## How to tell good climate science from bad

Ruth Sharpe, PhD 27<sup>th</sup> March 2018

### ocean wise.

## **True or Fish?**

### A night of trivia and more.

## APRIL 20 · 6-10 P.M.



#### **New Podcast from Ocean Wise!**













#### ocean.org/myocean



## Tuesday 24th April | 7 P.M.



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## How to tell good climate science from bad

Ruth Sharpe, PhD 27<sup>th</sup> March 2018

### ocean wise.





## Without knowing the science, get some idea what you can trust and what you should ignore.





## Need to know what we are doing is actually going to help and not make the situation worse





HOME / NEWS / POLITICS NEWSMAX Scientist: Carbon Dioxide Doesn't Cause Global Warming Noted geologist says Earth needs more, not less, carbon dioxide to feed plant life. By Paul Bedard, Staff Writer Oct. 7, 2009, at 4:15 p.m. 🄰 🤠 🔤 EXPRESS Home of the Daily and Sunday Express THEFiscaltimes POLICY + POLITICS NEWS SPORT COMMENT FINANCE TRAVEL 'Global warming the greatest LIFE + MO HOME OPINION POLICY + POLITICS BUSINESS + ECONOMY scam in history' claims founder You are here: Home > Policy + Politics > Keystone Pipeline and the 'Myth' of Global Warming of Weather Channel Keystone Pipeline and the 'Myth' of Global Warming THE debate about climate change is finished - because it has been categorically proved NOT to exist, one of the world's best known climate change sceptic has claimed EXPRESS Home of the Daily and Sunday Expres THE WALL STREET JOURNAL. ■ OPINION **EXCLUSIVE:** Ice in the Arctic OPINION and Antarctic is 'not melting', The Myth of the Climate Change '97%' says global warming expert What is the origin of the false belief—constantly repeated—that THE North and South Poles are "not melting", according to a leading global warming almost all scientists agree about global warming?

expert.



HEALTH

WORLD

TV

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Science Home | Pictures | Gadgets Gifts and Toys Store

Fracking causes as much seismic activity as 'jumping off a ladder': Controversial method for extracting gas is 'extremely unlikely to trigger an earthquake we would feel'

- Fracking is blasting underground rock deposits with water and chemicals
- It releases trapped gas pockets and was blamed for starting earthquakes
- But study says it's very unlikely we'll feel earthquakes caused by fracking

By NICK MCDERMOTT

PUBLISHED: 19:39 EST, 9 April 2013





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#### Fracking could lead to an 'earthquake domino effect' as it weakens fault lines deep in the earth's crust, scientists claim

- Scientists from Columbia University have claimed that earthquakes could be caused by pressure on fault lines created by hydraulic fracturing
- Danger occurs when the activity is agitated by distant earthquakes that can trigger tremors near waste water injection wells, they said
- Seismologists from the university have identified three quakes that were triggered at injection well sites by a major earthquake a long distance away

By SARAH GRIFFITHS

PUBLISHED: 09:22 EST, 12 July 2013





#### Things can be counterintuitive





#### Study: Gneezy & Rustichini. Journal of Legal Studies (2000)





#### **Completed PhD August 2017**



#### Executive Coordinator: 2014-2017



Now....Public Programs Manager (since Sept. 2017)



#### **Doing Science**



#### **Collecting Data**





#### **Academic Research Article**

#### Journal of Animal Ecology

#### Journal of Animal Envirop 2016, 85, 1401-1410

doi: 10.1111/1265-200612559

#### Prey size and scramble vs. contest competition in a social spider: implications for population dynamics

#### Ruth V. Sharpe' and Leticia Aviles

Department of Zontogy, University of British Columbia, Vancouver, BC, Canada

#### Summary.

 There are many benefits of group living, but also substantial costs, one of which is competition for resources. How scince flood resources are distributed among different members of a population or social group – whether via scramble are context competition – can influence out only the variance in individual fitness, but also the stability and therefore survival of the group in population.

2. Attributes of the food resources themselves, such as their size, may influence the type of intraspecific competition that occurs and therefore the intrinsic stability of a group or population.

3. By experimentally manipulating the size of pray fed to artificial colonies of the social spider Anteinstwar extensis, we to-sentigated whether pray size could after the degree of scramble vs. context competition that takes place and, thus, potentially influence colory population dynamics.

4. We found that large prey were shared more evenly than small prey and that individuals in poor condition were more likely to feed when prey were large than when prey were small. Additionally, we show that individuals participating in prey capture are also more likely to feed on the captured prey.

5. We developed a simple mathematical model to explore the prey sizes that would be energatically worth defending, i.e. prey that are 'economically defendable'. The model shows that nei-ther very small prey, more prey above a certain aim is worth monopoliting, eich originaterrendiate size prey being 'economically defendable'. We therefore suggest the small and large prey in our experiment corresponds to nur model's intermediate and large prey categories, respensively.

6. As the size of prey taptured by serial upder colories increases with colory size, our findings suggest that scramble competition may predominate in large colories. Scramble competition, combined with the fact that prey humans per capital declines as colories grow beyond a certain size, would then explain why extremely large colories of this social apider may suddenly go estimy). Our project thus illustrates the potential triple link between characteristics of the resources, individual behaviour and population dynamics, a link rarely considered in an empirical setting.

Koy-wordst environment, estinction, patch size, persintence, resource distribution, sociality, survival

#### Introduction

The method by which individuals in a population competifor finited renorman each as fixed, multiprepartments in mining space is known to fance a powerful schedule influence on individuals (e.g. Wein-Elechard 1983; Ishell 1991; Pfennig, Bize & Martin 2007); Less well studied is

how intruspecific competitions can affect the stability and long-term periodimete of a population, at selfs as permittal links heaviers properties of the measures, individual thetasizer and population dynamics. In general, it has been accepted that there are two estimate forms of astrappethe competition - sement and second forms of astrappethe competition - sement and second the own originally propend by Nicholson (1956) who defeed content competition as second as when each second all defend content on second and second all resource to univer and

"Consegnations author. It wall redurps (trackage abeau

© 2016 The Authors, Journal of Asiend Ecology © 2016 British Ecological Boointy

#### My Research to News





#### **Scientists**





#### 6-Steps to Tell Good Science from Bad



# Step 1: Is it important? Do you care?



Daily Hail	
.com	_
Home U.K. News Sports U.S. Showbiz Australia Femail Health Science	M¢
Latest Headlines   News   World News   Arts   Headlines   Pictures   Most read   Wires   Coupons	
Government department responsible for the environment has just TWO electric cars in its fleet of 4,000	•

Michael Gove's department has a fleet of 4,000 cars which are mainly diesel

dailymail.co.uk/news/article-5407081/Environment-department-just-TWO-electric-cars.html







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## Step 2: Understand Our Biases











### A bat costs one dollar more than the ball

### How much does the ball cost?



Thinking Fast And Slow, Daniel Kahneman (2011)







### The bat costs one dollar more than the ball

### How much does the ball cost?







Thinking Fast And Slow, Daniel Kahneman (2011)







### The bat costs one dollar more than the ball

### How much does the ball cost?











### The bat costs one dollar more than the ball

### How much does the ball cost?







#### **Two Brain 'Systems'**































#### The Truthfulness Bias







#### Aim for this instead!







#### **Conformation bias**





Alex Proimos | Wikimedia Commons

Study: Westen et al, Journal of Cognitive Neuroscience (2006)

### **Conformation bias**

Africa

Europe

UK

Americas

Asia-Pacific

Middle East

South Asia

Medical notes

Business

Health



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#### **Organic food 'better' for heart**

Organic fruit and vegetables may be better for you than conventionally grown crops, US research suggests.

A ten-year study comparing organic tomatoes with standard produce found almost double the level of flavonoids - a type of antioxidant.



Tomatoes contain compounds which are



news.bbc.co.uk/2/hi/health/6272634.stm

#### **Conformation bias**





#### Organic food 'not any healthier'

() 4 September 2012



Eating organic food will not make you healthier, according to researchers at Stanford University, although it could cut your exposure to pesticides.

They looked at more than 200 studies of the content and associated health gains of organic and non-organic foods.



Food labelled as organic must meet certain standards
## **Zero-Risk Bias**







## Step 2: Conclusion







# **Step 3: What do the numbers mean?**







'The clothing industry creates carbon emissions of <u>1.2 billion tonnes</u>...'

New Scientist 24<sup>th</sup> Feb 2018







**'The clothing industry creates carbon emissions of 1.2 billion tonnes...'** New Scientist 24<sup>th</sup> Feb 2018

'The clothing industry creates carbon emissions of <u>1.2 billion tonnes a year</u>..' New Scientist 24<sup>th</sup> Feb 2018







'The clothing industry creates carbon emissions of 1.2 billion tonnes...' New Scientist 24<sup>th</sup> Feb 2018

'The clothing industry creates carbon emissions of 1.2 billion tonnes a year..' New Scientist 24<sup>th</sup> Feb 2018

'The clothing industry creates carbon emissions of 1.2 million tonnes a year..'







'The clothing industry creates carbon emissions of 1.2 billion tonnes a year..' New Scientist 24<sup>th</sup> Feb 2018

#### World emits 36 billion tonnes of carbon per year

As of 2015: Neatherlands Environmental Assessment Agency







'The clothing industry creates carbon emissions of 1.2 billion tonnes a year..' New Scientist 24<sup>th</sup> Feb 2018

#### World emits 36 billion tonnes of carbon per year

As of 2015: Neatherlands Environmental Assessment Agency

Clothing industry creates 3.3% of global carbon emissions

Calculation by Ruth!







**'France will let its wolf population grow by 40%....'** New Scientist 24<sup>th</sup> Feb 2018













688 kg of the CO<sup>2</sup> is released for each tonne of New Zealand lamb for sale in Britain.

CM Saunders (2007)







688 kg of the CO<sup>2</sup> is released for each tonne of New Zealand lamb for sale in Britain.

CM Saunders (2007)

2,849 kg of the CO<sup>2</sup> is released for each tonne of New Zealand lamb raised and sold in Britain.

CM Saunders (2007)





## **Graph Scales Can Be Misleading**





20

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## **Graph Scales Can Be Misleading**

20

ocean wise.





## **Graph Scales Can Be Misleading**





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# Put numbers in context



# Step 4: Is it a correlation?





## What is correlation?







One thing increases with another thing











#### **Divorce Rates in Maine**

#### *correlates with* **Per Capita Consumption of Margarine!**





tylervigen.com

## Sometimes it's just a coincidence



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## Other things cause the pattern



20



## Other things cause the pattern





Children who sleep with a light on during the night could



## Other things cause the pattern





## Correlation.....





Sources: BP Statistical Review of World Energy, Historical data workbook World Bank, World Development Indicators (WDI)



## Correlation does NOT mean causation!







Sources: BP Statistical Review of World Energy, Historical data workbook World Bank, World Development Indicators (WDI)



## **Step 4: Conclusion**





# **Step 5: Is it a predication?**





































## Extrapolation





#### UN report: Loss of plants, animals making lonelier planet

Seth Borenstein, The Associated Press Published Friday, March 23, 2018 9:27AM EDT Last Updated Friday, March 23, 2018 12:09PM EDT

If current trends continue by the year 2050 the Americas will have 15 per cent fewer plants and animals than now. That means there will be 40 per cent fewer plants and animals in the Americas than in the early 1700s.











## What is a model?





## Model Example: Arctic Ice







NCAR climate model: www.youtube.com/watch?v=3v9aRQpumPA
### **Example: Temperature Predictions**





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# **Step 6: Who said it?**









# Try to Find The Original Source







#### What is the source?

**Most Reliable** 

















































## Find The Original Source (if you can)



#### Organic food 'not any healthier'

3 4 September 2012

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Eating organic food will not make you healthier, according to researchers at Stanford University, although it could cut your exposure to pesticides.

They looked at more than 200 studies of the content and associated health gains of organic and non-organic foods.



Food labelled as organic must meet certain standards

http://www.bbc.com/news/health-19465692



# Find The Original Source (if you can)

Crystal Smith-Spangler, MD, MS; Margaret L. Brandeau, PhD; Grace E. Hunter, BA; J. Clay Bavinger, BA; Maren Pearson, BS; Paul J. Eschbach; Vandana Sundaram, MPH; Hau Liu, MD, MS, MBA, MPH; Patricia Schirmer, MD; Christopher Stave, MLS; Ingram Olkin, PhD;

Dena M. Bravata, MD, MS





?

#### **Peer Reviewed Paper**



#### **Annals of Internal Medicine**<sup>®</sup> LATEST ISSUES CHANNELS CME/MOC IN THE CLINIC WEB EXCLUSIVES AUTHO JOURNAL CLUB PREV ARTICLE THIS ISSUE NEXT ARTICLE REVIEWS 4 SEPTEMBER 2012 Are Organic Foods Safer or Healthier Than Conventional A **Systematic Review** Probably Good Crystal Smith-Spangler, MD, MS; Margaret L. Brandeau, PhD; Grace E. Hunter, BA; J. Clay Bavinger, BA Eschbach; Vandana Sundaram, MPH; Hau Liu, MD, MS, MBA, MPH; Patricia Schirmer, MD; Christoph Dena M. Bravata, MD, MS **Science**









#### Can you always trust peer-reviewed articles?







#### Can you always trust peer-reviewed articles?







### **Fake Journals**





# Not in Wikipedia ightarrow probably fake!

#### Can you always trust peer-reviewed articles?







## Some reasons things may go wrong

- Graduate students and profs wanting to publish ⇒ "publish or perish"
- Research Funding Sources
- Difficulty getting 'negative' studies published





#### Can you always trust peer-reviewed articles?





#### Meta-analysis: Example Study







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#### Meta-analysis: Example Study



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#### Not peer-reviewed





### **IPCC** Report





www.ipcc.ch/report/ar5/syr/



















## **IPCC Report: Who wrote it?**

#### Climate Change 2014 Synthesis Report

Edited by

The Core Writing Team Synthesis Report IPCC Rajendra K. Pachauri Chairman IPCC Leo Meyer Head, Technical Support Unit IPCC

#### **Core Writing Team**

Rajendra K. Pachauri (Chair), Myles R. Allen (United Kingdom), Vicente R. Barros (Argentina), John Broome (United Kingdom), Wolfgang Cramer (Germany/France), Renate Christ (Austria/WMO), John A. Church (Australia), Leon Clarke (USA), Qin Dahe (China), Purnamita Dasgupta (India), Navroz K. Dubash (India), Ottmar Edenhofer (Germany), Ismail Elgizouli (Sudan), Christopher B. Field (USA), Piers Forster (United Kingdom), Pierre Friedlingstein (United Kingdom/Belgium), Jan Fuglestvedt (Norway), Luis Gomez-Echeverri (Colombia), Stephane Hallegatte (France/World Bank), Gabriele Hegerl (United Kingdom/Germany), Mark Howden (Australia), Kejun Jiang (China), Blanca Jimenez Cisneros (Mexico/UNESCO), Vladimir Kattsov (Russian Federation), Hoesung Lee (Republic of Korea), Katharine J. Mach (USA), Jochem Marotzke (Germany), Michael D. Mastrandrea (USA), Leo Meyer (The Netherlands), Jan Minx (Germany), Yacob Mulugetta (Ethiopia), Karen O'Brien (Norway), Michael Oppenheimer (USA), Loo Meyer (The Netherlands), Ramón Pichs-Madruga (Cuba), Gian-Kasper Plattner (Switzerland), Hans-Otto Pörtner (Germany), Scott B. Power (Australia), Robert Scholes (South Africa), Kristin Seyboth (USA), Youba Sokona (Mali), Robert Stavins (USA), Thomas F. Stocker (Switzerland), Petra Tschakert (USA), Detlef van Vuuren (The Netherlands), Jean-Pascal van Ypersele (Belgium)



www.ipcc.ch/report/ar5/syr/



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www.ipcc.ch/report/ar5/syr/



#### **DGE Researcher Profile**

0	CHRIS FI	ELD		
200	Title:	Director		
all	Lab:	Field		
	Phone:	650-319-8024		
	Email:	cfield@clw.edu		
		cumculum vitae		
Research Summary				

Chris Field is the founding director of the Carnegie Institution's Department of Global Ecology and Melvin and Joan Lane Professor for Interdisciplinary Environmental Studies at Stanford University. Field is research emphasizes field and laboratory studies of impacts of climate change, from the molecular to the global scale. He was, from 2008 to 2015, co-chair of Working Group II of the Intergovernmental Panel on Climate Change, which led the effort on the IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (2012) and Working Group II contribution to the IPCC Fith Assessment Report (2014). Field is research has been recognized with several American and international awards, including the Max Planck Research Award and the Roger Revetle Medal, and with election to learned societies, including the US National Academy of Sciences (2001). Field received his PhD from Stanford in 1981 and has been at the Carnegie Institution for Science since 1984.











### **Scientific Experts**









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www.ipcc.ch/report/ar5/syr/
















www.usnews.com/news/blogs/washington-whispers/2009/10/07/scientist-carbon-dioxide-doesnt-cause-global-warming









### ISNEWS NEWS » Sections Photos Best Countries Best States Healthiest Communities The Report

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### Scientist: Carbon Dioxide Doesn't Cause Global Warming

Noted geologist says Earth needs more, not less, carbon dioxide to feed plant life.

By Paul Bedard, Staff Writer Oct. 7, 2009, at 4:15 p.m.

### BY PAUL BEDARD, Washington Whispers

A noted geologist who coauthored the *New York Times* bestseller *Sugar Busters* has turned his attention to convincing Congress that carbon dioxide emissions are good for the Earth and don't cause global warming Leighton Stewards con Capitol Hill this week armed with studies and his book *Fire*, *lee and Paradise* in a bit of show scenario the theory of the arther of the tarbon dioxide cap-and-trade scheme could actually hurt the environment of the could be start.



### H. Leighton Steward

### Credentials

• Master of Science (Geology). [1]

### Background

H. Leighton Steward is the President and Chairman of Plants Need CO2, a group founded in 2009 with the mission "to educate the public on the positive effects of additional atmospheric CO2 and help prevent the inadvertent negative impact to human, plant and animal life if we reduce CO2."

Plants Need CO2 was listed as Number four among *Mother Jones*'s "Dirty Dozen of Climate Change Denial" in December, 2009. [2]

He is the Chairman of the Institute for the Study of Earth and Man (ISEM) Board of Trustees, and was Vice Chairman of the American oil and gas company Burlington Resources, Inc. until his retirement in 2000.



https://www.desmogblog.com/h-leighton-steward#s1





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### NOME / NEWS / POLITICS Scientist: Carbon Dioxide Doesn't Cause Global Warming

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ISNEWS NEWS » Sections Photos Best Countries Best States Healthiest Communities The Repor

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## And ... has an agenda



### H. Leighton Steward

### Credentials

• Master of Science (Geology). [1]

### Background

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https://www.desmogblog.com/h-leighton-steward#s1





https://www.desmogblog.com/h-leighton-steward#s1

# **Another Example**



The Washington Post Democracy Dies in Darkness

### **Energy and Environment**

# Trump meets with Princeton physicist who says global warming is good for us

### By Chris Mooney January 13, 2017 Mail the author

Yes, Donald Trump met with Al Gore. But on Friday, according to the Trump transition team, the presidentelect also met with <u>William Happer</u>, a Princeton professor of physics who has been a prominent voice in questioning whether we should be concerned about human-caused climate change.



## **Another Example**







## **Another Example**





# Expert in the correct field?

The Washington Post Democracy Dies in Darkness

**Energy and Environment** 

# Trump meets with Princeton physicist who says global warming is good for us

### By Chris Mooney January 13, 2017 💟 Email the author

Yes, Donald Trump met with Al Gore. But on Friday, according to the Trump transition team, the presidentelect also met with William Happer, Princeton professor of physics who has been a prominent voice in questioning whether we should be concerned about human-caused climate change.

## NOT AN EXPERT in *this* field

ocea

WIKIPEDIA The Free Encyclopedia	Article Talk   William Happer   From Wikipedia, the free encyclopedia	Read	Edit	View history	Search W
Main page Contents Featured content Current events Random article	This article is about the physicist. For the pro-wrestler, see William Murray Happer. William "Will" Happer (born July 27, 1939 <sup>[1]</sup> ) is an American physicist who has specialized in the study of atomic physics, optics and spectroscopy. <sup>2]</sup> He is the Cyrus Fogg Brackett <sup>[3]</sup> Prot Princeton University, <sup>[2]</sup> and a long-term member of the JASON advisory group, <sup>[1]</sup> where he pioneered the development of adaptive optics. From 1991 to 1993, Happer served as director of Science as part of the George HW Bush administration.	essor of the Dep	Physic: artmen	s <mark>, Emeritus</mark> , t of Energy's	at Office of







?

# Expert in the correct field?



Energy and E Trui glob	nvironment np meets with Princeton physicist who says al warming is good for us	
<b>By Chris Moo</b> Yes, Donal elect also r questionin	ney January 13, 2017 ■ Email the author d Trump met with Al Gore. But on Friday, according to the Trump transition team. the still net with William Happer, Princeton professor of physics g whether we should be concerned about human-concerned	NOT AN EXPERT in <i>this</i> field
Pro	bbably Bad Science	Read Edit View history Search W
Main page Contents Featured content Current events Random article	This article is about the physicist. For the pro-wrestler, see William Murray Happer. William "Will" Happer (born July 27, 1939 <sup>[1]</sup> ) is an American physicist who has specialized in the study of atomic physic Princeton University, <sup>[2]</sup> and a long-term member of the JASON advisory group, <sup>[1]</sup> where he pioneered the development Science as part of the George HW Bush administration.	sics, optics and spectroscopy. <sup>2]</sup> He is the Cyrus Fogg Brackett <sup>[3]</sup> Professor of Physics, Emeritus, at t of adaptive optics. From 1991 to 1993, Happer served as director of the Department of Energy's Office of











# Agenda?



- Campaigning organization
- Political Party
- Newspaper
- Non-profit
- Company
- NGO

GREE	NPEAC	🗲 Green	peace l	nternational	1999 I T		
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Home >	Publications > 0	Campaign reports :	> Climate >	Global Shift			

### **Global Shift**

Countries and subnational entities phasing out existing coal power plants and shrinking the proposed coal power pipeline

Publication - 18 October, 2017



# 6-Steps to Tell Good Science from Bad



## Take Home Message!





# **Further Reading!**





### Podcasts!!

- More or Less: Behind The Stats (BBC)
- Science Vs. (Gimlet)
- Hidden Brain (NPR)

For more see: <a href="https://www.nyingle.com">rvsharpe.github.io</a>



### **Remember:**



### **Contact me!**

ruth.sharpe@ocean.org

rvsharpe.github.io

Ocean Wise Team Stephanie Chong Ladies Learning Code! Terry McLeod (awesome volunteer!)

Thanks to:

