

# Climate Change: Are we on New Terrain?

Downers Grove First Congregational  
United Church of Christ

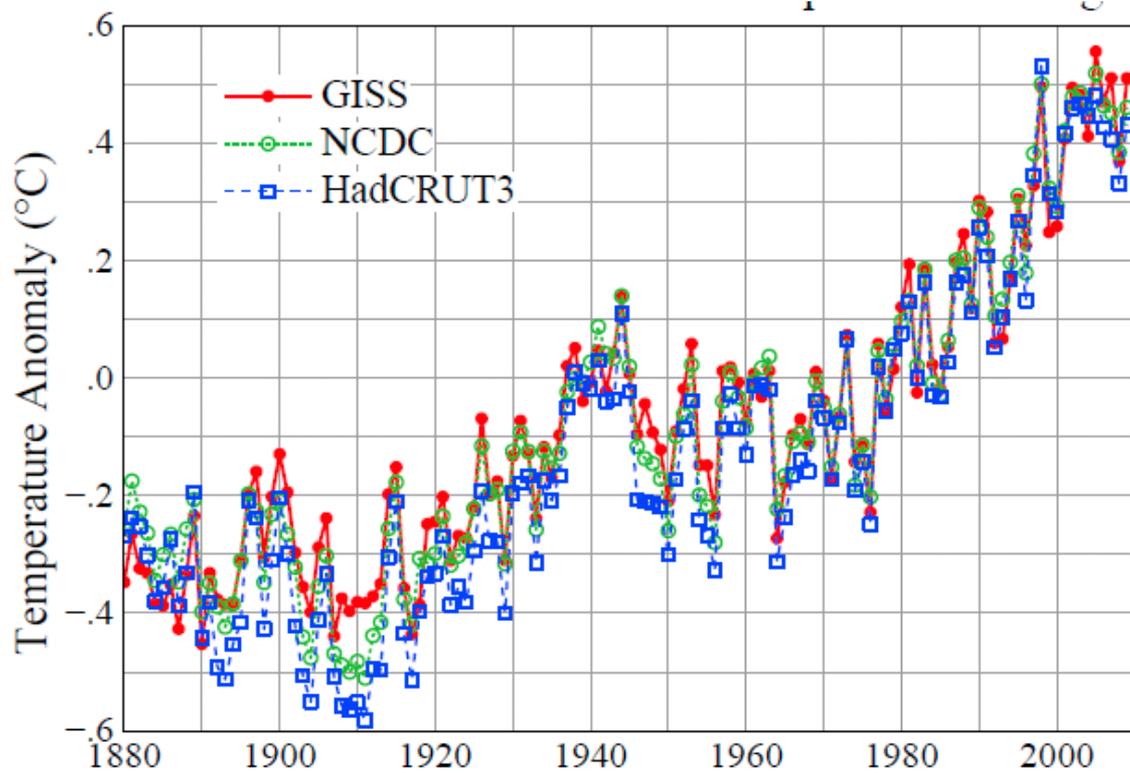
March 26, 2017

Jan P. Hessler, B.A. & Ph.D.

# Five Key Points:

- ▶ “Facts do not cease to exist because they are ignored.”
    - Aldous Huxley, Complete Essays 2, 1926–29.
  - ▶ It's Real
  - ▶ It's Us
  - ▶ Experts Agree
  - ▶ It's Bad
  - ▶ There's Hope
- 

# Surface Temperature Anomalies



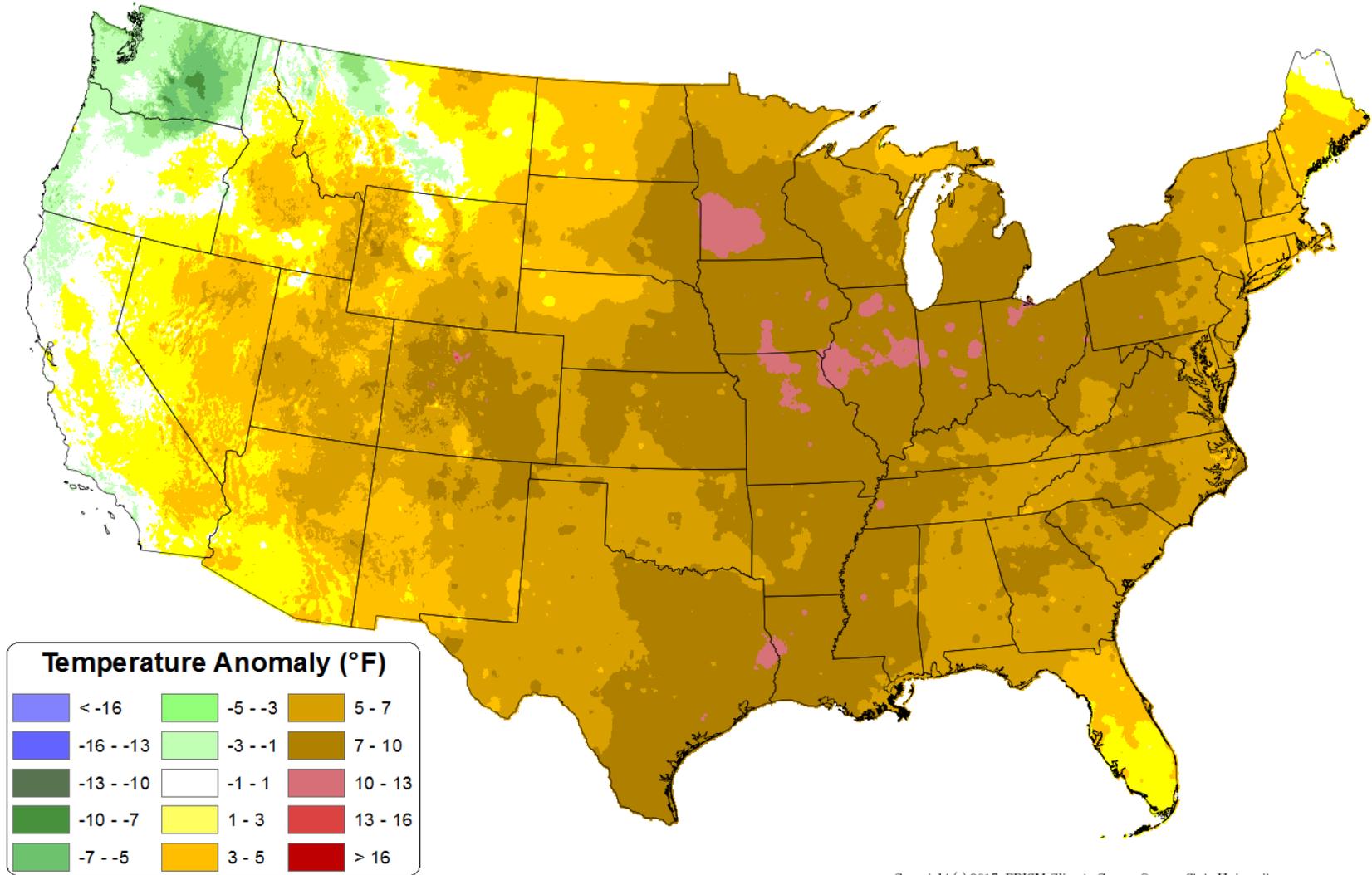
2016 warmest in 137 year history: 0.94 C  
2<sup>nd</sup> 2015: 0.90 C, 3<sup>rd</sup> 2014: 0.74 C,  
4<sup>th</sup> 2010: 0.70 C, and 5<sup>th</sup> 2013: 0.66 C

# Daily Mean Temperature Anomaly: February 2017

Period ending 7 AM EST 28 Feb 2017

Base period: 1981-2010

(Map created 02 Mar 2017)

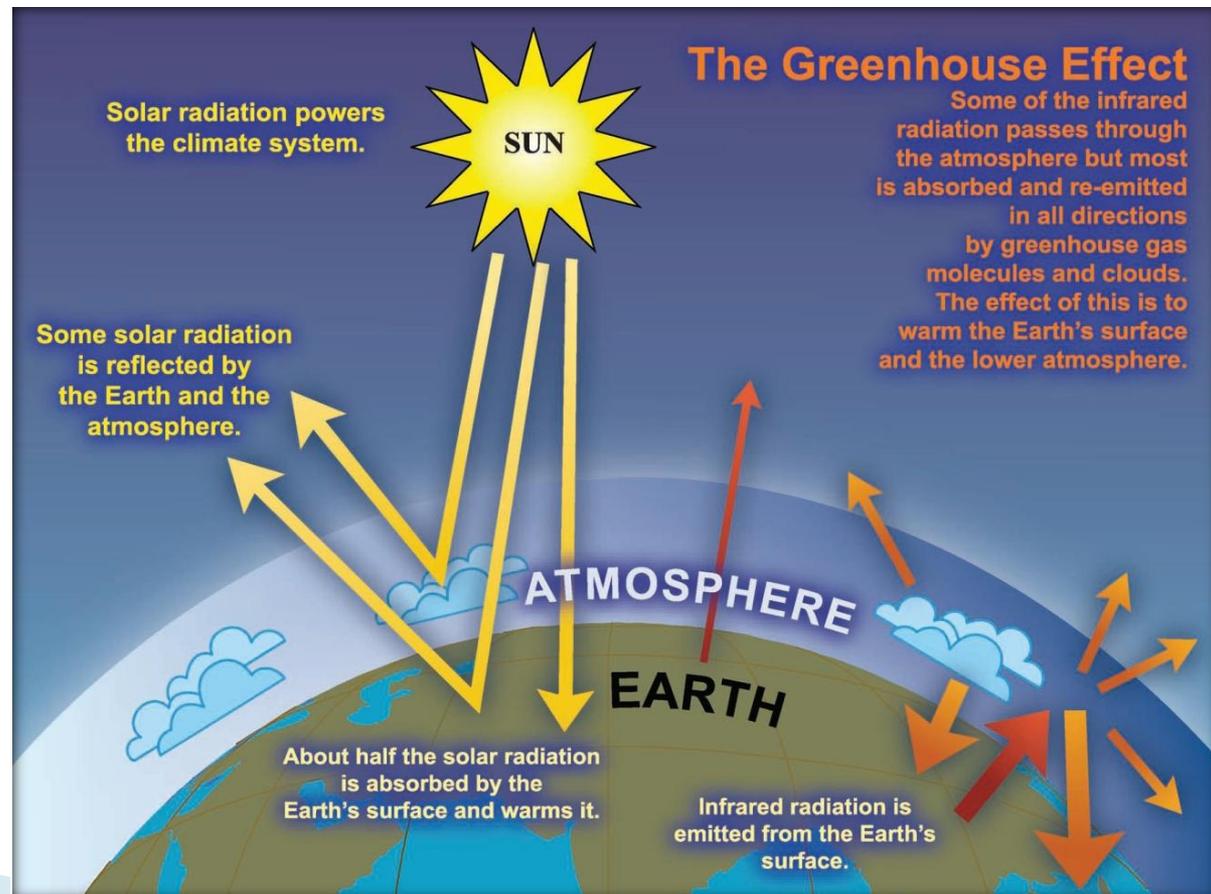


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PRISM Climate Group, Oregon State University  
Accessed, March 19, 2017

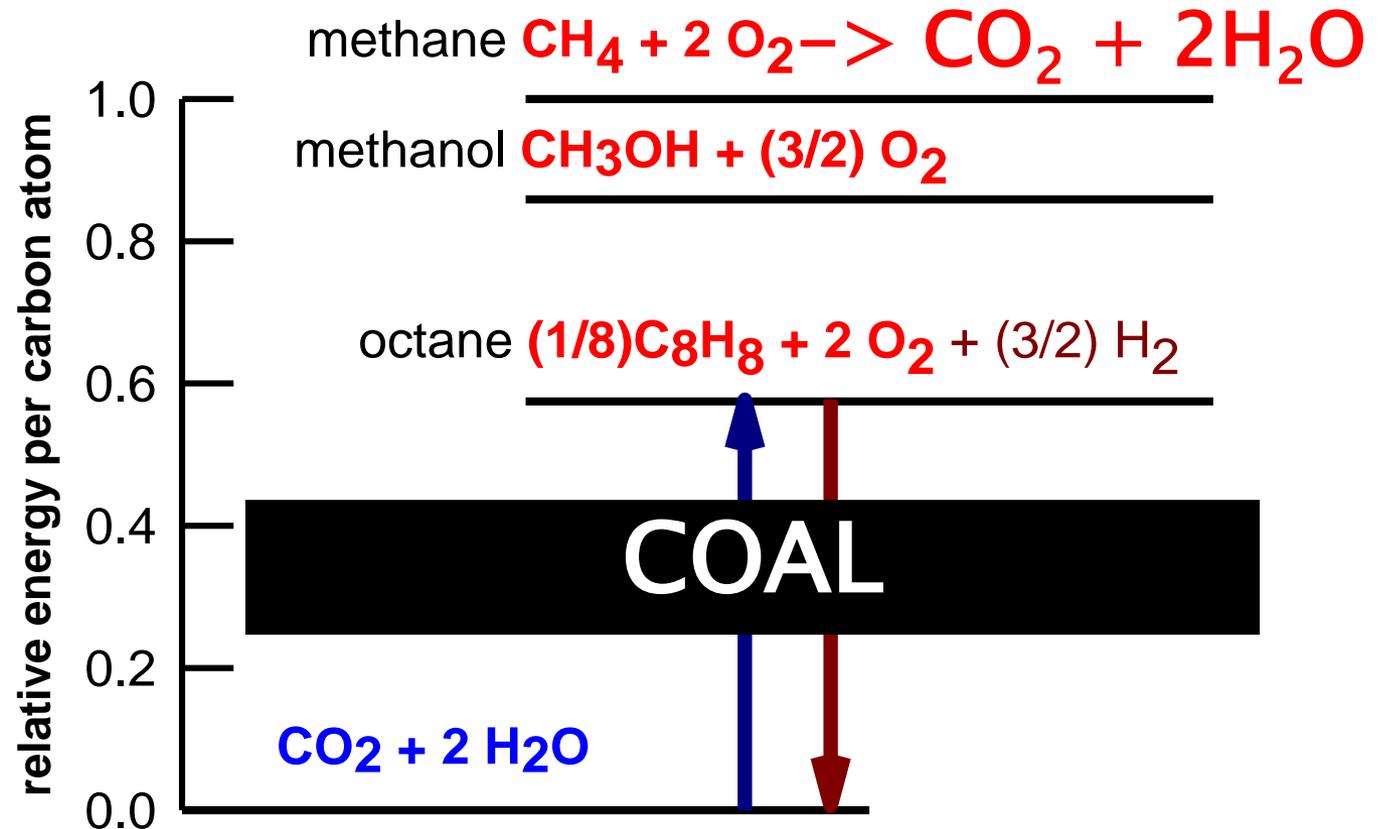
# Model of the Atmosphere

“The atmosphere acts like the glass of a hot-house, because it lets through the light rays of the sun but retains the dark rays of the ground.” J. B. J. Fourier (1827) *Mem. de l’Ac. R. d. Sci. de l’Inst. de France, Vol 7.*

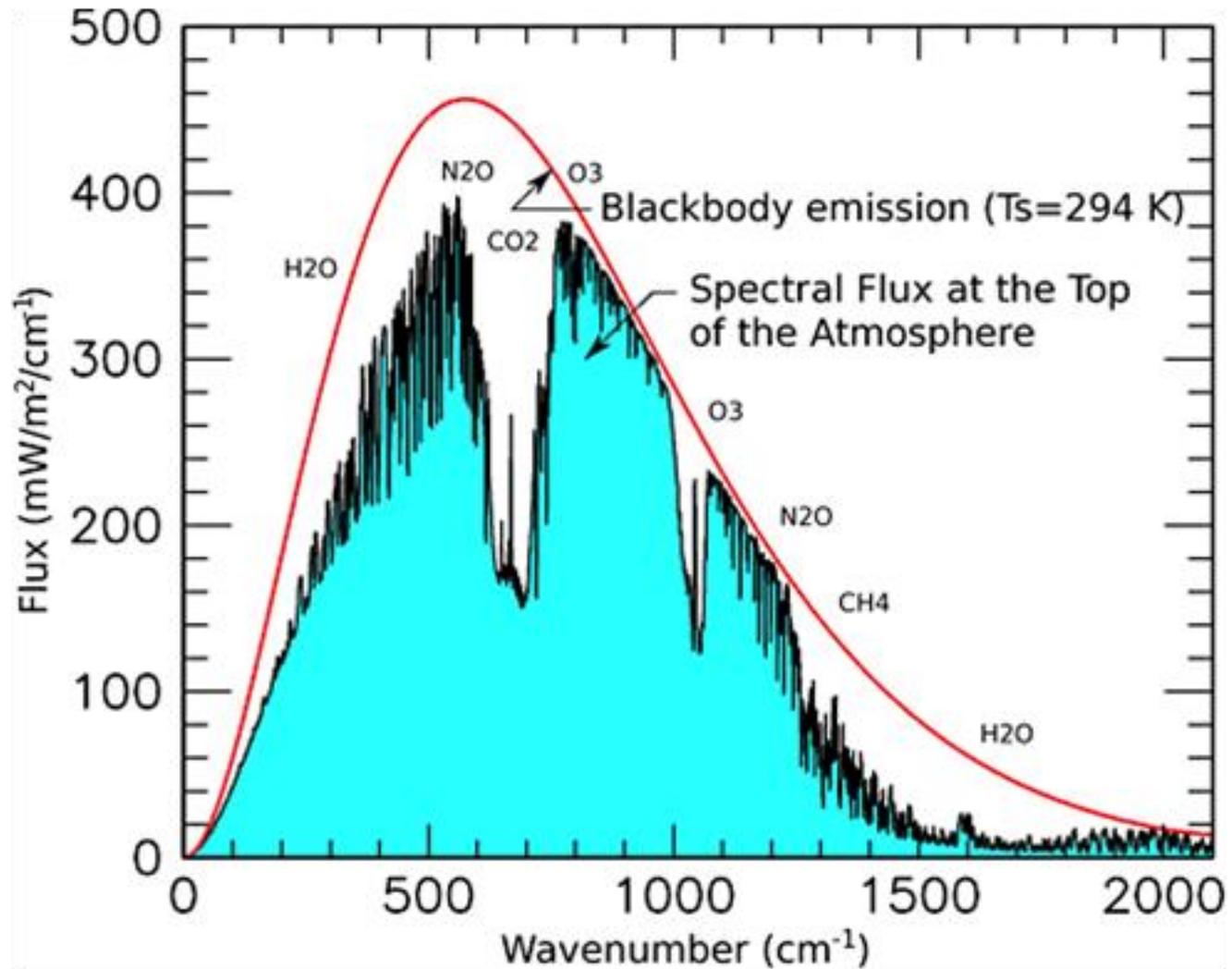


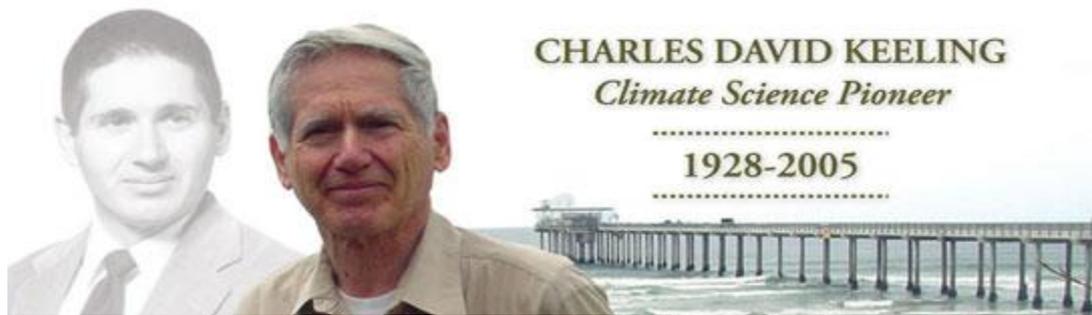
# Chemical Storage of Energy

## Chemical Energy Diagram



# Why is CO<sub>2</sub> Important?

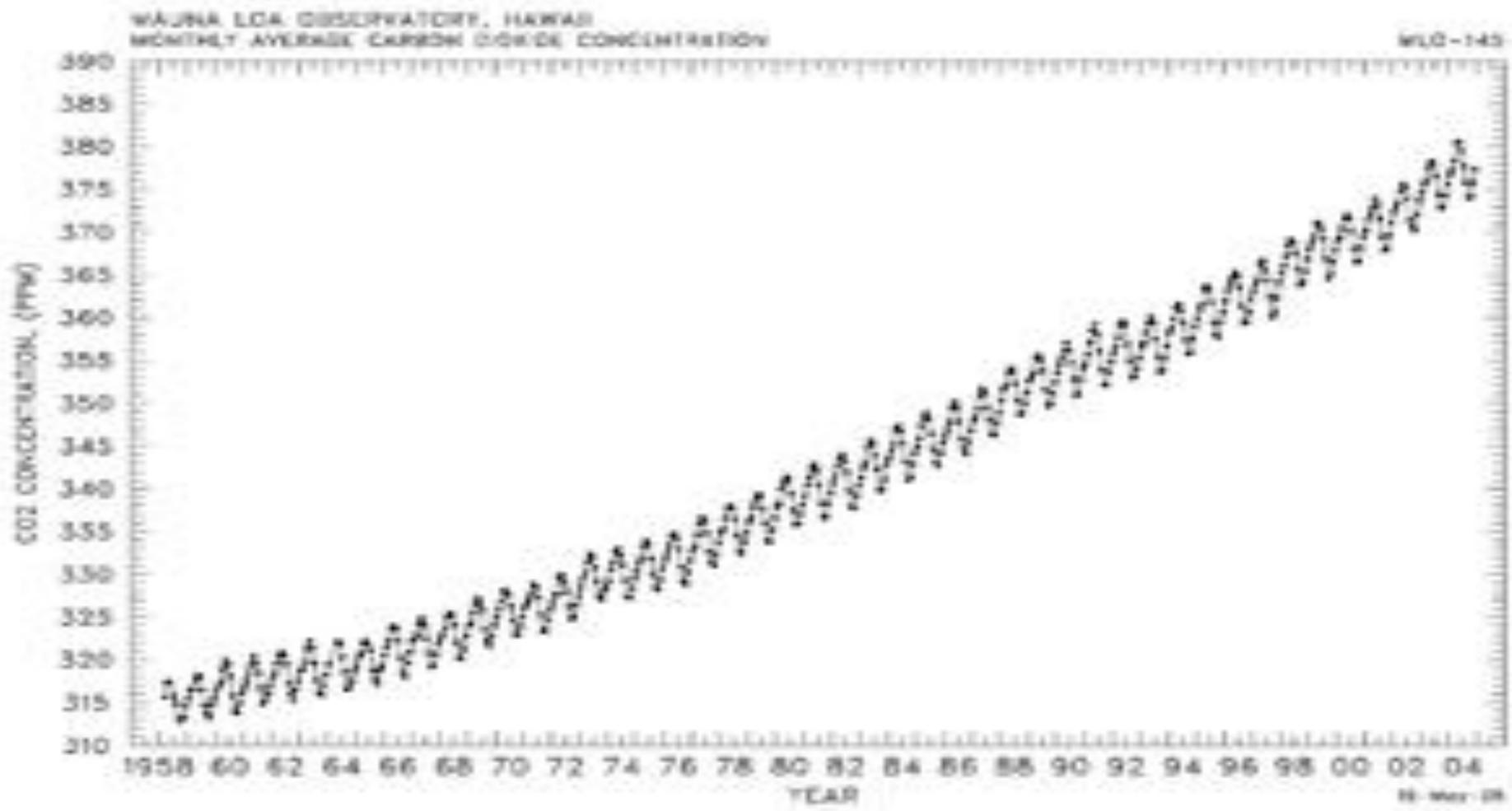




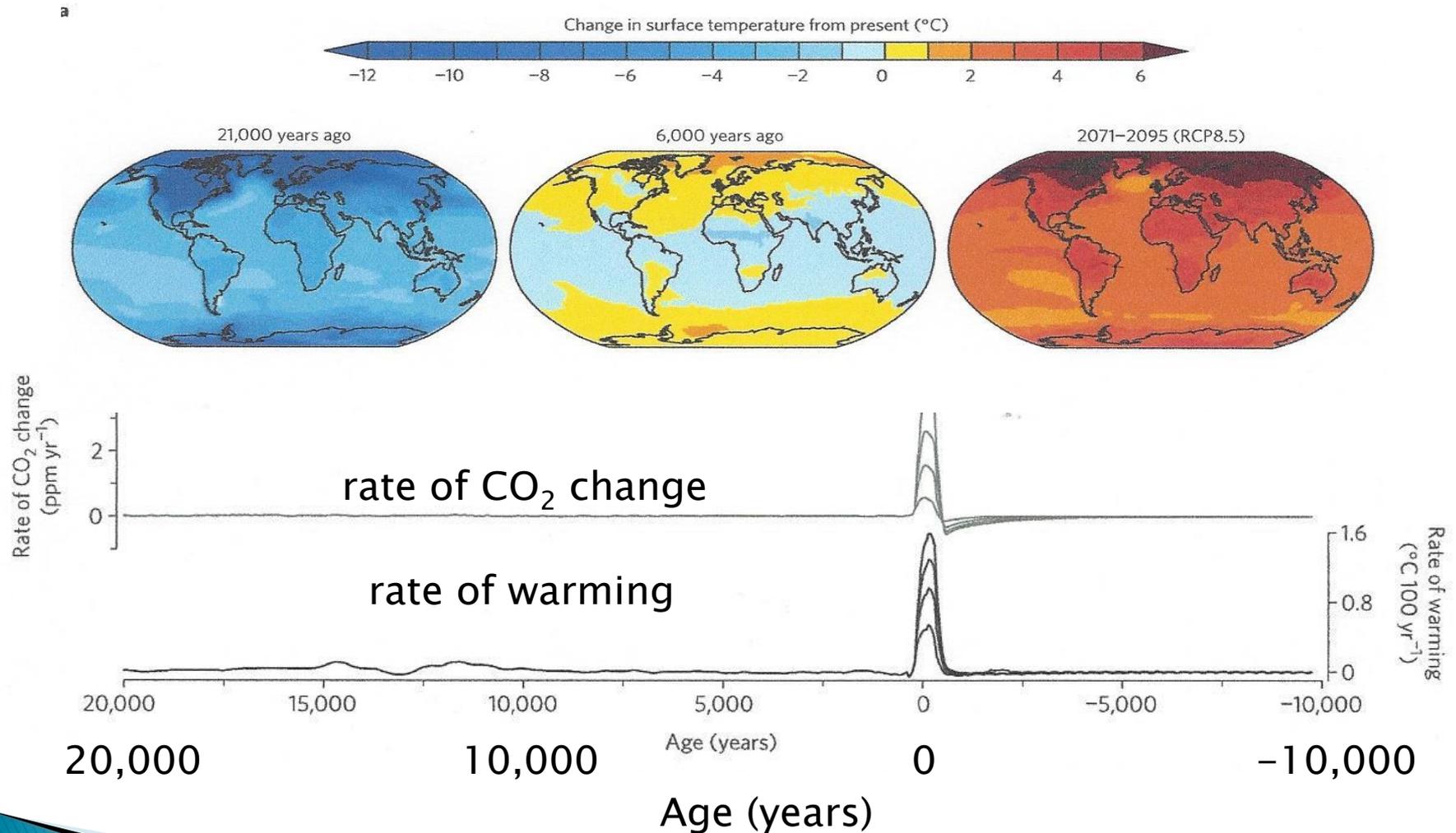
CHARLES DAVID KEELING  
*Climate Science Pioneer*

.....  
1928-2005  
.....

**Experiments:**  
Molecular species in atmosphere  
Ice cores of glaciers  
Information from satellites



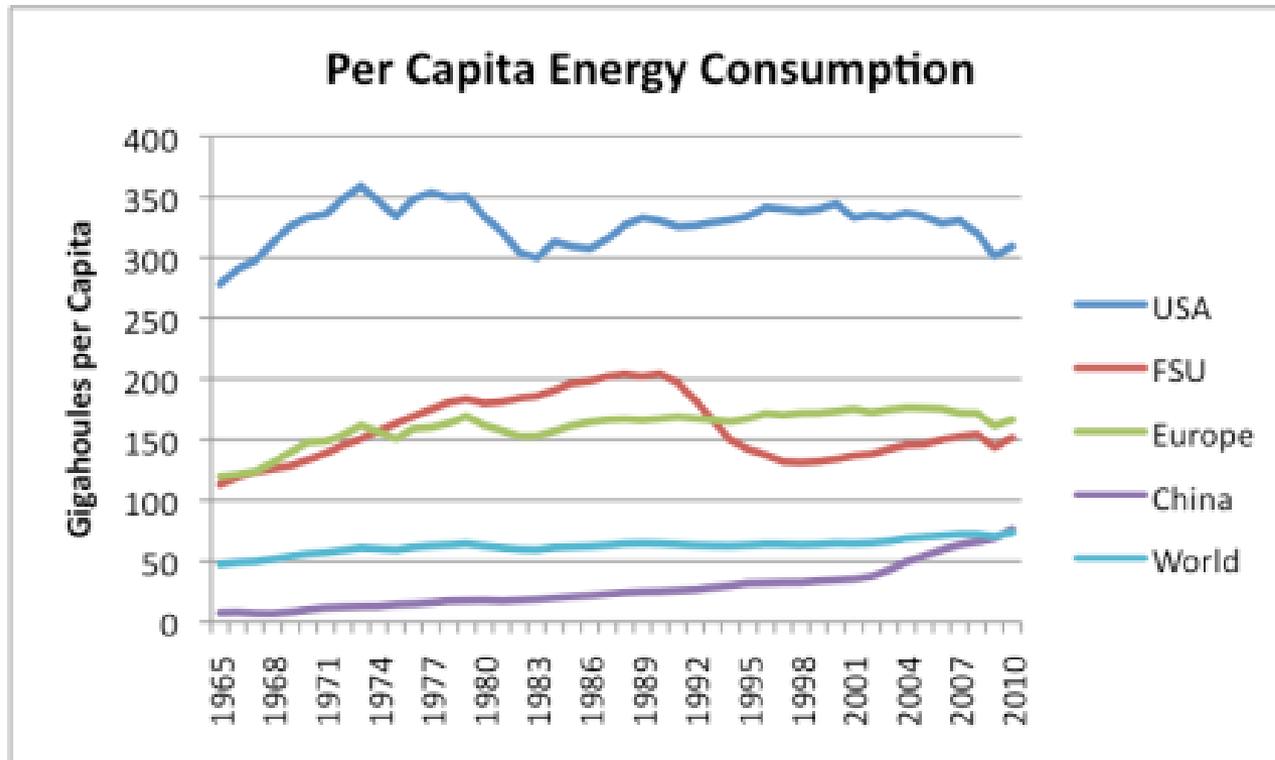
# The rates of change in CO<sub>2</sub>



P. U. Clark *et al.*,

*Nature Clim. Change*, 8 February 2016

# The Chinese are NOT the problem

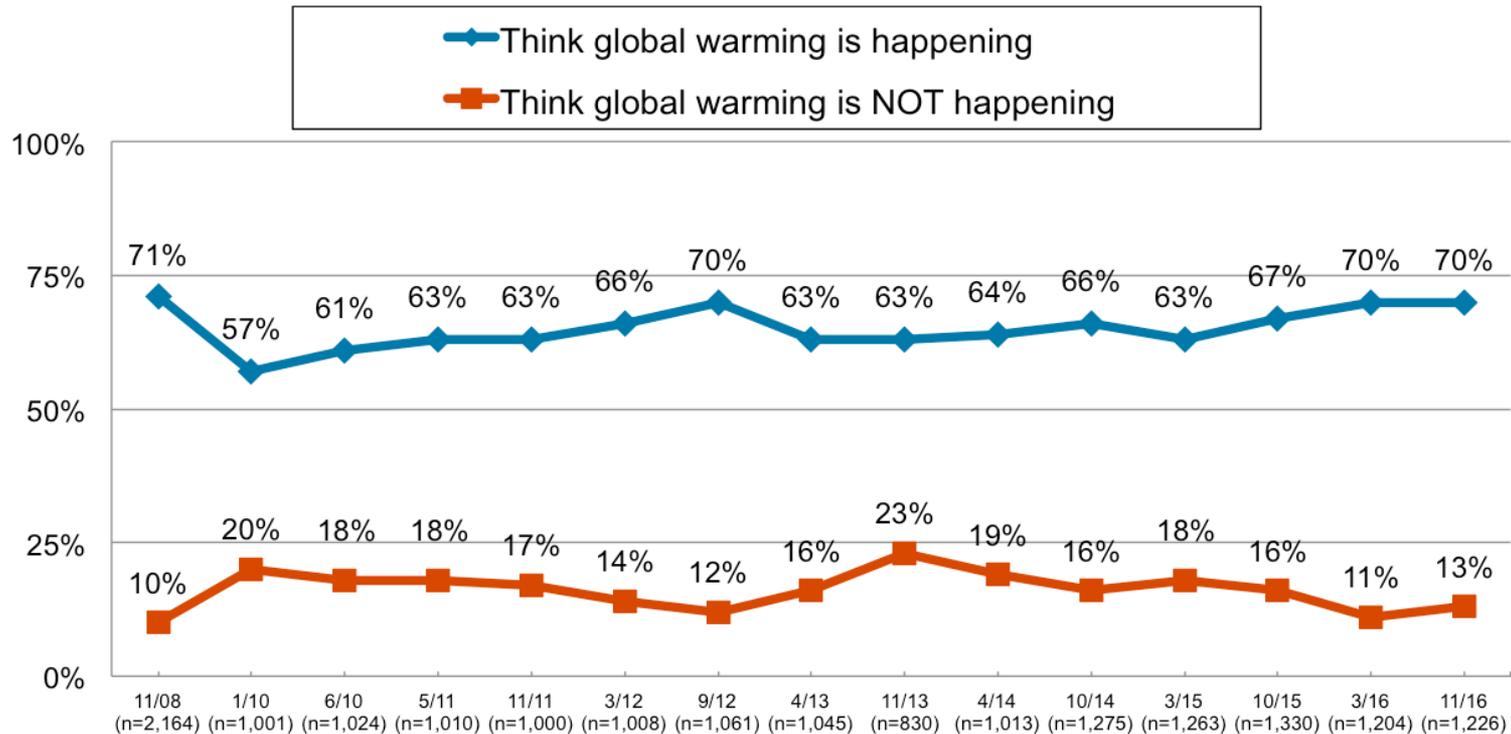


Source: Gail Tverberg, "World Energy Consumption Since 1820 in Charts", available at <http://ourfiniteworld.com/2012/03/12/world-energy-consumption-since-1820-in-charts/> accessed January 27, 2016.

# Actions: Past, Recent, and Future

- ▶ Emancipation Proclamation, **A. Lincoln** January 1, 1863
  - "that all persons held as slaves ... are, and henceforward shall be free."
- ▶ Clean Power Plan, **B. Obama** October 23, 2015
  - By 2030 reduce CO<sub>2</sub> emissions by 32% compared with 2005 levels.
- ▶ S.J. Res. 24 **Sen. S. M. Capito** (R-WV) October 26, 2015
  - Nullify the Clean Power Plan.
  - Passed House Nov. 11<sup>th</sup> & Senate Dec. 1<sup>st</sup>
  - Vetoed by President Obama Dec. 18<sup>th</sup>.
  - What will the **People of America** Do?

# Seven in Ten Americans Think Global Warming Is Happening



**Do you think global warming is happening?**

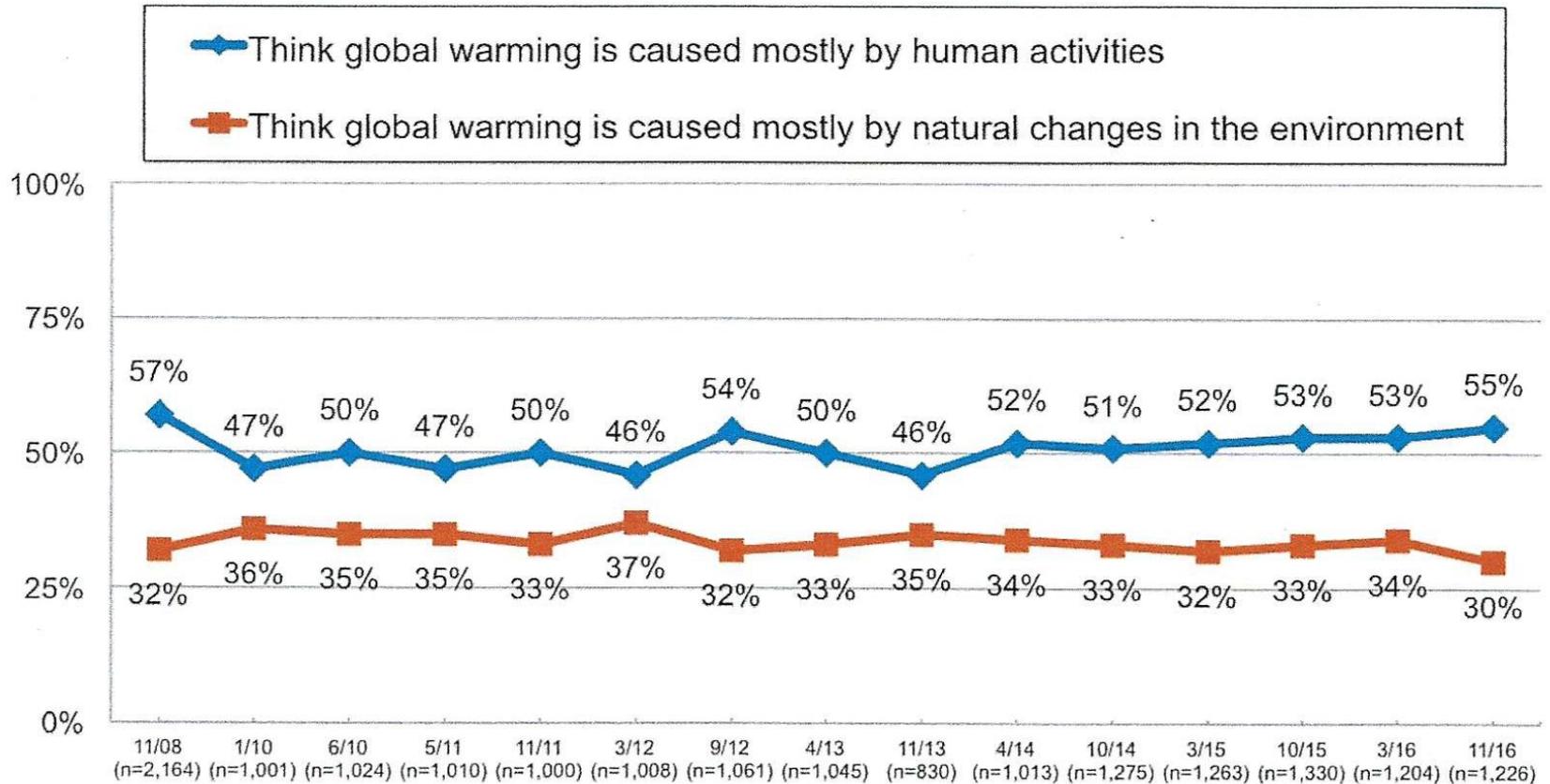
**Base: Americans 18+. November 2016.**

Notes: Respondents who either said they "don't know" or who did not answer the question are not included in the chart. Percentages therefore sum to less than 100%.



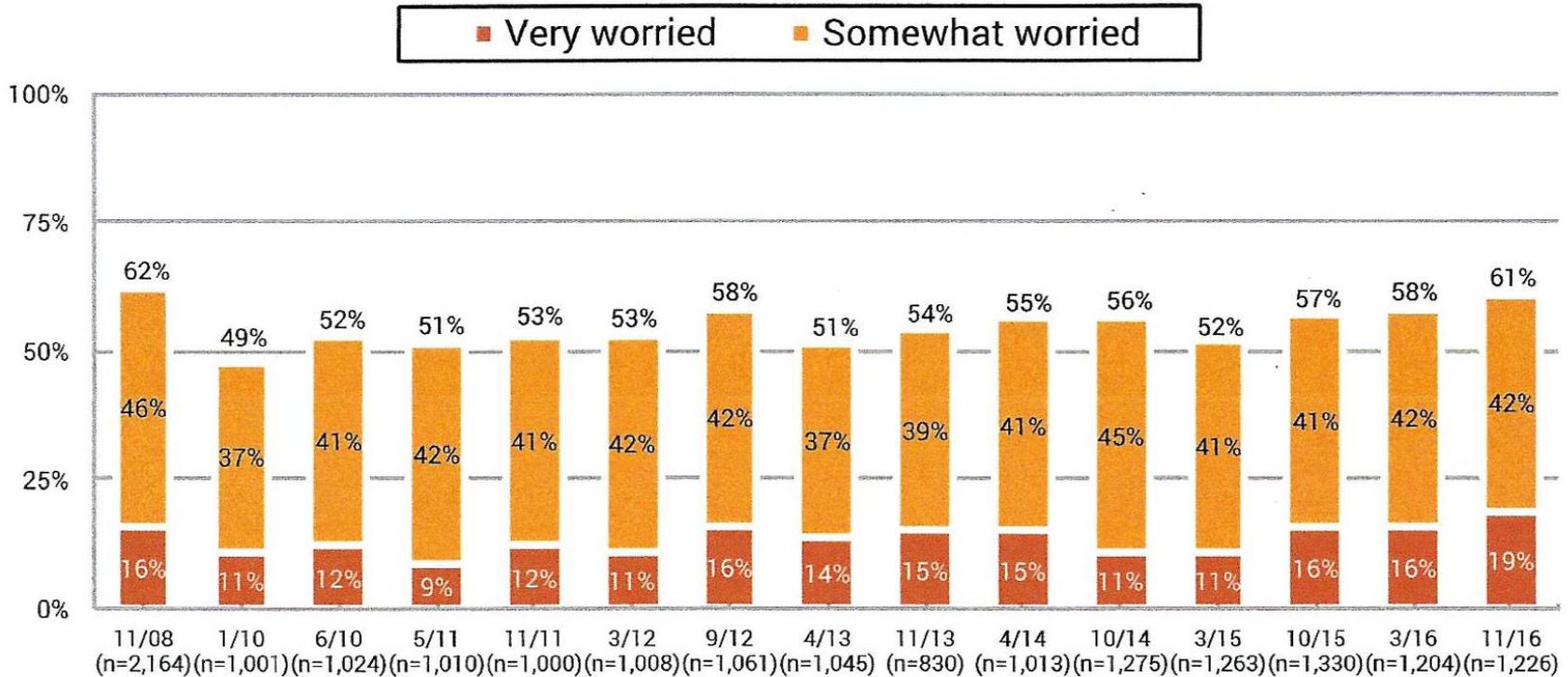
# More Than Half of Americans Think Global Warming Is Mostly Human Caused

- Little change since Spring 2013 -



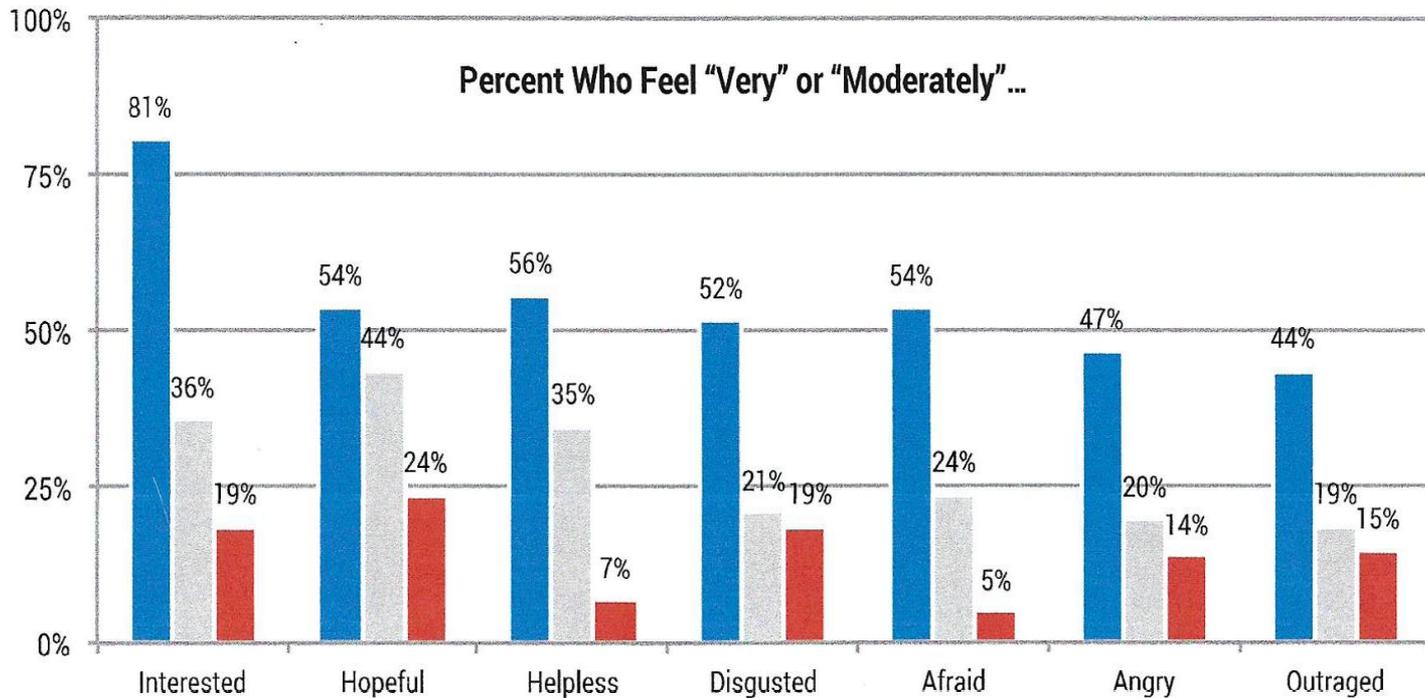
# Six in Ten Americans Are Worried About Global Warming; About One in Five Are “Very” Worried

- Highest levels of worry since November 2008 -



# A Majority of Americans Who Think Global Warming is Happening Are “Interested” and/or “Hopeful,” But Also Feel “Helpless,” “Afraid,” and/or “Disgusted”

■ Think global warming is happening (70%)  
■ Don't know if global warming is happening (17%)  
■ Think global warming is not happening (13%)



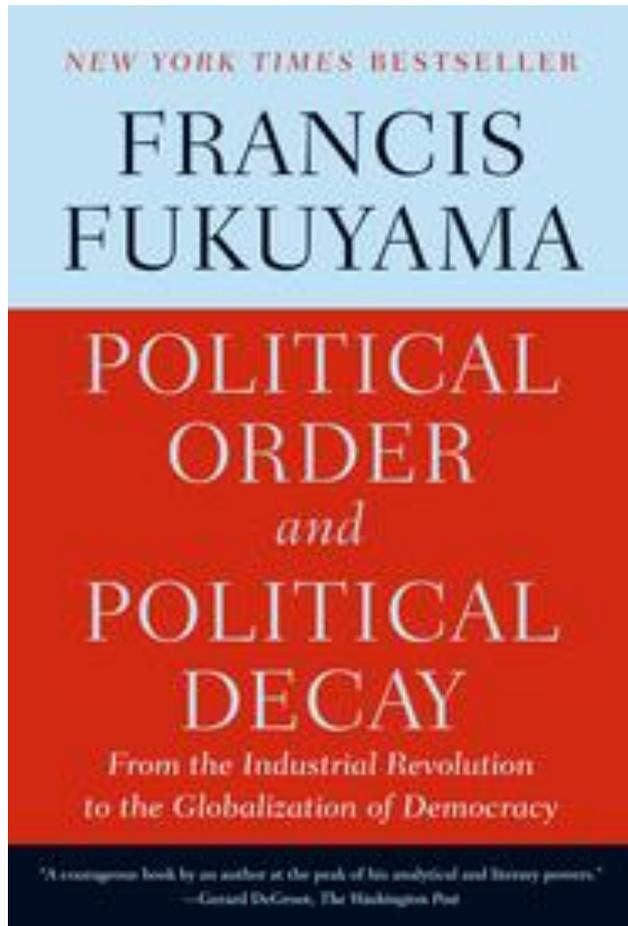
# Republican Platform

- ▶ Our Nation's Energy Abundance
  - Coal is a low-cost and abundant energy source with hundreds of years of supply. We look toward the private sector's development of new, state-of-the-art coal-fired plants that will be low-cost, environmentally responsible, and efficient.
- ▶ Reference:  
<https://www.gop.com/platform/americas-natural-resources> accessed October 2016

# Making America Great Again for Dirty Energy

- ▶ Repealed a regulation that limits coal companies from dumping coal ash into streams.
  - ▶ Repealed a rule that regulates methane flaring from natural gas drilling on public and tribal lands.
  - ▶ Pruitt (EPA) withdraw the Clean Power Plan
  - ▶ Pull out of the Paris Agreement
  - ▶ Roll back automotive emission standards
- 

# America the Vetocracy



- ▶ The long-standing distrust of the state that has always characterized American politics has led to an unbalanced form of government that undermines the prospects of necessary collective action. The results is what I label “vetocracy”. page 487

# Scientists agree

- ▶ On the influence of Carbonic Acid (CO<sub>2</sub>) in the Air upon the Temperature of the Ground.
  - Svante Arrhenius, 1895
- ▶ “This generation has altered the composition of the atmosphere on a global scale through radioactive materials and a steady increase in carbon dioxide from the burning of fossil fuels.”
  - President Lyndon B. Johnson, Special Message to Congress, Feb. 8, 1965.
  - <http://www.lbjlib.utexas.edu/johnson/archives.hom/speeches.hom/650208.asp>

# 1992 World Scientists' Warning to Humanity

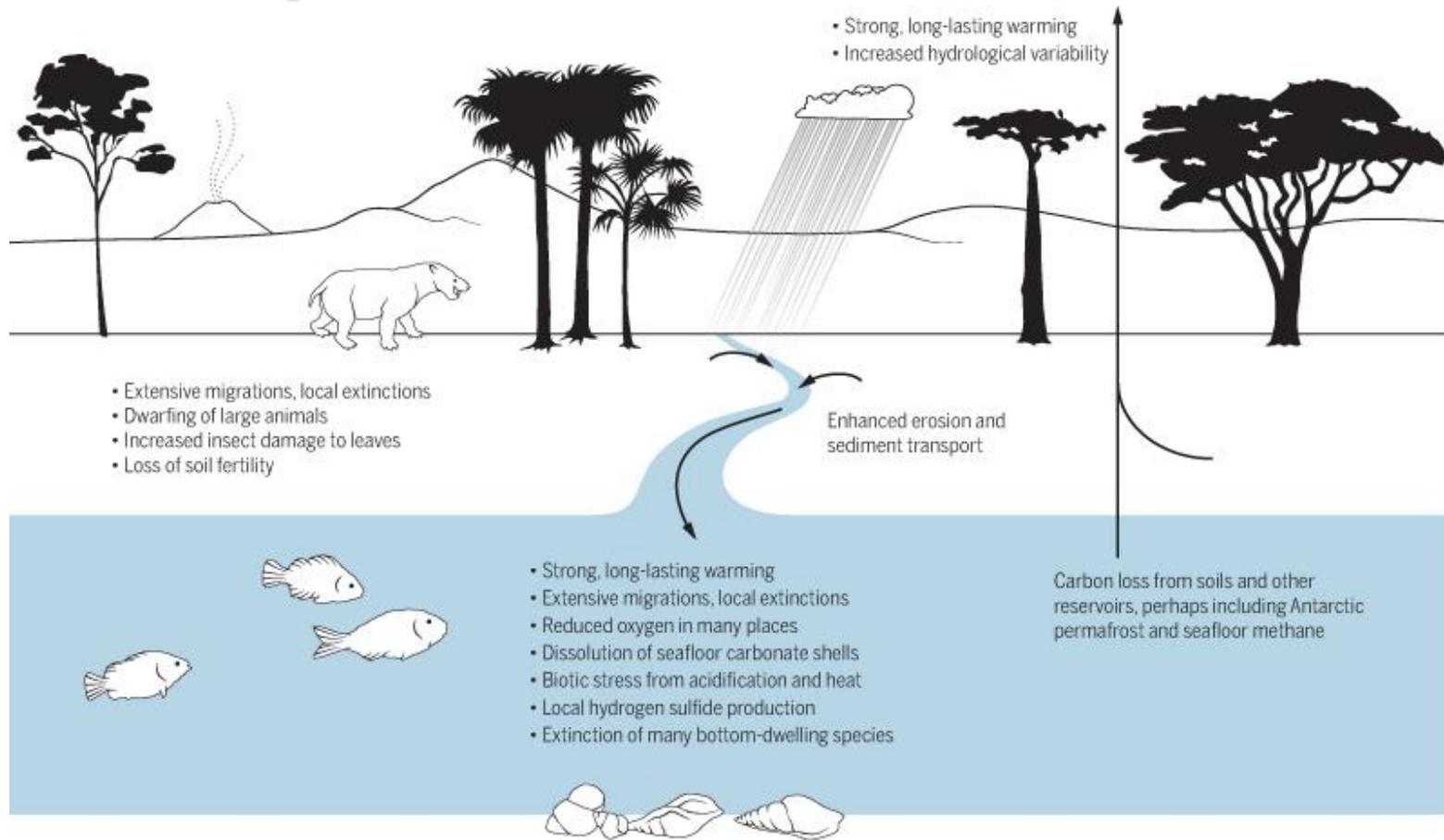
- ▶ Human beings and the natural world are on a collision course. ... Fundamental changes are urgent if we are to avoid the collision our present course will bring about.
- ▶ **Some 1700 of the world's leading scientists, including the majority of Nobel laureates.**  
*Union of Concerned Scientists.*

# The Dilemma

- ▶ If we do what humanity has always done in the past, we're likely to burn all of the fossil fuels, and then have a hard landing at a time of high population, with an unbearable climate posing existential risks, at just the time when we're facing the crisis of fossil fuels running out. That will hardly make for ideal conditions under which to de-carbonize, and there is a severe risk civilization will collapse. Leaving our descendents with few resources to deal with the unbearable environment we will have bequeathed them.

**Raymond T. Perrehumert, Oxford University  
formerly of The University of Chicago**

# Consequences

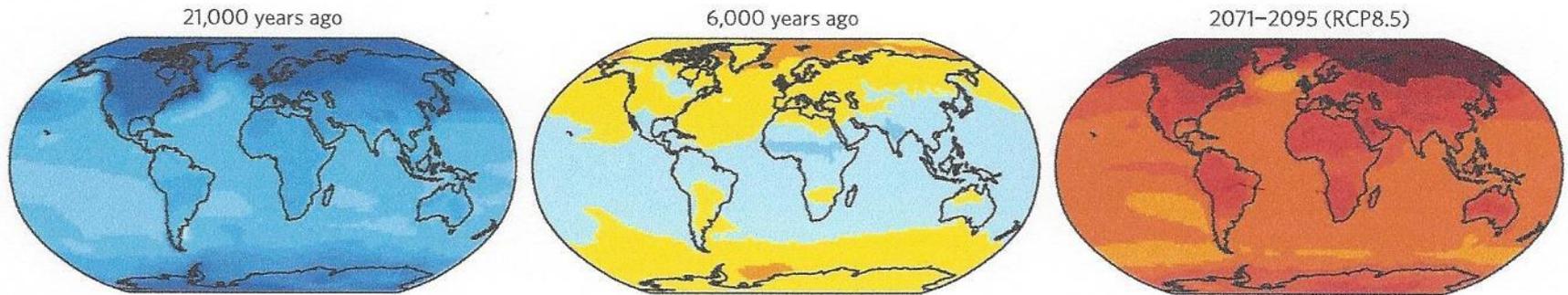
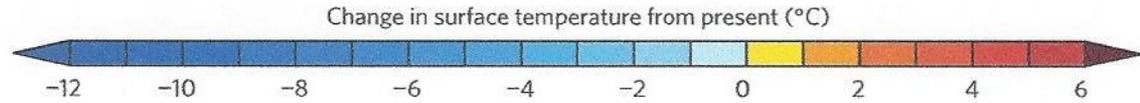


A heated mirror for future climate: Climate changes 55.9 million years ago resemble those expected in the future.

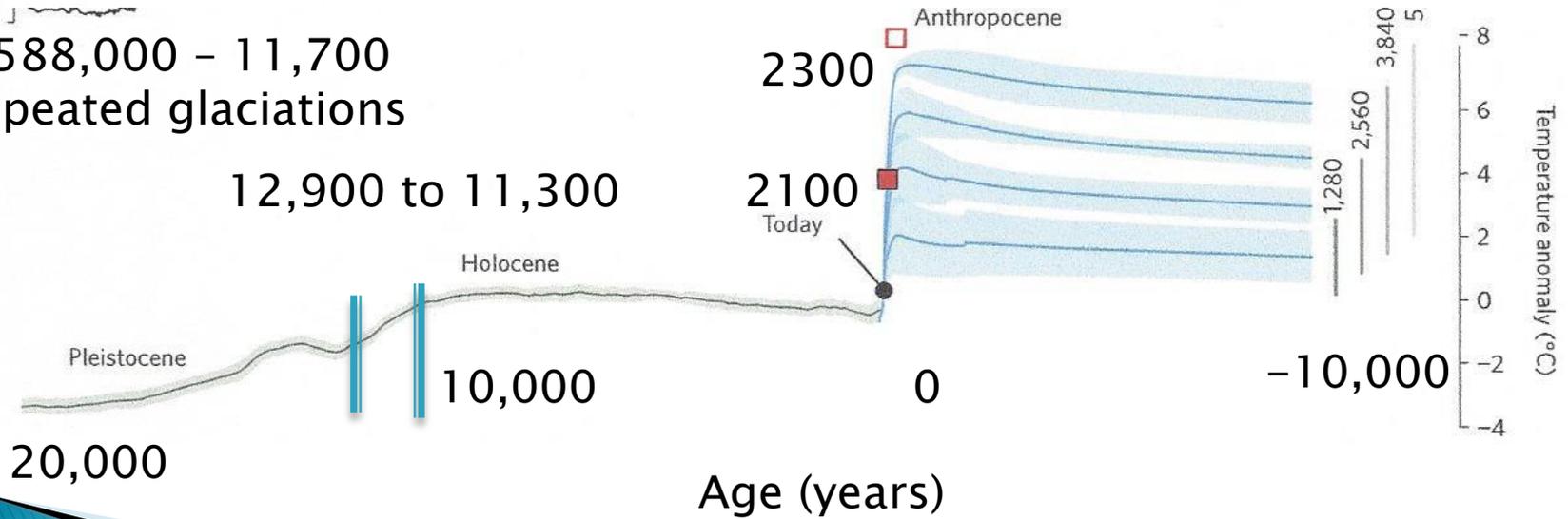
Richard B. Alley, *Science*, Vol. 352, 151–152, 2016

# Global Temperature

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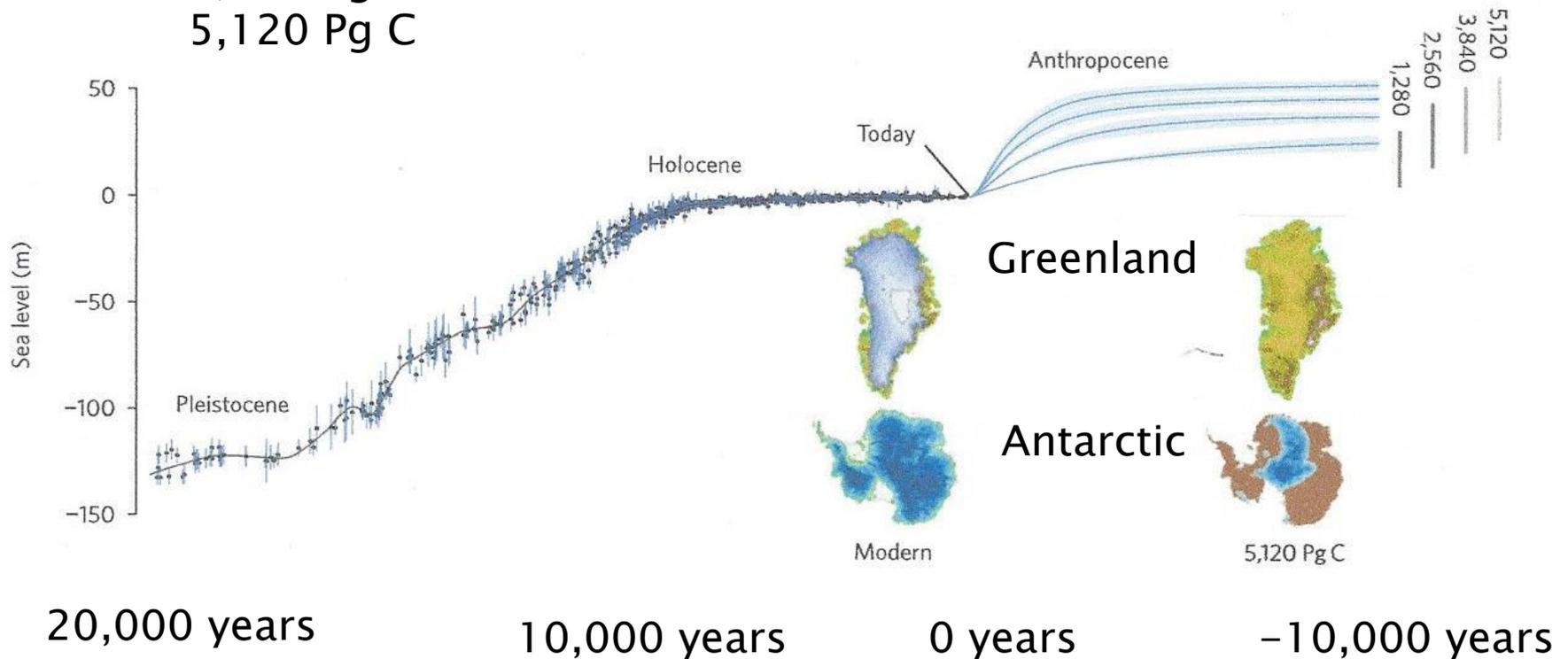


2,588,000 – 11,700  
Repeated glaciations



# Calculated sea-level change

1,280 Pg C from the year 2000  
2,560 Pg C  
3,840 Pg C  
5,120 Pg C



# Projected submerged areas



At least 50 million people live on the land that will be affected.

P. U. Clark *et al.*,  
*Nature Climate Change*, 8 February 2016

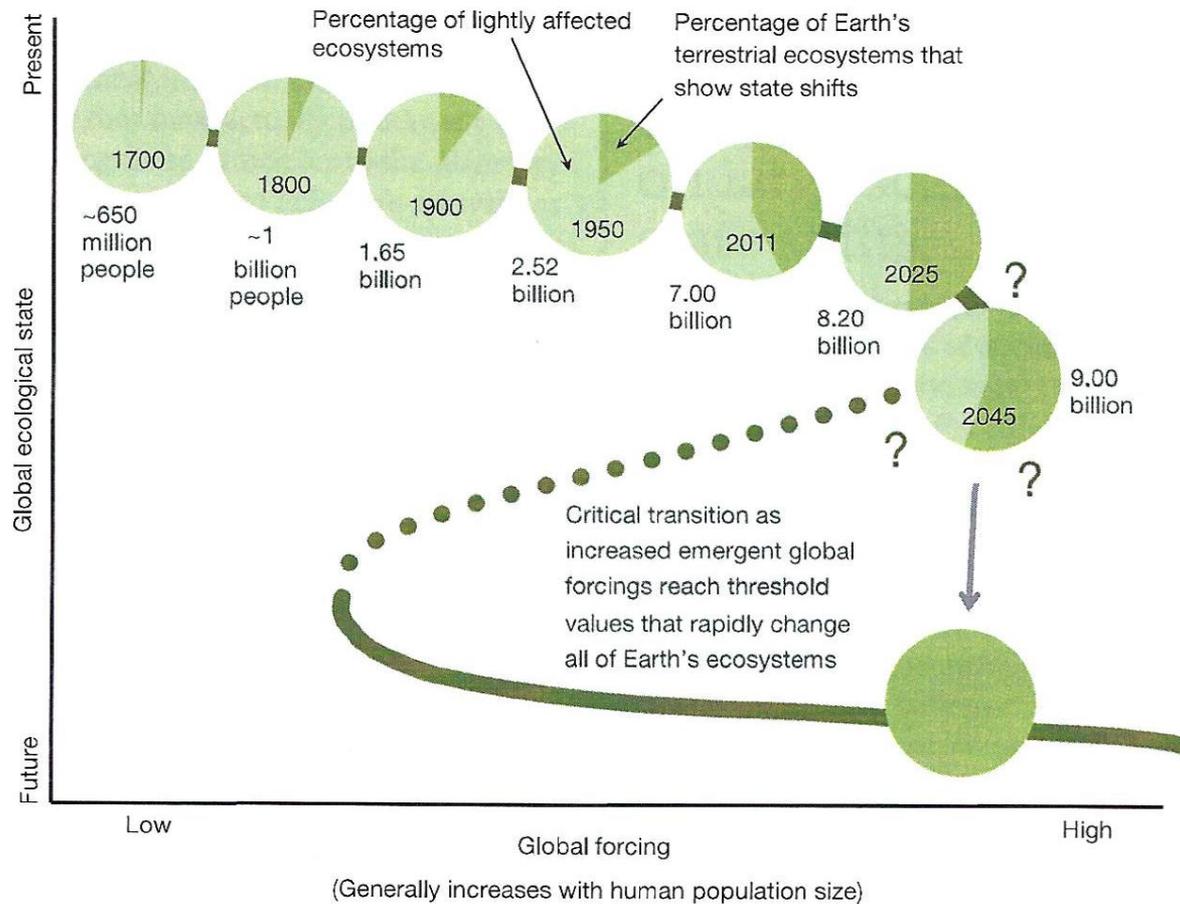
# How Close Are We to the Edge?



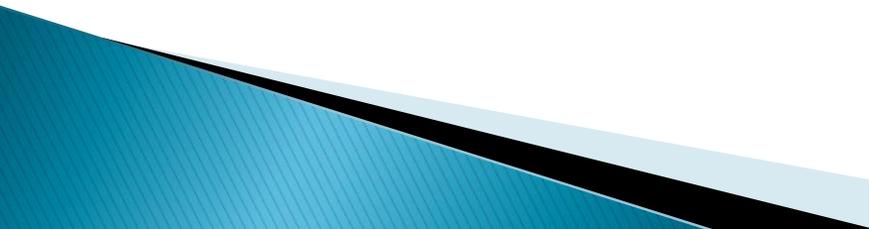
'Tipping Point for Planet Earth', by Cheng 'Lily' Li

- ▶ *Tipping Point for Planet Earth*
  - Anthony D. Barnosky and Elizabeth A. Hadly
  - Thomas Dunne Books 2016
- ▶ Approaching a state shift in Earth's biosphere
  - Anthony D. Barnosky and 21 other scientists
  - *Nature*, vol. 486, pp. 52–58 7 June 2012.

# Quantifying land use



# Recommendation & Conclusion

- ▶ This long-term view shows that the next few decades offer a **brief window of opportunity** to minimize large-scale and potentially catastrophic climate change that will extend longer than the entire history of human civilization thus far.
  - ▶ We conclude by recommending that, to avoid severe and persistent impacts from long-term climate change, there is a need for policies that lead to **complete de-carbonization of the world's energy systems.**
- 

# Revenue-Neutral Fee & Dividend

- ▶ Charge a fee on CO<sub>2</sub>, i.e. carbon atoms in fuel.
  - Collect at source!
  - Start at \$10.00/ton of CO<sub>2</sub>
  - Natural gas (methane) is most efficient
  - Oil less efficient than natural gas ~ 60% of methane
  - Coal is least efficient ~ 40% of methane
- ▶ Return a Dividend to each Household in U.S.!
  - Overhead ~ 1/2% if run by Social Security.
- ▶ Supported by scientists, economists, & others
  - This will drive the fourth industrial revolution.
  - Cap and Trade will not work: short vs. long term!

# A Fourth Industrial Revolution

- ▶ First – mechanization
  - 1794 cotton gin, Eli Whitney
- ▶ Second – electrification
  - 1802 incandescent light, Humphry Davy
- ▶ Third – digital computer
  - 1945 The Internally Stored Modifiable Program
    - Alan Turing & John von Neumann
- ▶ Fourth – de-carbonization of energy systems.
  - Resources must be managed in a sustainable way
  - Not only Energy generation but also Land Use and Agriculture

# Role of Religion I

- ▶ And God said, Let us make man in our image, after our likeness: and let them have **dominion** over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth. Gen. 1:26
- ▶ “God planned all of this explicitly for man’s benefit and rule: no item in the physical creation has any purpose other than to serve man’s purposes”
  - Lynn White, Jr., “The Historical Roots of our Ecological Crises”, *Science*, Vol. 155, Issue 3767, pp. 1203–1207, 10 March 1967.
- ▶ “The Christian is called upon to exhibit dominion, but exhibit it rightly; treating the thing as having value in itself, exercising dominion without destruction”
  - Francis Schaeffer, *Pollution and the Death of Man: The Christian View of Ecology* (Wheaton, IL: Tyndale House).

# Role of Religion II

## ▶ Islam

- “Corruption doth appear on land and sea because of (the evil) which men’s hands have done, that He may make them taste a part of that which they have done, in order that they may return.”
  - Quran 30:41

## ▶ Hinduism

- “The entire universe is to looked upon as the Lord.”
  - Shukla Yajur Veda, Ishavasya Upanishad – 1

# Key sources:

- ▶ The geography of American climate confusion: a visual guide
  - John D. Sutter, CNN
  - <http://www.cnn.com/2017/02/28/us/sutter-climate-options-maps/index.html> accessed 3/1/17
- ▶ Climate change in the American mind: November 2016
  - A. Leiserowitz, E. Maibach, C. Roser–Renouf, S. Rosenthal, & M. Cutler
  - Yale University and George Mason University, New Haven Ct., Yale Program on Climate Change Communication.