Stephen H. Schneider
Department of Biological Sciences
and
Center for Environmental Science and Policy
Stanford University

Are Animals Responding To Human Induced Climate Change

Preparing For Climate Disruption

Seattle, WA
27 October 2005

[for more details, see: http://stephenschneider.stanford.edu/]
{also: climatechange.net}

Stolen From…➔

A Global Signal Seen in Plant & Animal Changes

Terry L. Root

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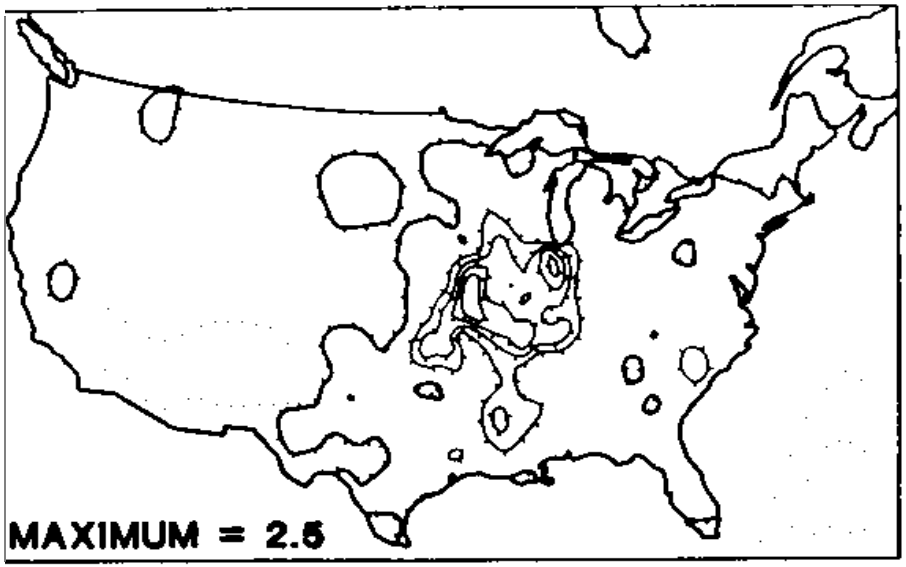
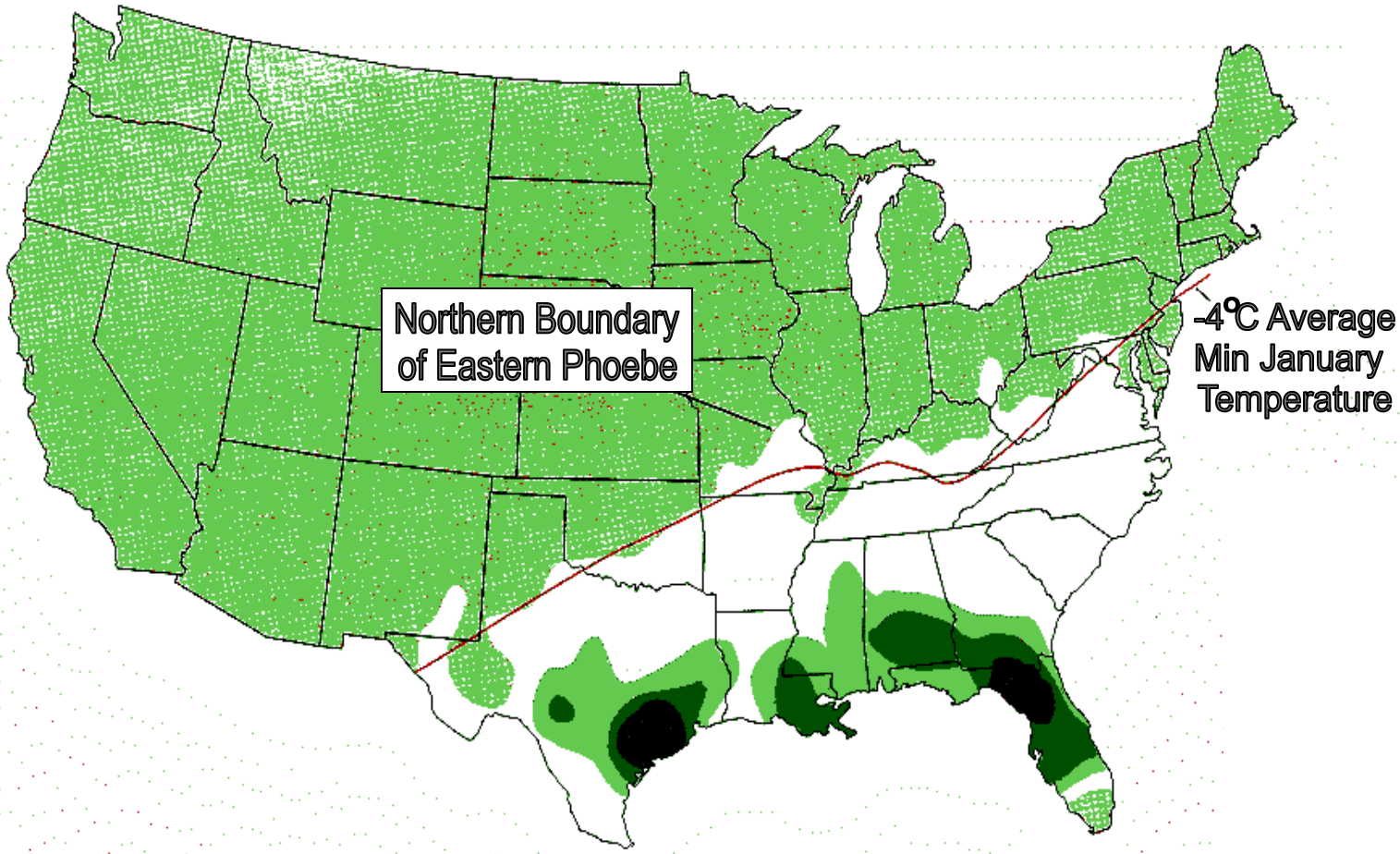
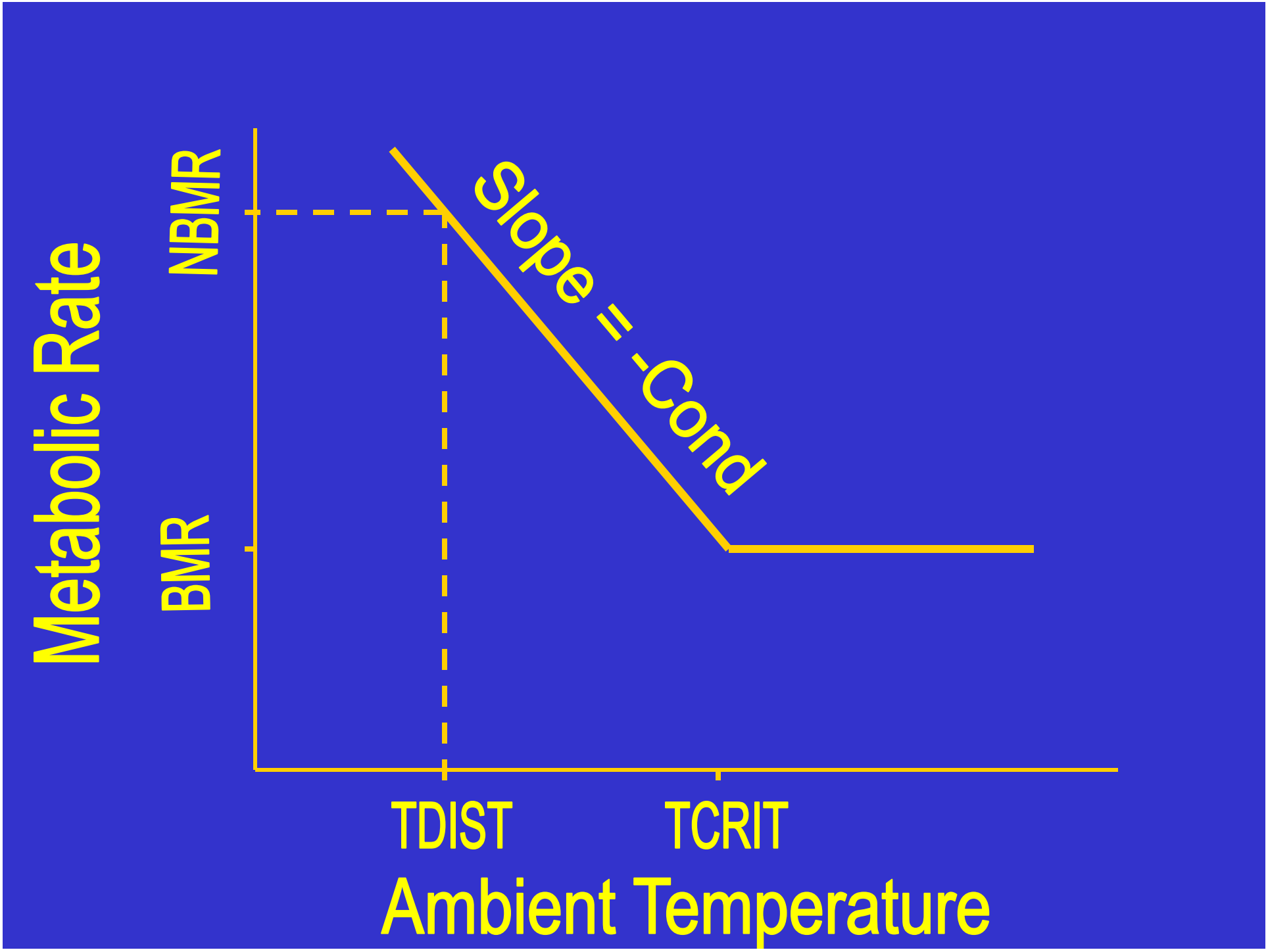
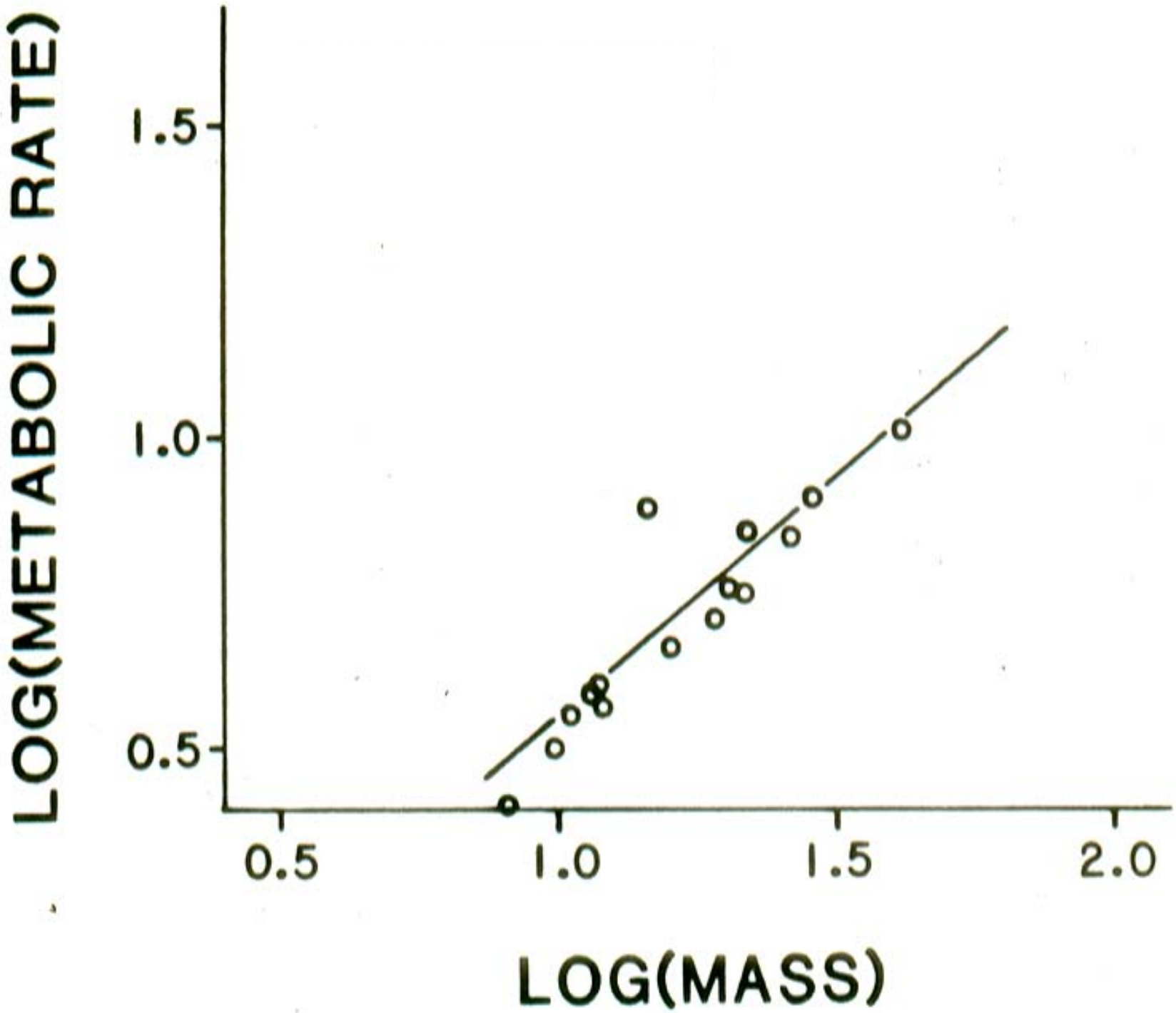
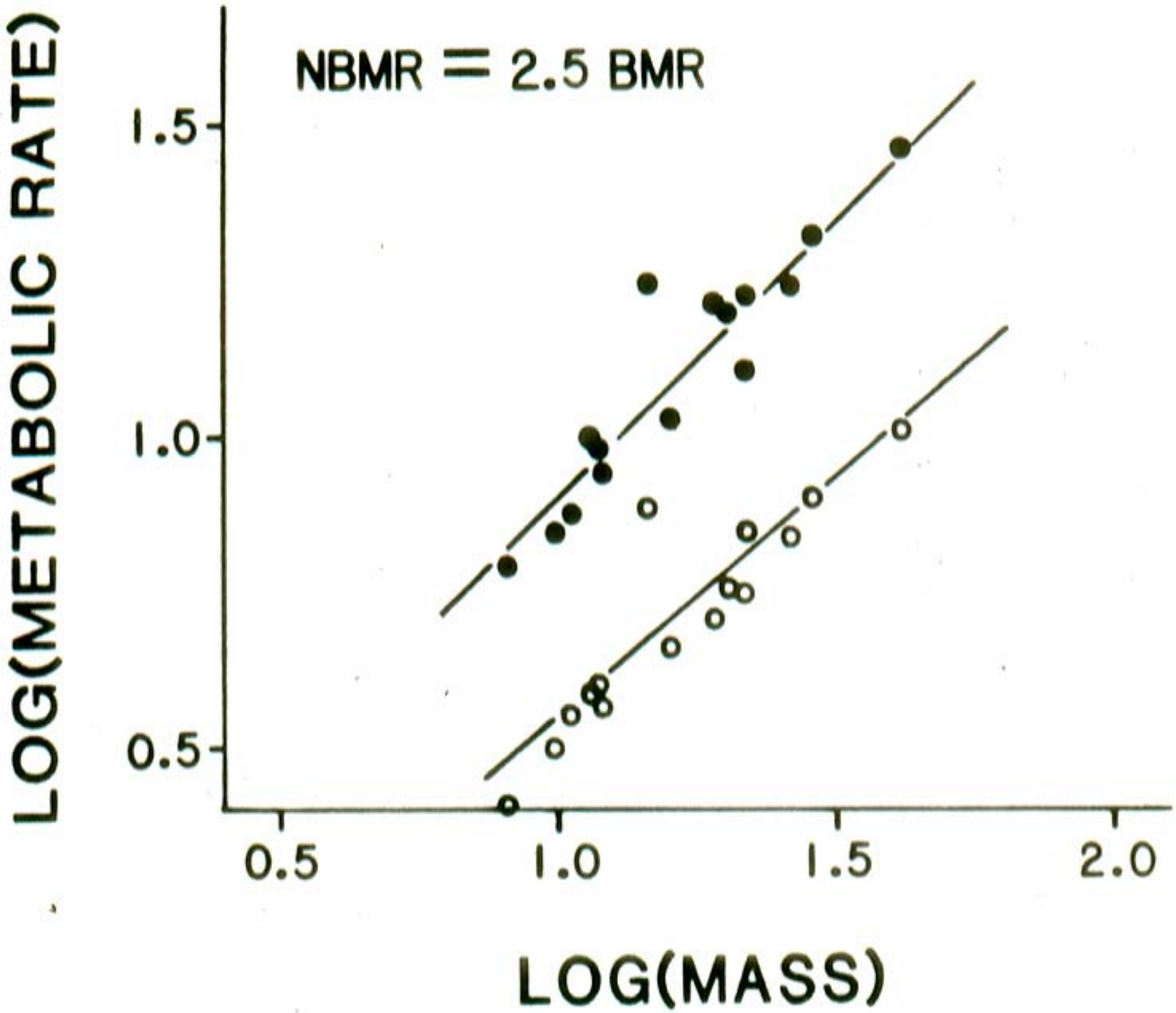
RED-HEADED WOODPECKER

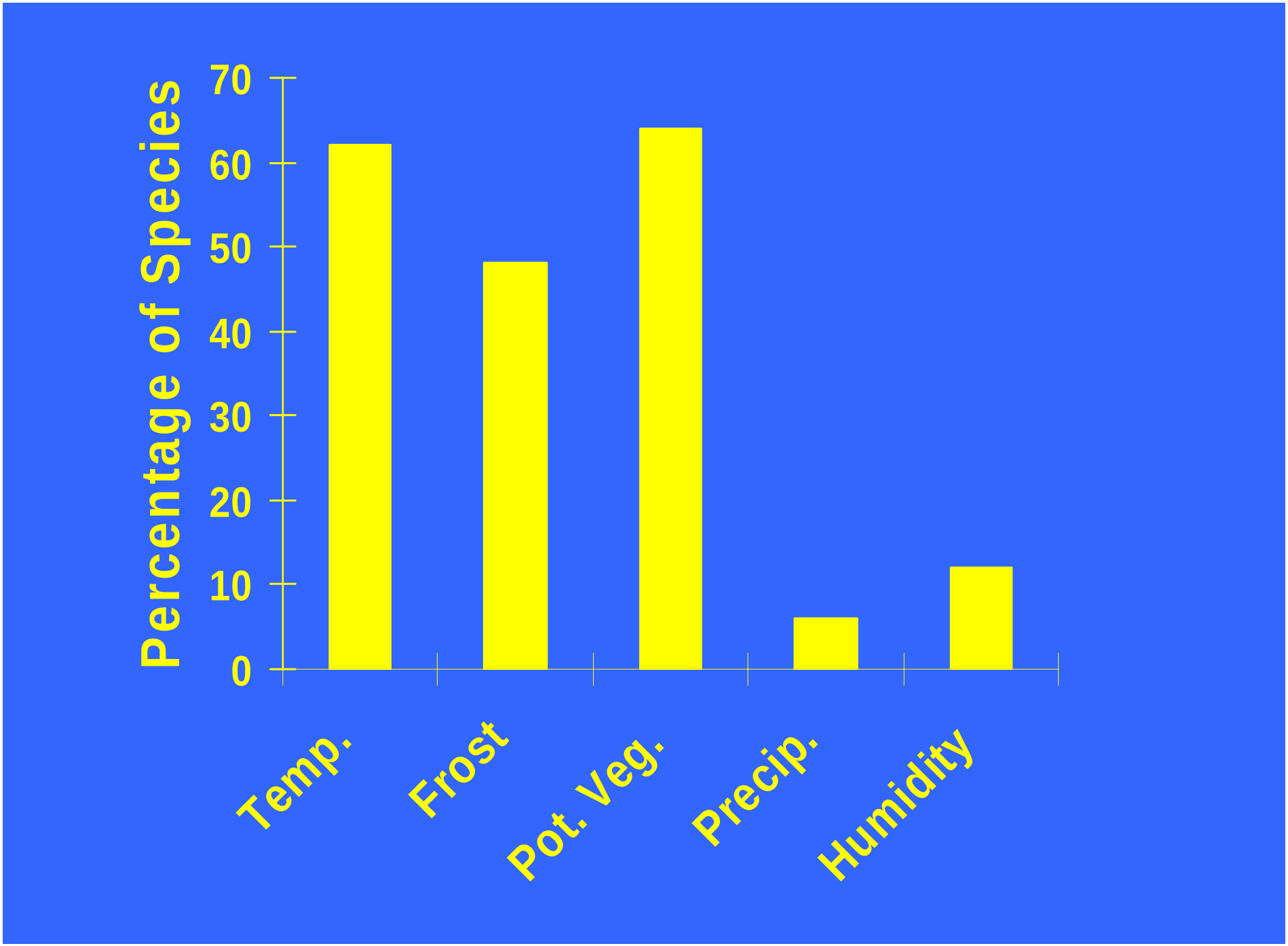


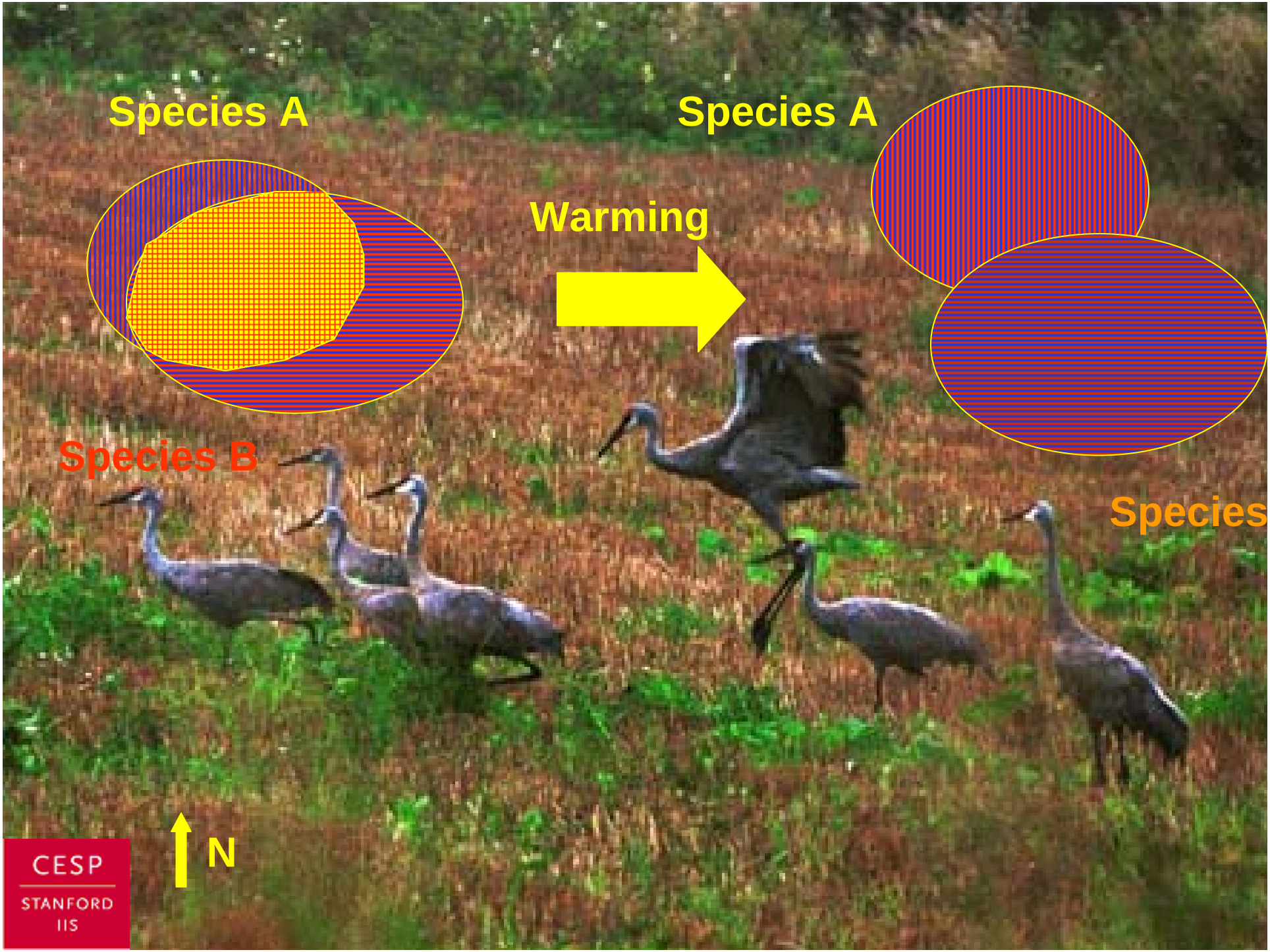

Northern Boundary
of Eastern Phoebe
-4°C Average
Min January
Temperature


Metabolic Rate
NBMR
BMR
Slope = -Cond
TDIST
TCRIT
Ambient Temperature


LOG(METABOLIC RATE)
1.5
1.0
0.5
0.5
1.0
1.5
2.0
LOG(MASS)


NBMR = 2.5 BMR
LOG(METABOLIC RATE)
1.5
1.0
0.5
0.5
1.0
1.5
2.0
LOG(MASS)


Percentage of Species
70
60
50
40
30
20
10
0
Temp.
Frost
Pot. Veg.
Precip.
Humidity


Species A
Species A
Warming
Species B
Species
N
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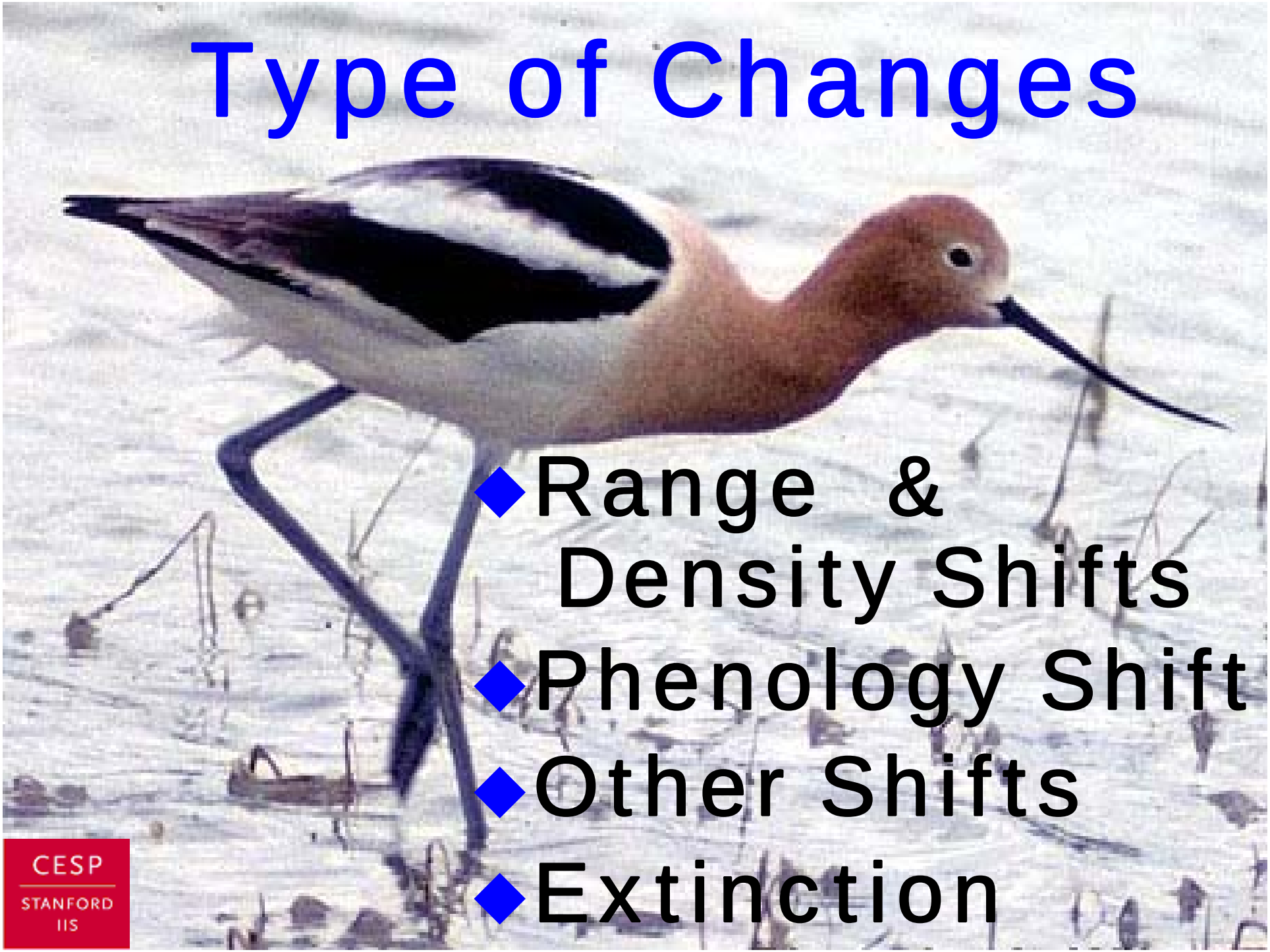
Type of Changes



- Range & Density Shifts
- Phenology Shift
- Other Shifts
- Extinction

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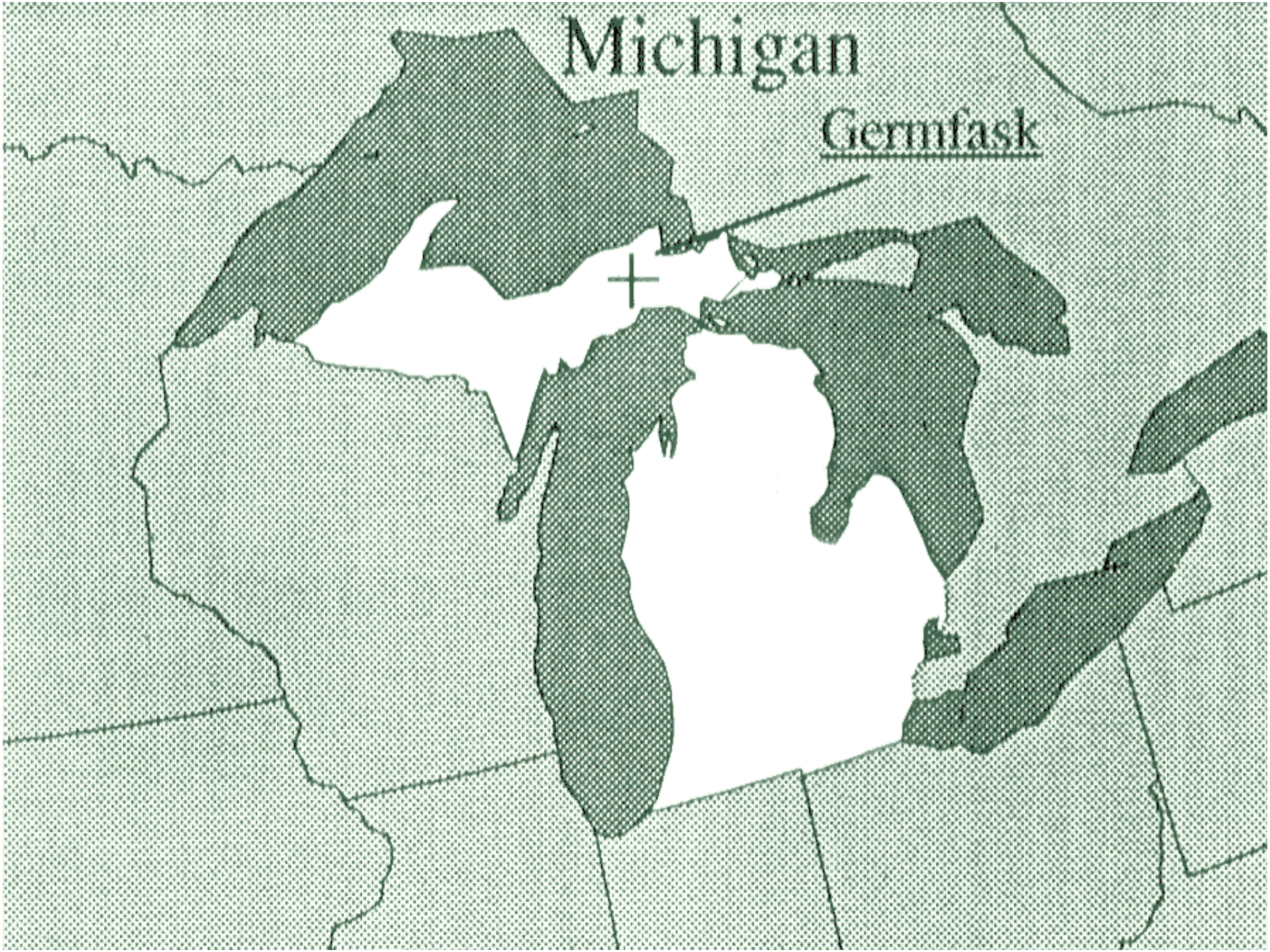
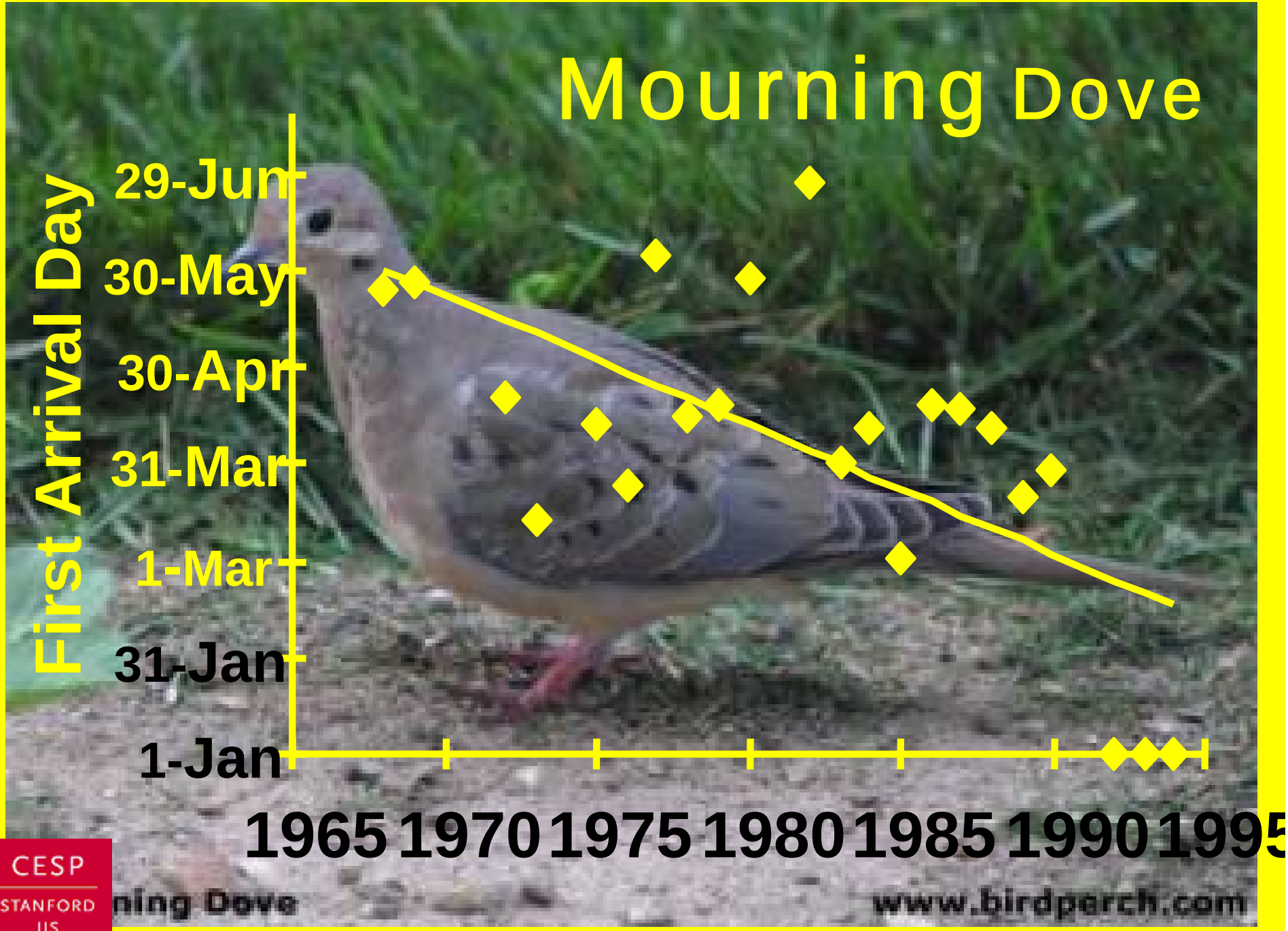

Michigan
Germfask

47 Total Species

13 Non-passerines

34 Passerines



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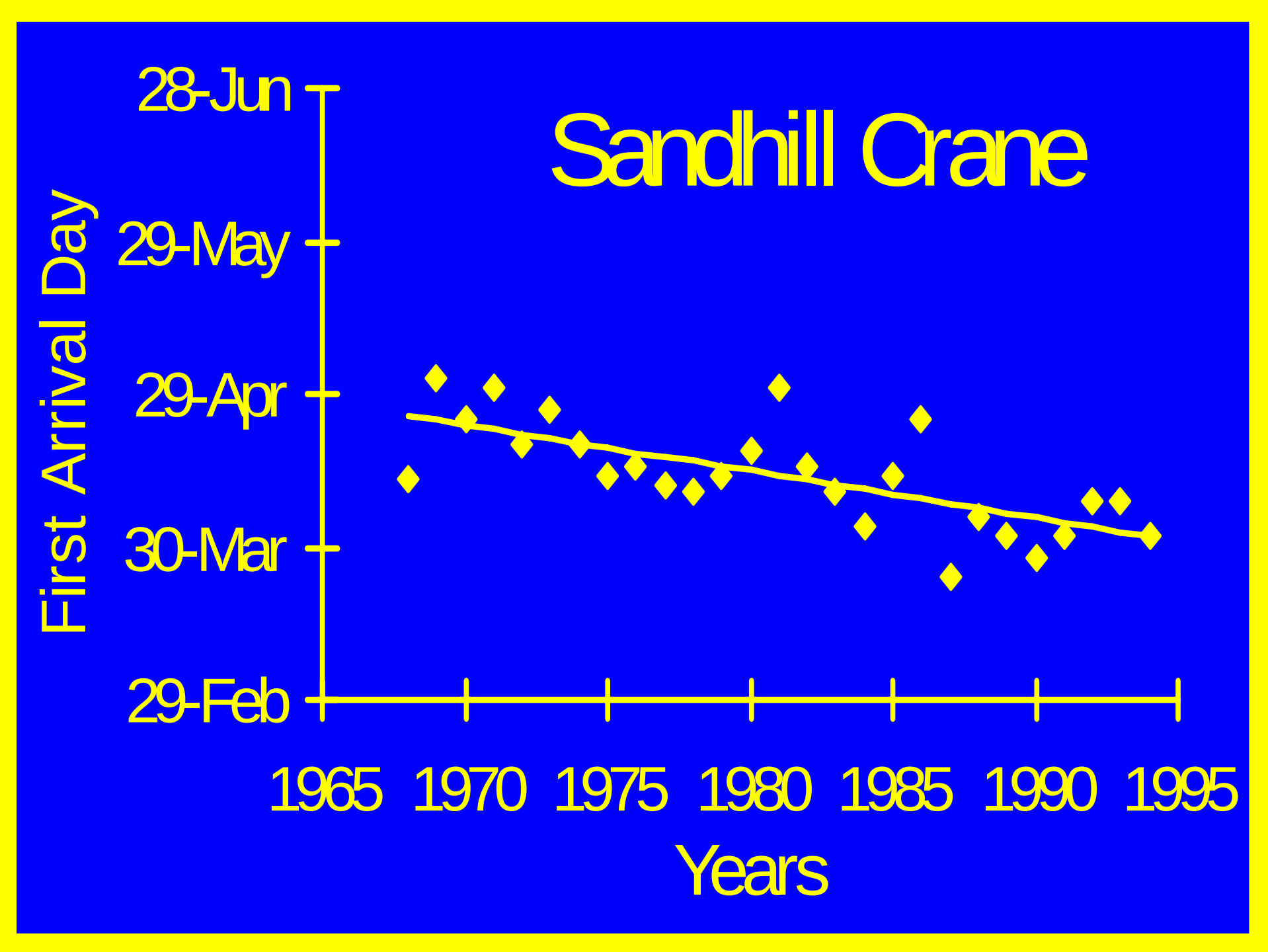
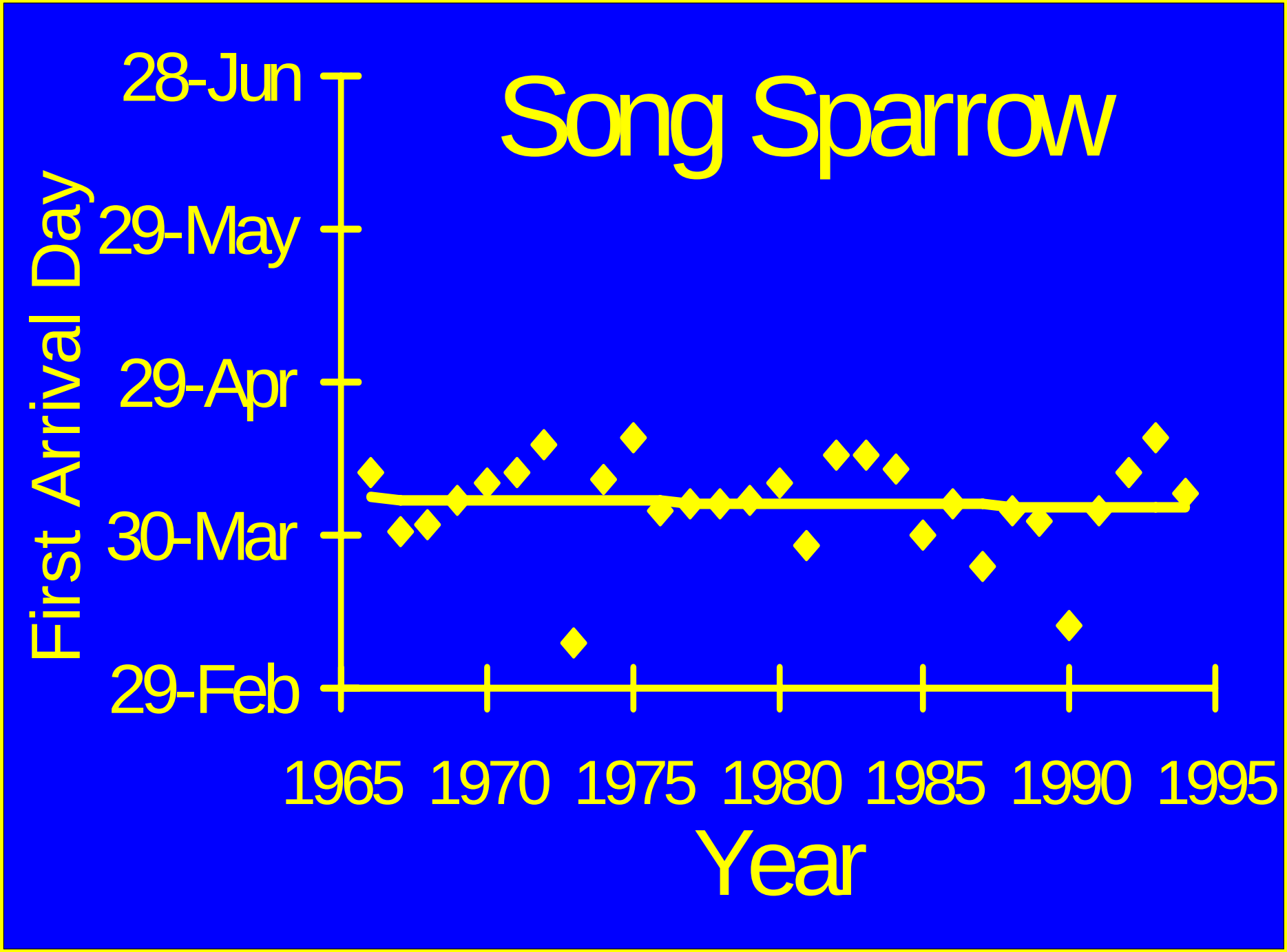
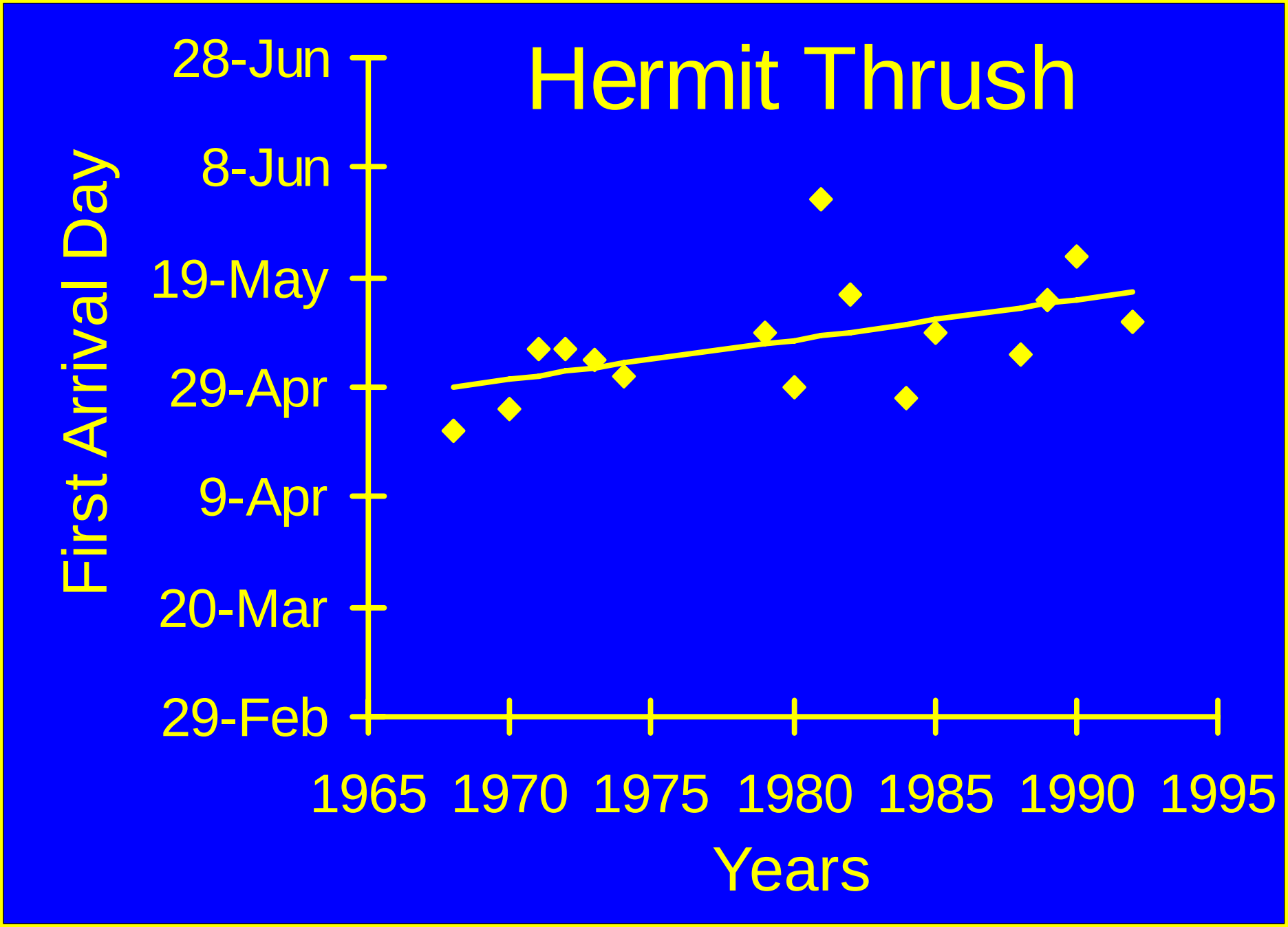
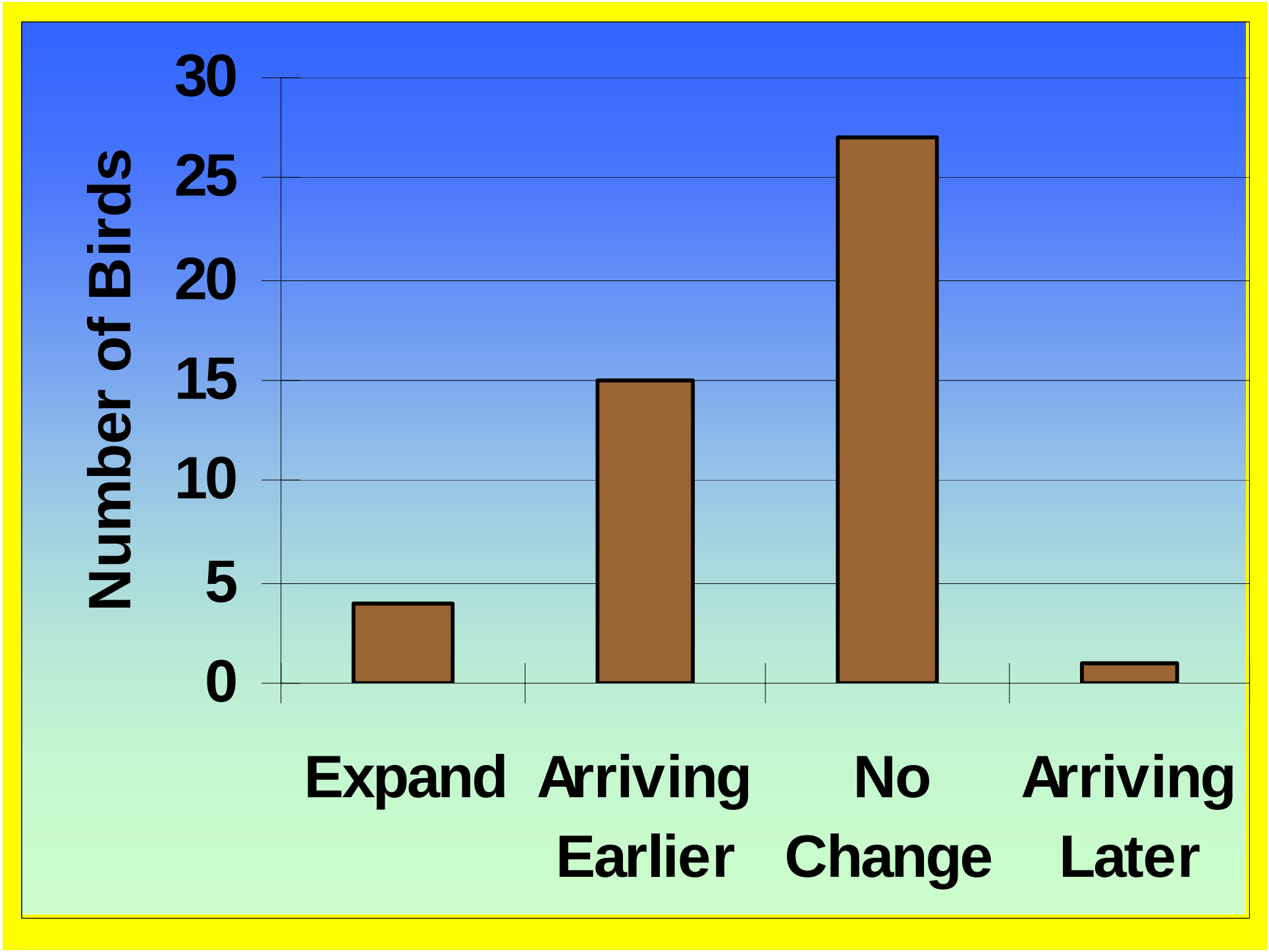
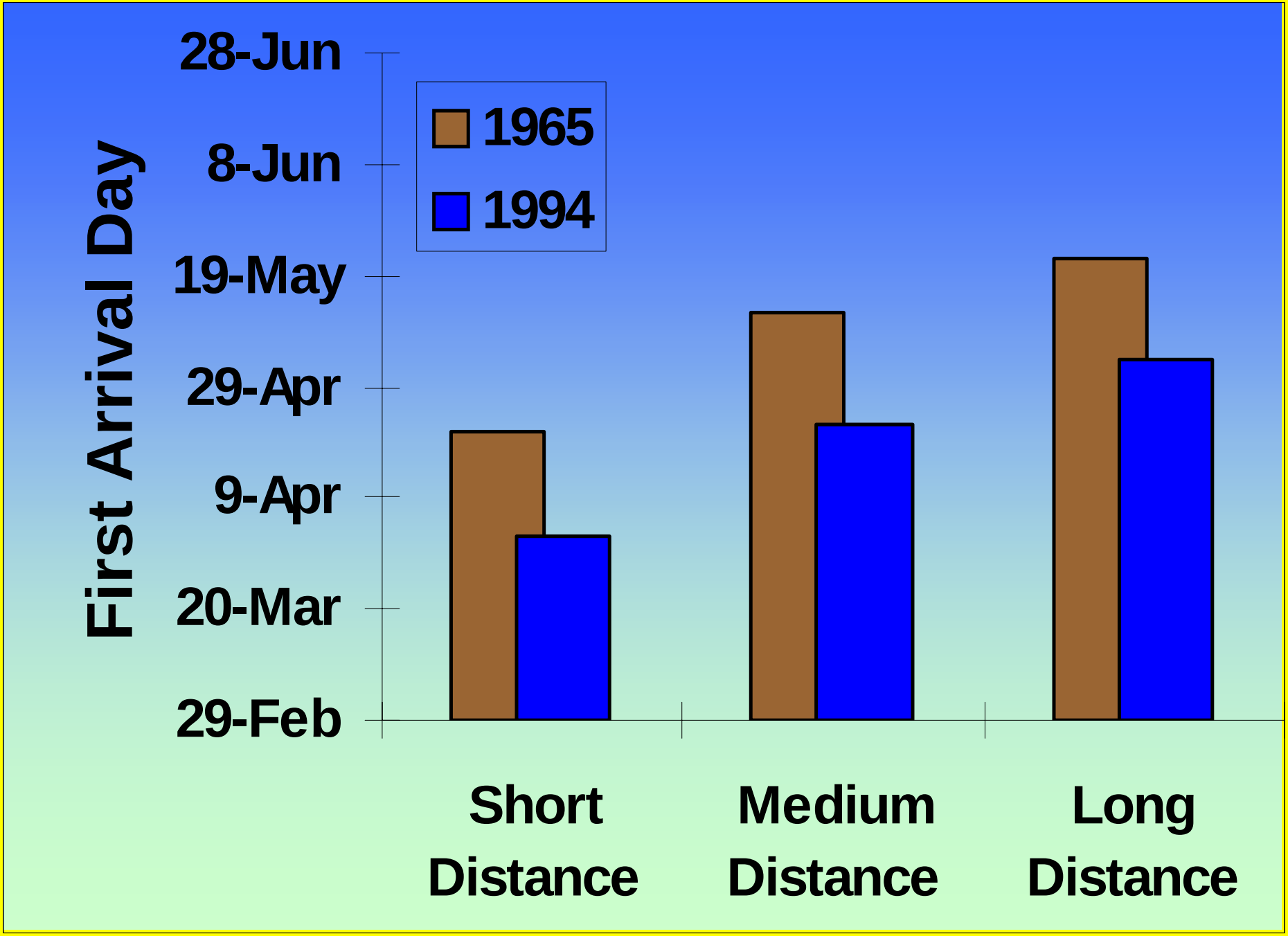

Sandhill Crane
First Arrival Day
28-Jun
29-May
29-Apr
30-Mar
29-Feb
1965
1970
1975
1980
1985
1990
1995
Years


Song Sparrow
28-Jun
29-May
29-Apr
30-Mar
29-Feb
First Arrival Day
1965
1970
1975
1980
1985
1990
1995
Year


Hermit Thrush
First Arrival Day
28-Jun
8-Jun
19-May
29-Apr
9-Apr
20-Mar
29-Feb
1965
1970
1975
1980
1985
1990
1995
Years


Number of Birds
30
25
20
15
10
5
0
Expand
Arriving Earlier
No Change
Arriving Later


First Arrival Day
28-Jun
8-Jun
19-May
29-Apr
9-Apr
20-Mar
29-Feb
1965
1994
Short Distance
Medium Distance
Long Distance

letters to nature

Fingerprints of global warming on wild animals and plants

Terry L. Root*, Jeff T. Price†, Kimberly R. Hall‡, Stephen H. Schneider§, Cynthia Rosenzweig‖ & J. Alan Pounds¶

Nature, Vol 421 pp57-60, 2003

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Spring
Phenology
Studies
694+ Species
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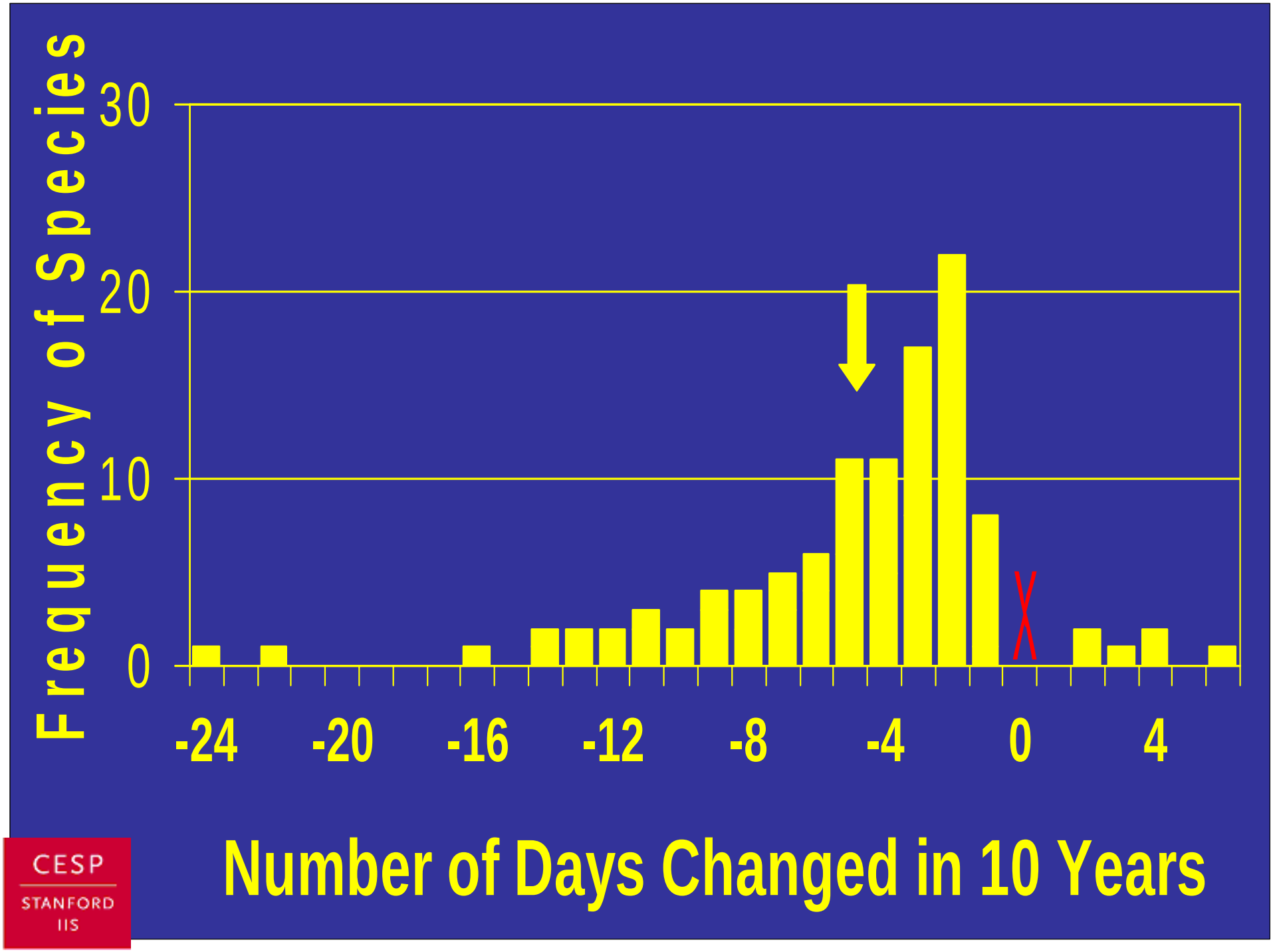

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Human-modified temperatures induce species changes: Joint attribution

Terry L. Root*, Dena P MacMynowski, Michael D. Mastrandrea, and Stephen H. Schneider

Center for Environmental Science and Policy, Stanford Institute for International Studies, Stanford University, Stanford, CA 94305-6055

PNAS, Vol 102, pp 7465-7469, 2005

Joint Attribution*

1. Humans Changing Regional Temperatures

   ("Discernible 1"--IPCC WG 1, 1996)

*AND

2. Human-Changed Regional Temperatures Changing Species

   ("Discernible 2"—IPCC WG 2, 2001)

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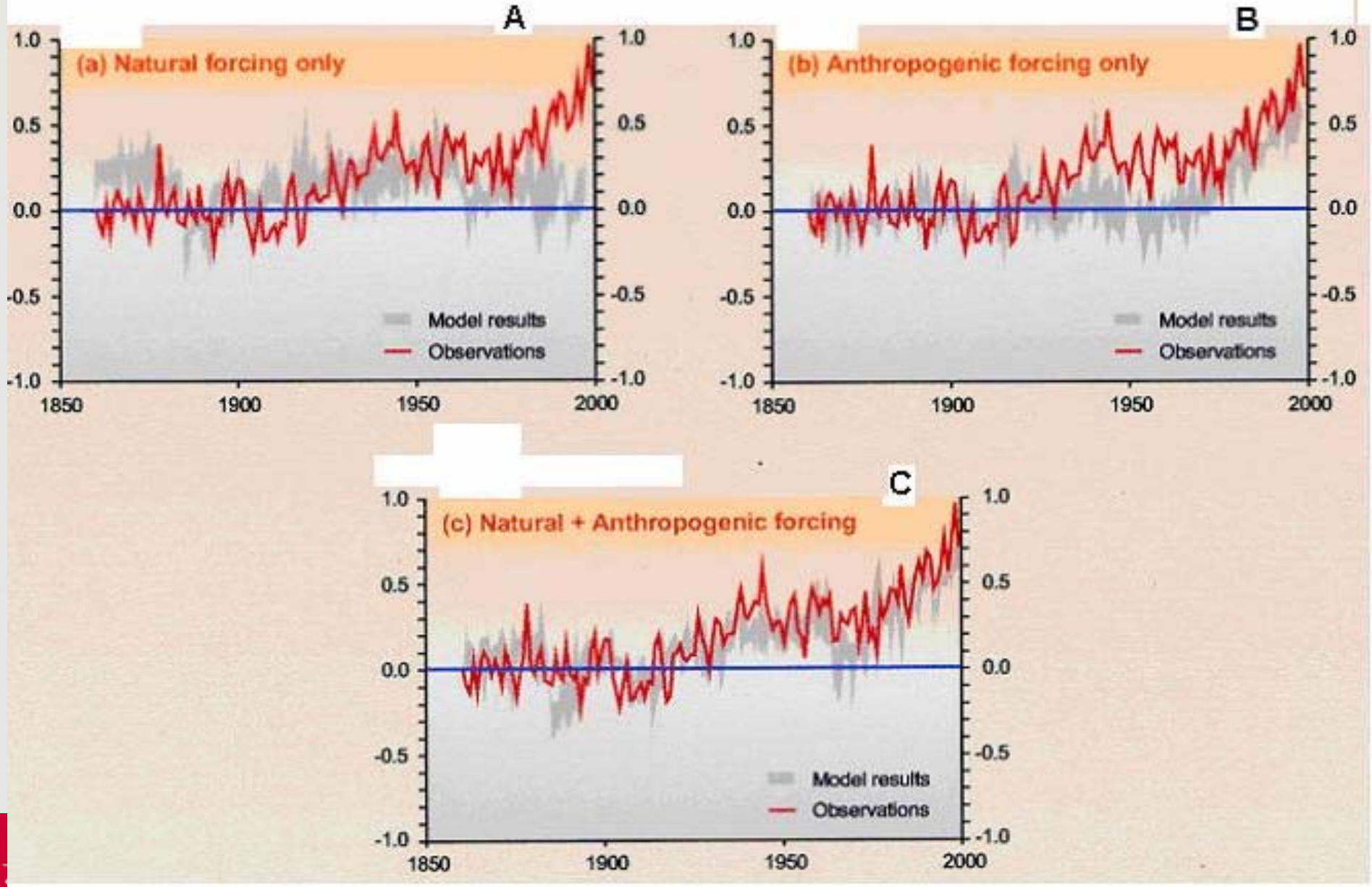
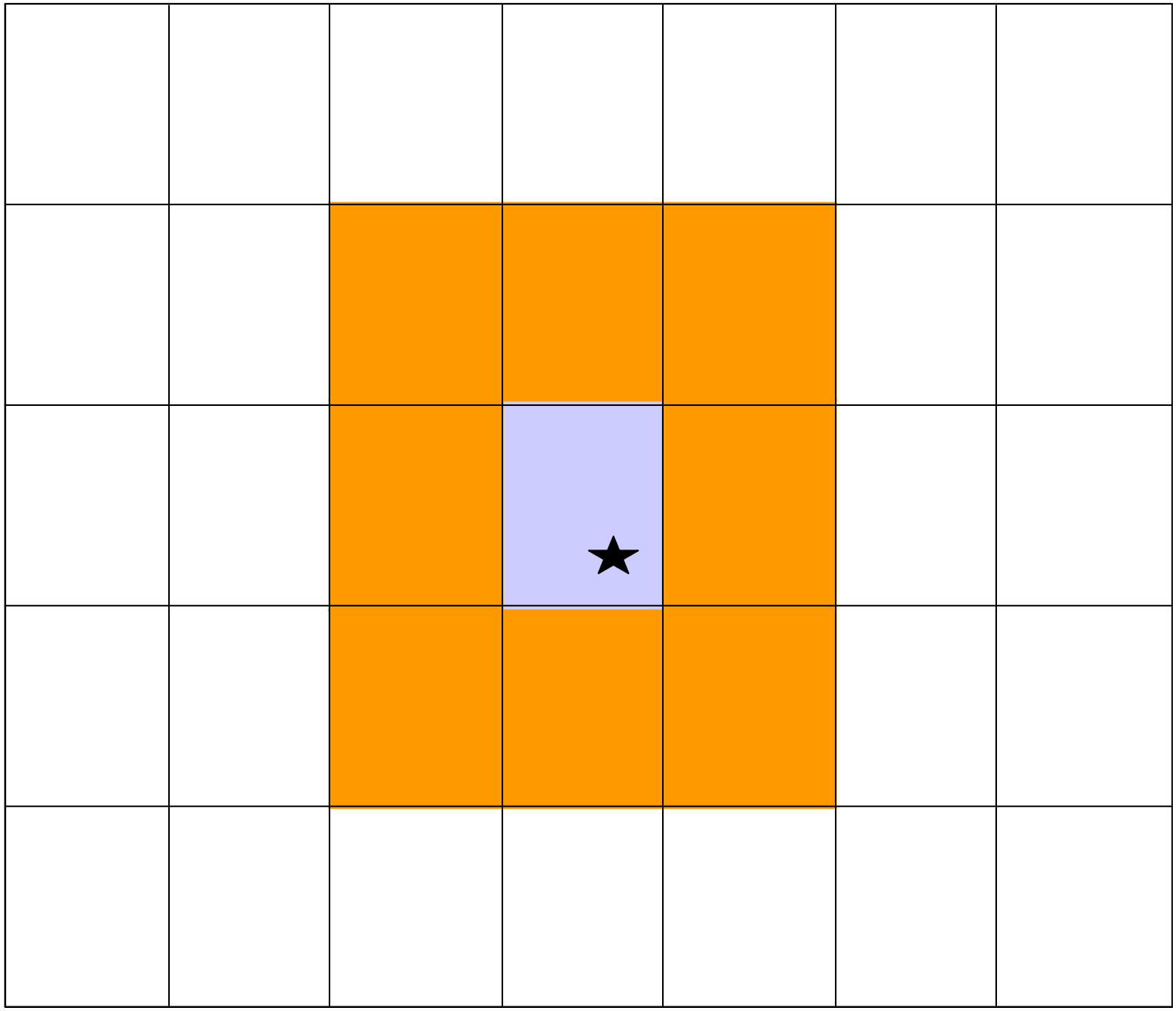
Comparison between model and observations of the temperature rise since 1860





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Joint Attribution

Also

Species as Proxies

Validate HadCM3

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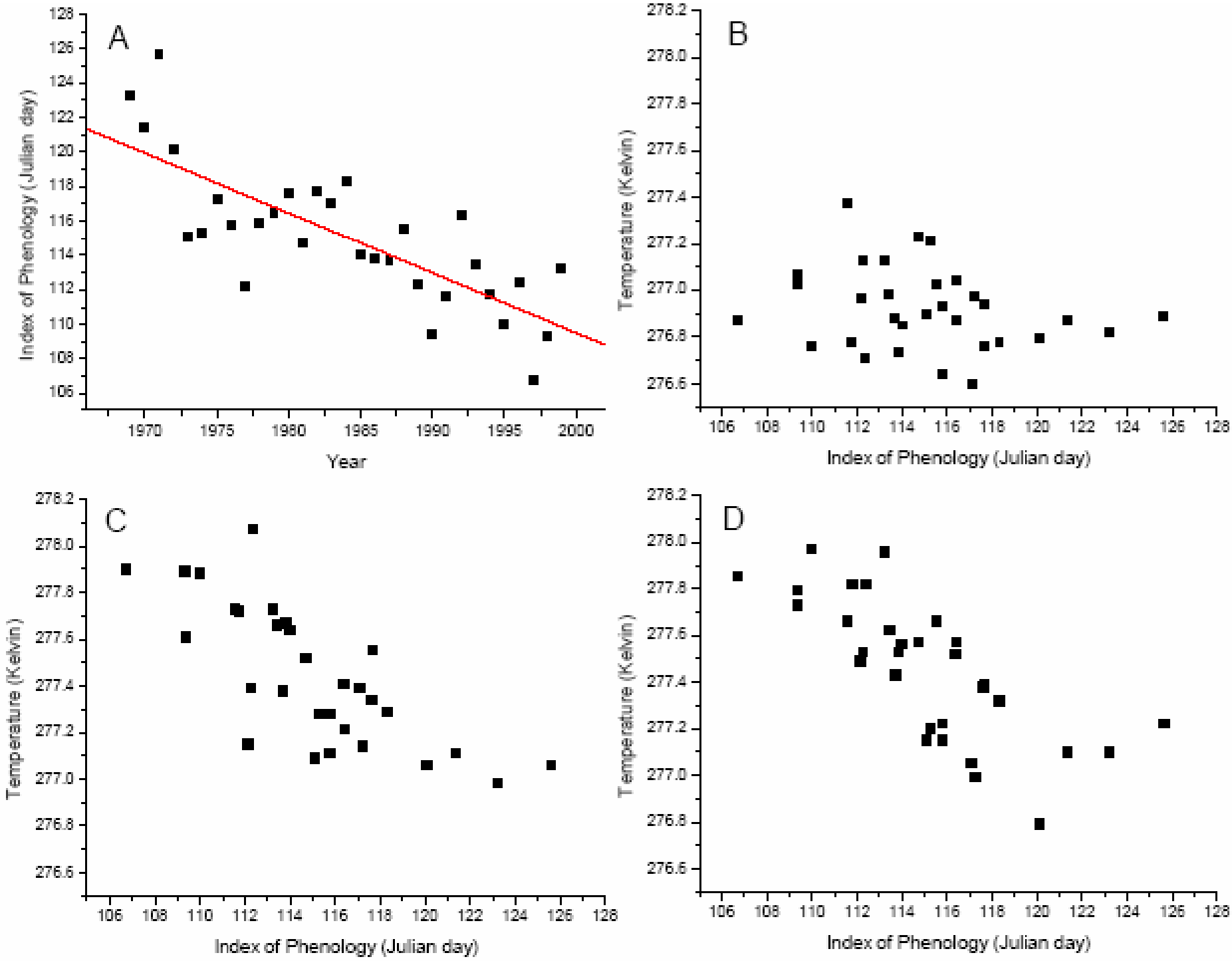
A
Index of Phenology (Julian day)
Year
B
Temperature (Kelvin)
Index of Phenology (Julian day)
C
Temperature (Kelvin)
Index of Phenology (Julian day)
D
Temperature (Kelvin)
Index of Phenology (Julian day)

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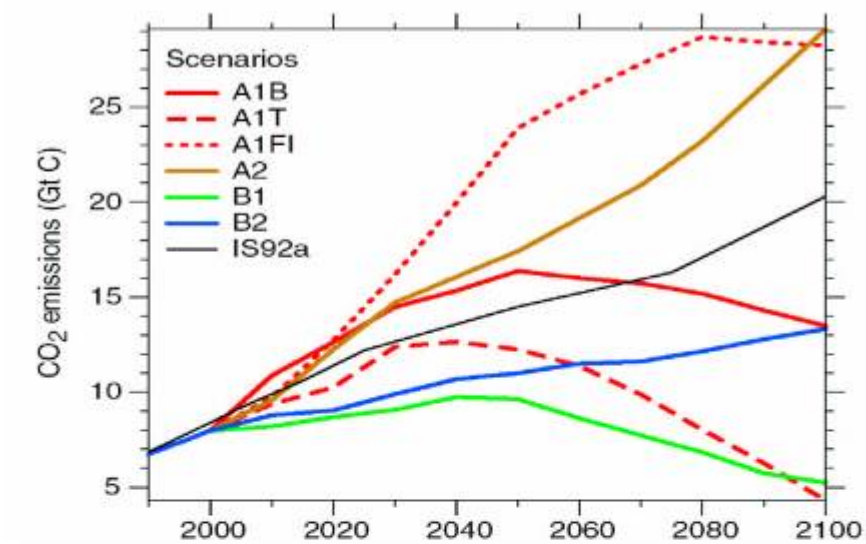
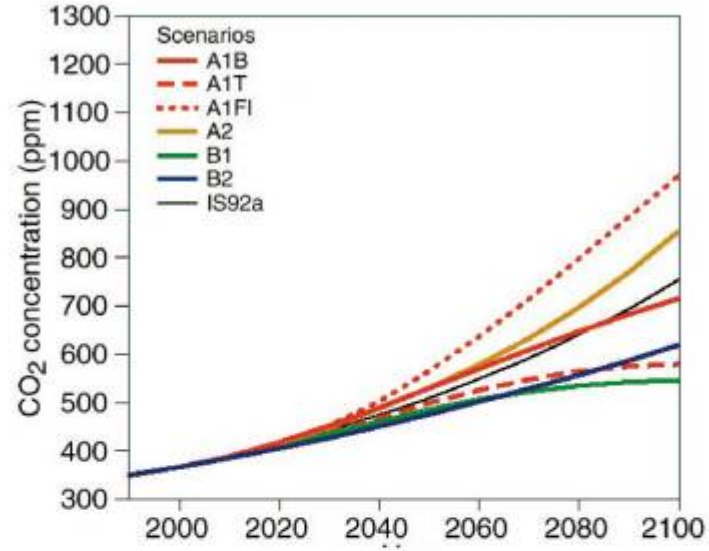
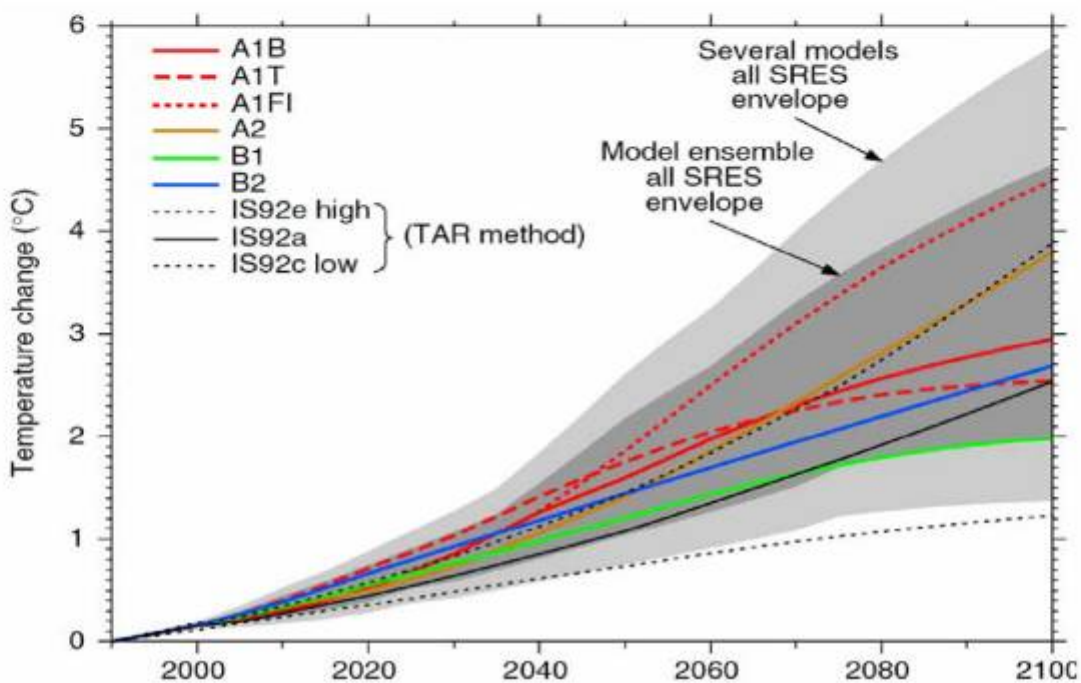
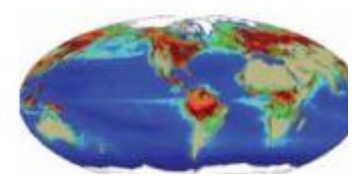
IPCC Scenarios

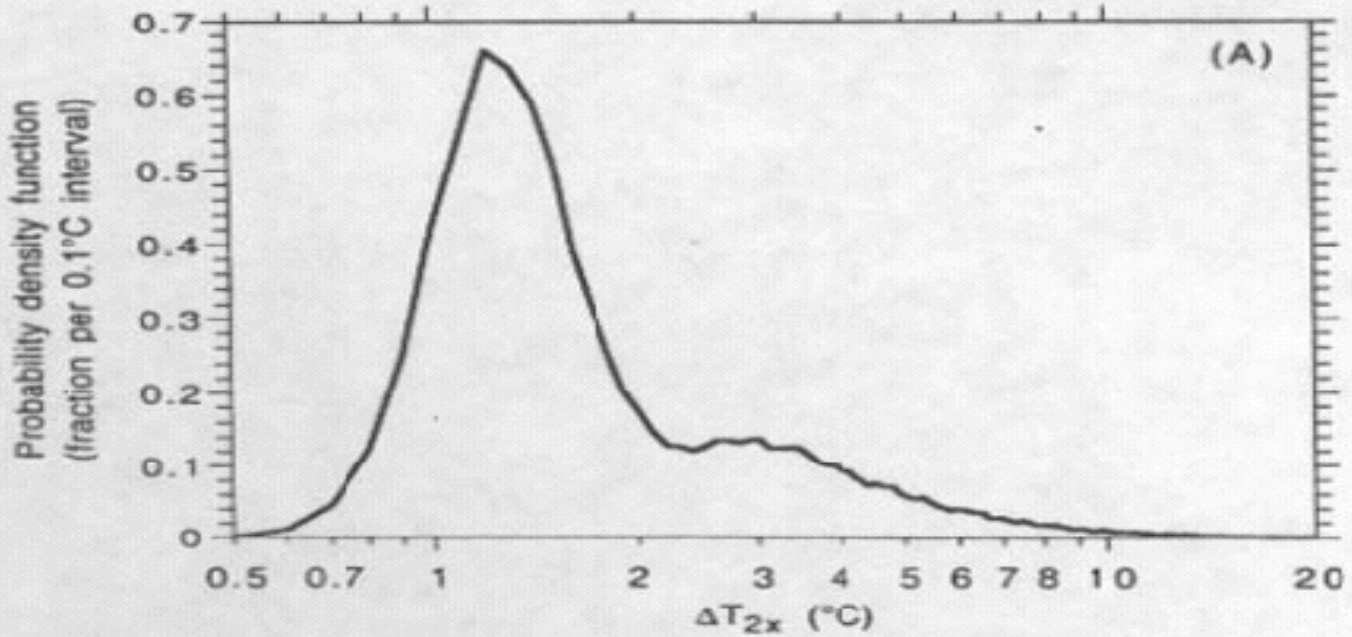
Lead to a range of emissions and atmospheres and warming

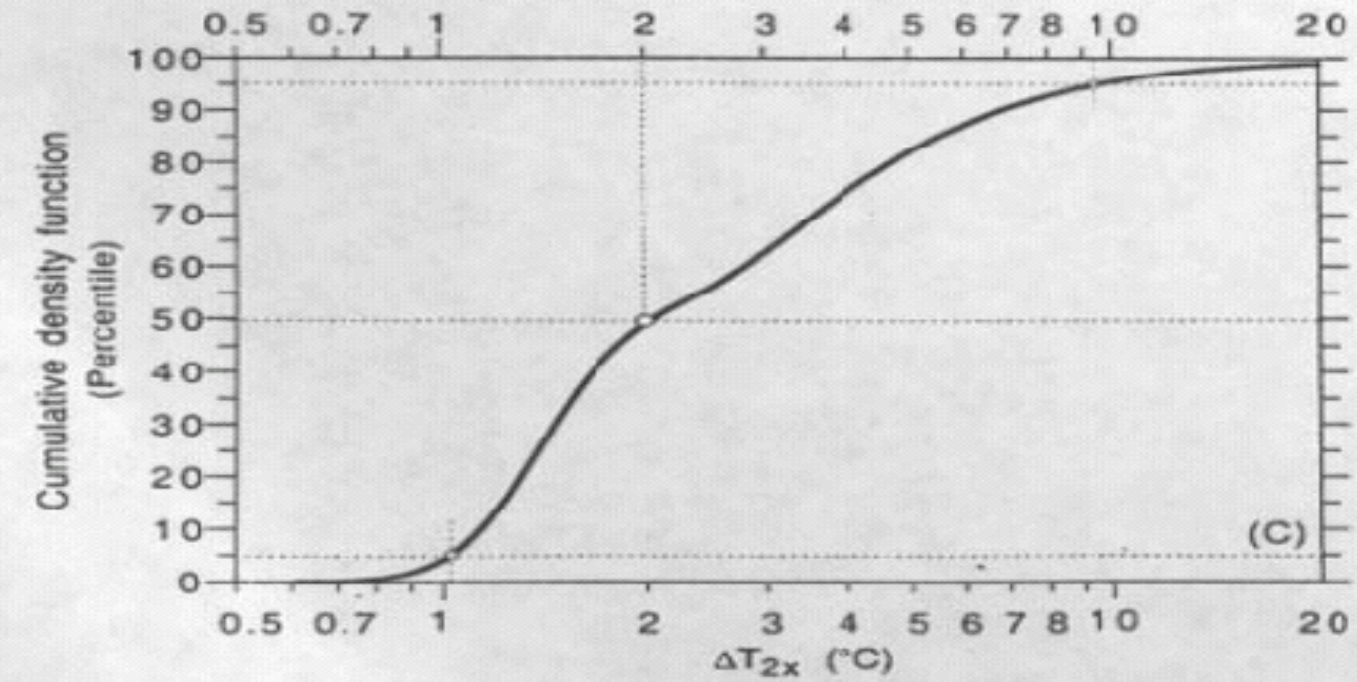


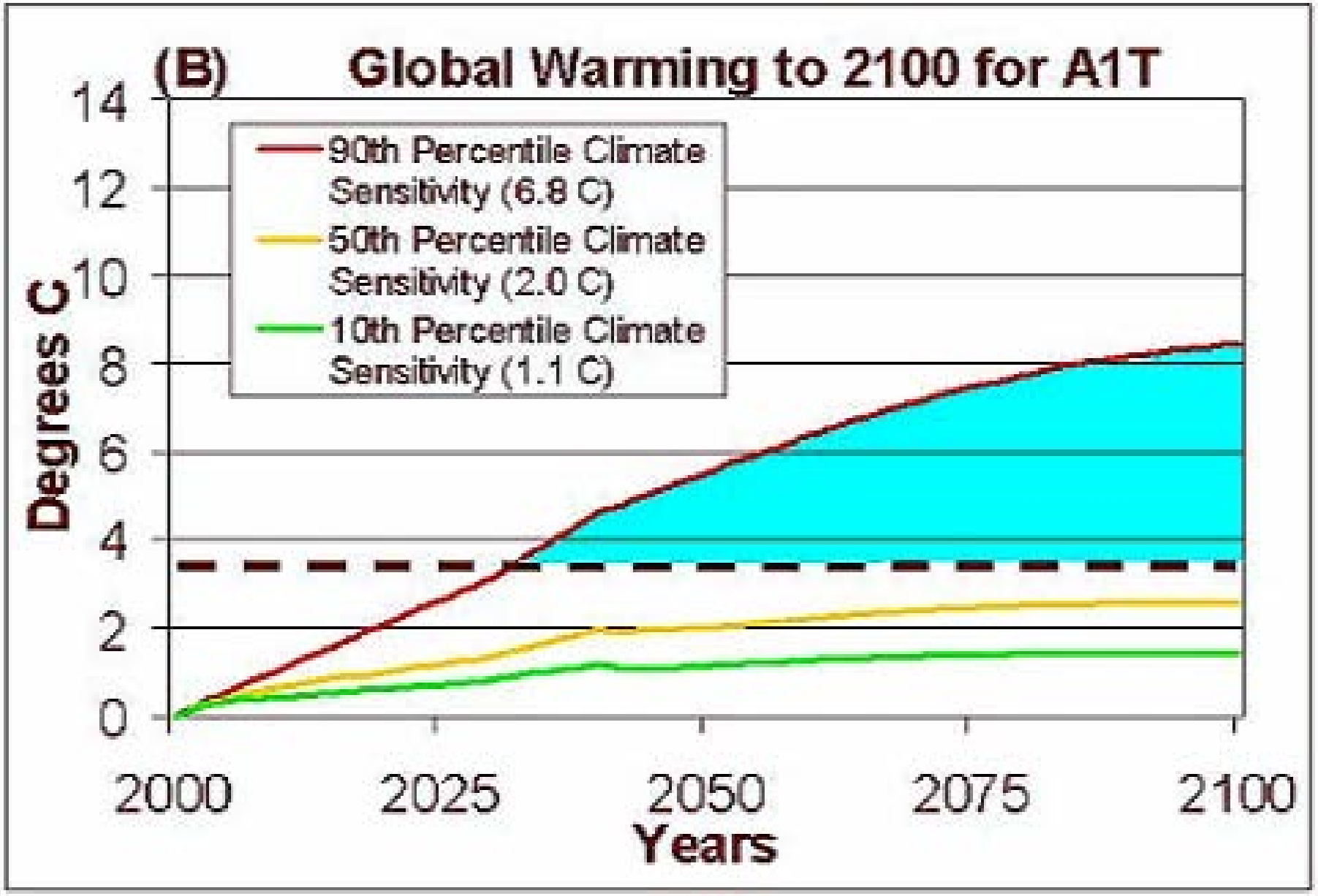


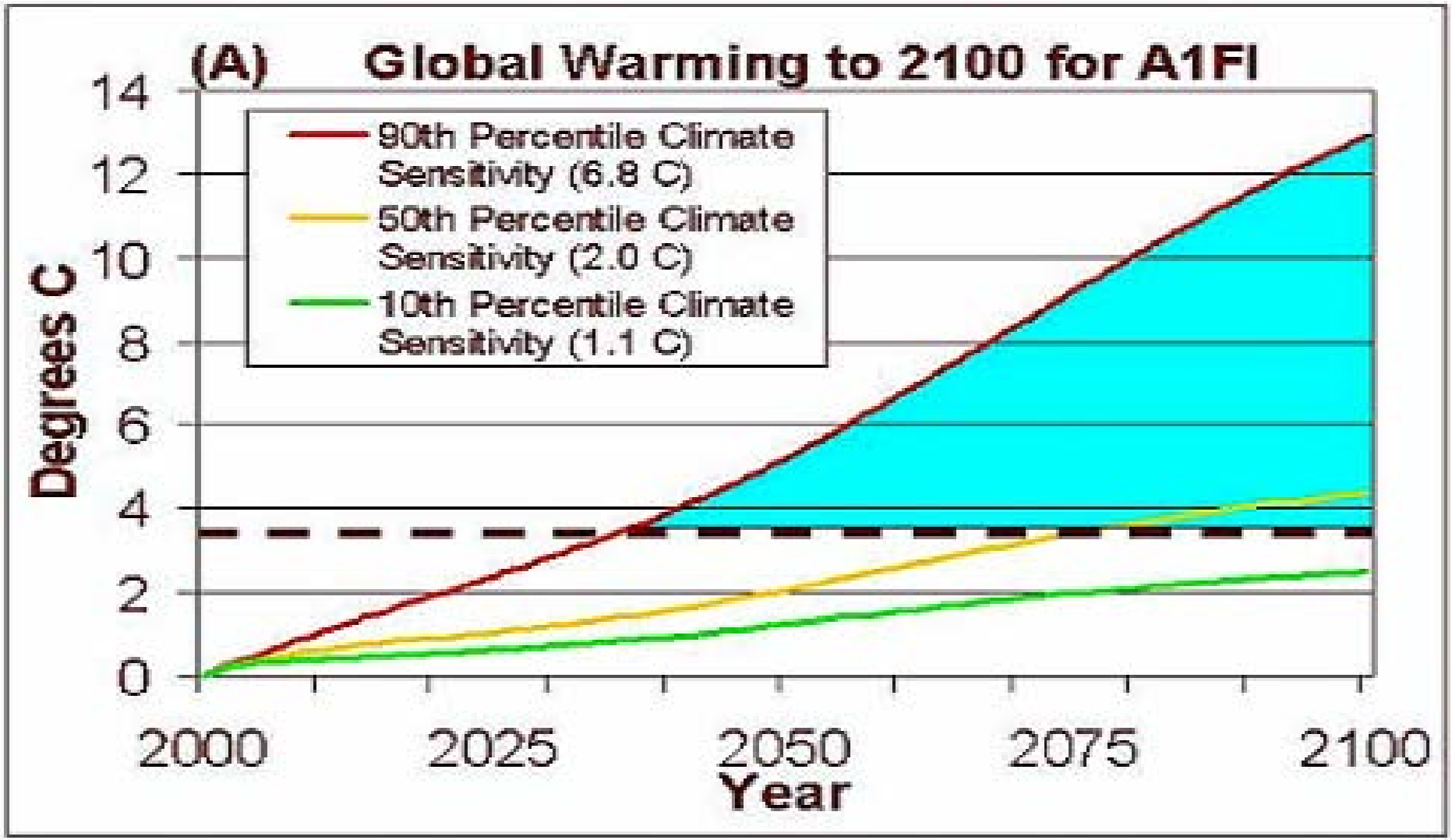


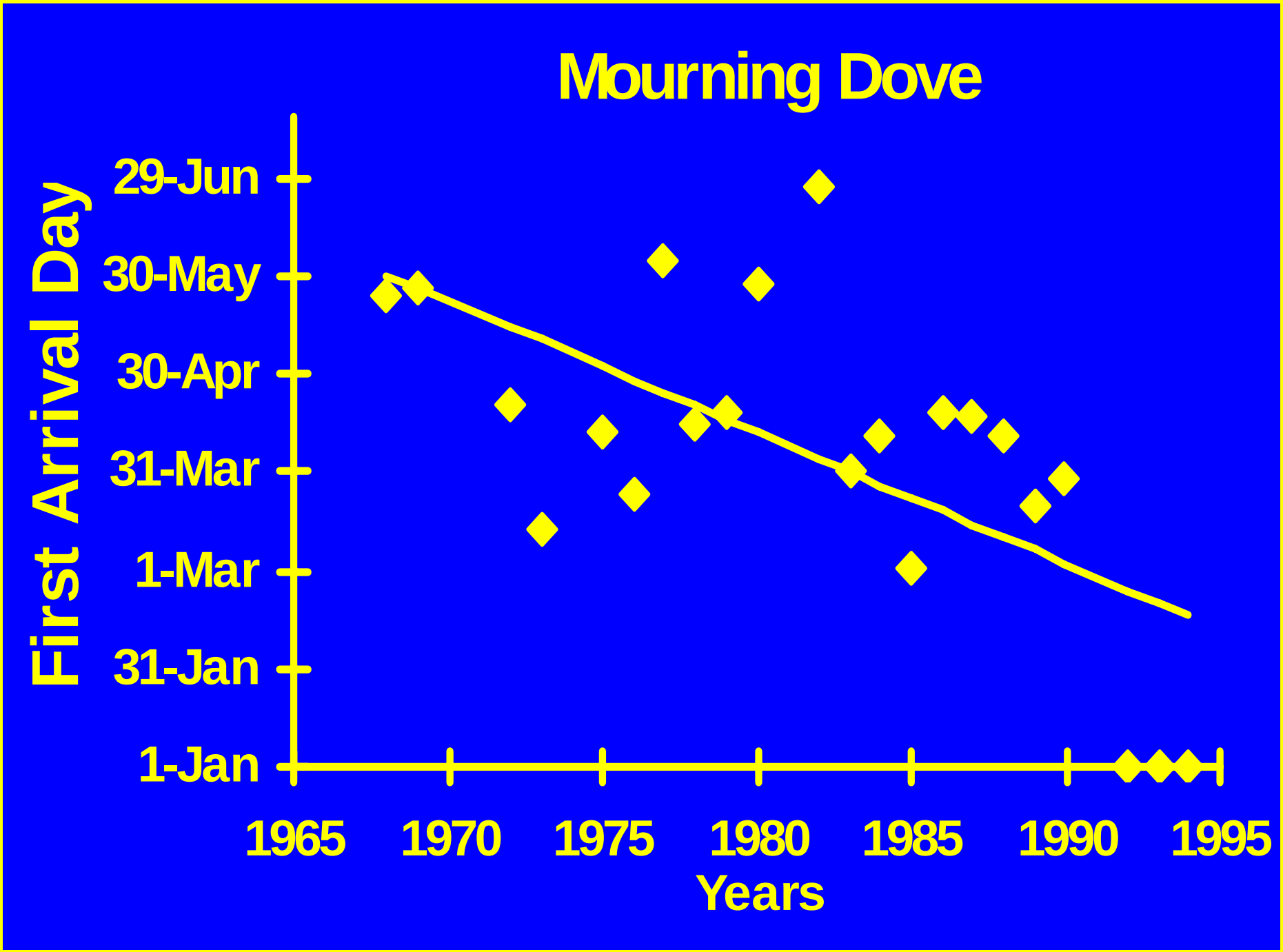



(A)
Probability density function
(fraction per 0.1°C interval)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.5 0.7 1 2 3 4 5 6 7 8 10 20
ΔT2x (°C)


0.5 0.7 1 2 3 4 5 6 7 8 10 20
Cumulative density function
(Percentile)
100
90
80
70
60
50
40
30
20
10
0
(C)
0.5 0.7 1 2 3 4 5 6 7 8 10 20
ΔT2x (°C)


(B) Global Warming to 2100 for A1T
90th Percentile Climate Sensitivity (6.8 C)
50th Percentile Climate Sensitivity (2.0 C)
10th Percentile Climate Sensitivity (1.1 C)
Degrees C
0
2
4
6
8
10
12
14
2000
2025
2050
2075
2100
Years


(A) Global Warming to 2100 for A1FI
90th Percentile Climate Sensitivity (6.8 C)
50th Percentile Climate Sensitivity (2.0 C)
10th Percentile Climate Sensitivity (1.1 C)
Degrees C
0
2
4
6
8
10
12
14
2000
2025
2050
2075
2100
Year


Mourning Dove
First Arrival Day
29-Jun
30-May
30-Apr
31-Mar
1-Mar
31-Jan
1-Jan
1965
1970
1975
1980
1985
1990
1995
Years

Bering Sea
Beaufort Sea
(Den.)
Reykjavik
Baffin Bay
Alaska (U.S.)
Banks Island
Victoria Island
Baffin Island
Nuuk (Godthåb)
Aleutian Islands
Fairbanks
Anchorage
Davis Strait
Arctic Circle
Gulf of Alaska
Whitehorse
Labrador Sea
Hudson Bay
Churchill
Happy Valley-Goose Bay
Canada
Island of Newfoundland
Edmonton
Vancouver
Winnipeg
Québec
Seattle
Montréal
Halifax
Pacific Ocean
Ottawa
Toronto
Boston
Detroit
United
New York
Philadelphia
Chicago
Salt Lake City
Denver
Washington
San Francisco
St. Louis
States
Atlantic Ocean
Los Angeles
Atlanta
El Paso
New Orleans
Houston

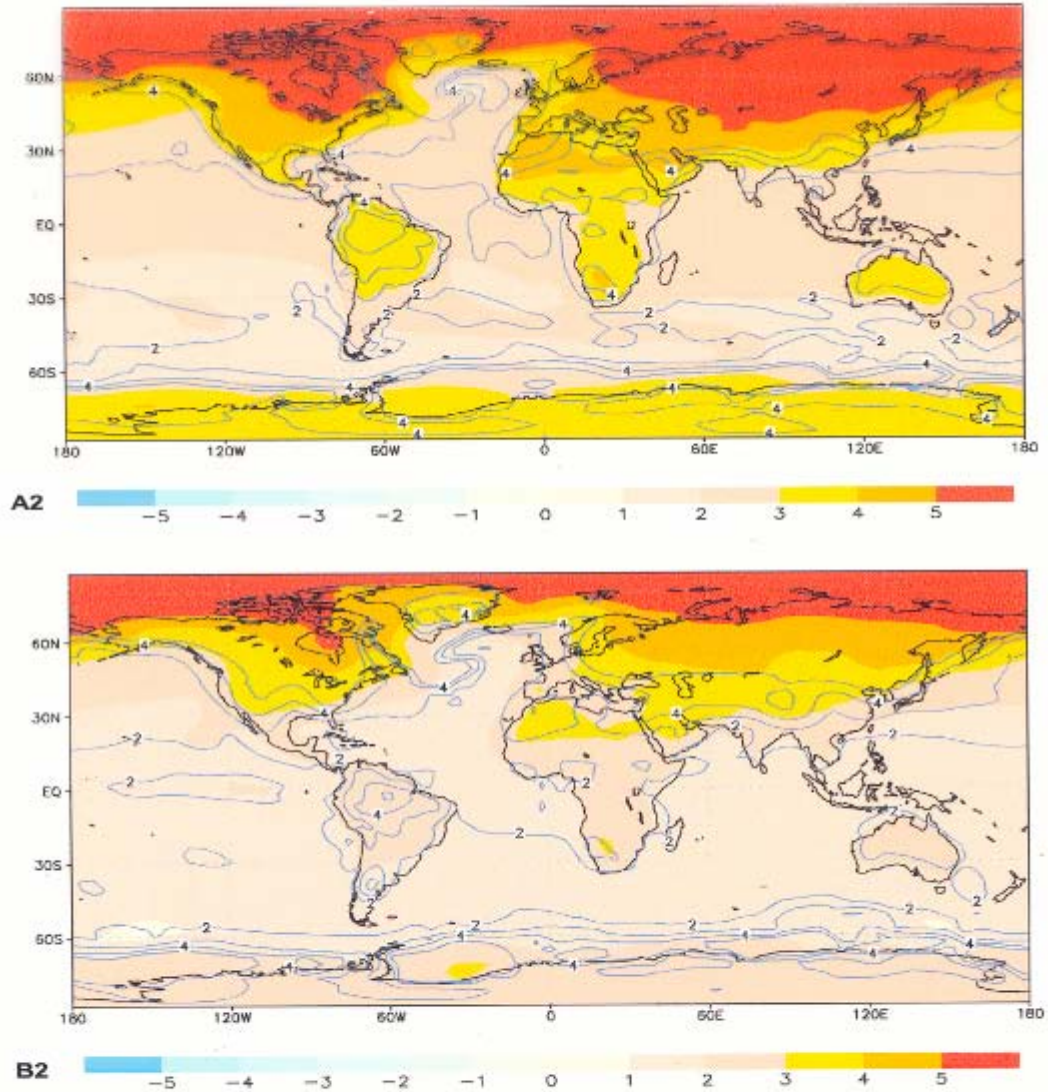
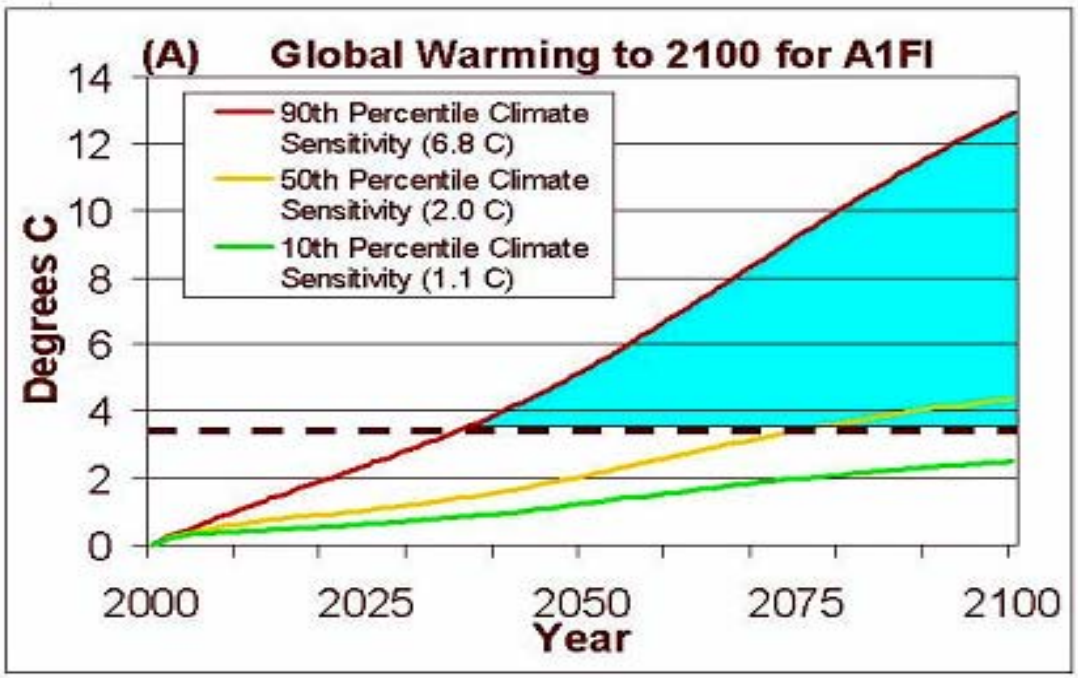
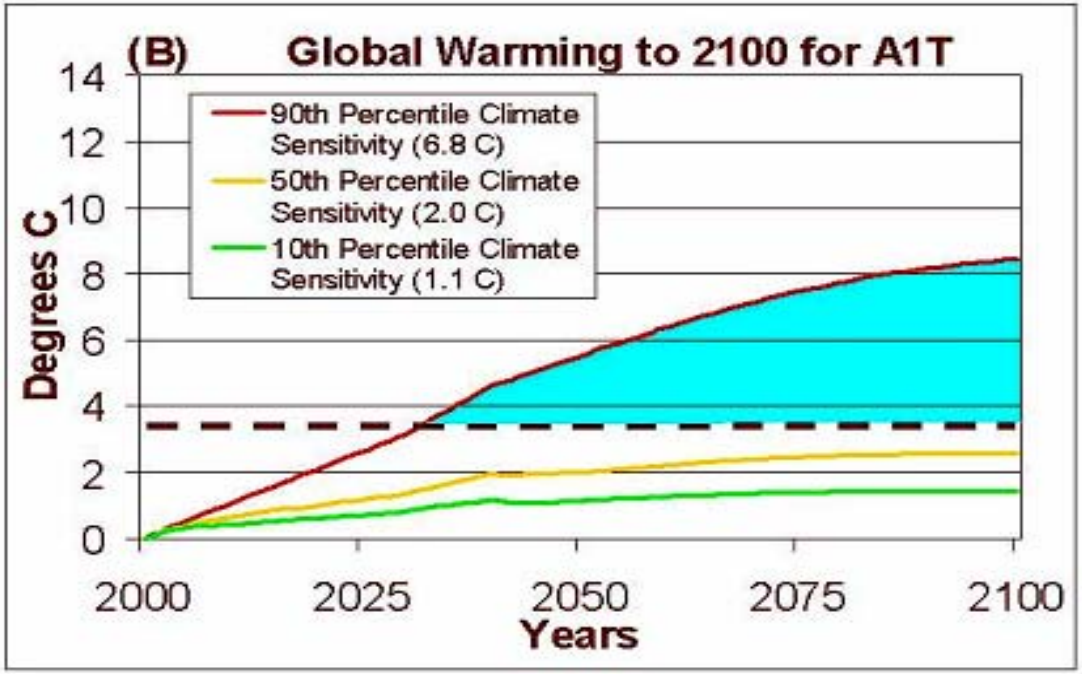
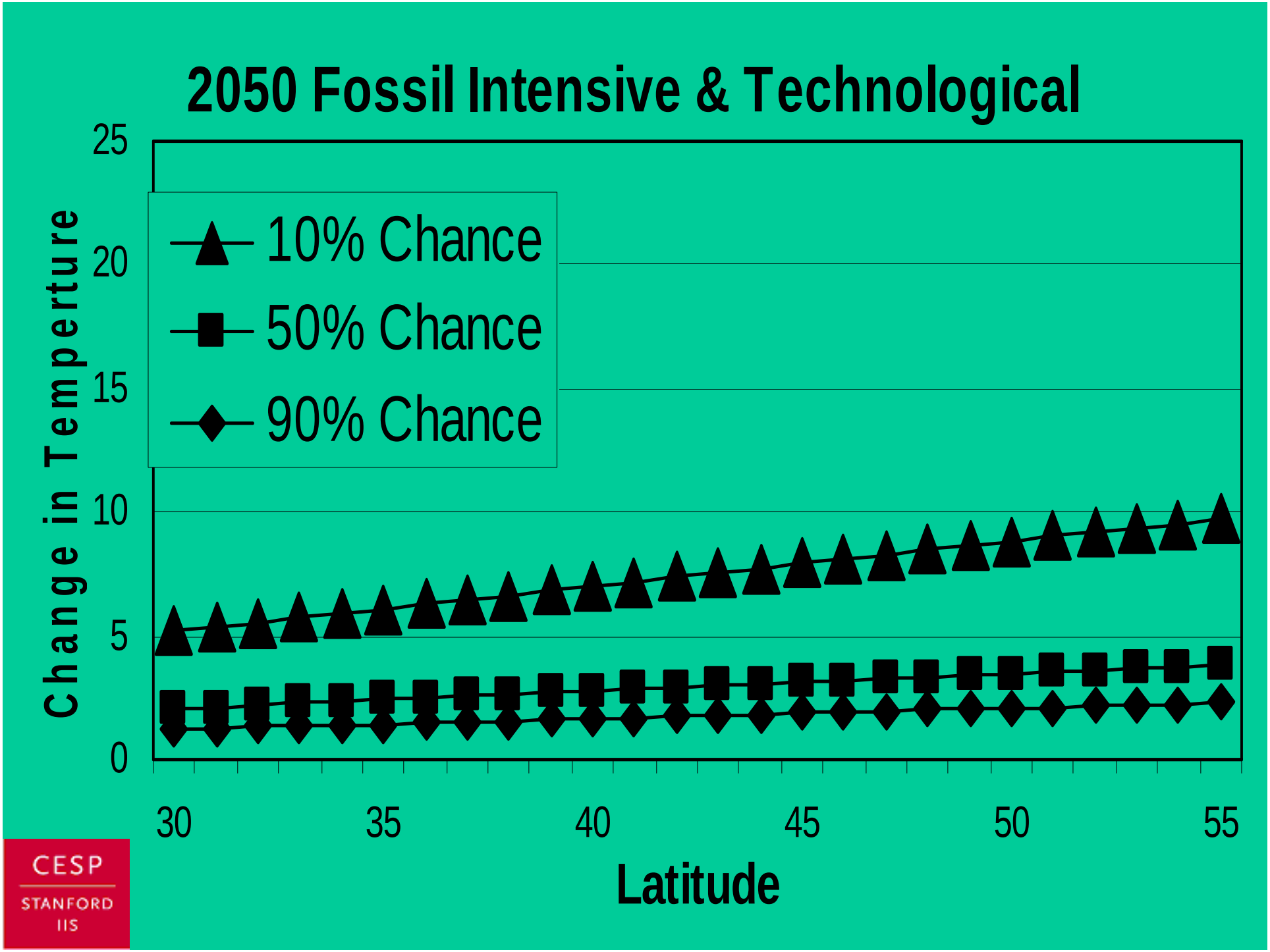
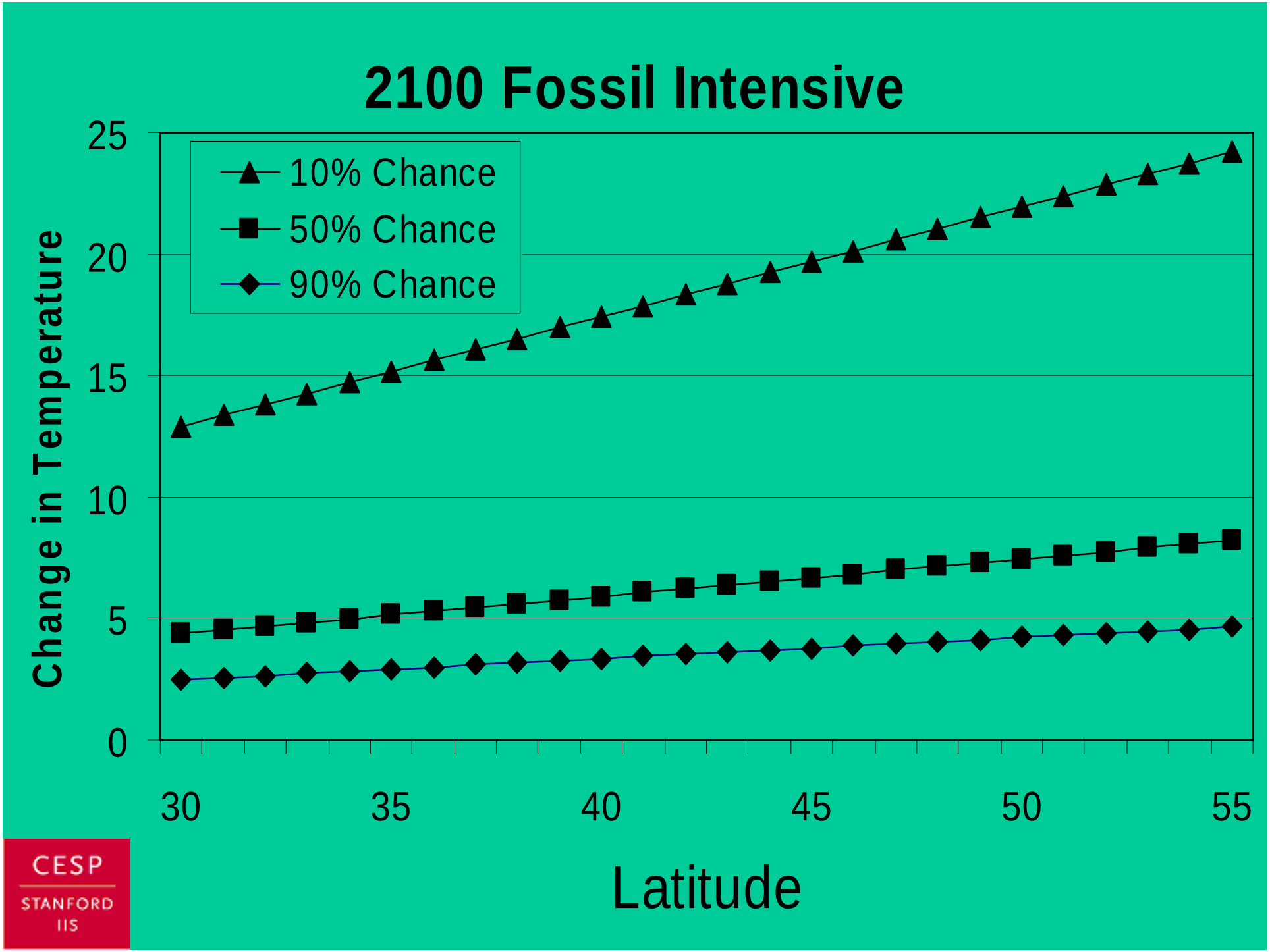


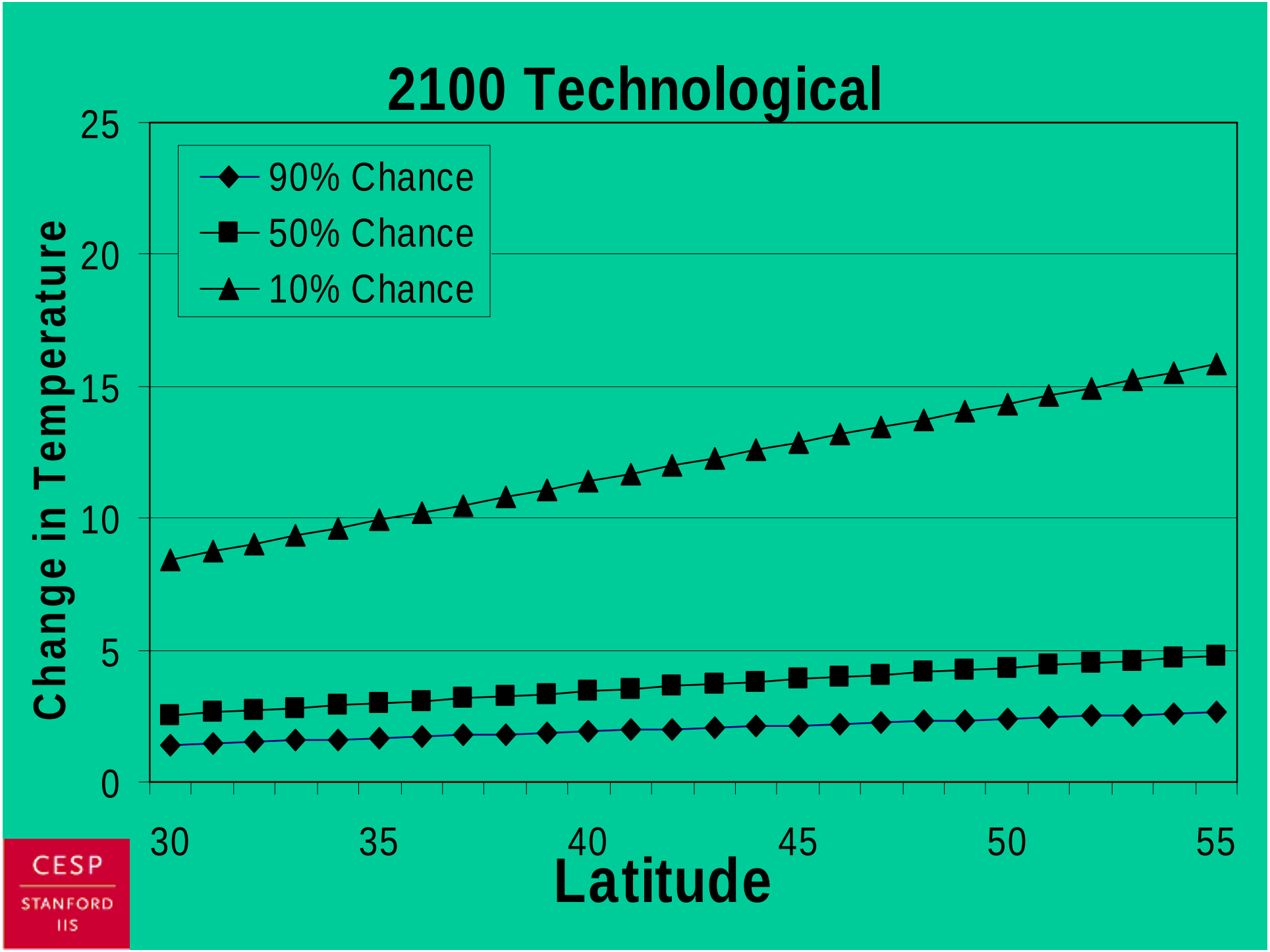
Figure 19: The annual mean change of the temperature (colour shading) and its range (isolines) [Unit: °C] for the SRES scenario A2 (upper panel) and the SRES scenario B2 (lower panel). Both SRES-scenarios show the period 2071-2100 relative to the period 1961-1990 and where performed by OAGCMs. [Based on Figures 9.10d-1 and 9.10e-1.]


(A)
Global Warming to 2100 for A1FI
90th Percentile Climate Sensitivity (6.8 C)
50th Percentile Climate Sensitivity (2.0 C)
10th Percentile Climate Sensitivity (1.1 C)
Degrees C
0
2
4
6
8
10
12
14
2000
2025
2050
2075
2100
Year

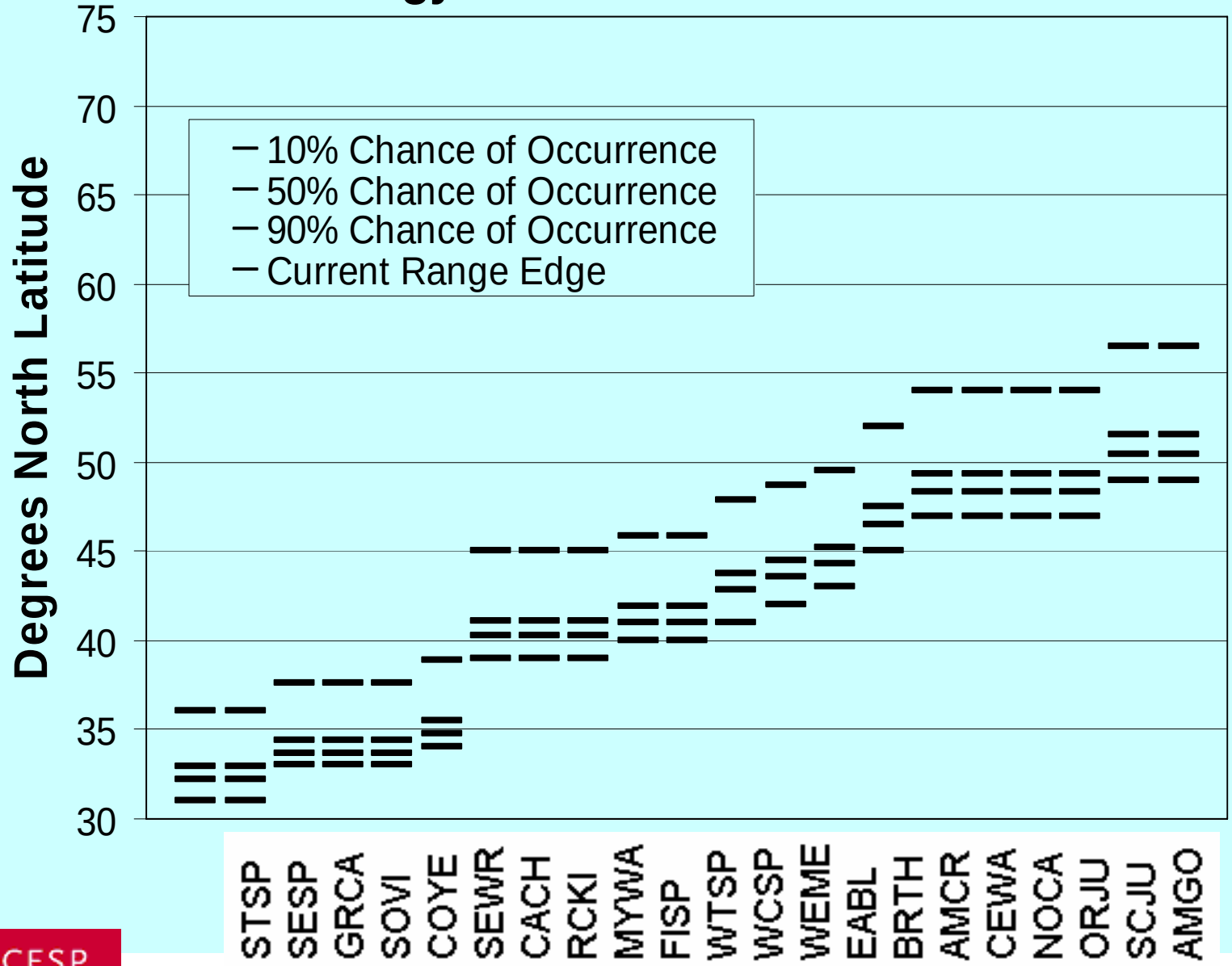

(B)
Global Warming to 2100 for A1T
90th Percentile Climate Sensitivity (6.8 C)
50th Percentile Climate Sensitivity (2.0 C)
10th Percentile Climate Sensitivity (1.1 C)
Degrees C
0
2
4
6
8
10
12
14
2000
2025
2050
2075
2100
Years


2050 Fossil Intensive & Technological
Change in Temperture
25
20
15
10
5
0
10% Chance
50% Chance
90% Chance
30
35
40
45
50
55
Latitude
CESP
STANFORD
IIS

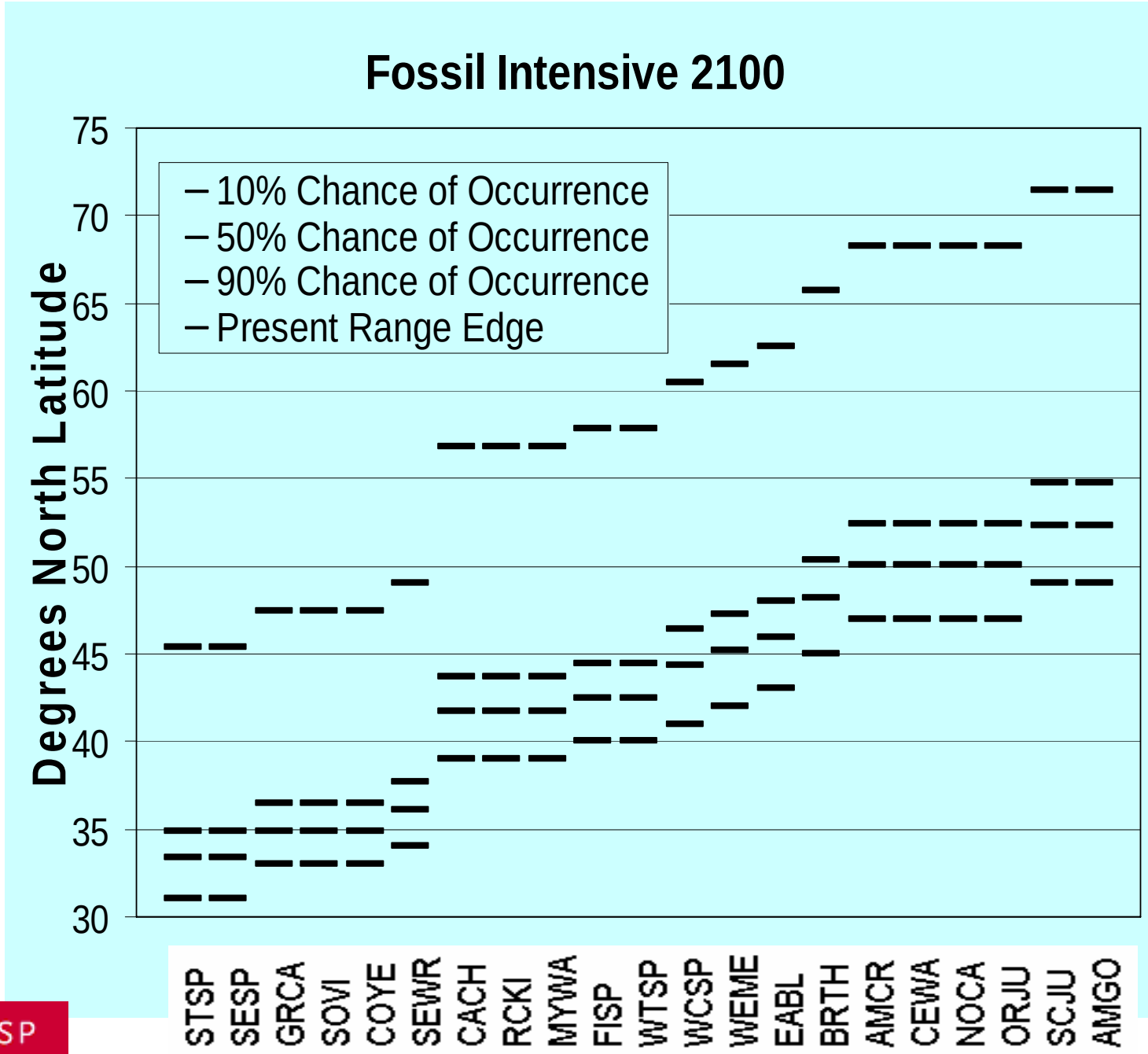

2100 Fossil Intensive
10% Chance
50% Chance
90% Chance
Change in Temperature
25
20
15
10
5
0
30
35
40
45
50
55
Latitude
CESP
STANFORD
IIS

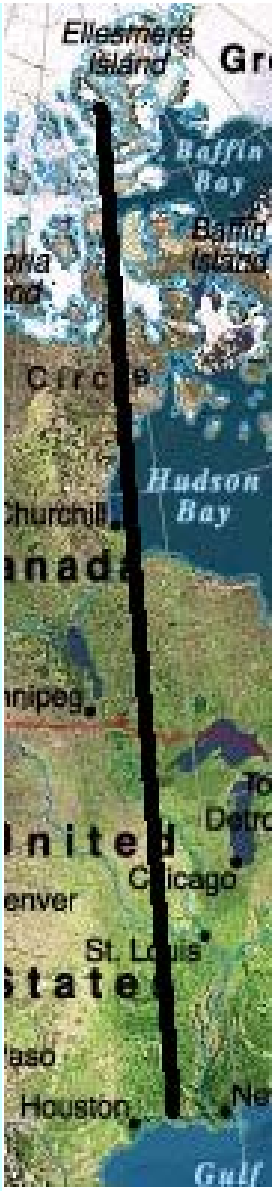

2100 Technological
90% Chance
50% Chance
10% Chance
Change in Temperature
25
20
15
10
5
0
30
35
40
45
50
55
Latitude
CESP
STANFORD
IIS

Technology and Fossil Intensive 2050



CESP
STANFORD IIS





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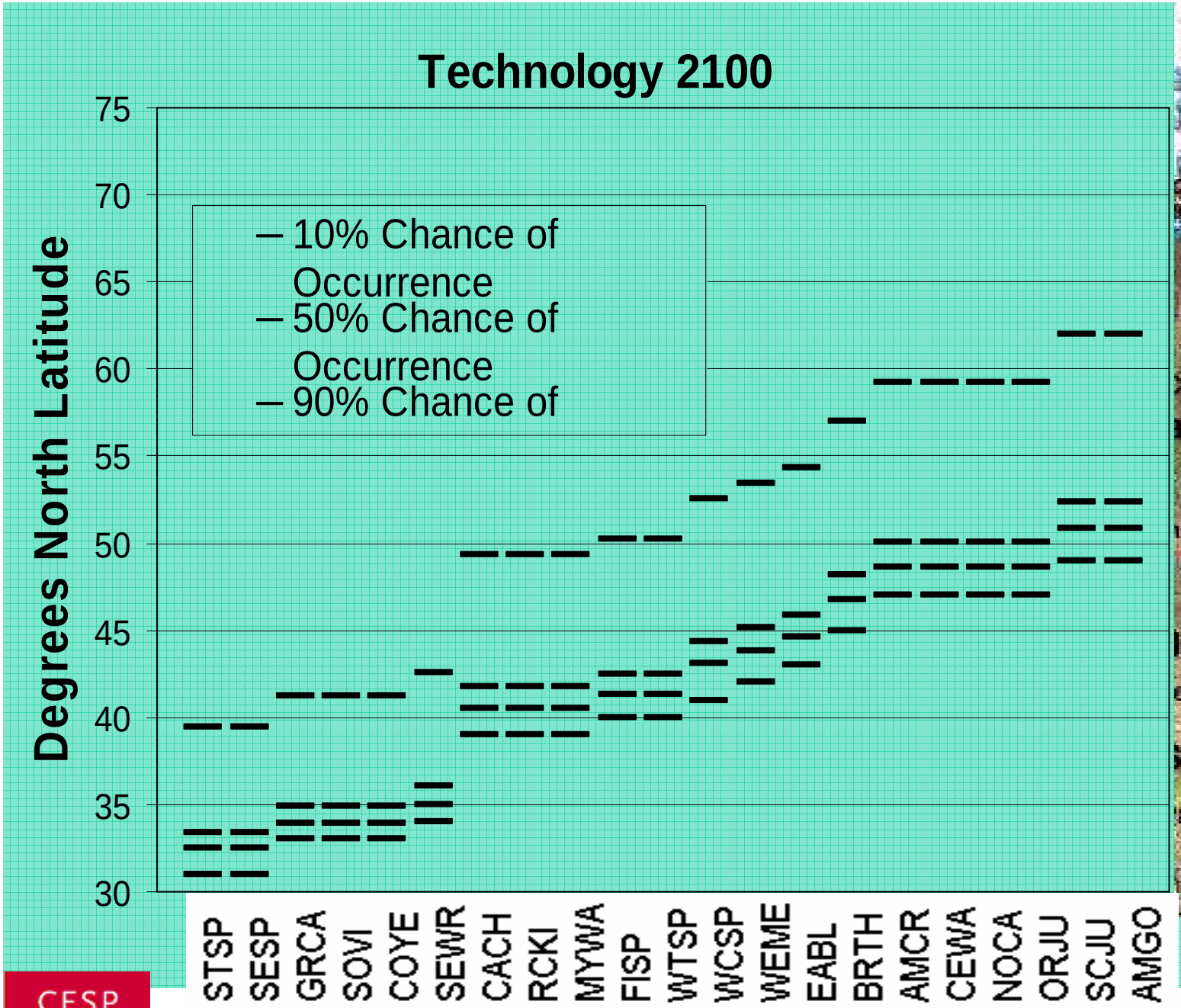

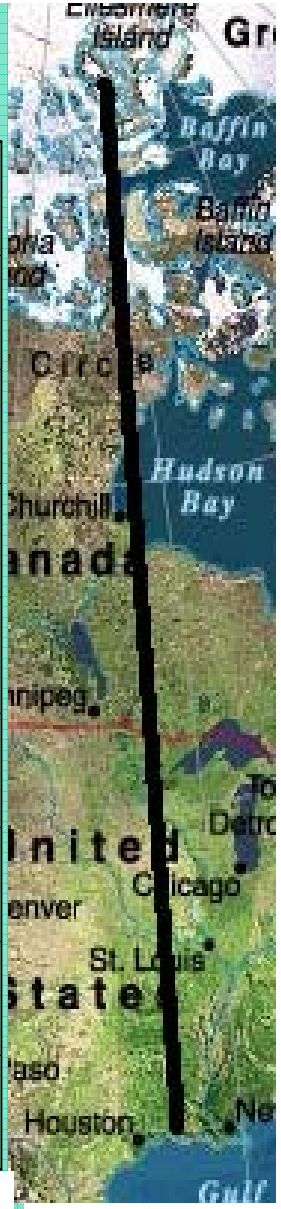

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