

Capitalism vs. the Planet

Where do we go from here

Paul Belanger

pebelanger@glassdesignresources.com

<http://denverclimatestudygroup.com/>

303-249-7966

SUMMARY

1. The world has been getting better
2. Changes are happening
3. We need to support science and new technologies

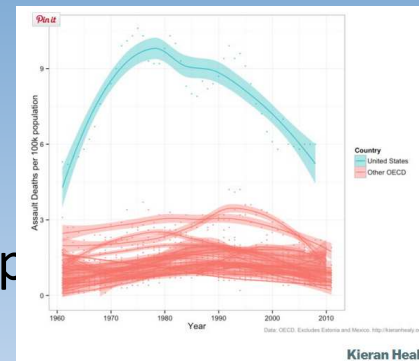
25 charts and maps that show the world is getting much, much better

- <http://www.vox.com/2014/11/24/7272929/charts-thankful>

Let's not regress; let's continue to improve our world and transition to a new future: A NEW NORMAL

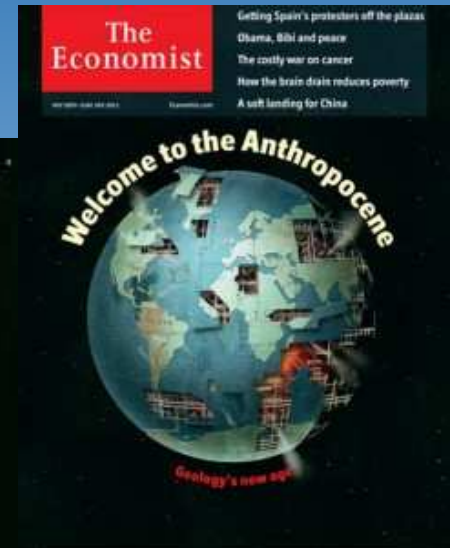
1. ECONOMIC PROGRESS: Extreme poverty has fallen
2. Hunger is falling
3. Child labor in decline
4. More leisure time
5. Income spent on food has plummeted in US
6. Health care: life expectancy is rising
7. Child Mortality is down
8. Death in childbirth is rarer
9. People are getting taller
10. More people have access to malaria bednets

11. Guinea worm is almost eradicated
12. Teen births in US are down
13. As is smoking
14. War is on the decline
15. Homicide rates are down in Europe
16. And the US too
17. Violent crime declining
18. Rapidly reduced the supply of nuclear weapons
19. More countries are democracies
20. More people going to school longer



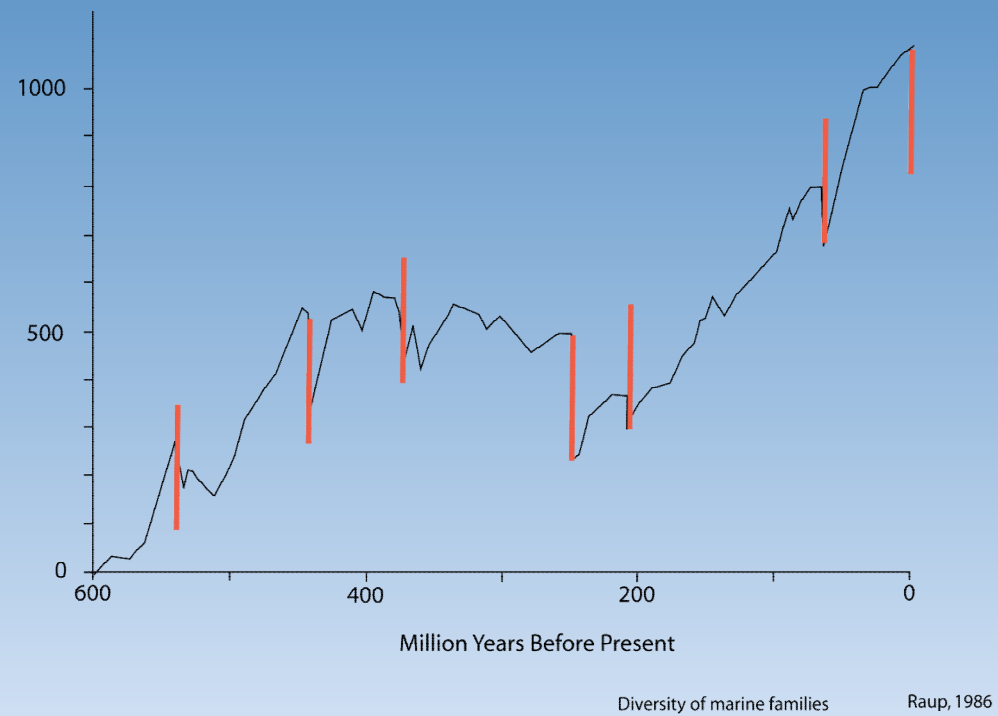
- 21. Literacy is up as well
- 22. US unsheltered homeless declined nearly 32% since 2007
- 23. Moore's law is still going (# transistors on a chip doubling) i.e. greater computer power
- 24. Access to internet increasing
- 25. Solar power is getting cheaper

Who will flourish in the Anthropocene?



Changes ARE happening

Mass Extinctions



Changes are Happening

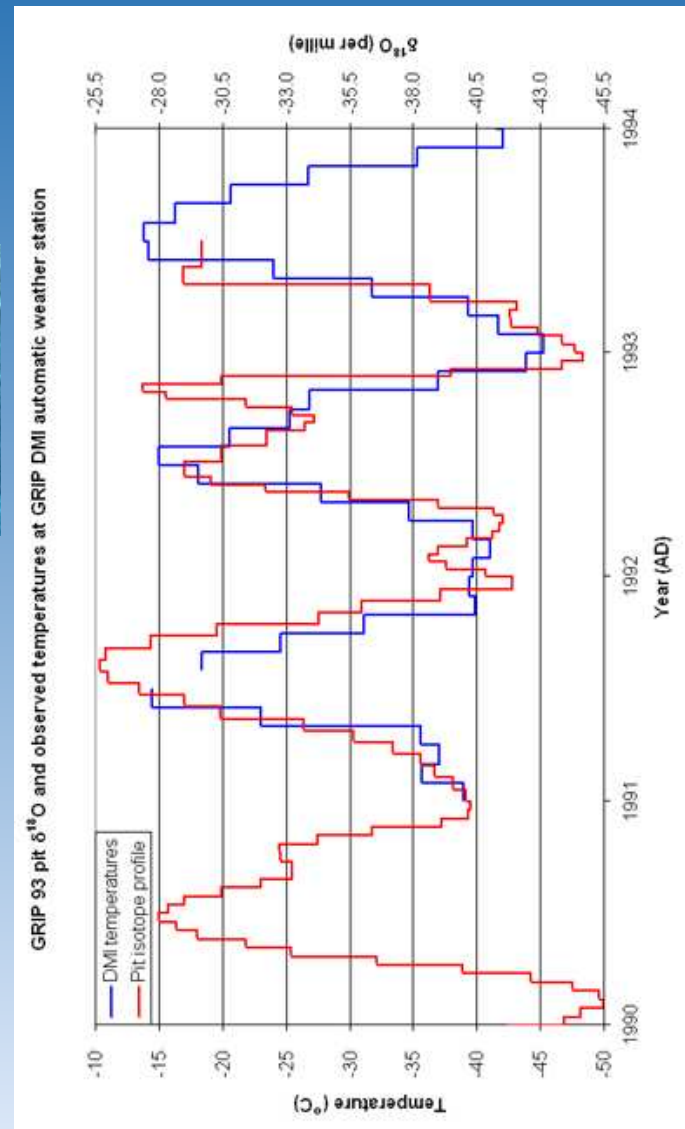
ICE

PRESENT

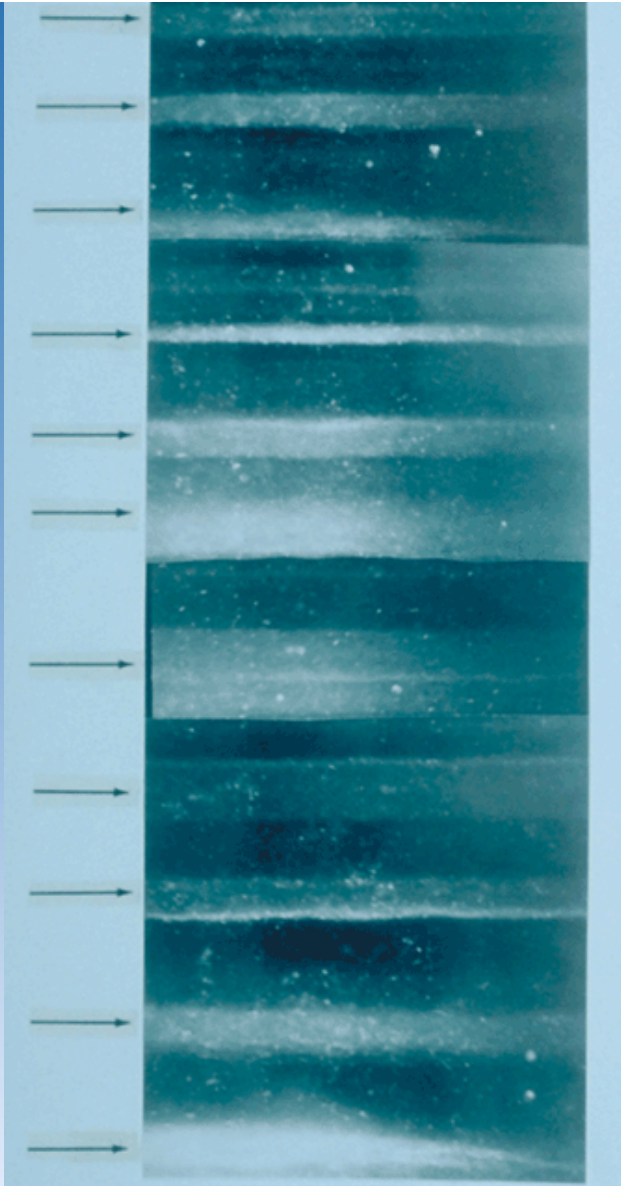


Snow Pit Stratigraphy

Temperature and Isotope Correlations
from Snow Pit at GRIP site, Greenland



U of Copenhagen



PAST: Stratified Ice

The pale bands are summer, the dark bands winter.

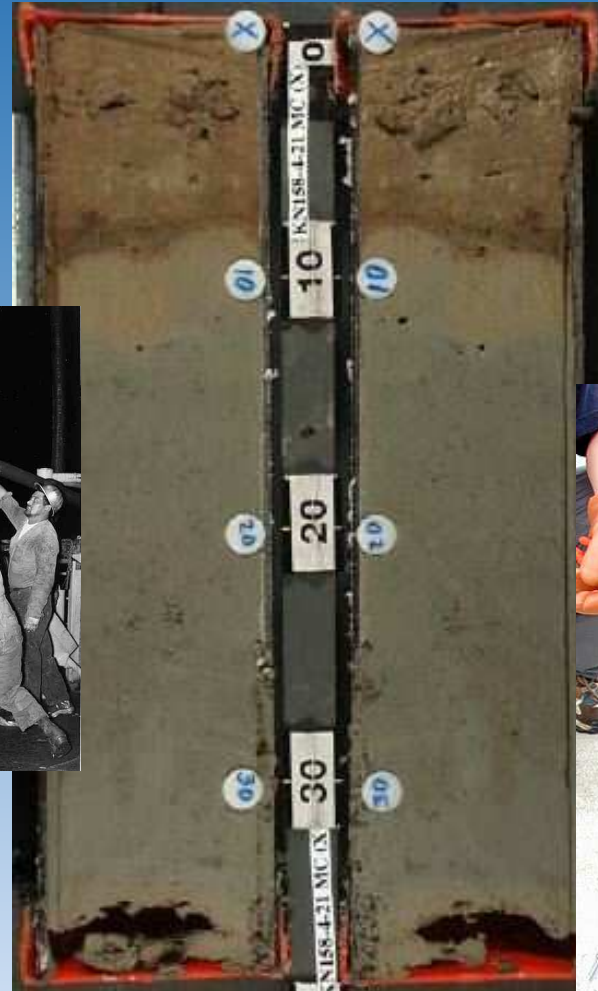


5 Cm

GISP 2 Core, 1855 meters

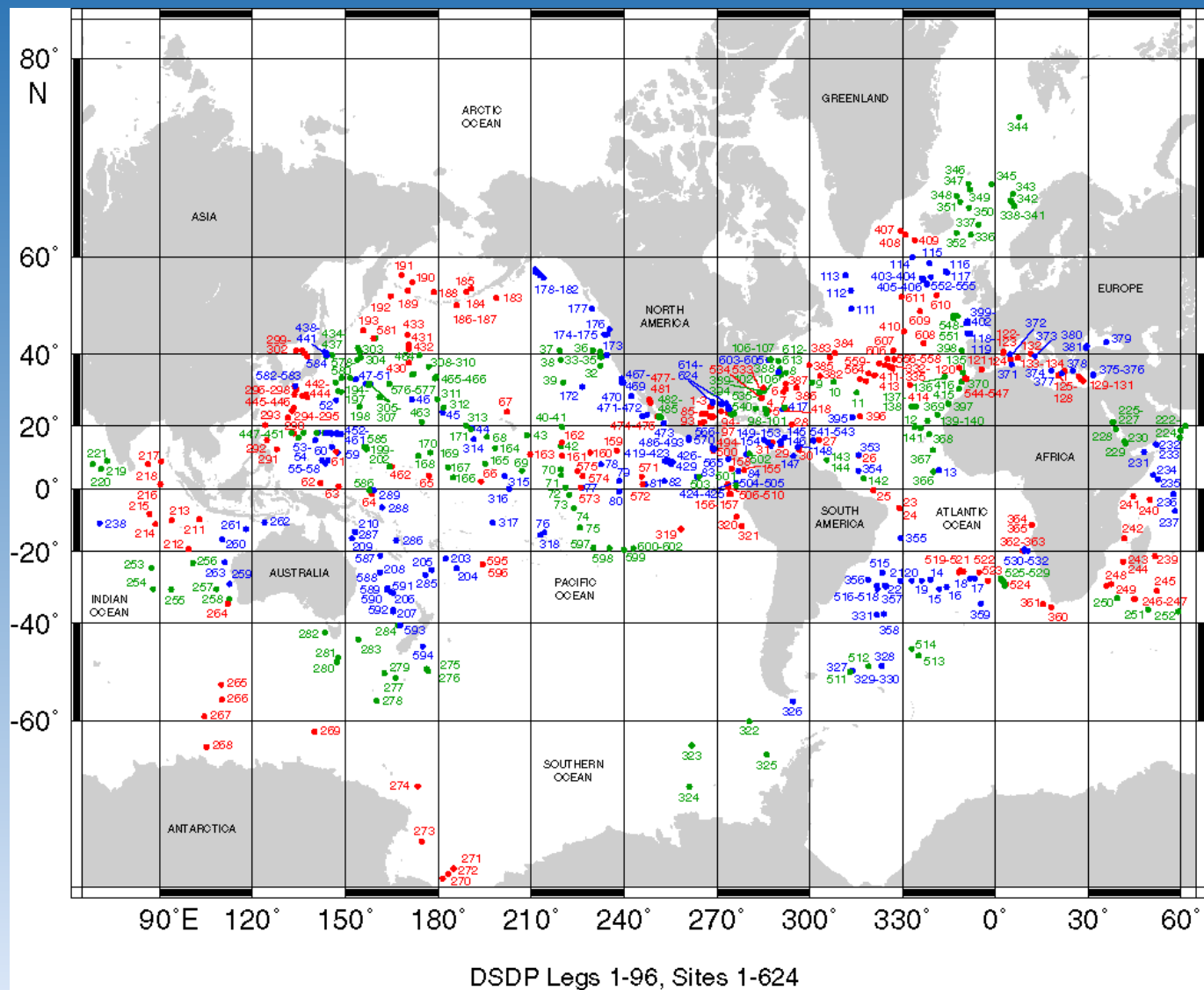
Changes are Happening

MUD



PAST & PRESENT





Changes are Happening

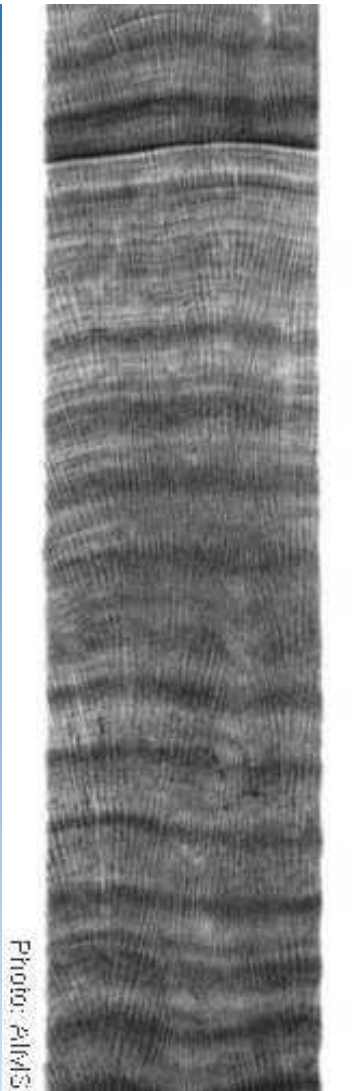
Caves and Reefs

Stalagmite

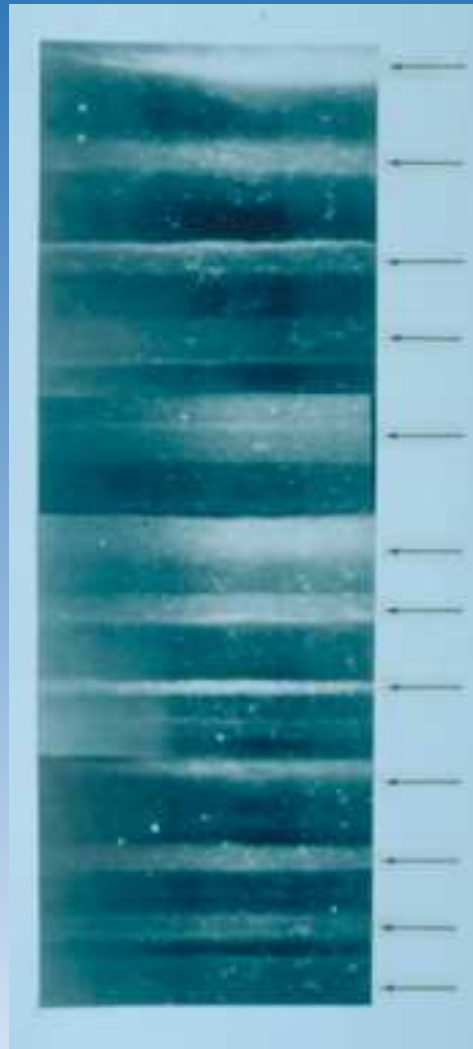
Paul Williams



UV Light



Coral, Australia



Ice, Greenland

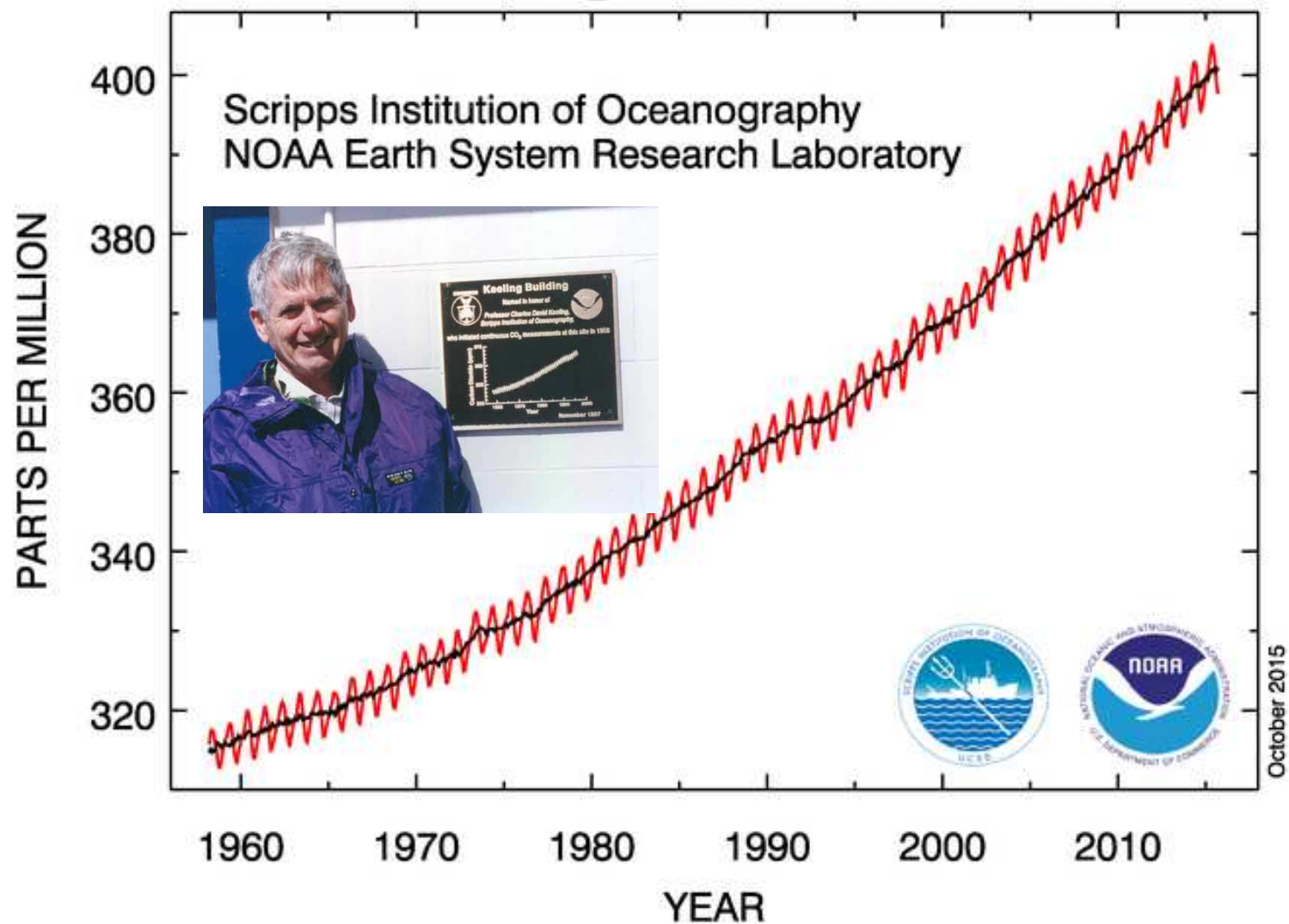


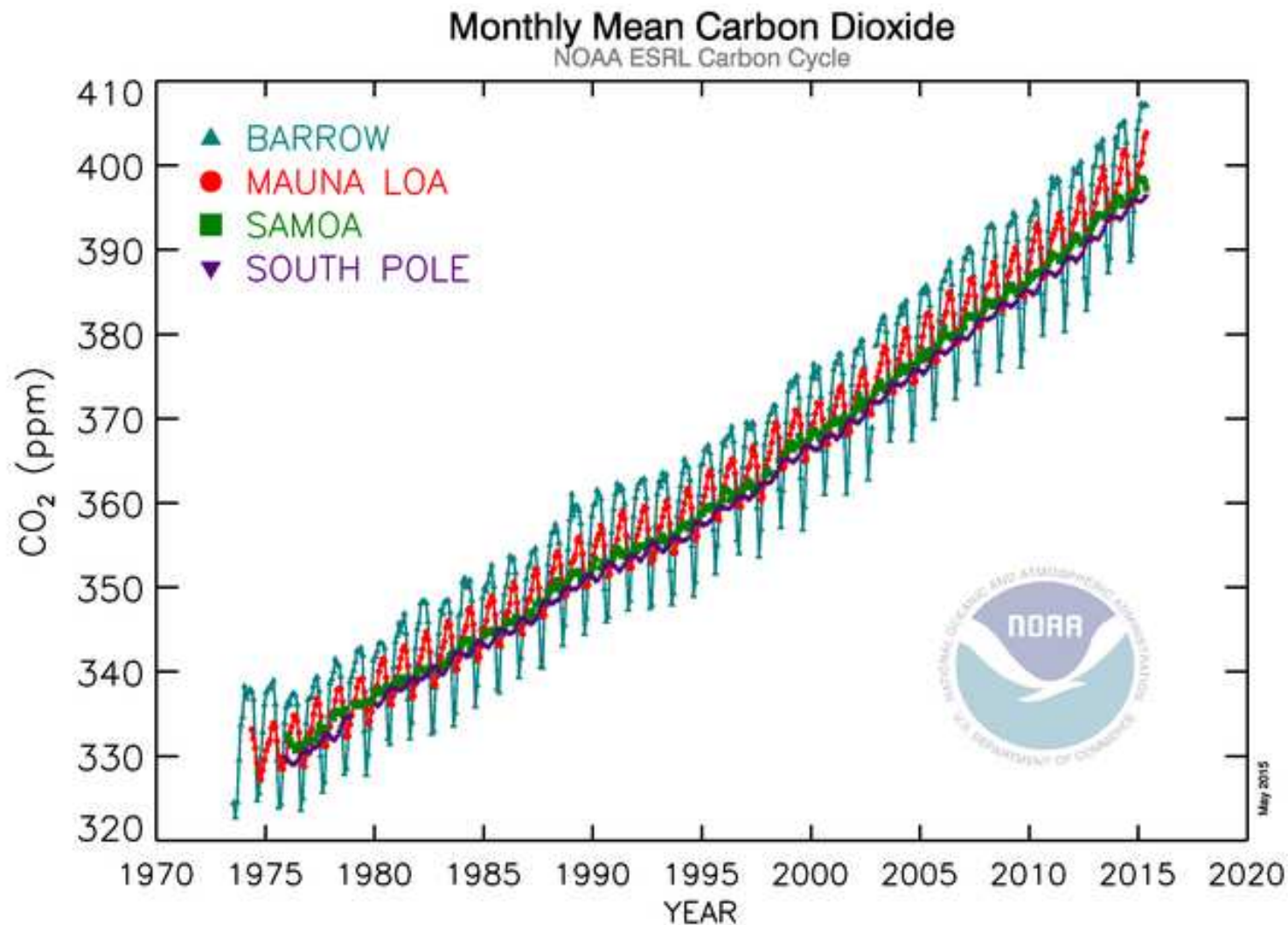
Lake Sediments, Turkey

Changes are Happening

AIR

Atmospheric CO₂ at Mauna Loa Observatory

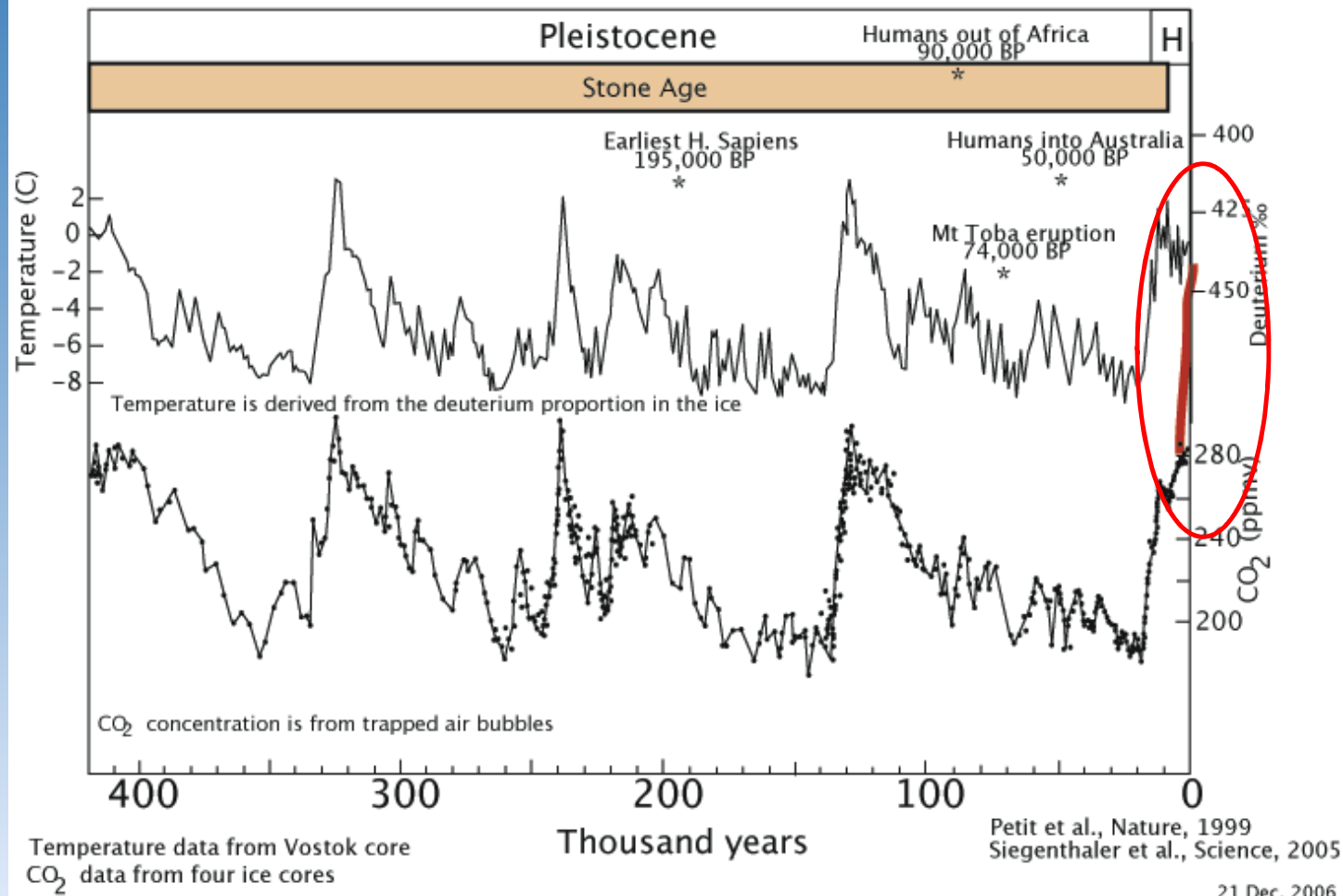




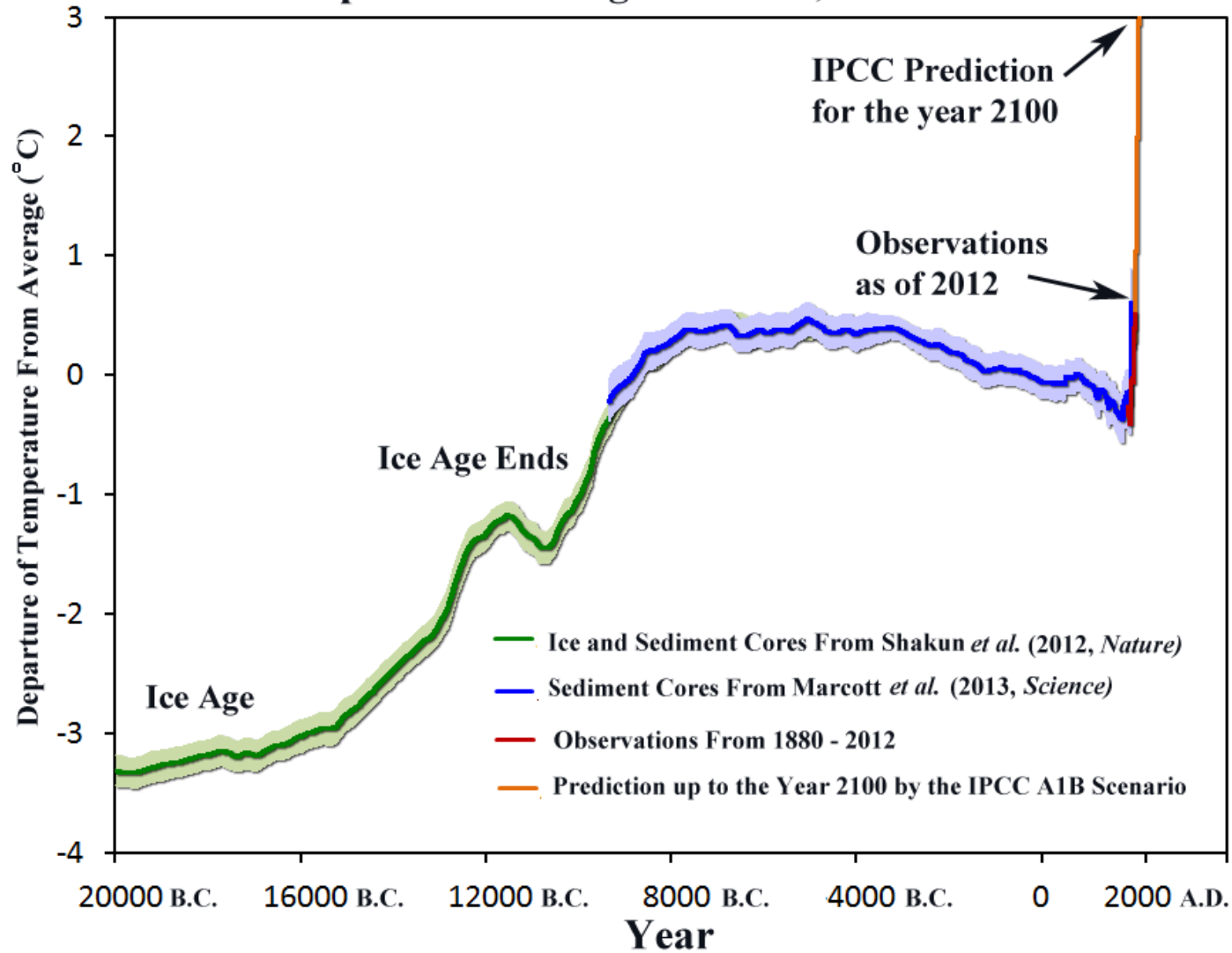
Atmospheric carbon dioxide mixing ratios determined from the continuous monitoring programs at the 4 Baseline Observatories. Contact: Dr. Pieter Tans, NOAA ESRL Carbon Cycle, Boulder, Colorado, (303) 497-6678, pieter.tans@noaa.gov, <http://www.esrl.noaa.gov/gmd/ccgg/>.

400,000 years

Antarctic Ice Cores



Global Temperature Change From 20,000 B.C. to 2012 A.D.

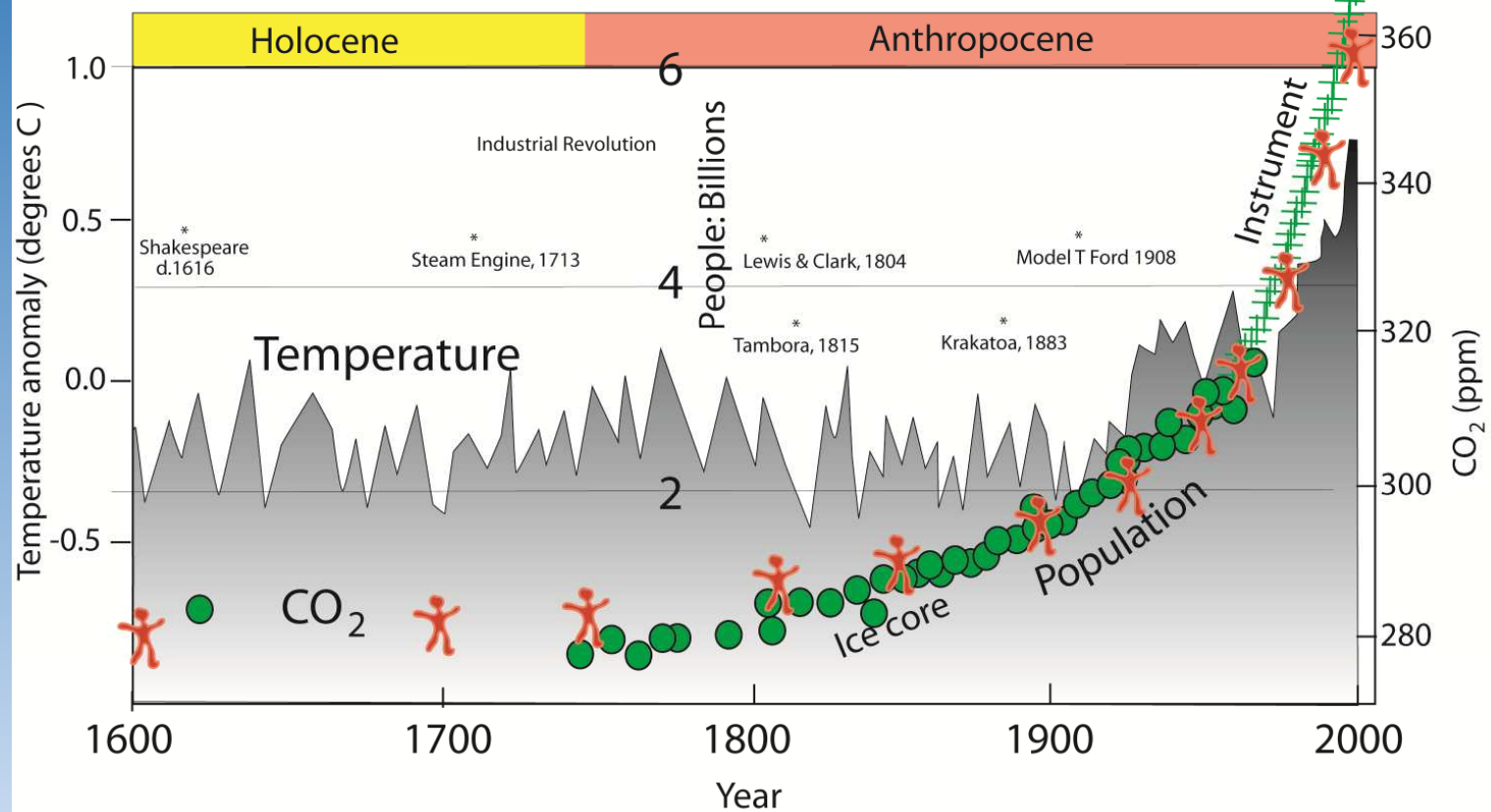


Changes are Happening

POPULATION

400 Years

Temp: tree rings and ice cores
CO₂: ice cores and measurements



Temperature: Mann et al., 1999, Geophysical Research Letters

CO₂: Friedli et al., 1986, Nature, in: Ruddiman fig. 17-12

Population: UN

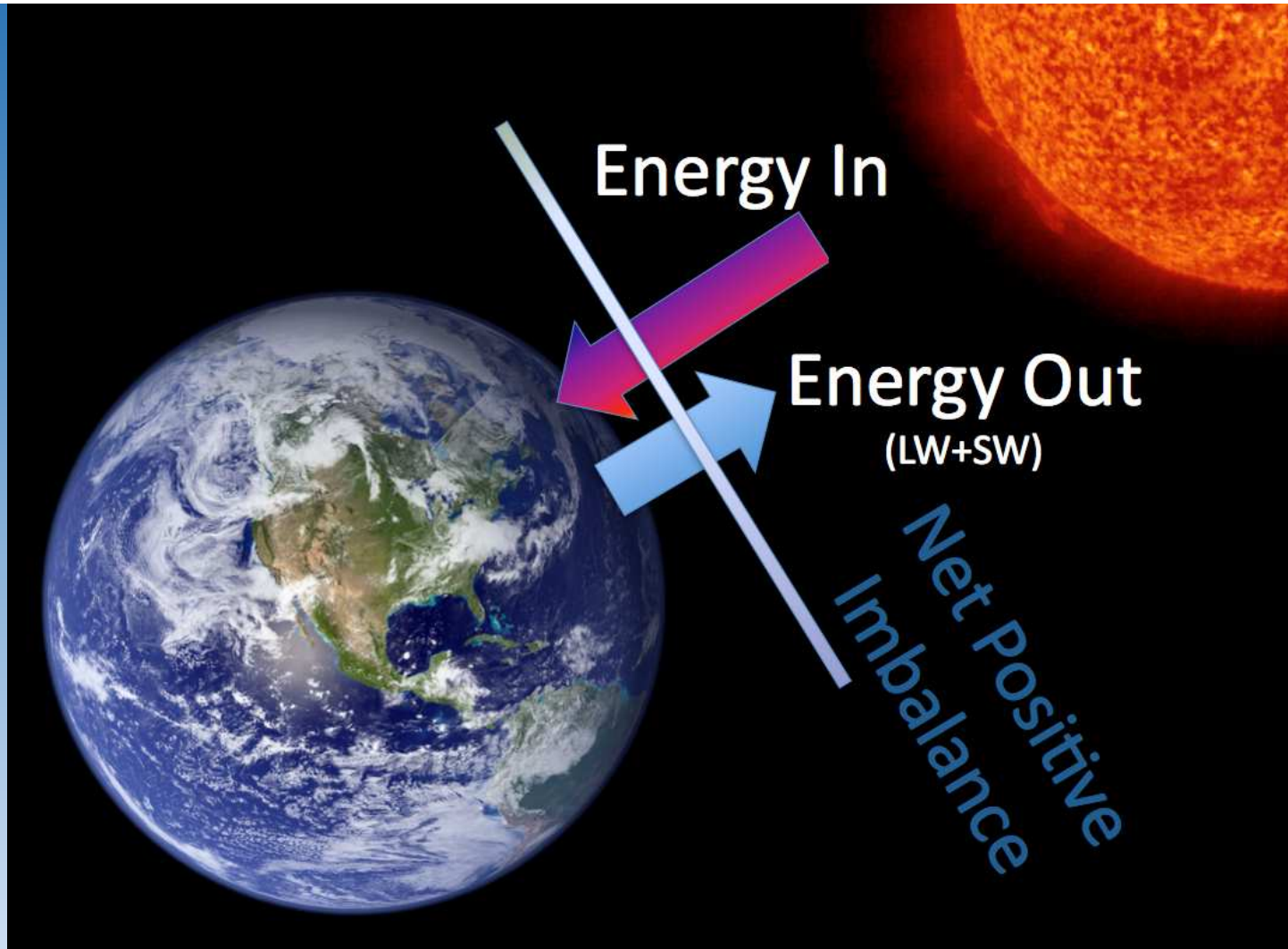
Changes are Happening

GLOBAL WARMING

About 342 w/m² comes in

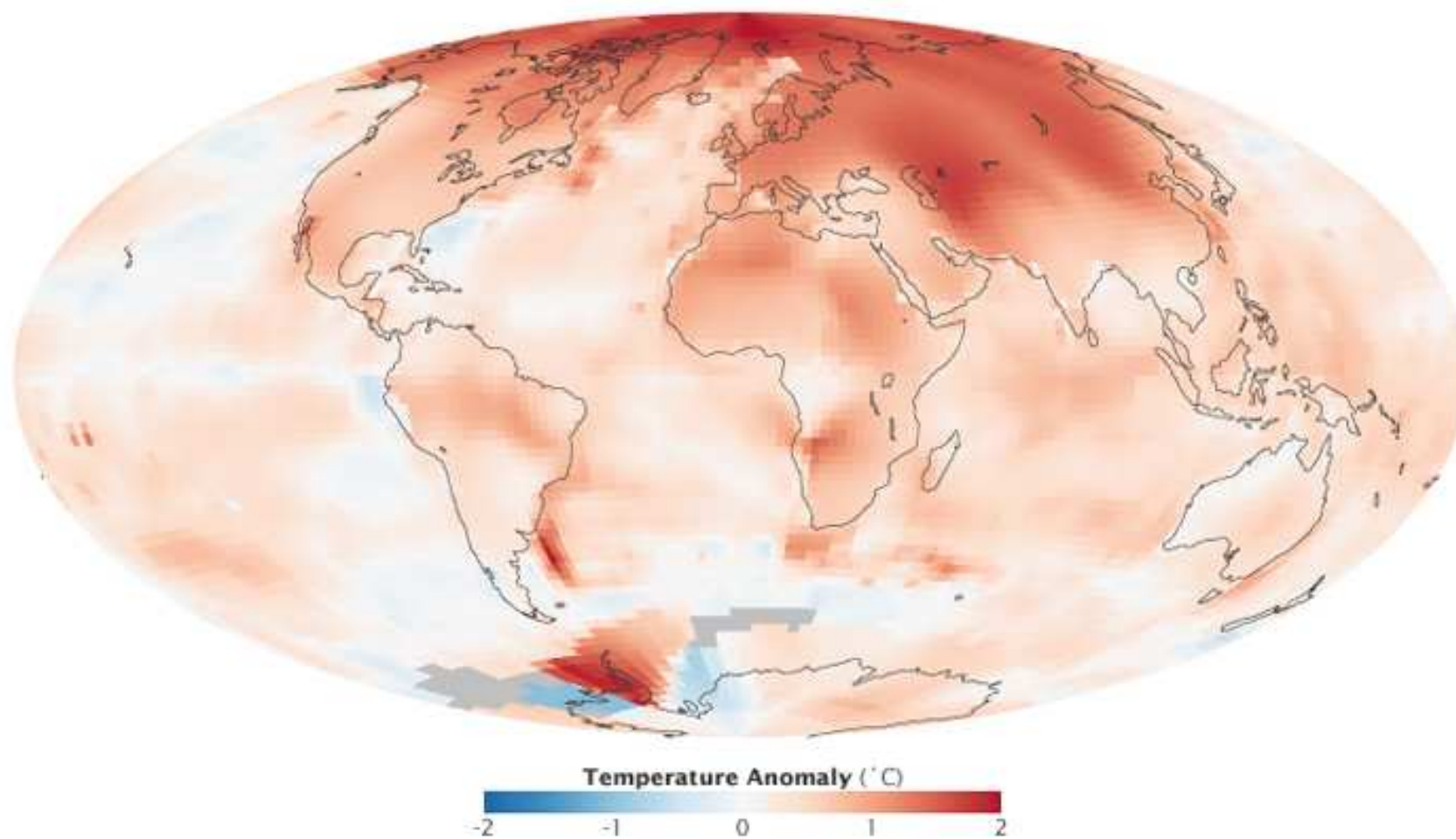
About 341 W/m² goes out



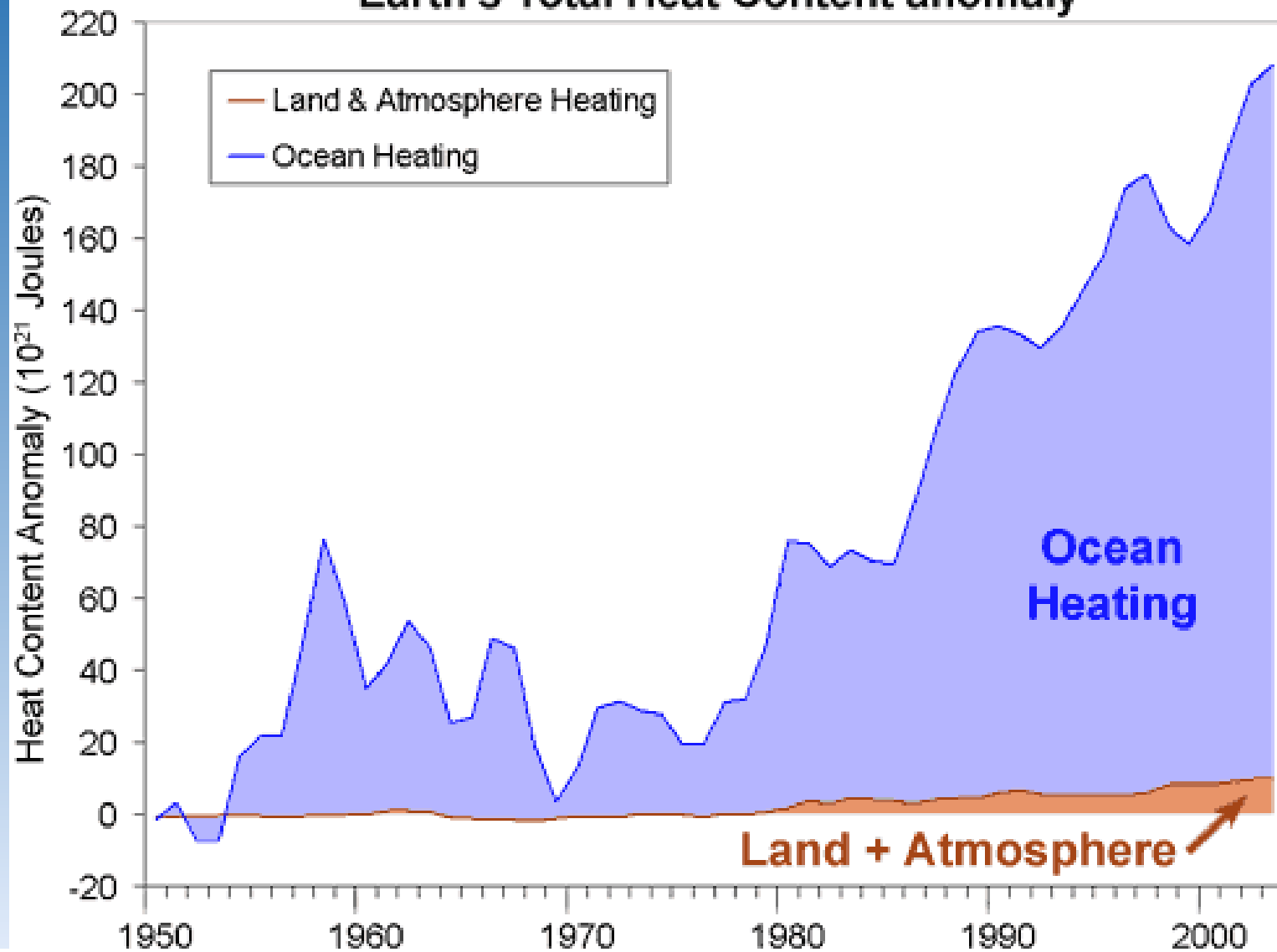


Change in temperature

2000-2009 vs. 1951-1980



Earth's Total Heat Content anomaly



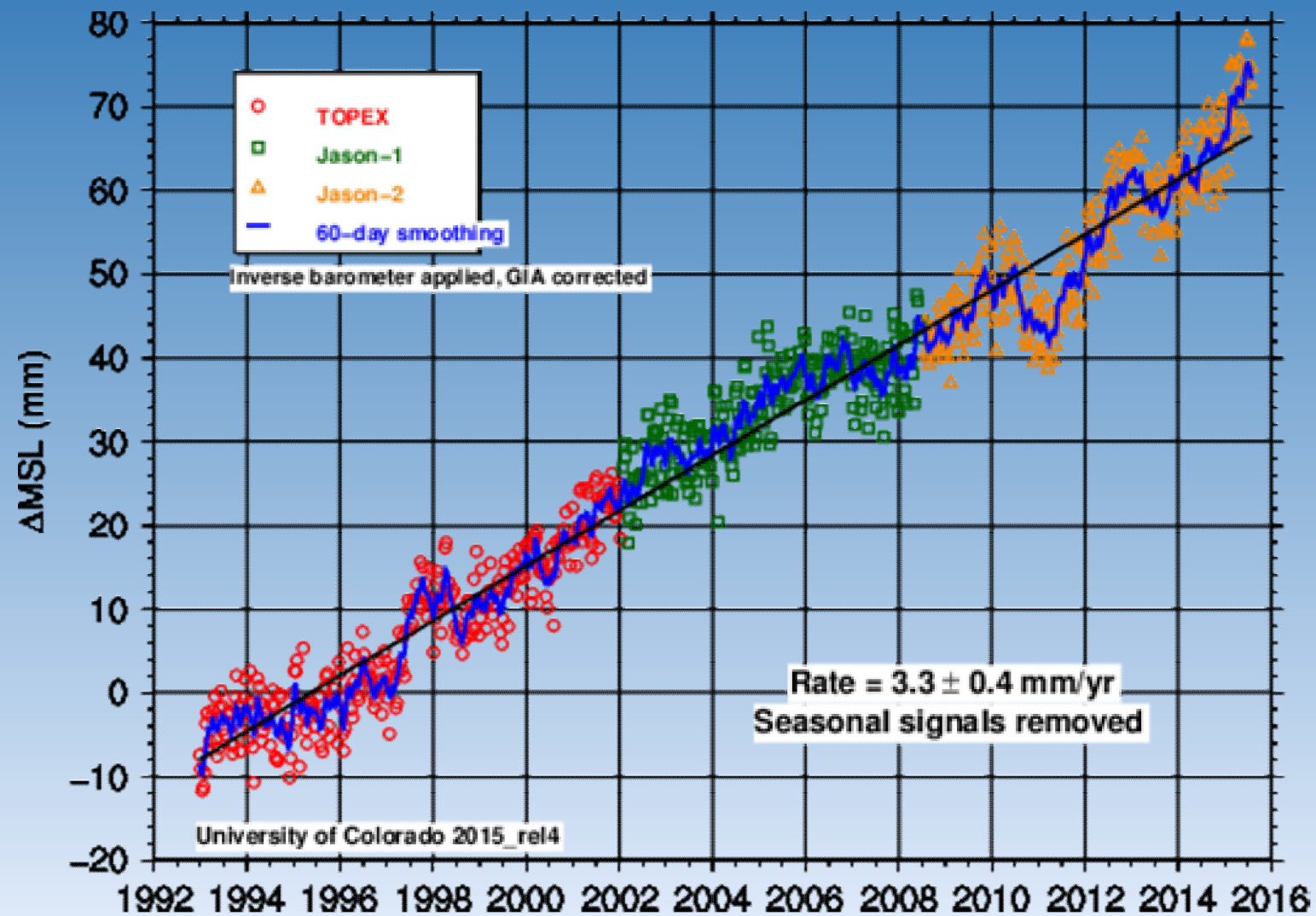
Heat capacity of air: 1005 J/kg/K

**Global Calculation of all air and ocean mass
Energy content in Joules/Degree Kelvin**

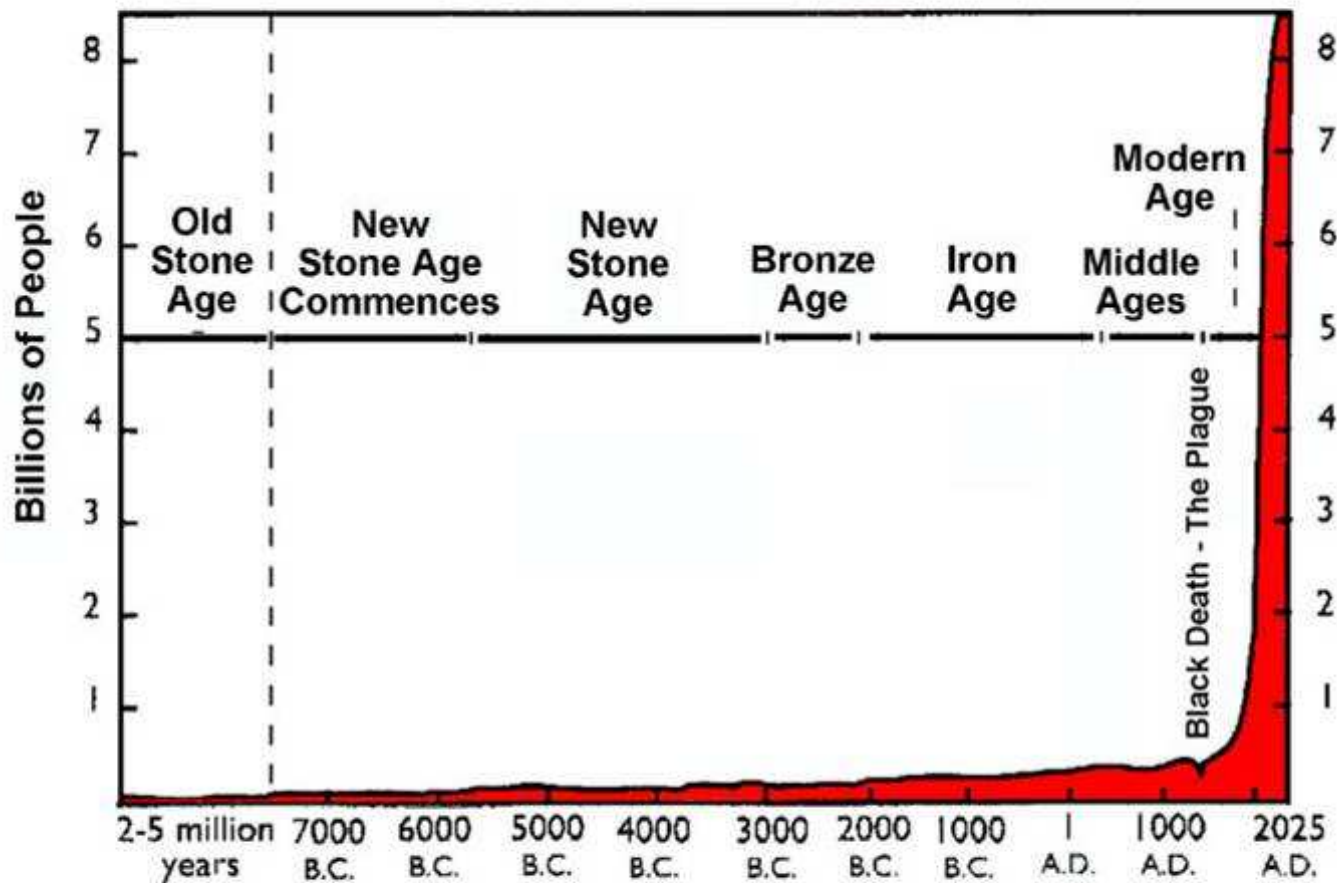


Heat capacity of ocean water: 3993 J/kg/K

Source: <http://noconsensus.wordpress.com/2011/04/05/234-5/>



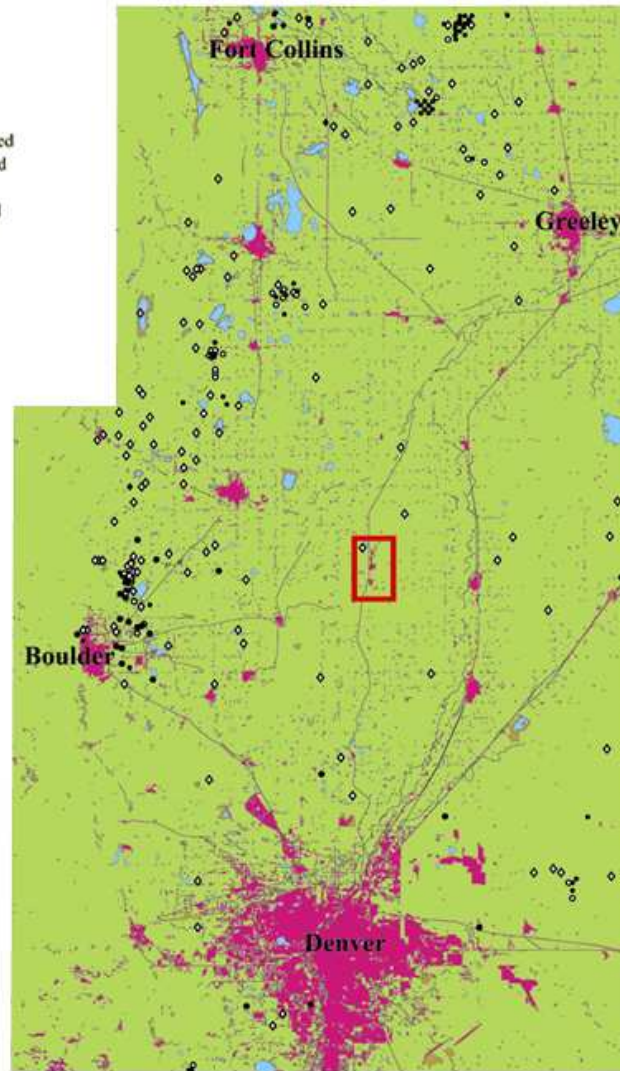
World Population Growth Through History



From "World Population: Toward the Next Century," copyright 1994
by the Population Reference Bureau

1960

- Developed
- Vegetated
- Water
- Gas Well
- Oil Well



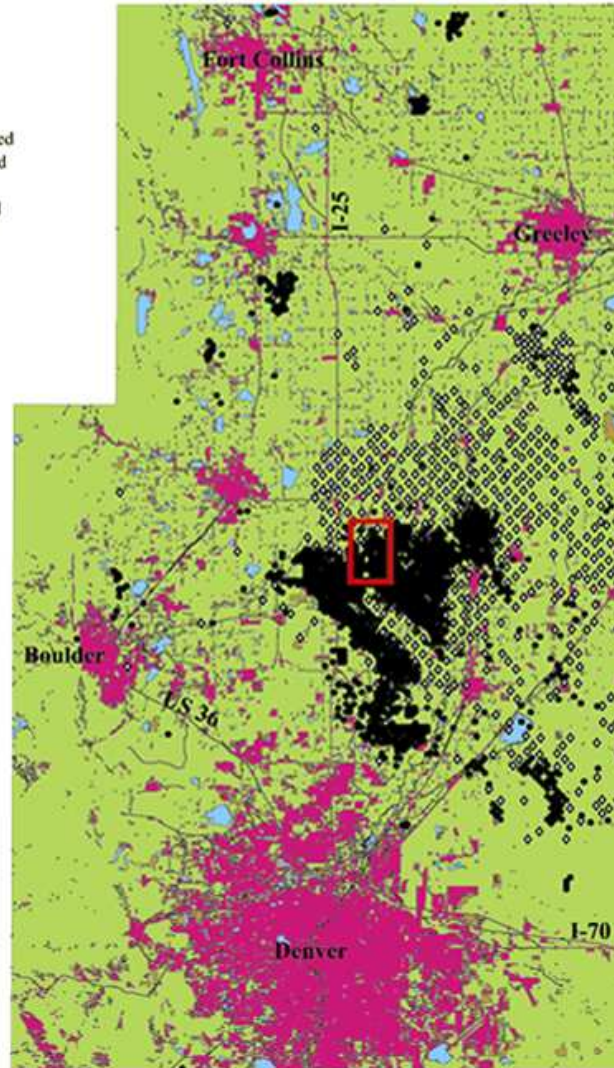
USGS

U

1980

U

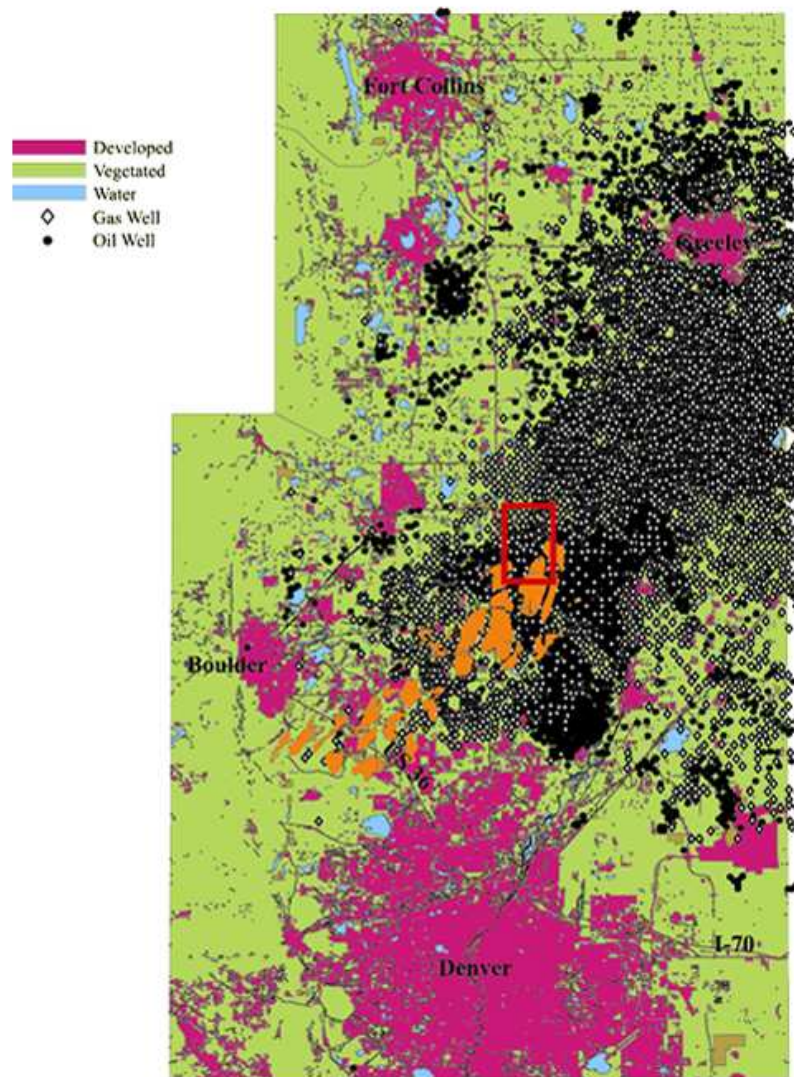
- Developed
- Vegetated
- Water
- Gas Well
- Oil Well



USGS

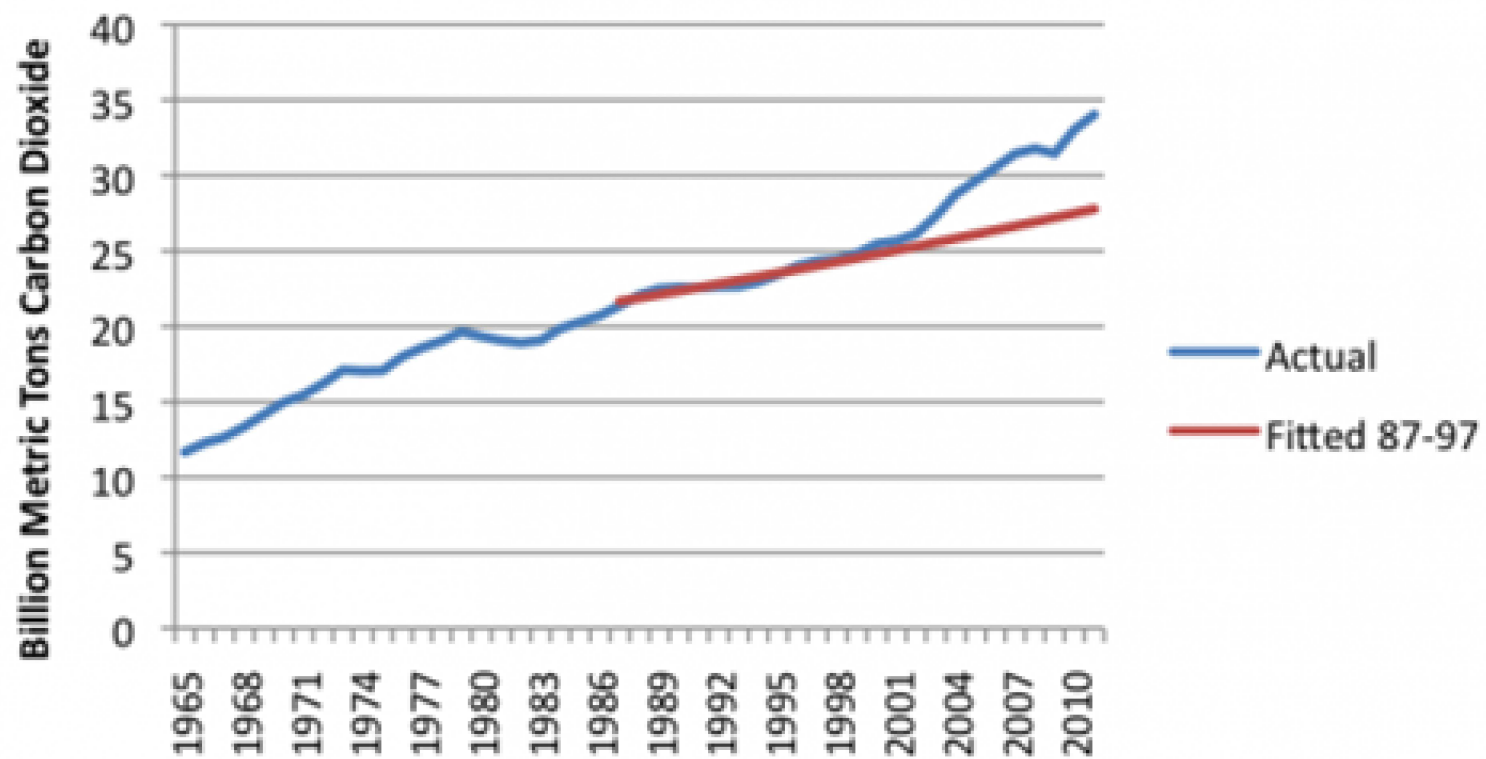
2000

U



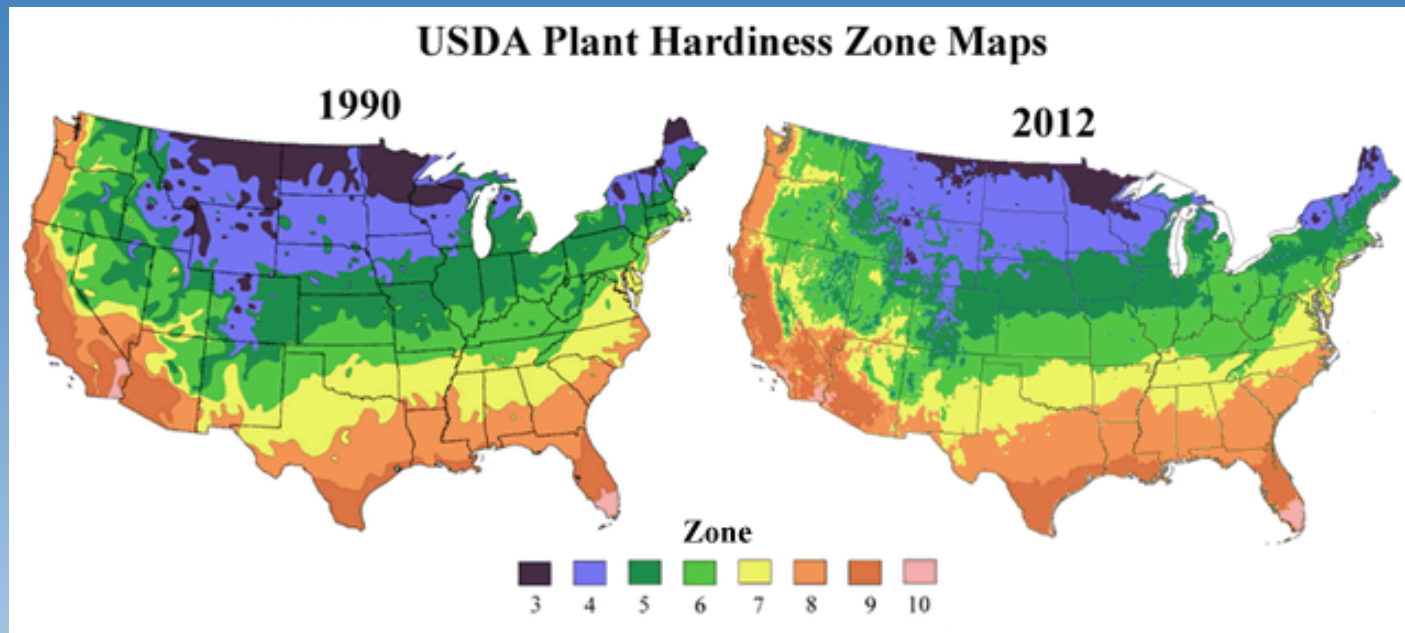
USGS

World Fossil Fuel Carbon Dioxide Emissions



BP, 2012;

Plants and Animals are Responding to a Warming Climate

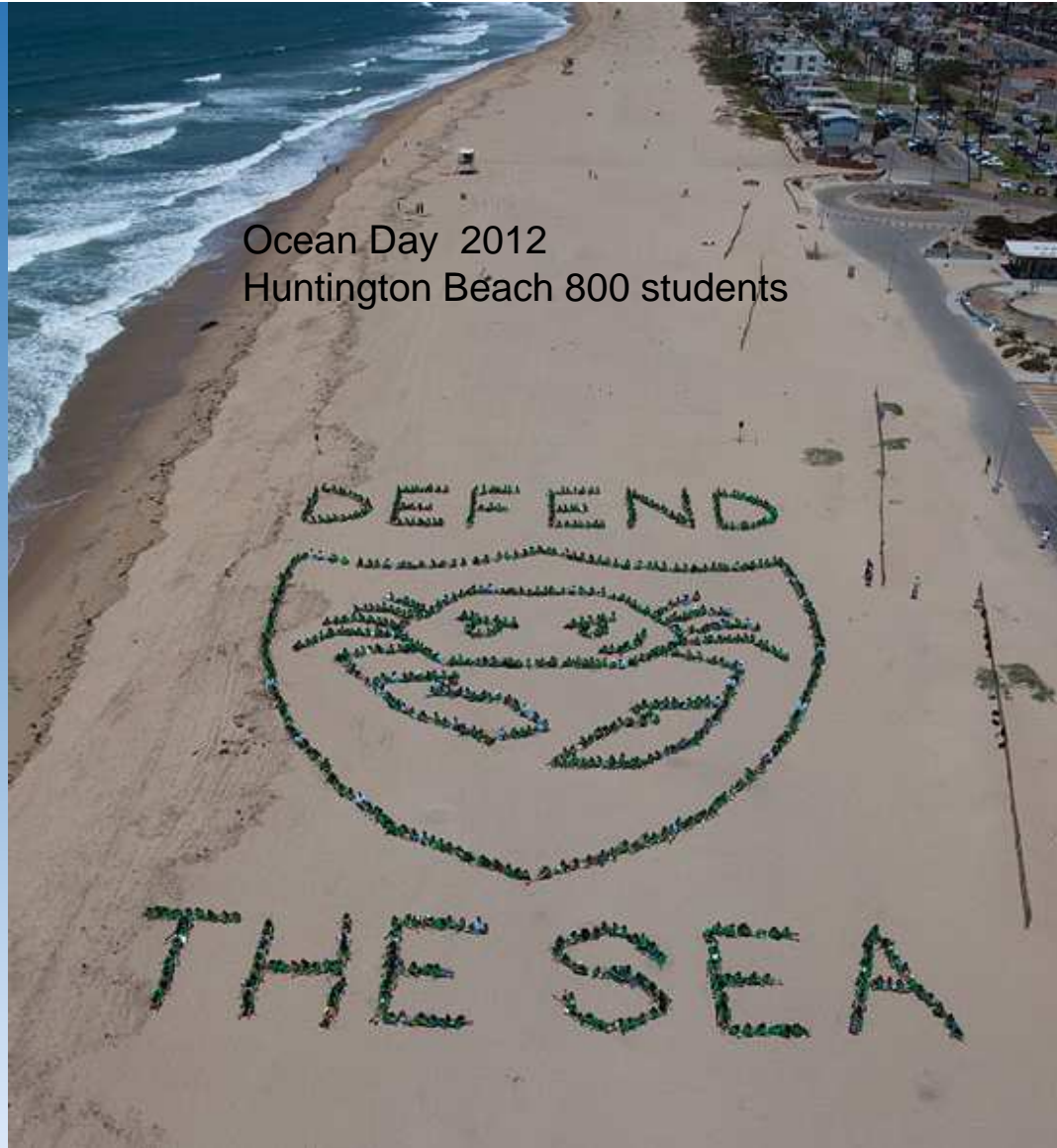


Spring is springing forward: Spring events, like bird and butterfly migrations, flower blooming times, and frog mating, have been advancing by about three days per decade over the past 30 years.

Source: Jeong et al., 2011, "Phenology shifts at start vs. end of growing season in temperate vegetation over the Northern Hemisphere for the period 1982–2008"

POWER OF THE PEOPLE

Ocean Day 2012
Huntington Beach 800 students





Ocean Day
Dockweiler Beach, LA
5000 students

Museums, Zoos and Your Children will save the World



Support science and new technologies

How do we advance if we don't believe in Science?

When we don't believe:

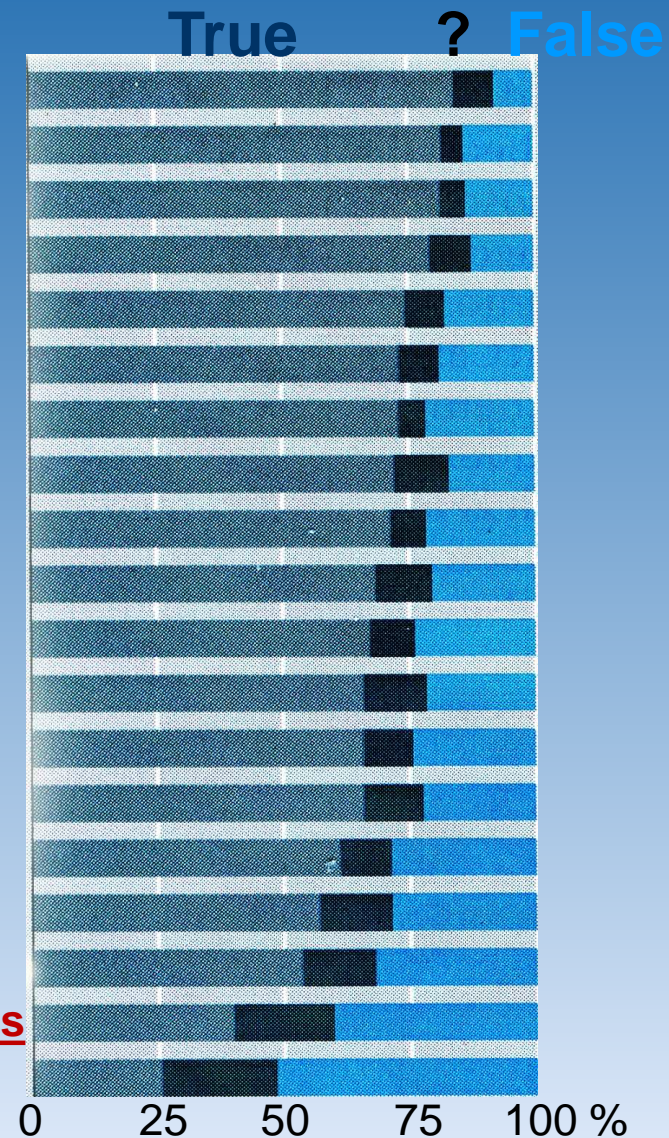
- In evolution?
- In climate change?

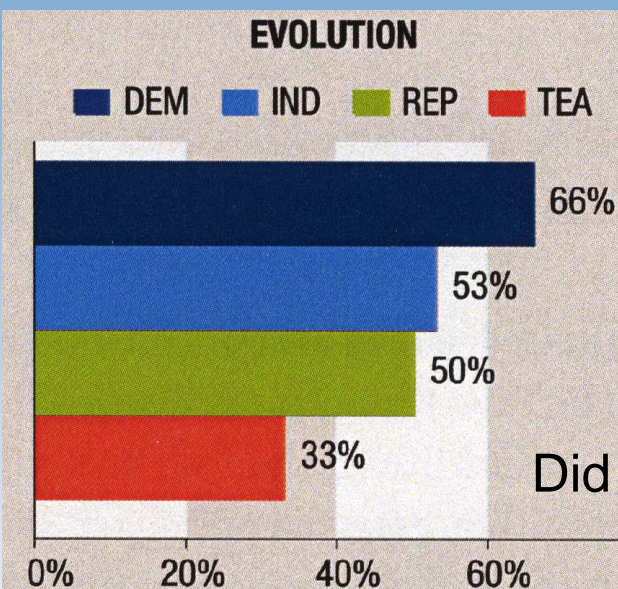
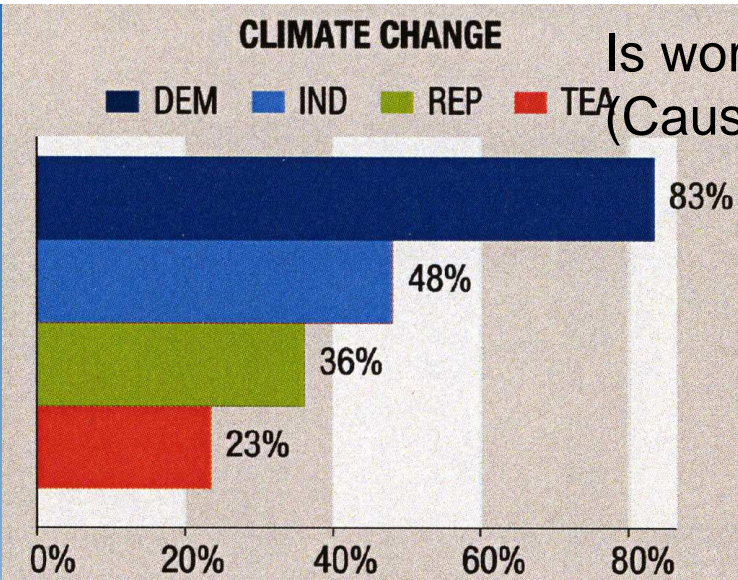
Public acceptance of evolution

Poll by New Scientist, 2006

(2012 Gallup poll found 49% of U.S. responders reject evolution, and another 25% accept it only as divinely steered to produce us)

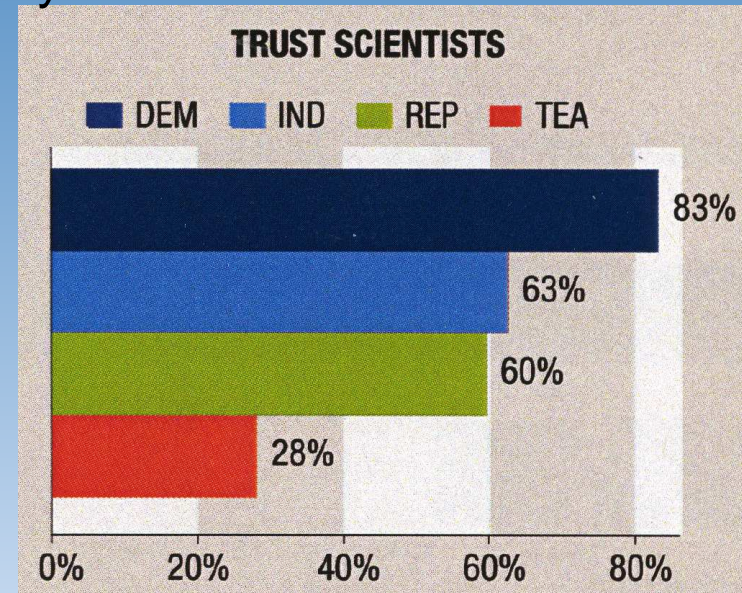
Iceland
Denmark
Sweden
France
Britain
Norway
Belgium
Spain
Germany
Italy
Netherlands
Hungary
Luxembourg
Ireland
Switzerland
Austria
Greece
United States
Turkey





New Hampshire poll,
UNH-Carsey Inst., 2014

Do you trust data from scientists?



(L.C. Hamilton, 2014)

CLIMATE

Ted Cruz: 'Climate Change Is Not Science. It's Religion.'

BY [SAMANTHA PAGE](#)  OCT 30, 2015 11:28AM



One can argue that the TEA party are not democratic when their mantra is my way or no way – sounds like dictatorship to me?

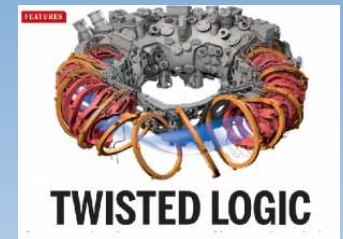
So what can we do?

- Ways to reduce your carbon footprint: <http://cotap.org/reduce-carbon-footprint/>
- Sometimes support BIG science projects; other times
- Think small
 - Remember IBM – now laptops
 - Remember big power plants – now rooftop solar, wind turbines
 - Big nuclear accelerators for Fusion – now thinking small (next slide/video)
- Think local
- Think seasonal
- BUT DO SOMETHING! – IT ALL COUNTS

WE NEED TO SUPPORT GAME CHANGERS; IN PARTICULAR:

1. ENERGY – NON-CARBON sources:

- FUSION: COMPACT FUSION OF LOCKHEED ([CLICK HERE for video](#))
- OR NEW GERMAN REACTOR ([CLICK HERE for PDF](#))
- SOLAR, OTHER NUCLEAR, MODERN GRID, ETC.



WE NEED TO SUPPORT GAME CHANGERS; IN PARTICULAR:



2. MITIGATION: BIOCHAR as a sequestration agent:

http://denverclimatestudygroup.com/?page_id=28

- *The potential for land-based biological CO2 removal to lower future atmospheric CO2 concentration-Tim Lenton, University of Exeter - [click here](#)*
- *Sustainable biochar to mitigate global climate change - [Woolf,](#)*

Cool Planet - @ 9:00 minutes

- https://youtu.be/JPJsYZLU_sM?t=535



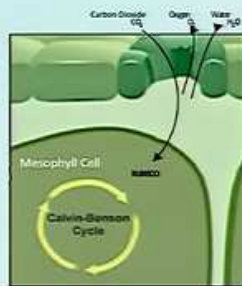
Rapid Growth C4 Plants Can Capture 10X CO₂

C3

- Trees
- Shrubs
- Flowers



Soybeans

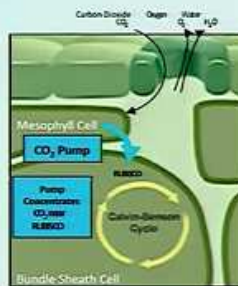


C4

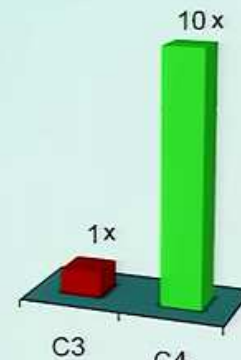
- Corn
- Switchgrass
- Sugarcane



Sorghum



Carbon Capture



C3

C4

Photosynthesis Cycles
Source: Wikipedia



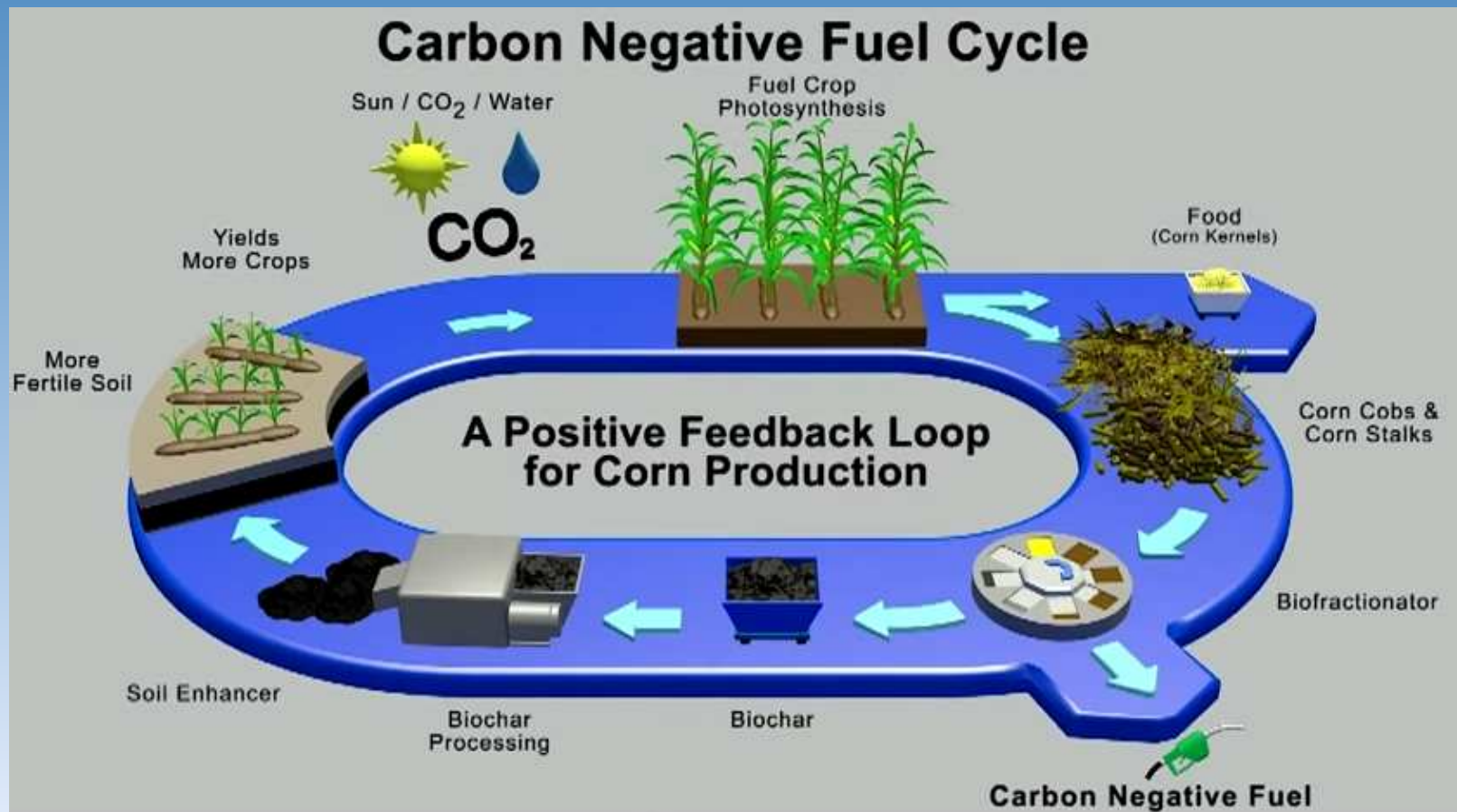
MISCANTHUS

C4 plants have a more efficient system of processing CO₂ than C3 plants

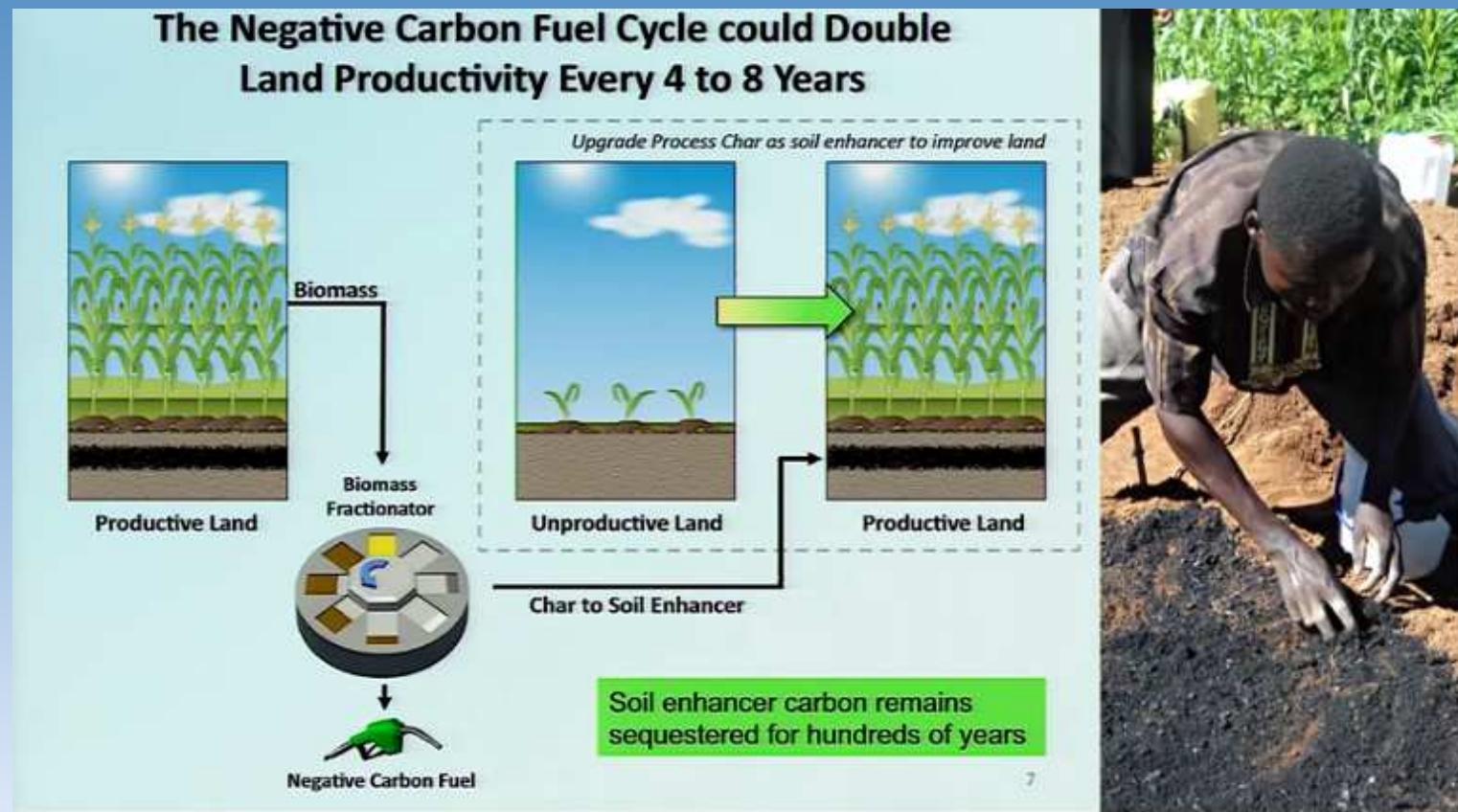
Source: Taub, D. Effects of Rising Atmospheric Concentrations of Carbon Dioxide on Plants. Nature (2010)
Source: Wikipedia, C4 carbon fixation, WEB, http://en.wikipedia.org/wiki/C4_plants (2011)

- About C3, C4 and Cam Photosynthesis and Plants:
- Photosynthetic efficiency: http://en.wikipedia.org/wiki/Photosynthetic_efficiency
- C3 carbon fixation: http://en.wikipedia.org/wiki/C3_carbon_fixation
- C4 carbon fixation: http://en.m.wikipedia.org/wiki/C4_carbon_fixation
- Summary table comparison: <http://www.cropsreview.com/types-of-photosynthesis.html>
- C3 C4 CAM Photosynthesis video: https://www.youtube.com/watch?v=Yg_pdXzWXVA

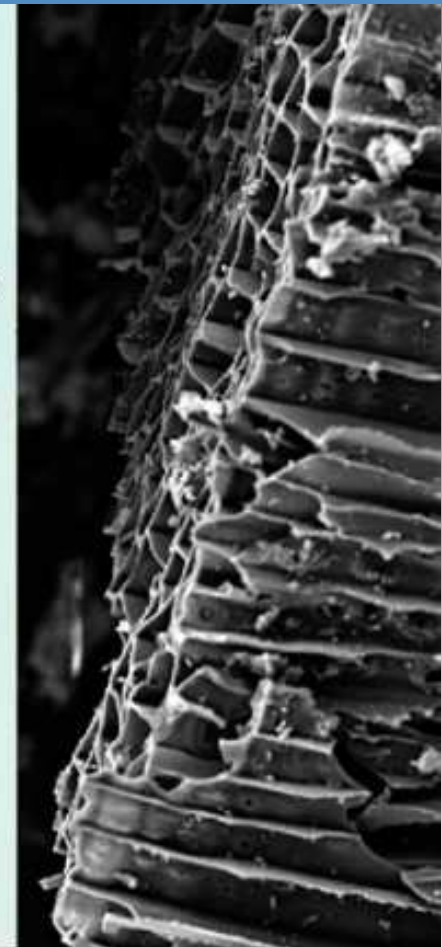
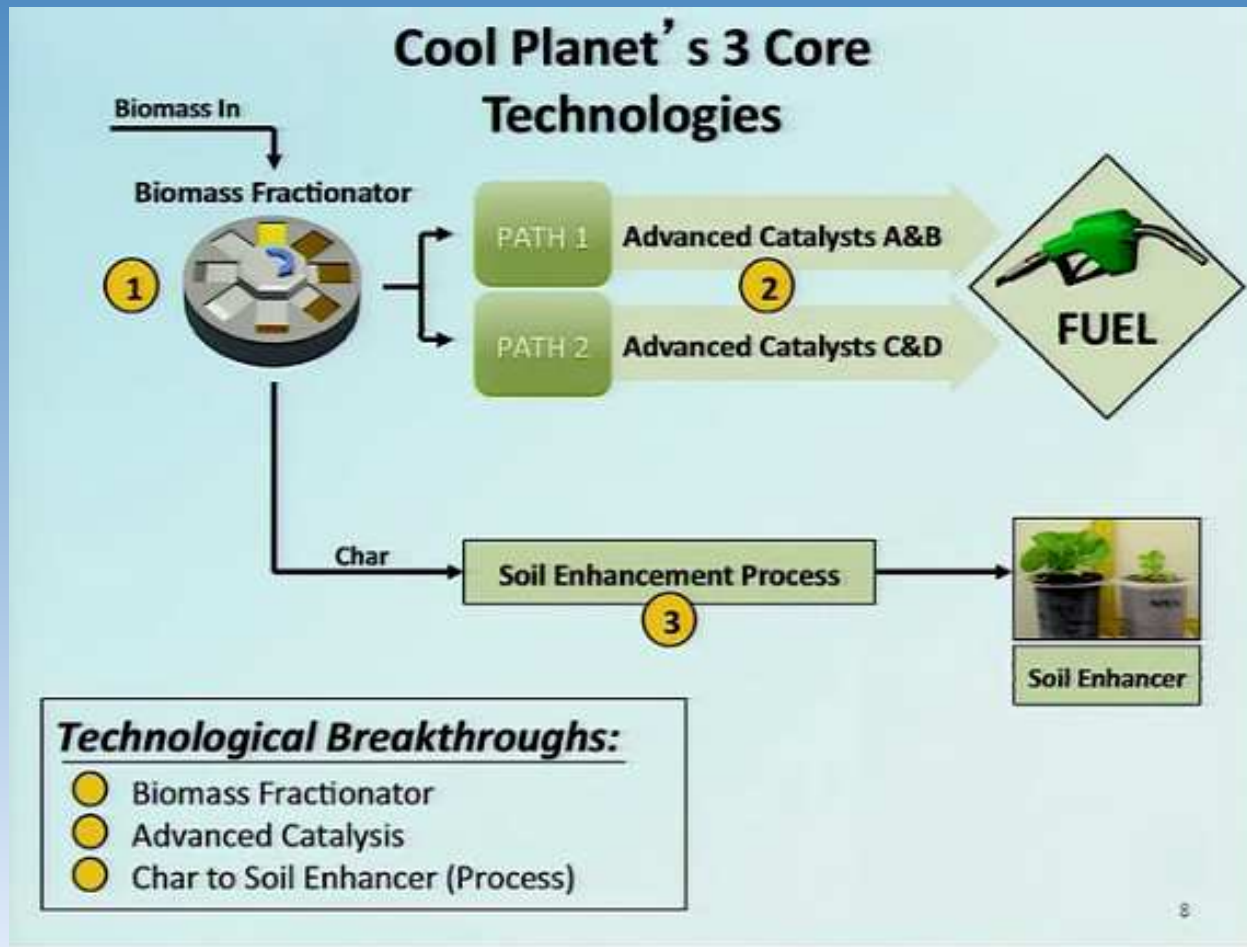
Carbon negative fuel cycle: Biochar and biofuels



Soil Enhancement



3 Core Technologies:





Current Plans to Deploy the Negative Carbon Fuel Cycle



Commercial Plants - 50 million gallons a year
(2,000 plants worldwide – developed world)



Global Village Plants - 1 million gallons a year
(100,000 plants worldwide – emerging world)

As suggested by:

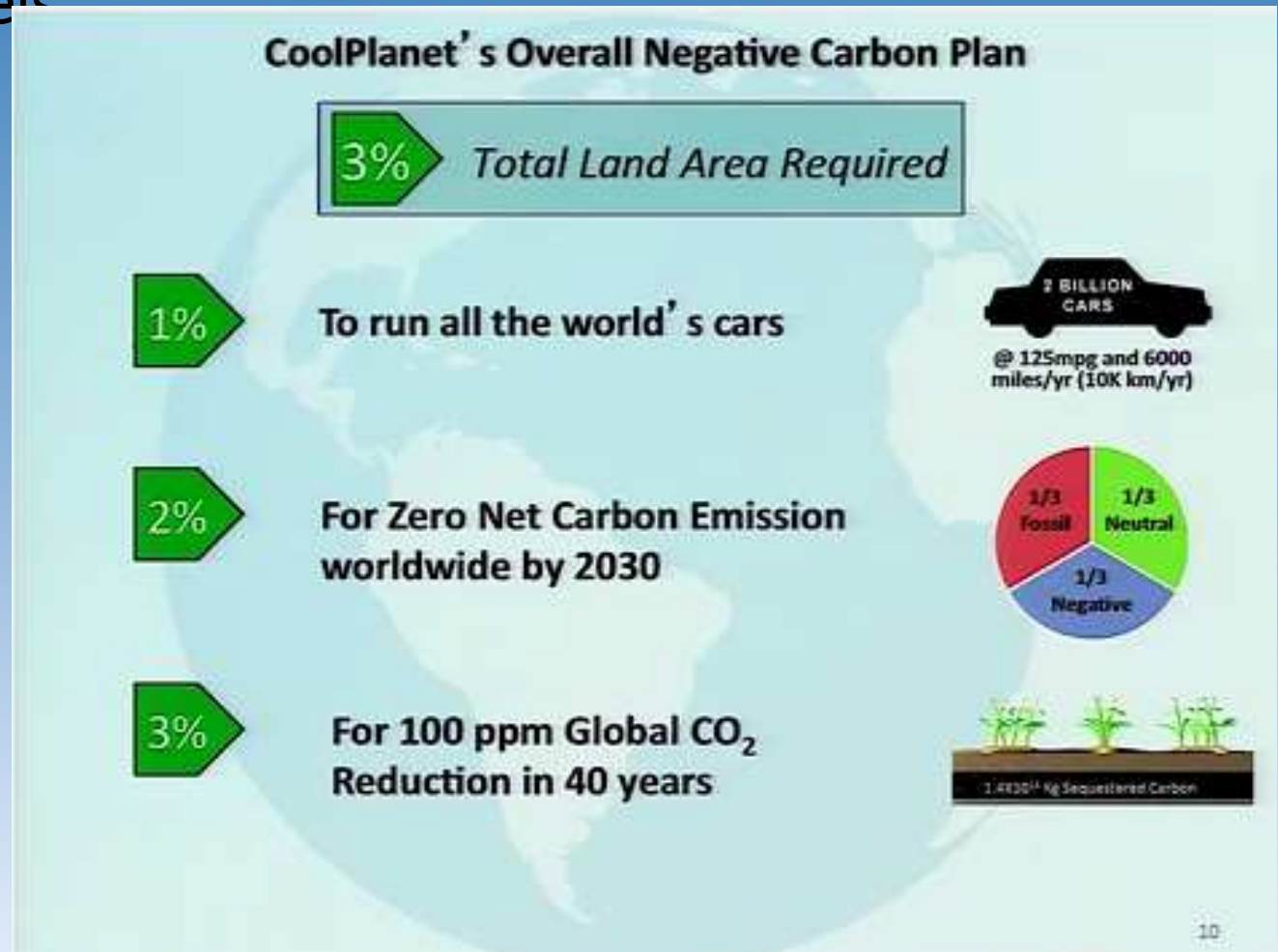
google.org

Up to 8X gain in village income by
increasing energy & food production
while bringing the village into
the information society



CARBON NEGATIVE BENEFITS:

- Sequester CO₂
- create Biofuels



Gloom and Doom?

NO! IT'S A CHALLENGE, and humanity has always been challenged and we are an adaptable species that has met the challenge over and over again!

So – let's not regress; come to the table, think small/think local and let's continue to improve our world and transition to a new future: A NEW NORMAL

There are few, if any, historical examples of civilizations consciously making sacrifices on behalf of descendants two or more generations removed.

- In that regard **we need a social paradigm shift**

Neil deGrasse Tyson – if I were in charge, I wouldn't be in charge – I would want to inform

- <https://www.facebook.com/techinsider/videos/428602874004741/>



**The Debate Should Not Be About Whether
Climate Change Is Happening...**

...Rather, What Are We Going to Do About It?

HHMI



Pixdaus