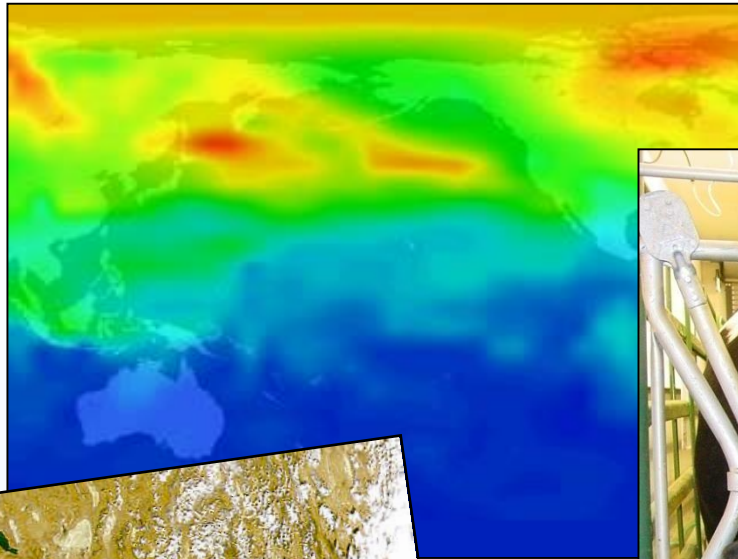


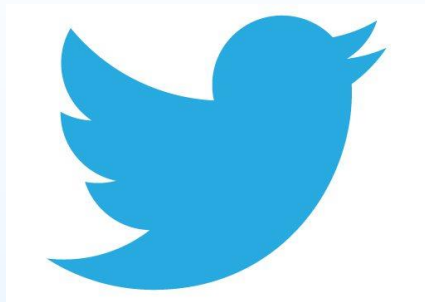


Climate-Smart Dairy: Global- and State Perspectives



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

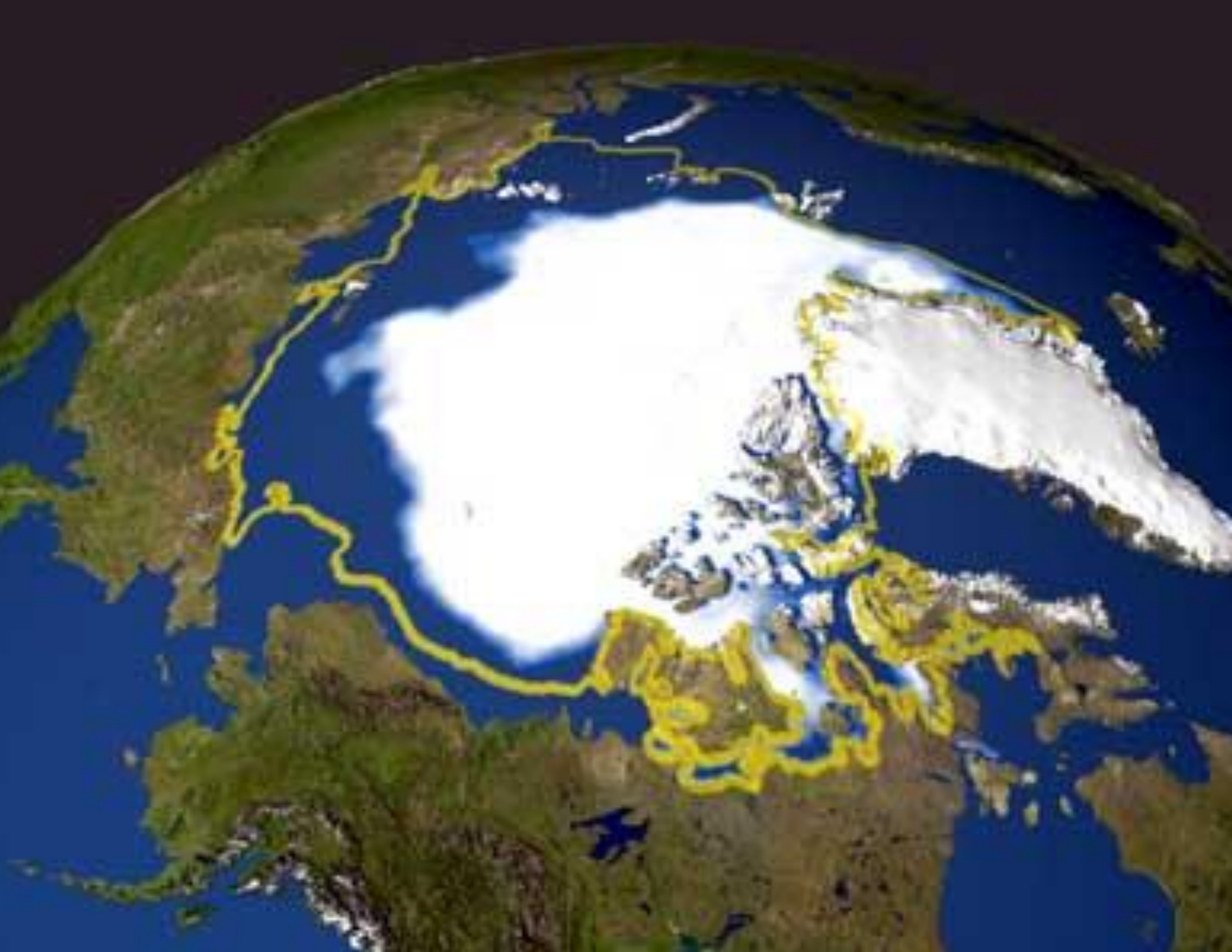
Follow me on Twitter

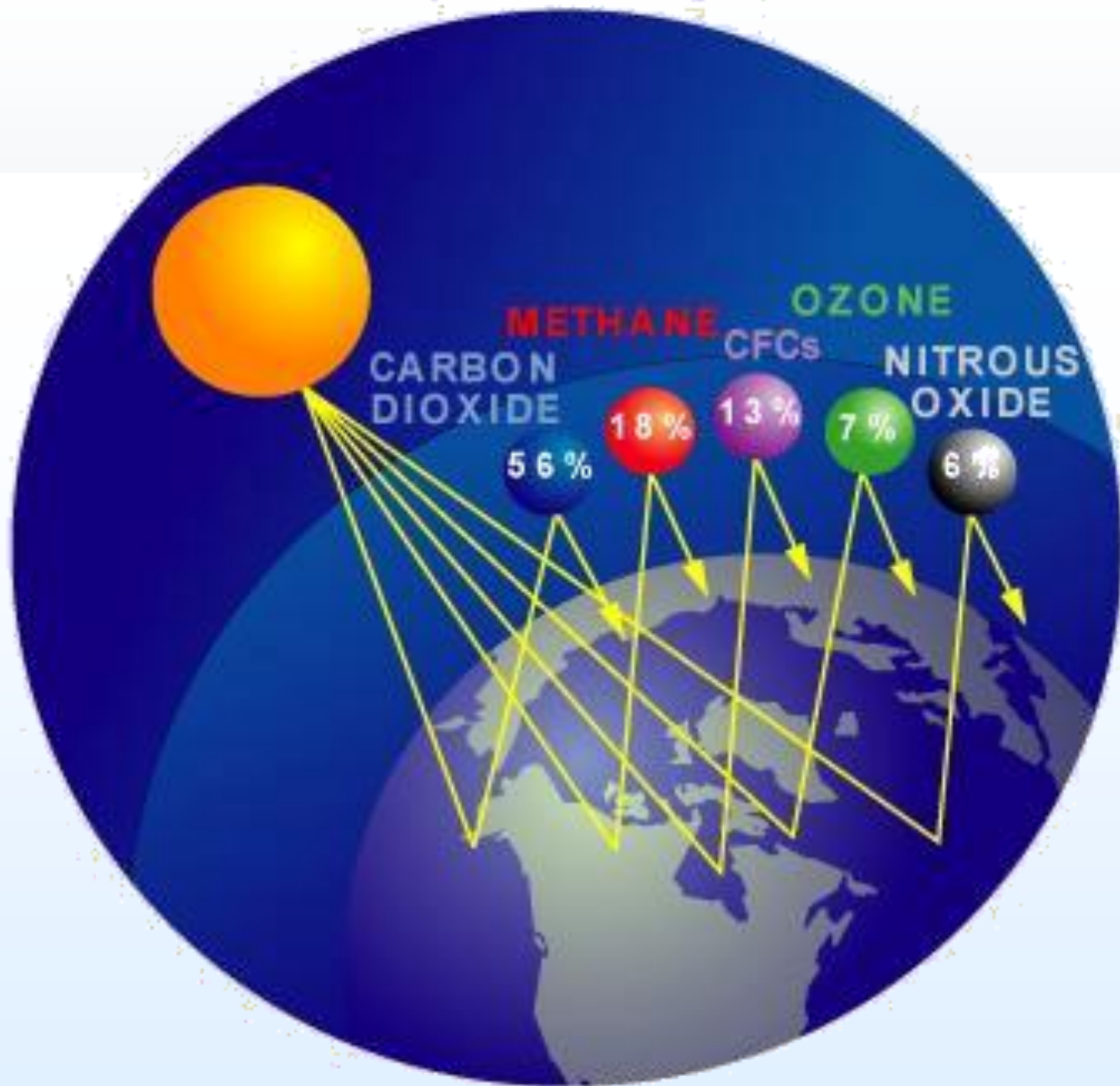


#GHGGuru





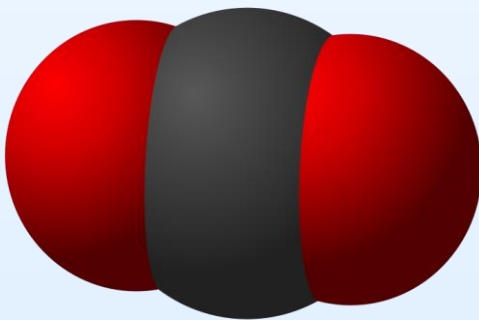




GHG & GWP

Global Warming Potential (GWP) of Main GHG

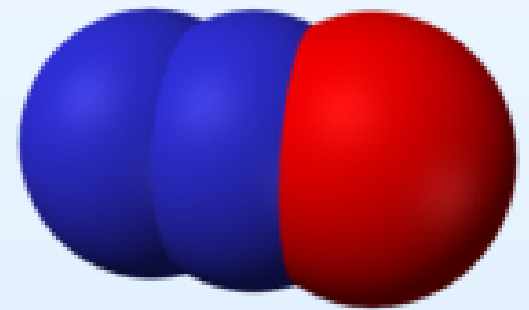
- Carbon Dioxide, CO₂ 1
- Methane, CH₄ 28
- Nitrous Oxide, N₂O 298



CO₂ - Carbon Dioxide

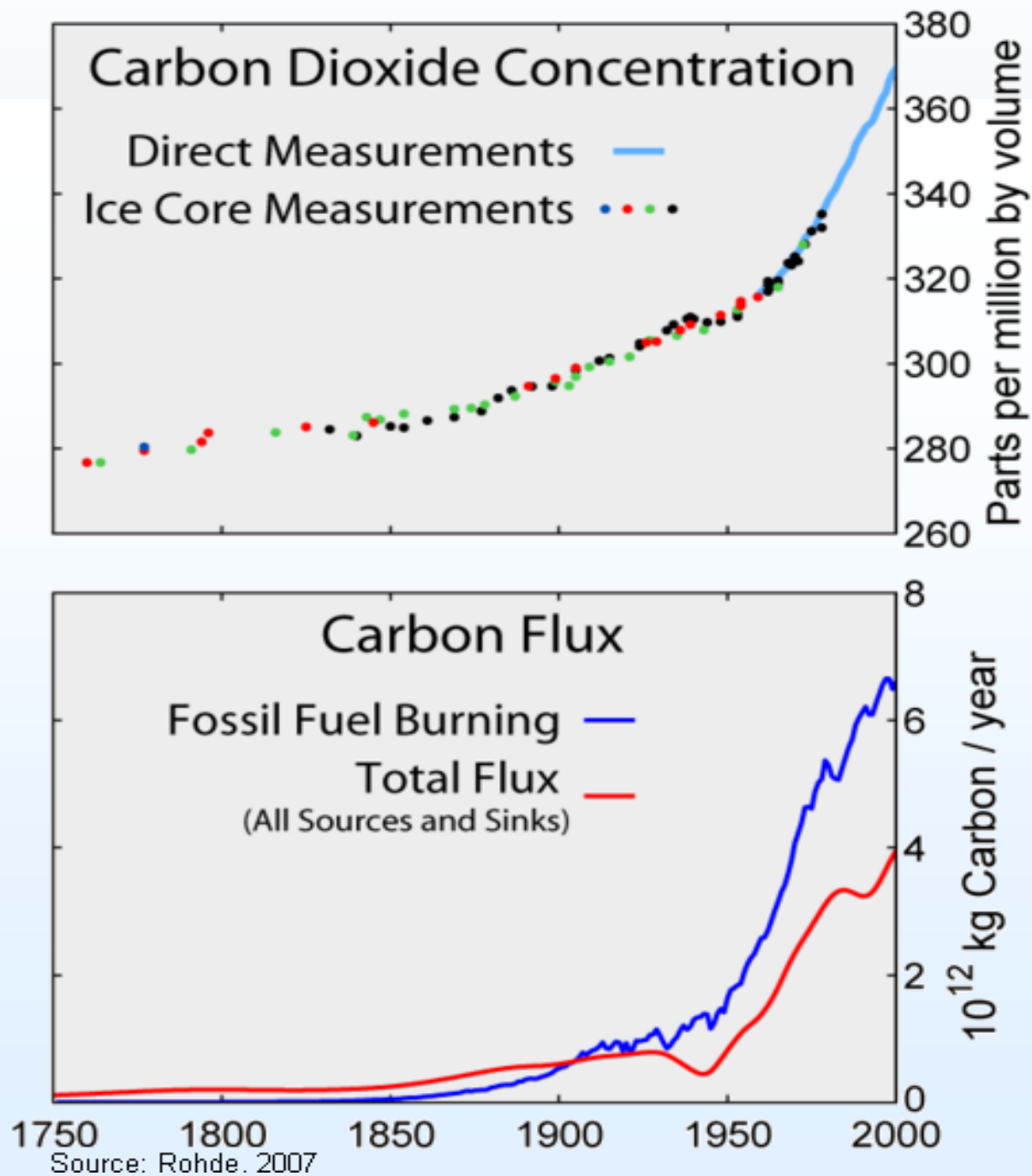


CH₄ - Methane



N₂O - Nitrous Oxide

Carbon Dioxide and Carbon Flux

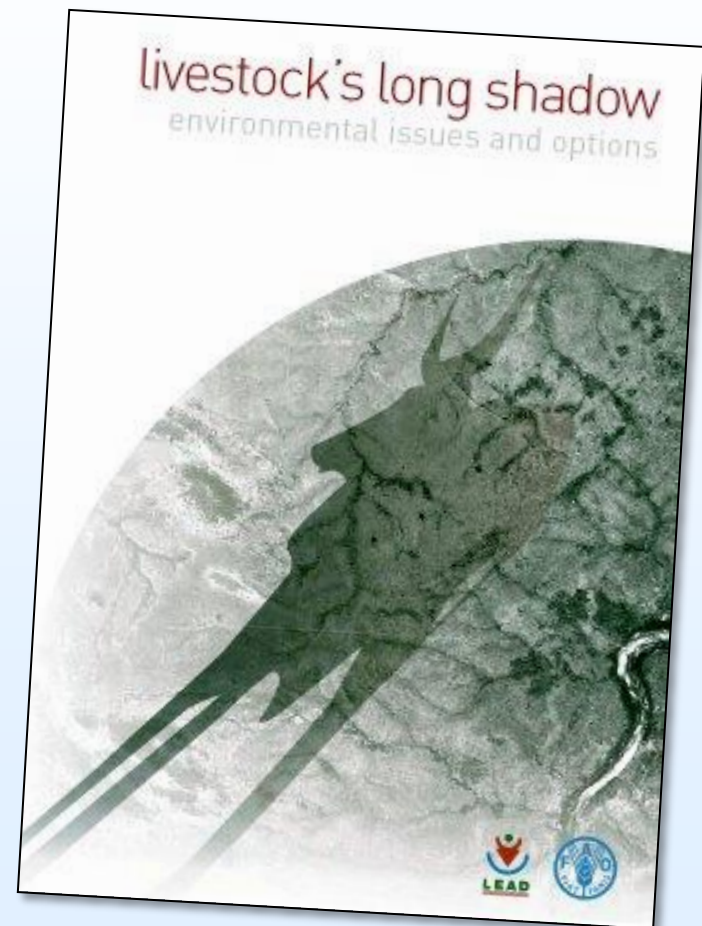


Facts or Fiction on Livestock and Climate Change

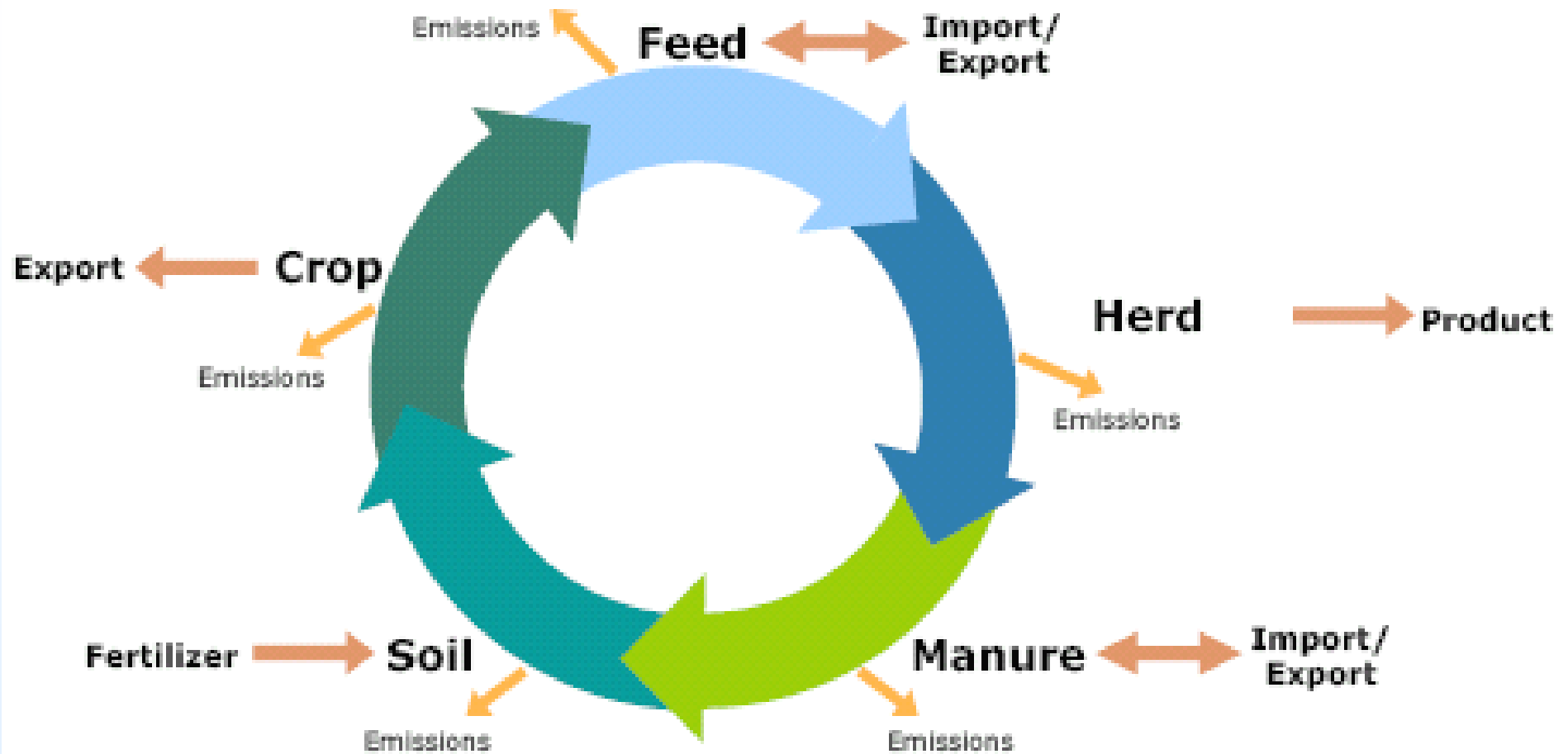
- Livestock produces 18% of all anthropogenic GHG globally
- Livestock produces more GHG than transportation
- Livestock occupies 70% of all agricultural land globally
- Grazing systems produce less GHG than conventional animal production in confinement systems

“Livestock’s Long Shadow” (FAO, 2006)

- “The Livestock sector is a major player, responsible for 18% of GHG emissions measured in CO₂e. This is a higher share than transport”



Life Cycle Assessment



Page last updated at 00:15 GMT, Wednesday, 24 March 2010

UN body to look at meat and climate link

By Richard Black

Environment correspondent, BBC News



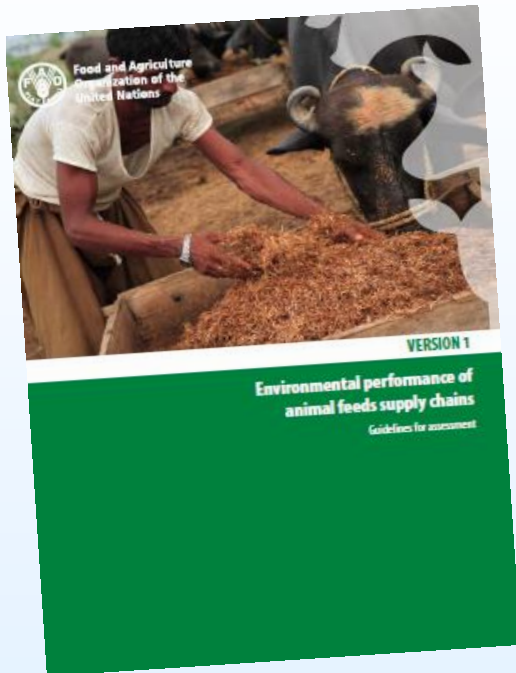
Livestock's Long Shadow calculated meat-related emissions from field to abattoir

UN specialists are to look again at the contribution of meat production to climate change, after claims that an earlier report exaggerated the link.

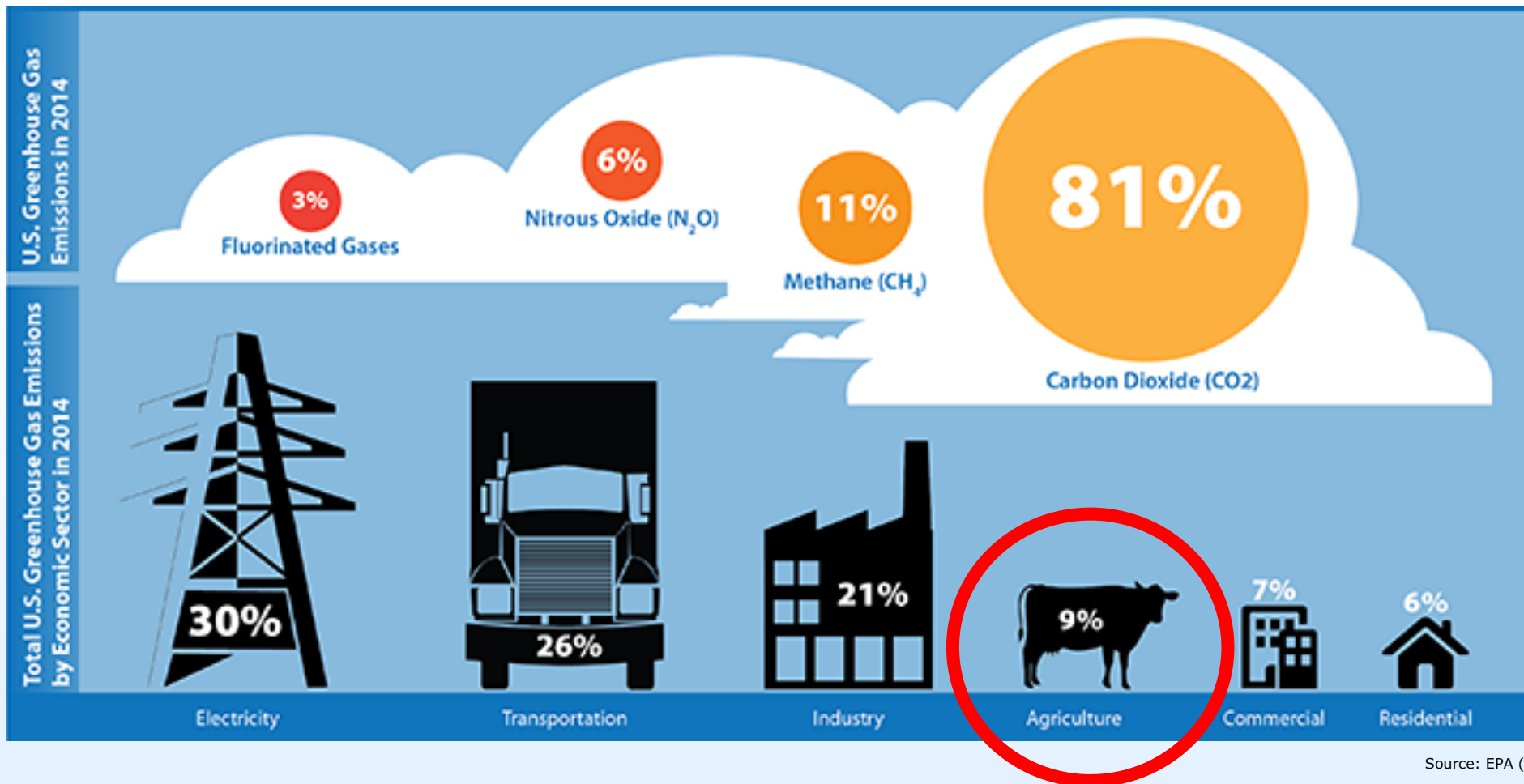
"I must say honestly that he has a point - we factored in everything for meat emissions, and we didn't do the same thing with transport, we just used the figure from the IPCC."

Livestock Environmental Assessment and Performance Partnership (LEAP)

- Internationally agreed sector-level methodologies and guidance to allow
 - transparent,
 - robust,
 - and fair measurement of the environmental performance of livestock supply chains
- FAO / LEAP LCA Guidelines officially released



National-Level U.S. GHG Inventory



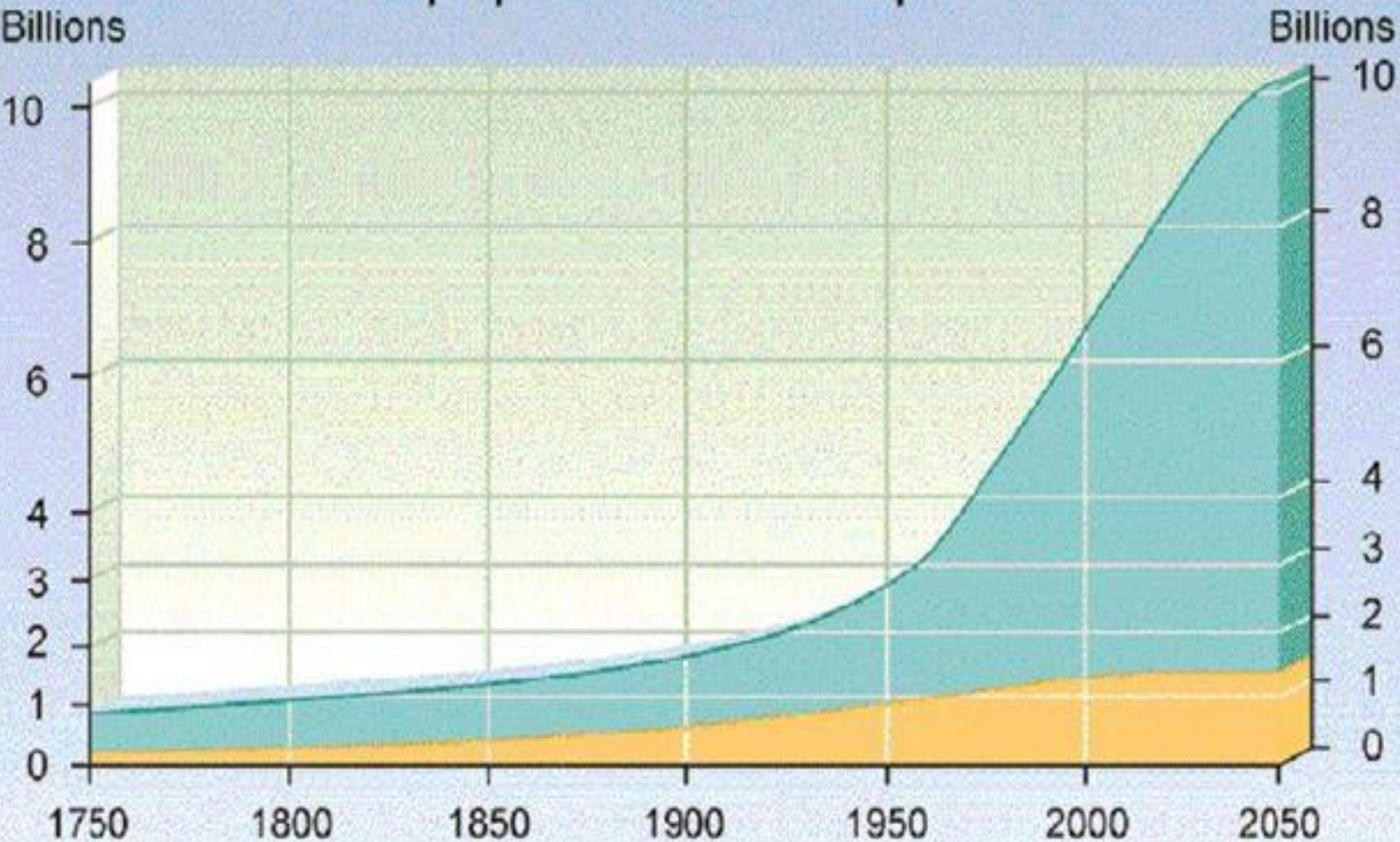
Source: EPA (2016)





Global Waste: 1 out of 3 calories

40% in US

World population development



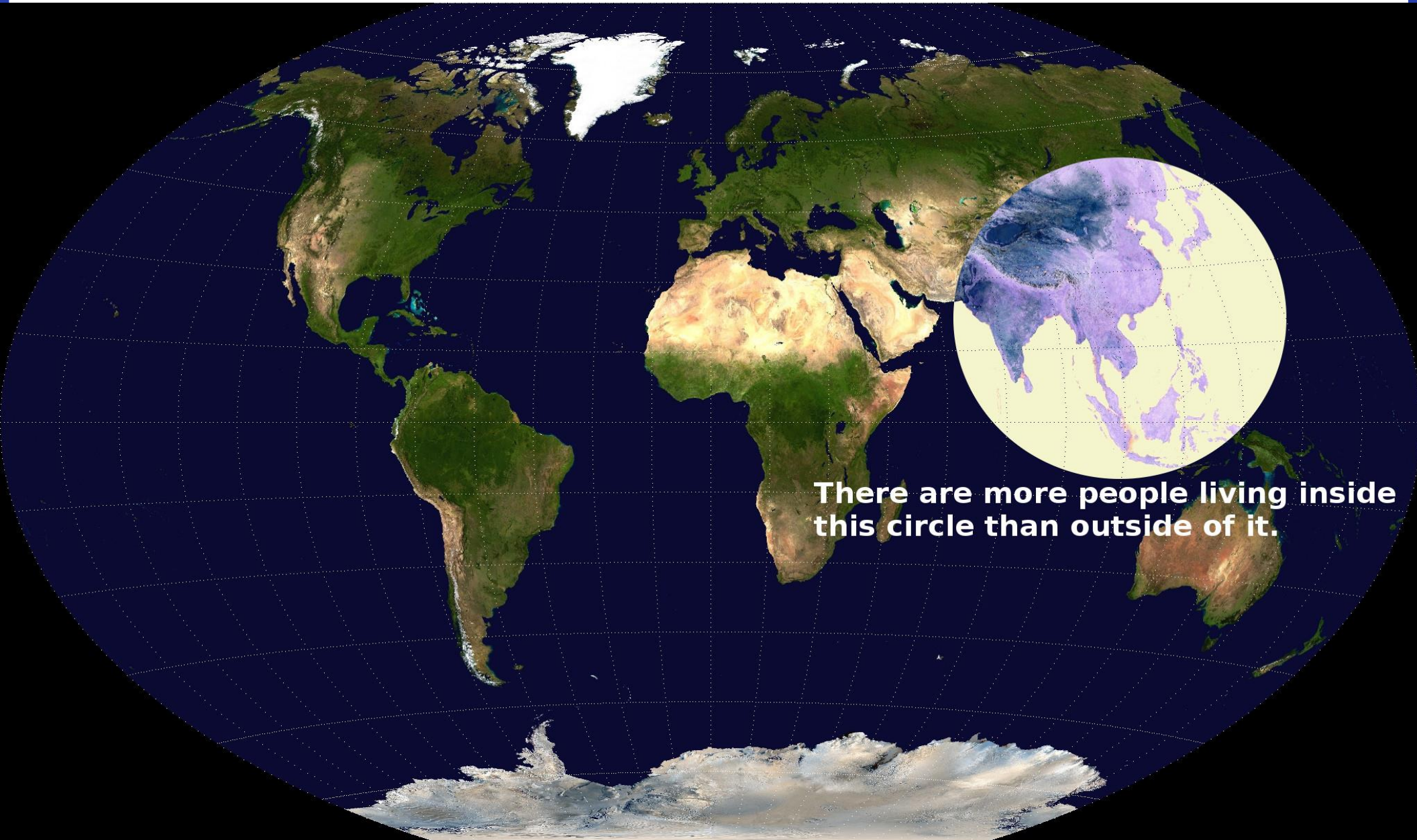
 Developing countries
 Industrialized countries



GRID
Arendal

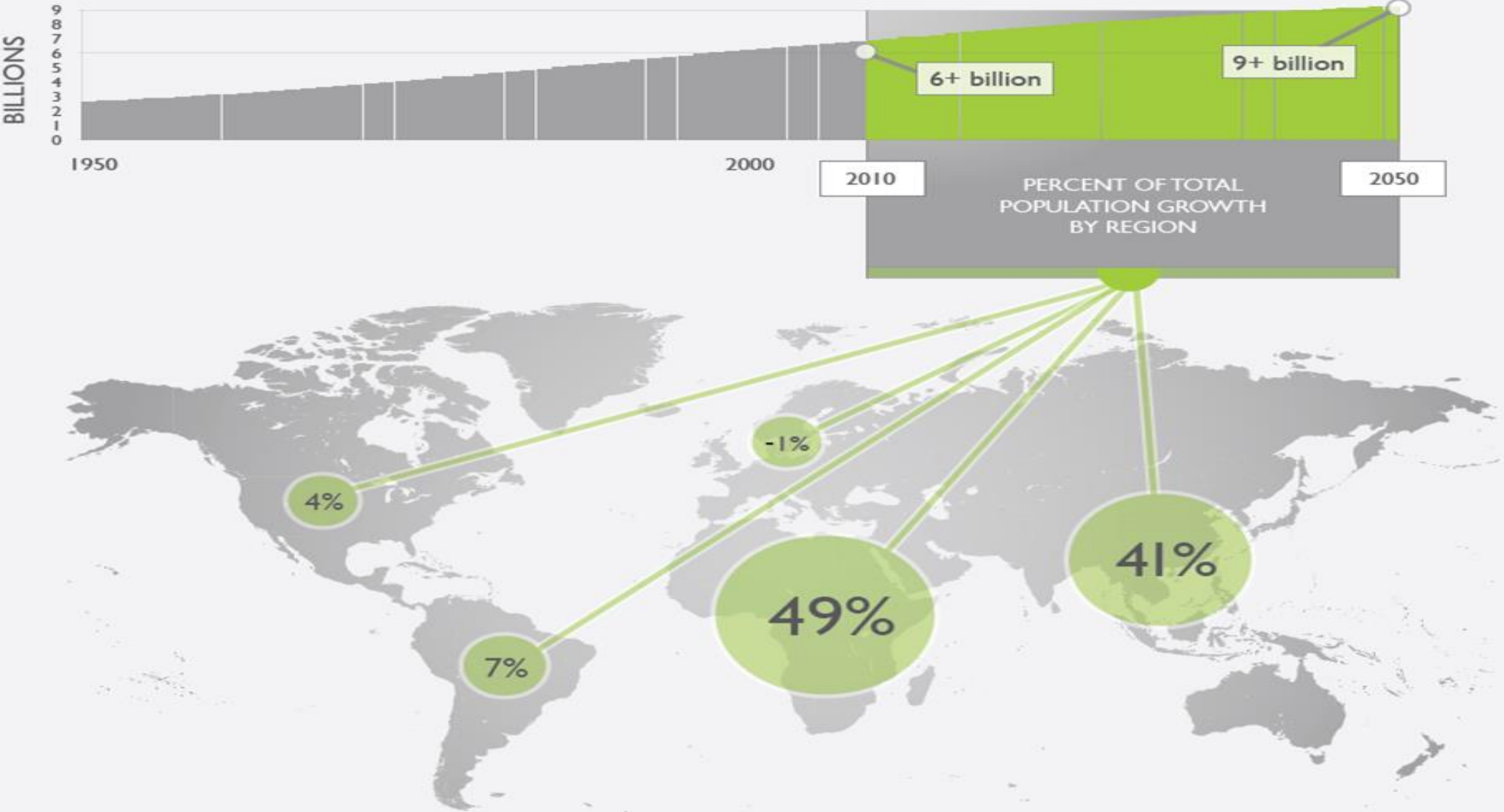


4.5 Billion + population of USA in 10 years

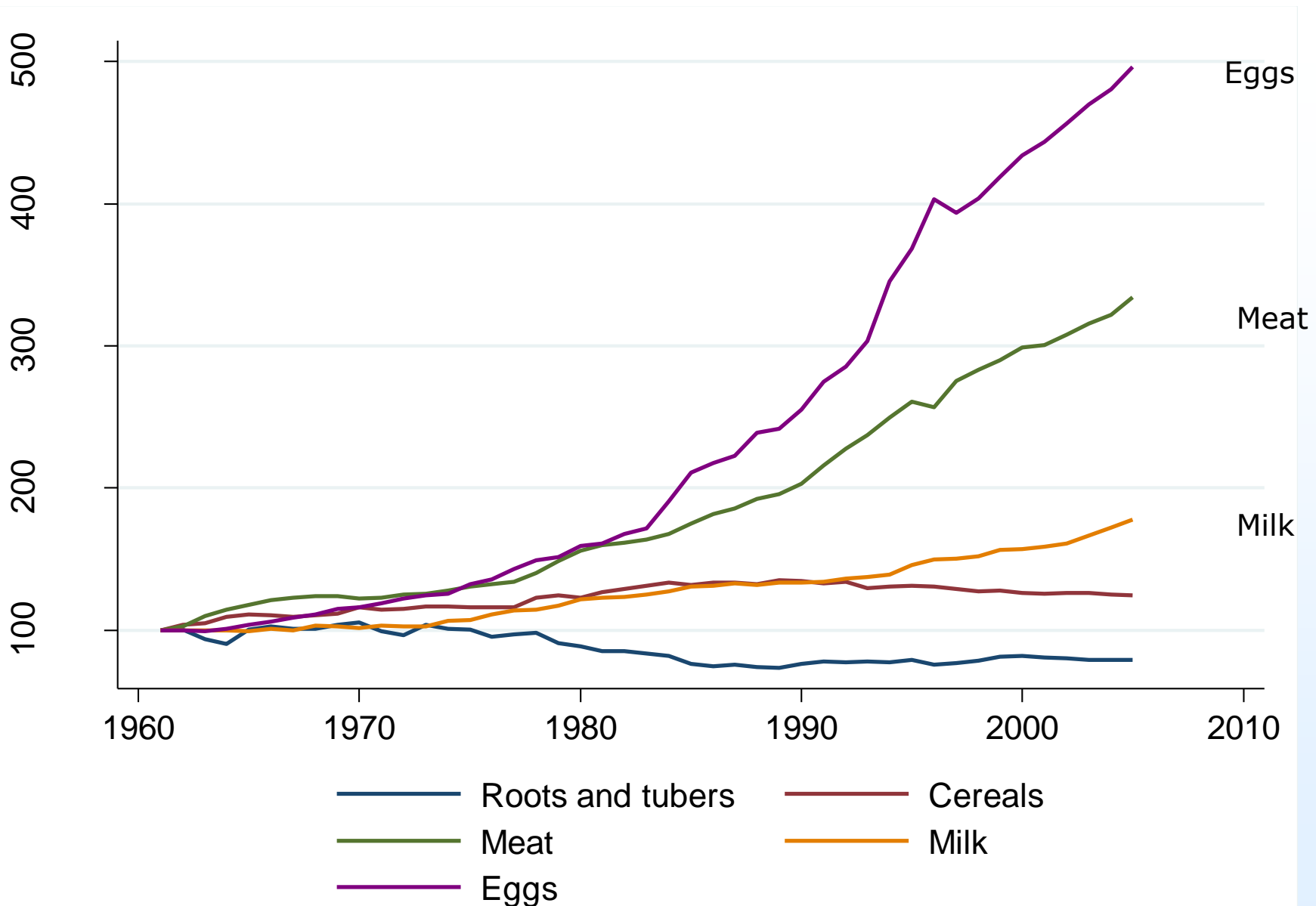


There are more people living inside this circle than outside of it.

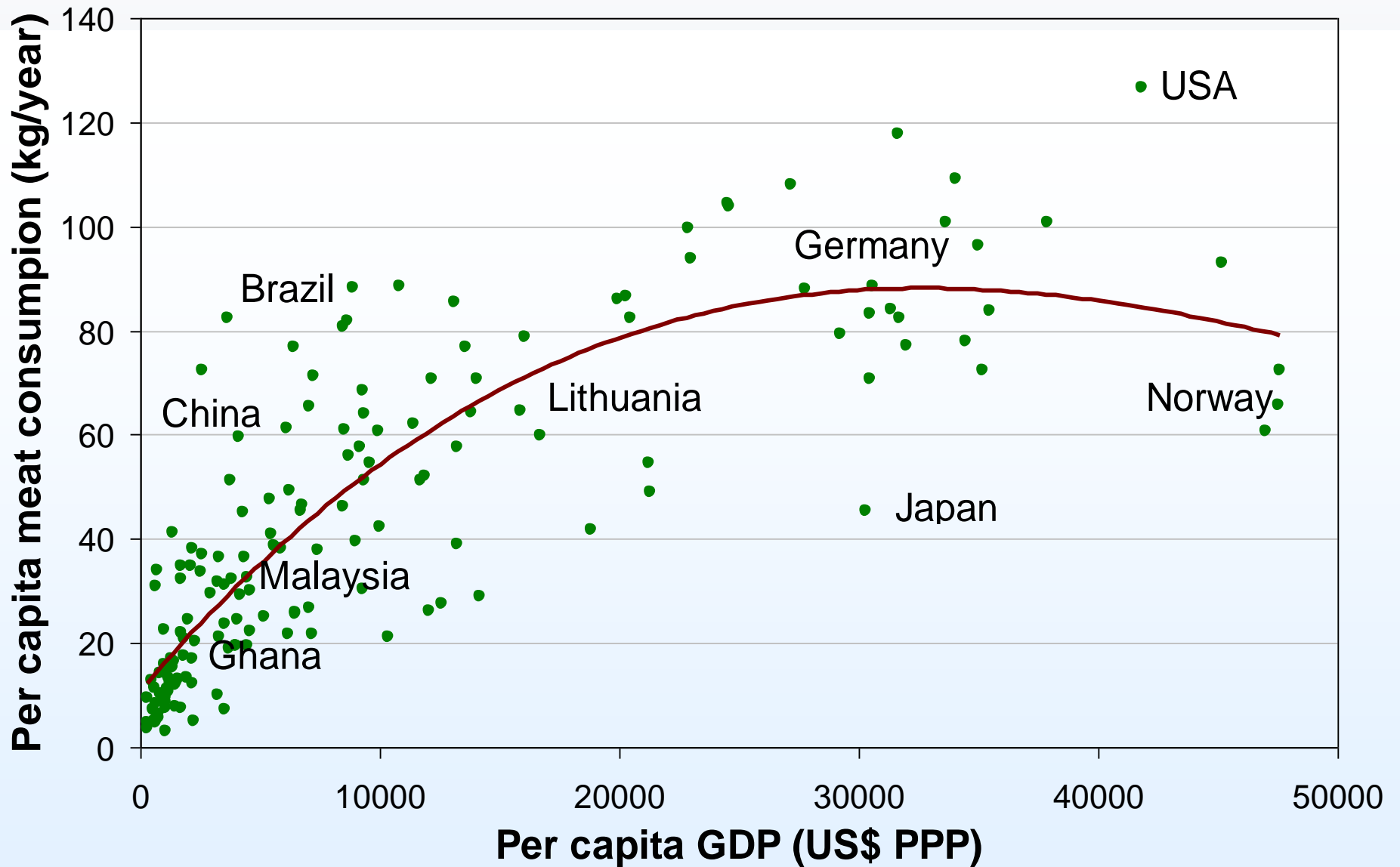
Today and Tomorrow's Markets



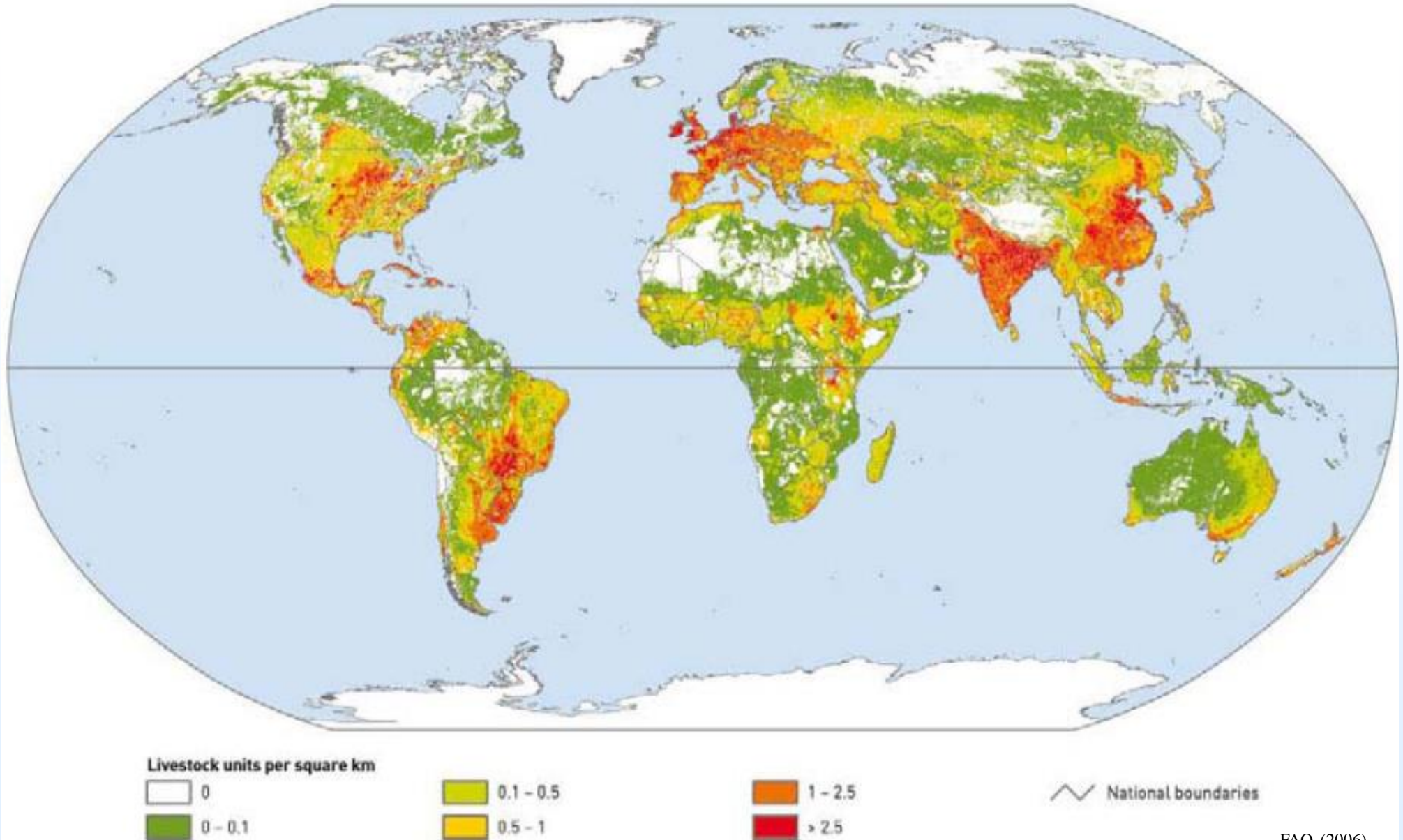
Consumption is growing rapidly in developing countries



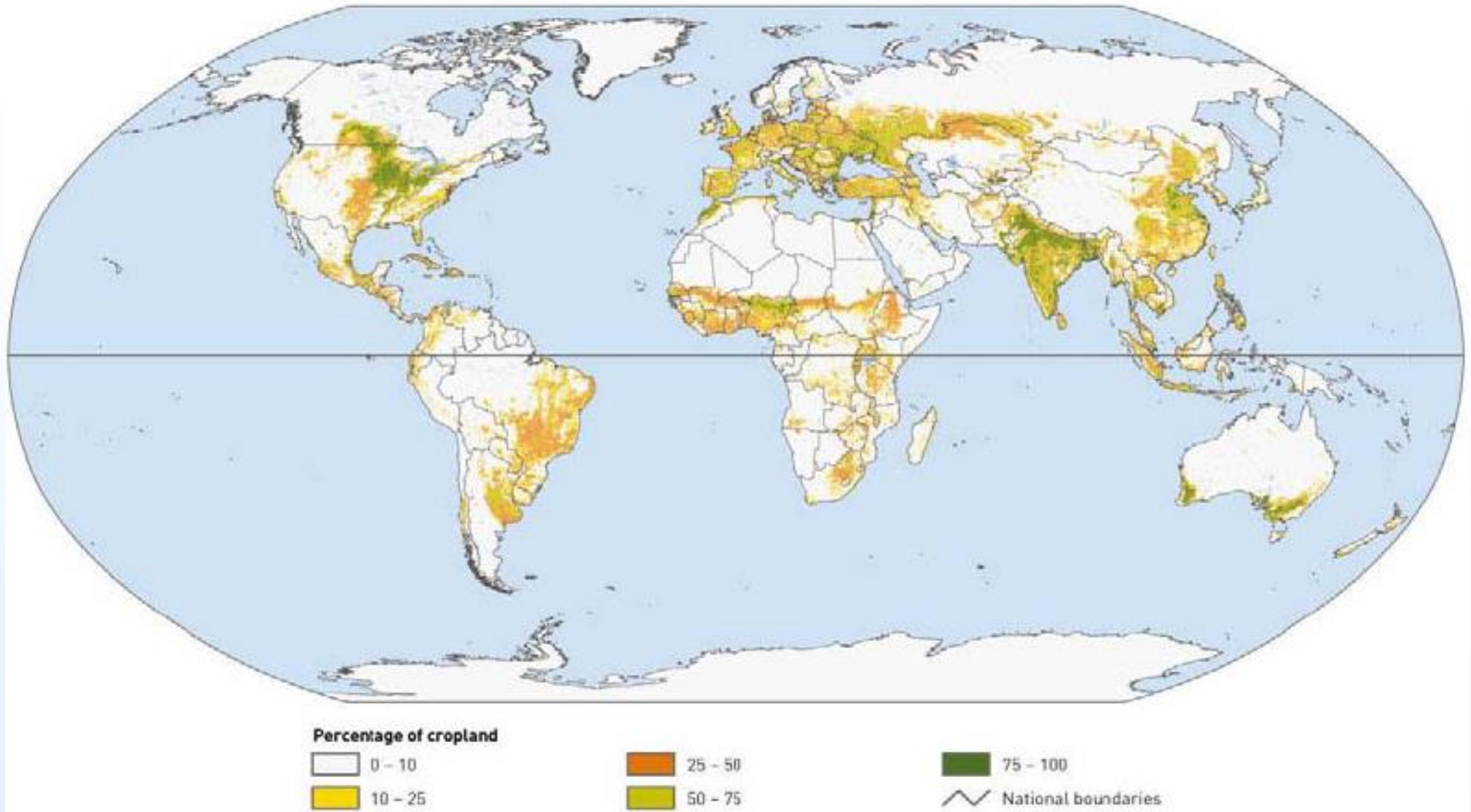
... driven by incomes ...



Global livestock distribution

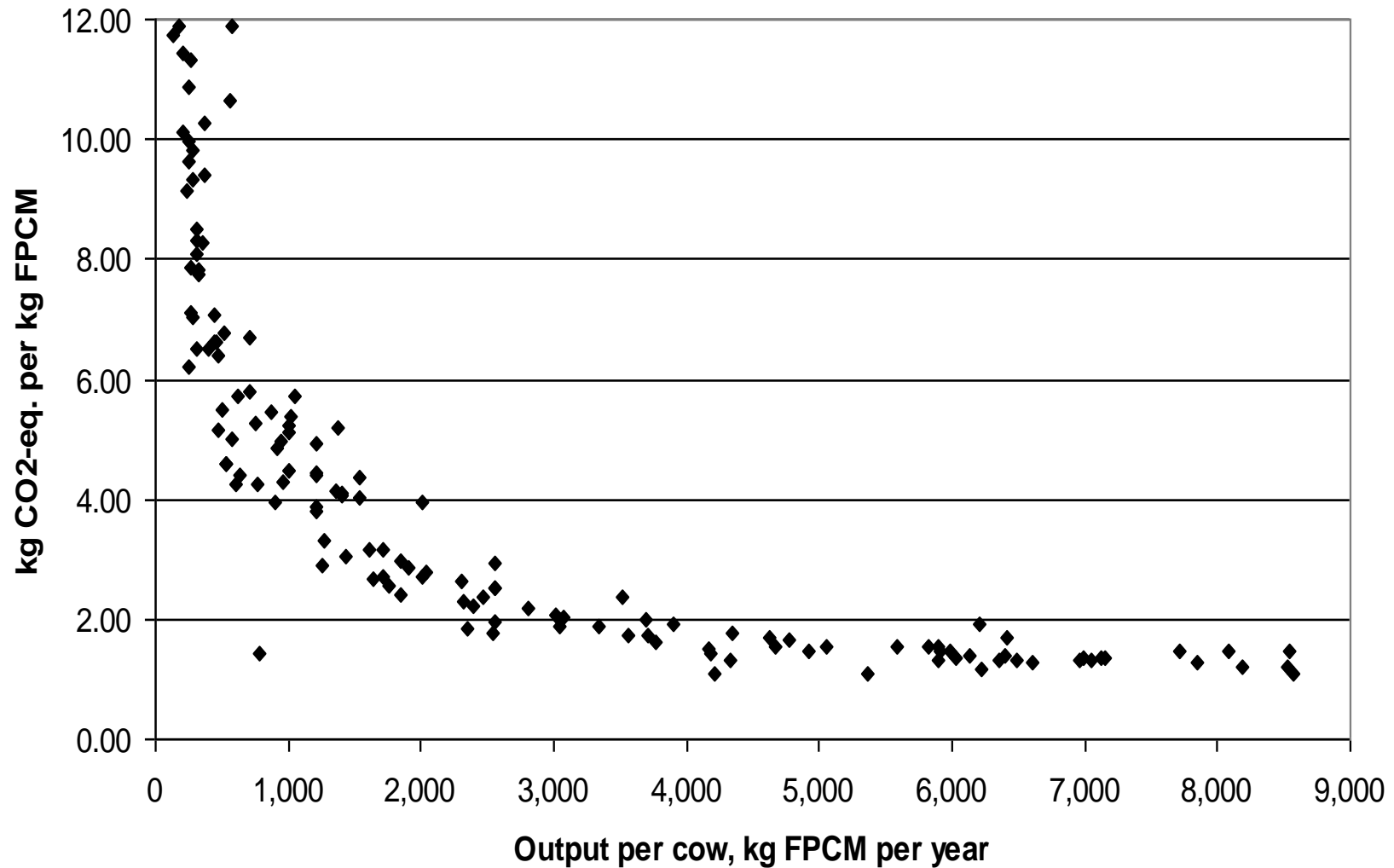


Distribution of cropland



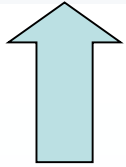
Source: FAO, 2006f.

Relationship between total greenhouse gas emissions and milk output per cow

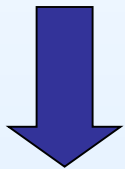


More Milk Produced per Cow – Less Methane & Waste

500 g



California Cow

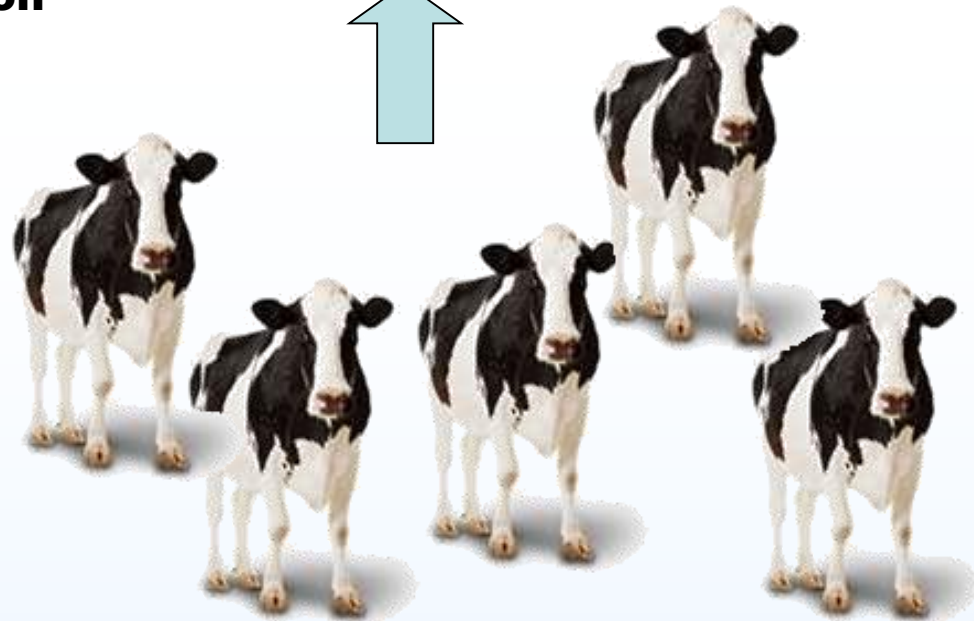
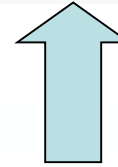


**23,000
lbs/yr/cow**

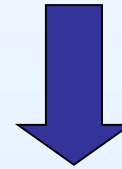


**Methane
Production**

2000 g

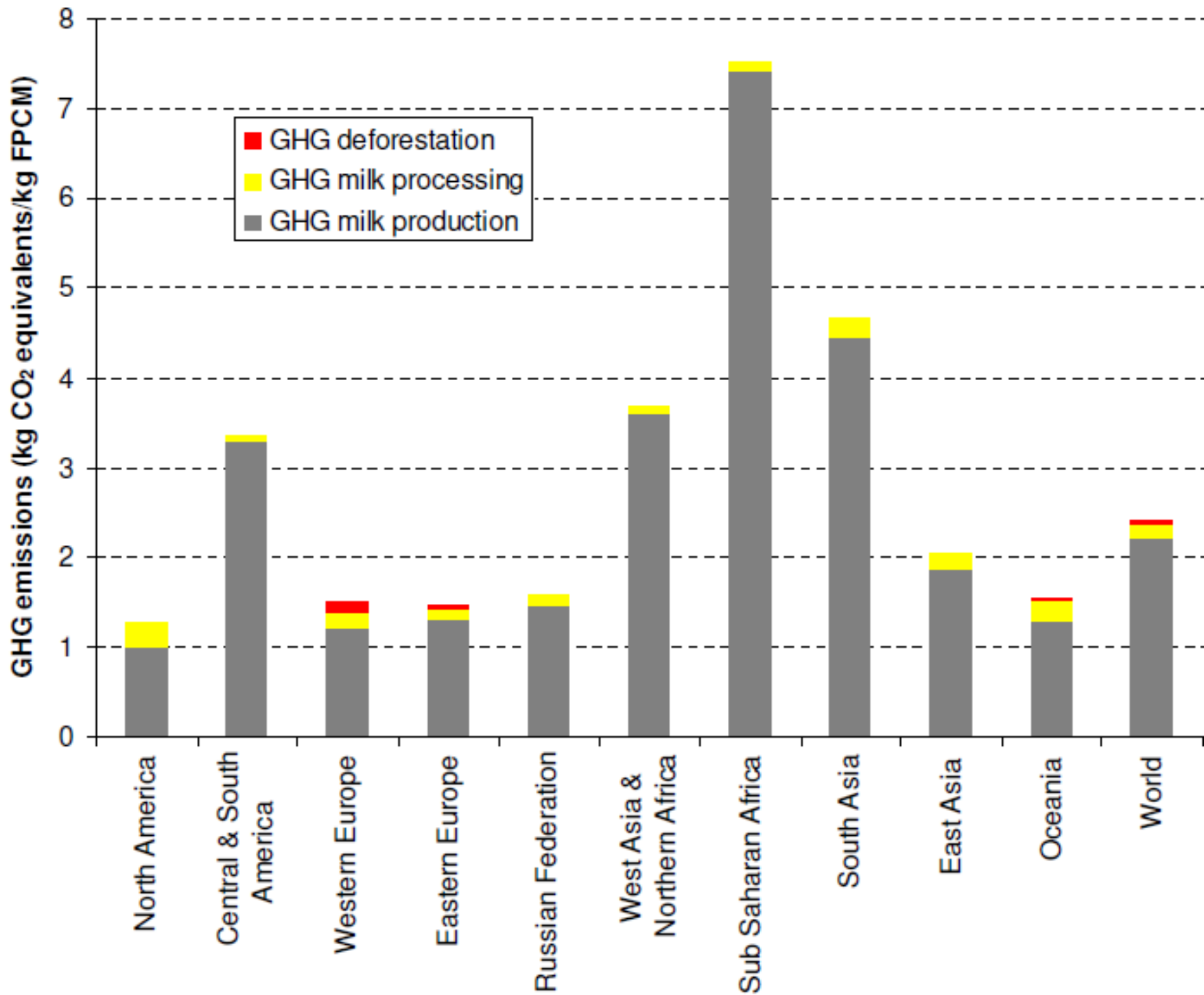


Mexican Cow

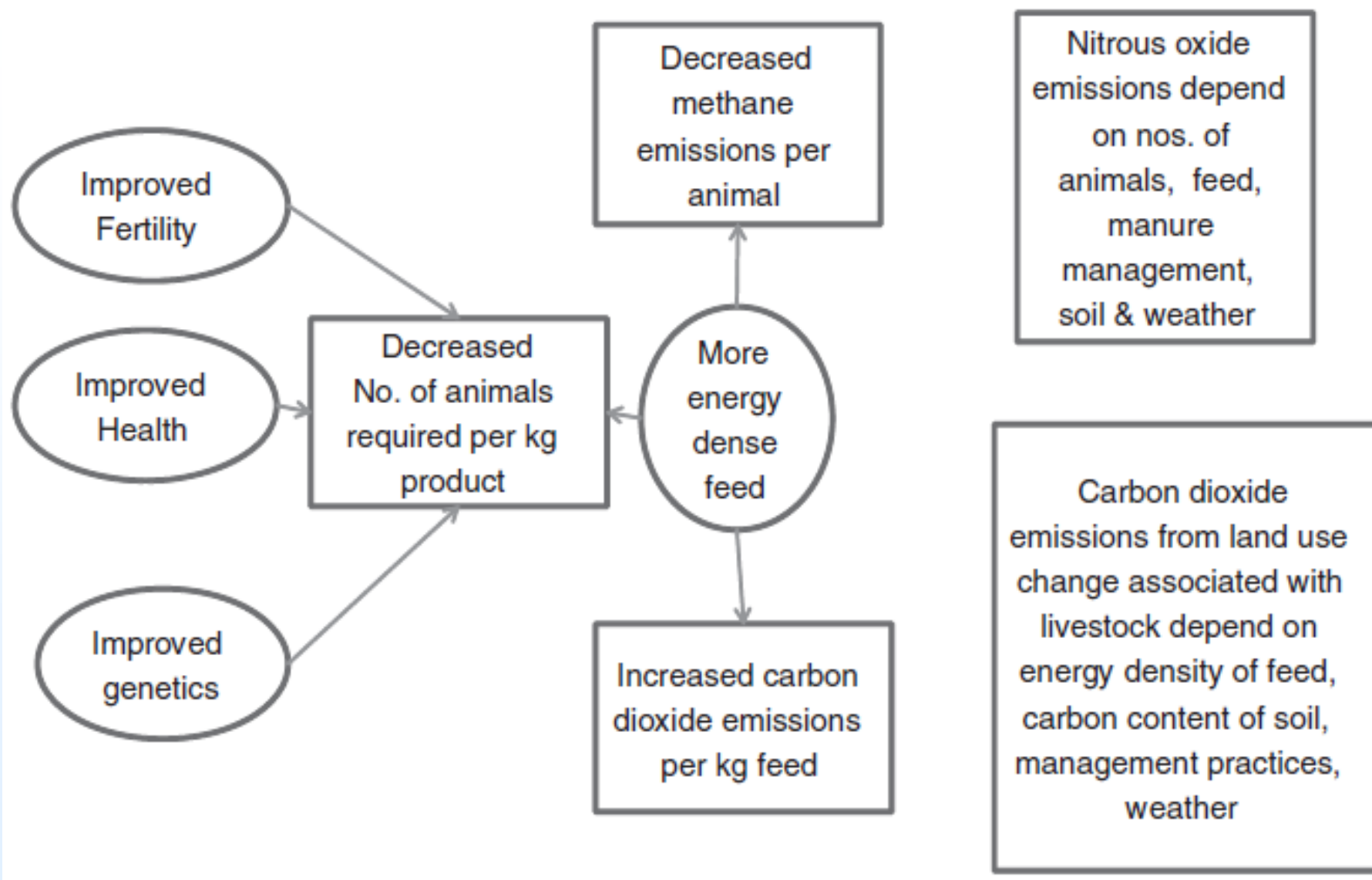


4,500 lbs/yr/cow





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

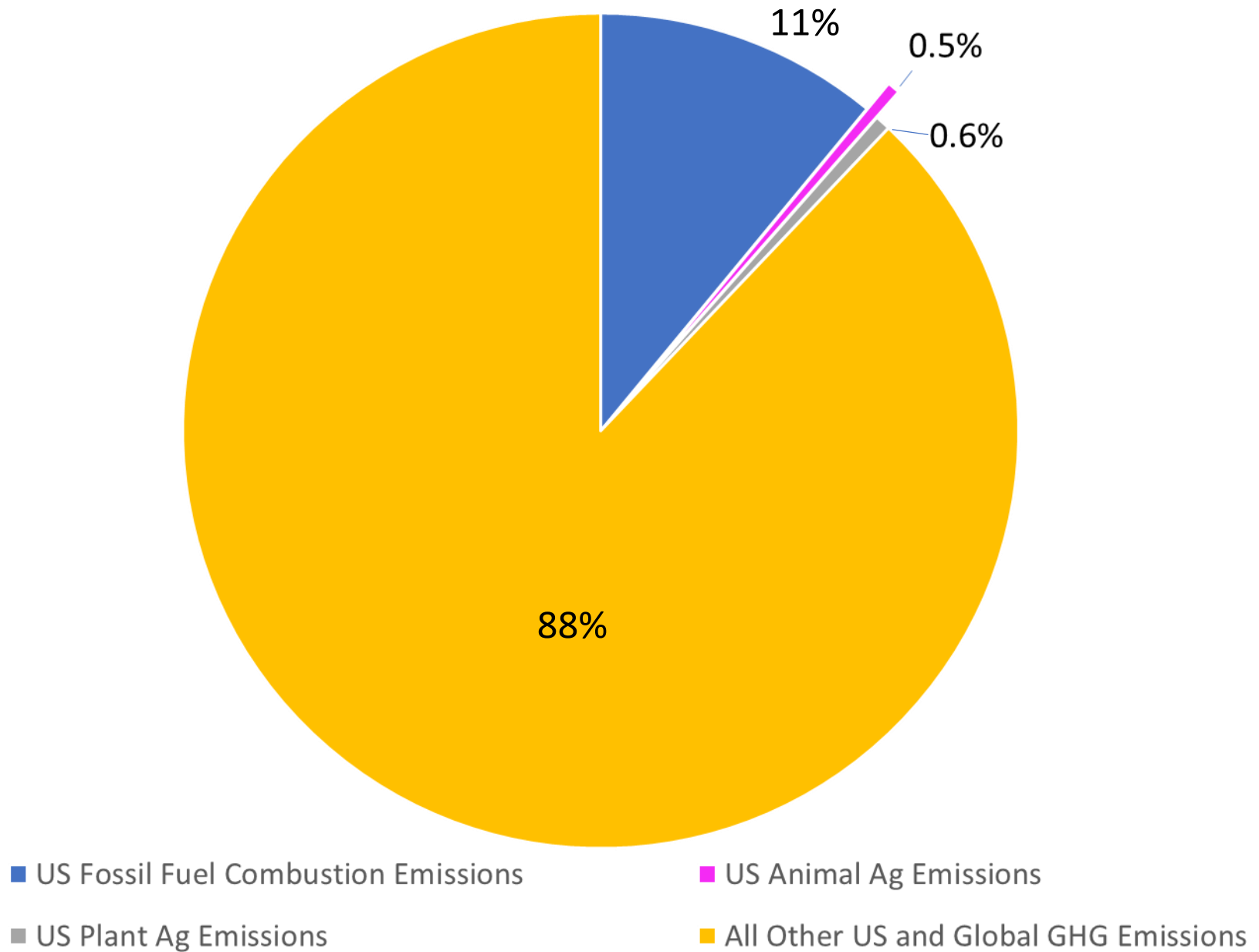
China Swine Example

- 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

Summary

- Livestock in developing countries contribute to 70-80% of global enteric- and waste emissions (IPCC)
- Reductions of enteric- and manure emissions possible
- Production intensity and emission intensity are inversely related

Global Greenhouse Gas Emissions in 2017 (Total Emissions were 49 Gt of CO₂ Equivalents)



NAEMS

National Air Emission Monitoring Study



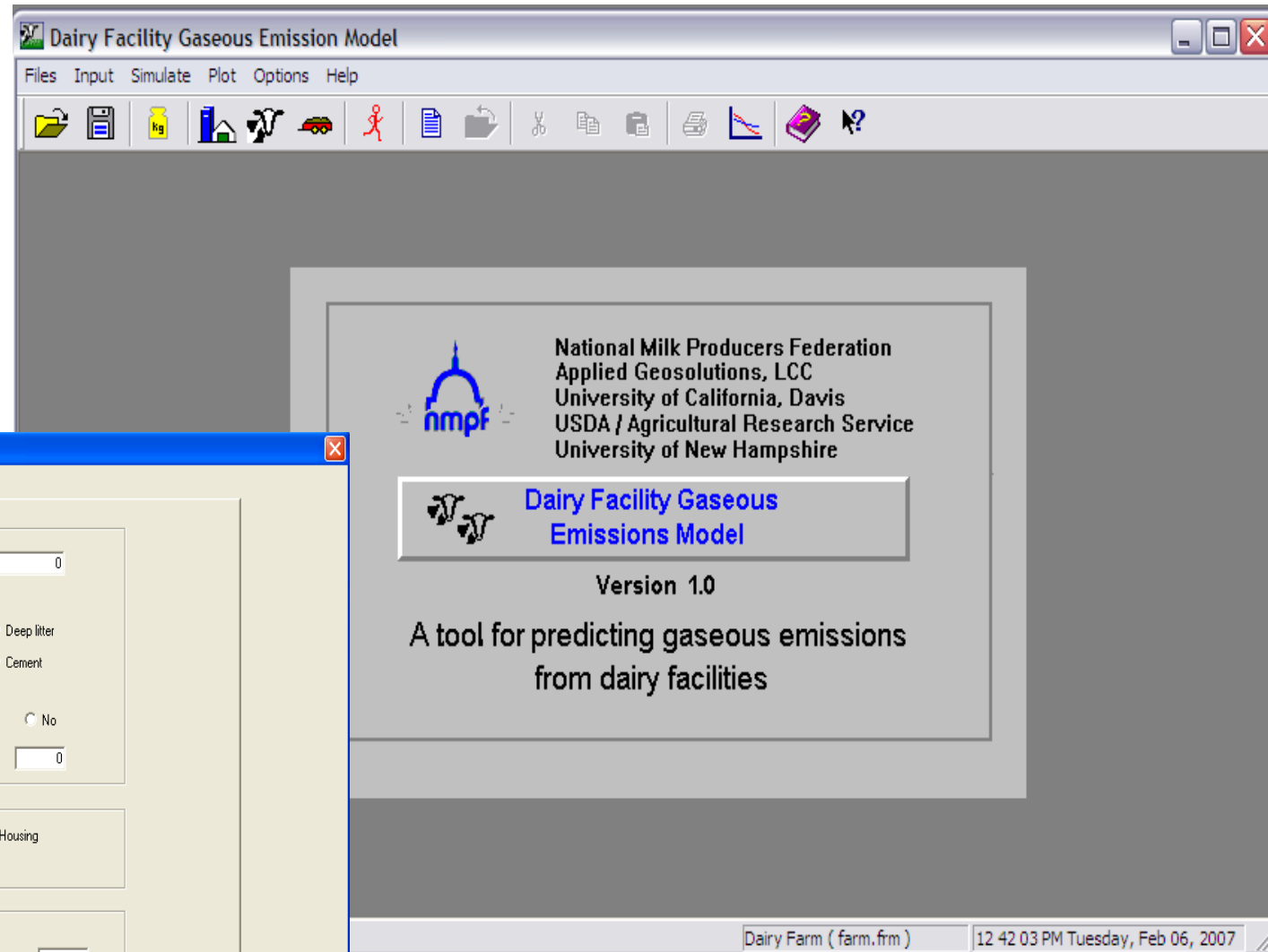
Pollutants and Health - Cal DEHRI

California Dairy Environmental Health Research Initiative





Process-based Emission Models



Input Information

Climate | Housing | Storage | Soil | Farming Management

Livestock

Animal type:

Animal number:

Daily production: Use annual average
 Use a daily data file

Milk production (kg/day):

Weight gain (kg/day):

Select a daily milk/meat production file:

Feeding material

C/N ratio of diet:

Get default data based on production:

Feeding rate (kg dry matter/animal/day):

Intake N (kg N/animal/day):

Intake protein (kg/animal/day):

Intake C (kg C/animal/day):

Floor conditions

Ground area (square m):

Ground surface:

Slatted floor with gutter Deep litter
 Mineral soil Cement

Add bedding material: Yes No

Initial accumulation of manure (kg DM):

Ventilation

Open air Shading Housing
 Controlled ventilation

Waste clearing method

Cleaning frequency (once every x days):

Water addition (mm/day):

Methane Enteric Emission Research



Manure Methane Benchmarking Research







UNIVERSITY OF CALIFORNIA

LET THERE BE LIGHT

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