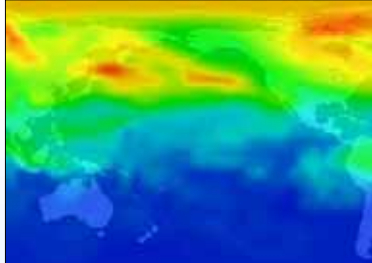




Climate Change Impact: Short and long term vision on red meat production, processing and marketing

Montevideo, Nov 22, 2010



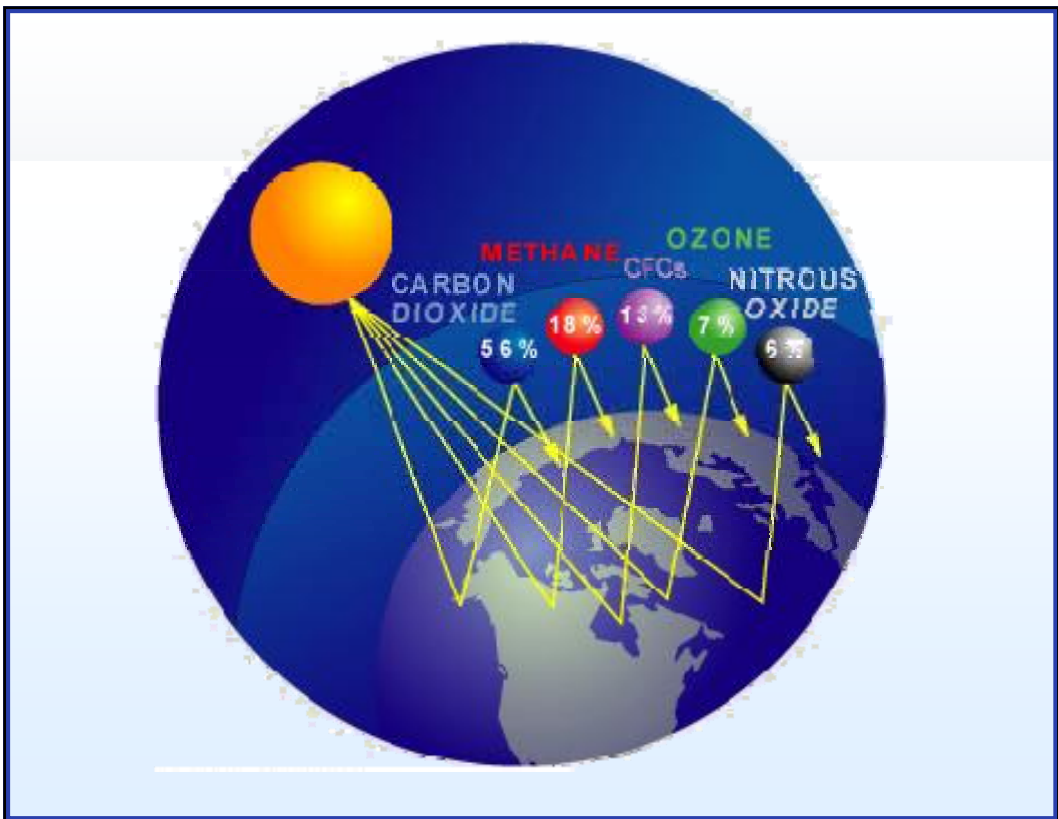
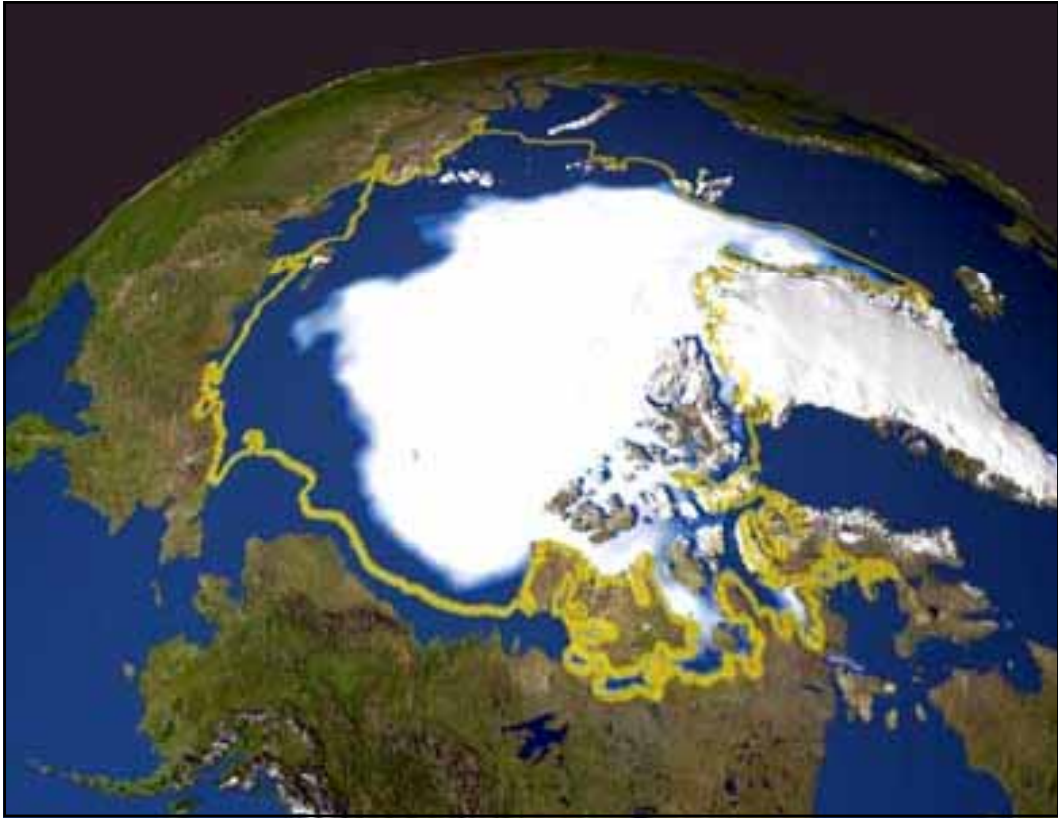
Frank Mitloehner, PhD
Assoc Prof & UC CE Specialist
Dept Animal Science, UC Davis

Mean Summary of US Consumer Concerns About Issues

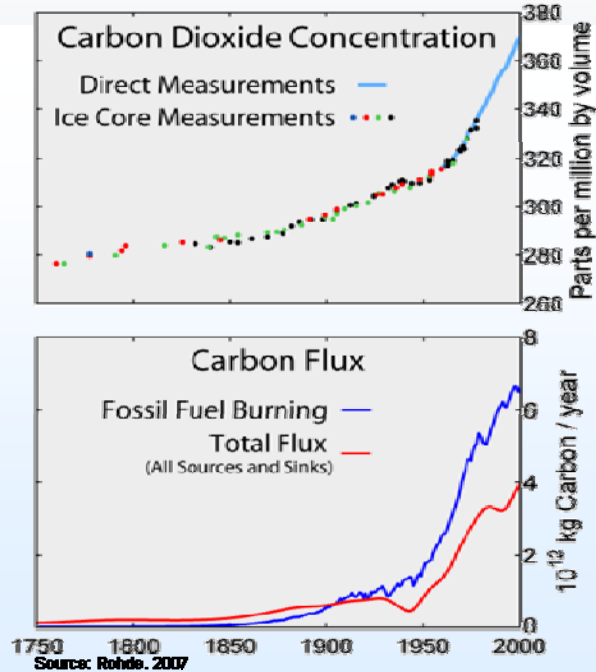
Issues	Total
The U.S. Economy	8.44
Rising Energy Costs	8.29
Rising Cost of Food	8.23
Rising Health Care Costs	8.21
Personal Financial Situation	8.04
Food Safety	7.67
U.S. military involvement in Iraq and Afghanistan	7.22
Access to accurate information to make healthy food choices	6.60
Humane Treatment of Farm Animals	6.43
Obesity in America	6.37
Global Warming	6.05

(n=2066)

2



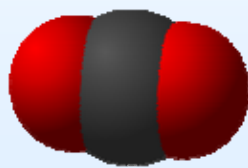
Carbon Dioxide and Carbon Flux



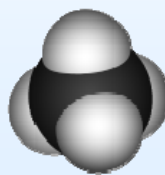
GHG & GWP

Global Warming Potential (GWP) of Main GHG

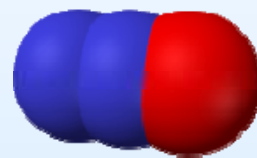
- Carbon Dioxide, CO₂ 1
- Methane, CH₄ 21
- Nitrous Oxide, N₂O 298



CO₂ – Carbon Dioxide



CH₄ – Methane

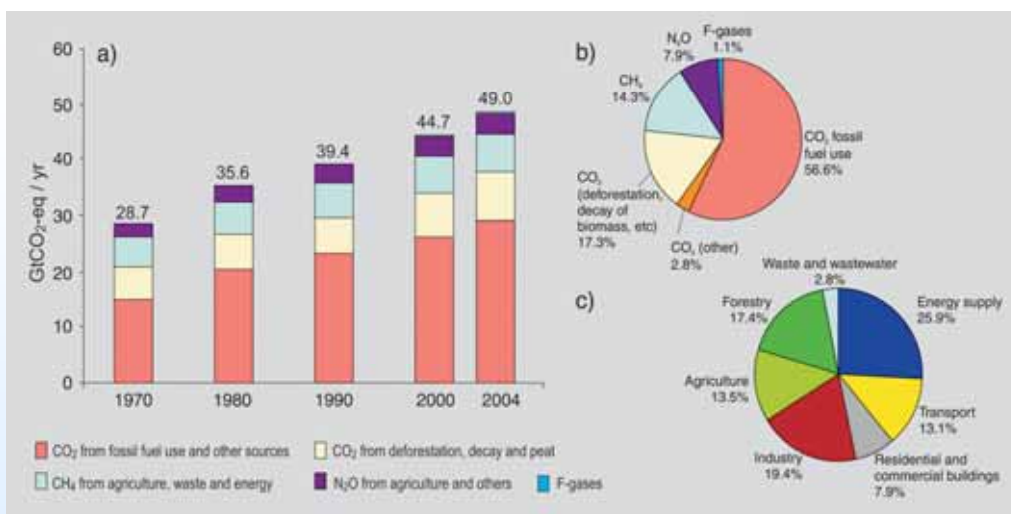


N₂O – Nitrous Oxide

What are the animal Ag pathways?

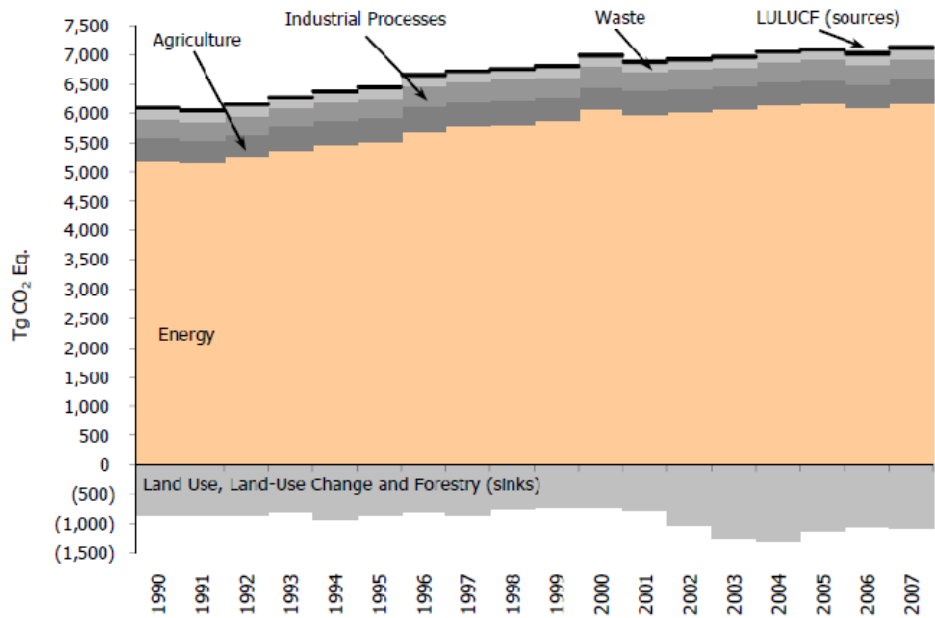
- CO₂ from land use and land-use change
- CH₄ from the guts of ruminants
- CH₄ from liquid waste
- N₂O from manure storage and use
- N₂O from fertilizer use for feed
- multiple mostly microbial pathways

Global big picture



Source: IPCC 4AR, 2004

U.S. – the big GHG picture



Source: EPA (2009)

Global Predictions

- Global meat production will double by 2050
- Growth will occur in areas that are currently forested
- In 2010 6.8 Billion people and in 2040 9.3 Billion

World Population and Food Security

Number of Years Required to Add One Billion People to the World's Population

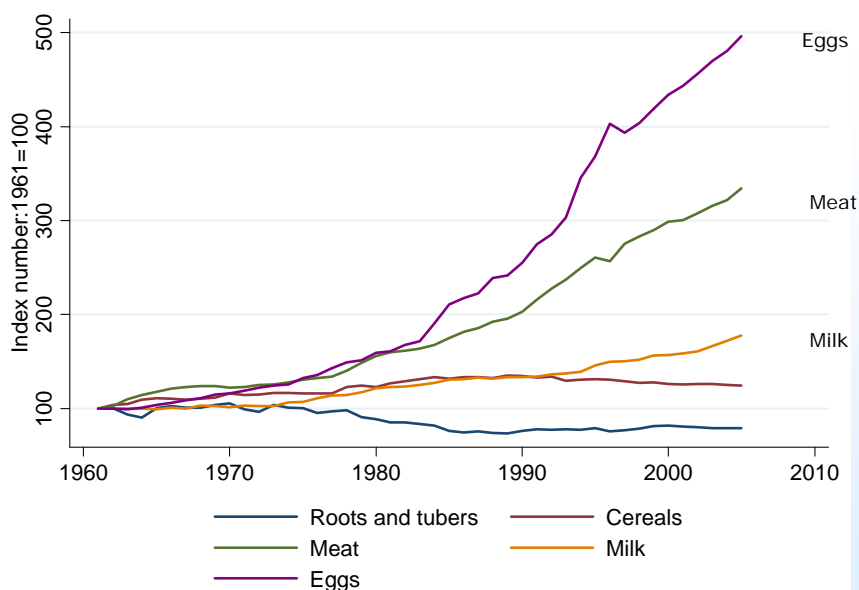
	Date Achieved	Years Required
First Billion	1800	All of Human History
Second	1930	130
Third	1960	30
Fourth	1974	14
Fifth	1987	13
Sixth	1998	11
Seventh	2009	11
Eighth	2021	11
Ninth	2035	14
Tenth	2054	19

While it took several million years of human history to reach the first billion, and 130 years to reach the second, today each new billion is added in 11 years.

Over the past 50 years, arable crop land per person has halved from 0.42 hectares to 0.23 hectares.

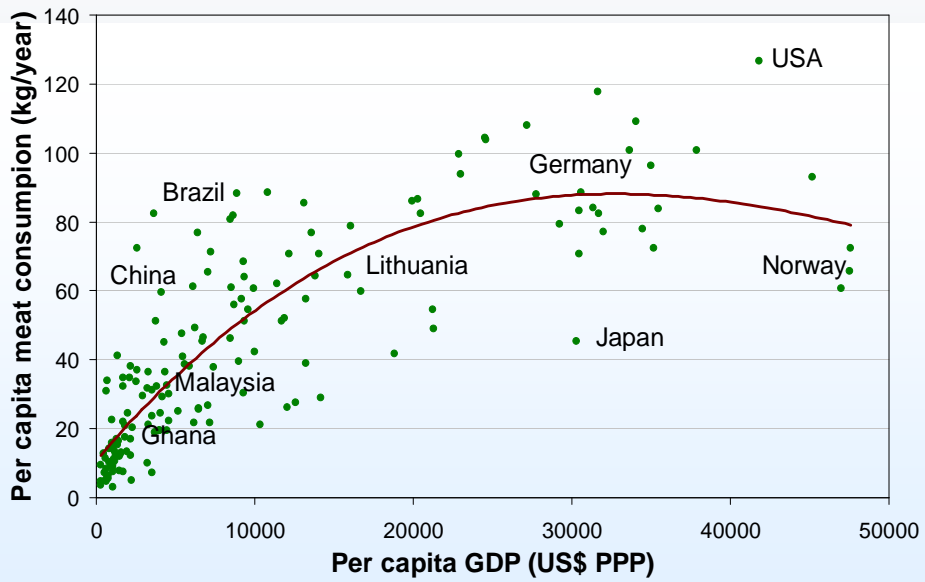
DEPARTMENT OF METEOROLOGY University of Maryland College Park, 1996

Consumption is growing rapidly in developing countries ...



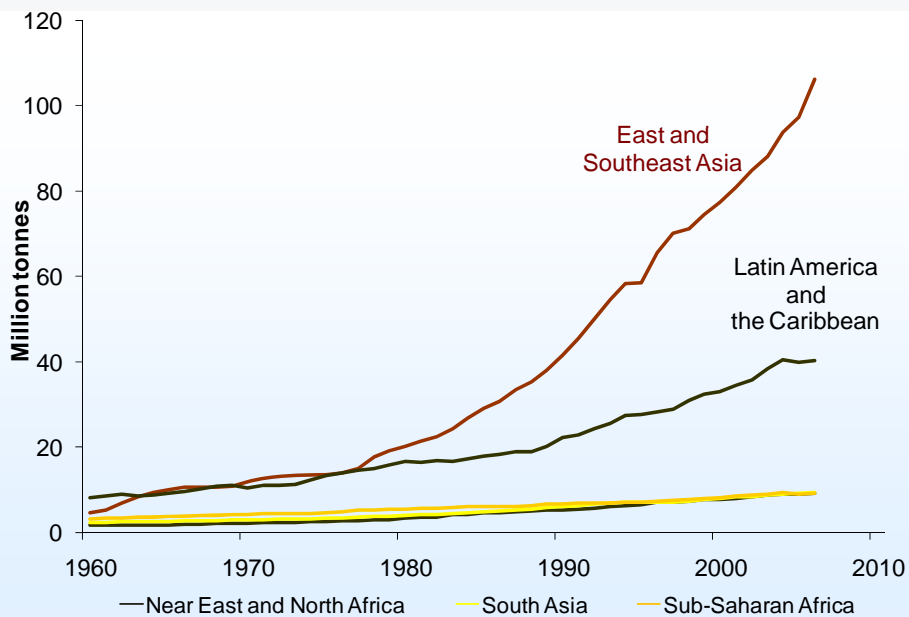
Per caput consumption of major food items in developing countries – kg per caput per year (index numbers 1961=100), Steinfeld, 2010

... driven by incomes ...



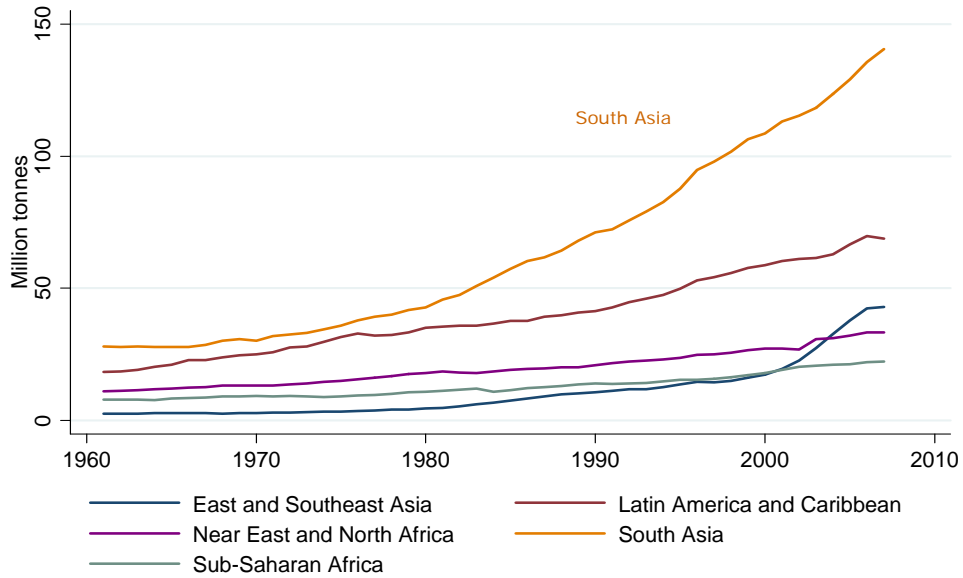
Per capita GDP and meat consumption by country, 2005; Steinfeld, 2010.

Meat production is growing ...



Source: The State of Food and Agriculture 2009.

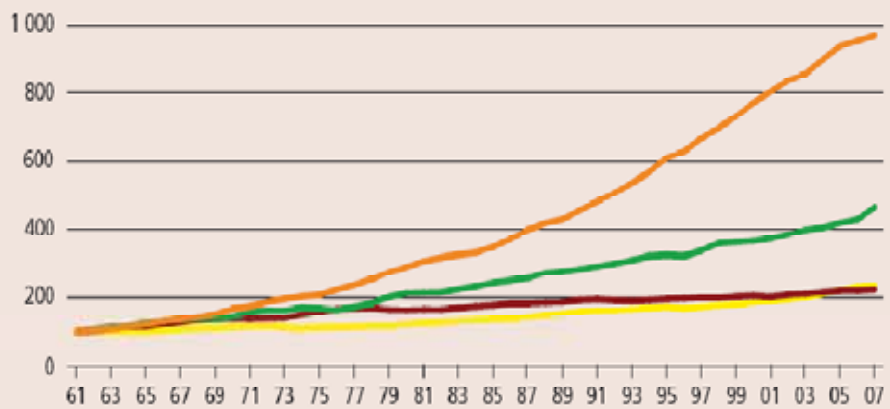
... as is milk production



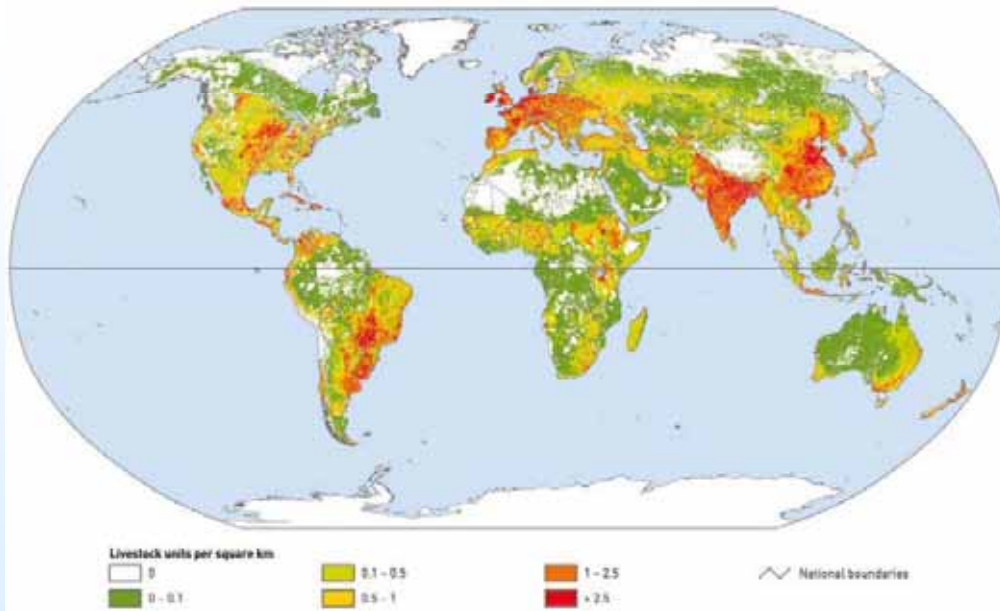
Source: The State of Food and Agriculture 2009.

World production of main categories of meat, 1961-2007

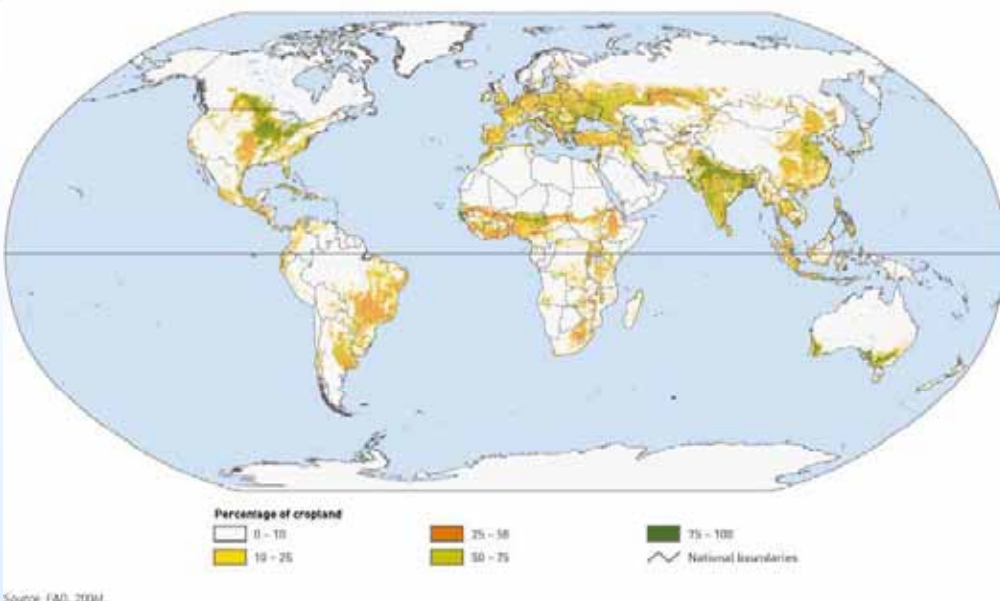
Index (1961 = 100)



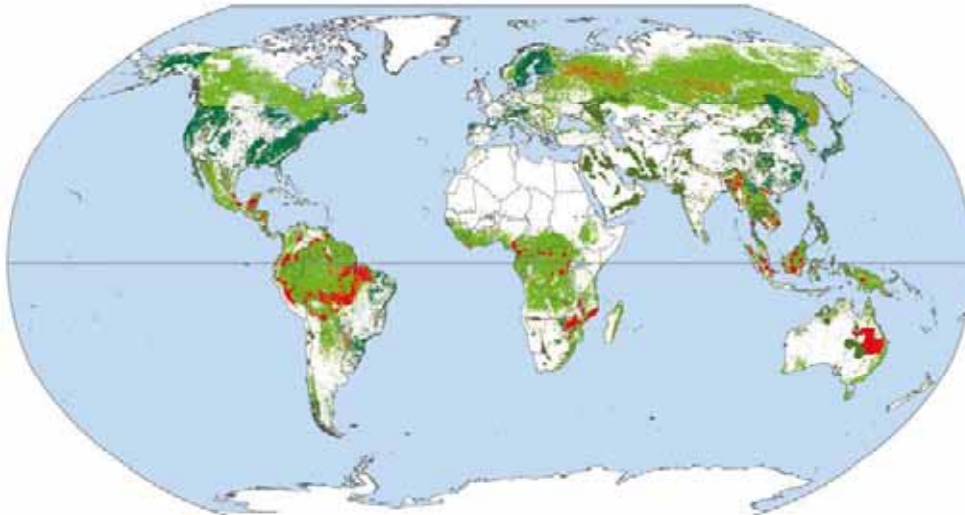
Global livestock distribution



Distribution of cropland



Forest transition and land degradation in dry lands

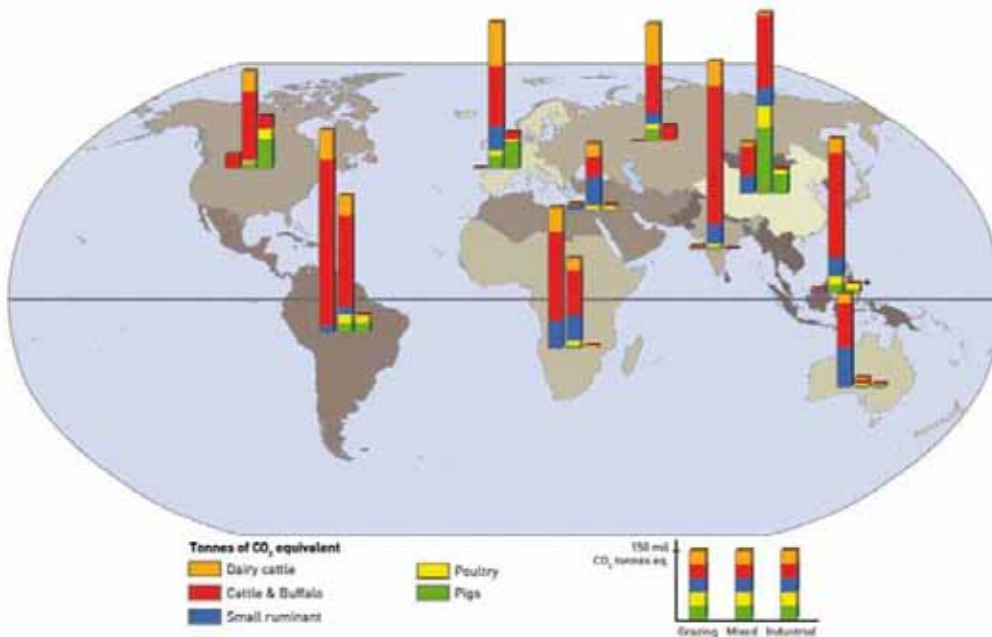


Source: FAO, 2006



Deforestation in the amazon for livestock production accounts for ~1/3 of the total GHG due to livestock

Total GHG emissions from enteric fermentation and manure per species and main production system



Tonnes of CO₂ equivalent

Dairy cattle

Cattle & Buffalo

Small ruminant

Poultry

Pigs

150 ml CO₂ tonnes eq

Grazing Meat Industrial



“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”

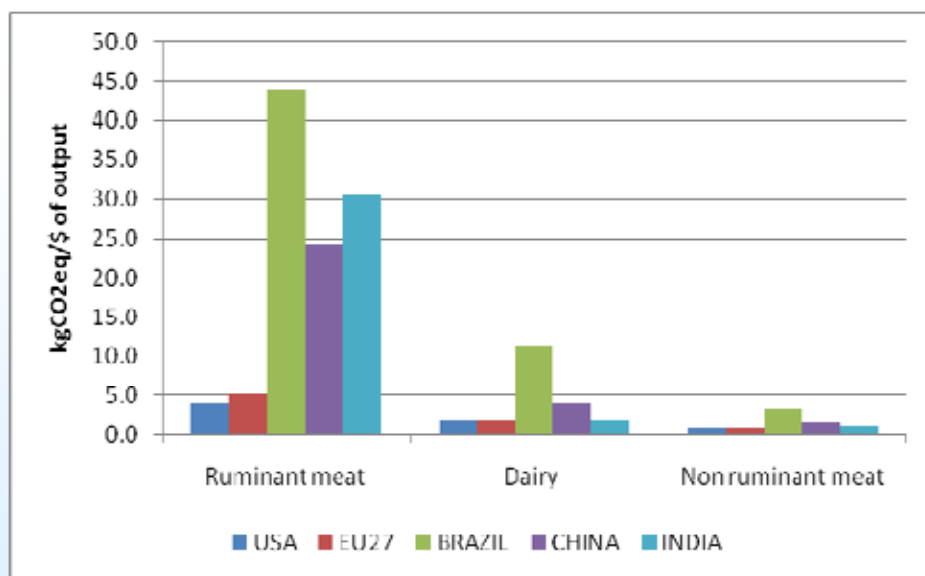


Shrinking the Shadow (UN FAO)

Principal Options

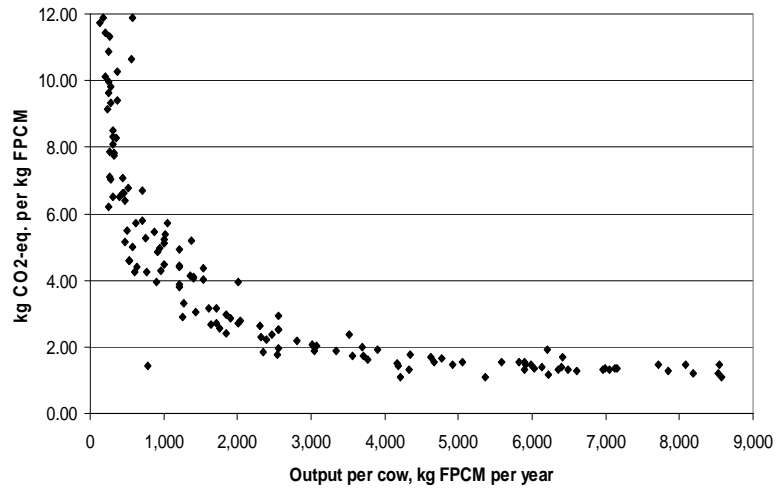
- Reduce Consumption
- Improve Practices – Realign Incentives
- Structural Change - species shifts, scale, location

Emission Intensities (direct emissions from livestock)

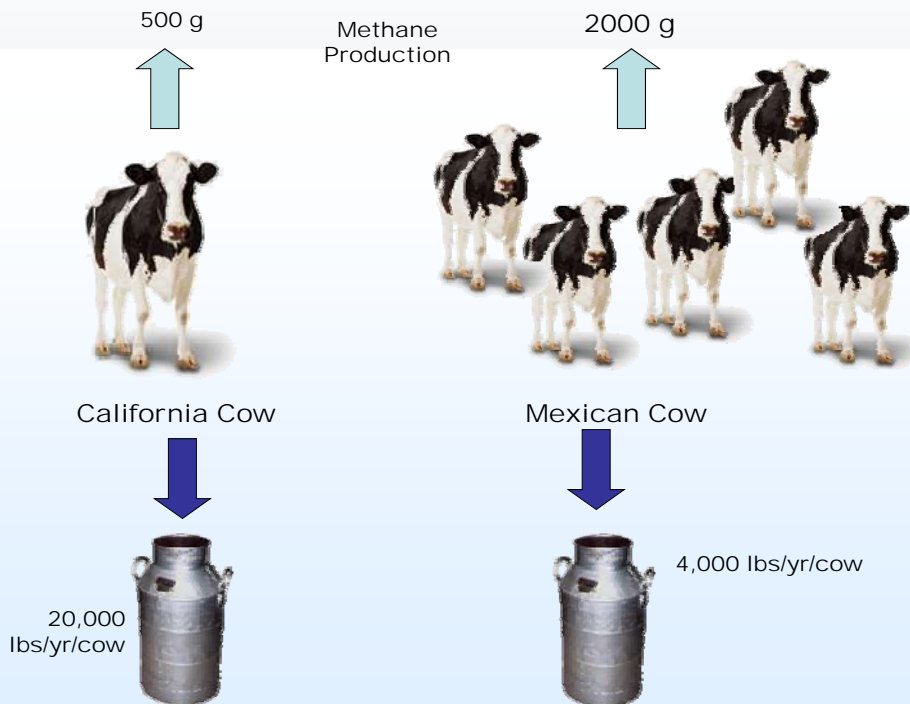


GTAP 2001 data base

Relationship between total greenhouse gas emissions and milk output per cow



More Milk Produced per Cow – Less Methane & Waste



Emissions from dairy and beef herds in selected countries

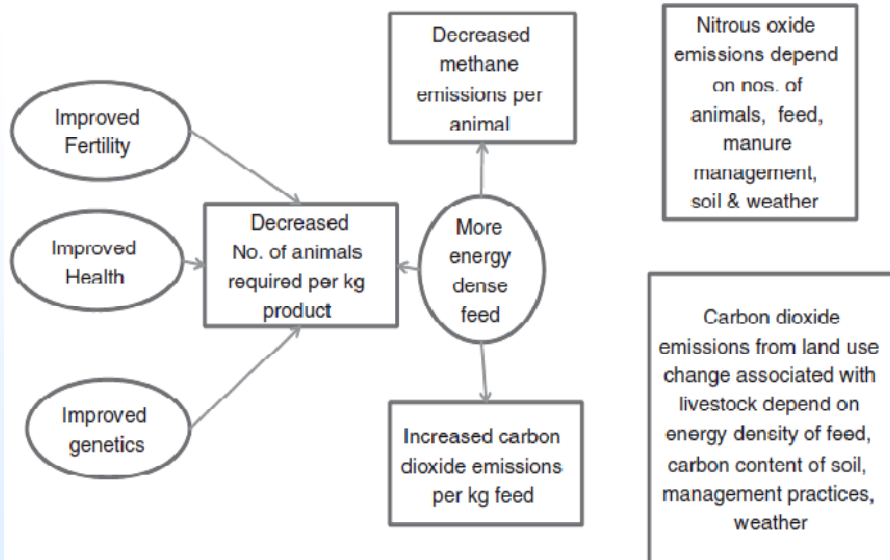
Country	Emissions to proteins (kg CO ₂ eq /kg protein)	
	Dairy herd	Beef herd
The Netherlands	46	176
India	160	543
Brazil	128	455

Production Efficiency

	Dairy emission factor (kg/head/yr)	Milk production (kg/head/yr)
North America	118	6,700
EU	100	4,200
Latin America	57	800
Africa	36	475

(IPCC, 1996)

Mitigation: interventions to improve productivity



Gill et al. (2010)

Intensification is key (UN FAO)

- Production intensity enhances biological efficiency
- Production intensity and emission intensity are inversely related
- High production intensities are controversial

Production Efficiency and Methane Emissions

- CH₄ mitigation from livestock - improvement of production and reproduction efficiencies.
- When comparing 1944 with 2007 dairies in the US, Capper *et al.* (2009) found that modern dairies require 21% less animals, 23% less feedstuffs, 35% less water, and 10% less land to produce the same one billion kg of milk.
- Emissions have also been reduced since 1944, dairies today produce 43% less CH₄ and 56% less N₂O per billion kg of milk (Capper *et al.*, 2009).
- Management with particular emphasis on improvements of production and reproduction efficiency will likely be among the most viable tools to most significantly reduce environmental impact of livestock systems.

Conclusions

- Intensification provides large opportunities for climate change mitigation, can reduce greenhouse gas emissions from deforestation, and is the long-term solution to more sustainable livestock production

