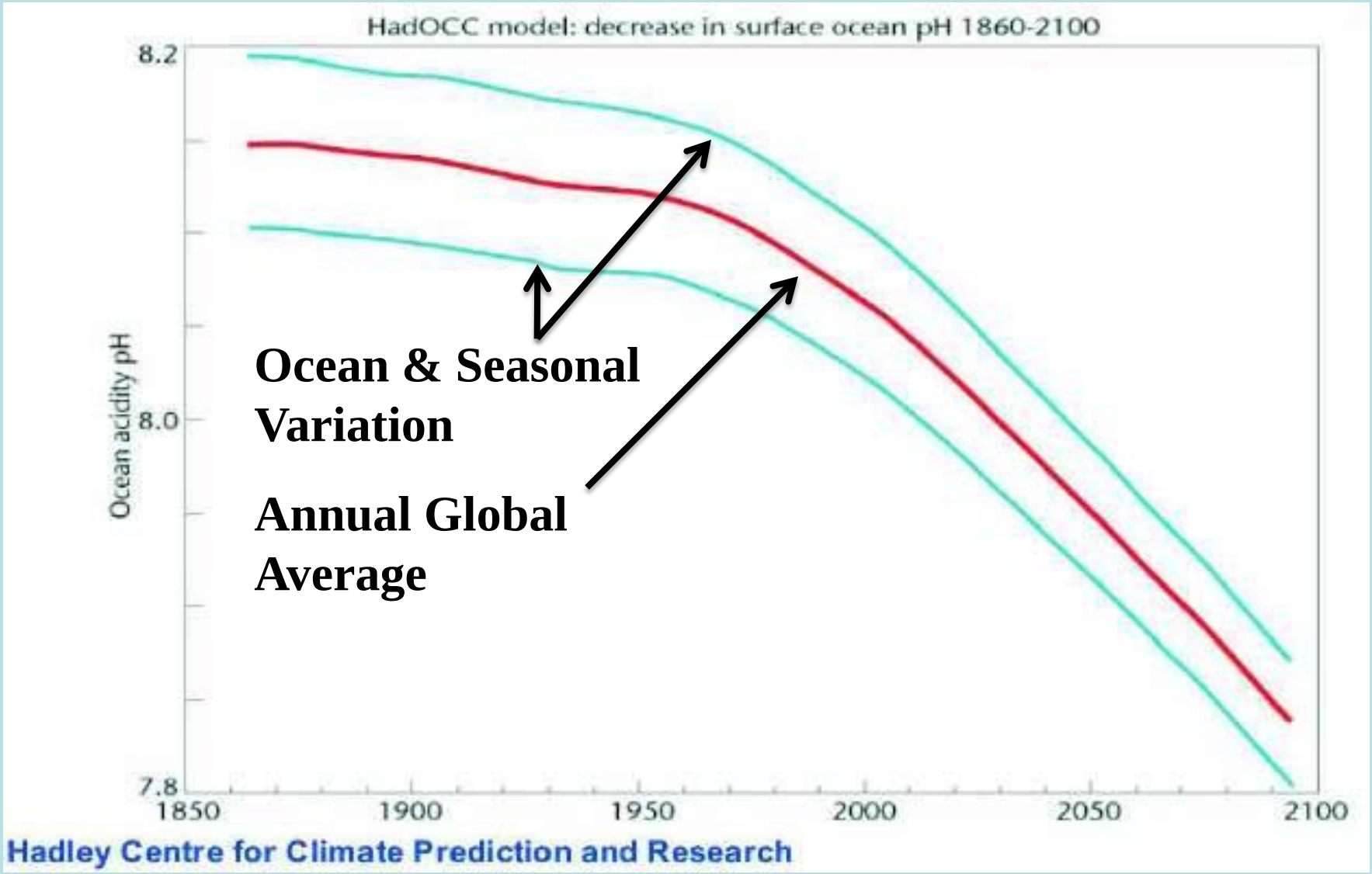
Meaningful dollar value for the polar bear ecosystem to use in a C/B??

Source: Henning Wagenbreth

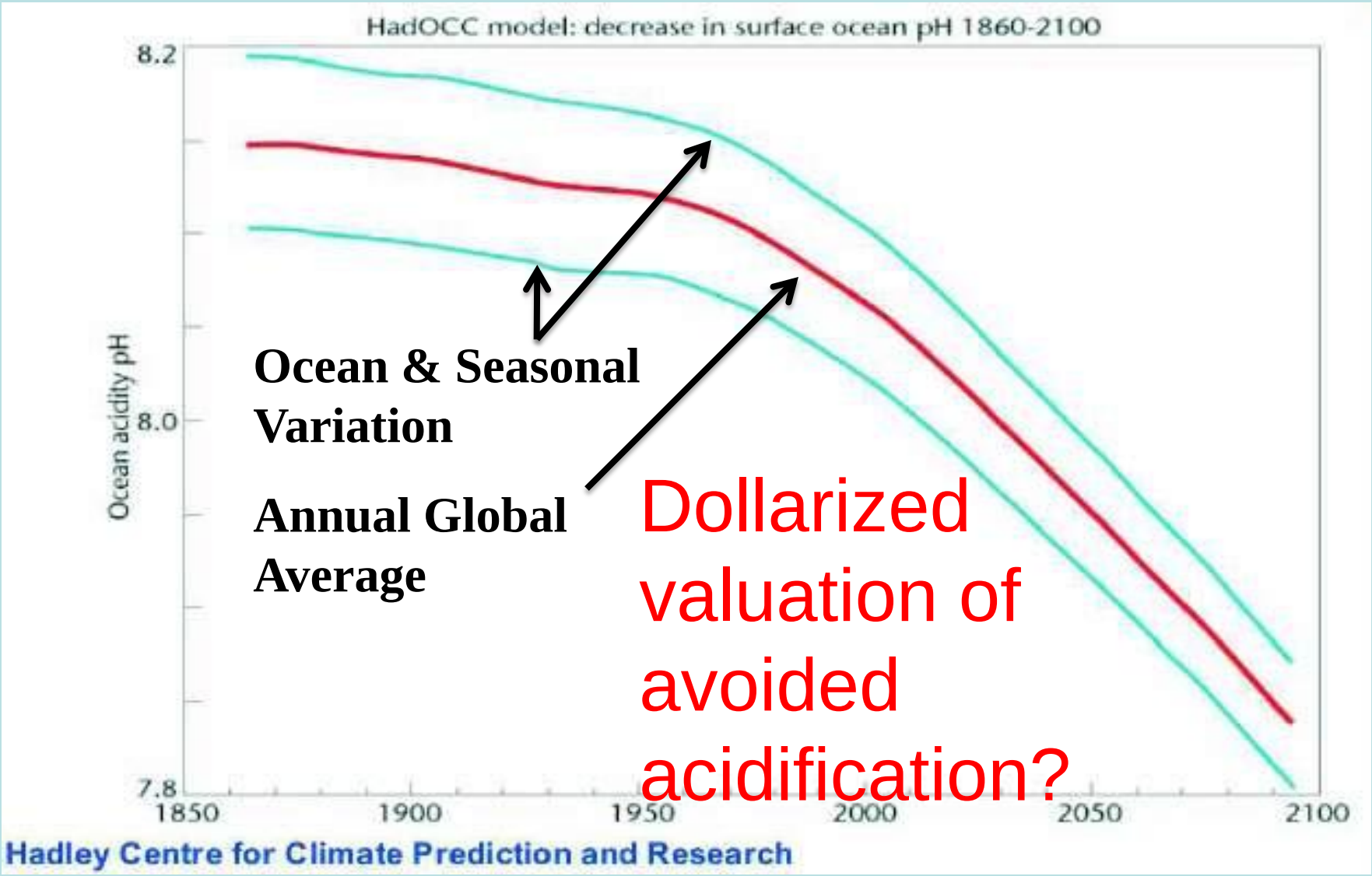
Role of Geoengineering? Where dealt with in NAS/IPCC…?

Source: Henning Wagenbreth

Ocean Acidification



Ocean Acidification



RECCOMMENDATION:

Policy makers, assessment groups, agencies, commissions, etc. need to be better coordinated to take into account the interactions among the drivers of global change, and their separate and synergistic impacts. This would include international level conventions, secretariats, etc.

Risk = Probability x Consequence

[What metrics of harm?]

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[What metrics of harm?]

-$/ton C avoided

Risk = Probability x Consequence

[What metrics of harm?]

-$/ton C avoided

-lives lost/ton C avoided

Risk = Probability x Consequence

[What metrics of harm?]

-$/ton C avoided

-lives lost/ton C avoided

-species lost/ton C avoided

Risk = Probability x Consequence

[What metrics of harm?]

-$/ton C avoided

-lives lost/ton C avoided

-species lost/ton C avoided

-increased inequity/ton C avoided*

Risk = Probability x Consequence

[What metrics of harm?]

-$/ton C avoided

-lives lost/ton C avoided

-species lost/ton C avoided

-increased inequity/ton C avoided*

-quality of life degraded/ton

Risk = Probability* x Consequence

[What metrics** of harm?]

-$/ton C avoided

-lives lost/ton C avoided

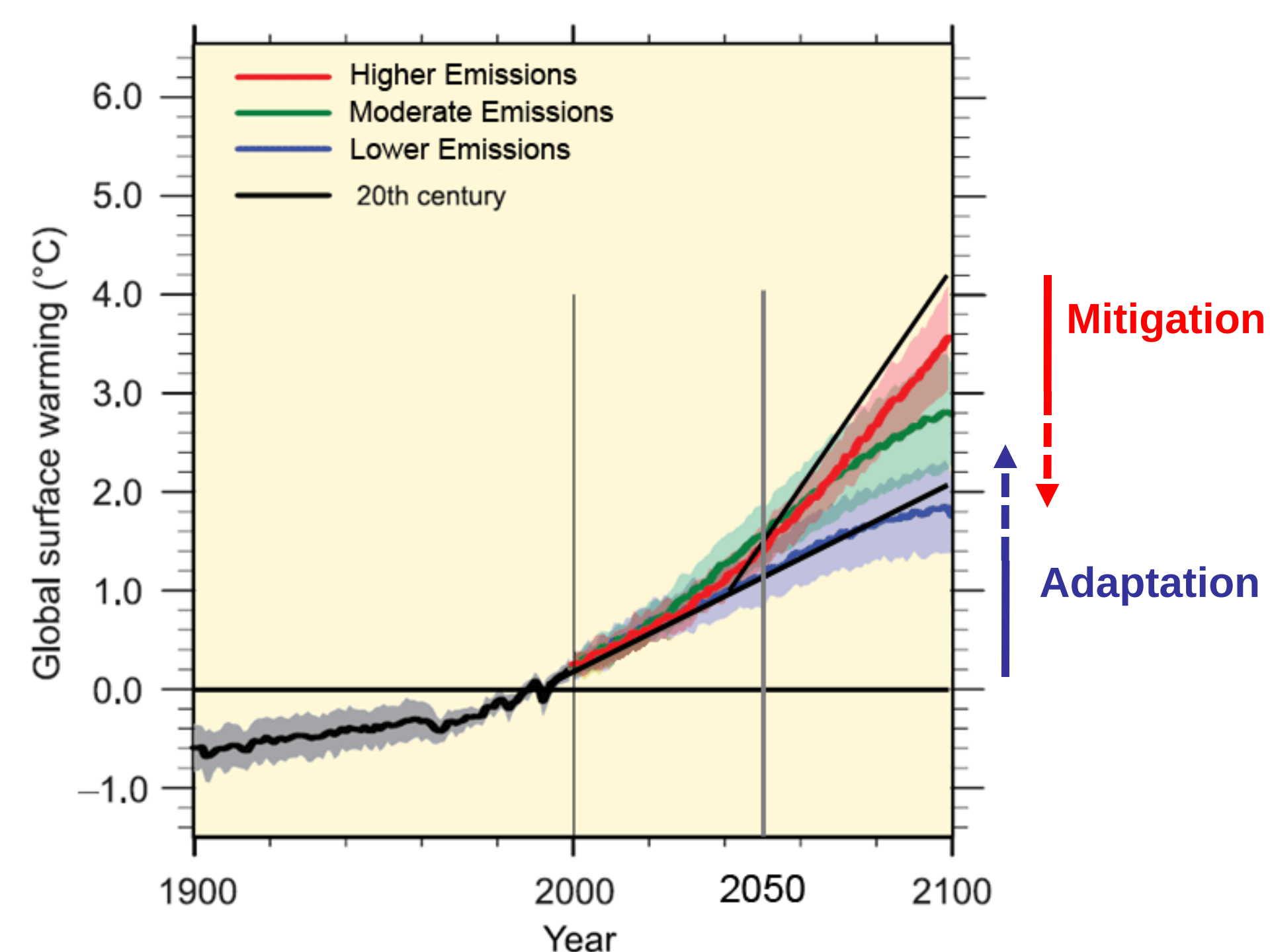
-species lost/ton C avoided

-increased inequity/ton C avoided*

-quality of life degraded/ton

*Subjective probability density functions

**Any weights on each metric are normative


Higher Emissions
Moderate Emissions
Lower Emissions
20th century
Global surface warming (°C)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
−1.0
1900
2000
2050
2100
Year
Mitigation
Adaptation

Vulnerability

Vulnerability (potential for harm)

Function of:

- Exposure
- Sensitivity
- Adaptation capacity

Vulnerability (potential for harm)

Function of:

- Exposure (Climate Dynamics)
- Sensitivity (Mix, Natural and Social Issues)
- Adaptation capacity (Largely Social Issues—Except for Ecosystems)

➔Mechanism for upstream integration across disciplinary-oriented working groups

- Exposure (Climate Dynamics)
- Sensitivity (Mix, Natural and Social Issues)
- Adaptation capacity (Largely Social Issues—Except for Ecosystems)

Questions?

Comments??