

American Farmers Save the Environment

Data to Accompany Testimony to the House Agriculture Committee

by Michael Shellenberger :: February 25, 2021



What's the TL;DR?



- 1. Emissions peaking and declining
- 2. Impact of climate declining
- 3. American farmers are world leaders
- 4. Low-efficiency farming bad for environment
- 5. American farmers can help farmers in poor nations
- 6. Climate change compared to other problems



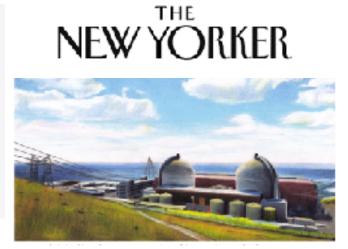
Michael Shellenberger & Environmental Progress



APOCALYPSE NEVER

WHY ENVIRONMENTAL ALARMISM HURTS US ALL

MICHAEL SHELLENBERGER



THE ACTIVISTS WHO **EMBRACE NUCLEAR** PO₩ER





- Time Magazine, "Hero of Environment" and Green Book Award Winner
- Author of best-selling and critically-acclaimed new book ${ \bullet }$ Apocalypse Never: Why Environmental Alarmism Hurts Us All
- Environmental activist for 30 years, founder of Berkeley-based ${\color{black}\bullet}$ Environmental Progress, & co-founder Breakthrough Institute
- Subject of Feb. 2021 New Yorker article, "The Activists Who Embrace Nuclear Power"
- Working with climate scientists James Hansen, Tom Wigley, and Kerry Emanuel to prevent premature closure of America's nuclear plants
- Contributor to New York Times, Washington Post, Forbes



1. Emissions peaking and declining

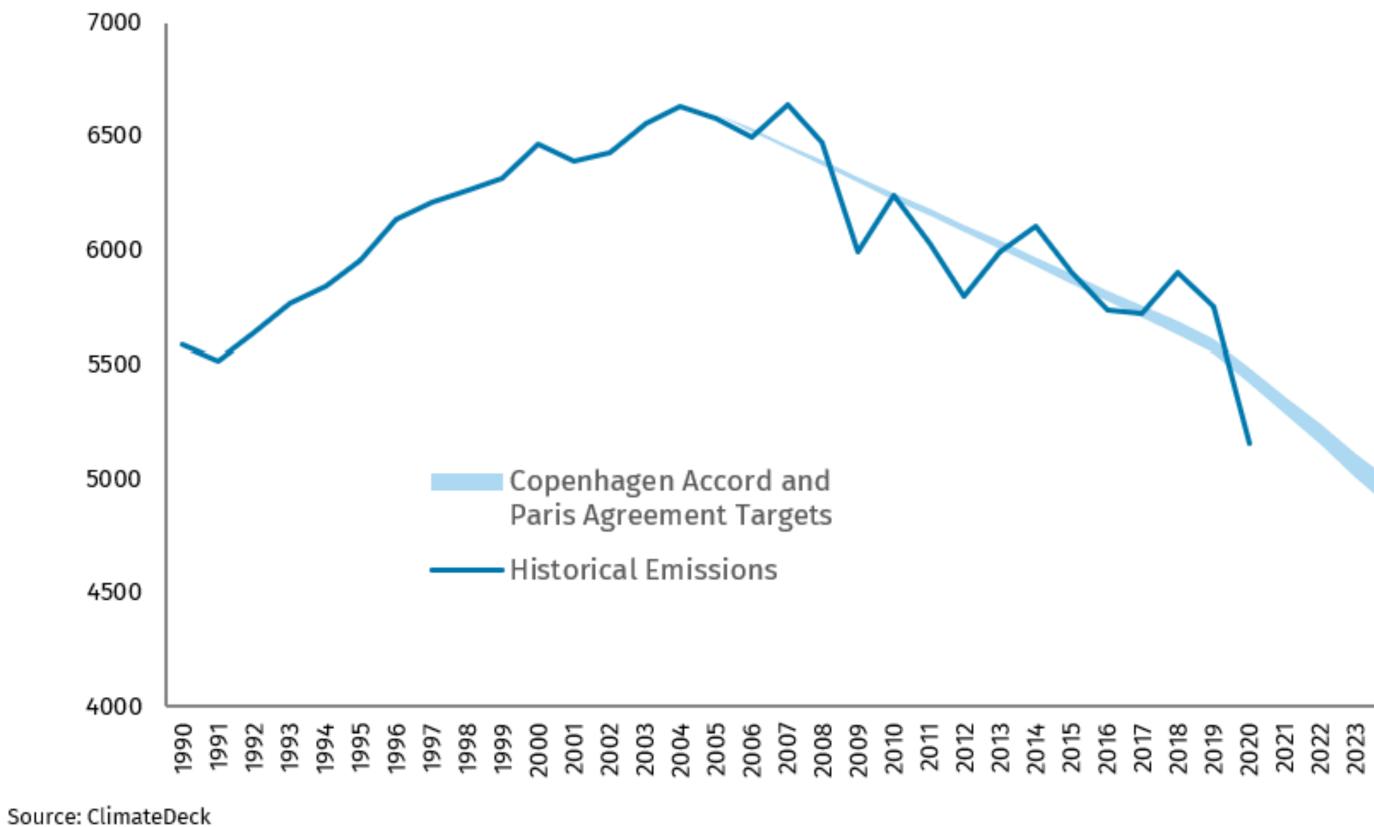


U.S. Is World Climate Leader

Million metric tons CO₂e, IPCC definitions, excludes international bunkers "The U.S. saw the largest decline 7000 in energy-related CO₂ emissions in 2019 on a country basis... US 6500 emissions are now down almost 6000 1 Gt from their peak in the year 5500 2000, the largest absolute decline by any country over that Copenhagen Accord and 5000 Paris Agreement Targets period." – International Energy Historical Emissions 4500 Agency, 2020



Net US GHG emissions relative to international commitments



Source: Rhodium Group, Jan 12, 2021









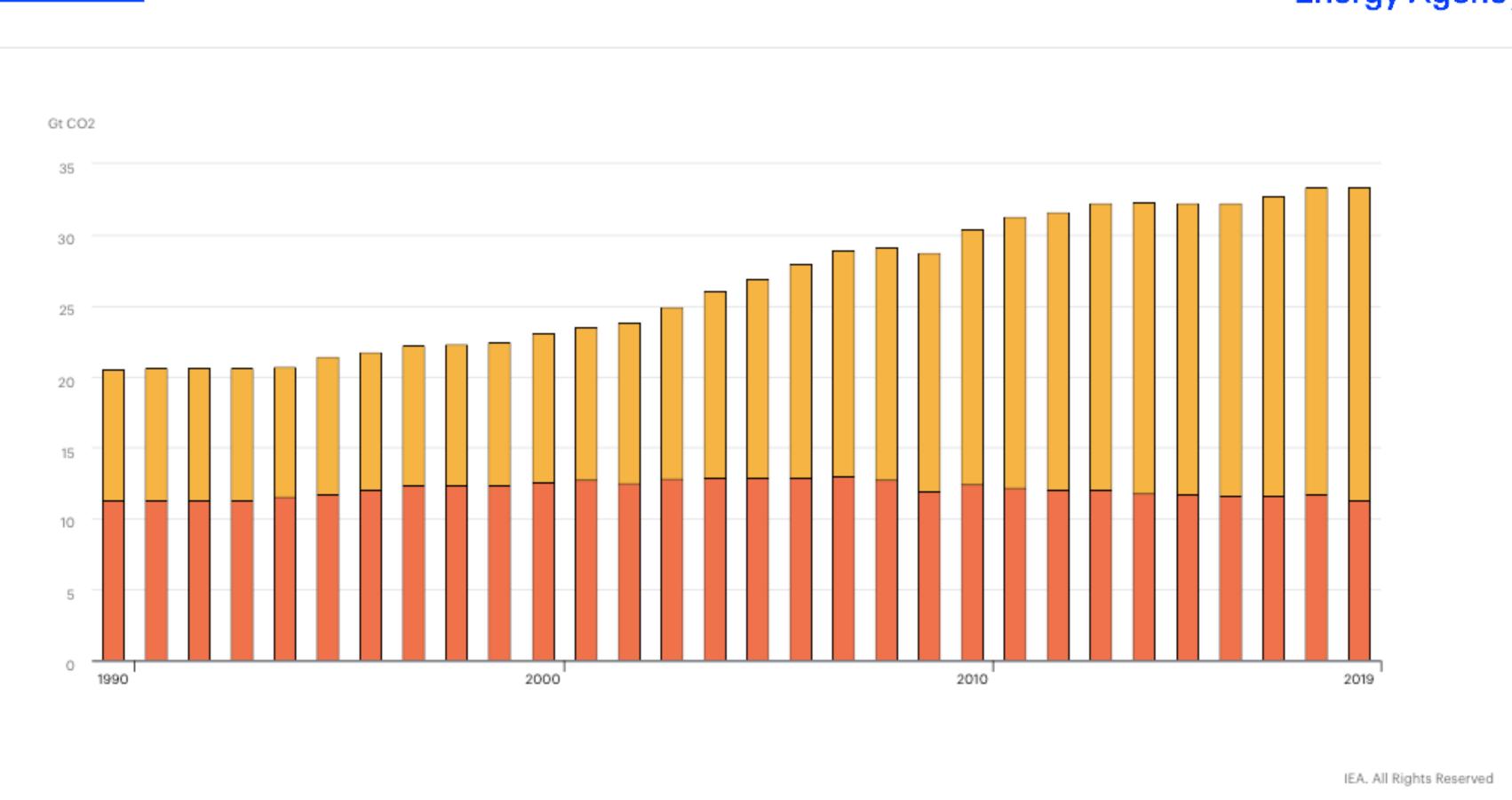


World at or near peak emissions

Energy related CO2 emissions, 1990-2019

Last updated 11 Feb 2020

Download chart ↓



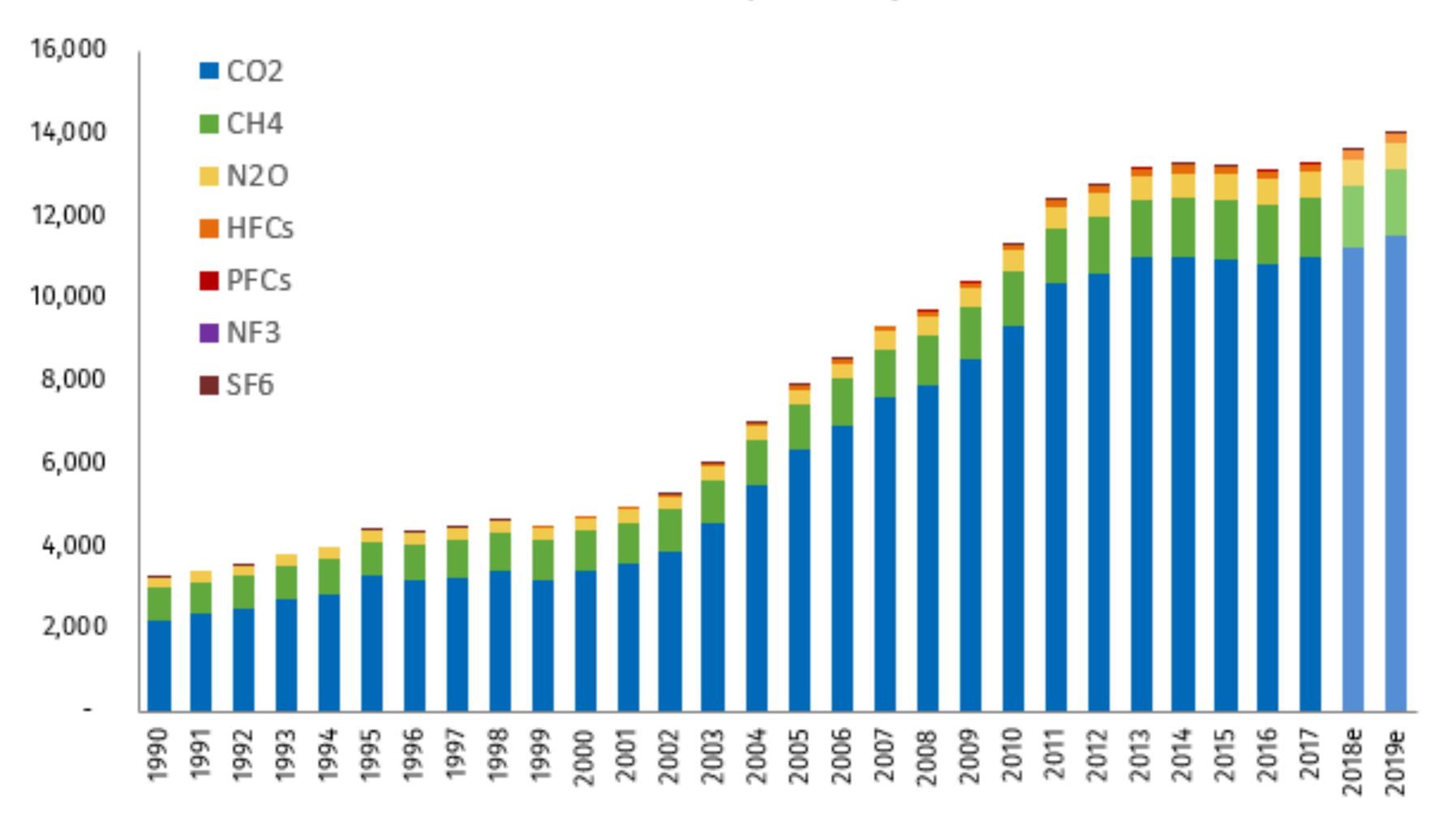


120 International Energy Agency

But China emissions rapidly rising

Net emissions in China by greenhouse gas, 1990-2019e

Million metric tons CO2e, 2018 and 2019 emissions are preliminary estimates





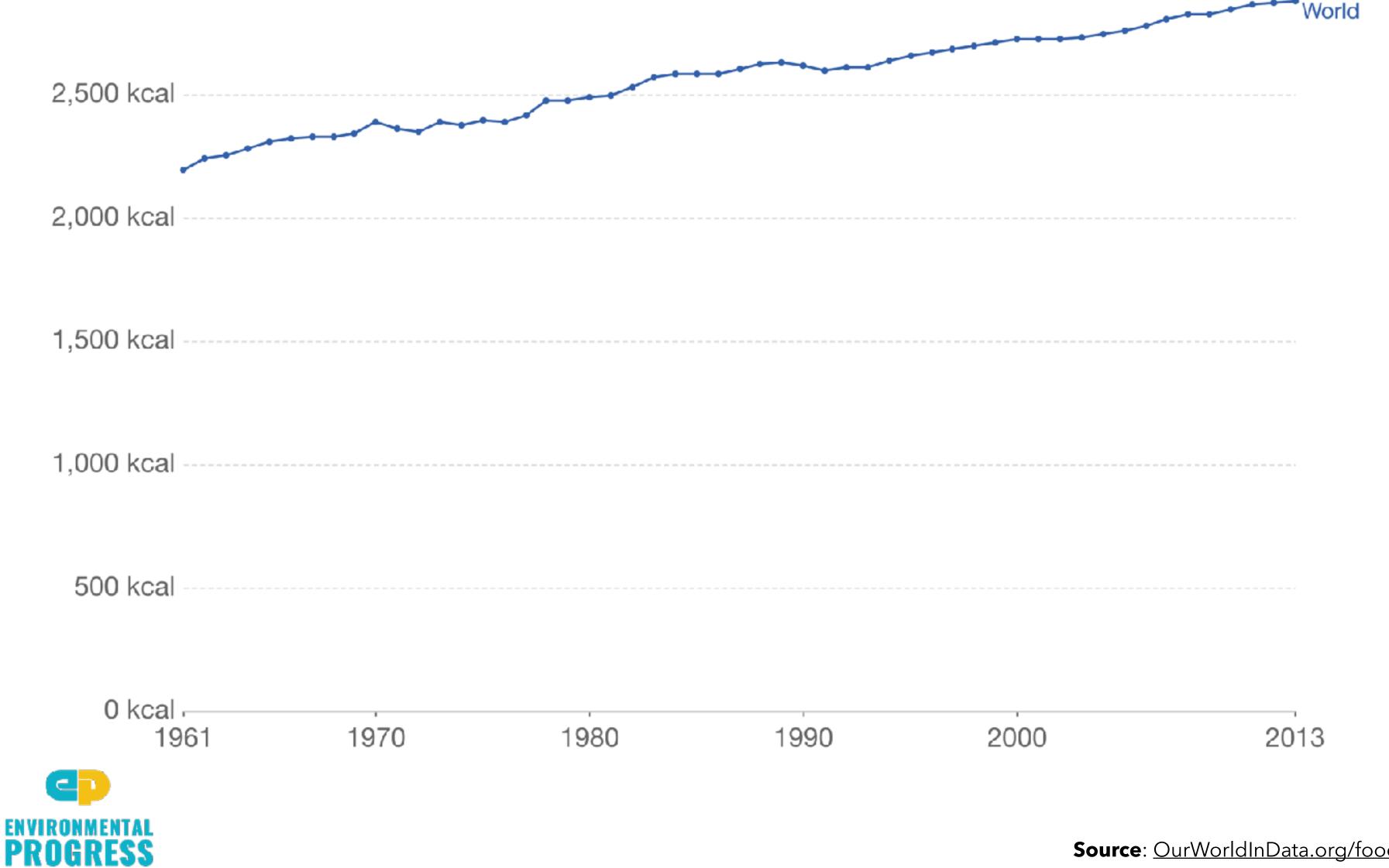
Source: Rhodium Climate Service



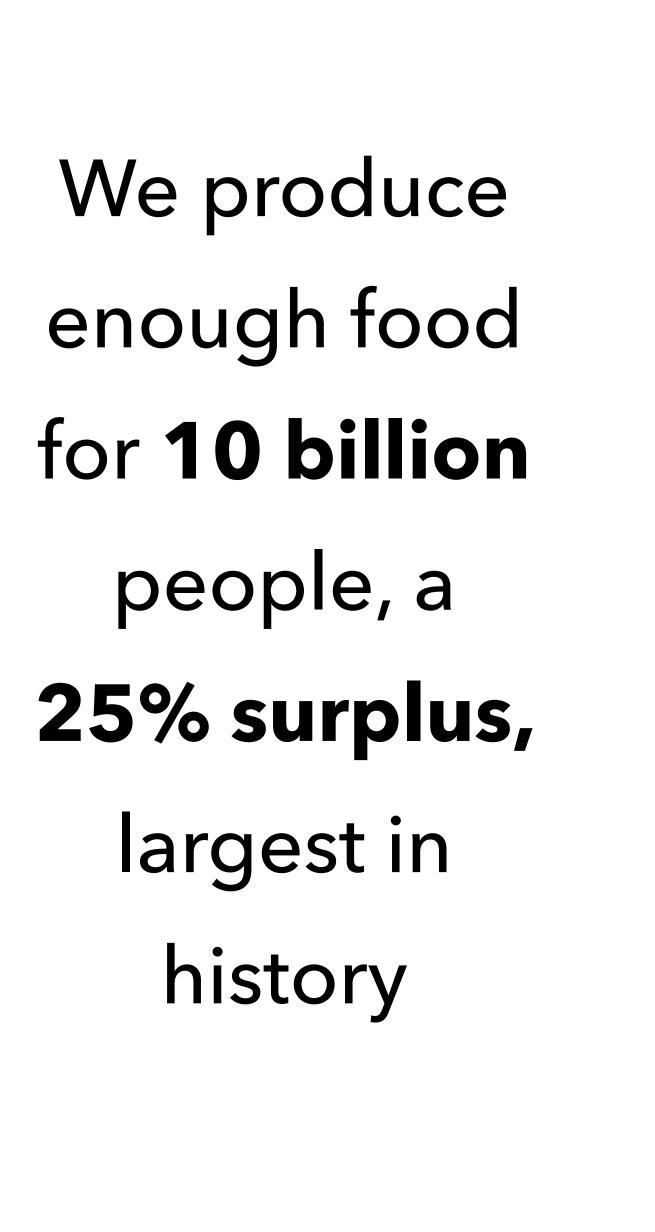
2. Impact of climate declining

Daily supply of calories, 1961 to 2013

Caloric supply is measured in kilocalories per person per day.

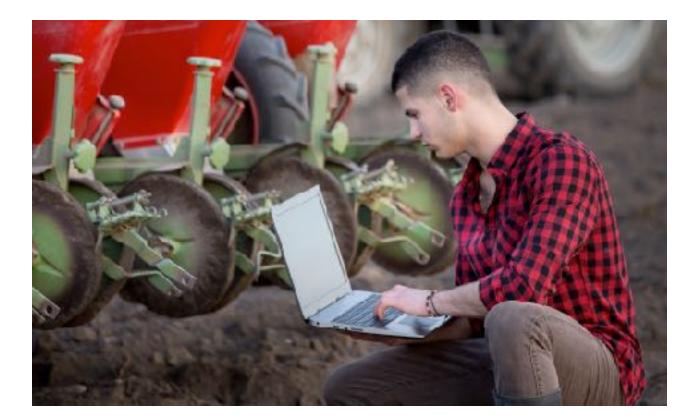


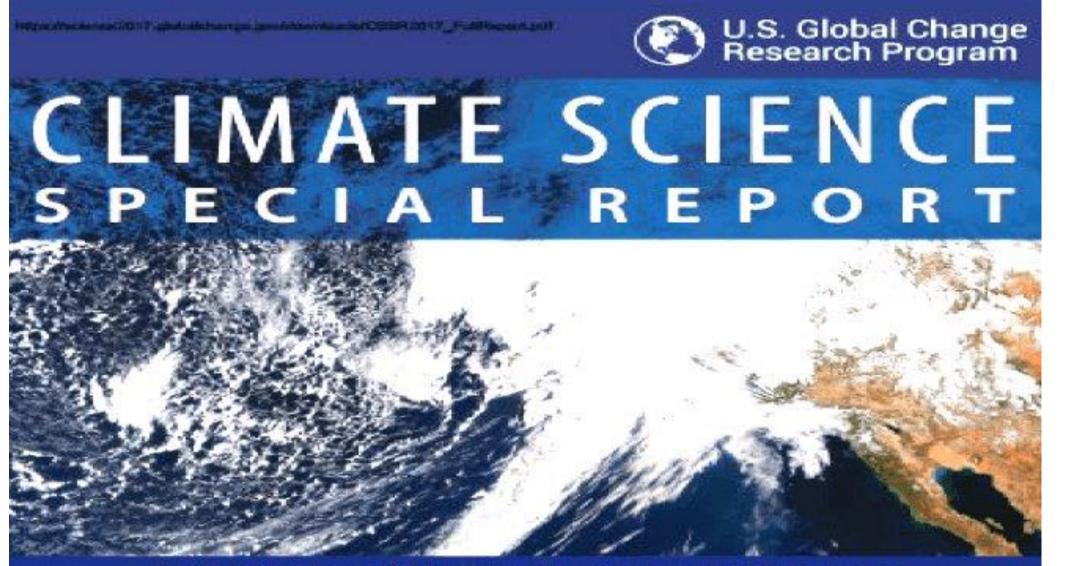




Source: <u>OurWorldInData.org/food-supply</u>; UN Food and Agriculture Organization (FAO)

American farmers adapting to climate





Fourth National Climate Assessment | Volume I

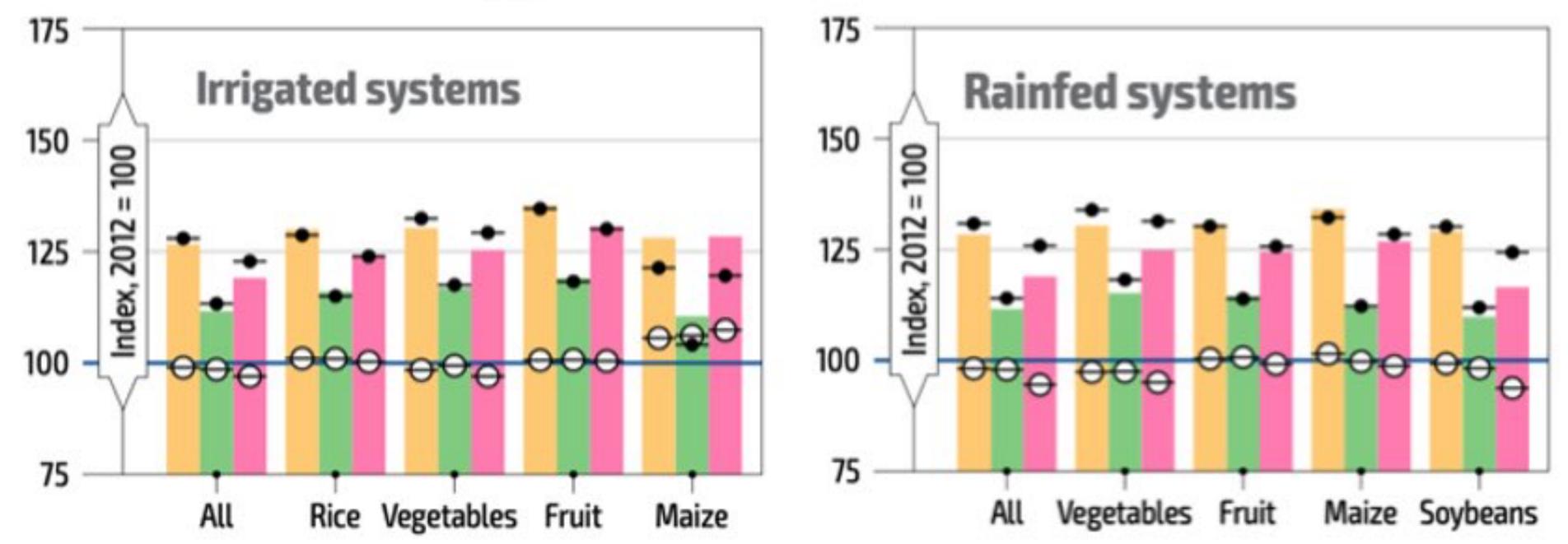
The U.S. Government's Fourth National Climate Assessment concludes that the risks of climate change to U.S. farmers can be mitigated by innovation and adaptation. Farmers can:

- Change seeds, rotate crops, and deploy irrigation.
- 2. Manage heat stress among life stock by changing breeds and diets, providing shade, and altering patterns of feeding and reproduction.
- 3. Use pest and disease management, climate forecasting tools, and crop insurance as proven effective ways to reduce risk and increase productivity and efficiency.

Gowda, P., J.L. Steiner, C. Olson, M. Boggess, T. Farrigan, and M.A. Grusak, 2018: Agriculture and Rural Communities. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 391-437. doi: 10.7930/NCA4.2018.CH10



Tech Change Outweighs Climate Change in Food Production



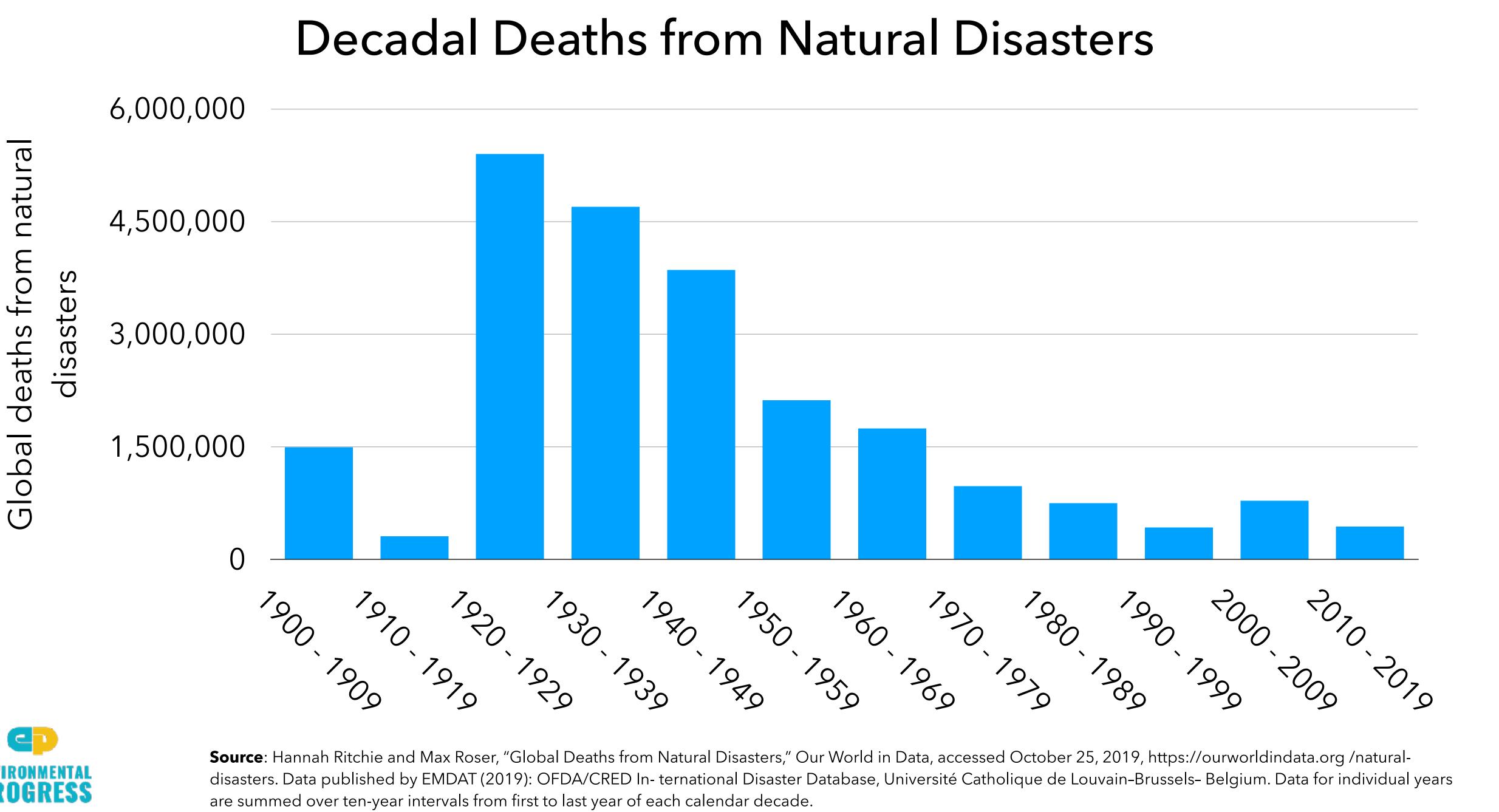
Note: Coloured bars indicate price-independent changes in yields attributed to both technical progress and climate change. The white circles indicate changes in yields arising from climate change, while the black barred dots indicate changes arising from technical progress. Climate change impacts are computed based on FAO-IIASA GAEZ v4 (scenario without CO2 fertilization, median value for five climate models). Changes in yields are shown for the four top commodities, as classified in the FAO GAPS model, in each region, and production system, ranked by value of production in 2012. In this figure, "Citrus" and "Other fruit" are aggregated into "Fruit". "All" refers to the aggregated change in production over the total harvested areas for all crops. Note that the results of research into the impacts of climate change on fruit trees are not conclusive (Ramírez and Kallarackal, 2015).

Sources: FAO Global Perspectives Studies, based on FAOSTAT (various years) for historical crop yields and value of production; FAO-IIASA GAEZ v4 for climate change shifters; and FAO expert judgement for technical shifters.

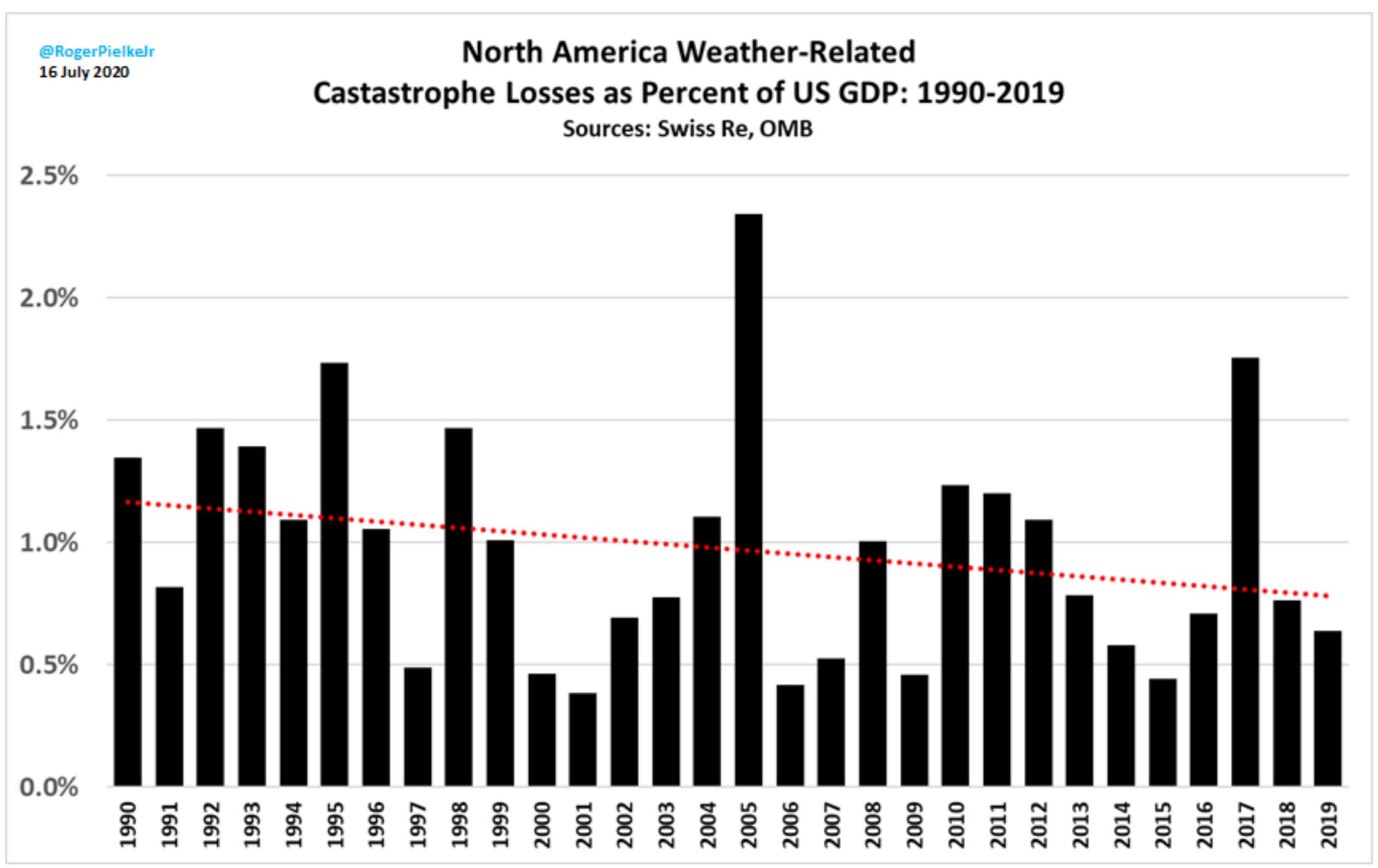
- Technical change
- ↔ Climate change

Combined effects by scenario

- Business as usual
- Towards sustainability
- Stratified societies

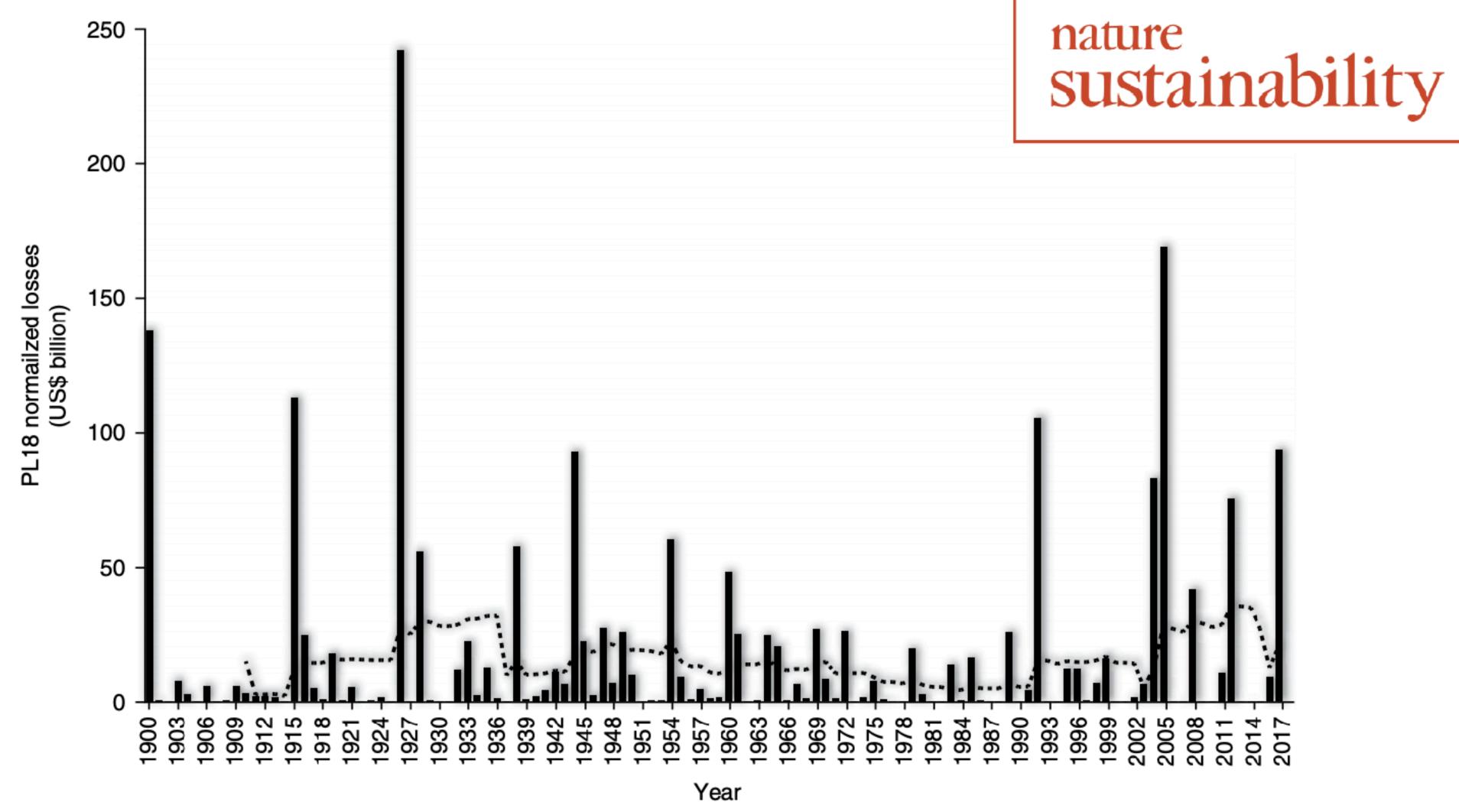








Normalized hurricane damage in the continental United States, 1900-2017





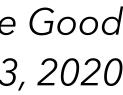
Source: Jessica Weinkle, Chris Landsea, Douglas Collins, et al., "Normalized Hurricane Damage in the Continental United States 1900-2017," Nature Sustainability 1 (2018): 808-813, https://doi.org/10.1038/s41893-018-0165-2



Forest management outweighs the climate



Source: Michael Shellenberger, "Forests That Survive Megafires Prove Good Management Trumps Climate Change," Forbes, September 13, 2020

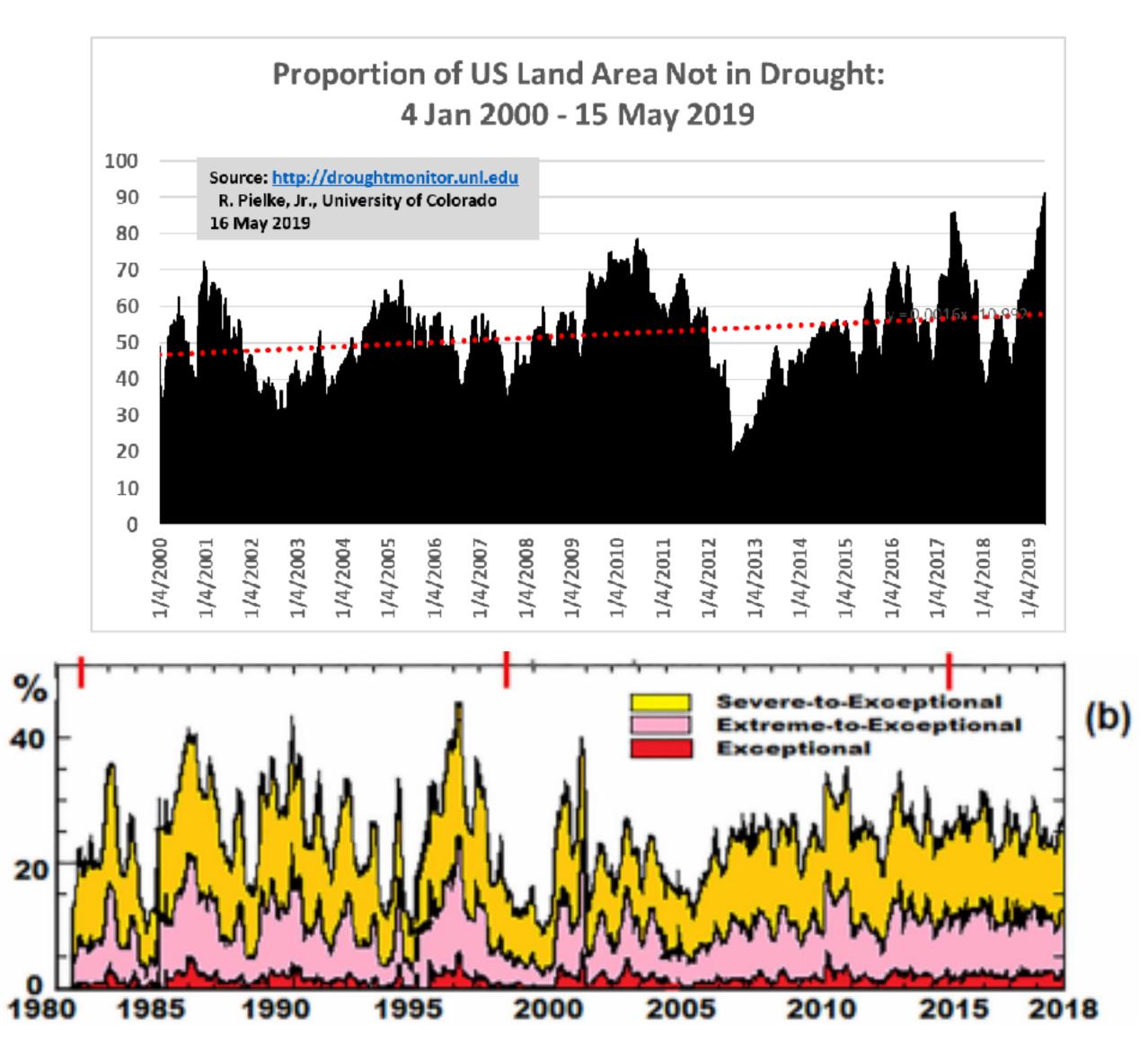


Droughts Not Increasing

"Global and main grain countries' drought area and intensity trends have not been following global climate warming since 1980's"

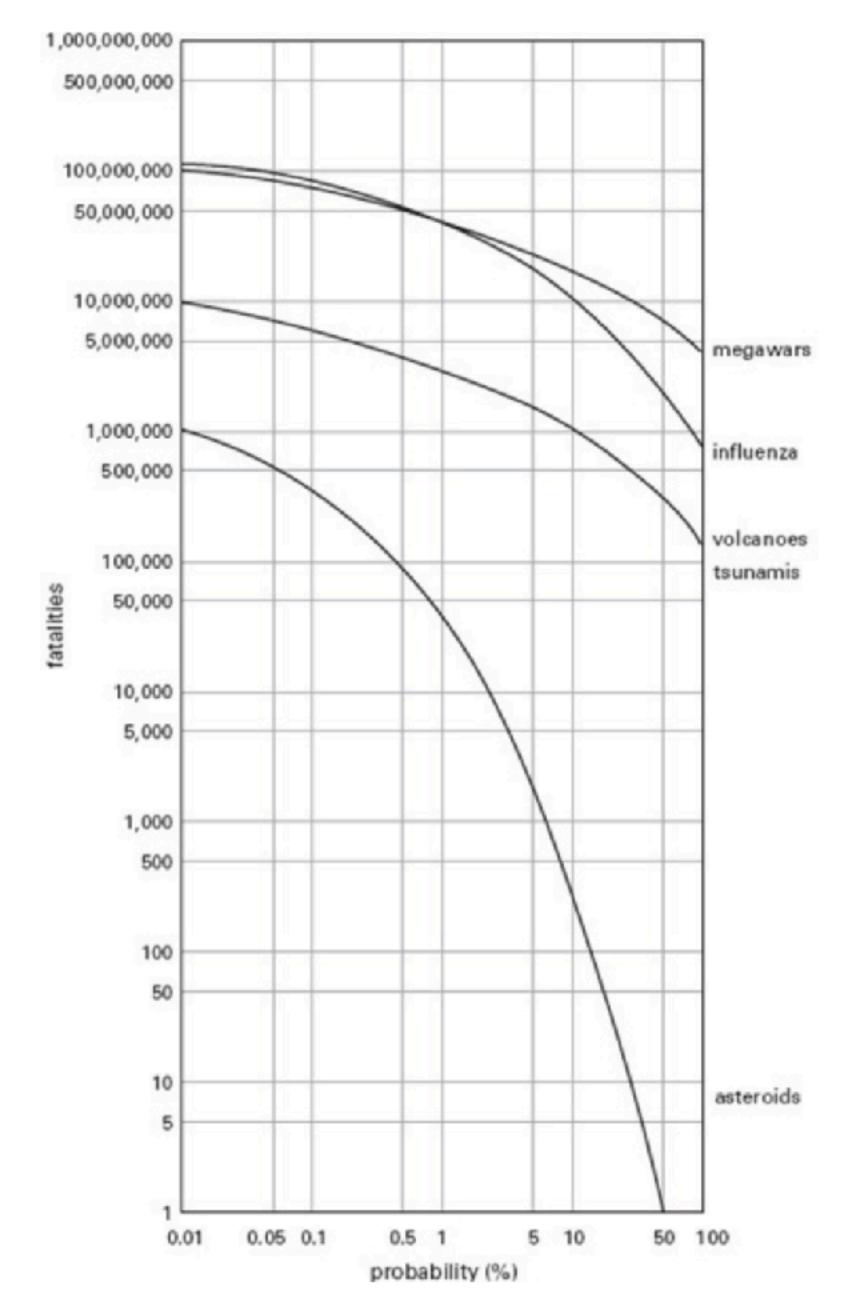
Felix Kogan , Wei Guo & Wenze Yang (2020) Near 40-year drought trend during 1981-2019 earth warming and food security, Geomatics, Natural Hazards and Risk, 11:1, 469-490, DOI: 10.1080/19475705.2020.1730452





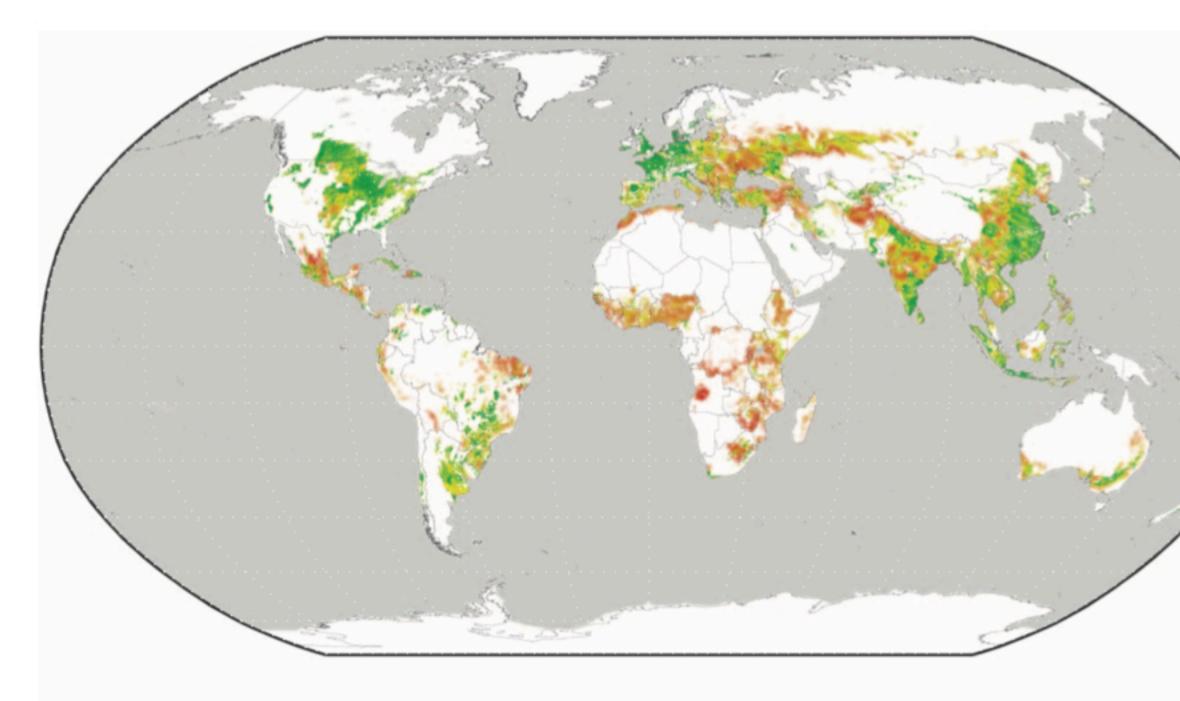
Wars, disease, volcanoes, tsunamis and asteroids, not climate change, pose the highest risk of catastrophe





Source: Vaclav Smil, "Global Catastrophes and Trends: The Next 50 Years," MIT Press (2008).





Major cereals: attainable yield achieved (%)												
0%	10%	20%	30%	40%	50%	60%	70%	80%	90%			
0%	10%	20%	30%	40%	50%	60%	70%	80%	90%			



Source: Nathaniel D. Mueller, James S. Gerber, Matt Johnston et al., "Closing Yield Gaps Through Nutrient and Water Management," Nature 490 (2012): 254-57, https://doi.org/10.1038/nature11420; Deepak K. Ray, "Increasing Global Crop Harvest Frequency: Recent Trends and Future Directions," Environmental Research Letters 8 (2013), https://iopscience.iop.org/article/10.1088/1748-9326/8/4/044041/pdf.

If every nation raised its agricultural productivity to the levels of its most successful farmers, global food yields would rise as much as 70%

Yields could rise an additional 50% if nations increased number of crops per year to their full potential



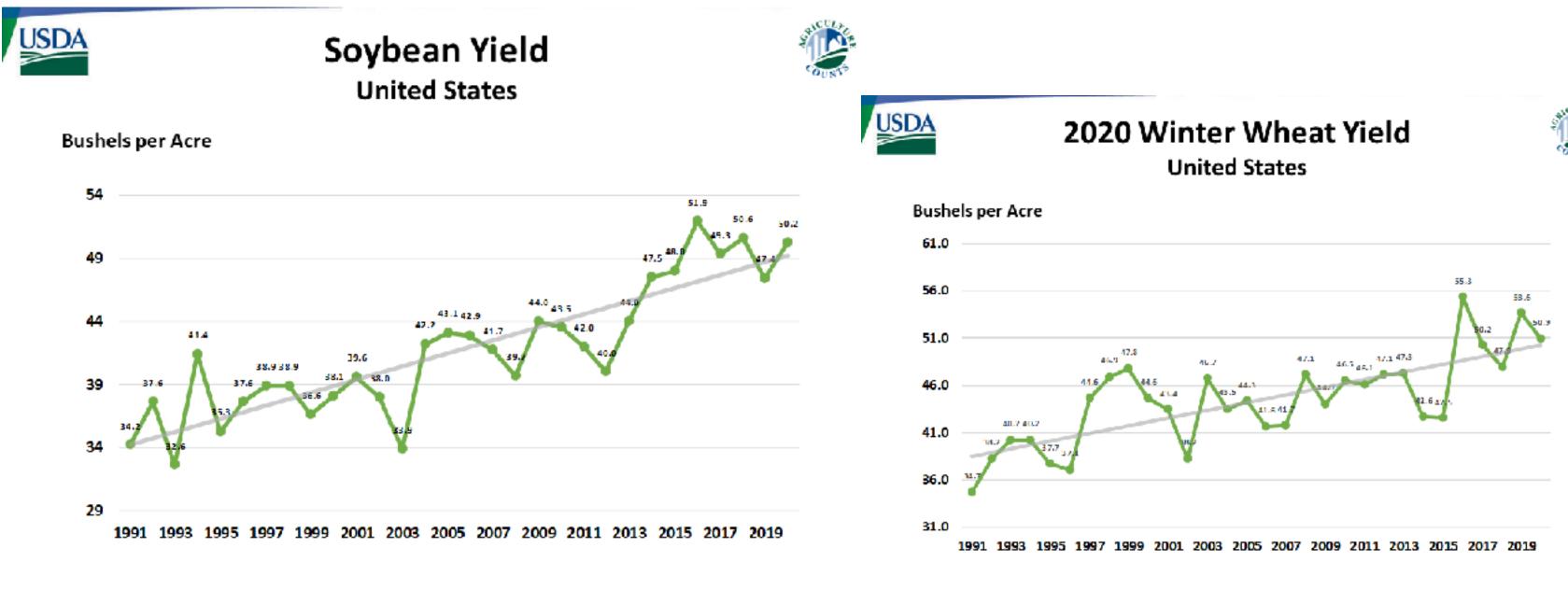




3. American farmers are world leaders in innovation, productivity, and environmental protection.



Yields Rising



United States Department of Agriculture National Agricultural Statistics Service

January 12, 2021

United States Department of Agriculture National Agricultural Statistics Service

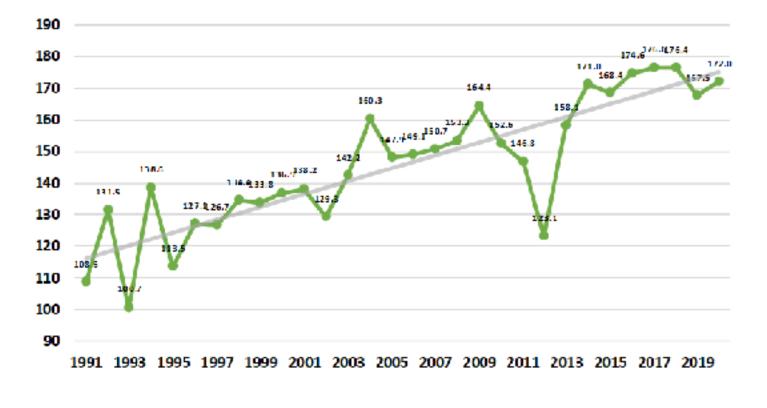




Corn Yield United States

September 30, 2020

Bushels per Acre



United States Department of Agriculture **National Agricultural Statistics Service**



January 12, 2021

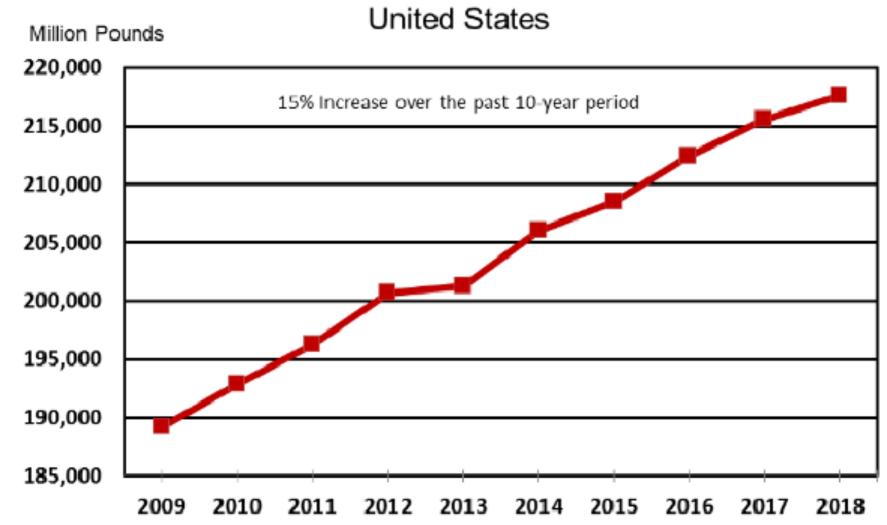
Happy Cows, More Milk



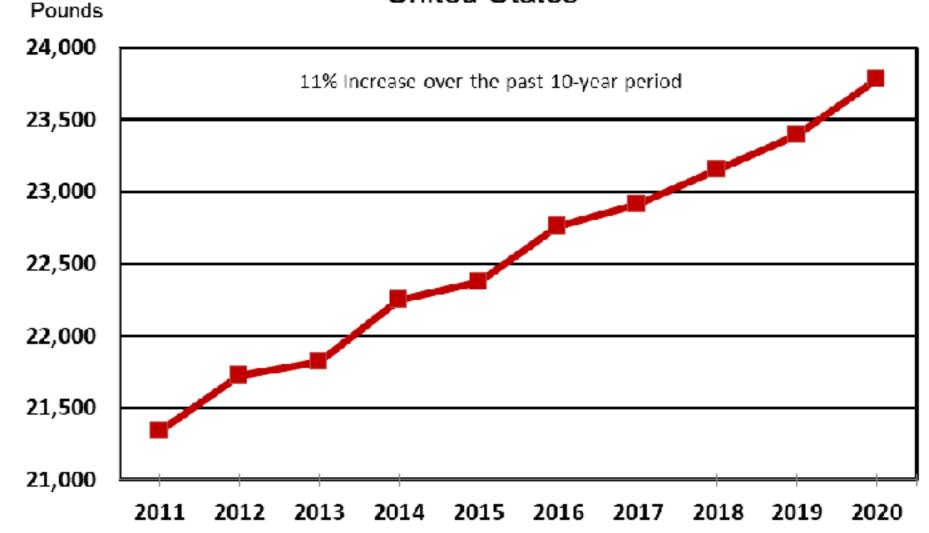


Matt & Jack Swanson, Associated Feed, Vierra Dairy, Hilmar, California, 2020

Milk Production, 2009-2018



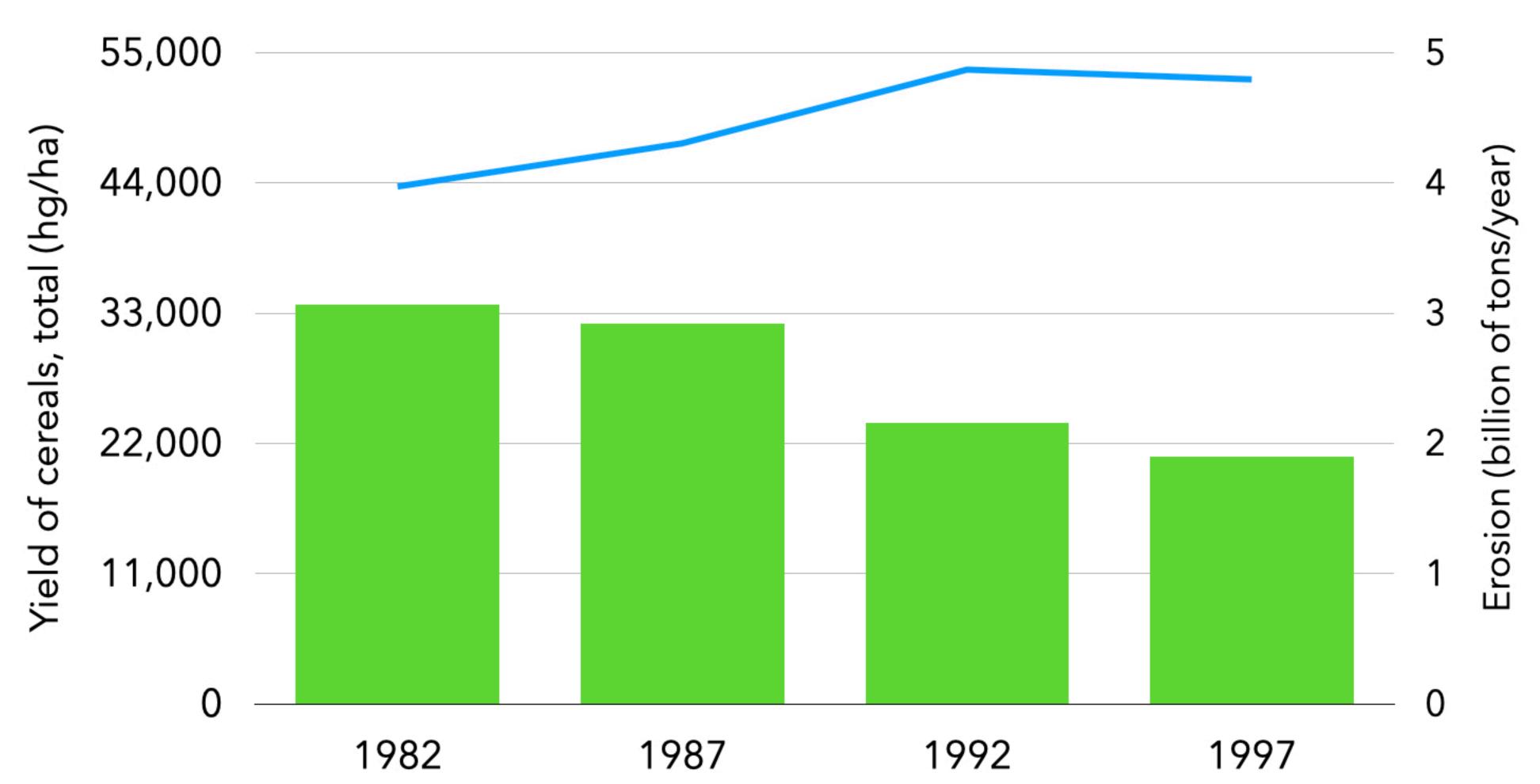
Production per Cow, 2011-2020 United States



Source: USDA, 2021

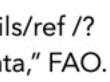


In the United States, soil erosion declined **40%** in just 15 years while yields rose

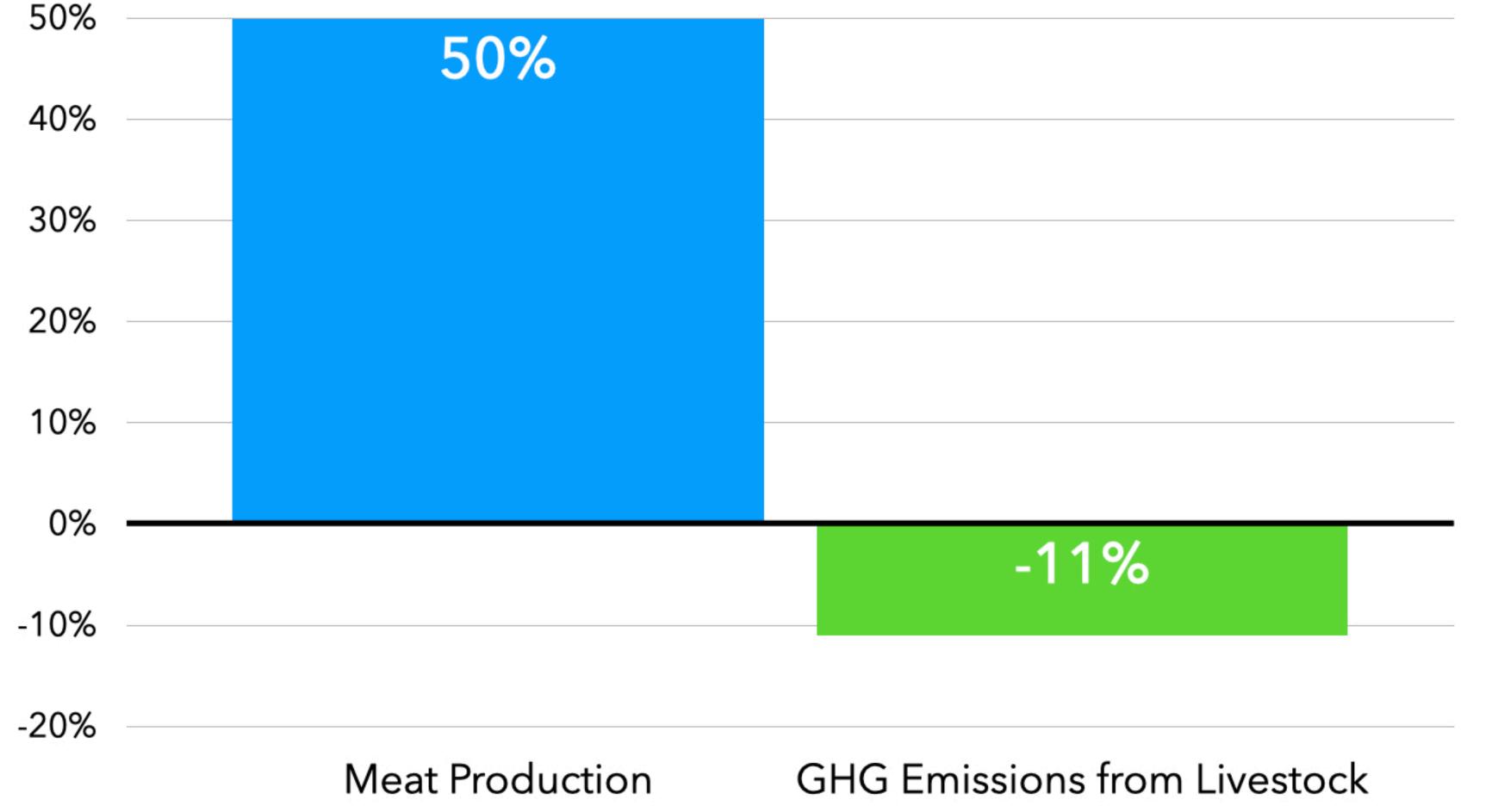




Source: "Changes in Erosion 1982-1997," U.S. Department of Agriculture, Janu- ary 4, 2001, https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref /? cid=nrcs143_013911. FAO data on crop yields show almost every major crop increasing in yield in the United States between 1982 and 1997. "Data," FAO.



Meat production in the U.S. roughly **doubled** since the early 1960s, yet greenhouse gas emissions from livestock declined by 11%





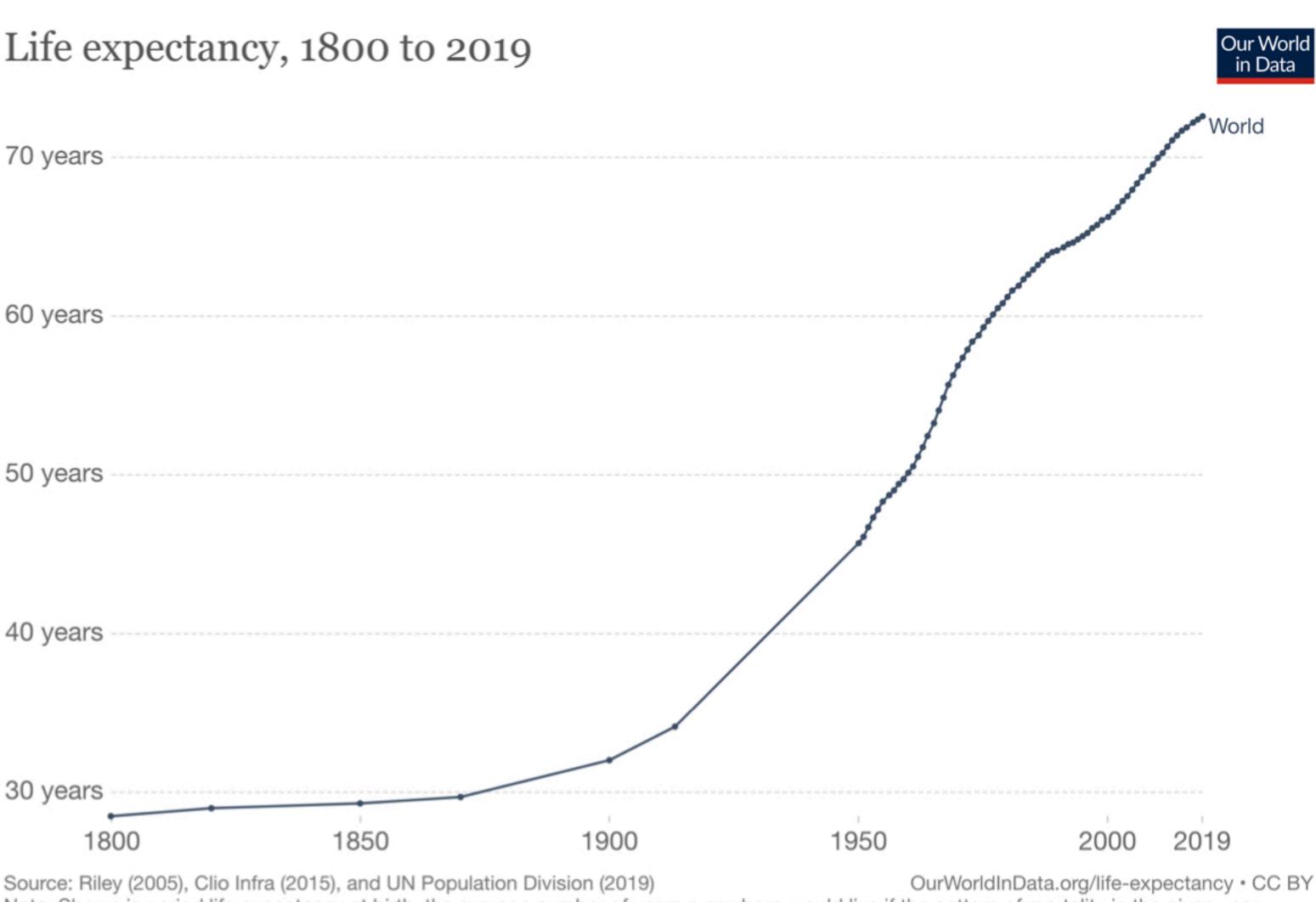
Source: FAO, cited in Frank Mitloehner, "Testimony before the Committee on Agriculture, Nutrition and Forestry US Senate"



Urbanization, 70 years industrialization, and energy 60 years consumption have 50 years contributed to an extension of life 40 years expectancy of 30 years 1800 over 40 years...



Source: Nikos Alexandratos and Jelle Bruinsma, "World Agriculture Towards 2030/2050: The 2012 Revision," ESA Working Paper no. 12-03, Agricultural Develop-ment Economics Division, Food and Agriculture Organization of the United Nations, June 2012, http://www.fao.org/3/a-ap106e.pdf.

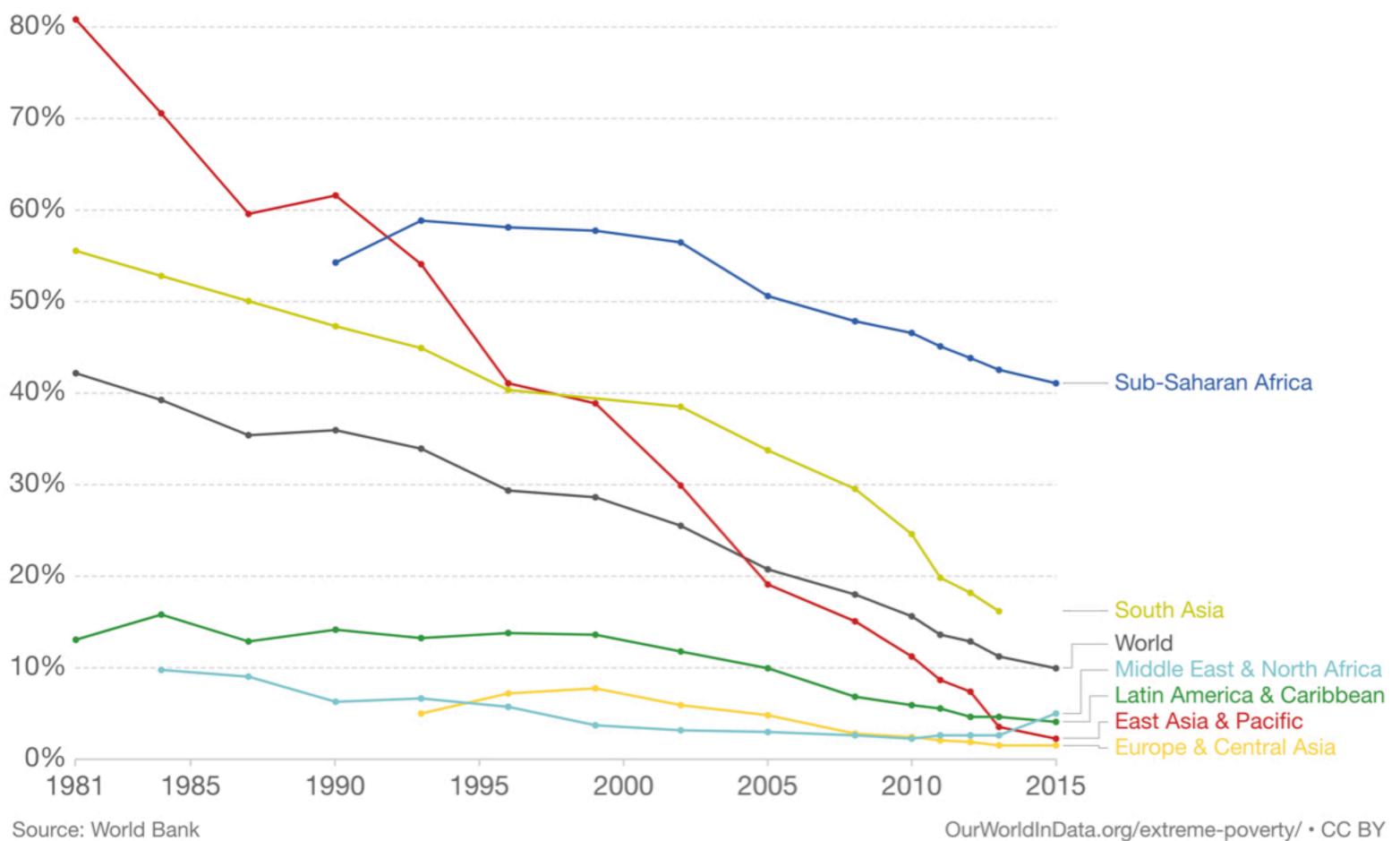


Note: Shown is period life expectancy at birth, the average number of years a newborn would live if the pattern of mortality in the given year were to stay the same throughout its life.



Share of population living in extreme poverty by world region

Extreme poverty is defined as living with less than 1.90\$ per day (in 2011 International Dollar). International dollars are adjusted for price differences across countries and across time.







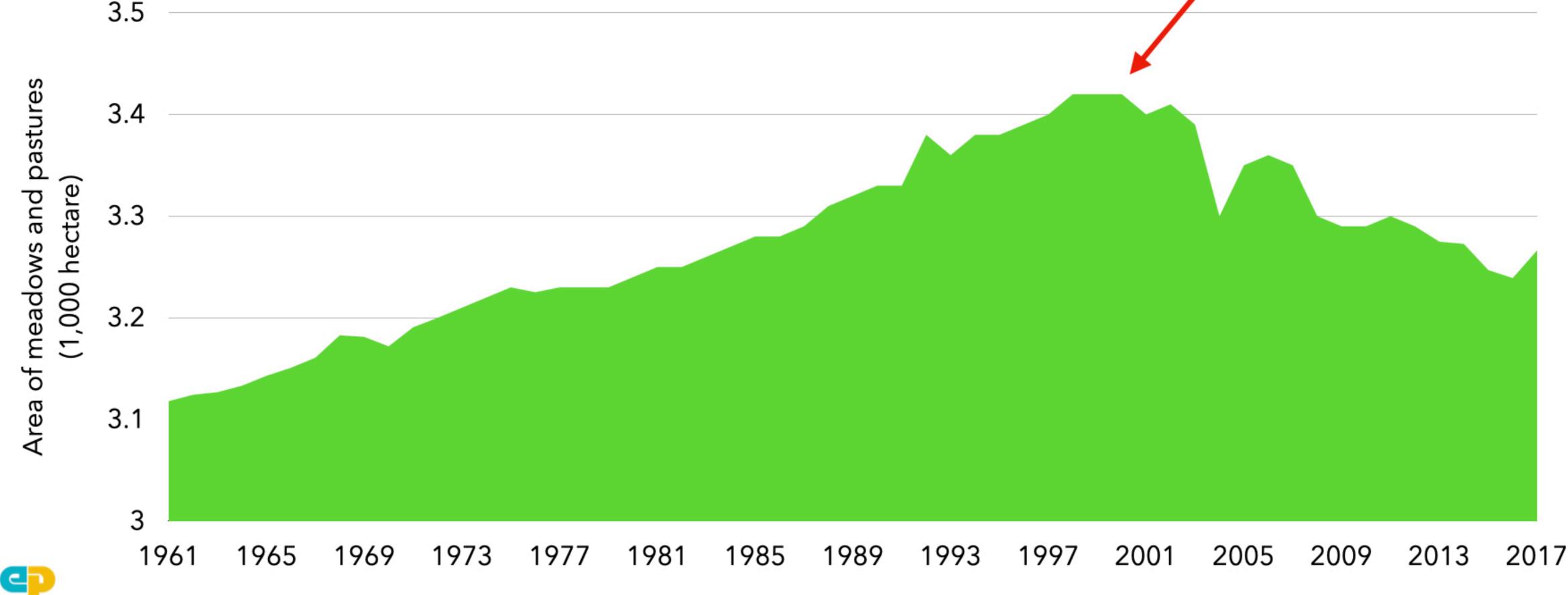


From 1981 to 2015, the global population living in extreme poverty fell from 44% to 10%

Source: Oxford University's Our World in Data



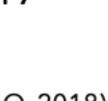
The total amount of land humankind uses to produce meat peaked in the year 2000. Since then, land used for livestock and pasture has decreased by an area 80% the size of Alaska

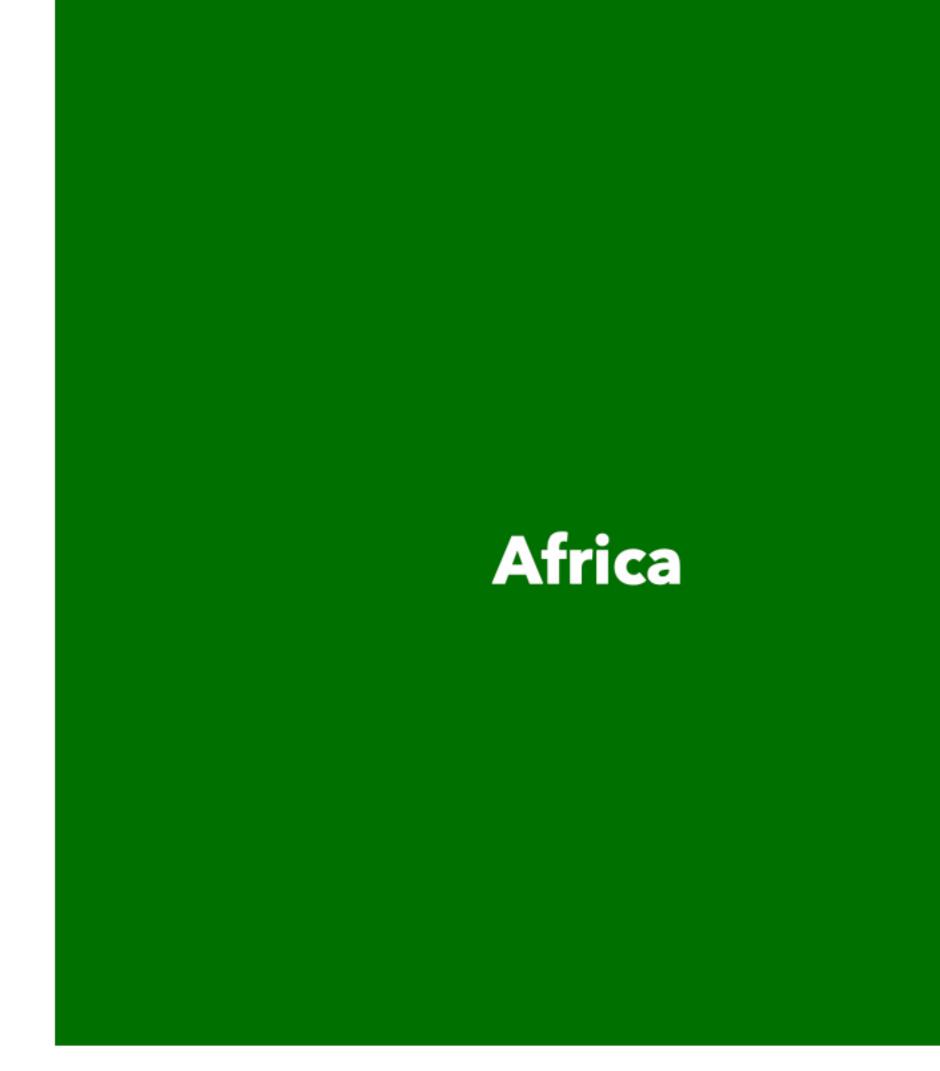




Source: FAO, World Livestock: Transforming the livestock sector through the Sustainable Development Goals (Rome: FAO, 2018)









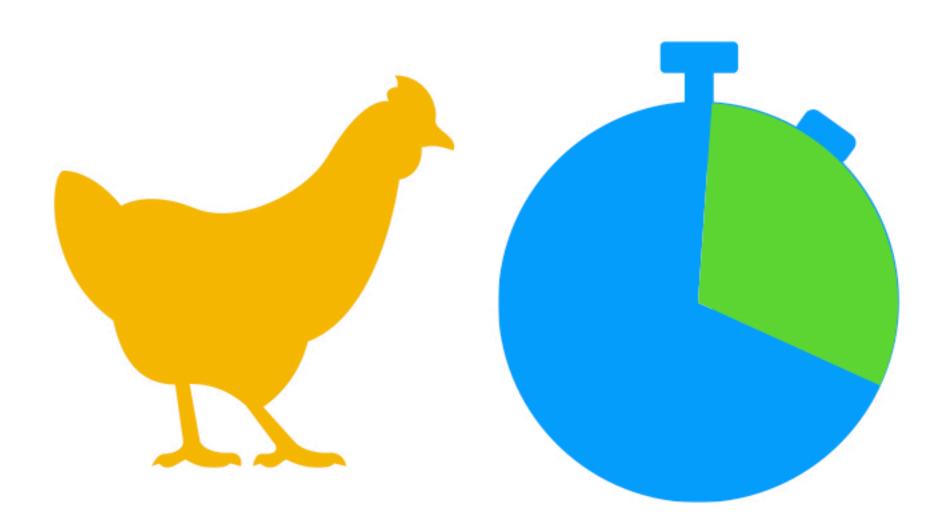
Source: Fa, et al., "Bushmeat Exploitation in Tropical Forests"; 5 million tons of bushmeat extracted in the Congo and Amazon basins: Emiel V. Elferink and Sanderine Nonhebel, "Variations in Land Requirements for Meat Production," Journal of Cleaner Production 15, no. 18 (2007): 1778-86, https://doi.org/10.1016/j.jclepro.2006.04.003.

The most efficient meat production in North America requires **20x less** land than the most efficient meat production in Africa

North America



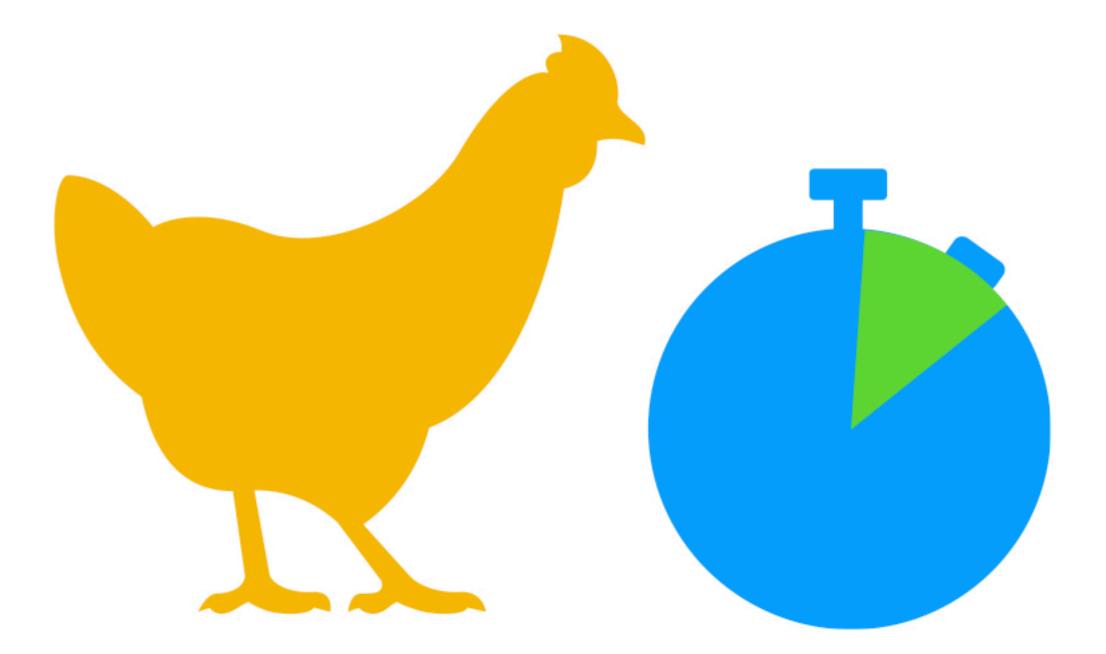
Between 1925 and 2017, U.S. breeders cut feeding time by more than half while more than doubling the weight



1925



Harris International



2017

Source: Kathryn Asher et al., "Study of Current and Former Vegetarians and Vegans: Initial Findings, December 2014," Humane Research Council and



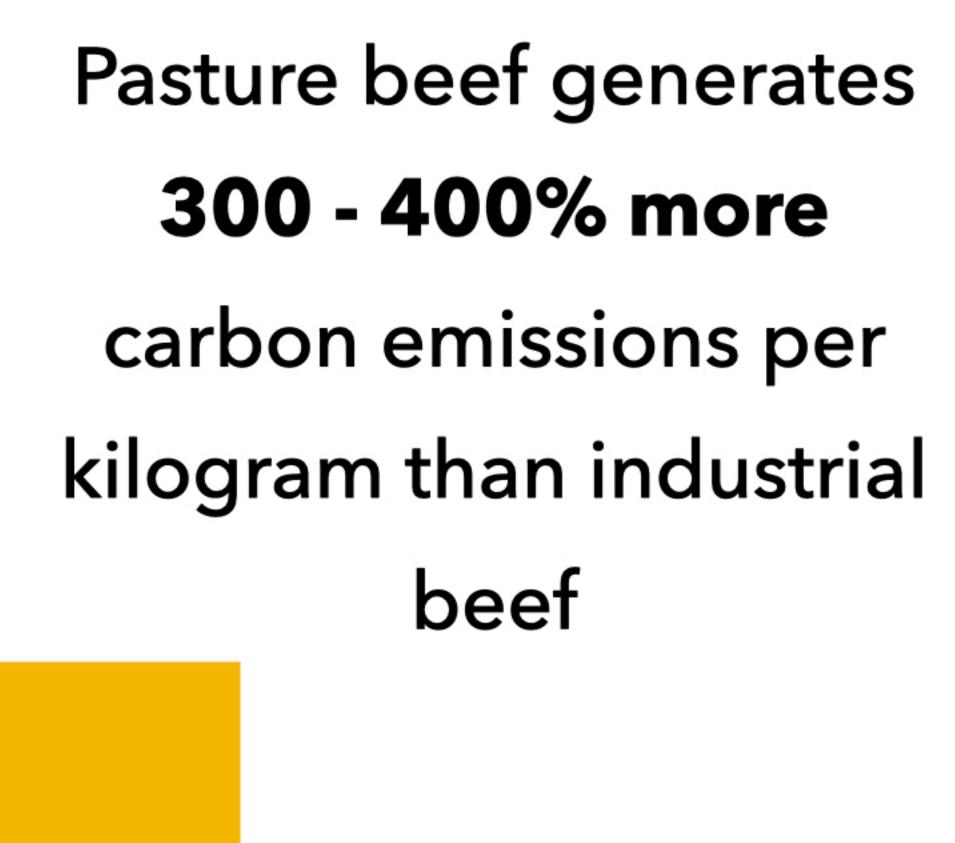
4. Low-efficiency farming is bad for the environment







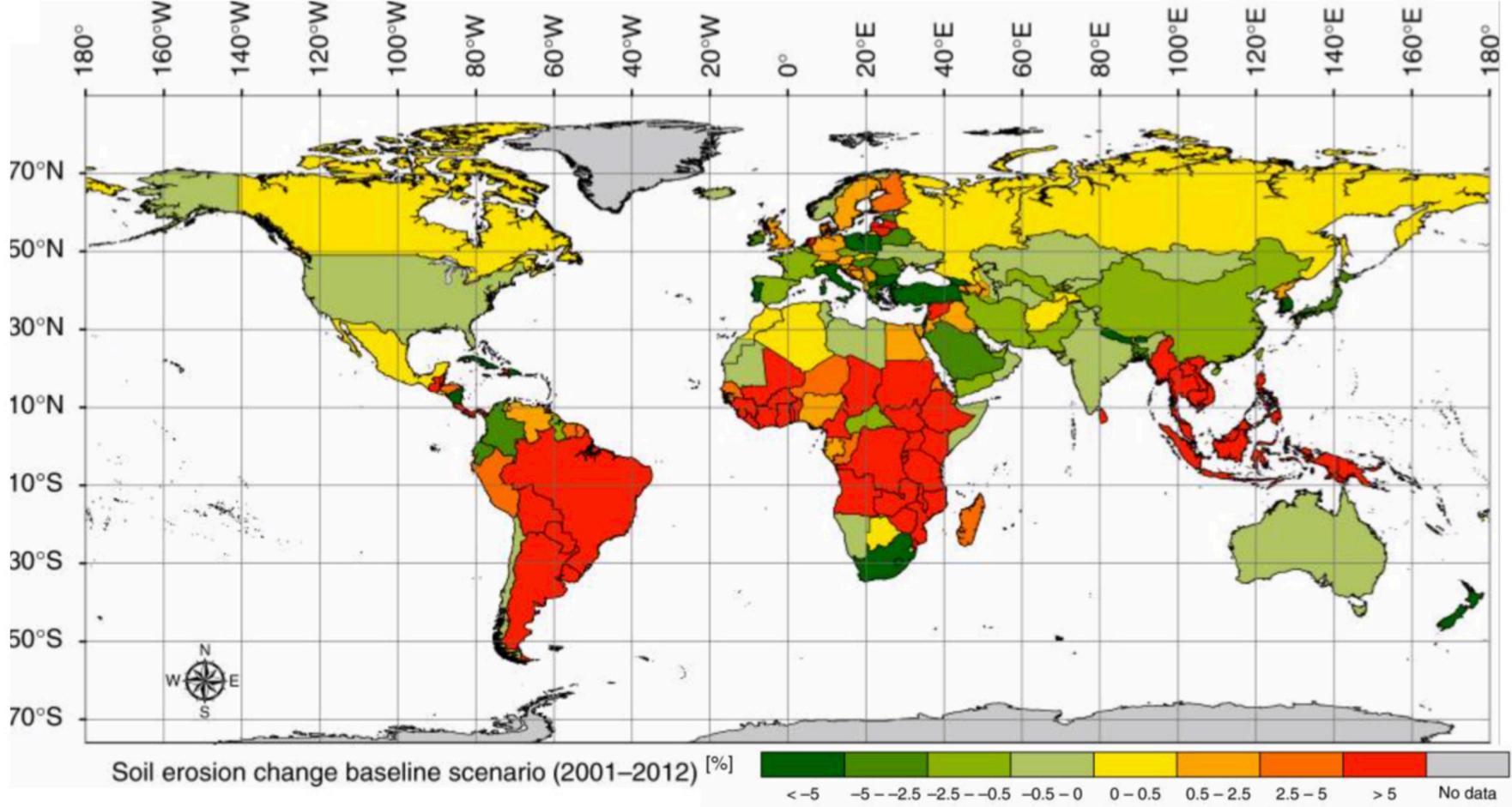
Source: Durk Nijdam, Geertruida Rood, and Henk Westhoek, "The price of protein: Review of land use and carbon footprints from life cycle assessments of animal food products and their substitutes," Food Policy 37 (2012): 760-770, https://doi.org/10.1016/j.foodpol.2012.08.002.



Industrial beef

of animal

80% of all degraded soils are in developing and poor nations, which experience soil loss at **twice** the rate of developed nations

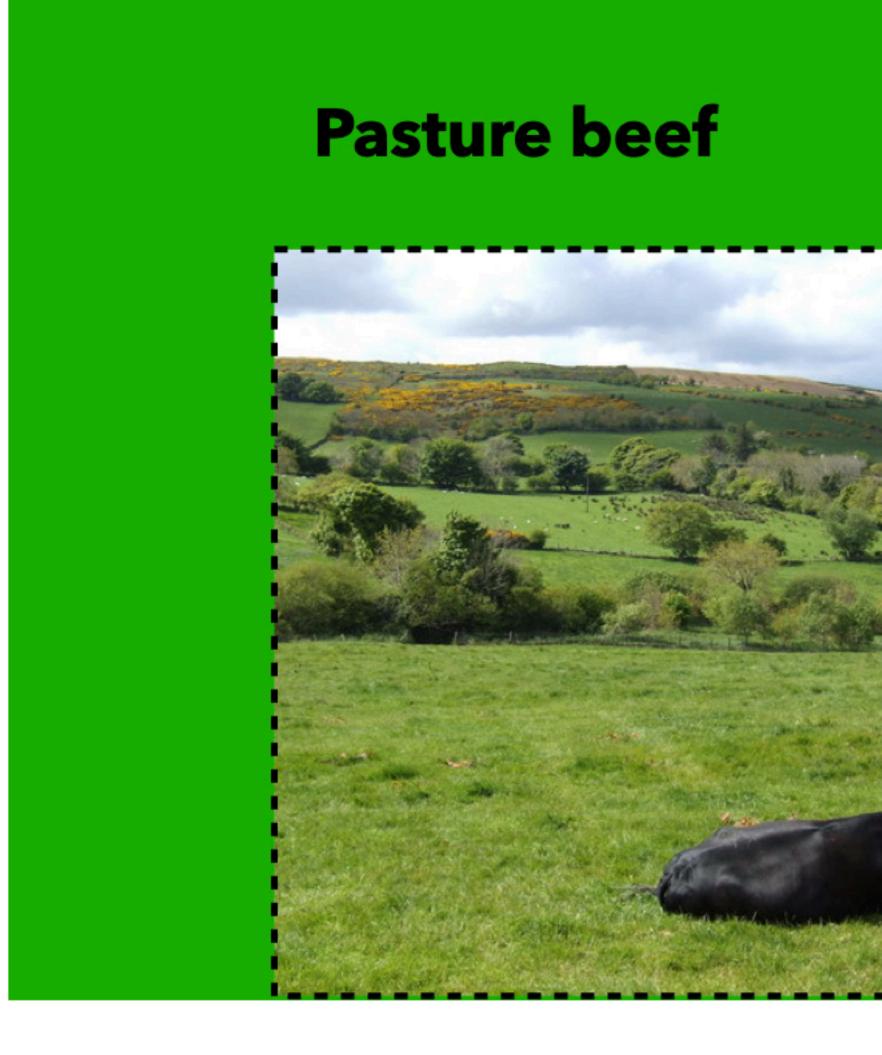




Source: Borrelli, Pasquale et al. "An assessment of the global impact of 21st century land use change on soil erosion." Nature communications vol. 8,1 2013. 8 Dec. 2017, doi:10.1038/s41467-017-02142-7









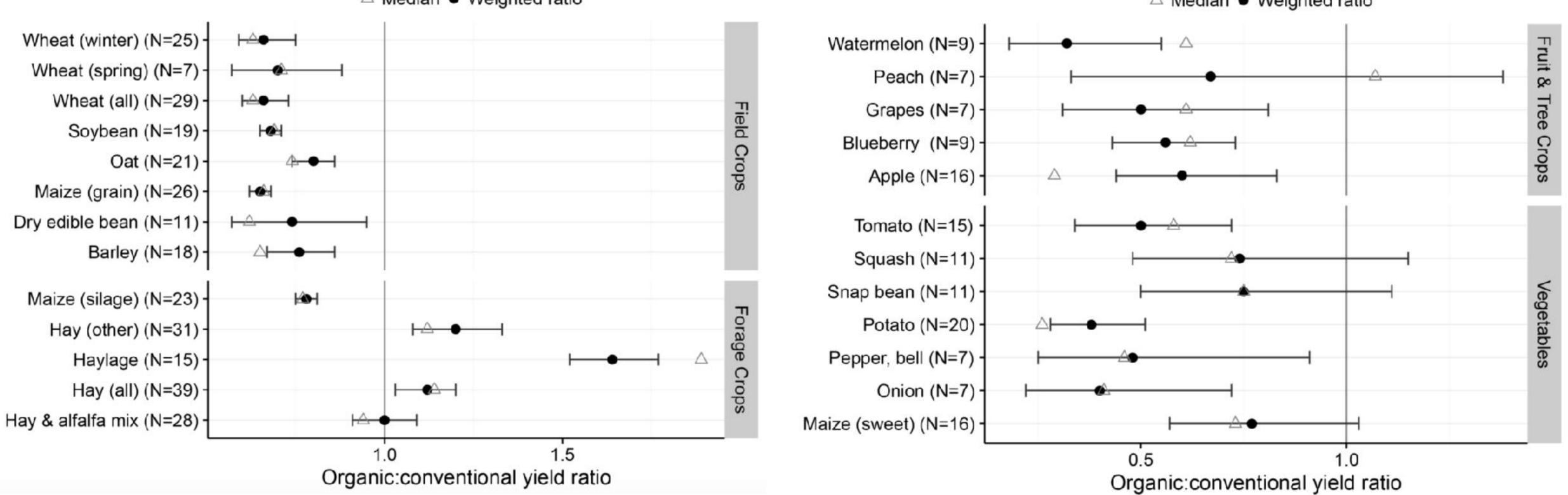
Source: Durk Nijdam, Geertruida Rood, and Henk Westhoek, "The price of protein: Review of land use and carbon footprints from life cycle assessments of animal food products and their substitutes," Food Policy 37 (2012): 760-770, https://doi.org/10.1016/j.foodpol.2012.08.002.

Pasture beef requires **14 - 19x** more land per kilogram than industrial beef

Industrial beef

of animal

Organics require more land than conventional



△ Median ● Weighted ratio



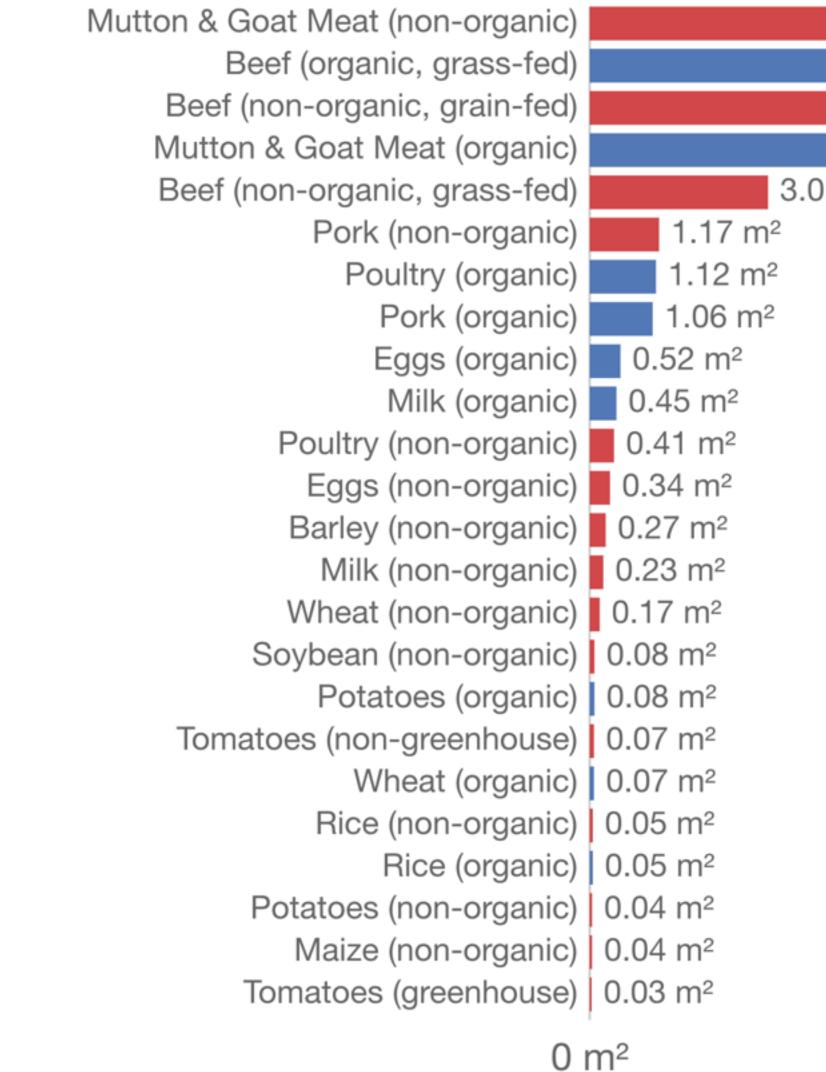
Source: Kniss AR et al., PLoS ONE, 2016. doi: 10.1371/journal.pone.0161673

△ Median ● Weighted ratio



Land use per 100 kilocalories by food and production type

Average land use per 100 kilocalories of food production, by food type and production system measured in metres squared (m²) per 100 kilocalories. Average values are based on a meta-analysis of studies across 742 agricultural systems and over 90 unique foods.





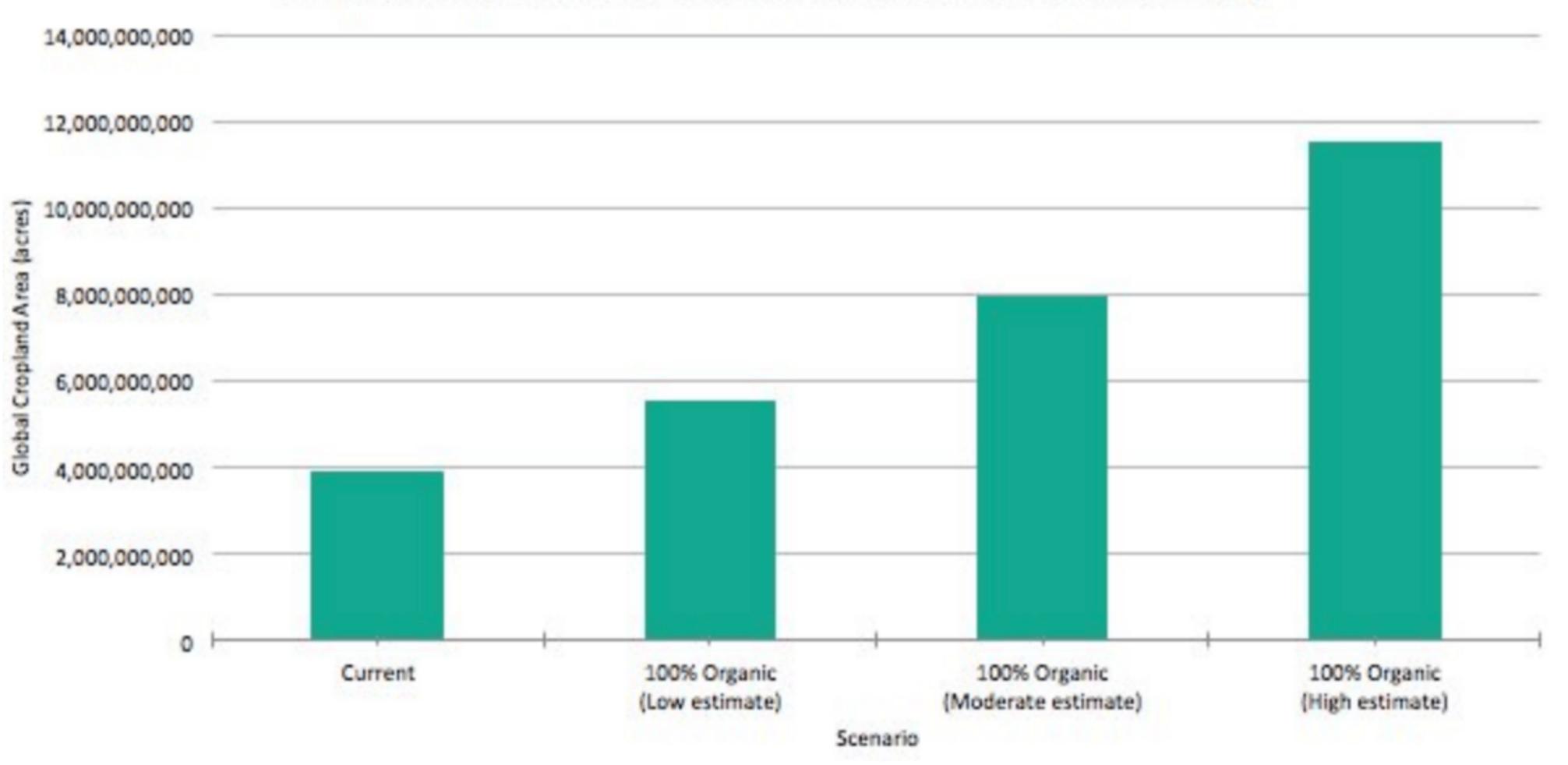
Source: Clark & Tilman (2017)

Our World in Data

			20.98 m	²
		13.55 m ²		
	8.27 m ²			
4.64 m ²				
1 m²				
5 m ²	10 m ²	15 m²	20 m²	
0 111				
		OurWo	orldInData.org • CC BY-S	SA

Increasing Organic Would Require More Land

Cropland Expansion Needed to Grow All Food Organically





Source: Dan Blaustein-Rejto et al, "Shadow Footprint of Organic Agriculture," Breakthrough Institute, March 22, 2018





5. American farmers can help farmers in poor nations





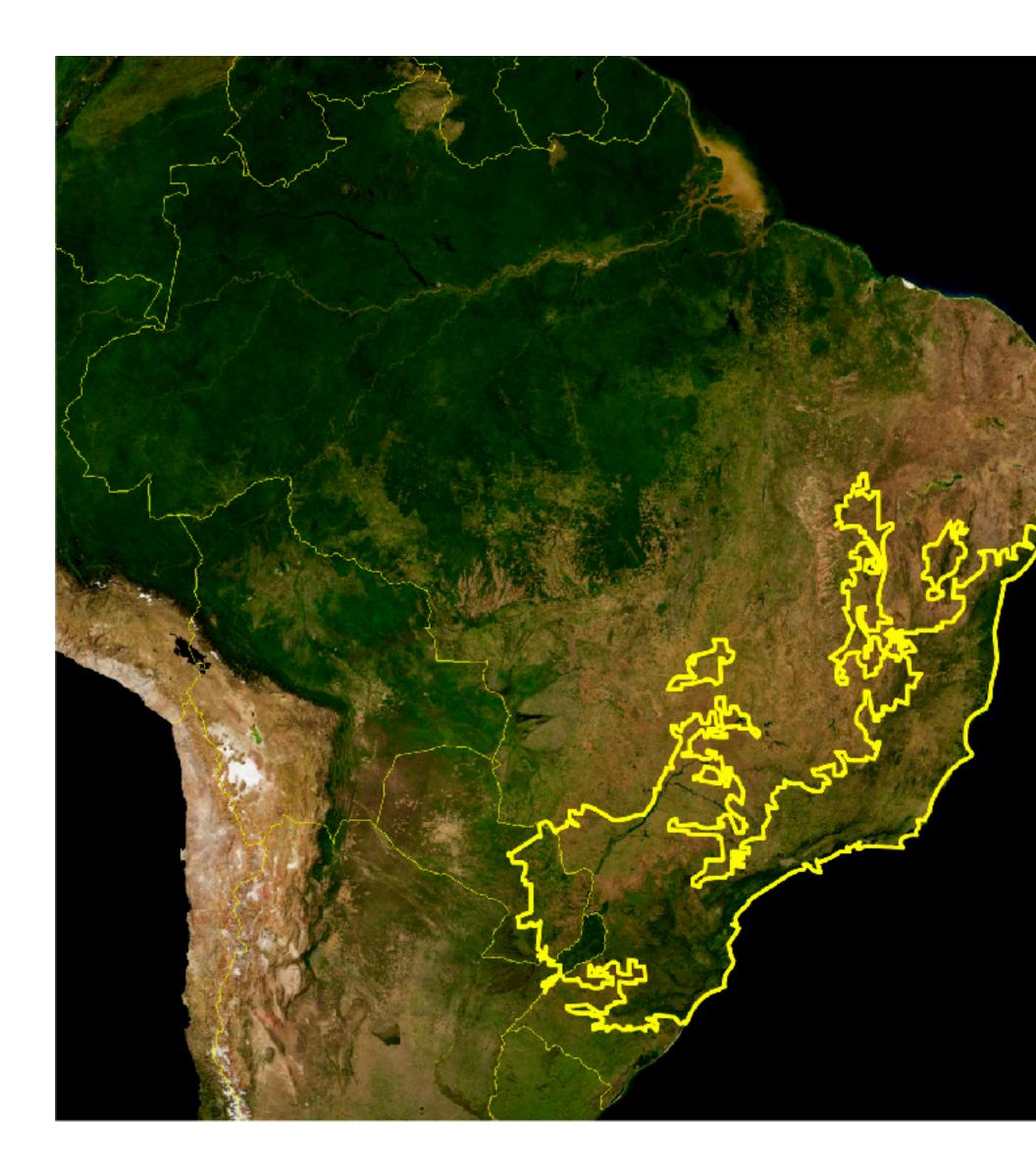
Source: FAO, The future of food and agriculture-Alternative pathways to 2050 (Rome: Food and Agriculture Organization of the United Nations, 2018), 76-77.

Experts say Sub-Saharan African farms can increase yields by nearly 100% by 2050 simply through access to irrigation, fertilizer, and farm machinery











Source: Bernardo B. N. Strassburg, Agnieszka E. Lataweic, Luis G. Barioni et al., "When Enough Should Be Enough: Improving the Use of Current Agricul- tural Lands Could Meet Production Demands and Spare Natural Habitats in Brazil," Global Environmental Change 28 (September 2014): 84–97, https:// doi.org/10.1016/ j.gloenvcha.2014.06.001

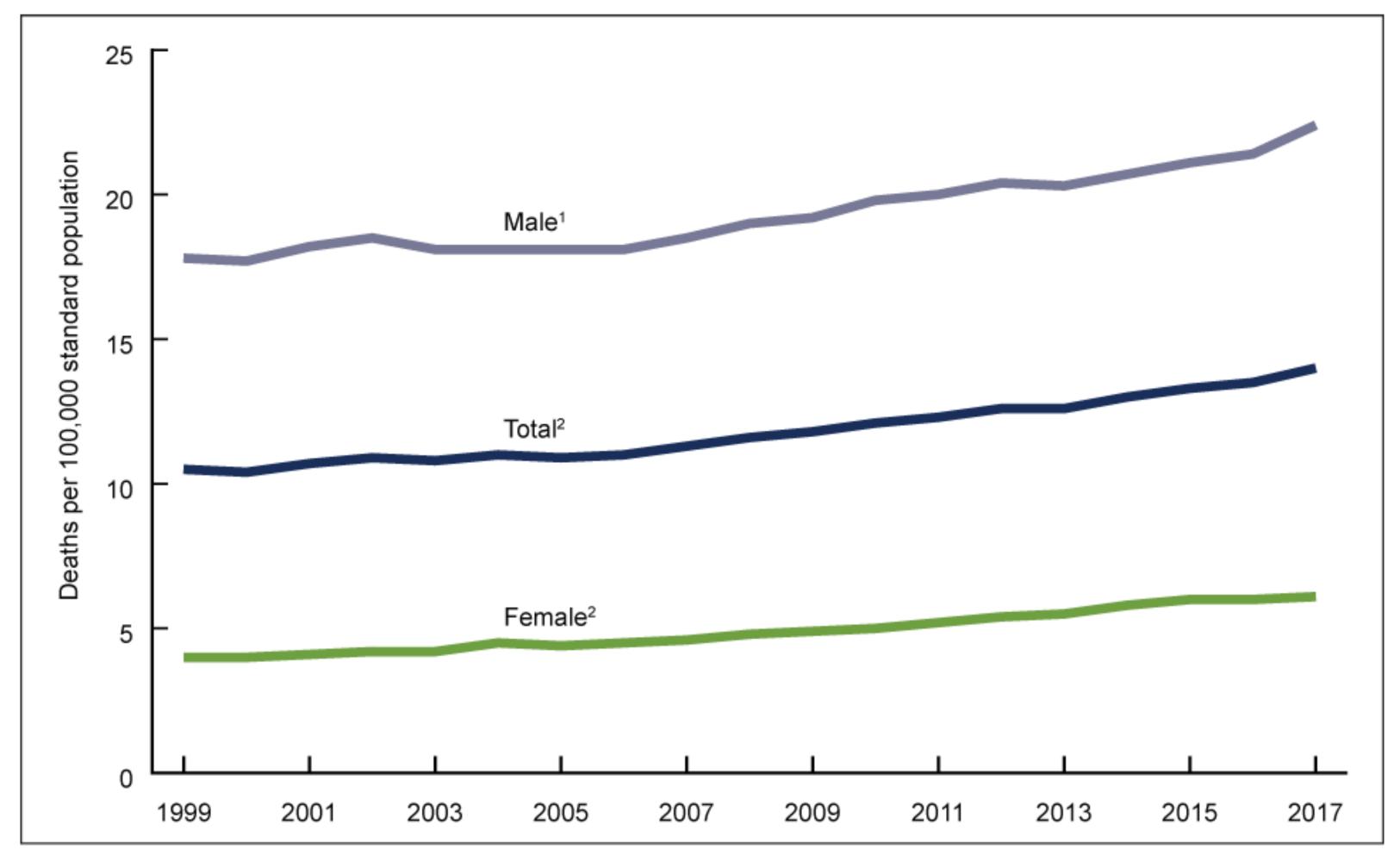
In Brazil, an area of land twice the size of Portugal could be restored to rainforest without impeding national agricultural expansion



6. Is climate change really the biggest problem facing the U.S. right now?

CDC: Suicides Rising

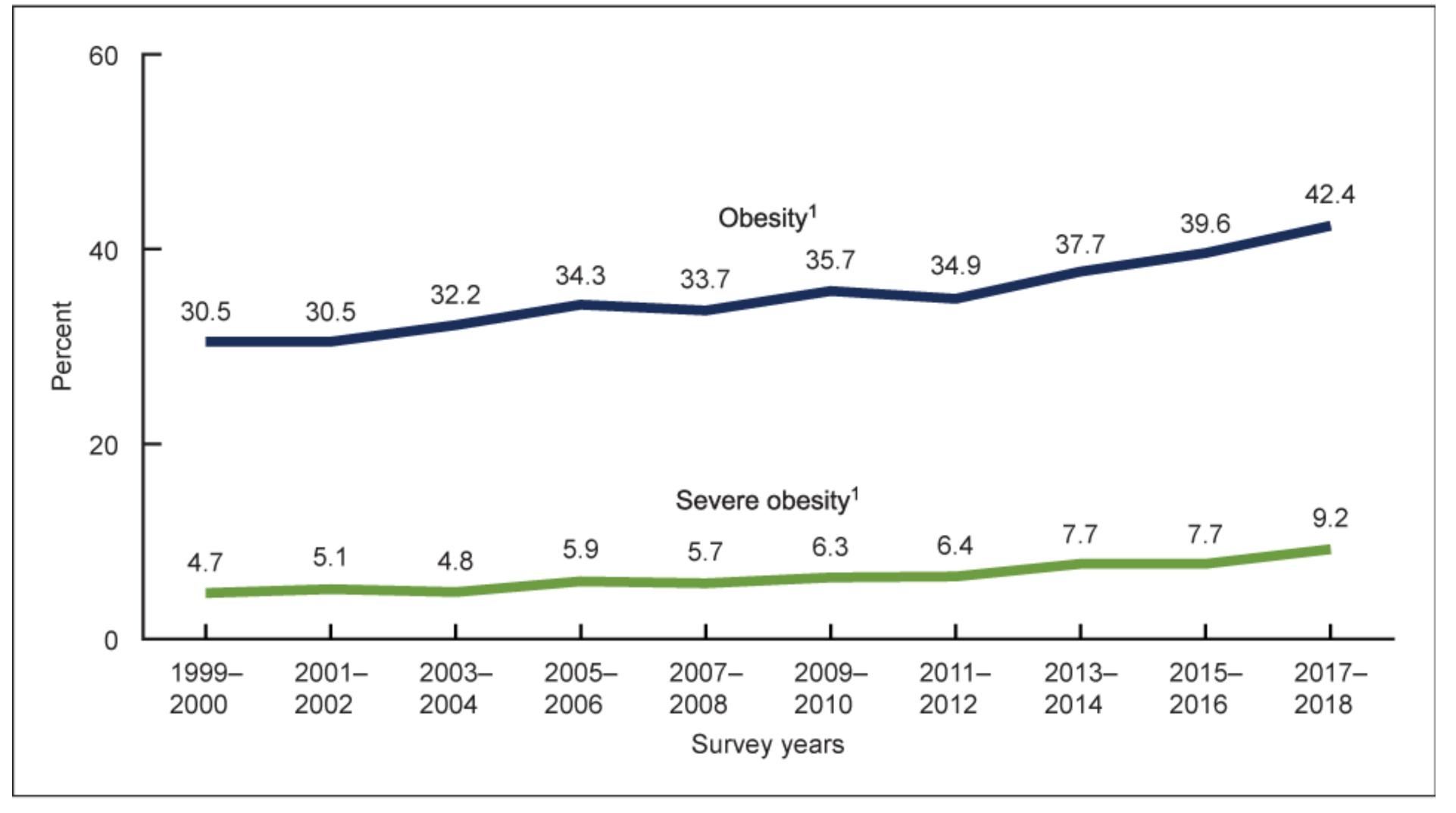
Figure 1. Age-adjusted suicide rates, by sex: United States, 1999–2017



¹Stable trend from 1999 through 2006; significant increasing trend from 2006 through 2017, p < 0.001. ²Significant increasing trend from 1999 through 2017 with different rates of change over time, p < 0.001. NOTES: Suicides are identified using International Classification of Diseases, Tenth Revision underlying cause-of-death codes U03, X60-X84, and Y87.0. Age-adjusted death rates were calculated using the direct method and the 2000 U.S. standard population. Access data table for Figure 1 at: https://www.cdc.gov/nchs/data/databriefs/db330_table-508.pdf#1. SOURCE: NCHS. National Vital Statistics System. Mortality.



CDC: Obesity rising





¹Significant linear trend.

NOTES: Estimates were age adjusted by the direct method to the 2000 U.S. Census population using the age groups 20–39, 40–59, and 60 and over. Access data table for Figure 4 at: https://www.cdc.gov/nchs/data/databriefs/db360_tables-508.pdf#4. SOURCE: NCHS, National Health and Nutrition Examination Survey, 1999–2018.

Deaths from drug overdose compared to deaths from extreme weather in U.S.



Drug Overdose

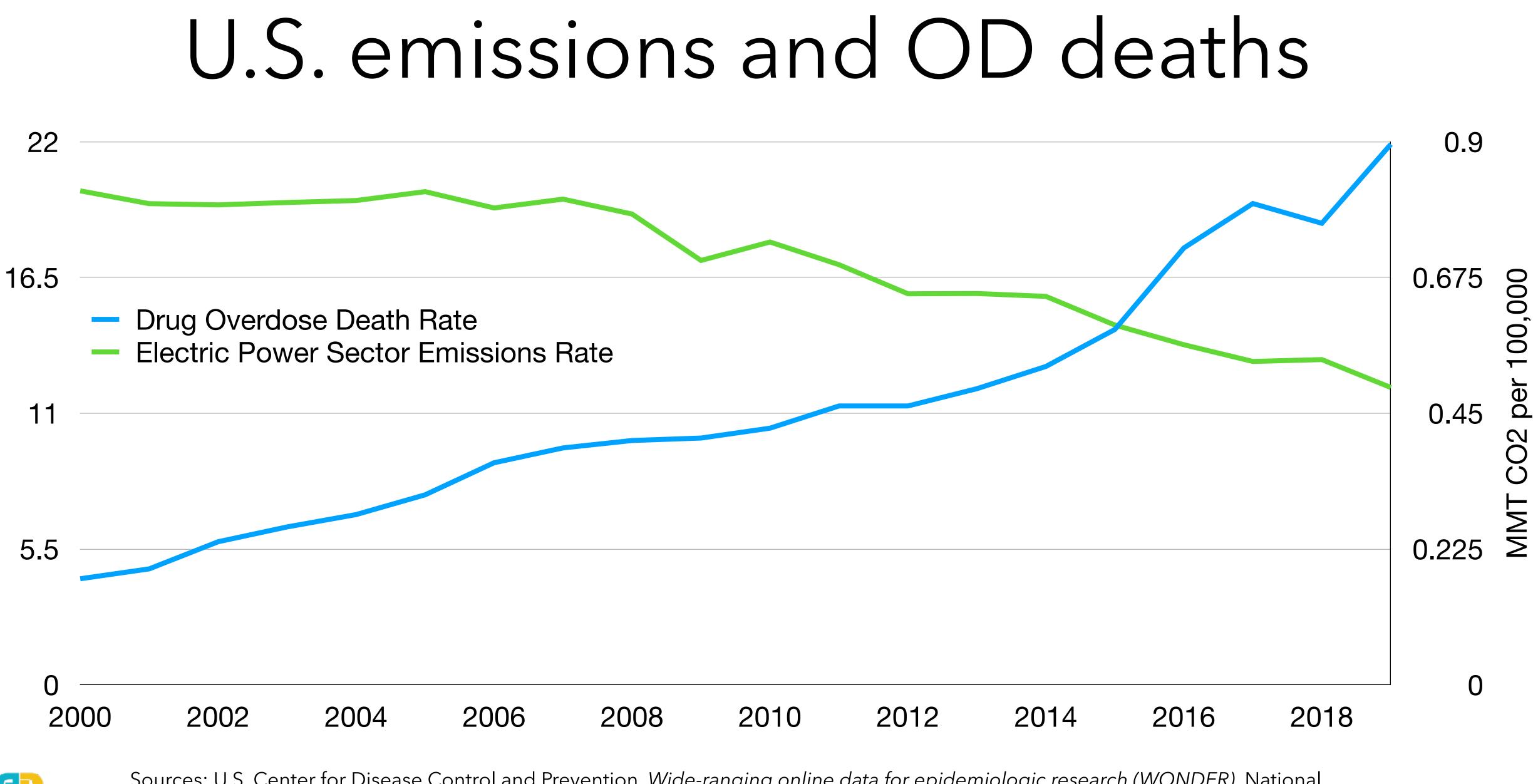


Sources: CDC, Wide-ranging online data for epidemiologic research (WONDER). National Center for Health Statistics; 2020. http://wonder.cdc.gov. National Center, Storm Events Database, National Oceanic and Atmospheric Administration, 2020. May 2019 - May 2020

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Extreme Weather





QD ENVIRONMENTAL PROGRESS

100,000

e

Deaths

Sources: U.S. Center for Disease Control and Prevention, Wide-ranging online data for epidemiologic research (WONDER). National Center for Health Statistics; 2020. http://wonder.cdc.gov. U.S. Energy Information Administration, Electric Power Monthly, 2021.





Thank You