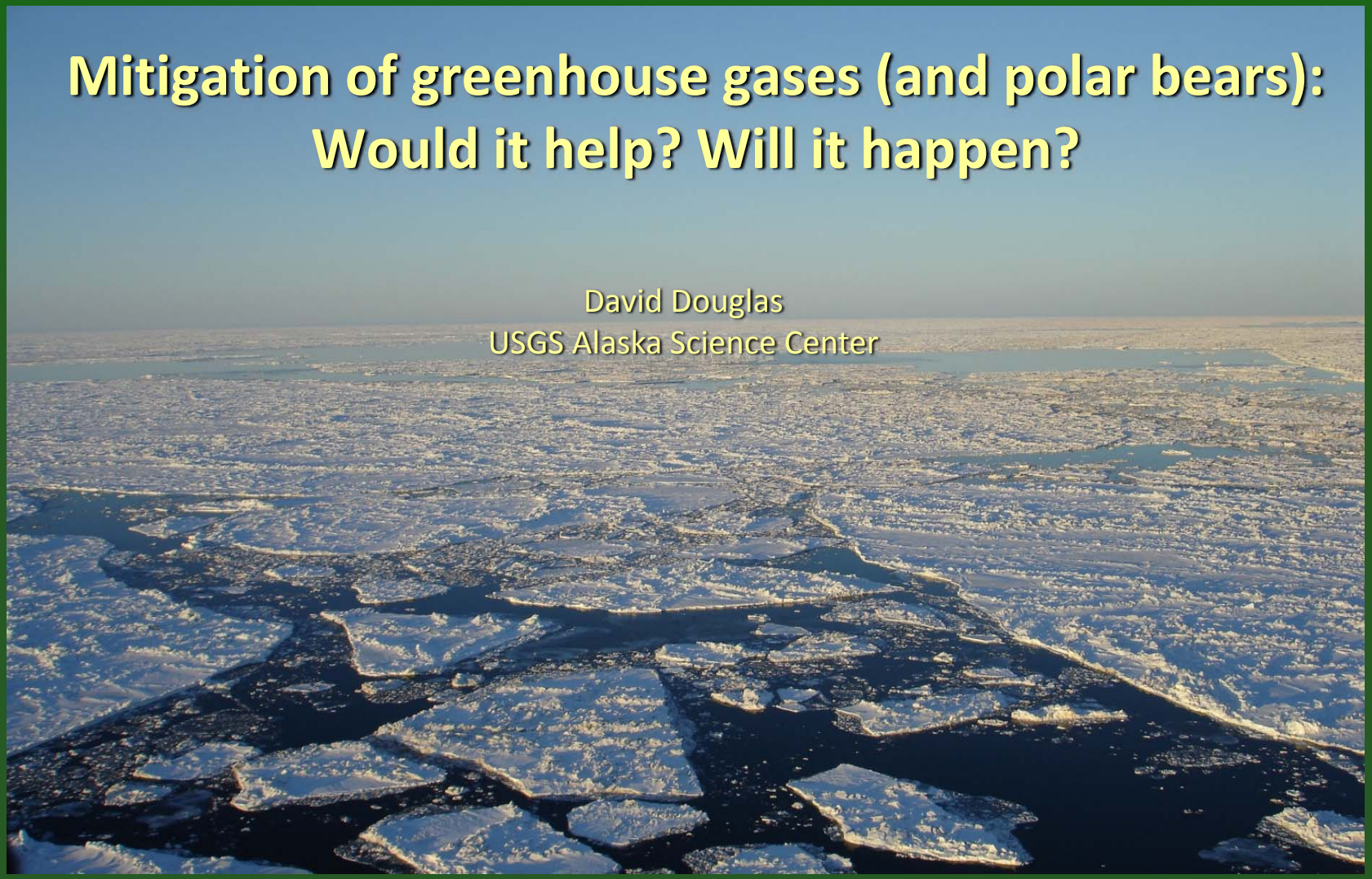
USGS
science for a changing world

Mitigation of greenhouse gases (and polar bears): Would it help? Will it happen?



David Douglas
USGS Alaska Science Center

U.S. Department of the Interior
U.S. Geological Survey

Would it help?

Greenhouse gas mitigation can reduce sea-ice loss and increase polar bear persistence

Steven C. Amstrup[1]†, Eric T. DeWeaver[2], David C. Douglas[3], Bruce G. Marcot[4], George M. Durner[1], Cecilia M. Bitz[5] & David A. Bailey[6]

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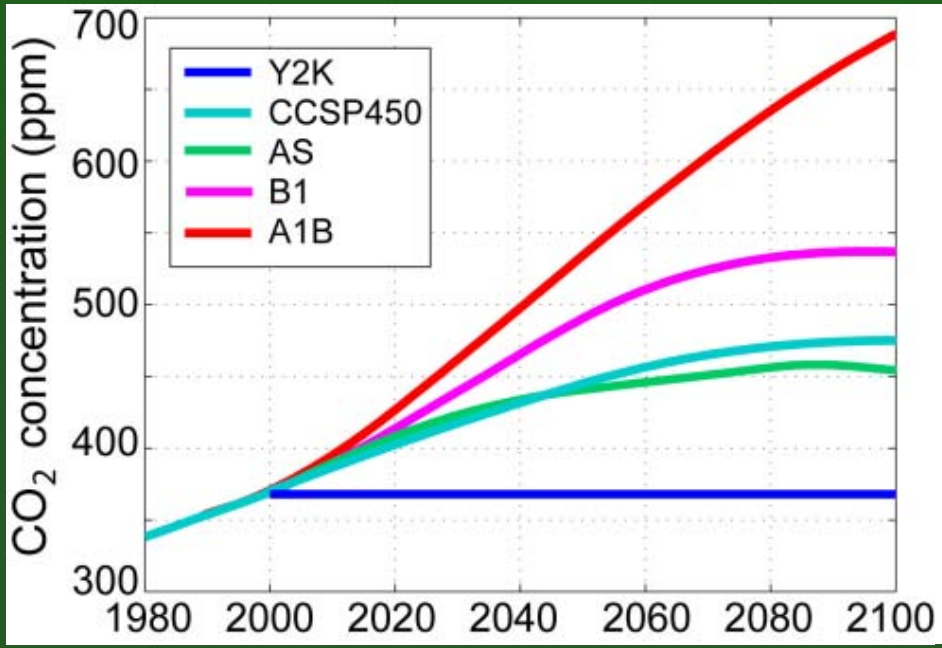
General Circulation Model (GCM)

Comparing forcing scenarios – CO_2



IPCC A1B
(Business as usual)

IPCC B1

Mitigation - MIT

Year 2000 Control – Y2K

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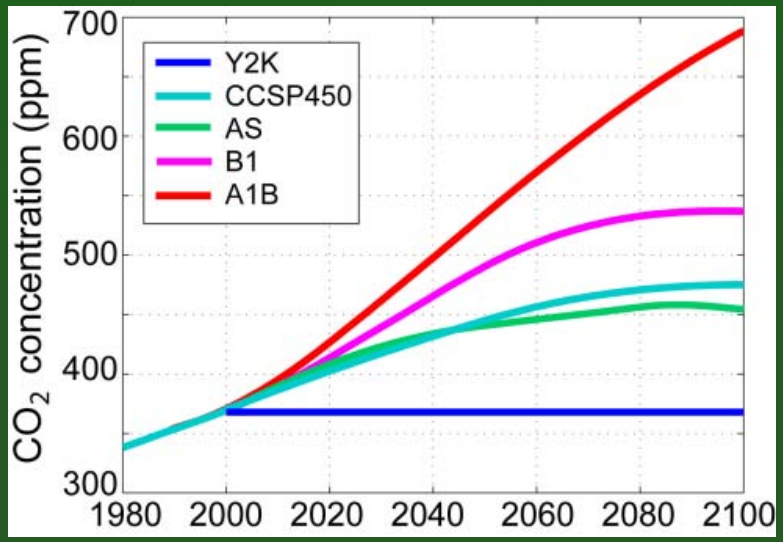
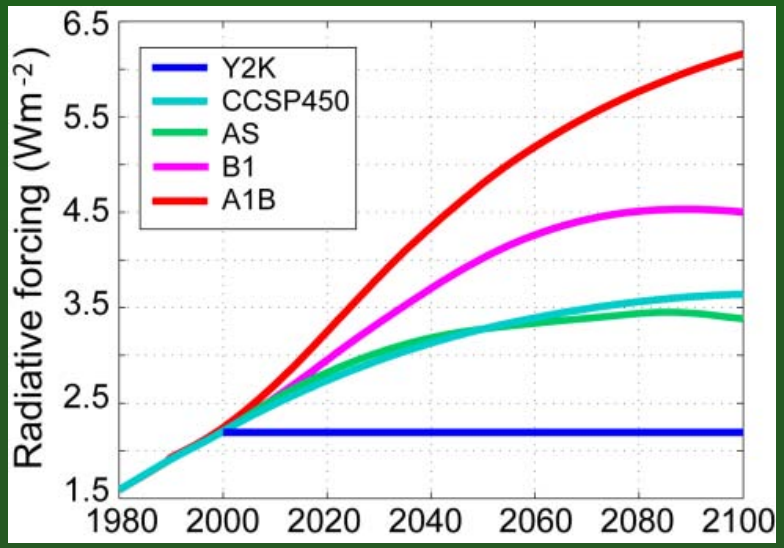
General Circulation Model (GCM)

Comparing forcing scenarios – Radiative forcing





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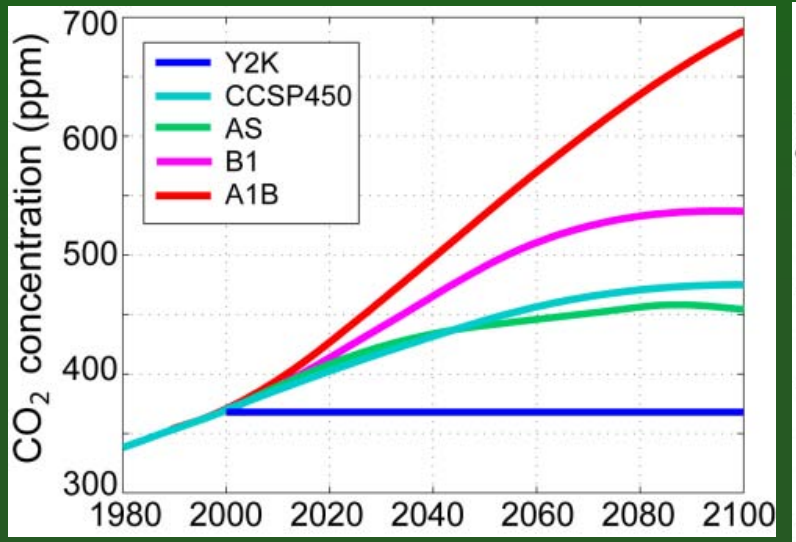
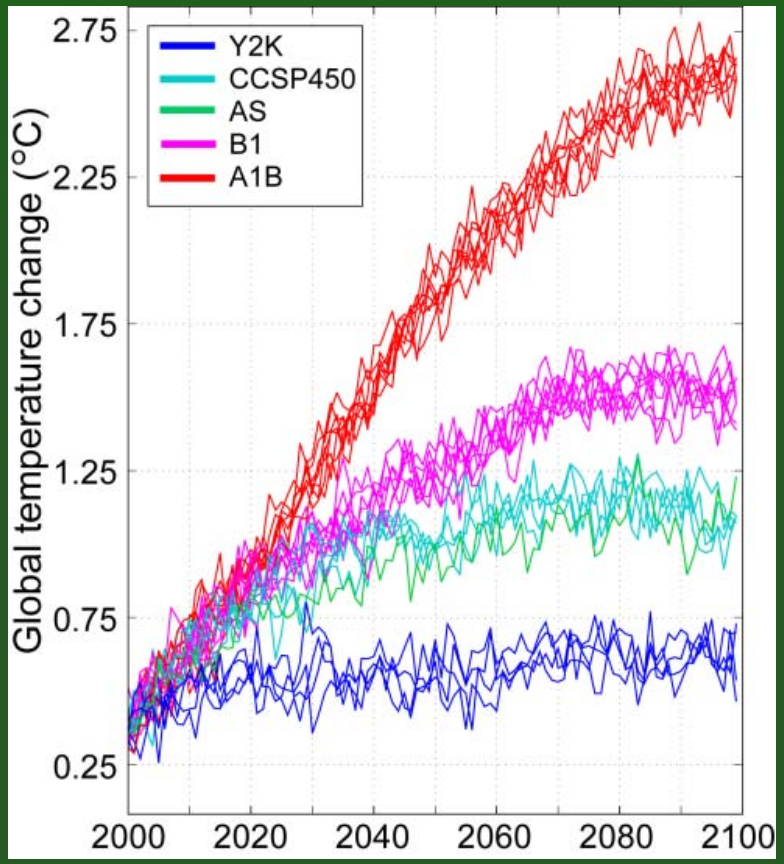
General Circulation Model (GCM)

Comparing forcing scenarios – Global temperature





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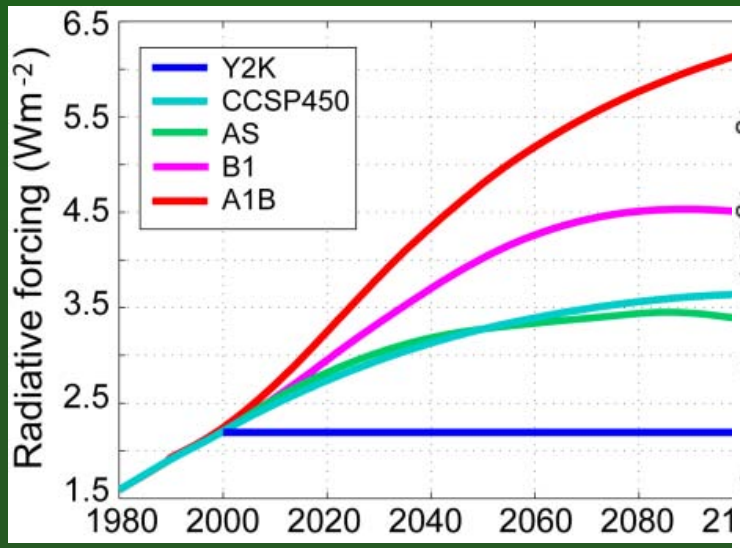
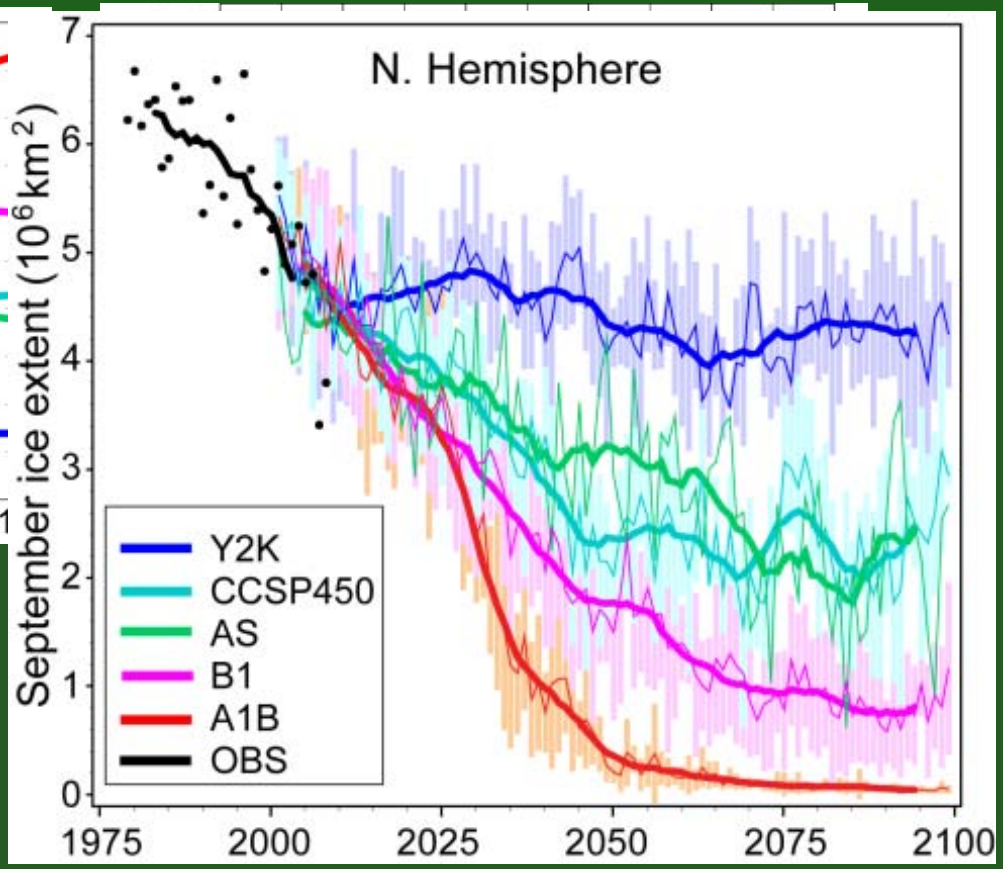
GCM: CCSM3

General Circulation Model (GCM)

Comparing forcing scenarios – Sea ice decline





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GCM: CCSM3

Bayesian Network Modeling

A Bayesian Network Modeling Approach to Forecasting the 21st Century Worldwide Status of Polar Bears

Amstrup, S. C., B. G. Marcot, and D. C. Dougles (2008), A Bayesian network modeling approach to forecasting the 21st century worldwide status of polar bears, in Arctic Sea Ice Decline: Observations, Projections, Mechanisms, and Implications, Geophys. Monogr. Ser., vol. 180, edited by E. T. DeWeaver, C. M. Bitz, and L.-B. Tremblay, pp. 213--268, AGU, Washington, D. C. Mechanisms, and Implications. Geophysical Monograph 180. American Geophysical Union, Washington DC.

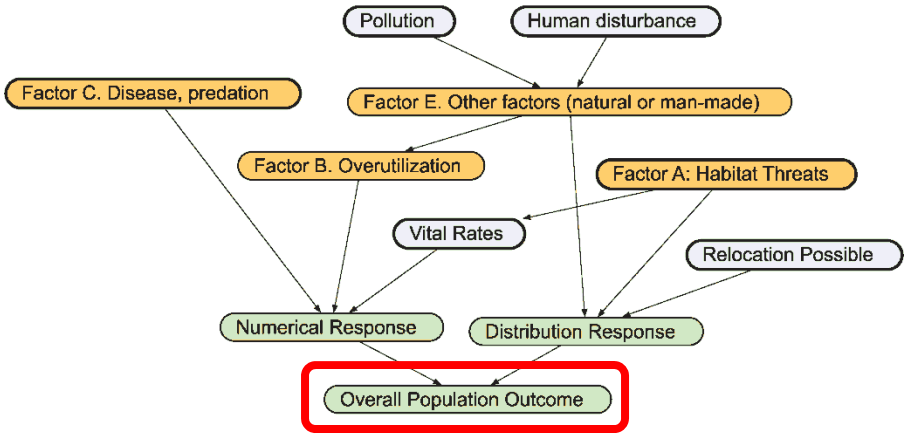

Plate 2. Basic influence diagram for the Bayesian network polar bear population stressor model showing the role of four listing factor categories (orange) used by U.S. Fish and Wildlife Service.

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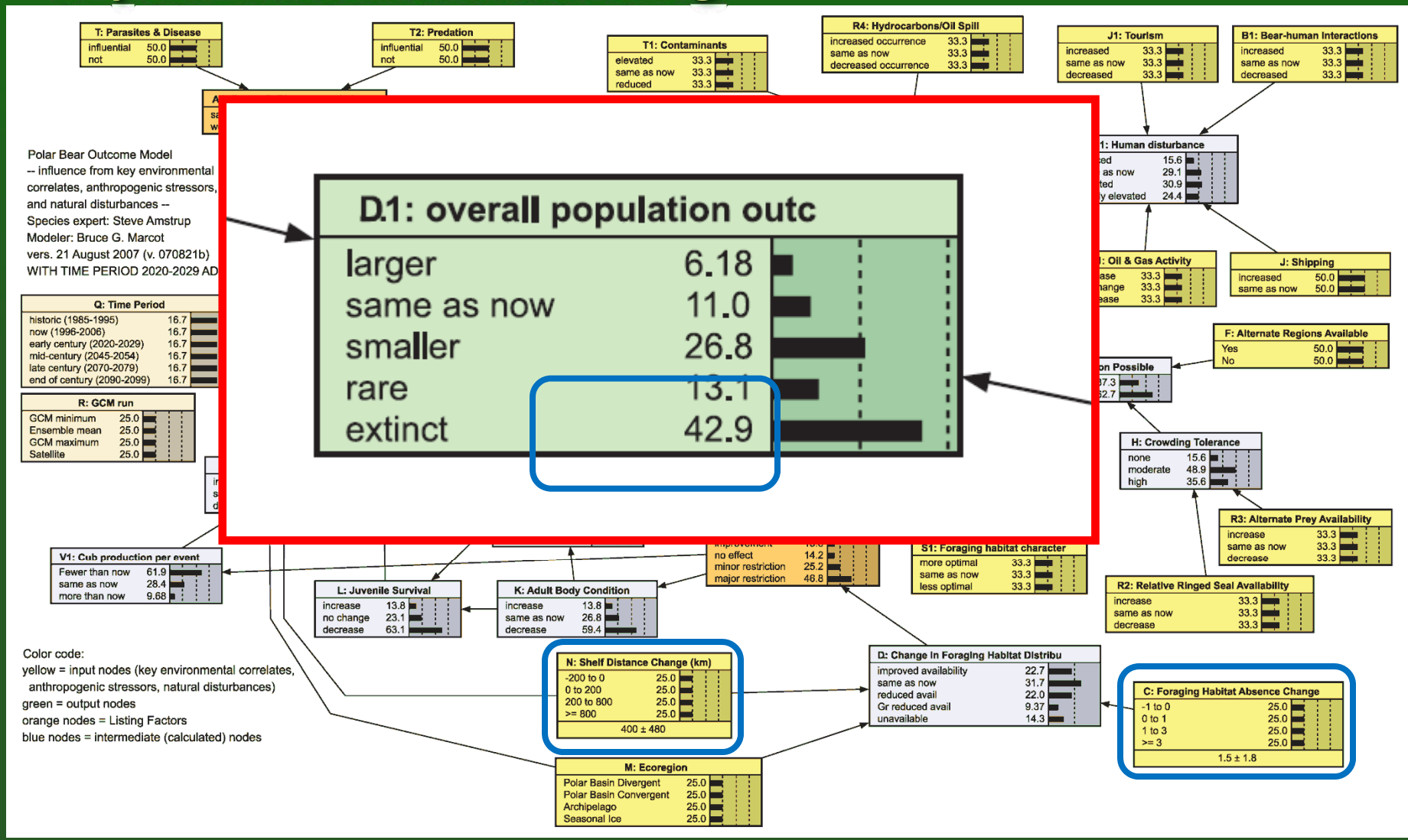
Bayesian Network Modeling



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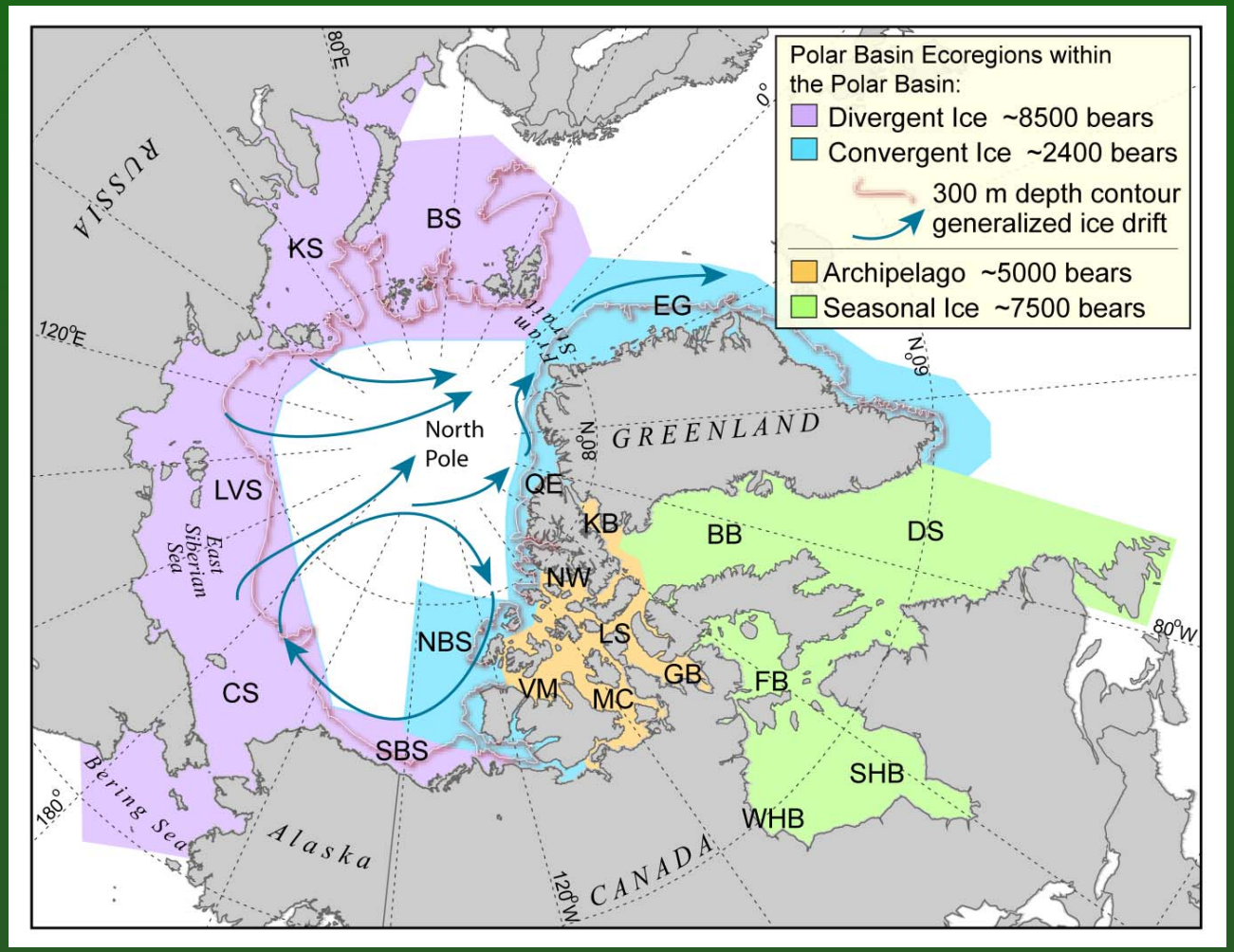
Bayesian Network Modeling



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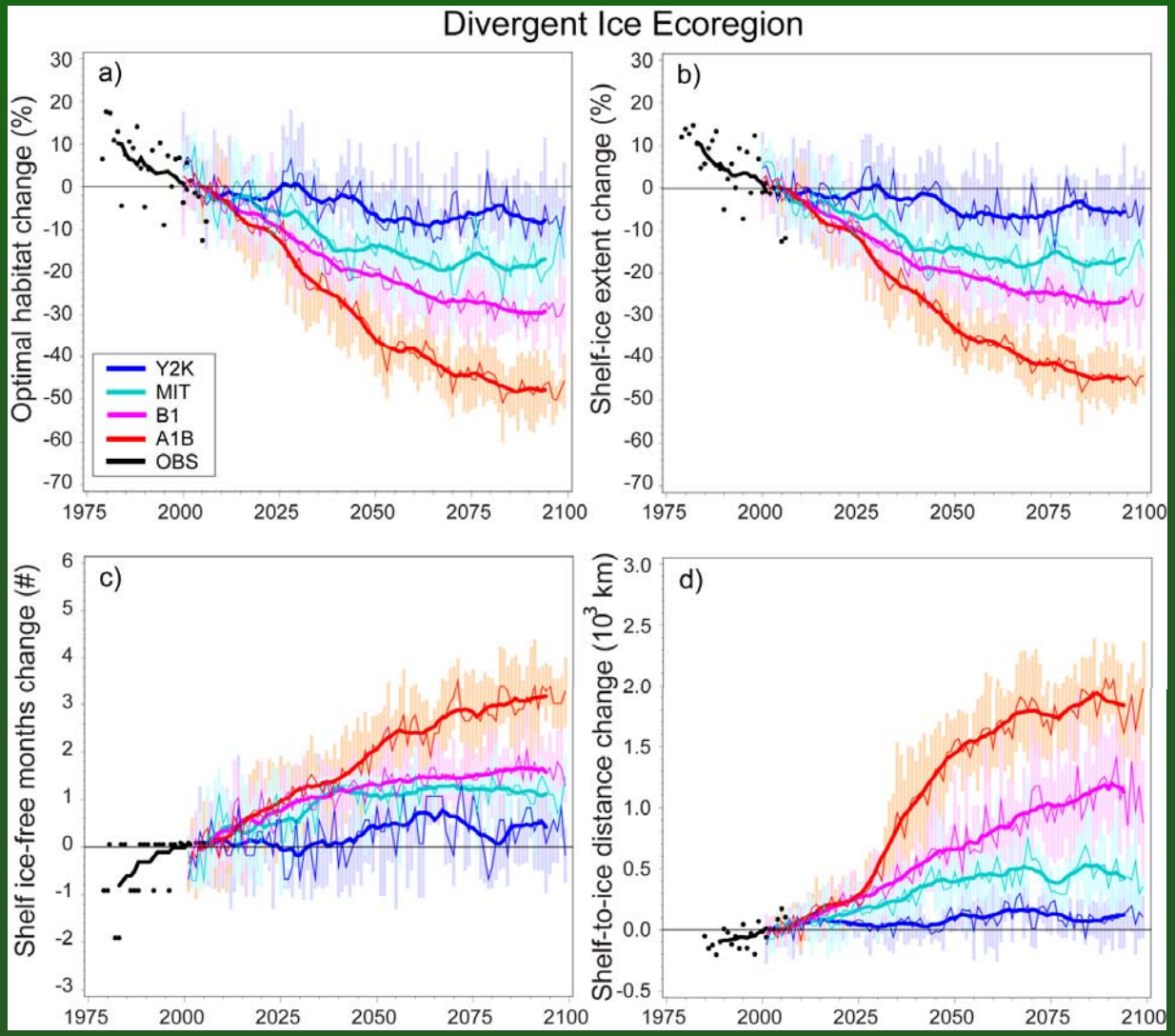
Bayesian Network Modeling – Sea ice inputs



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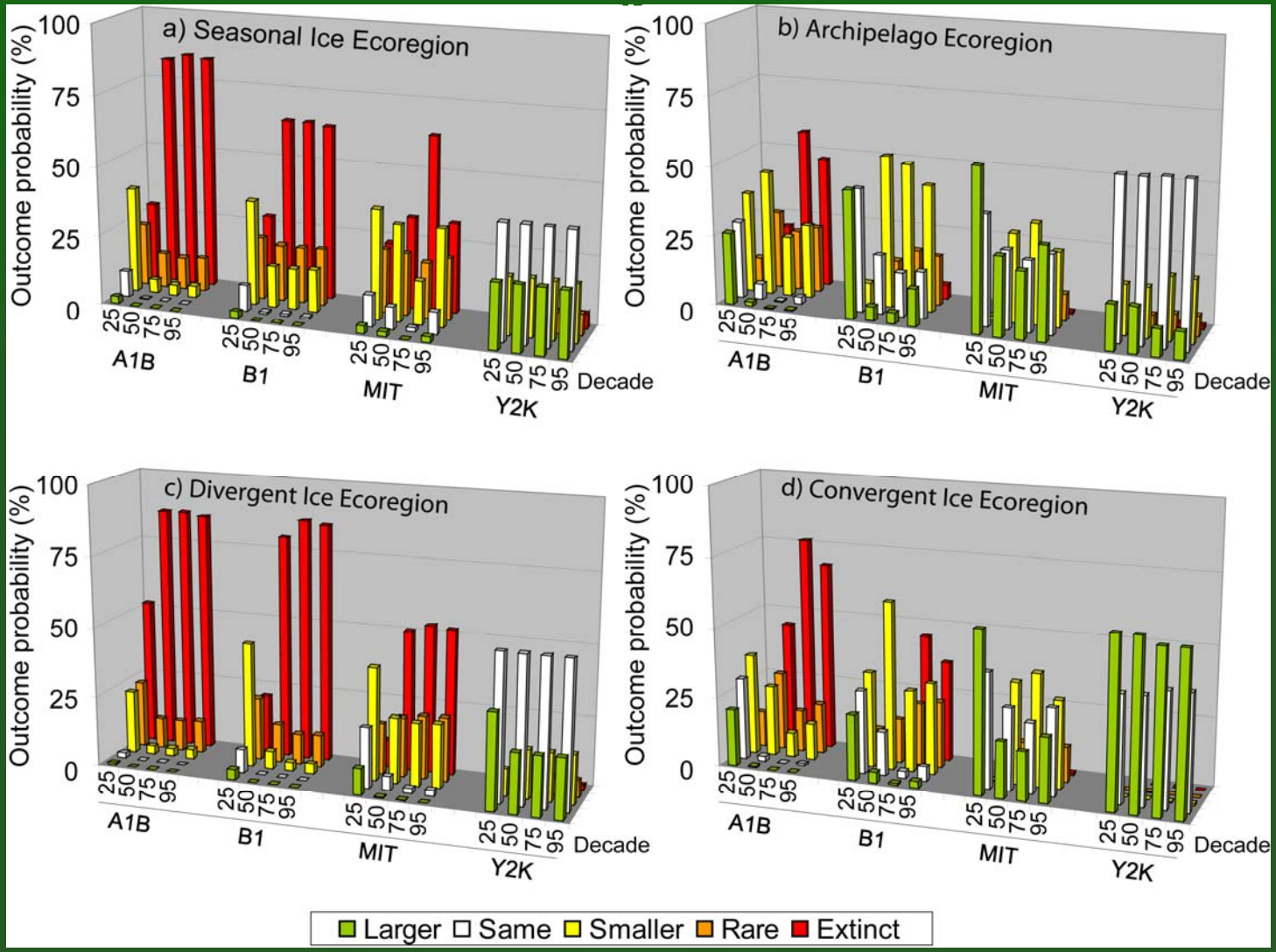
GCM: CCSM3

Bayesian Network Modeling - Results



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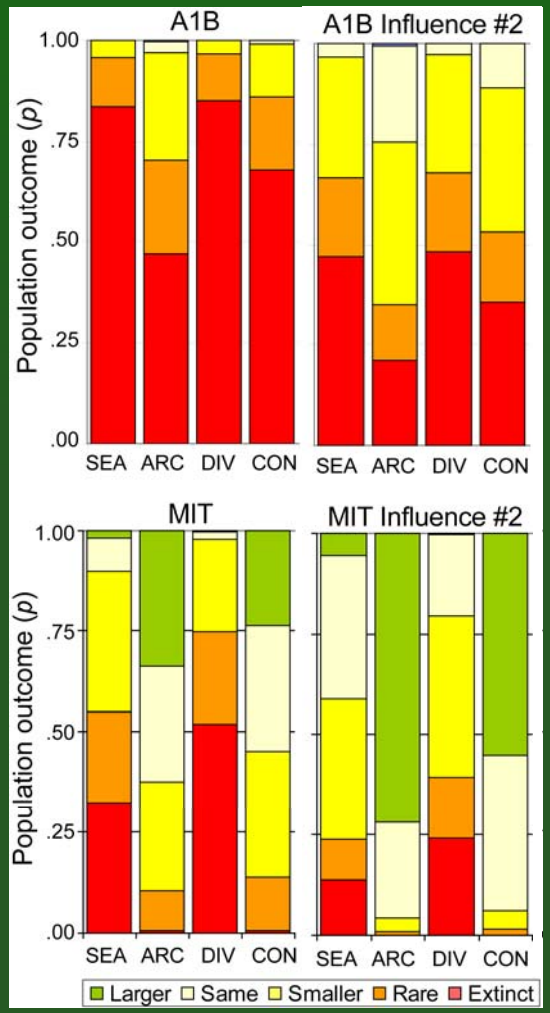
Bayesian Network Modeling – Influence run

2090 - 2099



Influence run #2

- Best possible management

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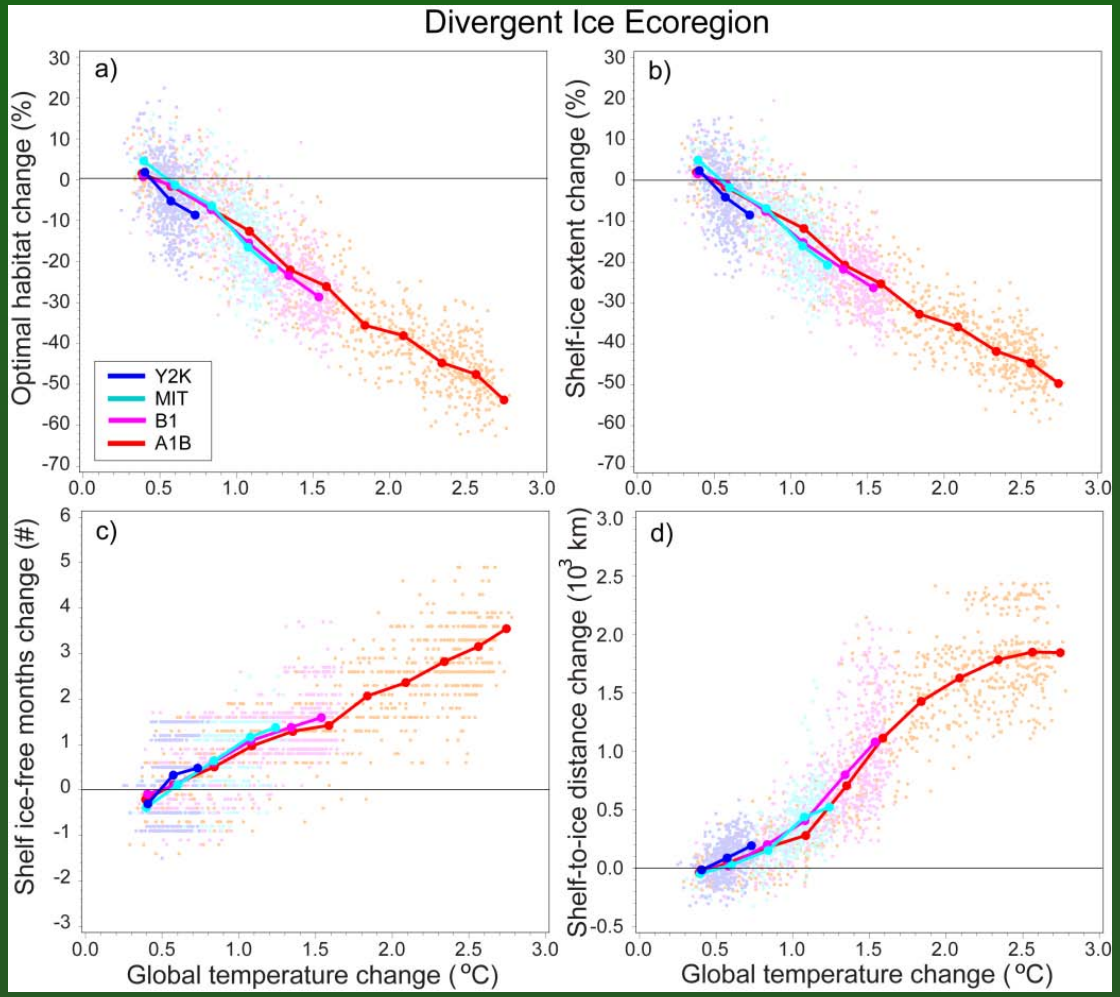
No evidence of a “tipping point”



GCM: CCSM3

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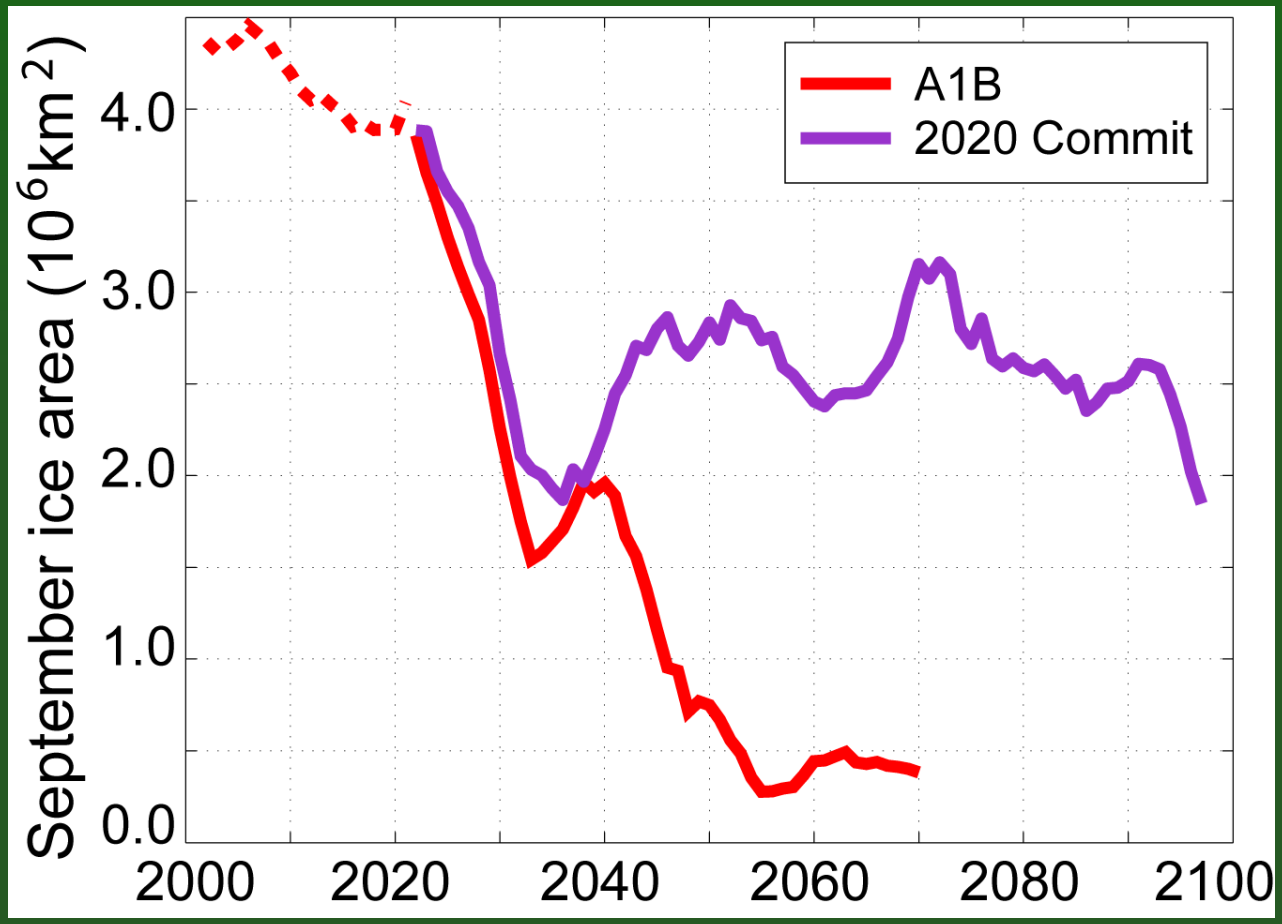
No evidence of a “tipping point”



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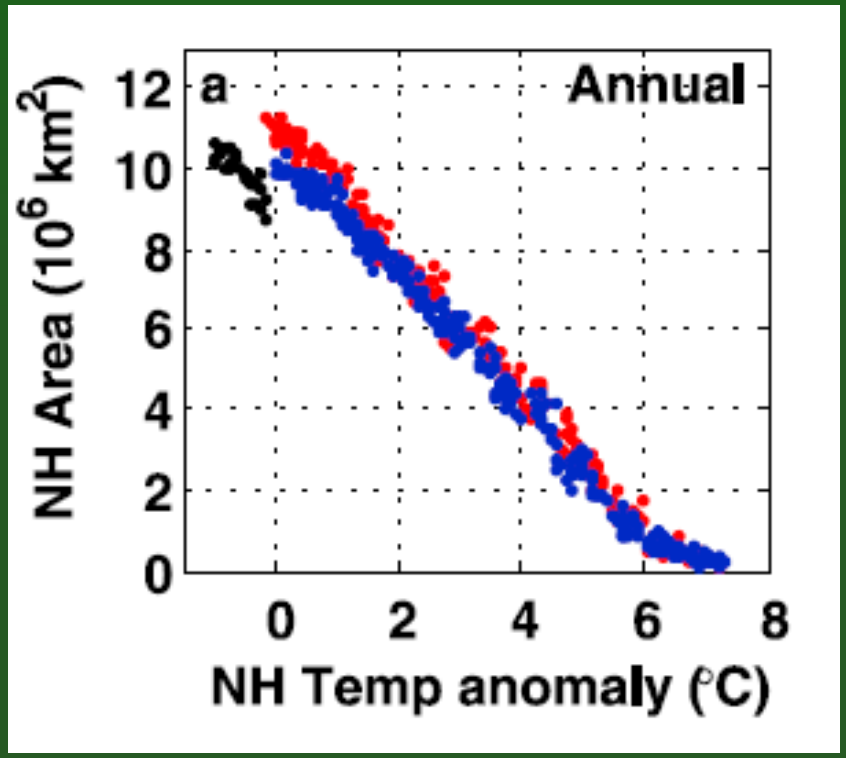
GEOPHYSICAL RESEARCH LETTERS, VOL. 38, L16705, doi:10.1029/2011GL048739, 2011

The reversibility of sea ice loss in a state-of-the-art climate model

K. C. Armour,[1] I. Eisenman,[2,3] E. Blanchard-Wrigglesworth,[3] K. E. McCusker,[3] and C. M. Bitz[3]



(red) Increasing GHG concentration 1% per year

(blue) Decreasing GHG concentration 1% per year

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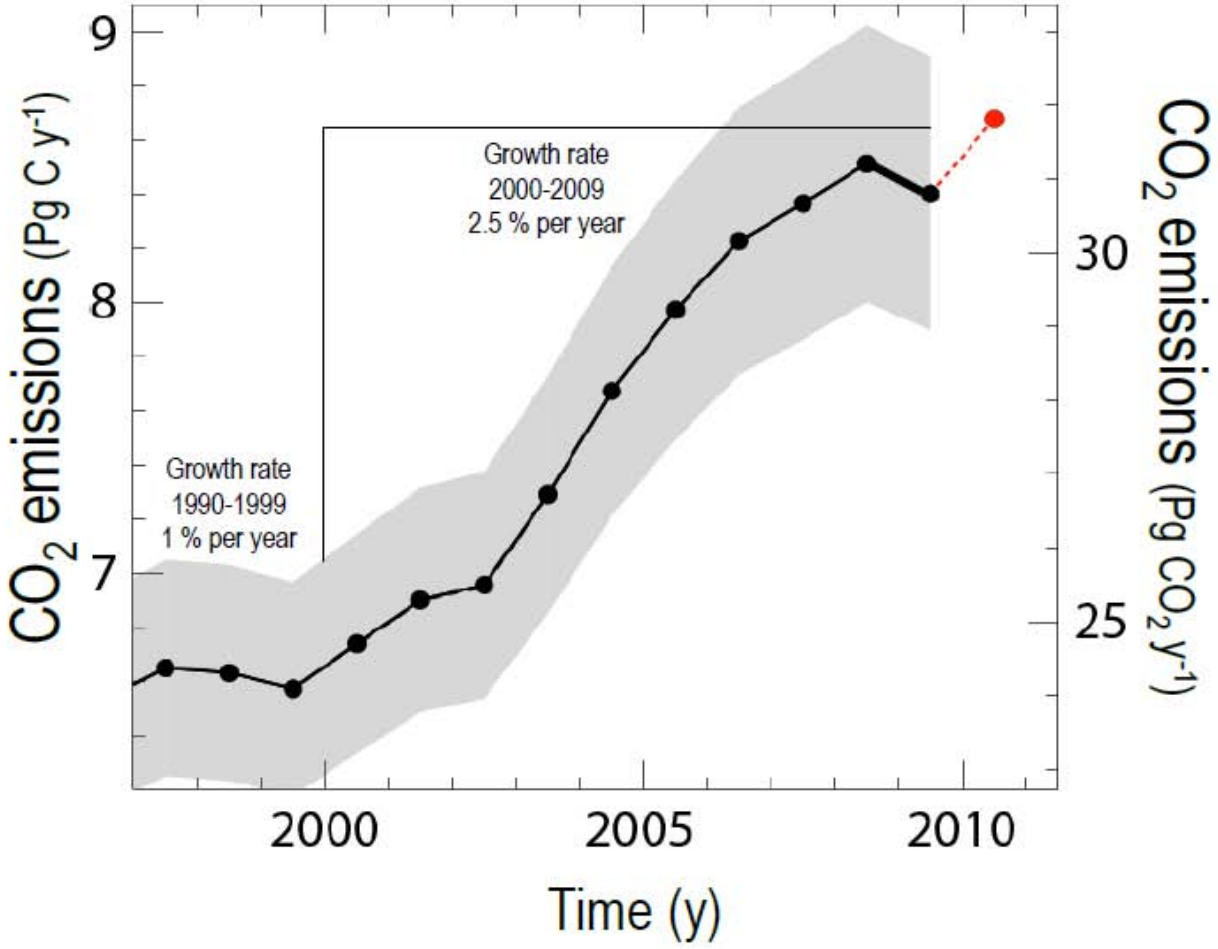
Fossil Fuel CO_2 Emissions

www.globalcarbonproject.org



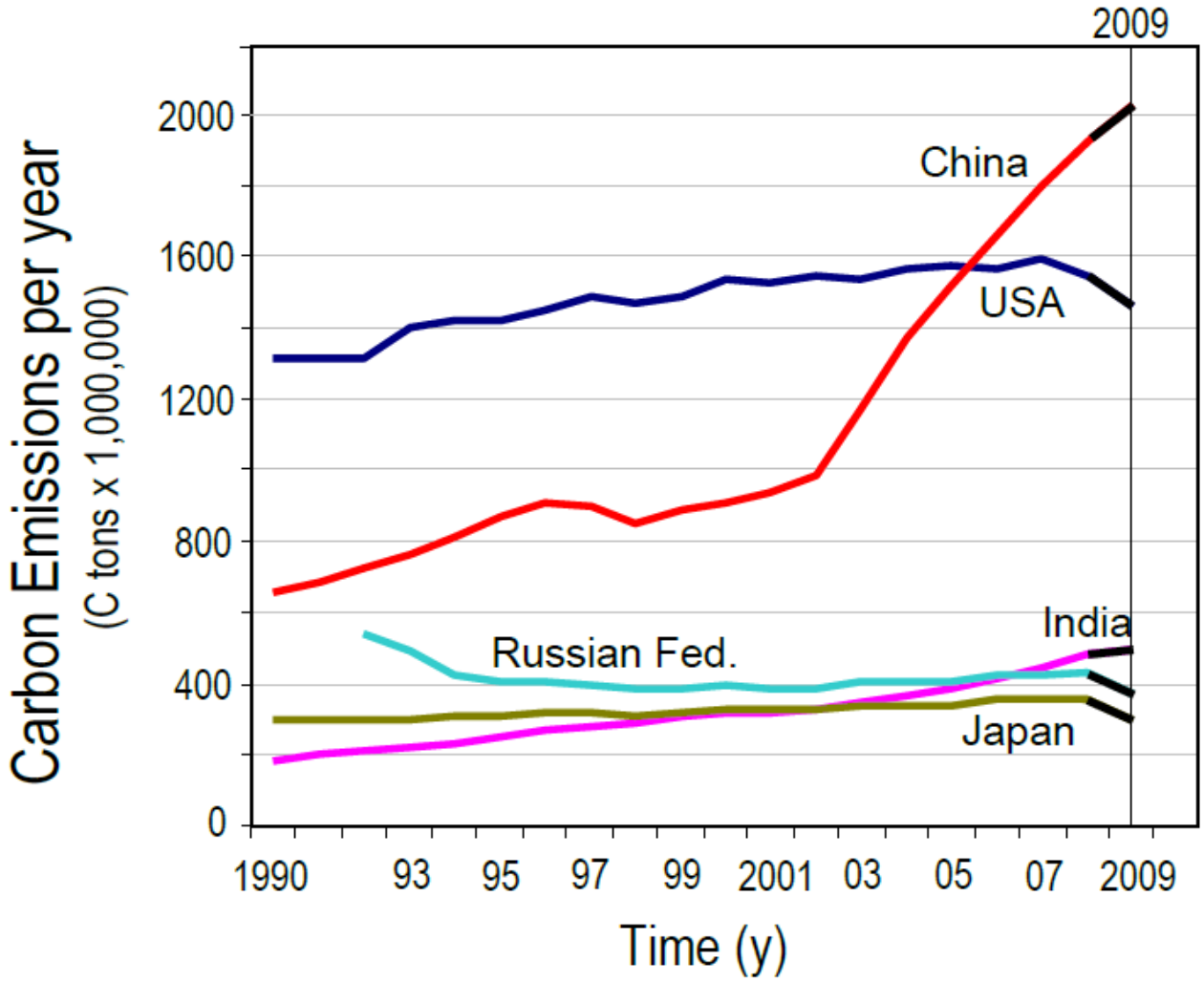
2009:
Emissions:8.4±0.5 PgC
Growth rate: -1.3%
1990 level: +37%

2000-2008
Growth rate: +3.2%

2010 (projected):
Growth rate: >3%

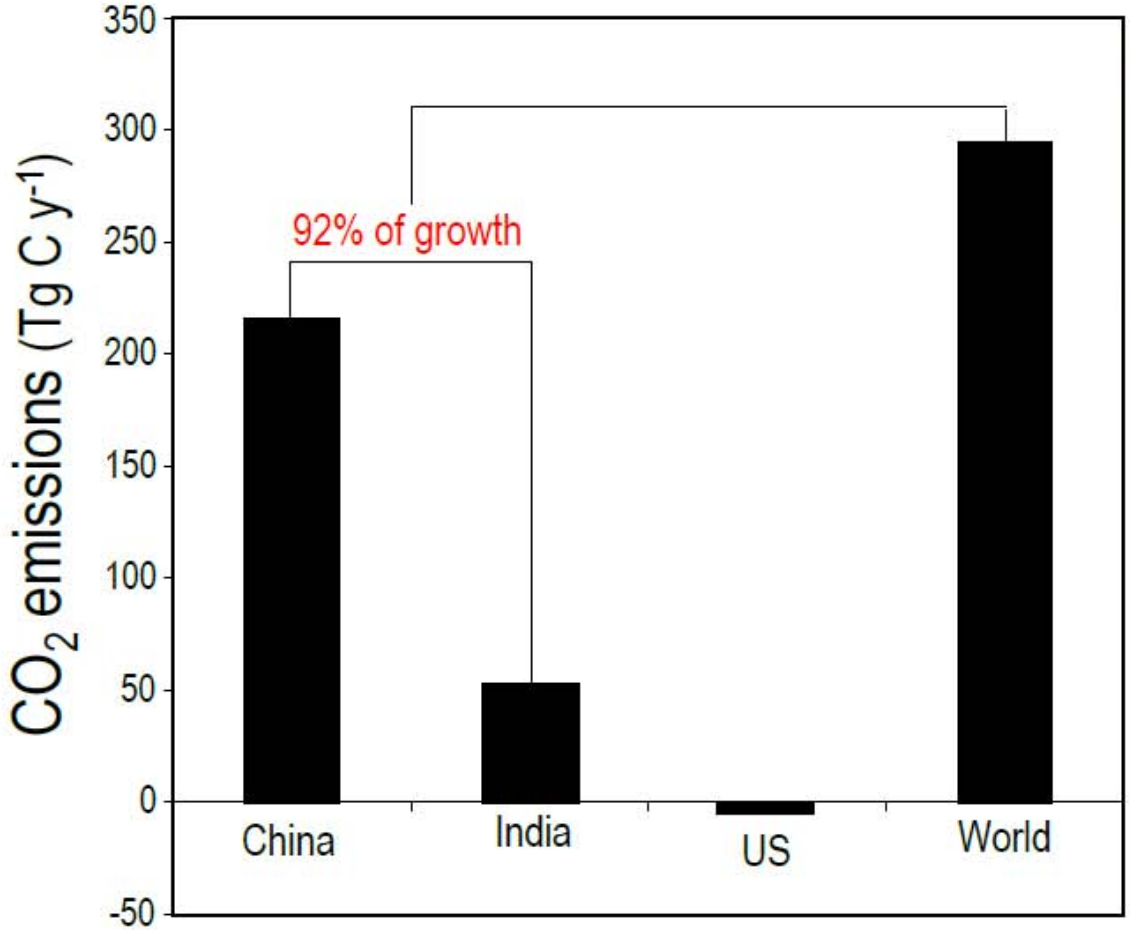
Friedlingstein et al. 2010, Nature Geoscience; Gregg Marland, Thomas Boden-CDIAC 2010

Fossil Fuel CO_2 Emissions: Top Emitters



Global Carbon Project 2010; Data: Gregg Marland, Tom Boden-CDIAC 2010

Change in CO_2 Emissions from Coal (2007 to 2009)

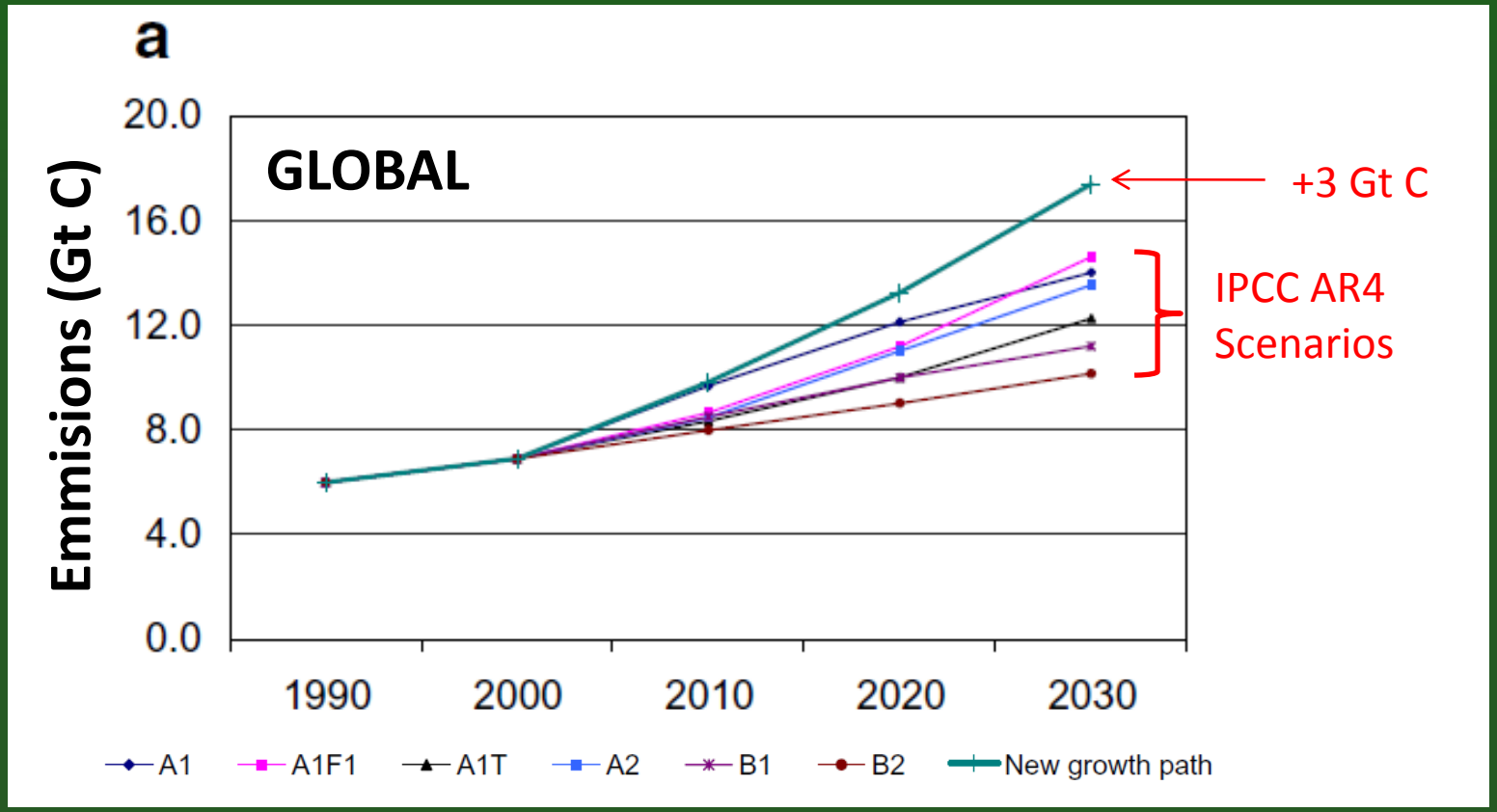


Global Carbon Project 2010; Data: Gregg Marland, Thomas Boden-CDIAC 2010

Climatic Change (2008) 91:211–231
DOI 10.1007/s10584-008-9415-z

The new global growth path: implications for climate change analysis and policy

Peter Sheehan



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Climatic Change (2008) 91:211–231
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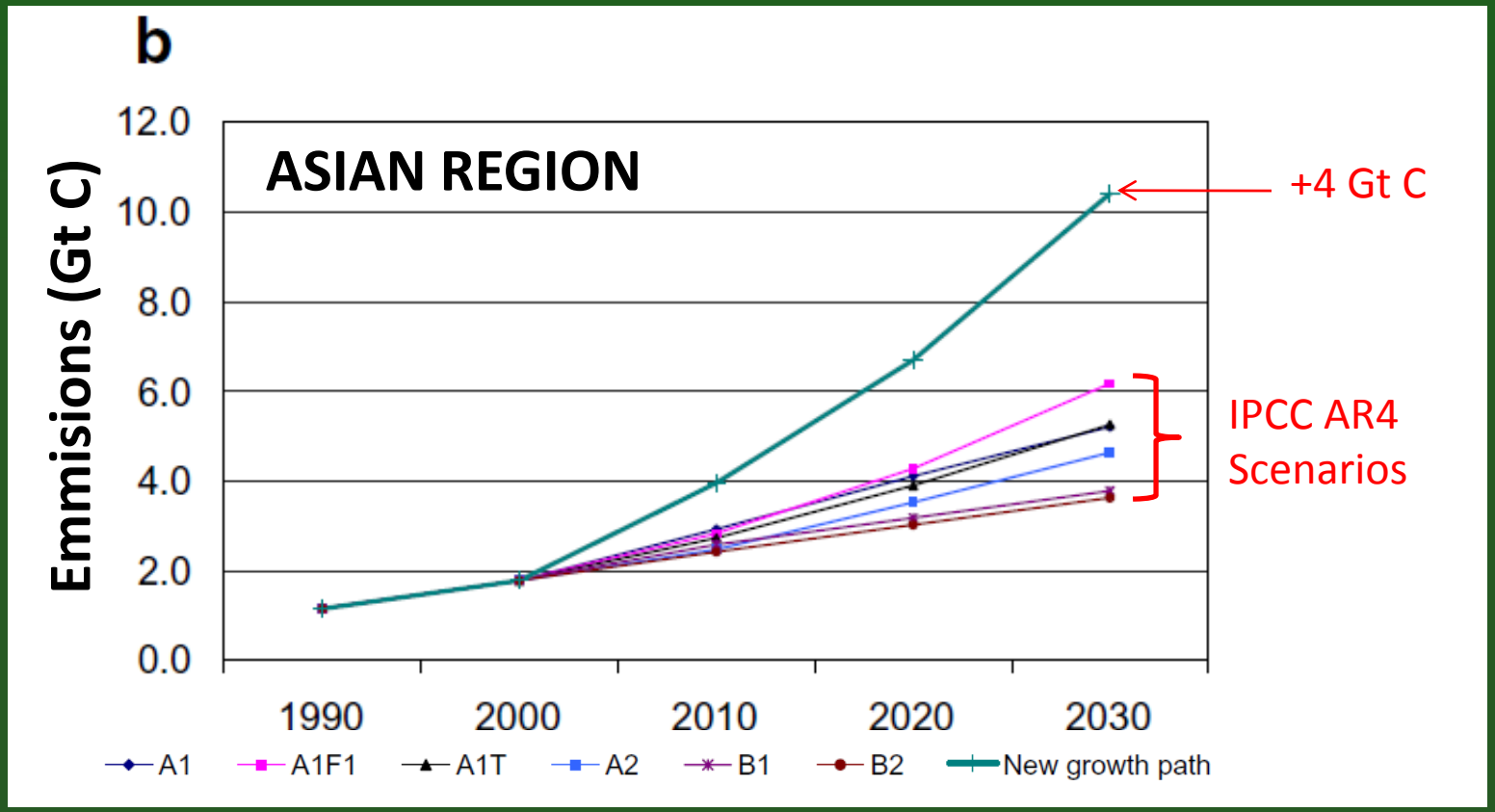
The new global growth path: implications for climate change analysis and policy

Peter Sheehan



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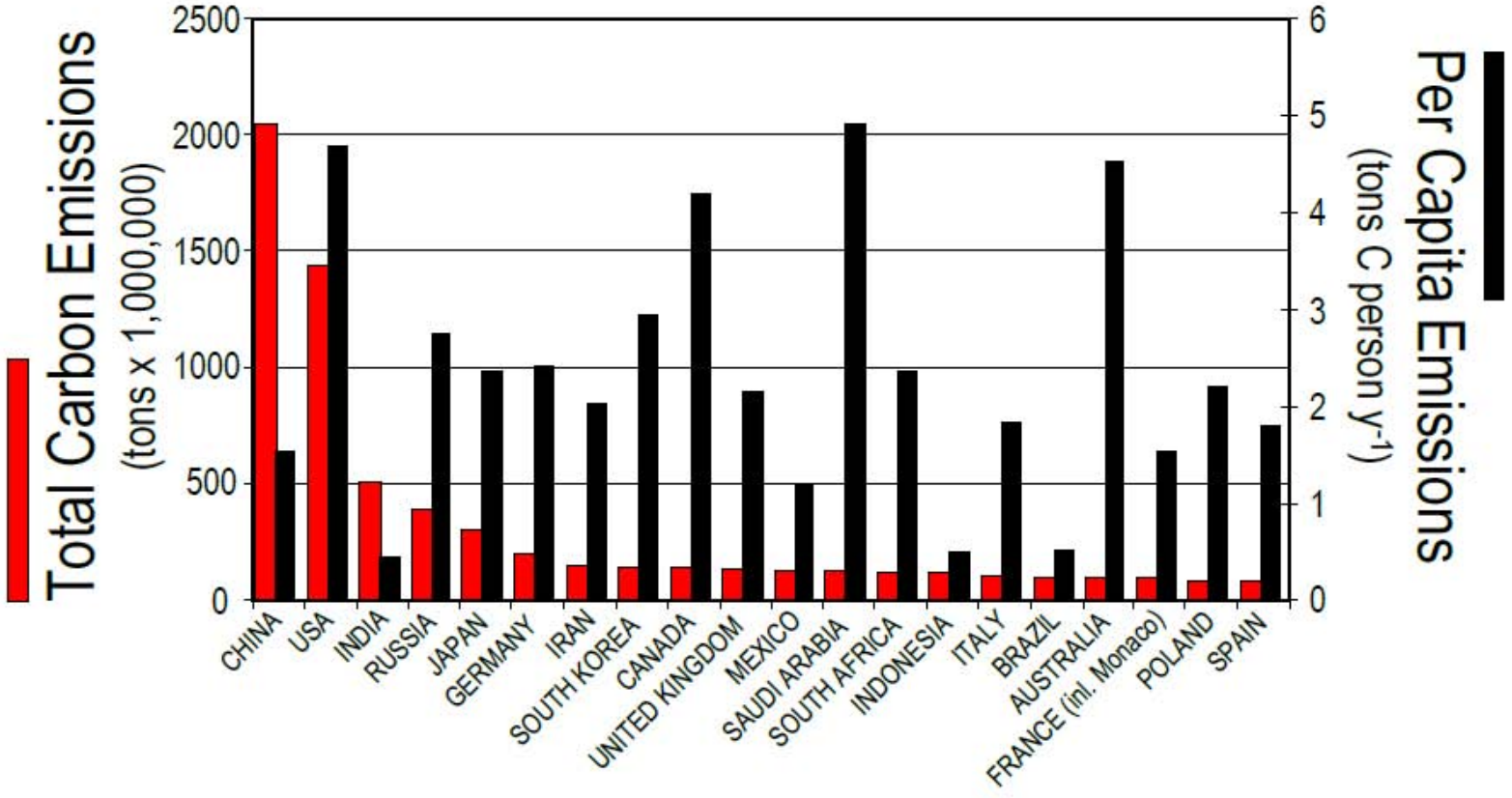
Top 20 CO_2 Emitters & Per Capita Emissions 2009



Global Carbon Project 2010; Data: Gregg Marland, Thomas Boden-CDIAC 2010; Population World Bank 2010

Forthcoming
IPCC Fifth Reporting Assessment (AR-5)

Climatic Change
DOI 10.1007/s10584-011-0148-z

The representative concentration pathways: an overview

Detlef P. van Vuuren · Jae Edmonds · Mikiko Kainuma · Keywan Riahi · Allison Thomson · Kathy Hibbard · George C. Hurtt · Tom Kram · Volker Krey · Jean-Francois Lamarque · Toshihiko Masui · Malte Meinshausen · Nebojsa Nakicenovic · Steven J. Smith · Steven K. Rose

Forcing scenarios -> Representative concentration pathways

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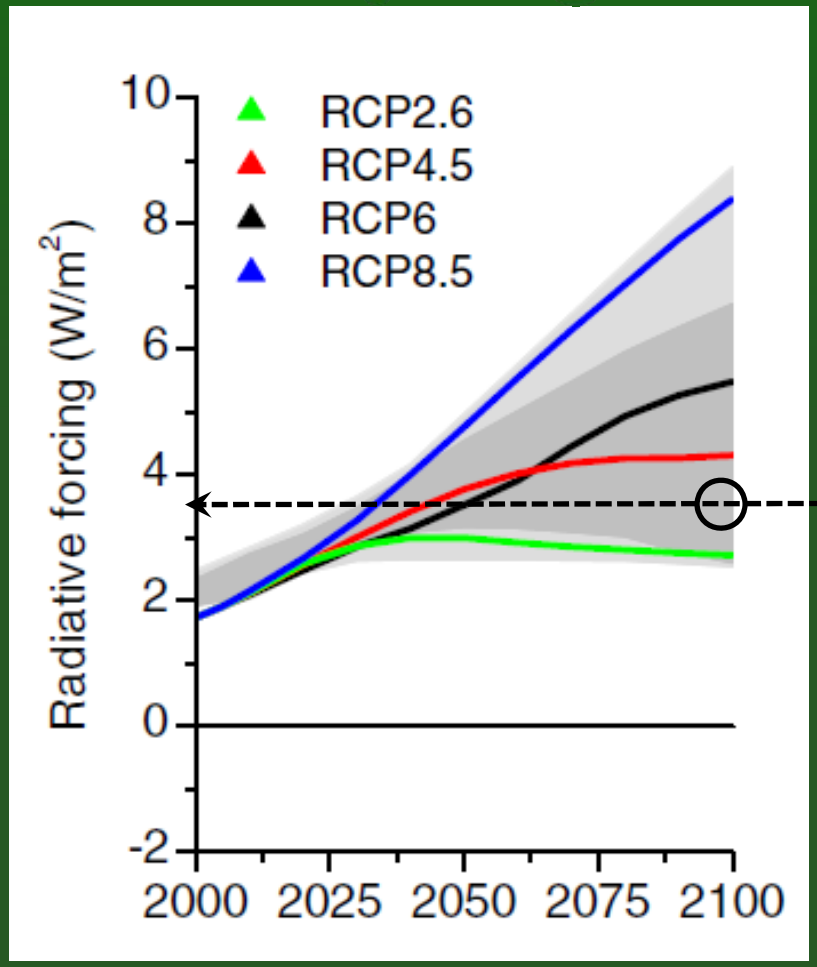
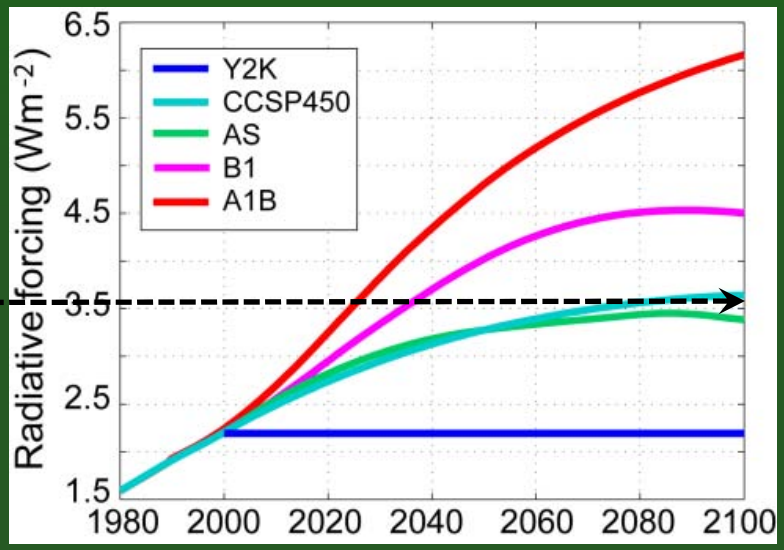
Forthcoming
IPCC Fifth Reporting Assessment (AR-5)





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Mitigation of greenhouse gases (and polar bears): Would it help? Will it happen?

Would it help?

Yes - Physics and wildlife biology

Will it happen?

Yes, but to what extent and on what timeframe is highly uncertain

- People
  - International
  - Economics
  - Politics

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