Research in organic food and farming as a tool for providing public goods

Jørgen E. Olesen



Ministry of Food, Agriculture and Fisheries
Danish Institute of Agricultural Sciences

Public goods in a political context (sustainability)

Reduced reliance on fossil fuels (EU biofuel directive)

Water quantity and quality (EU Nitrates Directive, Water Framework Directive)

Biodiversity (EU Habitat Directive, Natura 2000)

Soil quality (EU Soils Directive)

Greenhouse gases (UNFCCC – Kyoto Protocol)

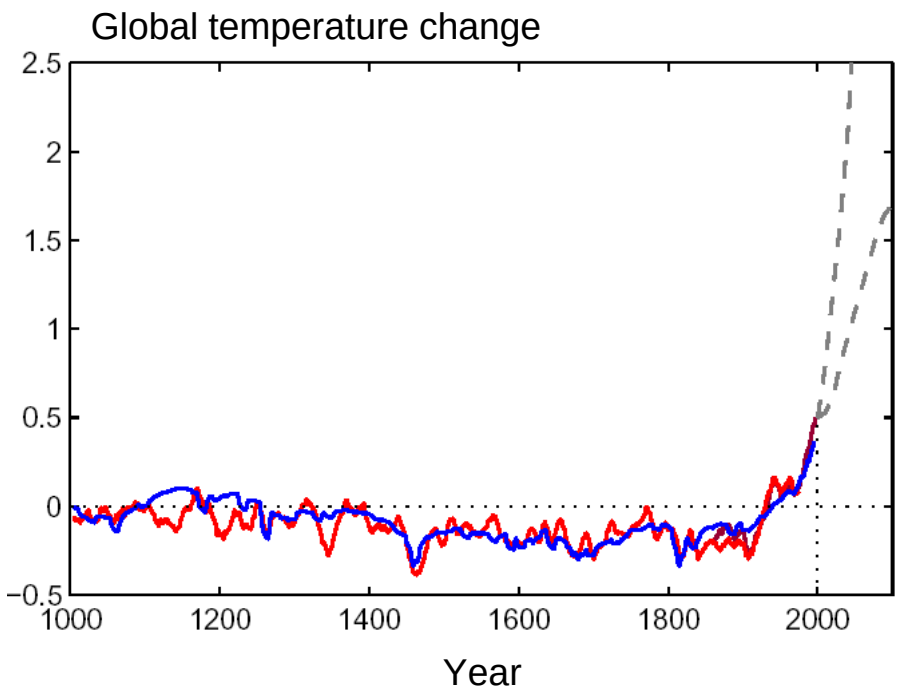
Consequence is need to reduce emissions from agricultural activities



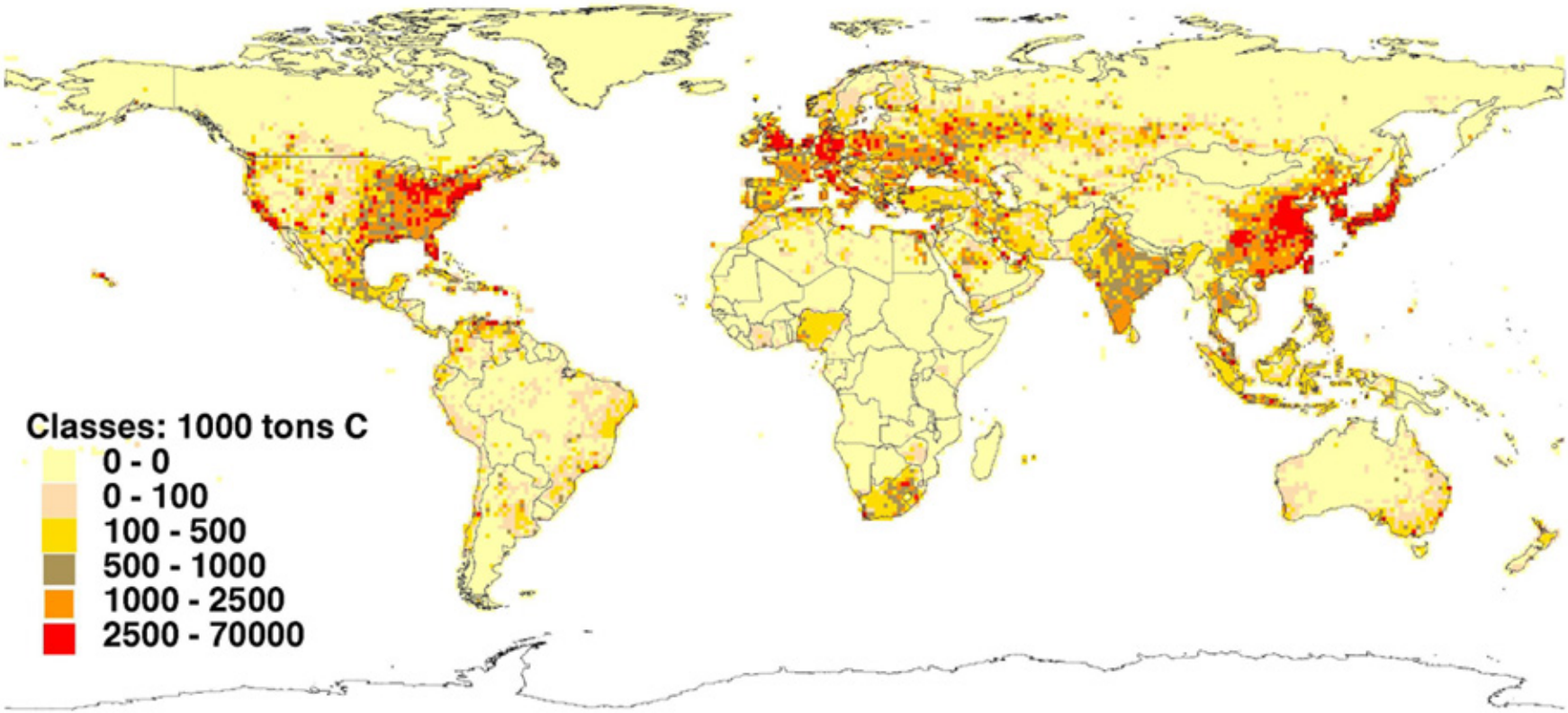
Public goods – beyond food and fibre

- Substitution of fossil fuels
- Preserving resources (soils and water)
- Protecting environment (climate and biodiversity)

Globalisation of environmental problems and ressource use issues

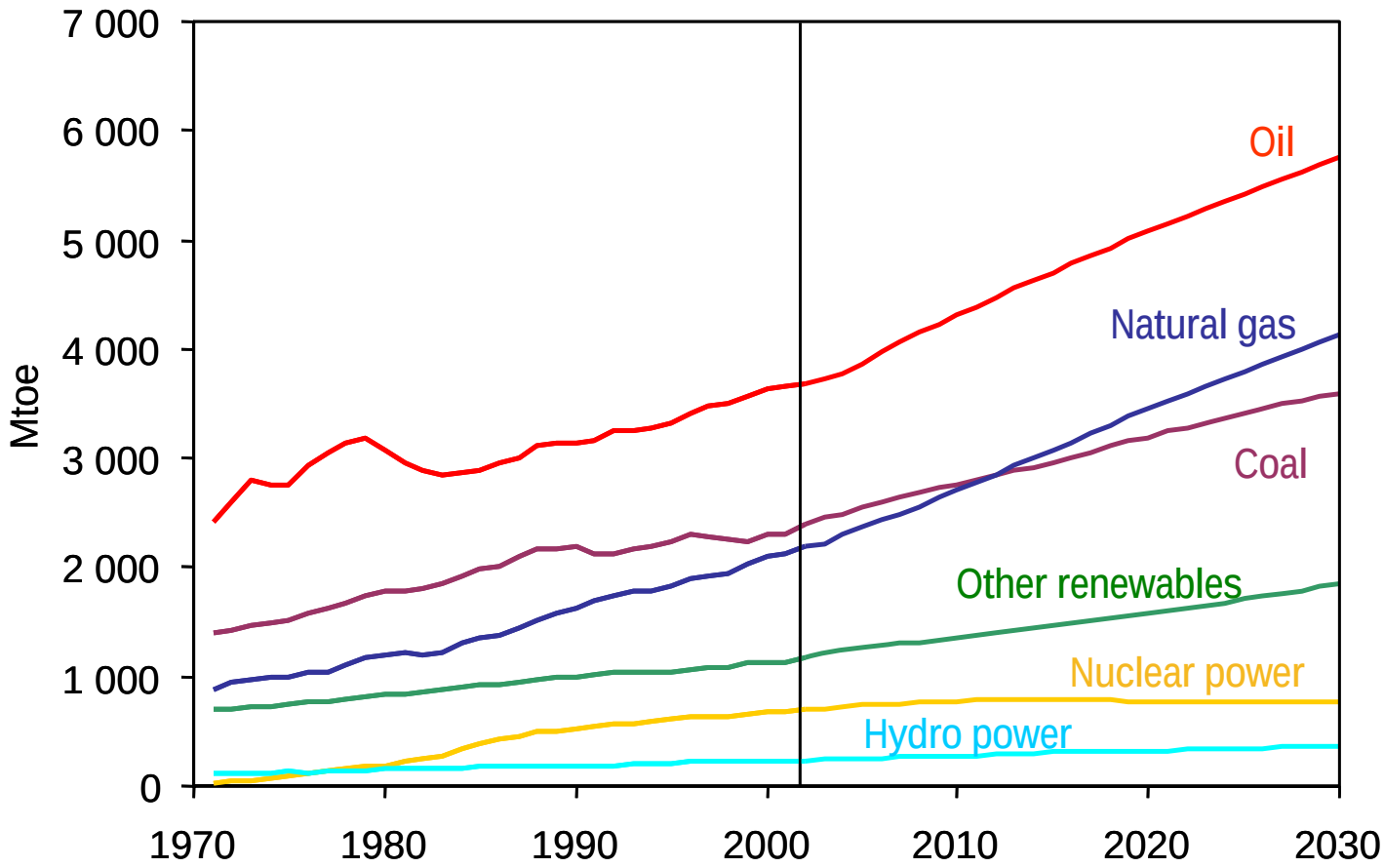


Fossil fuel burning



http://cdiac.esd.ornl.gov/epubs/ndp/ndp058a/ndp058a.html

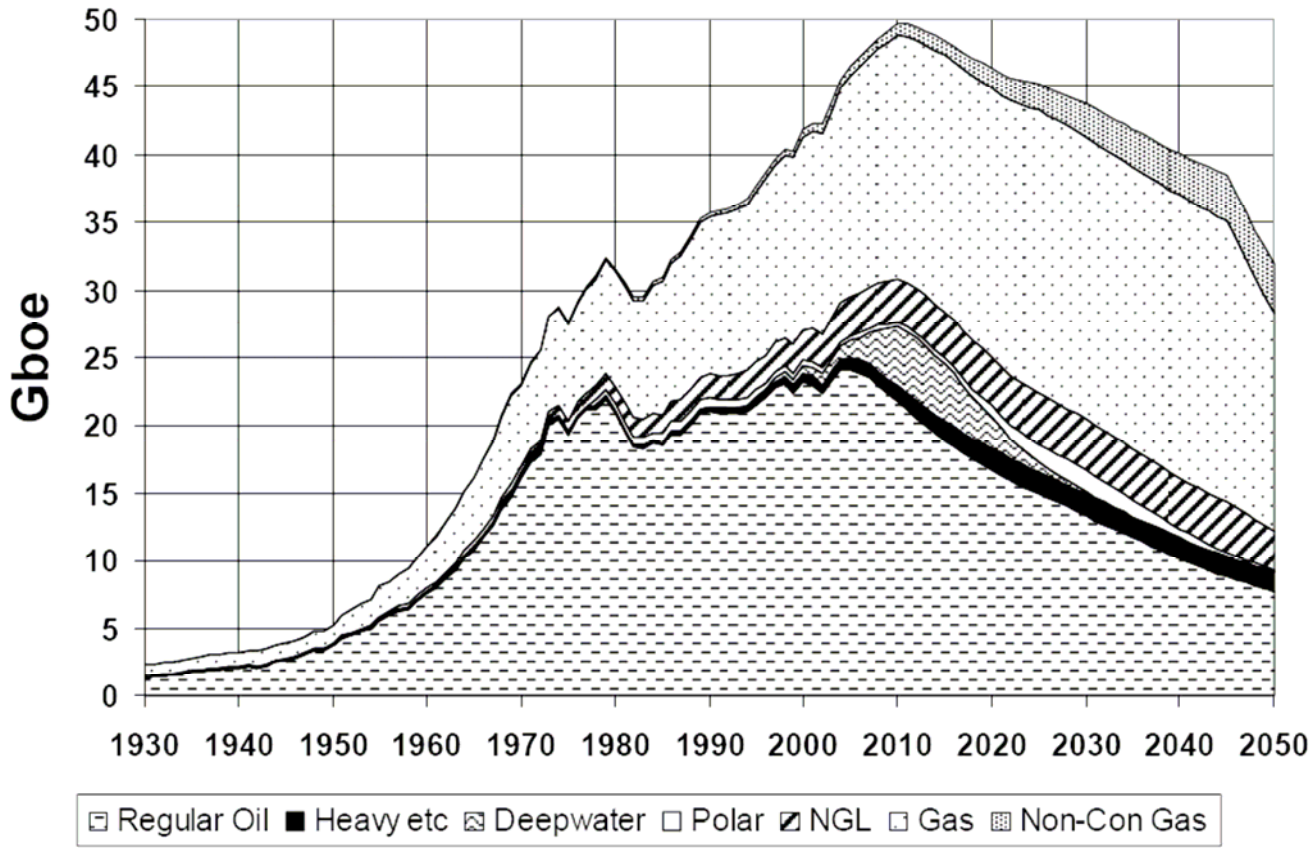
World primary energy demand



Fossil fuels account for almost 90% of the growth in energy demand between now and 2030

IEA (2004)

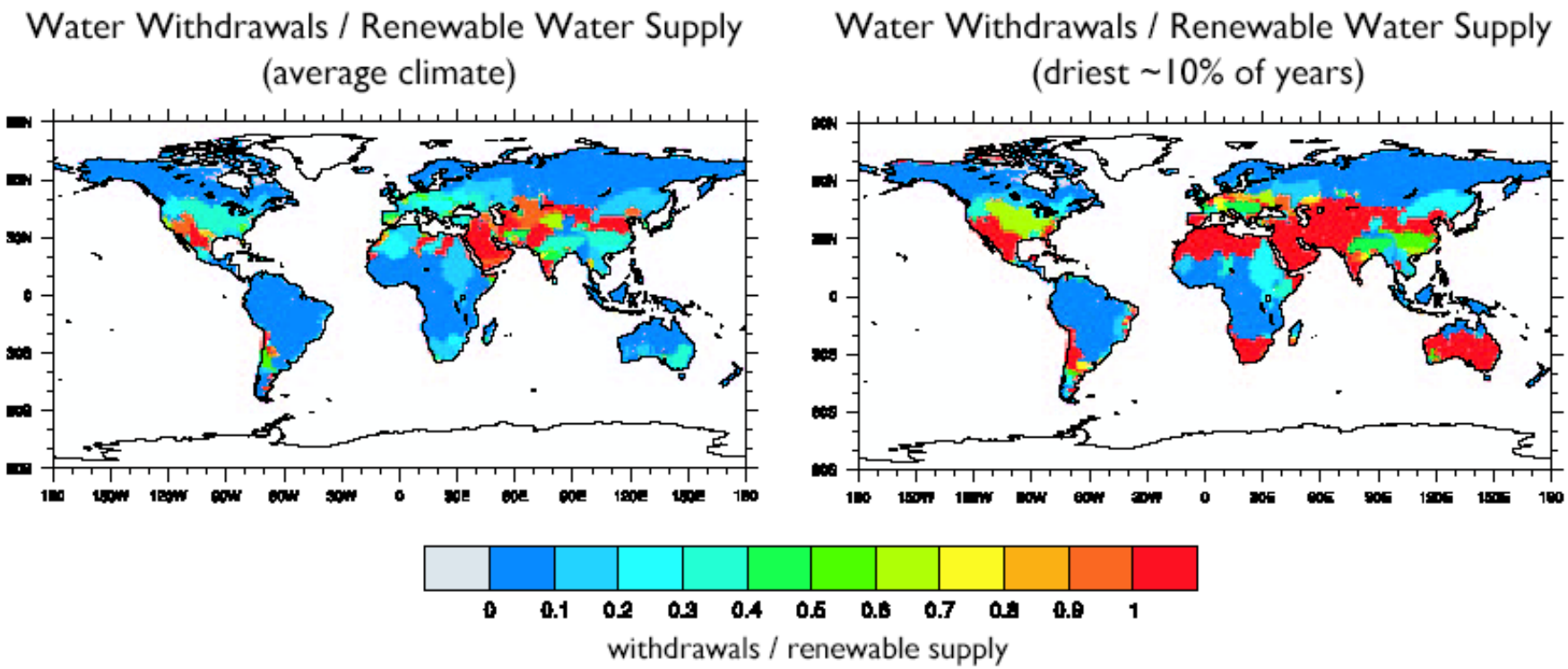
The world is running out of cheap oil



Energy use and production in organic farming

- Modern society is addicted to cheap energy
- So is current organic farming, with savings from fertiliser and pesticide production often being reduced by need for mechanical weed control
- Potentials for energy production in organic farming without sacrificing food production:
  - Plant residues, green manures, cover crops (biogas, bioethanol)
  - Perennial crops in shelterbelts (bioethanol, Combined Heat and Power generation)
- Research is needed on how to integrate energy production and organic farming

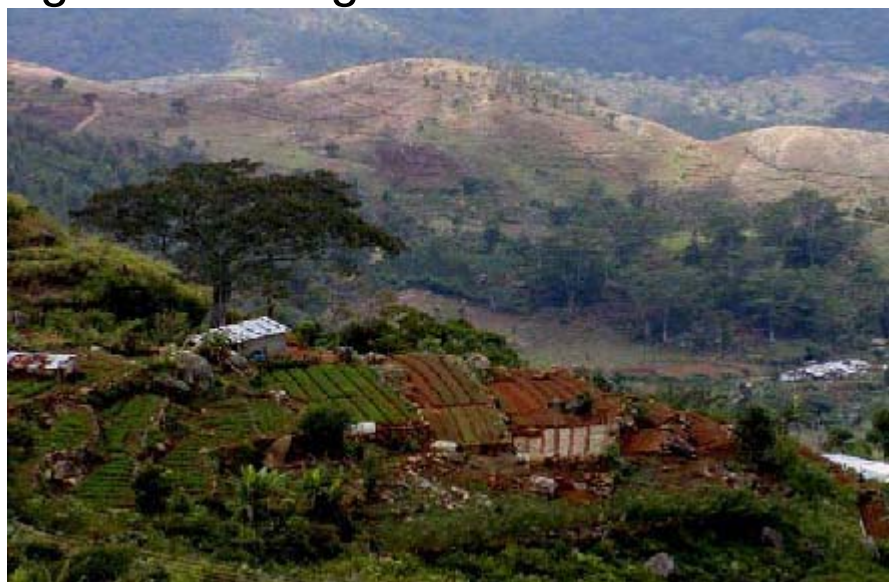
Preserving resources – water usage



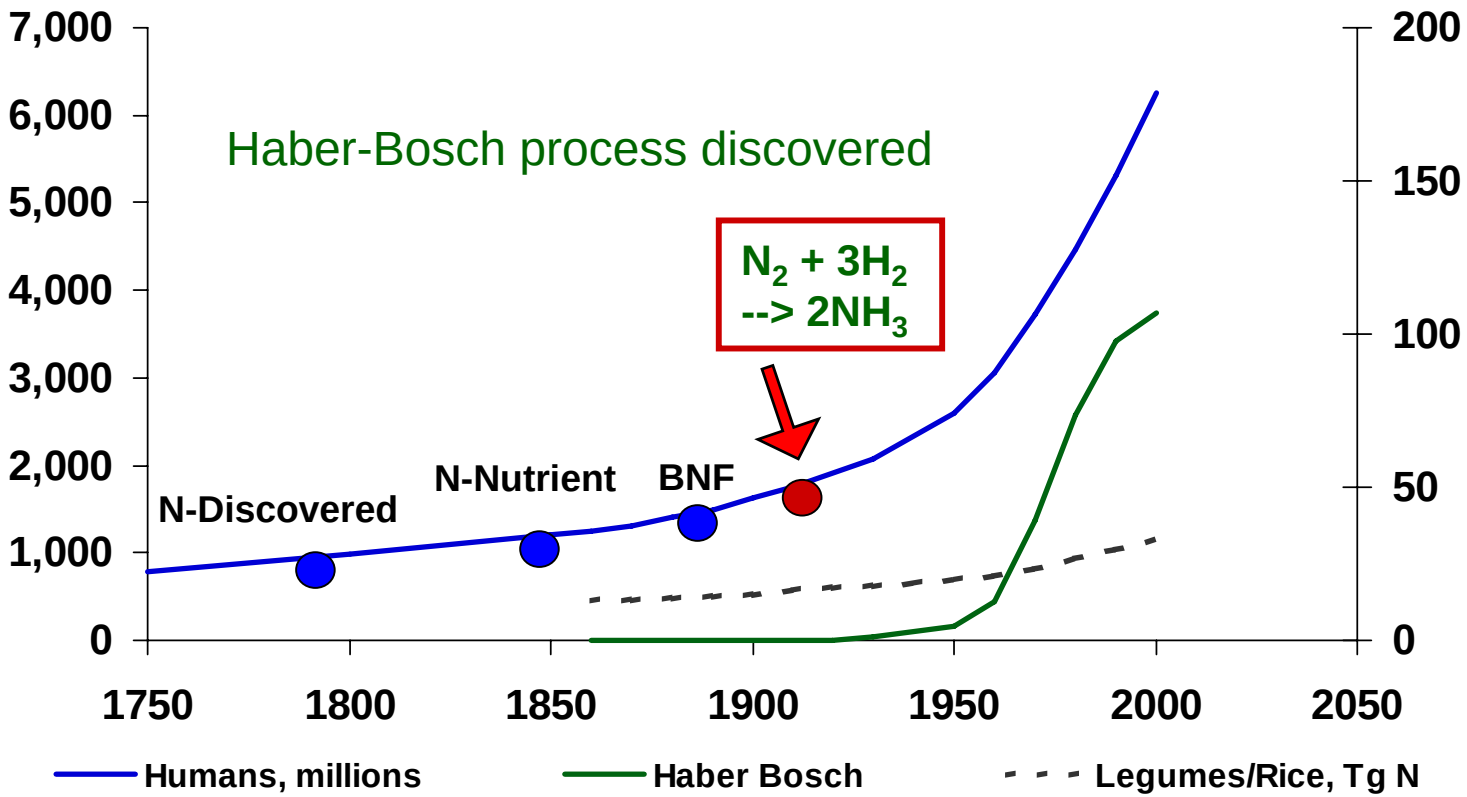
Agriculture is a major user of water.
Irrigation of arable land: e.g. East Asia 29% and South Asia 41%.
Need to increase water use efficiencies, also in organic farming.

Preserving resources - soils

- Degradation and loss of agricultural land arises mainly from soil erosion, salinization, waterlogging, and urbanisation.
- Loss of soil fertility arise from nutrient depletion, overcultivation, overgrazing, and soil compaction.
- Organic farming practices have a major focus on preserving fertility and may also have scope for reclaiming degraded lands.
- Need for particular focus in developing countries, where external inputs may be necessary, also in organic farming



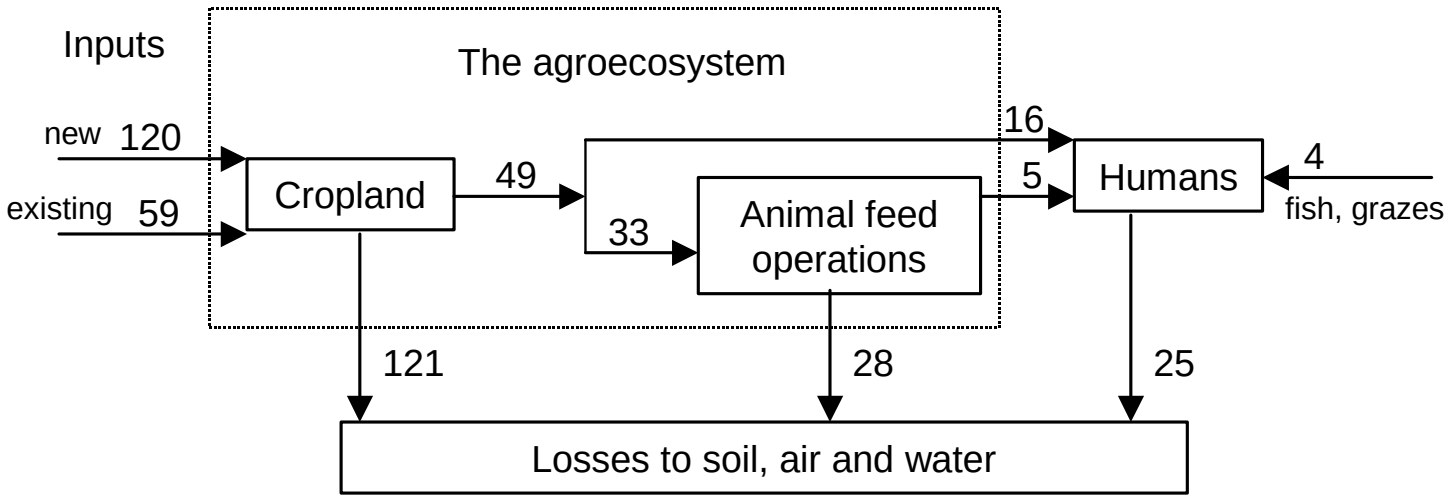
The history of nitrogen



The biosphere is gradually being saturated with reactive nitrogen

Galloway et al. (2002)

Global N flows (importance of agriculture)

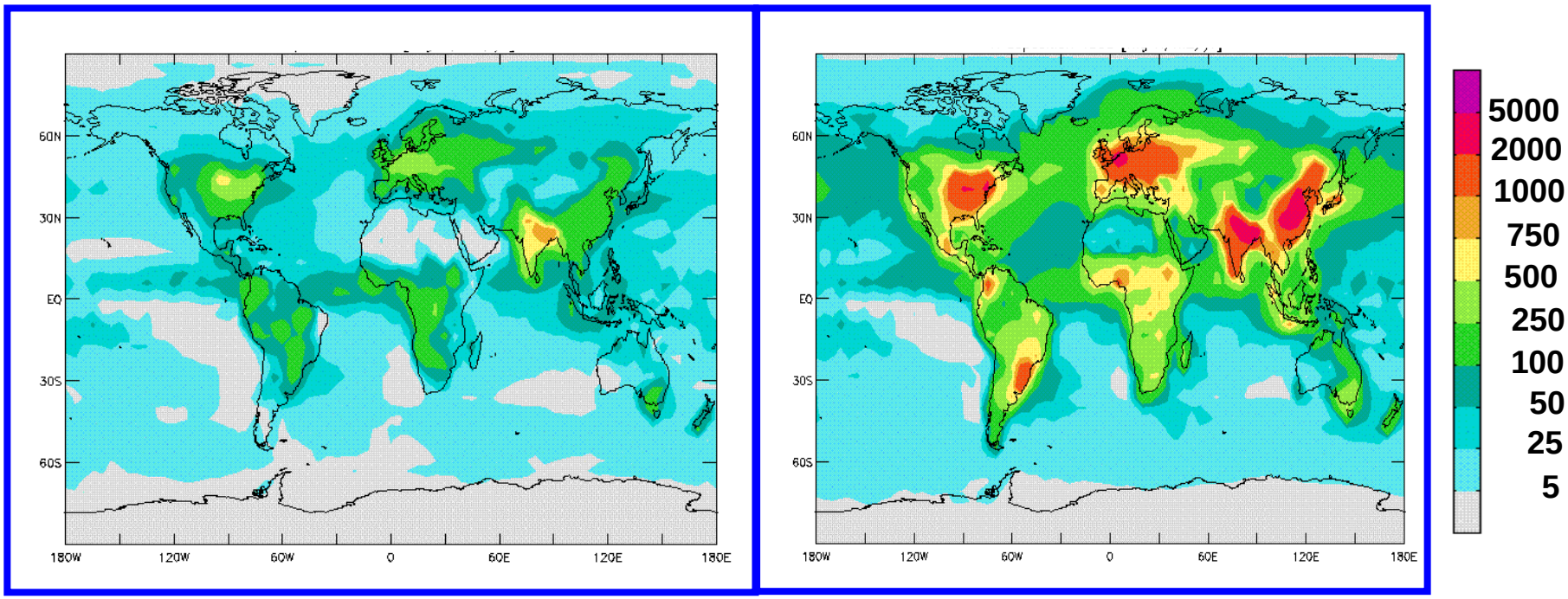


N efficiency of crop production: 27%
N efficiency of agriculture: 12%

Smil (2002)

Atmospheric nitrogen deposition

mg N/m^2/yr



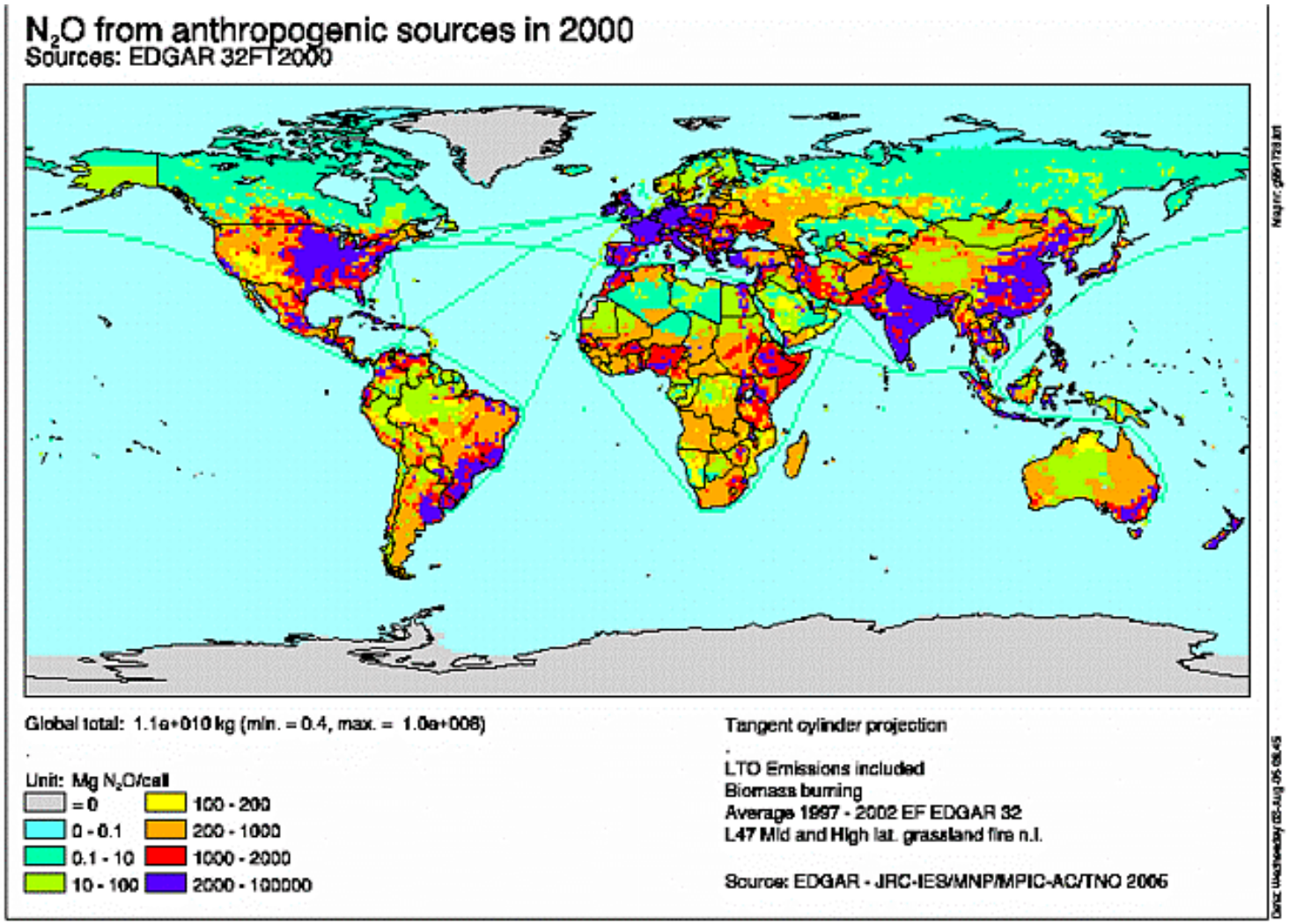
1860 **1993**

Large impacts on biodiversity

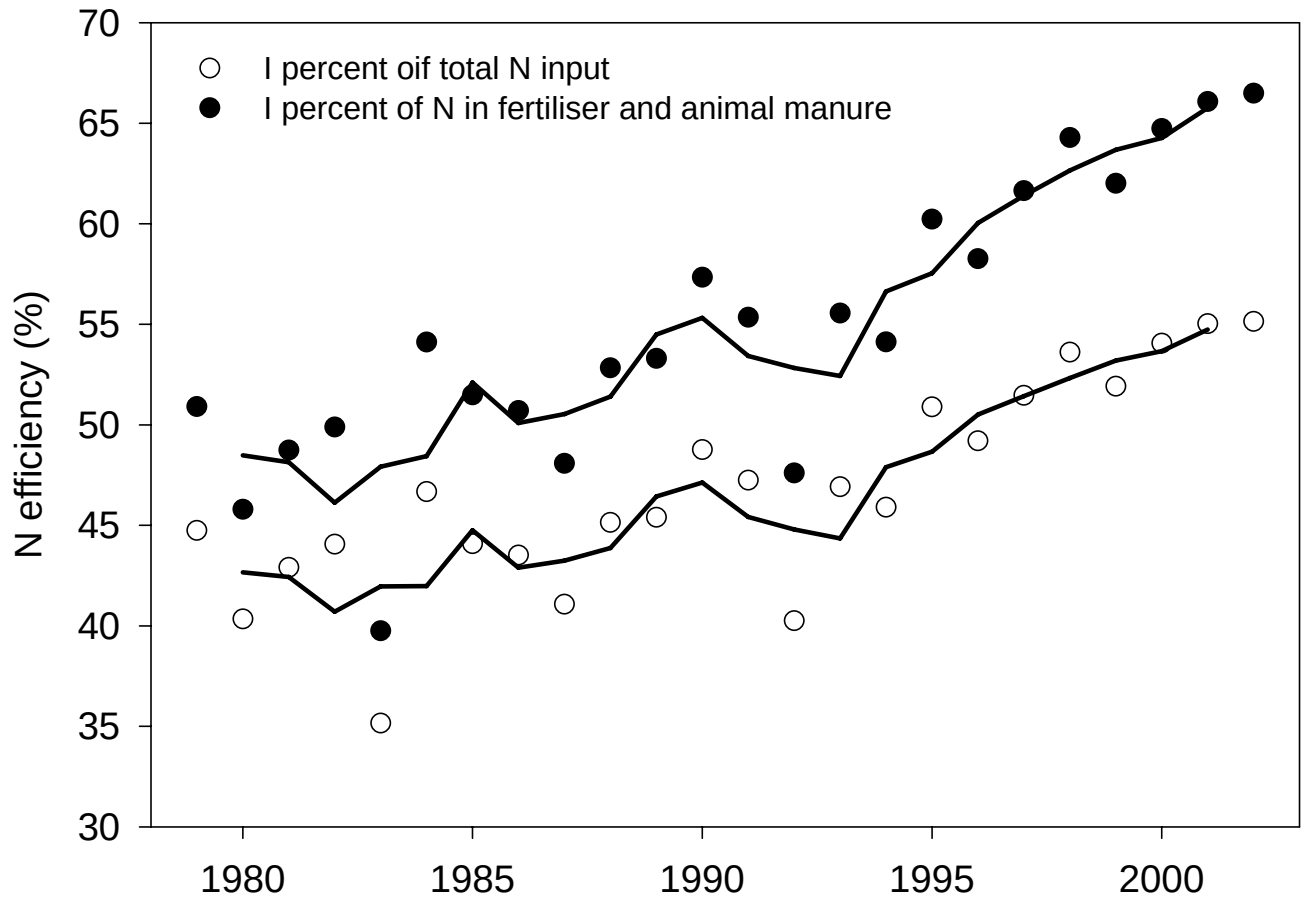
Ministry of Food, Agriculture and Fisheries
Danish Institute of Agricultural Sciences

Galloway et al. (2003)

Nitrous oxide (N_2O) is a major greenhouse gas



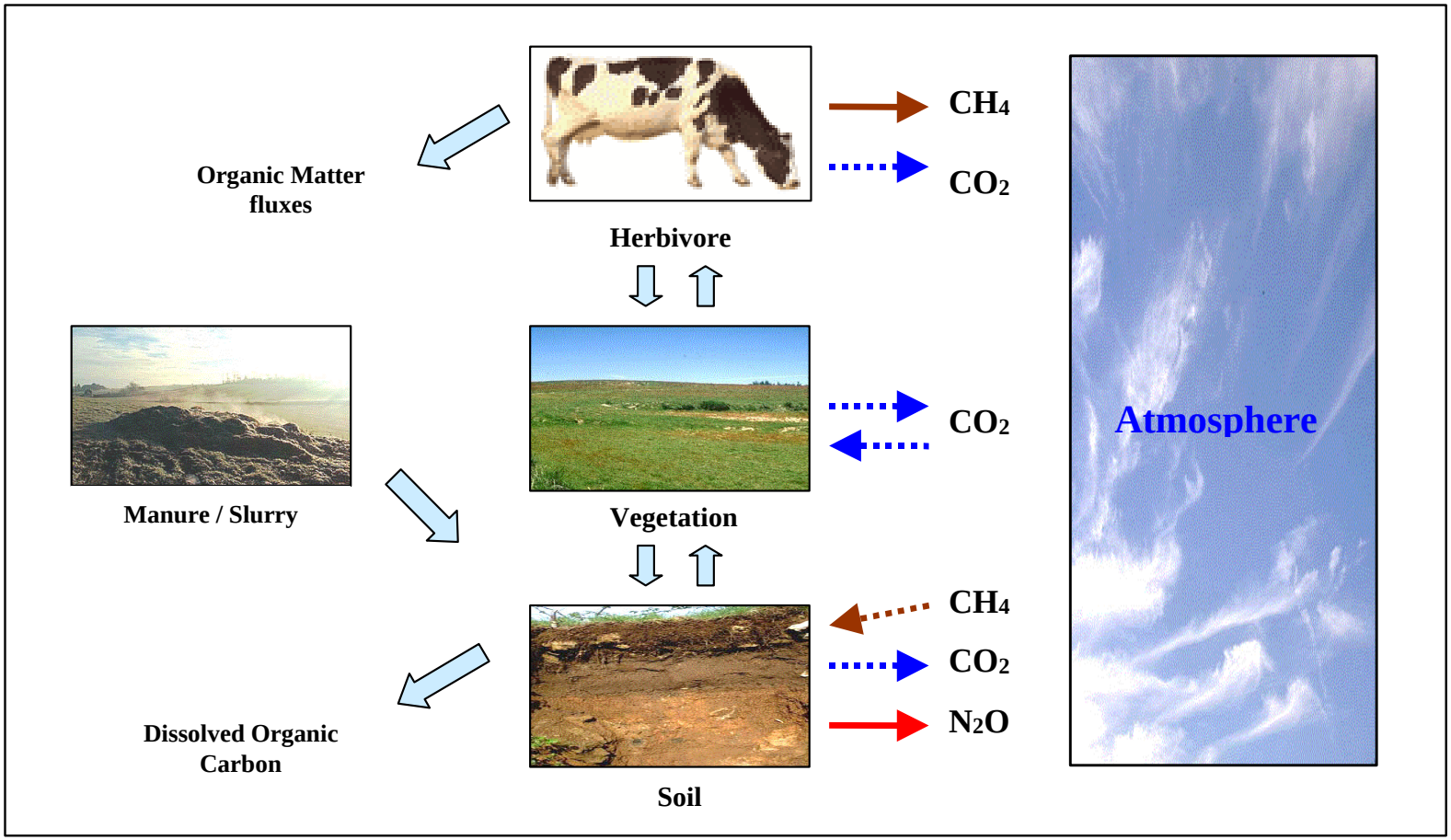
N efficiency in Danish agriculture has increased



Reasons for increasing N use efficiency in Denmark

- Limits on fertiliser use
- Lower losses during manure storage
- Better use of N in manures
- Better use of residual effects of previous crops, in particular grassland
- Use of catch crops
- Many of these aspects were investigated in projects under the research programmes for organic farming

Greenhouse gas emissions and C/N flows

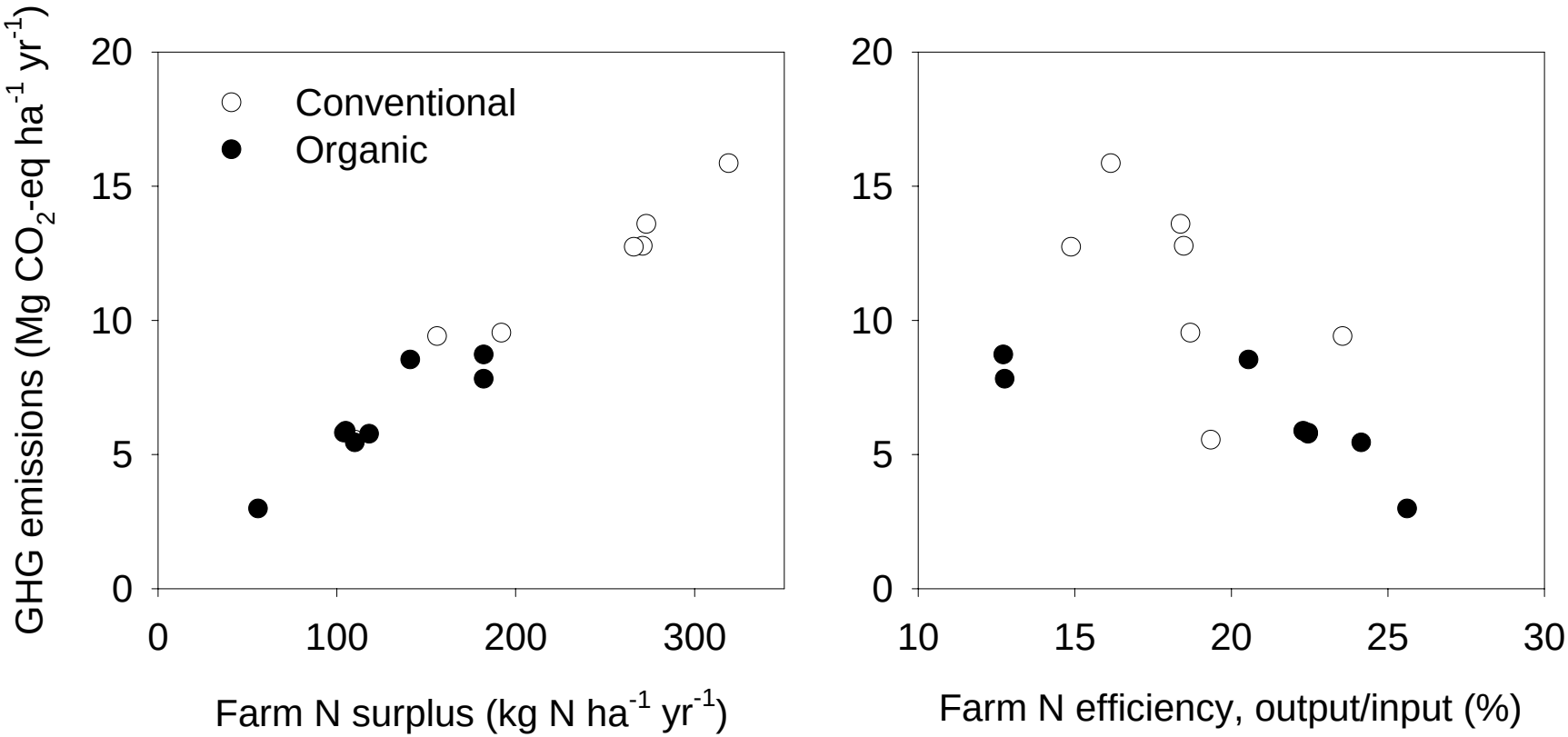


Organic farming and greenhouse gas emissions

- Increased carbon storage from green manures and grasslands
- Biological N fixation may reduce direct N_2O emissions, but uncertain effects from incorportation
- A low proportion of concentrates in cattle feed increases methane production
- Need to explore measures in organic farming for reducing GHG emissions

Greenhouse gas emissions from European dairy farms

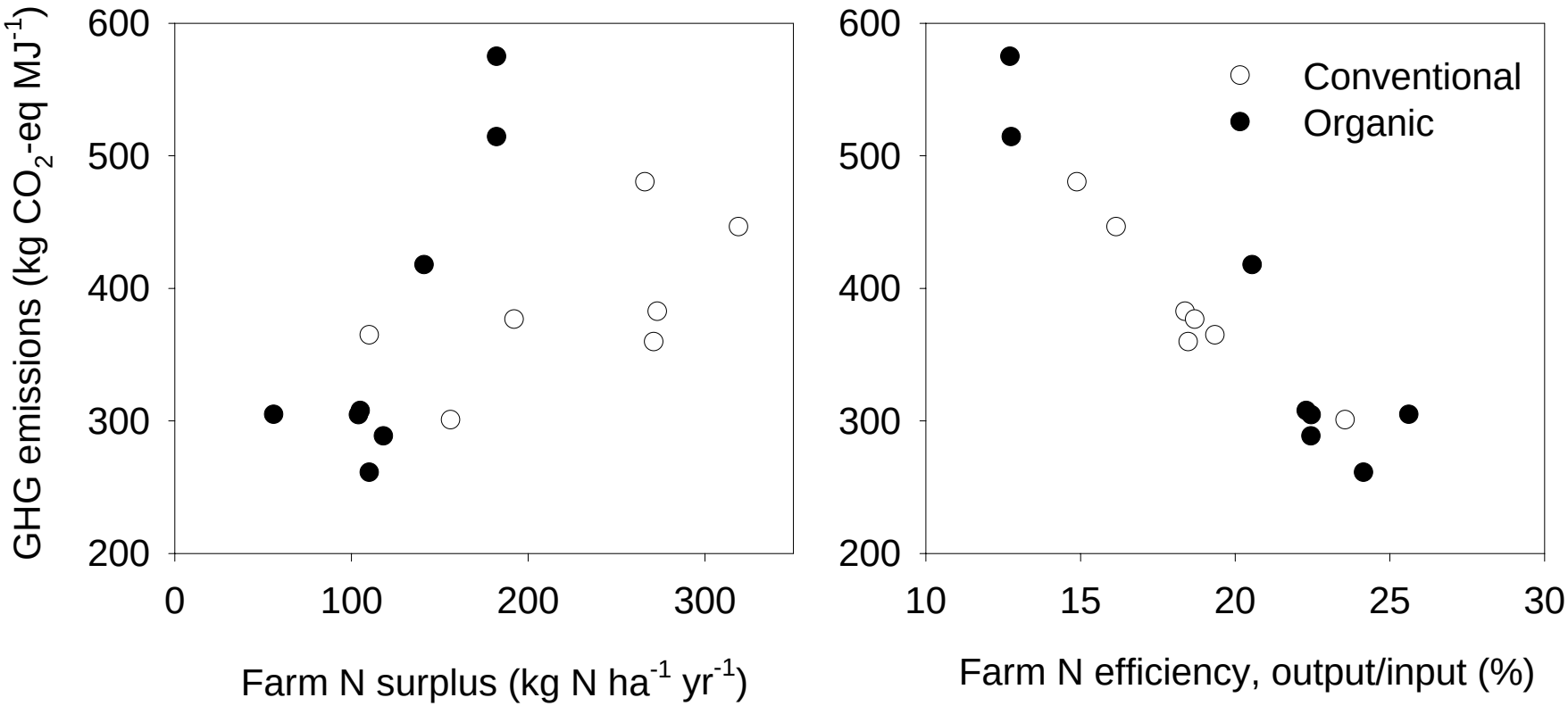
Emissions per area



Ministry of Food, Agriculture and Fisheries
Danish Institute of Agricultural Sciences

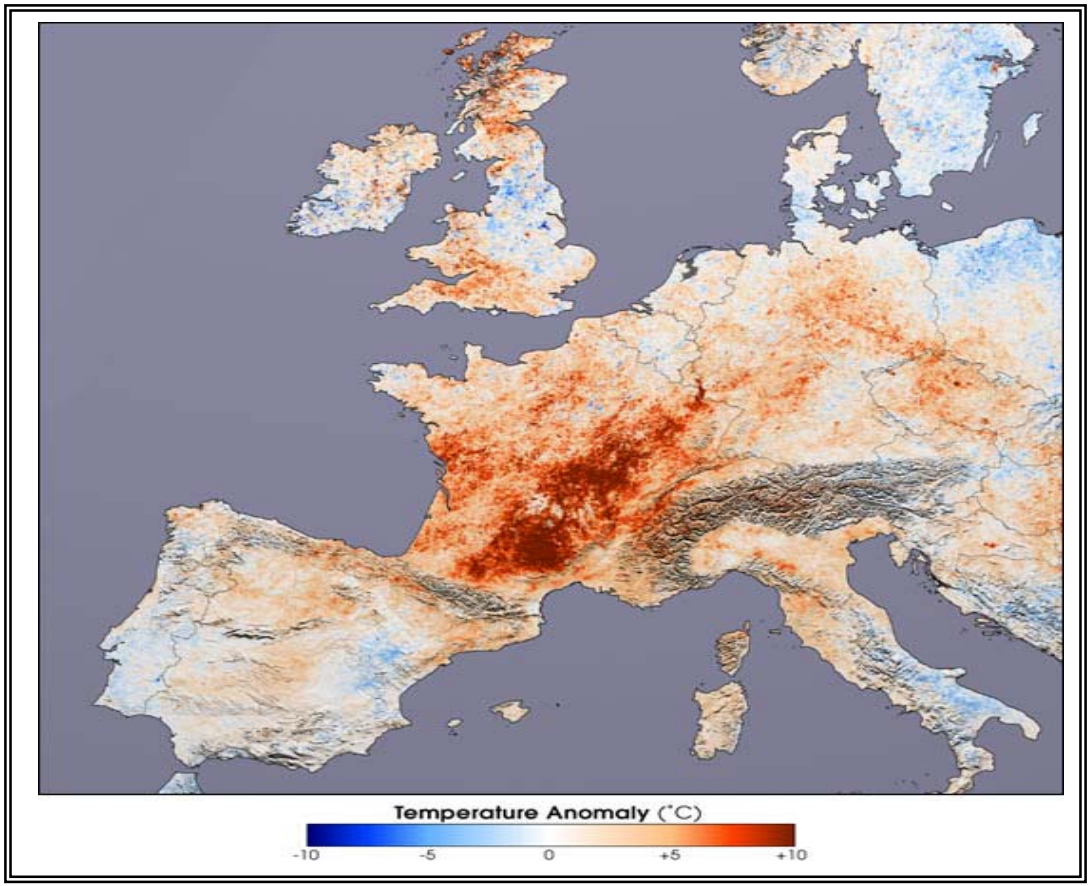
Olesen et al. (2006)

Emissions per unit product exported (in energy terms)



Olesen et al. (2006)

The 2003 summer heat wave in Europe



Global warming will increase climatic variability (more frequent heatwaves)
Will organic farming be more resilient to climatic variability?

Ministry of Food, Agriculture and Fisheries
Danish Institute of Agricultural Sciences

MODIS data

Challenges and perspectives

- Organic farming is very diverse with management practices that are locally adapted (landscape, climate, soil, pre-history)
- Need to better understand the fluxes of water, carbon and nitrogen in organic systems, and how management interacts with natural regulation systems
- Research should focus on measures that can reduce agricultural emissions, while providing high quality foods, energy self-sufficiency and resilience to environmental change.
- Research in organic farming has large spin-off effects on sustainability of conventional farming systems