Marianne SV Douglas
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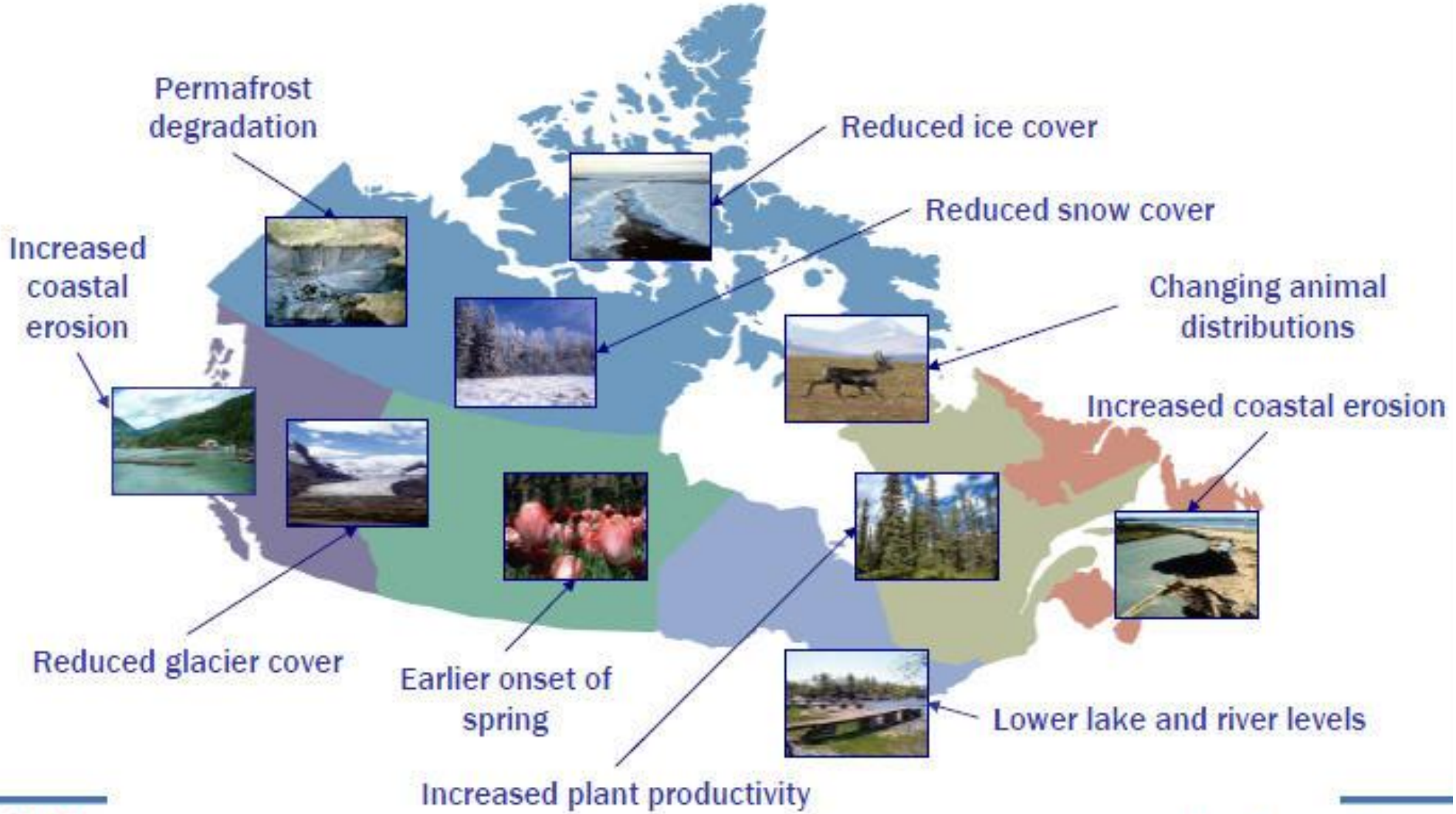
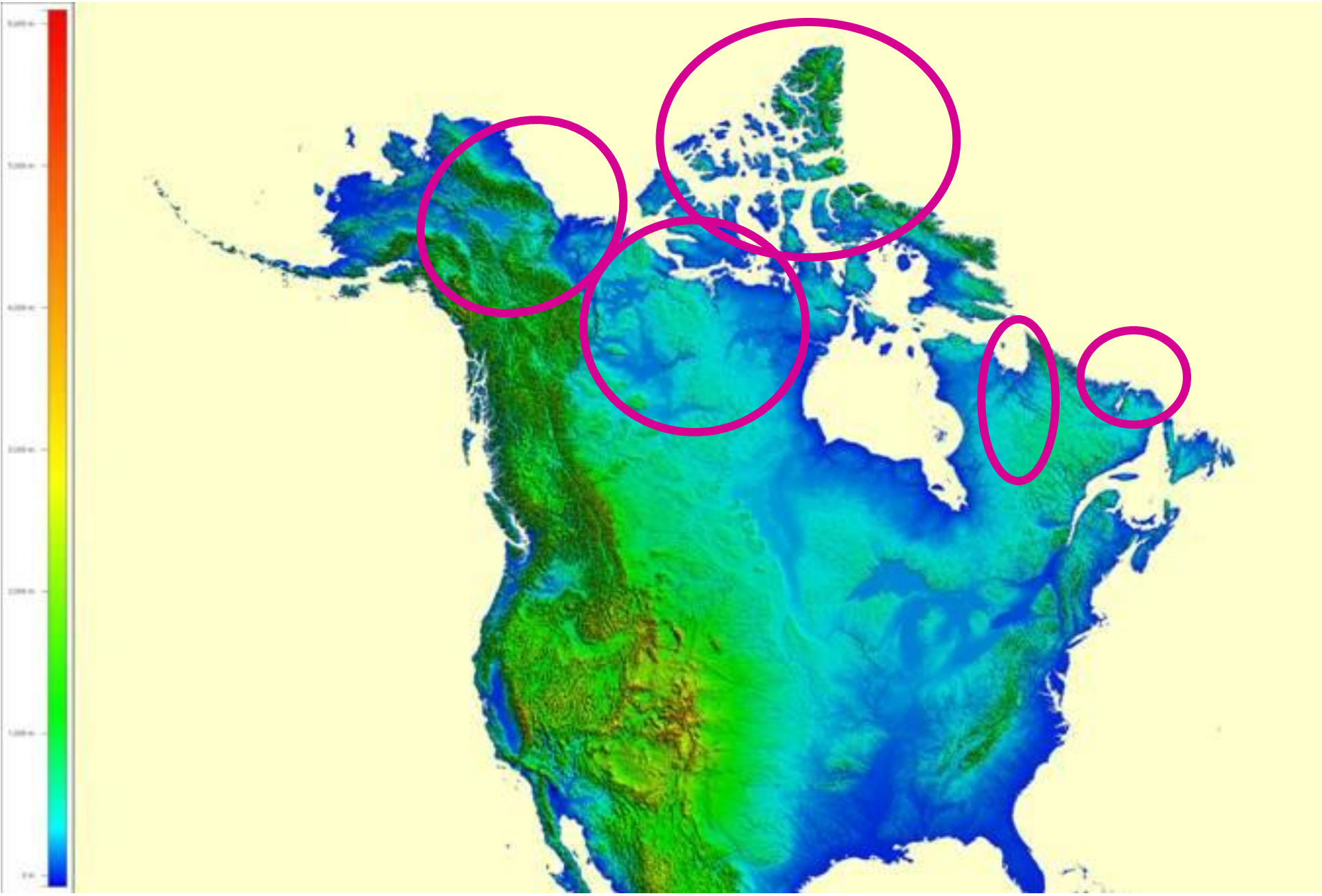
marianne.douglas@ualberta.ca

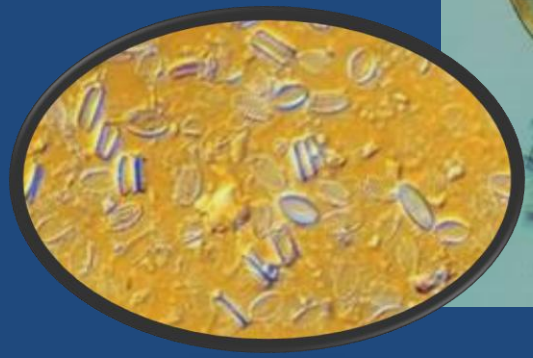

Permafrost degradation
Reduced ice cover
Reduced snow cover
Increased coastal erosion
Changing animal distributions
Increased coastal erosion
Reduced glacier cover
Earlier onset of spring
Lower lake and river levels
Increased plant productivity

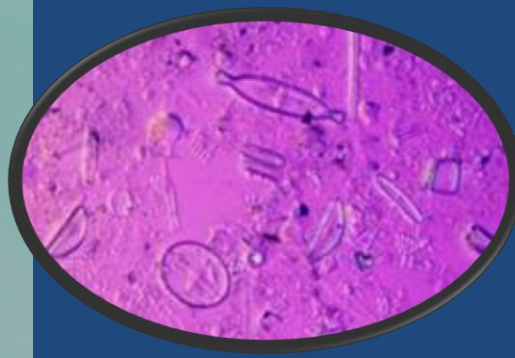


Community diversity model:

<u>Cooler:</u> few taxa, simple

Shorter growing season

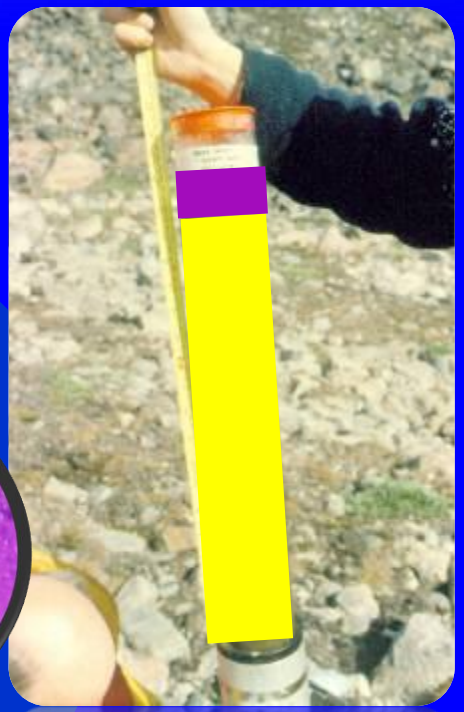




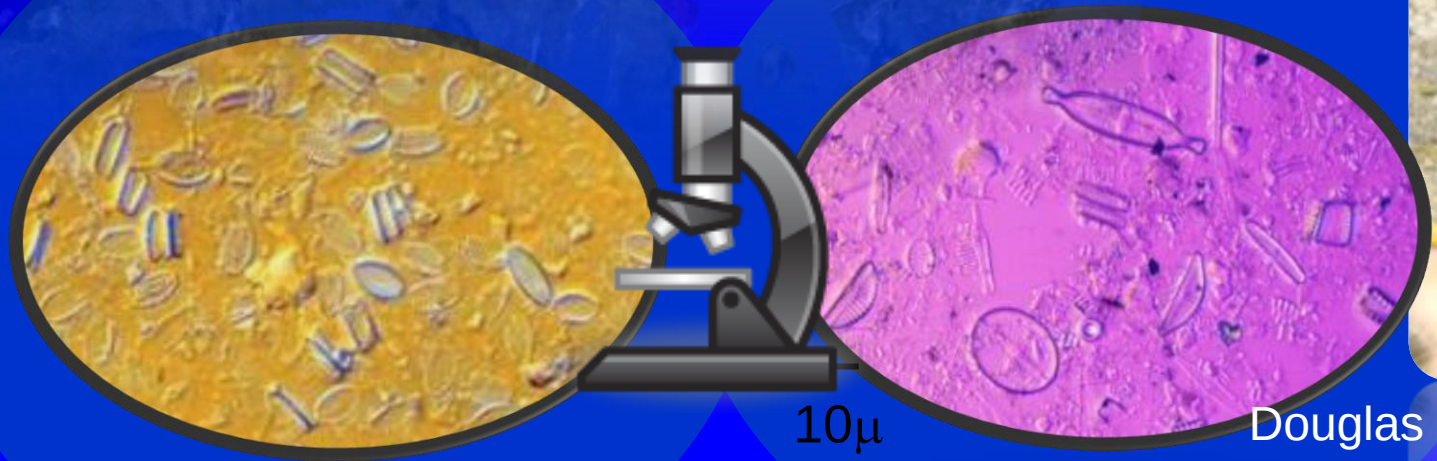
<u>Warmer:</u> diverse, intricate

Longer growing season

Cape Herschel, Ellesmere Island

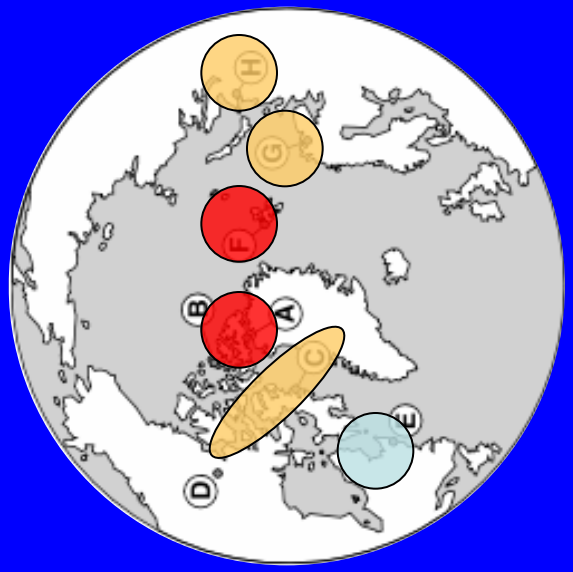


Diatoms: two different assemblages:



10μ

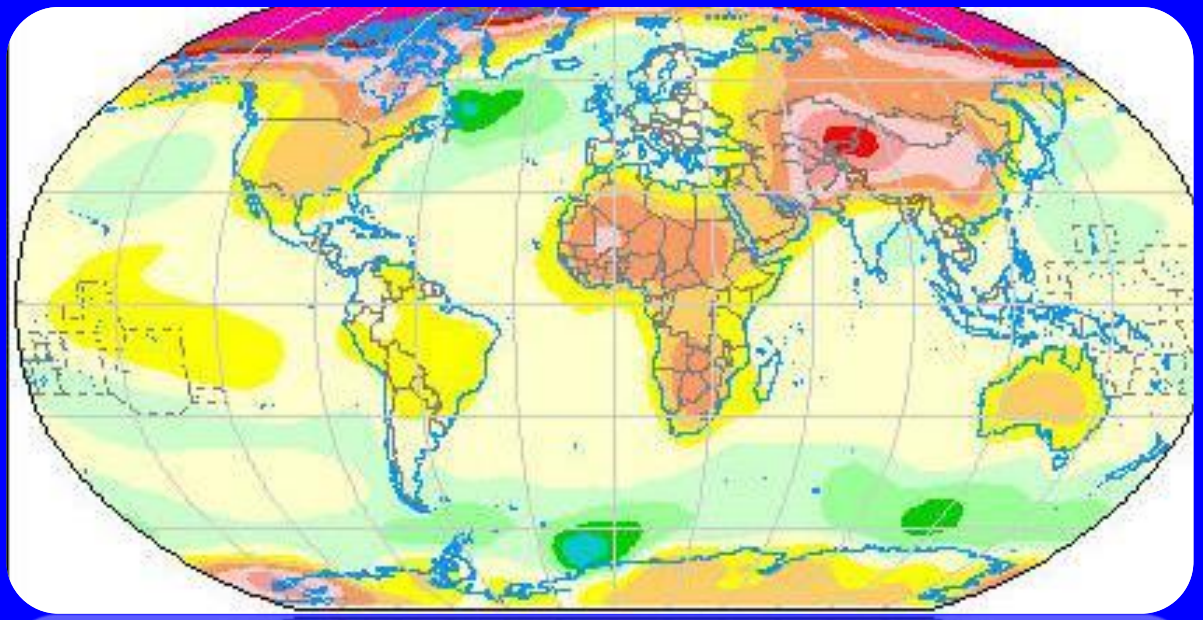
Douglas et al., Science 1994



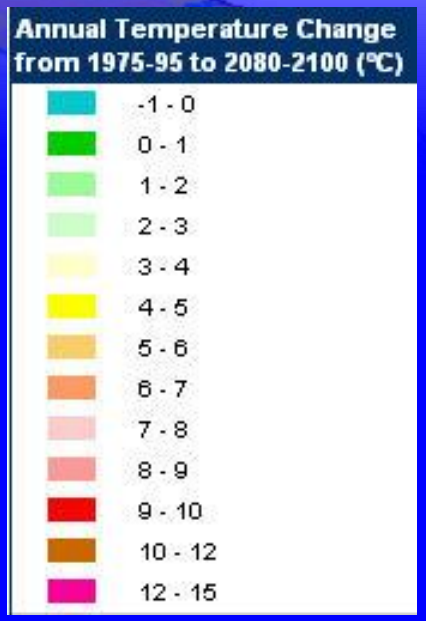
Smol et al. PNAS 2005

Degree of change

- High
- Medium
- Low



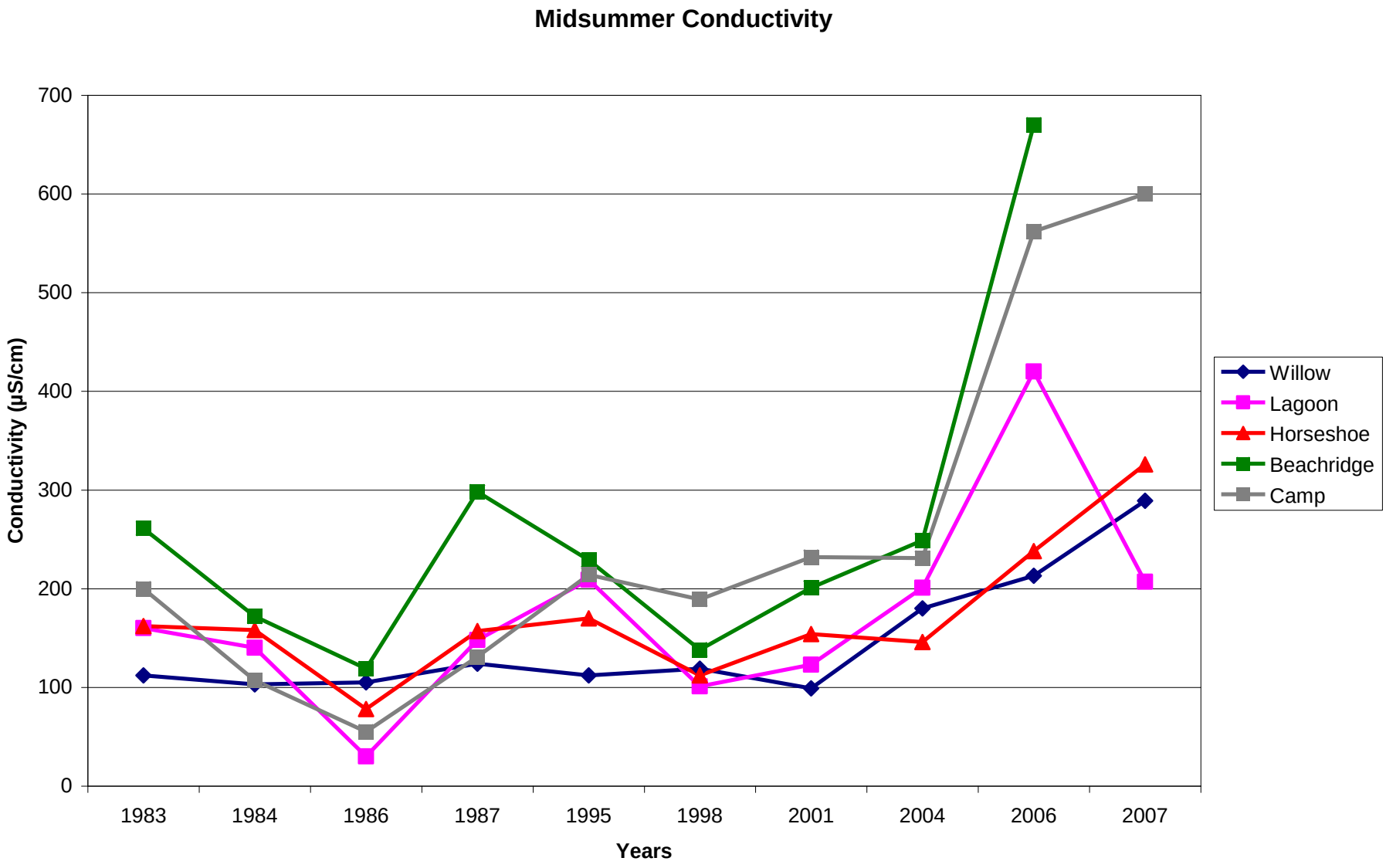
General Circulation Model (GCM)

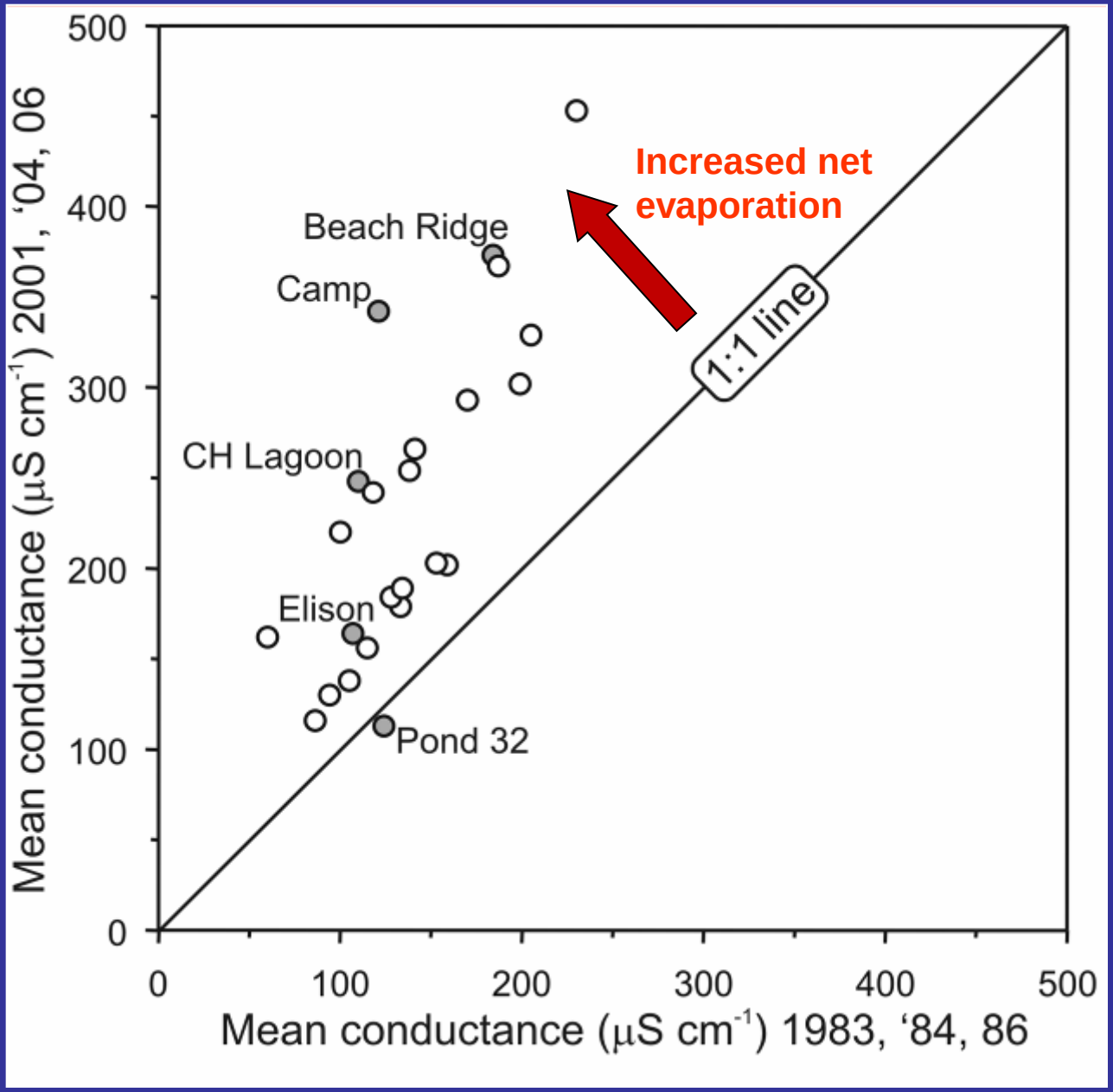


Canadian Centre for Climate Modelling and Analysis, CCCma;

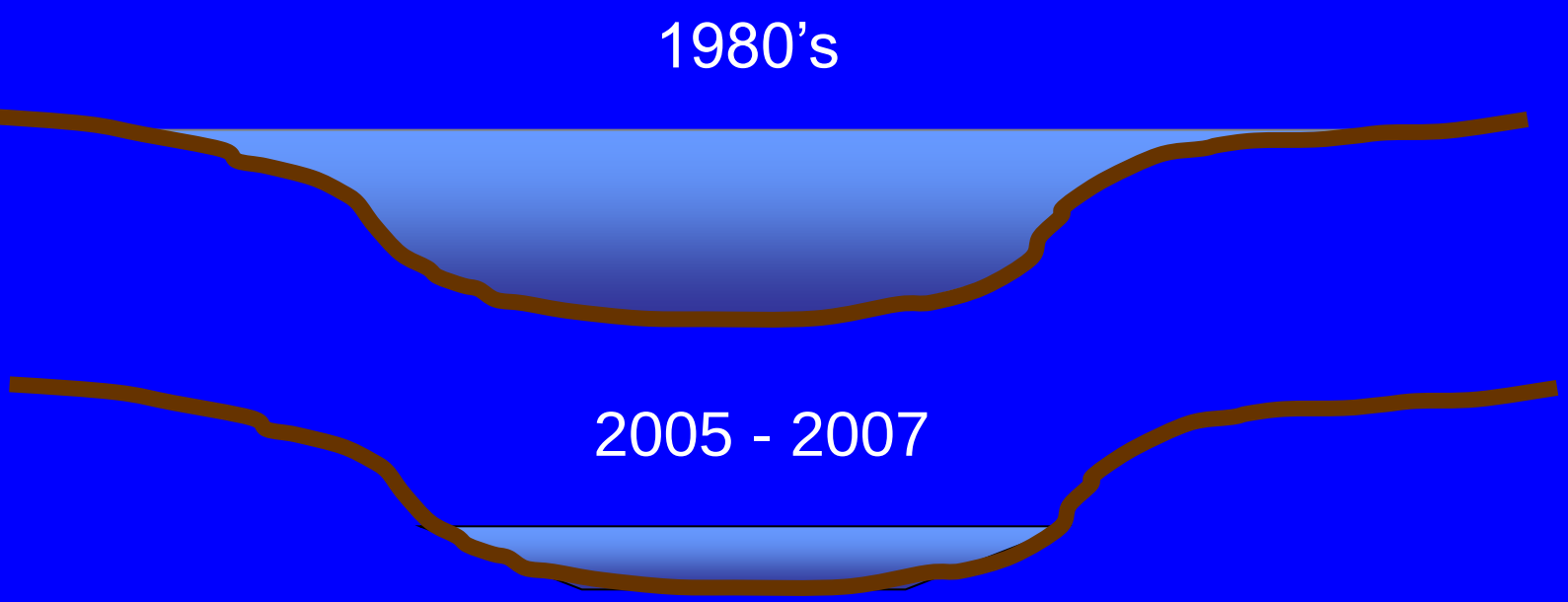

A
Camp Pond, 14 Jul 1979

Specific Conductivity 1983 - 2007



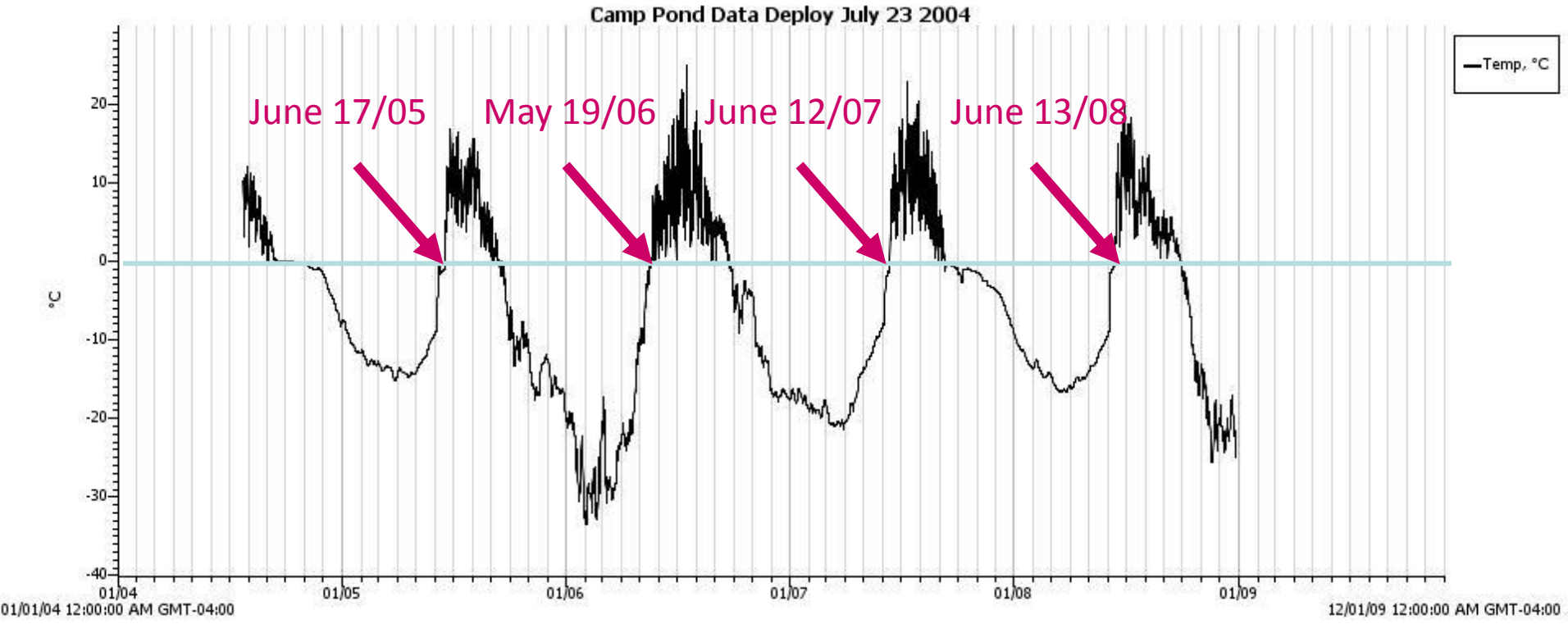


Smol & Douglas (2007) *PNAS* 104: 12395-7.


1980’s
2005 - 2007

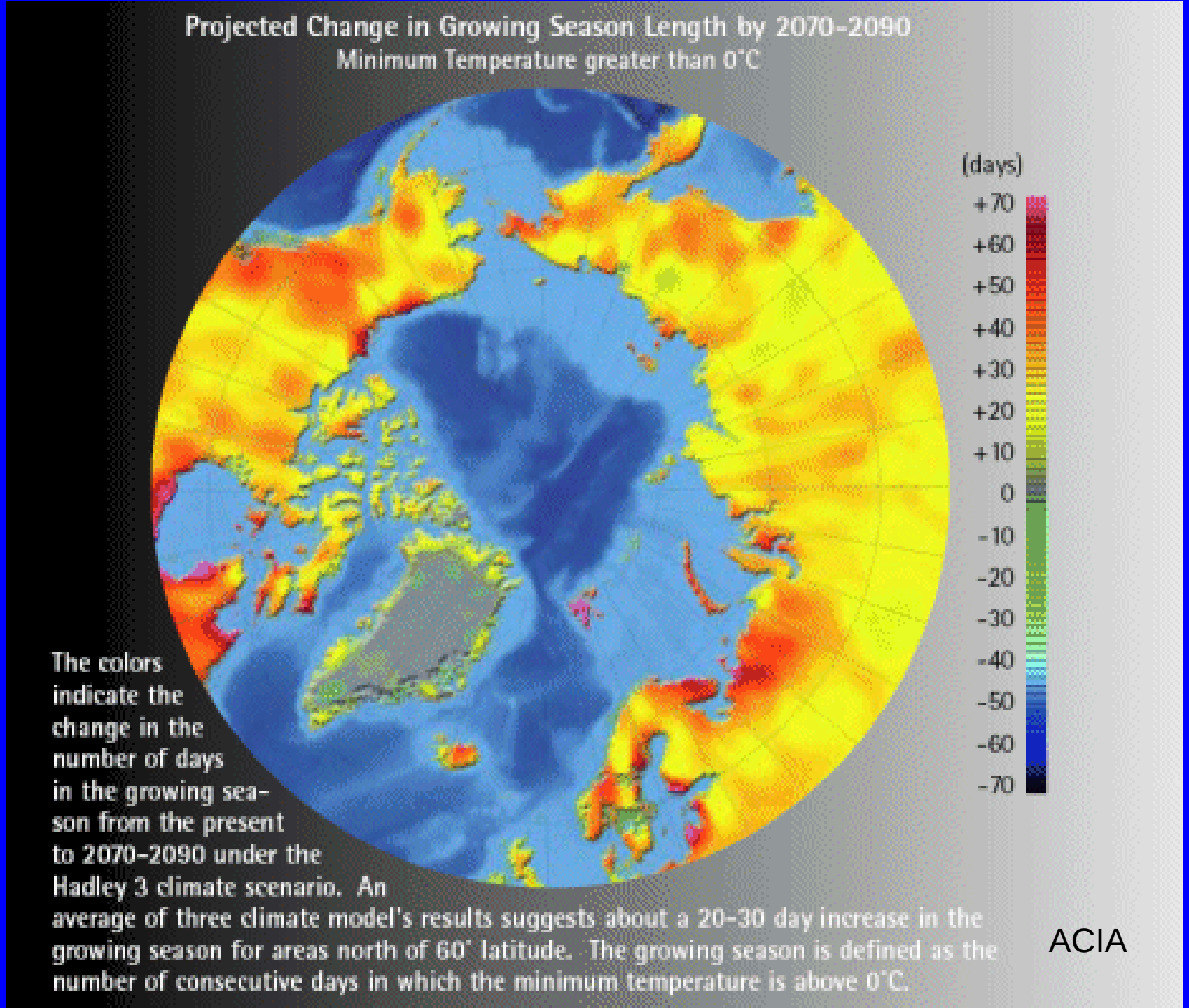
Thermister data from Camp Pond

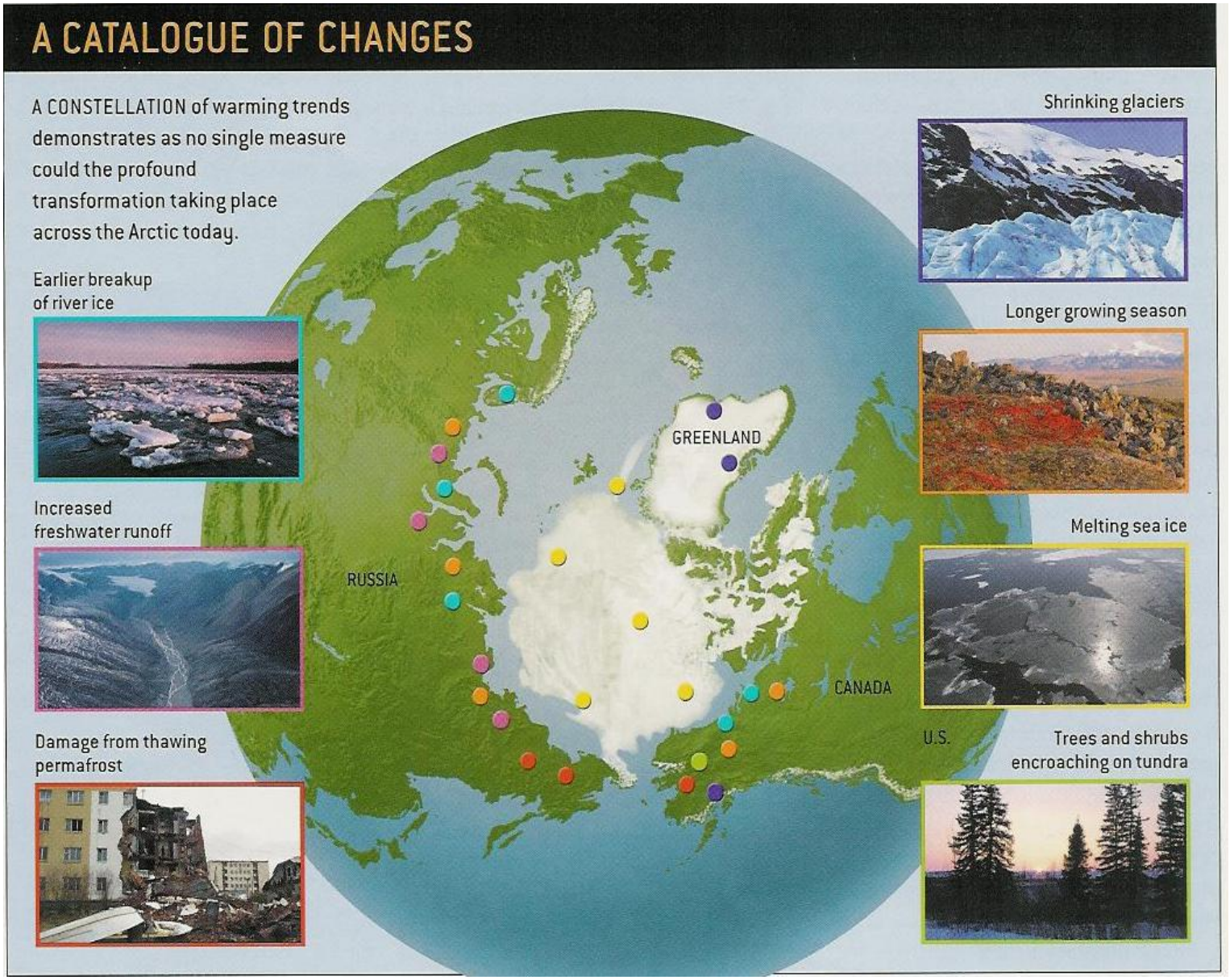
← July 4th 1986



Growing seasons (ice free season in lakes) is longer

(M. Douglas, unpublished data)


Projected Change in Growing Season Length by 2070-2090
Minimum Temperature greater than 0°C
(days)
+70
+60
+50
+40
+30
+20
+10
0
-10
-20
-30
-40
-50
-60
-70
The colors indicate the change in the number of days in the growing season from the present to 2070-2090 under the Hadley 3 climate scenario. An average of three climate model's results suggests about a 20-30 day increase in the growing season for areas north of 60° latitude. The growing season is defined as the number of consecutive days in which the minimum temperature is above 0°C.
ACIA



Sturm, Perovich and Serreze, Sci American 2003


OH, GET SERIOUS! THERE WILL ALWAYS BE ICE IN THE ARCTIC...
ARCTIC SEA ICE MAY BE GONE BY THE YEAR 2040

Thawing ground is disrupting infrastructure

M. Westlake

Landslide over permafrost due to rapid thaw.

Photo:: **Ellesmere Island, August 2005** A. Lewkowicz, U. of Ottawa


C. Vangel 2014

Ice is a platform

e.g., Transportation
Hunting, etc

Global Significance of Polar ~~Lakes~~ Regions

- Polar amplification → Experiencing rapid climate (and environmental change) change → Sentinels of climate change

- Carbon cycle complex and some additional lakes will become sources of greenhouse gases

Feedback Loops

Anthropogenic C emissions

↓

warming climate

↓ +

Melting Permafrost:
peat warming, drying; soil respiration

↓ +

Increased C emissions

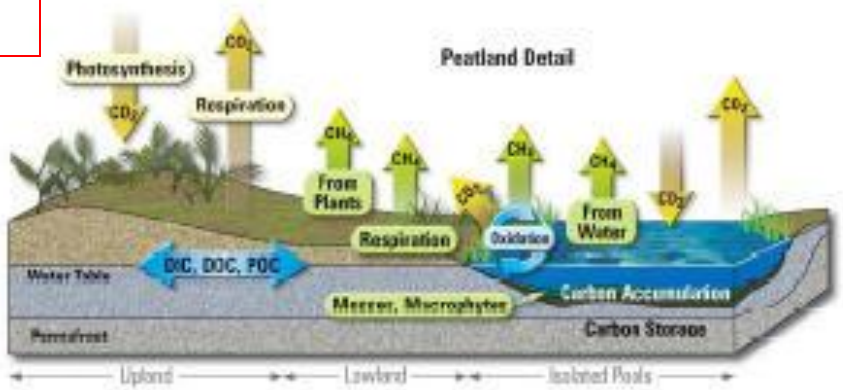
+

CO_2 and CH_4

↑ ↓

Steffan 2006

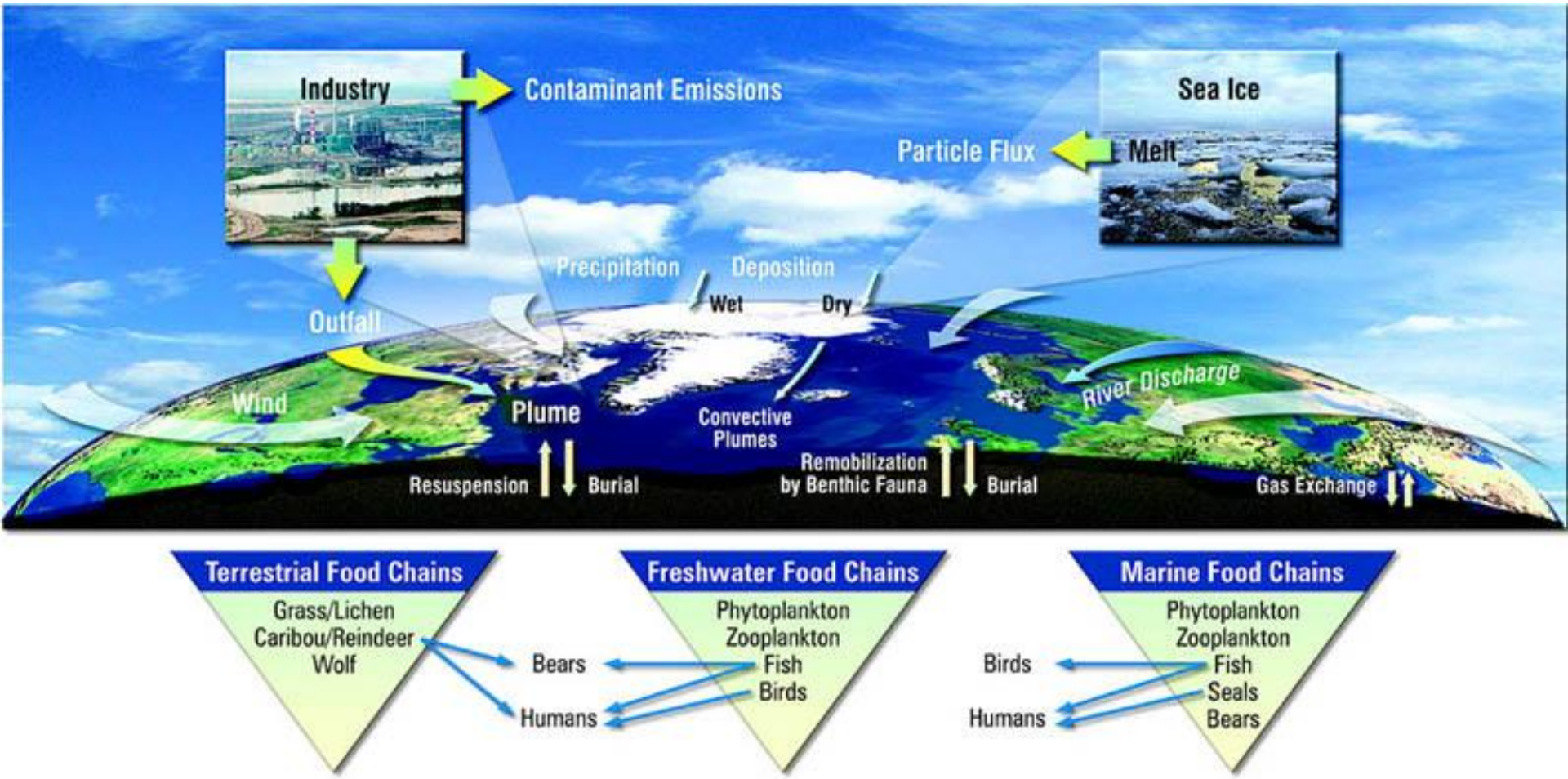
Only one scenario?



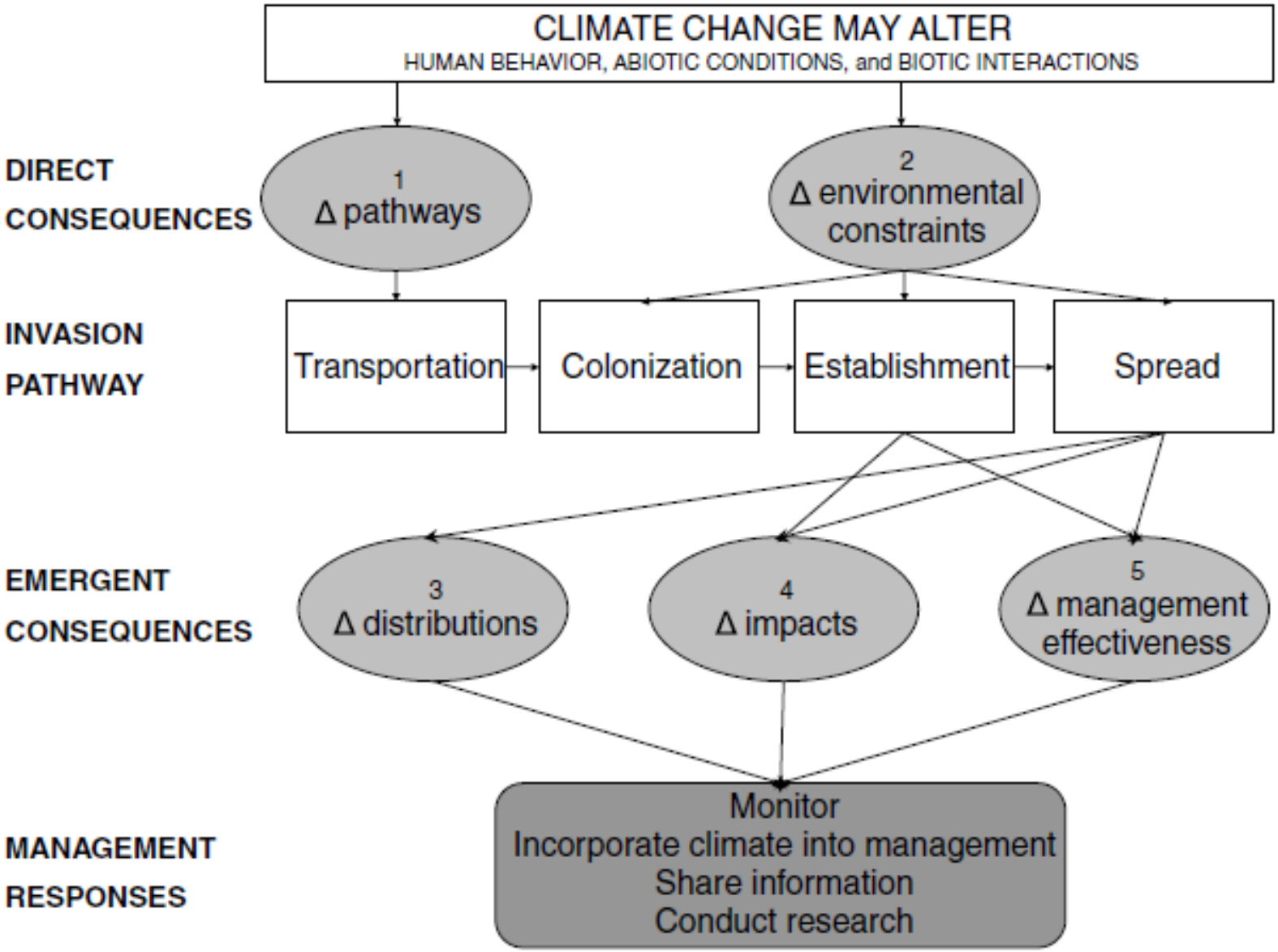
Prowse et al. 2006

Contaminant sources and pathways

e.g., Mercury, Persistant Organic Pollutants (POPs)



Wrona et al. 2006

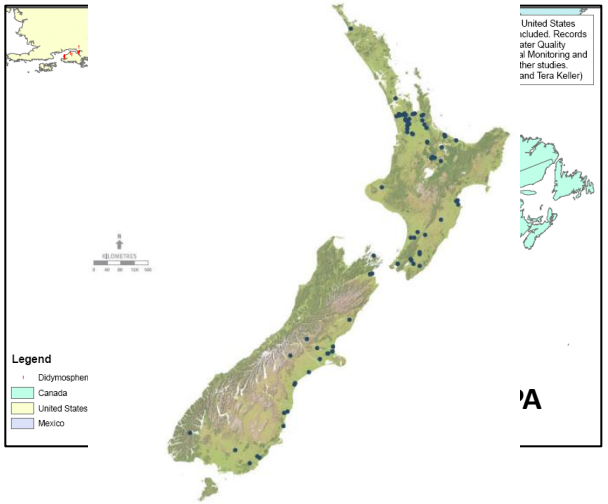


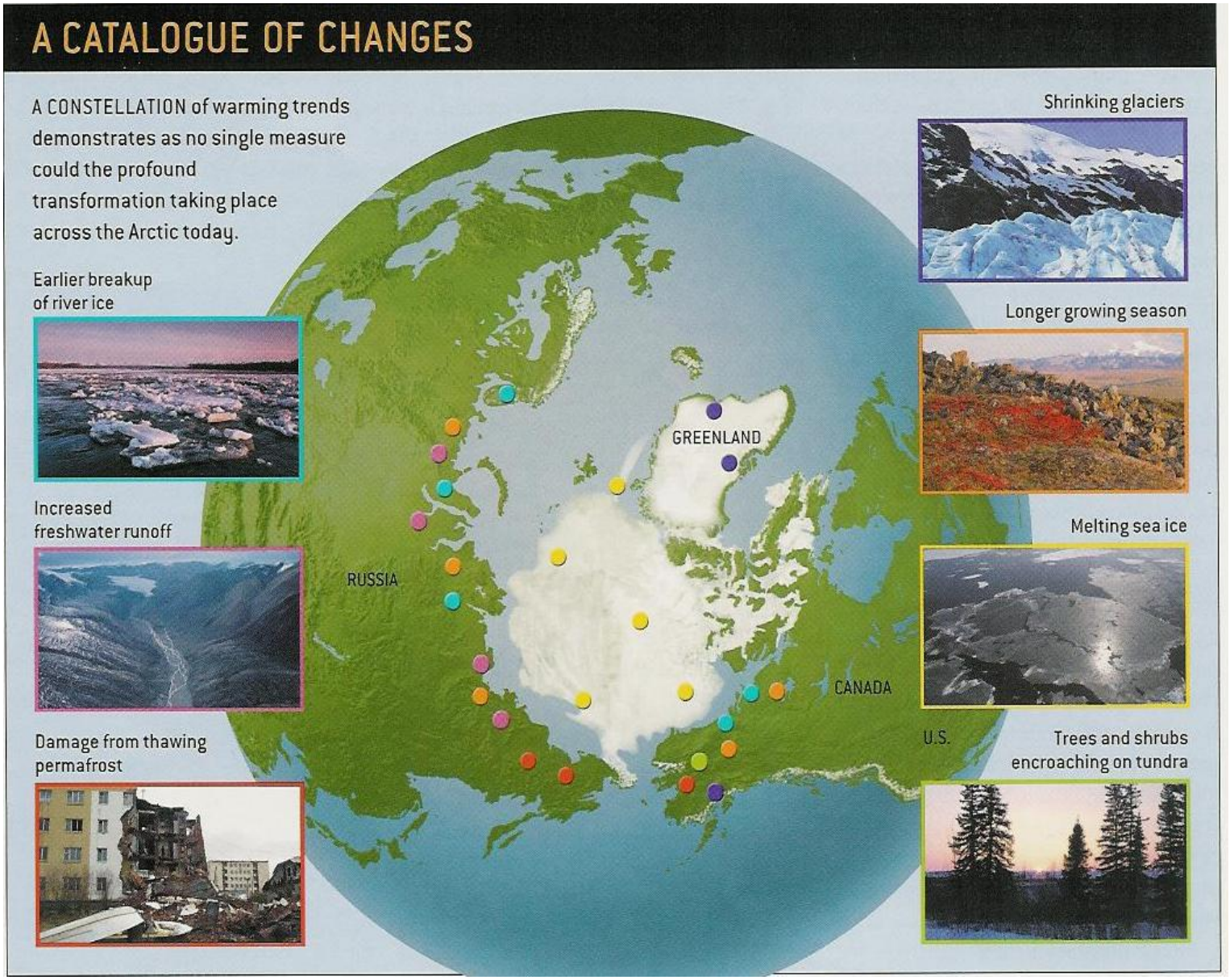
Conservation Biology
Volume 22, No. 3, 2008

Hellman et al 2008

Nuisance freshwater algae (diatom)
e.g., Didymosphenia geminata
(aka "Didymo")

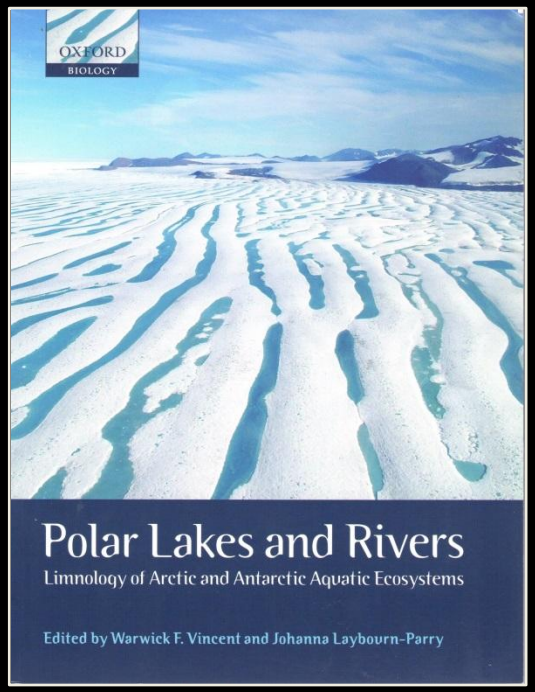
- *Occurrence:* usually oligotrophic streams and rivers throughout western NA, although spreading to east. Non-toxic
- *Threat:* harms aquatic ecosystems through microhabitat alteration in form of massive benthic mats.
- *Impacts:* reduced biodiversity
  nuisance blooms
  fish spawning, food web
- *Concerns:* spreading rapidly
- *Scope of project*: survey and monitoring of sites in Canadian Arctic (and elsewhere); ➔economic impact





Sturm, Perovich and Serreze, Sci American 2003

Thank you!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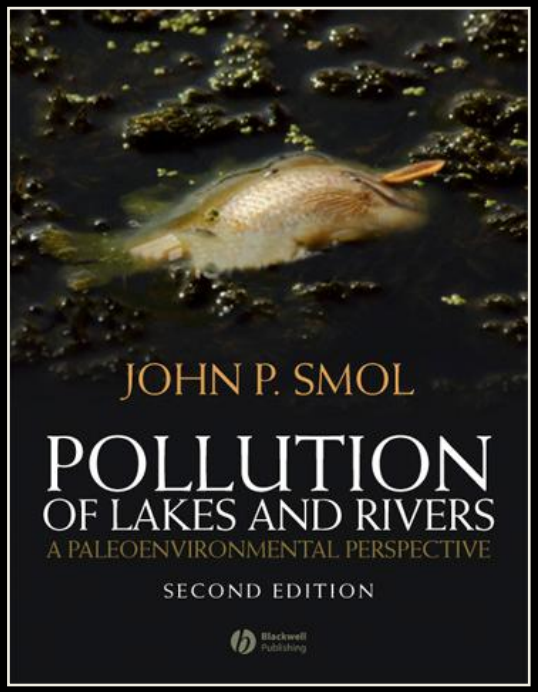
Limnology of Arctic and Antarctic Aquatic Ecosystems
Edited by Warwick F. Vincent and Johanna Laybourn-Parry


JOHN P. SMOL
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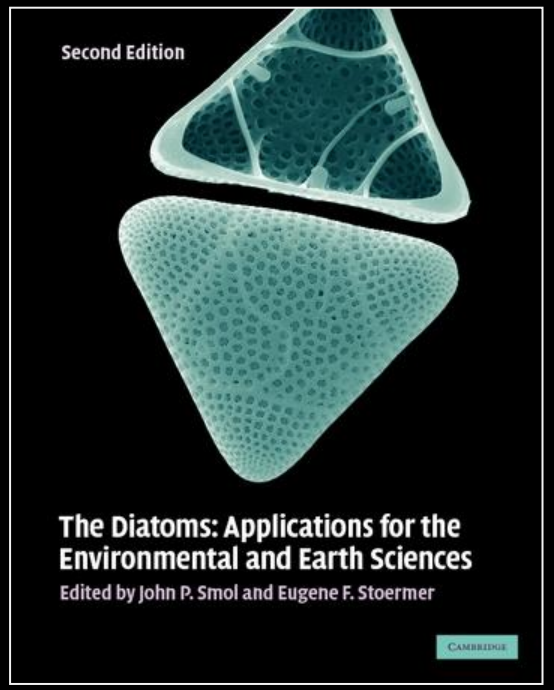
OF LAKES AND RIVERS
A PALEOENVIRONMENTAL PERSPECTIVE
SECOND EDITION
Blackwell Publishing


Second Edition
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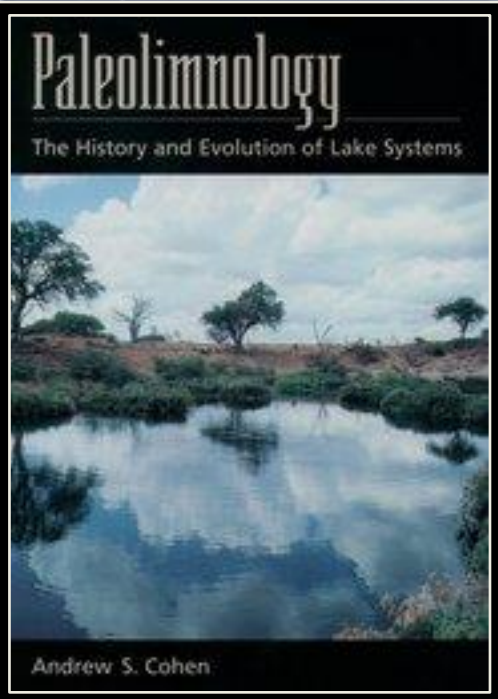
Edited by John P. Smol and Eugene F. Stoermer
CAMBRIDGE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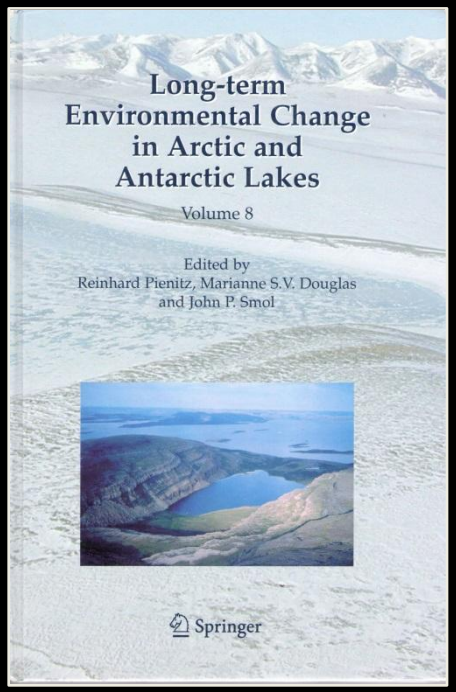
Andrew S. Cohen


John P. Smol Series Editor
Developments in Paleoenvironmental Research
Springer


Long-term Environmental Change in Arctic and Antarctic Lakes
Volume 8
Edited by
Reinhard Pienitz, Marianne S.V. Douglas
and John P. Smol
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