

# ICROFS' Knowledge synthesis on

## "The contribution of organic farming to public goods"

Oct. 2015

# Økologiens betydning for samfundsgoder

Vidensyntese 2015





Tyttebær  
Lingonberry



Sommersar  
Summer savory



Ramsløg  
Ramson



Ribs  
Redcurrant

# MAFFRA – Multicomponent antibacterial feed additive for weaning piglets against intestinal diseases



- Gastro-intestinal infections in pigs reduce the welfare of the animals, increase the mortality and result in a high consumption of antibiotics, zinc and copper.
- MAFFRA investigates the possibility of developing new plant-based remedies against gastro-intestinal problems in pigs.
- By mixing selected plant species with differing antibacterial mechanisms, the researchers expect to achieve an antibacterial cocktail effect that will make it more difficult for the bacteria to develop resistance.

# The four basic principles of organic agriculture

Endorsed by IFOAM, September 2005

## *Principle of* **HEALTH**

Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.

## *Principle of* **ECOLOGY**

Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.

## *Principle of* **FAIRNESS**

Organic Agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities.

## *Principle of* **CARE**

Organic Agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.



**Healthy soil**  
**Healthy crops**  
**Healthy livestock**  
**Healthy people**

Immunity and  
resilience

**Agro-ecology**  
**Diversity**  
**Recycling**

Sustainable  
and efficient  
use of natural  
capital

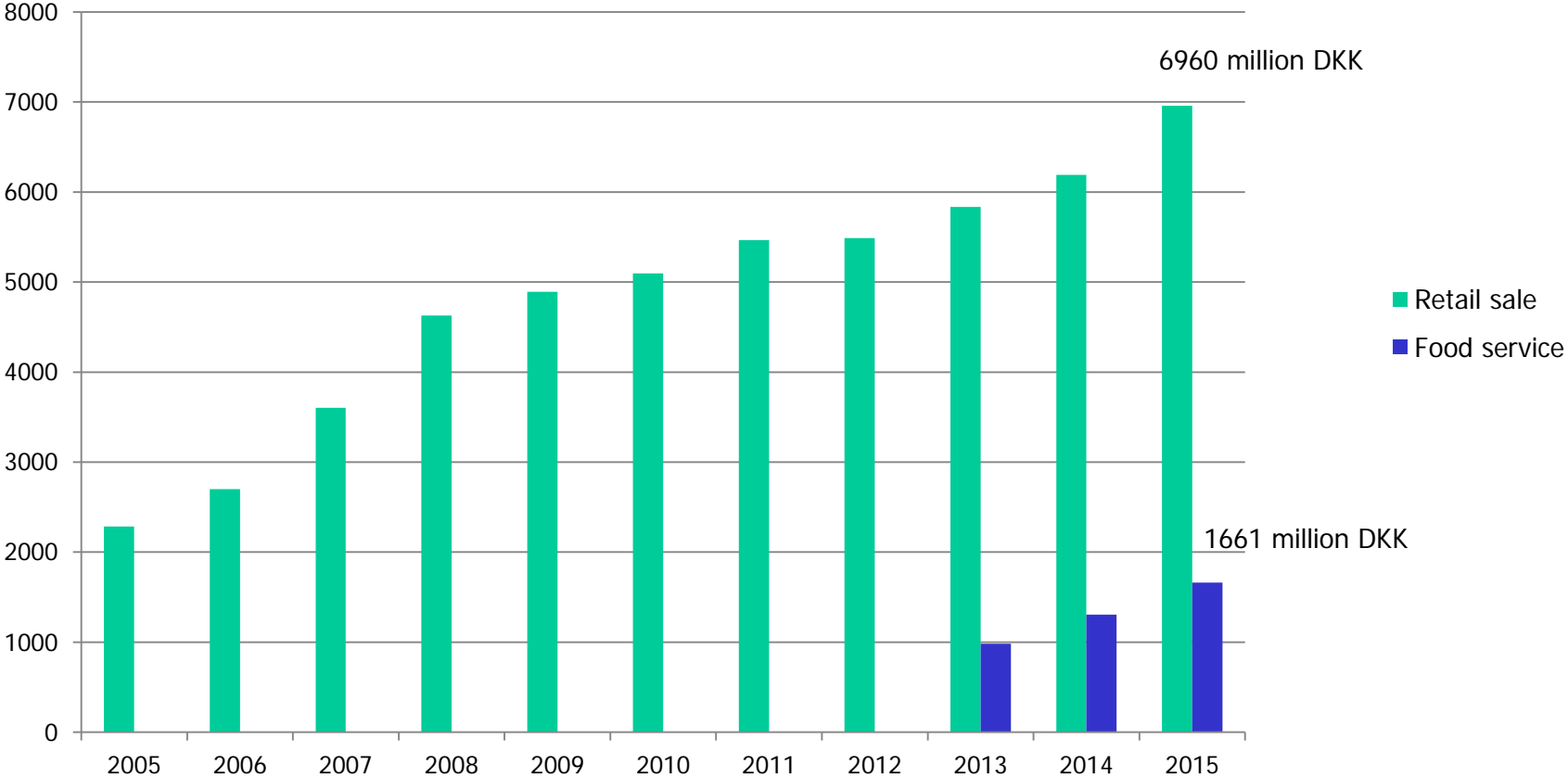
**Ecological and  
social justice**

Fair Trade?

**Precaution**  
**Technology**  
**assessment**  
**Respect tacit**  
**knowledge**

Synergies with ecosystems services

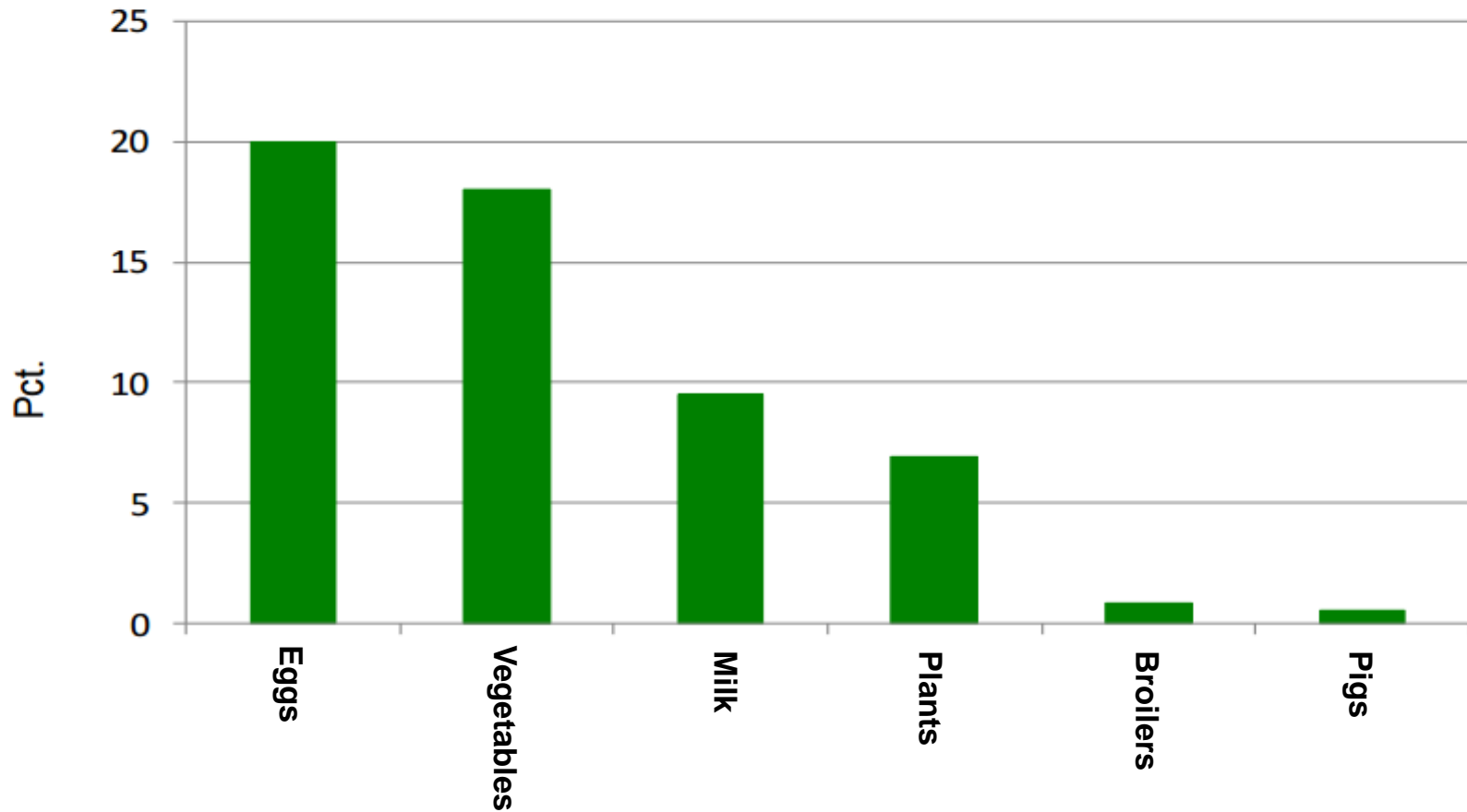
# Organic Retail and Food Service Sale in DK



Source: Statistics Denmark

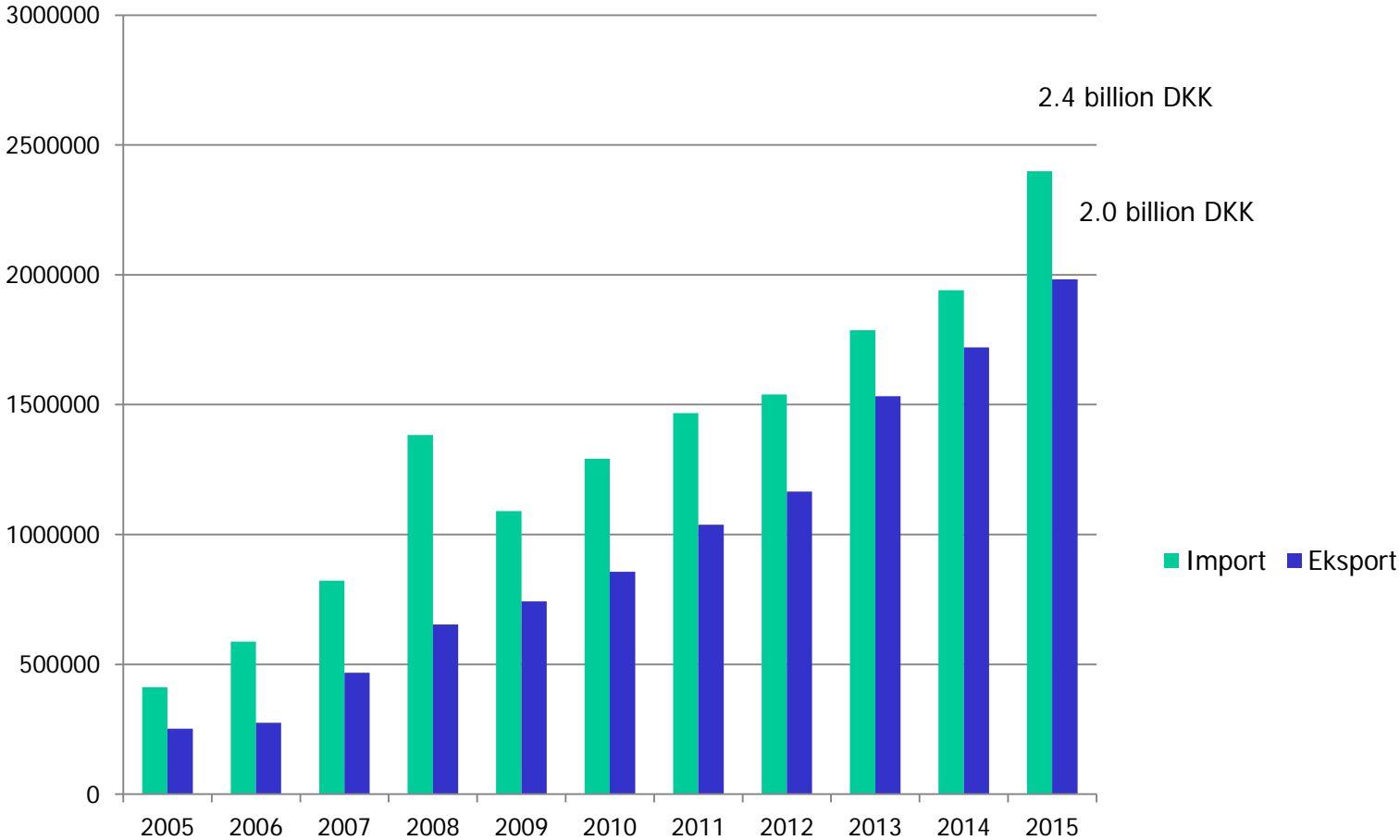


# Organics' share of the total agricultural production in 2014\*



Source: Statistics Denmark and Ministry of Environment and Food of Denmark \*Preliminary numbers

# Danish Organic Import and Export 2005-2015



Source: Statistics Denmark



# Objective:

The objective of the knowledge synthesis is

- to collect and structure the existing knowledge on the
  - positive and negative contribution of organic farming,
  - its insufficiencies and development potential
  - in relation to public goods in Denmark







# Public goods are:

- Goods or services that society wants its citizens to have access to, but which are normally not "tradeable", which means that the price and amount is not determined by the market, i.e, the good is
  - Non-excludable and non rival: Everybody can enjoy or consume the good without reducing the amount available to others
  - The good can be enjoyed/consumed without payment of it, but it is only free because others secure that the good is available.

# The process:

- Kick-off meeting for the Knowledge synthesis 18 December 2014
- Stakeholder meeting 12 February 2015
- Christiansborg Conference 22 April 2015 w. short version
- Knowledge synthesis edition meeting with chapter coordinators 13 May 2015
- Involvement of app. 65 experts and scientists
- Publication of about 330 pgs. Knowledge synthesis report November 2015



# Organic principles

Organic rules =  
minimum requirements

Organic production  
and processing

+ ÷

## COMMON GOODS

Nature  
and Bio-  
diversity

Environment

Human  
health and  
welfare

Animal health  
and welfare

Energy  
and  
climate

Rural  
development

Business  
and social  
innovations



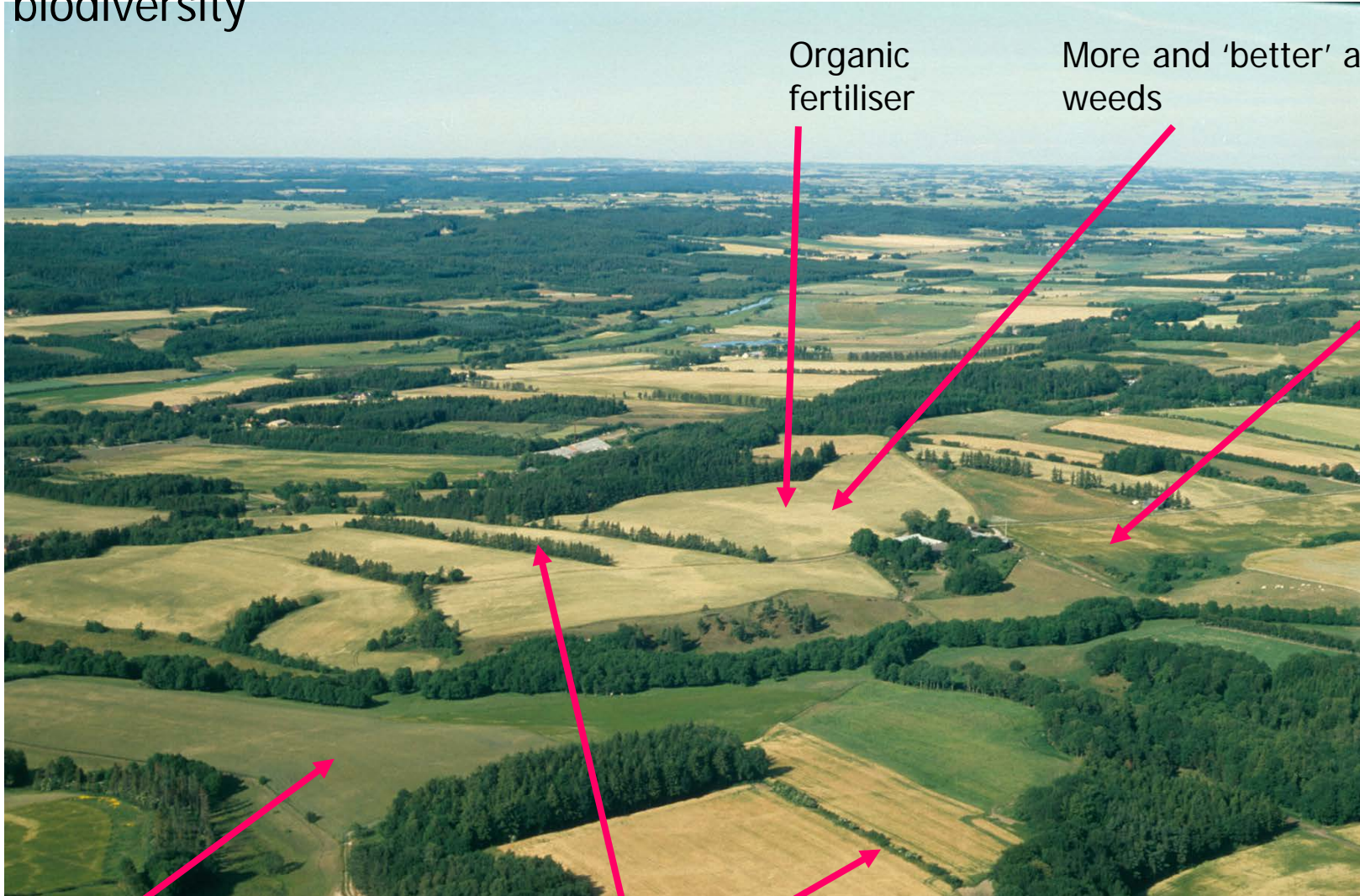
## Structure of public goods chapters:

- Formulation of the problems in relation to the public good
- General regulation and action plans in relation to the public good
- Organic principles and rules with relevance to the public good
- Overview of the scientifically documented contributions (positive and negative) to the public good.
- Need for documentation, research, development and advice in order to increase the contribution of organic production to the public good





# The management of organic farms and their land use increase the biodiversity



Organic fertiliser

More and 'better' arable weeds

More permanent pastures with low yield

Increased crop diversity on arable farms  
More biodiversity favorable crops on cattle farms

Hedges, roadsides, etc. are not affected by pesticides

# Biodiversity and organic farming



More species of birds, plants and useful insects on organic farmland.

More earthworms and a higher content of micro-organisms in the soil.



More bees and bee species in hedges along organic fields

– and a lot more in landscapes with a higher proportion of organic fields.

International results

# Bees, business and biodiversity: The road ahead is organic

Food & Environment minister, Esben Lunde Larsen says:

- Therefore the theme is sector integration, i.e. to integrate biodiversity more efficiently into policy areas within agriculture, forestry and fishery.
- - In order to achieve the goal, business and biodiversity need to start walking hand in hand all over the world.
- *Just as we have seen in Denmark with organic farming.*



Miljø- og  
Fødevareministeriet

2 December 2016





## Organic Agriculture and soil quality

Results from different  
long term experiments:



- Higher carbon sequestration (rootmass) and biological activity from fungi and microbes – DK long term trials
- The organically treated soils are
  - physically more stable,
  - biologically more active than conventional
  - contained smaller amounts of soluble nutrients (DOK trials)
- Increased soil organic matter => soil captures and retains more water in the crop root zone, also during torrential rains. (Rodale Institute)



# Organics' contribution to the environment:



Minimise the risk of pesticides in the ground water and in natural areas close to the fields

Contributes to the fulfilment of water plans by lower nitrogen emissions from areas with organic milk production

Contributes to the preservation of soil tilth by maintaining the organic matter in the soil

# The challenges of organics:

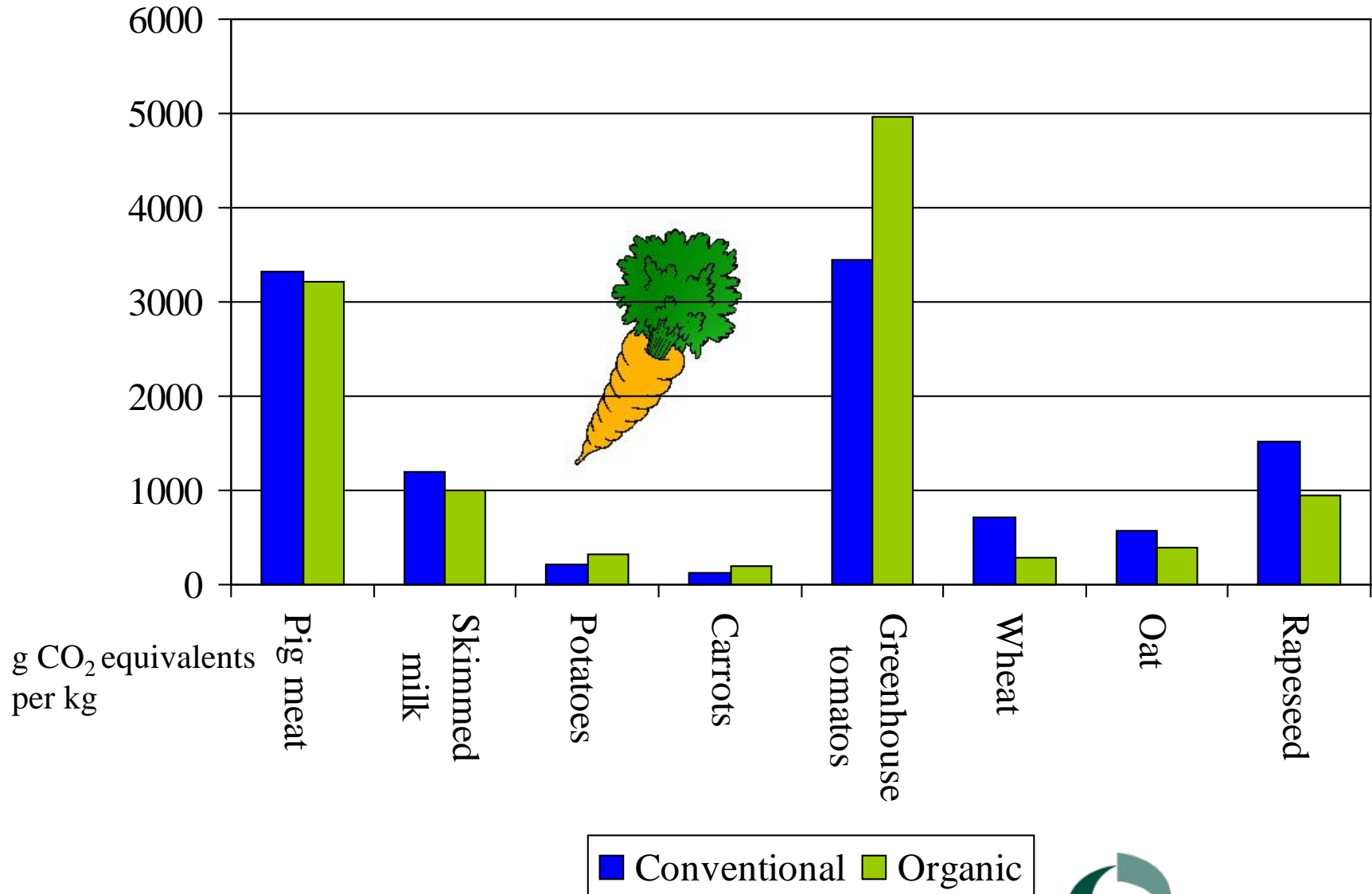
Nitrogen leaching from areas under organic plant and pig production

Ammonia from the pig production

Low recirculation of nutrients from the surrounding society

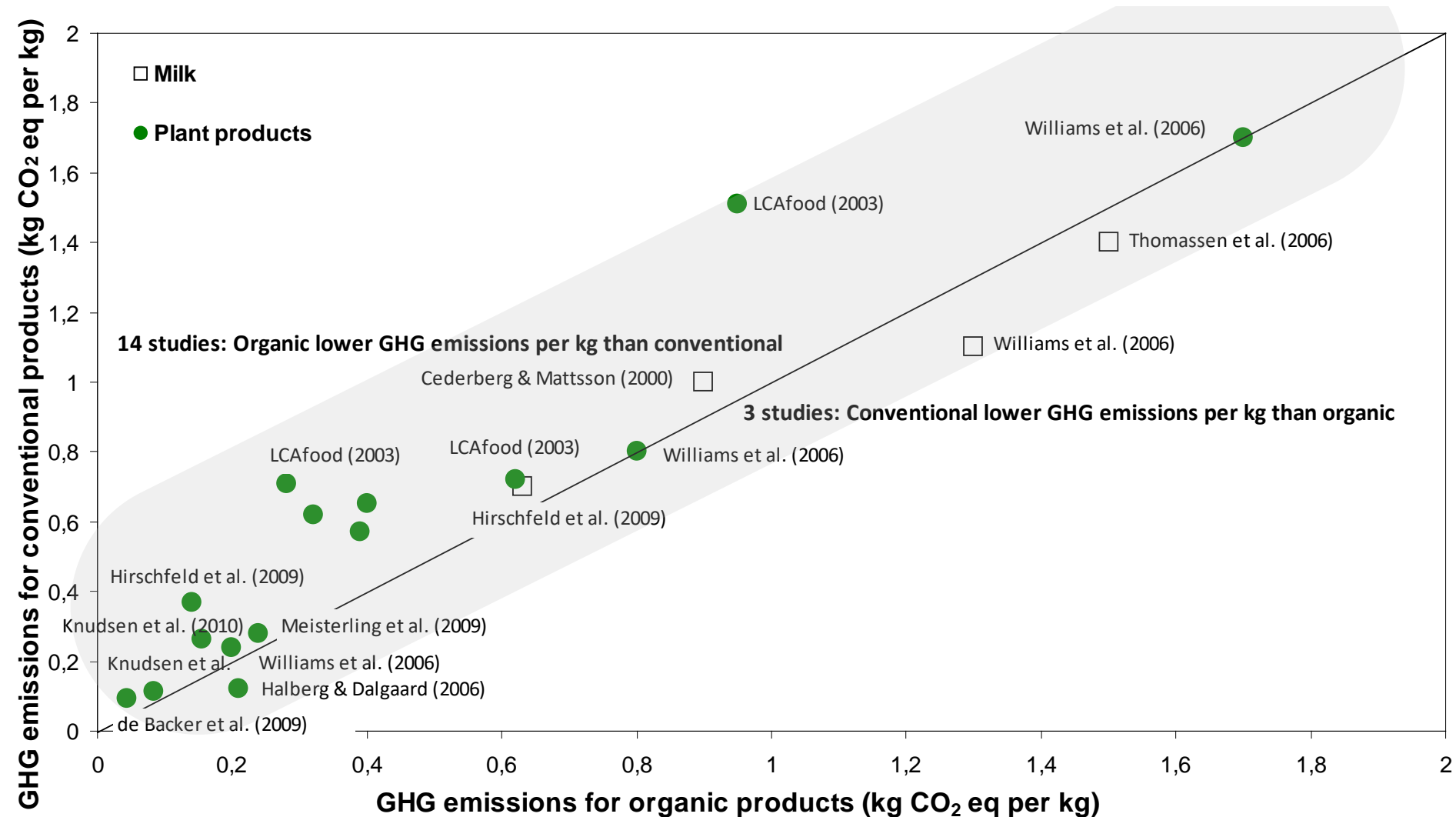


# LCA of Danish organic and conventional products



Not Included: Pesticides!!

# Greenhouse gas emissions: Organic vs. conventional



Idea after Niggli et al.(2008)

# Organics has a clear-cut profile with regard to animal welfare with emphasis on naturalness

Organic livestock have:

- outdoor life
- plenty of space
- late weaning / late slaughter
- less use of antibiotics



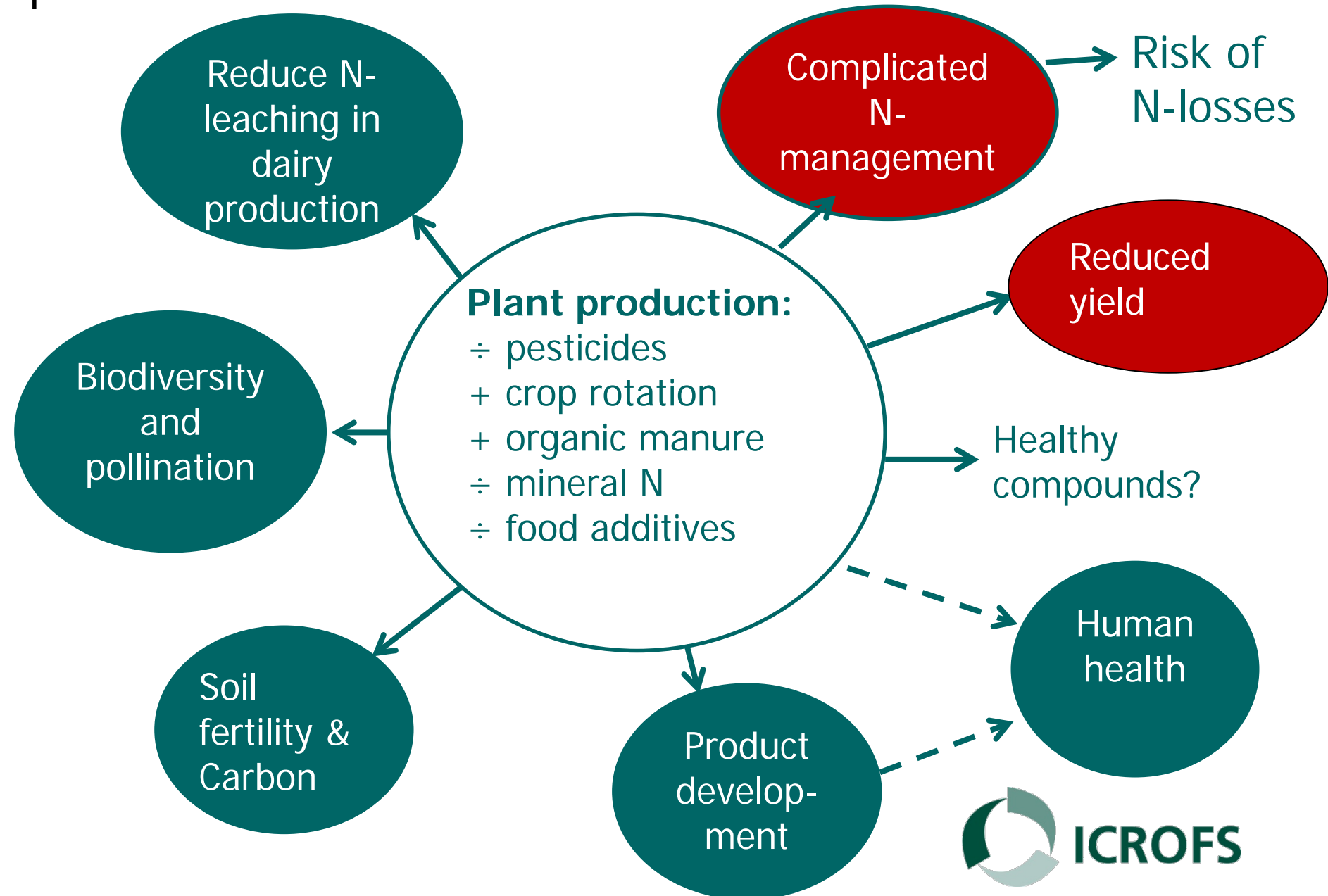
# The challenge of organics – which way to go?

Organic livestock will have:

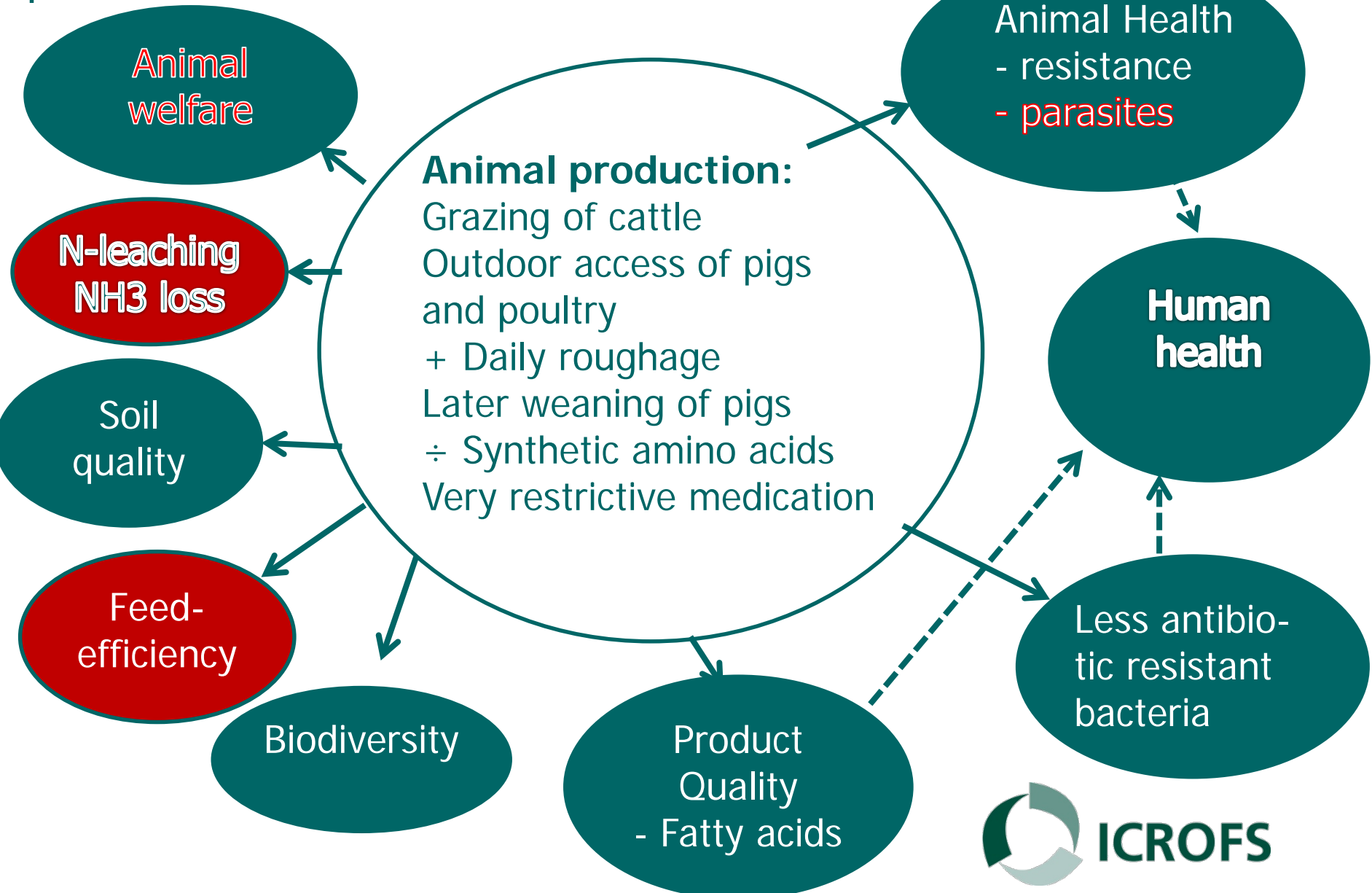
- **Cheaper** indoor life?
- less use of antibiotics?
- earlier weaning?
- more use of antibiotics?
- **More expensive?** indoor life
- more use of antibiotics?
- later weaning?
- less use of antibiotics?



# Examples of effects of the organic rules in relation to plant production



# Examples of effects of the organic rules in relation to animal production







# Contribution of organic farming to public goods

	Mainly			Rules	Principles
	Positive	No effect/ not documented	Negative		
Nature and biodiversity	X	(x)		+	+
Environment	X	X	X	+	+
Energy and climate	X	X	X	÷	(+)
Soil fertility	X			+	+
Human health and welfare	X	(x)		+	+
Animal health and welfare	X		X	+	+
Enterprise and rural development	x	X	x	÷	÷



# Innovation and better contact to the consumers



# Letting the high value market pay premium for development of agro-ecological farming systems



# Sustainability in agriculture: Long-term perspective





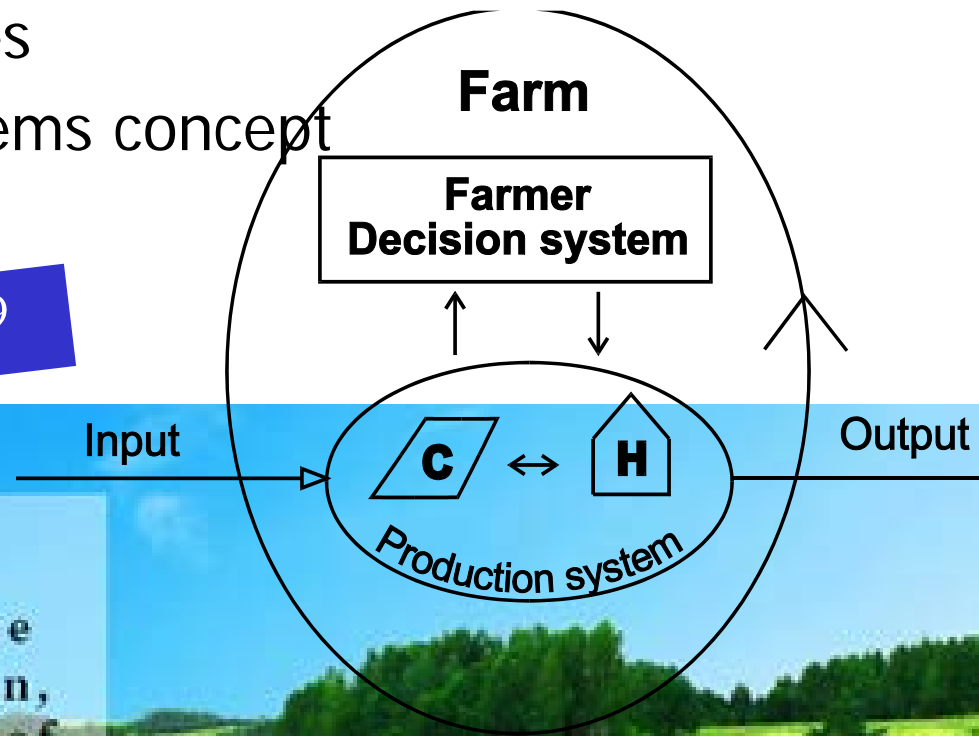
Organic agriculture as the laboratory for future farming systems  
Organic 3.0



# Meanings of Agroecology

- A research discipline
- A set of farming practices
- A (holistic) farming systems concept
- A movement

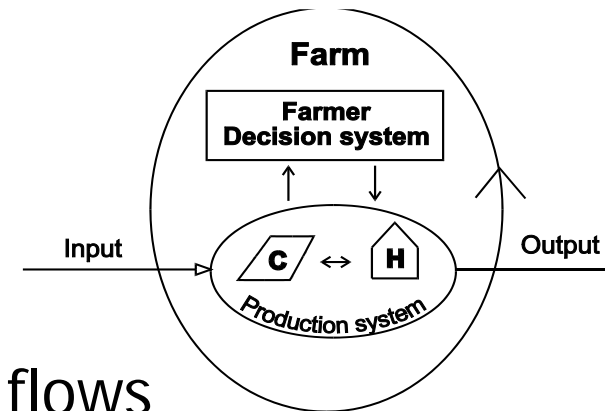
After Wezel et al., 2009



**Agroecology** means the science of ecology applied to the design, development and management of agriculture.

# Basic functions of agroecosystems

- Production:
  - food, biomass, other output
- Metabolic function:
  - nutrient cycling, soil fertility, energy flows
- Immune function:
  - health maintenance, prevention, resilience,
- Self-sufficiency (?): protein, ...



⇒ A balanced research approach: innovation and evidence!  
⇒ how to improve synergies with Ecosystems services?  
How to use new knowledge domains?

# The Sustainability of Organic Farming in a Global Food Chains Perspective: The Agroecology of Organic Farming Systems

- ❑ Organic farms in all five case studies operate within organic standards, yet fall short of agroecological ideals
- ❑ Strong focus on target crops reduces incentives for more agroecological practices
- ❑ Role of companies might further inhibit farmers' adoption of agroecological practices

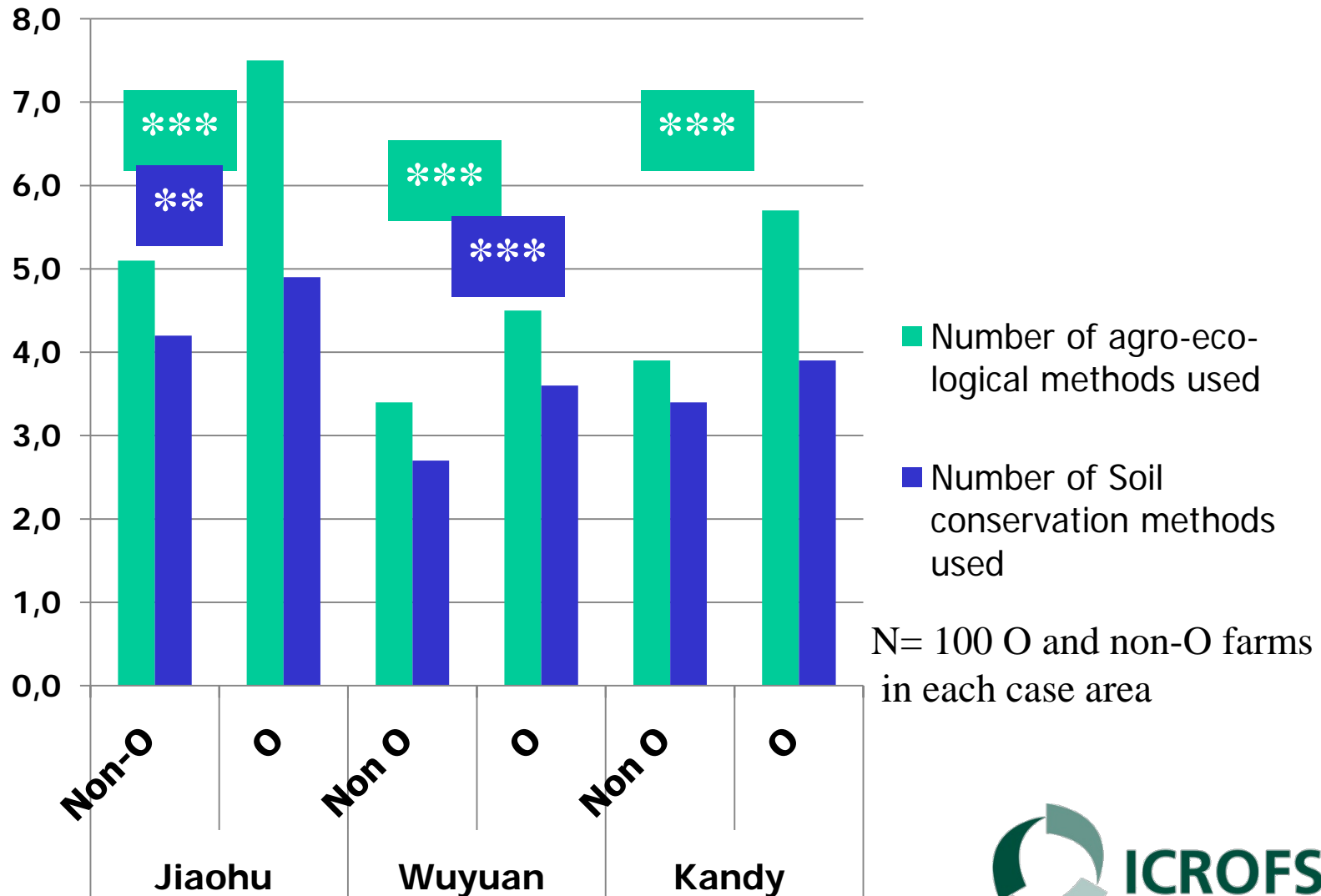


Case studies in Brazil, China, Egypt  
Myles Oelofse, Ph.D., 2013





# Average use of agro-ecological methods in organic and conventional farms in 3 areas in China and Sri Lanka





# Critical elements in a R&I strategy building on agroecology

- Crop production
  - based on improved synergy with ecosystems services (building on and maintaining natural capital)
  - molecular breeding techniques (Rewilding?)
- Efficient livestock production

based on robust systems building health and resilience at animal and herd levels

Microbial ecology, ICT, sensors, ...
- Farming systems level taken into account
  - crop-livestock integration, farm management, precision technologies
- Methods for co-production of knowledge with stakeholders
- Respecting context dependancy AND the needs for validated and generalisable knowledge

# Resilience as a dynamic health concept for livestock

The animals' ability for recuperation as affected by

- Feeding
- Living conditions
- Systems vs. Management
- Breeds and breeding
- Studied with biomarkers,  
Health challenges, observations



# Agroforestry systems



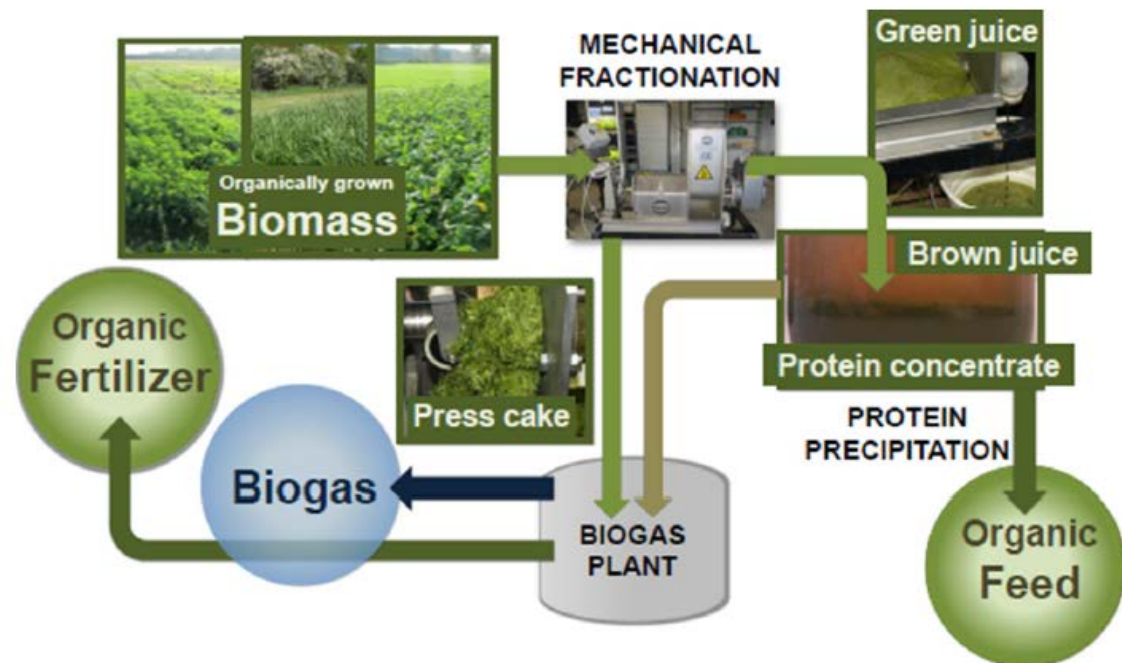
**Eco-functional  
intensification  
including  
animals**

# Combining crop and livestock innovations : green high value protein from improved land use

- Integrated bio-based industries and biorefineries in the optic of circular approaches
- Increasing crop-based protein products for feed and food by
  - using green, fresh biomass in cascade bio-refining and
  - returning residuals and nutrients to the soil



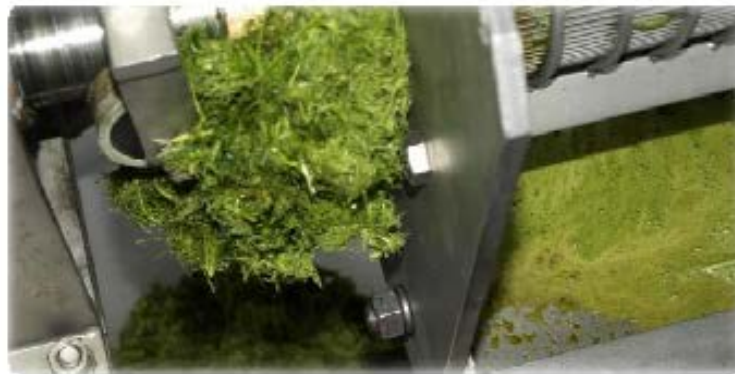
## ORGANOFINERY



# Results from protein refinement

Protein yield from sap:

- 5 – 10 kg protein (dry weight) from 1 ton of fresh biomass
- 15 – 20 per cent of the protein from the plant is extracted
  - The remaining protein is in the presscake and in the brown sap
- The amino acid composition promising with regard to poultry and pigs
  - The methionine contents is as a minimum the same as fodder based on soya



# Organic food systems?

*Food systems includes*

- ❖ *farming, processing, logistics and trading, retail and consumption of food*
  - ❖ *consists of the farms, companies, institutions and consumers and*
  - ❖ *their activities and relationships as well as*
  - ❖ *the outcomes in terms of resource use, food and nutrition, economics, livelihoods and impact on ecosystems services.*
- 
- Food systems as *the new black*,
    - where is organic agriculture?
  - New urban drivers and rural-urban linkages
  - Large kitchens and their role in regional food systems
  - How to promote the synergies between diets and health, ecosystems services/climate and food security?

# The Copenhagen House of Food

A transition in both heads and saucepans

**Conversion of 1100 kitchens &  
80000 daily meals  
at no extra cost  
(a process of change)**

By changing habits both regarding dietary composition and production, an almost 100 percent conversion to organic food was implemented without additional expenditure.

Less meat, more and fresher vegetables,

Old housekeeping virtues - rational kitchen operation (less waste)

Critical use of full-and semi-processed goods - more ingredients

Health, welfare of customers?





# Next step: Visions for the future

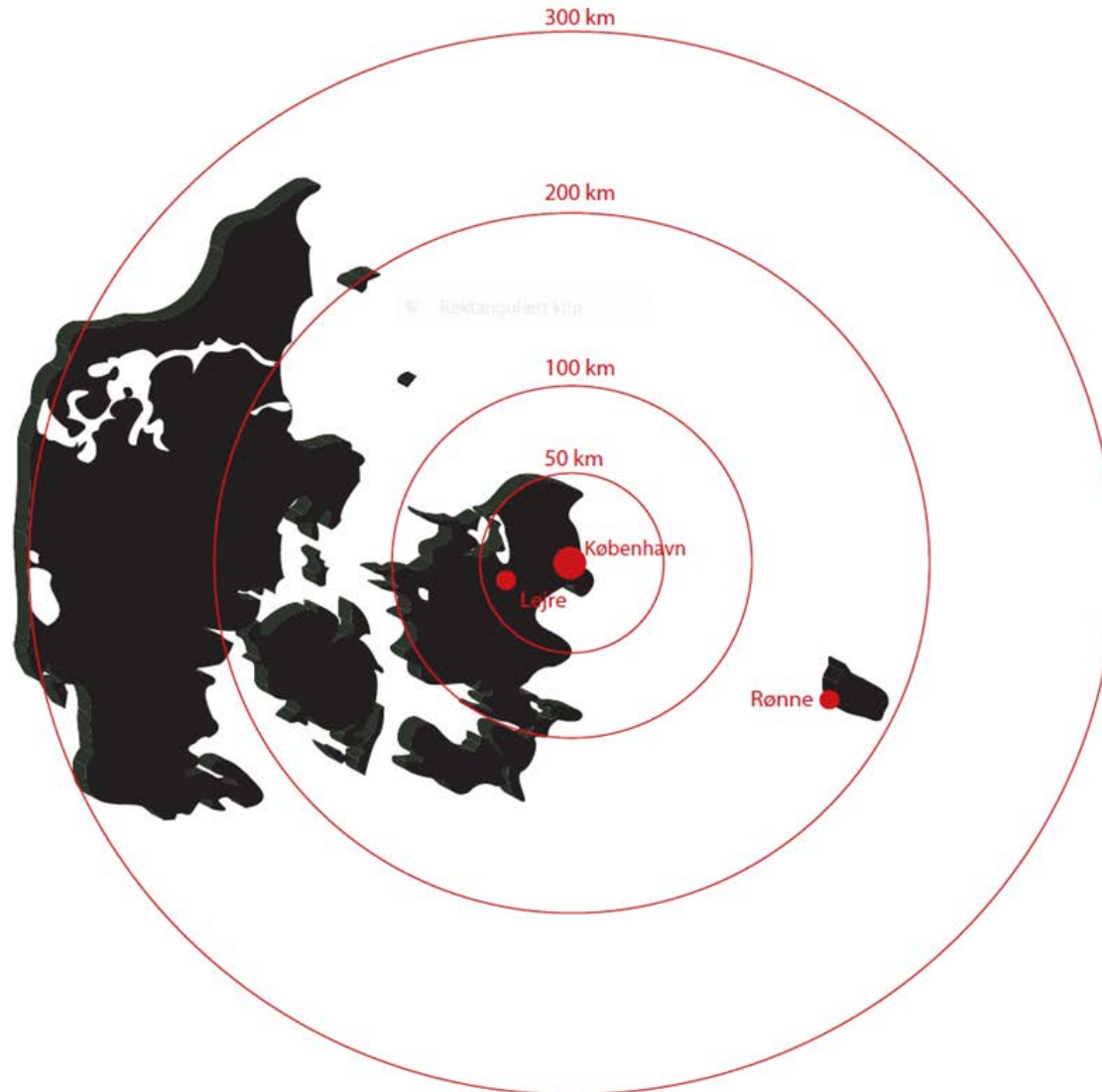
- Local food systems - local supply
- Creating relationships between end users and producers – between the city and the land
- Sustainability in a wider perspective – how do we address this in public procurement – carbon footprint? Social sustainability? Can we reduce transport? Reduce packaging?



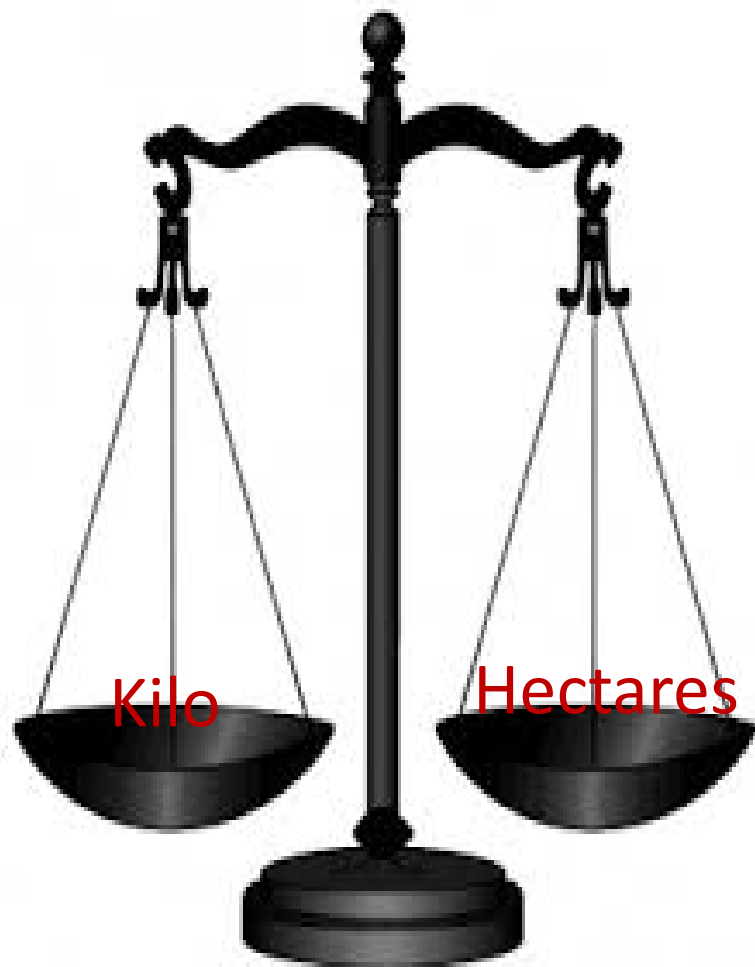
City-Region food systems...(FAO)  
Milan Urban Food Policy Act



# Local food supply



# We will convert consumption to hectares

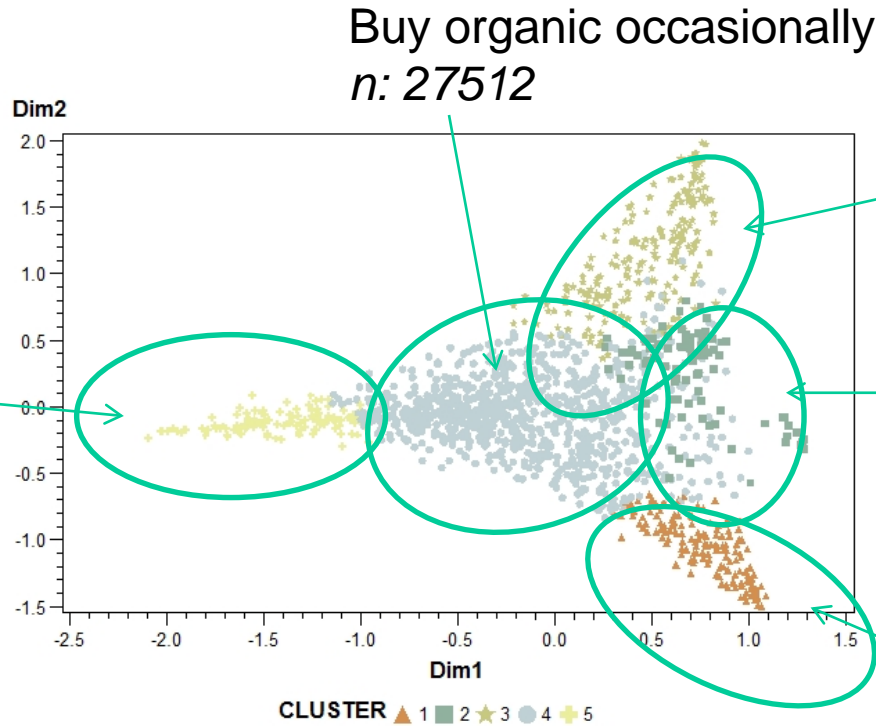


- Copenhagen's public consumption as a driver for regional development of sustainable production.
- But more kilos and producers are necessary.
- Cooperation and a strategy are necessary.
- Make it concrete!
- **Logistic challenges – market losses?**

# Attitudes towards organics

- 5 clusters

Buy organic regularly/often  
*n: 7606*



Too expensive  
*n: 4484*

Avoid organic  
*n: 5700*

No interest in organic  
*n: 9009*



# Conclusion: Diet composition

Cluster 5, **who buys organic regularly/often**, eats a larger proportion of healthy food:

♂ ↑

- + 20 % fruit
- + 27 % vegetables
- + 49 % legumes
- + 38 % vegetable oil
- + 247 % wholemeal
- + 239 % nuts

↓

- 34 % soft drinks, etc.
- 18 % alcohol
- 34 % meat
- 22 % fast food

♀ ↑

- + 31 % fruit
- + 28 % vegetables
- + 85 % legumes
- + 36 % vegetable oil
- + 153 % wholemeal
- + 381 % nuts

↓

- 46 % soft drinks, etc.
- 8 % alcohol
- 32 % meat
- 25 % fast food

♂ + ♀ : -43 % milk, -31 % processed meat

Denis Lairon<sup>1</sup>, Fabien Szabo<sup>2</sup>, Sandrine Péneau<sup>2</sup>,  
 Caroline Méjean<sup>2</sup>, Pilar Galan<sup>2</sup>, Serge Hercberg<sup>2</sup> and Emmanuelle Kesse-Guyot<sup>2</sup>.  
<sup>1</sup> Aix-Marseille Université, Joint Research Unit NORT, Human nutrition; Inserm, UMR-S 1062; Inra, UMR- 1260 ; 13005, Marseille, France  
<sup>2</sup> Université Paris 13 Sorbonne Paris Cité, UREN (Unité de Recherche en Epidémiologie Nutritionnelle), Inserm, UMR-557; Inra UMR-1125), Cnam, F-93017 Bobigny, France



Thank you



**Pippi as a role model ....**  
**- organic also breaks all the rules!**

# Thank you



# Cross cutting synthesis: synergies and dilemmas - examples

Rule:	Synergy	Dilemma
Grazing cattle	Animal welfare <-> Human health (fatty acids) <-> Environment (less N-leaching) <-> Biodiversity	Animal welfare <-> Animal health (parasites)
Outdoor pigs	Animal welfare <-> rural development	Animal welfare <-> animal health <-> Environment (increased N-leaching and N-evaporation) <-> Human health (parasites)
Animal manure	Animal welfare <-> climate change (C sequestration) Biodiversity and soil fertility	Environment (N-leaching + NH <sub>3</sub> volatilisation) <-> enterprise (lower yield and employment/ha) <-> climate-change (CH <sub>4</sub> + CO <sub>2</sub> + N <sub>2</sub> O)
- pesticides	Environment <-> Biodiversity <-> Energy (consumption/ha) <-> Animal health ? <-> Human health ? (not documented)	Energy (consumption/product) <-> crop yield <-> Climate (CO <sub>2</sub> from humus due to mechanical weeding)



# Conclusion

- The strength of organic farming compared to other “tools” is its positive contribution to more public goods at the same time, but it can do better, especially as regards environment, animal health and welfare and energy and climate.
- The public goods delivered by organic farming are partly paid by the consumers.
- Need for more organic farming to increase contribution, but despite a rapidly growing market there is little increase in the Danish organic area.
- Need for more documentation, research and advice to develop organic farming further to increase the contribution to public goods



# Agroecological crop management

- IPM for integrated weed management and intelligent control of pests and diseases
- The next era of plant breeding?
- Sensors, monitoring, observation skills, molecular methods: what will be the limiting factors?
- Diversified crop rotations without ruminants? – where is the market opportunities?
- Incentives, motives for landscape level cooperation - and benefits for farmers and public goods

# ProtectFruit



# Key figures

- Copenhagen municipality purchases for 300+ mill. kr.
- 11.200+ tons consumed
- Resulting in about 2.500 ha farmland
- App. 1/6 of Lejre's farmland or 1/12 of Bornholm's



# Organic conversion in the saucepan

## What is done differently in the kitchen?

- 1) Less meat – different meat – the whole animal
- 2) More vegetables – greens in season - diversity
- 3) More potatoes – better potatoes
- 4) Fruit in season - fruit alone is not enough
- 5) More or different use of bread and grains
- 6) Beware of the sweet and expensive
- 7) Composition of the menus - difference between everyday and feast
- 8) Old housekeeping virtues - rational kitchen operation (less waste)
- 9) Critical use of full-and semi-processed goods - more ingredients
- 10) Find the weak point, one or more of the above



# HealthyHens:

## Promoting good health and welfare in European organic laying hens

The objectives of the project are:

- to identify management strategies that promote animal health and welfare in European organic laying hens
- while limiting environmental impacts

Special attention will be paid to potential problems related to the actual change to 100% organic feed ingredients

Project leader: Prof. Dr. Ute Knierim, University of Kassel, Germany

Countries: DE, DK, IT, UK, NL, AU, SE, BE

