

# Main Points

**1) Review from 28 March**

**2) The scientific evidence for human-induced climate change**

-- history and prehistory of climate trends

-- the greenhouse effect

-- the bizarre and unfortunate politicalization of climate change

\* warning: Jake's opinions may creep into this lecture

**3) National energy demand as a driver of climate change, and a local example of why it is important to pay attention to things**

**Tuesday 4 April = presentations on federal and state/local regulations for curbing climate change.**

For non-presenters, remember to print out and bring "different group evaluation" handouts from website.

**Changes to syllabus: we will have a help session for tutorial #3 the day it is due (6 April). As always, feel free to come to Jake's office hours with questions about the tutorial.**

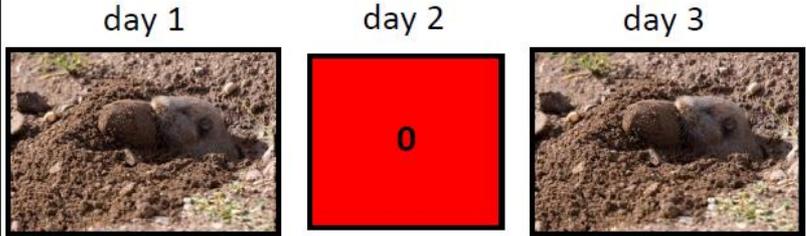
**Pre-reading: Tuesday 4 April = NA**

**Thursday 6 April = Bergstrom et al**

**Terms: greenhouse gas, conflict of interest**

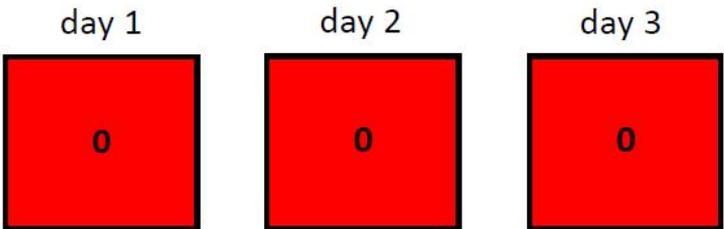
**What we learned #1:** detection histories allow us to estimate  $\Psi$  and  $p$ , the two parameters of interest in occupancy modeling. Typically, we estimate both parameters through likelihood estimation using a computer (in Program Presence, R, Mark, or others).

**Consider Multiple Surveys, With a Closed Population**



$$\Psi_i * p_i * 1 - p_i * p_i$$

Probabilities are multiplied because only this series of events could cause the detection history



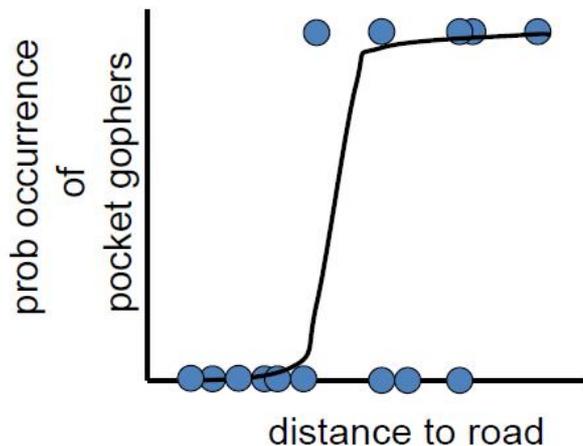
Event 1 = true absence      Event 2 = non-detection error

$$1 - \Psi_i + \Psi_i * 1 - p_i * 1 - p_i * 1 - p_i$$

**What we learned #2: environmental covariates can be used to predict  $\Psi$  and  $p$ . Odds are to logistic regression what slopes are to linear regression; odds describe how  $\Psi$  changes with changes in one or more environmental covariates.**

## Site-Specific Variation in Covariates

- coefficients of predictors in logistic regression are odds = when exponentiated to the inverse of the natural log (e.g.,  $2.71^{b_1}$ ) and multiplied by 100, these give the percent change in the probability of an event occurring (e.g., the occurrence probability)

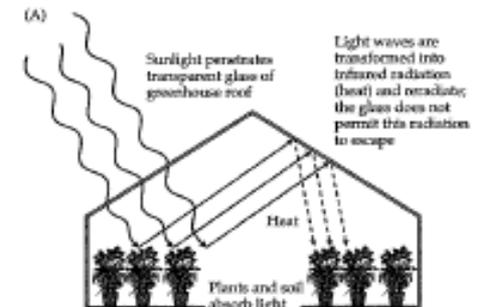
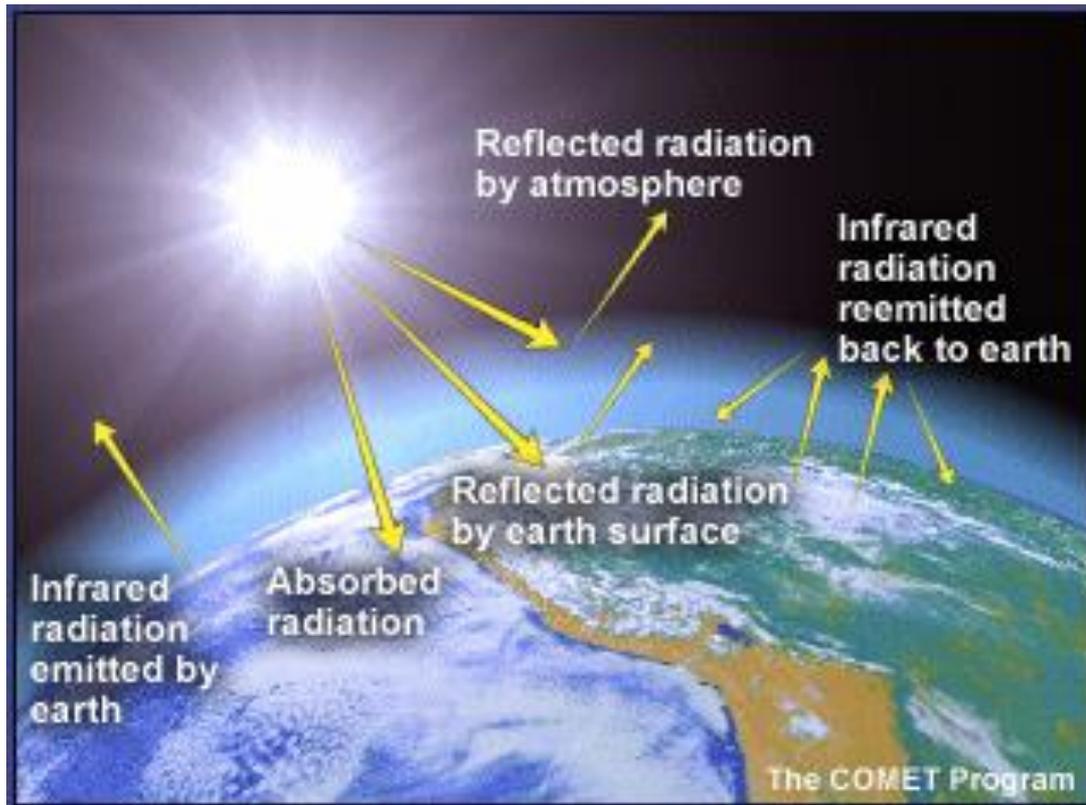


## **Scientific basis of climate change**

- **“Climate change is the one threat that exists everywhere, cannot be reversed by local actions, and will continue even if all nations come to agreement to tackle the problem”  
—C. Parmesan 2006.**

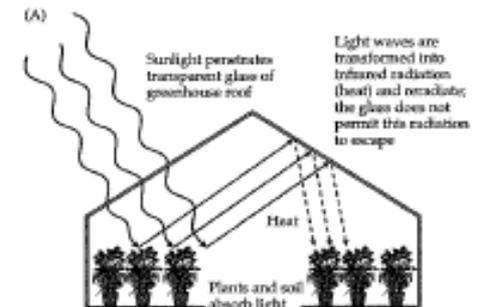
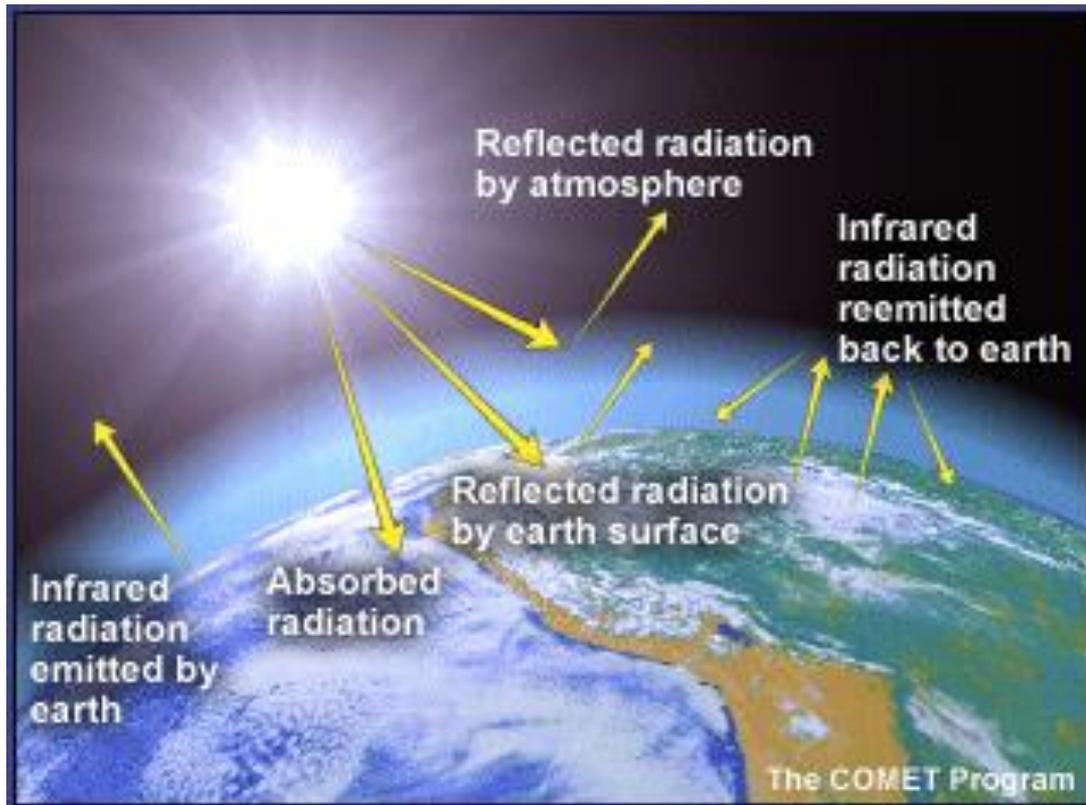
# Scientific basis of climate change

- **greenhouse effect** = the transformation of short-wave (UV) to long-wave (IR) energy that is subsequently prevented from dissipating back into space.

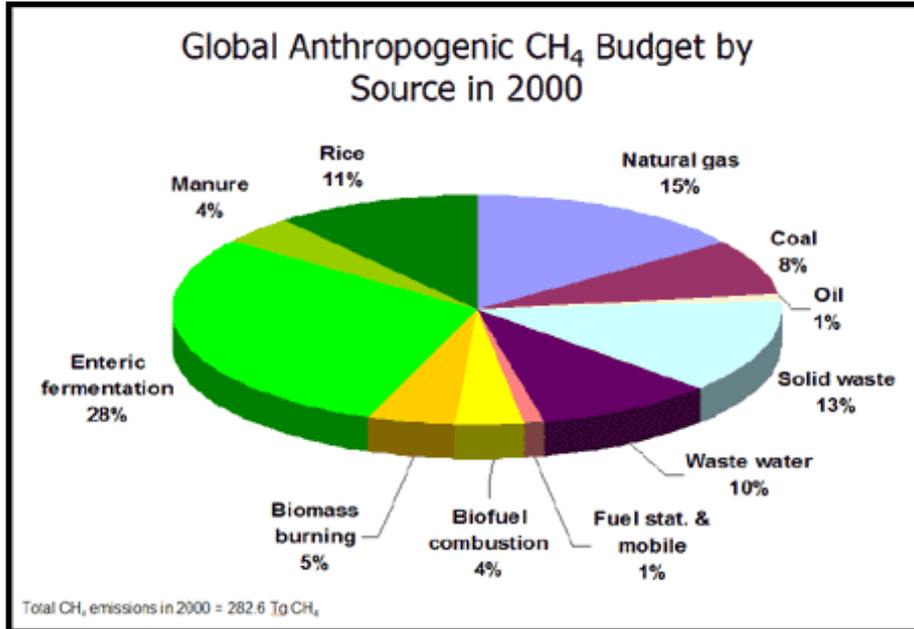


# Scientific basis of climate change

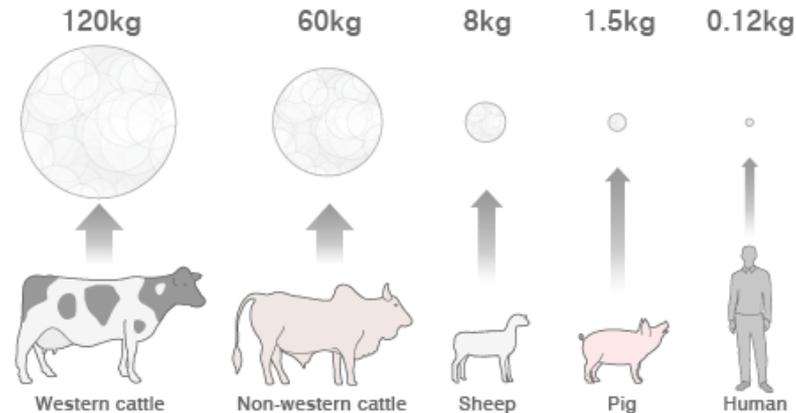
- greenhouse gasses (CO<sub>2</sub>, methane, nitrous oxide, etc) trap heat re-radiated from the Earth's surface, causing temperatures to warm.



# Scientific basis of climate change



Methane emissions per animal/human per year

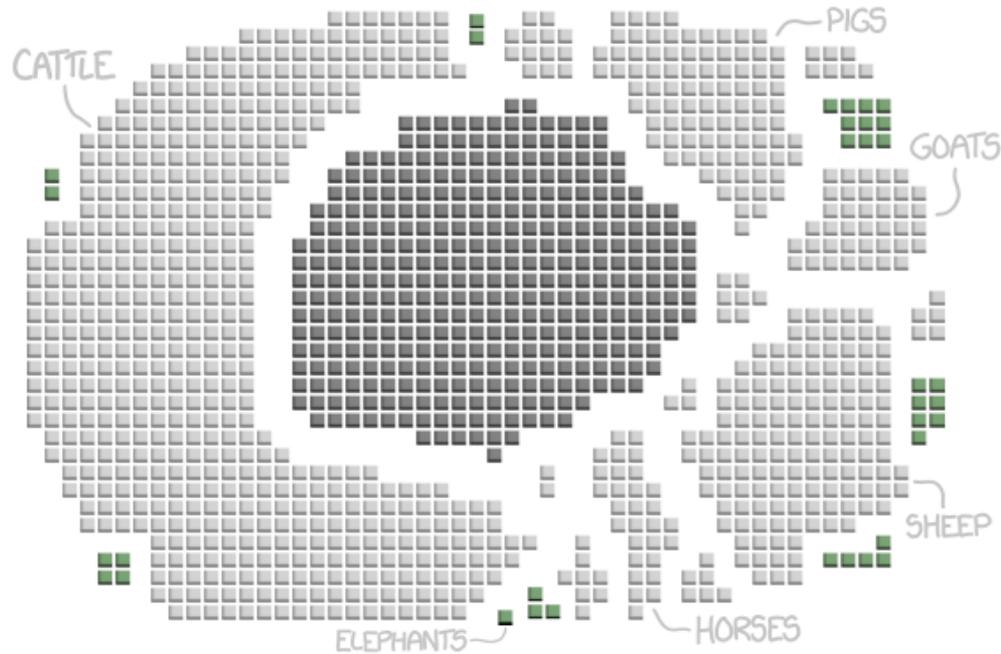


SOURCE: Nasa's Goddard Institute for Space Science

# EARTH'S LAND MAMMALS BY WEIGHT

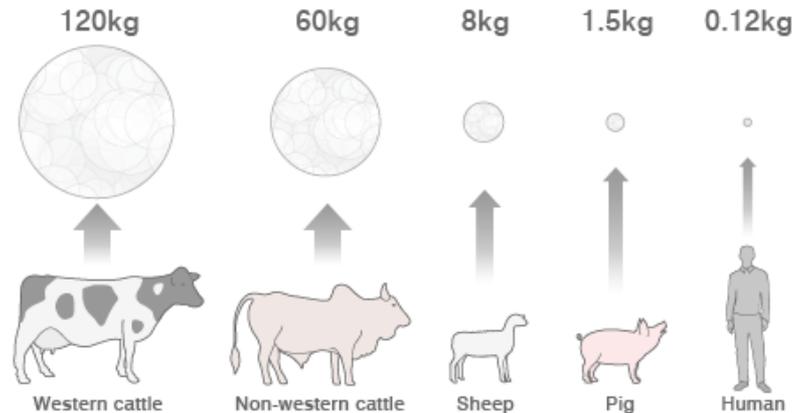
■ = 1,000,000 TONS

■ HUMANS ■ OUR PETS AND LIVESTOCK ■ WILD ANIMALS



DATA FROM VALENTIN SMIL'S *THE EARTH'S BIOSPHERE: EVOLUTION, DYNAMICS, AND CHANGE*, PLUS A FEW OTHER SOURCES.

## Methane emissions per animal/human per year



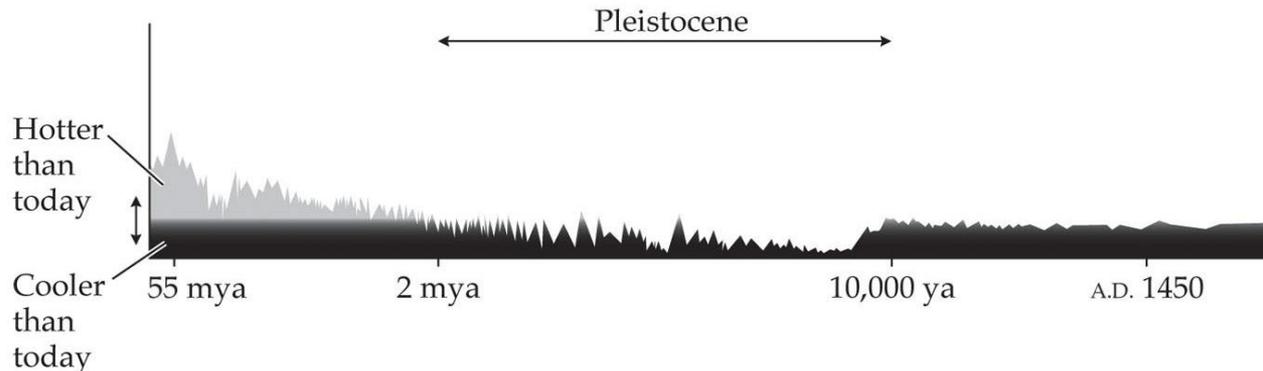
SOURCE: Nasa's Goddard Institute for Space Science

## Scientific basis of climate change

- **Since 1860s, burning of coal, oil, and natural gas has increased greenhouse gases by 30%, leading to a 0.6 C increase.**

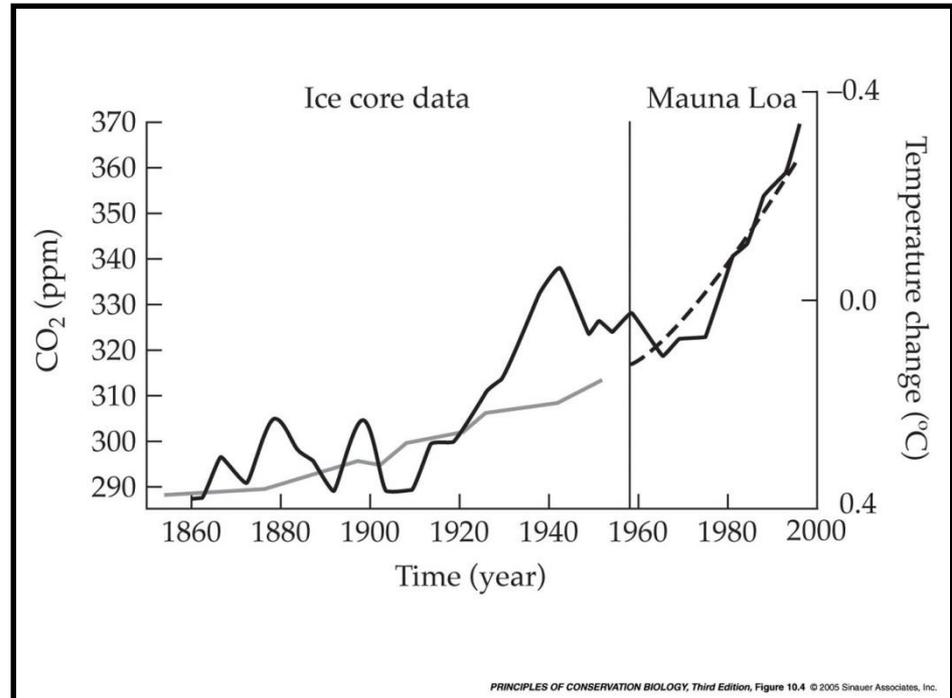
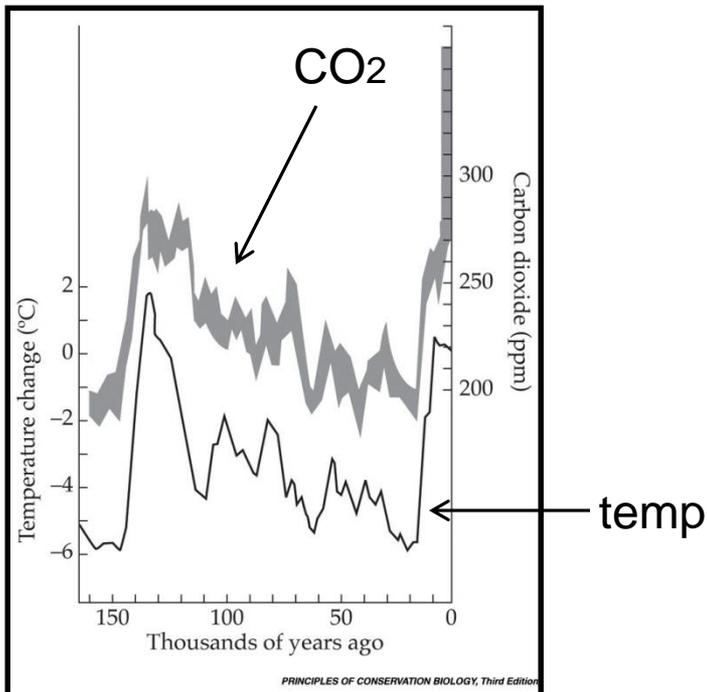
# Scientific basis of climate change

- Since 1860s, burning of coal, oil, and natural gas has increased greenhouse gases by 30%, leading to a 0.6 C increase.
- Global climate varies based on the observer's time scale; temperatures have been cooling over the past 50-60 million years.

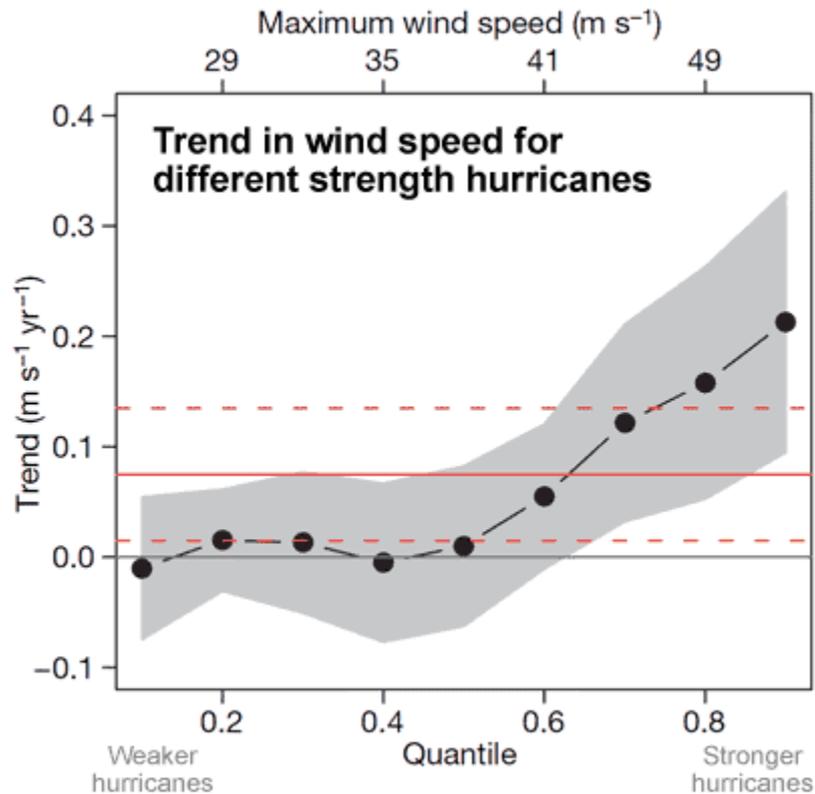


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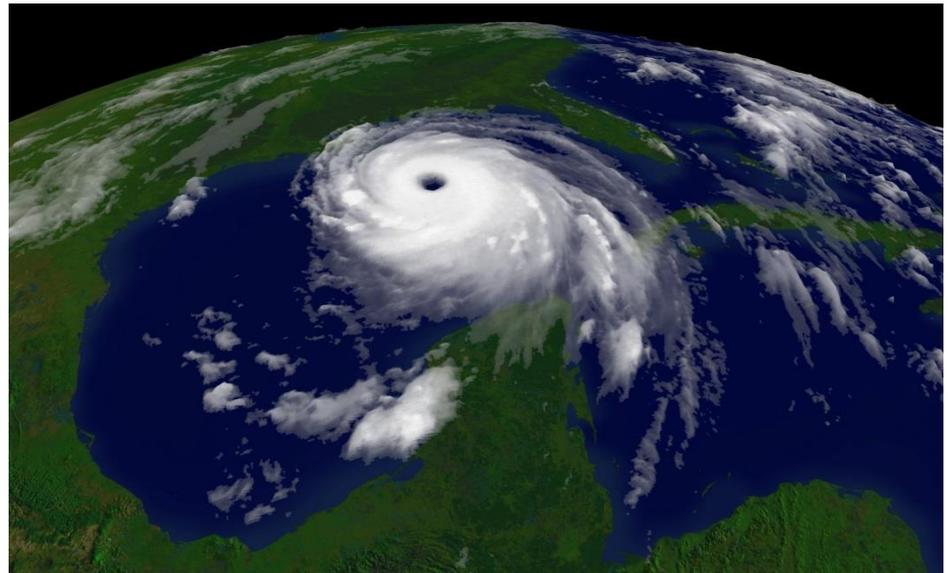
- Data from oxygen isotope ratios in ice cores demonstrates a positive correlation between temperature change and carbon dioxide.
- Atmospheric carbon dioxide levels rose 36% since 1910—from 280-380 ppm.



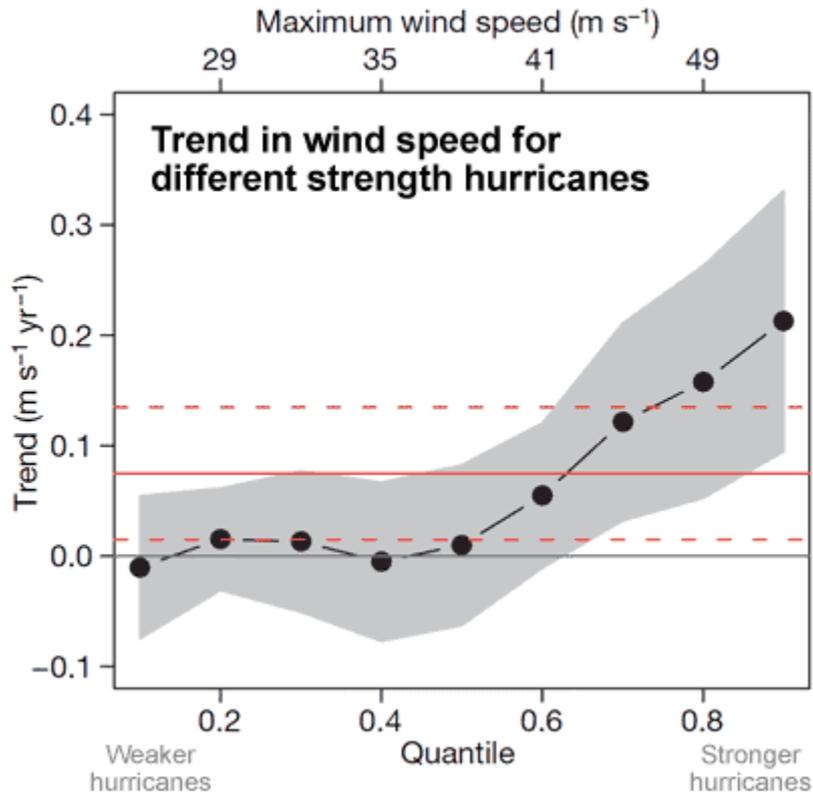
- **# Americans killed by domestic terrorism since 2001 = 2997**



Elsner et al. 2008. Nature.

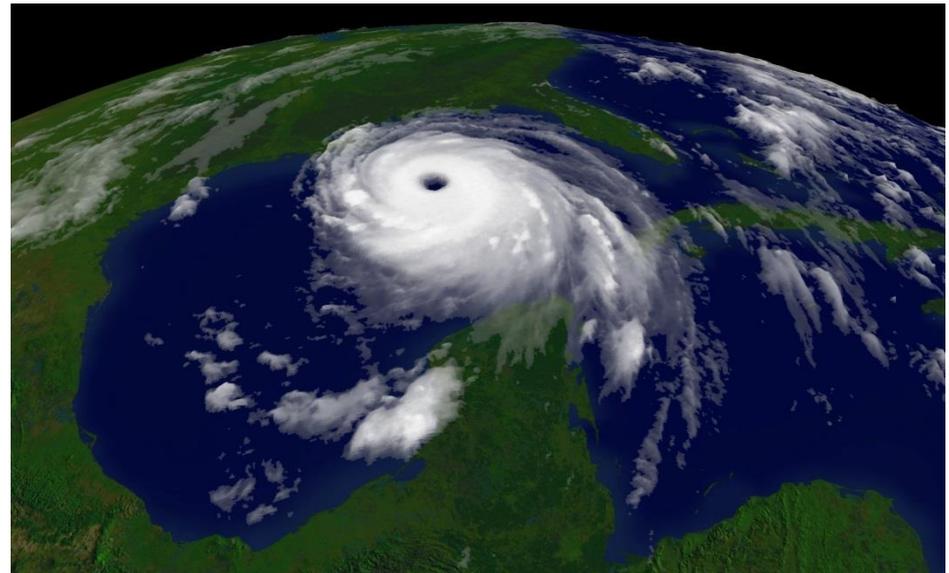
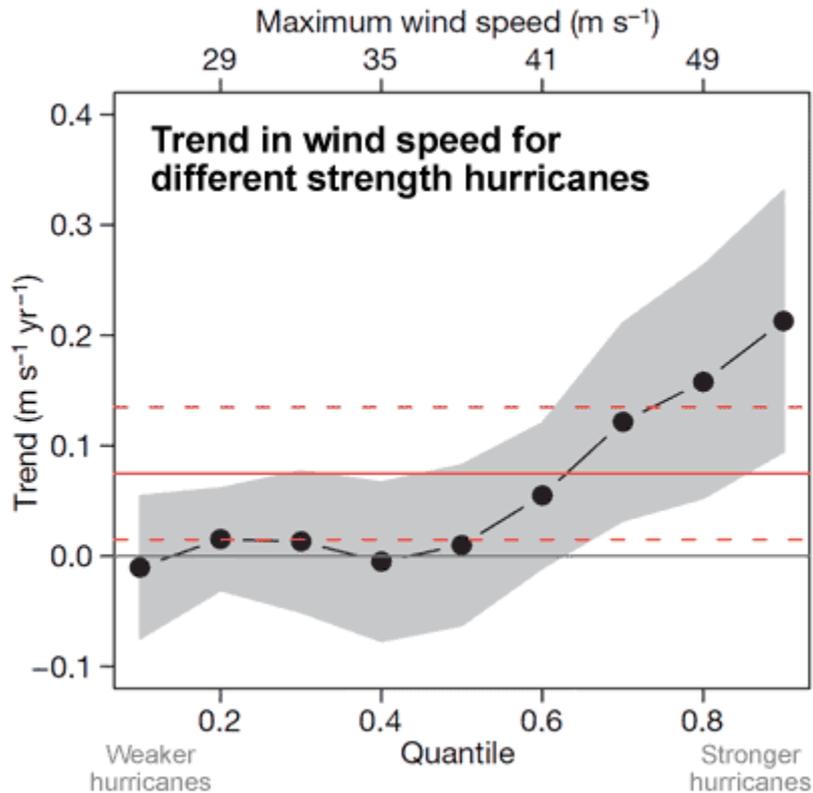
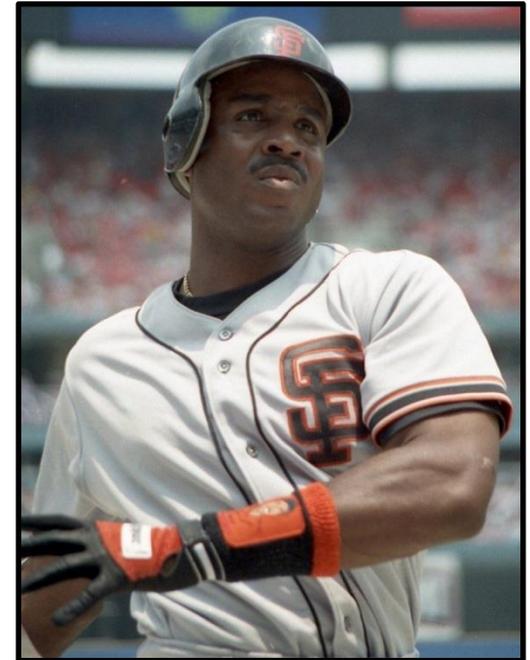
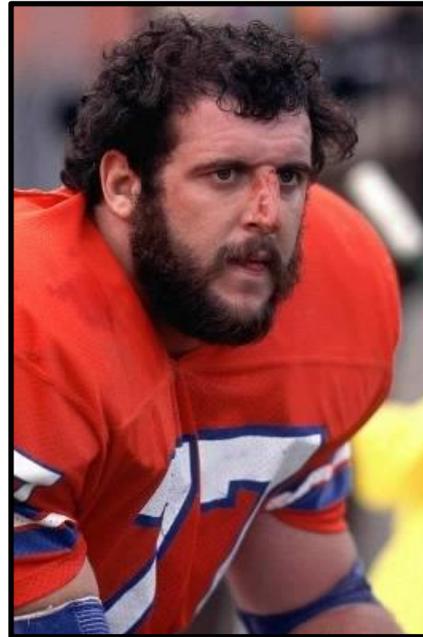


- **# Americans killed by hurricanes, tornados, and floods since 2001 = 2772**



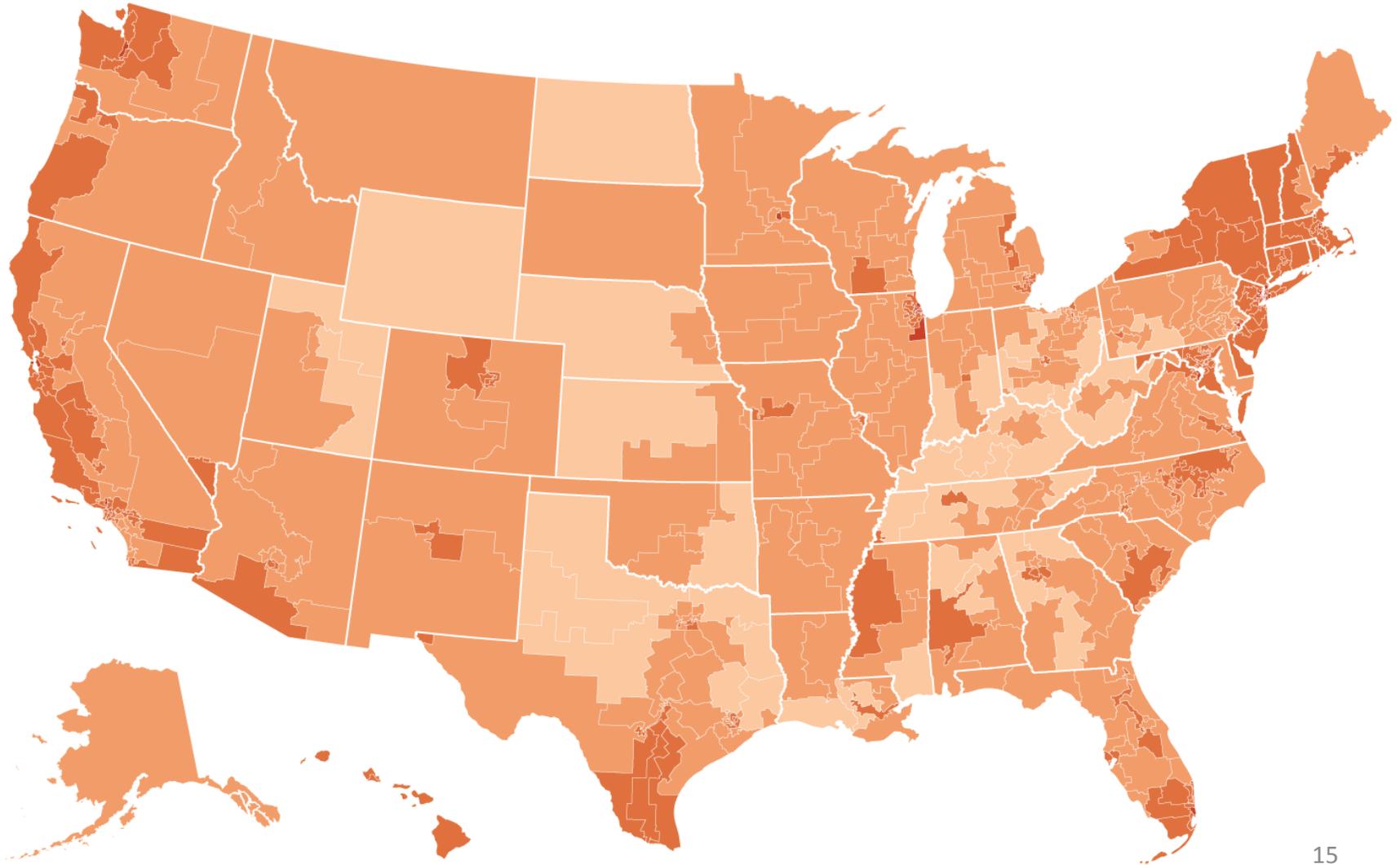
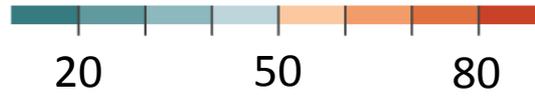
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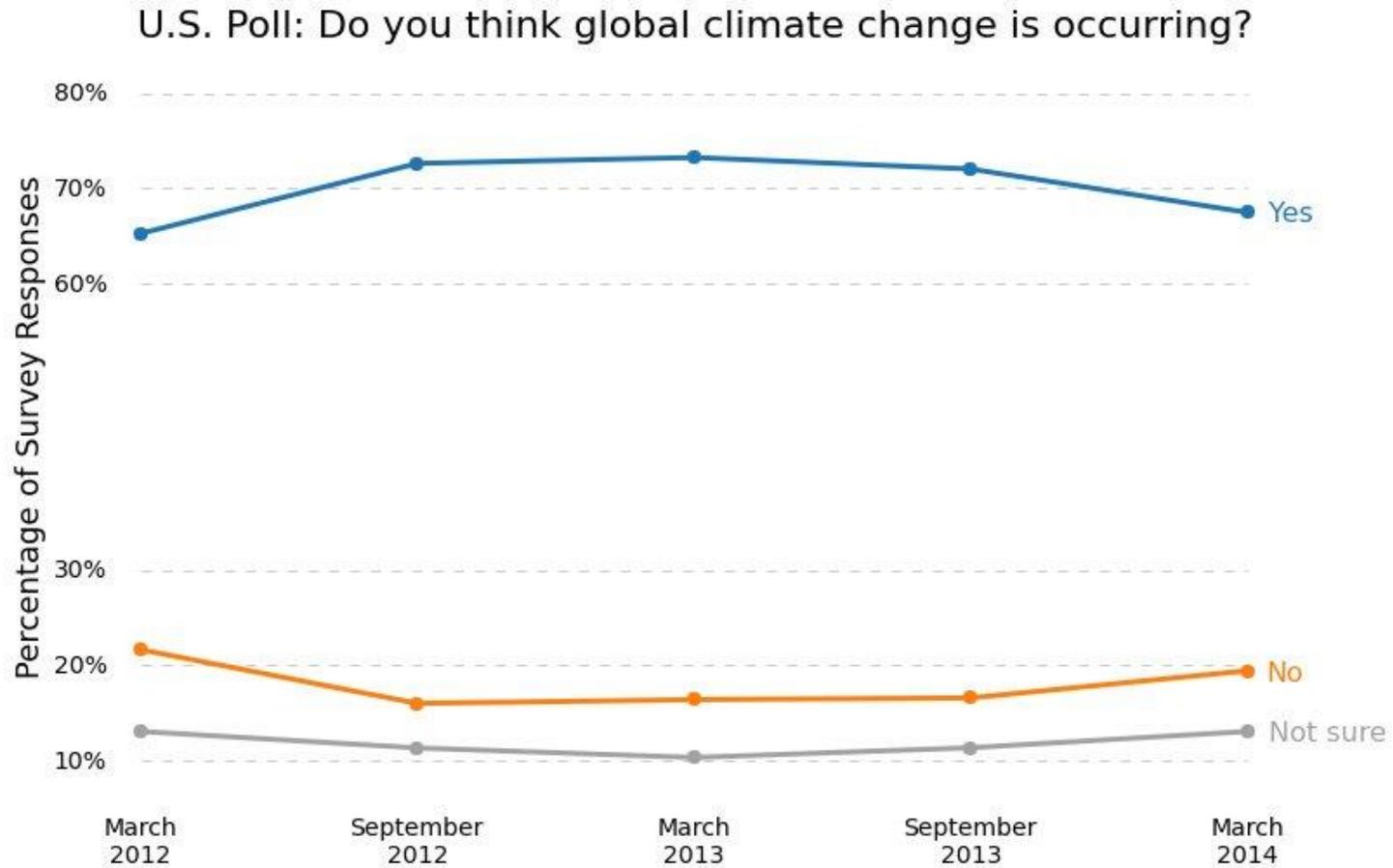


Elsner et al. 2008. Nature.

## % of adults by congressional district who support federal CO<sub>2</sub> limitations (national avg = 68%)



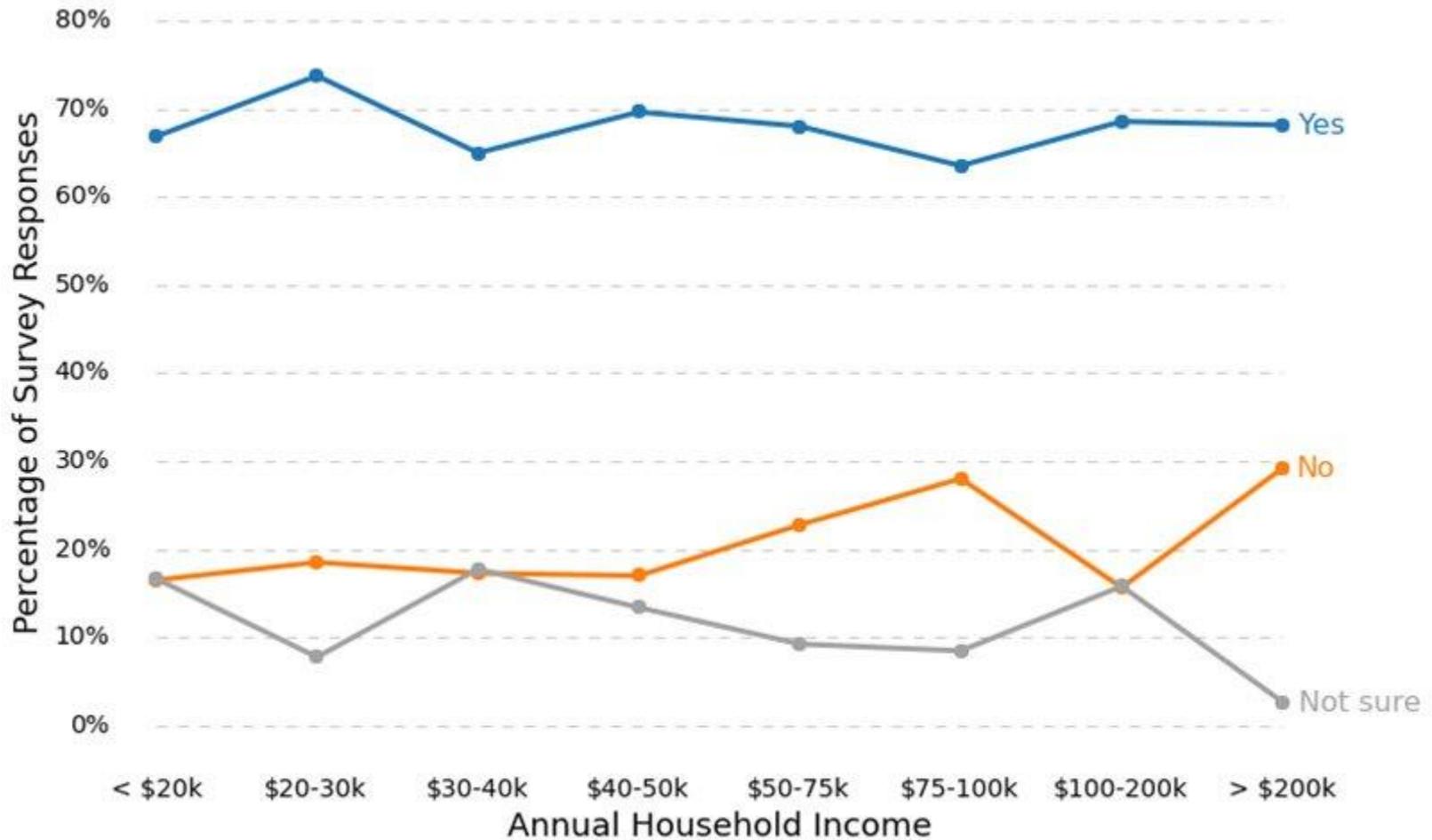
# Politics and climate change



Data source: UT Energy Poll ([utenergypoll.com](http://utenergypoll.com))  
Author: Randy Olson ([randalolson.com](http://randalolson.com) / [@randal\\_olson](https://twitter.com/randal_olson))

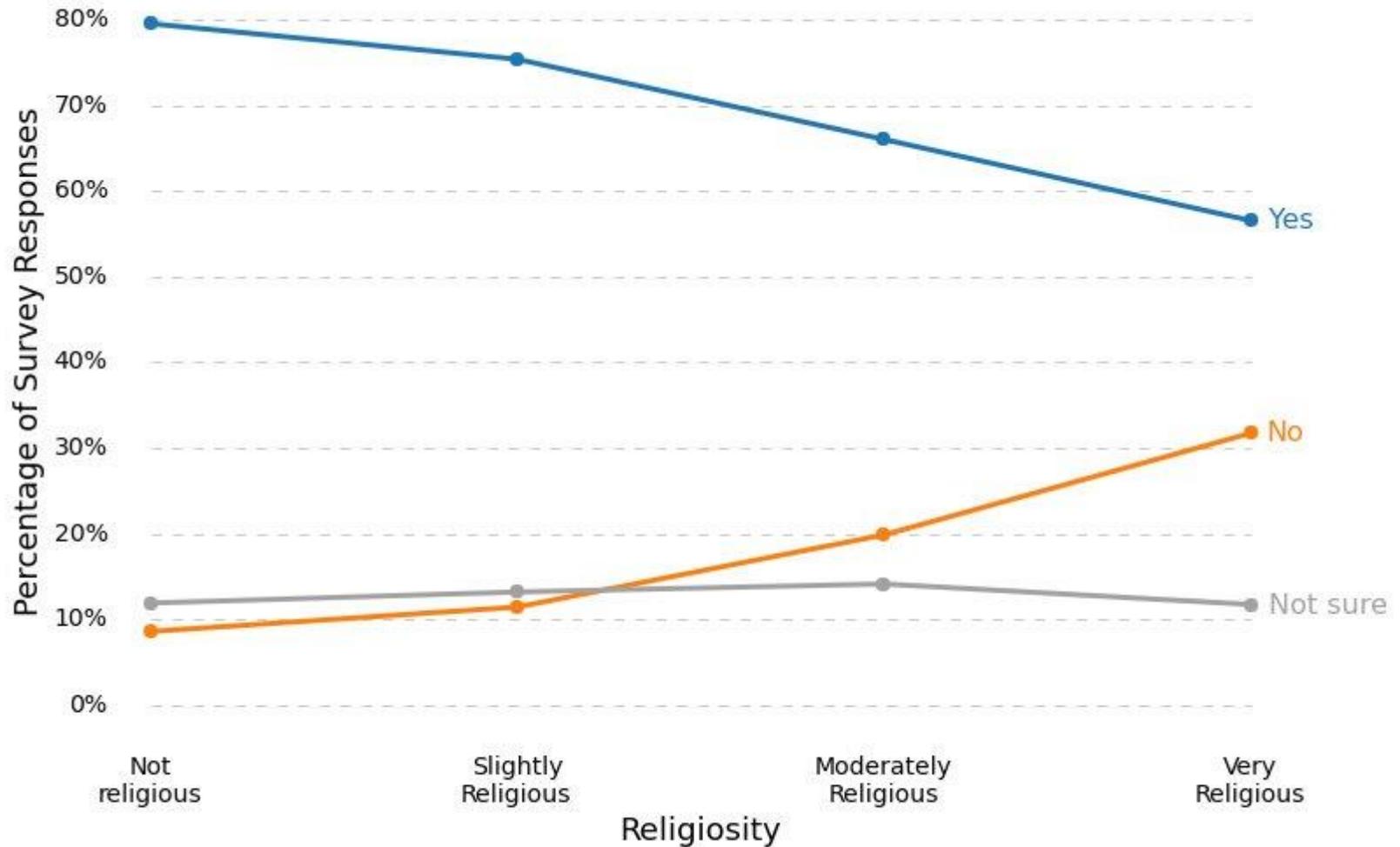
# Politics and climate change

U.S. Poll: Do you think global climate change is occurring?

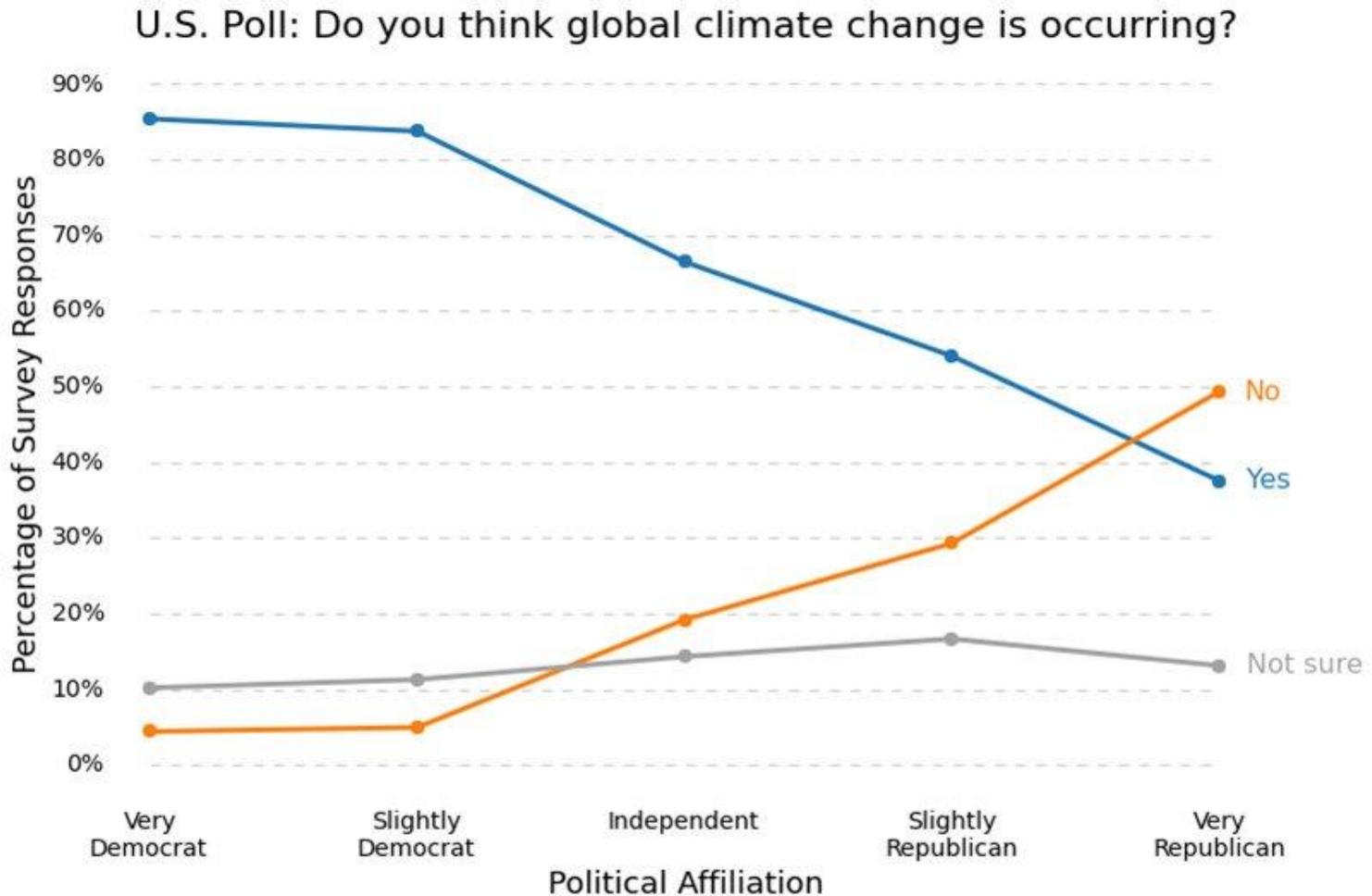


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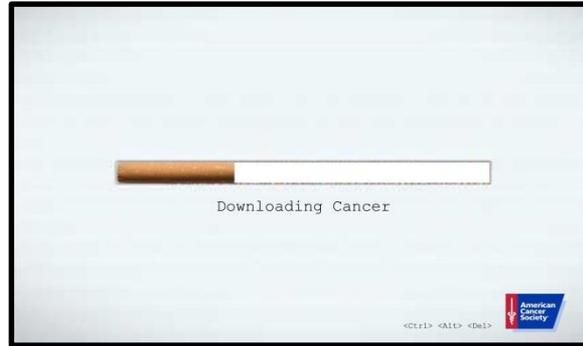


Data source: UT Energy Poll (utenergypoll.com), Wave 6 (March 2014)  
Author: Randy Olson (randalolson.com / @randal\_olson)

# Conflicts of interest, denial, and cultural shifts

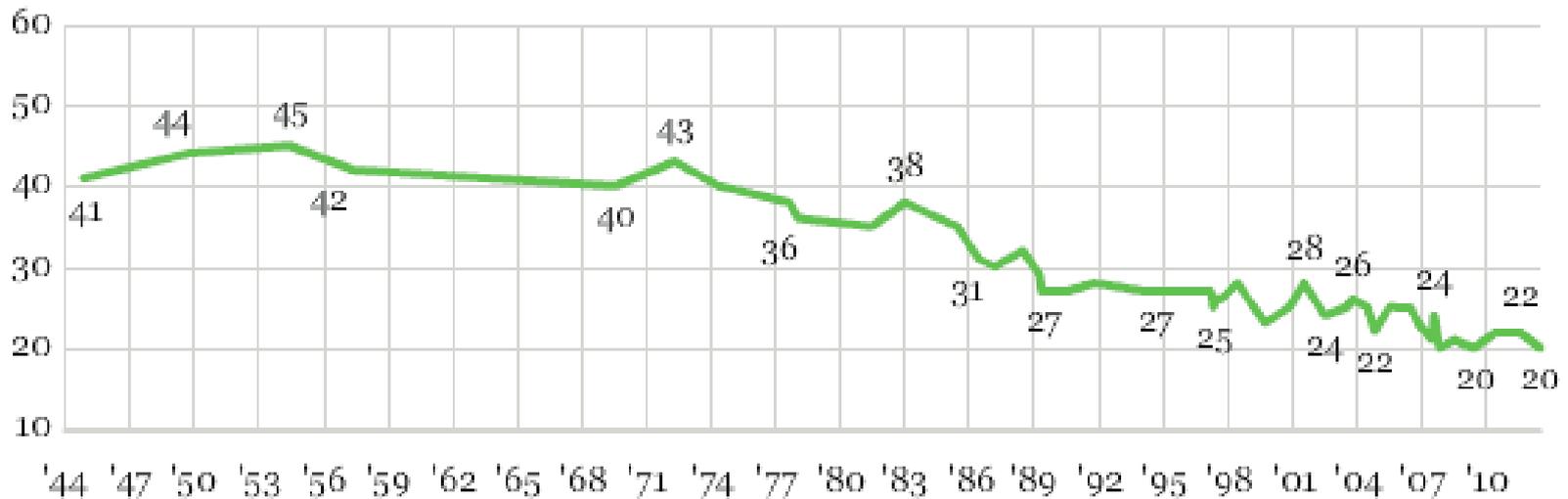


# Conflicts of interest, denial, and cultural shifts



*Percentage of U.S. Adults Who Smoke Cigarettes, 1944-2012*

Have you, yourself, smoked any cigarettes in the past week? (% yes shown)



# Conflicts of interest, denial, and cultural shifts

We come here today in deference to the memory of those stalwart patriots who on July 4, 1776, pledged their lives, their fortunes, and their sacred honor to establish and defend the proposition that governments are created by the people, empowered by the people, derive their just powers from the consent of the people, and must forever remain subservient to the will of the people.

Today, 188 years later, we celebrate that occasion and find inspiration and determination and courage to preserve and protect the great principles of freedom enunciated in the Declaration of Independence.

It is therefore a cruel irony that the President of the United States has only yesterday signed into law the most monstrous piece of legislation ever enacted by the United States Congress.

It is a fraud, a sham, and a hoax. This bill will live in infamy.

To sign it into law at any time is tragic.

To do so upon the eve of the celebration of our independence insults the intelligence of the American people.

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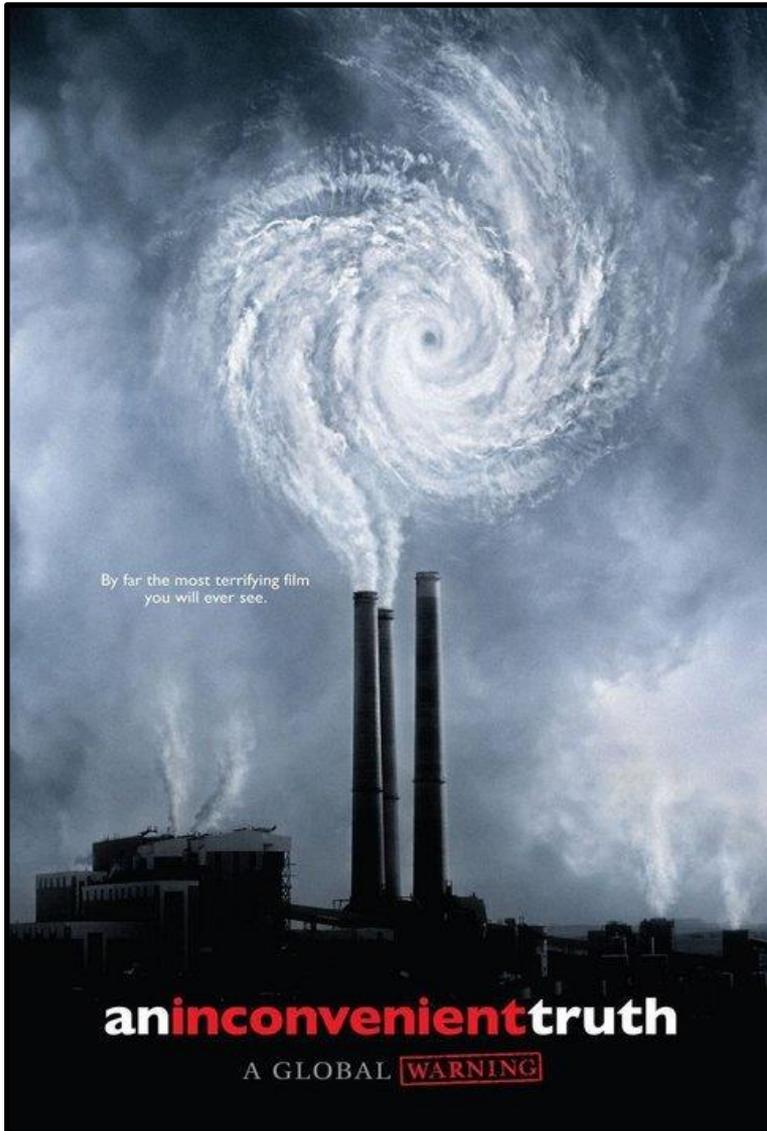
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# Why has climate change become a cultural/political issue?

- 1) The “figureheads” for climate change are mostly democrats.



# Why has climate change become a cultural/political issue?

2) Admitting humans are at the root of climate change may force economically-costly action



The image is a screenshot of a news article from a website. The browser tabs at the top show 'us\_consbio\_zoobot442...' and 'Wyoming Schools Won't T...'. The URL is '7/3412131/wyoming-rejects-ngss/'. The page features a 'Free Hotmail' and 'Windows' logo. The article title is 'Wyoming Schools Won't Teach Kids About The Reality Of Climate Change' in large, bold black font. Below the title, it says 'BY KATIE VALENTINE' with a Twitter icon and 'MAR 17, 2014 2:04PM'. The main image shows a female teacher with blonde hair leaning over a desk, helping a young girl with dark hair who is writing on a piece of paper. Other students are visible in the background, some sitting at desks and others standing. A whiteboard with some writing is also visible. At the bottom right of the photo, it says 'CREDIT: AP PHOTO/STEVE RUARK'. Below the photo is a social media sharing bar with a Facebook 'Share' button (1,495 shares) and a Twitter 'Tweet' button (282 tweets). At the very bottom, there is a short paragraph of text.

Wyoming has become the first state to reject new national science education standards, a decision based in part on some Wyoming lawmakers' concerns that the standards teach climate change as a scientifically-accepted phenomenon.

# Why has climate change become a cultural/political issue?



us\_consbio\_zoobot442... x Wyoming Schools Won't T... x +

7/3412131/wyoming-rejects-ngss/

Free Hotmail Windows Windows Media

**CLIMATE**

## Wyoming Schools Won't Teach Kids About The Reality Of Climate Change

BY **KATIE VALENTINE** [Twitter](#) MAR 17, 2014 2:04PM



CREDIT: AP PHOTO/STEVE RUARK

[f](#) Share 1,495 [T](#) Tweet 282

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**2) Admitting humans are at the root of climate change may force economically-costly action**

**“the standards handle global warming as settled science” — (Former!) Rep. Matt Teeters (R)**

**“I don't accept, personally, that climate change is a fact. The standards are very prejudiced in my opinion against fossil-fuel development” —State Board of Education Chair Ron Micheli**

# Why has climate change become a cultural/political issue?



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# Why has climate change become a cultural/political issue?

3) Economically-costly action will require strong, federal interventions, taxation, and public adaptation. IOW “big government”.

us\_consbio\_zoobot442... x Wyoming Schools Won't T... x +

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# A local example of why it is important to pay attention



<http://www.nytimes.com/2012/10/27/us/controversy-lingers-over-wyoming-universitys-removal-of-carbon-sink.html>

[http://trib.com/business/energy/emails-university-of-wyoming-officials-spod-up-touted-removal-of/article\\_4f9332ee-d83c-5d58-a38b-19e913ba739d.html](http://trib.com/business/energy/emails-university-of-wyoming-officials-spod-up-touted-removal-of/article_4f9332ee-d83c-5d58-a38b-19e913ba739d.html)

<http://wyomingpublicmedia.org/post/documents-show-artwork-removed-early-due-pressure>

<http://www.wyofile.com/column/behind-the-carbon-curtain-art-and-freedom-in-wyoming/>

<http://www.uwyo.edu/trustees/members-of-the-board-of-trustees/kermit-brown-information.html>