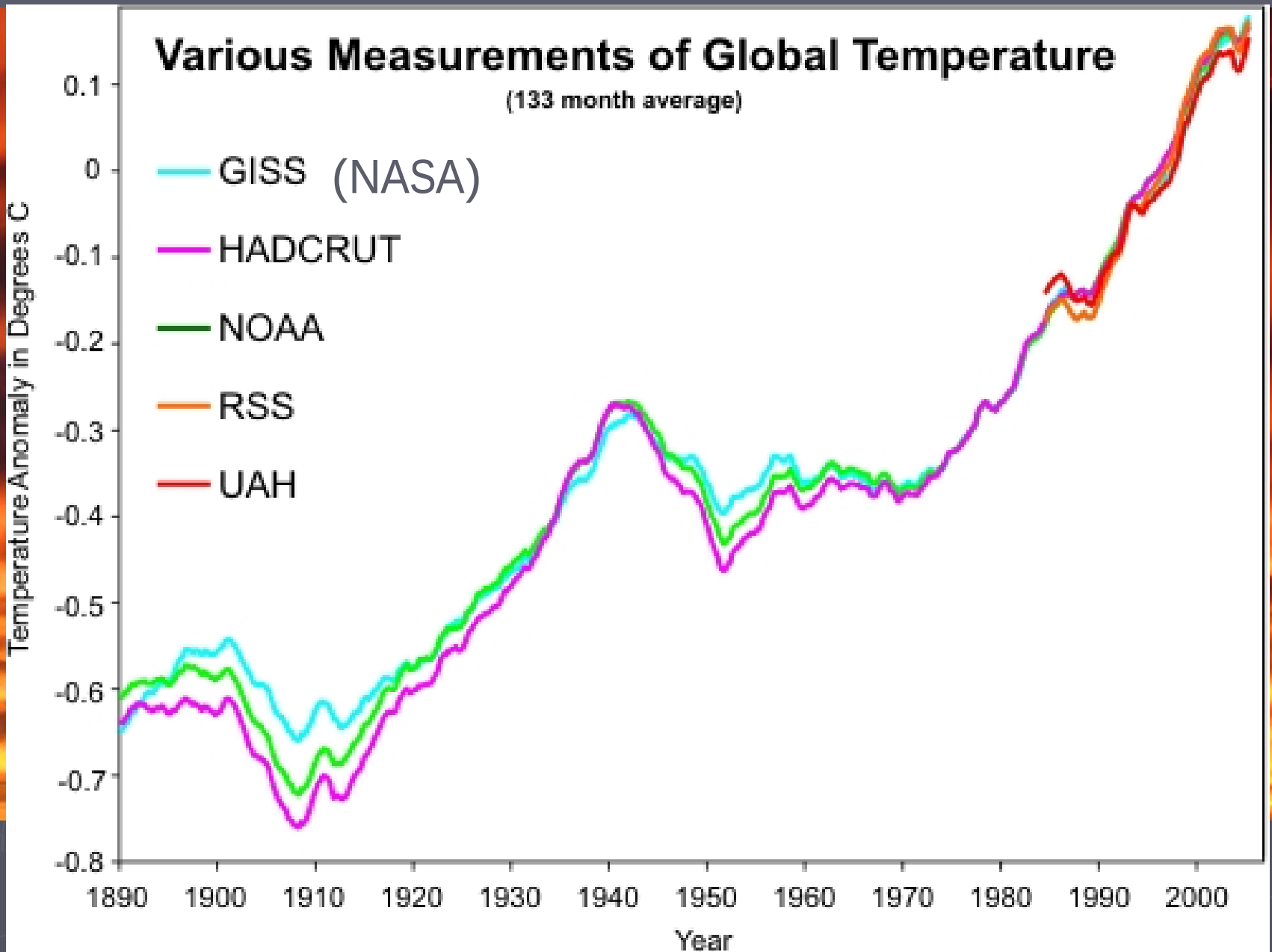
Learning to Fight *the Climate Crisis*

Susan M. Schneider, PhD

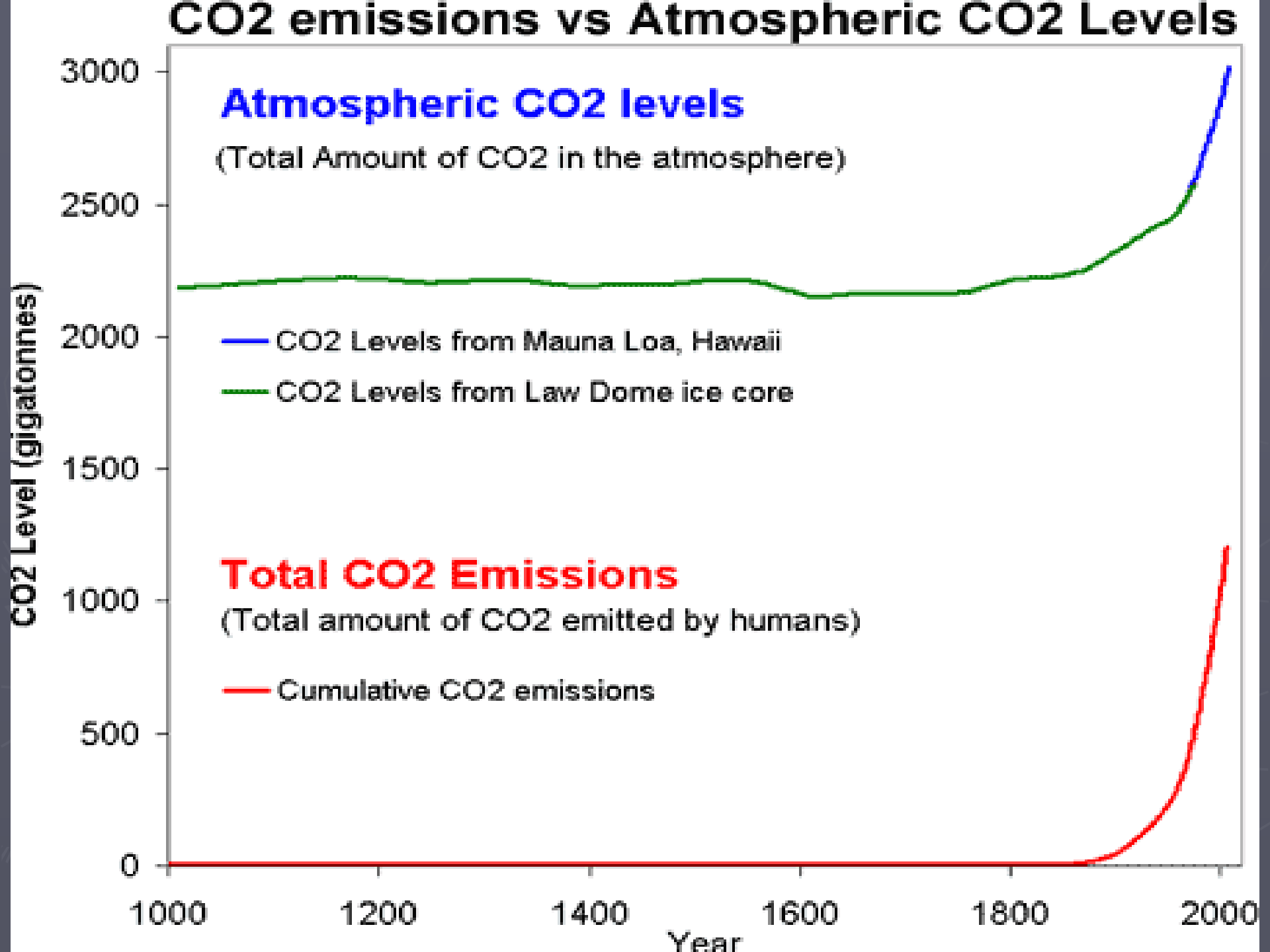
The Bad News


Various Measurements of Global Temperature
(133 month average)
GISS (NASA)
HADCRUT
NOAA
RSS
UAH
Temperature Anomaly in Degrees C
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Year

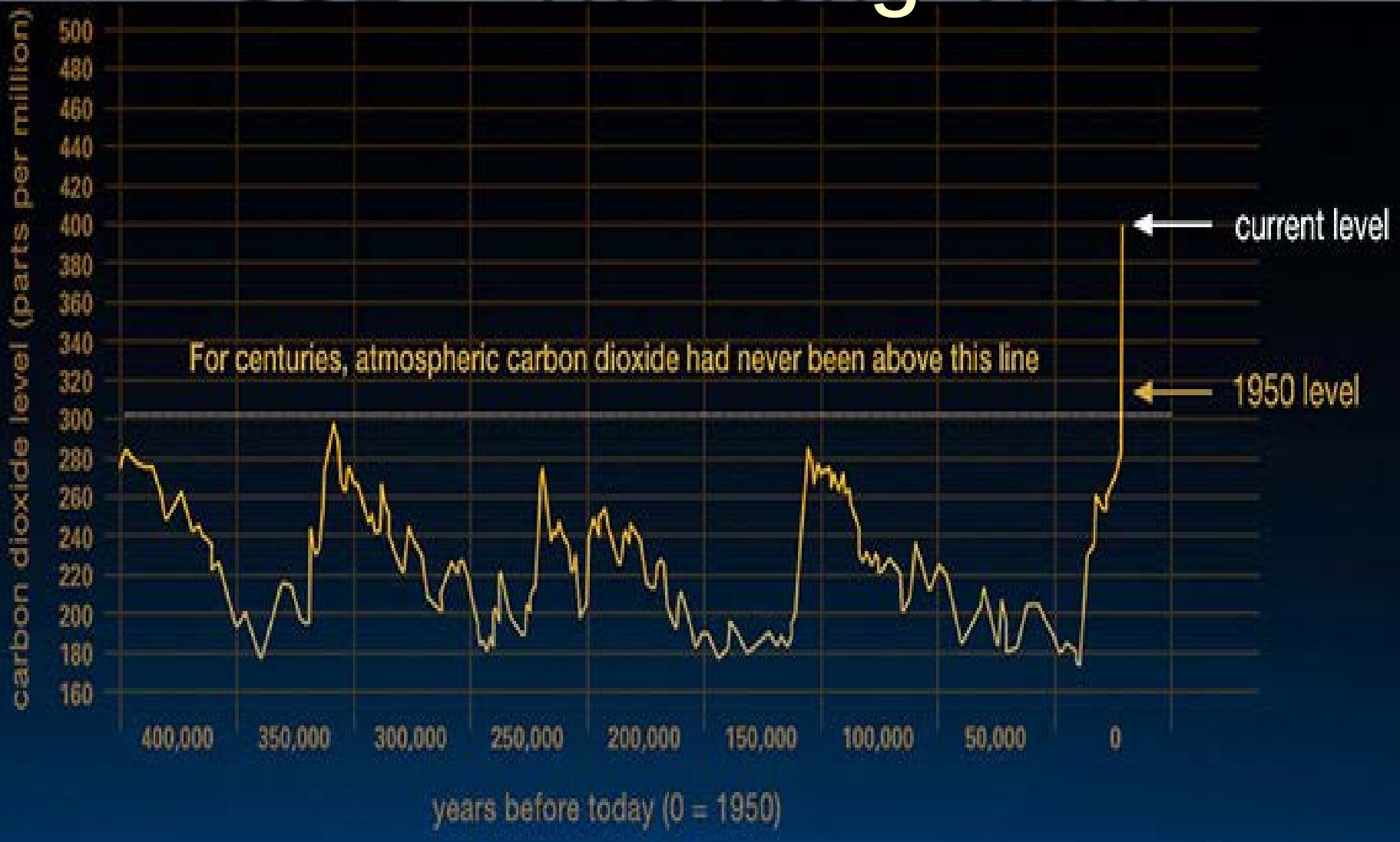
IPCC October 2018 Report
A Clarion Call

“The impact of human-induced warming is worse than previously feared, and only drastic coordinated action will keep the damage short of catastrophe.”

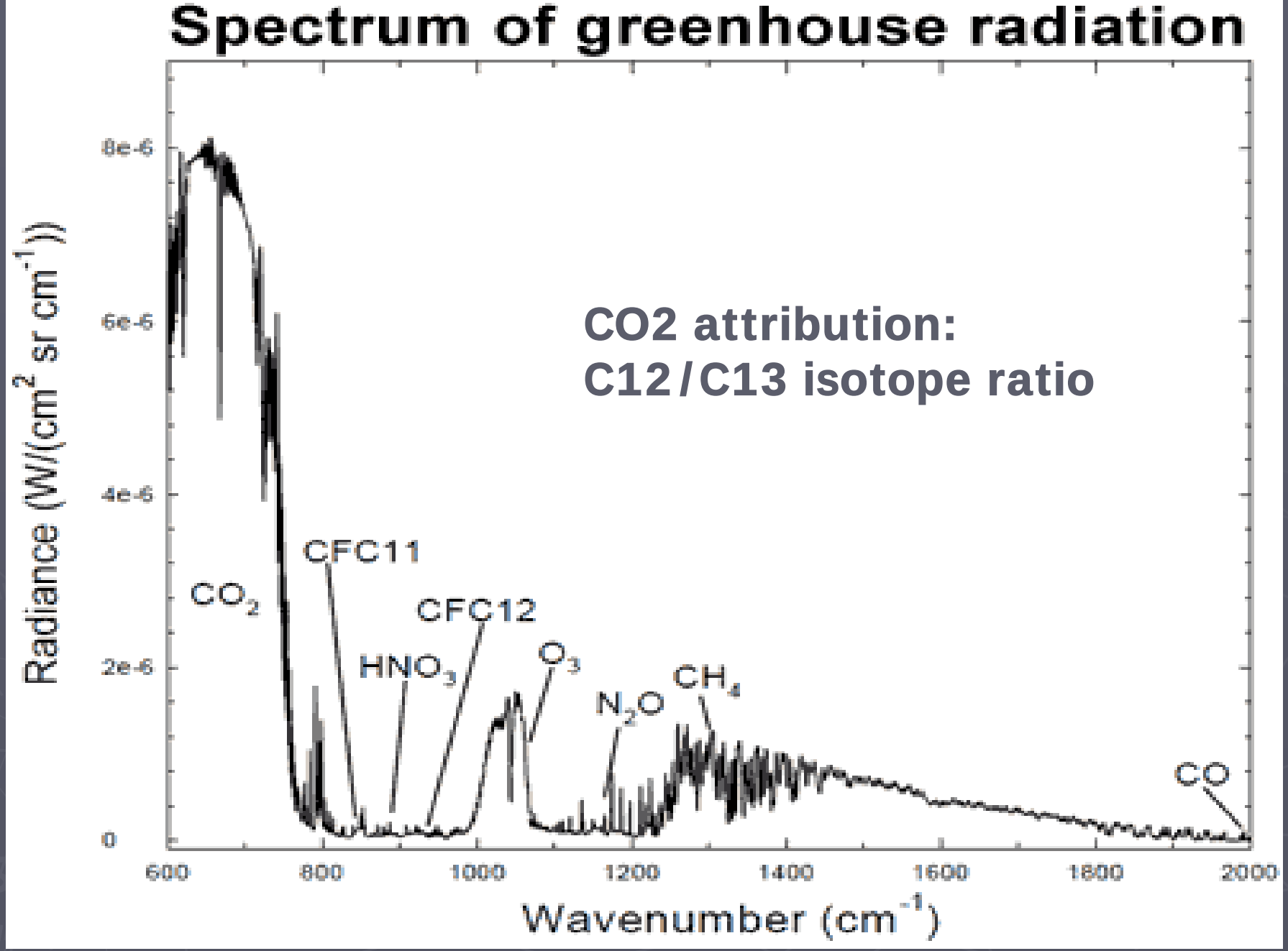
The world faces a *10-year* deadline


CO2 emissions vs Atmospheric CO2 Levels
Atmospheric CO2 levels
(Total Amount of CO2 in the atmosphere)
CO2 Levels from Mauna Loa, Hawaii
CO2 Levels from Law Dome ice core
Total CO2 Emissions
(Total amount of CO2 emitted by humans)
Cumulative CO2 emissions
CO2 Level (gigatonnes)
3000
2500
2000
1500
1000
500
0
1000
1200
1400
1600
1800
2000
Year

CO2 – The Long View



Source: NASA


Spectrum of greenhouse radiation
Radiance (W/(cm^2 sr cm^{-1})))
8e-6
6e-6
4e-6
2e-6
0
600
800
1000
1200
1400
1600
1800
2000
Wavenumber (cm^{-1})
CO_2
CFC11
CFC12
HNO_3
O_3
N_2O
CH_4
CO
CO2 attribution:
C12/C13 isotope ratio

Evans (2006)

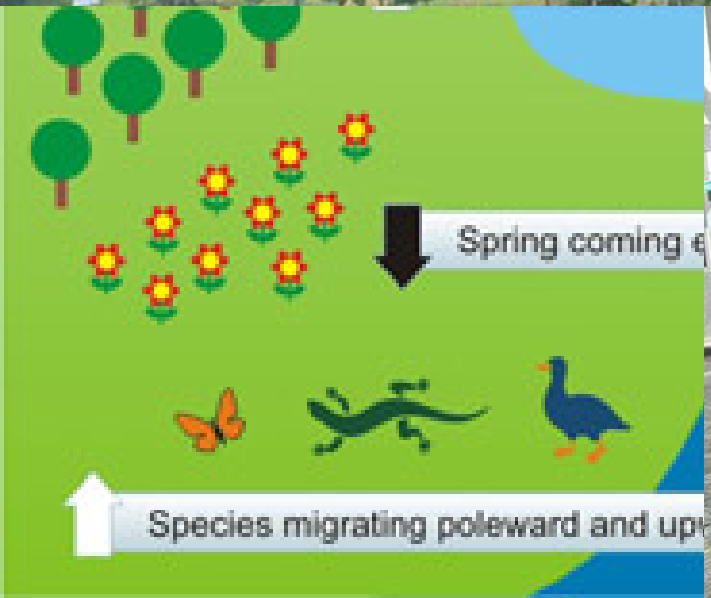
The Consensus

97 out of 100 climate experts think humans are changing global temperature

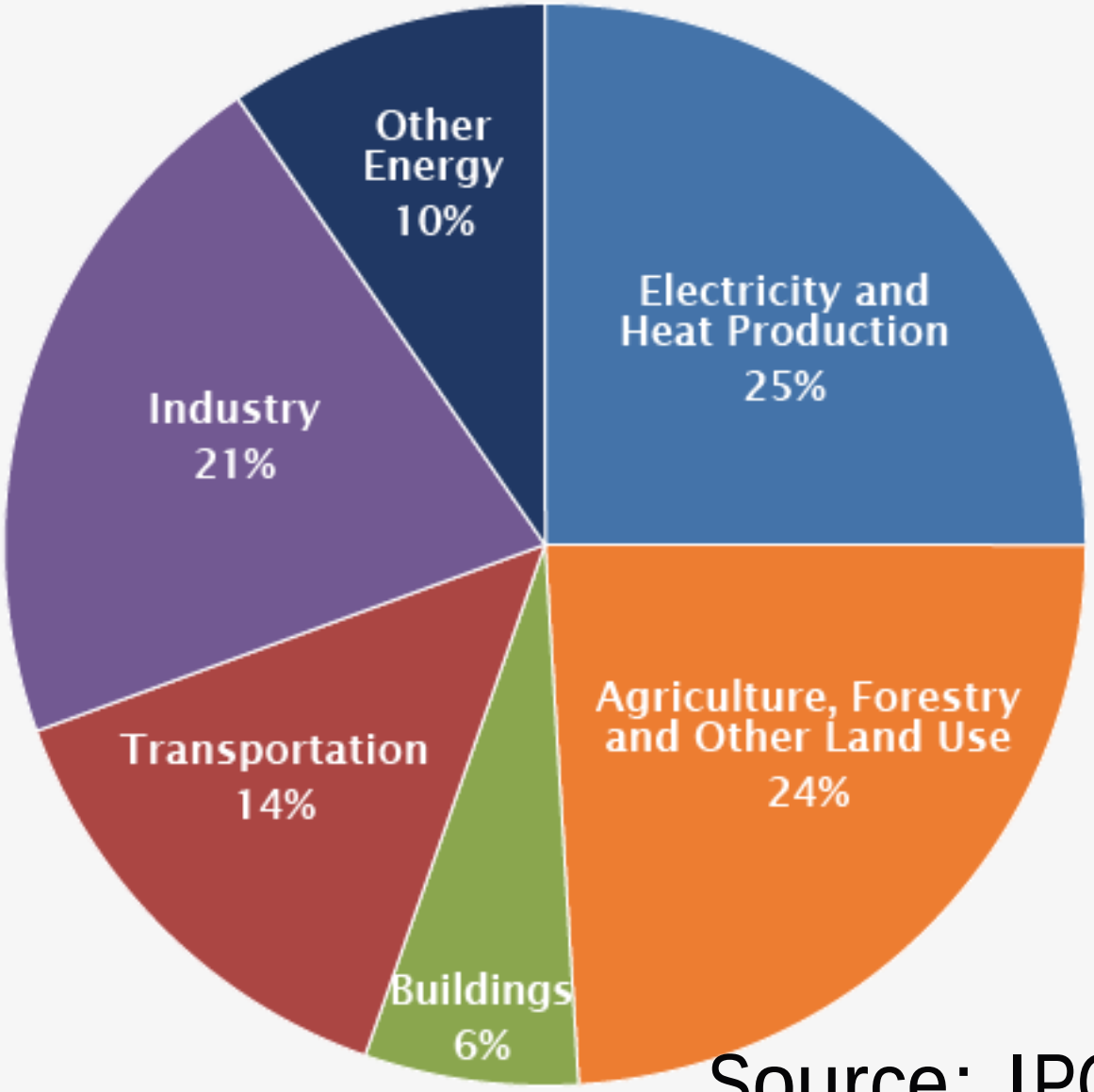
Recent survey:
Only 15% of the US public knows this

Doran et al 2009, Anderegg et al 2010

Indicators of a Warming World



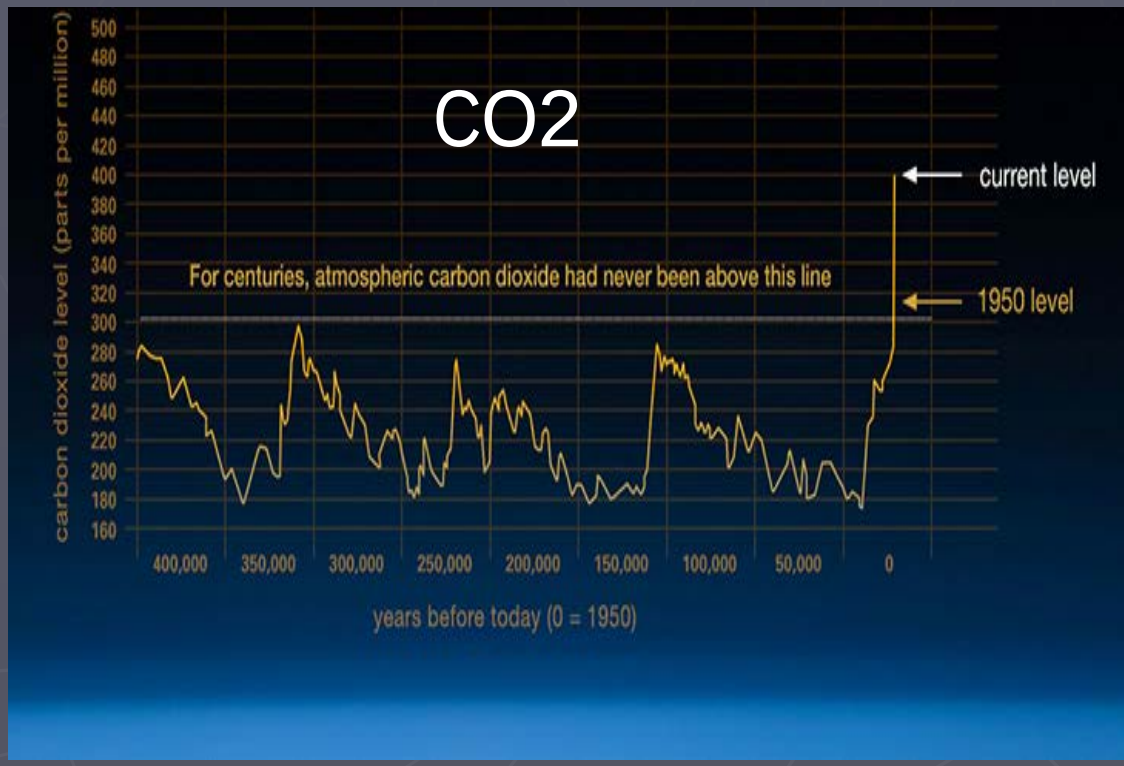
Global Greenhouse Gas Emissions by Economic Sector



Source: IPCC

Carbon Footprints

US: 18 tons CO2e per capita
Australia: 16 tons
Canada: 16 tons
Germany: 11 tons
UK: 8 tons
Sweden: 7 tons
China: 6 tons
India: 2 tons



US Department of Energy/
UN/Global Carbon Project

Climate Change Websites

Home | Arguments | Software | Resources | Comments | The Consensus Project | Translations | About | Donate

Search... GO

Posts Comments Email

MOST USED Climate Myths
and what the science really says...

1. Climate's changed before
2. It's the sun
3. It's not bad
4. There is no consensus
5. It's cooling
6. Models are unreliable
7. Temp record is unreliable

Explaining climate change science & rebutting global warming misinformation

Scientific skepticism is healthy. Scientists should always challenge themselves to improve their understanding. Yet this isn't what happens with climate change denial. Skeptics vigorously criticise any evidence that supports man-made global warming and yet embrace any argument, op-ed, blog or study that purports to refute global warming. This website gets skeptical about global warming skepticism. Do their arguments have any scientific basis? What does the peer reviewed scientific literature say?

Newcomers, start here | History of Climate Science (1930 1940 1950 1960) | The Big Picture

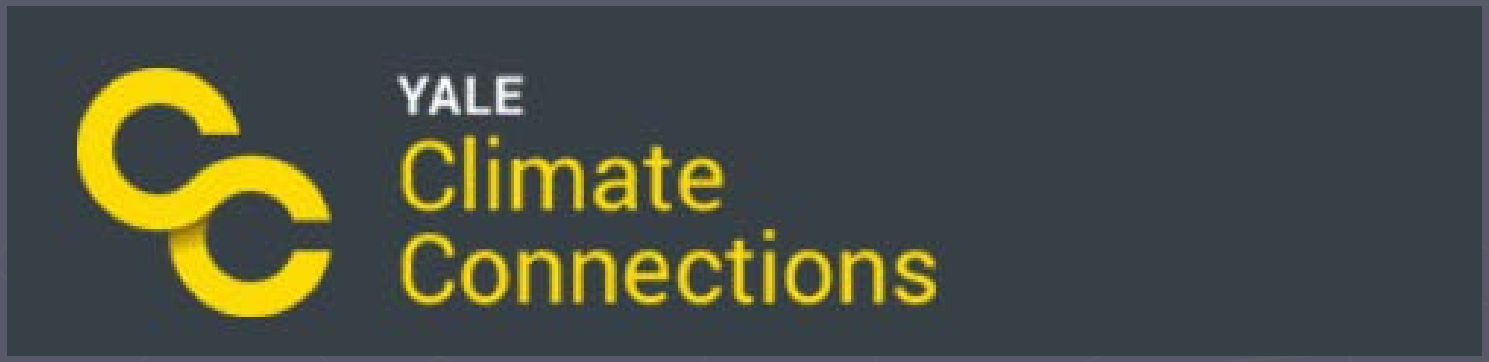
Rising CO2 levels could push 'hundreds of millions' into malnutrition by 2050

Posted on 5 September 2018 by Guest Author

Winner of the 2011 Australian museum Eureka Prize Advancement of climate change knowledge

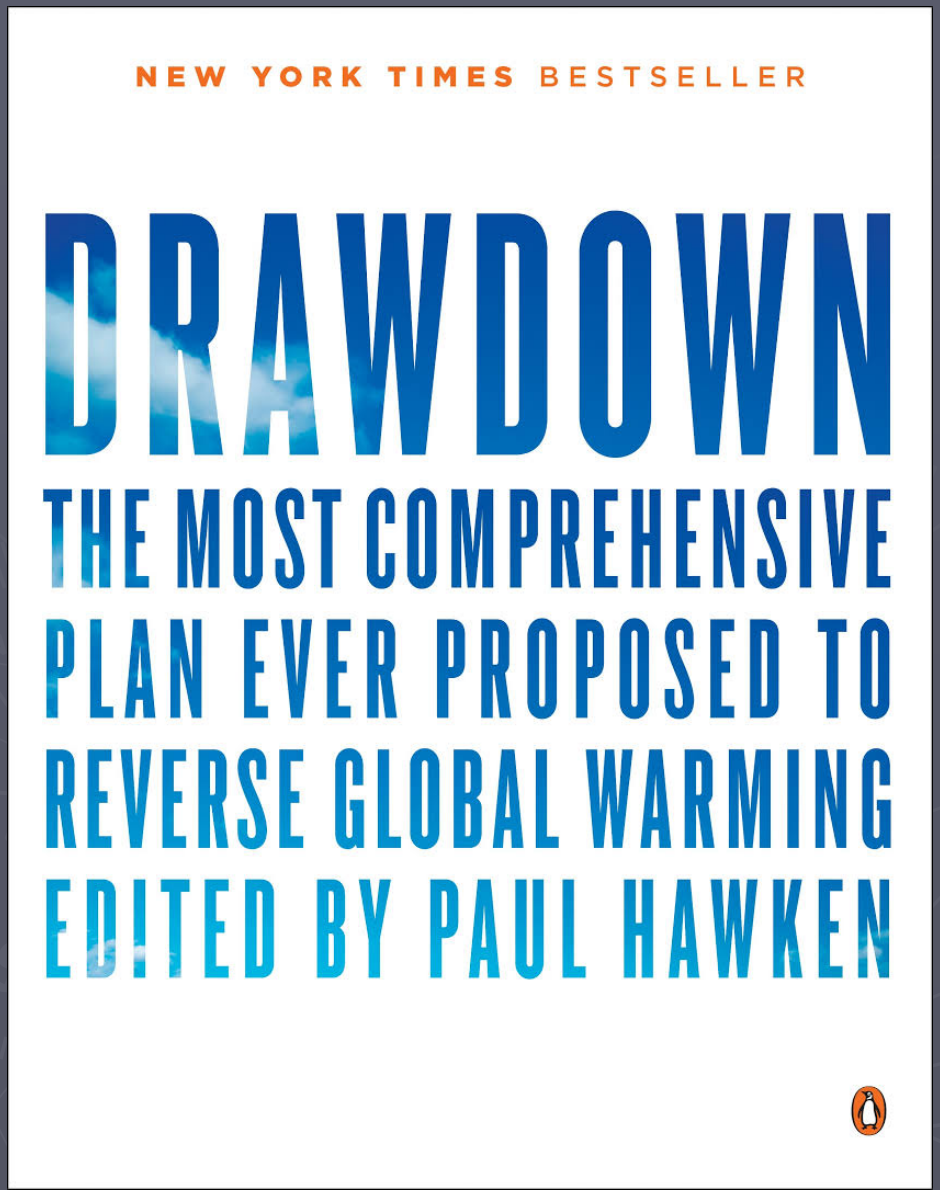
Climate Science CROWD SOURCING FUNDING

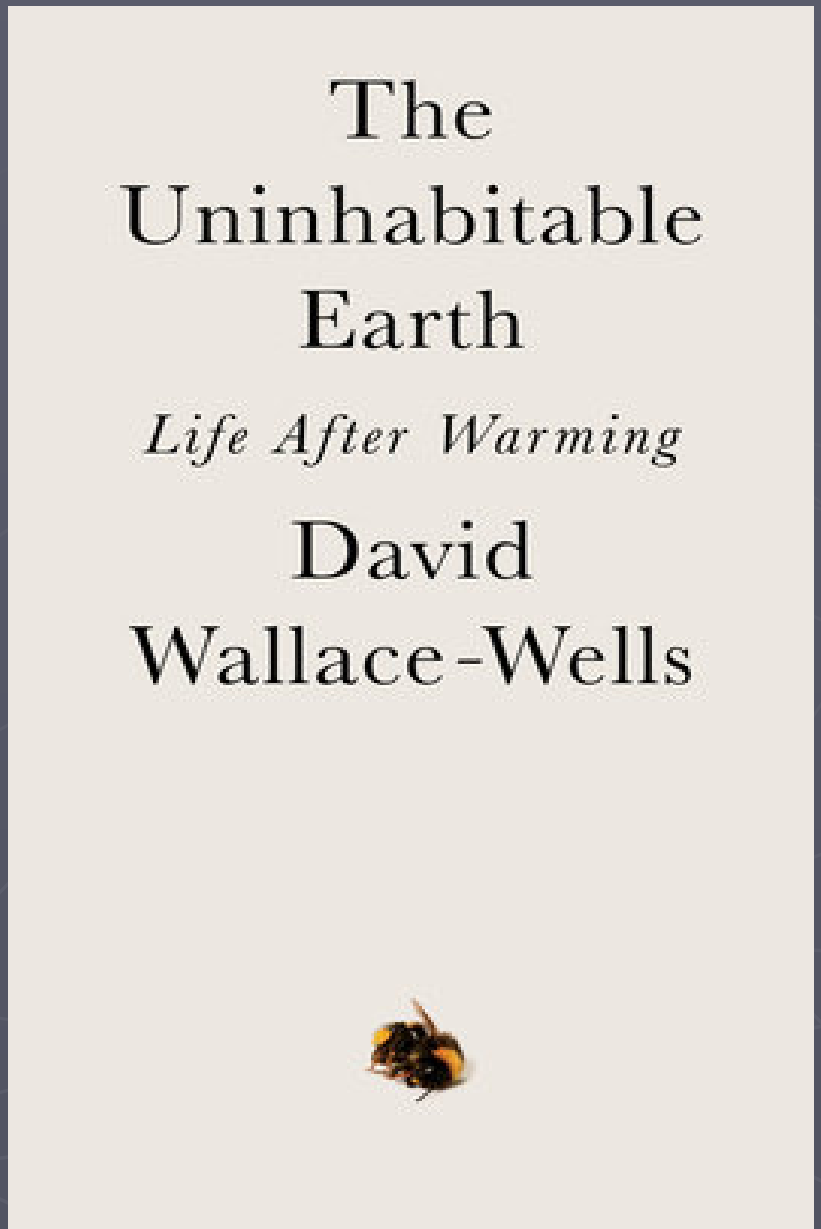
Climate Change E-Newsletters



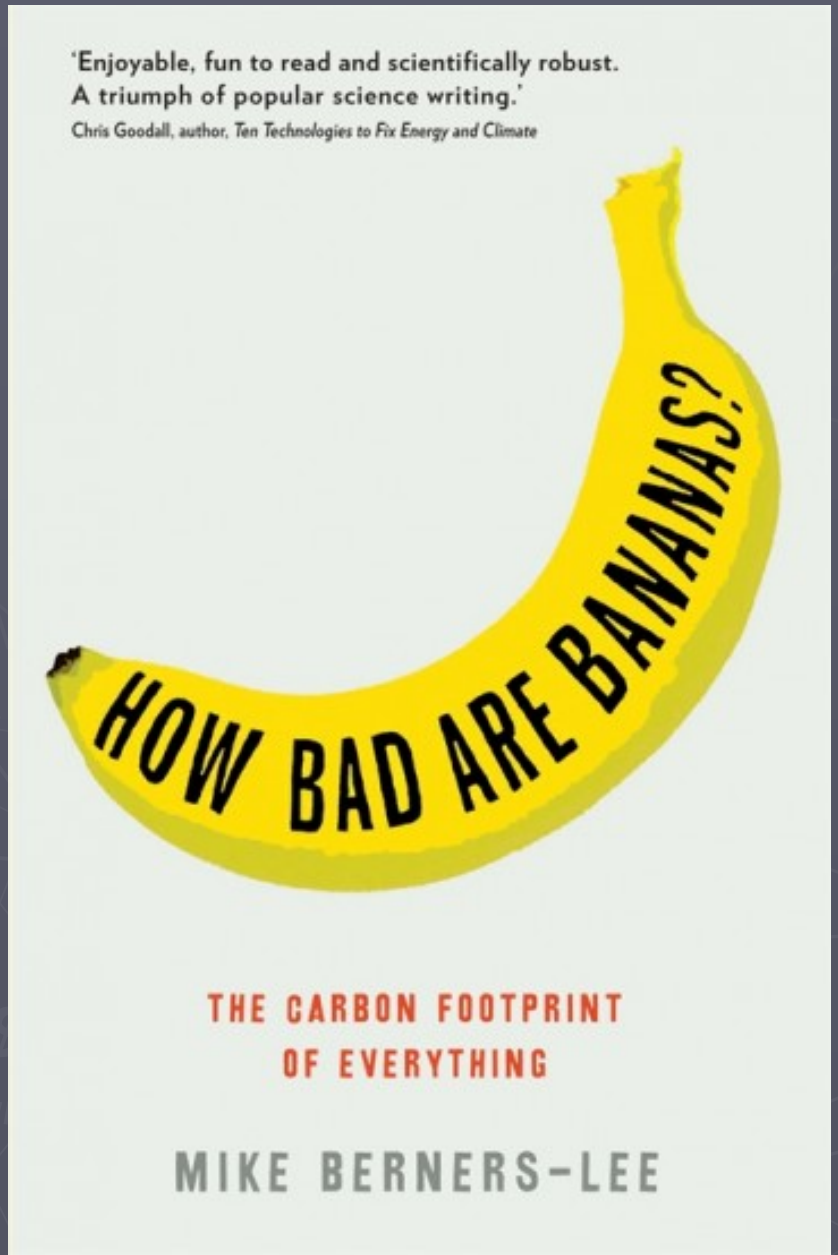
- Yale Climate Connections
- World Resources Institute

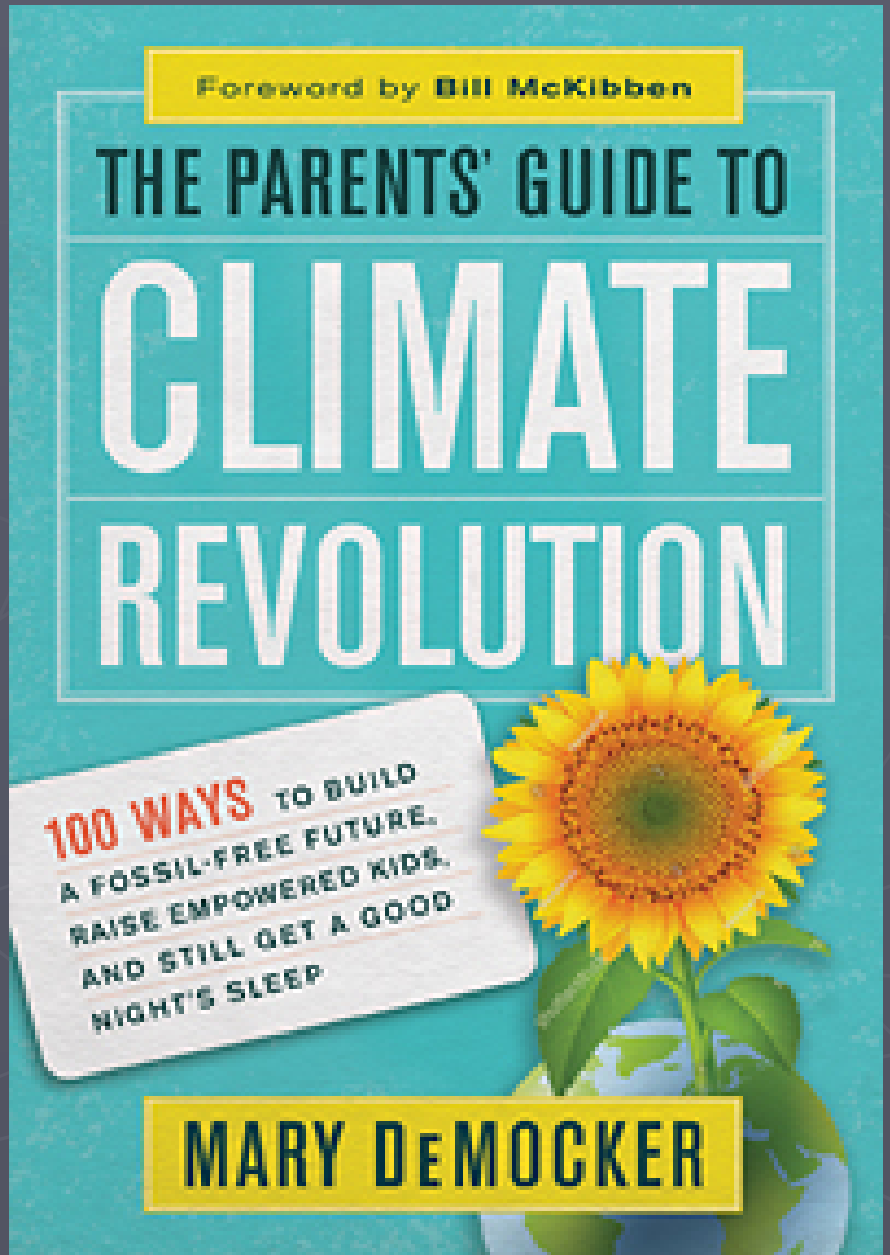
Outstanding Climate Change Books



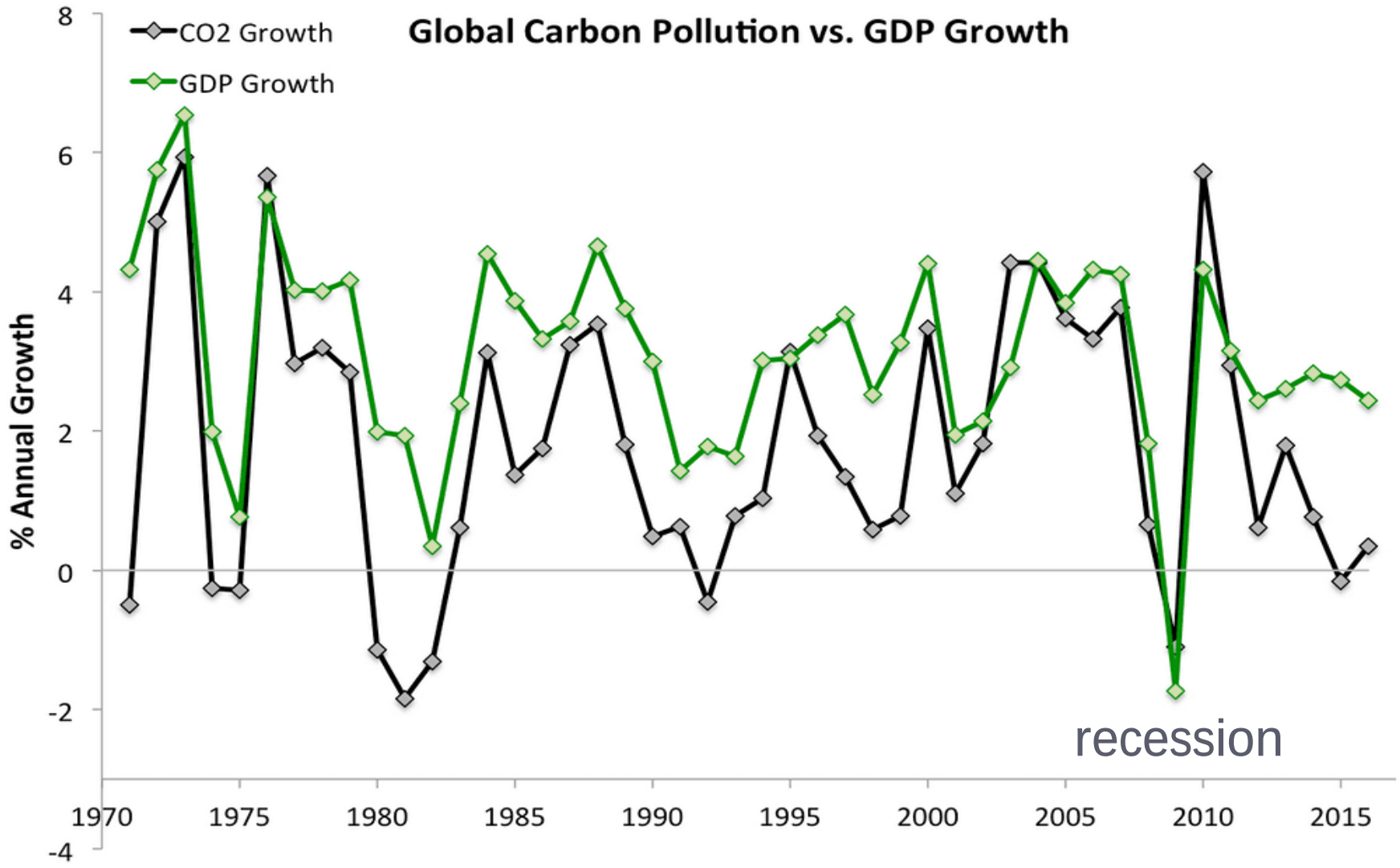


Outstanding Climate Change Books





Good News!



World Bank

https://www.theguardian.com/environment/climate-consensus-97-per-cent/2017/oct/30/new-data-gives-hope-for-meeting-the-paris-climate-targets

Good News/Bad News

- Knowledge and technology
- Huge financial savings
- Big obstacles

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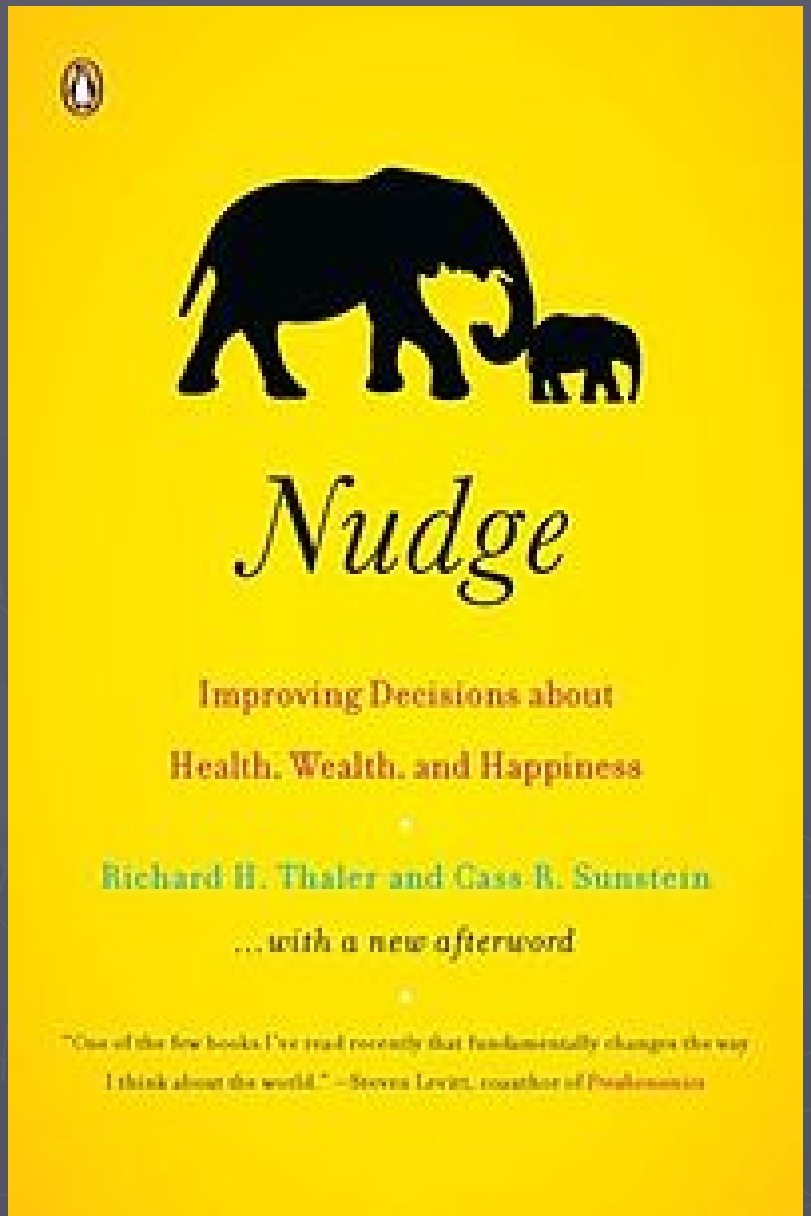
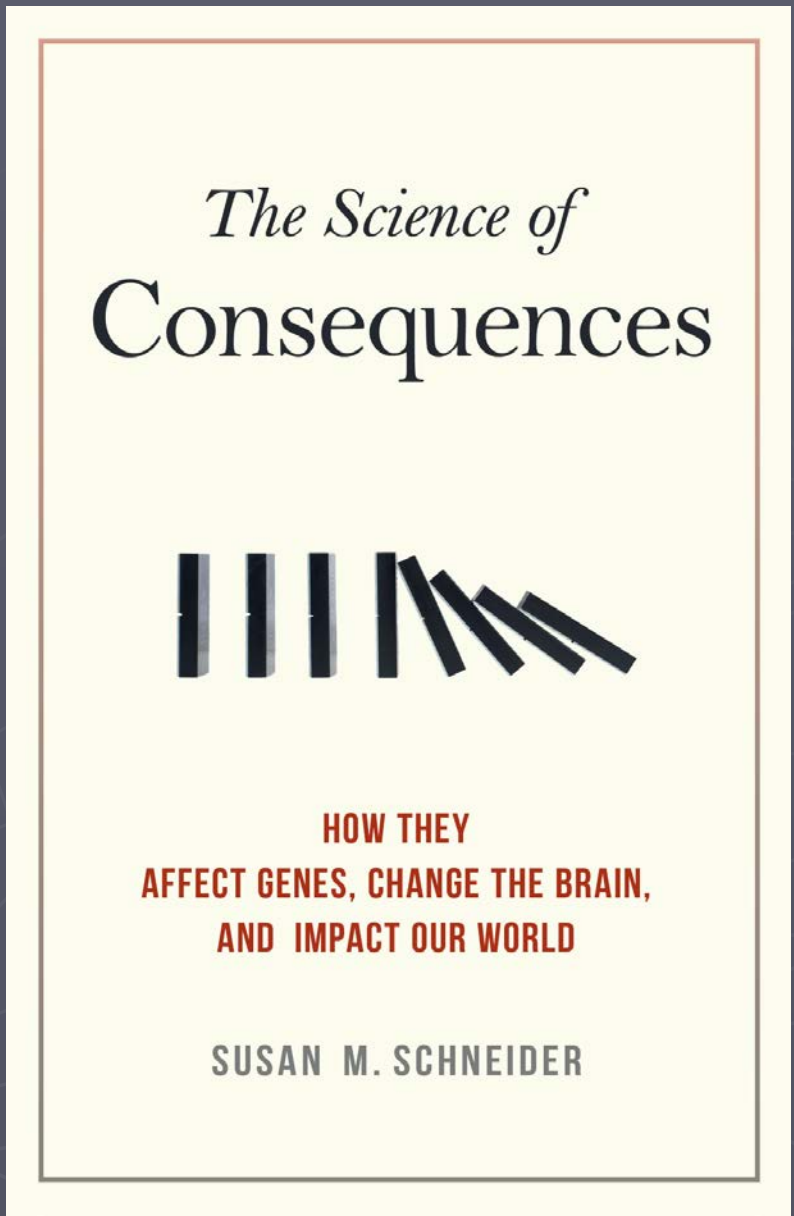
The best science and technology doesn't help us if we don't use it

Information is *Seldom Enough*

1970s oil embargo

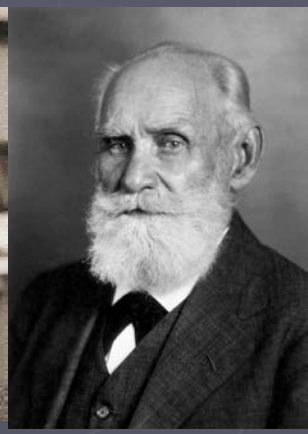
Behavioral Economics





Learning Principles

- A century of research
- Well-quantified
- Extensive application
- Awesome generality:
  hundreds of species
- Advanced neurophysiological and genetic understanding



American Psychological Association Task Force

The Main Barriers

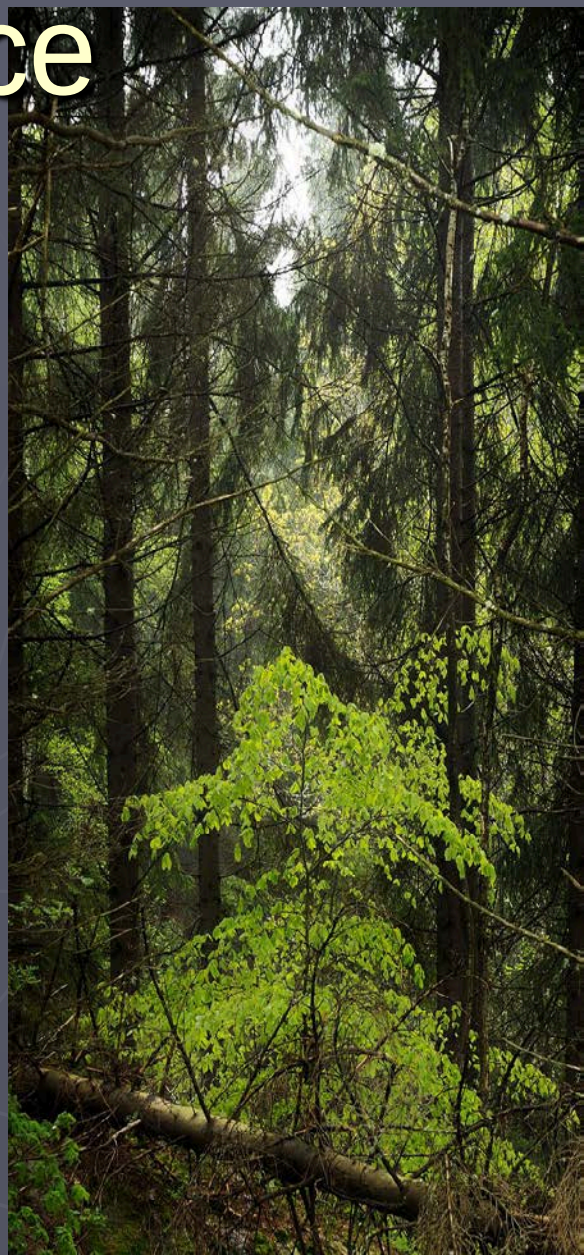
Old Habits

A Sense of Futility

Ideally: New green habits

New social norms

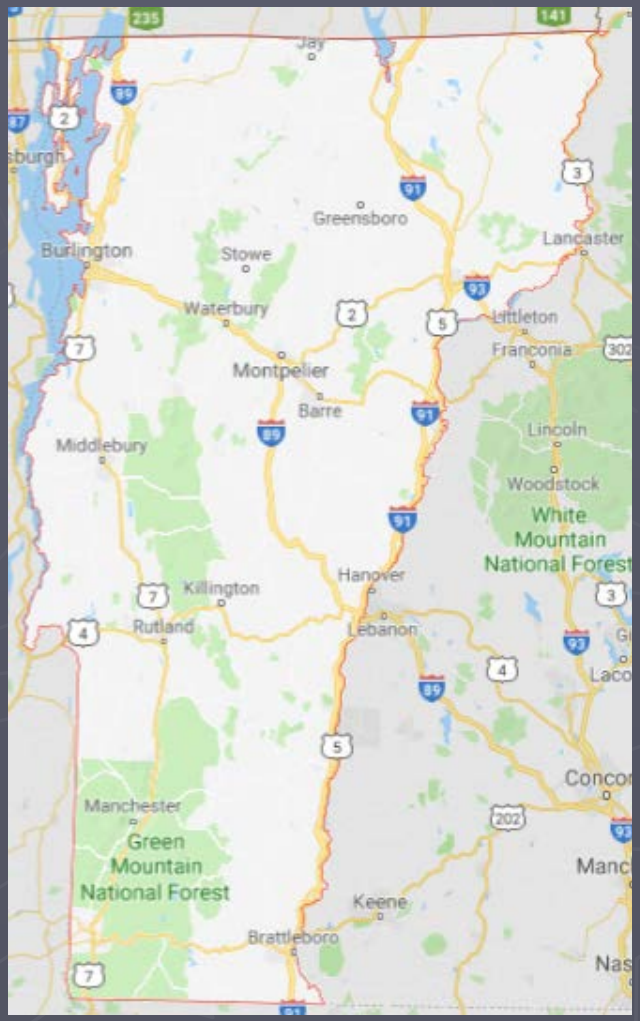
Natural rewards



Incentives & Sustainability

Think outside the box!

Vermont and time-of-use electricity pricing



Hypermilers & Feedback

"Hybridfest" competition to astonishing levels

- *180* mpg

http://www.wikiwand.com/en/Toyota_Prius_(XW20)

Variable Schedules of Reinforcement

Gambling

Stream clean-ups

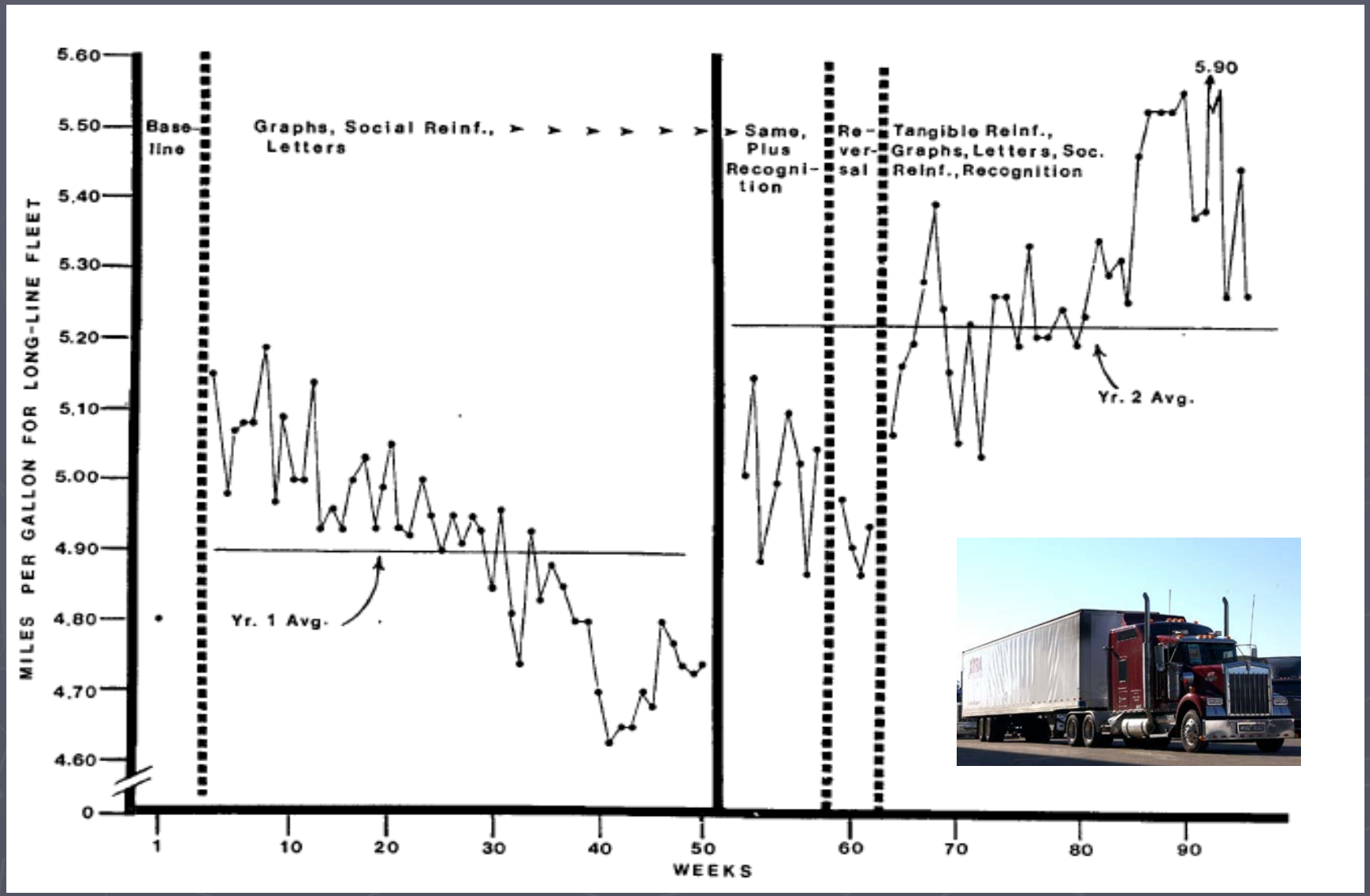
Variable Schedules

Deslauriers, B. C., & Everett, P. B. (1977). Effects of intermittent and continuous token reinforcement on bus ridership. *Journal of Applied Psychology, 62*, 369–375.

Schedules & Maintenance

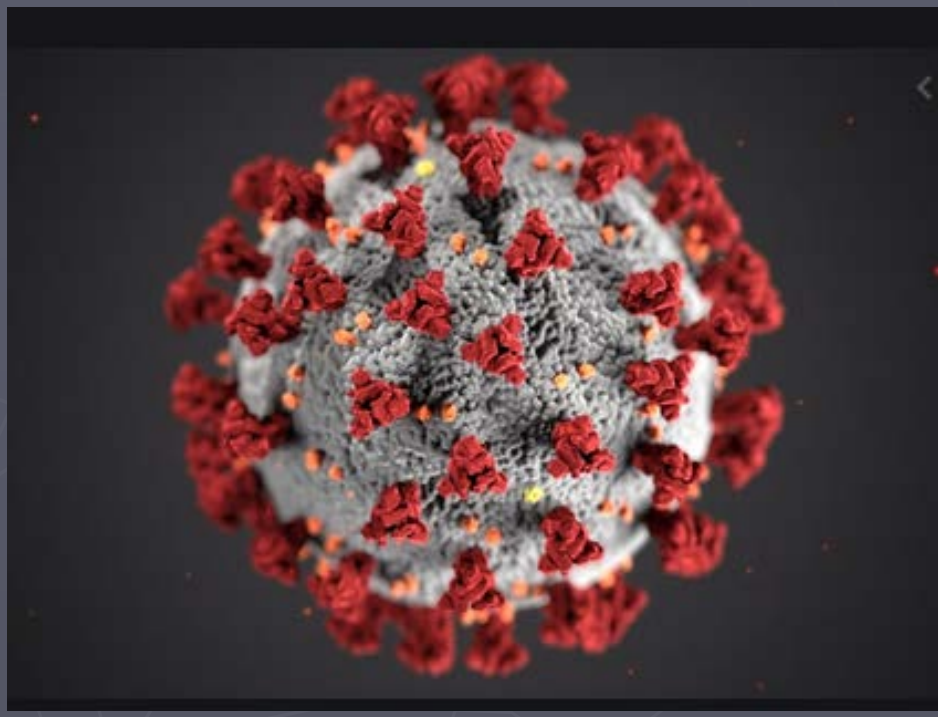
Runnion, A., Watson, J. D., & McWhorter, J. (1978). Energy savings in interstate transportation through feedback and reinforcement. *Journal of Organizational Behavior Management, 1,* 180-191.

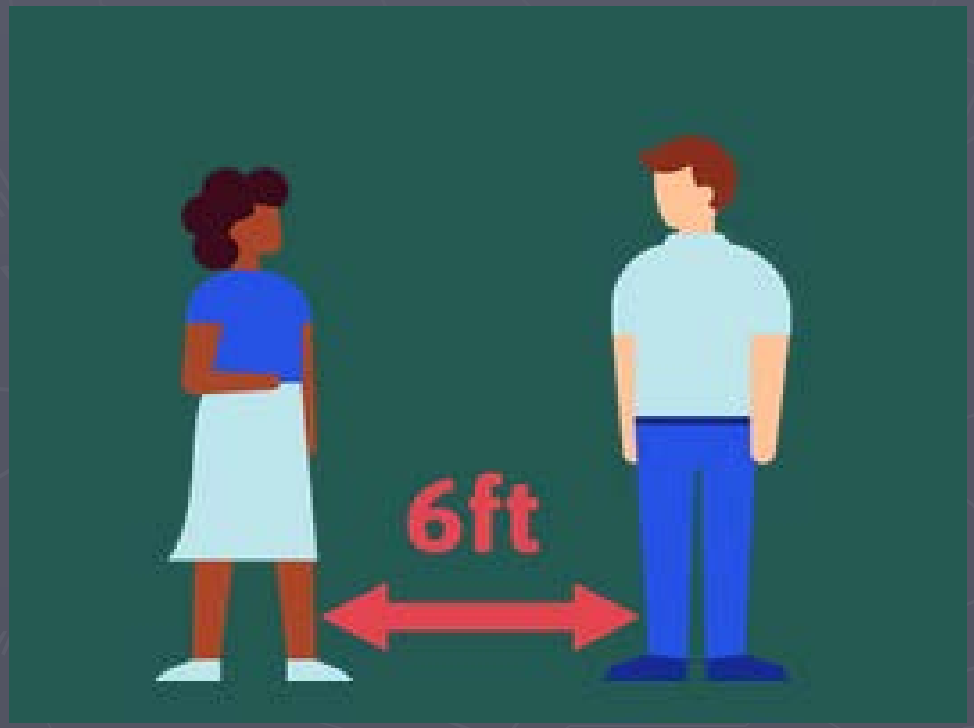
Schedules & Maintenance



Runnion, A., Watson, J. D., & McWhorter, J. (1978). Energy savings in interstate transportation through feedback and reinforcement. *Journal of Organizational Behavior Management, 1,* 180-191.

The Problem of “Delay Discounting” Climate Crisis/Coronavirus Crisis





Fostering Wiser Choices

- Establishing new habits
- Social support/new social norms
- Informal/formal commitments
- Healthier alternative rewards
- Successful models to follow
- Recording progress on checklists, charts, and apps

Large Scale Gamification

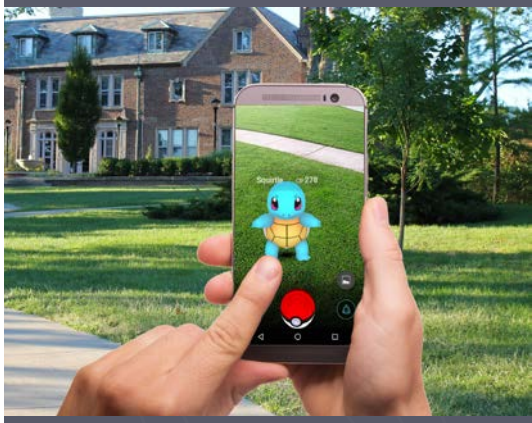
MIT Technology Review

Rewriting Life

Pokemon Go Increased U.S. Activity Levels by 144 Billion Steps in Just 30 Days

This gaming craze increases activity levels for players, regardless of their age, sex, or weight.

by Emerging Technology from the arXiv October 21, 2016



Althoff, White, & Horvitz (2016)

Over 25 million players in US

Over 800 actives in the study/ 26,000 controls

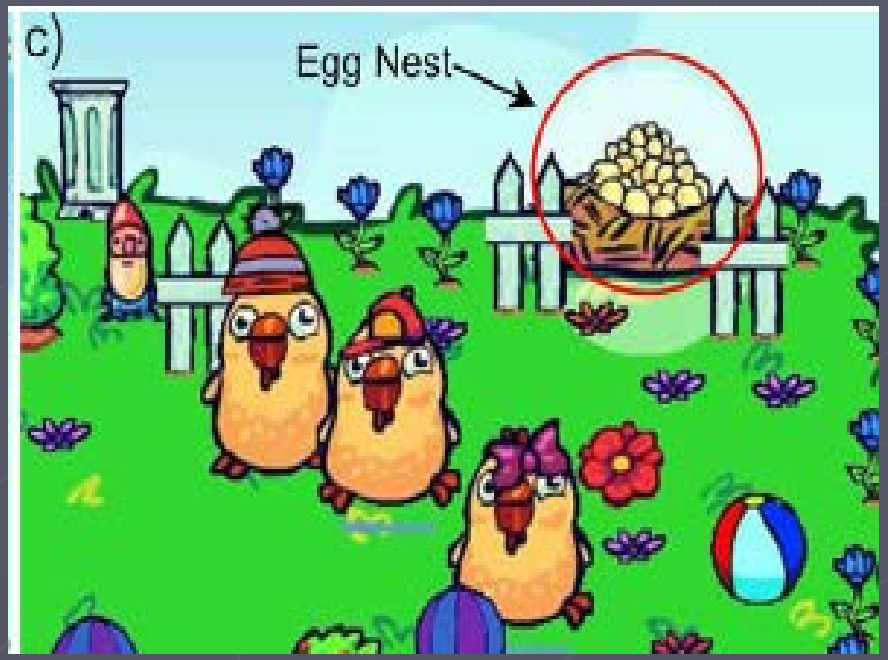
Gamifying Sustainability: Energy Chickens!

Level -2	Level -1	Baseline 0	Level +1	Level +2
				

Orland, B., Ram, N., Lang, D., Houser, K. W., Kling, N., & Coccia, M. (2014). Saving energy in an office environment: A serious game intervention. *Energy and Buildings, 74*, 43-52.

Energy Chickens at the Office – Success!

- Individual scoring, use collected eggs to build up farm

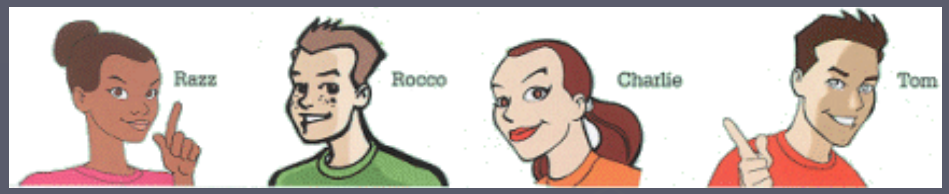


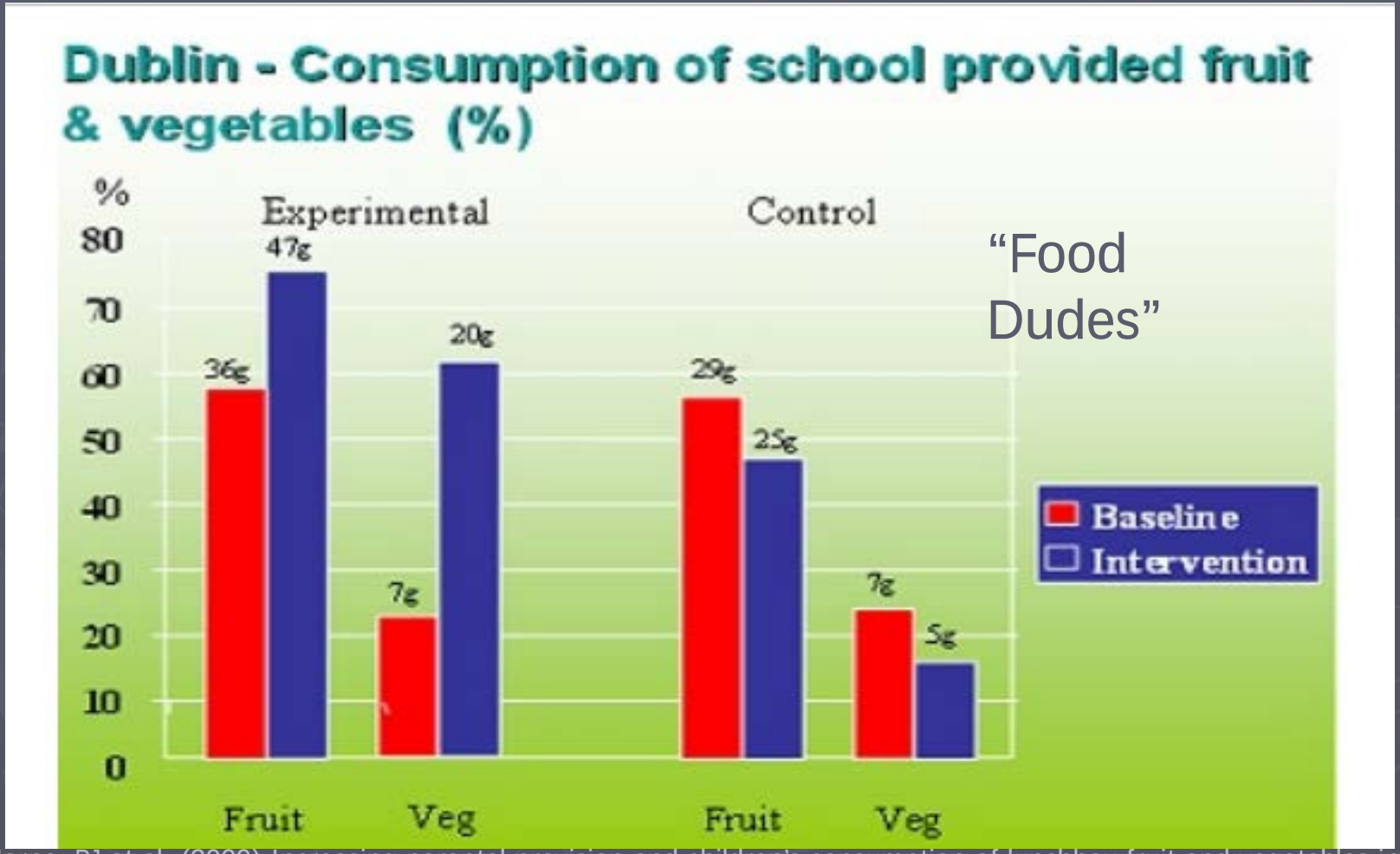
- 42 participants
- 288 devices, 12 weeks

- 13% decline in energy use

Orland, B., Ram, N., Lang, D., Houser, K. W., Kling, N., & Coccia, M. (2014). Saving energy in an office environment: A serious game intervention. *Energy and Buildings, 74,* 43-52.

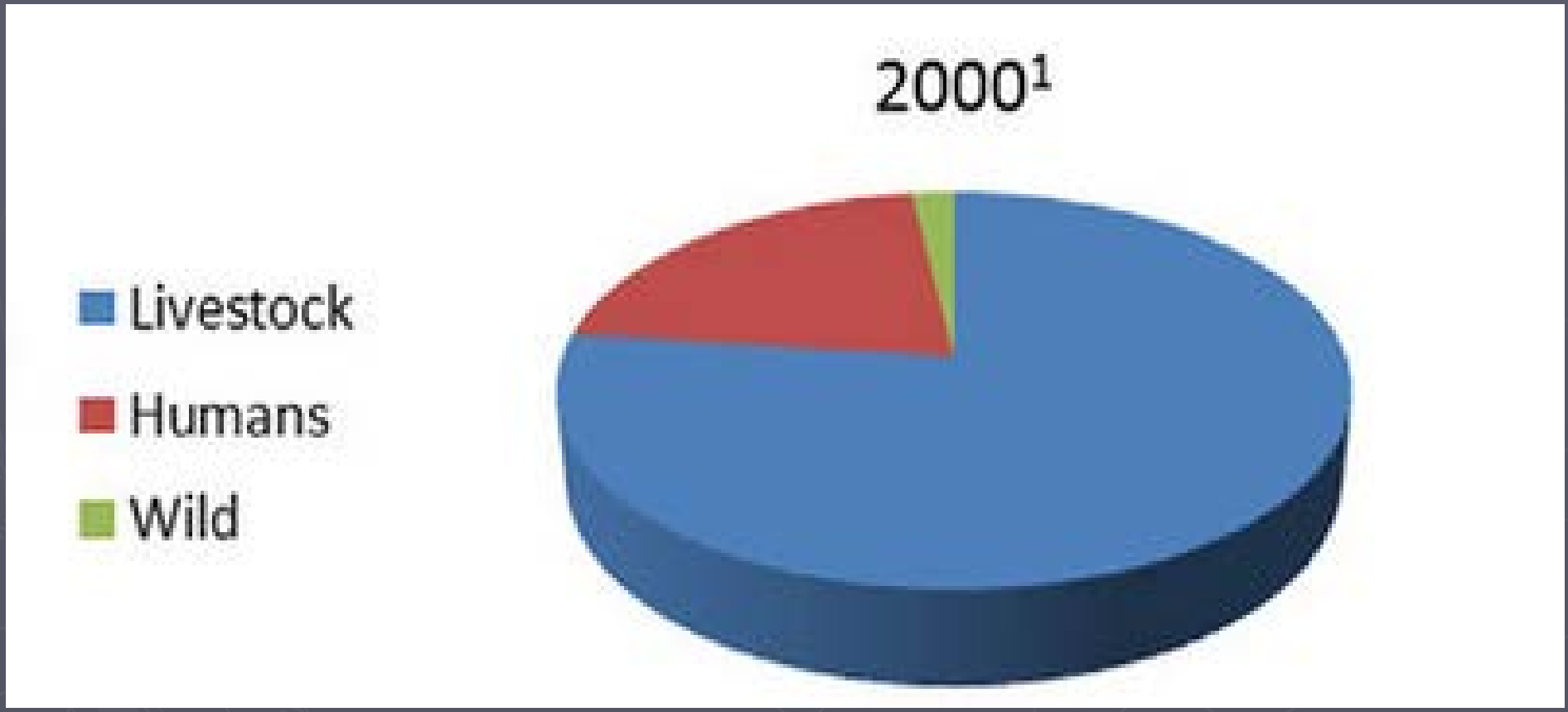
Food Dudes





Horne, PJ et al. (2009) Increasing parental provision and children's consumption of lunchbox fruit and vegetables in Ireland: the Food Dudes intervention. *European Journal of Clinical Nutrition, 63,* 613-18.

Global Mammalian Biomass



Zeller, U., Starik, N., & Gottert, T. (2017). Biodiversity, land use and ecosystem services—An organismic and comparative approach to different geographical regions. *Global Ecology and Conservation 10*:114-125.

High Impact & Broad Impact

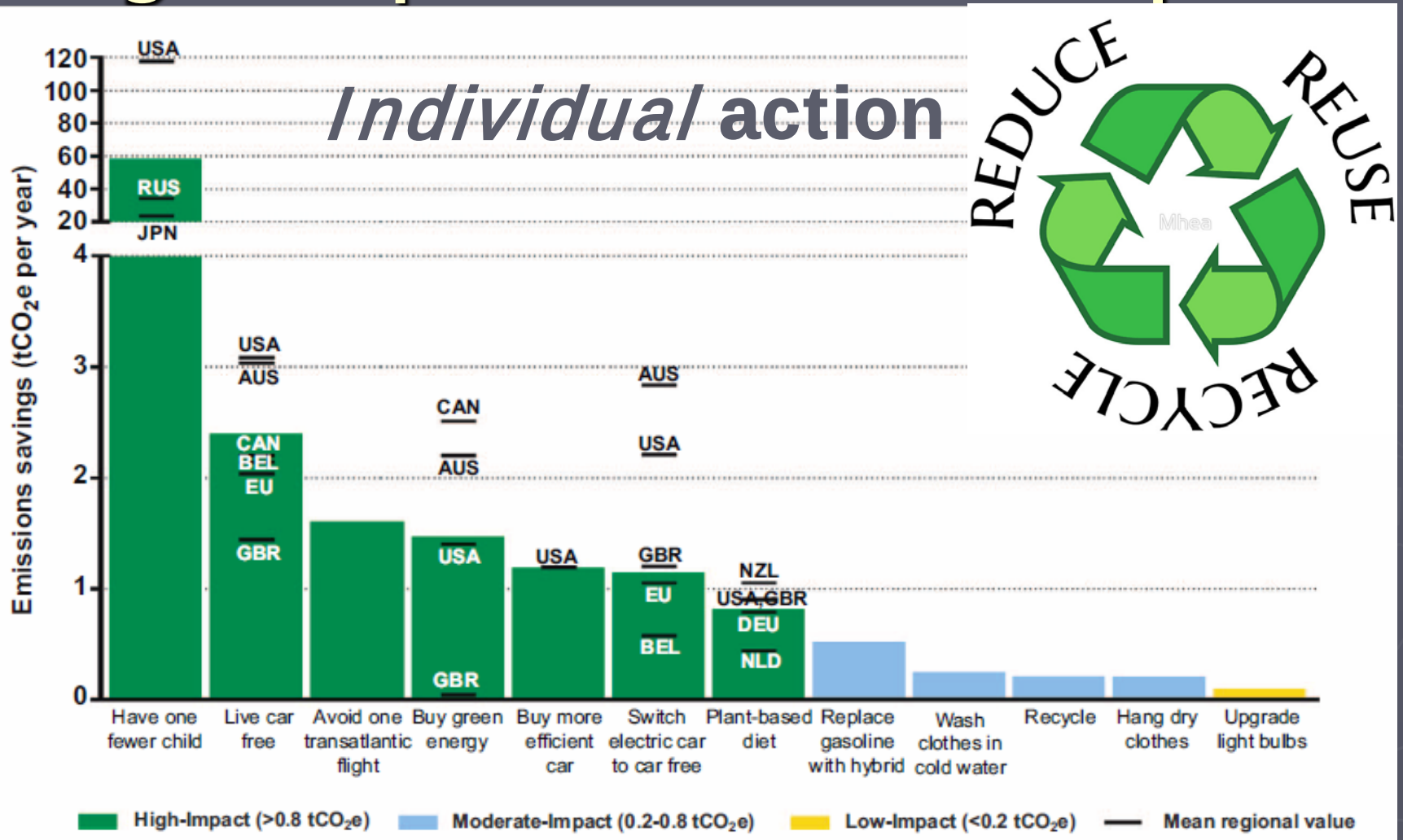


Figure 1. A comparison of the emissions reductions from various individual actions. The height of the bar represents the mean of all studies identified in developed nations, while black lines indicate mean values for selected countries or regions (identified by ISO codes) where data were available from specific studies. We have classified actions as high (green), moderate (blue), and low (yellow) impact in terms of greenhouse gas emissions reductions. Note the break in the y-axis. See supplementary materials 5 for details.

Wynes, S., & Nicholas, K. A. (2017). The climate mitigation gap: education and government recommendations miss the most effective individual actions. *Environmental Research Letters, 12.*

Success: Seattle's "In Motion" Initiative

- Reduce solo car trips/Increase public transit, carpooling, biking
- Barriers identified
- Timing
- Start small (shaping)
- Pledges/free transit card
- Public meetings
- Individual tracking charts online, weekly reinforcing emails, reminders

Seattle's "In Motion" Initiative

Typical 20% drop in solo car trips

New habits formed

©Wings 777 at flickr

Success: A Focus on the Group - & Feedback

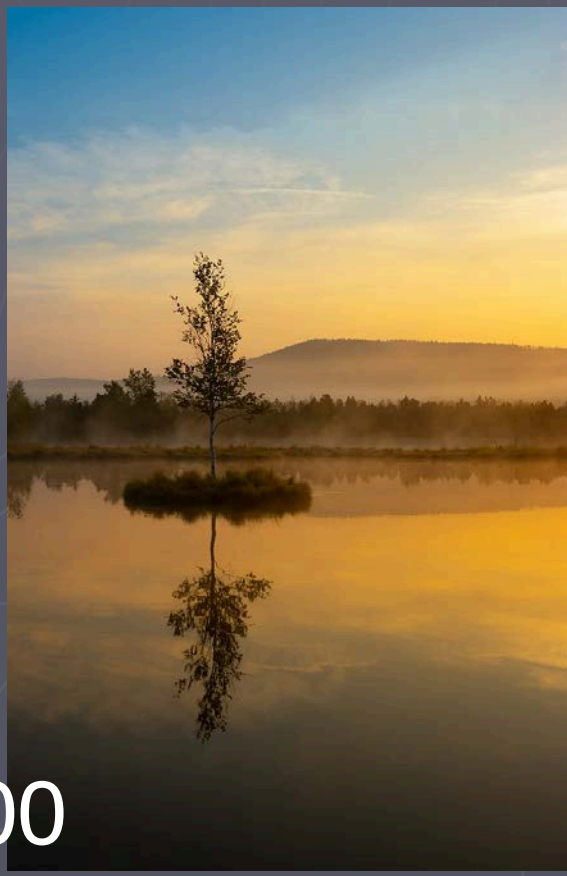
Oberlin College

Petersen, J.E.; Shunturov, V.; Janda, K.; Platt, G.; Weinberger, K. (2007). Dormitory residents reduce electricity consumption when exposed to real-time visual feedback and incentives. *Int. J. Sustain. High. Educ., 8*, 16–33.

Success: A Focus on the Group - & Feedback

Minnesota school district as an Energy Star!

- Inclusive 13-year program
- Teams
- Rival school competition
- Immediate reinforcement
- Public recognition



>30% savings: over $5,000,000

General Behavioral Strategies

- Make it understandable and vivid:
  an average global 3º F rise is *serious*
- Use incentives - wisely
- Provide comparative data on greenhouse gas emissions – give feedback!
- Offer people choices
- Create goals & celebrate progress
- Frame climate change as a challenge we can overcome

The Positive Side – The *Natural* Rewards