

Supertrends sources

This is the source list for the book *Supertrends*, of which Danish and English versions are published in 2019. I put these sources online instead of at the end of the book; partly so that I can add to it from time to time, but mainly to make it much easier for a reader to jump straight to the sources online for further examination or perhaps book ordering, etc.

Chapter 1: Feeler, Thinker, Hedgehog, Fox – On Predictions

Robert Prechter

<https://www.zerohedge.com/article/robert-prechters-glimpse-apocalypse-come>

<https://www.businessinsider.com.au/bob-prechter-forecasts-2011-2>

<https://www.cxoadvisory.com/individual-gurus/robert-prechter/>

<https://www.businessinsider.com/robert-prechter-were-on-the-verge-of-the-biggest-bear-market-in-300-years-2010-9?r=US&IR=T>

Myers-Brigg

<https://www.myersbriggs.org/my-mbti-personality-type/mbti-basics/thinking-or-feeling.htm?bhcp=1>

Paul R. Ehrlich

Simon, J.: Paul Ehrlich Saying It Is So Doesn't Make It so, *Social Science Quarterly*, Vol. 63, No. 2, June, 1982.

https://www.jstor.org/stable/42861021?seq=1#page_scan_tab_contents

Ehrlich, P.: *The Population Bomb*, Buccaneer Books, 1995

https://www.amazon.com/population-bomb-Paul-R-Ehrlich/dp/0345021711/ref=sr_1_1?keywords=The+Population+Bomb&qid=1566552212&s=gateway&sr=8-1

Ehrlich, P.: *The End of Affluence: A Blueprint for Your Future*, Amereon Ltd; Later Printing edition (February 1, 1976)

https://www.amazon.com/End-Affluence-Paul-R-Ehrlich/dp/0345290496/ref=sr_1_1?keywords=The+End+of+Affluence&qid=1566552254&s=gateway&sr=8-1

https://en.wikipedia.org/wiki/Paul_R._Ehrlich

The Seekers

Festinger, L. & ; H. W. Riecken & S. Schachter: *When Prophecy Fails: A Social and Psychological Study of a Modern Group that Predicted the Destruction of the World*. University of Minnesota Press, 1956

https://www.amazon.com/When-Prophecy-Fails-Leon-Festinger/dp/1578988527/ref=sr_1_1?keywords=When+Prophecy+Fails&qid=1566552284&s=gateway&sr=8-1

Pargament, K.: *The Psychology of Religion and Coping: Theory, Research, Practice*. Guilford Press, 1997

https://www.amazon.com/Psychology-Religion-Coping-Research-Practice/dp/1572306645/ref=sr_1_1?keywords=The+Psychology+of+Religion+and+Coping&qid=1566552314&s=gateway&sr=8-1

Hedgehogs and foxes

Berlin, i: *The Hedgehog and the Fox: An Essay on Tolstoy's View of History*, Weidenfeld & Nicolson, 1953

https://www.amazon.com/Hedgehog-Fox-Tolstoys-History-Second/dp/069115600X/ref=sr_1_1?keywords=The+Hedgehog+and+the+Fox&qid=1566552351&s=gateway&sr=8-1

Theodore Roosevelt conference

[http://voicesofdemocracy.umd.edu/theodore-roosevelt-conservation-as-a-national-duty-speech-text/.](http://voicesofdemocracy.umd.edu/theodore-roosevelt-conservation-as-a-national-duty-speech-text/)

<https://archive.org/details/proceedingsofcon00conf/page/n17>

<http://www.ebooksread.com/authors-eng/dc-conference-on-conservation-of-natural-resources-1/proceedings-of-a-conference-of-governors-in-the-white-house-washington-d-c--fno/page-3-proceedings-of-a-conference-of-governors-in-the-white-house-washington-d-c--fno.shtml>

<http://voicesofdemocracy.umd.edu/theodore-roosevelt-conservation-as-a-national-duty-speech-text/>

<https://www.nytimes.com/1908/05/14/archives/governors-cheer-roosevelts-talk-he-tells-them-conservation-of-all.html>

George Wald

<http://www.elijahwald.com/generation.html>

Flying machines

<https://www.nytimes.com/1903/10/09/archives/flying-machines-which-do-not-fly.html?mtrref=www.google.com&gwh=99E30A898313C14B2B04217941AFCC58&gwt=pay>

<http://www.garfield.library.upenn.edu/essays/v3p167y1977-78.pdf>

<http://www.garfield.library.upenn.edu/essays/v3p167y1977-78.pdf>

Maxwell, J. C.: *Failing Forward: Turning Mistakes Into Stepping Stones for Success*, Thomas Nelson Publishers, 2007

<https://www.amazon.com/Failing-Forward-Turning-Mistakes-Stepping/dp/0785288570>

Simon Newcomb also wrote in his book "Side-lights on Astronomy and Kindred Fields of Popular Science. "...The demonstration that no possible combination of known substances, known forms of machinery and known forms of force, can be united in a practical machine by which man shall fly long distances through the air, seems to the writer as complete as it is possible for the demonstration of any physical fact to be."

[https://www.amazon.com/Side-lights-Astronomy-Kindred-Fields-Popular/dp/1406852236/ref=sr_1_3?keywords=sidelights+on+astronomy&qid=1566553112&s=books&sr=1-3:](https://www.amazon.com/Side-lights-Astronomy-Kindred-Fields-Popular/dp/1406852236/ref=sr_1_3?keywords=sidelights+on+astronomy&qid=1566553112&s=books&sr=1-3)

<https://archive.org/details/sidelightsonastr00newcrich/page/344>

https://invention.psychology.msstate.edu/library/Magazines/Airship_Coming.html

Clarke, A. C: *Profiles of the Future* ,Orion Pub, 2000

https://www.amazon.com/Profiles-Future-Inquiry-Limits-Possible/dp/0575402776/ref=sr_1_1?keywords=Profiles+of+the+Future&qid=1566553421&s=books&sr=1-1

In 1888 Simon Newcomb wrote: "We are probably nearing the limit of all we can know about astronomy." However, when he wrote "Side-lights on Astronomy and Kindred Fields of Popular Science, he had totally changed his mind: "What lies before us is an illimitable field, the existence of which was scarcely suspected ten years ago, the exploration of which may well absorb the activities of our physical laboratories, and of the great mass of our astronomical observers and investigators for as many generations as were required to bring electrical science to its present state."

https://books.google.ch/books?id=NYqYAwAAQBAJ&pg=PA15&lpg=PA15&dq=1888+Simon+Newcomb+wrote:+%22We+are+probably+nearing+the+limit+of+all+we+can+know+about+astronomy.%22&source=bl&ots=H4CDV06pk2&sig=ACfU3U0gPfh2N81HMsW_w2XHhZSdLuLiHQ&hl=en&sa=X&ved=2ahUKEwigvqe72pjKAhWh16YKHeXJBdoQ6AEwBnoECAgQAQ#v=onepage&q=1888%20Simon%20Newcomb%20wrote%3A%20%22We%20are%20probably%20nearing%20the%20limit%20of%20all%20we%20can%20know%20about%20astronomy.%22&f=false

Long term human innovation trends

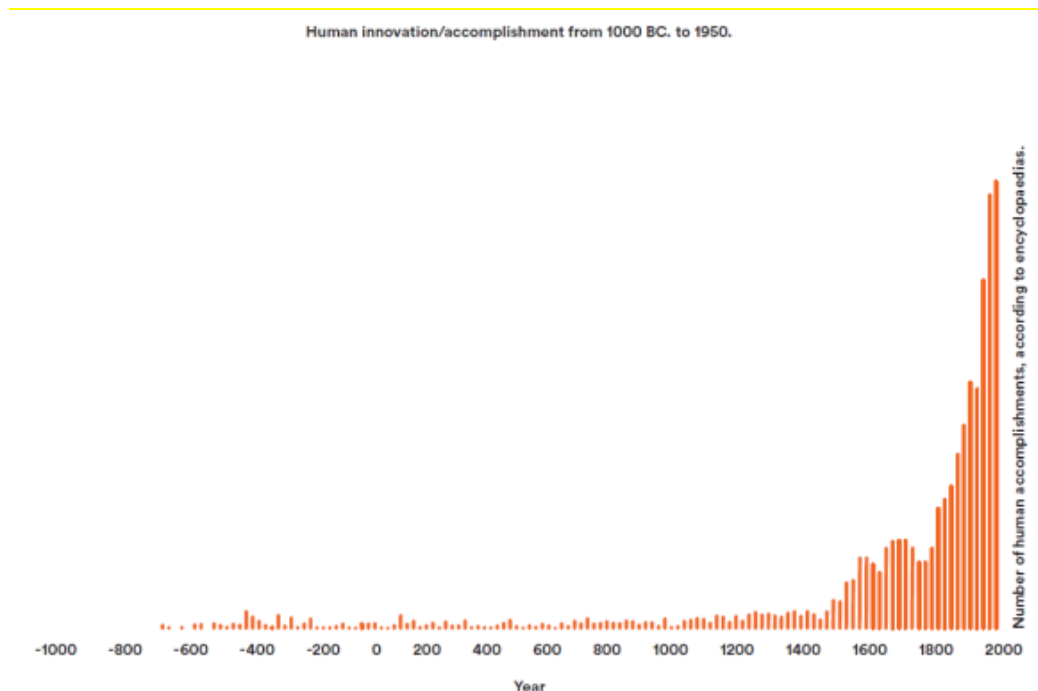


Illustration: Human innovation over 2,850 years

Sources to this illustration are Murray, C.: *Human Accomplishment: The Pursuit of Excellence in the Arts and Sciences, 800 B.C. to 1950* and my own Tvede, L.: *The Creative Society*, 2016. Murray was so kind to send me his research data in Excel so I could present them graphically.

Murray, C.: *Human Accomplishment: The Pursuit of Excellence in the Arts and Sciences, 800 B.C. to 1950*, HarperCollins Publishers, 2003

<https://www.amazon.com/Human-Accomplishment-Pursuit-Excellence-Sciences/dp/0060929642>

Tvede, L.: *The Creative Society*, Lid Publishing, 2015

https://www.amazon.com/Creative-Society-How-Future-Can/dp/1910649724/ref=sr_1_1?keywords=The+Creative+Society&qid=1566553872&s=books&sr=1-1

Gay, P.: *The Enlightenment: The Science of Freedom*, W. W. Norton & Company, 1996

<https://www.amazon.com/Enlightenment-Science-Freedom-Vol-Interpretation/dp/0393313662>

Exponential technologies and Ziman's Law

Ziman, J.M.: *The Force of Knowledge: The Scientific Dimension of Society*, Cambridge University Press, 1976

<https://www.amazon.com/Force-Knowledge-Scientific-Dimension-Society/dp/0521780306>

Kurzweil, R.: *The Singularity Is Near: When Humans Transcend Biology*, Viking Adult, 2005

https://www.amazon.com/Singularity-Near-Humans-Transcend-Biology/dp/0143037889/ref=sr_1_1?keywords=%E2%80%A2The+Singularity+Is+Near%3A+When+Humans+Transcend+Biology&qid=1566567758&s=books&sr=1-1

Brock, D.: *Understanding Moore's Law: Four Decades of Innovation*, Chemical Heritage Foundation, 2006

https://www.amazon.com/Understanding-Moores-Law-Decades-Innovation/dp/0941901416/ref=sr_1_1?keywords=Understanding+Moore%27s+Law%3A+Four+Decades+of+Innovation&qid=1566750468&s=books&sr=1-1

<https://kk.org/thetechnium/was-moores-law/#targetText=But%20while%20Moore's%20Law%20is,the%20Law%20rests%20on%20economics.>

The Human Genome Project

Venter, C.: *A Life Decoded: My Genome: My Life*, Penguin Books; 2008

https://www.amazon.com/Life-Decoded-My-Genome/dp/0143114182/ref=sr_1_1?keywords=My+Genome%3A+My+Life&qid=1566554019&s=books&sr=1-1

Venter, C.: *Life at the Speed of Light: From the Double Helix to the Dawn of Digital Life*, Abacus, 2014

https://www.amazon.com/Life-Speed-Light-Double-Digital/dp/0143125907/ref=sr_1_1?keywords=Life+at+the+Speed+of+Light%3A+From+the+Double+Helix+to+the+Dawn+of+Digital+Life&qid=1566554049&s=books&sr=1-1

Shreeve, J.: *The Genome War: How Craig Venter Tried to Capture the Code of Life and Save the World*, Ballantine Books; Reprint edition, 2005.

https://www.amazon.com/Genome-War-Craig-Venter-Capture/dp/0345433742/ref=sr_1_1?keywords=The+Genome+War%3A+How+Craig+Venter+Tried+to+Capture+the+Code+of+Life+and+Save+the+World&qid=1566554079&s=books&sr=1-1

<http://longnow.org/seminars/02005/sep/23/kurzweils-law/>

<http://www.russellsteinberg.com/blog/2014/11/27/ray-kurzweil-and-exponential-growth>

Stone age development

http://stoneageskills.com/articles/pdf/Human_technology_timeline.pdf

http://en.wikipedia.org/wiki/Timeline_of_human_prehistory

Wade, N.: *Before the Dawn, Recovering the Lost History of our Ancestors*, Penguin Books, 2006

https://www.amazon.com/Before-Dawn-Recovering-History-Ancestors-ebook/dp/B000PDYVRA/ref=sr_1_1?keywords=Before+the+Dawn%2C+Recovering+the+Lost+History+of+our+Ancestors&qid=1566558810&s=digital-text&sr=1-1

AlphaZero versus StockFish 8

<https://en.chessbase.com/portals/all/2018/10/AlphaZero-PDR/AlphaZero-en.pdf>

Carlson Curve

<https://www.economist.com/special-report/2006/08/31/life-20>

Innovation is infinite

Deutch, D.: *The Beginning of Infinity: Explanations that Transform The World*, Penguin, 2012

https://www.amazon.com/Beginning-Infinity-Explanations-Transform-World/dp/0143121359/ref=sr_1_1?keywords=The+Beginning+of+Infinity%3A+Explanations+that+Transform+The+World&qid=1566767128&s=gateway&sr=8-1

Amaras law

<https://spotlessdata.com/blog/amaras-law>

Searls, D.: *The Intention Economy: When Customers Take Charge*. Harvard Business Press, 2012

<https://www.oxfordreference.com/view/10.1093/acref/9780191826719.001.0001/q-oro-ed4-00018679>

The Flynn effect

Flynn, J.R.: *Are We Getting Smarter?: Rising IQ in the Twenty-First Century*, Cambridge University Press, 2012

<https://www.amazon.com/Are-We-Getting-Smarter-Twenty-First/dp/1107609178>

<https://www.semanticscholar.org/paper/The-secular-rise-in-IQ%3A-Giving-heterosis-a-closer-Mingroni/62b812ff9744e9c04a8edc6adc98234cbe33d3d9>

<https://www.sciencedirect.com/science/article/abs/pii/S0160289615000082>

<https://www.ncbi.nlm.nih.gov/pubmed/12394524>

The world's a much better place than people think

Rosling, H.: *Factfulness: Ten Reasons We're Wrong About the World--and Why Things Are Better Than You Think*, Flatiron Books, 2018

https://www.amazon.com/Factfulness-Reasons-World-Things-Better/dp/1250107814/ref=sr_1_1?keywords=Factfulness%3A+Ten+Reasons+We%27re+Wrong+About+the+World--and+Why+Things+Are+Better+Than+You+Think&qid=1566554268&s=books&sr=1-1

Ridley, M.: *The Rational Optimist*, Harper Perennial, 2011

<https://www.amazon.com/Rational-Optimist-Prosperity-Evolves-P-s/dp/0061452068>

Diamandis, P. H. & S. Kotler: *The Future Is Better Than You Think*, Free Press, 2012

https://www.amazon.com/Abundance-Future-Better-Than-Think/dp/145161683X/ref=sr_1_1?keywords=The+Future+Is+Better+Than+You+Think&qid=1566554331&s=books&sr=1-1

Lomborg, Bjørn: *The Skeptical Environmentalist: Measuring the Real State of the World*, Cambridge University Press, 2001

https://www.amazon.com/Skeptical-Environmentalist-Measuring-State-World/dp/0521010683/ref=sr_1_1?keywords=The+Skeptical+Environmentalist&qid=1566567826&s=books&sr=1-1

Irrational fearmongering

Meadows, D. H.: *Limits to Growth*, Signal, 1972

https://www.amazon.com/Limits-Growth-Project-Predicament-Mankind/dp/0876639015/ref=sr_1_3?keywords=Limits+to+Growth&qid=1566749475&s=books&sr=1-3

Booker, C. & R. North: *Scared to Death, From BSE to Global Warming: Why Scares are Costing Us the Earth*, Continuum, 2007

https://www.amazon.com/Scared-Death-Global-Warming-Costing/dp/0826476201/ref=sr_1_1?keywords=Scared+to+Death%2C+From+BSE+to+Global+Warming%3A+Why+Scares+are+Costing+Us+the+Earth&qid=1566554361&s=books&sr=1-1

Mackay, C. : *Memoirs of Extraordinary Popular Delusions*, CreateSpace Independent Publishing Platform, 2016

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A. Herman: *The Idea of Decline in Western History*, Free Press, 2007.

https://www.amazon.com/Idea-Decline-Western-History/dp/1416576339/ref=sr_1_1?keywords=The+Idea+of+Decline+in+Western+History&qid=1566567484&s=books&sr=1-1

E: Walter, *The Immorality of Limiting Growth*, State University of New York Press, 1981

https://www.amazon.com/Immorality-Limiting-Growth-Edward-Walter/dp/0873954793/ref=sr_1_1?keywords=The+Immorality+of+Limiting+Growth+Edward+Walter&qid=1566752574&s=gateway&sr=8-1

Moore's Law

D. Franklin.: *Megatech*, The Economist, 2017

https://www.amazon.com/Megatech-Technology-2050-Economist/dp/1610398254/ref=sr_1_1?keywords=Megatech&qid=1566554879&s=books&sr=1-1

The creative design field

Deutsch, D.: *The Beginning of Infinity: Explanations That Transform the World*, Penguin Books, 2012

https://www.amazon.com/Beginning-Infinity-Explanations-Transform-World/dp/0143121359/ref=sr_1_1?keywords=The+Beginning+of+Infinity&qid=1566545850&s=books&sr=1-1

Easterly, W.: *The Elusive Quest for Growth, Economists` Adventures and Misadventures in the Tropics*, First M.I.T. Press, 2002

https://www.amazon.com/Elusive-Quest-Growth-Economists-Misadventures/dp/0262550423/ref=sr_1_1?keywords=The+Elusive+Quest+for+Growth&qid=1566748577&s=books&sr=1-1

Chapter 2: Demography and Prosperity

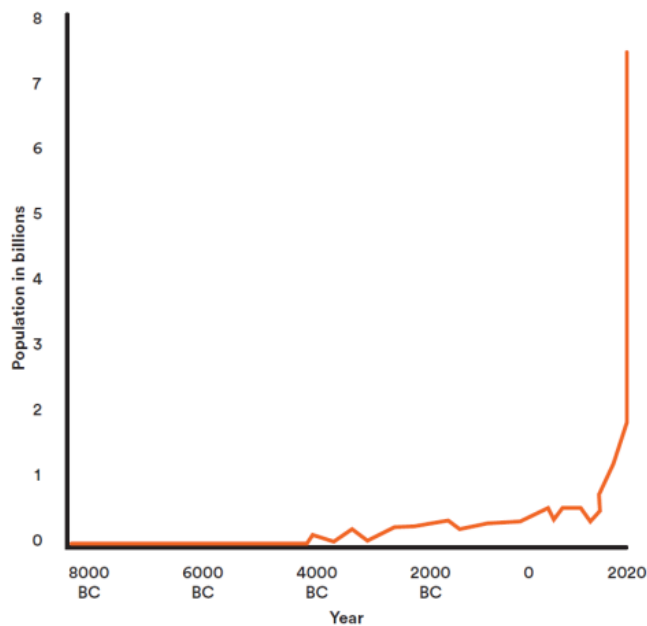


ILLUSTRATION: THE WORLD'S LONG-TERM POPULATION GROWTH

The data are shown in OurWorldinData.org and taken from History Database i Global Environment (HYDE) & United Nations. The dent around the middle of the 14th century is due to the plague, which killed an estimated 75 to 200 million people in Eurasia and peaking in Europe from 1347 to 1351.

<https://ourworldindata.org/uploads/2018/11/Annual-World-Population-since-10-thousand-BCE-for-OWID.png>

<https://ourworldindata.org/future-population-growth>

https://en.wikipedia.org/wiki/World_population_estimates

<https://www.quora.com/Is-the-present-day-human-population-growth-following-a-J-shaped-curve-or-S-shaped-curve>

<http://www.fullertreacymoney.com/system/data/images/archive/2011-05-17/population.pdf>

<http://globalpublicsquare.blogs.cnn.com/2011/10/31/the-end-of-population-growth/>

Stages of western civilization

Tvede, L.: *The Creative Society*, Lid Publishing, 2015

https://www.amazon.com/Creative-Society-How-Future-Can/dp/1910649724/ref=sr_1_1?keywords=The+Creative+Society&qid=1566554912&s=books&sr=1-1

Why did the West take the lead?

Tvede, L.: *The Creative Society*, Lid Publishing, 2015

https://www.amazon.com/Creative-Society-How-Future-Can/dp/1910649724/ref=sr_1_1?keywords=The+Creative+Society&qid=1566554912&s=books&sr=1-1

Kennedy, P.: *The Rise and Fall of Great Powers*, Random House, 1987

<https://www.amazon.com/Rise-Fall-Great-Powers-ebook/dp/B004774792>

Ferguson, N.: *Civilization, The West and the Rest*, Penguin Books, 2011

<https://www.amazon.com/Civilization-West-Rest-Niall-Ferguson/dp/0143122061>

[https://www.researchgate.net/publication/46544350_Charting_the_Rise_of_the_West Manuscripts and Printed Books in Europe A Long-Term Perspective from the Sixth through Eighteenth Centuries](https://www.researchgate.net/publication/46544350_Charting_the_Rise_of_the_West Manuscripts_and_Printed_Books_in_Europe_A_Long-Term_Perspective_from_the_Sixth_through_Eighteenth_Centuries)

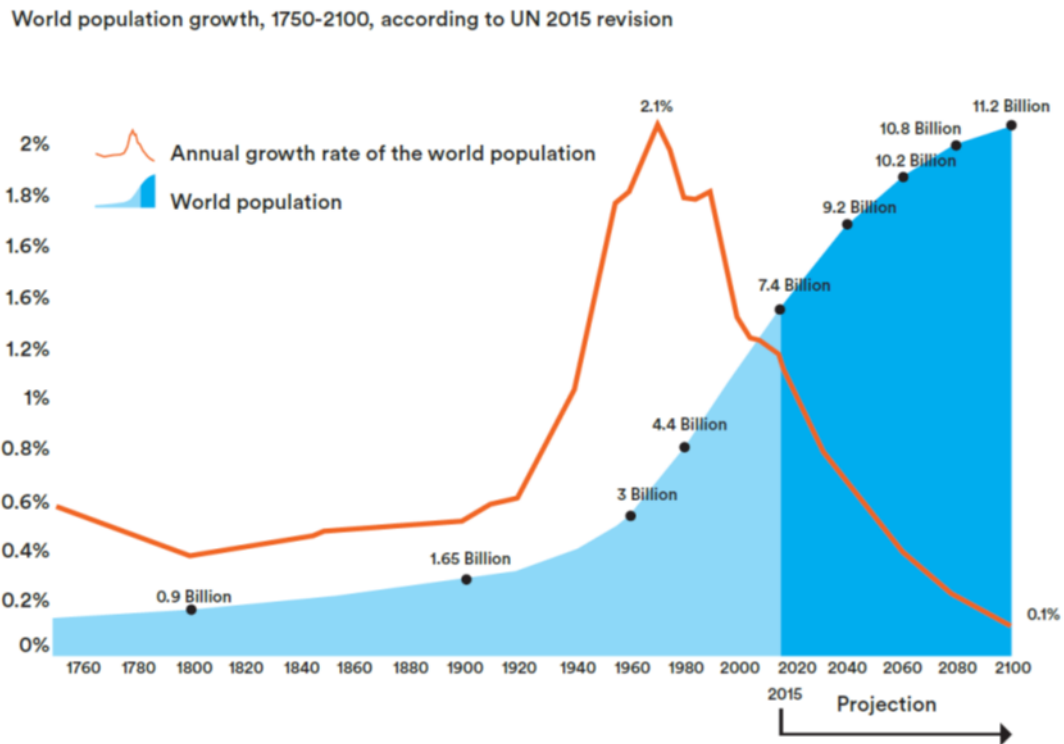
Huff, T.E.: *The Rise of Early Modern Science: Islam, China, and the West*, Cambridge University Press, 1993

https://www.amazon.com/Rise-Early-Modern-Science-Islam/dp/1107571073/ref=sr_1_1?keywords=The+Rise+of+Early+Modern+Science%3A+Islam%2C+China%2C+and+the+West&qid=1566558238&s=books&sr=1-1

Fromkin, D.: *The Way of the World: From the Dawn of Civilizations to the Eve of the Twenty-first Century*, Vintage, 2000

https://www.amazon.com/Way-World-Civilizations-Twenty-first-Century/dp/0679766693/ref=sr_1_1?keywords=The+Way+of+the+World%3A+From+the+Dawn+of+Civilizations+to+the+Eve+of+the+Twenty-first+Century&qid=1566557687&s=books&sr=1-1

Population peak and peak child



[ILLUSTRATION: LONG-TERM POPULATION GROWTH AND POPULATION SIZE, 1750-2100](#)

The illustration appears in OurWorldinData.org: <https://ourworldindata.org/uploads/2019/06/2019-Revision-%E2%80%93-World-Population-Growth-1700-2100.png>

Kako, M.: *Physics of the Future: How Science Will Shape Human Destiny and Our Daily Lives by the Year 2100*, Anchor, 2012

https://www.amazon.com/Physics-Future-Science-Shape-Destiny/dp/0307473333/ref=sr_1_1?keywords=The+Physics+of+the+Future&qid=1566559867&s=b&sr=1-1

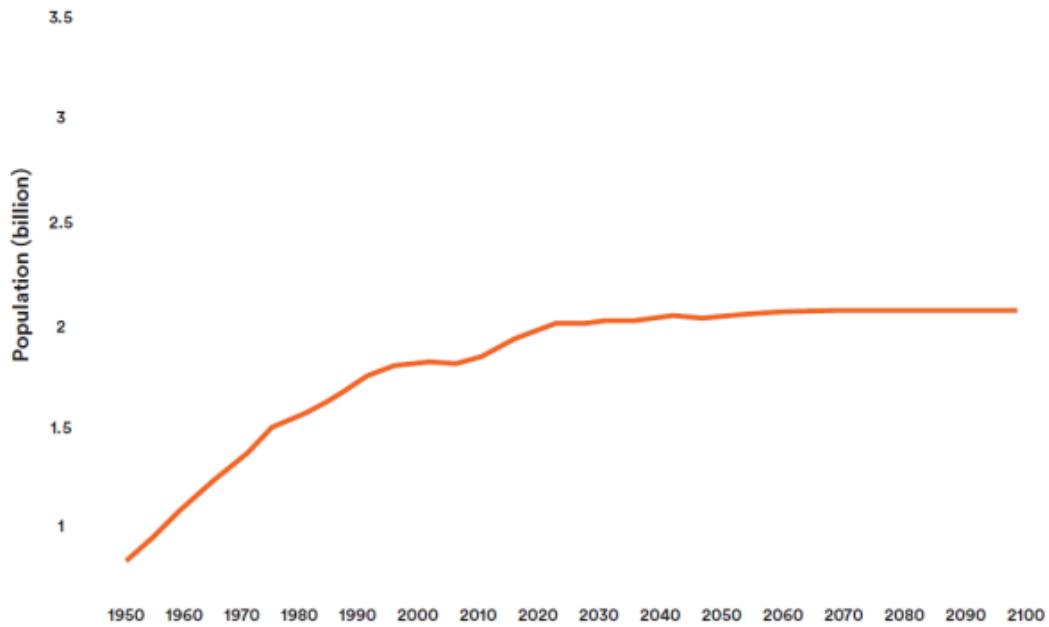


ILLUSTRATION: THE GLOBAL POPULATION OF YOUNG PEOPLE UP TO 14 YEARS

Source: World Population Prospects, United Nations, Department of Economic and Social Affairs, Population Division, 2017 revision. The graph only shows the median estimate.

https://population.un.org/wpp/Publications/Files/WPP2019_DataBooklet.pdf

https://population.un.org/wpp/Publications/Files/WPP2017_DataBooklet.pdf

Illustration: Global Population growth by region.

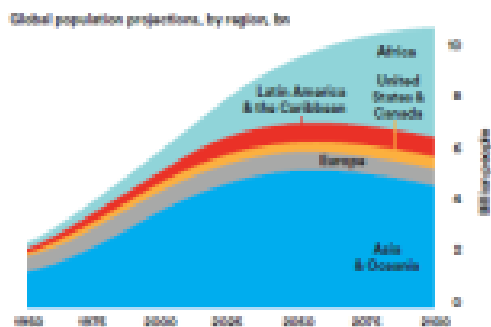


ILLUSTRATION: WORLD POPULATION GROWTH BY REGION PROJECTED TO 2100

The sources are HYDE (2016) & UN, WPP (2019). However, the graph can also be found on Ourworldindata.org:

<https://ourworldindata.org/world-population-growth>

Global fertility

The world population grew 20% from 1970 to 1980, then 19% until 1990, 15% from 1990 to 2000 and 14% from 2000 to 2010. The UN expects it to grow 11%, 8%, 6%, and 4% respectively over the following decades and we may go below replacement fertility between 2020 and 2025 or at least before 2030, which would signal a coming population decline.

In 2011, Sanjeev Sanyal from Deutsche Bank published an analysis which included calculations based on the same statistics, the UN used, but with very different conclusions: His argument was based on the total birth rate. For various reasons, this has to be a little over two children per woman to ensure a stable population, but in the 1950s, for example, it was 6.1 in China and 5.9 in India. This figure, however, had, in 2012, decreased to 1.8 in China and 2.6 in India. Furthermore, there were around 119 boys born for every 100 girls in China, and in India the ratio was 110:100. If you adjust for this, Sanyal pointed out, effective birth rates were just 1.5 in China and 2.4 in India. This meant China faced a rapid population decline and India had already come very close to a level that would provide stabilization.

<http://globalpublicsquare.blogs.cnn.com/2011/10/31/the-end-of-population-growth/>

<https://www.un.org/en/development/desa/population/publications/fertility/fertility-transition.asp>

Bricker, D. & J. Ibbitson: *Empty Planet: The Shock of Global Population Decline*, Crown, 2019

https://www.amazon.com/Empty-Planet-Global-Population-Decline/dp/1984823213/ref=sr_1_1?keywords=Empty+Planet&qid=1566571854&s=books&sr=1-1

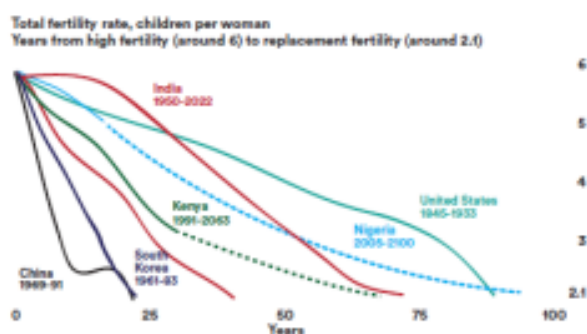


ILLUSTRATION: TOTAL FERTILITY RATES FOR SELECTED COUNTRIES; RECORDED AND PREDICTED BY THE UN IN THEIR 2019 REVISION

https://population.un.org/wpp/Publications/Files/WPP2019_DataBooklet.pdf

Continued wealth growth

<https://www.accenture.com/sk-en/insight-artificial-intelligence-future-growth>

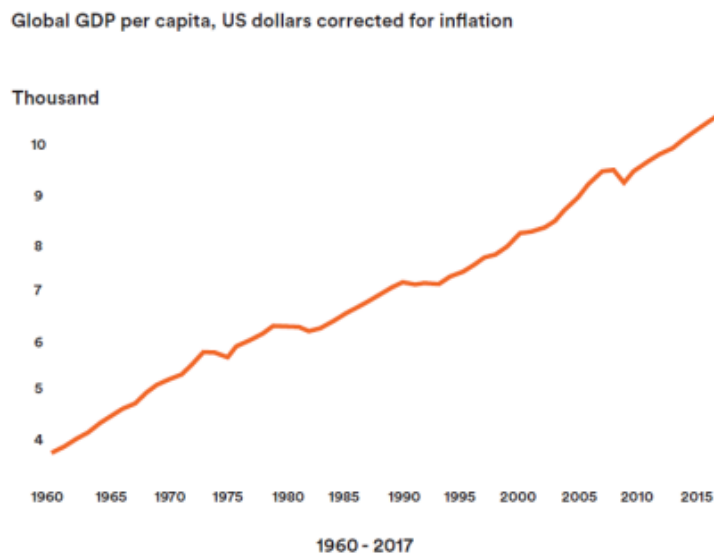


ILLUSTRATION: GLOBAL GDP PER CAPITA. THE SOURCE IS WORLD BANK: GDP PER CAPITA (CONSTANT 2010 US\$),

<https://data.worldbank.org/indicator/NY.GDP.PCAP.KD>

Urbanisation/depopulation of rural areas

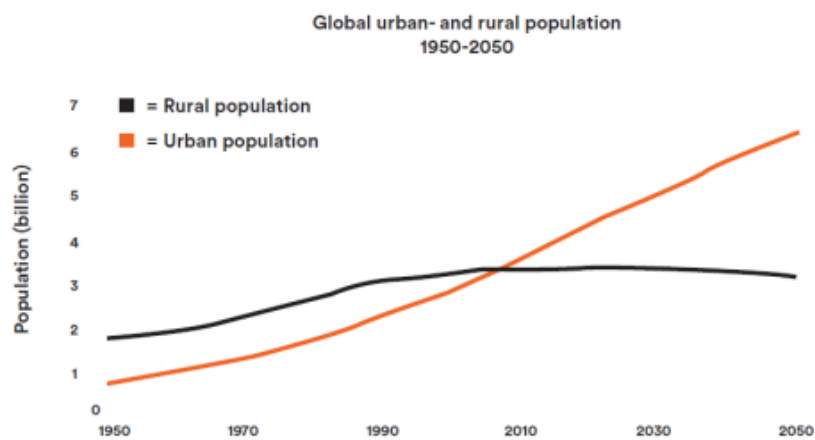


ILLUSTRATION: THE GLOBAL URBAN AND RURAL POPULATION

Source: Department of Economic and Social Affairs. World Urbanization prospects: the 2018 revision, United Nations; 2018.

[https://www.un.org/development/desa/publications/2018-revision-of-world-urbanization-prospects.html#targetText=The%20urban%20population%20of%20the,to%204.2%20billion%20in%202018.&targetText=Today%2C%20the%20most%20urbanized%20regions,%25\)%20and%20Oceania%20\(68%25\).](https://www.un.org/development/desa/publications/2018-revision-of-world-urbanization-prospects.html#targetText=The%20urban%20population%20of%20the,to%204.2%20billion%20in%202018.&targetText=Today%2C%20the%20most%20urbanized%20regions,%25)%20and%20Oceania%20(68%25).)

Global aging

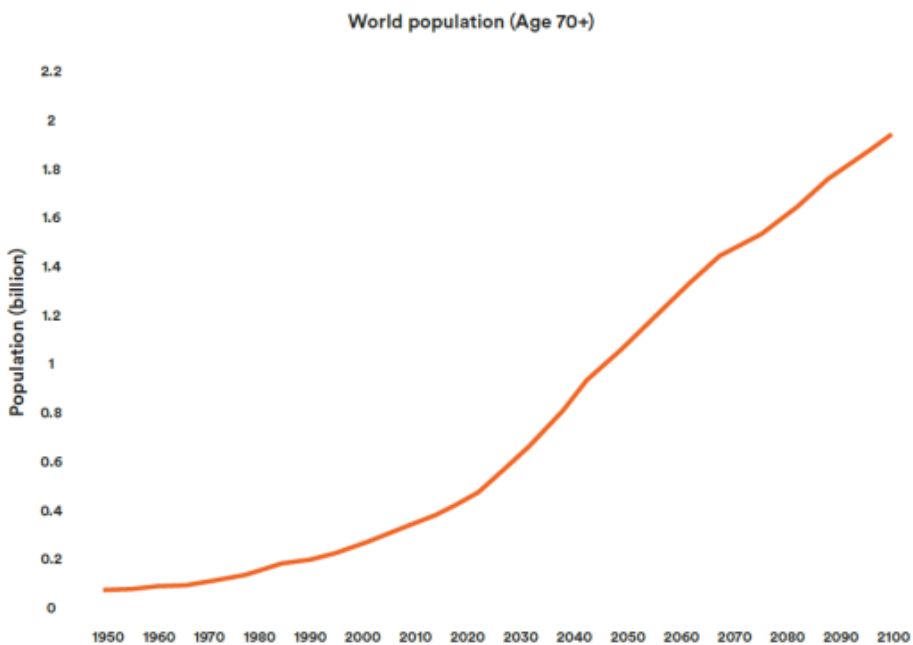


ILLUSTRATION: THE GLOBAL POPULATION OF ELDERLY 70+.

Source: World Population Prospects, United Nations, Department of Population and Social Affairs, 2017 revision:

<https://www.un.org/development/desa/publications/world-population-prospects-the-2017-revision.html#targetText=World%20Population%20Prospects%3A%20The%202017%20Revision&targetText=The%20current%20world%20population%20of,Nations%20report%20being%20launched%20today.>

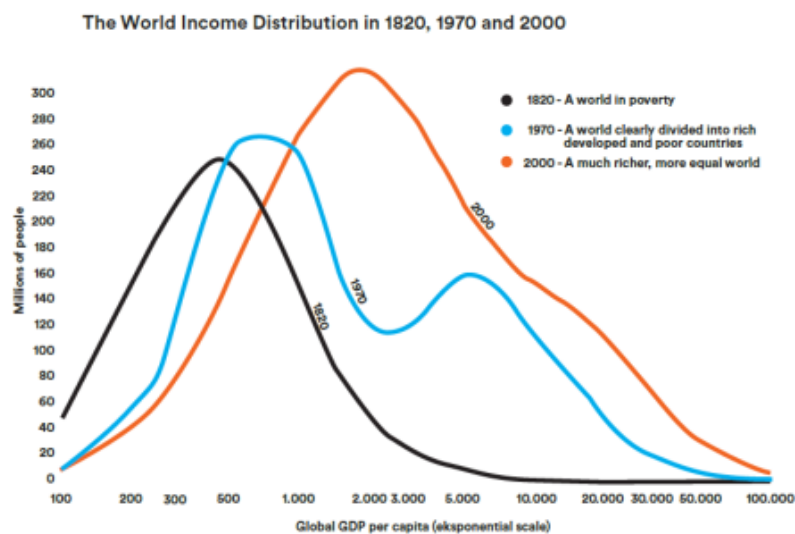
The graph shows the central estimate.

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Global income distribution and inequality



[ILLUSTRATION: GLOBAL INCOME DISTRIBUTION IN 1820, 1970 AND 2000](#)

Source: OurWorldinData.org. based on How Was Life, van Zanden et al., 2015, OECD.

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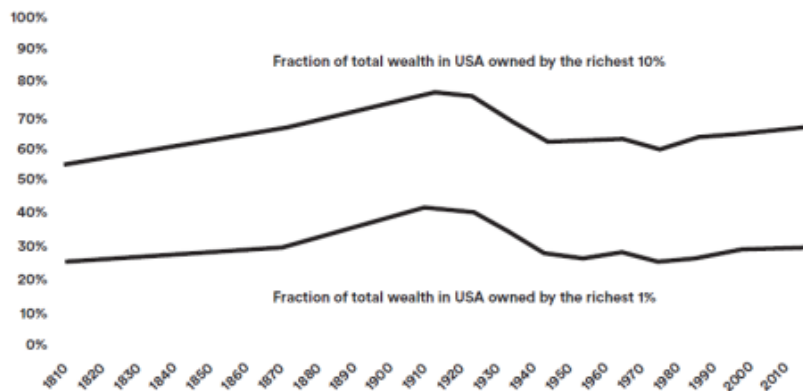
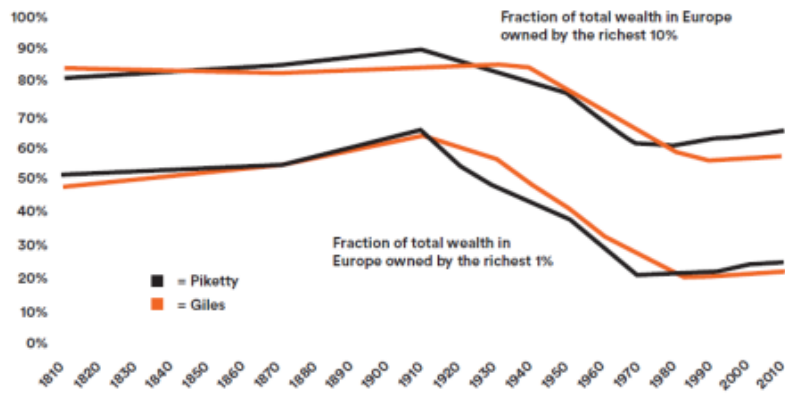
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Source: <https://newrepublic.com/article/117899/overrated-financial-times-finds-errors-thomas-piketlys-data>

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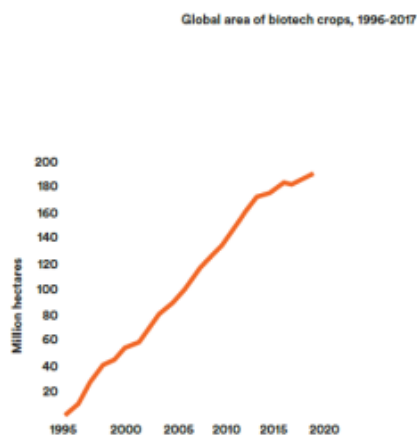


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IPv6

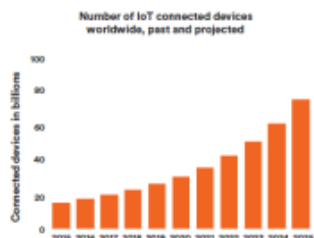


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The Path to Infinite Energy

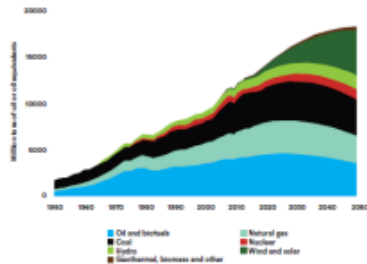


ILLUSTRATION: FORECAST FOR THE DEVELOPMENT OF THE GLOBAL ENERGY SUPPLY, 2017-2050

Source: World Energy 2017-2050: Annual Report, Dr. Minqi Li, Department of Economics, University of Utah

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ILLUSTRATION: US ENERGY CONSUMPTION PER UNIT OF GDP

Richard F., and Jonathan G. Koomey: "Electricity Consumption and Economic Growth: A New Relationship with Significant Consequences?" The Electricity Journal. vol. 28, no. 9., 2015.:

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Vast, constantly-growing reserves



ILLUSTRATION: KNOWN OIL AND GAS RESERVES

I have found these numbers in a number of sources. Including on Bloomberg and in a Bank Credit Analyst study that is not available in the public. However, an example of a freely downloadable graph can be seen here:

<http://www.muroskoenergyeconblog.com/2018/09/does-investing-for-future-mean-going.html>

<http://peakoilbarrel.com/jean-laherrere-on-proven-reserves/>

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https://www.researchgate.net/figure/Proven-oil-reserves-and-reserves-annual-production-ratio-source-of-data-BP-Statistical_fig3_261991725

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https://en.wikipedia.org/wiki/List_of_countries_by_natural_gas_proven_reserves#/media/File:World_Gas_Reserves.png

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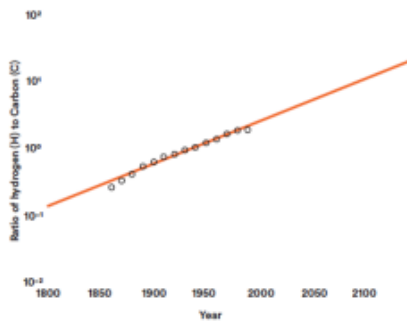


ILLUSTRATION: THE GLOBAL SHIFT FROM COAL TO HYDROGEN

Source: Ausubel, J.H.: Can Technology Spare the Earth? American Scientist 84, 1996.

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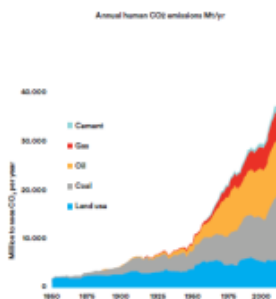


ILLUSTRATION: HUMAN CO2 EMISSIONS SINCE 1850, SOURCE: CO2 EMISSIONS BY FUEL TYPE, WORLD, OURWORLDINDATA.ORG:

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<https://www.bbc.com/news/world-europe-32709431>

https://www.who.int/phe/eNews_52.pdf#targetText=Issue%2052%20%2F%20February%202013&targetText=This%20is%20the%20first%20Dever,and%20their%20potential%20health%20implications.

<https://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/safety-of-nuclear-power-reactors.aspx>

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https://www.amazon.com/Nuclear-Power-Present-Concise-Physics/dp/1681745046/ref=sr_1_6?keywords=thorium&qid=1566640301&rnid=2941120011&s=books&sr=1-6

<https://www.ncbi.nlm.nih.gov/pubmed/15624306>

<https://www.nextbigfuture.com/2008/03/deaths-per-twh-for-all-energy-sources.html>

When the text states that; this shall of course be seen in comparison to other energy forms. Here is a list of total number of fatalities form nuclear accidents:

[https://en.wikipedia.org/wiki/Nuclear_and_radiation_accidents_and_incidents#targetText=Serious%20nuclear%20power%20plant%20accidents,-1%20accident%20\(1961\).](https://en.wikipedia.org/wiki/Nuclear_and_radiation_accidents_and_incidents#targetText=Serious%20nuclear%20power%20plant%20accidents,-1%20accident%20(1961).)

[https://www.nextbigfuture.com/2008/03/deaths-per-twh-for-all-energy-sources.html#targetText=Paul%20Gipe's%20estimate%20as%20of,883%20fatalities%20for%20every%20TW&targetText=yr\)%20in%20the%20period%201969%E2%80%931996.](https://www.nextbigfuture.com/2008/03/deaths-per-twh-for-all-energy-sources.html#targetText=Paul%20Gipe's%20estimate%20as%20of,883%20fatalities%20for%20every%20TW&targetText=yr)%20in%20the%20period%201969%E2%80%931996.)

This source provides the following numbers:

Energy form	Number of deaths per TWh (terawatt-hours)	Mortality compared to nuclear power
Coal	161	4.025 times
Oil	36	900 times
Biofuel	12	300 times
Peat	12	300 times
Natural gas	4	100 times
Hydro	1,4	35 times
Solar panels	0,44	11 times
Windmills	0,15	3,75 times
Nuclear power	0,04	-

In other words: nuclear is by far the safest energy source we have.

Hormesis

<https://www.ncbi.nlm.nih.gov/pubmed/11452146>

<http://www.jameslefanu.com/science-dish-the-dirt-and-keep-healthy.html>

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Dolan, T. J.: Molten Salt Reactors and Thorium Energy, Woodhead Publishing, 2017

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<https://www.youtube.com/watch?v=N2vzotsvkw>

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Nuclear fusion

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ILLUSTRATION: REAL PRICES FOR INDUSTRIAL RAW MATERIALS

I first saw these numbers in a time series from Bank Credit Analyst going from 1800 to 1913, and I then added numbers from Bloomberg, which uses BP Statistical review as their primary source:

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ILLUSTRATION: REAL PRICES FOR WHEAT

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<https://www.reuters.com/article/us-crops/peak-farmland-is-here-crop-area-to-diminish-study-idUSBRE8BGOQH20121217>

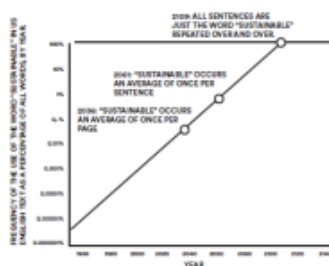


ILLUSTRATION: WHY THE USE OF THE WORD SUSTAINABLE IS UNSUSTAINABLE

The image is inspired by this one on xkcd.com:

<https://xkcd.com/1007/>

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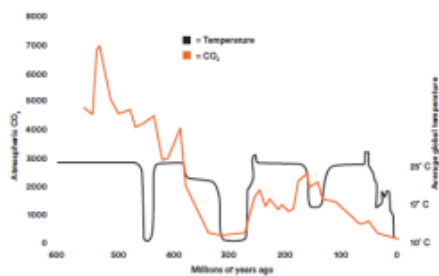
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[ILLUSTRATION: GLOBAL TEMPERATURES AND CO₂ CONCENTRATIONS OVER THE PAST 600 MILLION YEARS.](#)

The source is here:

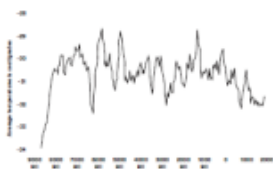
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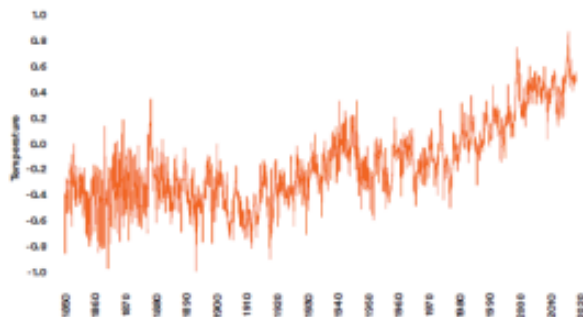


ILLUSTRATION: GLOBAL TEMPERATURES, 1850-2019

The graph is based on two sources. Up until and including 2014, its HadCRUT3 global monthly surface air temperatures 1850 - 2014. From 2014 to 2019, its UAH MSU global monthly lower troposphere temperature anomaly 2014-2019. The easiest way to see both and the latter updated with the latest numbers at any time is on:

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ILLUSTRATION: CURRENT WARMING IN PERSPECTIVE

This is the previous graph showing temperatures in Antarctica over the past 450,000 years- with an extension. I have extended it because for technical reasons, the previous graph only took us to around 1850, thus excluding the recent global warming period. As for the developments since 1850, we have thermometer measurements, and for those, I have inserted 1.5 degree.

It should be noted that the measurements on Greenland shows temperature rise of approx. 1.5 centigrade (or a bit lower) since 1850, whereas the global average warming has only been approx. 1 degree. This correspond to a general observation that temperature fluctuations are larger at the poles than around equator.

A source: T. Kobashi, et al.: Climate of the Past, 2012.

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Alroy, J. (2008). "Dynamics of origination and extinction in the marine fossil record". Proceedings of the National Academy of Sciences of the United States of America. 105

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The number of conformed extinct species since 1500 AD can be checked by downloading Table 3a from this link:

<https://www.iucnredlist.org/resources/summary-statistics>

The extinct species since year 1500 AD are listed in the left column, and as of August, 2019, it amounted to 732 species. However, most scientific sources put the actual number of known extinct species over this period a bit higher – at just under 1,000 – or equivalent to probably approx. 0.066 % of known species. For instance, the standard textbook for genetic studies in conservation A Primer

of Conservation Genetics and Introduction to Conservation Genetics from 2007 and 2010 listed both 917 extinct species since the year 1600 (and not since 1500, which is where the IUCN list starts). The following is an estimate of how they are distributed, based on key categories.

Category	Number of known species	Known species extinctions since 1600	Proportion of known species extinct since 1600
Mammals	4,500	110	2.444 %
Birds	9,500	103	1.084 %
Reptiles	6,300	21	0.333 %
Amphibians	4,200	5	0.119 %
Fish	24,000	82	0.342 %
Mollusks	100,000	235	0.235 %
Crustaceans	4,000	9	0.225 %
Vascular plants	250,000	396	0.158 %
Insects and other	1,200,000	98	0.008 %
<i>Total</i>	<i>1,602,500</i>	<i>1,059</i>	<i>0.066 %</i>

<https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1001127>

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https://www.amazon.com/Tropical-Deforestation-Species-Extinction-Whitmore/dp/041245520X/ref=sr_1_1?keywords=Tropical+Deforestation+and+Species+Extinction%3B&qid=1566680280&s=books&sr=1-1

Frankham, R., J.D. Ballou & Briscoe D.A: A Primer Of Conservation Genetics, Cambridge University Press, 2007

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Fisher, D.O. & S.P. Blomberg: Correlates of rediscovery and the detectability of extinction in mammals. Proceedings of the Royal Society of London B 278, 2011

<https://royalsocietypublishing.org/doi/full/10.1098/rspb.2010.1579>

A complication in estimating the number of extinct species is that, after you can no longer locate a species, you deliberately wait some years or decades before you declare it extinct, as quite a number have reappeared after having been declared extinct (for example, one study found that more than a third of mammals reappeared after having officially been declared extinct).

Fisher, D.O. & S.P. Blomberg: Correlates of rediscovery and the detectability of extinction in mammals. Proceedings of the Royal Society of London B 278, 2011

<https://royalsocietypublishing.org/doi/full/10.1098/rspb.2010.1579>

In any event, the numbers in the table above indicate that approximately 0.0001625 % of the 1.6 million known species have been lost annually.

New Networks and Decentralised Technologies

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Layar

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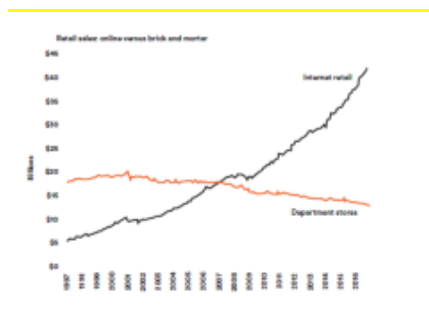


ILLUSTRATION: PHYSICAL VERSUS DIGITAL COMMERCE IN THE UNITED STATES

Source: U.S. census Bureau

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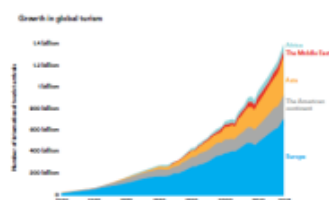


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Source: World tourism barometer (2019), United Nations World Tourism Organization:

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