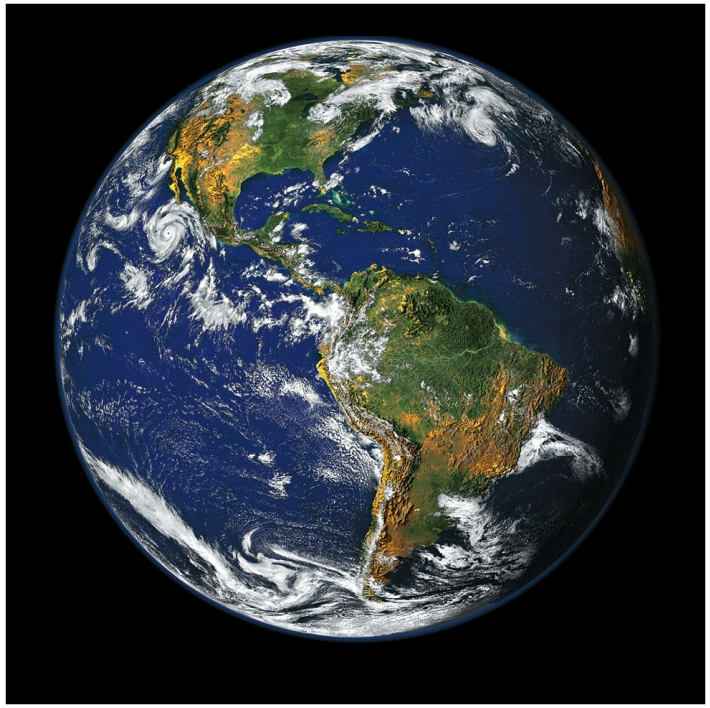


Population, Reports and Treaties

Academy of Lifelong Learning

Denver, CO

October 6, 2016

JFOrmes@comcast.net

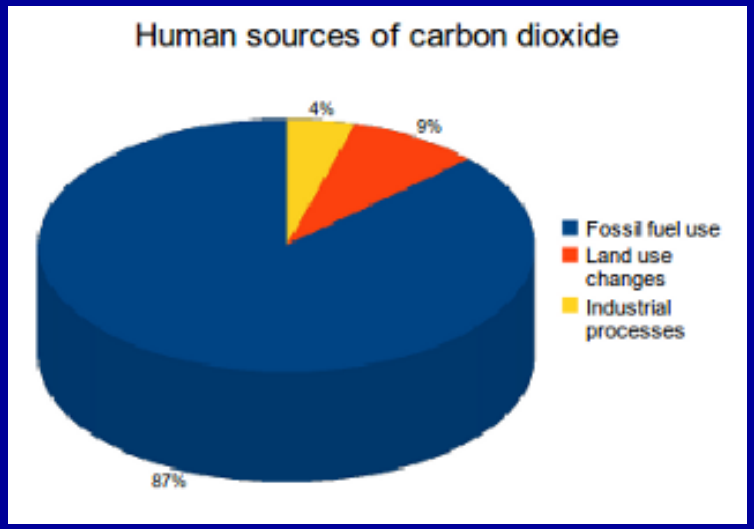
CO_2 as waste

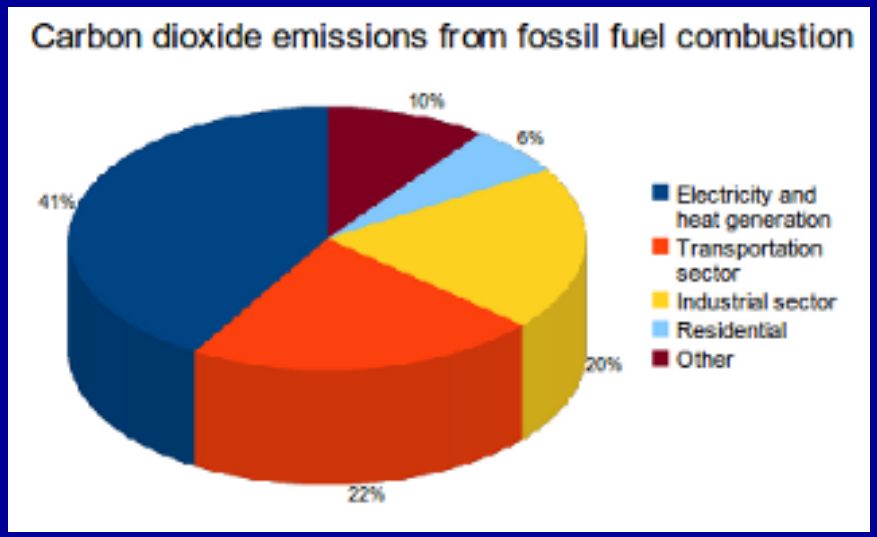
Atmosphere ("global commons") waste dump

- Solid waste produced annually about 1 billion metric tons
- Fossil fuel burning -> 30 billion metric tons/year

$$(30 \times 10^9)/(300 \times 10^6) = 100$$

Anthropogenic Sources of CO_2





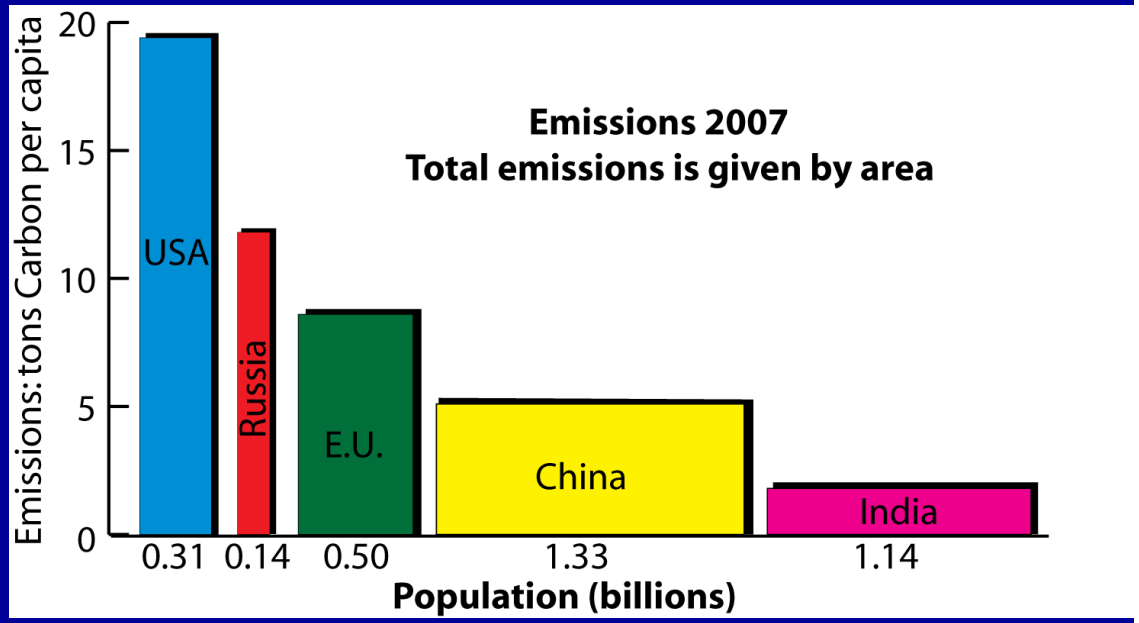
http://www.iea.org/publications/freepublications/publication/CO2emissionfromfuelcombustionhighlightsMarch2013.pdf or http://whatsyourimpact.org/greenhouse-gases/carbon-dioxide-sources

2007 emissions: Population matters!

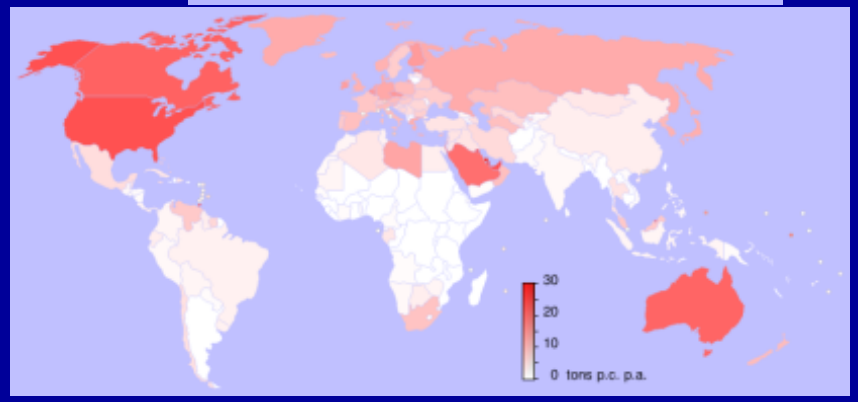
China biggest emitter

- 14% more than US
- Per capita Pop.

U.S.:	19.4	0.31
Russia:	11.8	0.14
E. U.:	8.6	0.50
China:	5.1	1.33
India:	1.8	1.14
	tons	Billions



Tons of CO_2 per capita



Netherlands Environmental Assessment Agency 2008

Compare 2007 and 2015 emissions:

China biggest emitter

- 14% more than US
- Per capita / Pop.

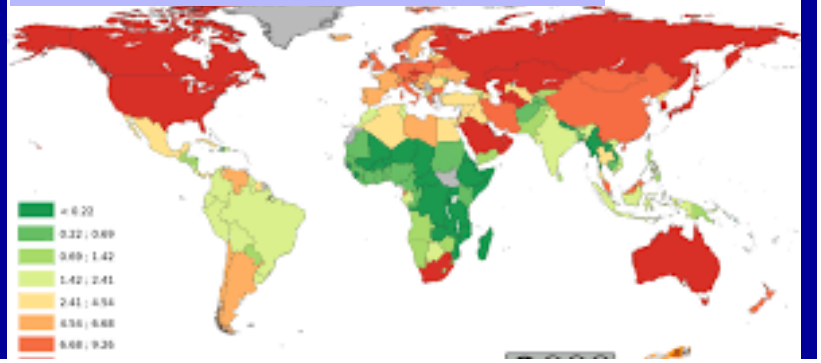
	Per capita	Pop.
U.S.:	19.4	0.31
Russia:	11.8	0.14
E. U.:	8.6	0.50
China:	5.1	1.33
India:	1.8	1.14
	tons	Billions

China biggest emitter

- 75% more than US
- Per capita / Pop.

	Per capita	Pop.
U.S.:	19.8	0.32
Russia:	16.2	0.14
E. U.:	8.8	0.50
China:	8.1	1.37
India:	2.4	1.25
	tons	Billions

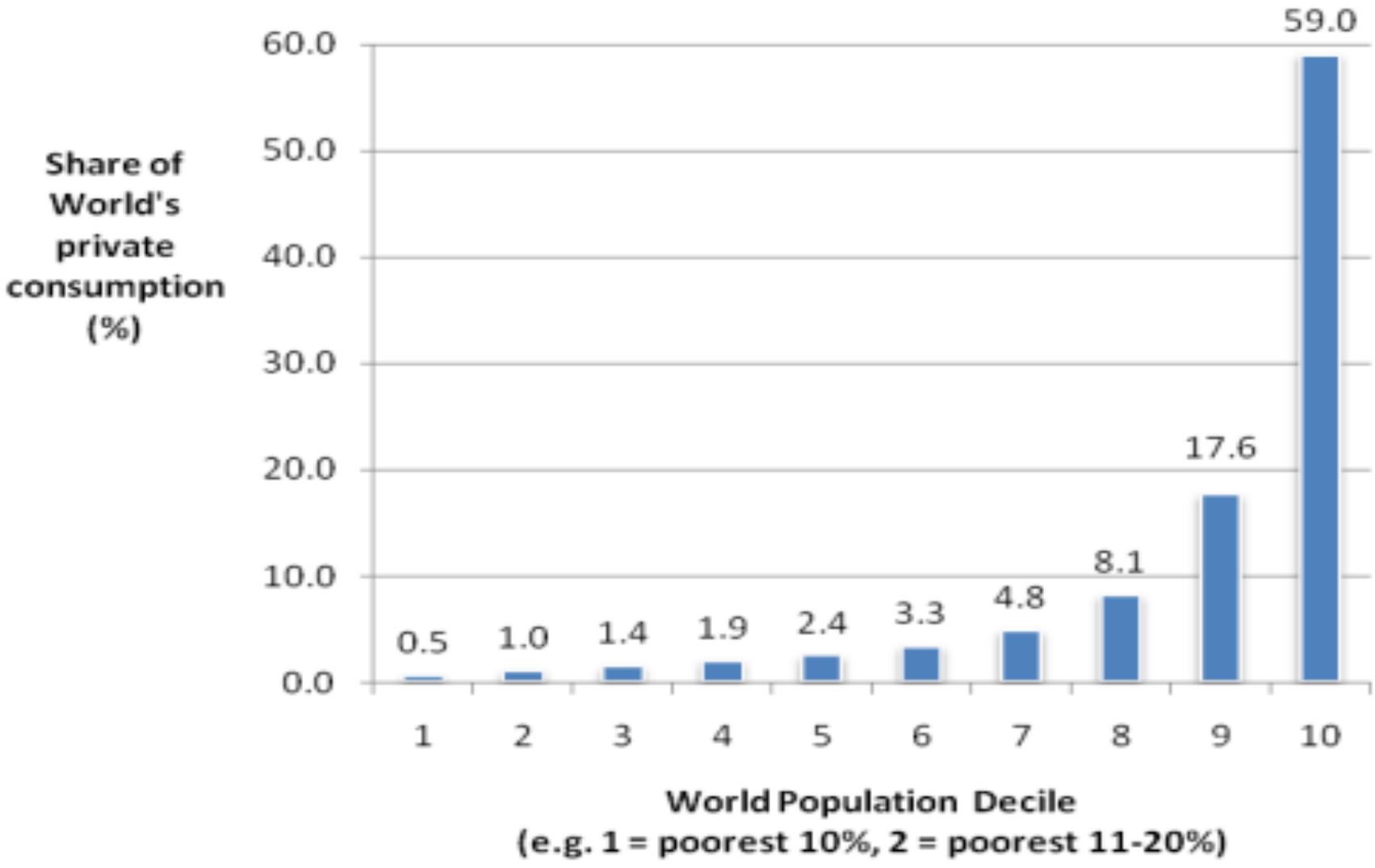
Tons of CO_2 per capita



Times of India

It wasn't ants, or apes or elephants

Inequality of Consumption, 2005



Source: World Bank Development Indicators 2008

Why it’s serious

Population

and many other things related to them

Exponential growth

For "other things", see talk by Jeffrey Sachs
at the American Geophysical Union

https://virtualoptions.agu.org/media/U12B.+Frontier%27s+of+Geophysics+Lecture%2C+Presented+By+Jeffrey++Sachs/0_pf006u0q

Click here

Exponential growth – understand it! Rule of 70 (well, ok, 69.3)

$$N = N_o e^n$$

$$N / N_0 = e^n$$

$$\ln(N / N_o) = n$$; n = 2 for doubling

for $N / N_o = 2,\ \ln(2) = 0.693$

N and n are dimensionless

% are scaled 100x

Rule of 69.3 (100*0.693):
If you have an annual interest rate of r, the time to double your money is 70years/r

e.g. 7% interest, double your money in 10 years

Chess board

There's a famous legend about the origin of chess that goes like this. When the inventor of the game showed it to the emperor of India, the emperor was so impressed by the new game, that he said to the man "*Name your reward!*"

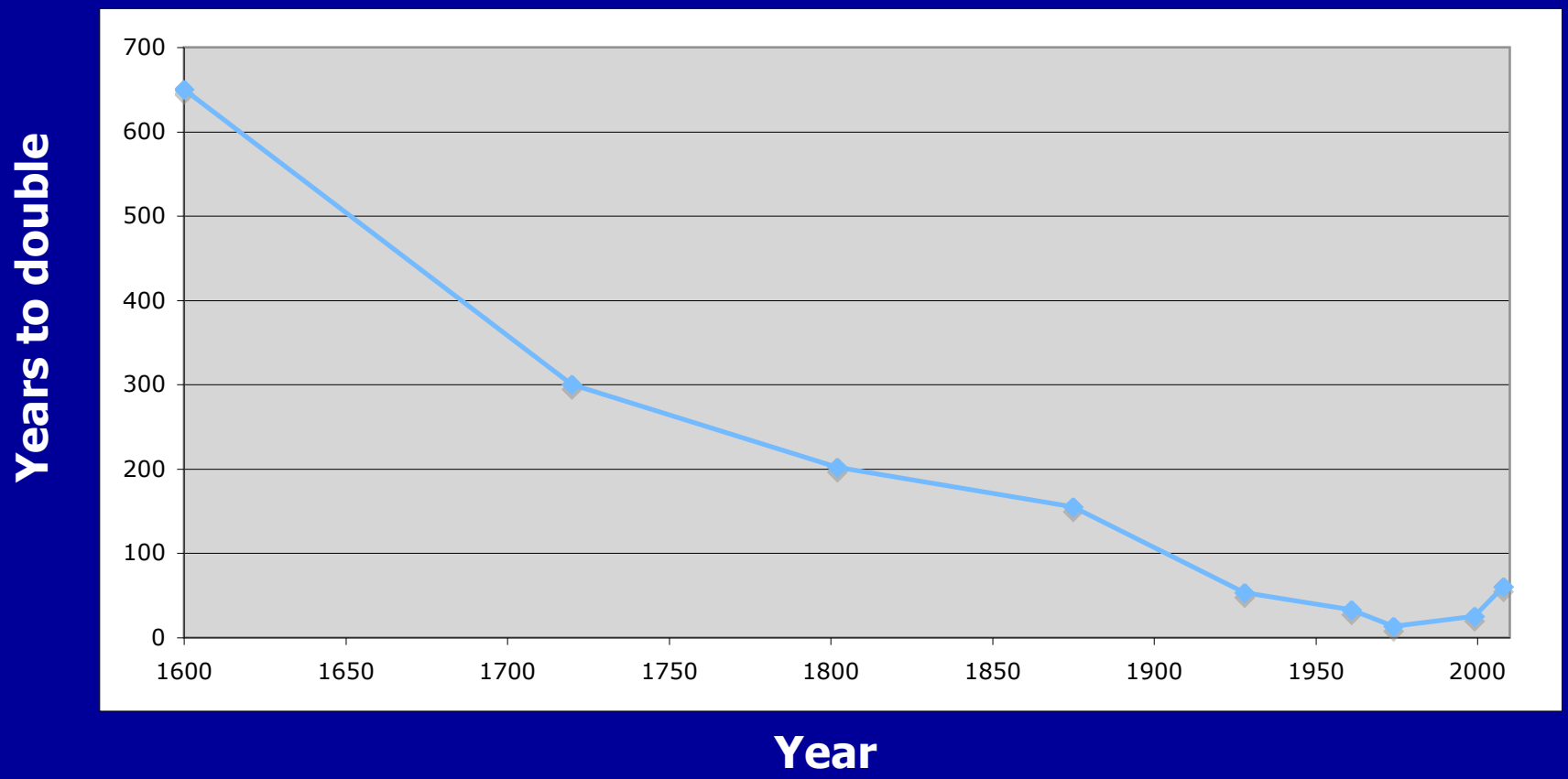
The man responded, "*Oh emperor, my wishes are simple. I only wish for this. Give me one grain of rice for the first square of the chessboard, two grains for the next square, four for the next, eight for the next and so on for all 64 squares, with each square having double the number of grains as the square before.*"

Chess board

The emperor agreed, amazed that the man had asked for such a small reward - or so he thought. After a week, his treasurer came back and informed him that the reward would add up to an astronomical sum, far greater than all the rice that could conceivably be produced in many many centuries!

The "granary" at Harappa, Pakistan

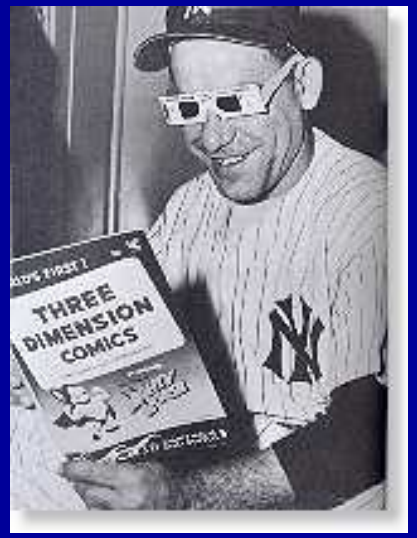
Population doubling time



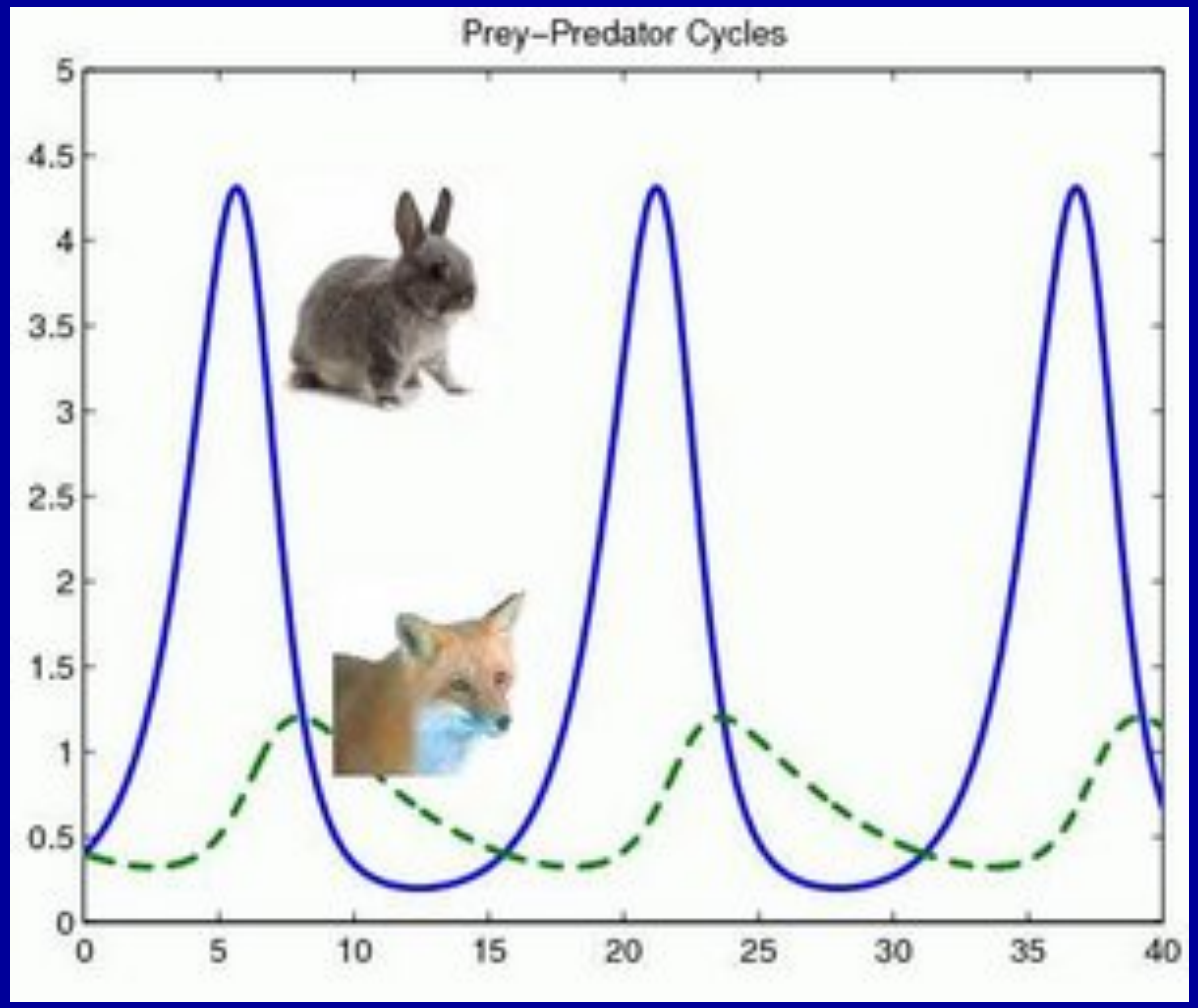
20th Century growth rate was “super exponential”

- “It’s hard to make predictions, especially about the future.”

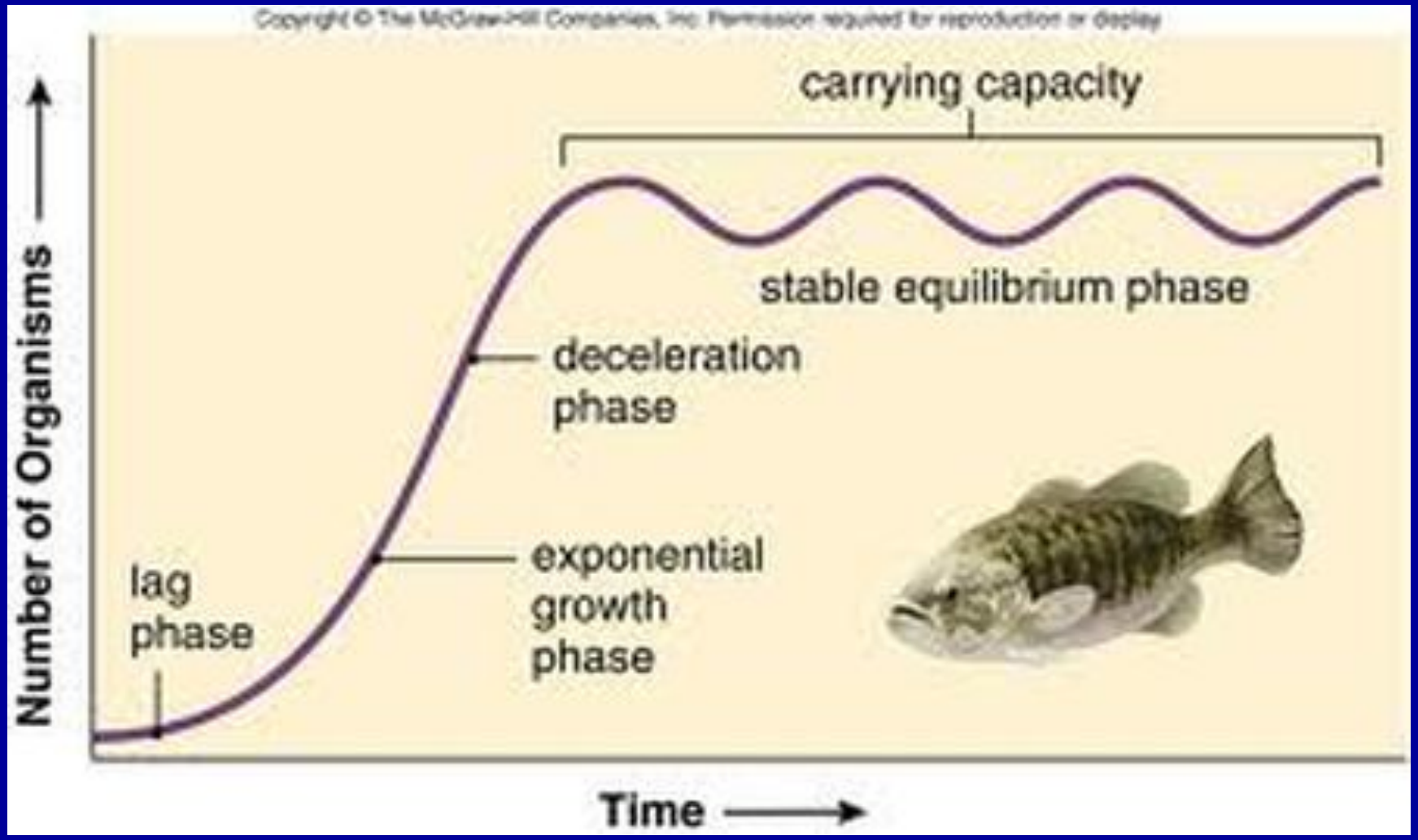
Lawrence Peter "Yogi" Berra



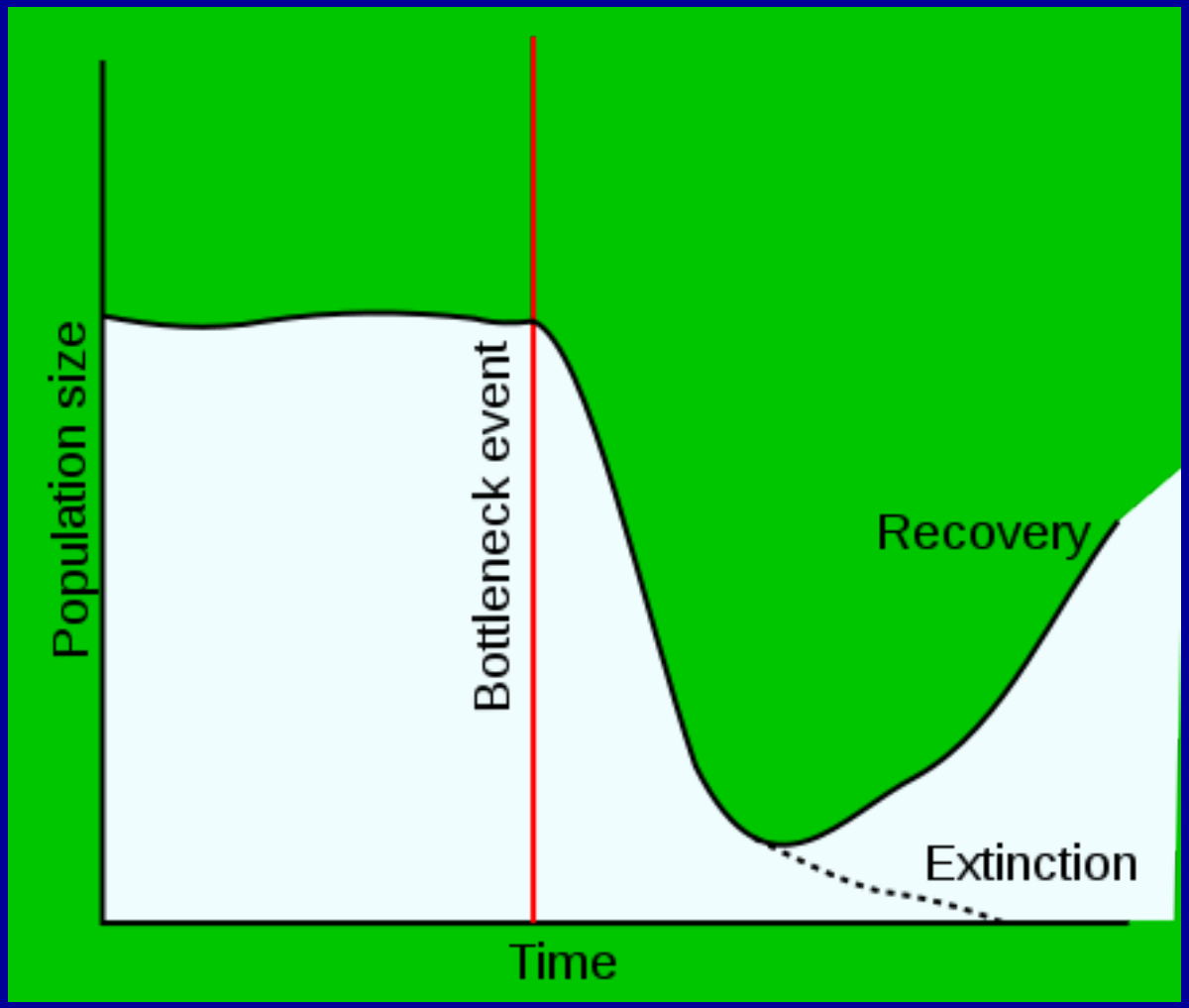
predator prey population cycle



resource limited population model



Population bottleneck



An external event suddenly decreases a population reducing the gene pool.

Human hunting has induced bottlenecks for many species.

- Passenger pigeons
- California condors

Population

Background on population
Past, present & future

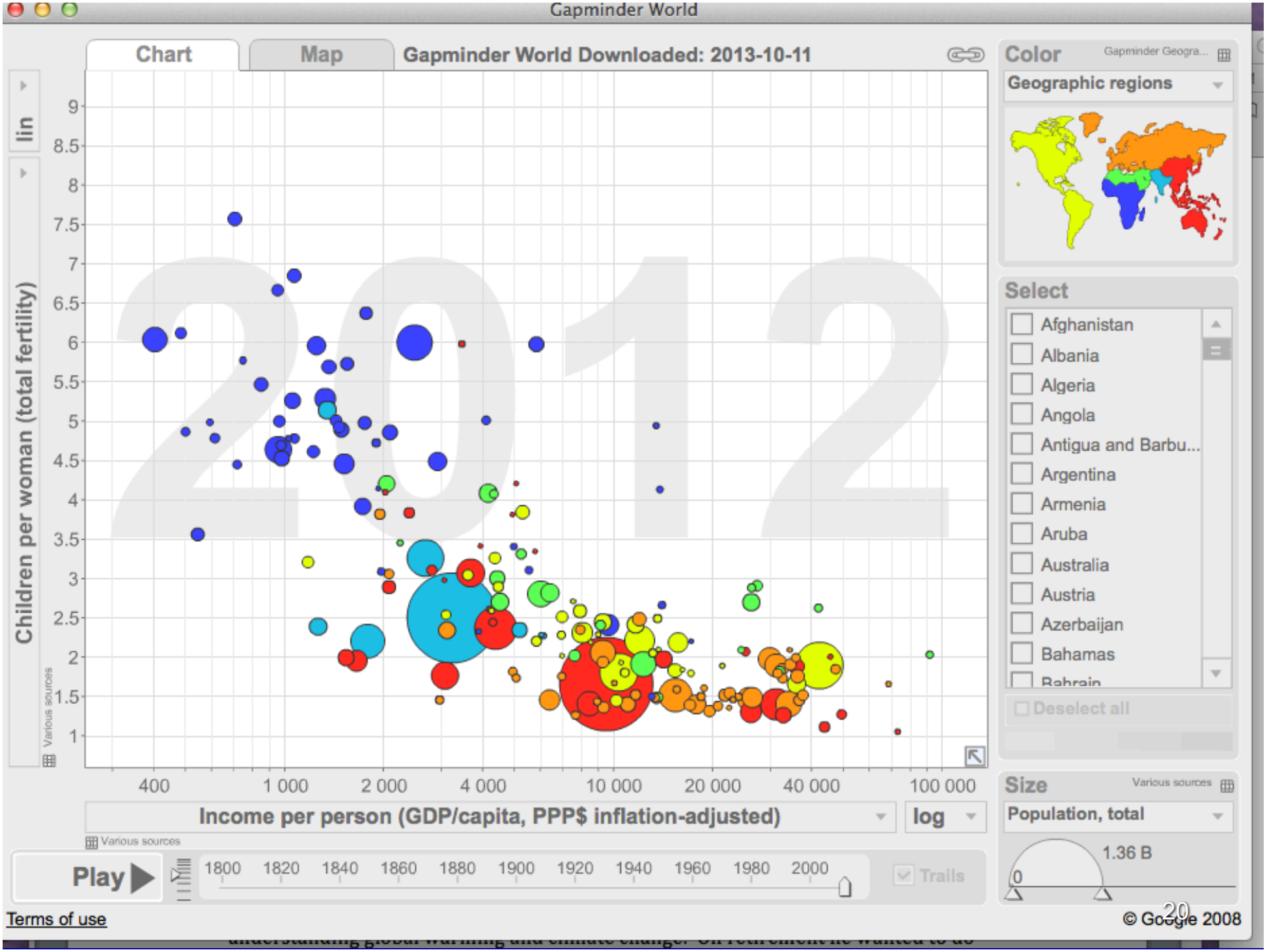
Recommend TED talks by Hans Rosling, Swedish Dr., academic, statistician, lecturer

http://www.ted.com/talks/hans_rosling_on_global_population_growth?language=en

http://www.ted.com/talks/hans_rosling_religions_and_babies?language=en

http://www.gapminder.org

Population pyramids
http://www.worldlifeexpectancy.com/united-states-population-pyramid


Gapminder World
Chart
Map
Gapminder World Downloaded: 2013-10-11
Color
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Geographic regions
Select
Afghanistan
Albania
Algeria
Angola
Antigua and Barbu...
Argentina
Armenia
Aruba
Australia
Austria
Azerbaijan
Bahamas
Deselect all
Size
Various sources
Population, total
1.36 B
0
lin
Children per woman (total fertility)
Various sources
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
2012
400
1 000
2 000
4 000
10 000
20 000
40 000
100 000
Income per person (GDP/capita, PPP$ inflation-adjusted)
log
Various sources
Play
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1820
1840
1860
1880
1900
1920
1940
1960
1980
2000
Trails
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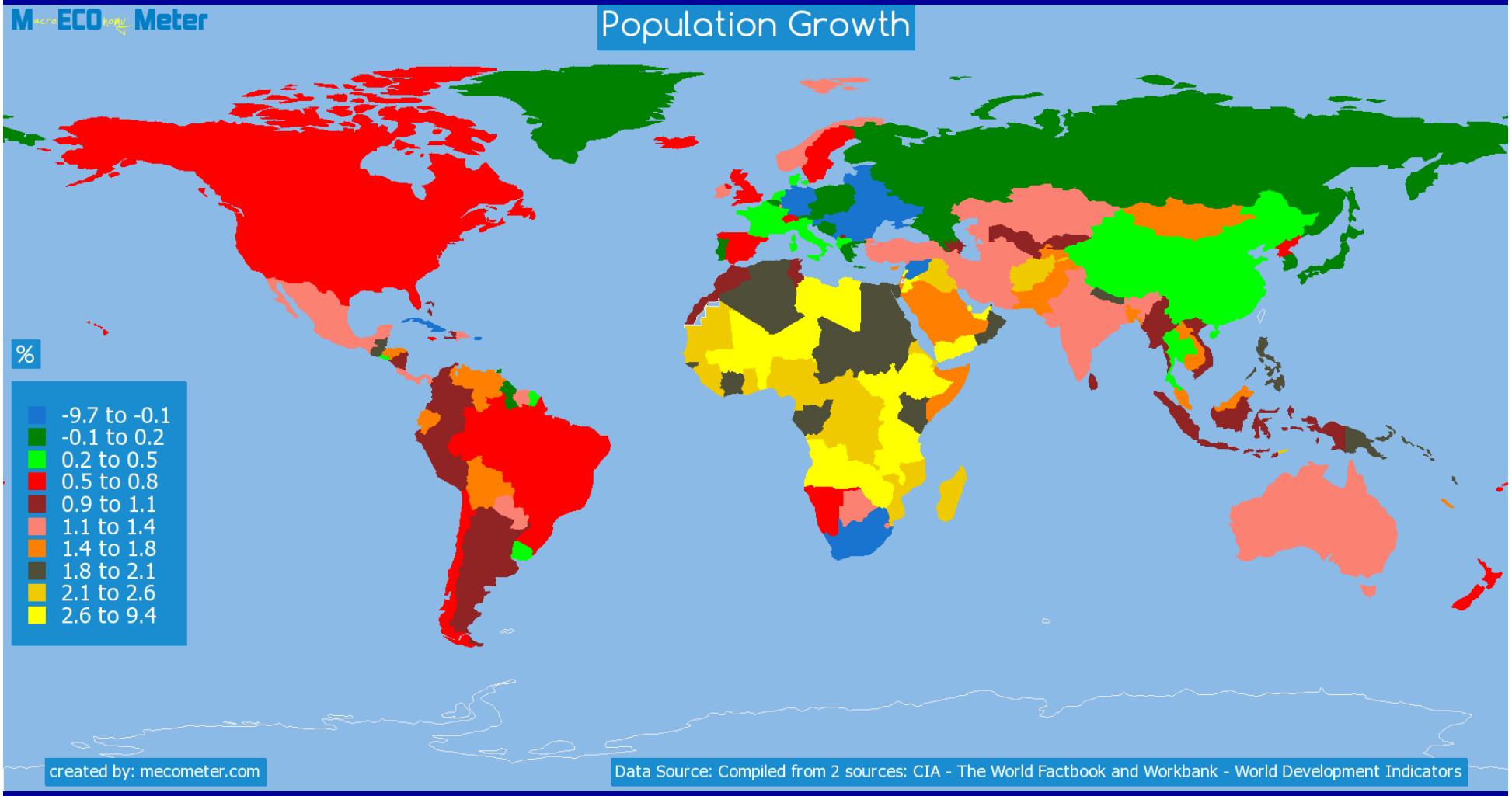
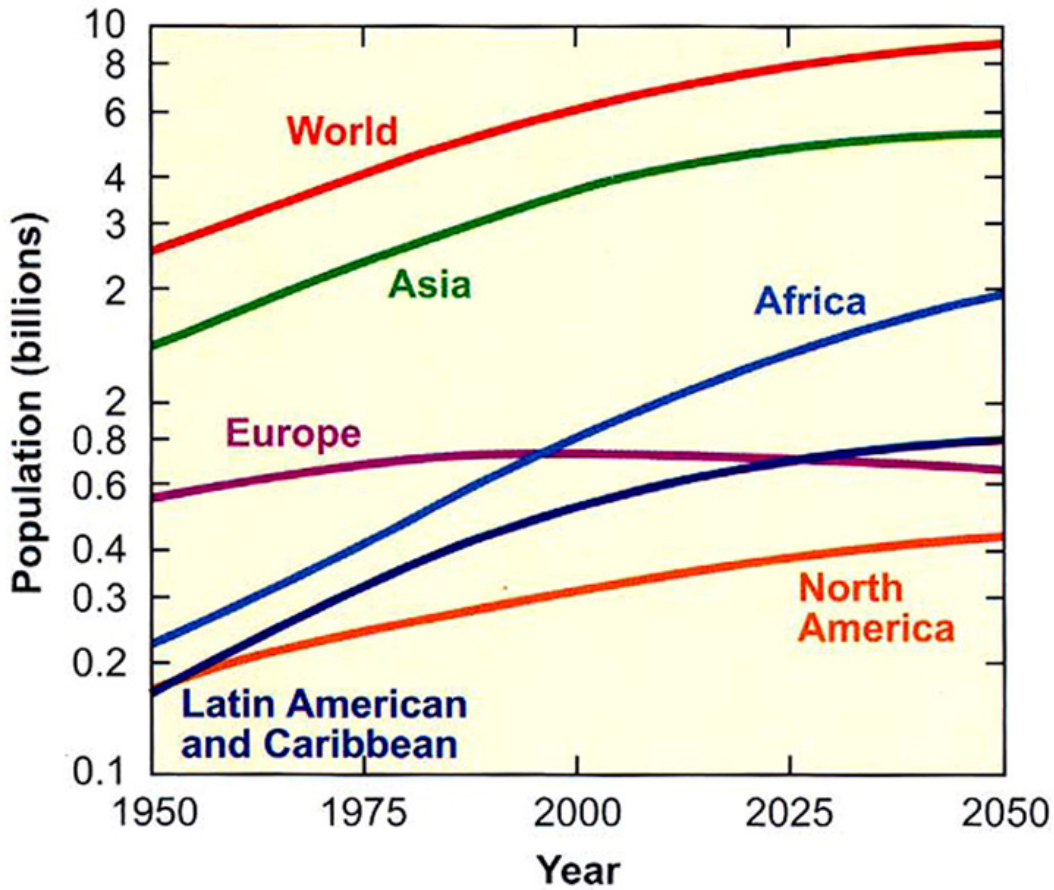


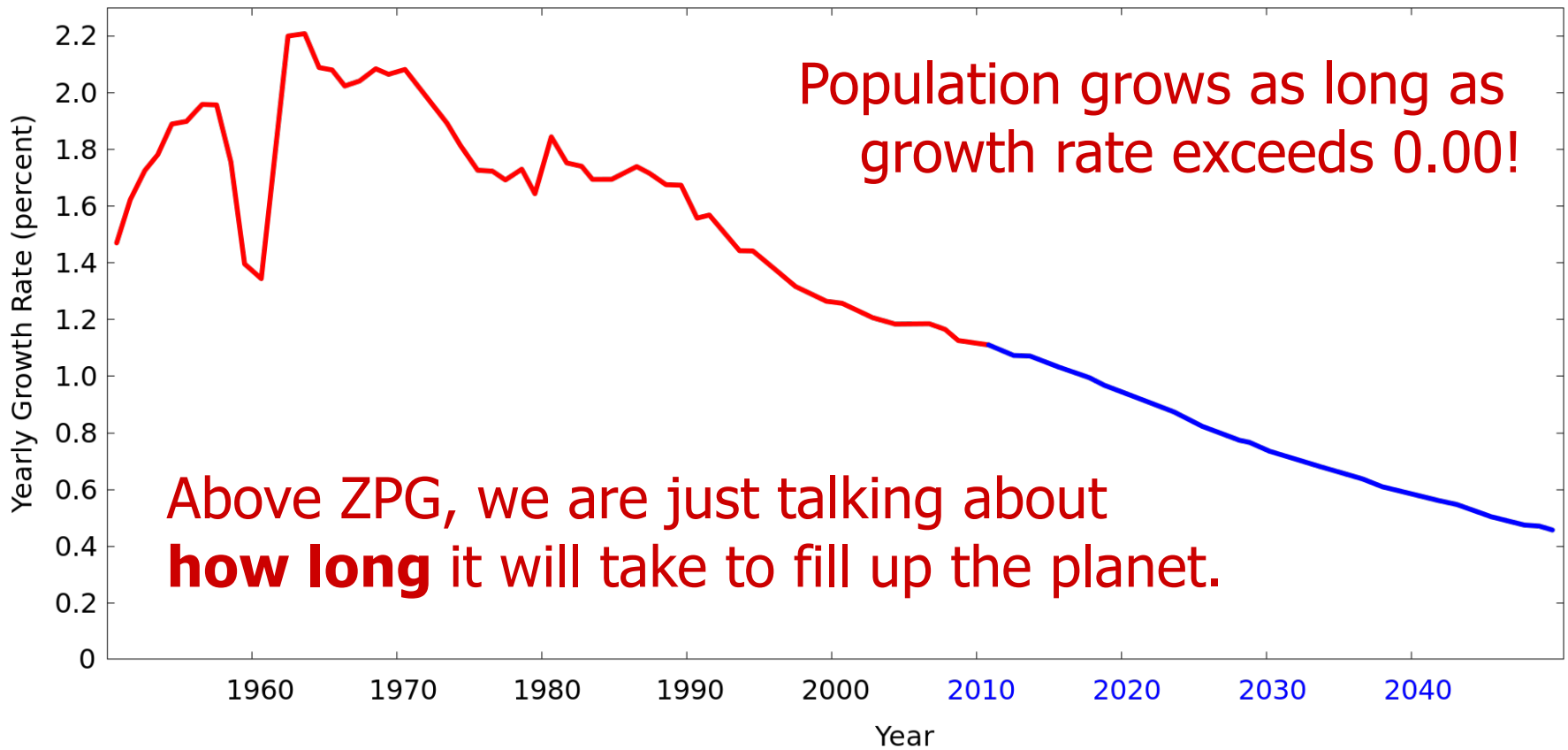
http://mecometer.com/whats/japan/population-growth/

Population growth by region



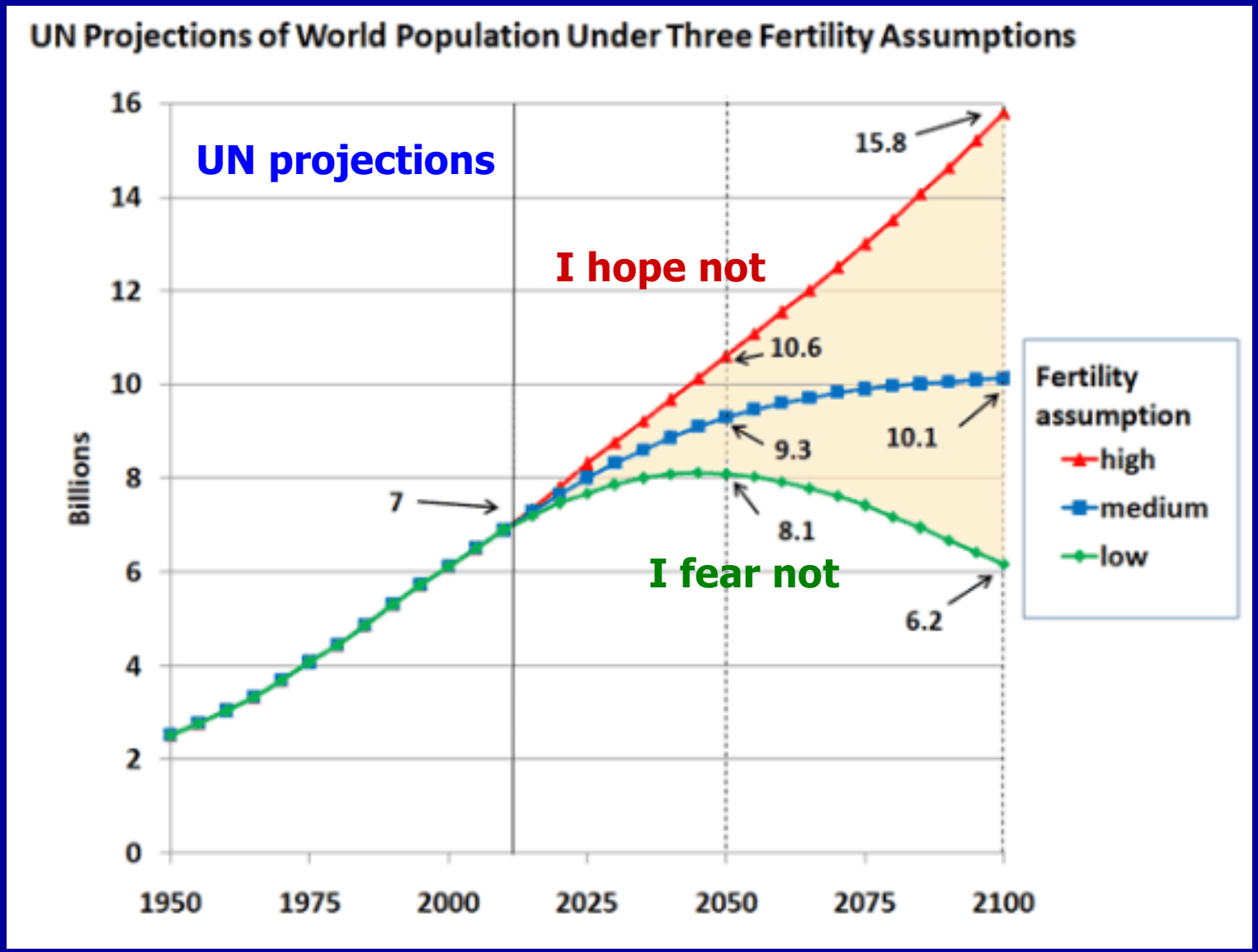
Population evolution, 1950–2050, on different continents. The vertical axis is logarithmic. (Image courtesy Donal Reiskoffer/Wikipedia.)

Declining growth rate cause for optimism? Census projections: A dose of reality!



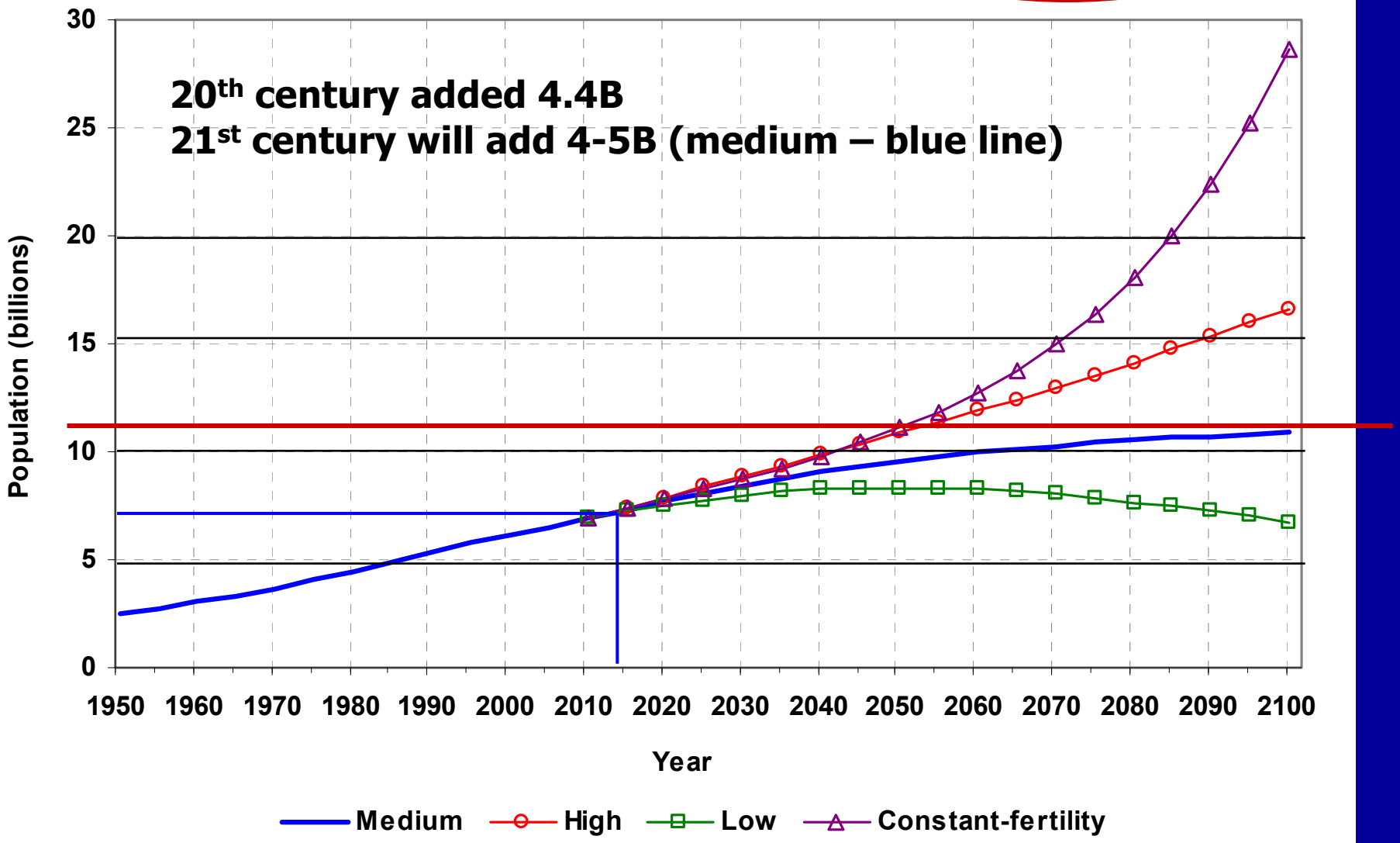
0.00

ZPG by 2040?? by 2100? never?



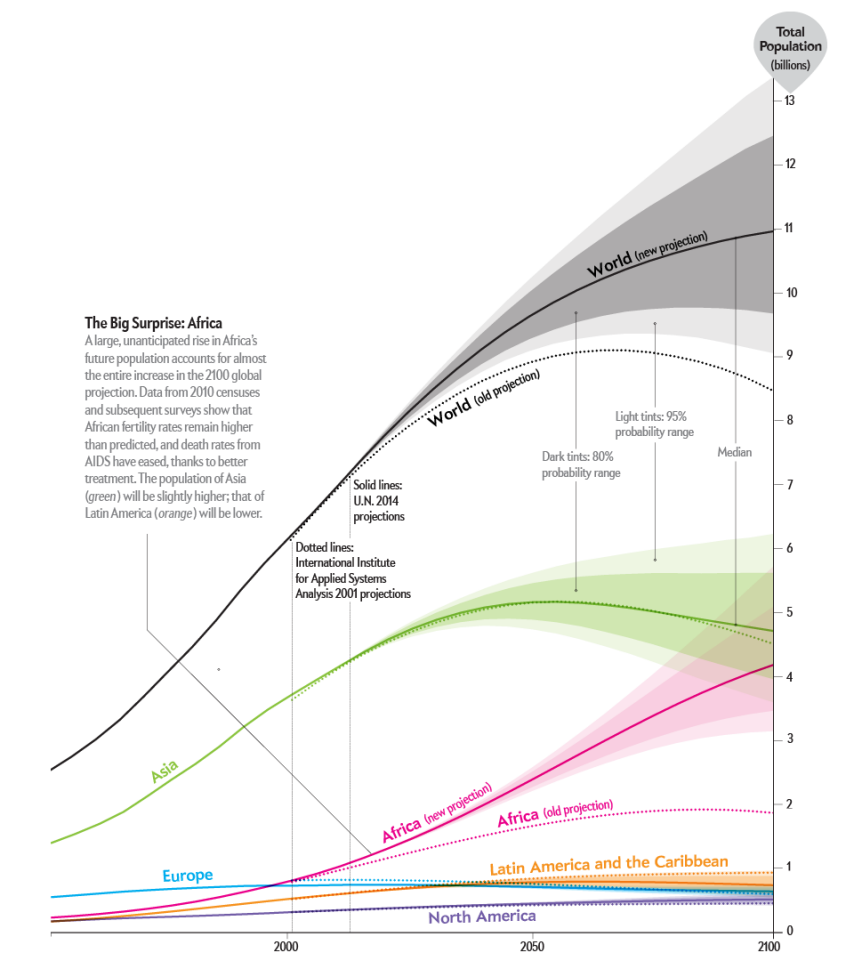
UN projections to 2100

World Population to 2300: 2012 Revision



New projection Nov. 2014

Earlier models "had anticipated that fertility rates in Africa would drop quickly, but they haven't," says Adrian Raftery, a statistician at the University of Washington, who assessed the revised estimates. How the world will feed a few billion more people is the question of the day.



Scientific American
World population will hit nearly 11 billion by 2100
Nov 18, 2014 |By Mark Fischetti

Summary

The **high fertility curves** won't happen because the planet cannot support that many people.

Mother Nature will limit population

- How she does it might not be pretty

Population's future

- We will reach >10 billion unless some catastrophe
- Empower women to bring the poorest 2 B out of poverty, else growth will continue
- Assuming this happens the age distribution will become more uniform and potentially stable
- Main issue is the carrying capacity of the Earth: How many can we water and feed?

Babies per woman < 2 => stable population

Babies per woman decrease when

- Children survive
- Children not needed for work
- Empower women
- Family planning is accessible

If you're not pro birth control, you're not pro life!

Credit Hans Rosling, TED talk 2012