Fossil Fuels, and Human and Environmental Well-Being

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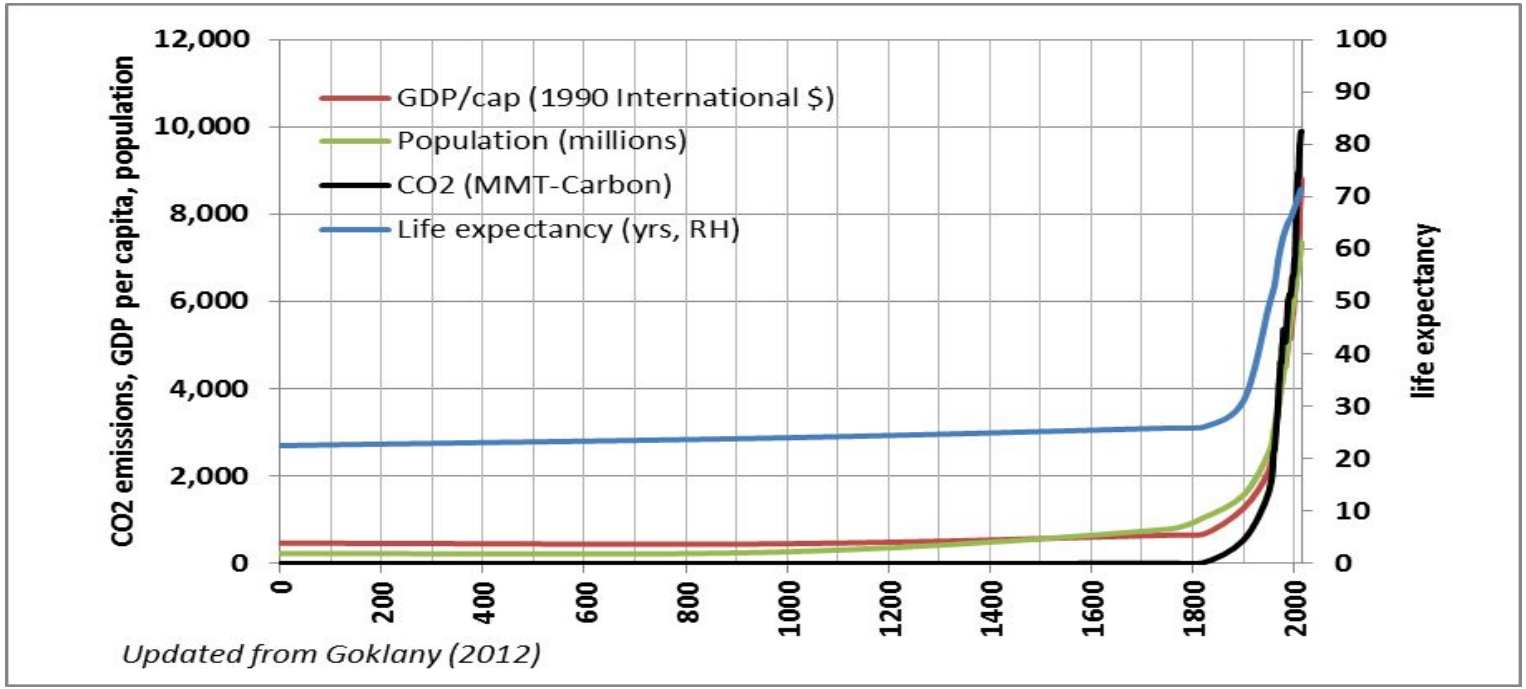
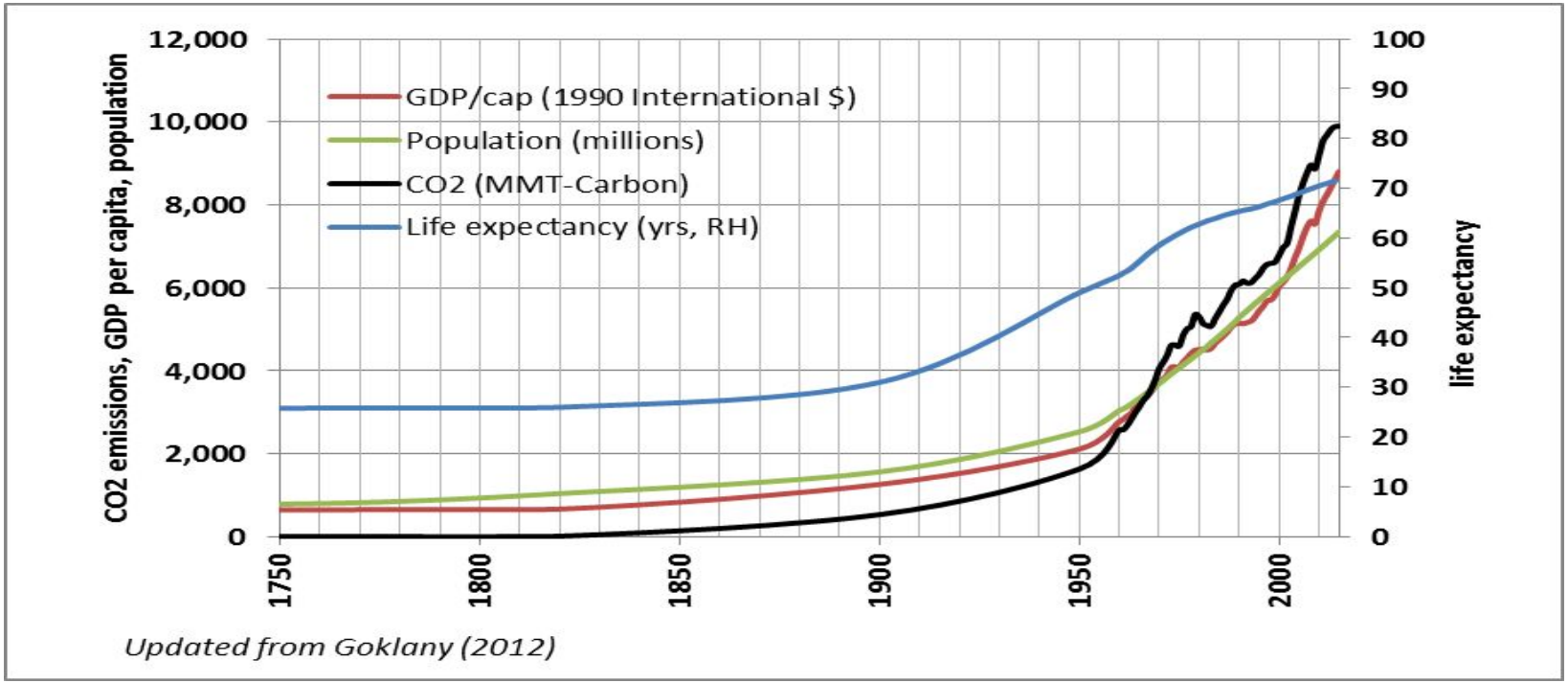
Human Progress & CO2 Emissions, AD 1–2015



Update based on World Bank (2017); Le Quéré et al. (2016), via CDIAC

Human Progress & CO2 Emissions, AD 1750–2015



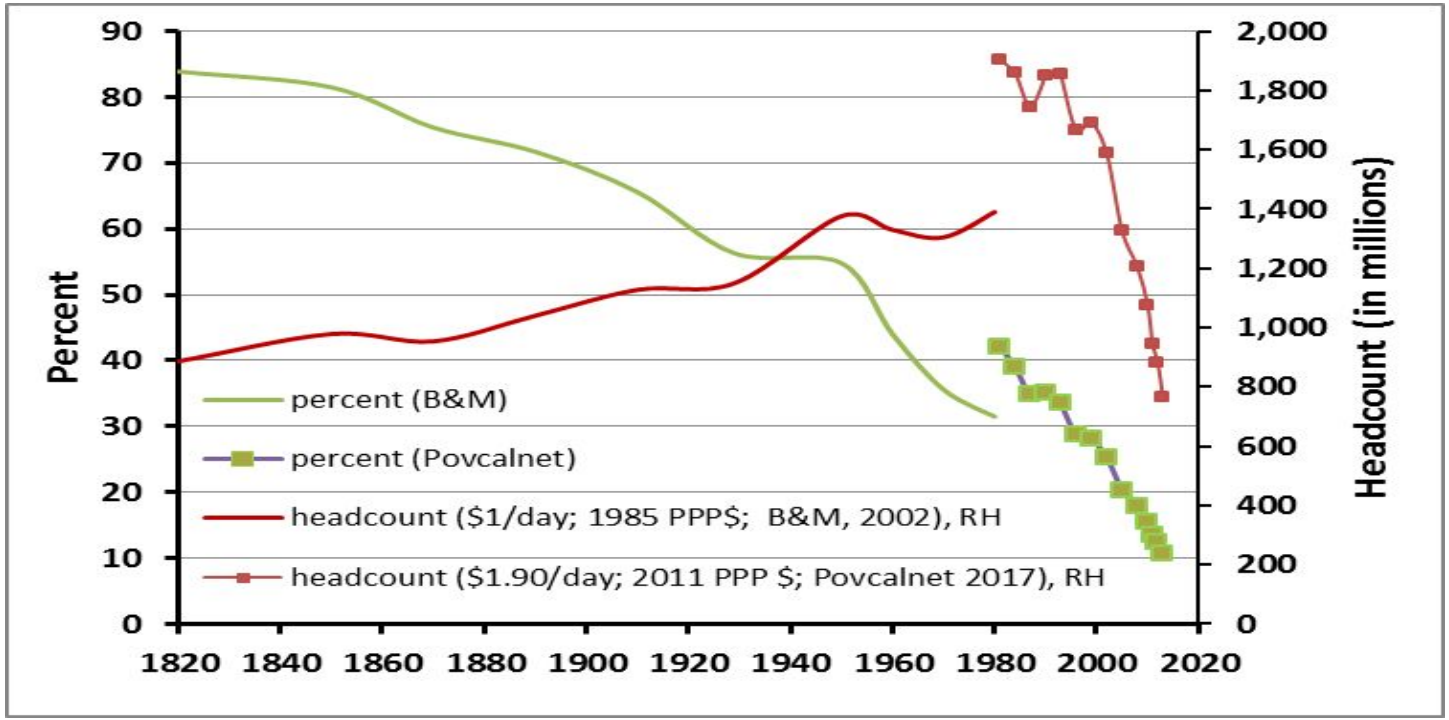
Update based on World Bank (2017); Le Quéré et al. (2016), via CDIAC

Living longer and healthier, but CO2 is going up!

	Life expectancy in 1950 (unadjusted) (yrs)	Health-adjusted life expectancy – 2000 (yrs)	Health-adjusted life expectancy – 2015 (yrs)
China	**41**	**64.6**	**68.5**
India	**32**	**54.2**	**59.6**
USA	**68**	**67.2**	**69.1**
World	**49**		**63.1**
Atmospheric CO2 level	**311**	**370**	**401**

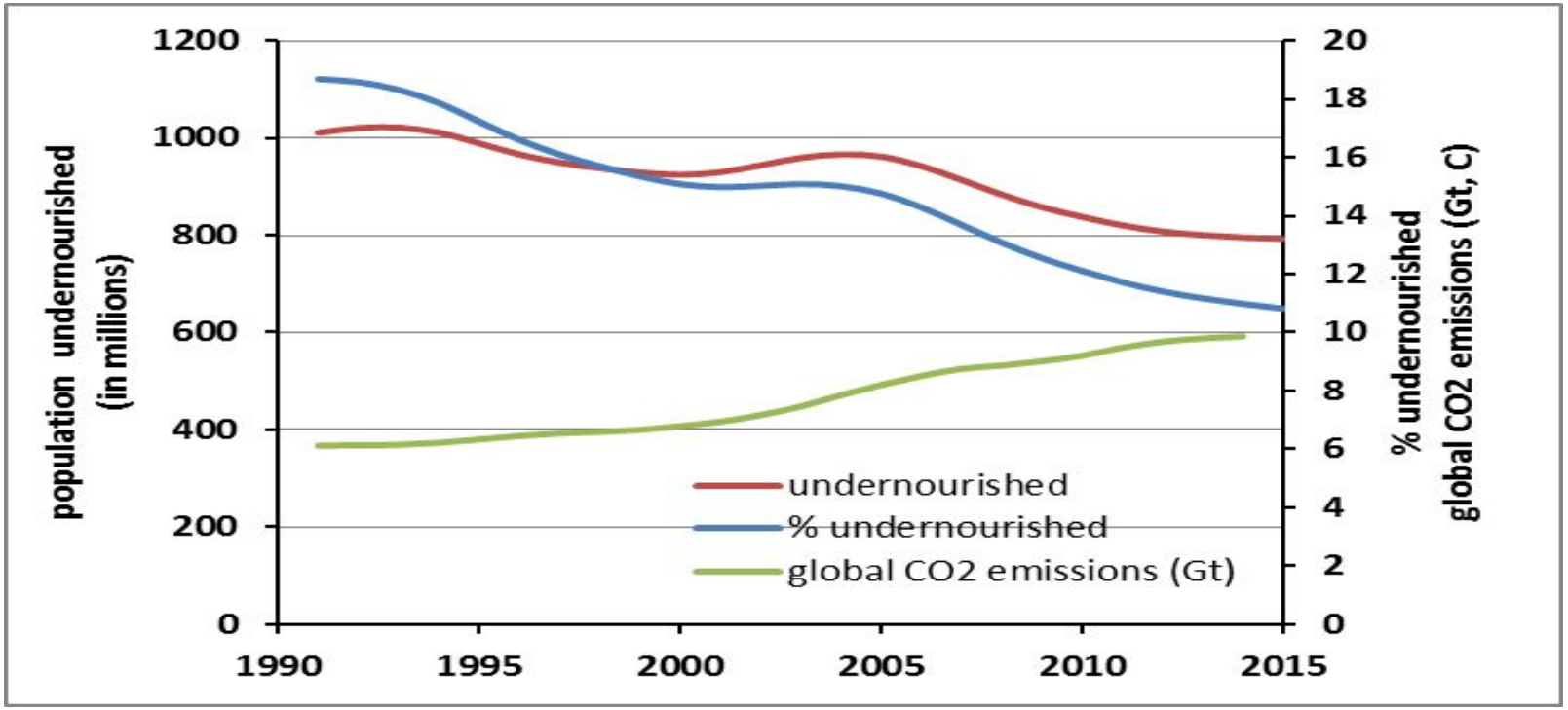
Sources: Maddisson (2001), p.30; ESRL Mauna Loa data, ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_annmean_mlo.txt; WHO (2016), http://gamapserver.who.int/gho/interactive_charts/mbd/hale_1/atlas.html .

Global Poverty, 1820–2013



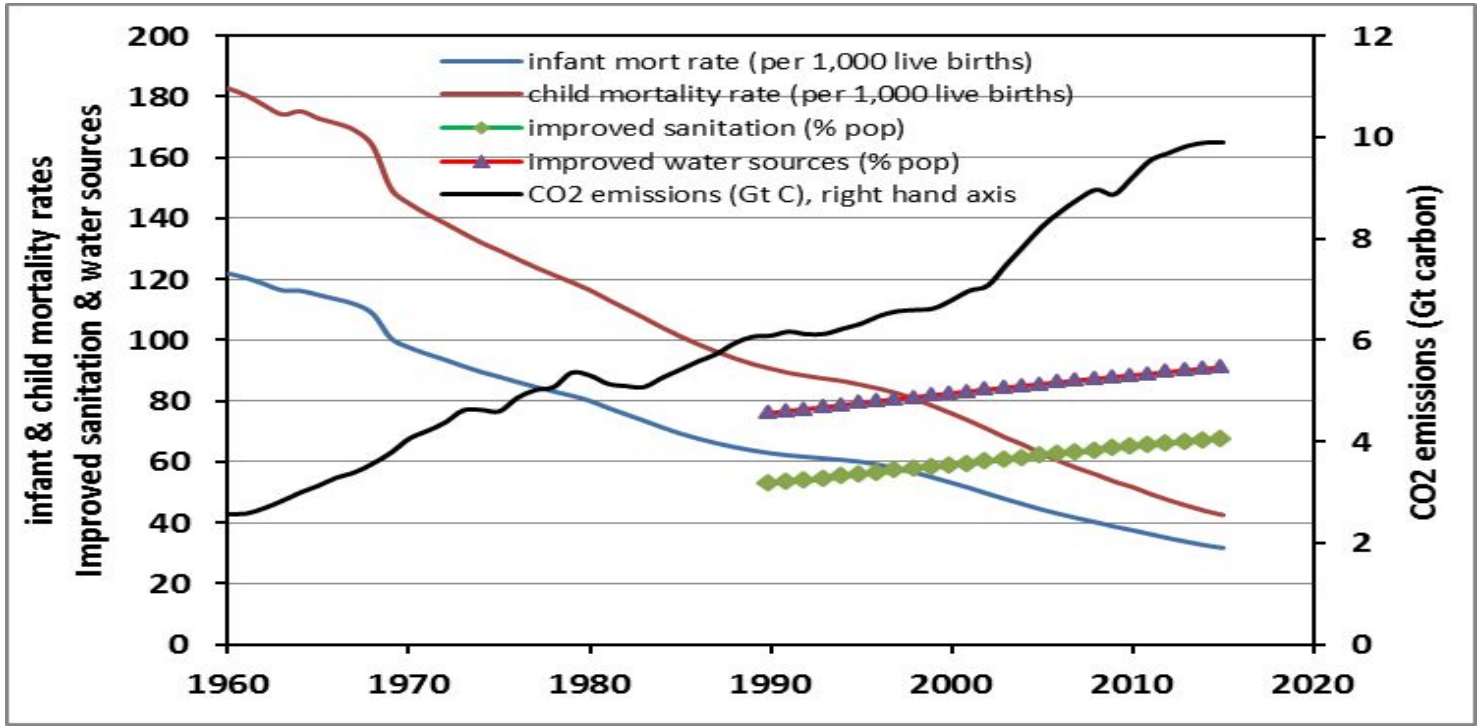
Sources: Morrison & Bourginon (2002), World Bank (2017)

Global Hunger & CO2 Emissions, 1991–2015



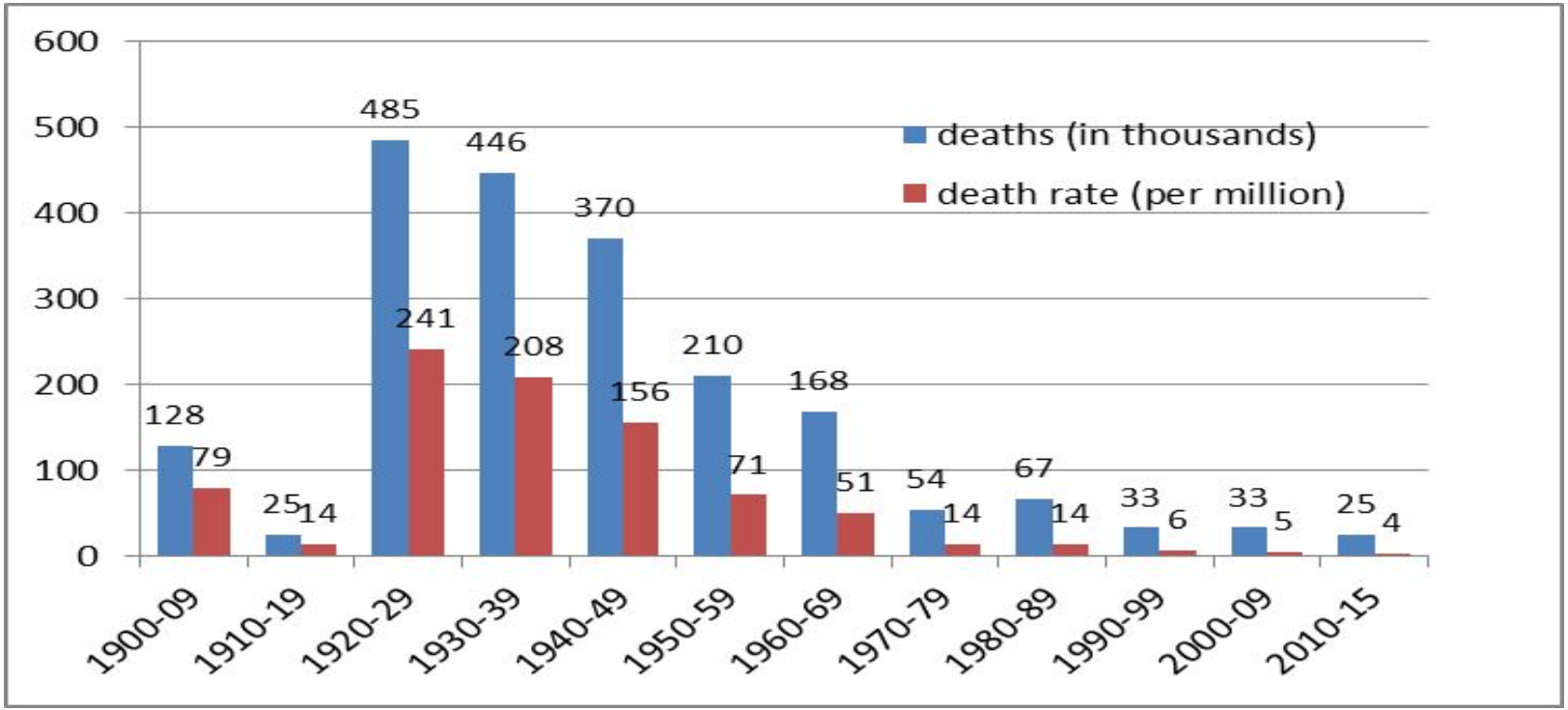
Sources: FAO (2016); Le Quéré et al. (2016), via CDIAC

Trends: CO2 Emissions & Various Measures of Human Well-Being, 1960–2015



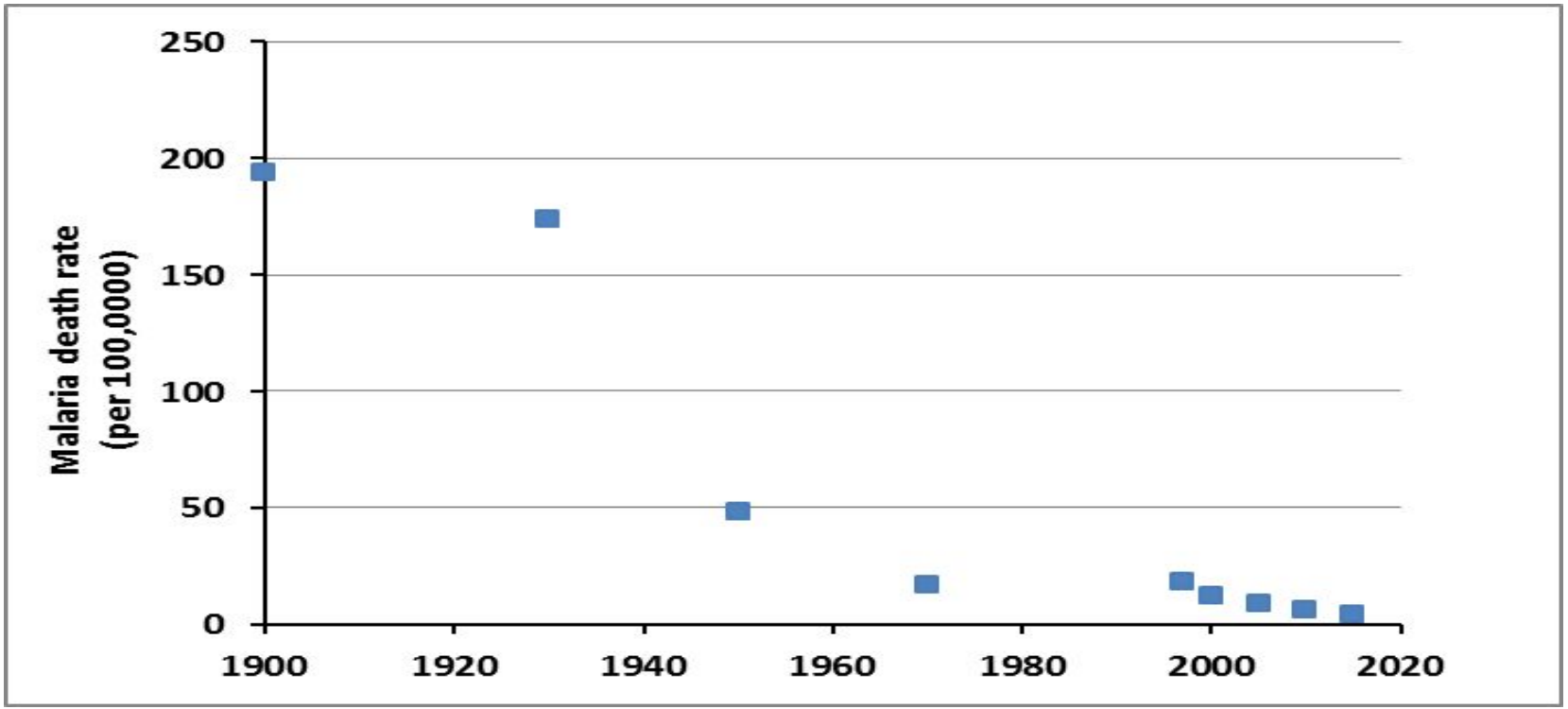
Sources: World Bank (2017); Le Quéré et al. (2016), via CDIAC

Global deaths & deaths rates from extreme weather events, 1900–2015



Sources: Updated from Goklany (2009) using EM-DAT (2017) and World Development Indicators (2017)

Global malaria death rates, 1900–2015



Sources: 1900-1997: World Health Report 1999, Chapter 4; 2000-2015: World Malaria Report 2016

Planet is greener, mainly from FF related factors (70% CO2, 9% N-deposition, 8% climate change)

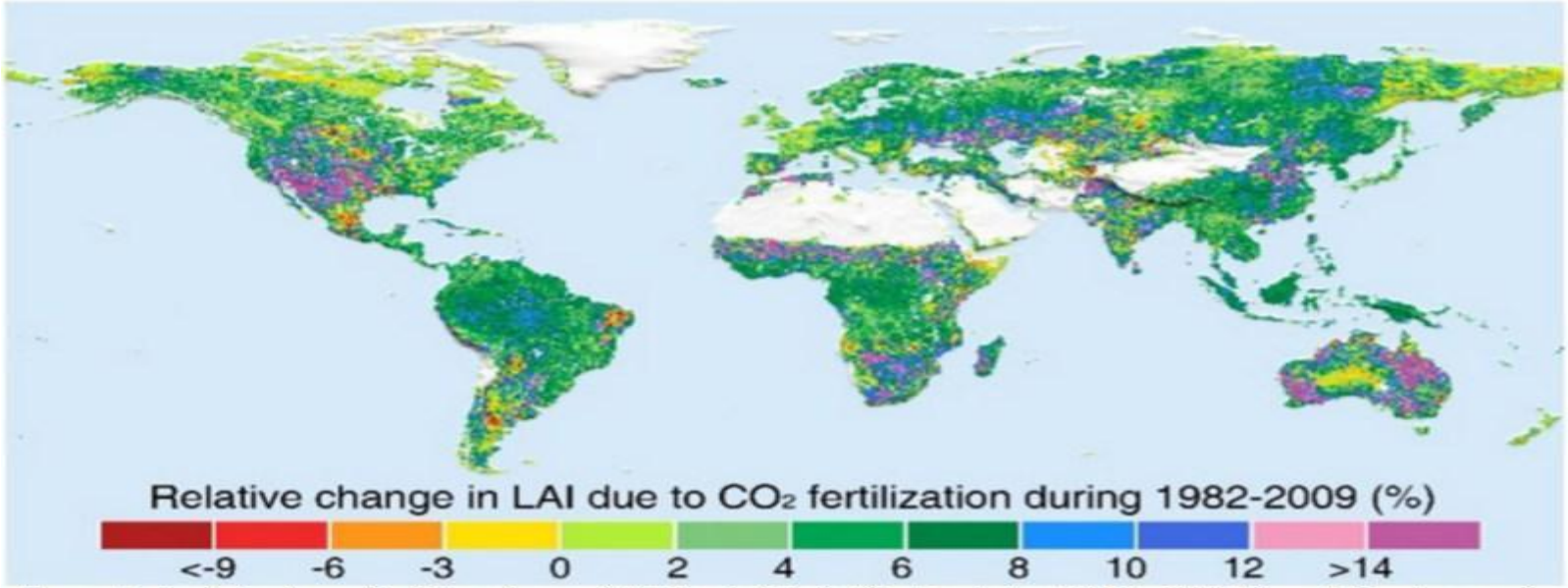
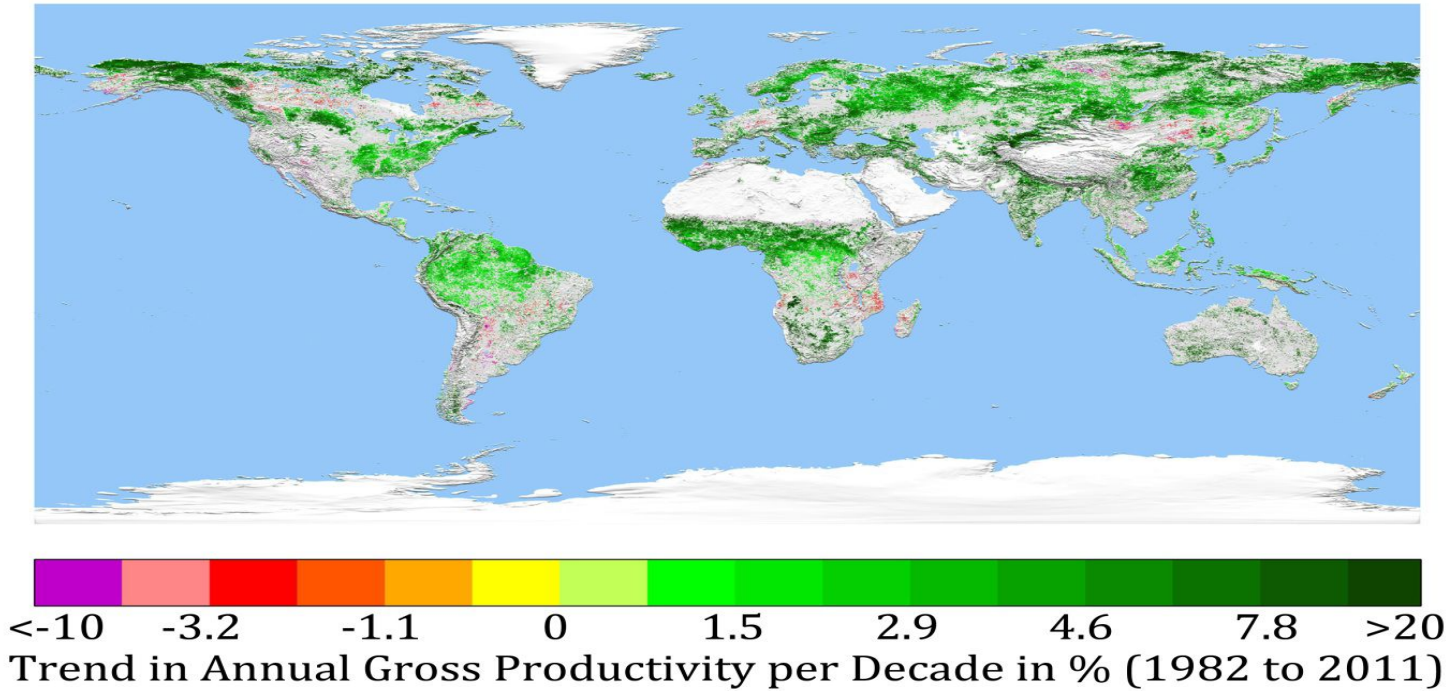


***Figure 1**. Spatial pattern of relative change of LAI due to CO_2 fertilization during 1982 to 2009. The relative change of LAI in each pixel is derived from the ratio of the increment of LAI driven by elevated atmospheric CO_2 to the 28-year average value of LAI simulated by model ensemble mean under scenario S1. Source: Figure S12, supplementary information from Zhu et al. (2016)*

Earth is more productive
[14% increase in gross productivity, 1982–2011]



Zhu & Myneni (2014), A Greener Earth?, Global vegetation monitoring and modelling, Avignon, France, February 3–7, 2014.

Conclusion: CO2 must be reduced

- Global population is becoming wealthier. Poverty is falling
- Fewer people go hungry. Malnutrition is dropping
- People are healthier and, what's worse, living longer
- Deaths from extreme weather events are down
- More people have safer water & better sanitation
- Population continues to increase
- The world is greener and more productive
- Creates space for Rest of Nature to coexist with humans

</sarcasm>

Back-up slides

Contributions of FF to economic growth and human well-being

- Increases land productivity:
  - Increases available food
  - Reduces hunger
  - Improves health
  - Enhances human capital
- Substitutes for human and animal labor
  - Frees up human time and energy to pursue other activities
  - Enhances human capital

Contributions of FF to economic growth and human well-being

- Human capital
  - Electricity (67% worldwide from FF) “creates” more time at humanity’s disposal which allows individuals to accumulate human capital
- Bulk of new technology powered directly or indirectly by energy [81% of global energy from FF]