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Ecosystem services and the European agricultural land

Rastislav Stanik, European Environment Agency

Wallonie

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2014 International Year of Family Farming

Land for family farming ? — Namur, 07/10/2014

Context

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- EU is the world's biggest importer of food and the second biggest agricultural exporter after the US

- European agriculture is very diverse, with the most productive and specialised farming systems located in lowland western Europe and more extensive practices in southern, eastern and mountainous regions

- Agricultural land represents around 47* % of the land cover in the EU

*MAES second report, 2014

Context

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- Share of agriculture land is decreasing, with both basic land cover types (arable/crop land; mosaics/pastures) being either consumed by artificial land take or under process of withdrawal from farming, the decline of production area is offset by strong increase in productivity

- Land and soil are finite and non-renewable resources

Map of agricultural areas in Europe

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http://www.eea.europa.eu/data-and-maps/explore-interactive-maps/agricultural-areas-in-europe CLC-based

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Namur surroundings

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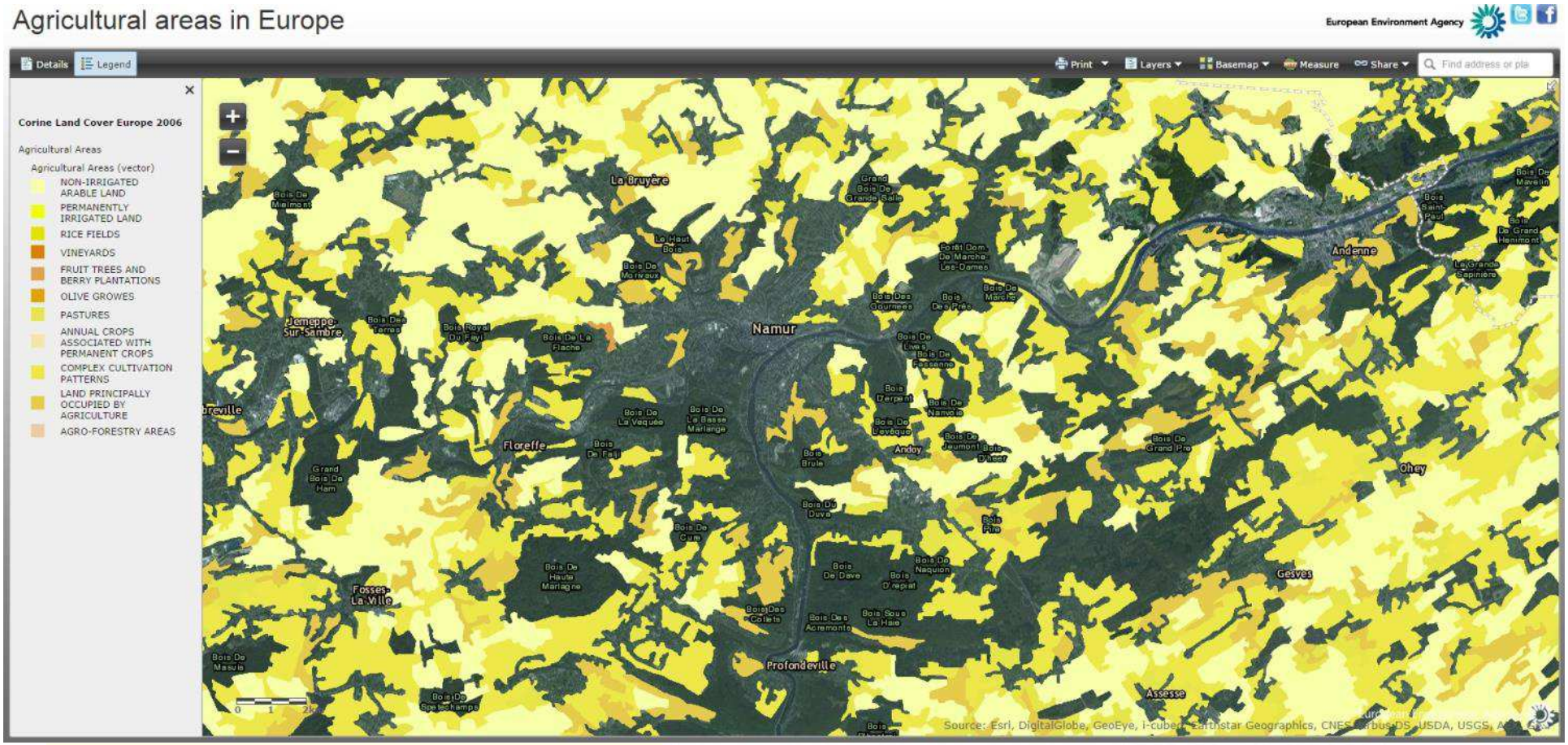
Agricultural areas in Europe



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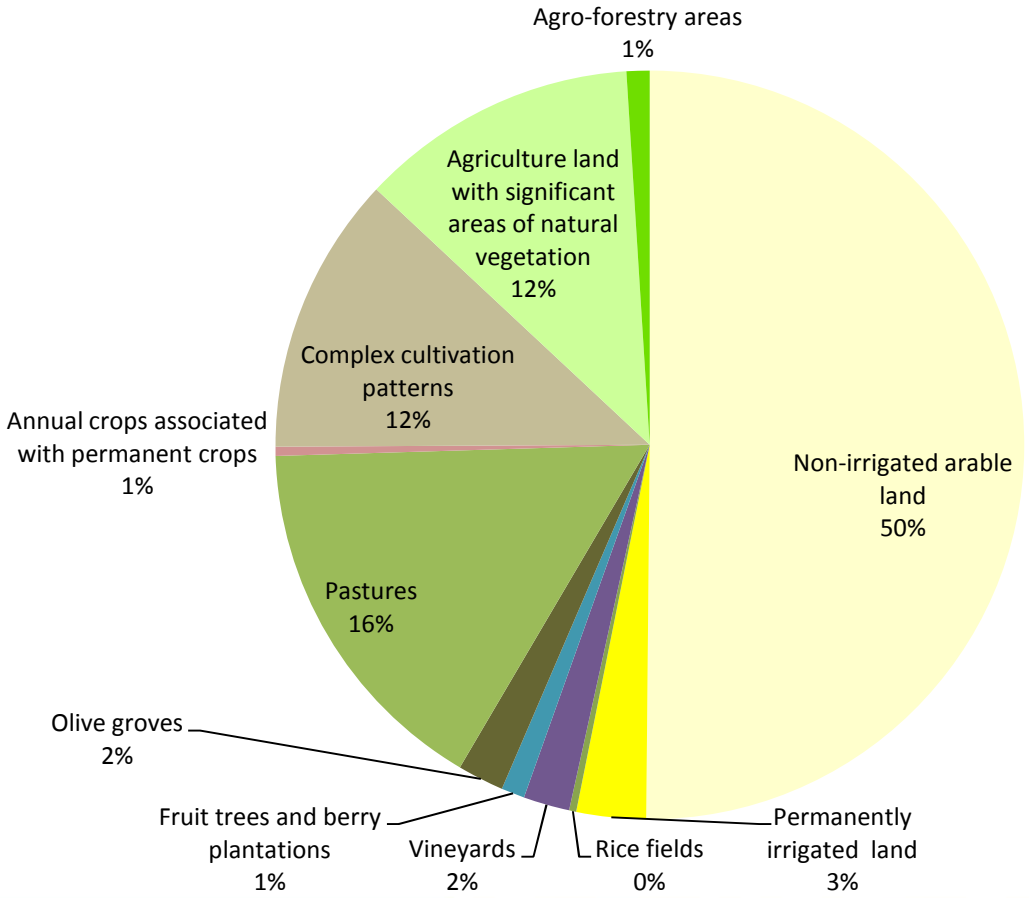
Composition of EU agricultural land cover (source: CLC 2006)



Ecosystem services

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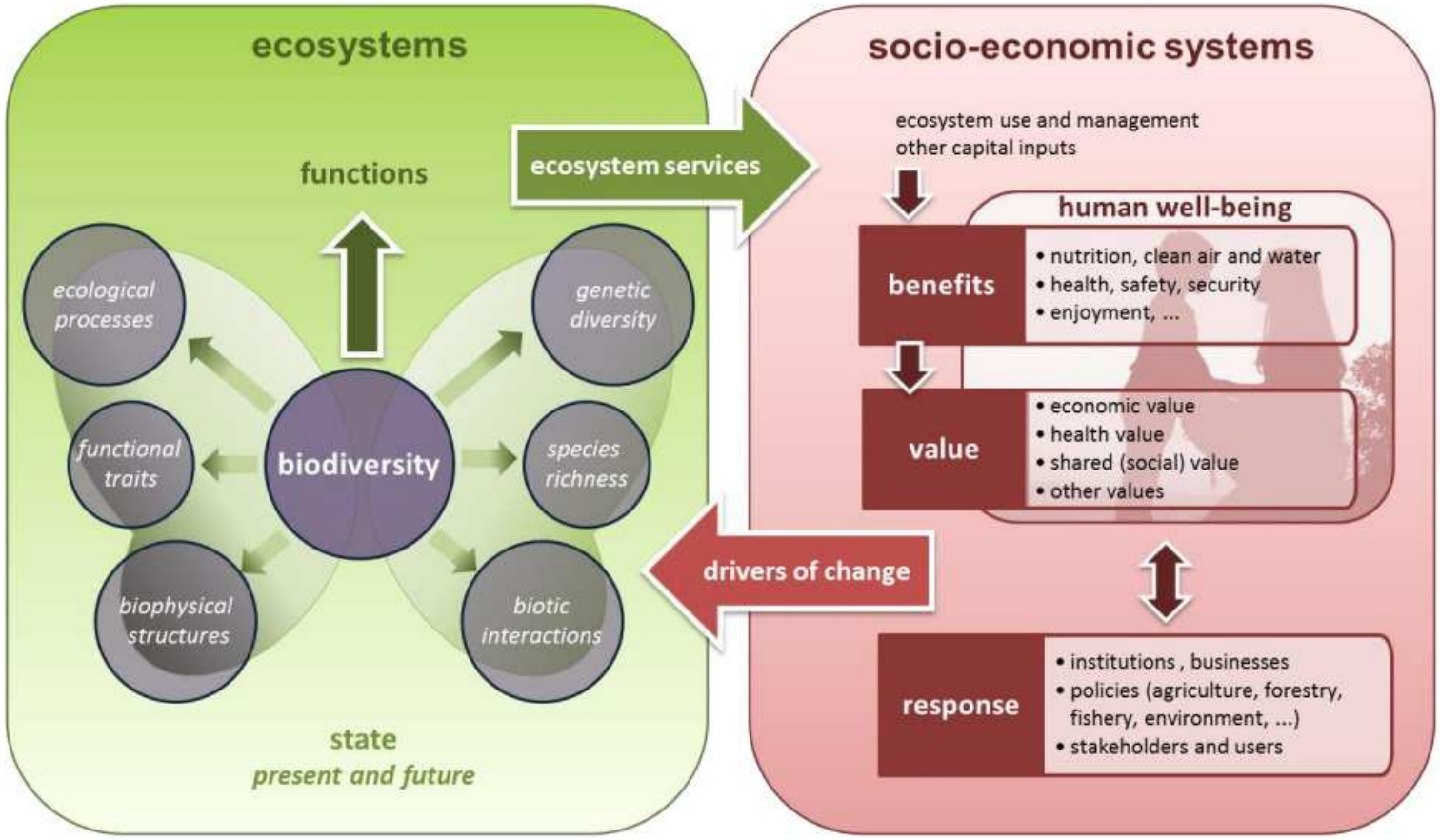
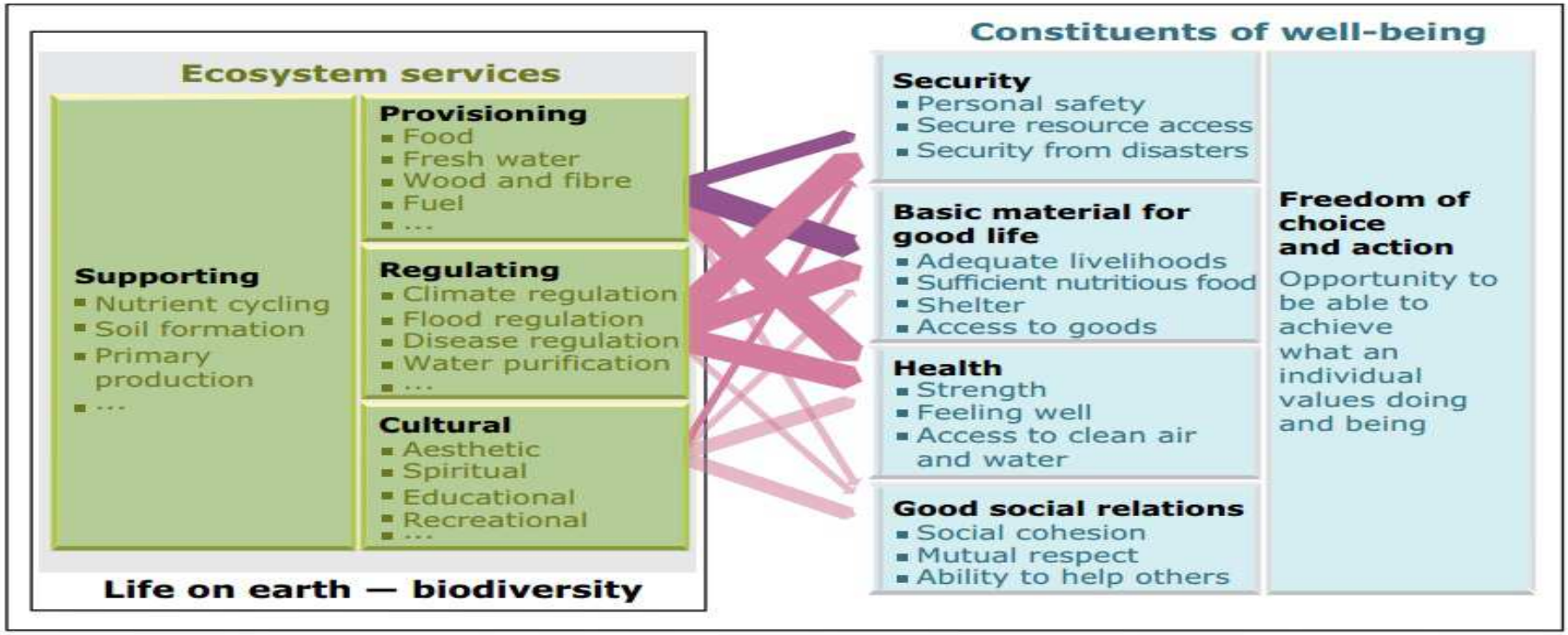


Ecosystem services

European Environment Agency



Arrow's color

Potential for mediation by socioeconomic factors

Low Medium High

Arrow's width

Intensity of linkages between ecosystem services and human well-being

Weak Medium Strong

Source: MA, 2005.

Ecosystem services of agriculture ecosystems

- Supporting

soil formation, nutrient cycling, primary production

- Provisioning

food, raw materials, biomass, fresh water, genetic bank

- Regulating

pollination, pest regulation, water regulation, carbon sequestration

- Cultural

cultural heritage, recreation, aesthetic value, educational

Indicators at EU level

Indicators for provisioning services delivered by agro-ecosystems.

Division	Group	Class	Cropland	Grassland
Nutrition	Biomass	Cultivated crops	• Yields of food and feed crops (ton/ha; ton dry matter/ha; MJ/ha) • Food and feed crop area (ha)	• Yields (ton/ha; ton dry matter/ha; MJ/ha) • Grassland area (ha)
		Reared animals and their outputs	• Livestock data (LU/ha, Ton/yr/region)	
		Wild plants, algae and their outputs		
		Wild animals and their outputs	• Wild game bag data (merged with forest ecosystems) • Wild game population estimates	
		Plants and algae from in-situ aquaculture		
		Animals from in-situ aquaculture		
	Water	Surface water for drinking	• High Nature Value farmland	
		Ground water for drinking	• Areas important for groundwater abstraction in agro ecosystems	
Materials	Biomass	Fibres and other materials from plants, algae and animals for direct use or processing	• Yields of fibre crops (ton/ha; ton dry matter/ha; MJ/ha) • Fibre crop area (ha) • Manure (ton/yr)	
		Materials from plants, algae and animals for agricultural use		
		Genetic materials from all biota	• Yields of crops used for medicinal and cosmetic purposes (ton/ha; ton dry matter/ha; MJ/ha) • Area of crops used for medicinal and cosmetic purposes (ha)	
	Water	Surface water for non-drinking purposes	***See freshwater ecosystems***	
		Ground water for non-drinking purposes	***See freshwater ecosystems***	
Energy	Biomass-based energy sources	Plant-based resources	• Yields of energy crops (ton/ha; ton dry matter/ha; MJ/ha) • Energy crop area (ha) • Biofuel, biodiesel, bioethanol (kToe)	• Yields of grassland for energy production (ton/ha; ton dry matter/ha; MJ/ha) • Grassland for energy area (ha)
		Animal-based resources	• Energy from manure treatment systems	
	Mechanical energy	Animal-based energy		

source:
MAES, 2nd report – final, 02/2014

Indicators for regulation and maintenance services delivered by agro-ecosystems.

Division	Group	Class	Cropland	Grassland
Mediation of waste, toxics and other nuisances	Mediation by biota	Bio-remediation by micro-organisms, algae, plants, and animals		
		Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals		
	Mediation by ecosystems	Filtration/sequestration/storage/accumulation by ecosystems	• Concentration of pollutants in soil in agricultural areas • Concentration of nutrient elements (C, N, P, K, Ca, Mg, S) in soil in agricultural areas	
		Dilution by atmosphere, freshwater and marine ecosystems		
		Mediation of smell/noise/visual impacts	• Hedgerow length	
Mediation of flows	Mass flows	Mass stabilisation and control of erosion rates	• Percentage of soil cover in cropland (conservation tillage (low tillage), zero tillage, winter crops, Cover crop or intermediate crop, plant residues) • Density of hedgerows • Soil erosion risk	• Percentage of grassland cover • Soil erosion risk
		Buffering and attenuation of mass flows	• Density of hedgerows	
	Liquid flows	Hydrological cycle and water flow maintenance	• Retention capacity of water in agricultural soils	
		Flood protection	• Share of agroforestry within floodplains	
	Gaseous / air flows	Storm protection	• Density of hedgerows	
		Ventilation and transpiration	• Amount of biomass	
Maintenance of physical, chemical, biological conditions	Lifecycle maintenance, habitat and gene pool protection	Pollination and seed dispersal	• Pollination potential • Pollinators distribution • Pollinators species richness • Number of beehives • Areal coverage of vegetation features supporting pollination (hedgerows, flower strips, High Nature Value Farmland etc.)	
		Maintaining nursery populations and habitats	• Share of High Nature Value farmland • Traditional orchards	
	Pest and disease control	Pest control	• Density of hedgerows	
		Disease control		
	Soil formation and composition	Weathering processes	• Share of organic farming • Soil organic matter content • Ph of topsoil • Cation exchange capacity	
		Decomposition and fixing processes	• Area of N fixing crops • Gross nitrogen balance	
	Water conditions	Chemical condition of freshwaters	***See water pilot***	
		Chemical condition of salt waters	***See water pilot***	
	Atmospheric composition and climate regulation	Global climate regulation by reduction of greenhouse gas concentrations	• Carbon sequestered by permanent crops	• Carbon sequestered by grasslands
		Micro and regional climate regulation	• Humidity index	

source:
MAES, 2nd report – final, 02/2014

Indicators for cultural services delivered by agro-ecosystems.

Division	Group	Class	Cropland	Grassland
Physical and intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings]	Physical and experiential interactions	Experiential use of plants, animals and land-/seascapes in different environmental settings	• Number of visitors in agricultural areas • Number of Number of rural enterprises offering tourism-related services • Farm tourism • Walking and biking trails • Number of hunting licences, number of birdwatchers • Expenditures related to hunting	
		Physical use of land-/seascapes in different environmental settings		
	Intellectual and representative interactions	Scientific	• Amount of scientific studies on agro-ecosystems	
		Educational	• Number of didactic farms	
		Heritage, cultural	• Number of agricultural-livestock fairs • Number of monuments in agricultural areas • Number of certified products that require traditional landscape management	
		Entertainment	• Contests and competitions related to agriculture	
		Aesthetic	• Number of visitors in agricultural areas • Number of nature/agricultural landscape photos uploaded on web portals	
Spiritual, symbolic and other interactions with biota, ecosystems, and land-/seascapes [environmental settings]	Spiritual and/or emblematic	Symbolic	• Remarkable trees • Symbolic species	
		Sacred and/or religious	• Religious monuments, pilgrim paths in agro-ecosystems	
	Other cultural outputs	Existence	• Cropland or grassland in protected agricultural areas (e.g. Natura2000, Biosphere reserves, IUCN category V areas, World Heritage Unesco sites related to agricultural landscape, landscape conservation areas)	
		Bequest	• Willingness to pay for landscape measures in cropland or grassland areas	

source: MAES, 2nd report – final, 02/2014

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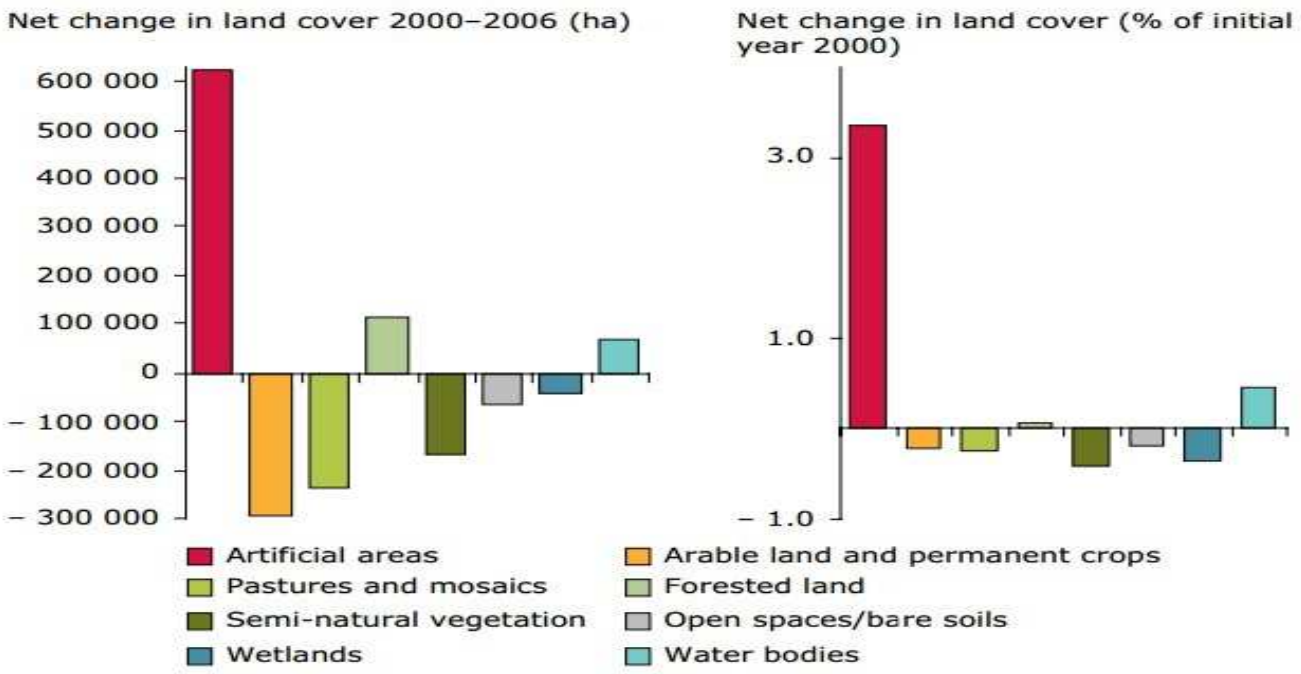
Land cover dynamics within the sector

Net land-cover changes 2000–2006 in Europe — total area (left) and percentage change (right)



Note: The data presented here cover the 36 European countries in the Corine Land Cover 2006 data set.

Source: EEA/ETC-LUSI, 2010.

Land cover dynamics within the sector

- Conversions from pastures to arable land

Baltic countries (especially Estonia and Lithuania), Croatia, France, northern Germany, Hungary and the southern part of Spain

- Land abandonment

Benelux countries, Hungary, Ireland, Poland, the southern half of Portugal and Slovakia

Land cover dynamics within the sector

- Pastures extension

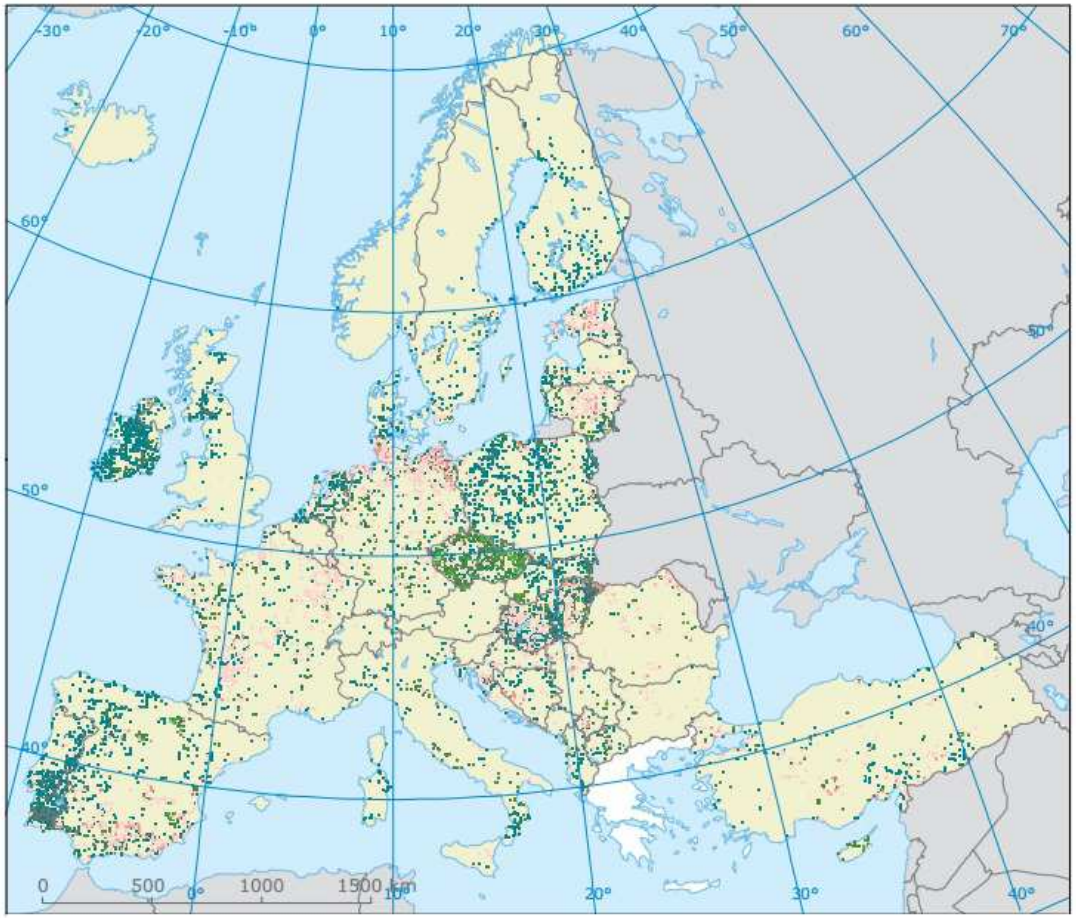
border regions of Czech Republic, in Hungary and to a lesser extent in southern Sweden

- Formation of new agricultural areas

through conversion of natural and semi-natural land is concentrated mostly in the south-western half of Spain, in southern Turkey and to a lesser extent in south-western Iceland

Agricultural land cover changes

European Environment Agency



Agricultural land cover changes, 2000–2006

Conversion from pasture to arable land and permanent crops (%)	Extension of set-aside fallow land and pasture (%)	Withdrawal of farming (%)	
0–1	0–1	0–1	No data
1–5	1–5	1–5	Outside coverage
5–10	5–10	5–10	
> 10	> 10	> 10	

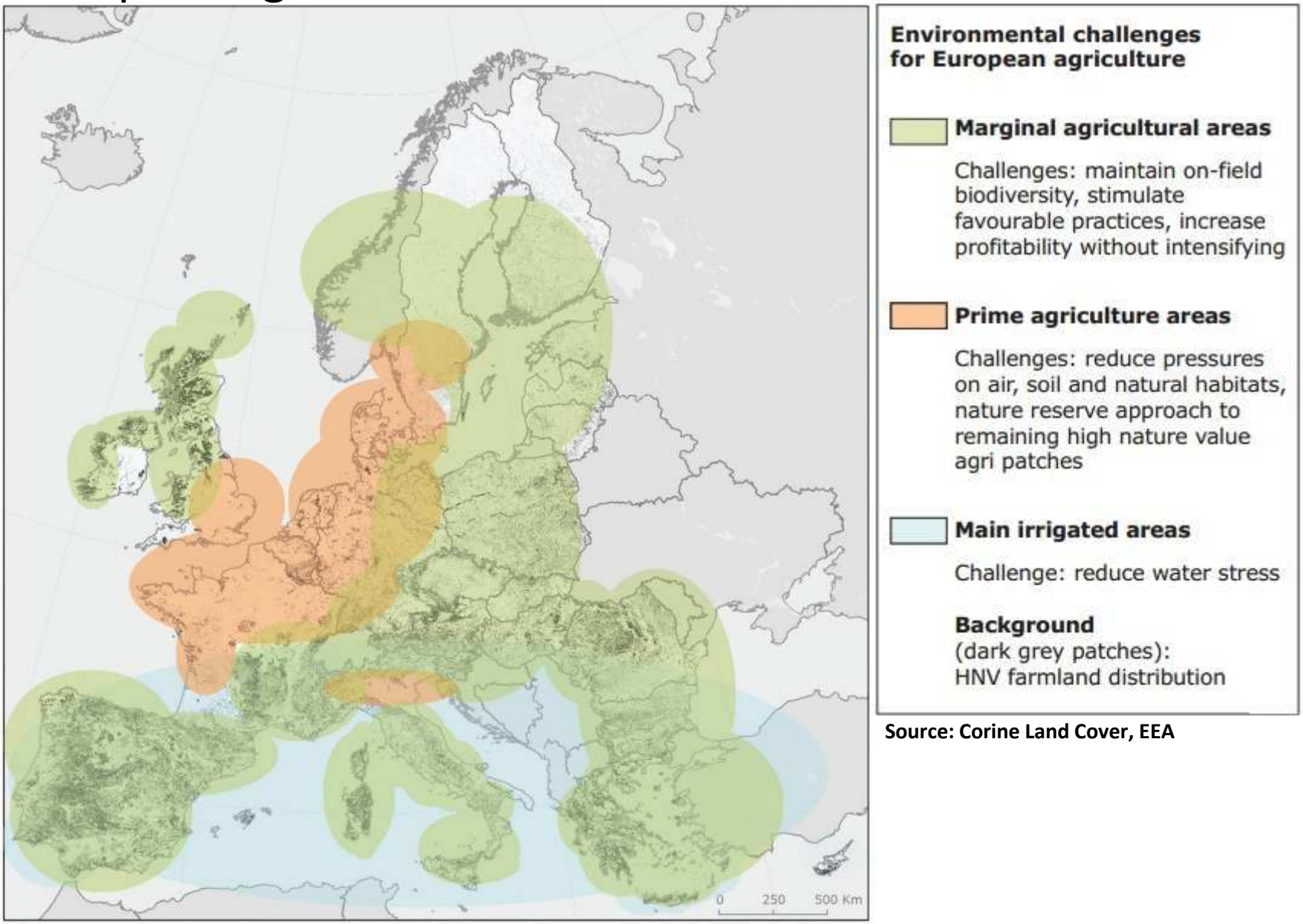
Source: Corine Land Cover.

Pressures to the sector

- Land take (artificial surfaces) mainly driven by the sprawl of economic sites and infrastructures, resulting in sealing of the surface and loss of original ecosystem services; increased competition for good arable land
- Loss of ecosystem services as consequence of soil sealing due to disruption of e.g. water and nutrient cycles upon breaking the connection between geo- and atmosphere
- Land abandonment, often resulting in woodland creation and in loss of some of the services, also in soil degradation

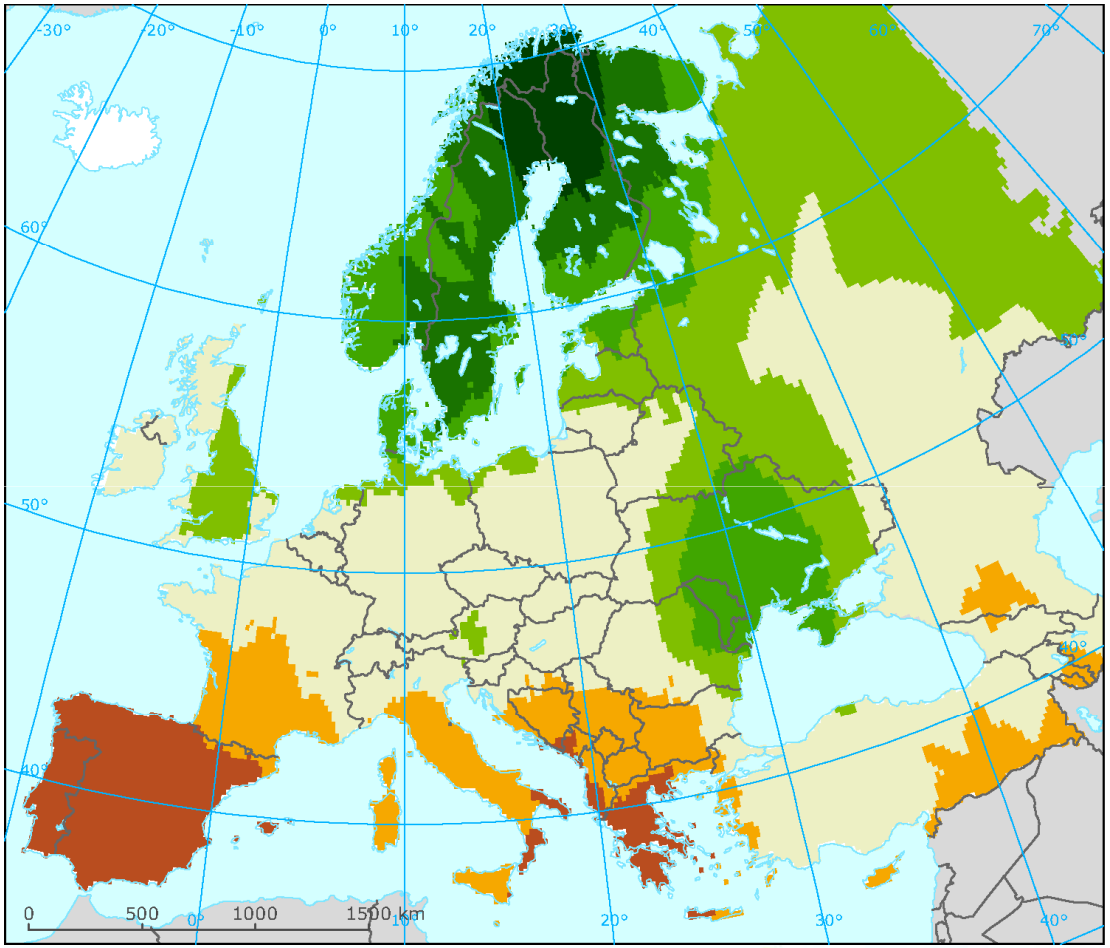
Environmental challenges for European agriculture

European Environment Agency



Source: Corine Land Cover, EEA

Mean relative changes in water-limited crop yield simulated by ClimateCrop model for 2050s compared with 1961-1990



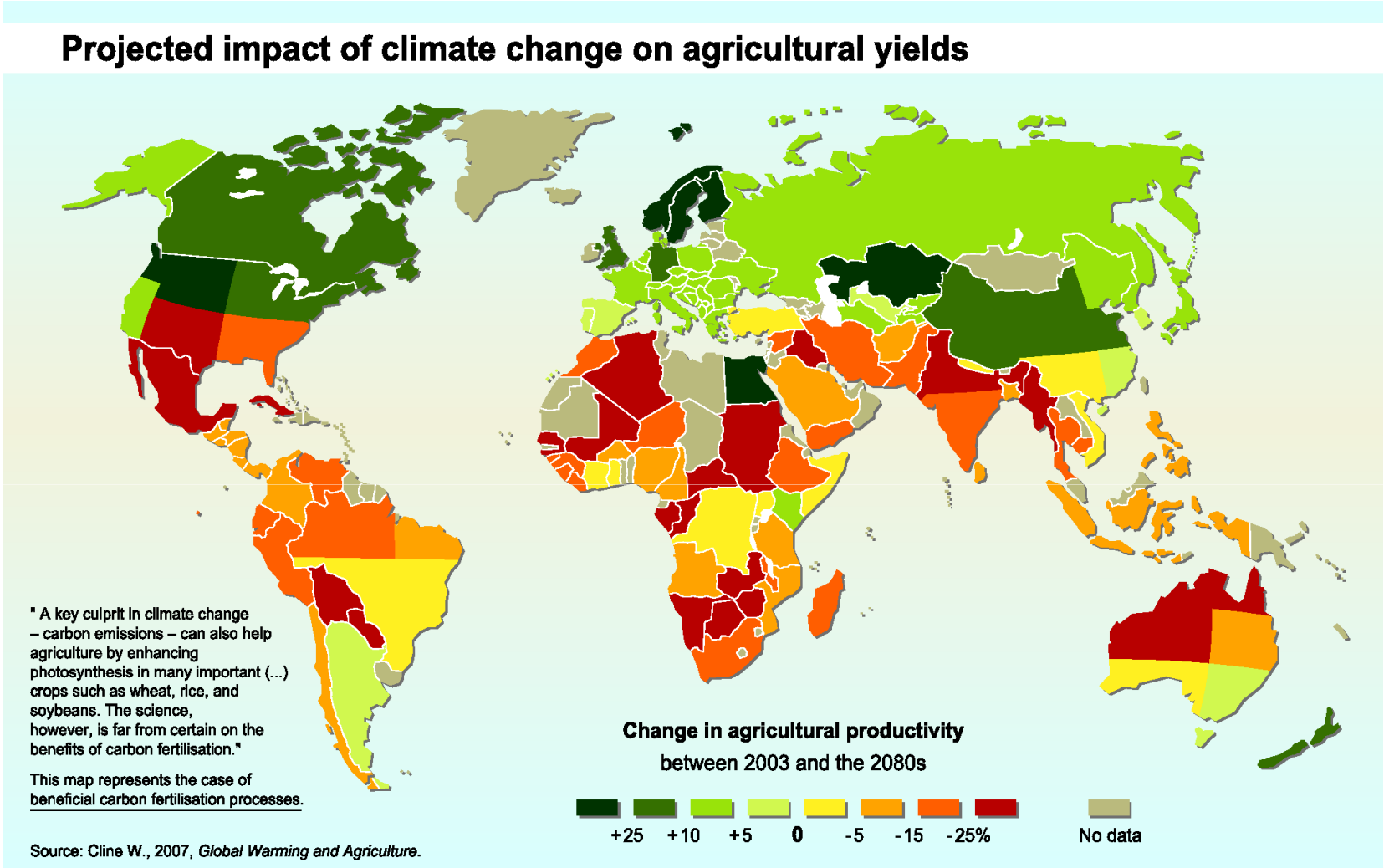
Projected changes in water-limited crop yield

(%)

- – 25 to – 15
- – 15 to – 5
- – 5 to 5
- 5 to 15
- 15 to 25
- 25 to 35
- > 35
- No data
- Outside coverage

source:EEA

National productivity by 2080 compared to 2003 levels



Pressures from the sector

- Global

GHGs concentration increase through deforestation, crop and livestock production, pollution from biomass burning

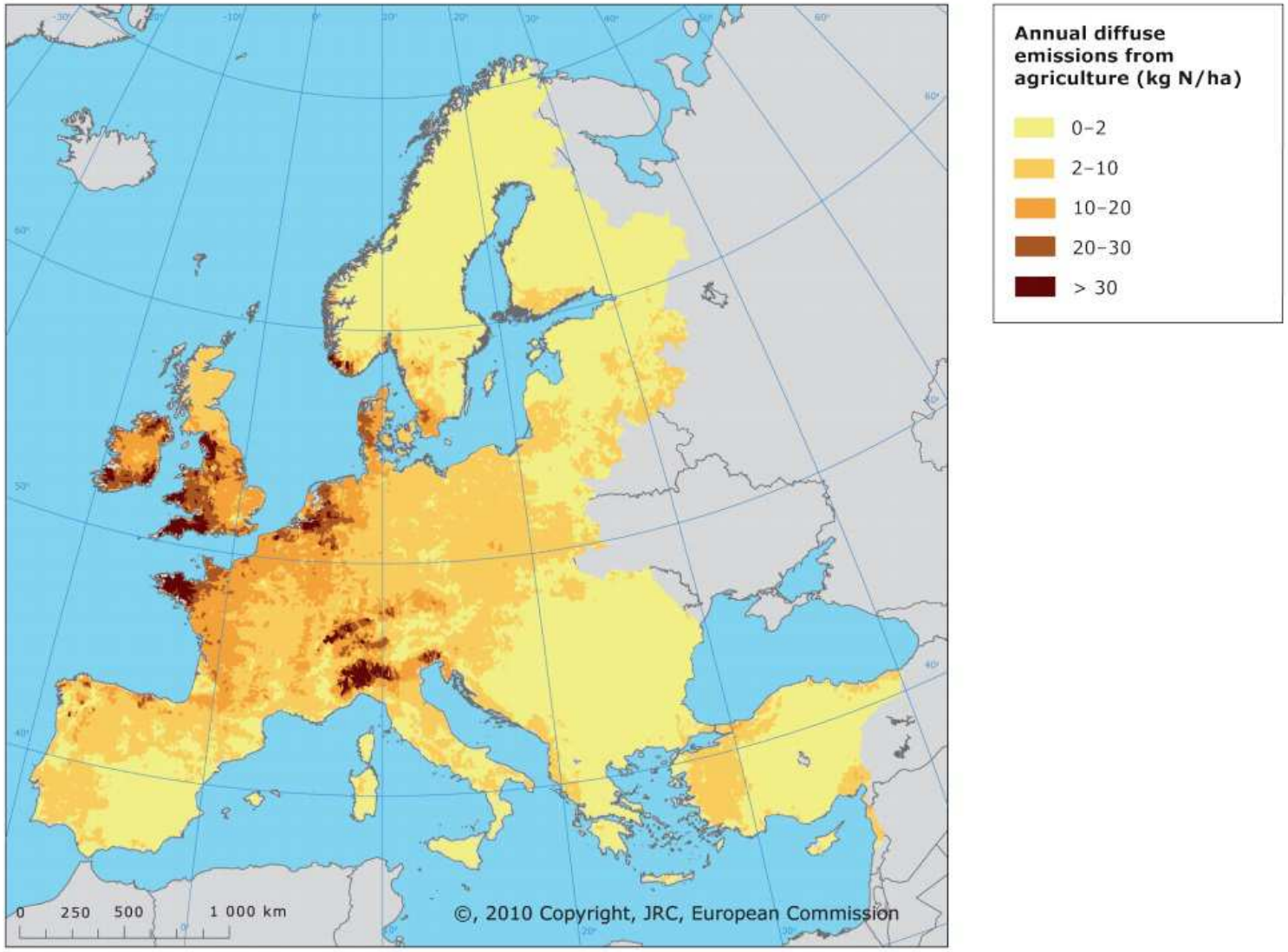
- Impacts on water

irrigation mismanagement, eutrophication, pesticide and livestock waste pollution

Pressures from the sector

European Environment Agency

Diffuse emissions of nitrogen to freshwater from agriculture



Source: EEA 2010. *The European environment — state and outlook 2010: freshwater quality*, European Environment Agency.

Pressures from the sector

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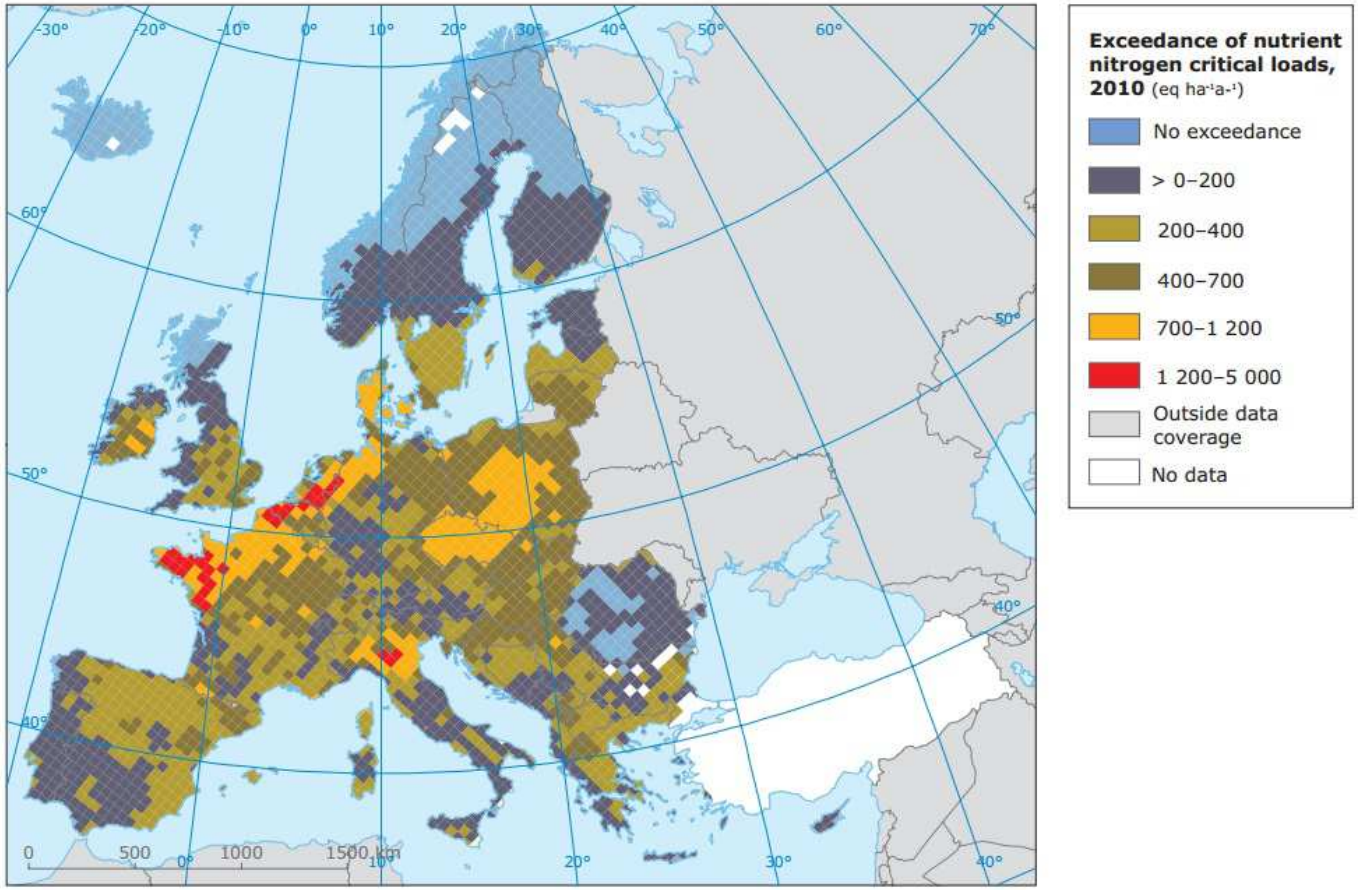
Exceedance of the critical nitrogen loads for eutrophication in Europe (as average accumulated exceedances)



Note: Figures for 2010 are model based and were computed using the 2008 Critical Loads Database hosted by the Coordination Centre for Effects (CCE).

A critical load is defined as 'a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge' (UNECE, 2004, http://www.unece.org/env/lrtap/WorkingGroups/wge/definitions.html).

Source: CSI-005 indicator, based on Hettelingh et al., 2008 (http://www.pbl.nl/en/publications/2009/Critical-load-dynamic-modelling-and-impact-assessment-in-Europe-CCE-Status-Report-2008).

Pressures from the sector

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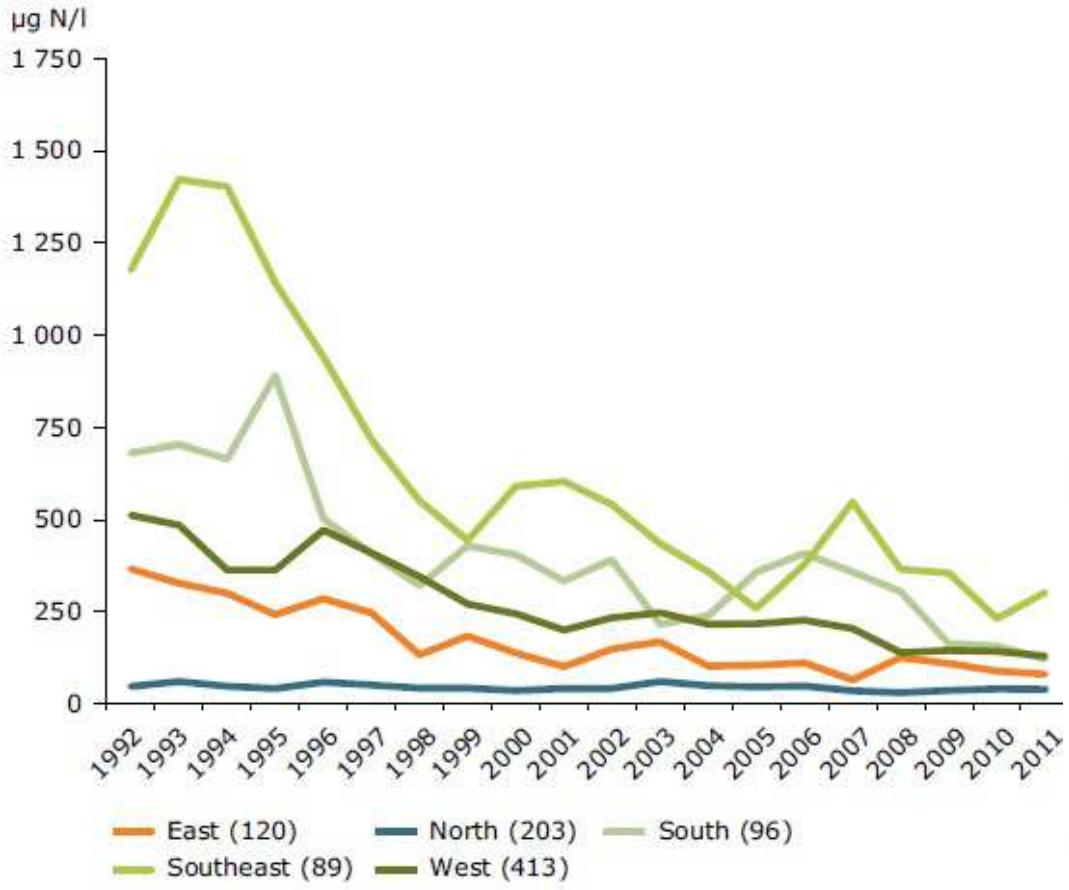

Concentration levels of ammonium in waters have declined, while nitrate pollution from agriculture is still an issue

Note: The data series per region are calculated as the average of the annual mean for river monitoring stations in the region. Only complete series after inter/extrapolation are included (see indicator specification). The number of river monitoring stations included per geographical region is given in parentheses.

Geographical coverage:
North (Finland, Norway (**), Sweden (**));
West (Austria, Belgium, Denmark (*), Germany (**), France, Ireland, Liechtenstein (**), Luxembourg, United Kingdom);
South (Spain);
East (Czech Republic (*), Estonia, Latvia, Lithuania, Poland (**), Slovenia, Slovakia (*));
Southeast (Albania, Bulgaria, and former Yugoslav Republic of Macedonia).

(*) Denotes countries included in the top figure only.

(**) Denotes countries included in the bottom figure only.

Source: EEA (CSI 019).

Pressures from the sector

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- Impacts on land

intensification of production (impact on soil fauna -› nutrient cycling), land degradation (erosion, soil fertility decline, salinization, lowering of water table, soil contamination by pesticide residues, accum. of metals) – threat to food security by degraded productivity

- Loss of biological and ecosystem biodiversity

pollination, decreased genetic bank, less complete use of resources and lower primary production, loss of valuable landscape elements

Loss of grassland butterfly biodiversity (17 species in 19 countries)

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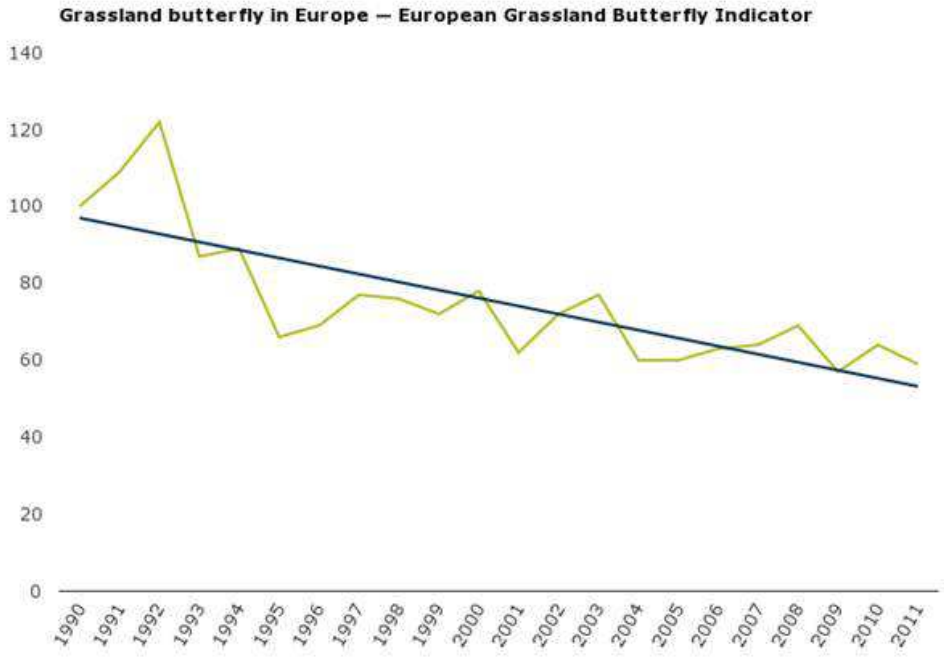
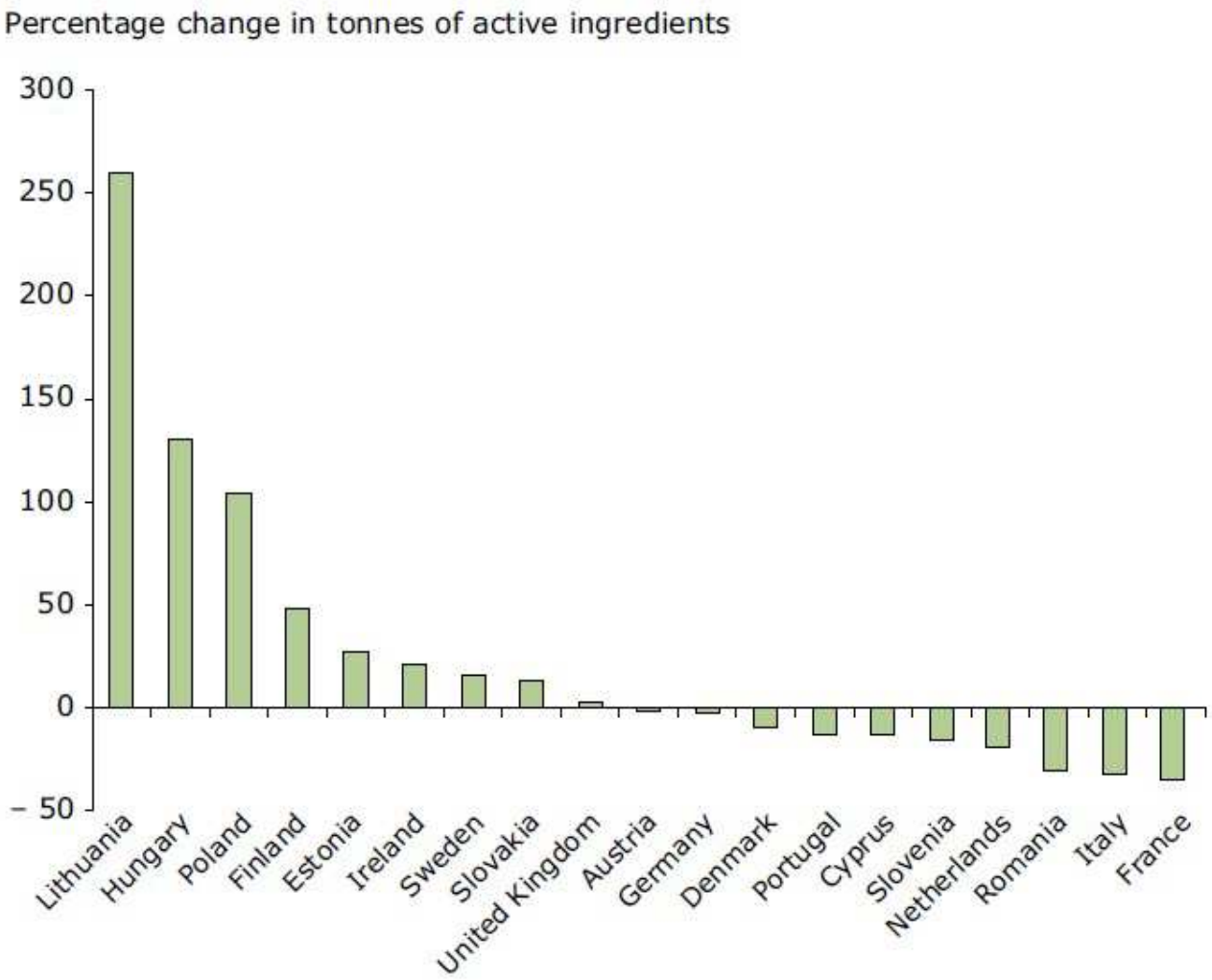


Butterfly Conservation Europe / Statistics Netherlands

European Environment Agency

Net change in pesticide use, 2000–2009



Note: Based on data on the use of insecticides, herbicides, fungicides and bactericides in the EEA-33 countries for which data are available.

Source: FAO.

Application of pesticides has generally declined in the EU

Policies and outlooks

European Environment Agency

Common Agriculture Policy Objectives

- enhancing EU food production, securing farm incomes, stabilising food price levels, maintaining rural social fabric, reducing environmental pressures

- „Greening the CAP“(2014-2020) – Coupling agricultural subsidies to stricter cross-compliance with environmental legislation and „greening elements“: compulsory crop diversification and maintanence of permanent grassland and ecological landscape elements (ecological focus areas)

Main elements of „greened“ CAP

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	Pillar I	**Pillar II**
Mainly contributing to CAP objectives	Viable food production Sustainable management of natural resources and climate action	Sustainable management of natural resources and climate action Balanced territorial development
Main instruments	Annual direct payments to farmers Market measures	Multi-annual rural development measures, on contractual basis
EU budget (7 years)	317 billion euros	101 billion euros
Co-financing by Member States required	No	Yes
Main proposed changes	Introduction of greening measures (30% budget direct payments) New standards for cross-compliance More possibilities for coupled payments	New priorities, instruments More freedom in distribution of budget Change from 3 'axes' (thematic themes) to six priorities Enhanced risk management toolkit

Greening the CAP

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Under Pillar II,Rural development, focus areas of the priority „Restoring, preserving and enhancing ecosystems dependent on agriculture and biodiversity“ are:

- Restoring, preserving and enhancing biodiversity, including Natura 2000 areas, areas facing natural or other specific constraints, High Nature Value farmland, and the state of European landscapes;
- Improving water management, including fertiliser and pesticide management;
- Preventing soil erosion and improving soil management.

Family farming and CAP

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- 97% of EU farms are family farms, their composition is diverse
- Pillar I – distribution of payments, Small Farmers Scheme
- Pillar II – knowledge transfer and innovation, success depends on participation and adoption of new measures

Policies and outlooks

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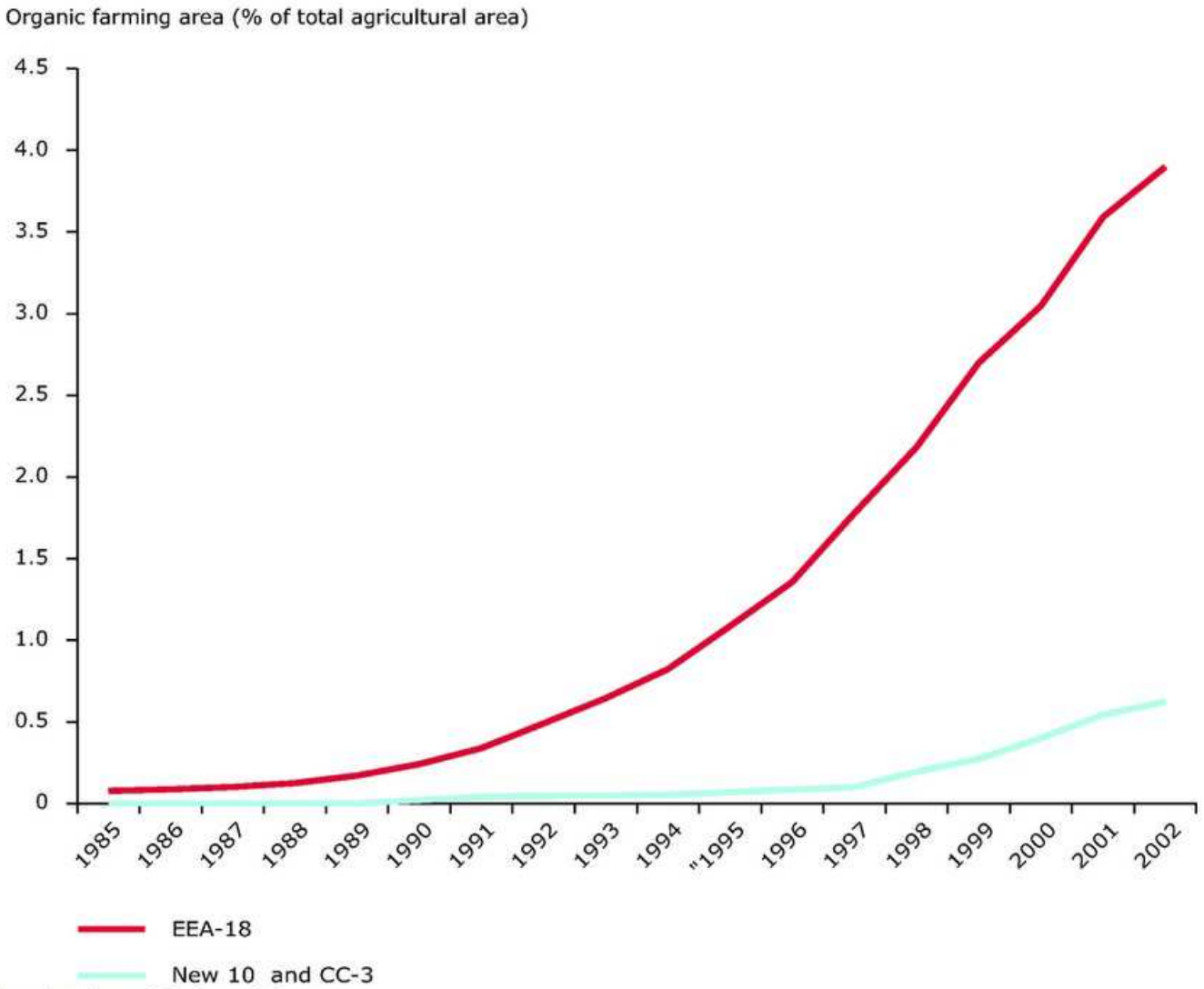


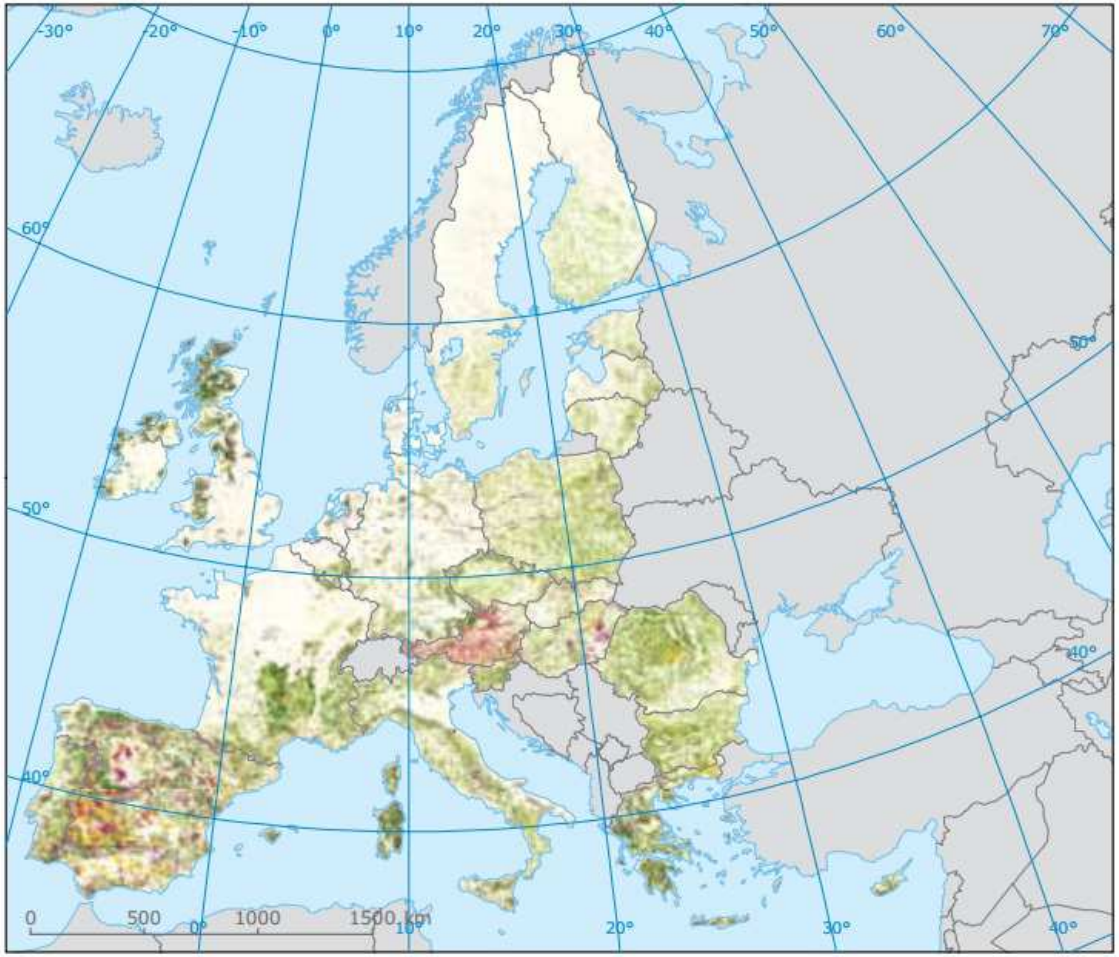
Note: The figure shows the organic farming area in Europe

Data source:

Institute of Rural Sciences, University of Wales, Aberystwyth

High nature value farmland in EU

European Environment Agency



Approximate distribution of high nature value (HNV) farmland across Europe

Nature areas
- Nature 2000 sites
- Prime butterfly areas (PBAs)
- Important bird areas (IBAs)

HNV farmland %
- 0
- 1–25
- 25–50
- 50–75
- 75–100

Outside coverage

Source: Paracchini et al., 2008; and Corine Land Cover.

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Policies and outlooks

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EU Biodivesity Strategy to 2020

Target 3 – Increase the contribution of agriculture and forestry to maintaining and enhancing biodiversity.

3a - maximise areas under agriculture across grasslands, arable land and permanent crops that are covered by biodiversity related measures under the CAP so as to ensure the conservation of biodiversity and to bring about a measurable improvement in the conservation status of species and habitats that depend on or are affected by agriculture and in the provision of ecosystem services as compared to the EU2010 Baseline, thus contributing to enhance sustainable management.

Policies and outlooks

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The 7th Environmental Action Programme

- Greening of the CAP
- Resource-efficient, productive and responsible sustainable agriculture
- Improve delivery of ecosystem services to economic sectors
- Rural development
- Carbon sink

Conclusion

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European agriculture sector is a very complex sector, governed by CAP to balance it´s evolving economic, social and environmental goals, with a current fundamental shift towards ecological approaches.

Precision farming techniques and organic farming systems have capacity to deliver on these goals, in connection to the diversity to EU agriculture providing opportunities to balance agricultural production with other land management needs, using potential of integrated spatial planning.

Support for family farming with focus on knowledge transfer and innovation will help to deliver environmental and well-being co-benefits.

Thank you for your attention!

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