Image source: www.bbc.co.uk (last accessed April 2019)

The Climate Emergency: Scientific evidence and response required by business

Sustainable Business Network Autumn Meeting, 19 October 2019

Ian Williams
Professor of Applied Environmental Science
Associate Dean (Enterprise)
Faculty of Engineering and Physical Sciences,
University of Southampton, UK.

idw@soton.ac.uk; @EnviroTaff

Source: https://waikatoenviroschools.files.wordpress.com (last accessed September 2019)

Outside Swedish Parliament, 20 August 2018

Home Moments Search Twitter Have an account? Log in

Jeremy Corbyn
@jeremycorbyn

Leader of the Labour Party.

UK
labour.org.uk/volunteering
Joined February 2010

3,483 Photos and videos

Follow

Jeremy Corbyn
@jeremycorbyn

Follow

Climate change is the greatest threat that we all face but it is the school kids of today whose futures are most on the line.

They are right to feel let down by the generation before them and it's inspiring to see them making their voice heard today. #SchoolStrike4Climate

2:39 AM - 15 Feb 2019

4,562 Retweets **15,128** Likes

1.3K 4.6K 15K

Jonathan Stanley @JonMarcStanley · Feb 15
Replying to @jeremycorbyn
1. Untrue.

2. Skipping school is truancy. You have encouraged mass truancy.

44 7 90

TheLuckyHeron @LuckyHeronSay · Feb 15
School strikes are allowed under certain circumstances

#schoolstrike4climate is one very valid strike, as an ex teacher, I certainly support these kids right to strike on this crucial issue

14 2 200

Jonathan Stanley @JonMarcStanley · Feb 15
It will make zero difference and compromise their education.

35 35

New to Twitter?
Sign up now to get your own personalized timeline!

Sign up

You may also like · Refresh

The Labour Party
@UKLabour

Theresa May
@theresa_may

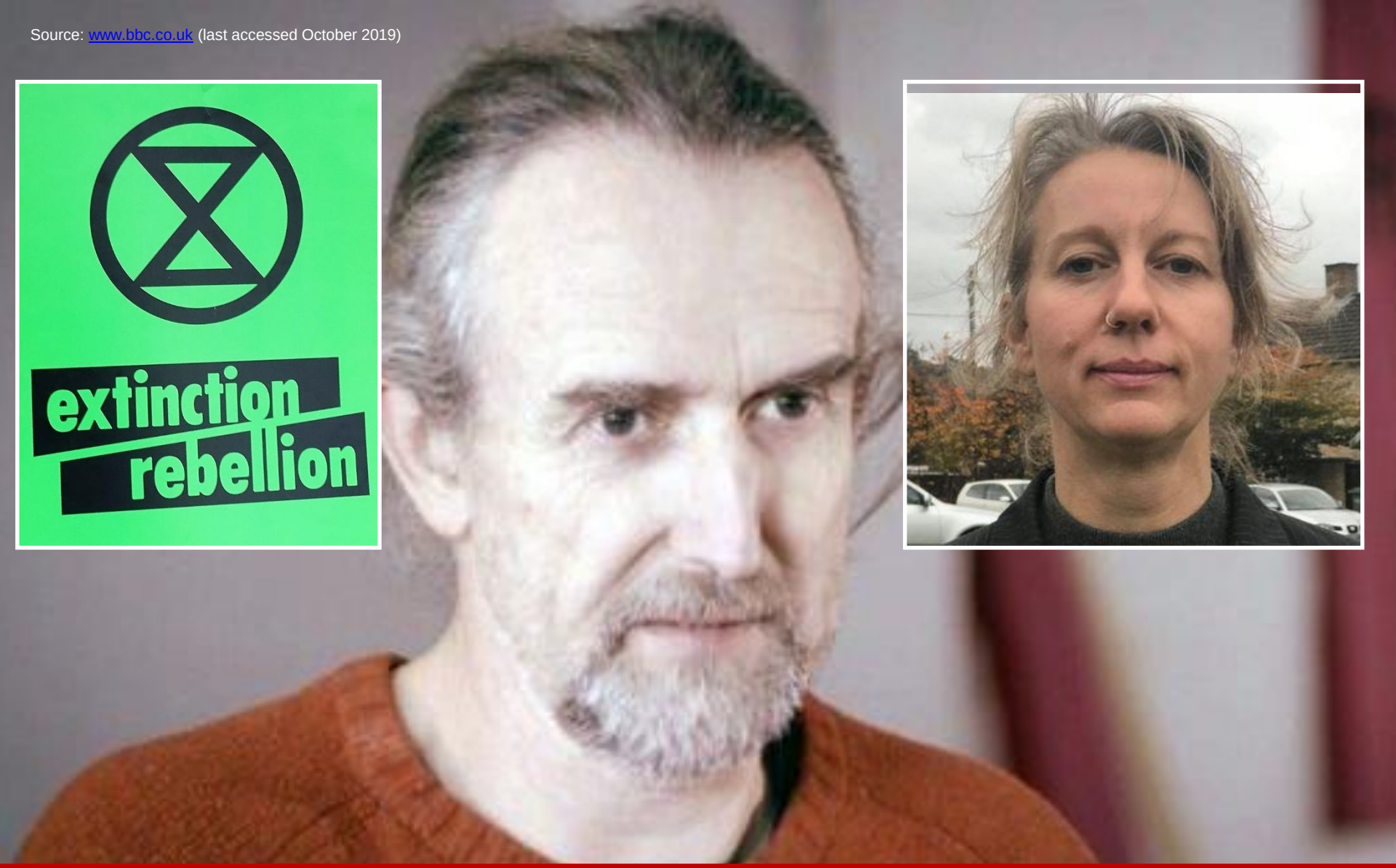
Owen Jones
@OwenJones84

Sadiq Khan
@SadiqKhan

John McDonnell MP
@johnmcdonnellMP

Source: www.bbc.co.uk (last accessed April 2019)

Source: www.bbc.co.uk (last accessed October 2019)



Extinction Rebellion established May 2018 by academics.

Launched 31 October 2018 by Roger Hallam and Gail Bradbrook.

University World News
THE GLOBAL WINDOW ON HIGHER EDUCATION

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Related Links

GLOBAL
UN urges universities to be catalysers of sustainability

GLOBAL

Networks of 7,000 universities declare climate emergency

Brendan O'Malley 10 July 2019

Networks representing more than 7,000 higher and further education institutions from six continents have announced that they are declaring a 'climate emergency', and agreed to undertake a three-point plan to address the crisis through their work with students.

The three-point plan, published in an open letter on 10 July, includes:

• Committing to going carbon neutral by 2030 or 2050 at the very latest.

• Mobilising more resources for action-oriented climate change research and skills creation.

• Increasing teaching and learning about environmental and sustainability education across curricula, campus and community outreach programmes.

The letter says: "The young minds that are shaped by our institutions must be equipped with the knowledge, skills and capability to respond to the ever-growing challenges of climate change. We all need to work together to nurture a habitable planet for future generations and to play our part in building a greener and cleaner future for all."


Source: www.bbc.co.uk (last accessed September 2019)
Global Climate Strike
20 September 2019
Southampton, England

Melbourne, Australia

Bangkok, Thailand

Source: www.bbc.co.uk (last accessed September 2019)

Berlin, Germany

London, England

Nairobi, Kenya

Source: www.bbc.co.uk (last accessed September 2019)

Lodz, Poland

Source: www.bbc.co.uk (last accessed September 2019)

Prague, Czech Republic

Source: www.bbc.co.uk (last accessed September 2019)

Quezon City, Philippines

Source: www.bbc.co.uk (last accessed September 2019)

New Delhi, India

Sanur beach, Bali, Indonesia

Climate emergency declarations in 1,120 jurisdictions and local governments cover 285 million citizens

Source: https://climateemergencydeclaration.org (last accessed October 2019)

Posted on *13 October 2019*

1,120 jurisdictions in 20 countries have declared a climate emergency. Populations covered by jurisdictions that have declared a climate emergency amount to 285 million citizens, with 47 million of these living in the United Kingdom. This means in Britain now roughly 70 per cent of the population lives in areas that have declared a climate emergency. In New Zealand, the percentage is even higher: 74 per cent of the population. It's around 25 per cent in countries like Switzerland and Italy.

Source: www.bbc.co.uk (last accessed October 2019)

- Almost 400 all-time high temperatures set in northern hemisphere over summer 2019
- Records broken in 29 countries (1 May - 30 August 2019)
- A third in Germany, followed by France and Netherlands

Source: www.bbc.co.uk (last accessed October 2019

- Almost 400 all-time high temperatures set in northern hemisphere over summer 2019
- Records broken in 29 countries (1 May - 30 August 2019)
- A third in Germany, followed by France and Netherlands

How did we get to this point?

Source: www.climate.gov (last accessed September 2019)

ART. XXXI.—*Circumstances affecting the Heat of the Sun's Rays;* by EUNICE FOOTE.

(Read before the American Association, August 23d, 1856.)

MY investigations have had for their object to determine the different circumstances that affect the thermal action of the rays of light that proceed from the sun.

Several results have been obtained.

First. The action increases with the density of the air, and is diminished as it becomes more rarified.

The experiments were made with an air-pump and two cylindrical receivers of the same size, about four inches in diameter and thirty in length. In each were placed two thermometers, and the air was exhausted from one and condensed in the other. After both had acquired the same temperature they were placed in the sun, side by side, and while the action of the sun's rays rose to 110° in the condensed tube, it attained only 88° in the other. I had no means at hand of measuring the degree of condensation or rarefaction.

The observations taken once in two or three minutes, were as follows:

Exhausted Tube		Condensed Tube.	
In shade.	In sun.	In shade.	In sun.
75	80	75	80
76	82	78	95
80	82	80	100
83	86	82	105
84	88	85	110

This circumstance must affect the power of the sun's rays in different places, and contribute to produce their feeble action on the summits of lofty mountains.

Secondly. The action of the sun's rays was found to be greater in moist than in dry air.

In one of the receivers the air was saturated with moisture—in the other it was dried by the use of chlorid of calcium.

Both were placed in the sun as before and the result was as follows:

Dry Air.		Damp Air.	
In shade.	In sun.	In shade.	In sun.
75	75	75	75
78	88	78	90
82	102	82	106
82	104	82	110
82	105	82	114
88	108	92	120

The high temperature of moist air has frequently been observed. Who has not experienced the burning heat of the sun that precedes a summer's shower? The isothermal lines will, I think, be found to be much affected by the different degrees of moisture in different places.

Thirdly. The highest effect of the sun's rays I have found to be in carbonic acid gas.

One of the receivers was filled with it, the other with common air, and the result was as follows:

In Common Air.		In Carbonic Acid Gas.	
In shade.	In sun.	In shade.	In sun.
80	90	80	90
81	94	84	100
80	99	84	110
81	100	85	120

The receiver containing the gas became itself much heated—very sensibly more so than the other—and on being removed, it was many times as long in cooling.

An atmosphere of that gas would give to our earth a high temperature; and if as some suppose, at one period of its history the air had mixed with it a larger proportion than at present, an increased temperature from its own action as well as from increased weight must have necessarily resulted.

On comparing the sun's heat in different gases, I found it to be in hydrogen gas, 104°; in common air, 106°; in oxygen gas, 108°; and in carbonic acid gas, 125°.

ART. XXXII.—*Review of a portion of the Geological Map of the United States and British Provinces by Jules Marcou;** by WILLIAM P. BLAKE.

GEOLOGICAL maps of the United States published in Europe and widely circulated among European geologists, are necessarily regarded by us with no small degree of attention and curiosity. This is more especially true, when such maps embrace regions of which the geography has only recently been made known and the geology has never before been laid down on a map with any approach to accuracy.

The recent geological map and profile by M. J. Marcou, which has appeared in the Annales des Mines and in the Bulletin of

* Carte Géologique des Etats-Unis et des Provinces Anglaises de l'Amérique du Nord par Jules Marcou. *Annales des Mines*, 5e Série, T. vii, p. 329. Published also with the following:

Résumé explicatif d'une carte géologique des Etats-Unis et des provinces anglaises de l'Amérique du Nord, avec un profil géologique allant de la vallée du Mississippi aux côtes du Pacifique, et une planche de fossiles, par M. Jules Marcou *Bulletin de la Société Géologique de France.* Mai, 1855, p. 813.

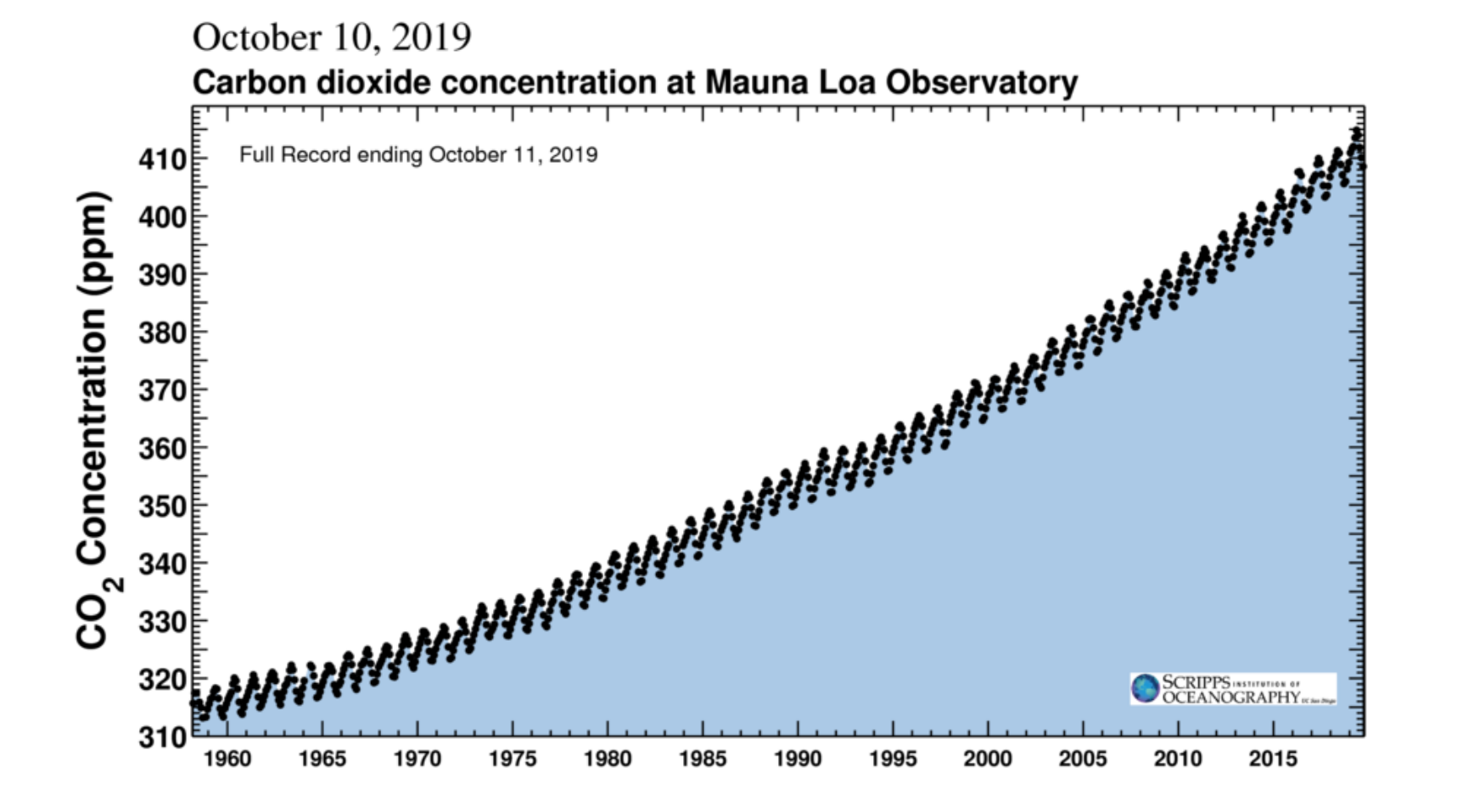
Eunice Newton Foote (July 17, 1819 – September 30, 1888)

Source: www.climate.gov (last accessed September 2019)

- Theorized that changing proportion of CO_2 in atmosphere would change average atmospheric temperature
- Identified root cause of the greenhouse effect
- **"Circumstances affecting the heat of the sun's rays" (1856)**
  - American Association for the Advancement of Science Conference
  - Presented by Professor Joseph Henry (of the Smithsonian Institution)
  - Women not allowed to present!
- 1820s - Jean-Baptiste Joseph Fourier - first person to suggest that Earth's atmosphere traps heat and warms the planet
- 1859 – John Tyndall's experiments to test whether gases in the atmosphere could trap heat at the Royal Institution laboratories
- 1896 - Svante Arrhenius postulated anthropogenic global warming
- 1930s - G.S. Callendar insisted greenhouse warming on the way
- 1960s - C.D. Keeling measures atmospheric CO_2 concentrations

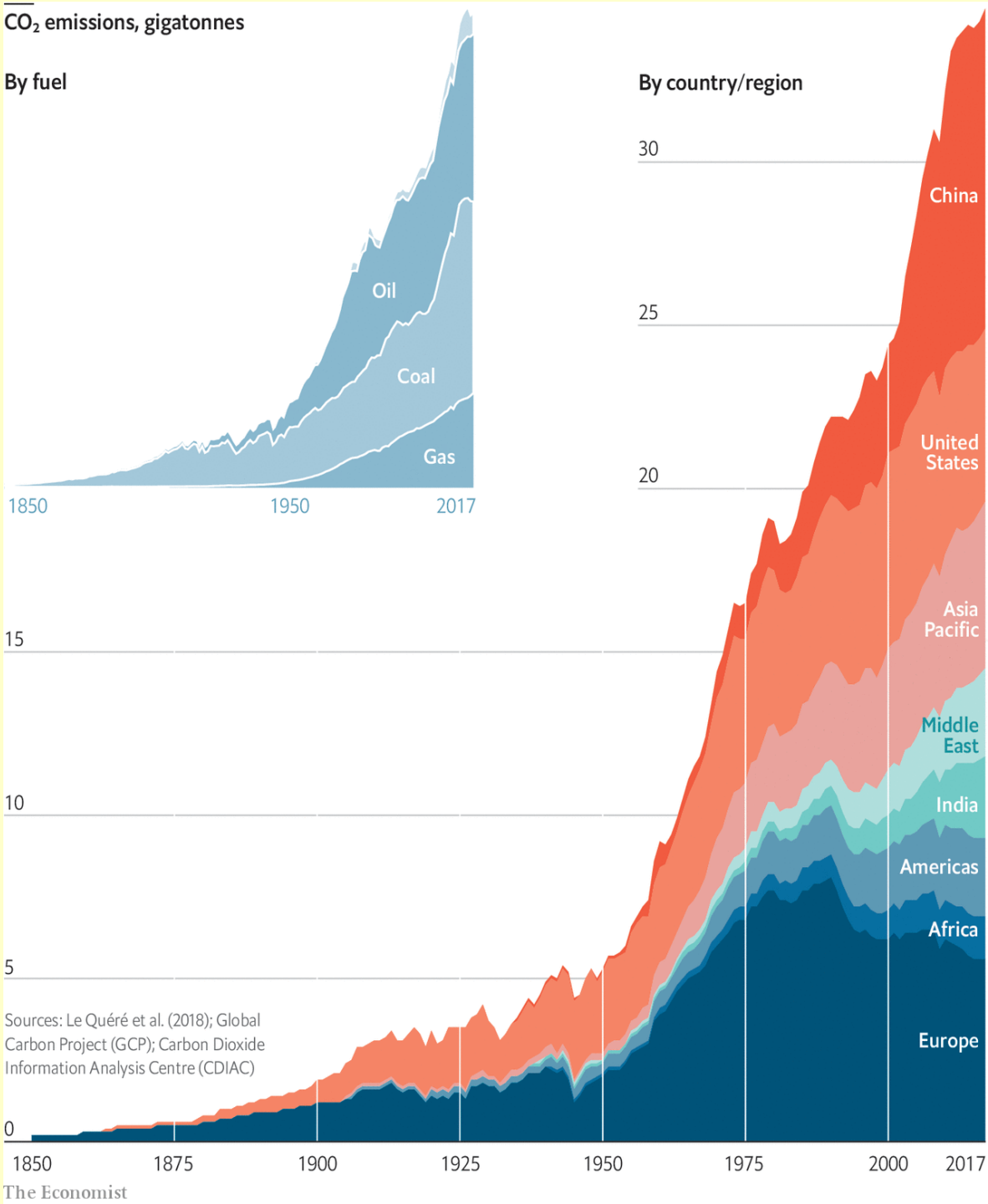
Eunice Newton Foote (July 17, 1819 – September 30, 1888)

The Keeling Curve



Source: https://scripps.ucsd.edu/programs/keelingcurve/ (Last accessed October 2019)

Carbon Emissions from Fossil Fuel Consumption 1850–2017



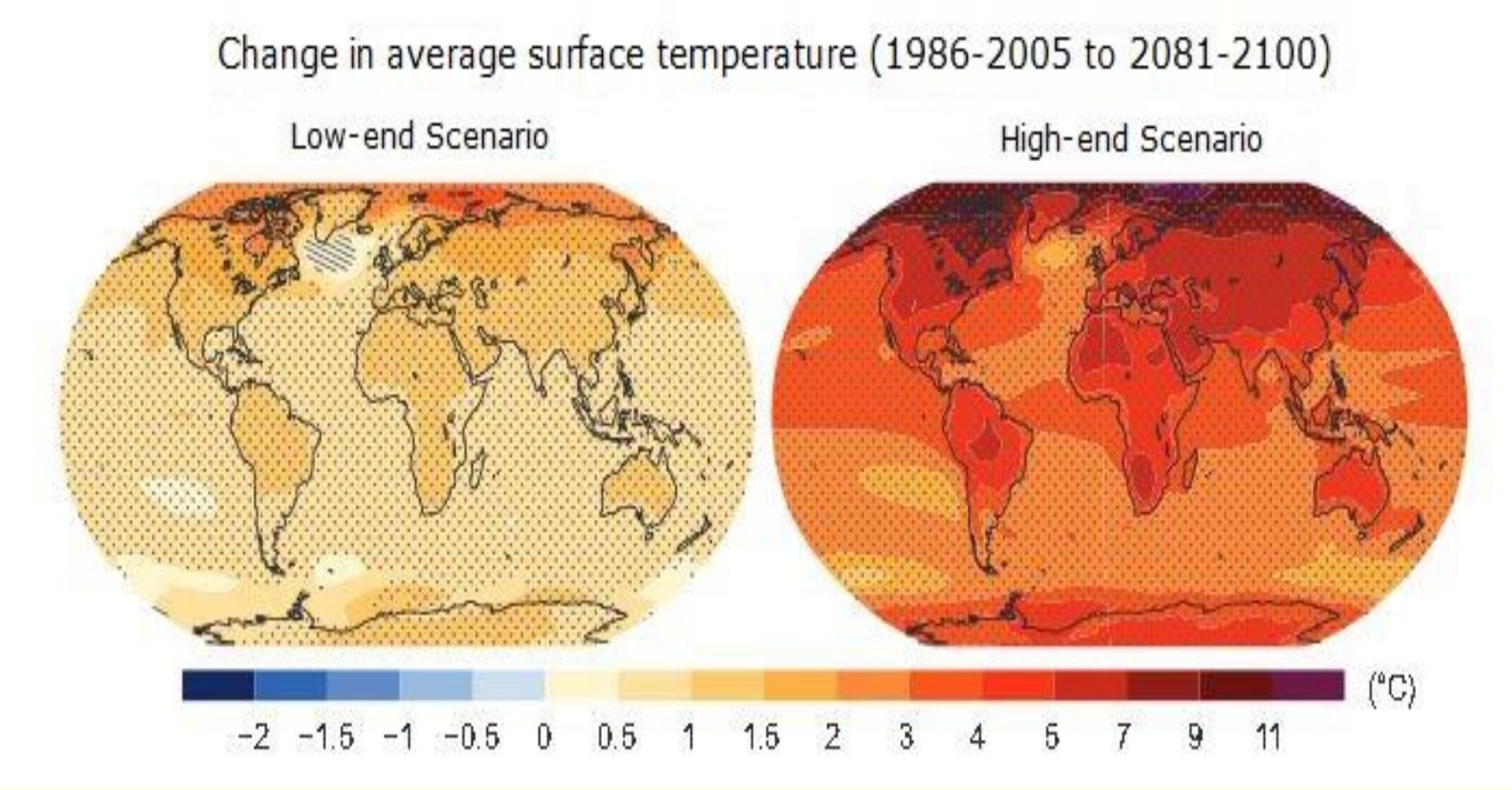
Source: www.economist.com (Last accessed October 2019)

Evidence for rapid climate change is compelling:

- Global temperature rise
- Warming oceans
- Shrinking ice sheets
- Glacial retreat
- Decreased snow cover
- Sea level rise
- Declining Arctic sea ice
- Extreme events
- Ocean acidification

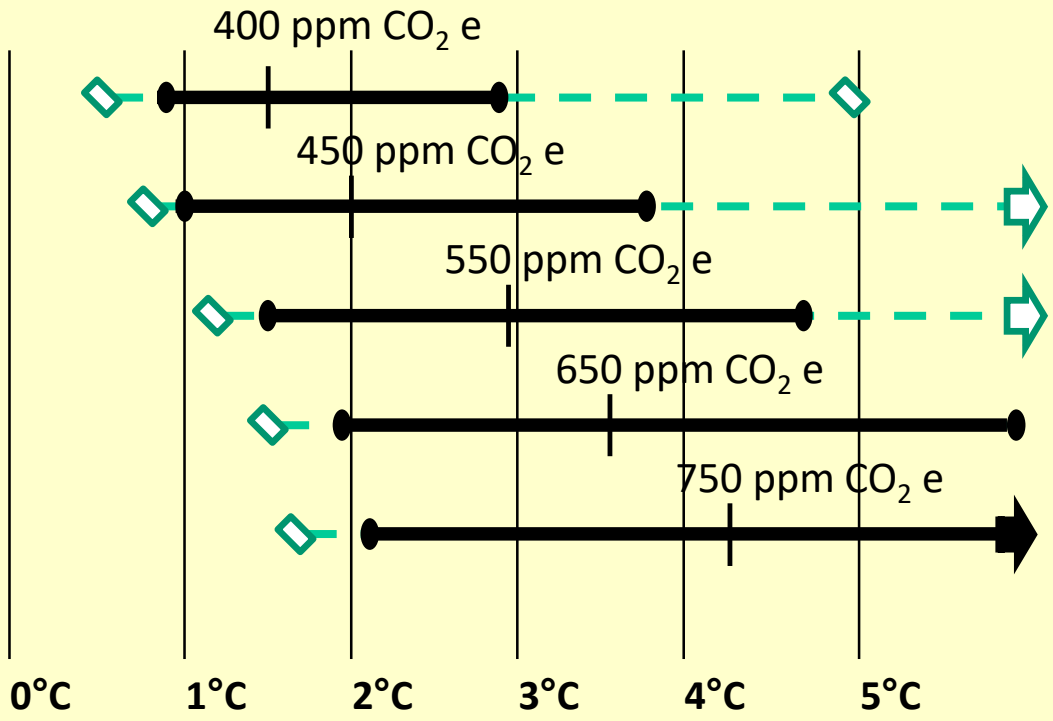
Image source: climate.nasa.gov (last accessed June 2019)

Global Temperature Trends to 2100: Two Scenarios



Source: IPCC, 2013

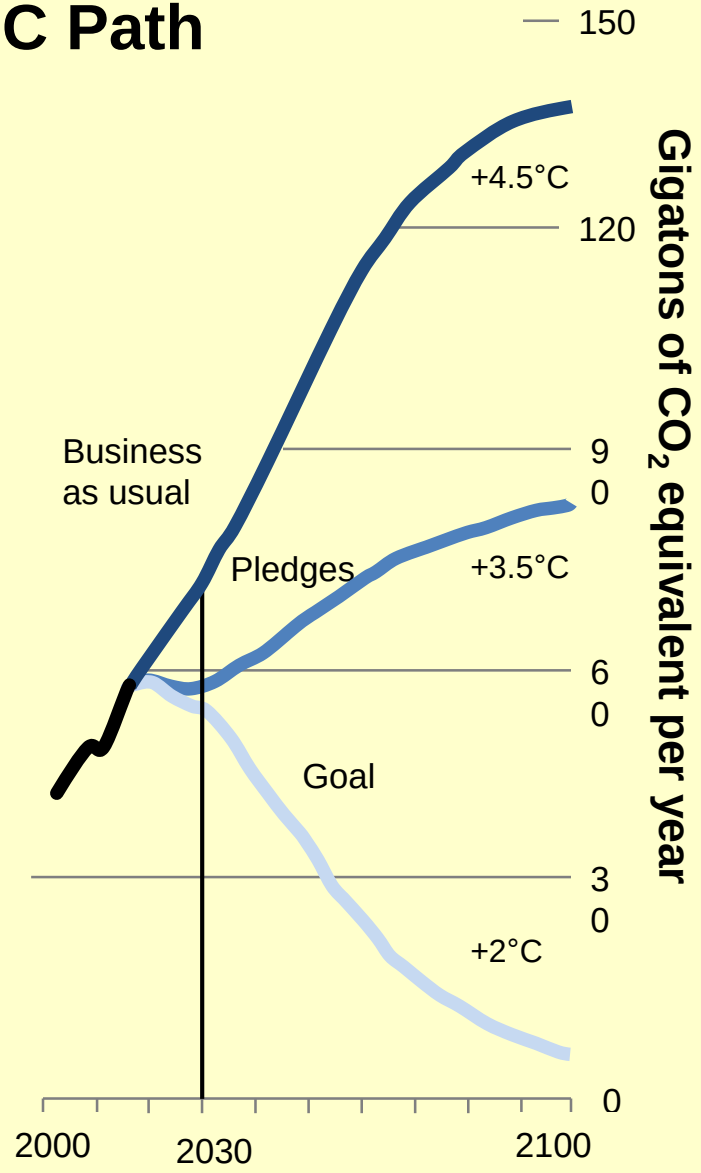
Relationship Between Level of Greenhouse Gas Stabilization and Eventual Temperature Change



Eventual Temperature change (relative to pre-industrial)

Source: Stern, 2007.
Note: CO_2e = CO_2 equivalent; ppm = parts per million.

Business as Usual, Paris Pledges and 2°C Path



Source: http://www.nytimes.com/interactive/2015/11/23/world/carbon-pledges.html?_r=1 (Last accessed June 2016). *Note:* 2°C = 3.6°F; 3.5°C = 6.3°F; 2 4.5°C = 8.1°F.

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ENVIRONMENTAL RESEARCH LETTERS
Environ. Res. Lett. **8** (2013) 024024 (7pp)
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Quantifying the consensus on anthropogenic global warming in the scientific literature

John Cook[1,2,3], Dana Nuccitelli[2,4], Sarah A Green[5], Mark Richardson[6], Bärbel Winkler[2], Rob Painting[2], Robert Way[7], Peter Jacobs[8] and Andrew Skuce[2,9]

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Online at stacks.iop.org/ERL/8/024024

Abstract
We analyze the evolution of the scientific consensus on anthropogenic global warming (AGW) in the peer-reviewed scientific literature, examining 11 944 climate abstracts from 1991–2011 matching the topics 'global climate change' or 'global warming'. We find that 66.4% of abstracts expressed no position on AGW, 32.6% endorsed AGW, 0.7% rejected AGW and 0.3% were uncertain about the cause of global warming. Among abstracts expressing a position on AGW, 97.1% endorsed the consensus position that humans are causing global warming. In a second phase of this study, we invited authors to rate their own papers. Compared to abstract ratings, a smaller percentage of self-rated papers expressed no position on AGW (35.5%). Among self-rated papers expressing a position on AGW, 97.2% endorsed the consensus. For both abstract ratings and authors' self-ratings, the percentage of endorsements among papers expressing a position on AGW marginally increased over time. Our analysis indicates that the number of papers rejecting the consensus on AGW is a vanishingly small proportion of the published research.

"The number of papers rejecting the consensus on AGW is vanishingly small"

Source: www.bbc.co.uk (last accessed October 2019)

There are naysayers …….

Environmental Research Letters

REPLY

Consensus on consensus: a synthesis of consensus estimates on human-caused global warming

John Cook[1,2,3,16], Naomi Oreskes[4], Peter T Doran[5], William R L Anderegg[6,7], Bart Verheggen[8], Ed W Maibach[9], J Stuart Carlton[10], Stephan Lewandowsky[11,12], Andrew G Skuce[12,13], Sarah A Green[13], Dana Nuccitelli[3], Peter Jacobs[9], Mark Richardson[14], Bärbel Winkler[3], Rob Painting[3] and Ken Rice[15]

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CrossMark

OPEN ACCESS

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Keywords: scientific consensus, climate change, anthropogenic global warming

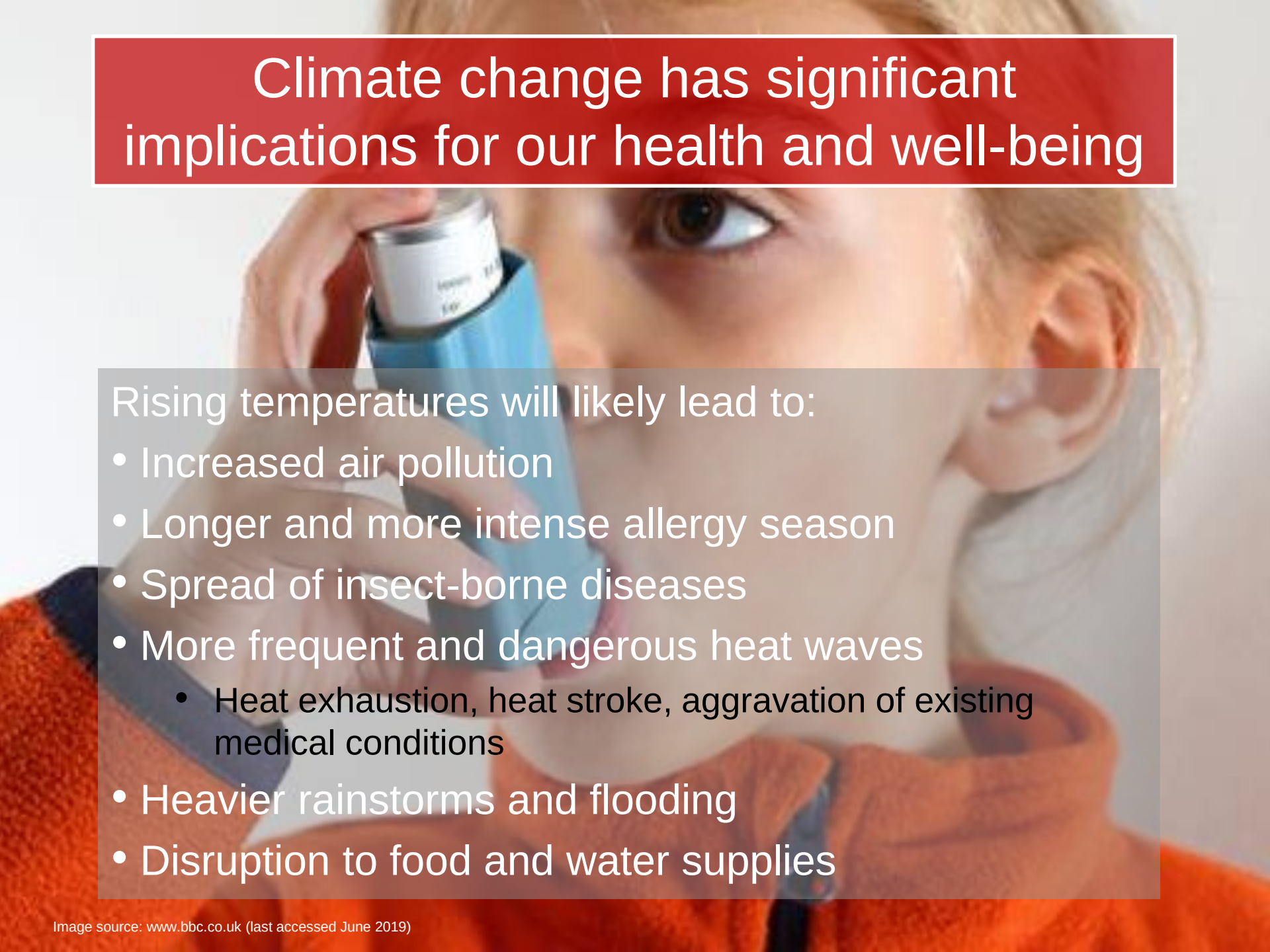
Supplementary material for this article is available online

"The finding of 97% consensus in published climate research is robust and consistent"

Abstract

The consensus that humans are causing recent global warming is shared by 90%–100% of publishing climate scientists according to six independent studies by co-authors of this paper. Those results are consistent with the 97% consensus reported by Cook *et al* (*Environ. Res. Lett.* 8 024024) based on 11 944 abstracts of research papers, of which 4014 took a position on the cause of recent global warming. A survey of authors of those papers ($N = 2412$ papers) also supported a 97% consensus. Tol (2016 *Environ. Res. Lett.* 11 048001) comes to a different conclusion using results from surveys of non-experts such as economic geologists and a self-selected group of those who reject the consensus. We demonstrate that this outcome is not unexpected because the level of consensus correlates with expertise in climate science. At one point, Tol also reduces the apparent consensus by assuming that abstracts that do not explicitly state the cause of global warming ('no position') represent non-endorsement, an approach that if applied elsewhere would reject consensus on well-established theories such as plate tectonics. We examine the available studies and conclude that the finding of 97% consensus in published climate research is robust and consistent with other surveys of climate scientists and peer-reviewed studies.

Climate change has significant implications for our health and well-being



Rising temperatures will likely lead to:

- Increased air pollution
- Longer and more intense allergy season
- Spread of insect-borne diseases
- More frequent and dangerous heat waves
  - Heat exhaustion, heat stroke, aggravation of existing medical conditions
- Heavier rainstorms and flooding
- Disruption to food and water supplies

Image source: www.bbc.co.uk (last accessed June 2019)

Source: www.un.org (last accessed September 2017)

Southampton's Plan in 2010

Southampton: low carbon city

INTERREG IVC
INNOVATION & ENVIRONMENT
REGIONS OF EUROPE SHARING SOLUTIONS

grabs
green and blue space adaptation for urban areas and eco towns

European Union

SOUTHAMPTON CITY COUNCIL ®


Southampton will thrive in a
economy. We will
business and exem
We will be a
future which is
ing.
anged
and safer.
It hasn't happened!
Why not?

If so, big lifestyle changes are the only answer ….

Source: www.bbc.co.uk (last accessed October 2019)

WE MUST MOVE FAST! AN EXAMPLE:

- Home heating - biggest challenge in terms of reducing UK emissions
- Accounts for average 21% of a household's carbon footprint
- UK - 30 million homes and 30 years to decarbonise

Chris Stark (UK Committee on Climate Change):

“Simple arithmetic suggests we need to decarbonise one million homes every year, starting now”

What can business do immediately?

CARBON

- Get staff buy-in, especially from senior management
- Measure, monitor and reduce your carbon footprint
- Switch grid electricity to renewable energy providers
- Encourage and facilitate active transport
  - Walking, cycling by staff/students
  - Reduce aviation emissions; encourage public transport
- Support virtual business meeting attendance
- Consume less – encourage reuse; sustainable procurement
- Support climate-smart policies and strategies
- Be a role model: take a lead and make a difference

What can business do immediately?

WATER & WASTE

- Get staff buy-in, especially from senior management
- Measure, monitor and reduce your water/waste footprints
- Consume less - use kitchens and washrooms better
- Encourage and facilitate prevention, avoidance, reuse and recycling – especially of food waste
- Regular maintenance regime - check for leaks and proper waste management
- Support circular economy policies and strategies
- Be a role model: take a lead and make a difference

What can business do in 3-6 months?

CARBON

- Incentivise active transport
- Incentivise virtual conference attendance & external examining
- Insulate buildings
- Refurbish rather than rebuild
- Write and adhere to climate-smart policies and strategies
- Be a role model: incentivise suppliers, partners and customers
- Make the business sustainable (do you really need that overseas visit?)
- Produce a sustainability report and put it on your website

What can business do in 3-6 months?

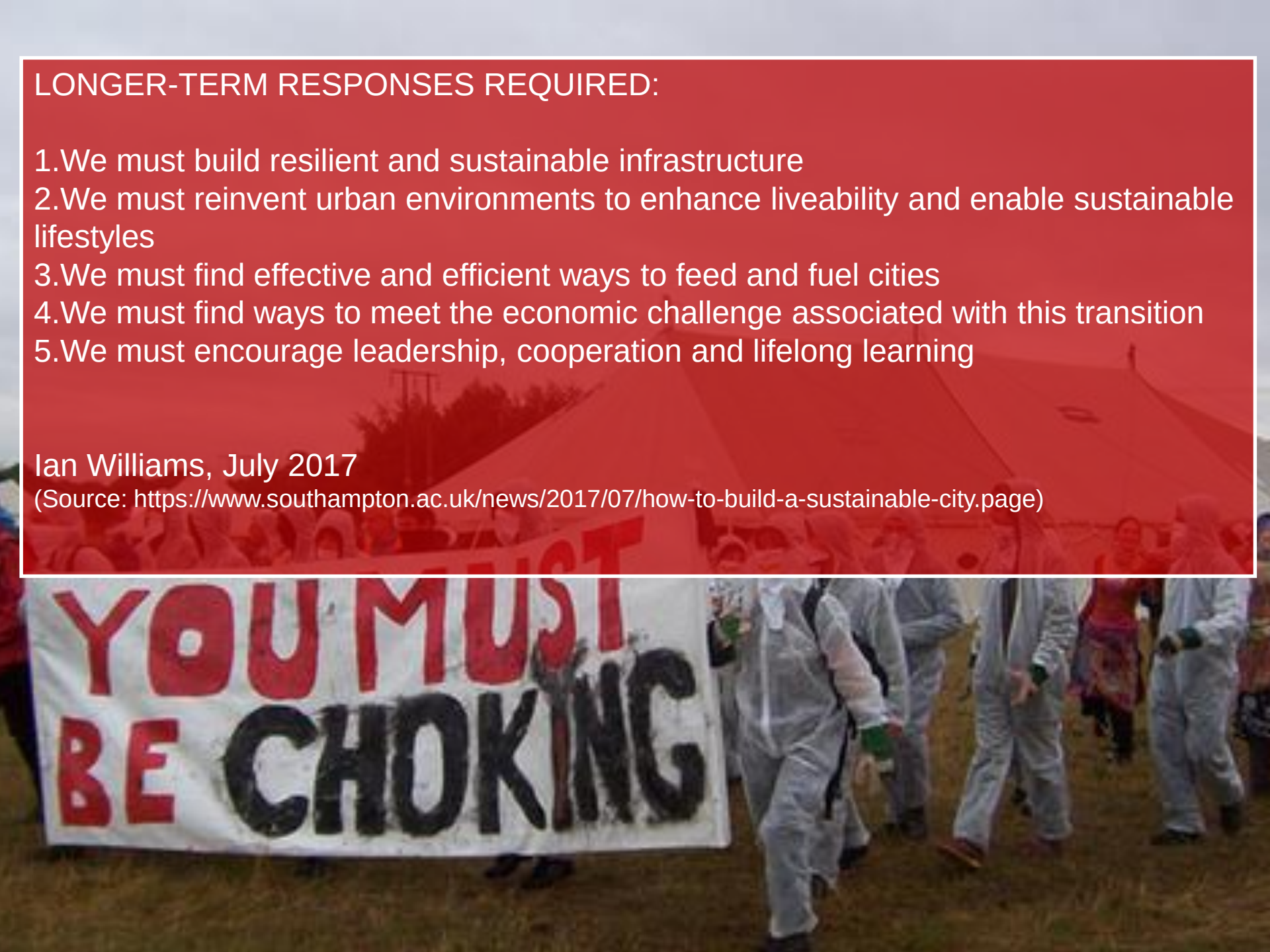
WATER & WASTE

- Install rainwater tanks where possible
- Install waterless urinals, low-flush toilets, sensor taps
- Install water meters and flow restrictors where possible
- Encourage and facilitate prevention, avoidance, reuse and recycling
- Regular maintenance regime - check for leaks and proper waste management
- Support circular economy policies and strategies
- Be a role model: incentivise suppliers, partners and customers
- Produce a sustainability report and put it on your website

LONGER-TERM RESPONSES REQUIRED:

1.We must build resilient and sustainable infrastructure
2.We must reinvent urban environments to enhance liveability and enable sustainable lifestyles
3.We must find effective and efficient ways to feed and fuel cities
4.We must find ways to meet the economic challenge associated with this transition
5.We must encourage leadership, cooperation and lifelong learning

Ian Williams, July 2017
(Source: https://www.southampton.ac.uk/news/2017/07/how-to-build-a-sustainable-city.page)



Source: www.bbc.co.uk (last accessed October 2019)

<u>May 2019:</u>

Heathrow campaigners lose challenge against third runway.

Court of Appeal Challenge starts 21 October.

Is government serious in pledge to become zero carbon economy?

Source: www.bbc.co.uk (last accessed October 2019)

October 2019:

Four new gas-fired turbines at Drax power station approved by UK government – against a ruling from its Planning Inspectorate.

Is government serious in pledge to become zero carbon economy?

Ah – so UK government is backing words with actions .. (not!)

Southampton's Plan in 2019

GREENCITY
SOUTHAMPTON

Green City Charter for Southampton

Making Southampton a cleaner, greener, healthier and more sustainable city.

The evidence shows that this really is an emergency.

The Climate Emergency: Scientific evidence and response required by business

Sustainable Business Network Autumn Meeting, 19 October 2019

Ian Williams
Professor of Applied Environmental Science
Associate Dean (Enterprise)
Faculty of Engineering and Physical Sciences,
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Be scientifically realistic.
Demand the politically impossible.
George Monbiot, October 2019