

DEPARTMENT OF AGROECOLOGY

Supporting the agricultural green transition

Jørgen E. Olesen



The faculties

Faculty of ARTS



The faculty covers:

- Theology
- Languages
- Archaeology
- Area studies
- Information science
- Educational science

among other subjects.

AARHUS BSS



The faculty covers:

- Economics
- Management
- Law
- Political science
- Psychology

among other subjects.

Faculty of HEALTH



The faculty covers:

- Medicine
- Odontology
- Optometry
- Sport science
- Nursing
- Public health

among other subjects.

Faculty of NATURAL SCIENCES



The faculty covers:

- Biology
- Physics
- Astronomy
- Chemistry
- Geology
- Mathematics
- Computer science
- Molecular biology
- Nanoscience

among other subjects.

Faculty of TECHNICAL SCIENCES



The faculty covers:

- Agroecology
- Bioscience
- Food
- Animal science
- Engineering science
- Environmental science

among other subjects.

DEPARTMENT OF AGROECOLOGY



AU FOULUM



AU FLAKKEBJERG

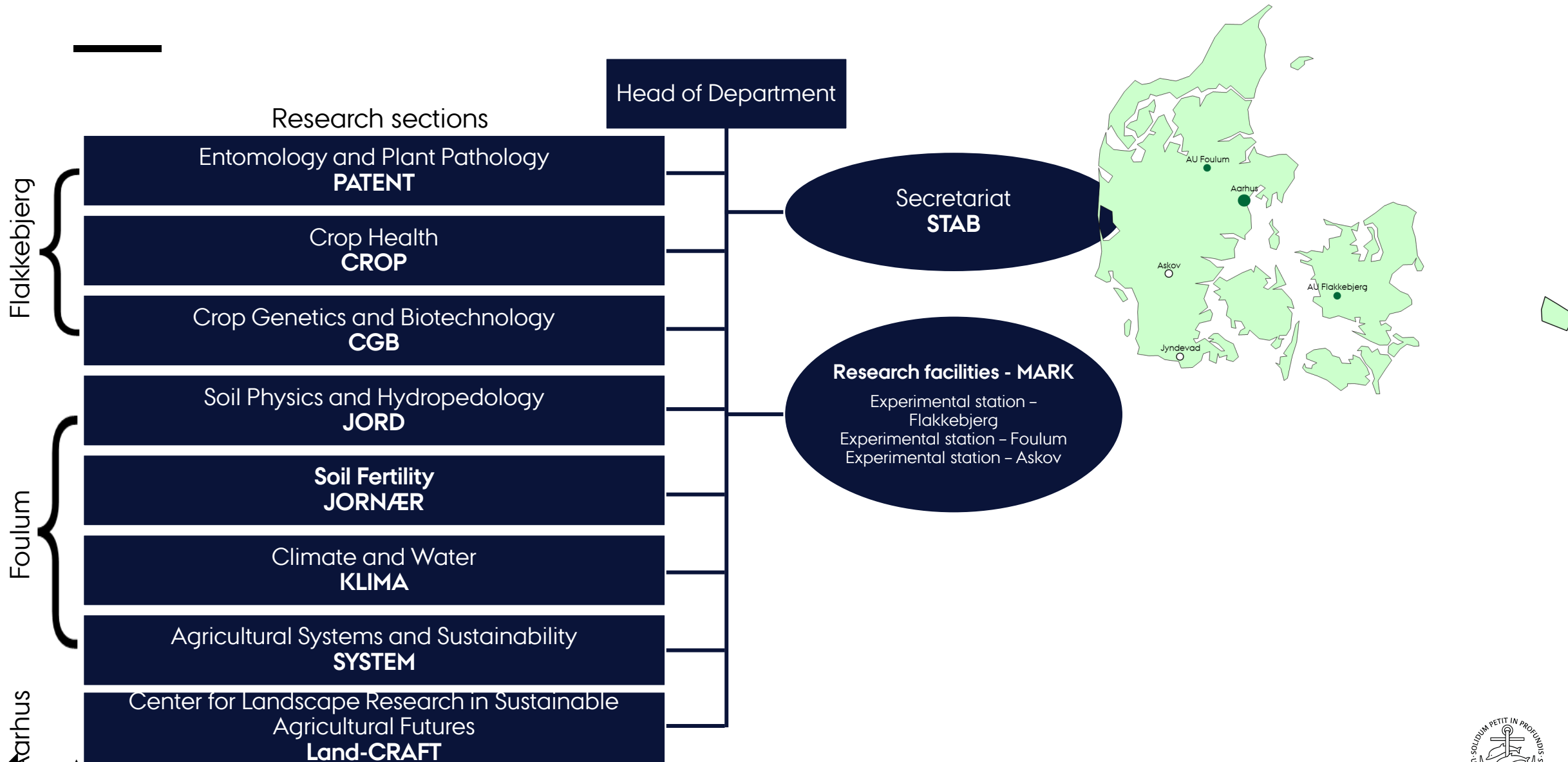


Experimental station ASKOV



Experimental station FOULUMGÅRD

DEPARTMENT OF AGROECOLOGY - ORGANISATION



Department management



Jørgen E. Olesen
Head of department



Birgit S. Langvad
Head of Secretariat



Jørgen Eriksen
JORNÆR



Per Kudsk
CROP



Mathias N. Andersen
KLIMA



Henrik Brinch-Pedersen
CGB



Mogens Nicolaisen
PATENT



Mogens H. Greve
JORD



Tommy Dalgaard
SYSTEM



Klaus Butterbach-Bahl
Land-CRAFT



Jens B. Kjeldsen
FOULUMGÅRD



Henning C. Thomsen
ASKOV



Søren Vangsgård
FLAKKEBJERG

PATENT – Entomology and Plant Pathology

Research areas:

- The Global Rust Reference Center
- Honey bee diseases, genetics and pollination
- Microbiome aided plant resilience
- Nematodes
- Entomology
- Molecular characterisation and diagnosis of pests
- Ecological modelling lab



CROP – Crop Health

Research areas:

- Seed science and technology
- Herbology and application technique
- Pesticide resistance
- Disease and pest management
- Natural product chemistry and environmental chemistry
- Phytobiome studies
- Ecosystem services



CGB – Crop Genetics and Biotechnology

Research area:

- Plant breeding
- New plant breeding techniques
- Genetics
- Biotechnology
- The quality of crops as feed, food and biomass



JORD – Soil Physics and Hydropedology

Research areas:

- Soil quality
- Soil spectroscopy
- Water and contaminant transport
- Digital soil mapping
- Soil mechanical behaviour
- Sustainable soil management
- Arctic soils



JORNÆR – Soil Fertility

Research areas:

- Biochar
- Grassland ecosystem services
- Microbial ecology of soil and manure
- Cover crops
- Emission of greenhouse gases
- Nutrients in wastes and fertilisers



KLIMA – Climate and Water

Research areas:

- Agrohydrology
- Bioenergy
- Climate change and biomass production
- Water quality
- Agrosystems modelling
- Informatics and GIS
- Agriculture's climate impact



SYSTEM – Agricultural Systems and Sustainability

Research areas:

- Sustainable resource management
- Life cycle assessment of food and other bio-based products
- Organic animal production
- Organisation of food systems
- Productivity and profitability in farming



Pioneer centre Land-CRAFT

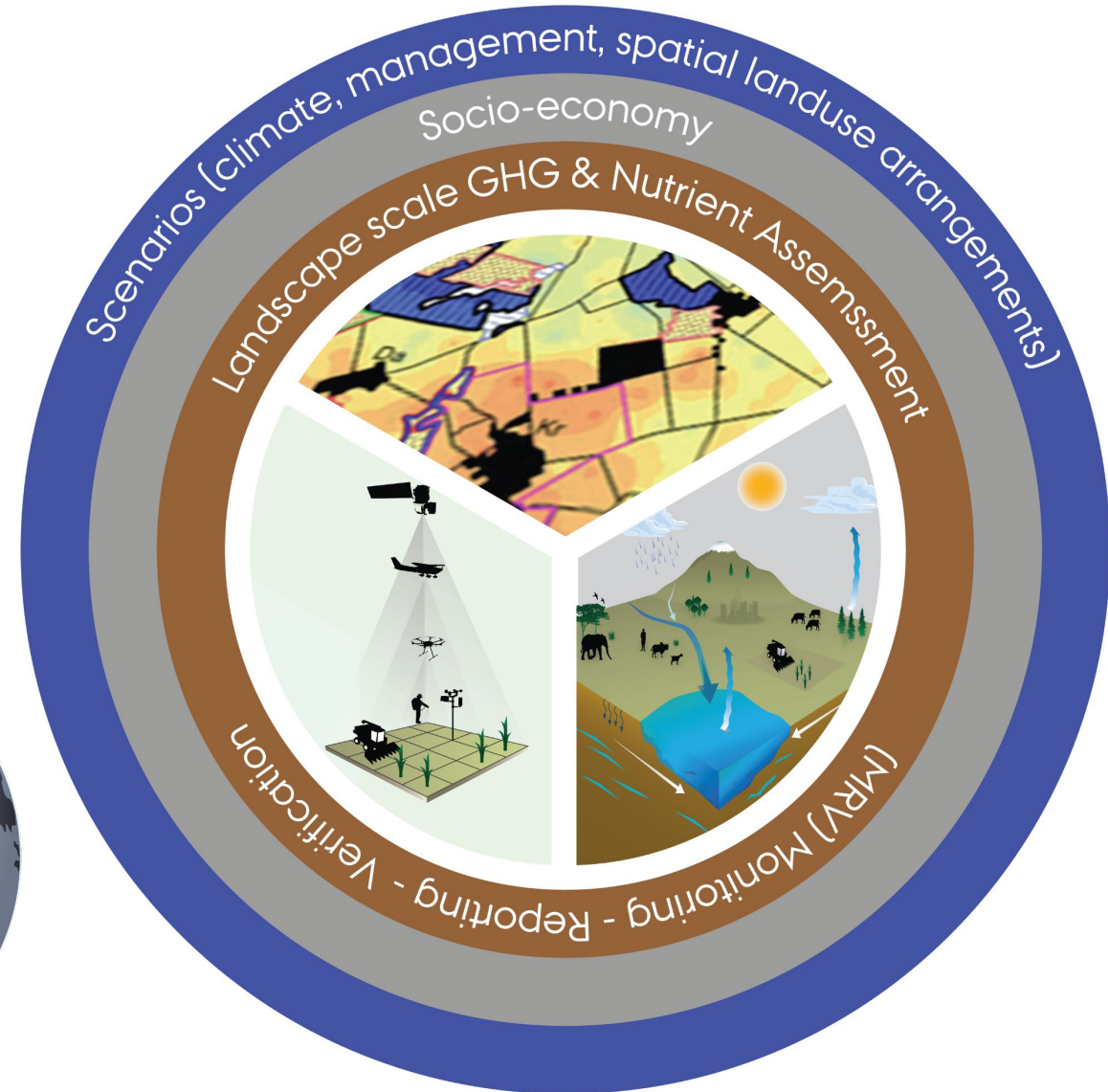
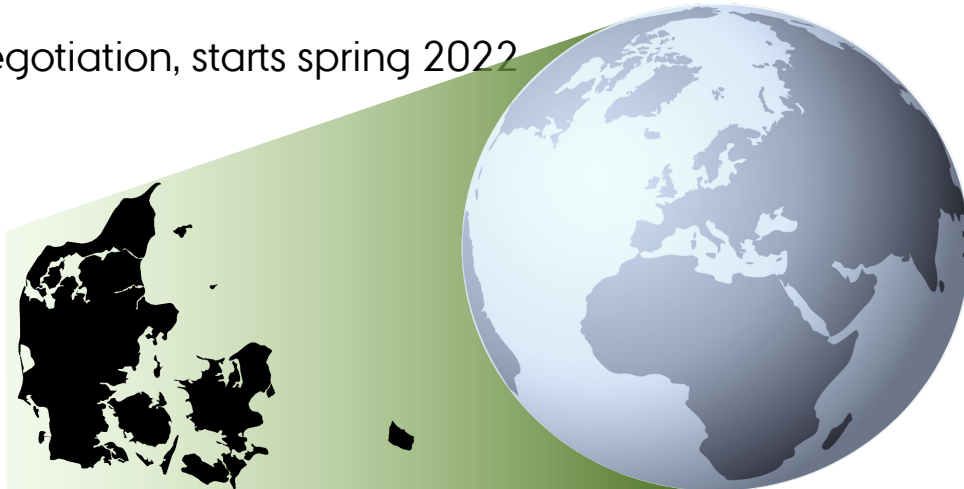
Support transformational change of current food systems

- Understand nutrient and GHG fluxes at landscape scale
- Identify and test mitigation actions at landscape scale
- Develop monitoring, reporting and verification (MRV)

Aarhus University
University of Copenhagen
Karlsruhe Institute of Technology
Colorado State University

Prof. Klaus Butterbach-Bahl

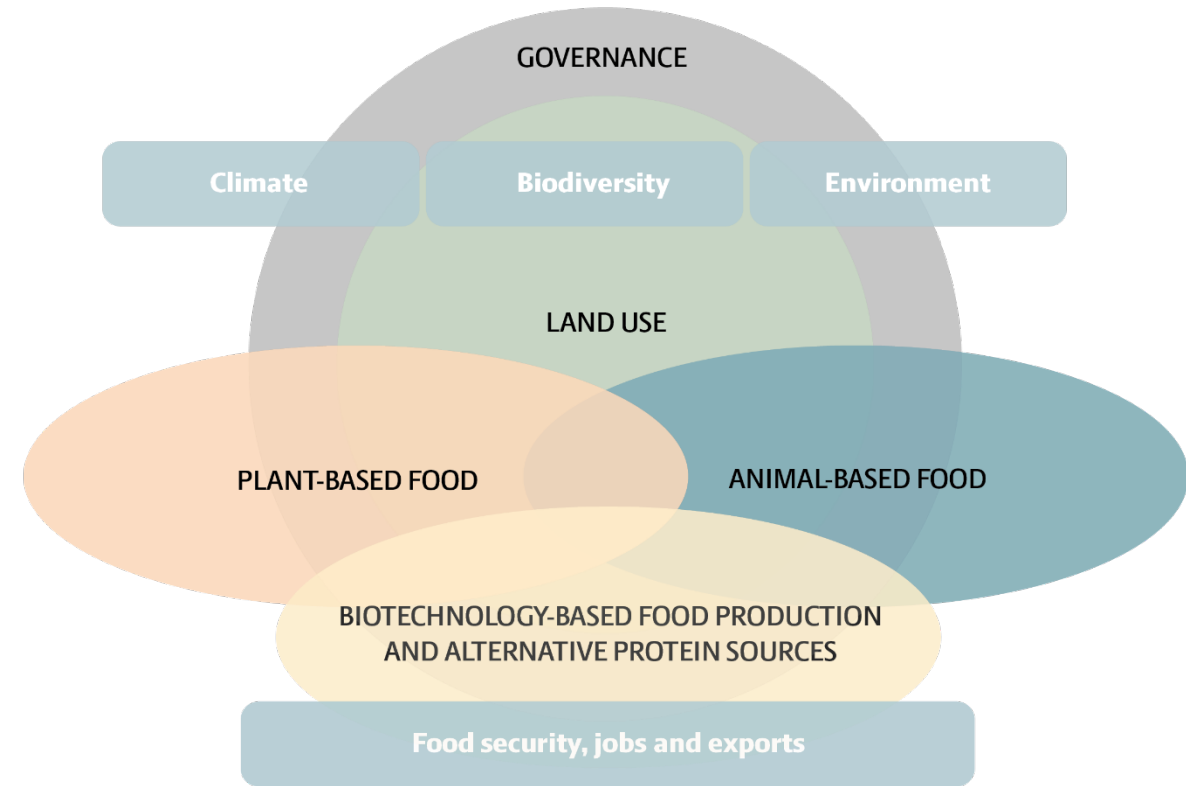
Now in contract negotiation, starts spring 2022



There are many sustainability challenges

- Lower GHG and environmental footprint
- Enhance biodiversity (inside and outside farming)
- Less pesticide use
- Land area for other purposes (infrastructure, nature, recreation, climate change adaptation)
- Increased production of
 - Food (globally +45% by 2050)
 - Bioenergy
 - Biomaterials
- Jobs and growth outside cities

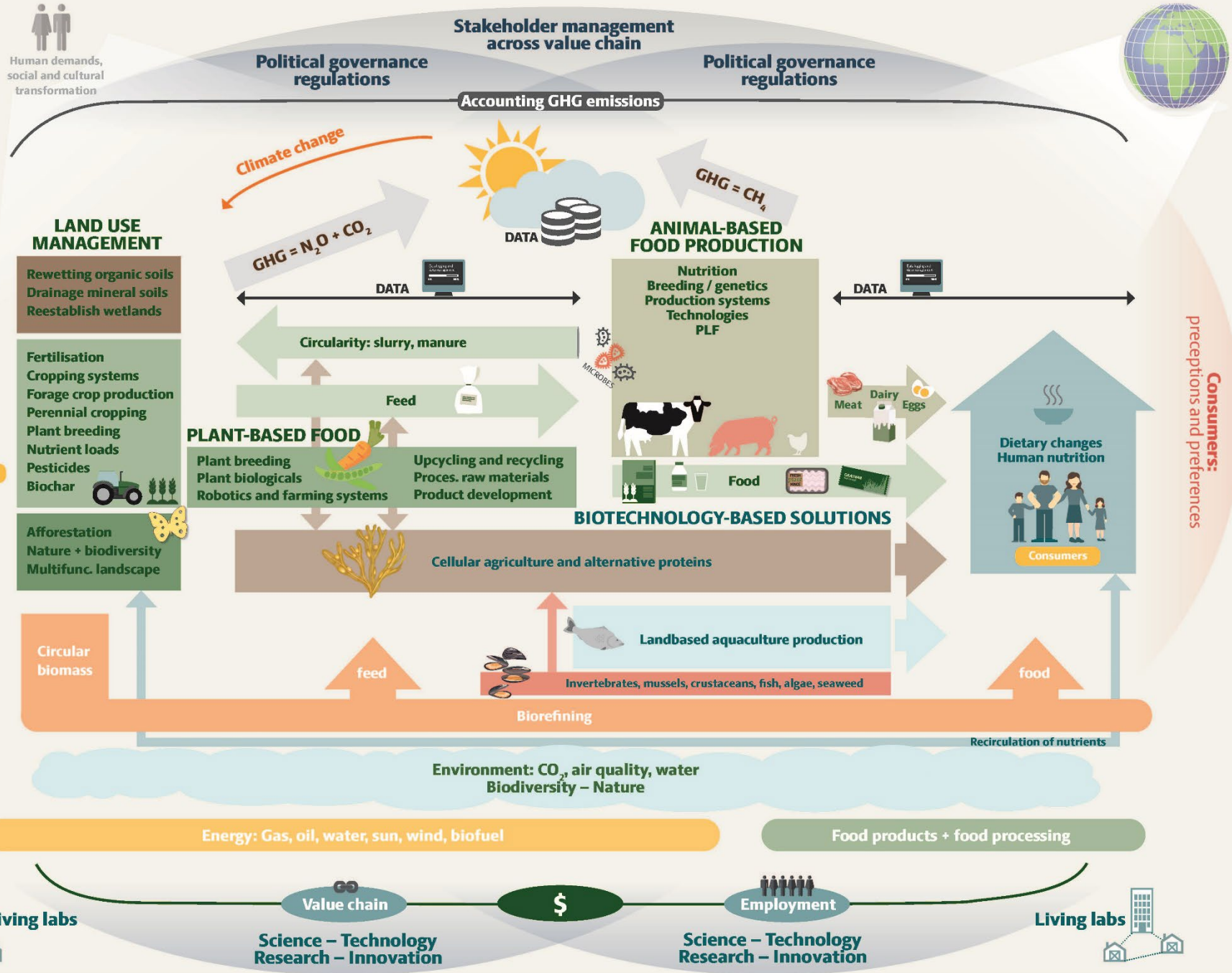
AgriFoodTure roadmap



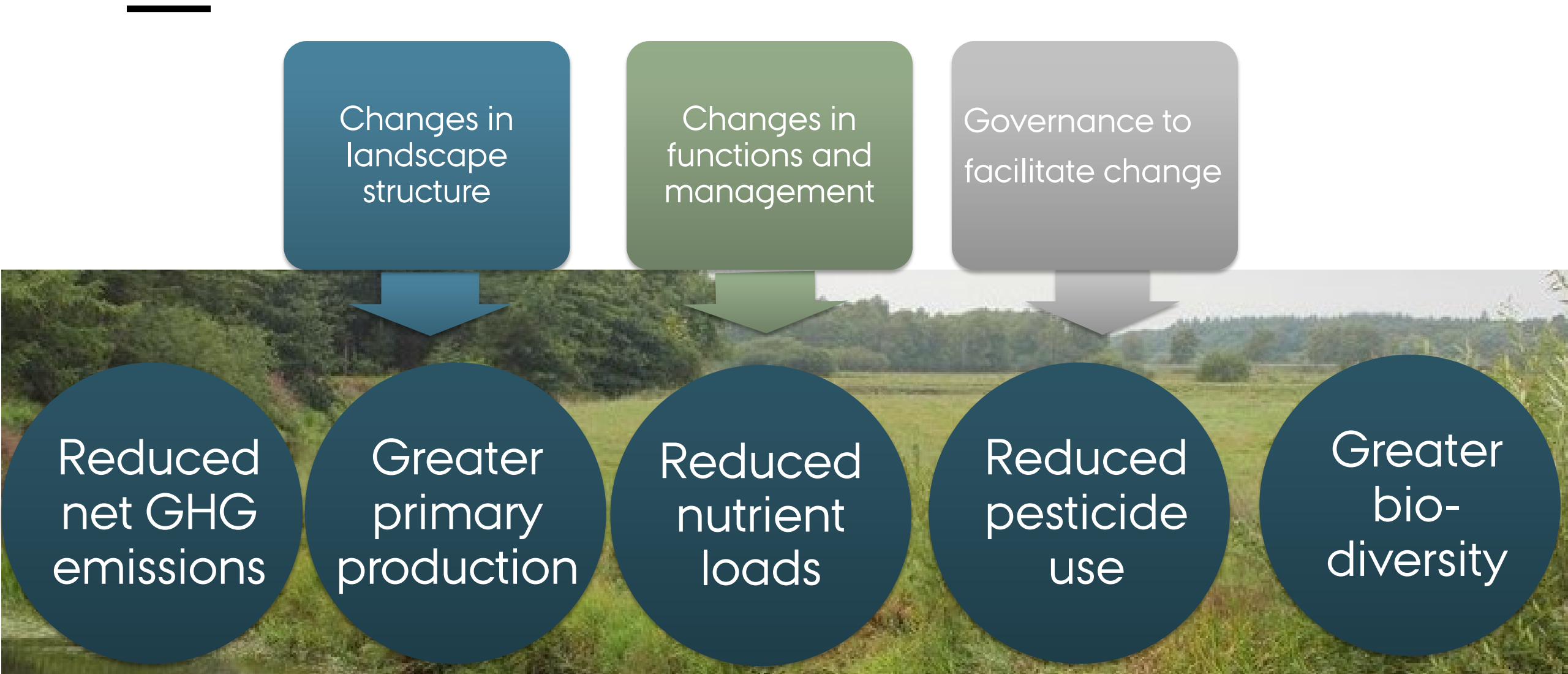
Roadmap developed by universities and agroindustry in Denmark

It is complex

GLOBAL FOOD SYSTEM



Land use and management is key to mission goals



Cropping systems



Arable cropping

- More biodiverse cropping systems, including legumes and mixtures
- Earlier harvesting of annual crops - improved establishment of cover crops to be harvested for biorefining (double cropping)

Forage cropping

- Grassland-based forage production based on multispecies mixtures

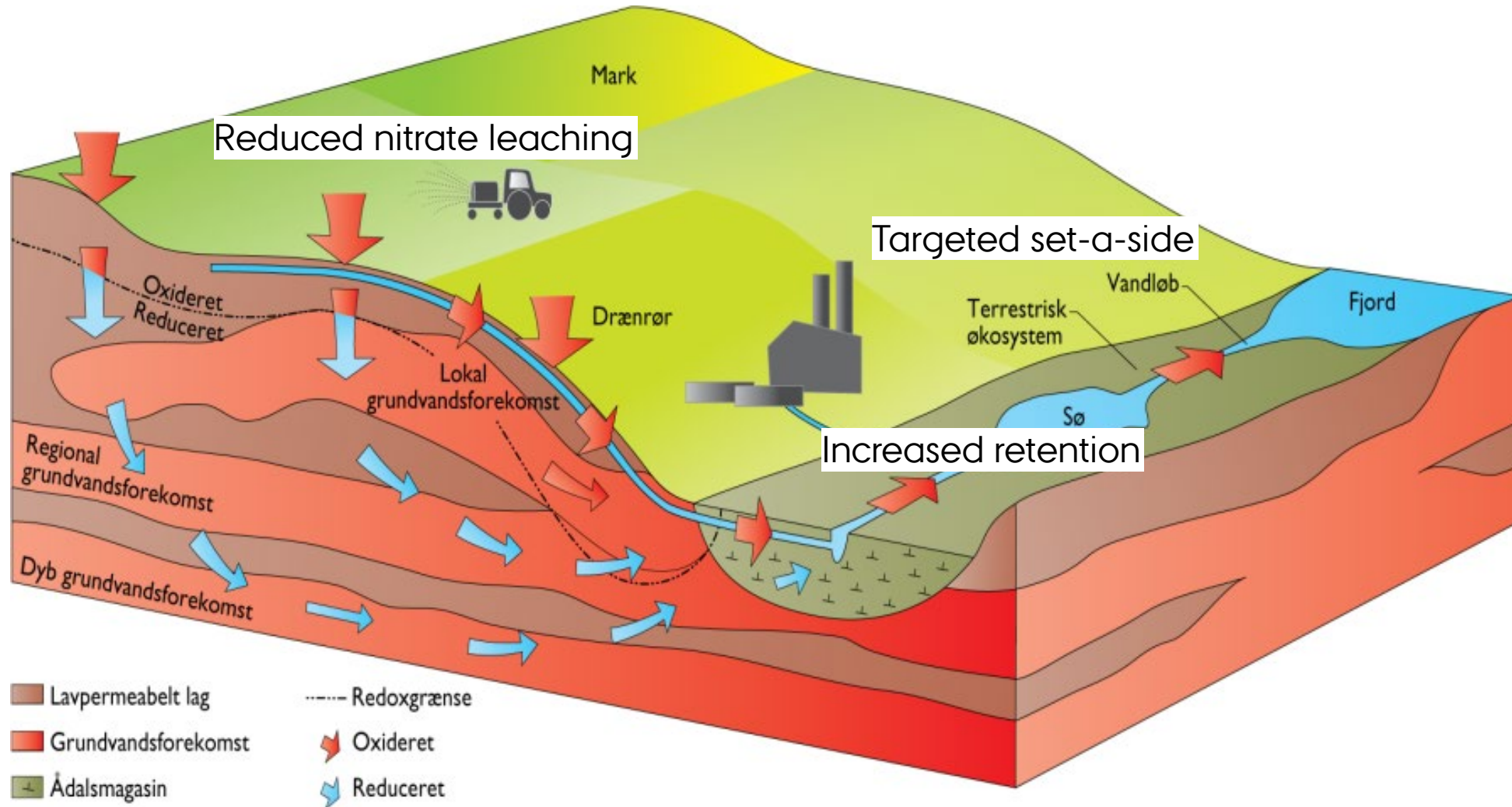
Perennial cropping systems

- Novel productive perennial crop production systems (incl. agroforestry)
- Integration with energy production (including photovoltaic)

Management

- Novel fertilizers and fertilization (including recycled nutrients)
- Precision farming technologies (sensors and robotics)
- Plant breeding - focus on environmental/climate aspects and efficiency in production chain
- Biorefining technologies - upcycle biomass from across the landscape
- Enhance soil carbon through biochar (integration with energy systems)

Lower leakage and increased nutrient retention



Stipulated GHG reduction (carbon neutrality)

Source	Baseline	Reduction		Reduction	
	(Mt CO ₂ eq) 2018	(%)		(Mt CO ₂ eq)	
		2030	2050	2030	2050
Enteric fermentation (CH ₄)	3.77	40	70	1.51	2.64
Manure management (CH ₄ , N ₂ O)	2.81	50	90	1.41	2.53
Fertilization (N ₂ O)	2.83	40	70	0.91	1.60
Crop residues (N ₂ O)	0.61	10	40	0.06	0.24
Ammonia volatilization (N ₂ O)	0.34	20	40	0.07	0.13
Nitrate leaching (N ₂ O)	0.33	10	30	0.03	0.10
Liming (CO ₂)	0.24	10	20	0.02	0.05
Energy use (CO ₂)	1.25	50	100	0.62	1.25
Organic soils (CO ₂ , N ₂ O)	5.75	30	80	1.73	4.60
Soil carbon (CO ₂)	-	-	-	1.80	4.30
Total	17.37	48	100	8.16	17.44

Targets are extremely ambitious, but feasible with extraordinary large and coordinated efforts

Biodiversity and pesticides require additional effort

Pesticide use

Measure	Reduction (%)	
	2030	2050
Perennial cropping systems	10	15
Diversity of arable cropping	5	20
Plant biologicals	5	10
Plant resistance breeding	10	15
Precision technologies	15	30
Total	45	90

Enhancing biodiversity

Category	Source	Area (1000 ha)	
		2030	2050
Land sparing	Rewetted areas	100	250
	Set-a-side	50	100
	Afforestation	50	100
Land sharing	Agroforestry	50	100
	Biodiverse perennial cropping	300	500
	Biodiverse arable cropping	500	1000
Total		1100	2050





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