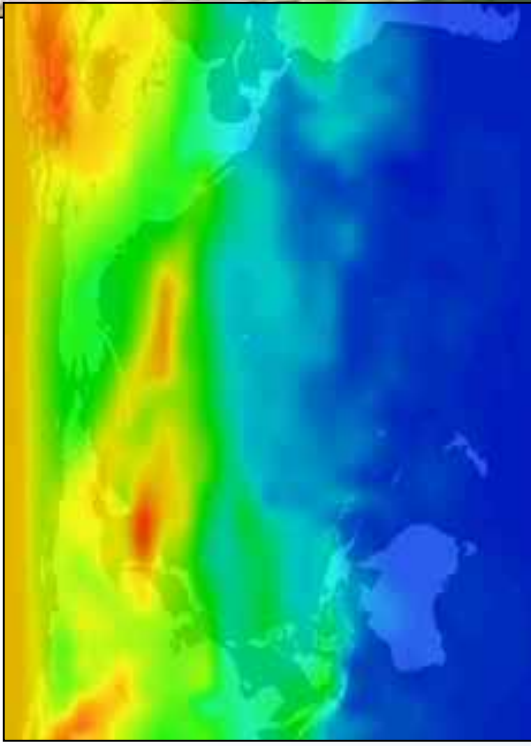




# Livestock's Long Shadow (FAO Report) The whole story

19th ADSA Discover Conference  
Brown County Inn, Nashville IN



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



- Om Max
- Vår Mat
- Kampanjer
- Hygiene & Press
- Ålde & Tveklings
- Jobb
- Restaurang
- Max & Miljön
- Om restaurangen
- Sambandspolis
- Intervju
- När du går
- Om oss
- Frågor & svar
- Om oss
- Om restaurangen
- När du går
- Kontakt



0,4 kg CO<sub>2</sub>e



Frisco Cheese'n Bacon

0,2 kg CO<sub>2</sub>e



Fisksburgare

## UTMÄRKTA BURGARE

Nu redovisar vi miljöbelastningsvärdet för alla produkter



**Max klimatavtryck**

Om Max: 1,8 kg CO<sub>2</sub>e / 1,4 kg CO<sub>2</sub>e



**Kollektorkompensation**

Vi kompenserar ditt klimatavtryck



**Utmärkta burgare**

Höchstleistung für alle Produkte.



**Nu ännu godare**

Förpackningen är god, smakfullare än



**Lite fisk**

1,4 kg CO<sub>2</sub>e / 1,4 kg CO<sub>2</sub>e



**Vindkraft**

Max har 2700 MW vindkraft



**Frågor & Svar**

Om Max: 1,8 kg CO<sub>2</sub>e / 1,4 kg CO<sub>2</sub>e



**Metod**

SE 100 givare vid Life cycle



**Om vi inte får**

Om vi inte får...

# Third-Party Initiatives

Rating within Category

## Top Milk

Change: Bottom Products View All Products



### Straus Fat Free Milk (Organic)

See [More Info](#) | [Quick Look](#) | [Add to Favorites List](#)  
[More from this brand \(4\)](#) >

7.3



### Stonyfield Farm, Fat Free Milk (Organic)

See [More Info](#) | [Quick Look](#) | [Add to Favorites List](#)  
[More from this brand \(3\)](#) >

7.3



### Organic Valley Pasteurized Fat Free, Skim, Nonfat Milk

See [More Info](#) | [Quick Look](#) | [Add to Favorites List](#)  
[More from this brand \(37\)](#) >

7.0



### Clover Stornetta Fat Free Milk (Organic)

See [More Info](#) | [Quick Look](#) | [Add to Favorites List](#)  
[More from this brand \(4\)](#) >

7.0



### Knudsen, Fat Free Milk

See [More Info](#) | [Quick Look](#) | [Add to Favorites List](#)  
[More from this brand \(5\)](#) >

6.9




### Clover Organic Farms Fat Free Vitamin A&D Milk

See [More Info](#) | [Quick Look](#) | [Add to Favorites List](#)  
[More from this brand \(4\)](#) >

6.9

## Detailed Product Review



**Straus Fat-Free Milk (Organic)**  
By Straus Family Creamery

Good Grade Rating: **7.3**

User Reviews: ★★★★☆  
[View the most helpful](#)

Average Price: Not Available

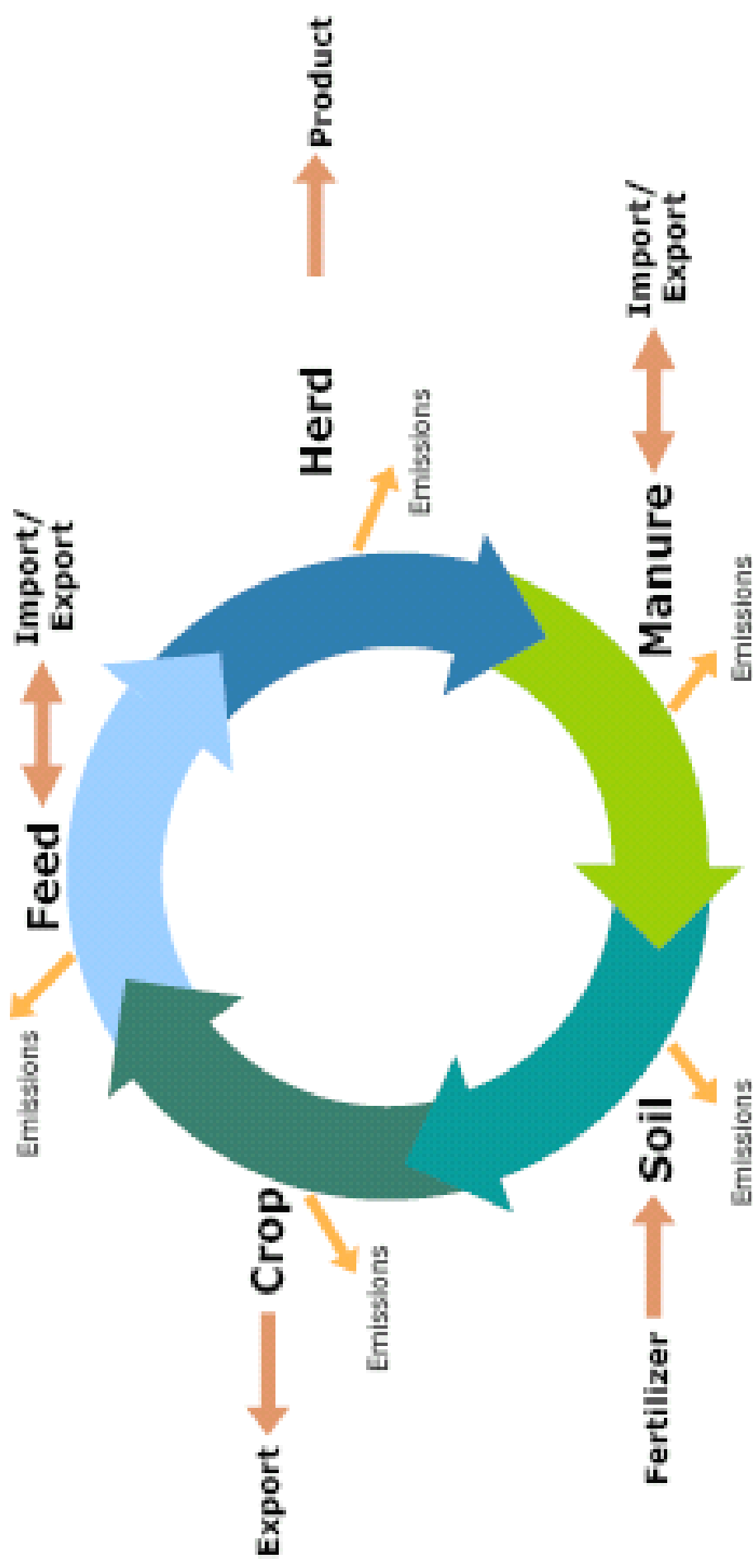
Quantity: Not Available

Energy	Global Warming	Water	Land	Air

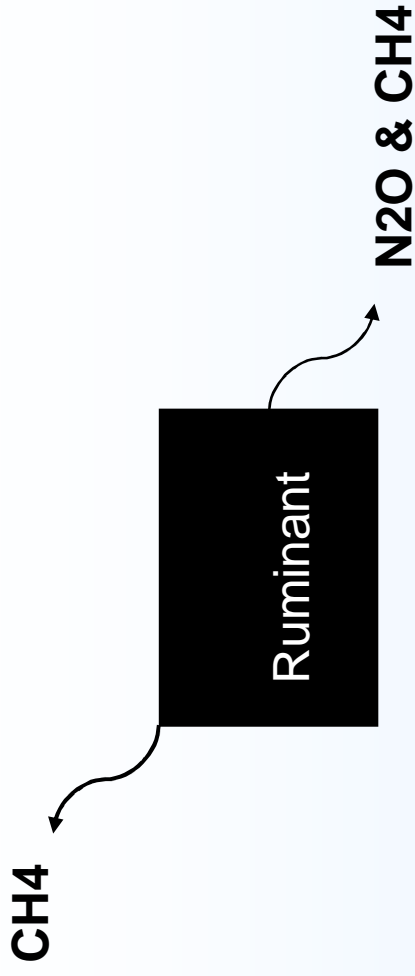
● High Impact    ▲ Some Impact    ● Low Impact    [See more details](#)

Nutrient	Performance in Milk	
<b>Saturated Fat</b>	● Low	Much better than others
<b>Cholesterol</b>	● Low	Near the average
<b>Sugars</b>	▲ Medium	Near the average
<b>Sodium</b>	● Low	Near the average

# Life Cycle Assessments

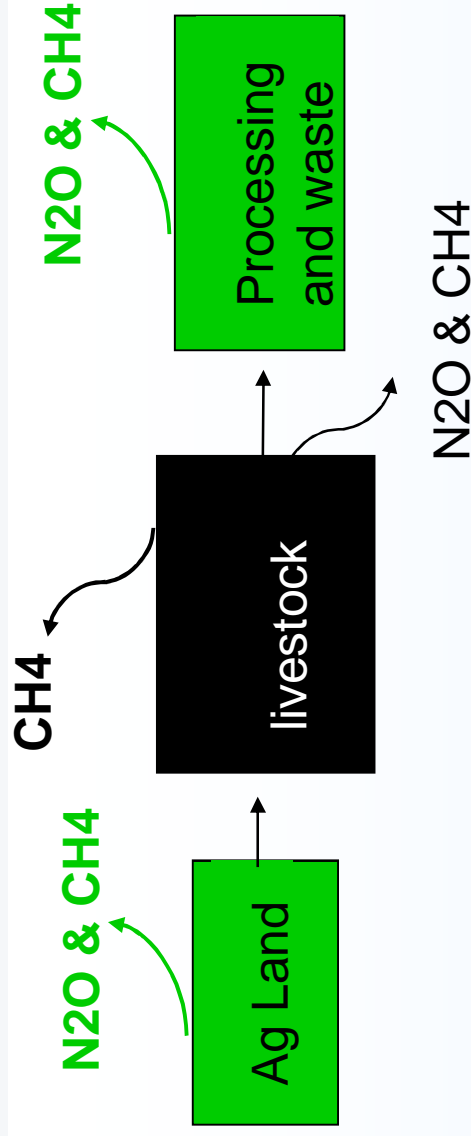


# LCA-1: Direct Emissions



Direct emissions: eructation enteric fermentation, manure and urine excretion

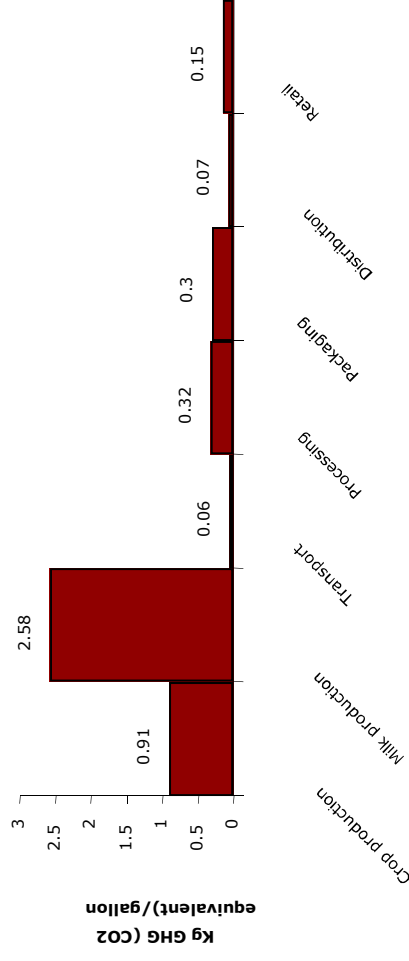
# LCA-2: Direct + Indirect Emissions from Livestock



Livestock Indirect emissions include:

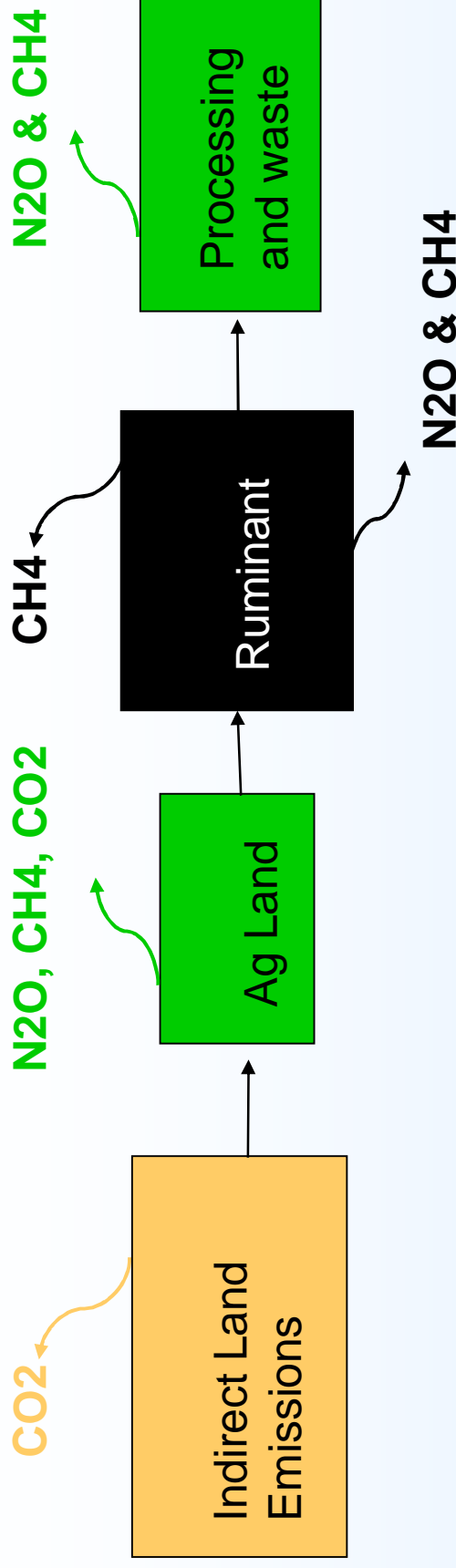
- feed crops
- manure application
- Direct mineral fertilizer emissions
- processing
- transportation
- deforestation
- desertification

Estimated GHG Contributions by Stage of Fluid Milk Supply Chain (per gallon of fluid milk)



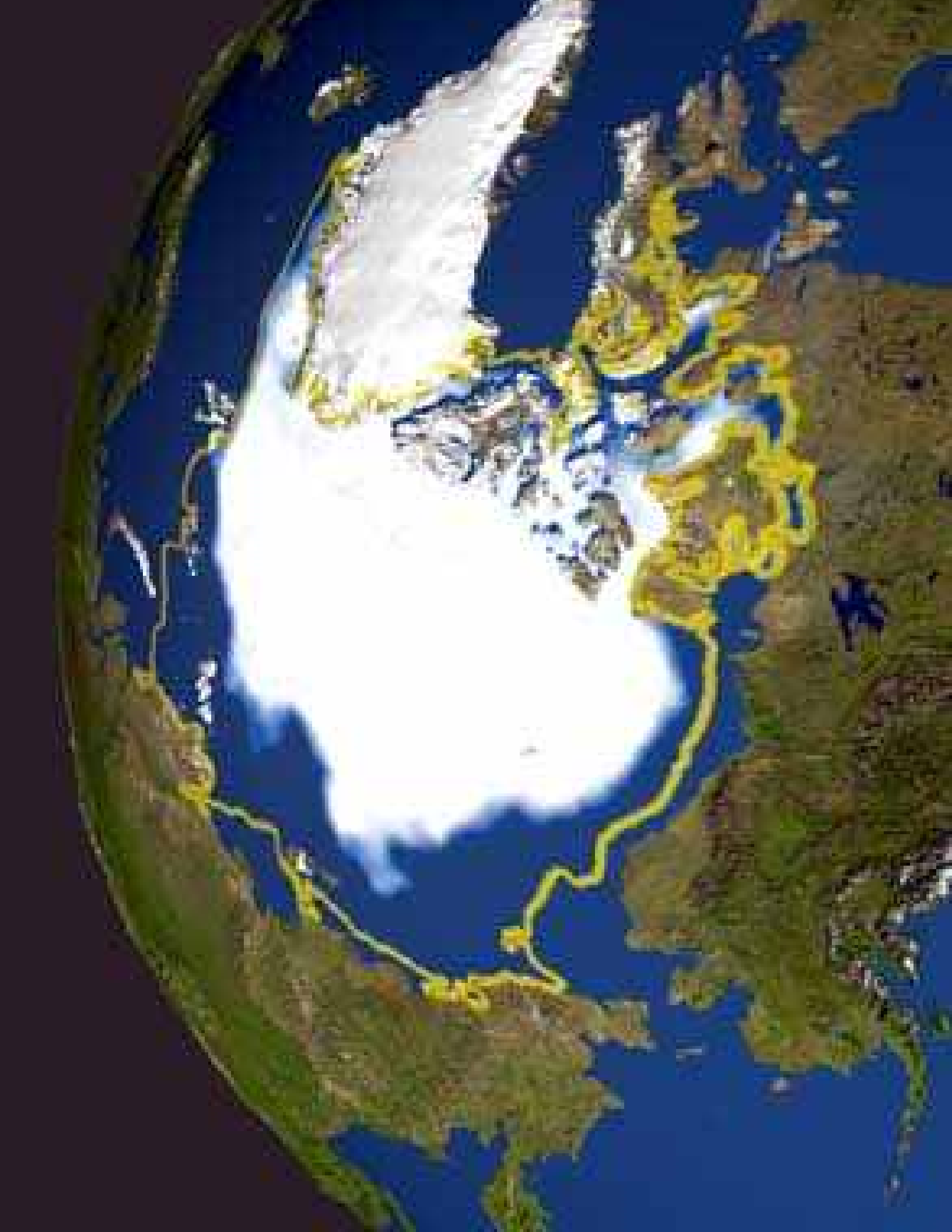
# LCA-3: "True" LCA

**LCA-3 (direct + indirect emissions from livestock + crop-based indirect emissions)**



Crop-based Indirect Emissions include:

- Fertilizer production
- Herbicide production
- Pesticide production
- E associated with irrigation

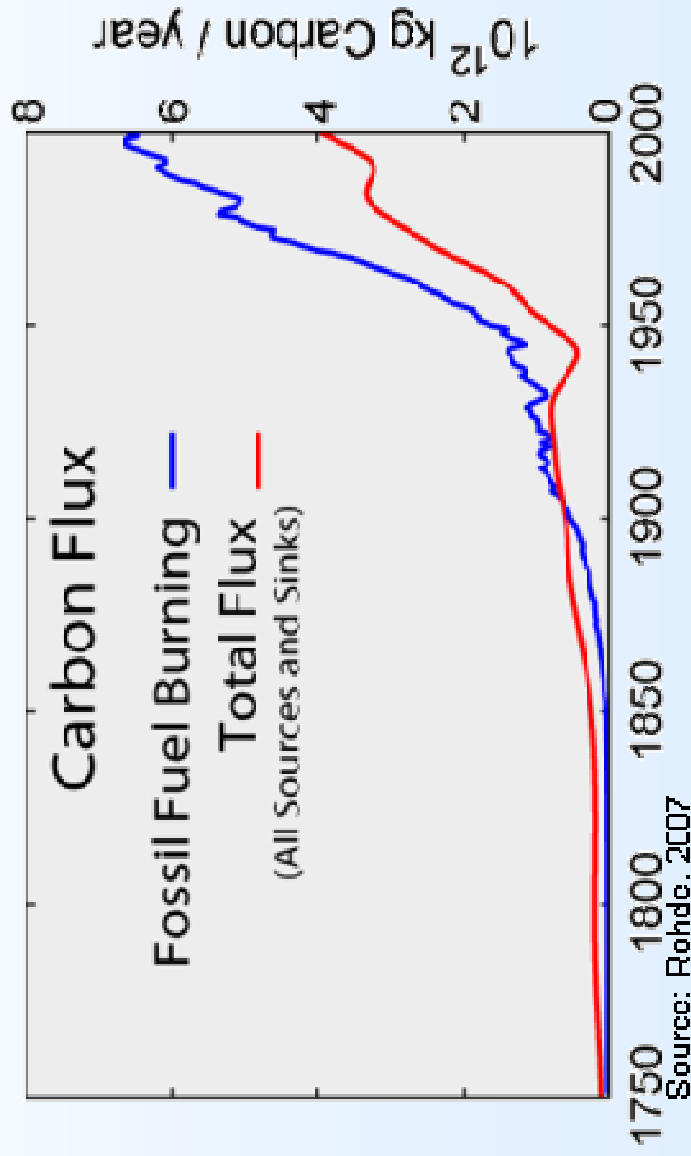
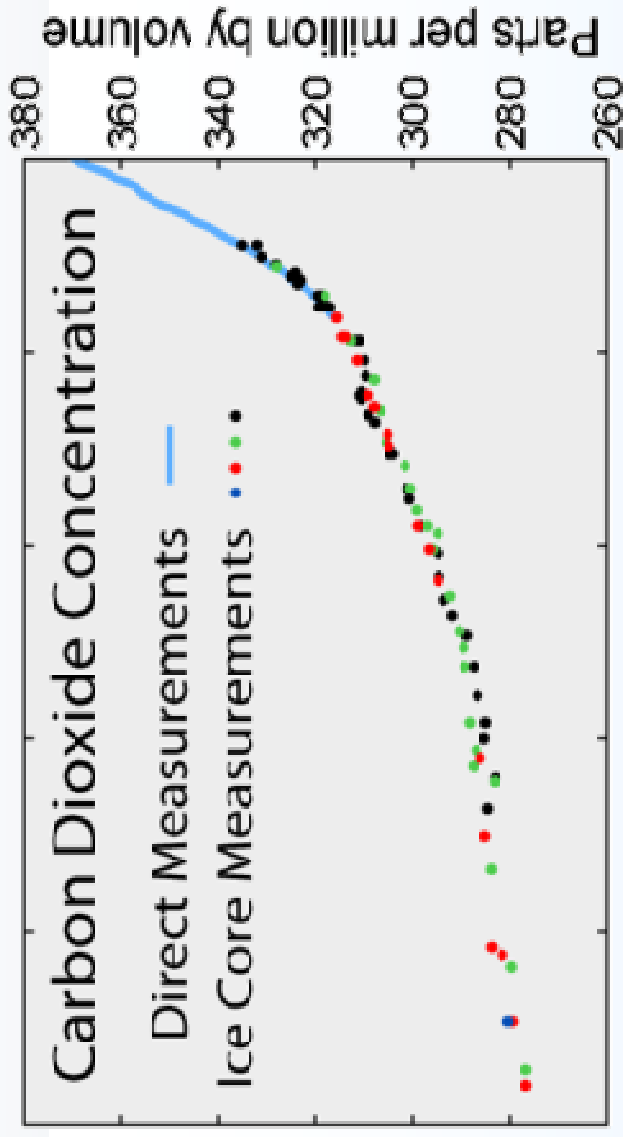


# The Five Stages of Climate Grief *Science Fiction or Science Fact?*

1. **Denial** – “the earth isn’t getting warmer, and if it’s not our fault
2. **Anger**
3. **Bargaining** - “It was always too cold in Montana anyway
4. **Depression**
5. **Accepting** climate change as a fact



# Carbon Dioxide and Carbon Flux

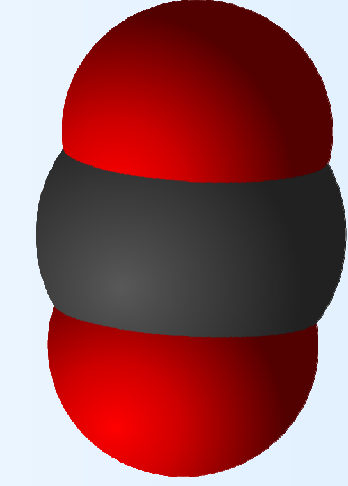


Source: Rohde, 2007

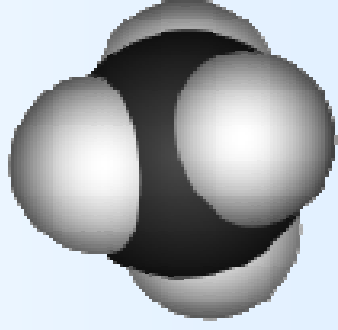
# GHG & GWP

## Global Warming Potential (GWP) of Main GHG

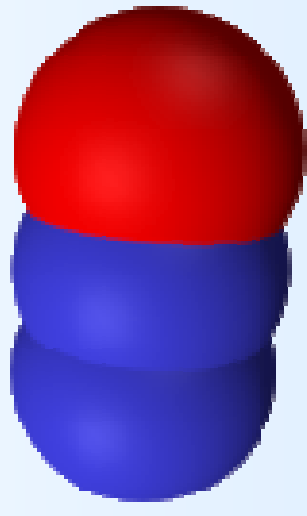
- Carbon Dioxide, CO<sub>2</sub> 1
- Methane, CH<sub>4</sub> 21
- Nitrous Oxide, N<sub>2</sub>O 298



CO<sub>2</sub> – Carbon Dioxide



CH<sub>4</sub> – Methane

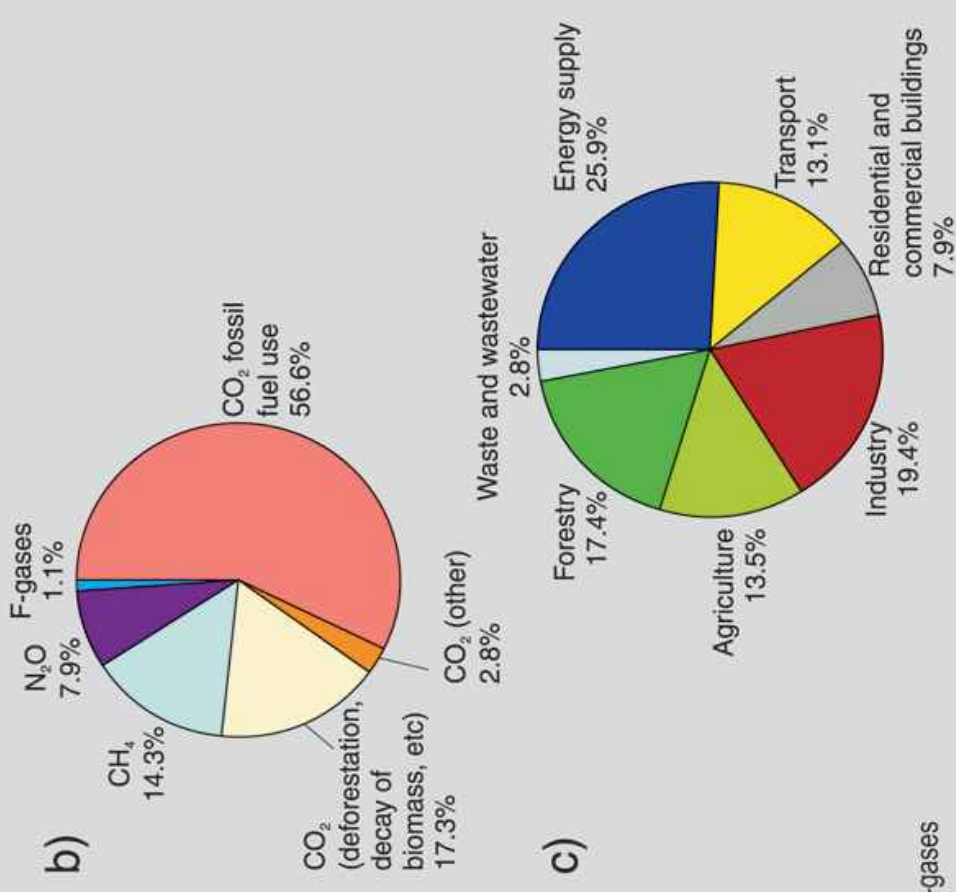
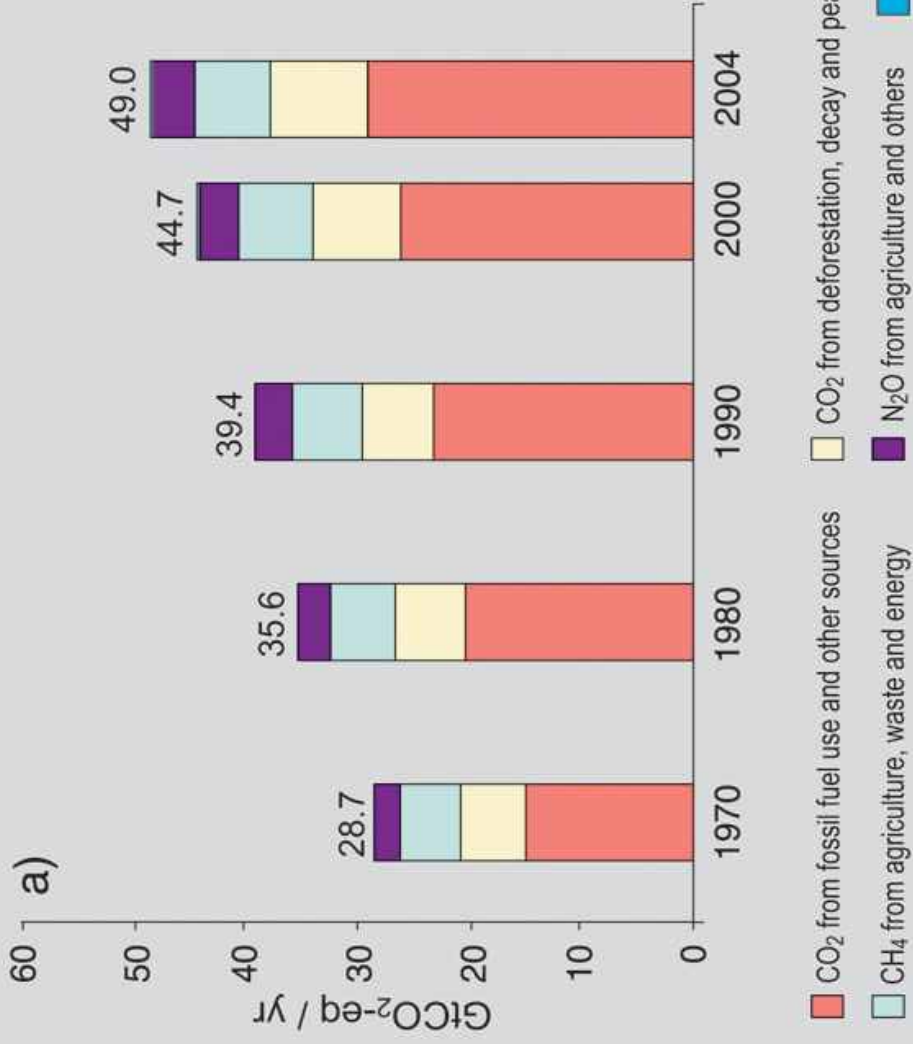


N<sub>2</sub>O – Nitrous Oxide

# Sources of GHG from Ag

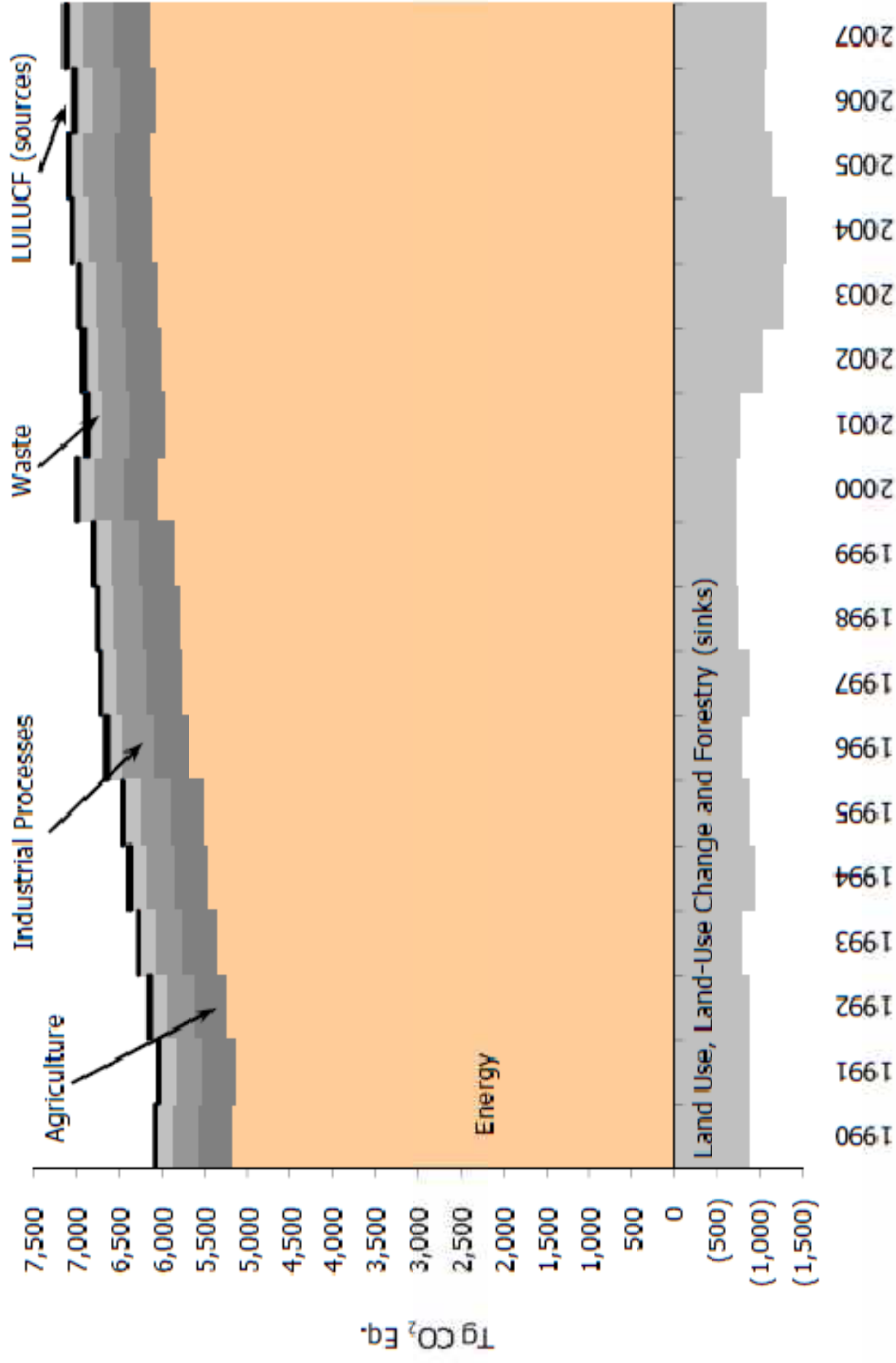
- Enteric fermentation ( $\text{CH}_4$ )
- Land application of manure ( $\text{N}_2\text{O}$ )
- Manure storage and treatment ( $\text{CH}_4$  and  $\text{N}_2\text{O}$ )
- Leading  $\text{CH}_4$  source is enteric fermentation from ruminants and manure decomposition
- Leading  $\text{N}_2\text{O}$  source is land incorporated manure and fertilizer

# Global big picture



Source: IPCC 4AR, 2004

# U.S. – the big GHG picture



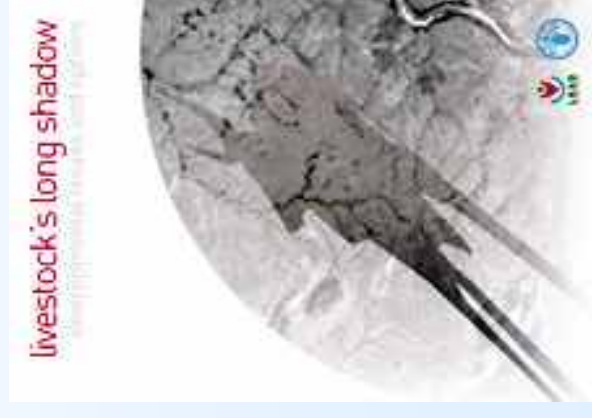
# California GHG inventory

- All GHG sources in California = 500 MMT CO<sub>2</sub>e
- Transport = 190 MMT CO<sub>2</sub>e
- Energy industry = 170 MMT CO<sub>2</sub>e
- Agriculture (all sectors) = 27 MMT CO<sub>2</sub>e
- Dairy (enteric and waste) = 11.2 MMT CO<sub>2</sub>e

# Livestock's Long Shadow (FAO, 2006)

LLS predictions are global not regional

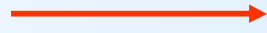
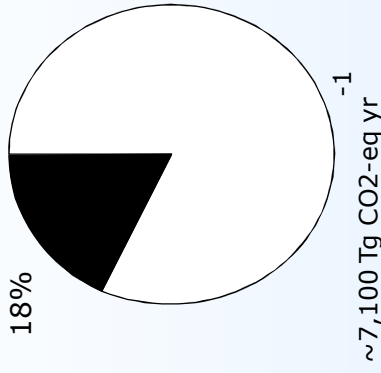
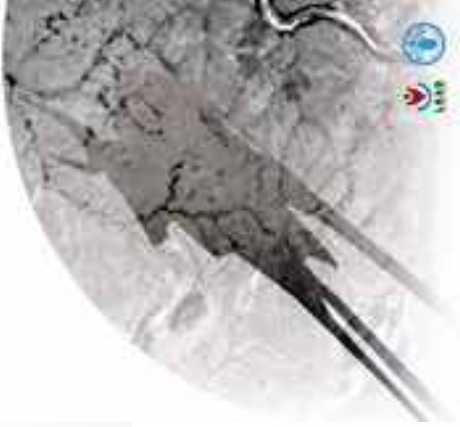
- 18% of all anthropogenic GHG from livestock
- 9% of all carbon dioxide ( $\text{CO}_2$ )
- 40% of all methane ( $\text{CH}_4$ )
- 65% of all nitrous oxide ( $\text{N}_2\text{O}$ )



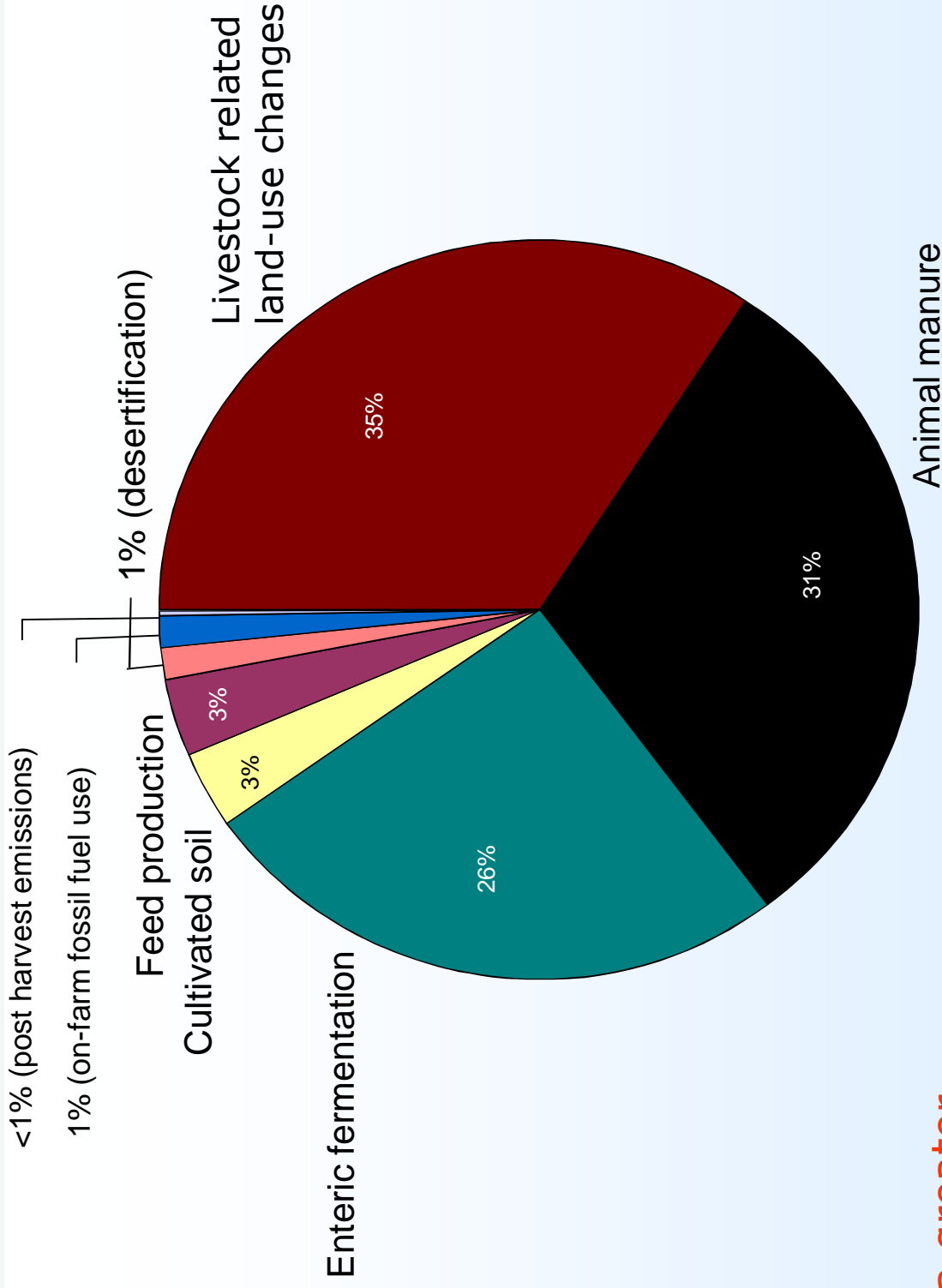
# **“Livestock’s Long Shadow” predictions and its misinterpretations**

- **“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” (FAO 2006)**
- **“Which is responsible for more global warming: your BMW or your Big Mac? Believe it or not, it’s your Big Mac” (Time, 2007)**
- **“A 16 oz T-bone is like a hummer on a plate. Switching to vegetarianism can shrink your carbon footprint by 1.5 tons of CO<sub>2</sub>e per year” (Time, 2007)**

# livestock's long shadow



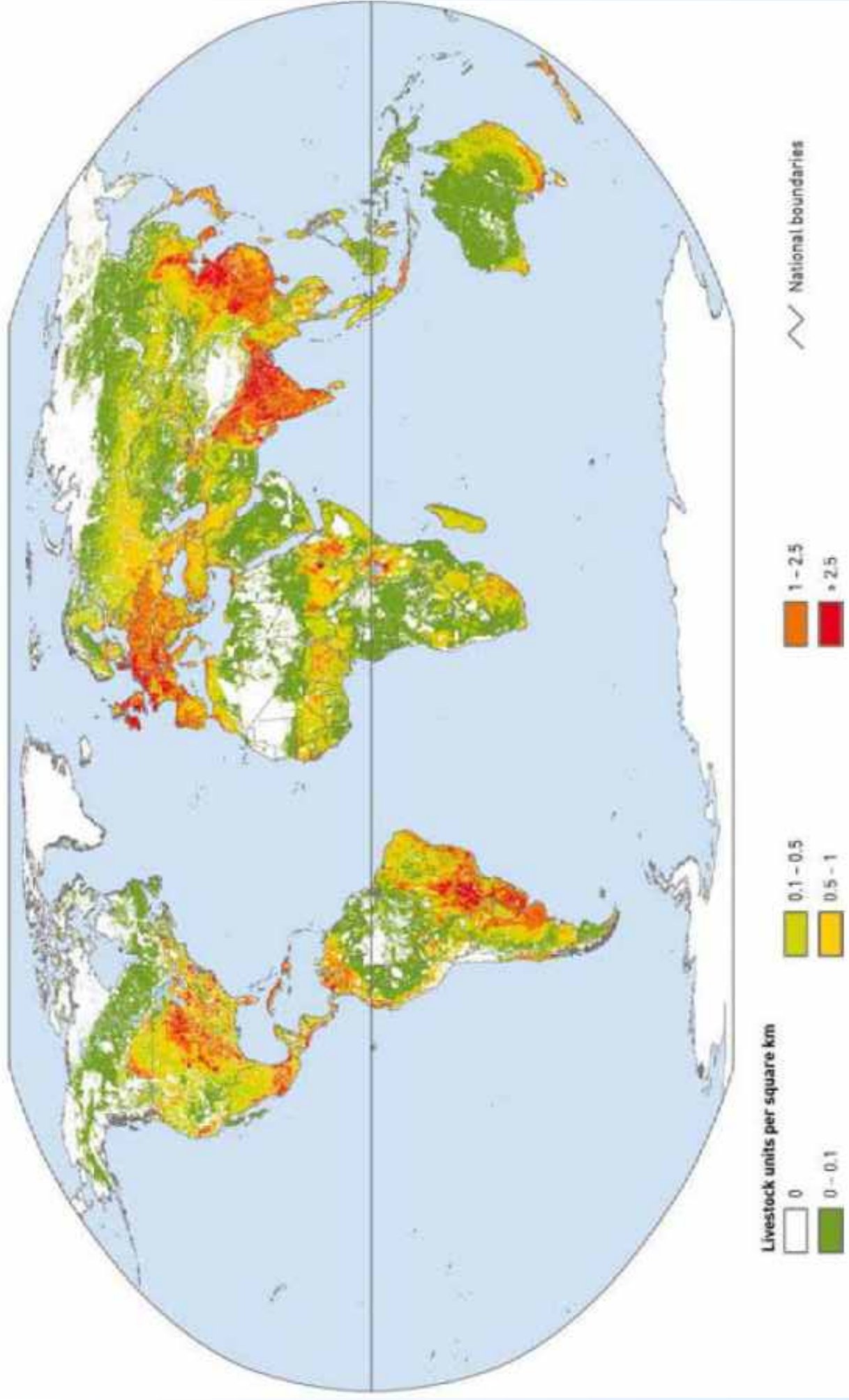
**"If true, livestock is a greater source of GHGs than the transportation sector" (FAO, 2006)**



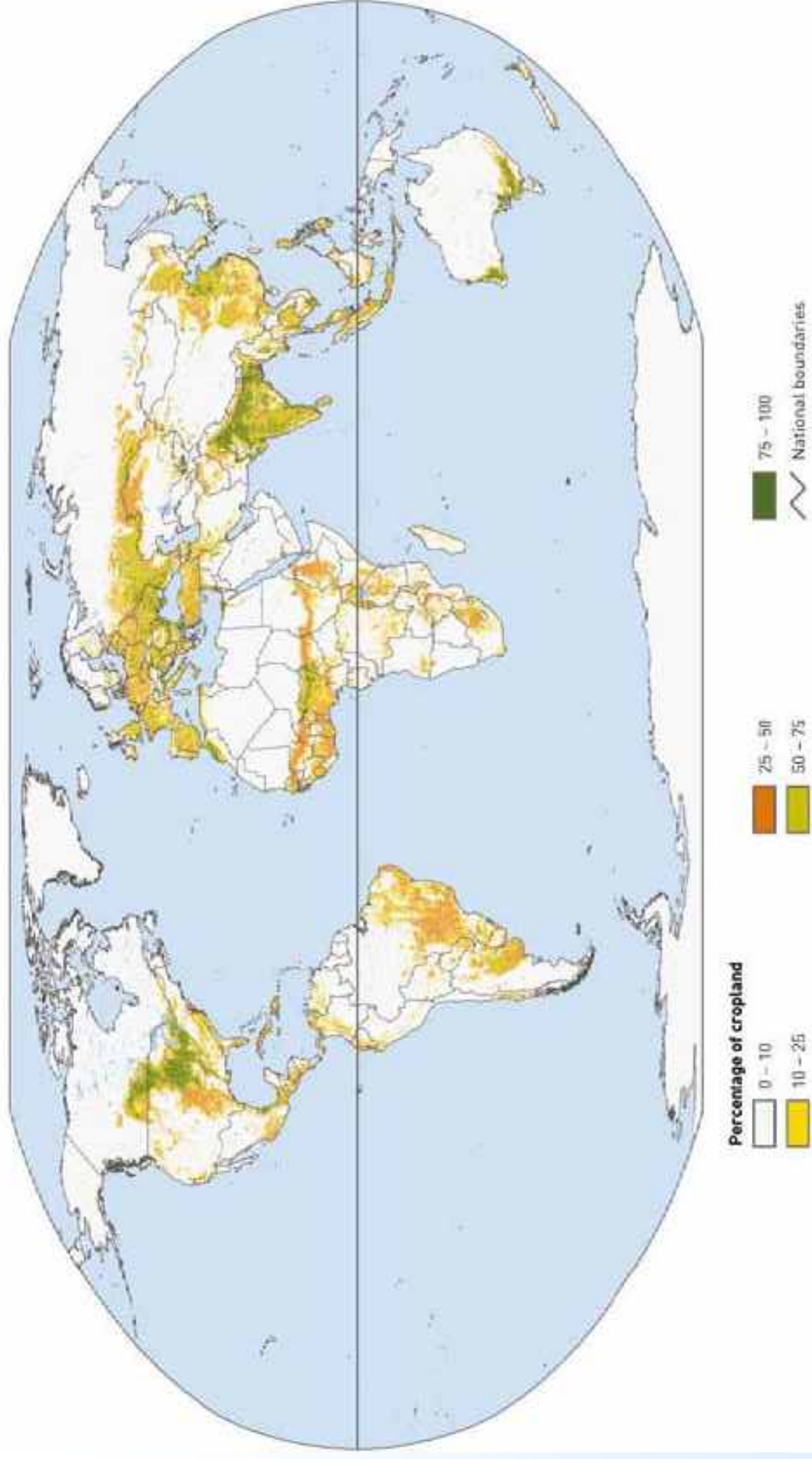
# Predictions leading to LLS

- 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

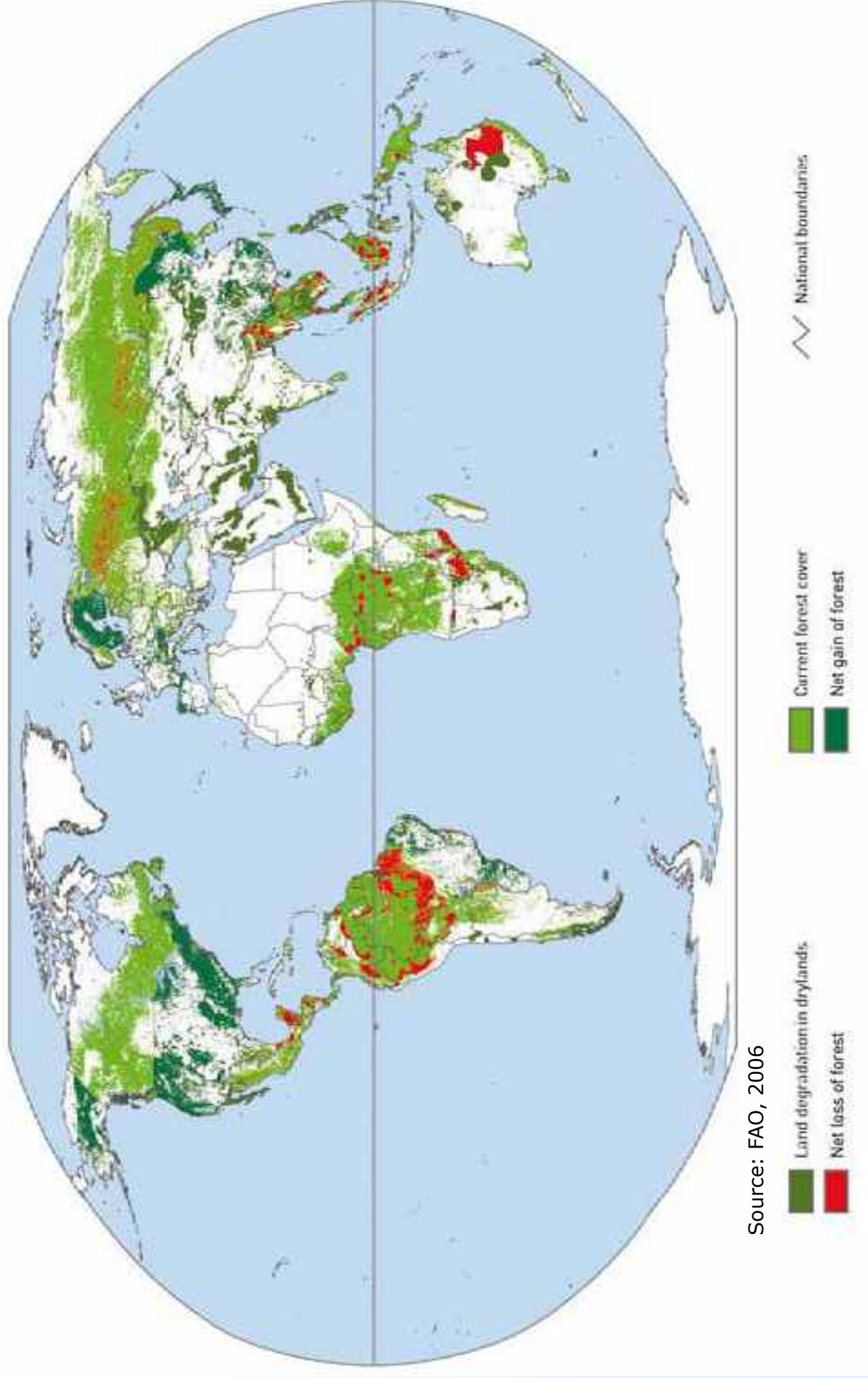
# Global livestock distribution



# Distribution of cropland



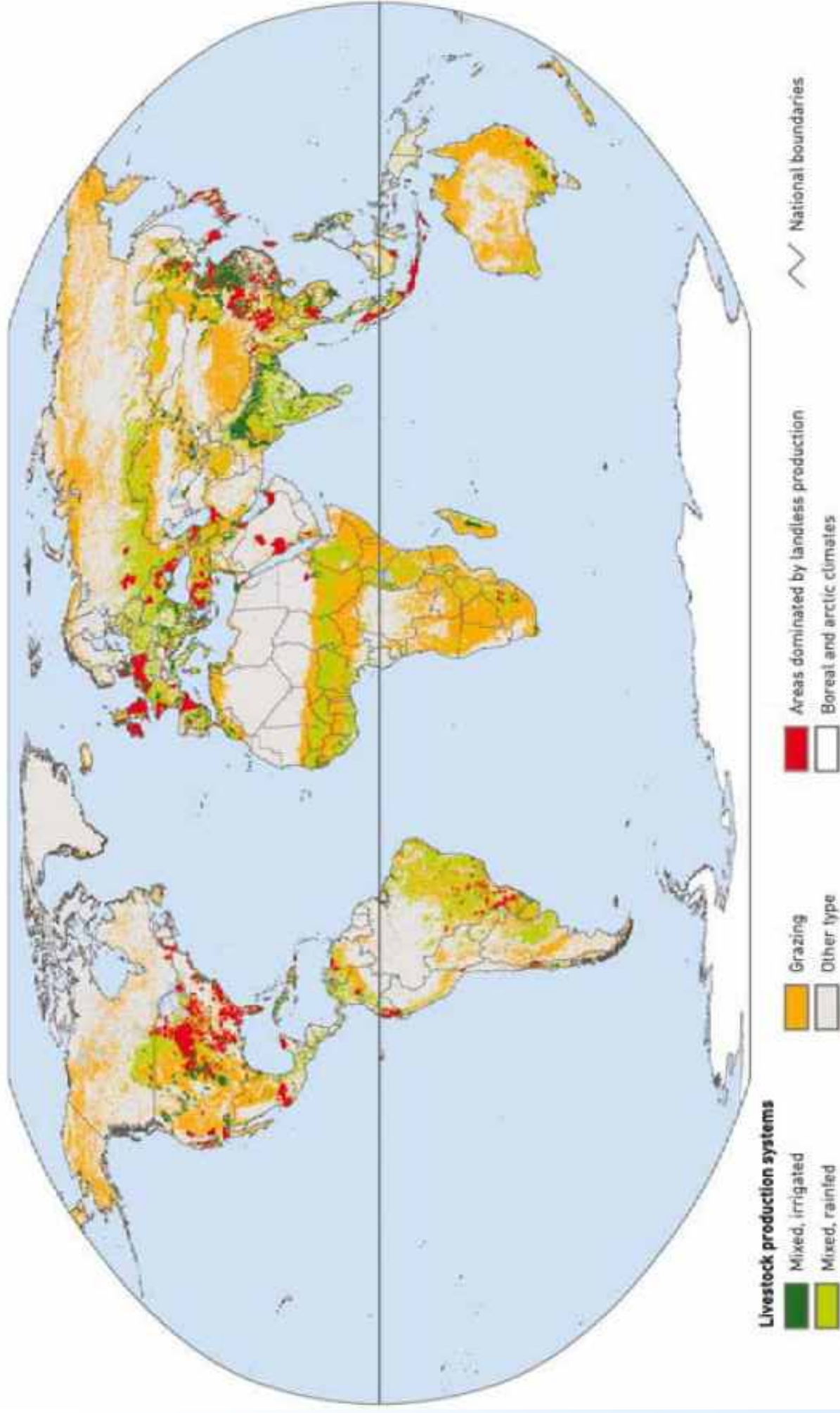
# Forest transition and lands degradation in dry lands



Source: FAO, 2006

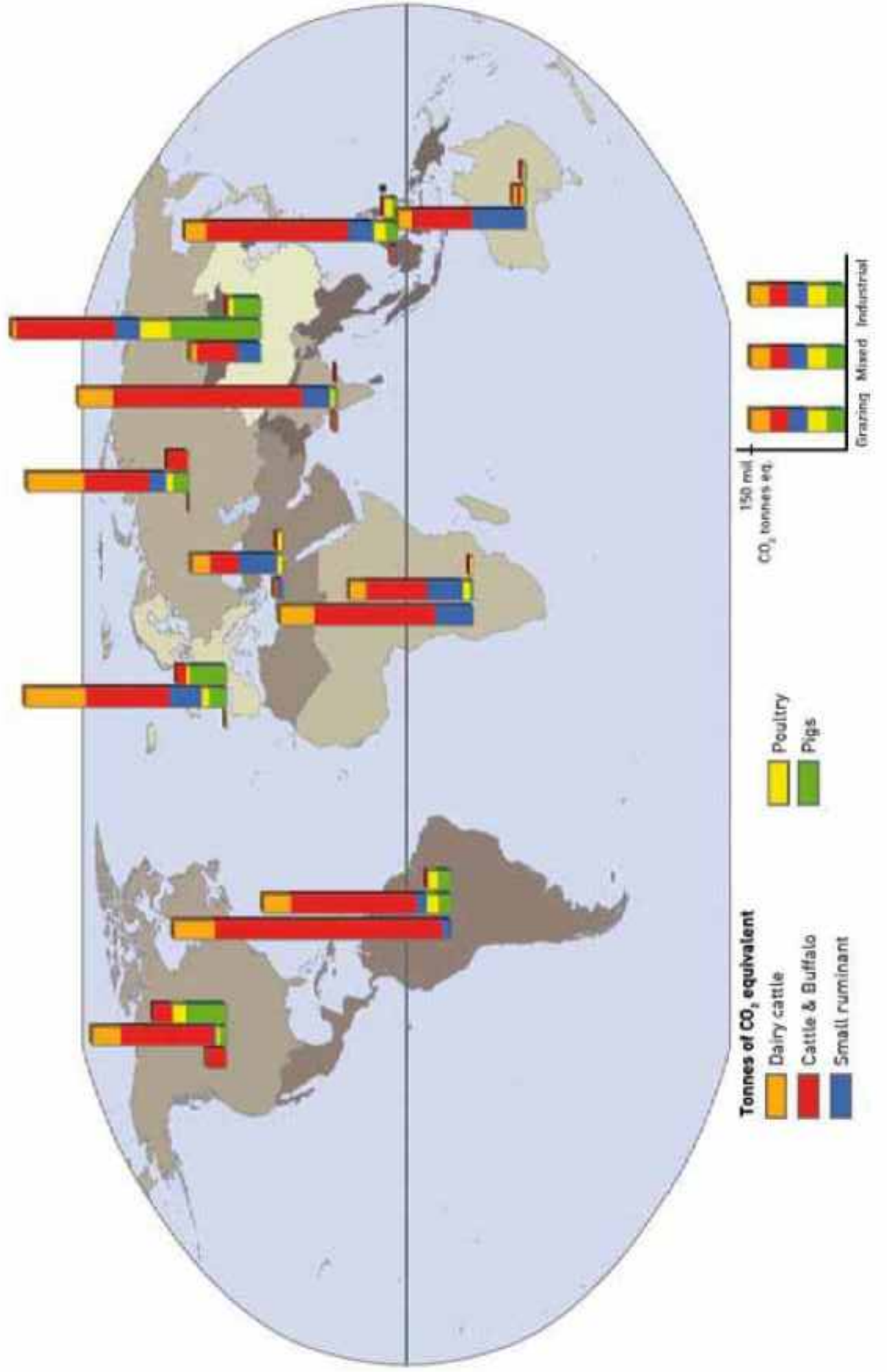
Deforestation in the amazon for livestock production accounts for  $\sim 1/3$  of the total GHG due to livestock

# Livestock Production Systems and land-use change

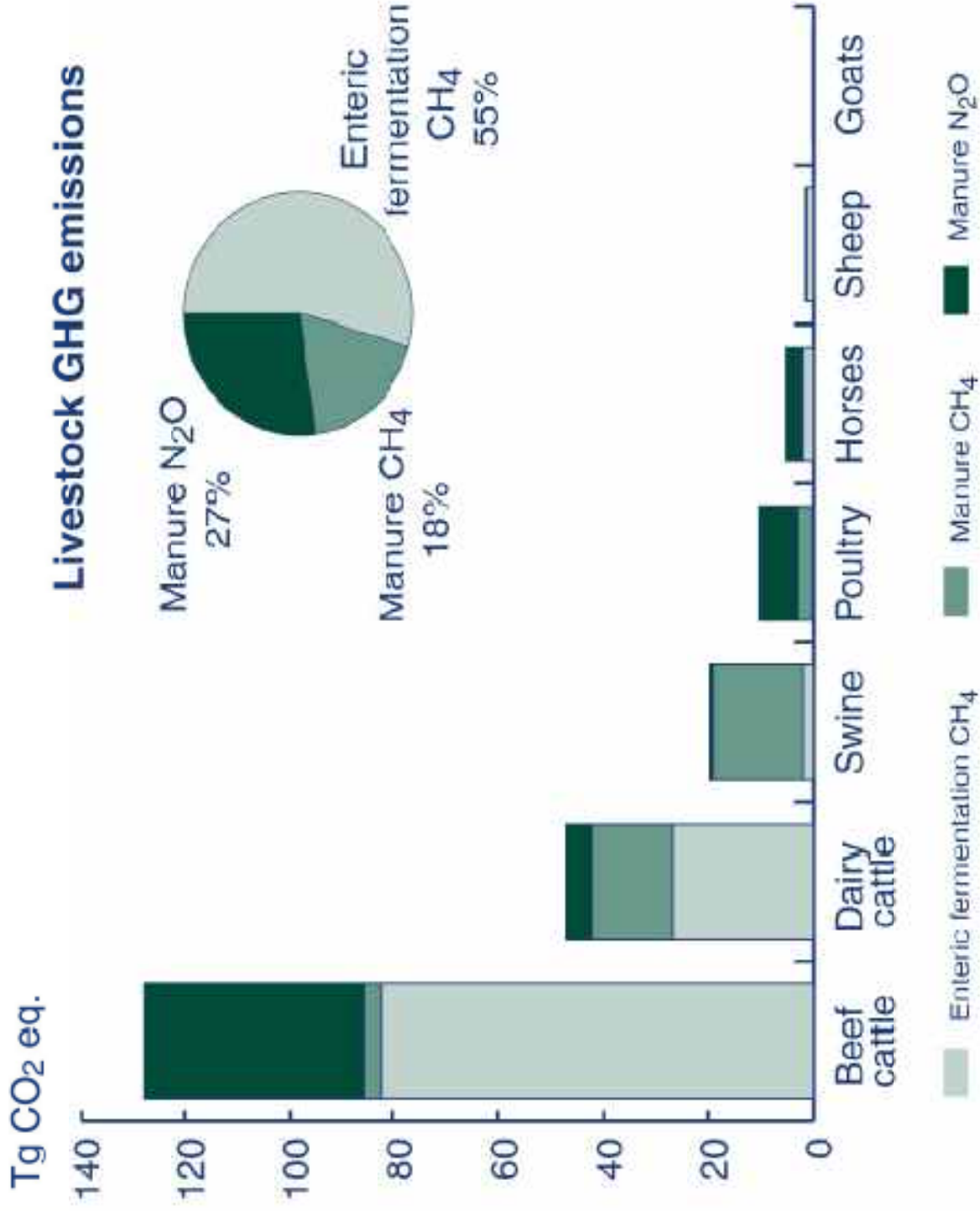


Extensive vs. intensive

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



# US GHG emissions from livestock



# **Clearing the Air: Livestock's Contributions to Climate Change**

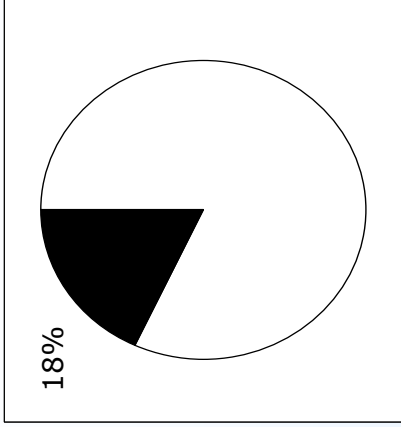
**Maurice Pitesky, Kim Stackhouse,  
and Frank Mitloehner**

*Advances in Agronomy, Vol 103*

# Reports summarized

## UN-FAO:

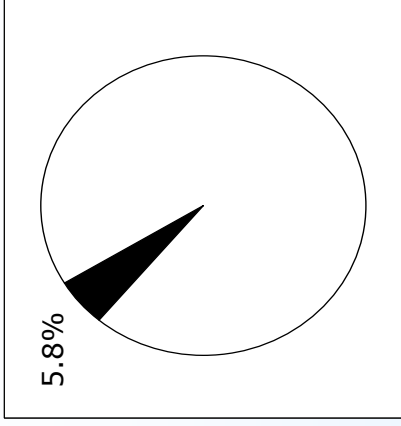
Livestock's Long Shadow (LLS)



Livestock as portion of emissions  
~7,100 Tg CO<sub>2</sub>-eq yr<sup>-1</sup>

## US-EPA:

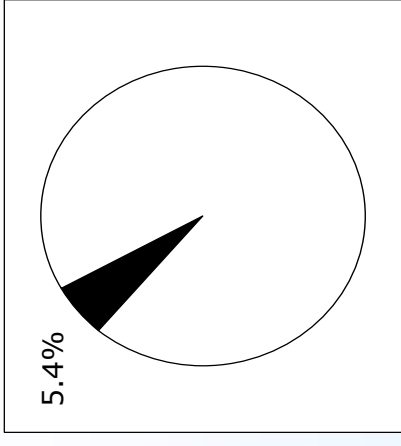
Inventory of U.S. Greenhouse Gas Emissions and Sinks



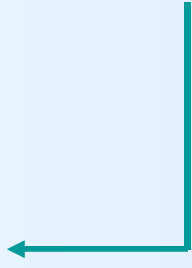
Agriculture as portion of emissions  
414 Tg CO<sub>2</sub>-eq yr<sup>-1</sup>

## CEC:

California GHG Inventory



Agriculture as portion of emissions  
27 Tg CO<sub>2</sub>-eq yr<sup>-1</sup>

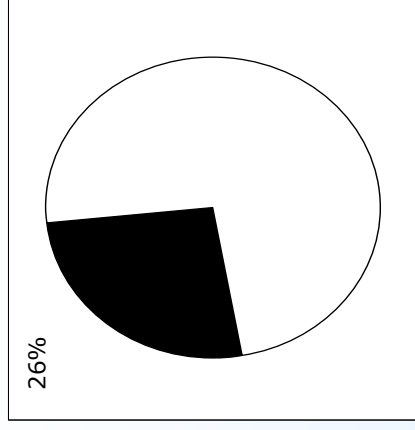


If true, livestock is a greater source of GHGs than the transportation sector (FAO, 2006)

# Livestock emissions - enteric fermentation

## UN-FAO:

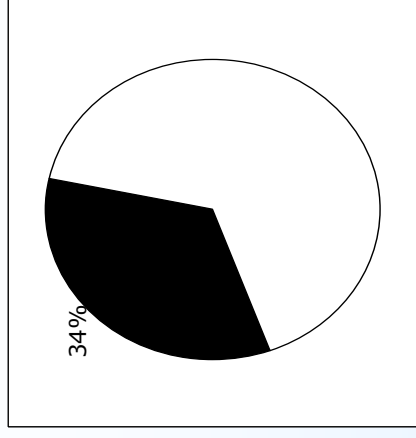
Livestock's Long  
Shadow (LLS)



1,800 Tg CO<sub>2</sub>-eq yr<sup>-1</sup>

## US-EPA:

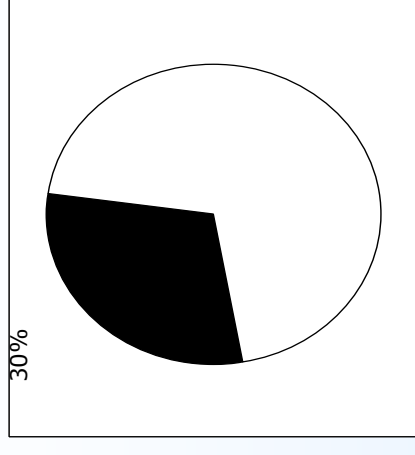
Inventory of U.S.  
Greenhouse Gas Emissions  
and Sinks



139 Tg CO<sub>2</sub>-eq yr<sup>-1</sup>

## CEC:

California GHG  
Inventory



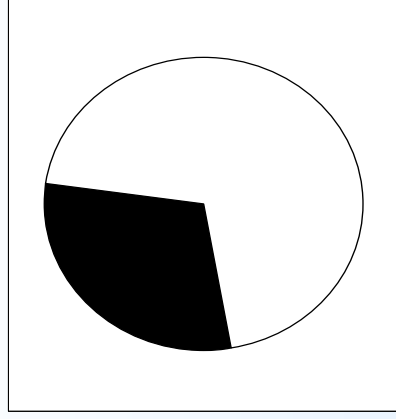
7 Tg CO<sub>2</sub>-eq yr<sup>-1</sup>

# Livestock emissions – animal manure

## UN-FAO:

Livestock's Long Shadow (LLS)

26%

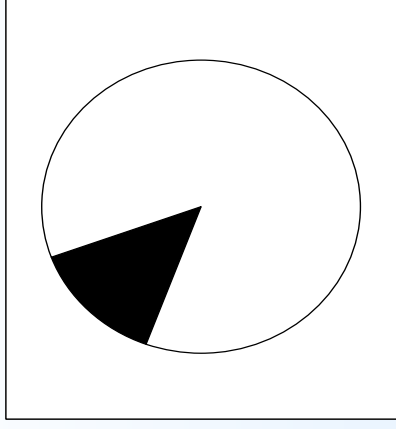


1800 Tg CO<sub>2</sub>-eq yr<sup>-1</sup>

## US-EPA:

Inventory of U.S. Greenhouse Gas Emissions and Sinks

34%

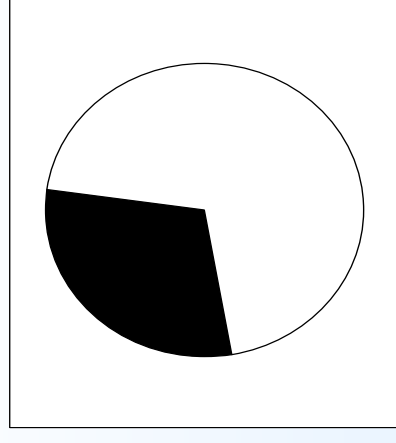


59 Tg CO<sub>2</sub>-eq yr<sup>-1</sup>

## CEC:

California GHG Inventory

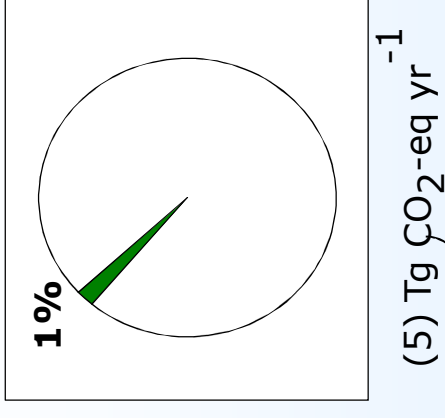
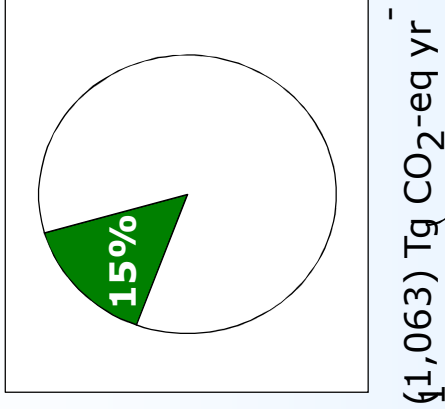
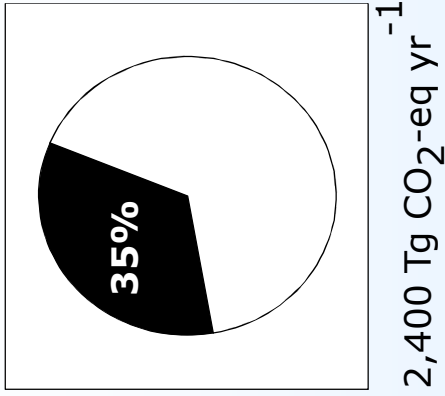
30%



7 Tg CO<sub>2</sub>-eq yr<sup>-1</sup>

# Global Livestock Emissions Land-use Change

**UN-FAO:** Livestock's Long Shadow (LLS)      **US-EPA:** Inventory of U.S. Greenhouse Gas Emissions and Sinks      **CEC:** California GHG Inventory



Net sequestration: via agricultural land and forest land

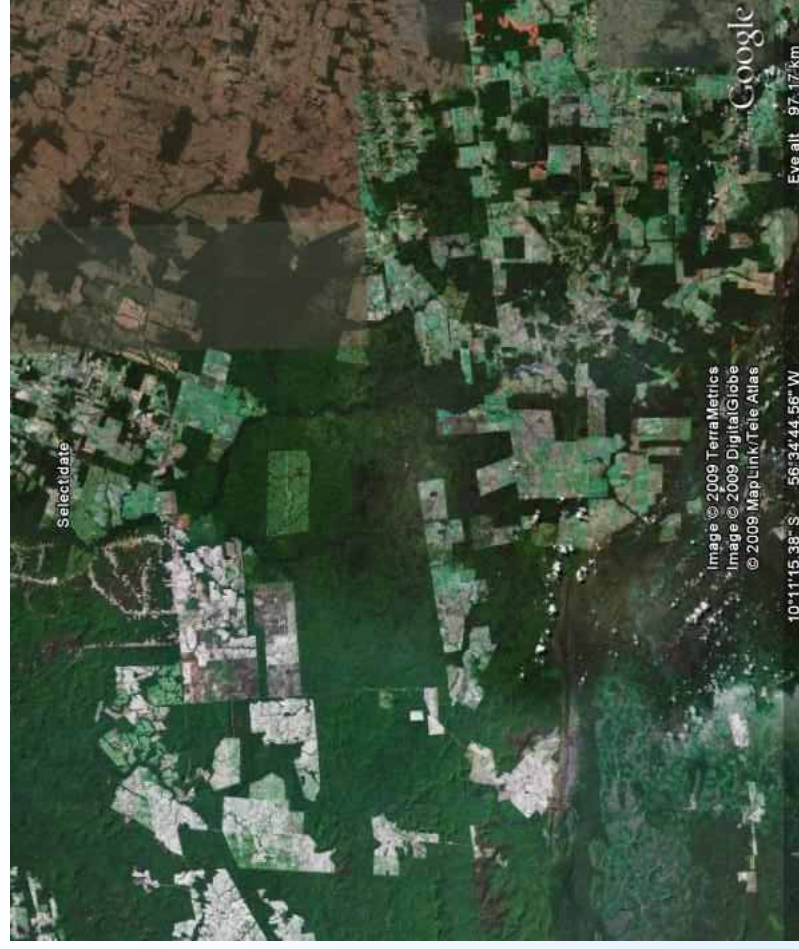
Since 1990, 23% increase in sequestration via land-use in U.S.(EPA,, 2009)  
In 2007, net sequestration of 1,063 Tg CO<sub>2</sub> Eq/yr represents an offset of 15% of total GHG.(EPA, 2009).



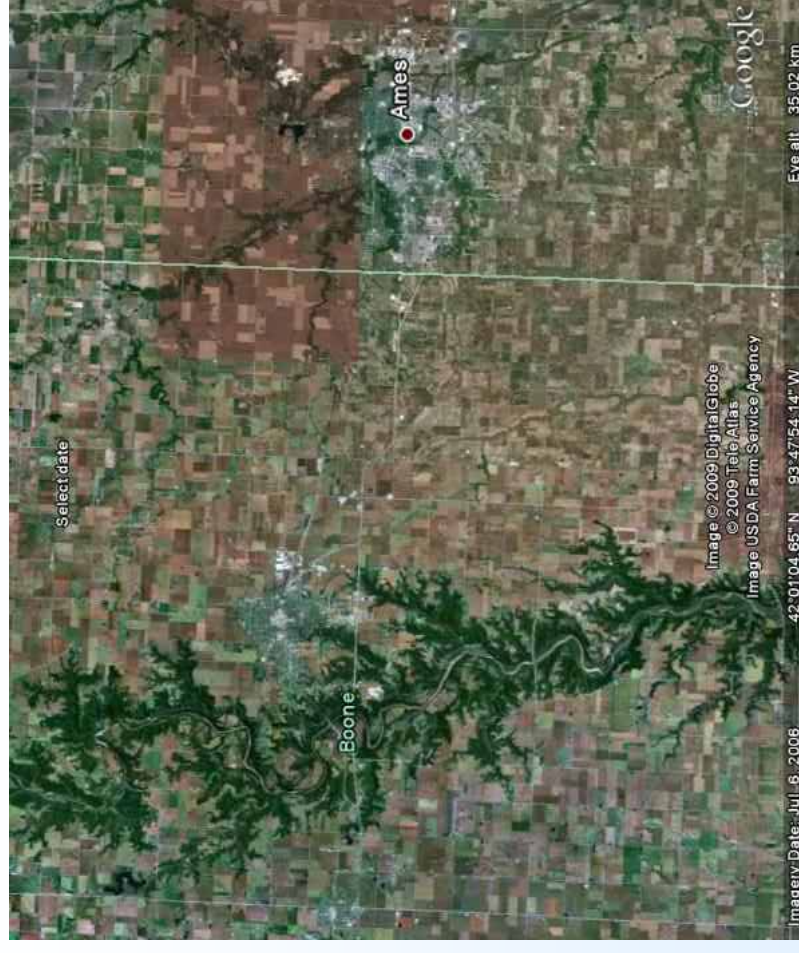


# Land-use Change

## Amazon



## Iowa



**70% of previously forested land in the Amazon is used as pasture**

# Production Efficiency

	Dairy emission factor (kg/head/yr)	Milk production (kg/head/yr)	Non-dairy emission factor (kg/head/yr)
North America	118	6,700	47
EU	100	4,200	48
Latin America	57	800	49
Africa	36	475	32

(IPCC, 1996)

# Conclusions

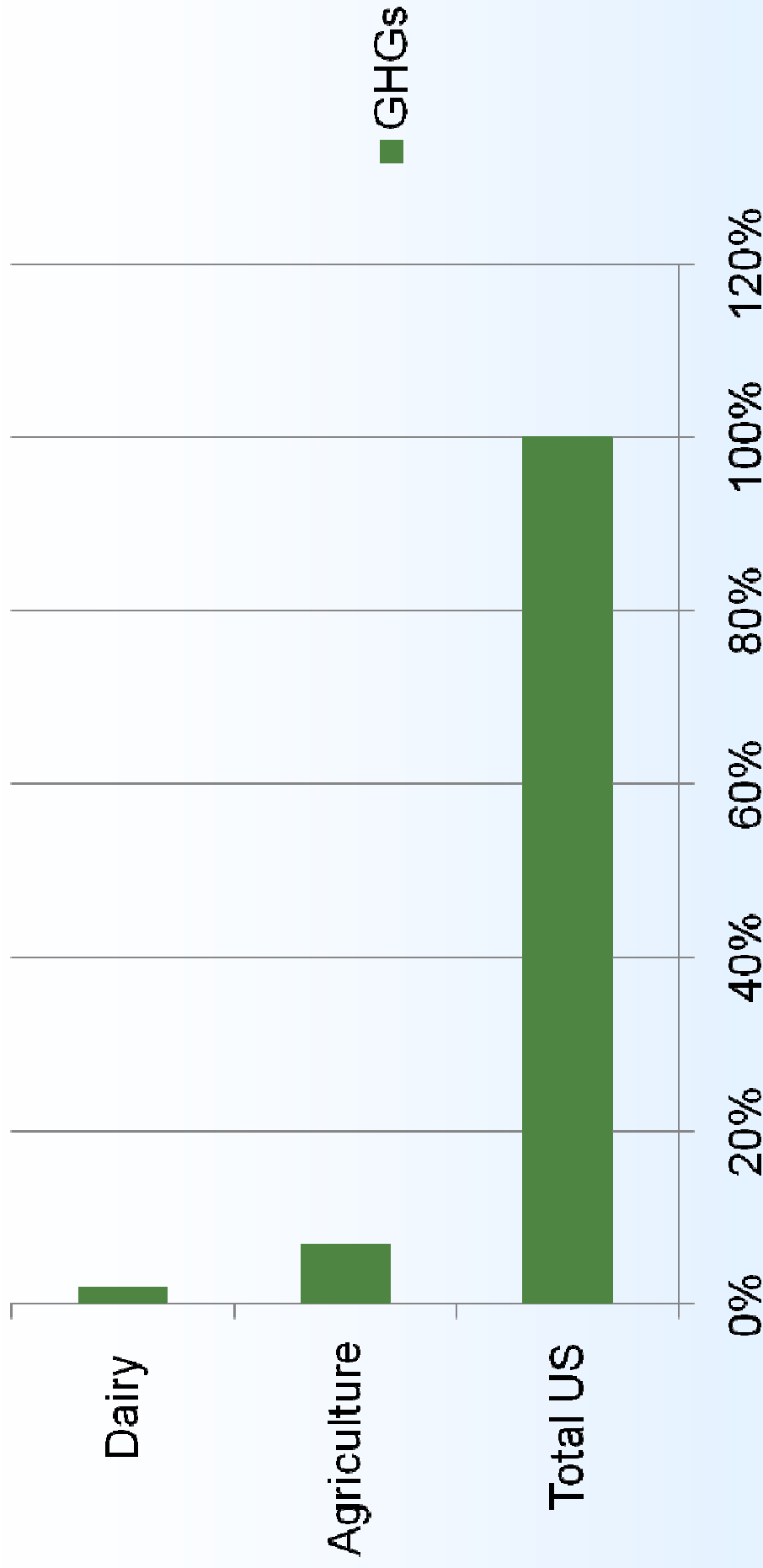
- Livestock in developed countries has relatively small GHG contribution dwarfed by large transportation, energy, and industry
- In developing countries livestock can be a dominant contributor to the GHG portfolio due deforestation and to their relatively smaller transportation and energy sectors

# Conclusions

- According to *Livestock's Long Shadow*, 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
- In the United States, transportation accounts for at least 26% of total anthropogenic GHG emissions, electricity for 31%, compared to roughly 6-8% for all of agriculture, which includes less than 3-4% associated with livestock production

# US Dairy is A Small Percentage Of Total Emissions

US Greenhouse Gases Produced



# Agricultural Contribution to Greenhouse Gases

- “Livestock’s Long Shadow” = livestock emissions 18%
- This is an intern. number and not representative of US livestock.
- This number includes land use issues in developing countries (wetlands reclamation & deforestation), which inflates the number by as much as one third.
- Comparison livestock vs transportation is inappropriate (LCA 3 vs LCA 1)
- Livestock production in US model for the rest of the world due to efficiencies
- Largest issues: digestibility (developing countries) and waste management (developed countries)

# Media's Response to Livestock's Long Shadow



**Save the planet: Stop eating meat**

The UN says so, and so do a growing list of school boards. Meet the new eco enemy

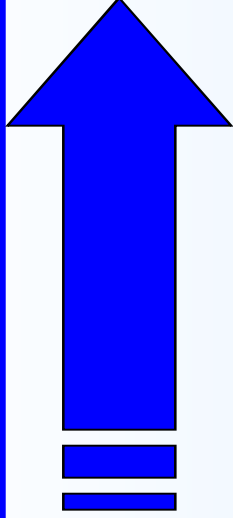


**Where's the beef?**

Scientist takes a second look at UN numbers that have led many environmentalists to forego meat

**CLEARING THE AIR: LIVESTOCK'S CONTRIBUTION TO CLIMATE CHANGE**

Maurice E. Pitesky,\* Kimberly R. Stackhouse,<sup>†</sup> and Frank M. Mitloehner<sup>†,‡</sup>



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,"



Dr Pierre Gerber,  
LLS contributing author

**NewScientist**

Cows, pigs and sheep: Environment's greatest threats?



UN admits flaw in report on meat and climate. The UN has admitted a report linking livestock to global warming exaggerated the impact of eating meat on climate change.



**Have we got it right on meat and greenhouse gas emissions? If**

intensive farming has the lowest environmental impact should we promote it?



# So how about the 18%?

