Looking to the Future:

4 Danish scenarios for future farming

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A Danish project: Future Farming

The Ecological Council, Copenhagen and Aarhus University
Funded by the Velux foundation

Four scenarios
for a sustainable future Danish agriculture
2030 and 2050:

- Equal scenarios, not ”good” and ”bad”
- The good future agriculture could be a combination
- Plus business-as-usual
- A holistic approach: environment, climate, nature, Soil fertility, economy, employment

- ***<u>Not</u> covered: animal welfare***
- ***Partly covered: global issues***

Green Growth

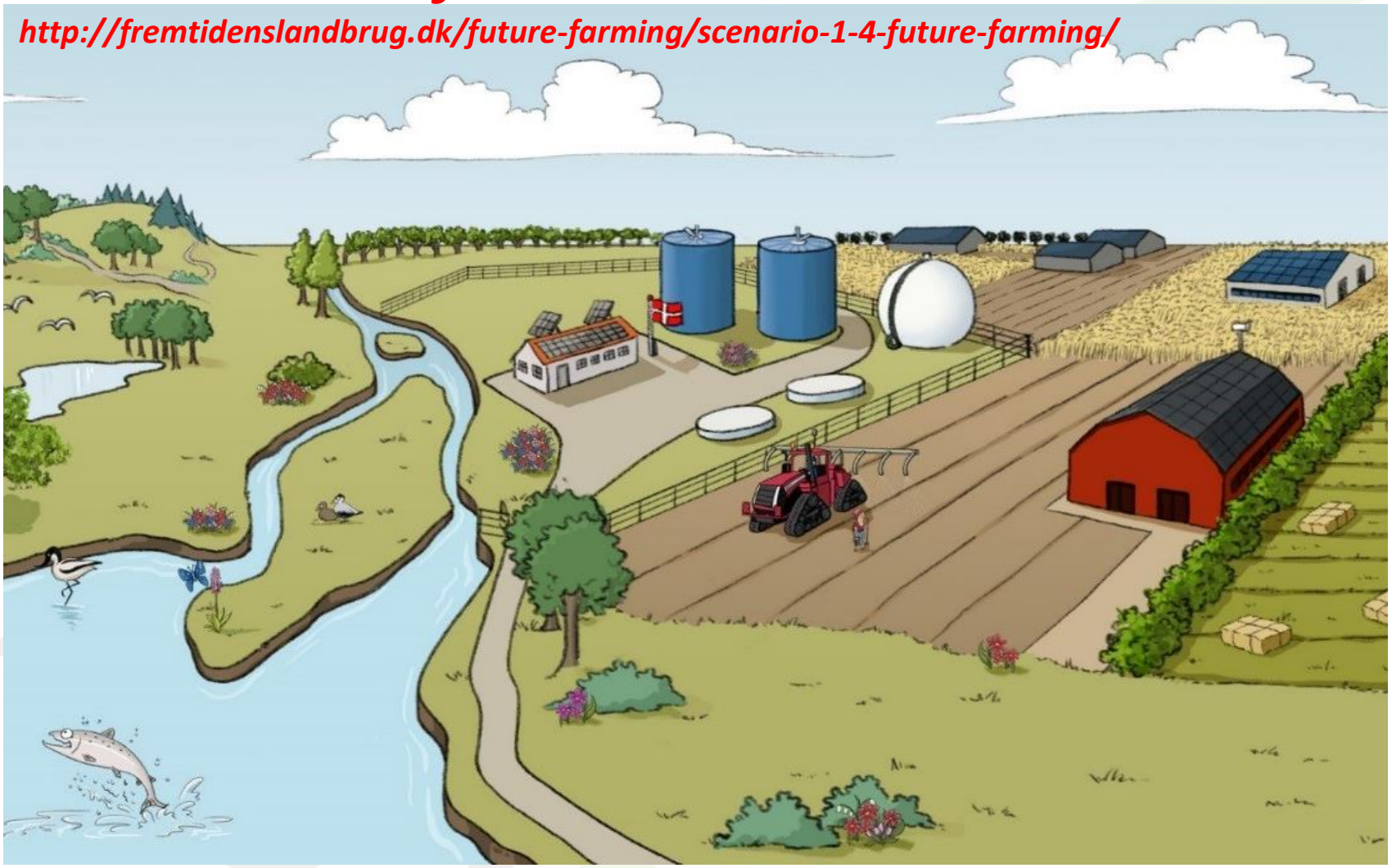
- Low pollution and climate gas emissions
- Option for growth is maintained
- Effective handling of nutrients
- Reduced emission of methane and laughing gas

  - ✓ Energy production – biogas, energy crops (willow)
  - ✓ Energy conservation
  - ✓ More organic farming
  - ✓ IPM – Monitoring andPesticide reducing technology

Green Growth

See animation film about "Green Growth" at

http://fremtidenslandbrug.dk/future-farming/scenario-1-4-future-farming/



Urban and Rural

- High share of organic farming – 50% in 2050
- Organic recycling agriculture
- Extensive organic farming on vulnerable land
- Focus on public goods

  - ✓ Rural development
  - ✓ Local manufacturing and marketing
  - ✓ A transparent food production
  - ✓ Agro-tourism - recreation

Urban and Rural

See animation film about "Urban and Rural" at

http://fremtidenslandbrug.dk/future-farming/scenario-1-4-future-farming/

The Biobased Society

- Production of food, energy, and biobased materials
- High production of energy crops
- High-tech processing of biomass
- Five large biorefineries in Denmark
- Maximum recycling of nutrients and carbon
- Fast phase-out of fossile fuels

The Biobased Society

See animation film about "The Biobased Society" at

http://fremtidenslandbrug.dk/future-farming/scenario-1-4-future-farming/

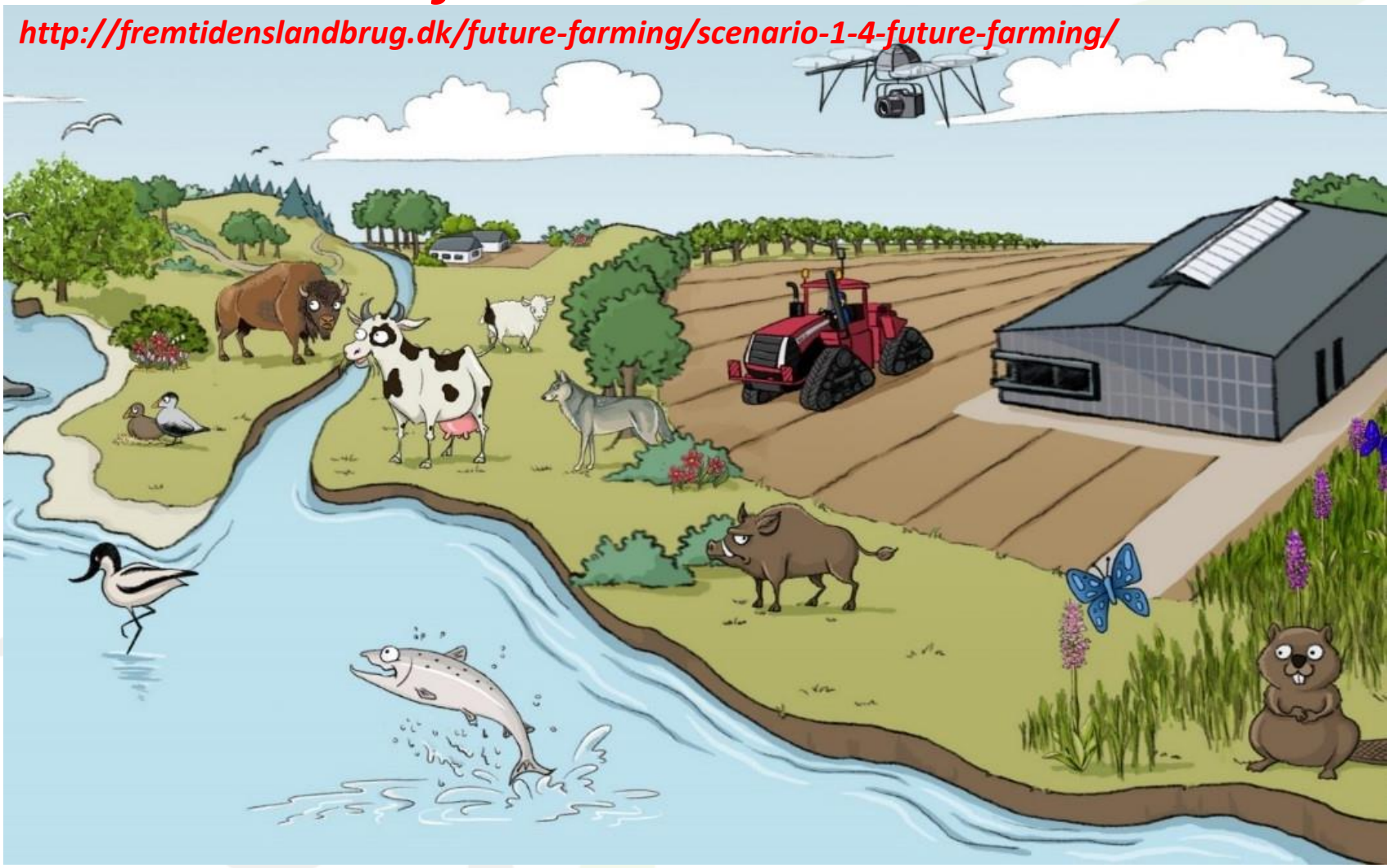
A Rich Nature

- High biodiversity – also in open land areas
- Nature in balance
- Large nature areas linked together
- Intensive and high-tech farming on the remaining
- Arable land – less than today
- More wetlands
- More meadows with grazing cows and sheep

A rich nature

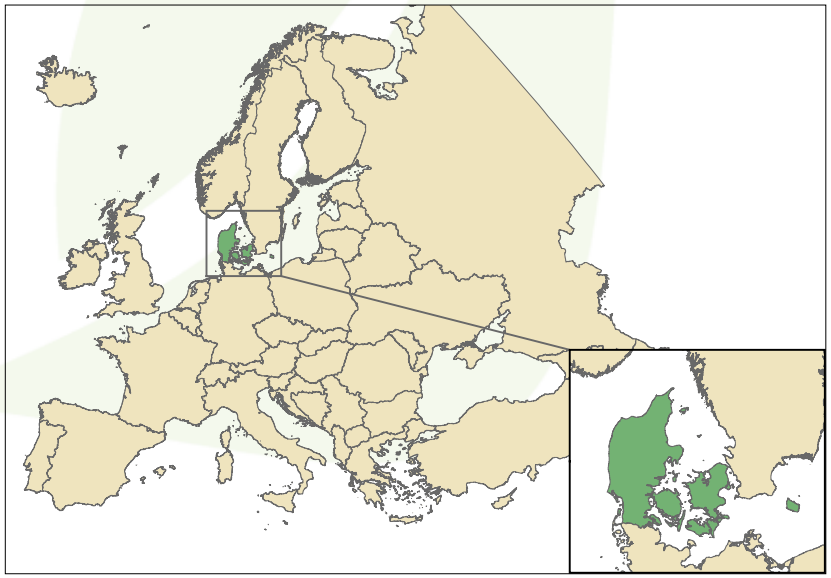
See animation film about "A Rich Nature" at

http://fremtidenslandbrug.dk/future-farming/scenario-1-4-future-farming/

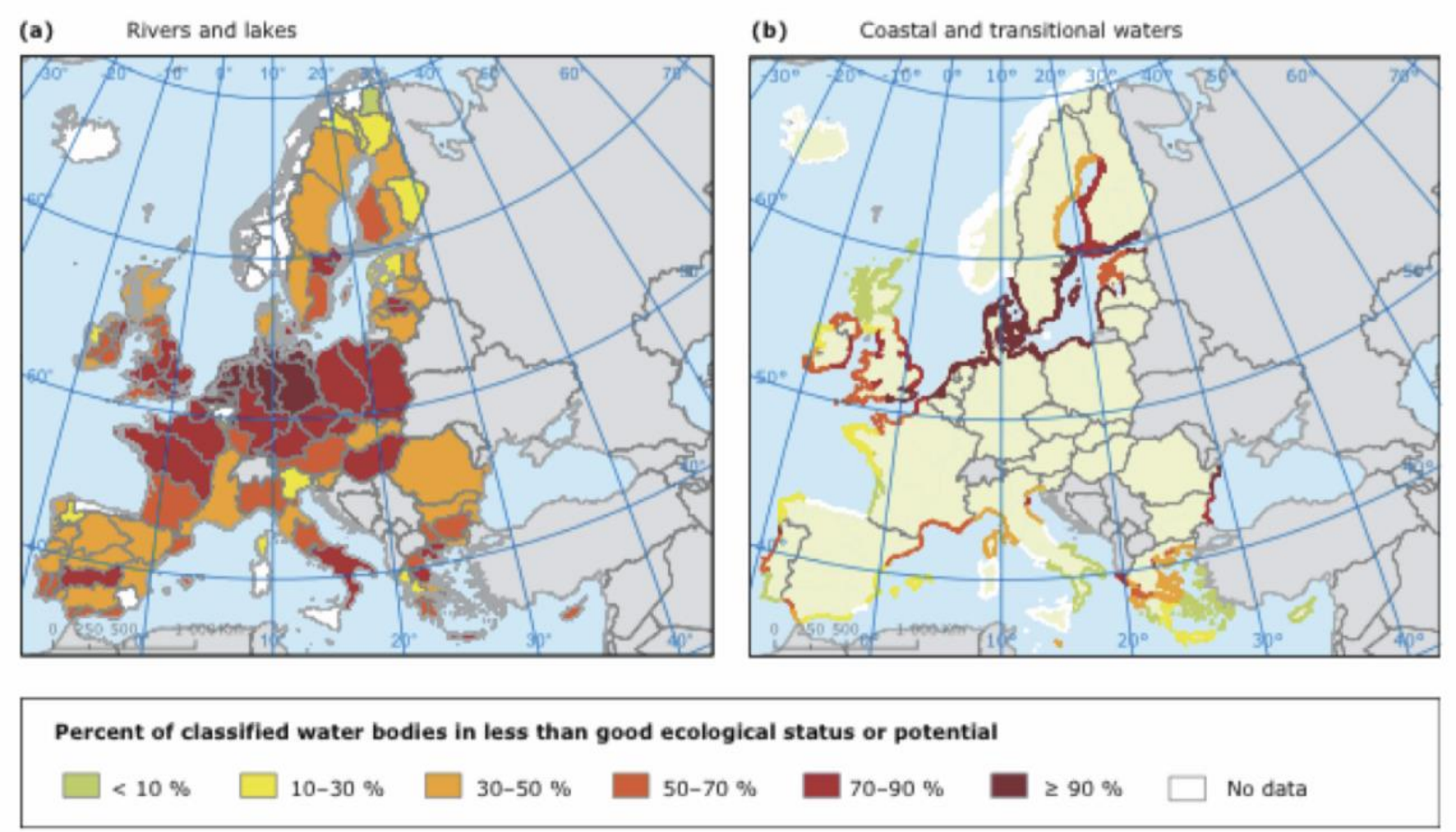


Intensive agriculture in Denmark

- 2.6 mio ha agricultural land (62% of total area)
- 5.5 mio people – 4.5 mio t milk - 29 mio pigs/yr
  - 9.7 t milk/cow/yr
  - 30 piglets/sow/yr
  - 7.5 t wheat/ha/yr
- 7500 km coastline

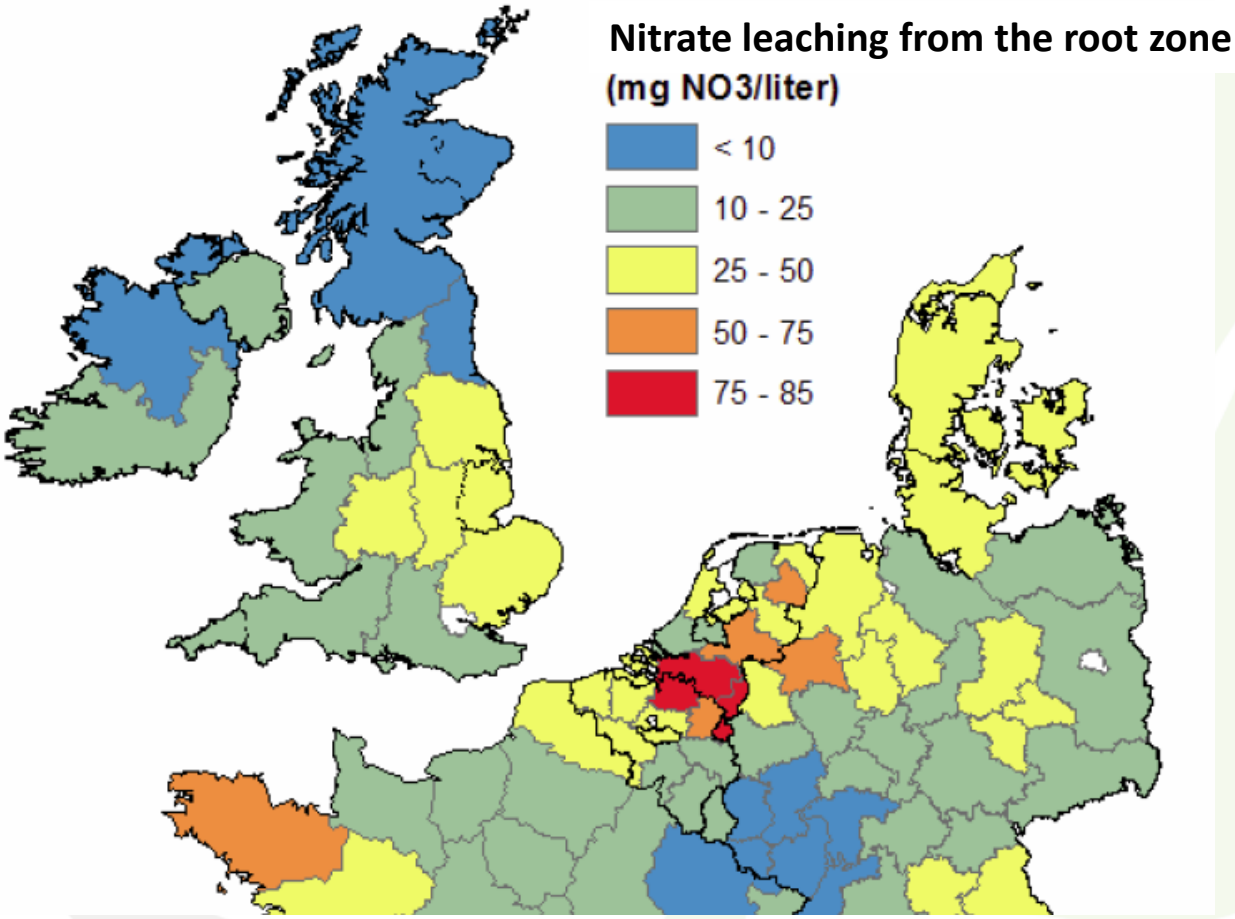


EU Water Framework Directive challenges



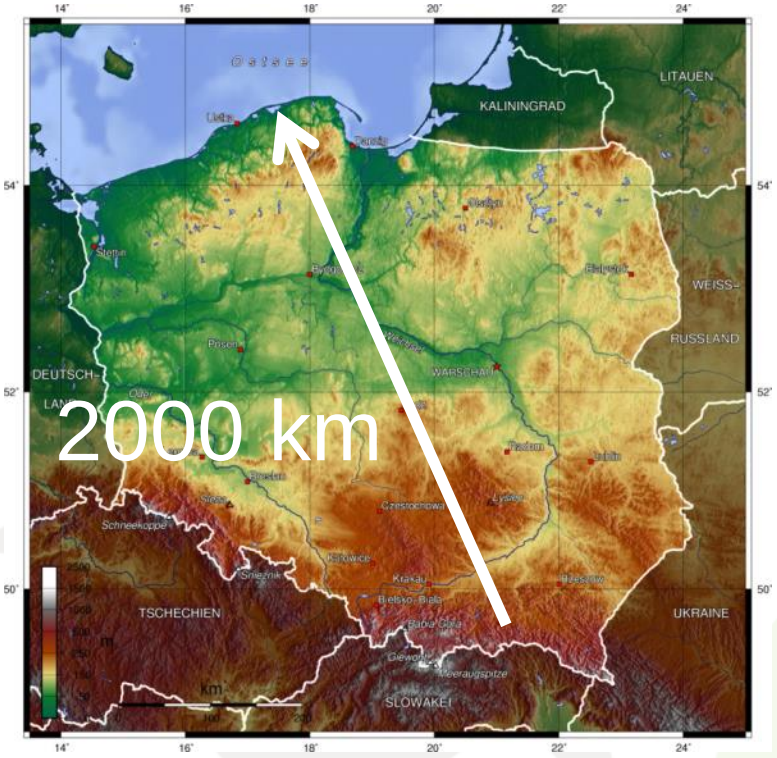
Source: EEA.eu

A general Northwestern European challenge

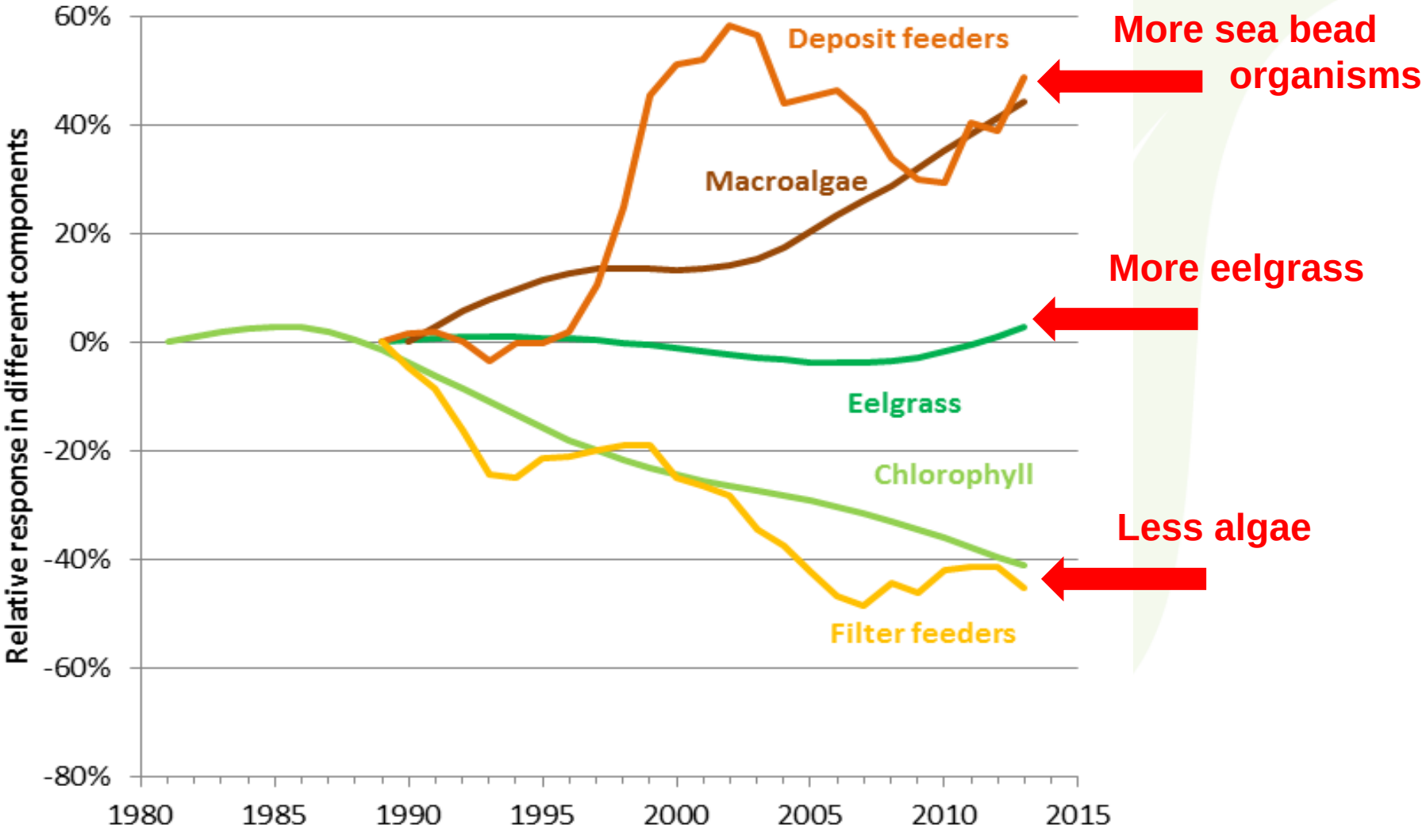


Van Grinsven HJM, ten Berge HFM, Dalgaard T *et al.* (2012) *Management, regulation and environmental impacts of nitrogen fertilization in northwestern Europe under the Nitrates Directive; a benchmark study.* Biogeosciences 9, 5143–5160, 2012. http://www.biogeosciences.net/9/5143/2012/bg-9-5143-2012.pdf

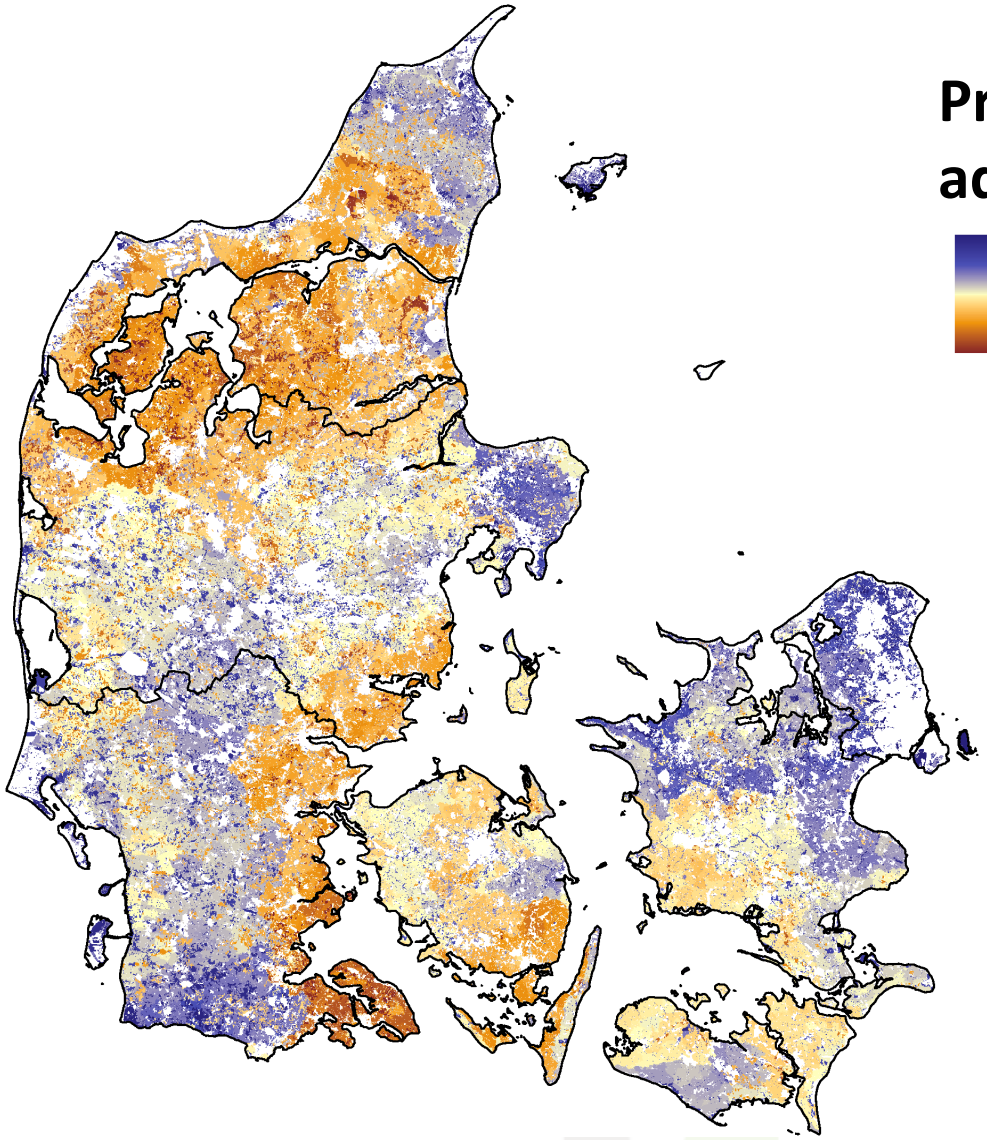
Intensive agriculture near to the coast



The policy measures have worked



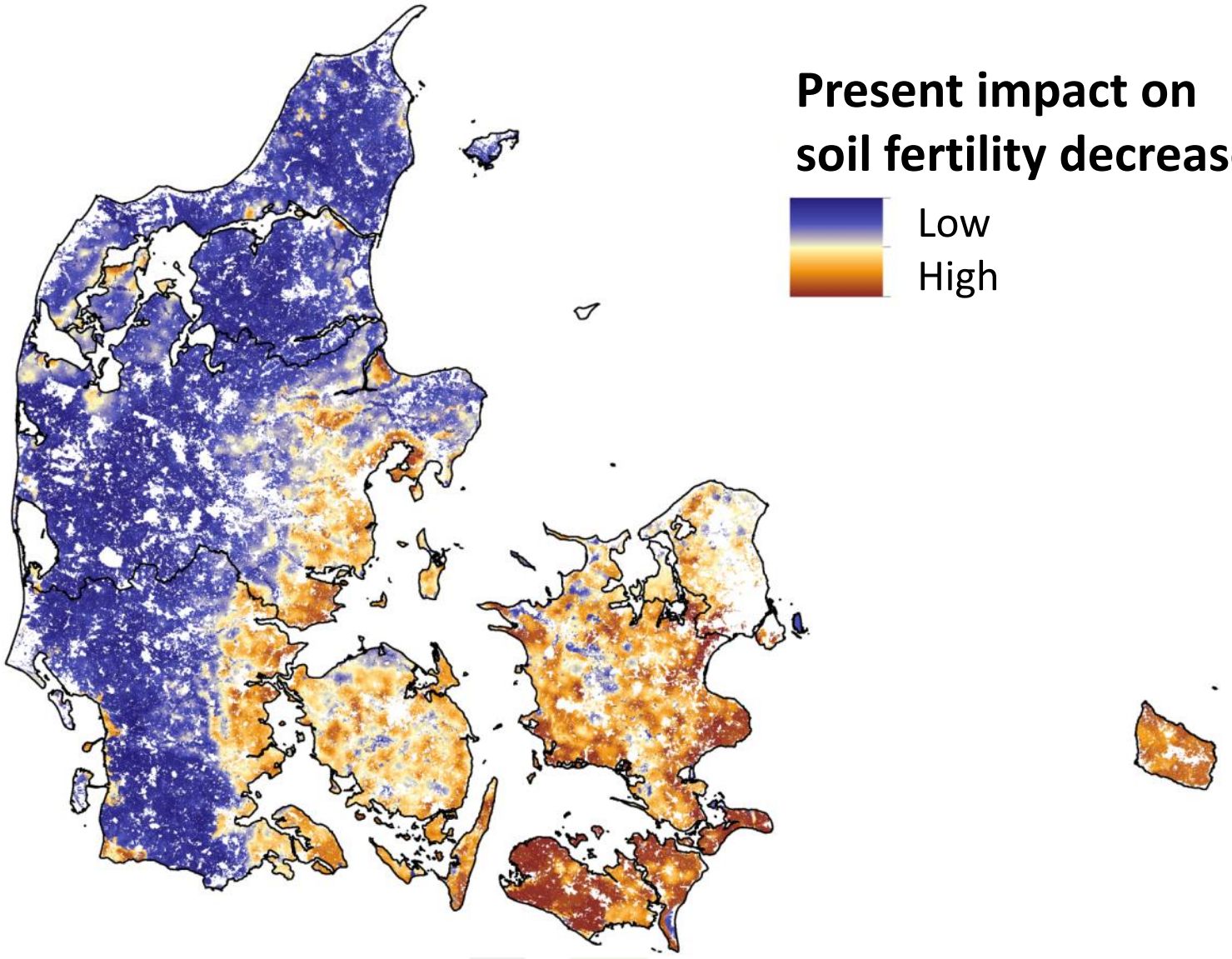
Geographically targetted measures needed



Present impact on the coastal aquatic environment

Low
High

Geographically targeted measures needed

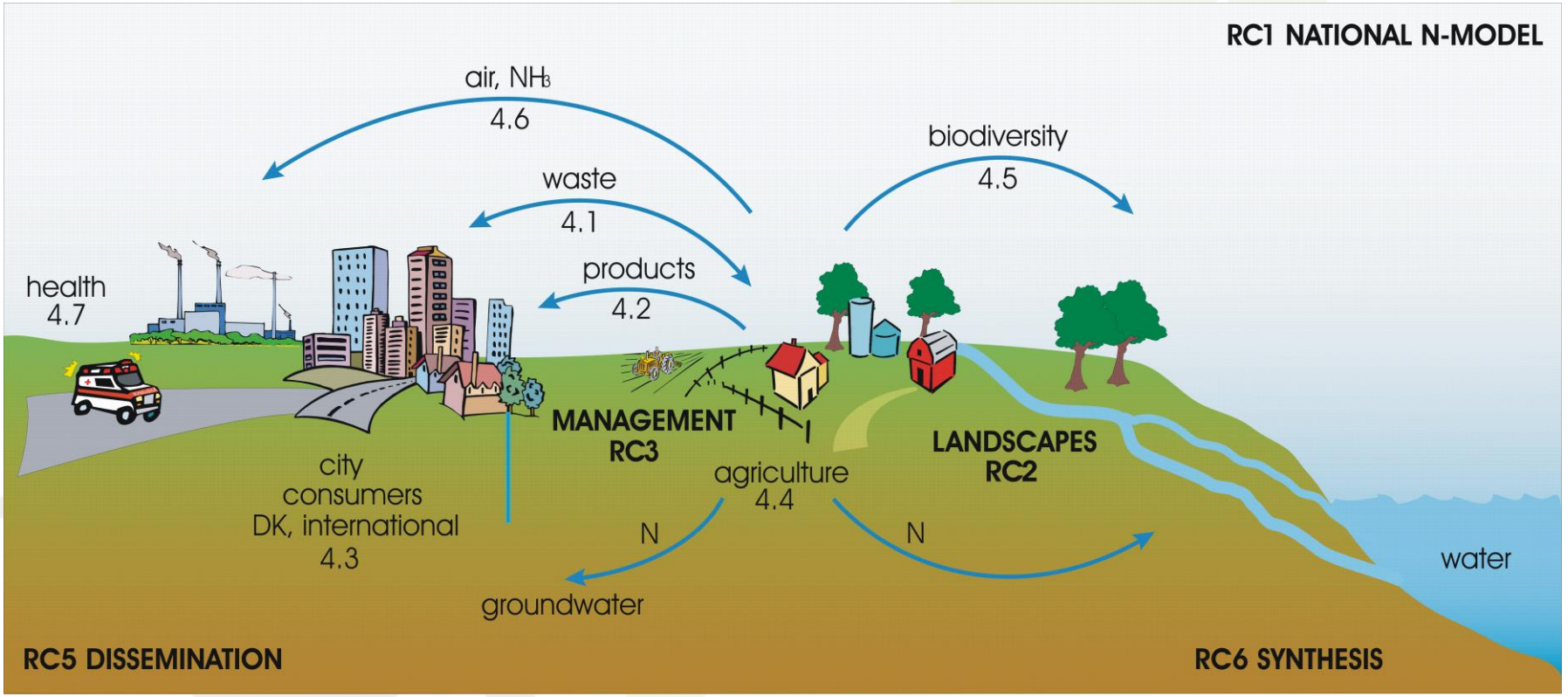


The multiple components of the Danish nutrient landscapes

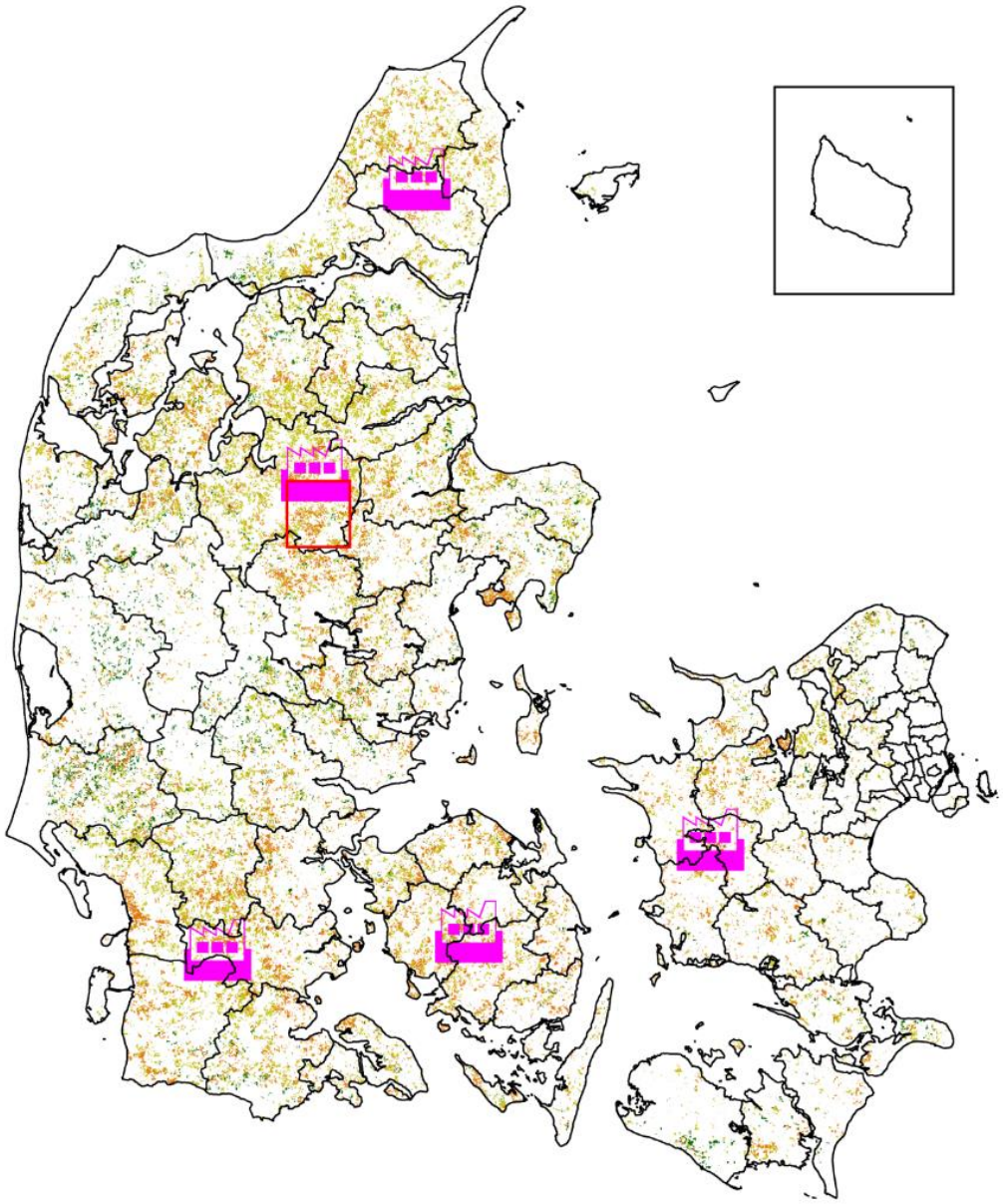
dNmark research alliance

www.dNmark.org

Research components:



Targetted green investments



Large scale biorefineries

- Afforestation
- Intensive Permanent Grasslands
- Short Rotation Energy Crops

The scenarios are based on targeted instruments:

- **Stronger on vulnerable land – weaker on robust land**

- **Synergy: for instance biogas combined with separation of manure, recycling of urban organic waste→ substitution of fossile fuels, recycling of phosphorus, reduced nitrogen-leakage**

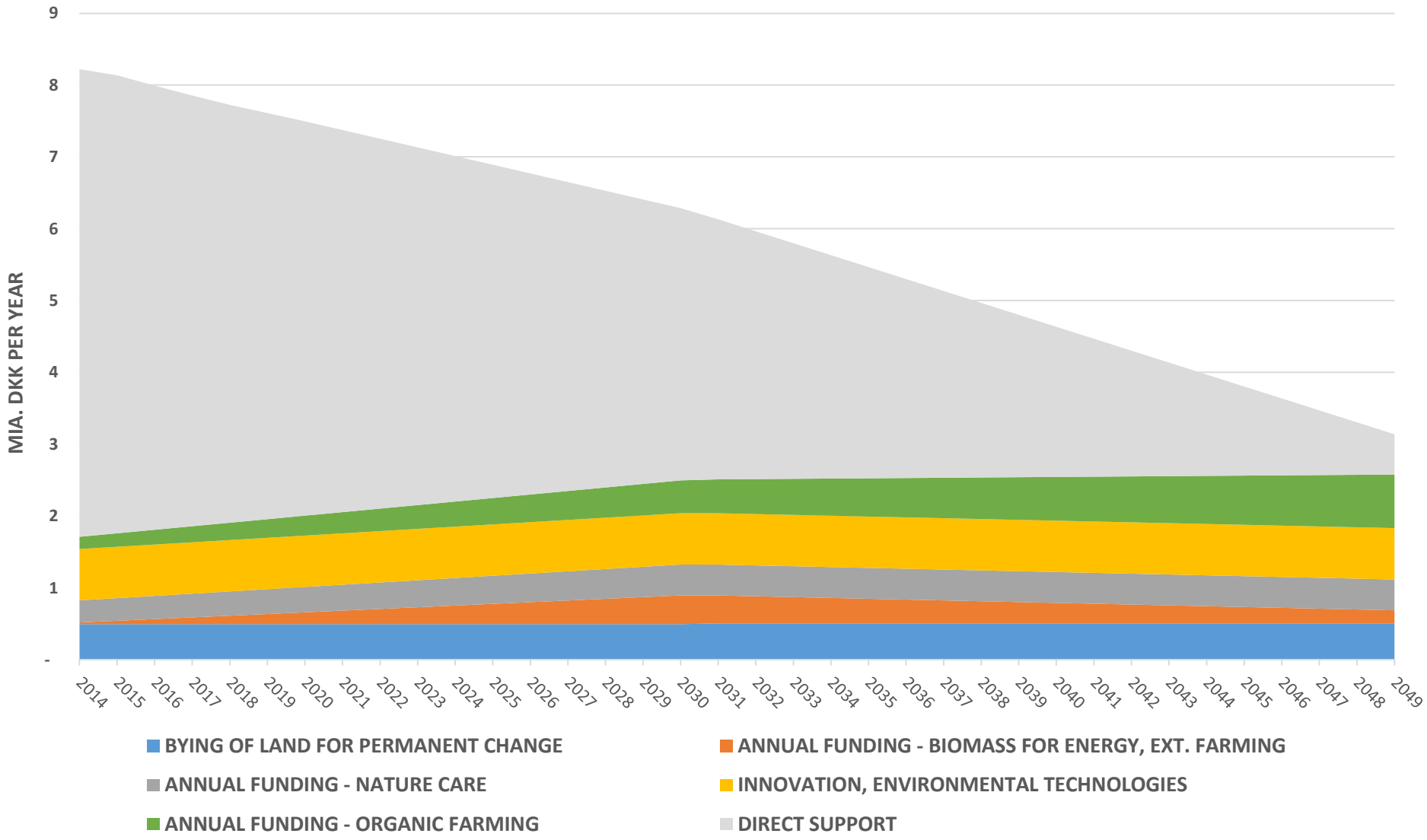
Financing

- Targeted instruments will not treat farmers equally
- Will require compensation
- Financed by EU/CAP – pillar two
- Combined with a national nature fund (state and private)
- Buy land and take vulnerable land out of cultivation

In three of the scenarios:
nature care and organic farming recieve 60-70% of the need for funding

FINANCING VIA CAP 2013-2050

GREEN GROWTH - SCENARIO



Effects on income and employment

Multi-Criteria Analysis (MCA)

- **The project has developed a decision support system**
  - A GIS based MCA model covering the entire agricultural are in Denmark
  - Represented by cells of 0.25 hectares each containing data for optimisation criteria

- **The MCA model is used to assess trade-offs between the following optimisation criteria**
  - Biodiversity
  - Aquatic environment
  - Soil fertility
  - Greenhouse gas emissions
  - Implementation costs and employment

Business-as-usual scenario (BAU)

- **The modelled scenarios are compared with a Business-As-Usual scenario**
  - projecting the development in agricultural employment and land use until 2030
  - Assuming labour productivity will keep increasing by 5,4 per cent per year and a constant production level

- **Present and predicted employment in primary agriculture**
  - Present: 66,000 man years
  - 2030: 21,000 man years (that is, minus 68 per cent)

- **Land use**
  - Only small predicted decline

Definition of social cost

- **Conversion of arable land to nature and environmentally friendly uses**
  - represents social costs

- **Short term**
  - Foregone land rent in arable farming
  - Temporary unemployment/loss of production

- **Long term**
  - Only foregone land rent in arable farming
  - Redundant labour assumed to be employed in other sectors

Land rent foregone in scenarios

Table 1. Land rent foregone in different scenarios, 2030

	Green growth	Bio-based society	Urban and rural	Rich nature
Land rent foregone, million euros/year	149	1	92	103
Per cent of total land rent in Danish agriculture	12.7	0.1	7.8	8.7

- **So far, there are no estimates available of the social value of enhanced environmental service flows in different scenarios**
  - Still, the social cost in terms of land rent forgone seems relatively small

Employment effects of scenarios

Table 2. Reduced employment in scenarios by 2030

- Without labour productivity adjustments

Reduced employment, man years	Green growth	Bio-based society	Urban and rural	Rich nature
Crop production	444	340	506	764
Livestock production	1,300	2,600	2,600	0
Ancillary sectors	2,900	5,800	5,800	0
Total reduction	4,644	8,740	8,906	764
Job creation, man years				
Bioenergy, primary agriculture	5,500-8,900			
Bioenergy, ancillary sectors	6,300-12,100			

Thank you for your attention

Read more on:

www.fremtidenslandbrug.dk/futurefarming