

Nitrogen Footprint of Food Production in the EU-27 and Africa

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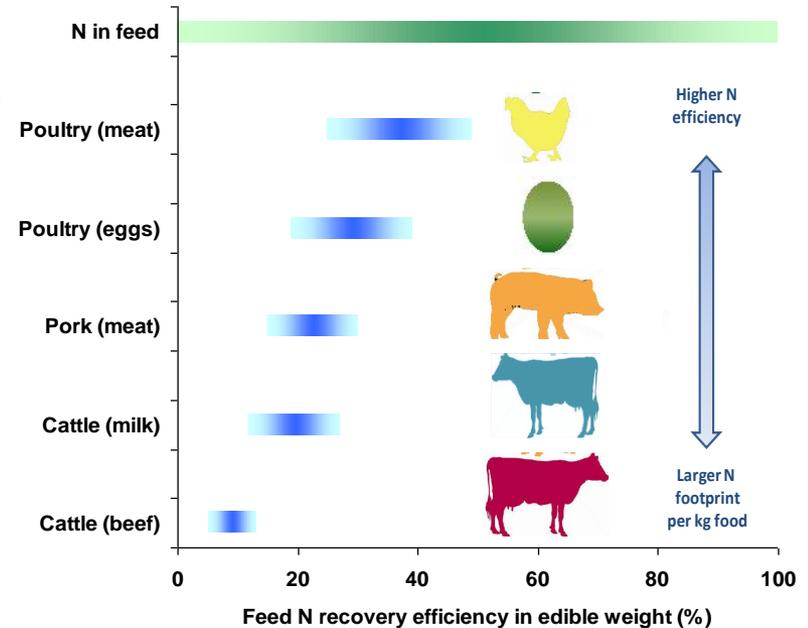
Outline presentation

- Introduction
- Model approach
- Comparison EU-27 and Africa
- N footprint results
- Discussion
- Conclusions



Introduction

- Need to increase food production and lower environmental impact
- N footprint for EU available
- Nitrogen use efficiency is generally low in livestock production systems
- N footprint for Africa still unknown

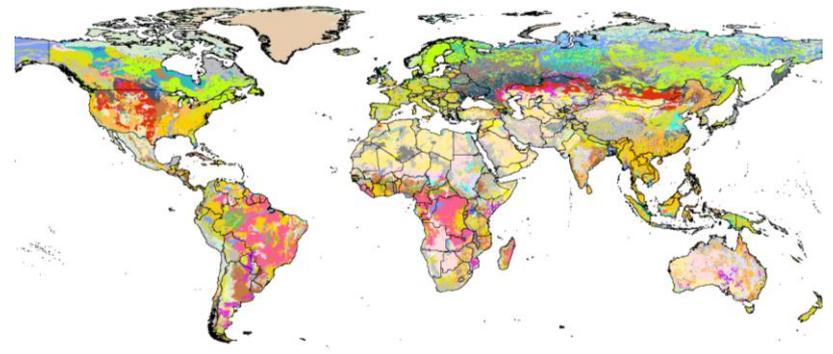
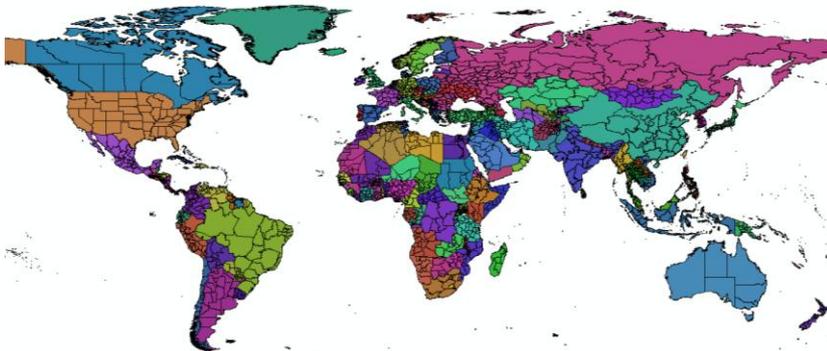


Sutton et al. (2011), ENA report



MITERRA-Global

- A model for *integrated* assessment of N (C and P) emissions from agriculture, based on MITERRA-Europe
- Global coverage
- At country and province level (n= 2467)
- Statistics (2007-2009 data)
 - 40 crop types (AgroMaps and FAOSTAT)
 - 12 livestock types (FAOSTAT)
- GIS maps (land cover, soil, climate, N deposition)



Excretion, emission and leaching factors

- Average crop nutrient content based on range of global studies and data sources
- Excretion and manure management systems: IPCC 2006 guidelines and GAINS and UNFCCC for EU-27
- GHG and SOC: IPCC 2006 guidelines (Tier 1-2)
- NH₃: EMEP/EEA emission inventory guidebook 2009, Tier 2 approach, based on TAN
- N leaching and runoff: according to MITERRA-Europe (Velthof et al., 2009)

Approach and Nr sources

- N footprint = $(N_{\text{input}} - N_{\text{output}}) / m_{\text{product}}$ (Leip et al., 2013)
 - N_{input} : manure, mineral fertilizer, BNF, deposition
- Included reactive N sources:
 - Housing and manure management
 - Direct (manure, grazing, mineral fertilizer) and indirect soil emissions
 - Fertilizer production
 - (Fossil fuel use)
- Allocation of N inputs and Nr emissions to feed and food crops

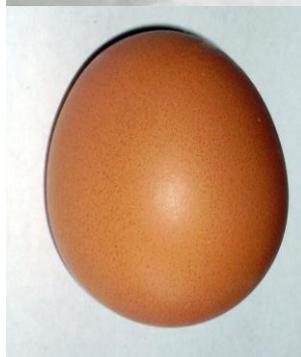
Commodities / functional units



1 kg carcass of meat
- beef
- pork
- chicken



1 kg of milk cow



1 kg of eggs

1 kg of cereals



1 kg of potato /root crop



1 kg of leguminous crops



1 kg of fruits and vegetables



1 kg of sugar crop

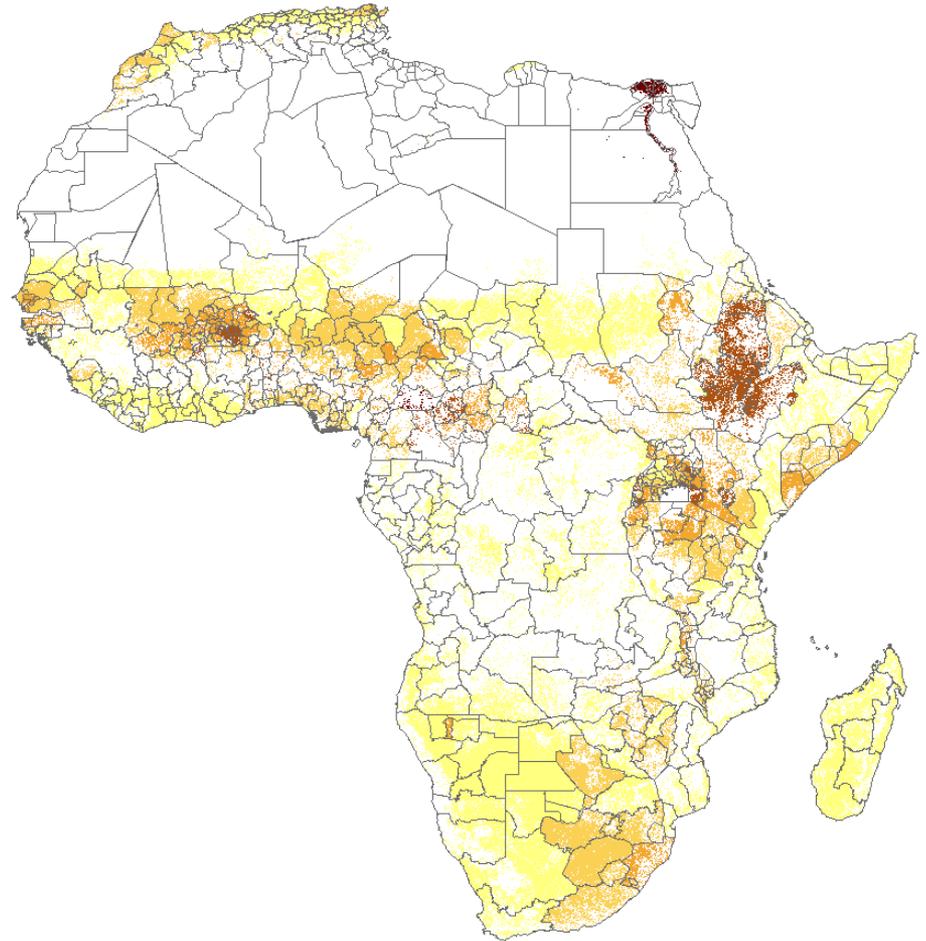
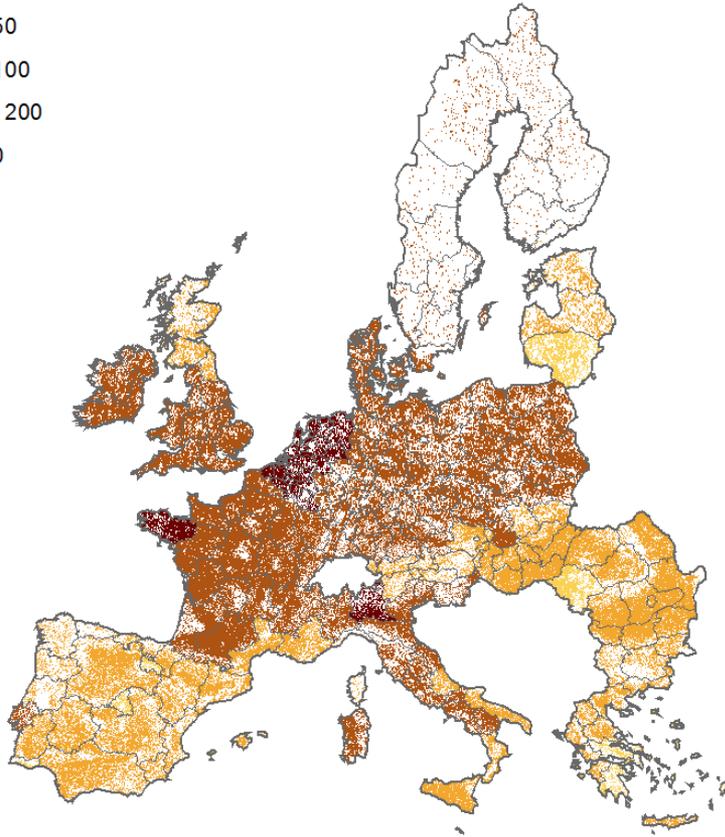
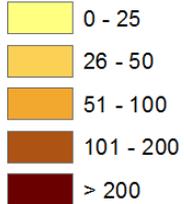


1 kg of oil crop



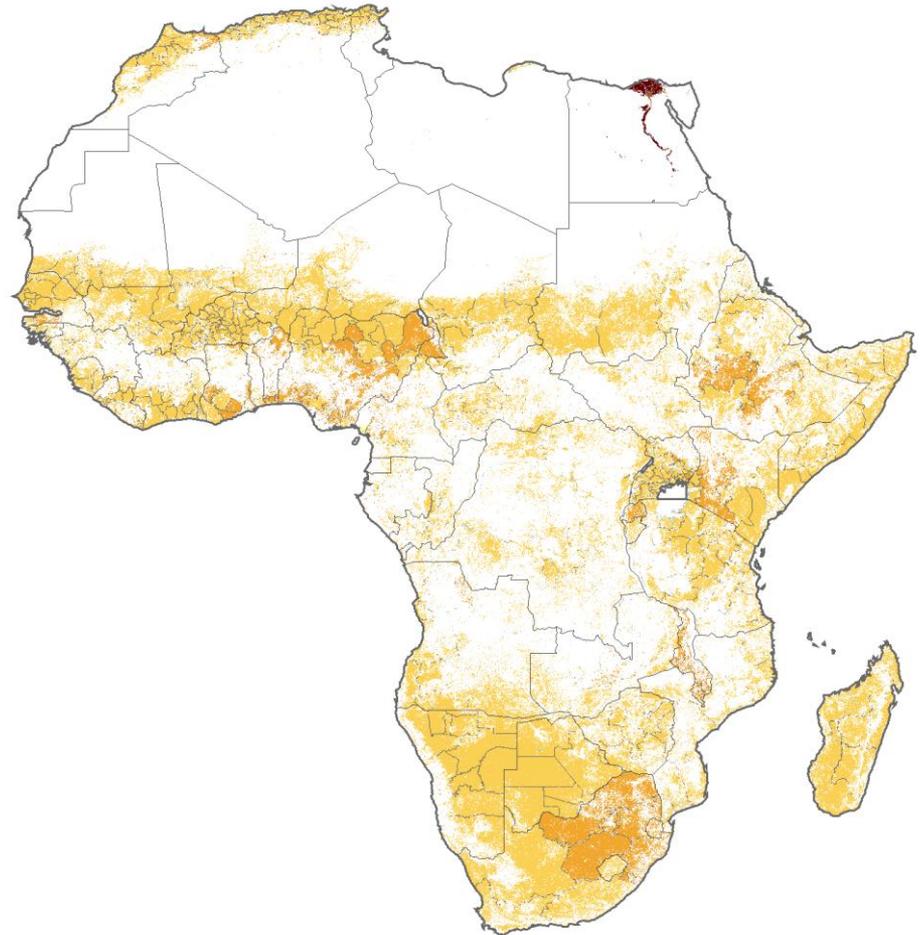
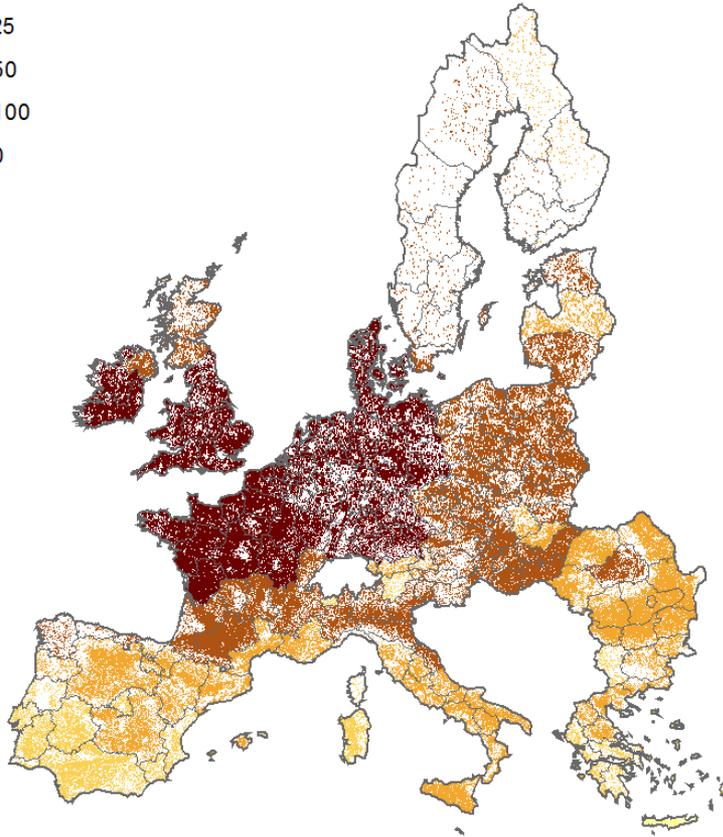
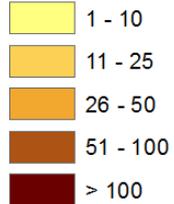
Total soil N input

N input [kg N/ha]



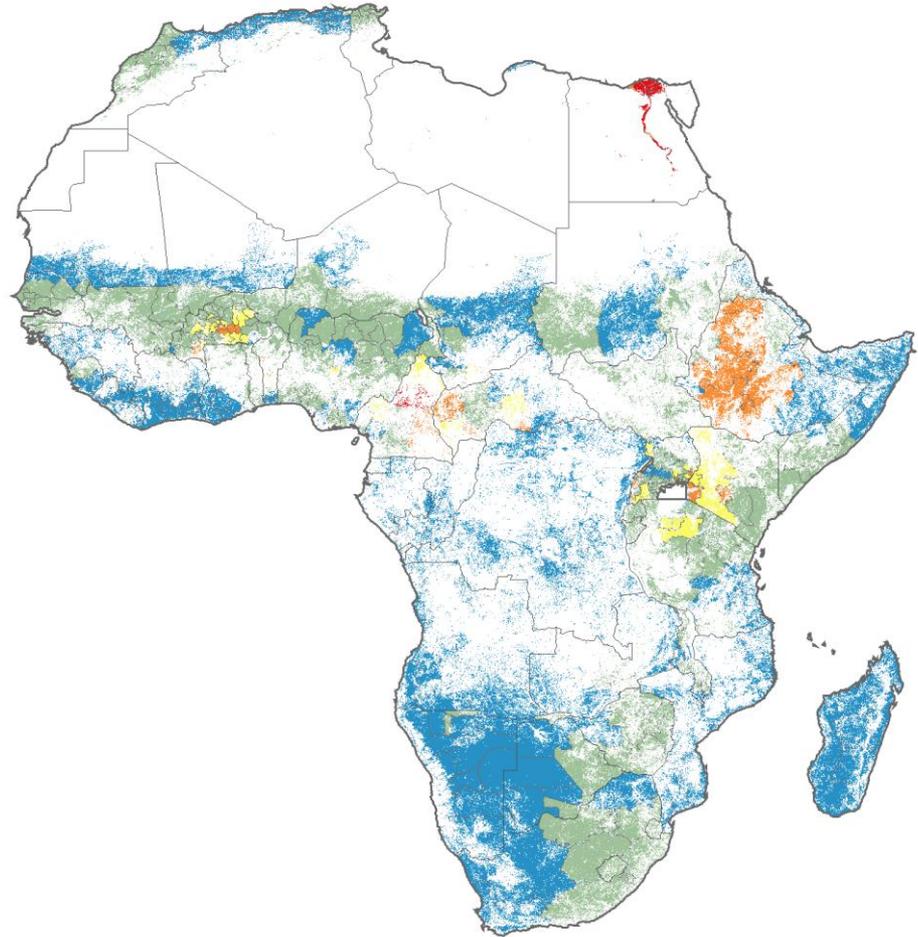
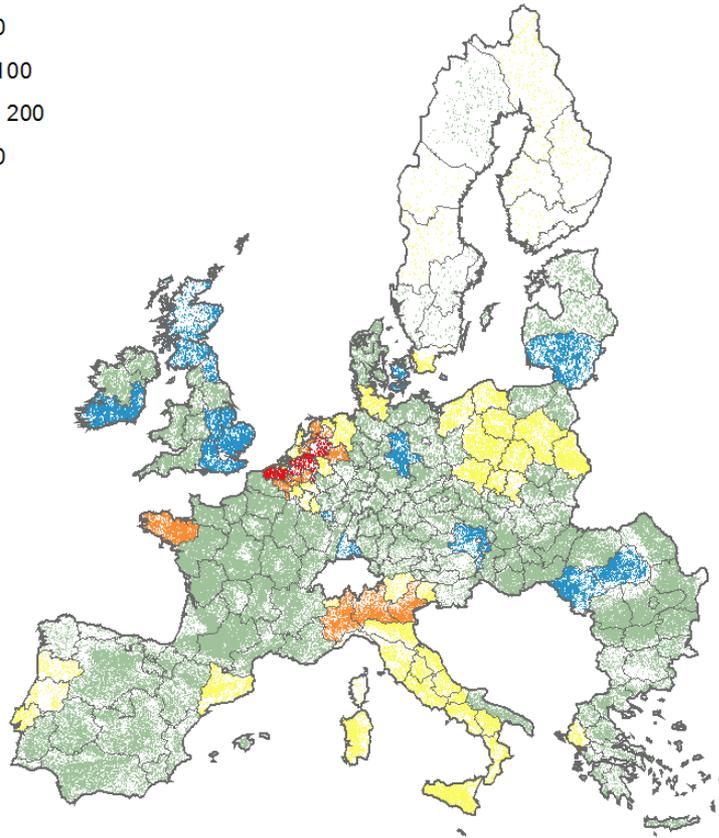
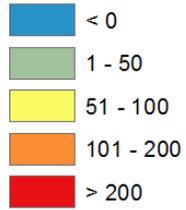
Harvested crop removal

Harvested crop [kg N/ha]



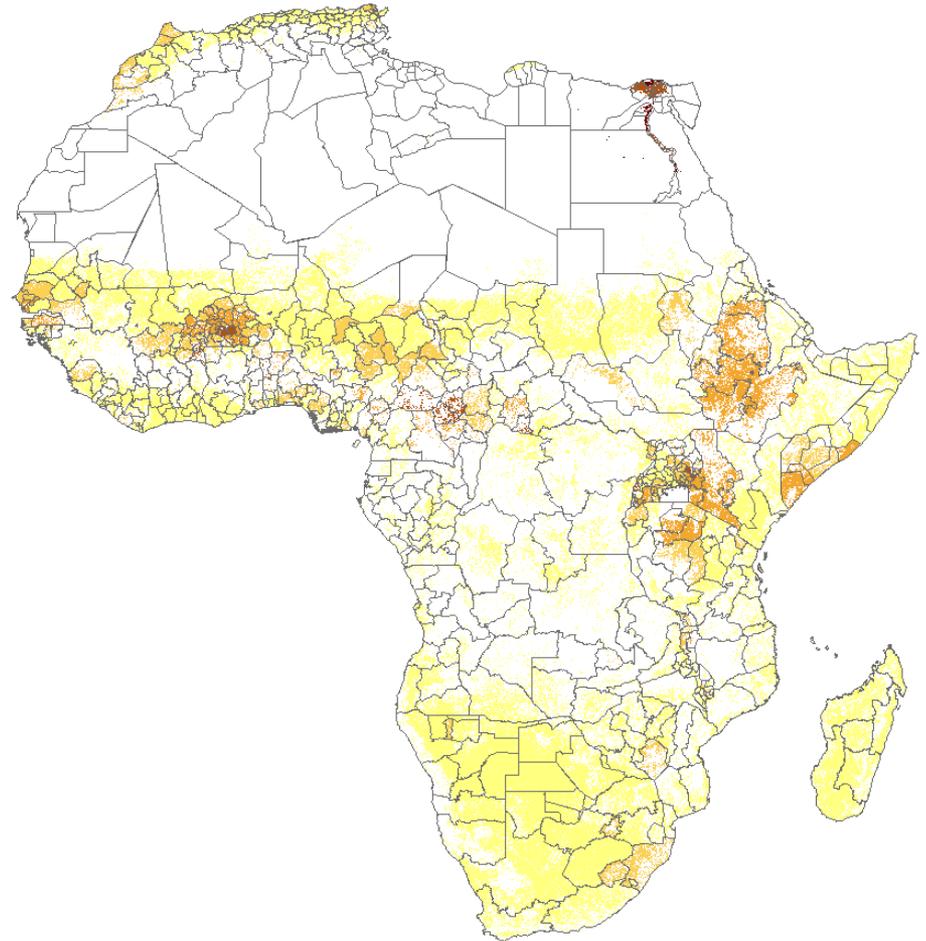
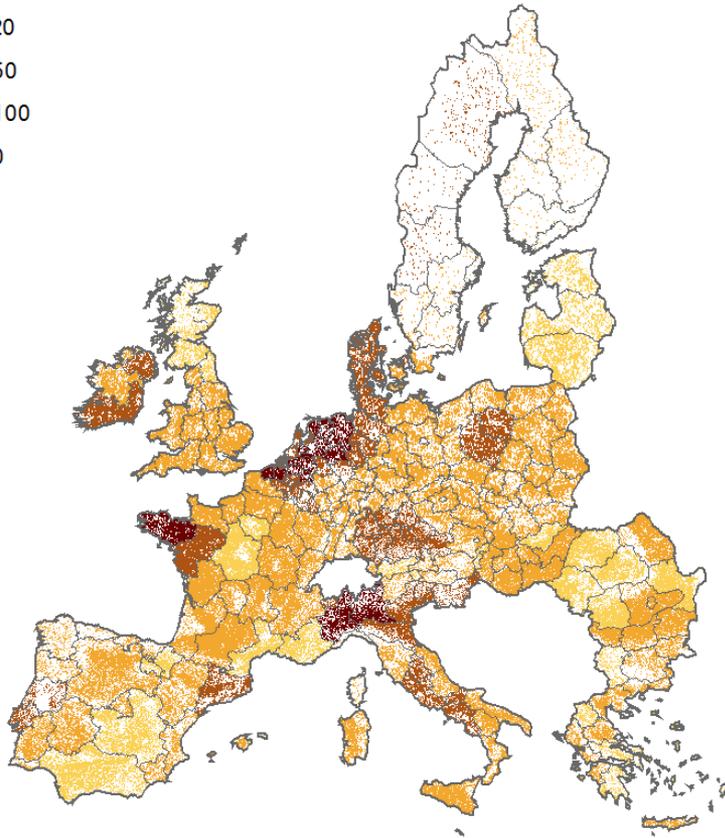
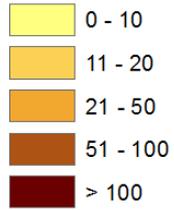
Soil N surplus

N surplus [kg N/ha]



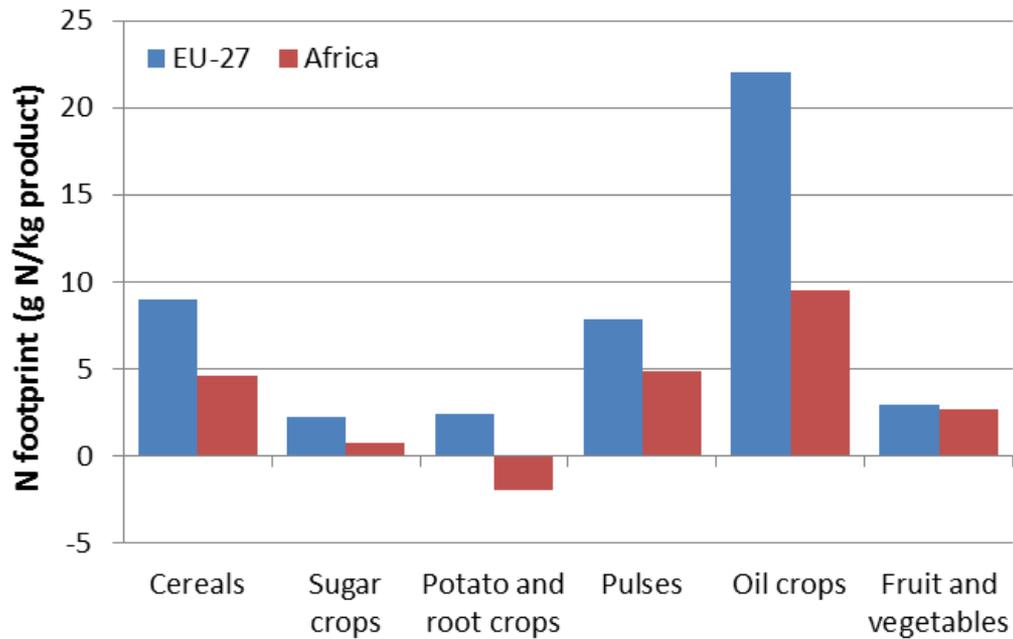
Reactive N emissions

Reactive Nitrogen emission [kg N/ha]

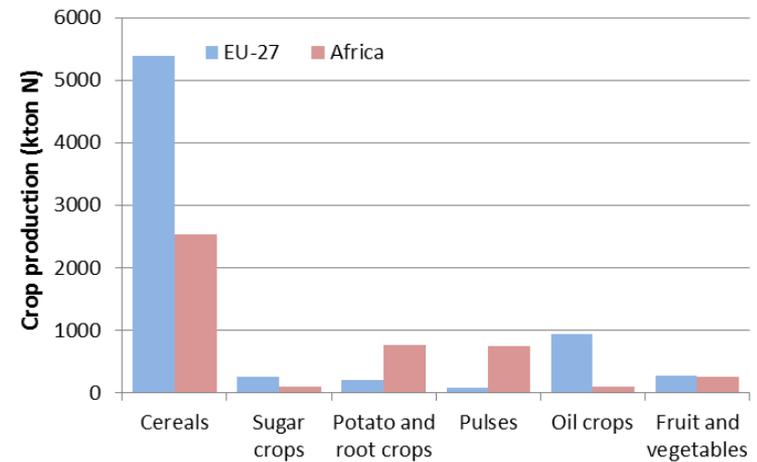


N footprint crop commodities

N footprint

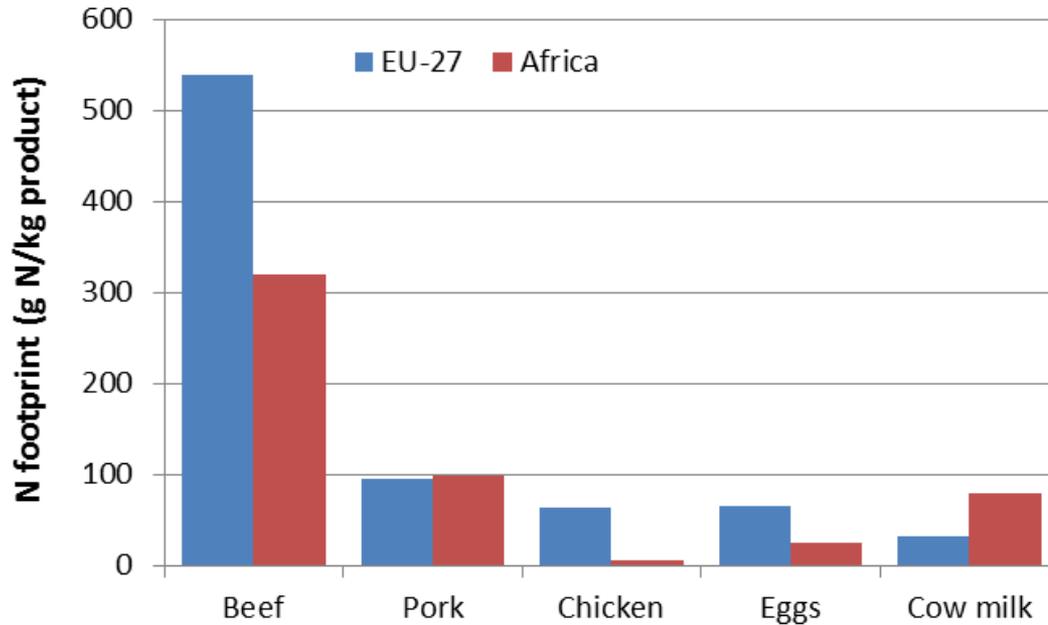


Crop production

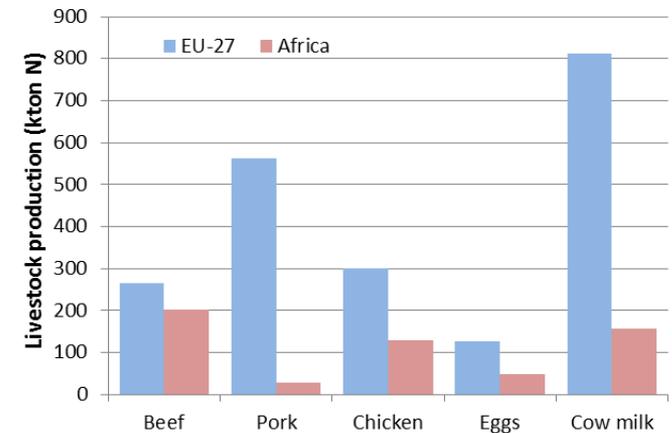


N footprint livestock commodities

N footprint

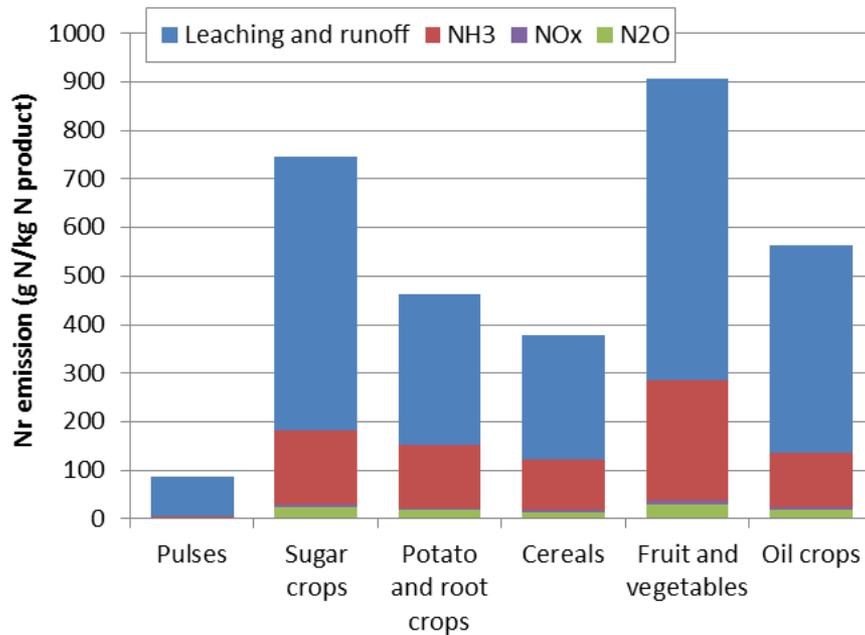


Livestock production

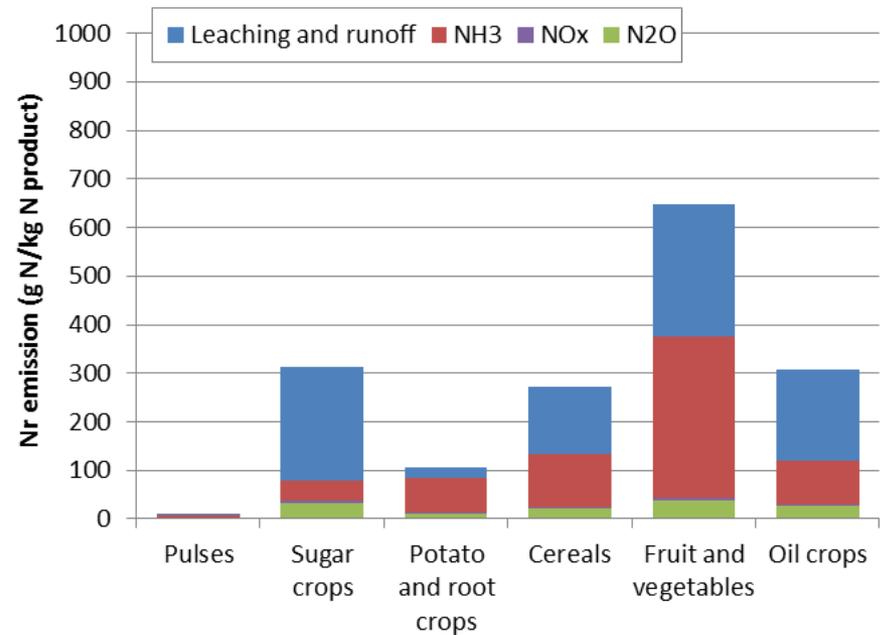


Nr emissions per crop commodity

EU-27

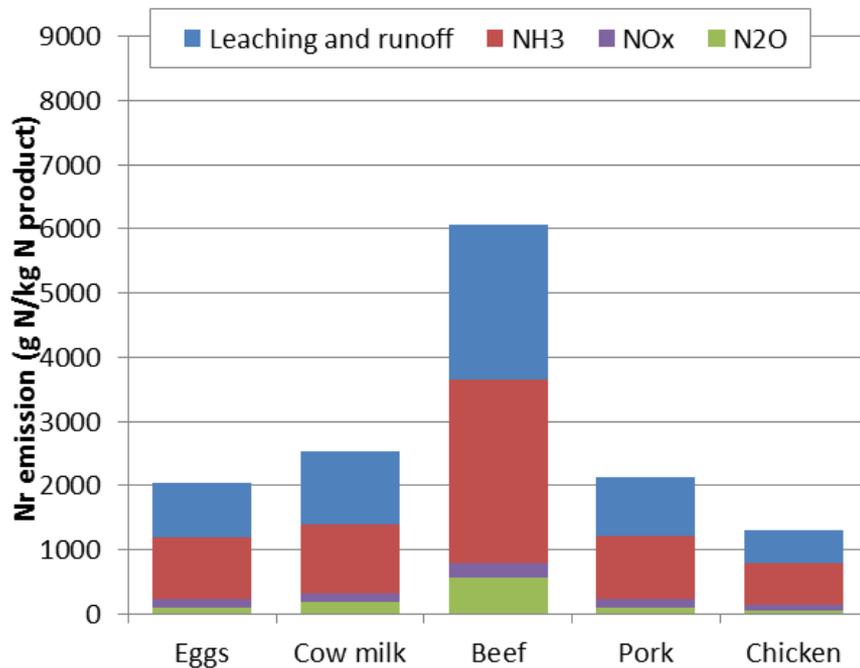


Africa

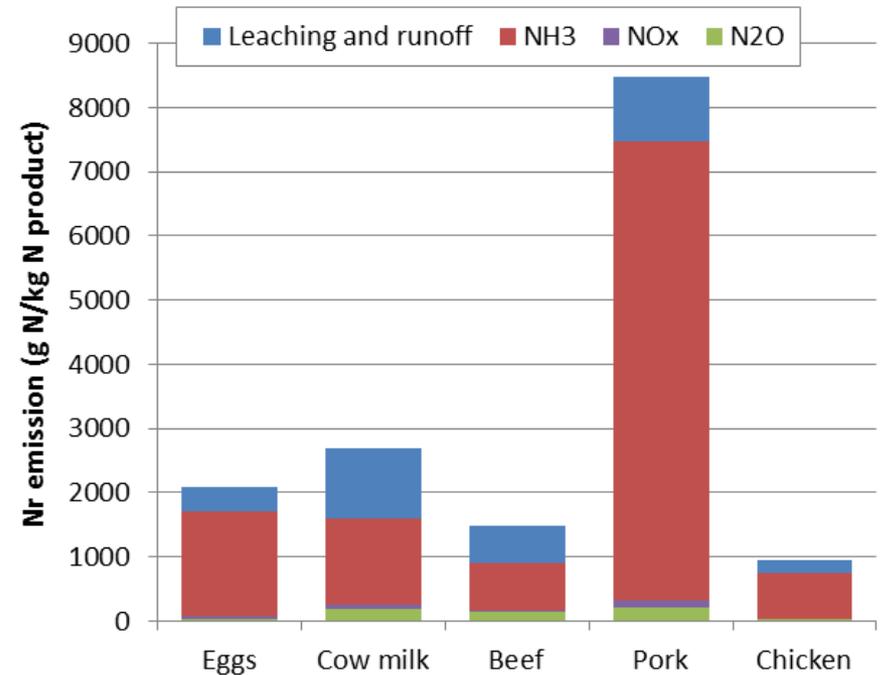


Nr emissions per livestock commodity

EU-27



Africa



Discussion

- Substantial uncertainties, especially for Africa:
 - Input data (e.g. grassland yield)
 - Allocation of feed to livestock species
 - Allocation of manure and fertilizer to different crops
 - Nitrogen content crops
- Non-ruminants have lower N footprint due to better feed conversion
- N footprint based on inputs not necessarily same as N footprint reactive N emissions

Conclusions

- Large differences in the N footprint between food commodities, with plant-based commodities having relatively low N losses and livestock products much higher N losses
- N footprint for most food commodities lower in Africa due to very low inputs, however, N_r emissions about equal
- N footprint of food consumption more determined by diet choices than region of food production

Thank you



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