FAO's global livestock life-cycle analysis: current state of play and forthcoming initiatives

Partnership Technical Seminar
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Michael MacLeod, Pierre Gerber, Carolyn Opio, Alessandra Falcucci, Giuseppe Tempio and Henning Steinfeld

MICCA MITIGATION of CLIMATE CHANGE in AGRICULTURE

Overview

- Background – why and how we undertake life-cycle analysis of livestock GHG
- Illustration of the potential of LCA
- Conclusions

The big picture

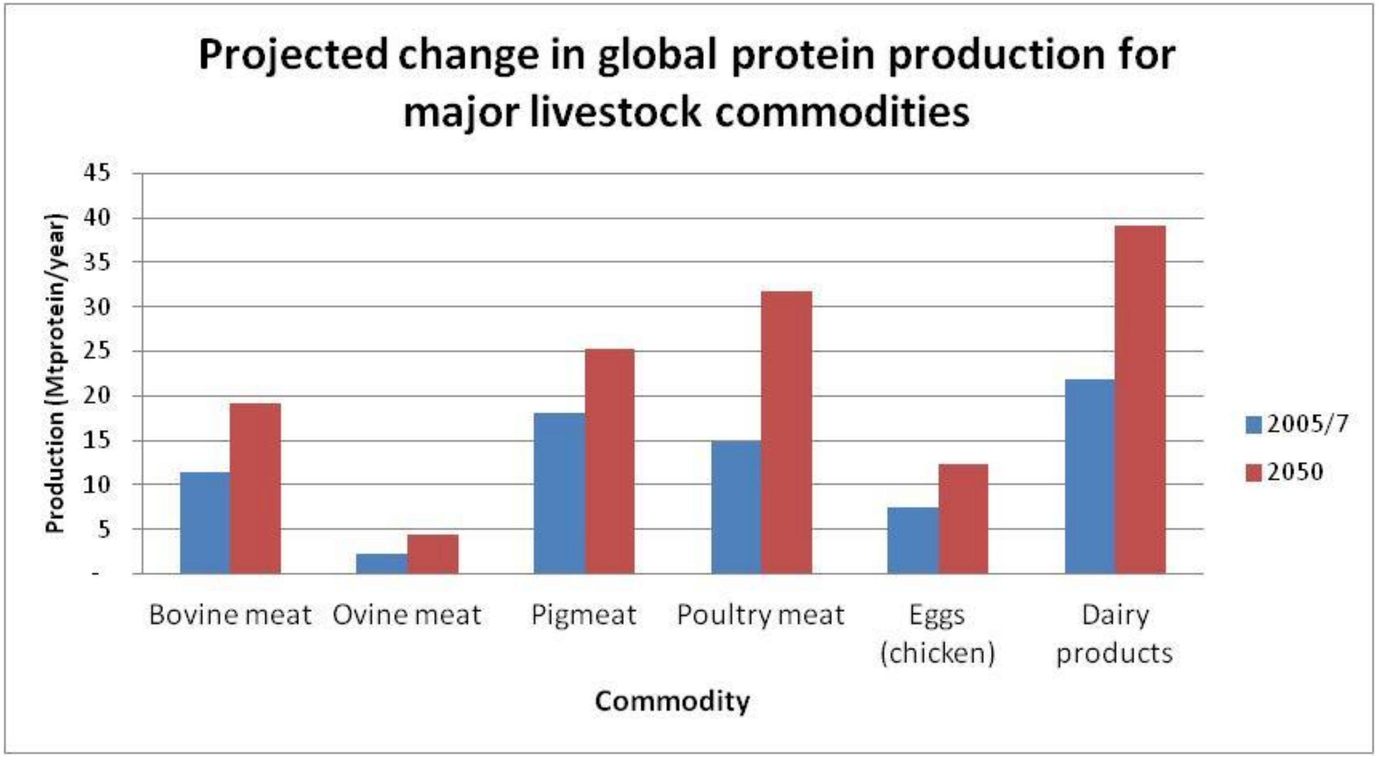
"Satisfying the growing demand for animal food products while at the same time sustaining the productive assets of the natural resource base – soil, water, air, biodiversity – and coping with climate change and vulnerability"

Pingali and McCullough (2010, p9)

-Fundamental changes in production make this a significant challenge-

Pingali, P. and McCullough, E. (2010) Drivers of change in global agricultural livestock systems. In Livestock in a Changing Landscape

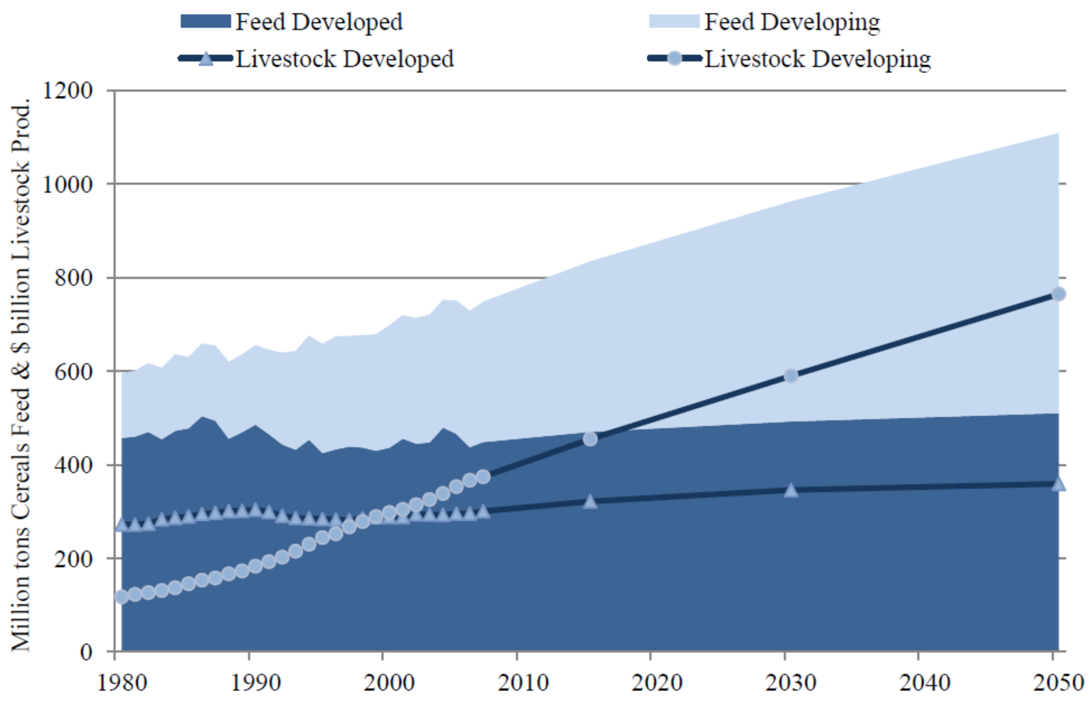
Food production forecasts to 2050



Figures based on: Alexandratos, N. and J. Bruinsma. 2012. World agriculture towards 2030/2050: the 2012 revision. ESA Working paper No. 12-03. Rome, FAO., Table 3.4, 3.5

Feed production forecasts to 2050

Figure 3.5 Cereals feed (million tonnes) and livestock production ($billion)



***-The bottom line**: improvements in the emissions per unit of product are required to avoid significant increases in the total emissions arising from livestock-*

Source: Alexandratos, N. and J. Bruinsma. 2012. World agriculture towards 2030/2050: the 2012 revision. ESA Working paper No. 12-03. Rome, FAO.

Improving the greenhouse gas emissions efficiency of livestock production raise many questions, such as:

- What are the ranges of emissions intensity and what influences variation?
- What is the relative importance of different stages in the supply chain?
- Where are the hotspots and points of intervention?
- What happens to the emissions intensity when you change X, Y or Z...and what might the unintended consequences be?
- To what extent is it possible to measure and predict for complex biophysical systems – and how can we communicate uncertainty?

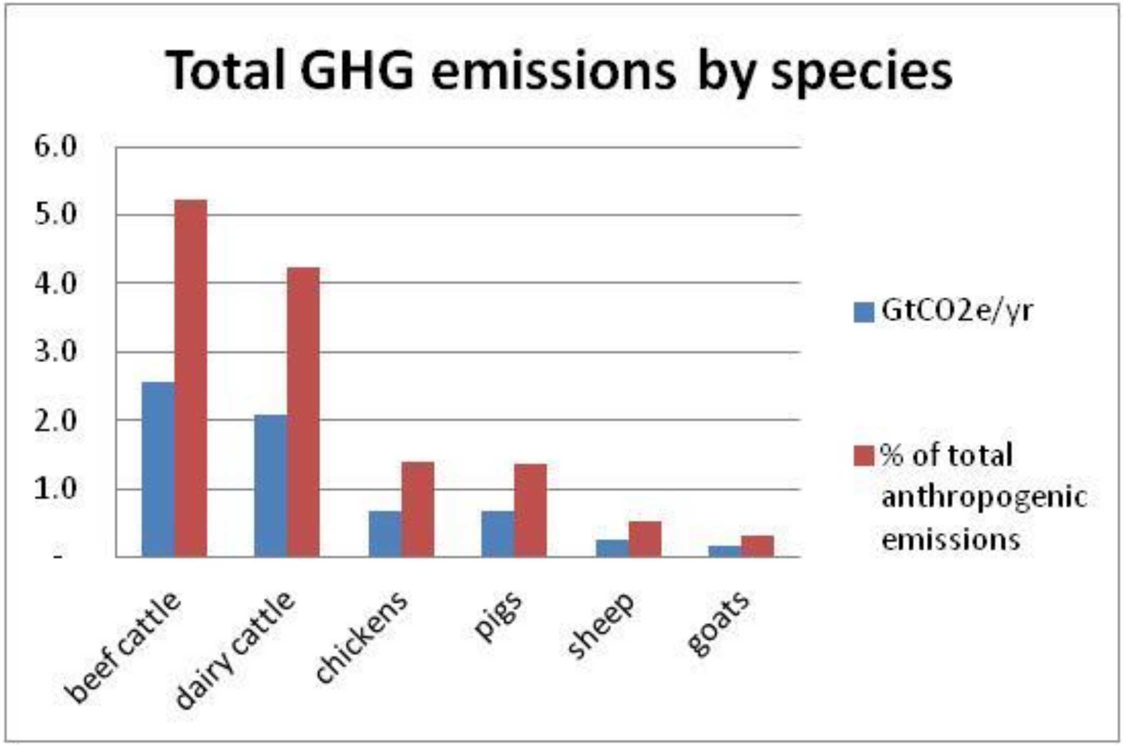
FAO's livestock LCA

- Specific objective: Produce estimates of global GHG emissions and emissions intensity for the following livestock sectors:
  - Dairy and beef cattle
  - Small ruminants
  - Buffalo
  - Pigs
  - Poultry
- Scope – cradle to retail point.
- Scope – main emissions categories included (soil carbon fluxes not arising from LUC to be included in V2.0)
- Predominant production systems.
- Main world regions and agro-ecological zones (AEZs).
- GIS-based model.

Current status of global livestock LCA

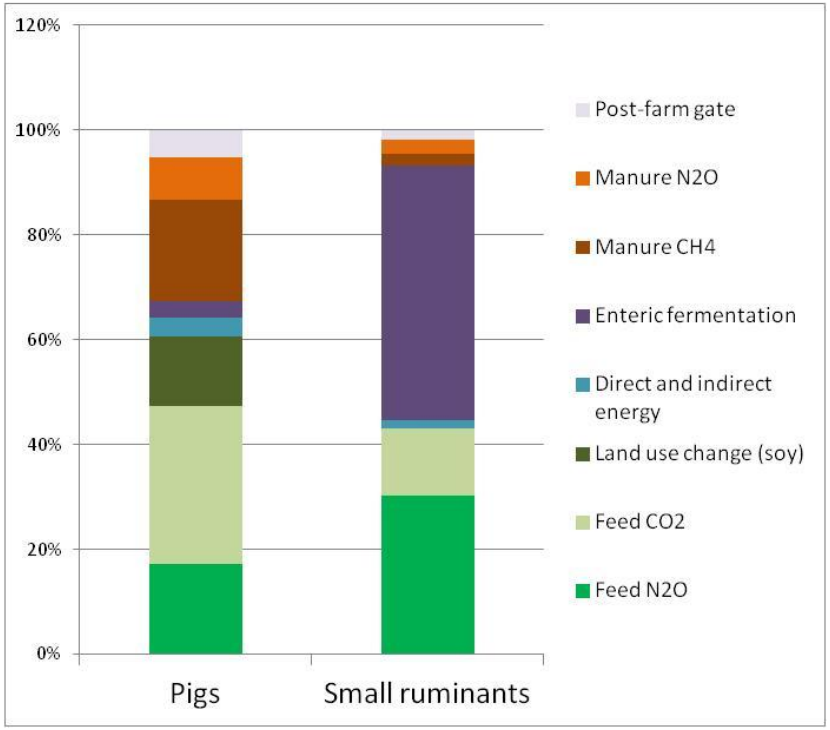
- V1.0 analysis of cattle, sheep, goats, pigs and chickens completed
- Two global LCA reports will be published this autumn: (1) beef and small ruminants, (2) pigs and chickens
- Buffalo analysis to be completed this summer, after mission to India

Total emissions



- Useful for putting livestock emissions in context
- Tells us little about the potential for improvement
- First step - understanding how emissions arise and why they vary

Comparison of pigs and small ruminants

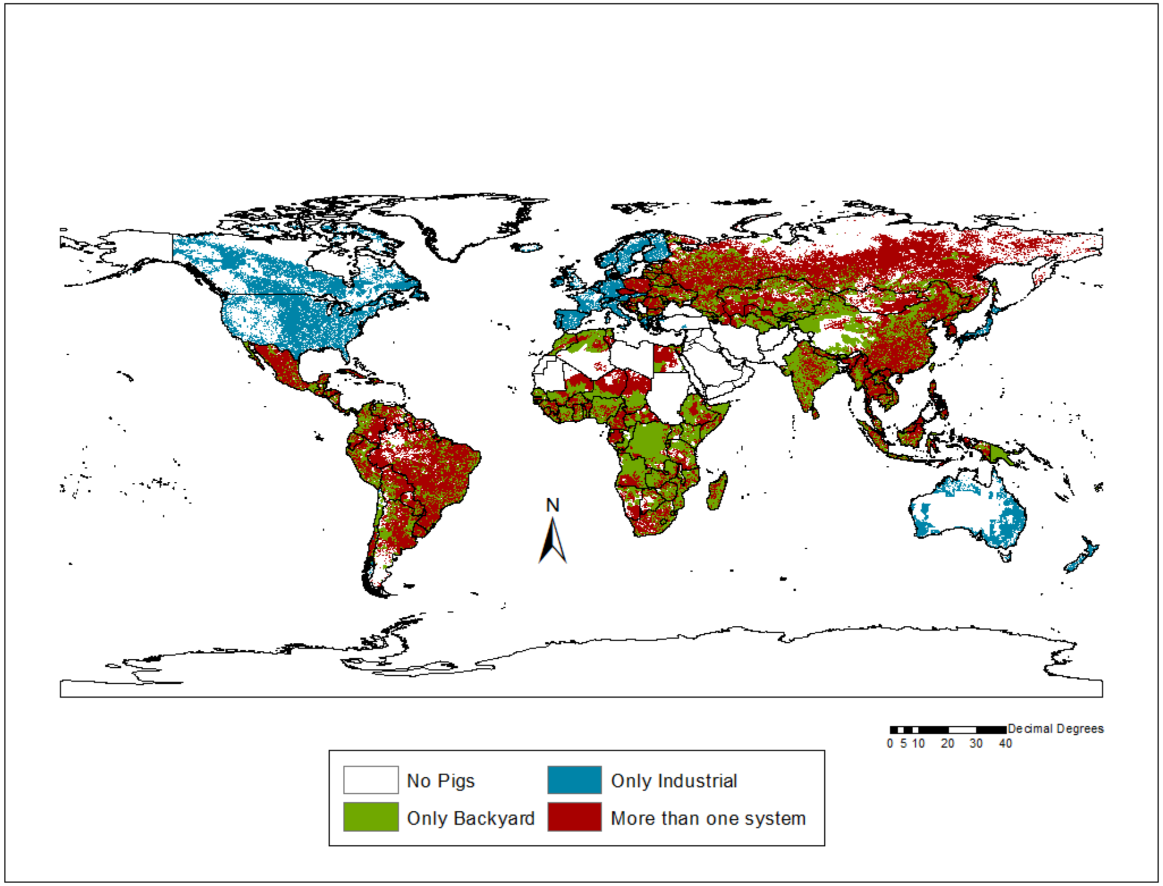


Contribution of each emission category for global pigs and small ruminants

- Different emissions profiles arising from differences in:
  - Physiology
    - Digestive systems
    - Nutritional requirements
  - Production systems
    - Rations
    - Feed conversion ratios
    - Manure management
  - Location
    - Physical conditions
    - Mode of feed production

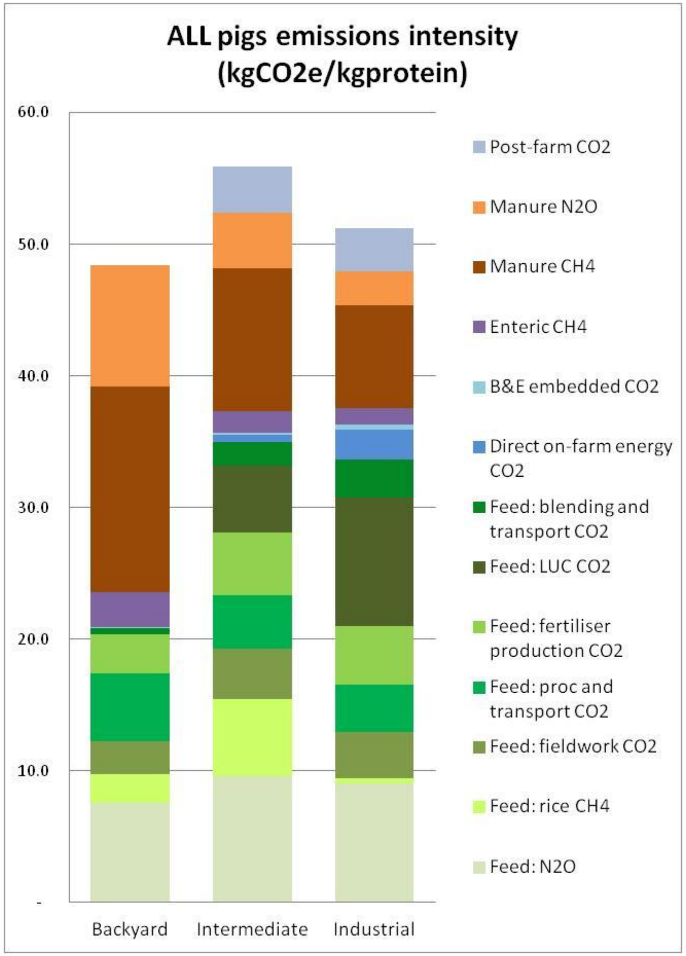
Production systems: they exist because they work, in a given context, e.g. are profitable, or resilient. Conditions vary, so production systems vary – 15 or so beef systems in UK, so will get ranges of performance.

Global pig production



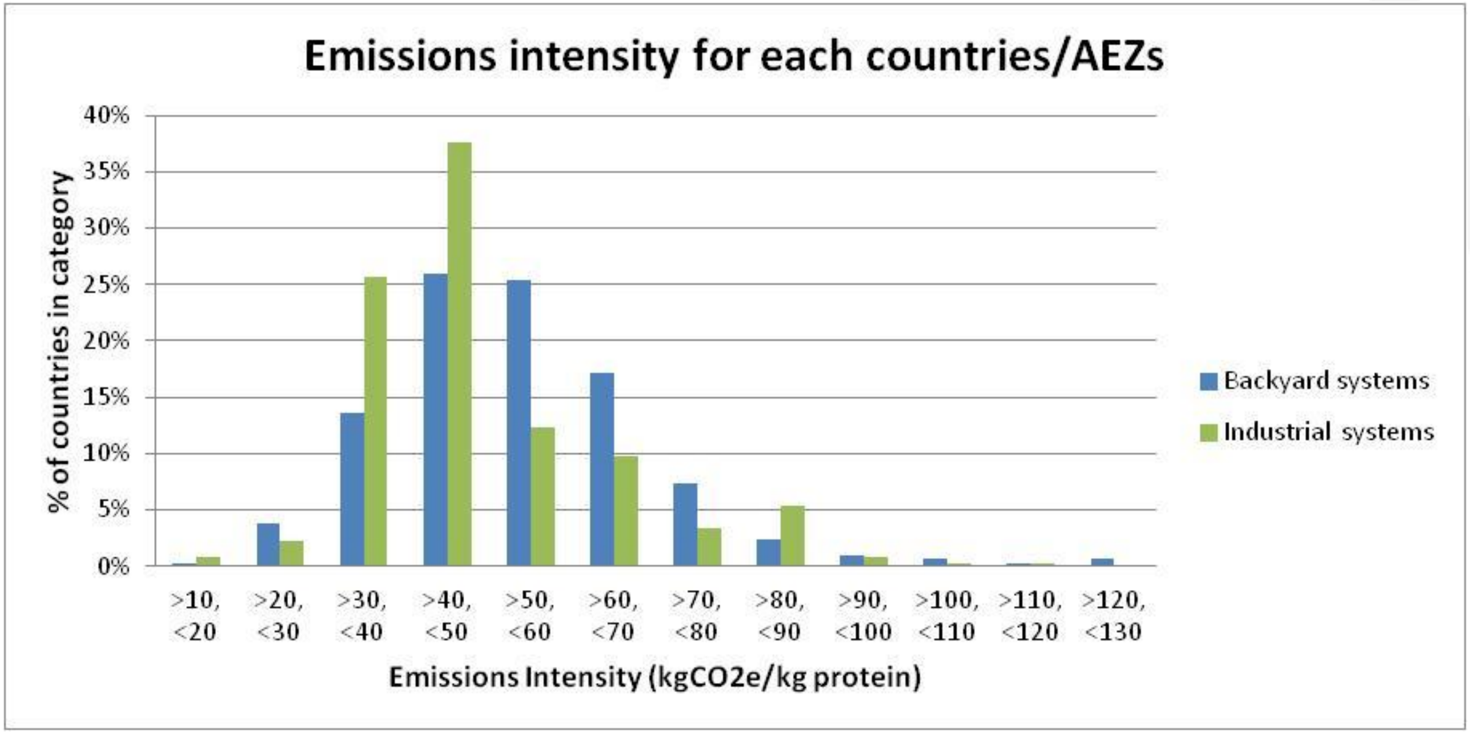
- Population: 900m head
- Production: 110bn kgCW per year
- Landless, so limited spatial link to feed production
- Over 70% of global herd in 3 areas (by head):
  - China (47%),
  - EU (18%),
  - USA (7%)
- LCA model classifies them into 3 systems:
  - Industrial
  - Intermediate
  - Backyard

Variation in emissions intensity by system

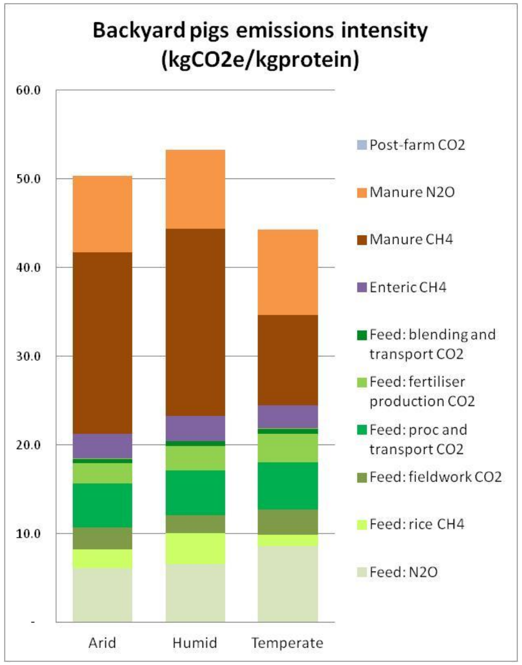


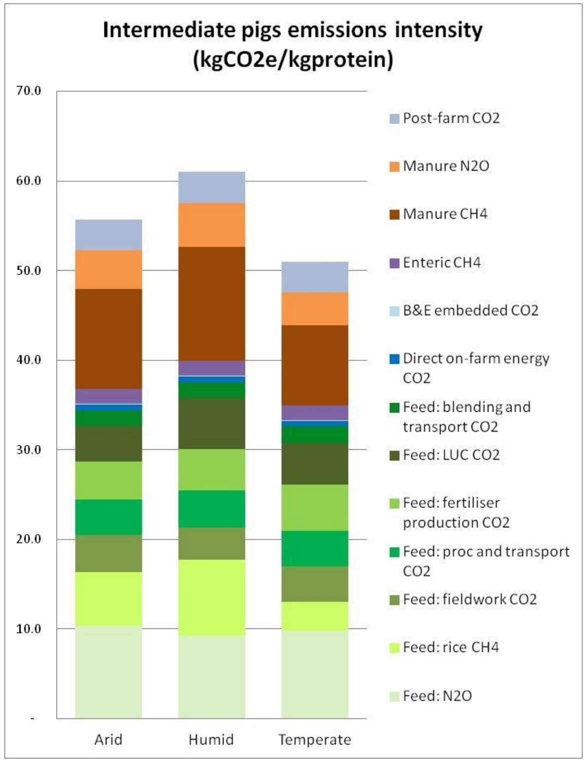
- Emissions from feed production (green) and manure management (brown) dominate in all 3 systems
- Backyard – highest on-farm emissions, but lowest overall EI - why?
  - Low FCR, low digestibility of the ration>high VS and N excretion
  - Feed CO2e low due to: no LUC, post-farm, direct or embedded energy, and greater use of swill and waste crops
- Why is intermediate higher than industrial?
  - Lower FCR
  - Lower digestibility ration
  - Lot of rice

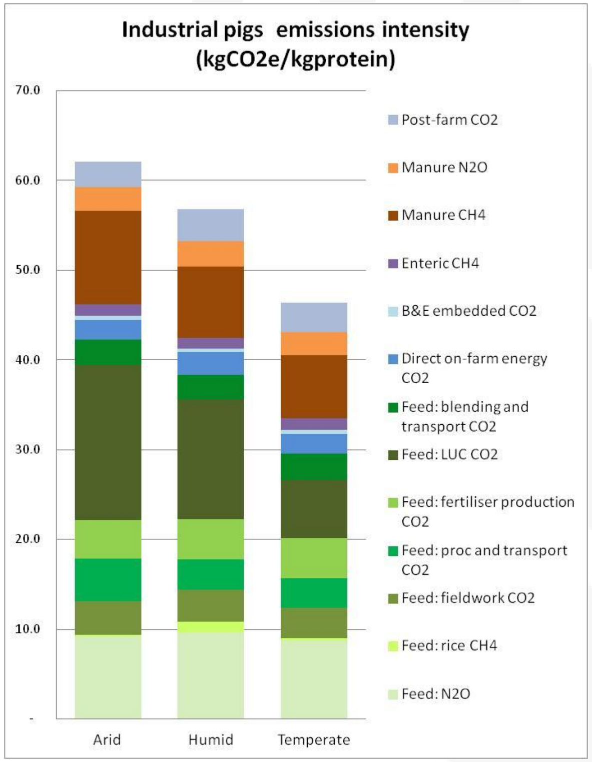
Distribution of EI within systems



Emissions intensity by system and AEZ



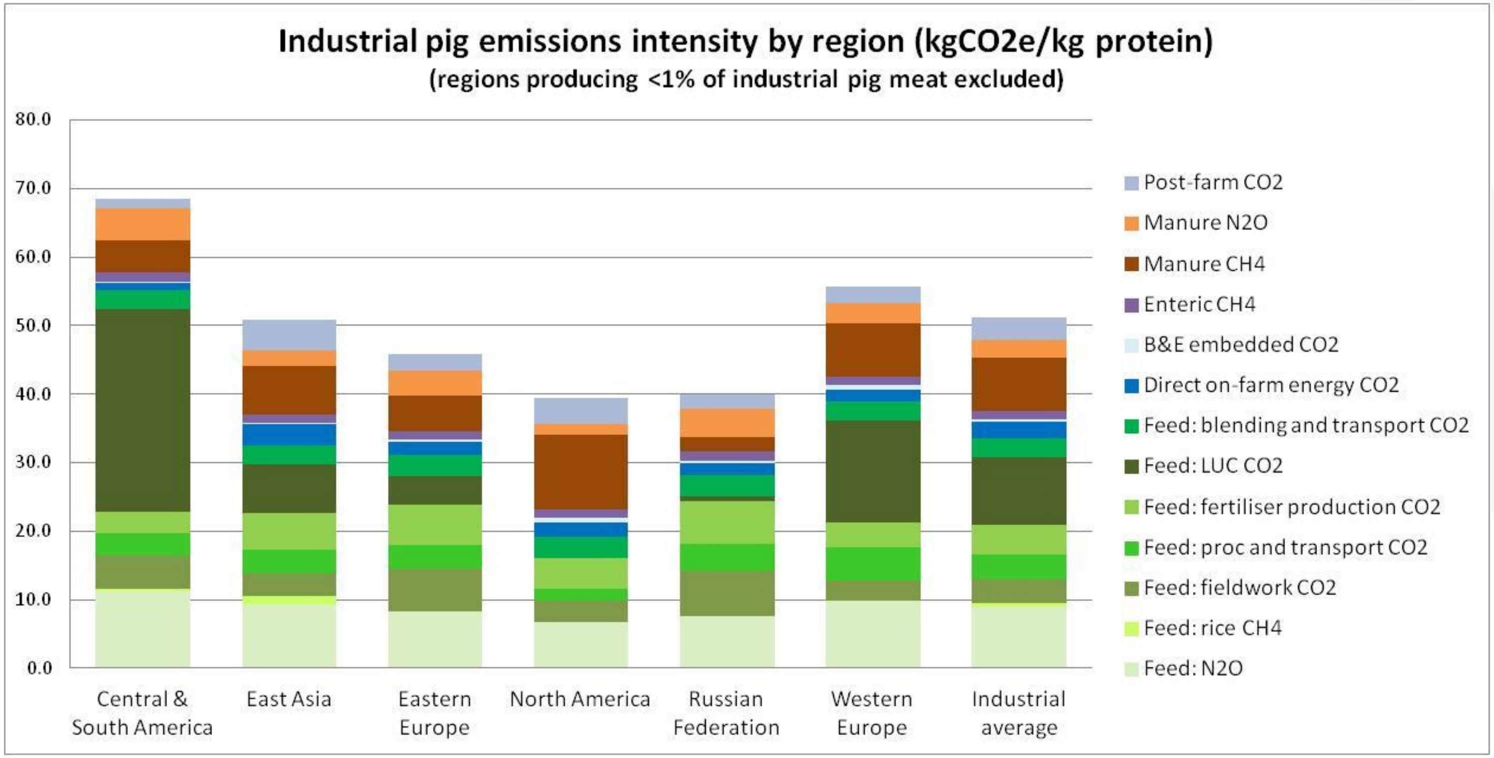




- Manure CH4 lower in temperate due to lower average T
- Humid – slightly higher manure CH4 and rice CH4
- Temperate – less use of soy associated with LUC, slightly lower manure CH4

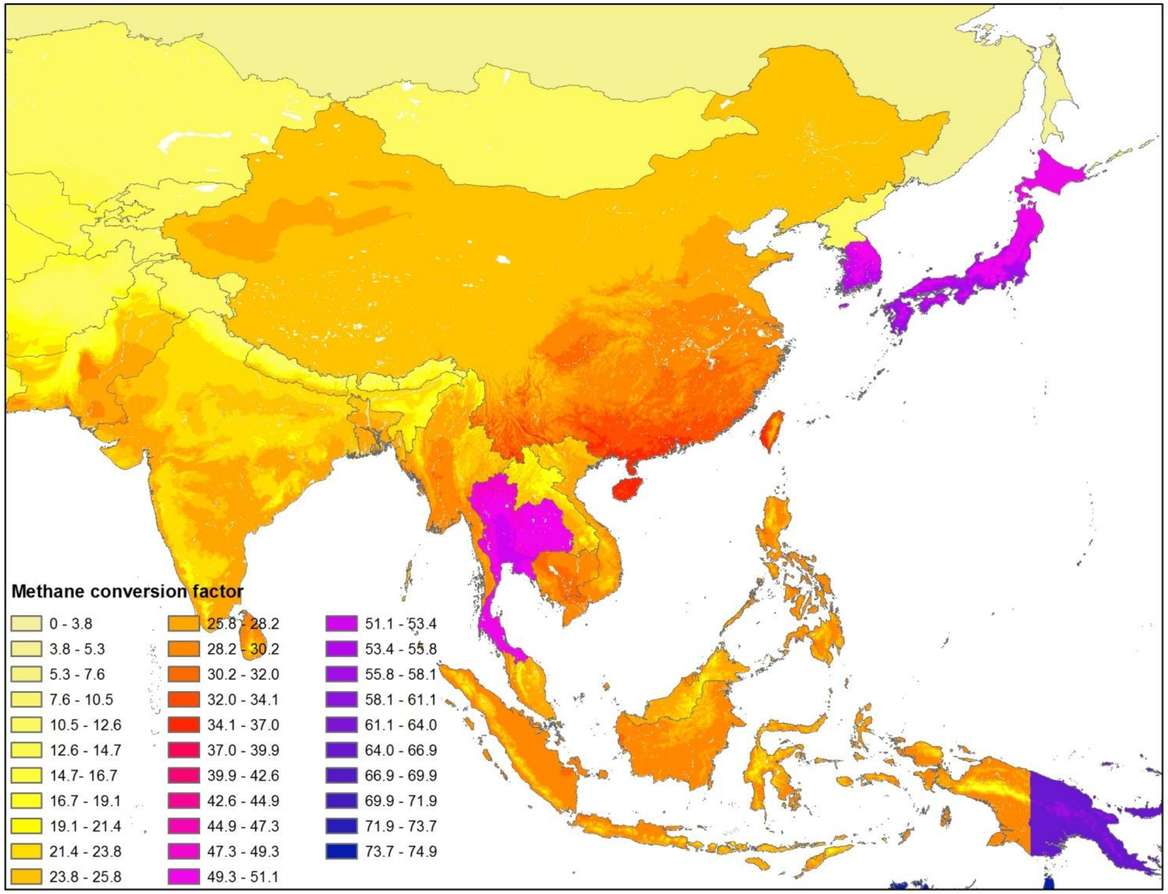
Emissions intensity by system and region

- For example, we can disaggregate by system and region...



GIS approach enables us to dig deeper

- Methane conversion factor (% of B_o) for industrial pigs



Challenges and opportunities

- Trade-off between scope and resolution>targeted data gathering for key parameters/locations
- Characterizing uncertainty
- Quantifying soil C fluxes
- Improving our understanding of manure management and recycling

-The work of the Partnership will help us to meet these challenges-

Priorities for development of the LCA

- Improve fundamentals – firm foundations essential
- Fully exploit the lessons to be learned from the attributional analysis
- Undertake consequential analysis:
  - Test proposed mitigation options
  - Explore the GHG implications of other policies
- Widen scope beyond GHG

Conclusions

- LCA can be a useful tool in identifying ways of improving efficiency.
- Excited about the potential of the Partnership to improve the quality of analysis.
- Also realistic - it won't be easy...
- ...but ultimately it will be worthwhile.