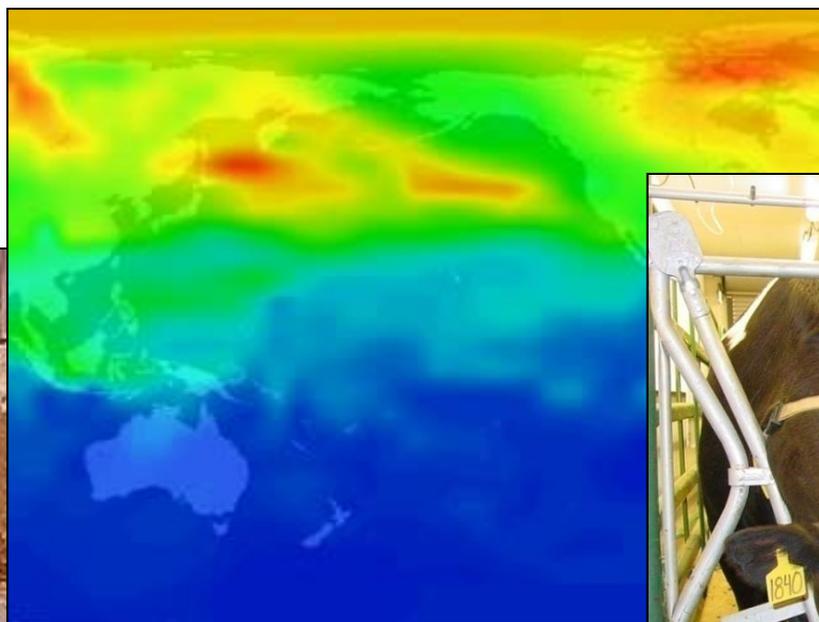


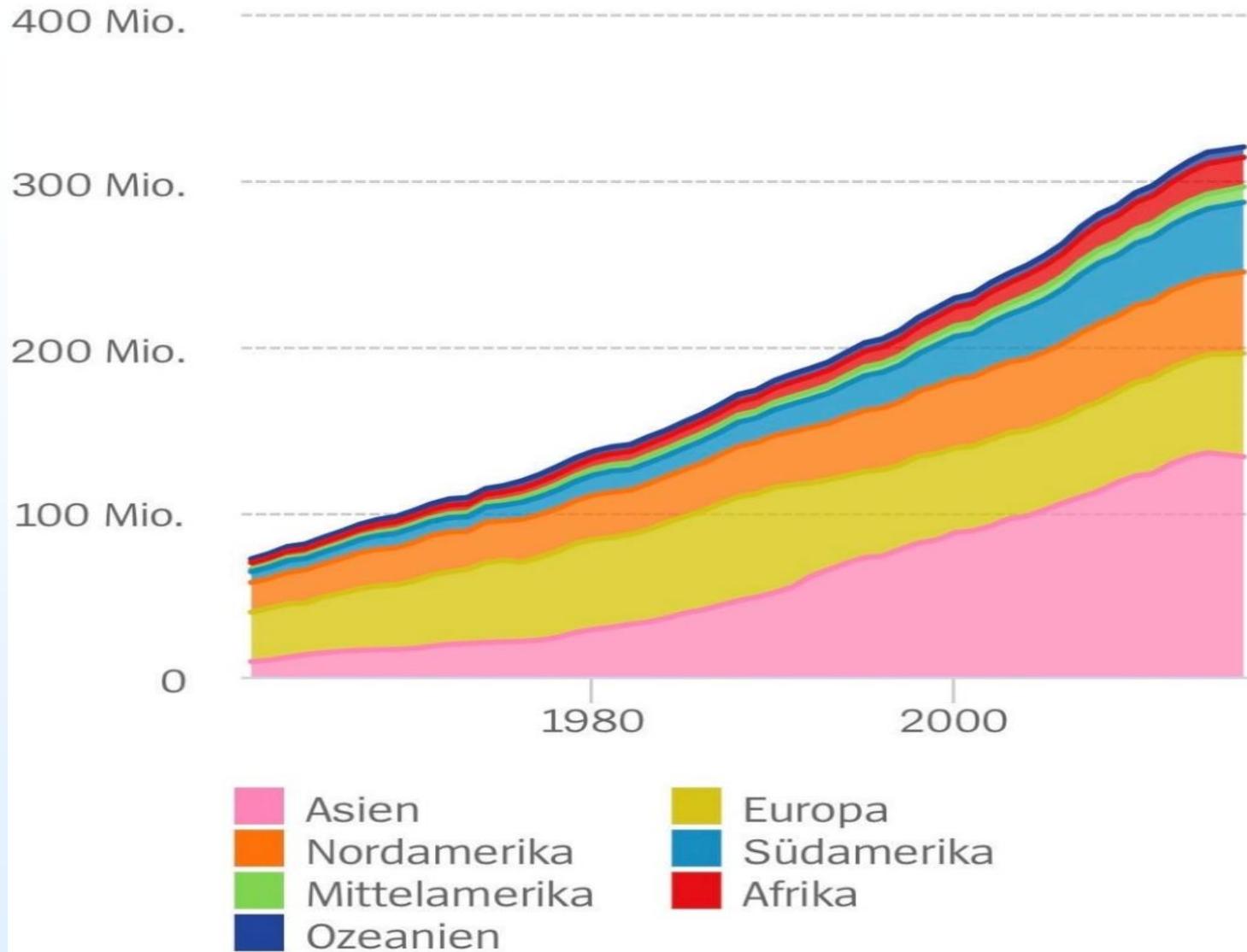
How to satisfy the rising demand for animal protein without depleting natural resources



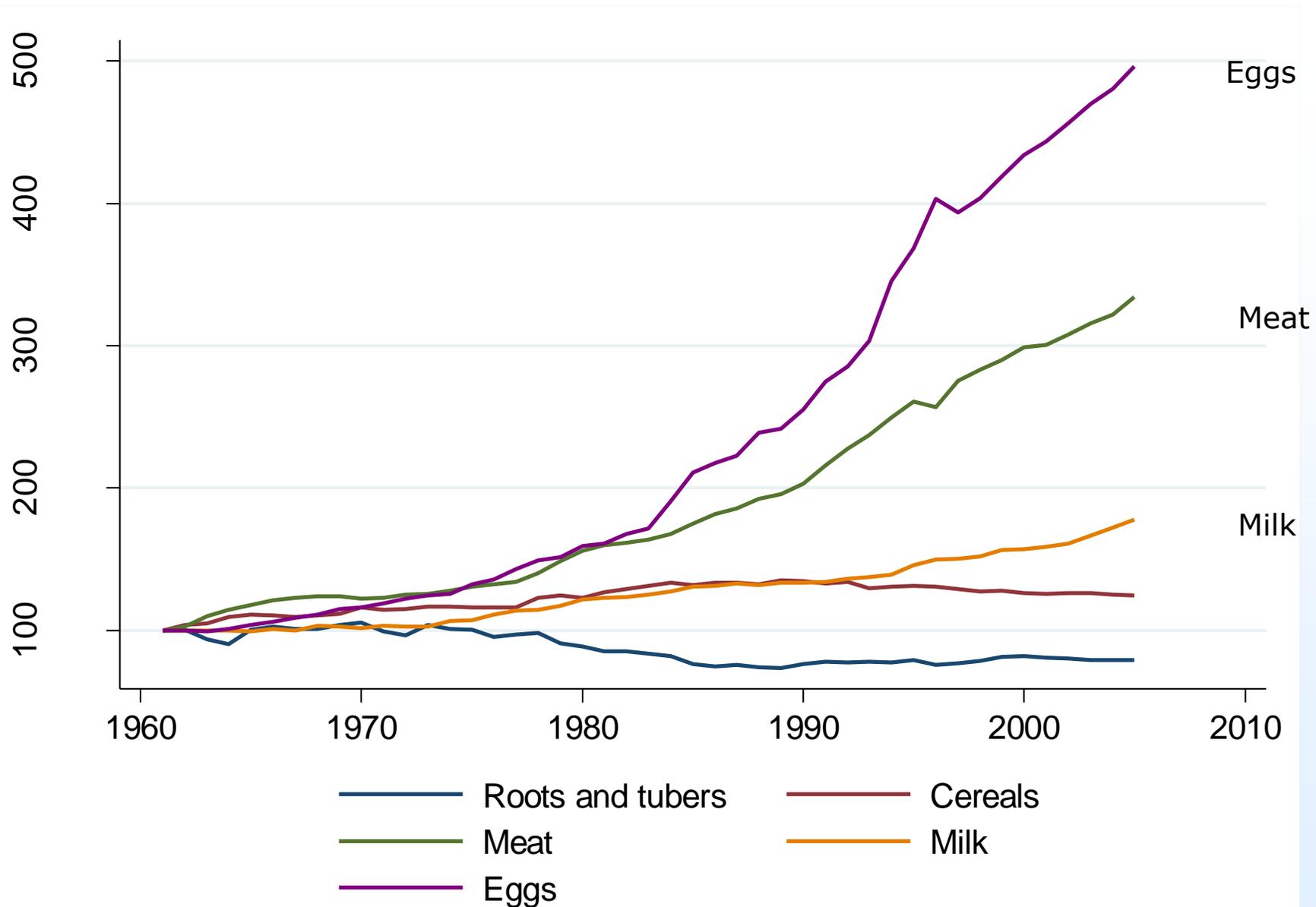
Frank Mitloehner, PhD
Professor & Air Quality Specialist
Dept Animal Science
University of California, Davis

ASF consumption globally (tons)

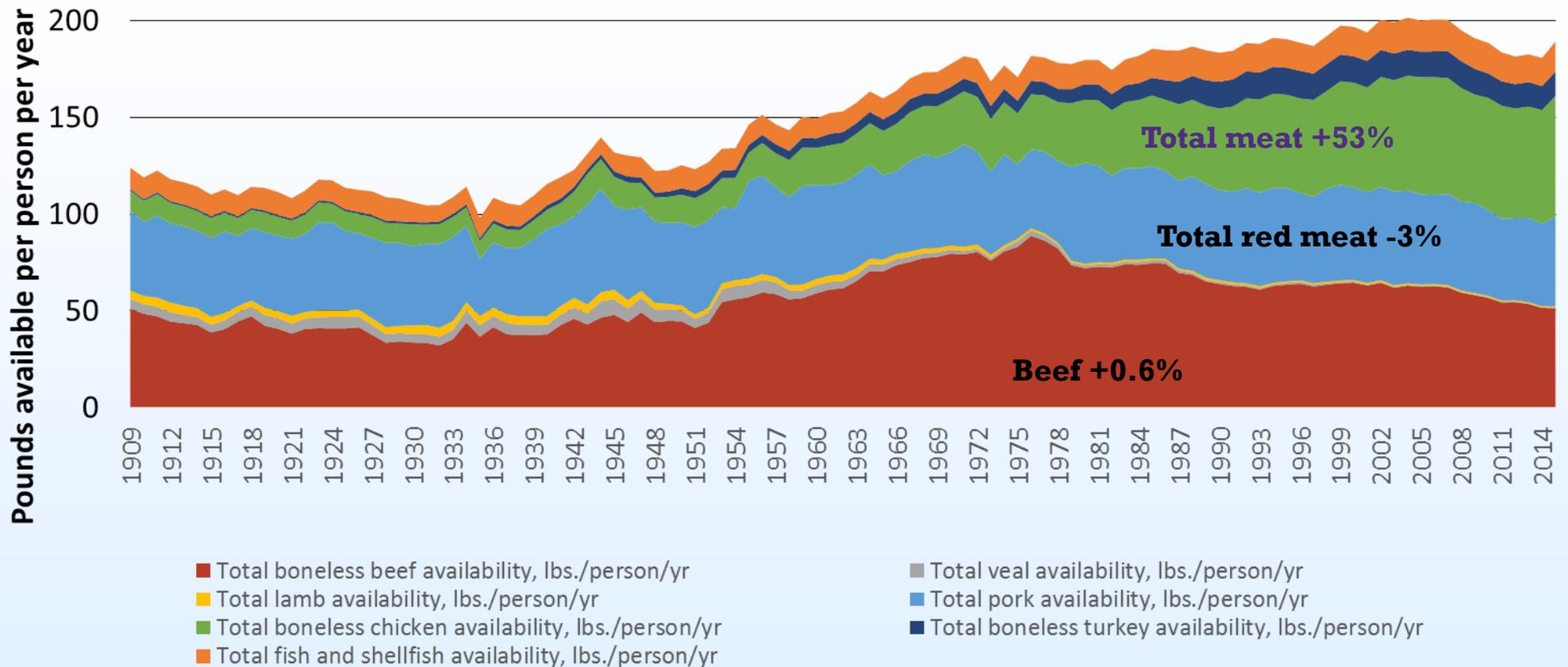
Angaben in Tonnen



ASF consumption is growing rapidly in developing countries



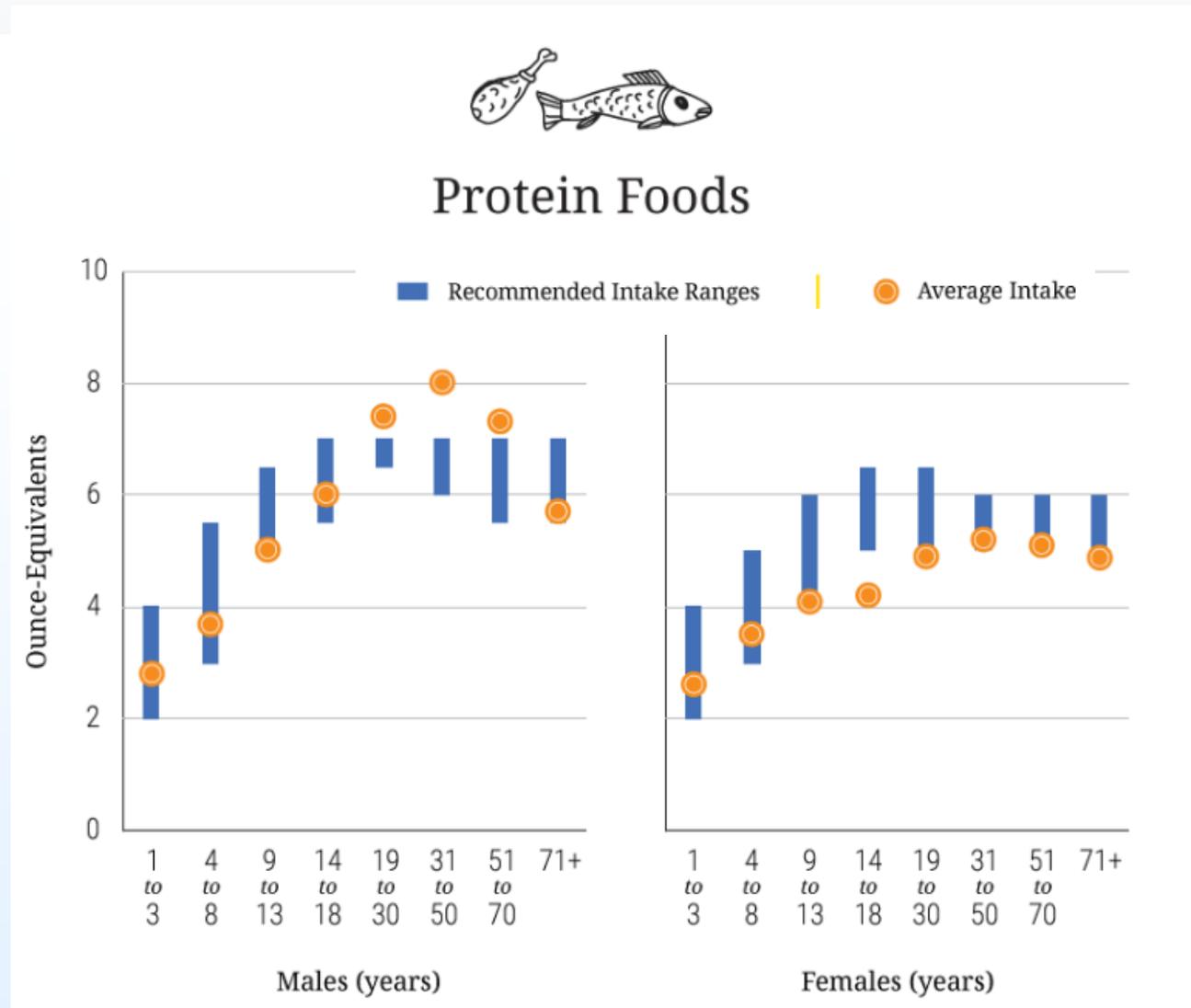
Americans eat the same amount of beef as 1909, but 500% more chicken



Source: USDA-ERS Food Availability Data System

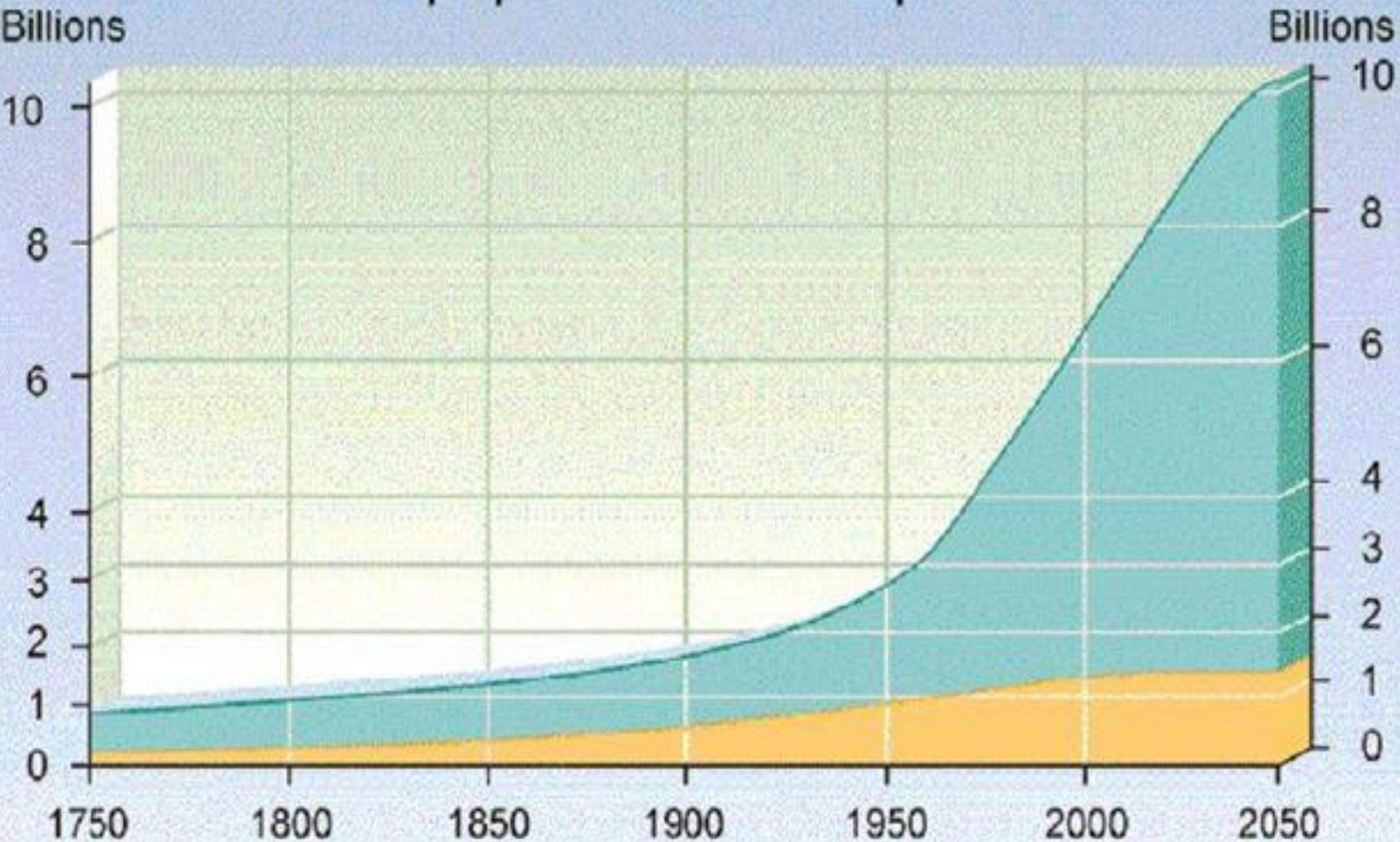
Publicly available data does not suggest we are overconsuming protein in the USA

- 2016:
 - USDA-ERS data estimate is we eat **5.8 ounces** of meat & poultry per day
 - 1.8 ounces of beef
- DG 2015-2020:
 - **5.5 ounce** equivalents of “protein foods”/day on 2000 calorie diet
 - **4 ounces** from meat, poultry, eggs



Source: What We Eat in America, NHANES 2007-2010 for average intakes by age-sex group. Healthy U.S.-Style Food Patterns, which vary based on age, sex, and activity level, for recommended intake ranges

World population development



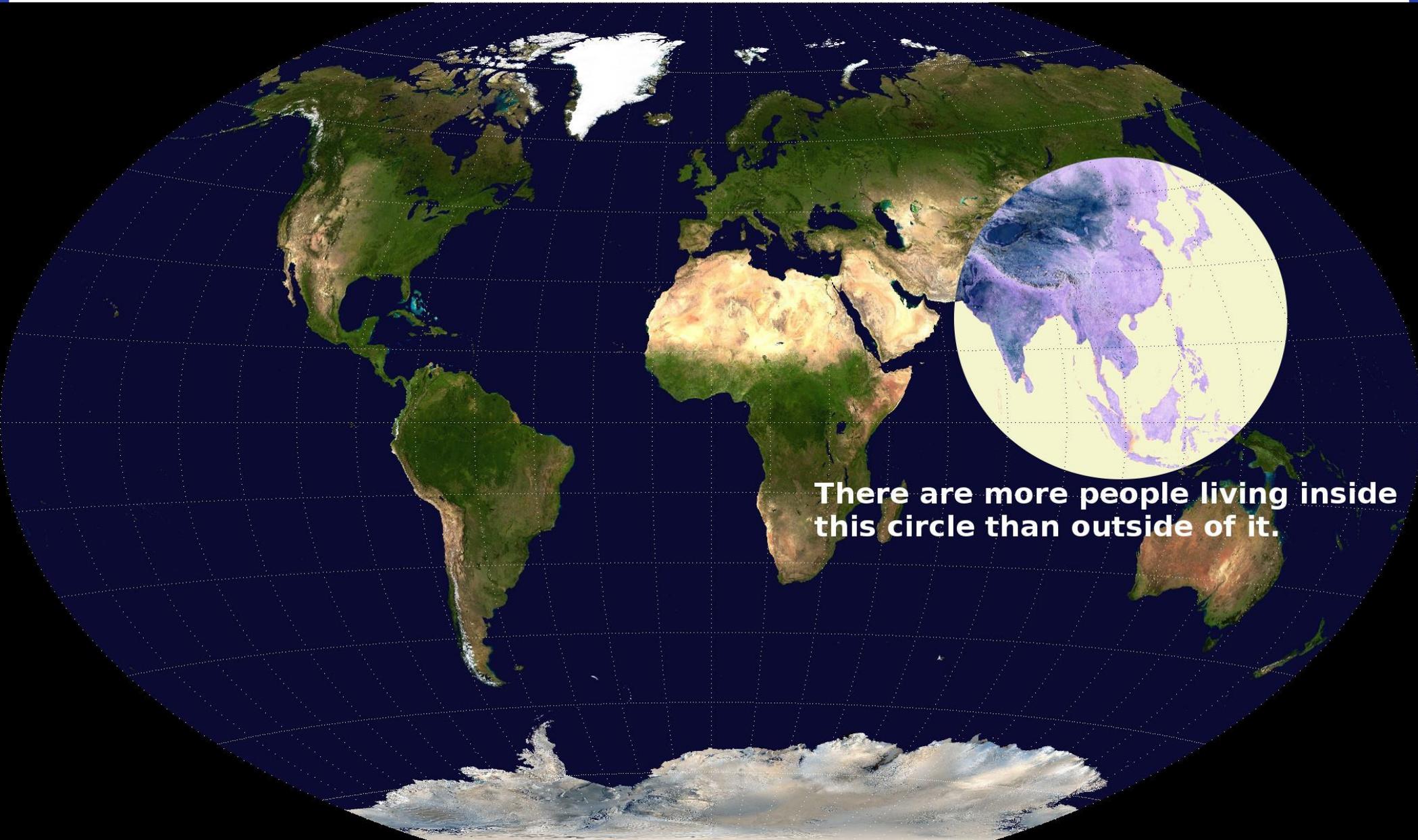
 Developing countries
 Industrialized countries



GRID
Arendal

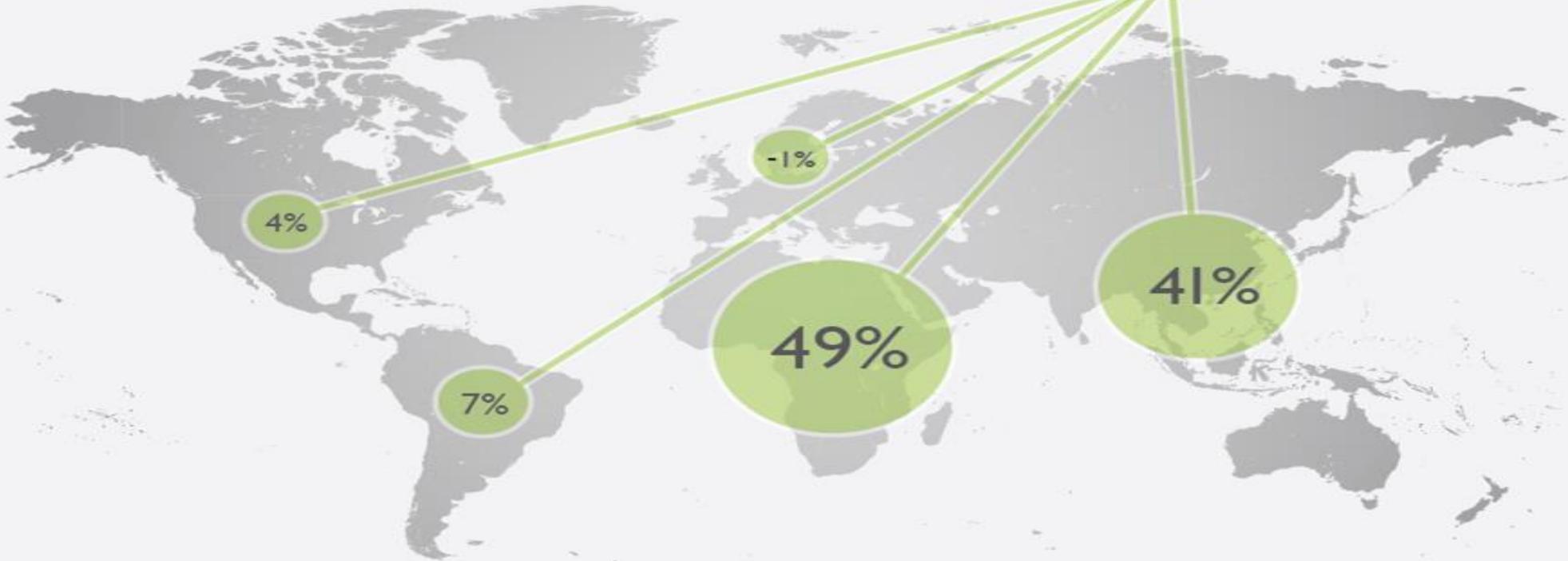
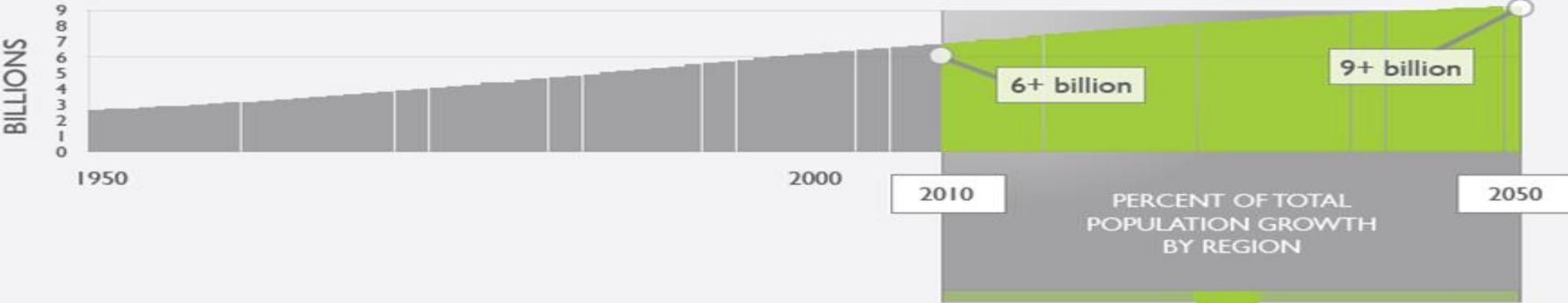


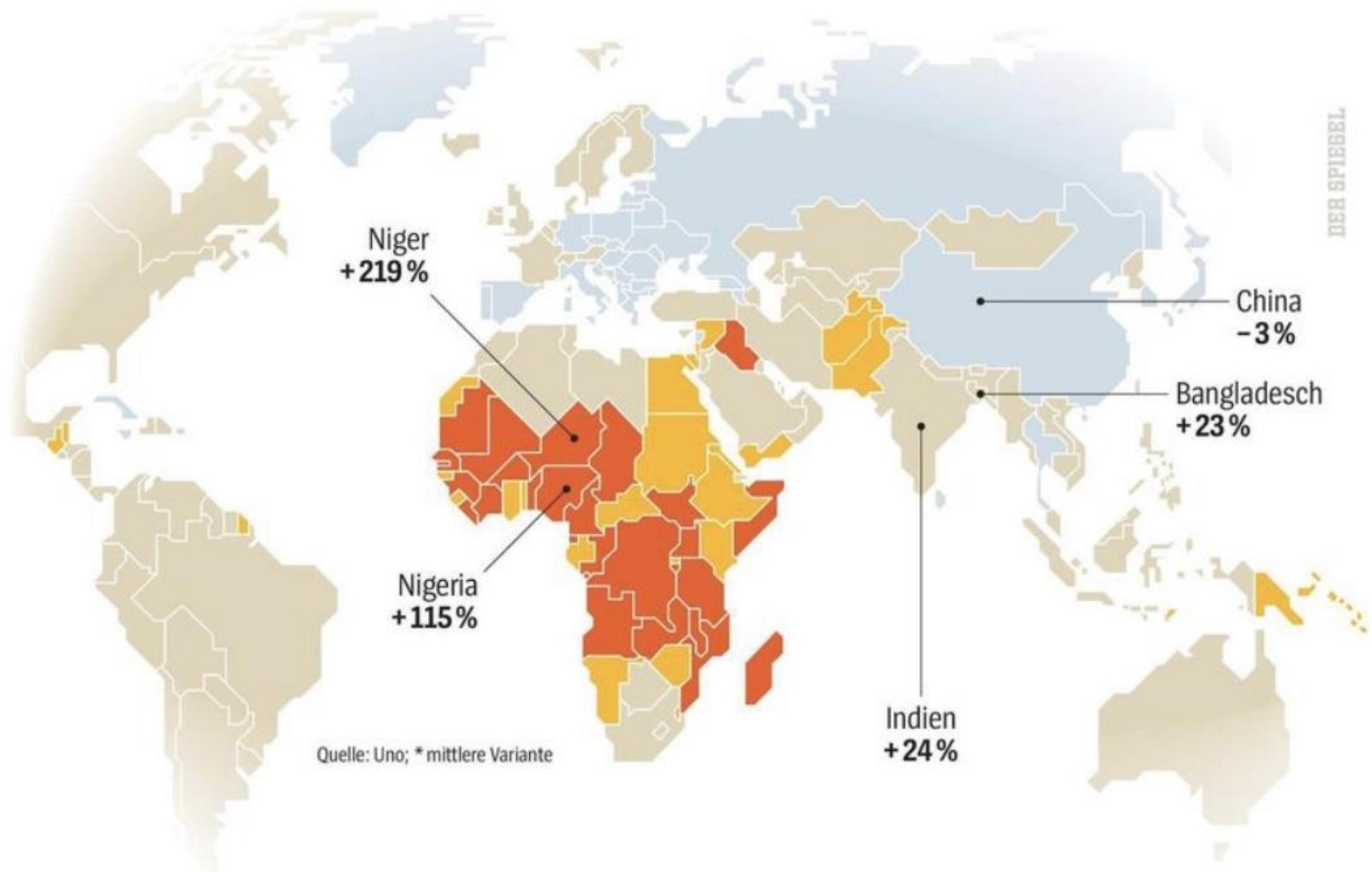
4.5 Billion + population of USA in 10 years



There are more people living inside this circle than outside of it.

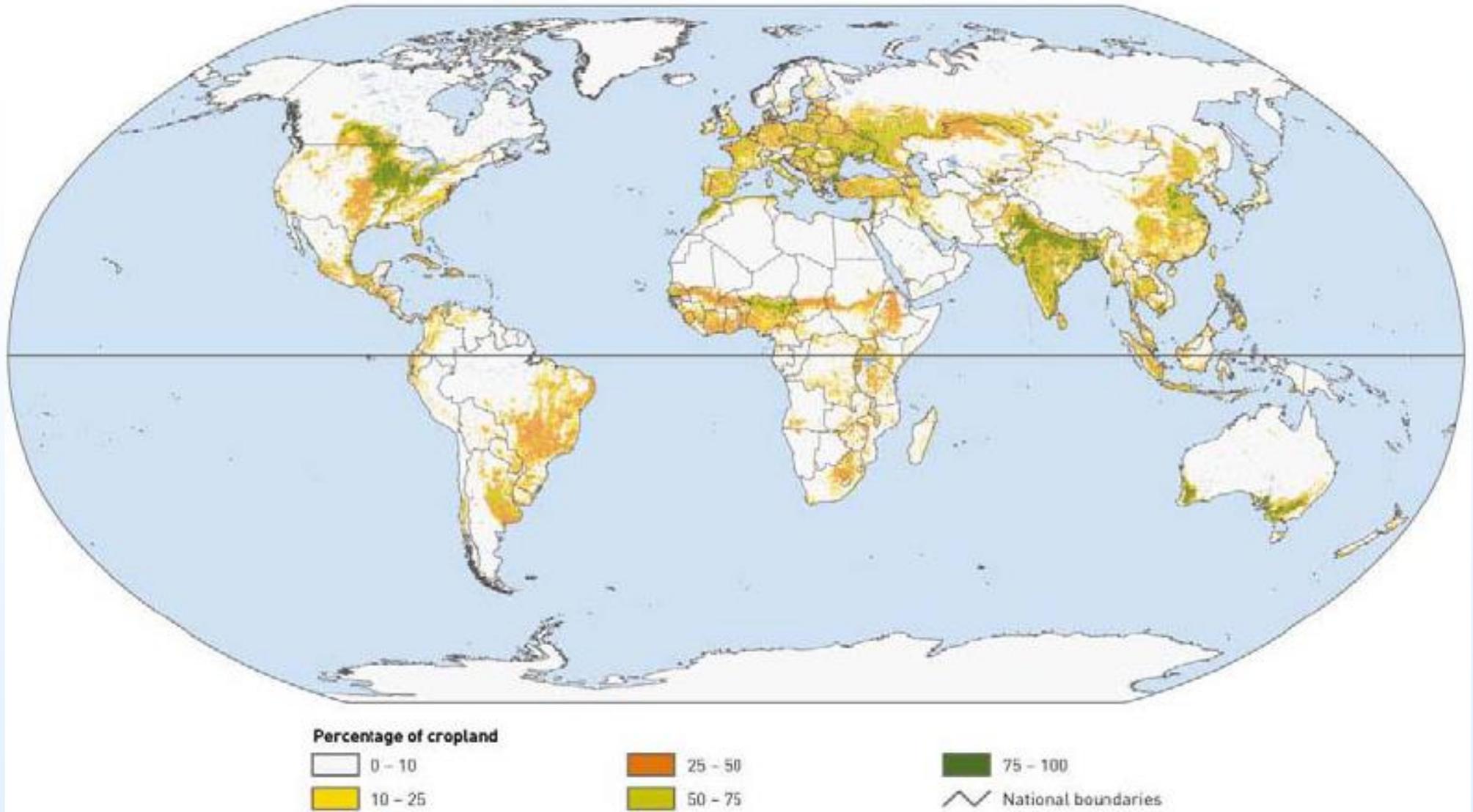
Today and Tomorrow's Markets





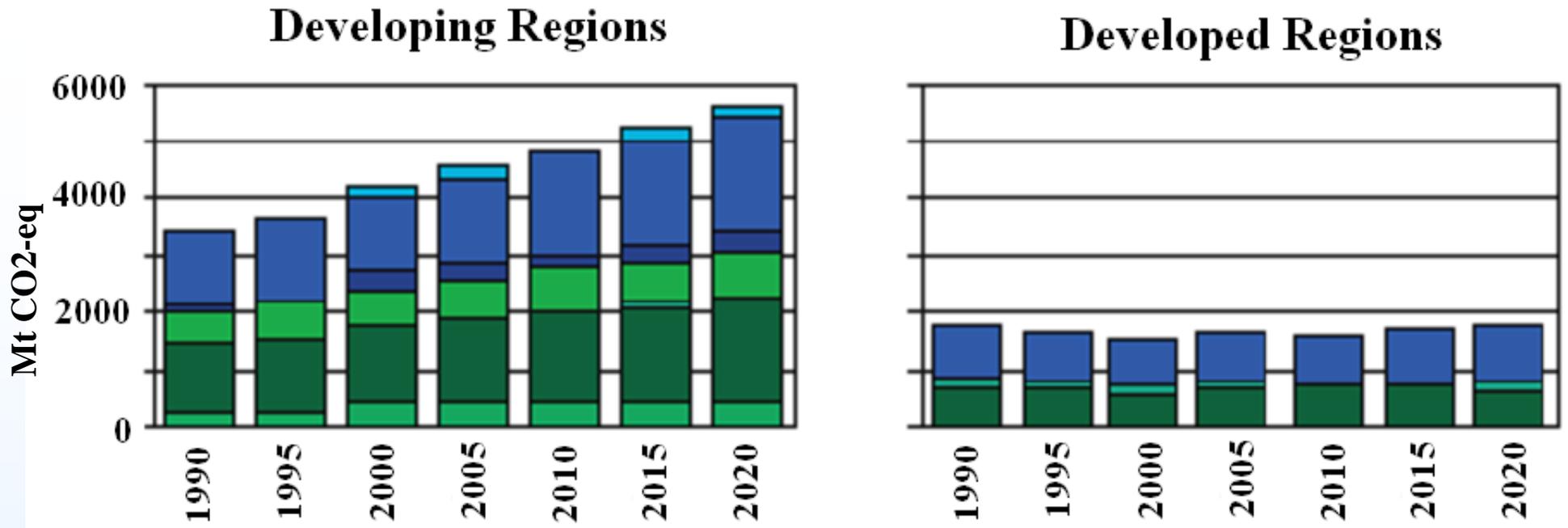
Quelle: Uno; * mittlere Variante

Distribution of cropland

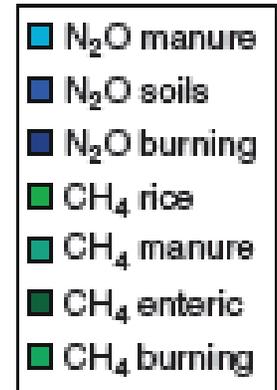


Source: FAO, 2006f.

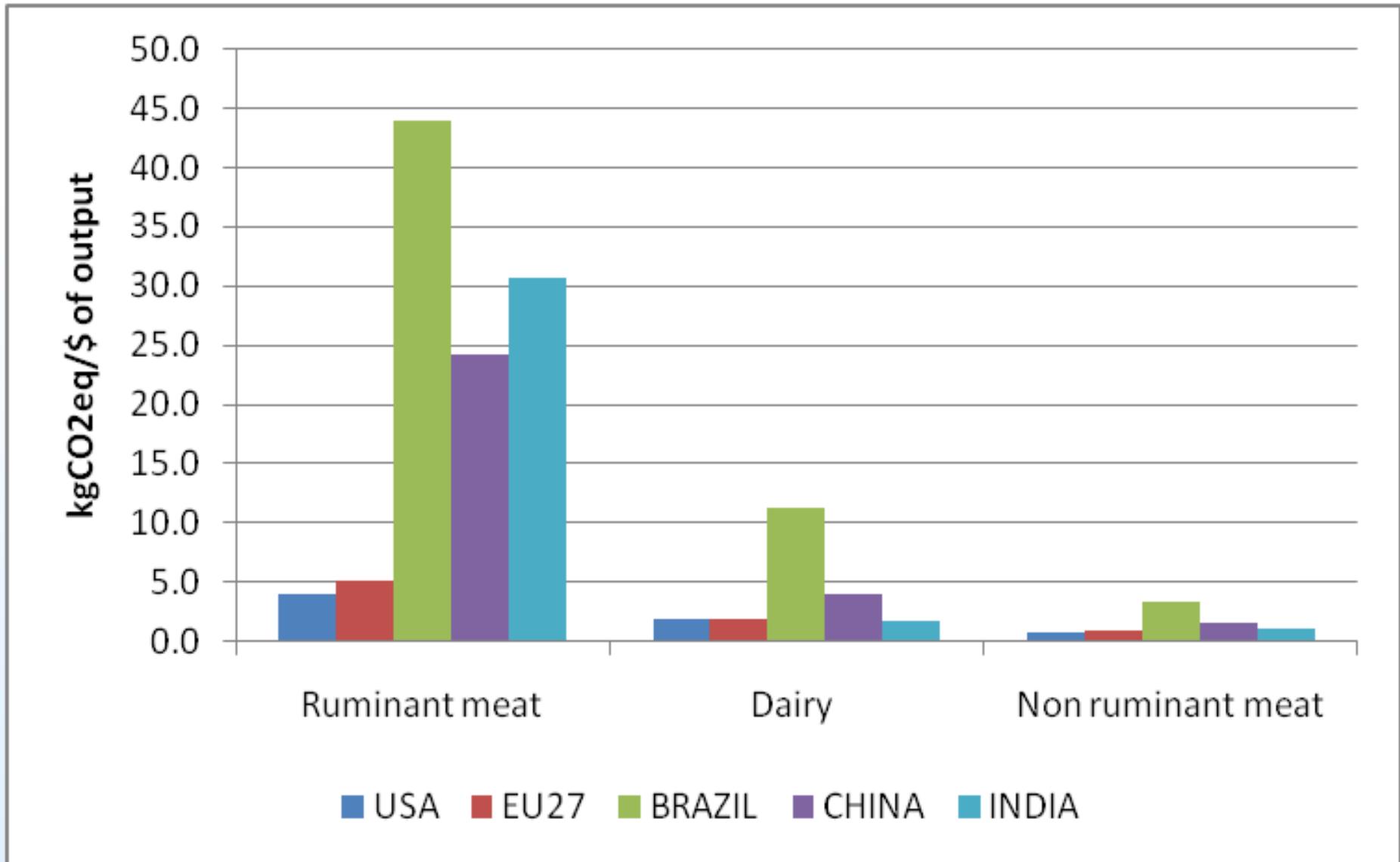
Livestock GHG in Developing- and Developed Regions

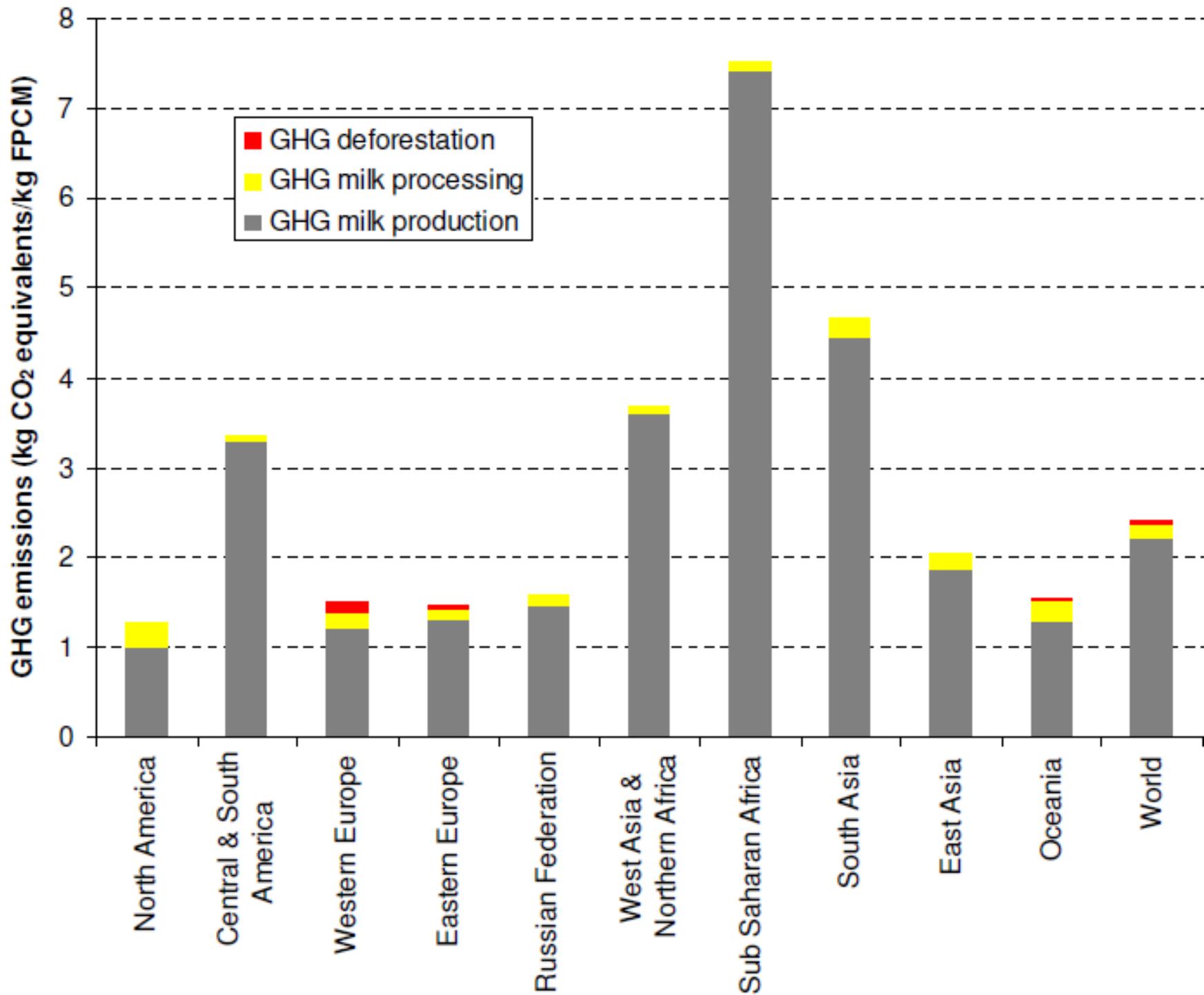


Time (years)

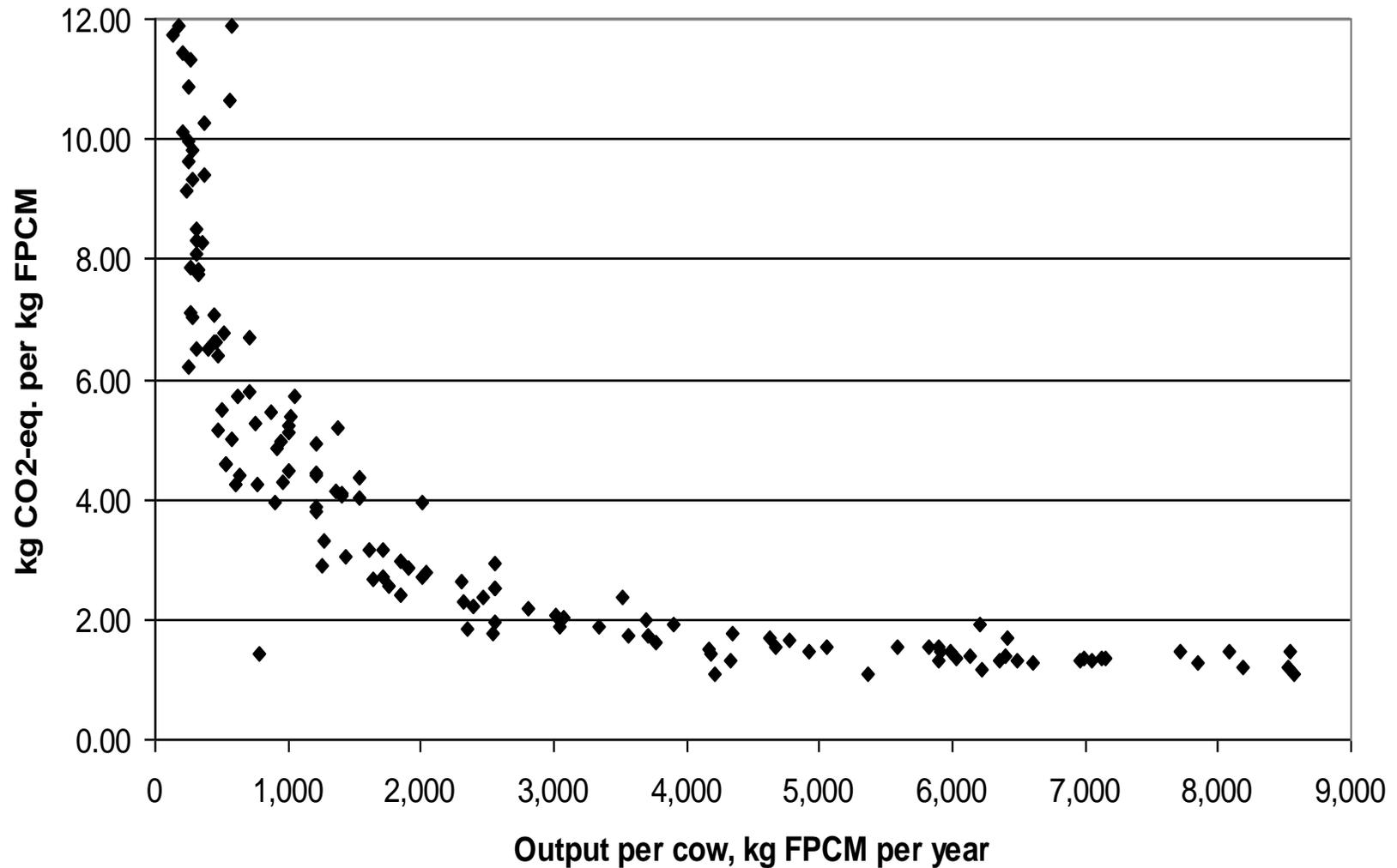


Emission Intensities (direct emissions from livestock)

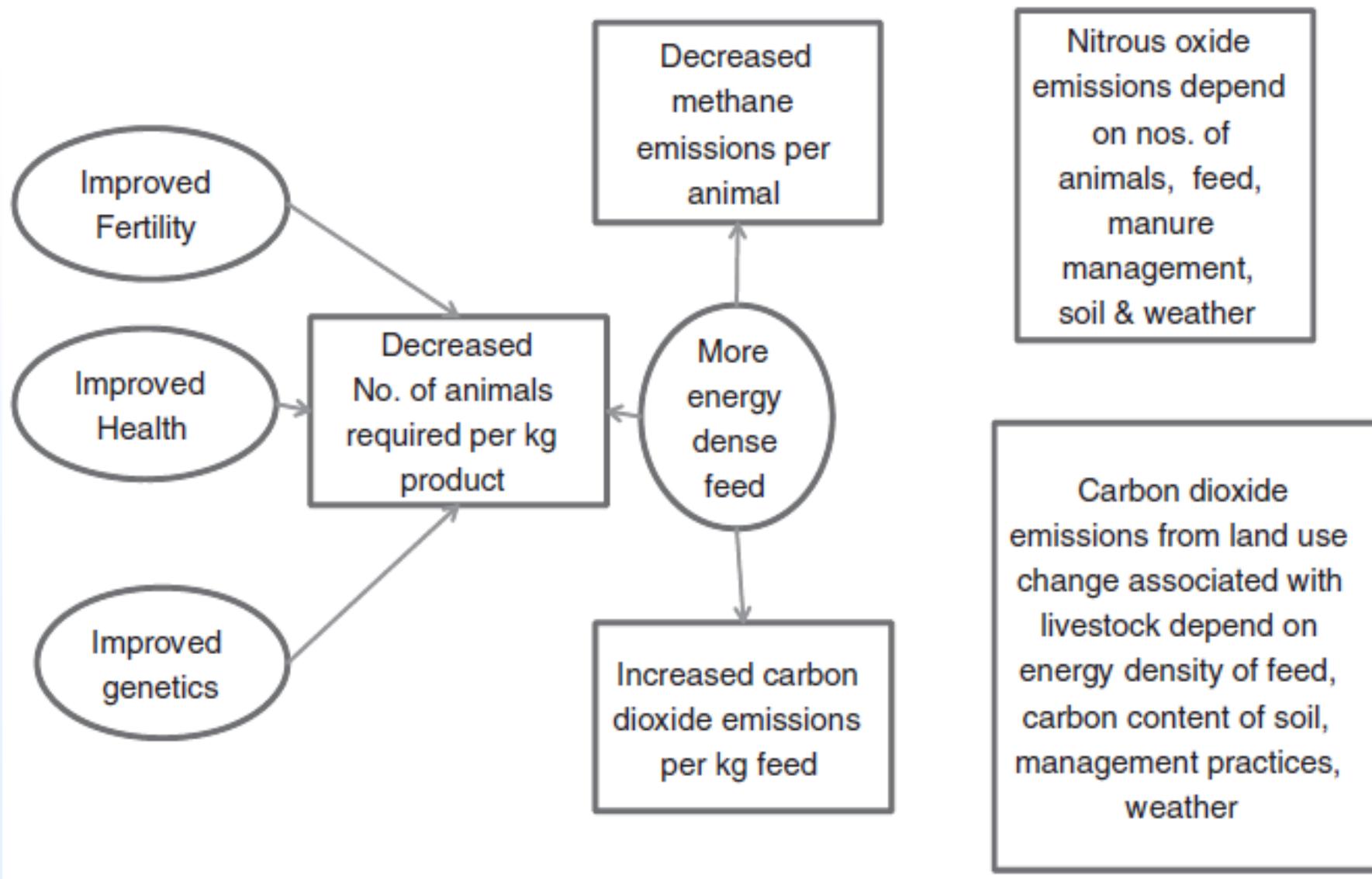




Relationship between total greenhouse gas emissions and milk output per cow



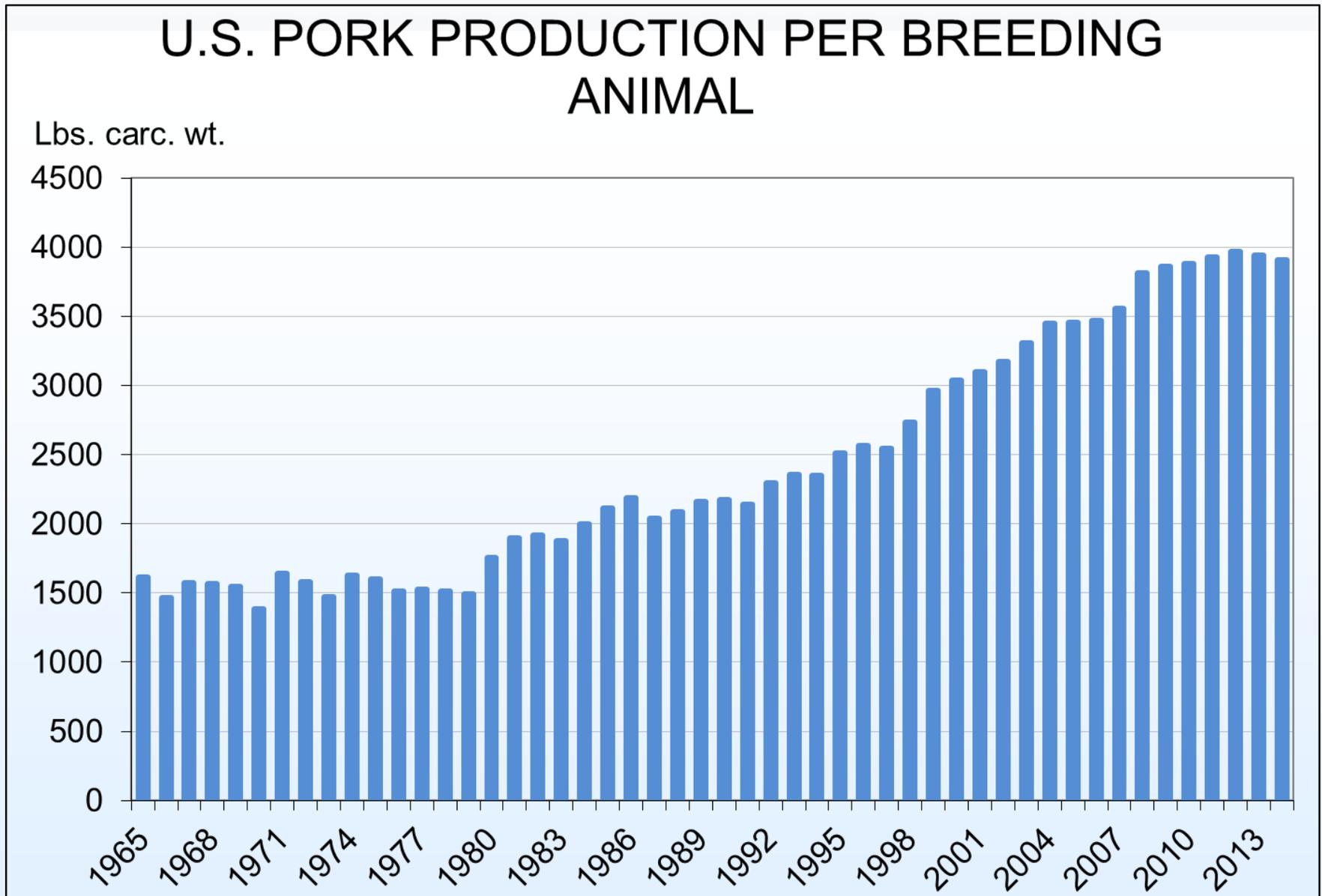
Mitigation: interventions to improve productivity



US Dairy trends

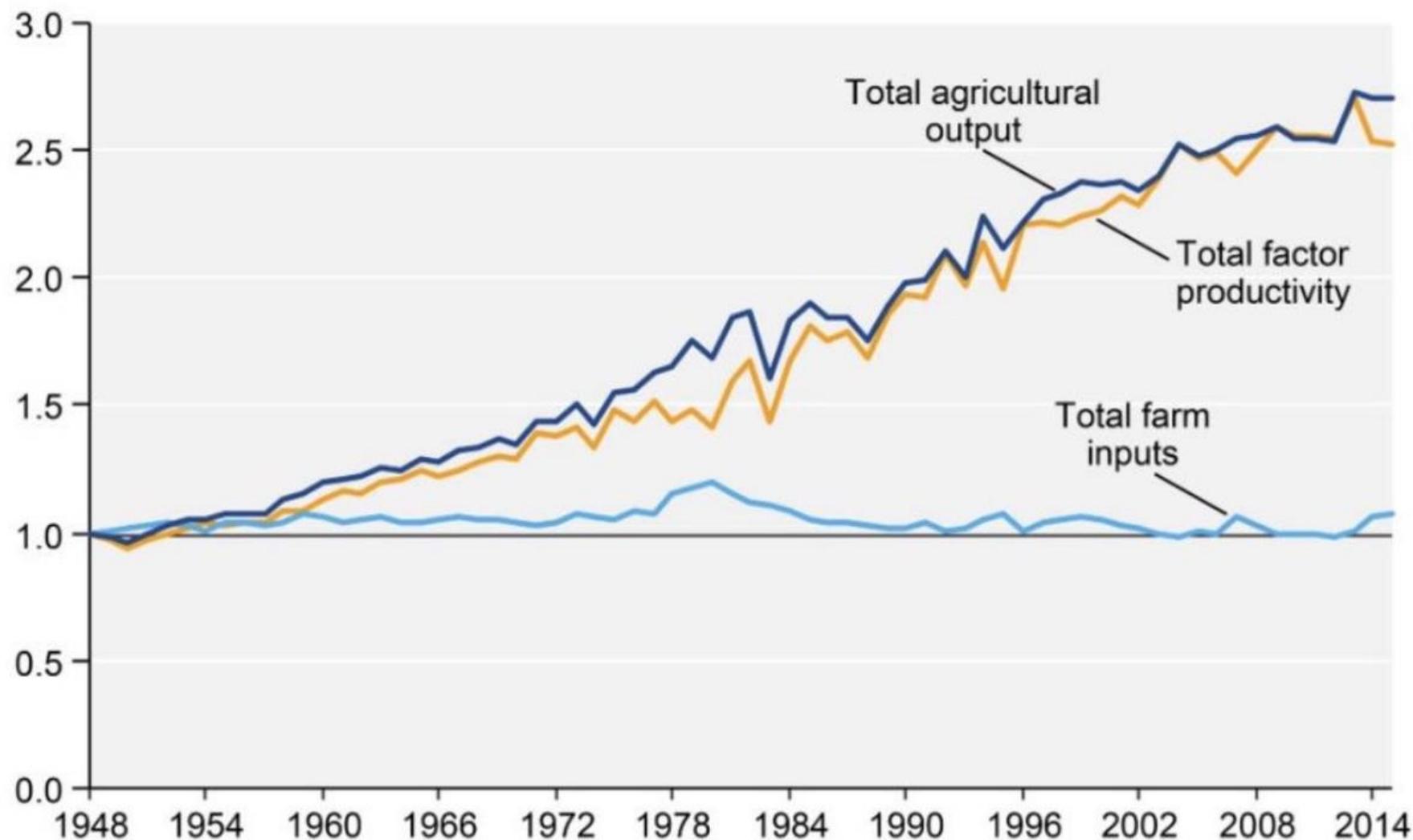
- In 1950, there were 25 million dairy cows in the US, vs 9 million today
- With 16 million fewer cows (1950 vs 2018), milk production nationally has increased 60 percent
- The carbon footprint of a glass of milk is 2/3 smaller today than it was 70 years ago

US Pork Trends



U.S. agricultural output, inputs, and total factor productivity, 1948-2015

Index, 1948=1



Source: USDA, Economic Research Service, *Agricultural Productivity in the U.S.* series; data as of October 2017.

China Swine Example

- China's five year plan focuses on making farms larger and more efficient
- Half of the world's pigs live in China
- 50 million sows w/ 20 piglets born alive
- Equals annual production of 1 Billion pigs
- Pre-weaning mortality causes 400 Million pigs to never make it to the market
- One more pig per sow would mean 1 Million tons of feed saved

Conclusions

- Demand for ASF is increasing in developing and emerging markets
- Developing and emerging markets have the greatest environmental footprint per unit of ASF product
- Main driver to reduce env impact is via production efficiencies
- Food production- and emission efficiencies are inversely related



UNIVERSITY OF CALIFORNIA

LET THERE BE LIGHT

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