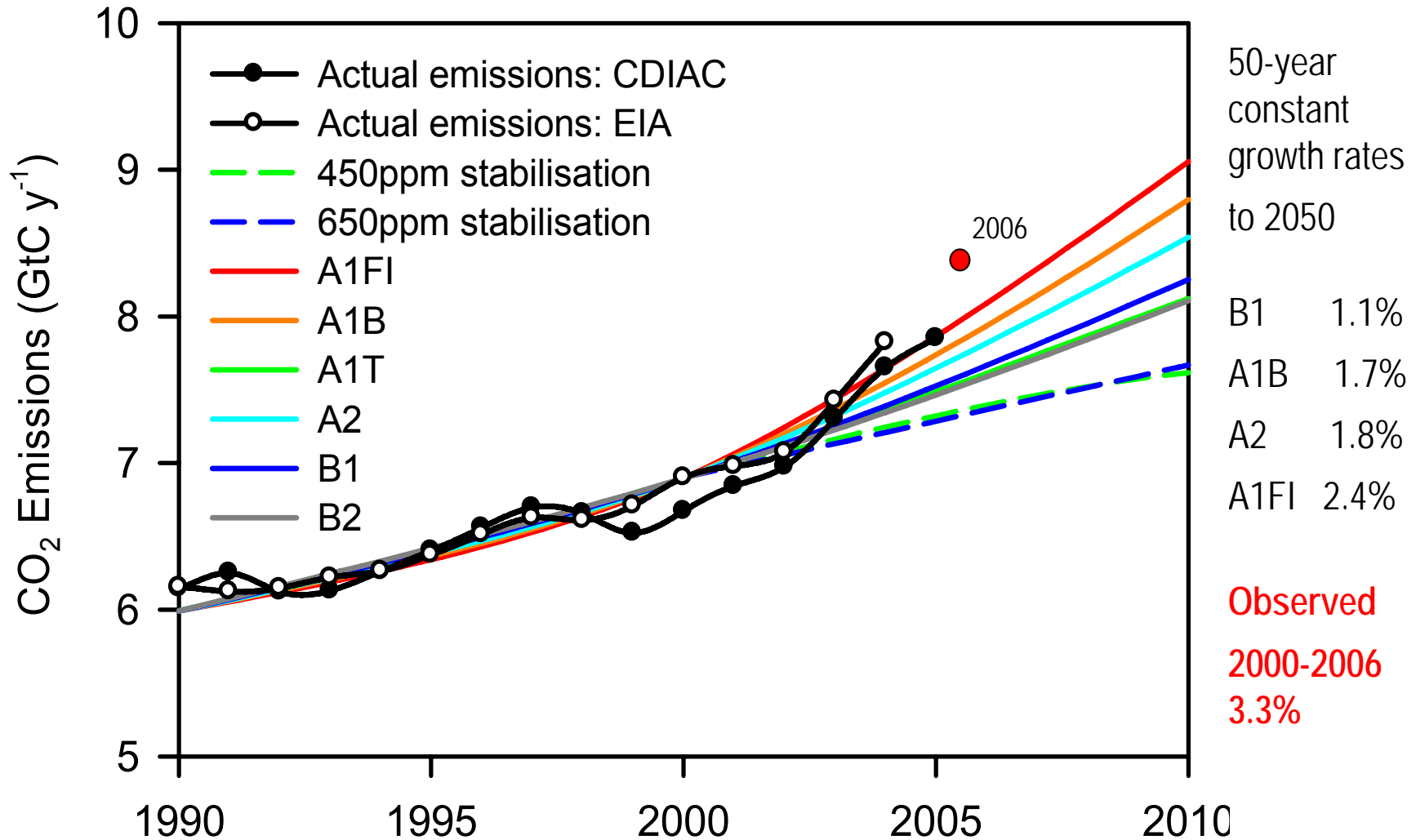


Recent Productivity & Disturbance Changes with High Latitude Climate Change

*Scott Goetz
& Colleagues*

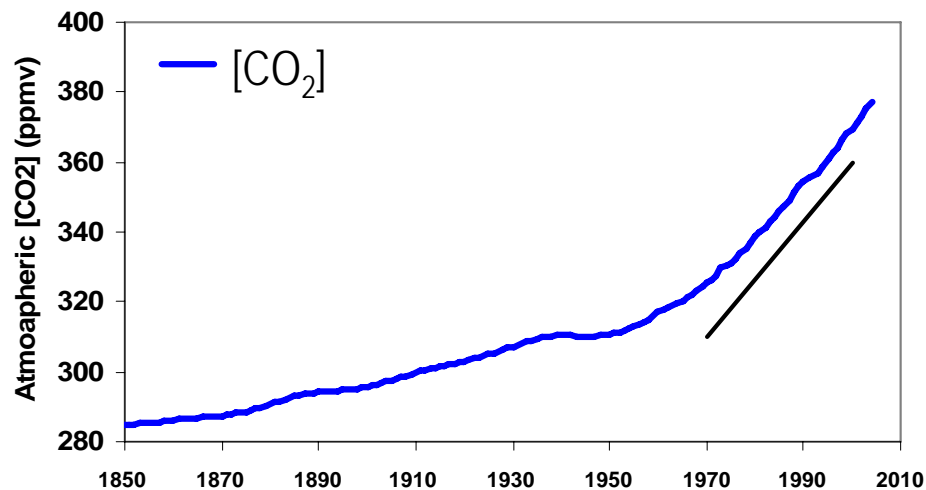


Trajectory of Global Fossil Fuel Emissions



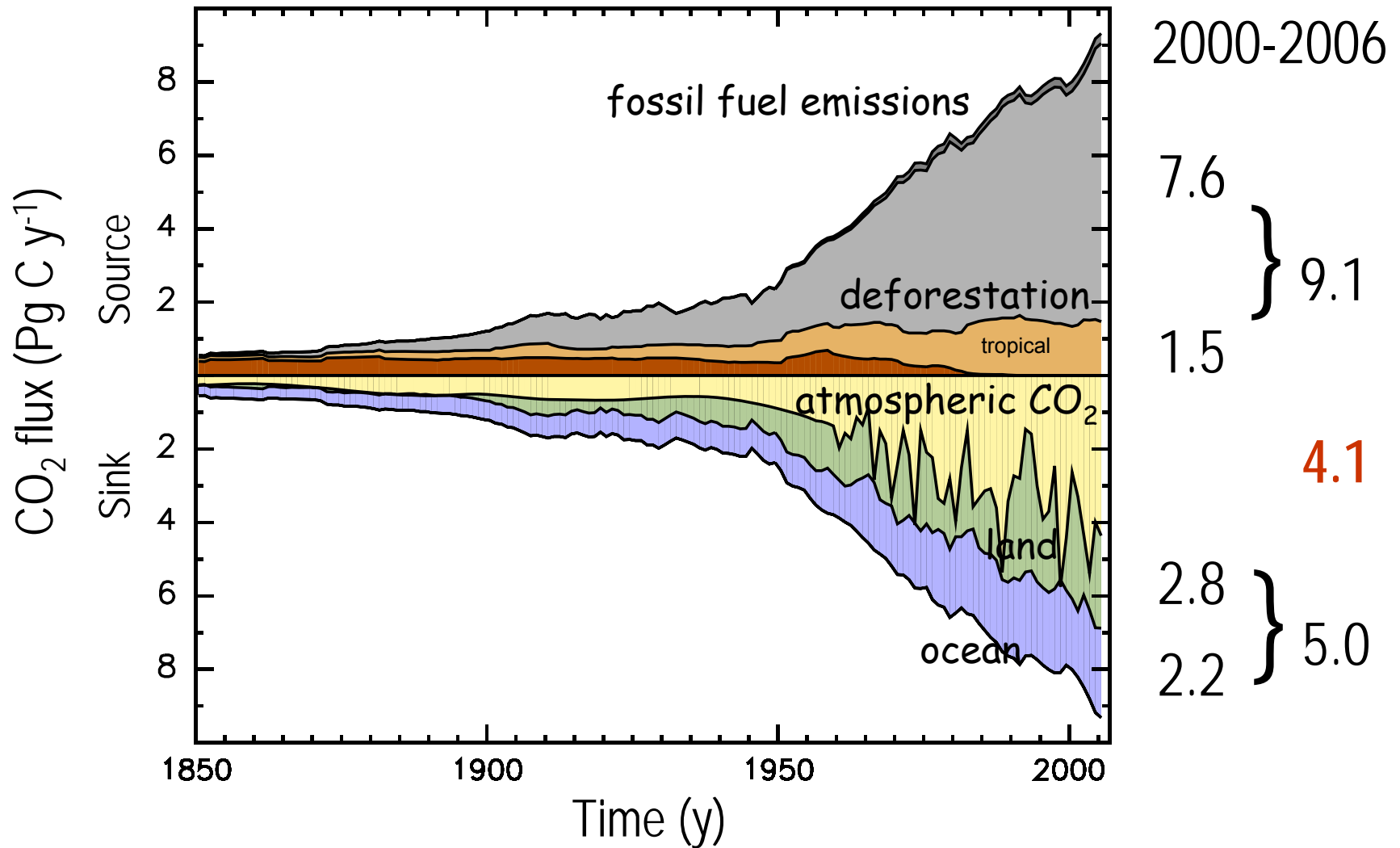
Atmospheric CO₂ Concentration

Year 2006
Atmospheric CO₂
concentration:
381 ppm
35% above pre-industrial

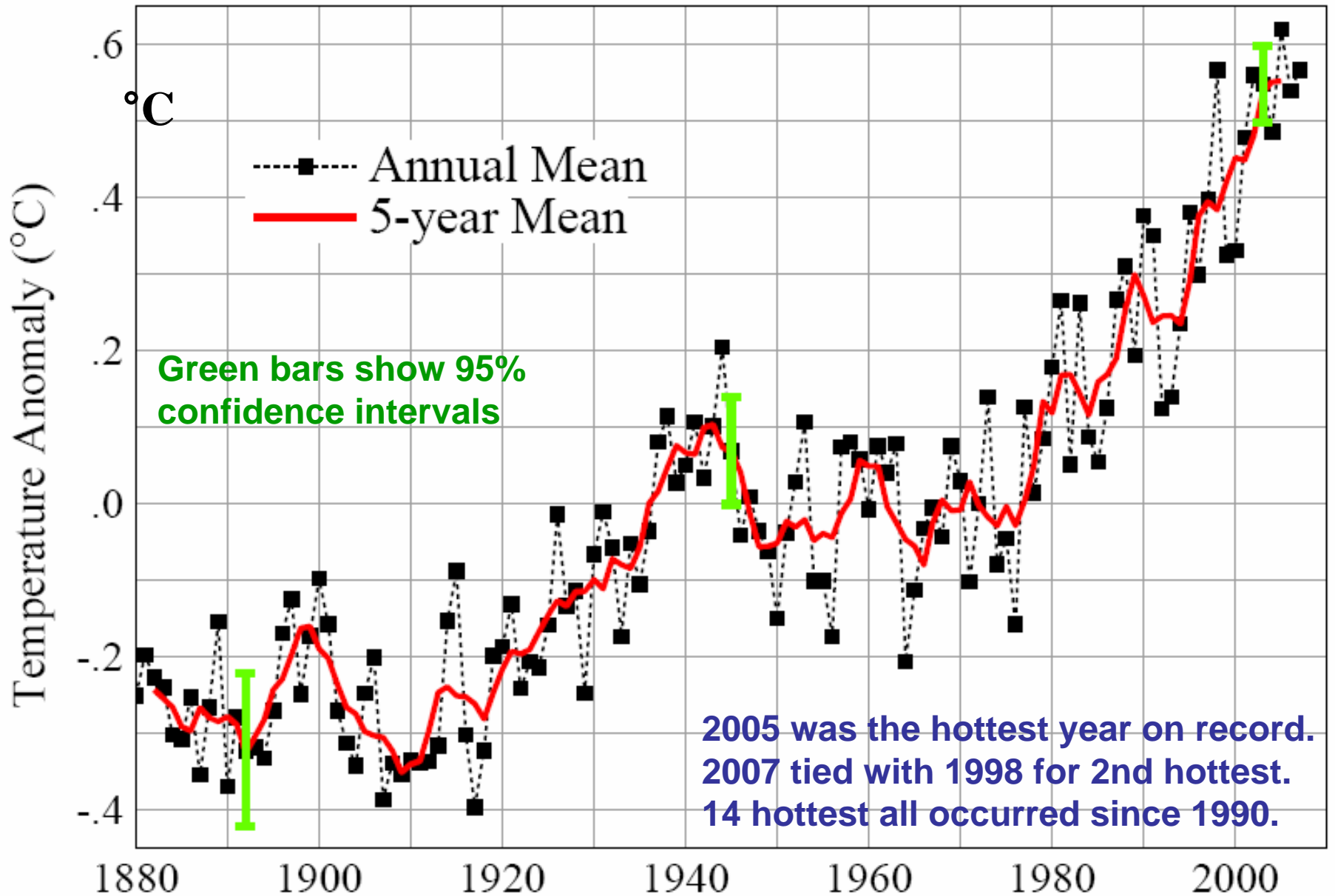


1970 – 1979: 1.3 ppm y⁻¹
1980 – 1989: 1.6 ppm y⁻¹
1990 – 1999: 1.5 ppm y⁻¹
2000 - 2006: **1.9 ppm y⁻¹**

Dynamics of Global Carbon Budget (1850 - 2006)



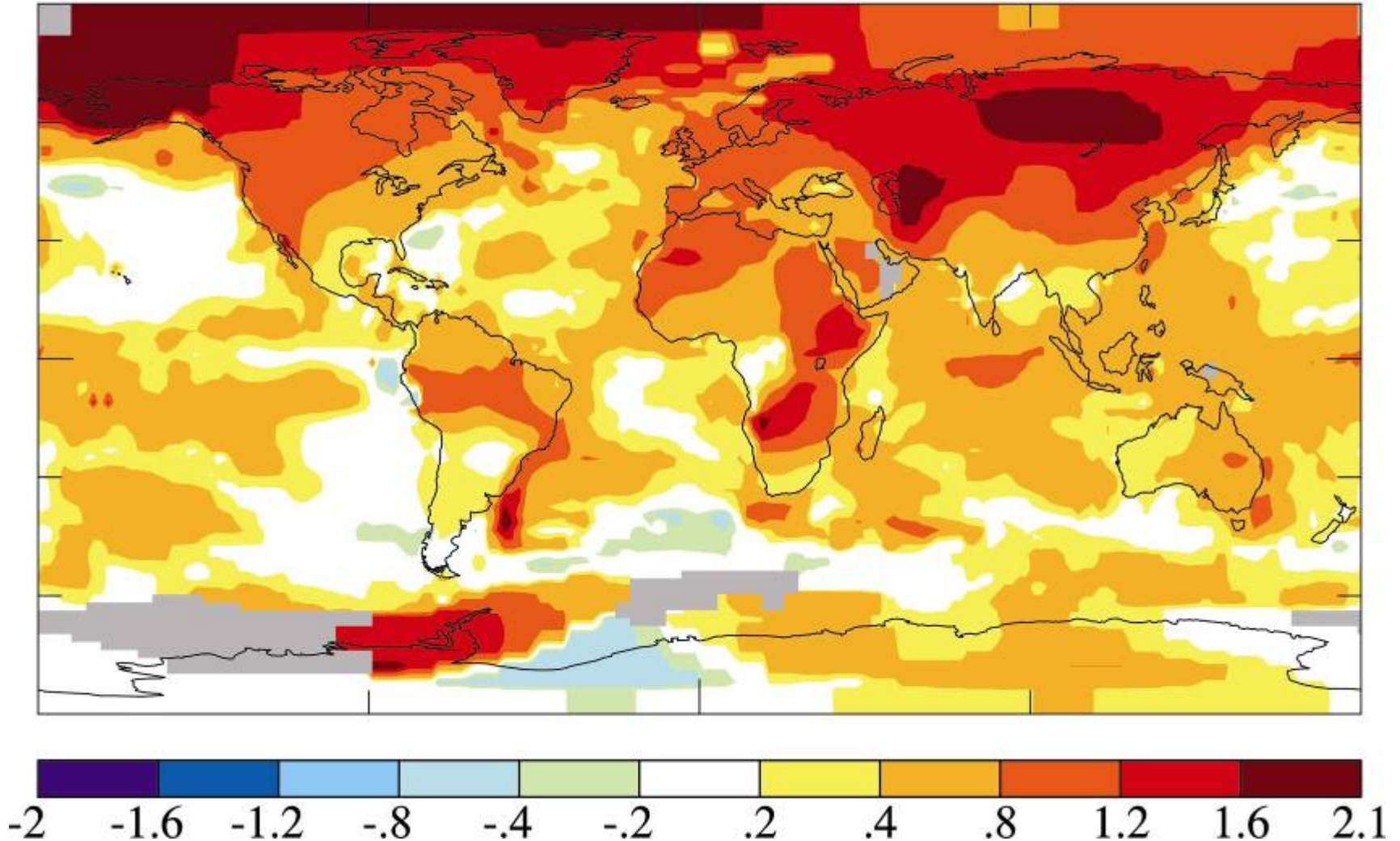
Global surface temperature since 1880



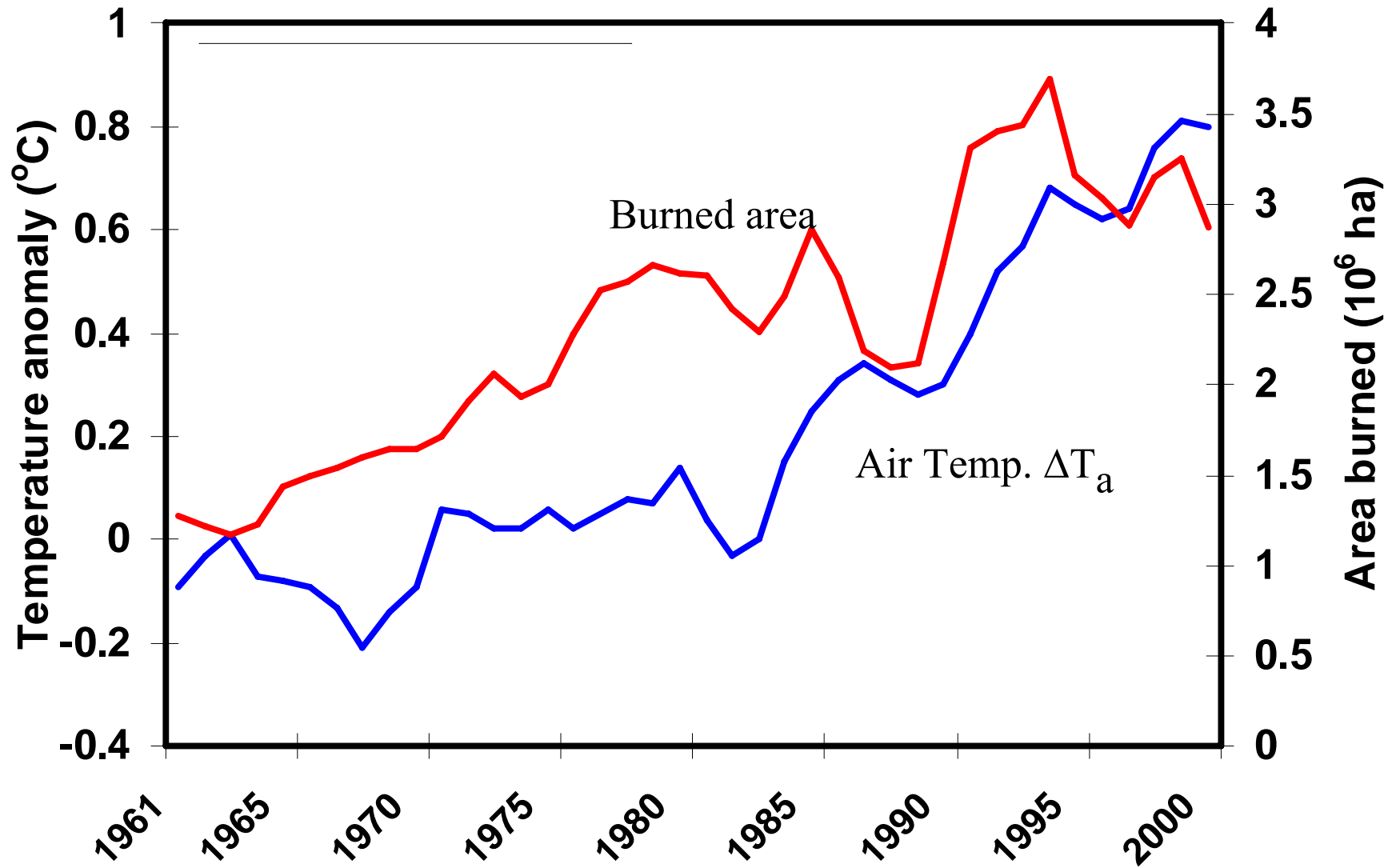
Average T in 2001-2005 versus 1951-80 base, °C

Base Period = 1951-1980

Global Mean = 0.53

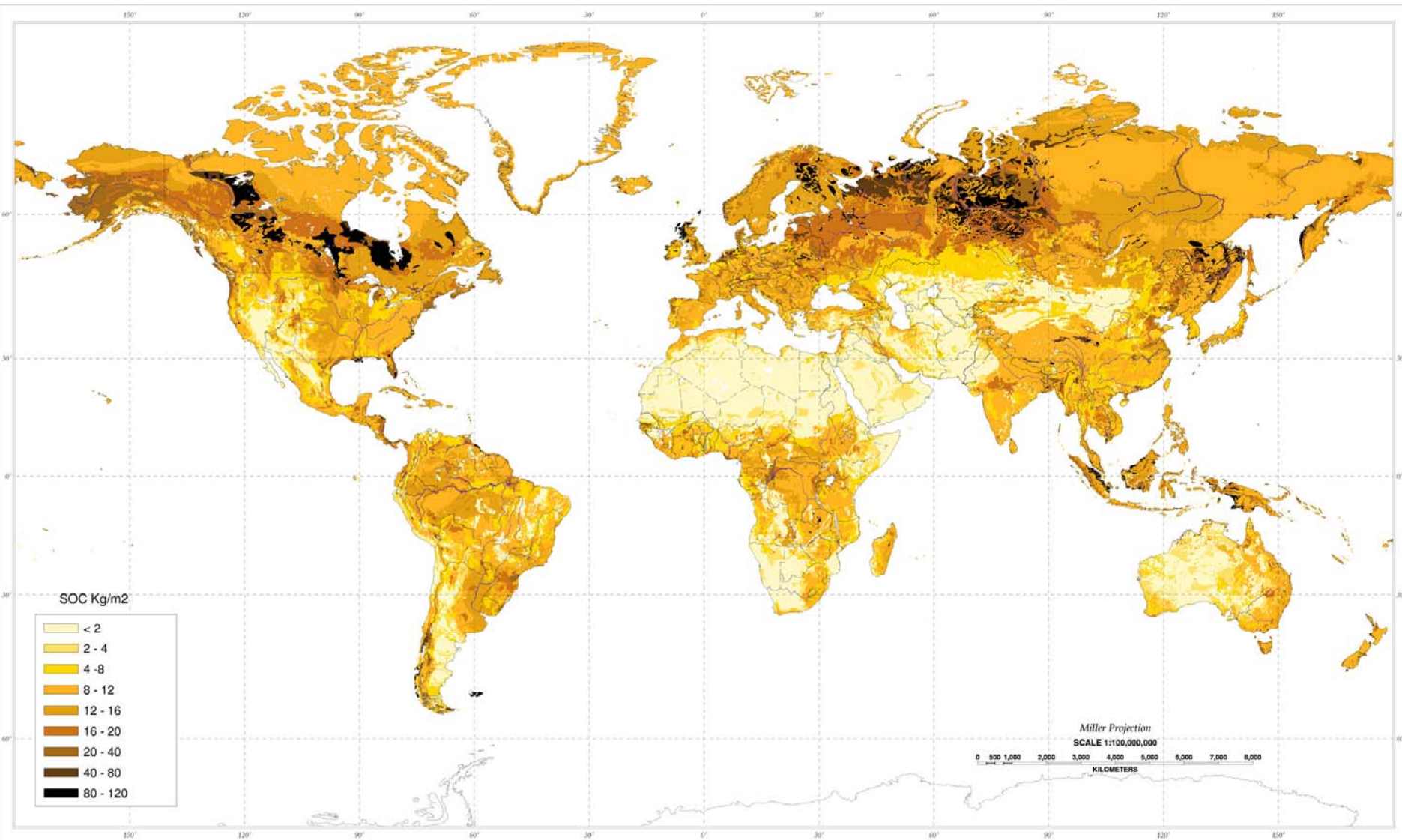


Temperature and Fire Trends in North American High Latitudes



Fires have become more frequent & extensive..

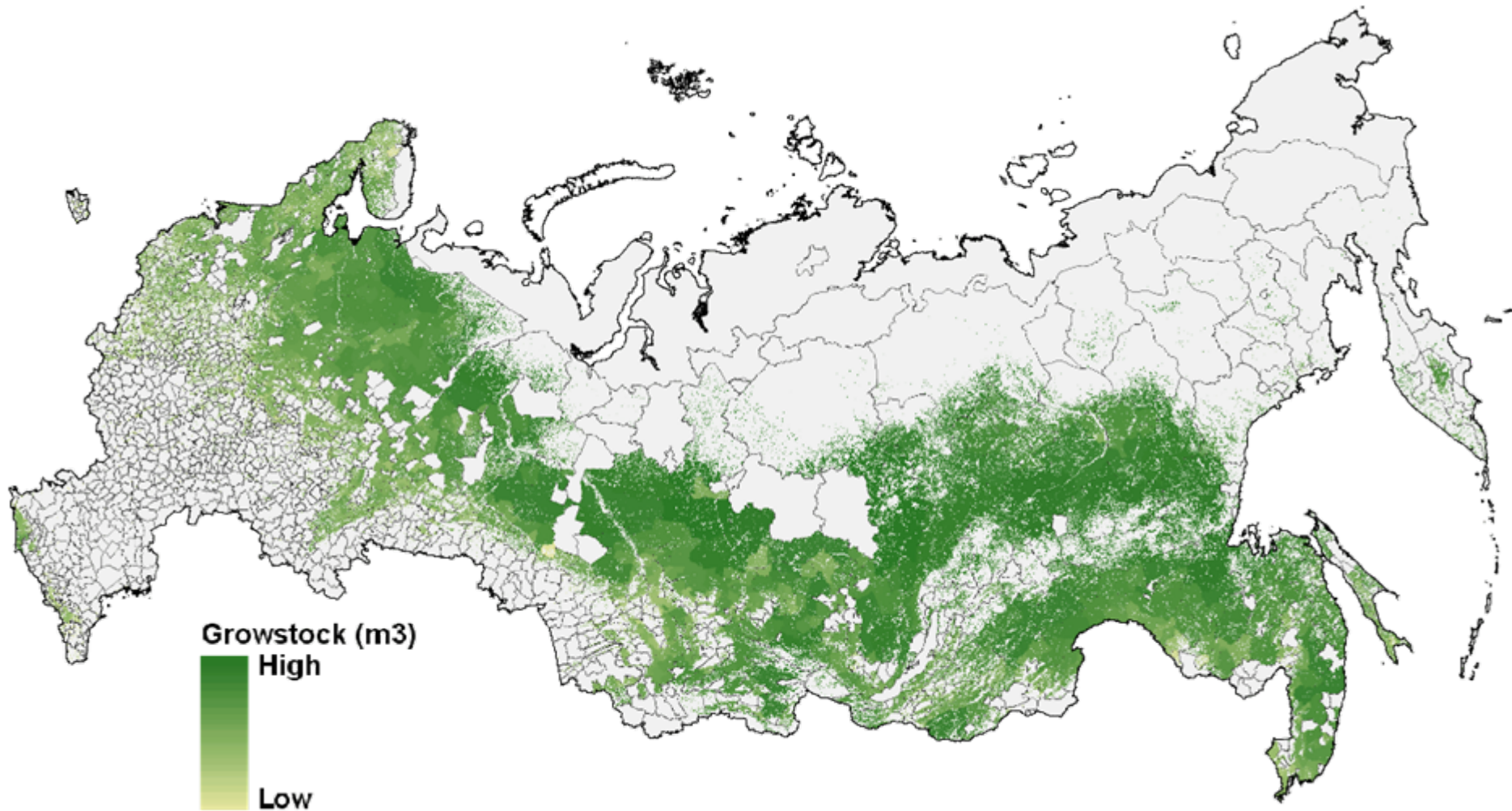
Soil Organic Carbon is Concentrated in High Latitudes



“The Carbon Bomb”

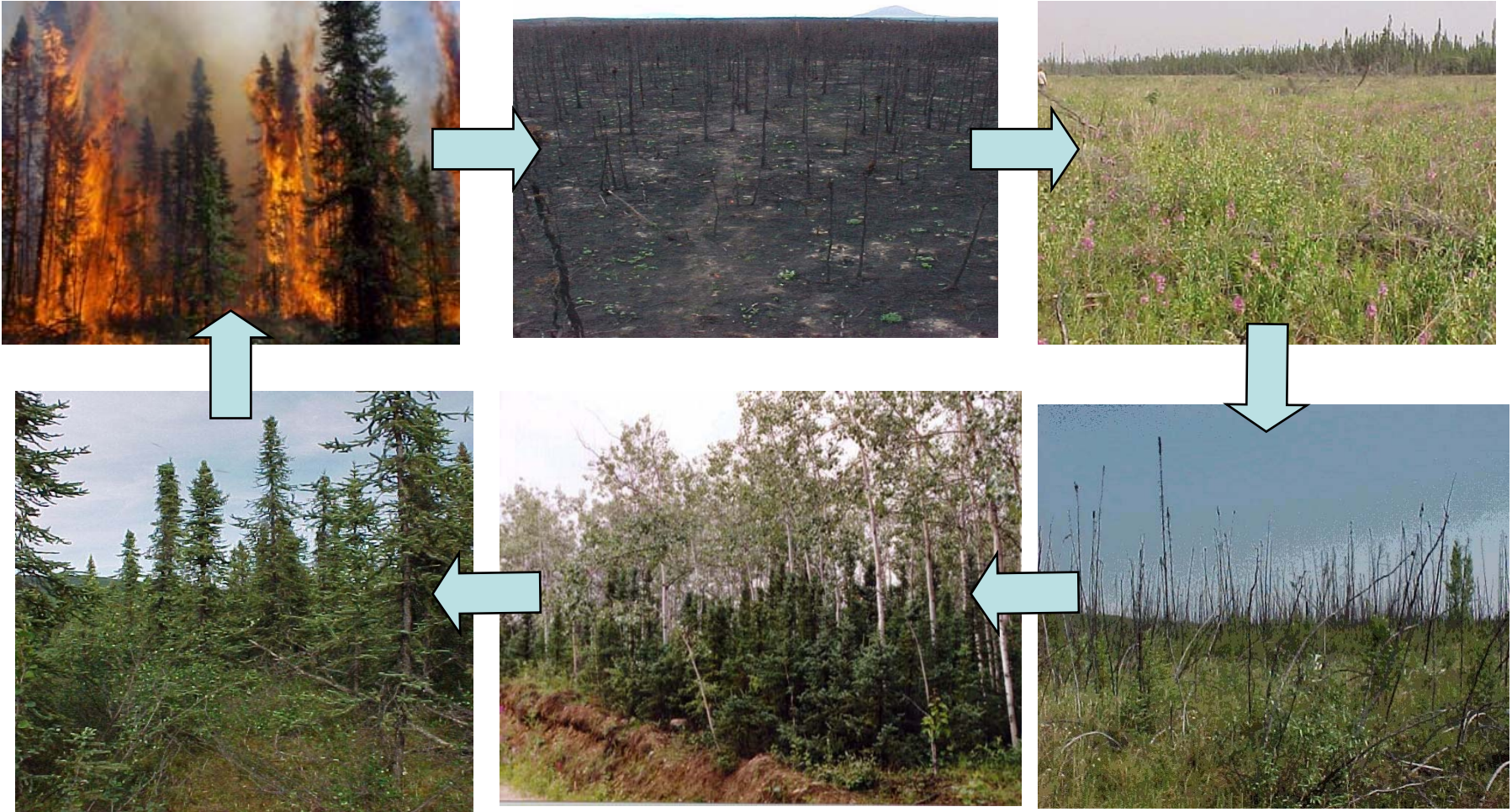
Source: USDA, graphic by Steve Allison (UCI)

Carbon Stock in Russian Forests



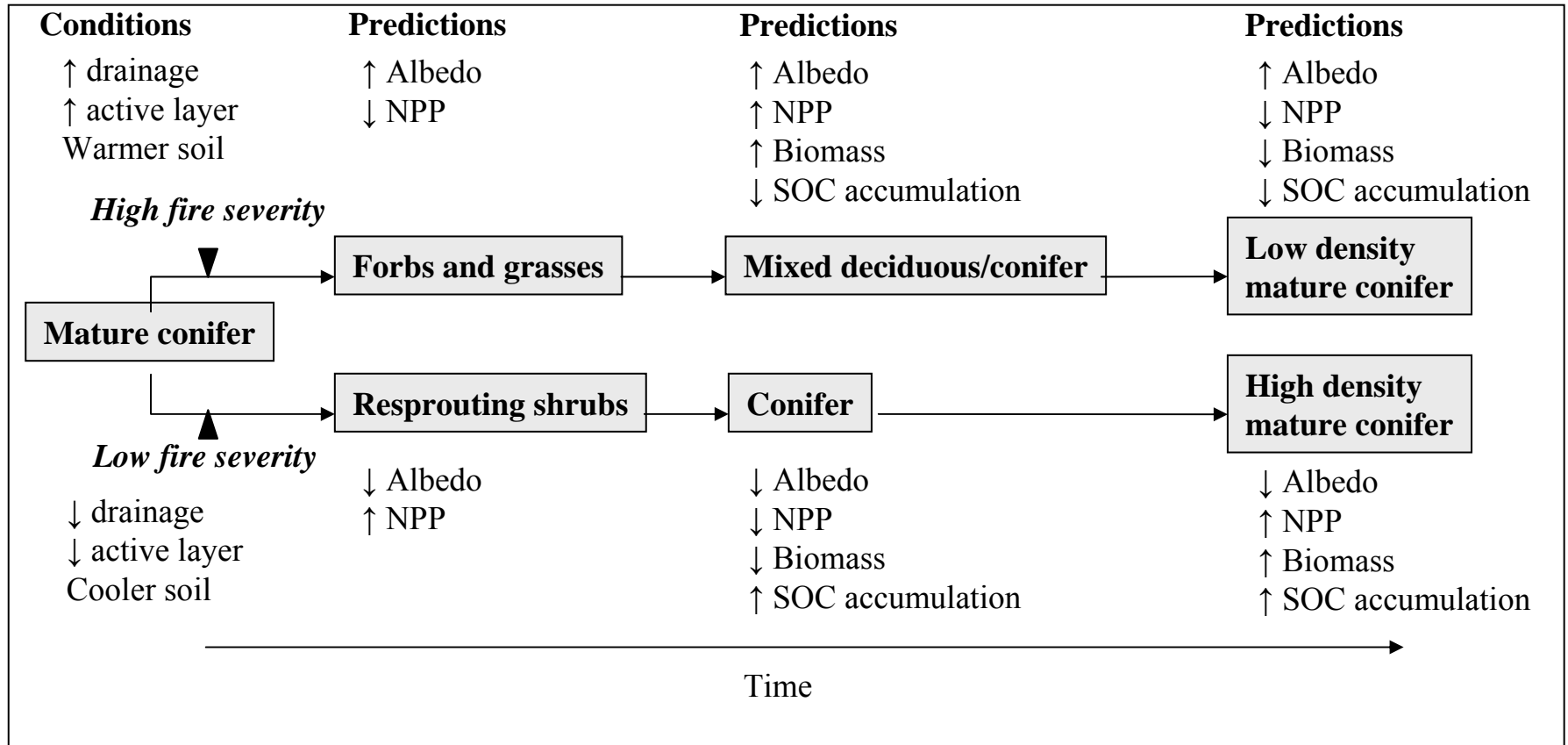
Houghton et al. (2007) ERL

Fire Disturbance in the Boreal Forest



photos: Jim Randerson

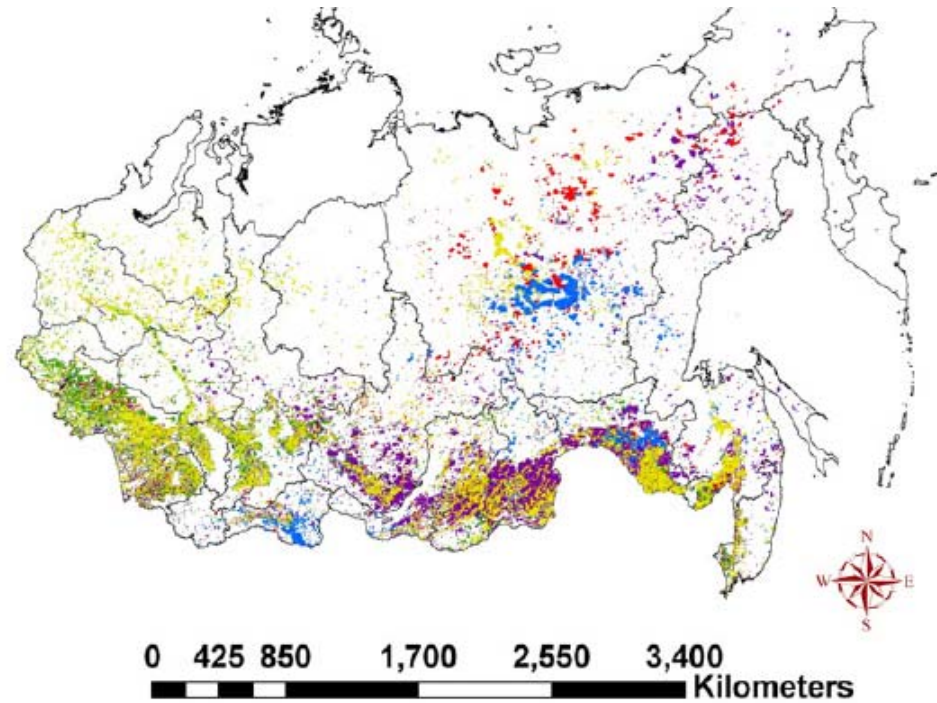
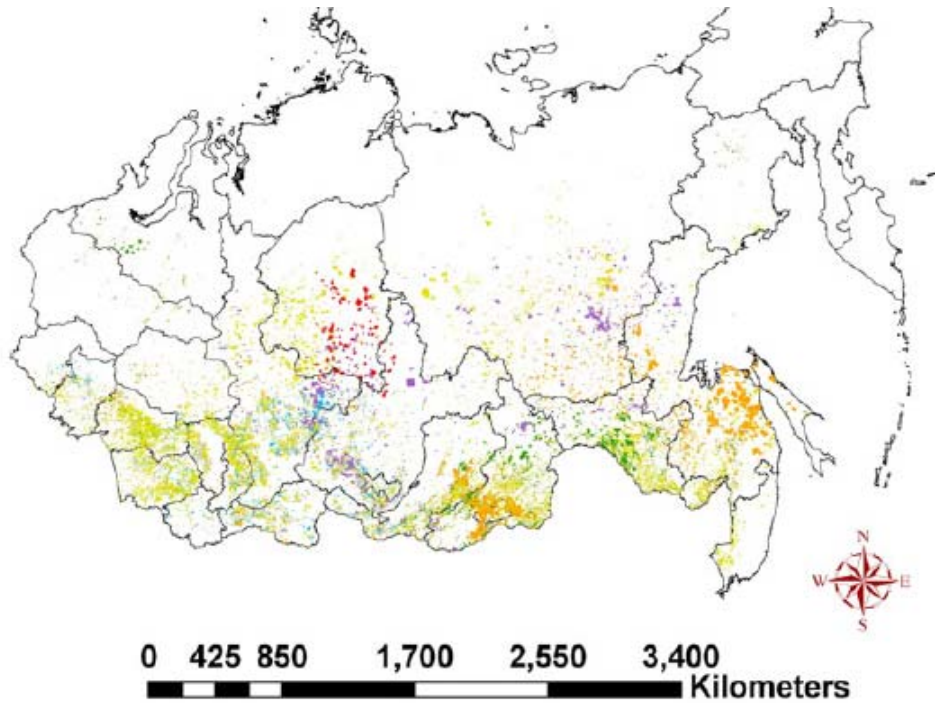
Fire Severity Implications for Trajectories of Regrowth Productivity & Albedo



Goetz et al. ERL 2007

{Mack, Johnstone, Kasischke}

Fires & Burned Area Maps



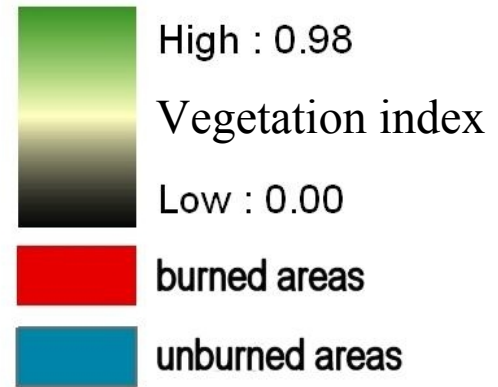
2000 fires
1999 fires
1998 fires
1997 fires

1996 fires
1995 fires
Siberia

2005 fires
2004 fires
2003 fires

2002 fires
2001 fires
Siberia

Burned Area Maps

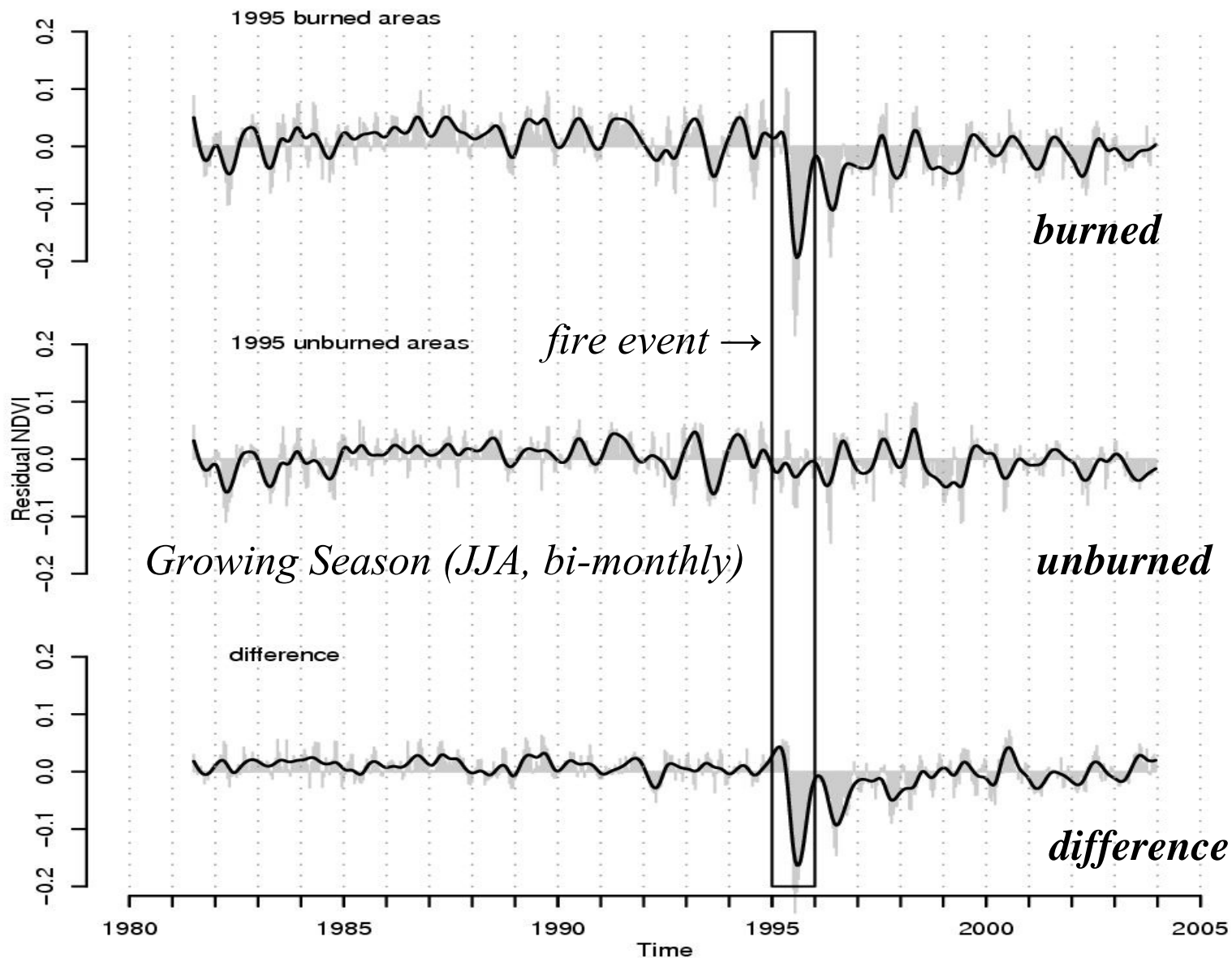


*Large Fire Database
(Brian Stocks, CFS)*

0 50 100 200 Kilometers

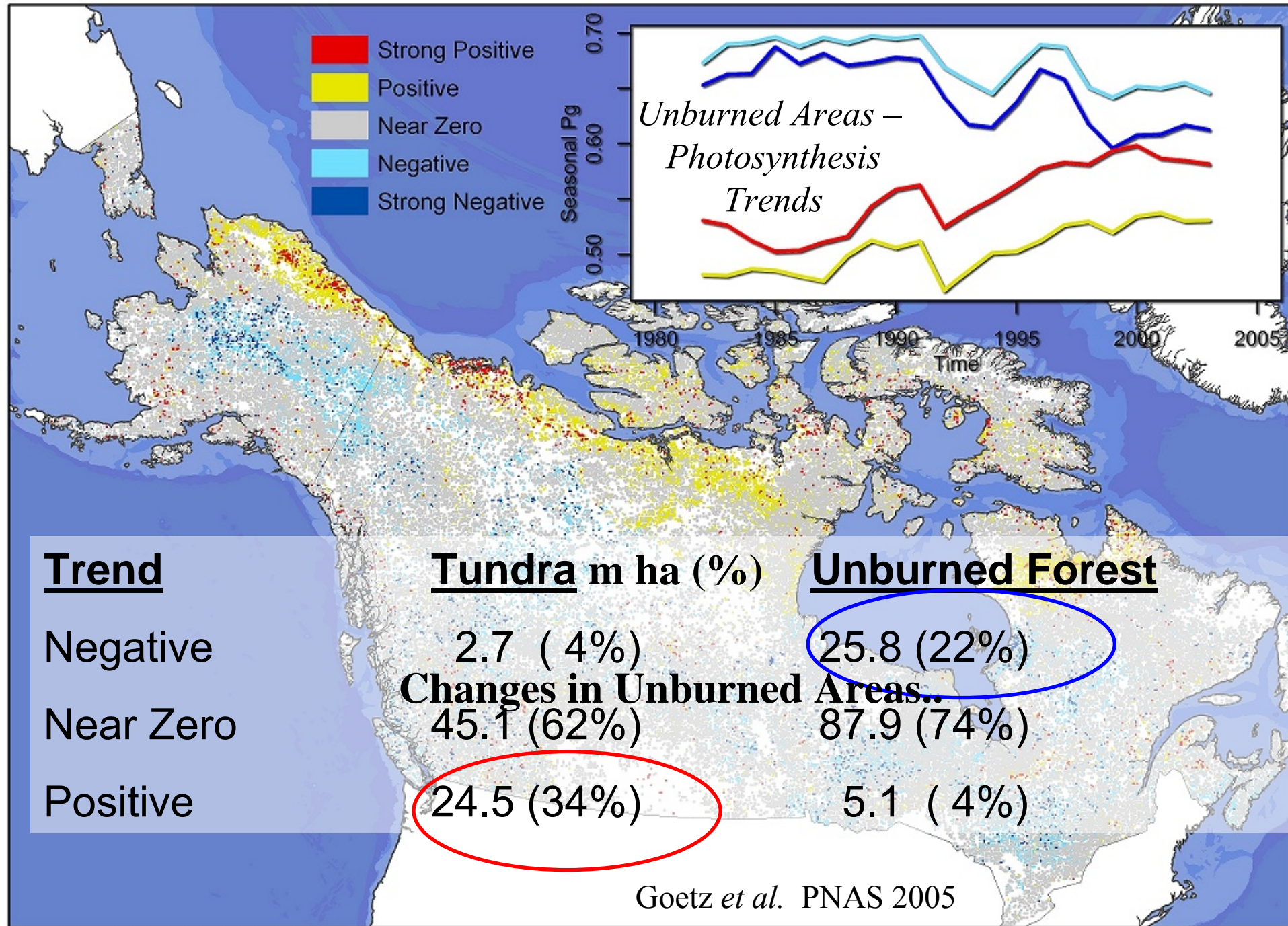
A horizontal scale bar with four segments, labeled '0', '50', '100', and '200 Kilometers'.

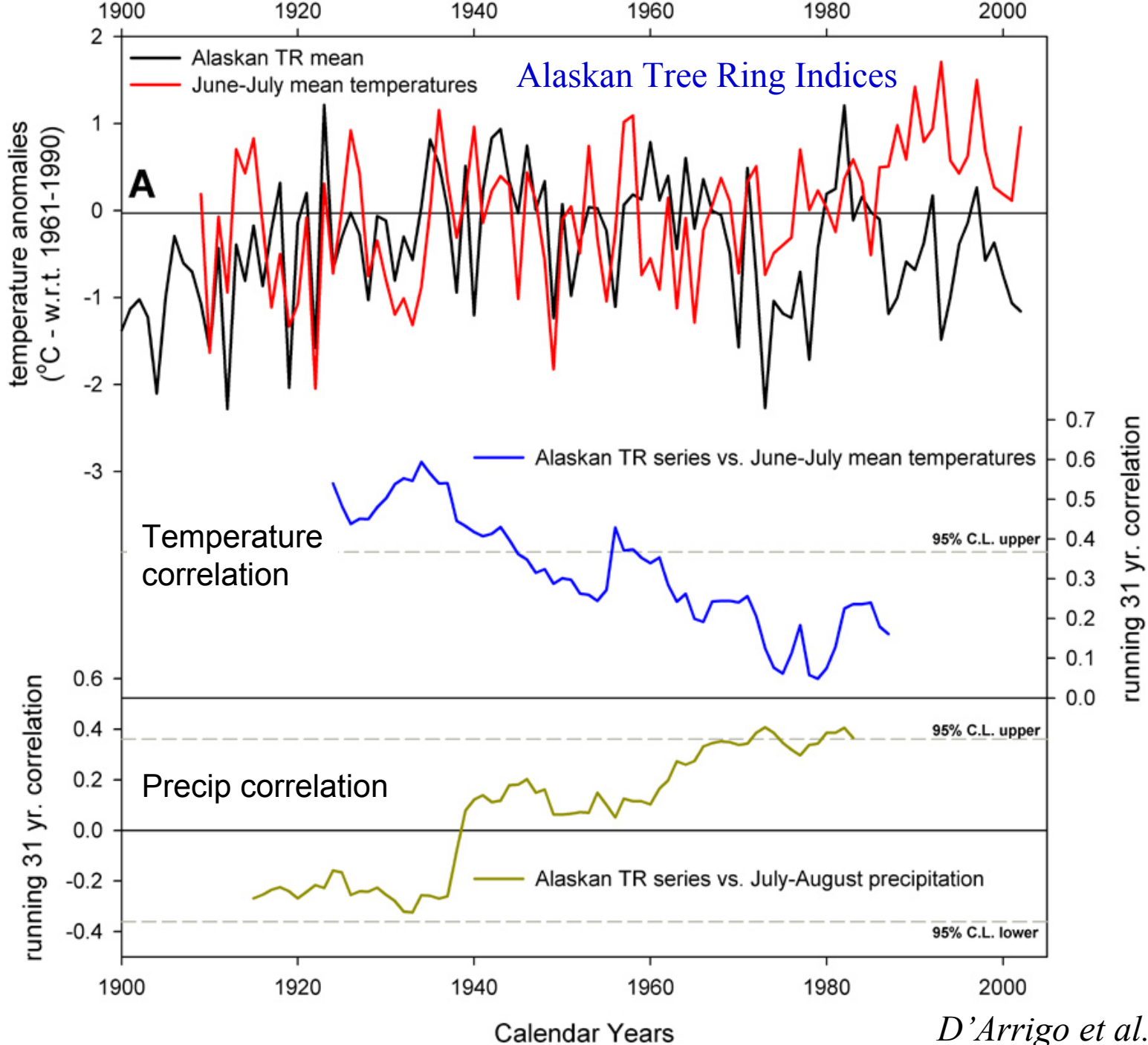
Satellite Monitoring of Forest Regrowth following Fire



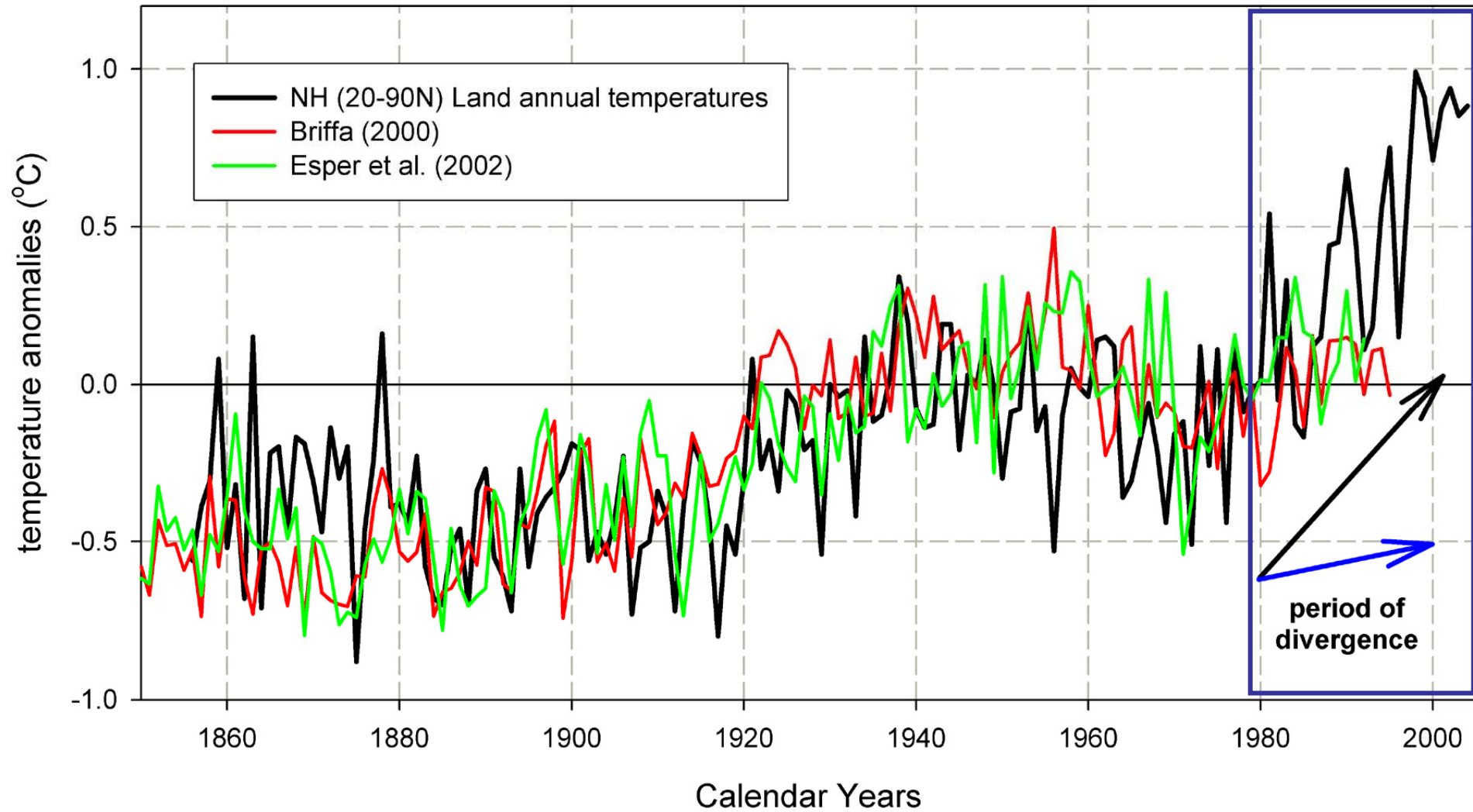
Anomalies: Burned –vs– Unburned Areas

*Goetz et al.
RSE 2006*





Extra-tropical Temperatures and Tree Ring Indices



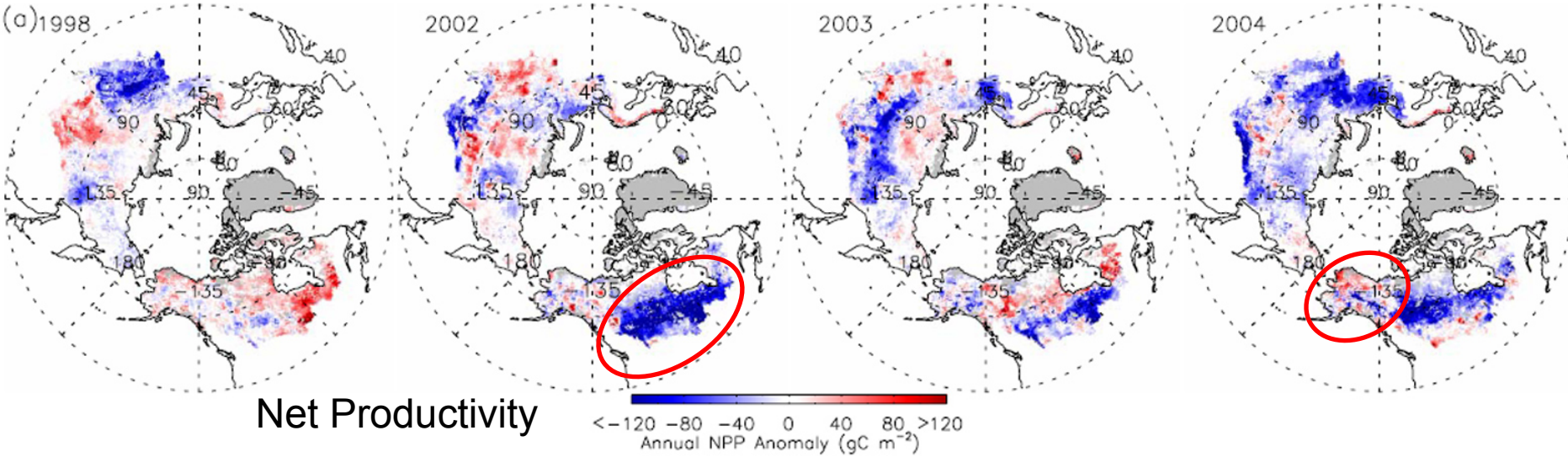
Links between High Latitude Productivity and “Drought”

1998

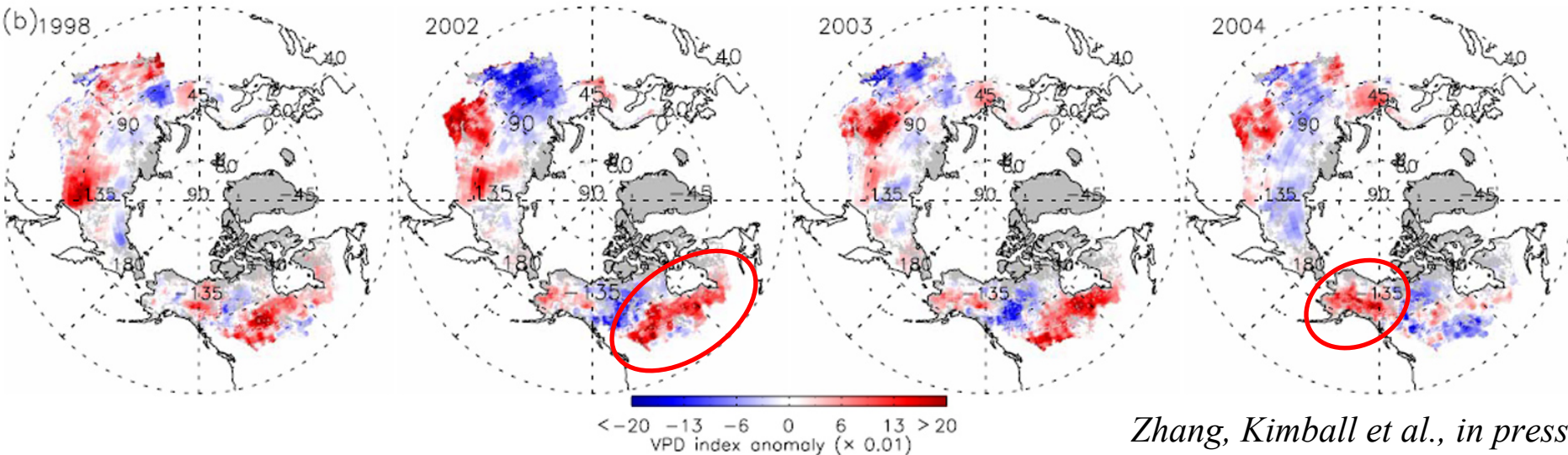
2002

2003

2004



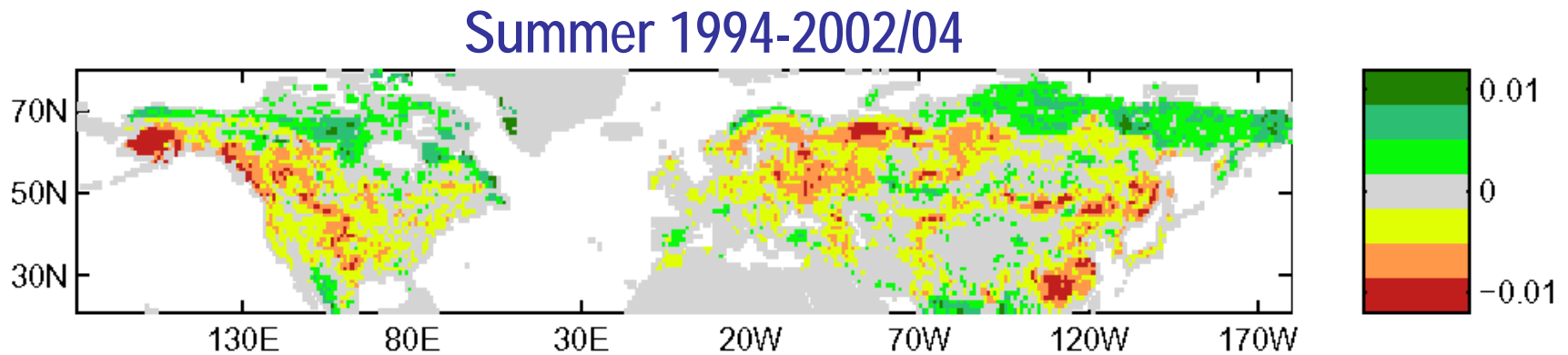
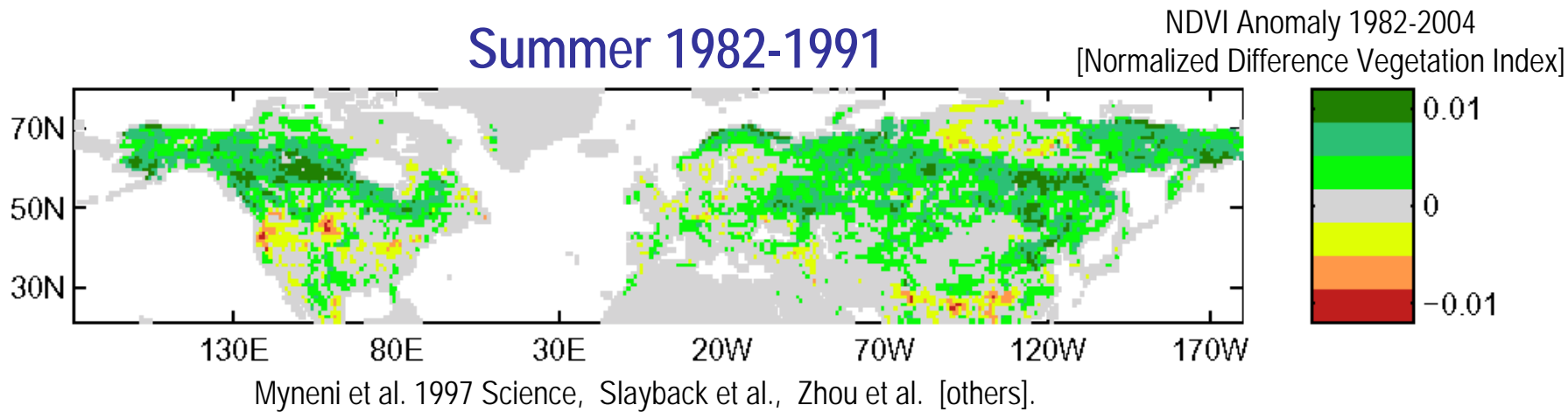
Dryness of Air (VPD)



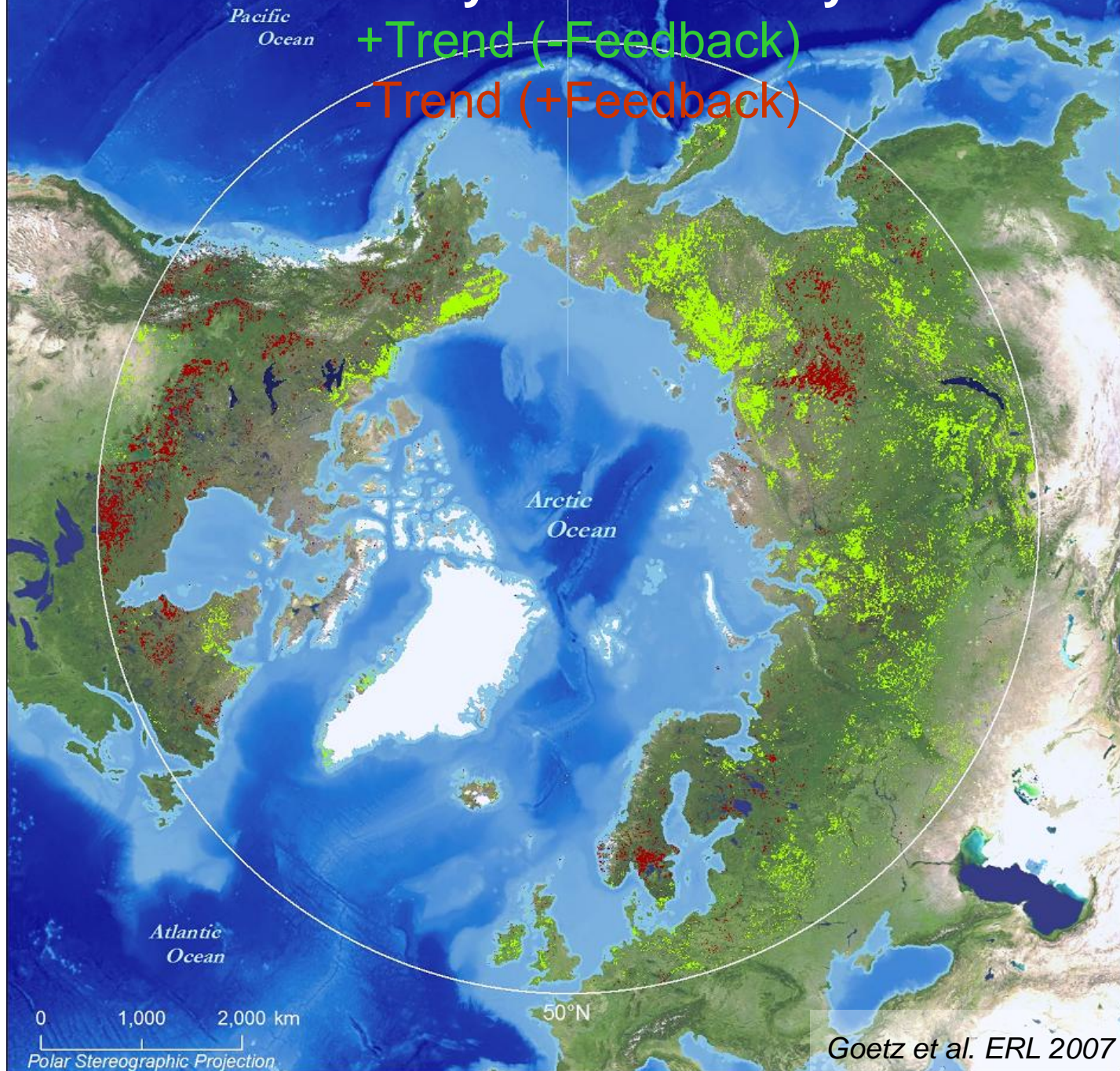
Zhang, Kimball et al., in press
Bunn et al. Eos 2007

Weakening of Mid to High Latitude Carbon Sinks

Observed weakening of the growth rate of terrestrial carbon sinks in these regions.



Trends In Photosynthetic Activity 1982-2005



Changes in Shrub Growth North Slope of Alaska

1957



2007



Photos courtesy of Ken Tape, UAF

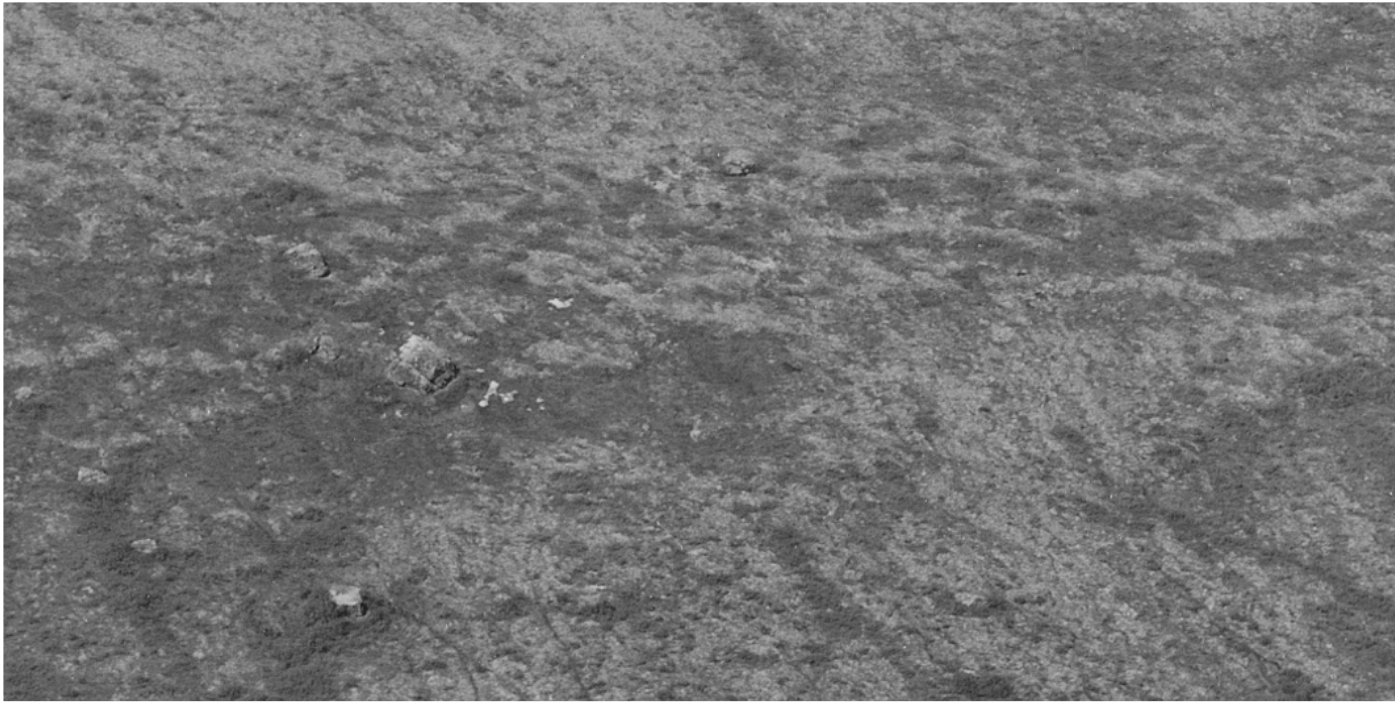
COL-OV-42-22

Shrubs increasing on valley slopes.



Chandler River

1957



2005



Anaktuvuk River Fire in Tundra, North Slope of Alaska 2007



~70 km long and ~13-20 km wide, total >1000 km²