


A Theory of Societal Collapse: Convergent Stress, Thermodynamic Disequilibrium, and Brittleness

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Five notable characteristics of contemporary world:

- Multiple stresses
 - Macro-perturbations of natural systems
 - Impending energy transition
 - Rising connectivity and complexity
 - Power shift
- 

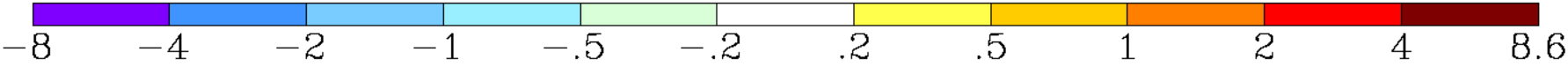
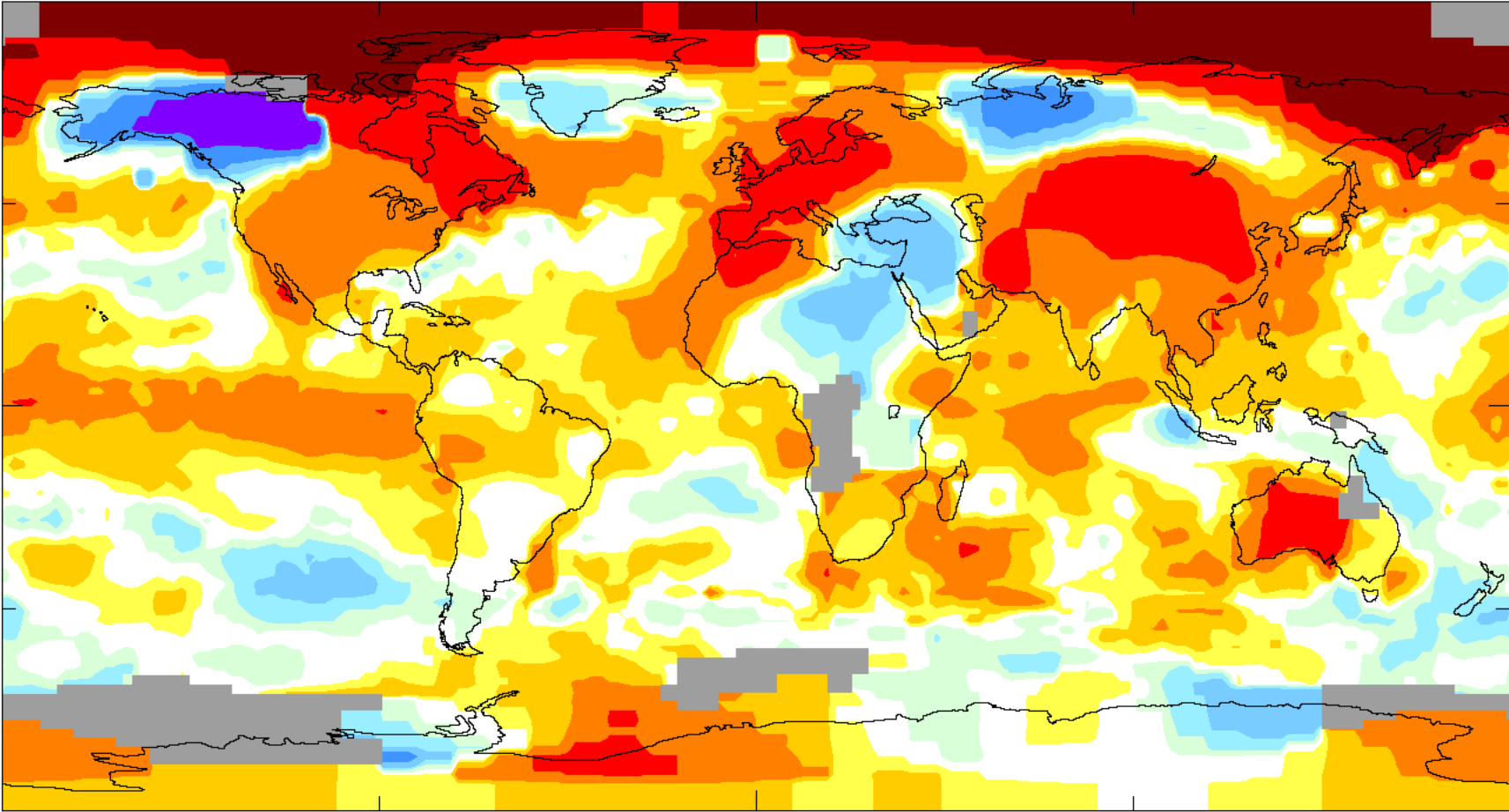
CLIMATE

Warming of the climate system is **unequivocal**, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level.

November 2006

L-OTI(°C) Anomaly vs 1951-1980

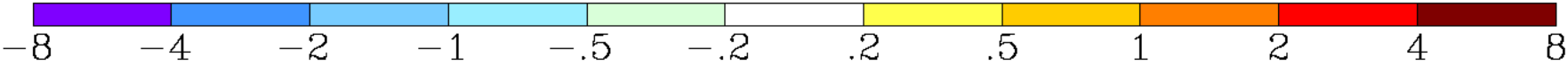
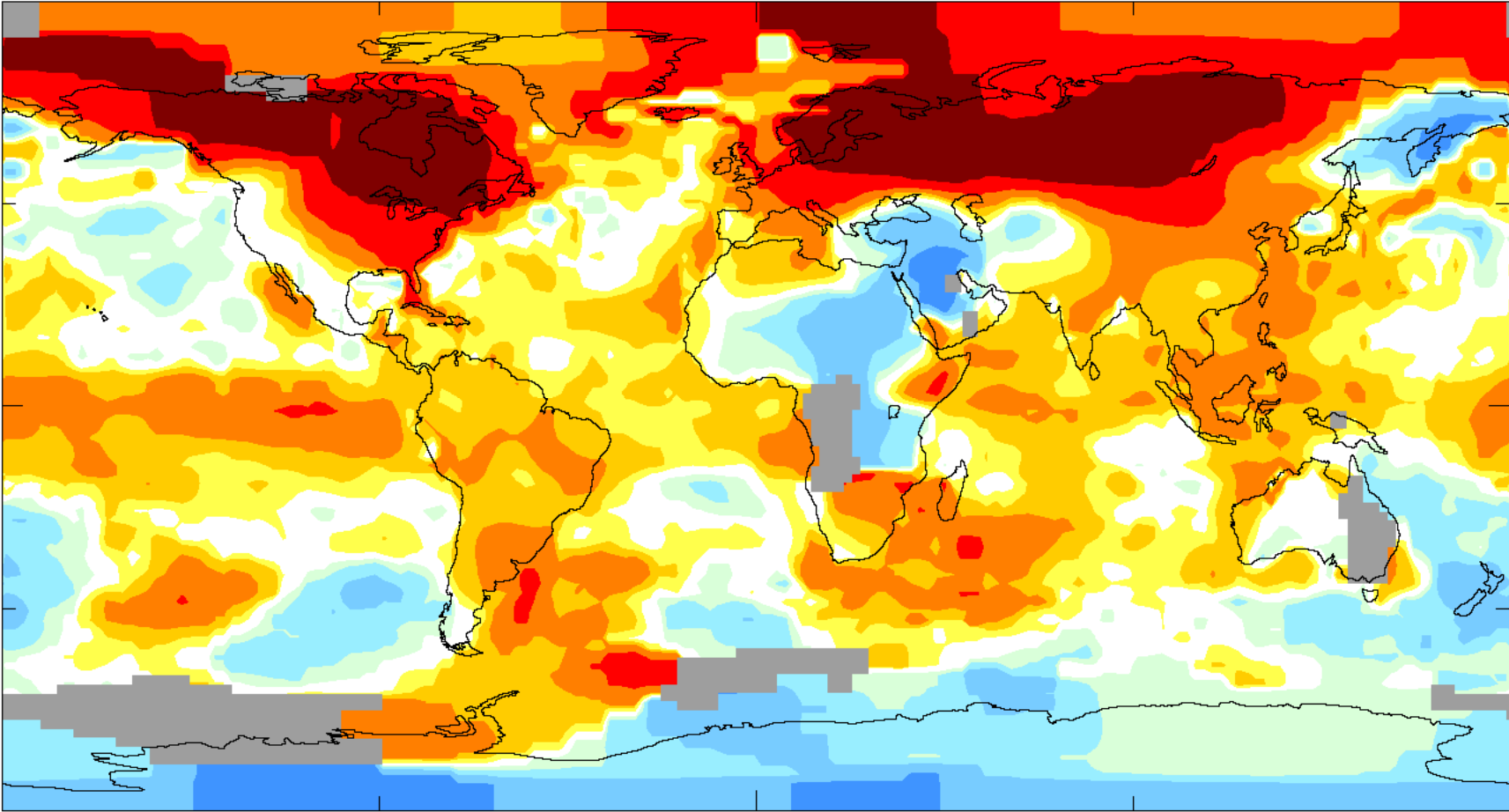
.60



December 2006

L-OTI(°C) Anomaly vs 1951-1980

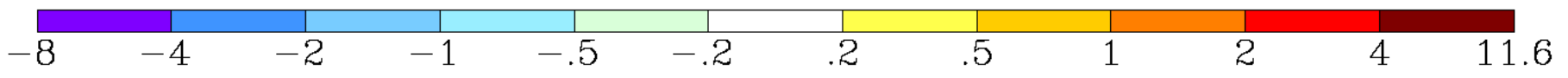
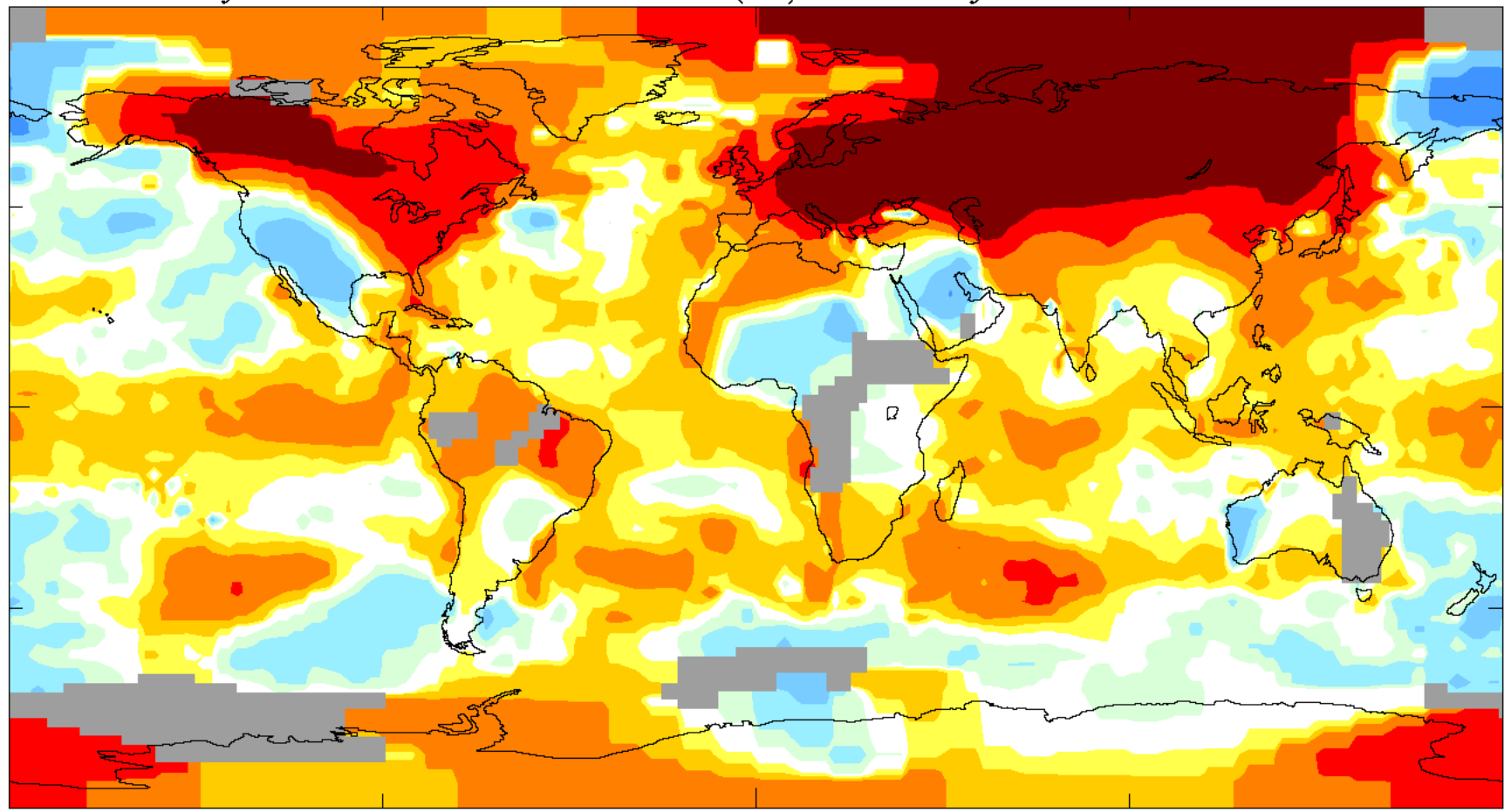
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January 2007

L-OTI(°C) Anomaly vs 1951-1980

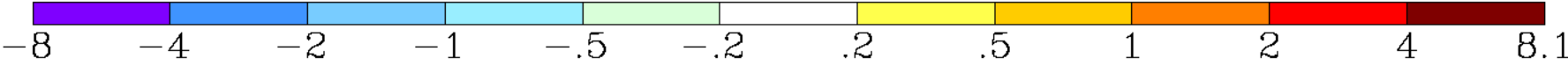
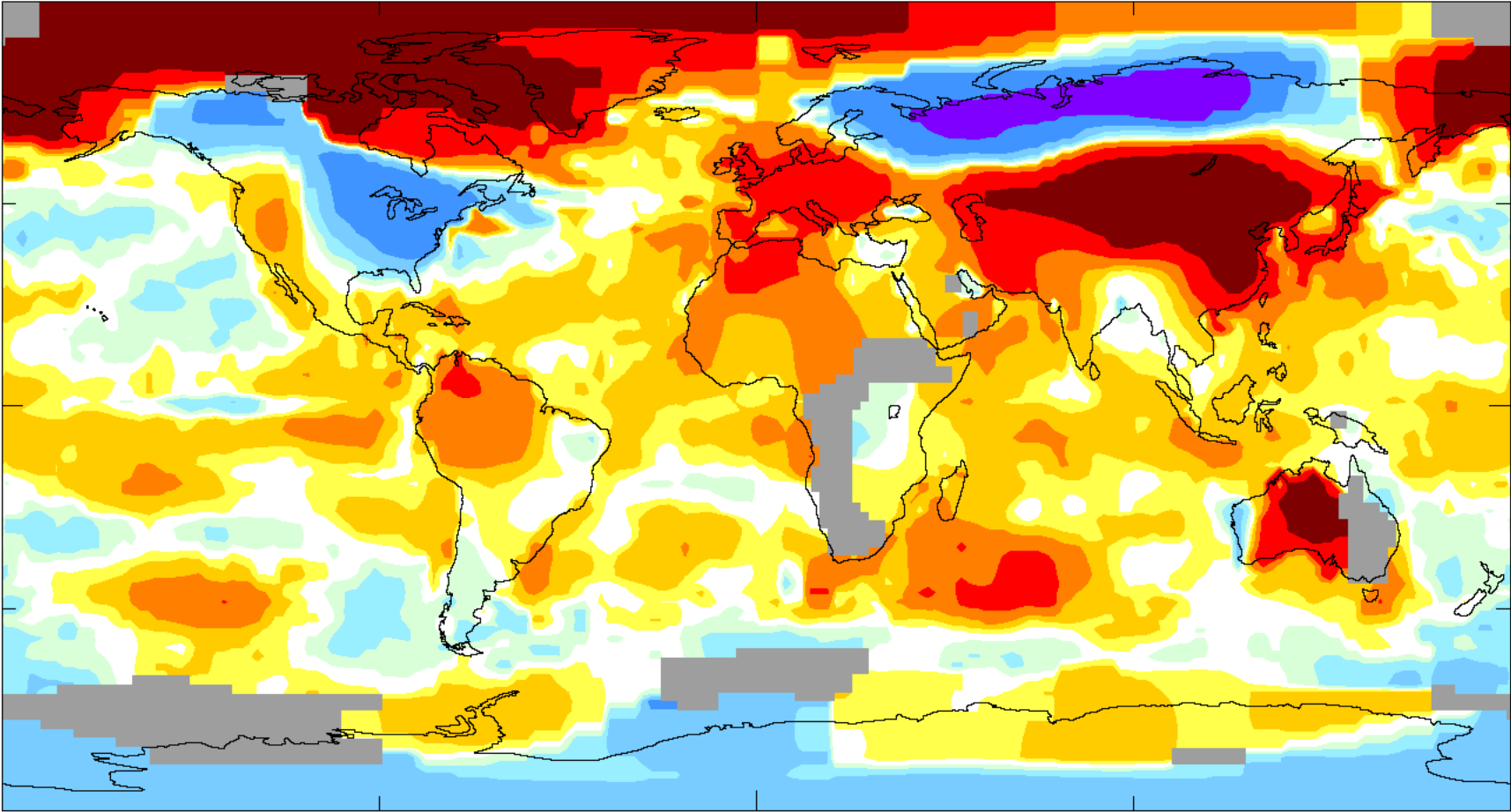
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February 2007

L-OTI(°C) Anomaly vs 1951-1980

.61



More rapid warming at poles

Main reason: Ice-albedo feedback

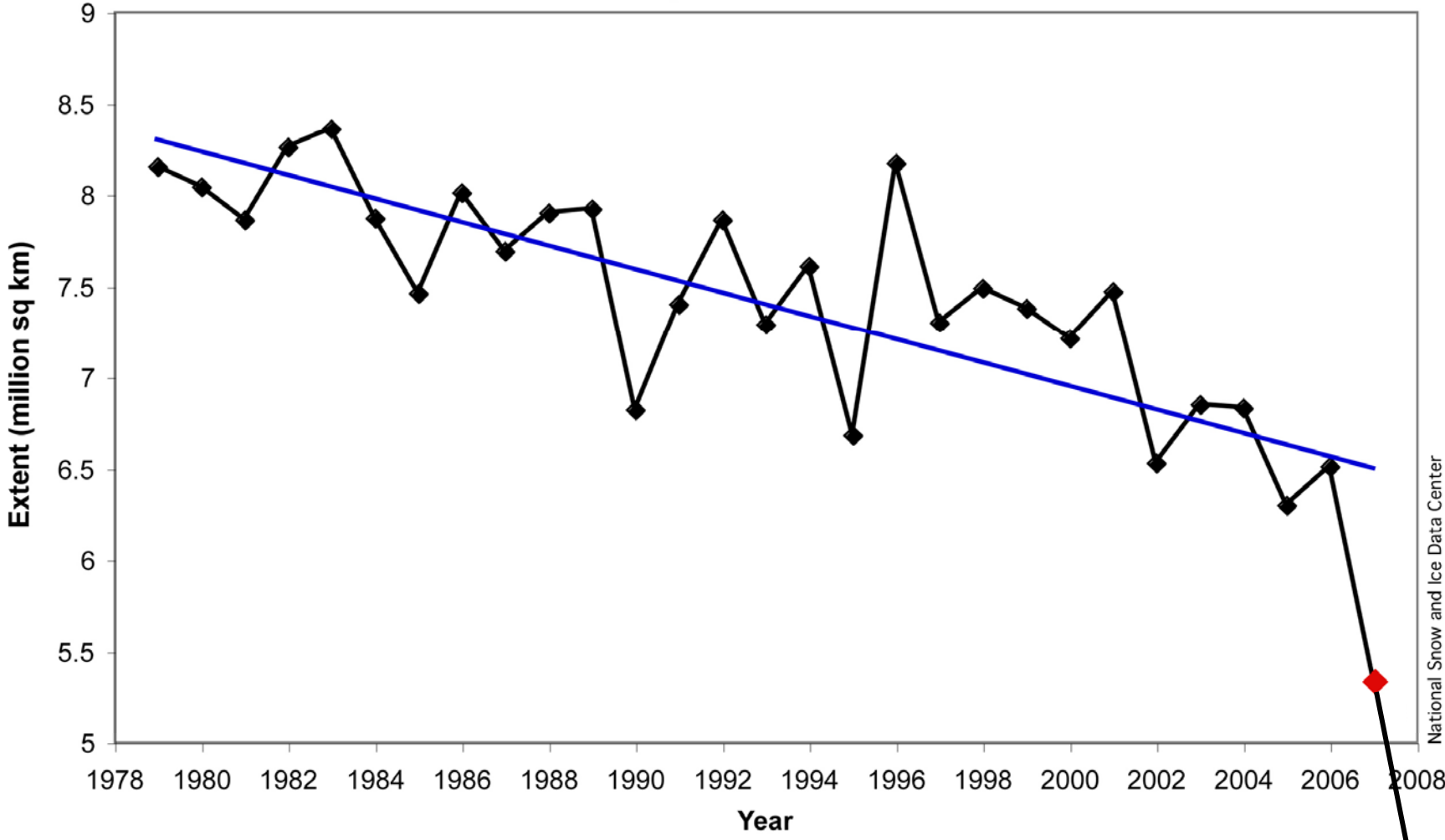
Melting of ice →

Lower reflectivity →

Increased absorption of sun's
energy →

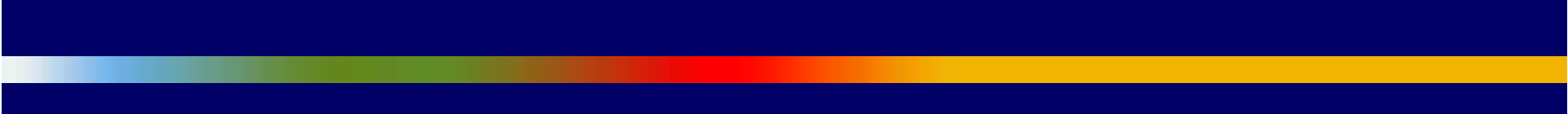
Melting of ice

August Ice Extent

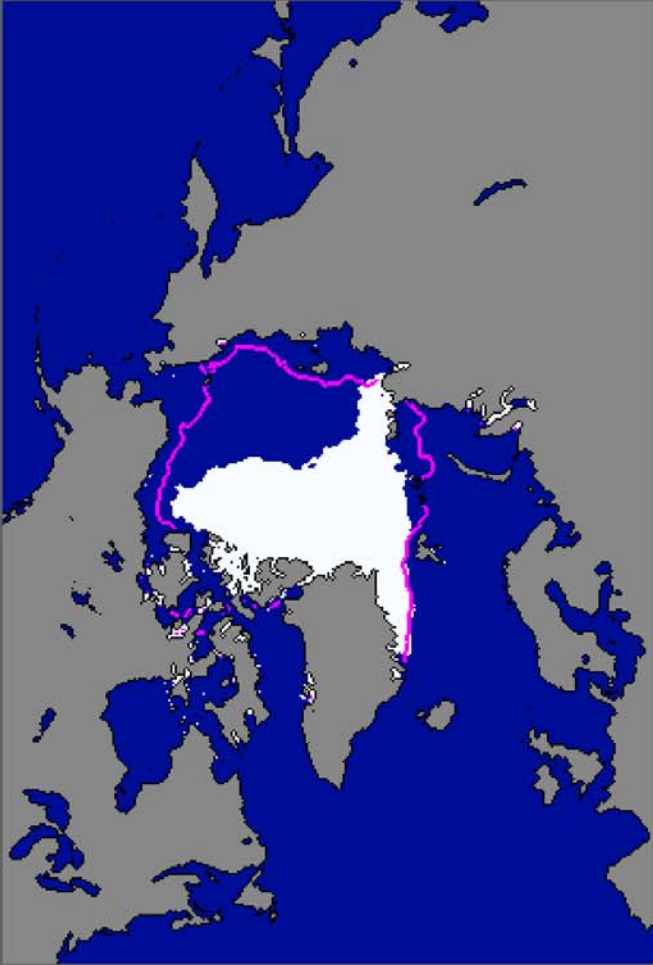


National Snow and Ice Data Center

Sept. 16
4.12 million km²



Current Ice Extent
09/16/2007

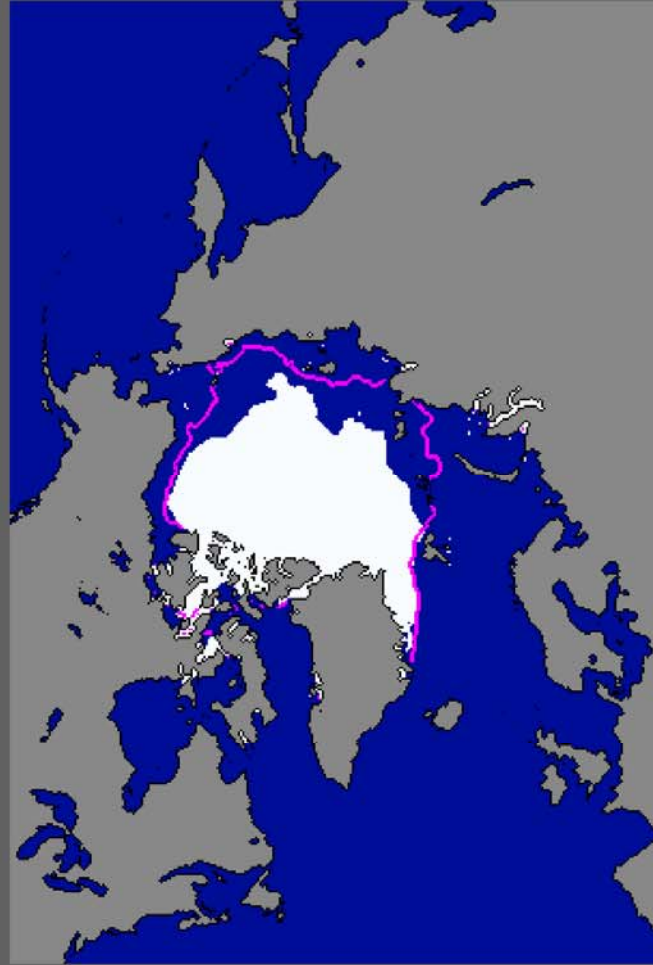


National Snow and Ice Data Center, Boulder, CO

median
ice edge

Total extent = 4.1 million sq km

Current Ice Extent
09/21/2005



National Snow and Ice Data Center, Boulder, CO

median
ice edge

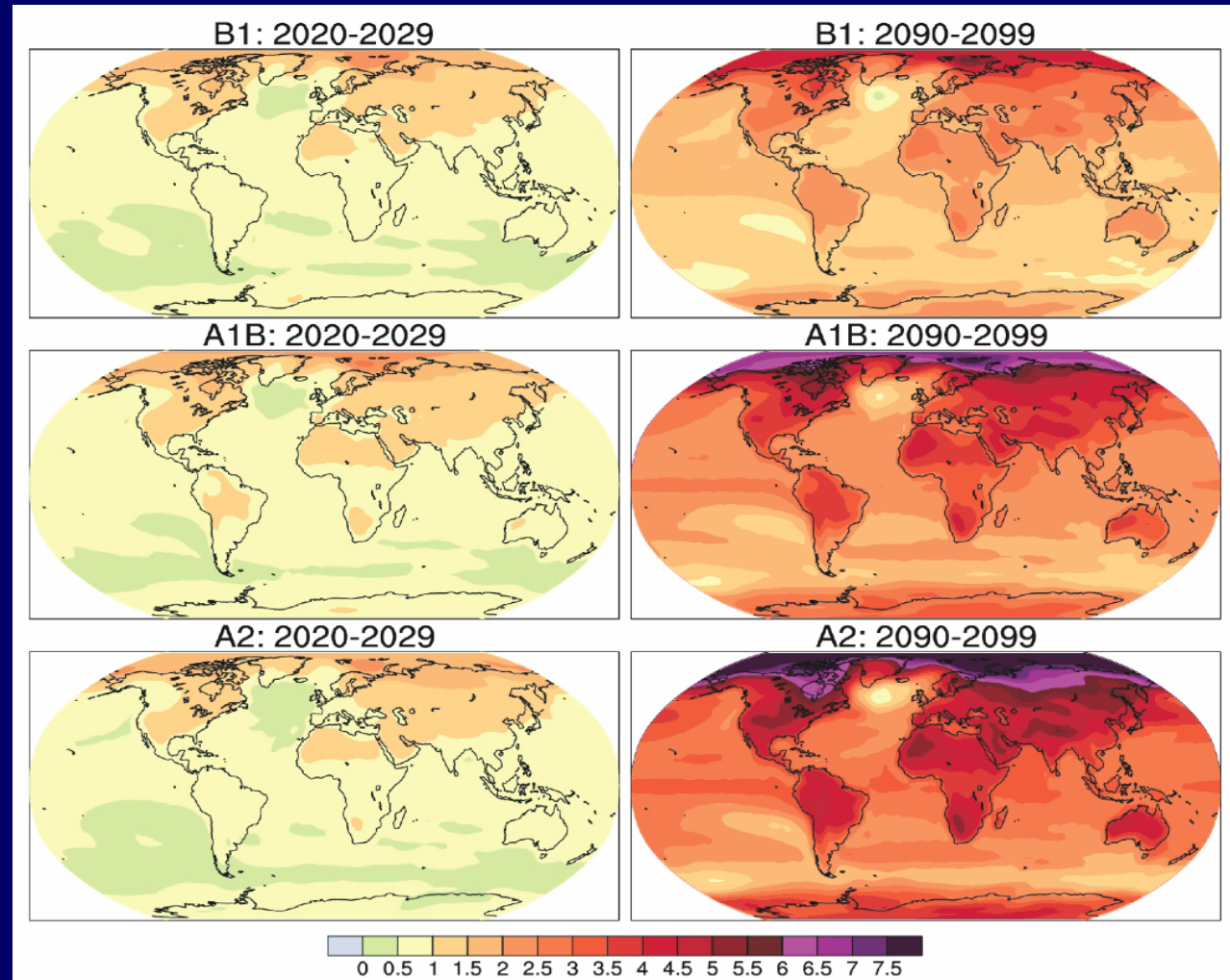
Total extent = 5.3 million sq km

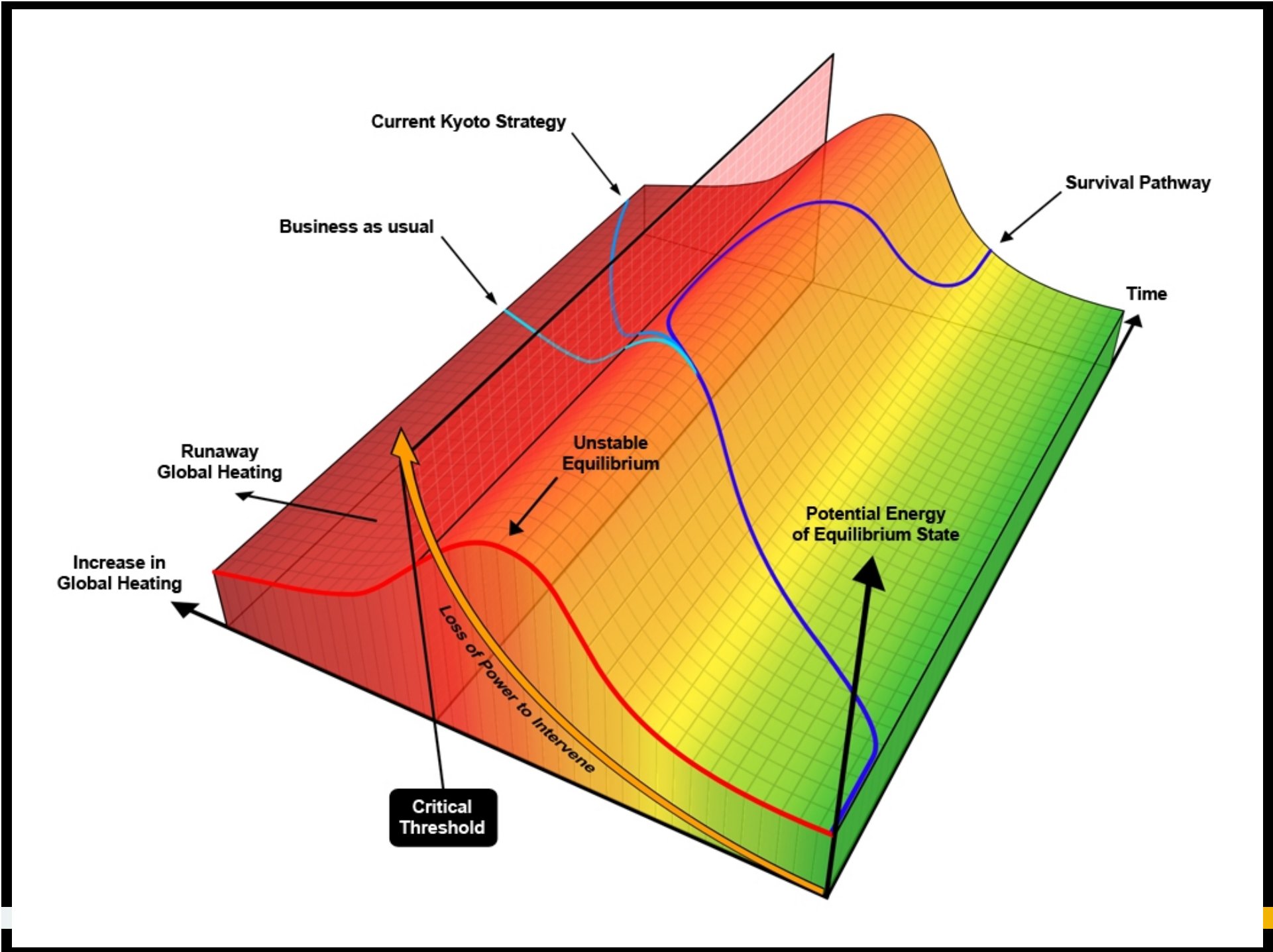
Projections of Future Changes in Climate

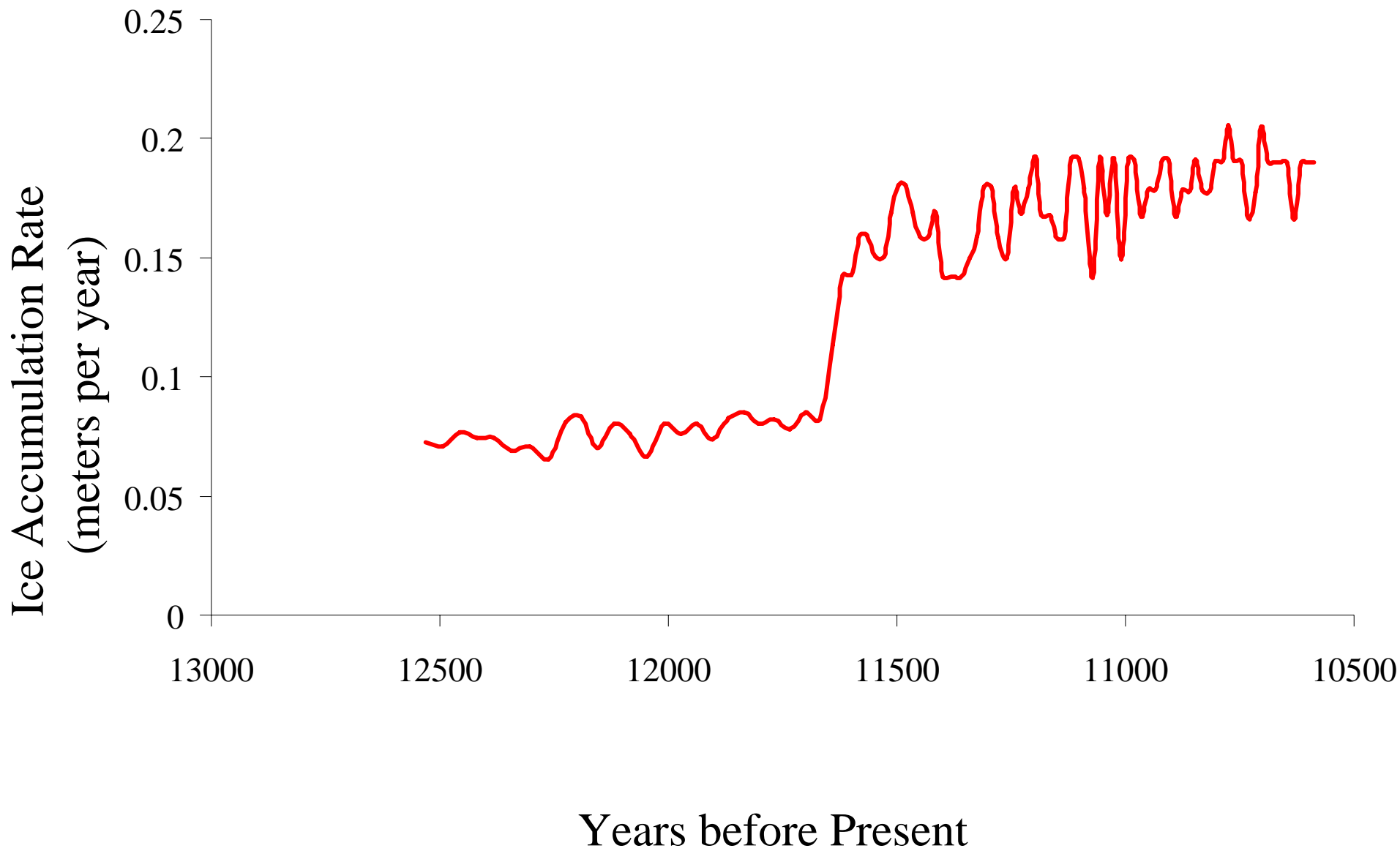
Projected warming in 21st century expected to be

greatest over land and at most high northern latitudes

and **least** over the Southern Ocean and parts of the North Atlantic Ocean







ENERGY

We are probably near peak
global output of conventional oil

Energy prices will rise sharply in
coming decades

Producing energy costs energy

This principle is best understood through the concept of

Energy Return on Investment (EROI)

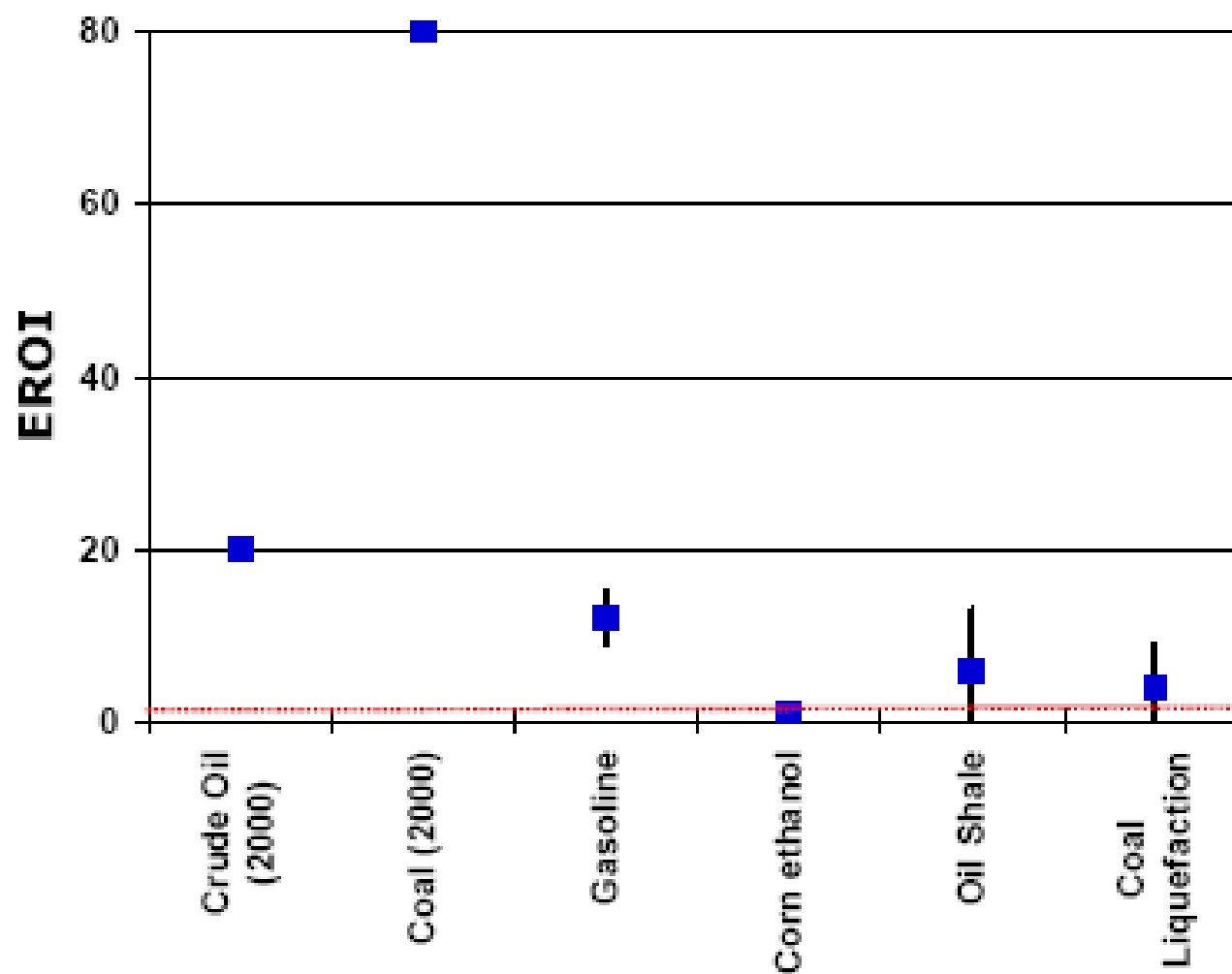
We're entering a transition from a regime of

abundant high-quality,
high-EROI energy

to one of

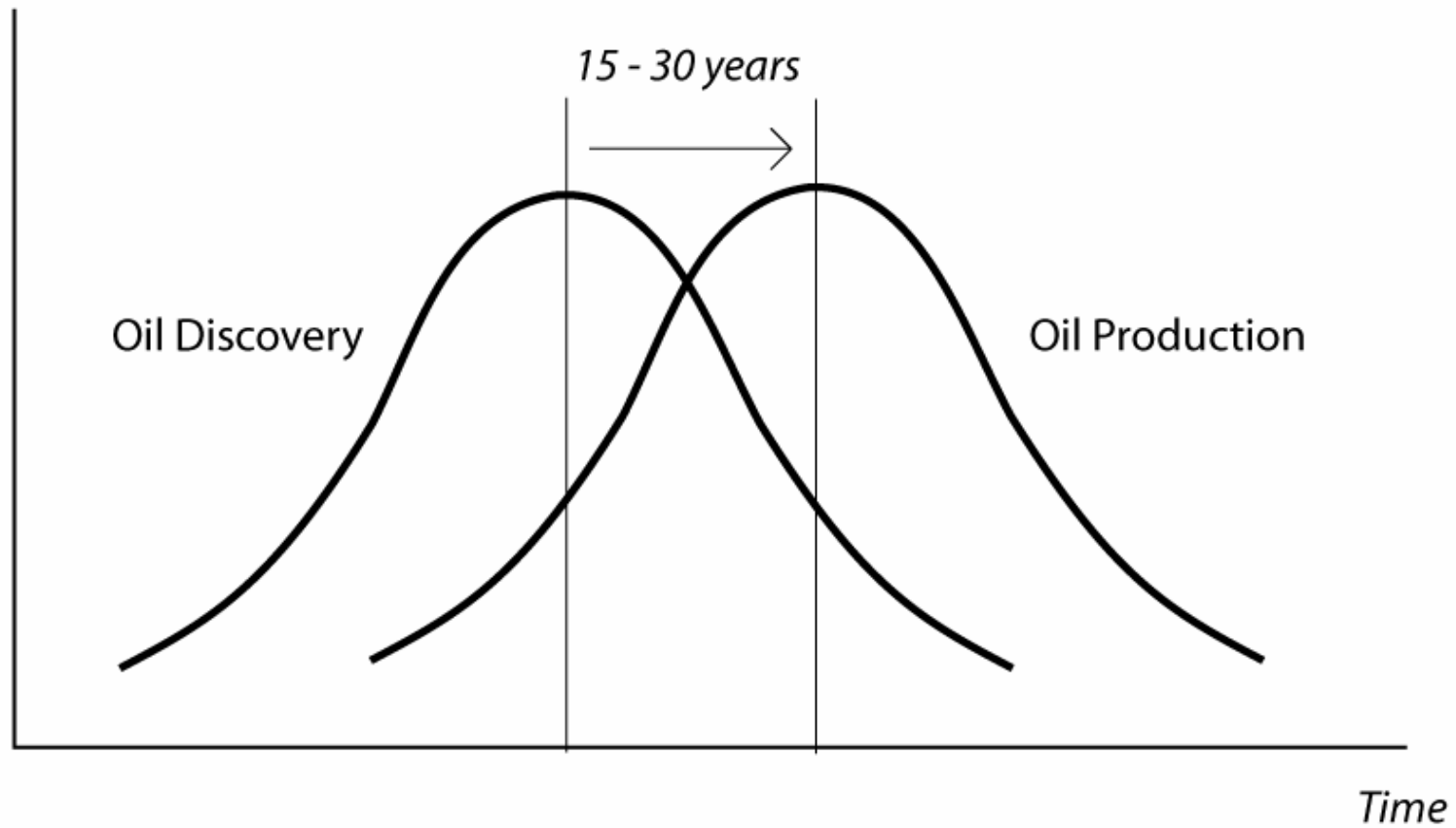
abundant mixed-quality,
low-EROI energy

EROI for Fuel Systems

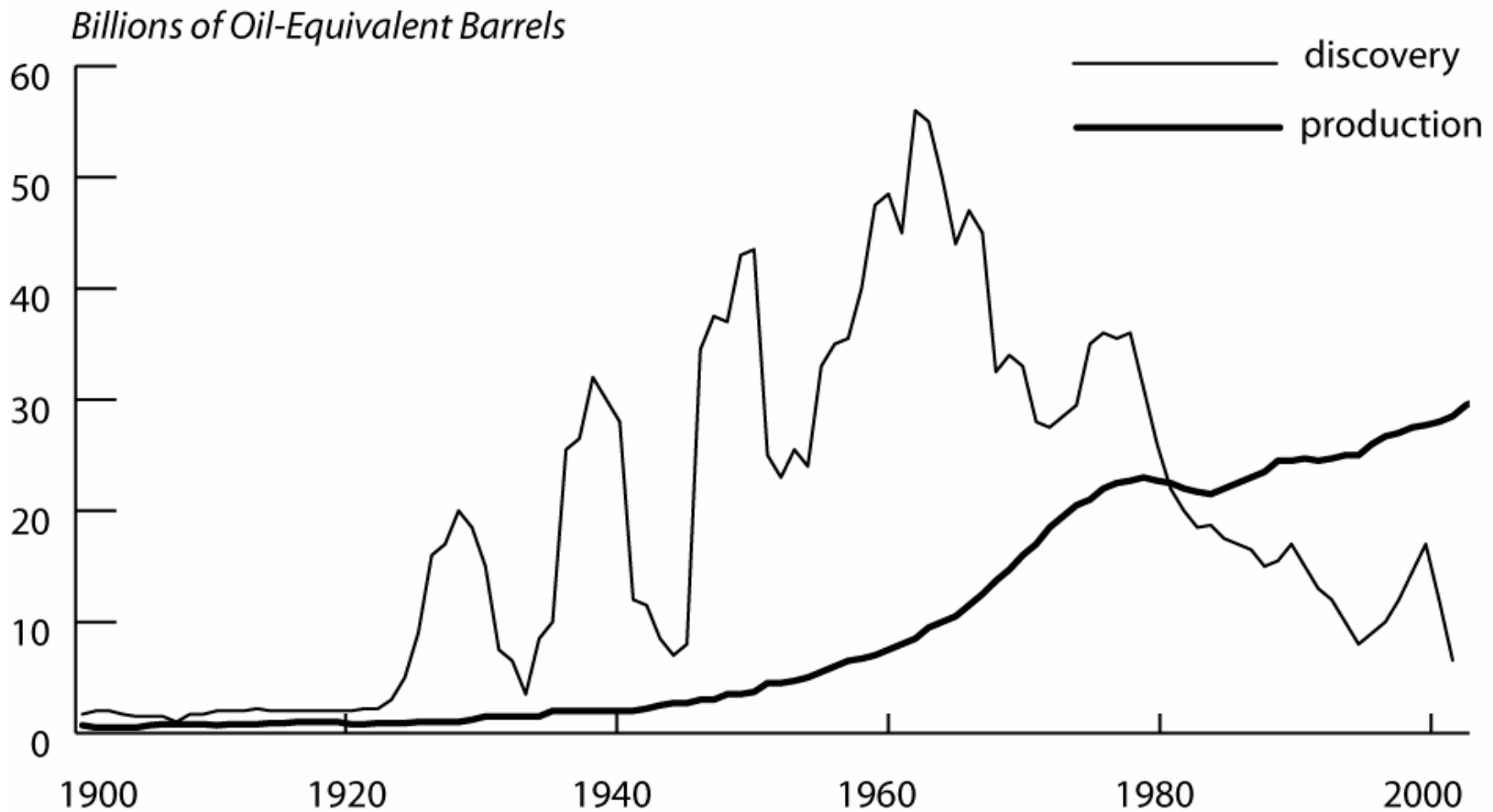


Difference between discovery peak and output peak

*Millions of Barrels
of Oil Equivalent*



Global oil discovery peaked in the early 1960s



Source: Harry Longwell, "The Future of the Oil and Gas Industry: Past Approaches, New Challenges," *World Energy* 5 3 (2002): 100-4, and Colin Campbell, personal correspondence.

COMPLEXITY

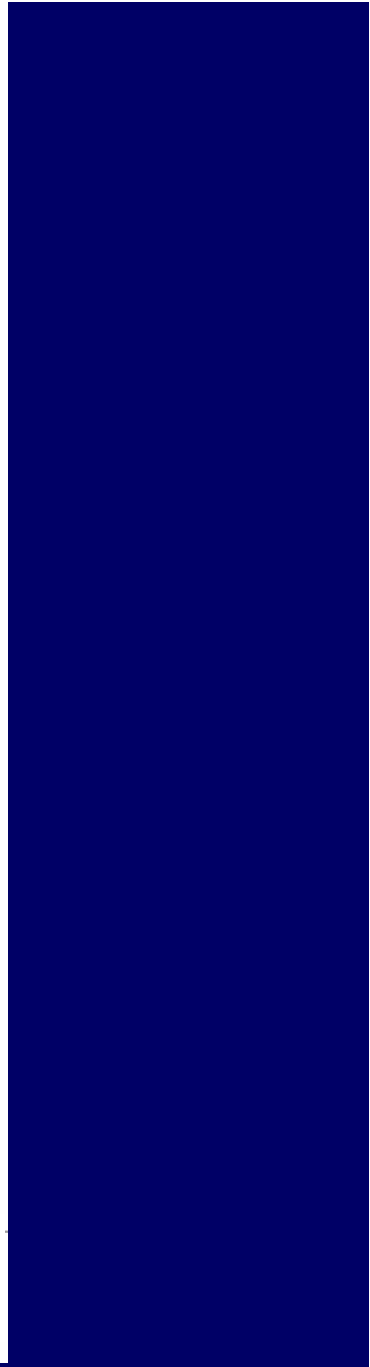
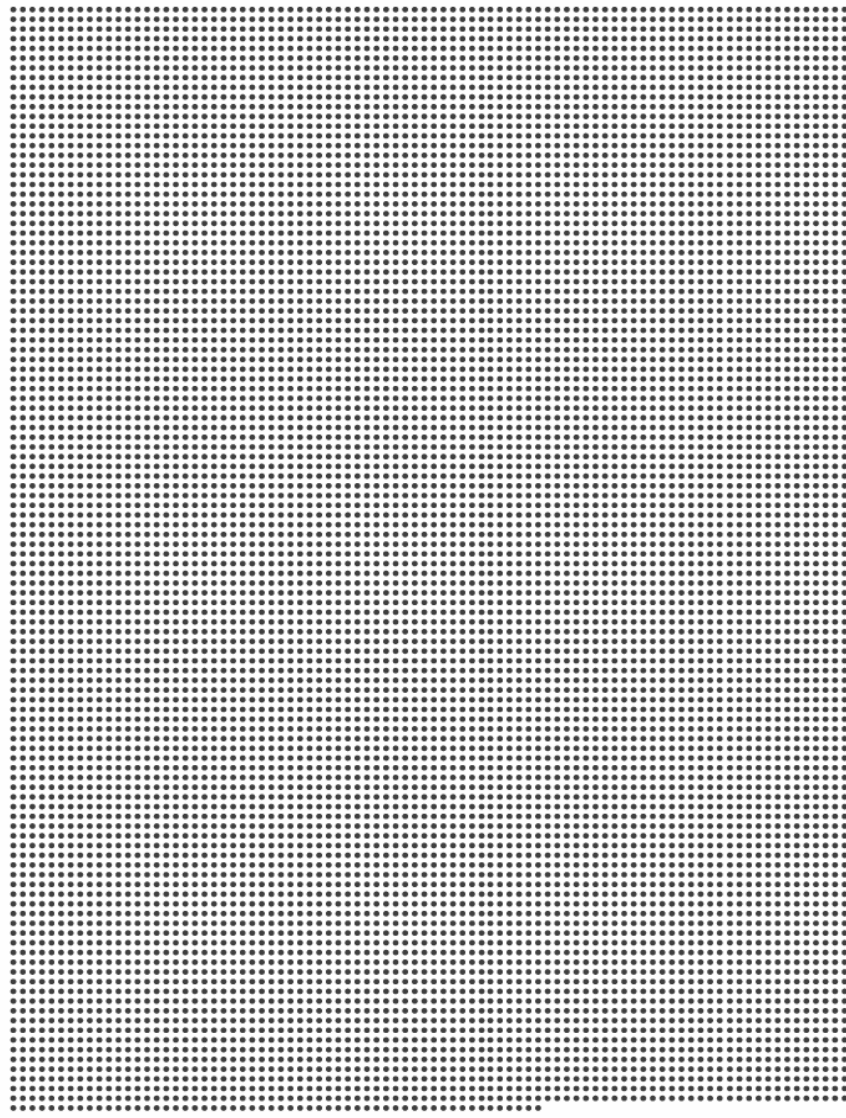
Complexity has risen because of advances in information technology and because of performance improvements at the level of system units (i.e., organizations, technologies and people)

These changes produce more complex networks with:

- More nodes
- A greater density of connections among nodes
- Faster movement of material, energy, and information along these connections

POWER SHIFT

Individuals and small groups
are developing immense capacity
to kill and destroy



OVERLOAD

Stress

Coping capacity

