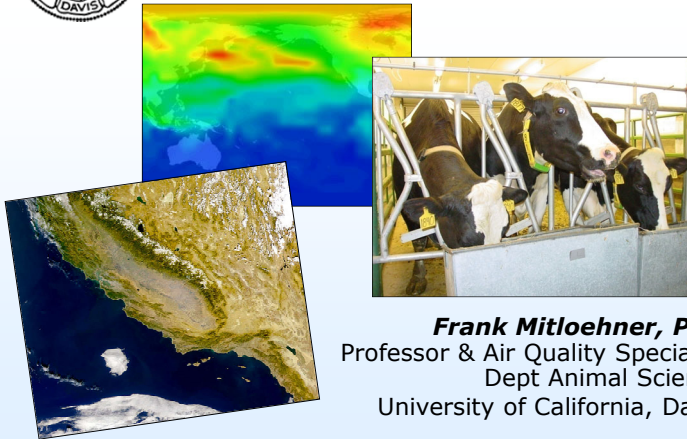




## Livestock and Climate Change: Fact or Faked

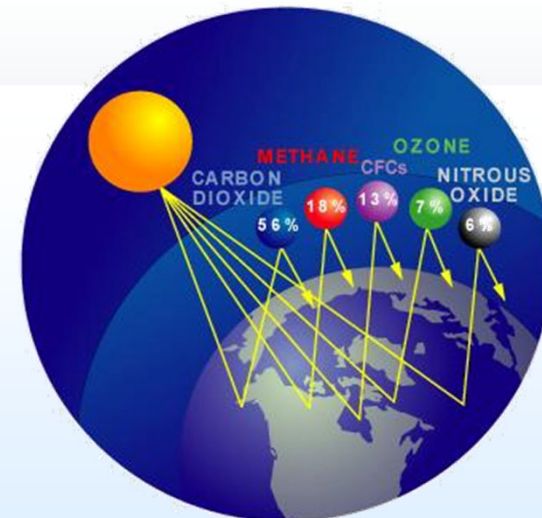
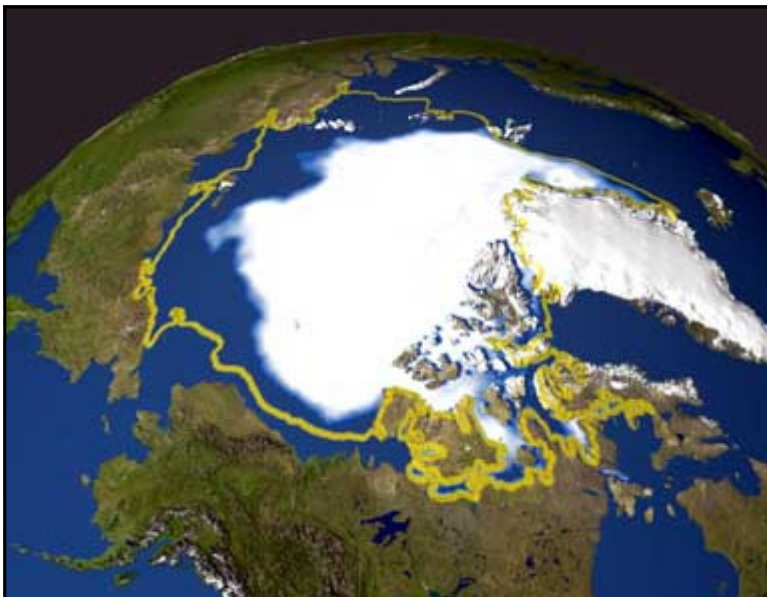


**Frank Mitloehner, PhD**  
Professor & Air Quality Specialist  
Dept Animal Science  
University of California, Davis

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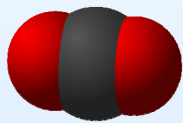
#GHGGuru



## GHG & GWP

### Global Warming Potential (GWP) of Main GHG

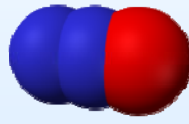
- Carbon Dioxide,  $\text{CO}_2$  1
- Methane,  $\text{CH}_4$  28
- Nitrous Oxide,  $\text{N}_2\text{O}$  298



$\text{CO}_2$  – Carbon Dioxide

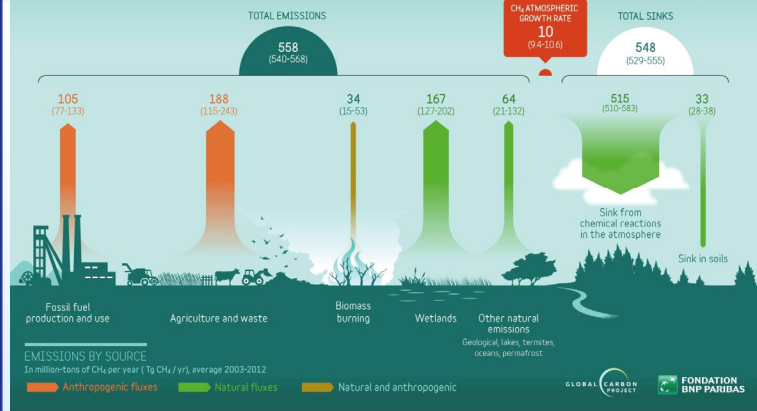


$\text{CH}_4$  – Methane



$\text{N}_2\text{O}$  – Nitrous Oxide

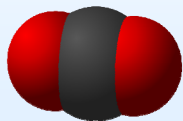
## GLOBAL METHANE BUDGET



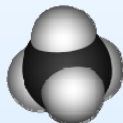
## GHG & GWP

### Global Warming Potential (GWP) of Main GHG

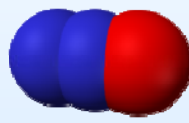
- Carbon Dioxide,  $\text{CO}_2$  1
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$\text{CO}_2$  – Carbon Dioxide

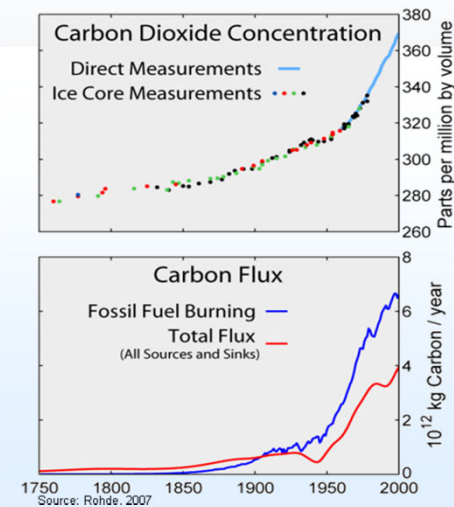


$\text{CH}_4$  – Methane



$\text{N}_2\text{O}$  – Nitrous Oxide

## Carbon Dioxide and Carbon Flux

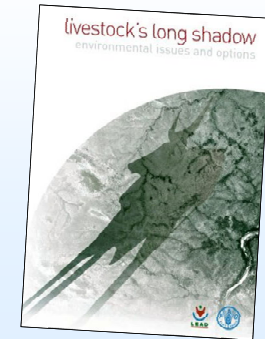


## Facts or Fiction on Livestock and Climate Change

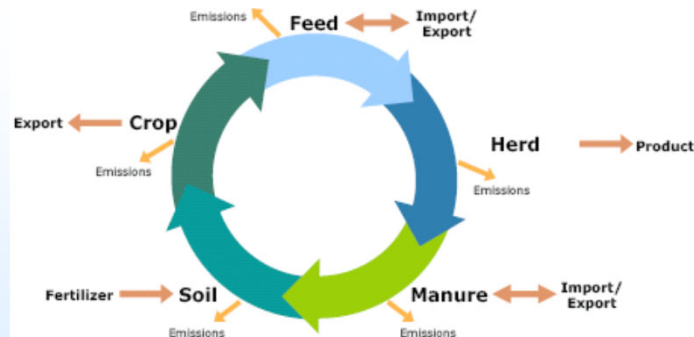
- Livestock produces 18% of all anthropogenic GHG globally
- Livestock produces more GHG than transportation
- Livestock occupies 70% of all agricultural land globally
- Grazing systems produce less GHG than conventional animal production in confinement systems

## "Livestock's Long Shadow" (FAO, 2006)

- "The Livestock sector is a major player, responsible for 18% of GHG emissions measured in CO<sub>2</sub>e. This is a higher share than transport"



## Life Cycle Assessment



(NRC, 2003)



**BBC** Home News Sport Weather TV Radio

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



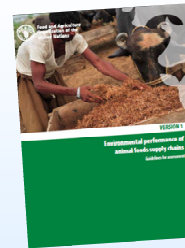
Livestock's Long Shadow calculated meat-related emissions from field to abattoir

"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."

**BBC** Dr. Pierre Gerber, LLS contributing author

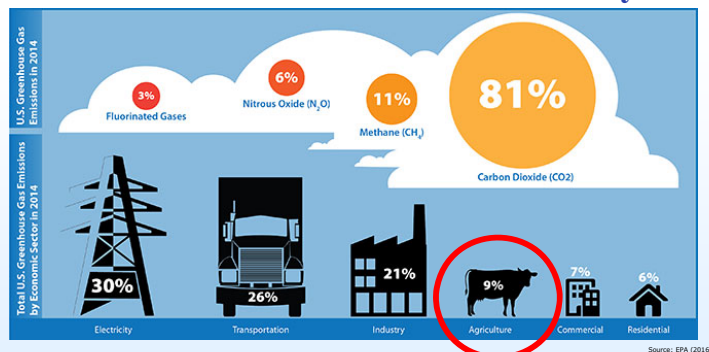
UN specialists are to look again at the contribution of meat production to climate change, after claims that an earlier report exaggerated the link.

## Livestock Environmental Assessment and Performance Partnership (LEAP)



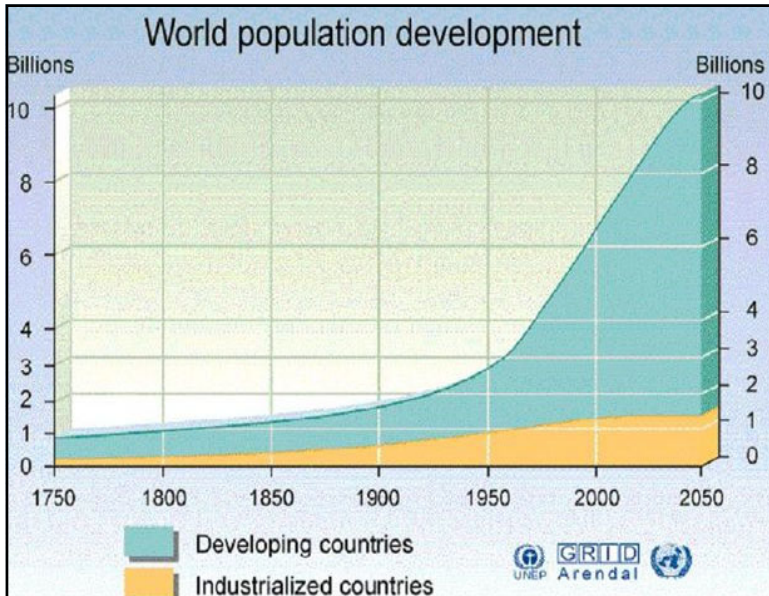
- Internationally agreed sector-level methodologies and guidance to allow
  - transparent,
  - robust,
  - and fair measurement of the environmental performance of livestock supply chains
- FAO / LEAP LCA Guidelines officially released

## National-Level U.S. GHG Inventory

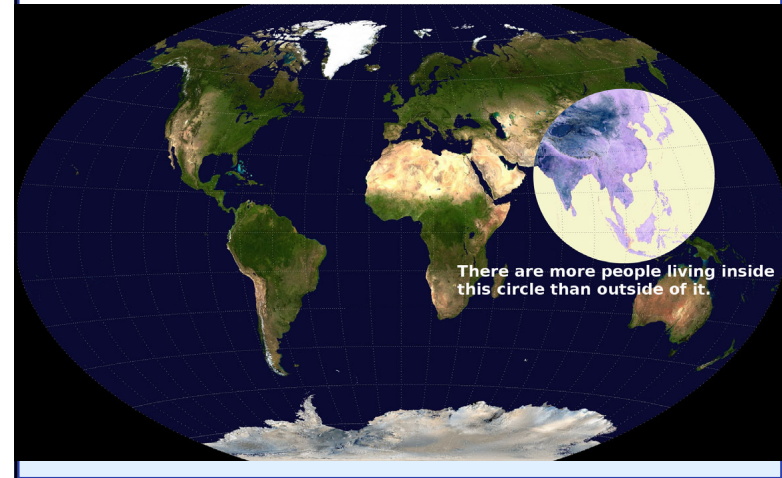


National Geographic

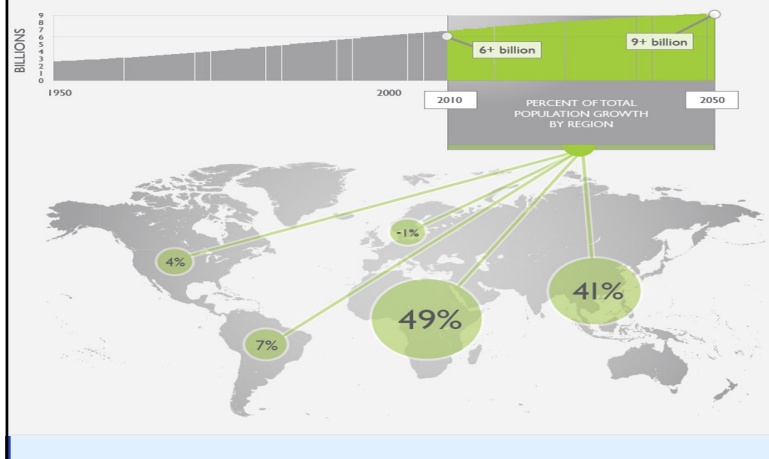




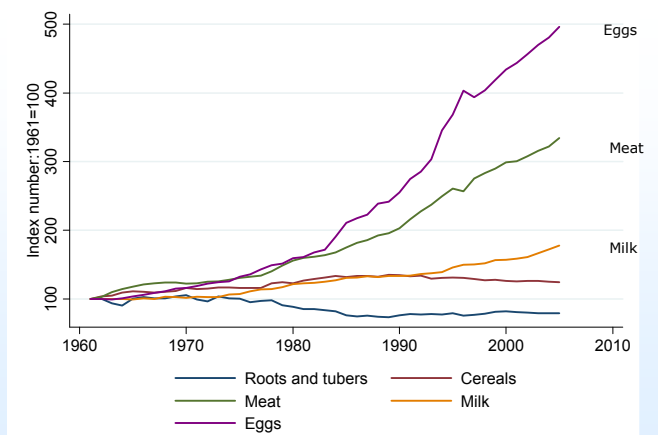
**4.5 Billion + population of USA in 10 years**



## Today and Tomorrow's Markets

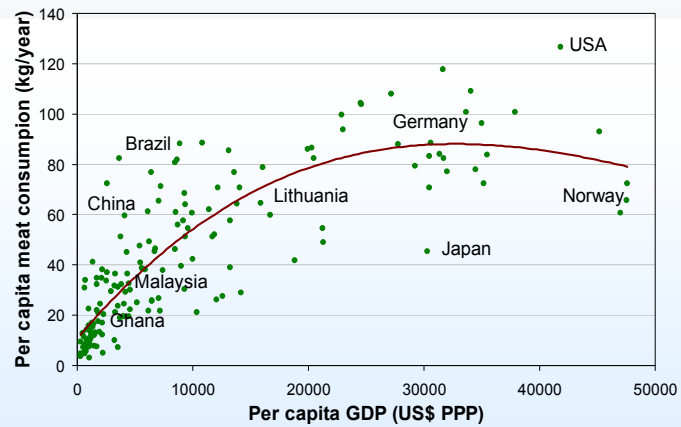


Consumption is growing rapidly in developing countries



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

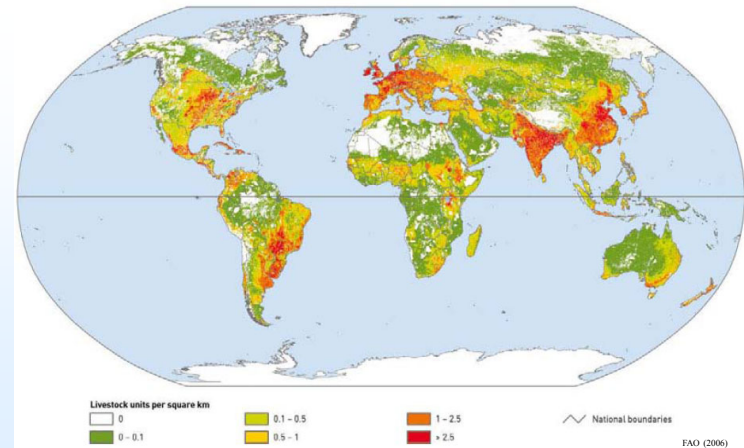
... driven by incomes ...



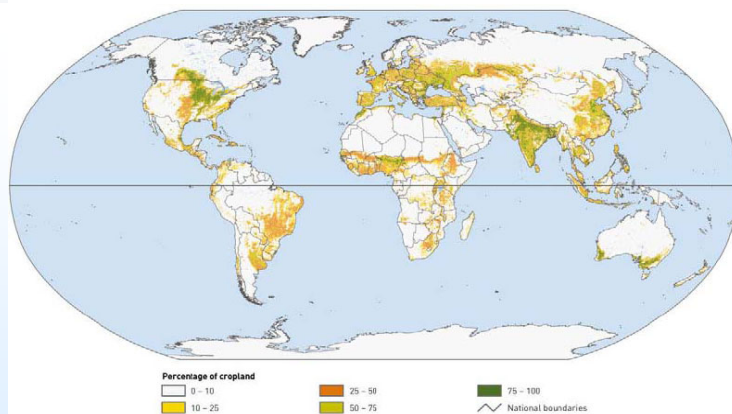
Per capita GDP and meat consumption by country, FAO, 2005.

21

## Global livestock distribution



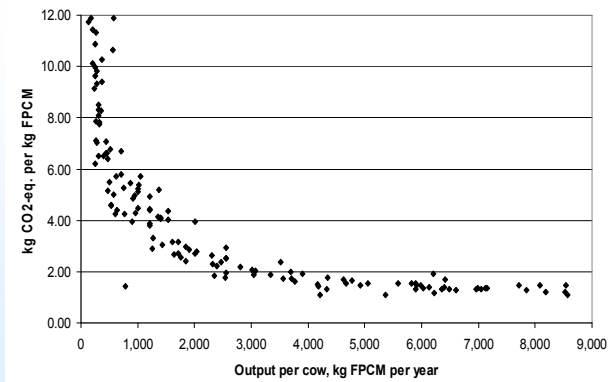
## Distribution of cropland



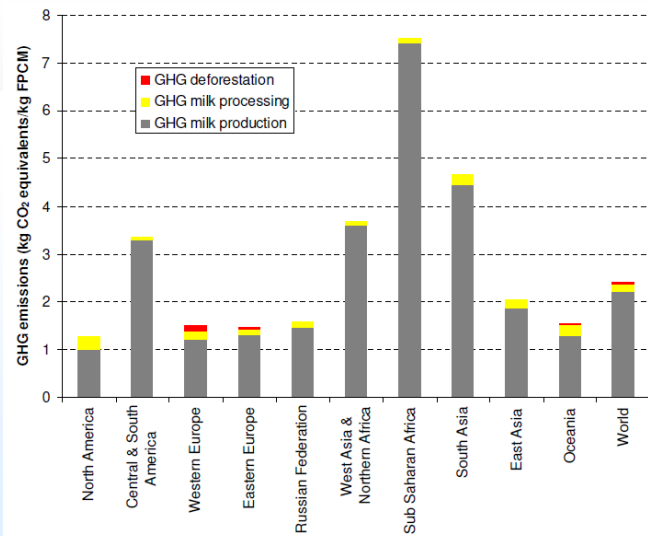
Source: FAO, 2006.

FAO (2006)

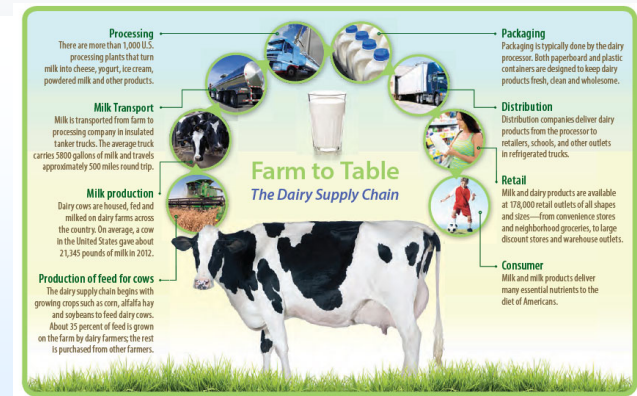
## Relationship between total greenhouse gas emissions and milk output per cow



H. Steinfeld, 2015



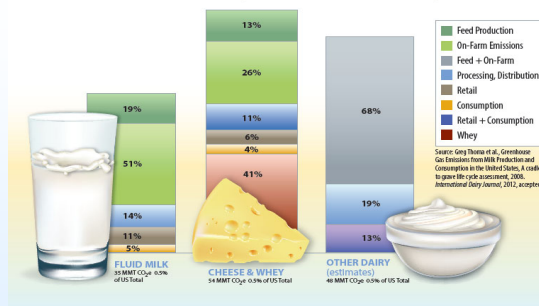
FAO (2010)



## Dairy is ~2% of Total US Greenhouse Gas Emissions

### U.S. Dairy Carbon Footprint — All Products

Total emissions = 137 MMT (2% of total U.S. GHG emissions)



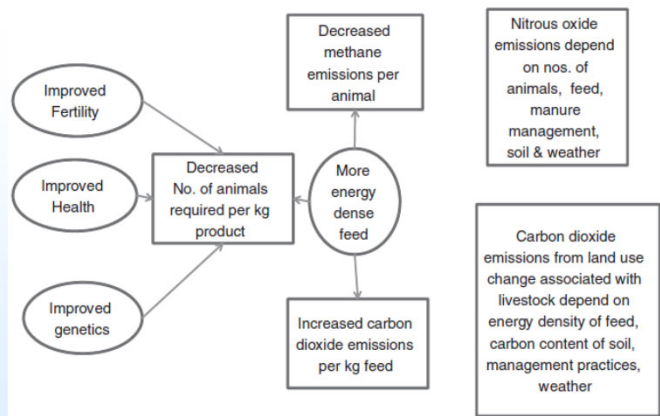
Source: G. Thomas et al., Greenhouse Gas Emissions from Milk Production and Consumption in the United States, A cattle to glass life cycle assessment, 2008. International Dairy Journal, 2012, accepted.

## Key finding: Dairy uses ~5.1% of U.S. water withdrawal



Hendriks, A., Asselt, A., and Heller, M., et al., U.S. Fluid Milk Consumption U.S. University of Michigan, Ann Arbor, Michigan, 2012.

## Mitigation: interventions to improve productivity



Gill et al. (2010)

## 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

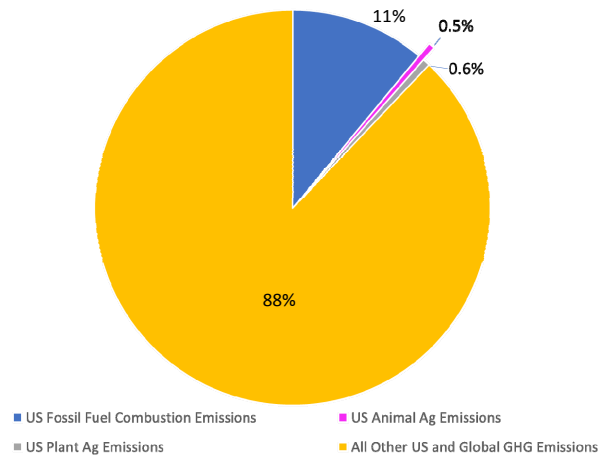
- China's five year plan focuses on making farms larger and more efficient
- Half of the world's pigs live in China
- 50 million sows w/ 20 piglets born alive
- Equals annual production of 1 Billion pigs
- Pre-weaning mortality causes 400 Million pigs to never make it to the market
- One more pig per 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 CO<sub>2</sub> Equivalents)



Source: US EPA Greenhouse Gas Emissions Inventory

