



# Mapping and Assessment of Ecosystems and their Services in Europe: Progress, prospects and applications

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# Action 5 of the Biodiversity Strategy

*Improve the knowledge of ecosystems and their services in the EU*

*“Member States, with the assistance of the Commission, to map and assess the state of ecosystems and their services in their national territory by 2014, assess the economic value of such services, and promote the integration of these values into accounting and reporting systems at EU and national level by 2020”*

*The working group on Mapping and Assessment of Ecosystems and their Services (**MAES**) oversees the implementation of Action 5*

**Stakeholder types:**

Science

Policy

Practice

**Action 5  
(MAES)**

**Member States  
and EU**

**Knowledge base  
(BISE, INCA)**

**Water  
Marine**

**Agriculture  
Forestry**

**Conservation**

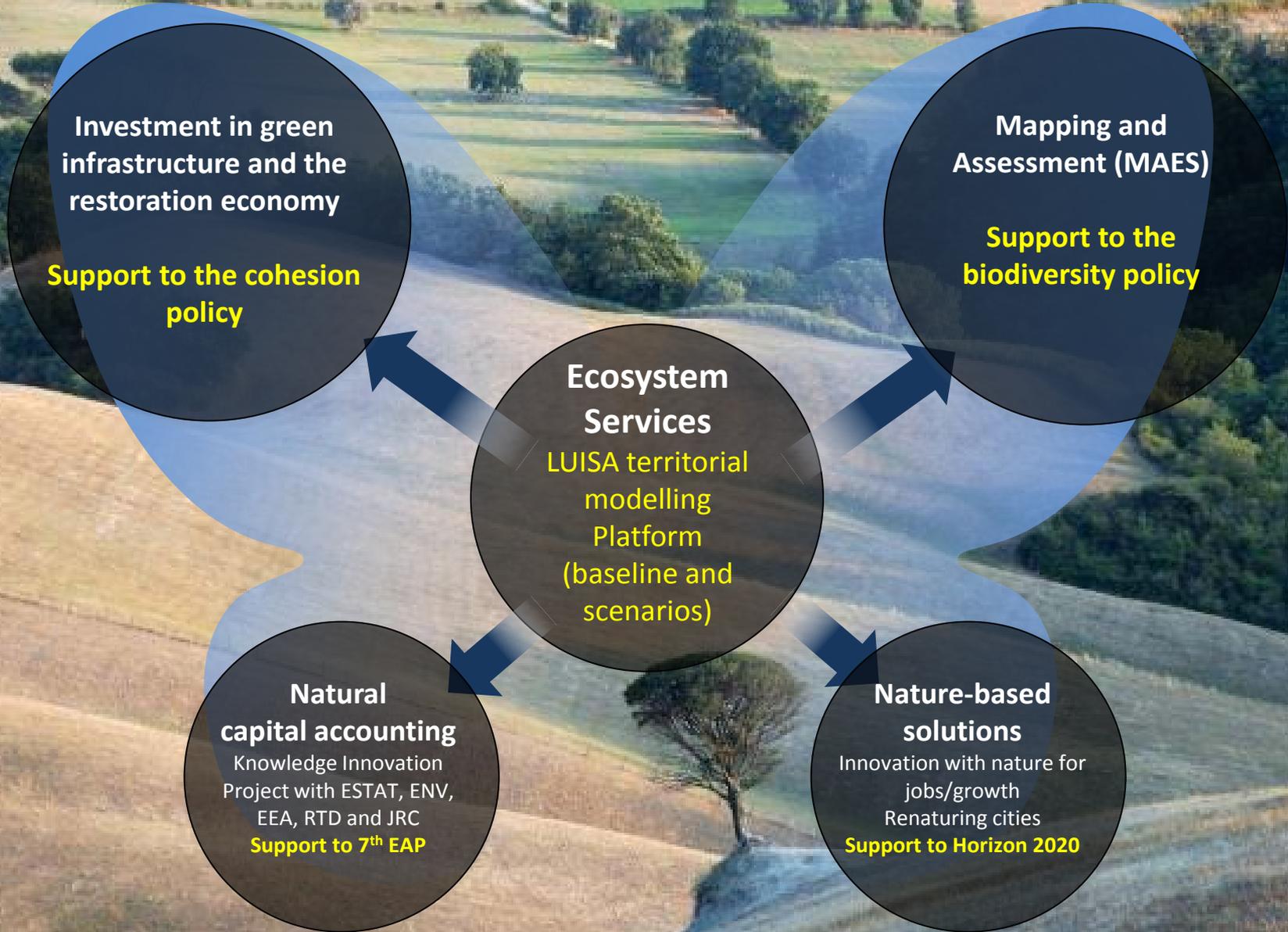
**Stakeholder roles:**

**Implement**

**Use**

**H2020 ESERALDA**

**Spatial  
planning  
and regional  
investments**





# Target 2 of the EU Biodiversity Strategy to 2020

By 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15 % of degraded ecosystems.

What is the trend to 2050?

- **LUISA (Land Use based Integrated Sustainability Assessment)**

What are the past trends (2000-2010)

1

Demand  
Module

Sector external models

ECONOMY

DEMOGRAPHY

AGRO-FOR

ENERGY

Demand settings

Land use demands/claims

2

Allocation  
Module

Policy-related suitability

Demand  
scenario

Location-specific suitability

Current  
land-use

Land-use change simulation

Projected Land Use Change

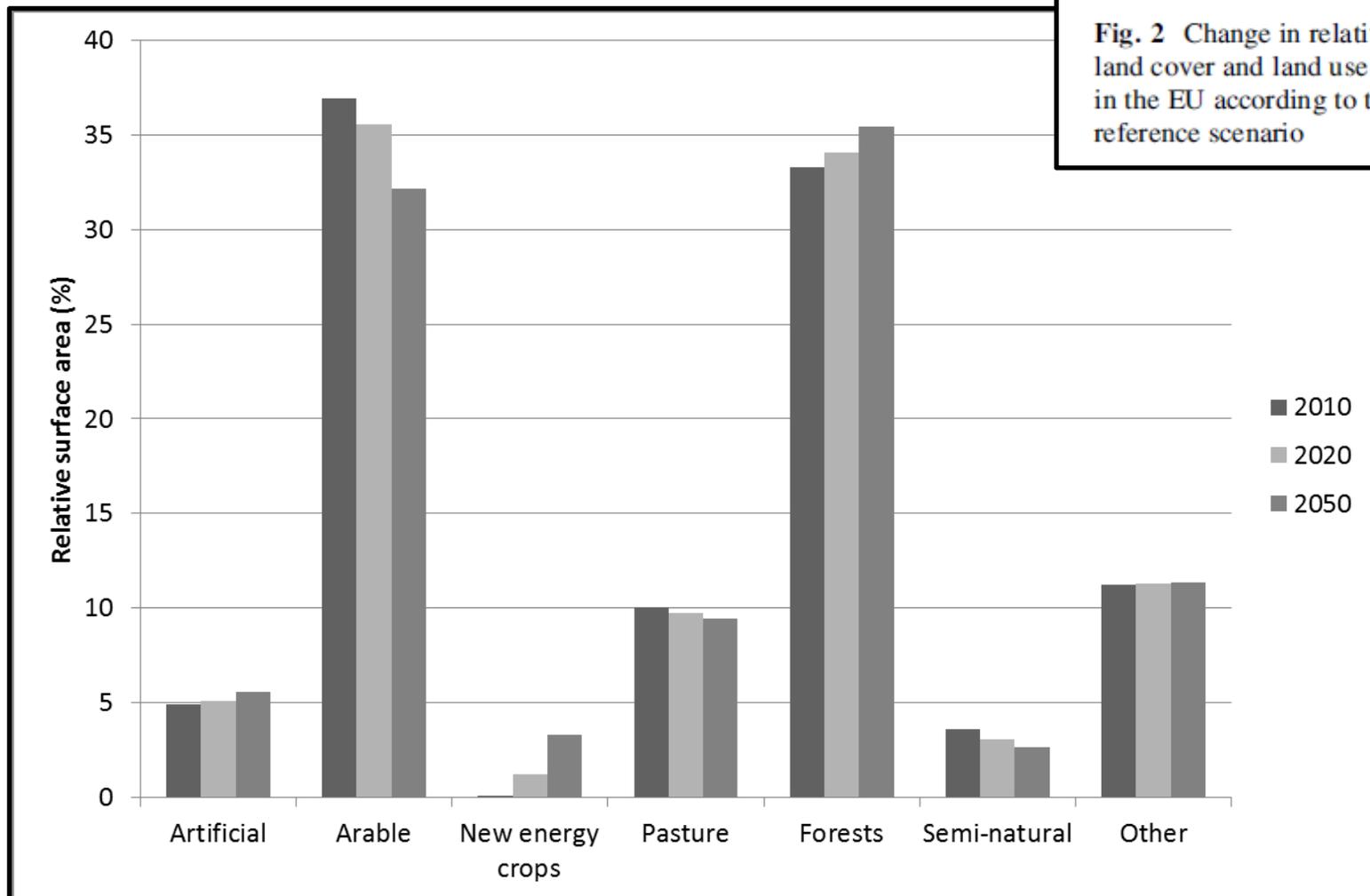
3

Ecosystem  
Services  
Module  
(ESTIMAP)

Indicators for ecosystem  
services

Indicators for  
biodiversity

**Fig. 2** Change in relative land cover and land use (%) in the EU according to the reference scenario





### Food production

(% share of agricultural land)



### Pollination

(supply by insects and demand by farmers)



### Water provision

(water supply by ecosystems and water abstraction by users)



### Soil erosion control

(vegetation in risk areas)



### Climate regulation

### Soil quality

(Soil carbon stocks )



### Recreation in nature

(recreation opportunities)



### Coastal protection

(protective role of dunes and coastal wetlands)



### Urban air quality regulation

(removal of air pollutants by trees)

# Changes in ecosystem services under the EU reference scenario

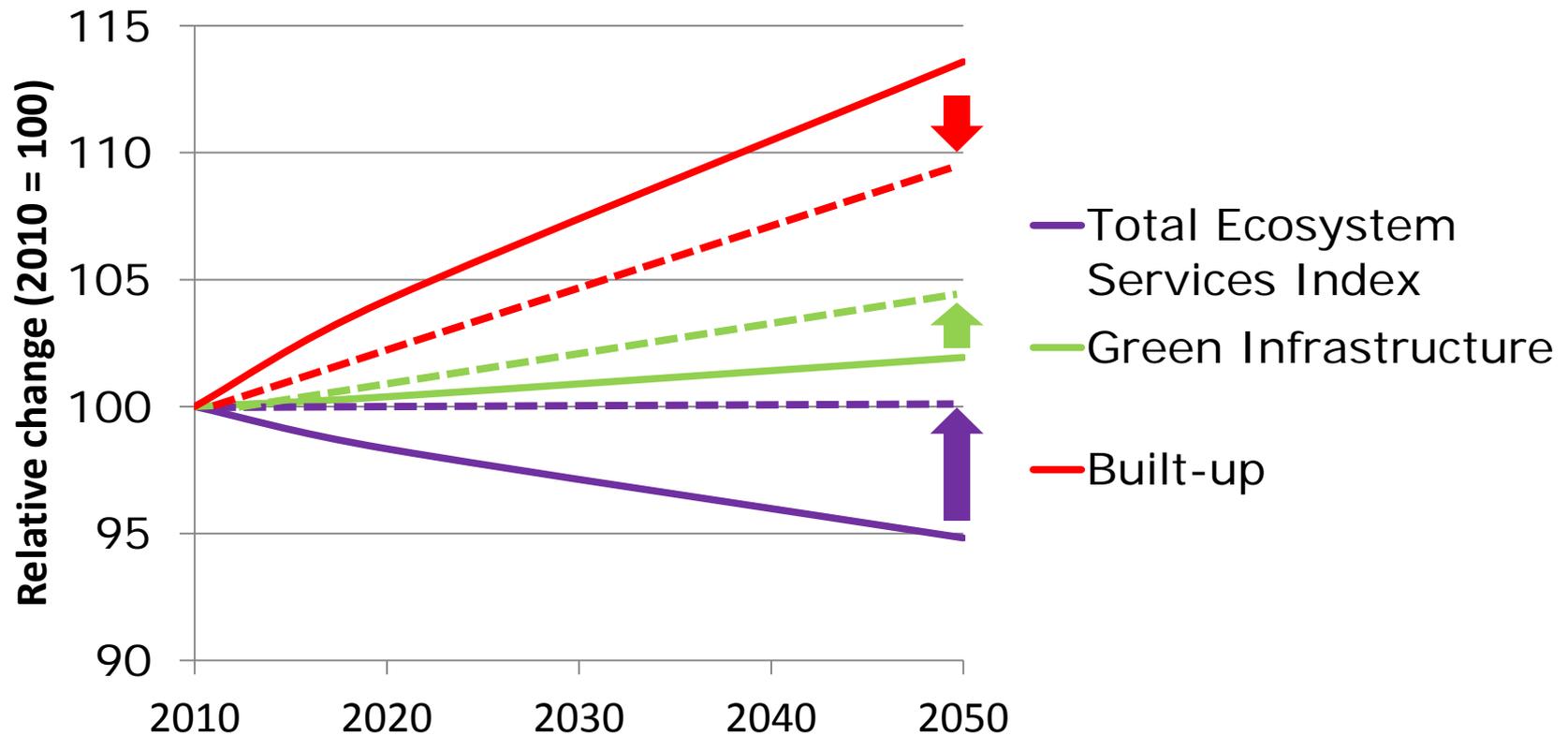
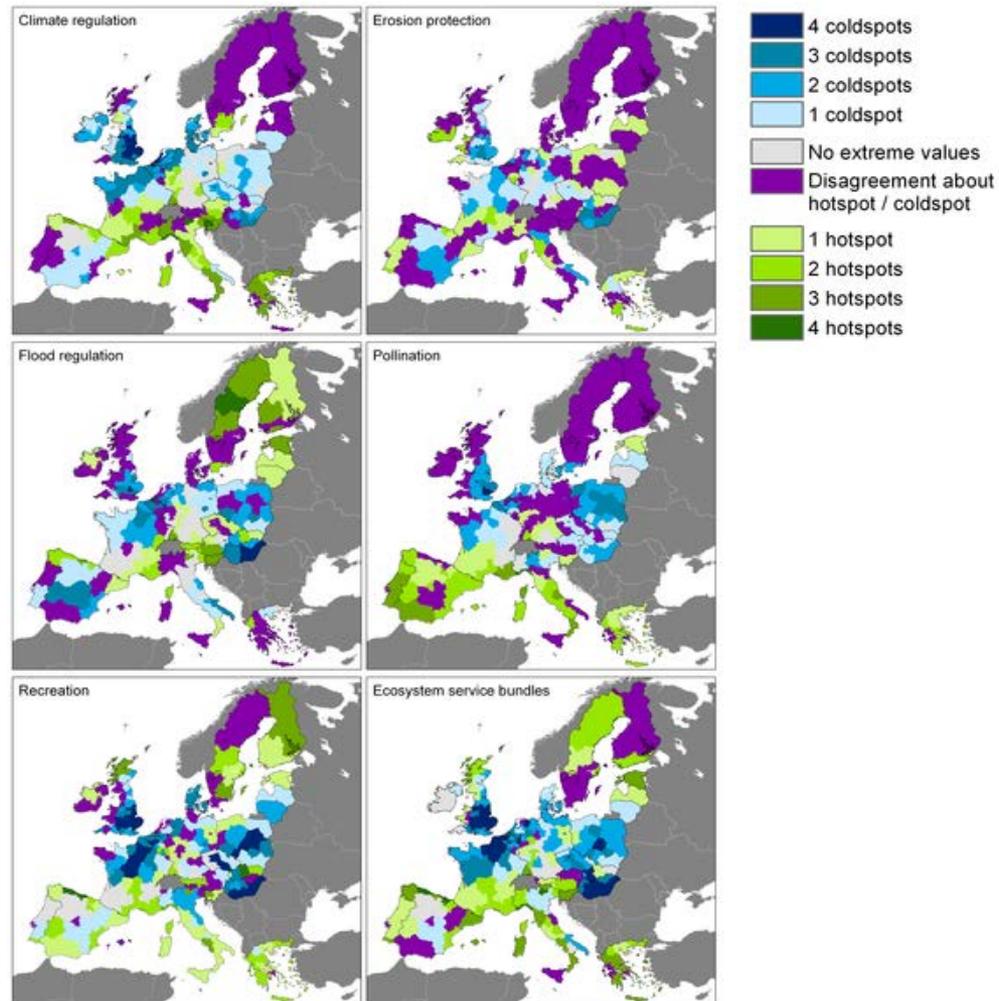
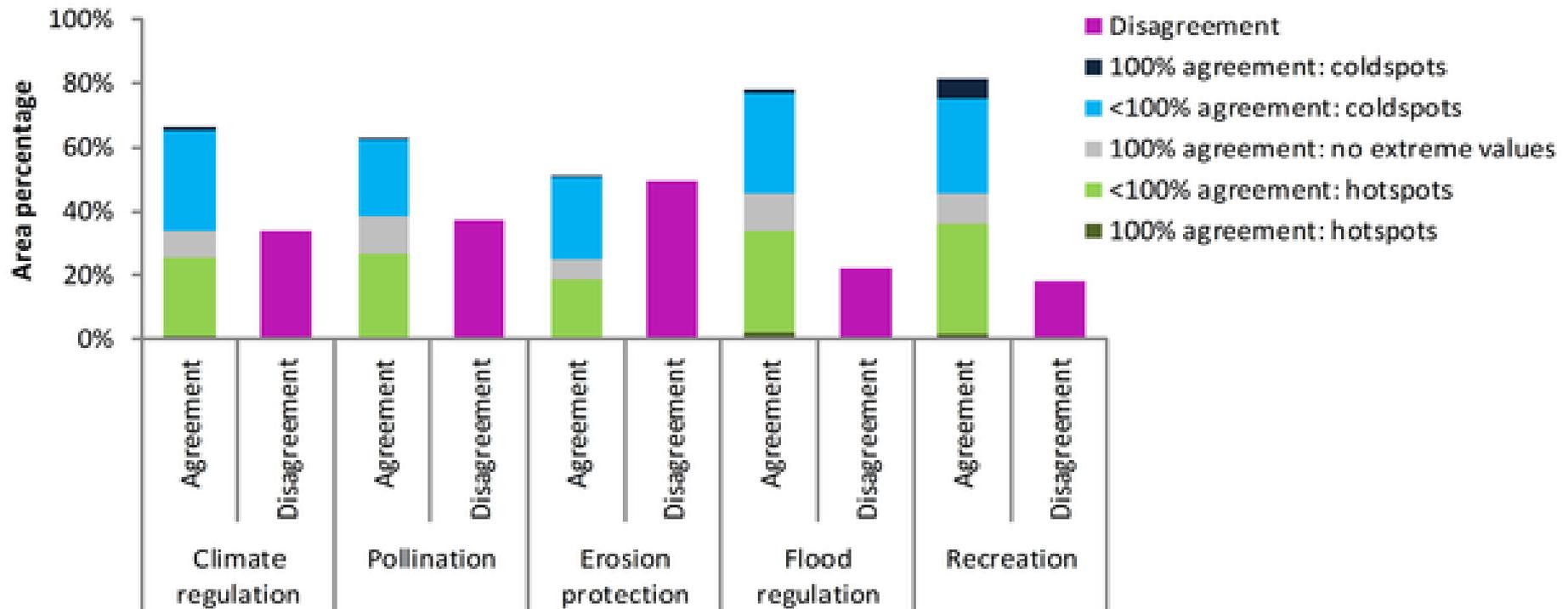


Figure 2. Agreement between maps for each ecosystem service.



Schulp CJE, Burkhard B, Maes J, Van Vliet J, Verburg PH (2014) Uncertainties in Ecosystem Service Maps: A Comparison on the European Scale. PLoS ONE 9(10): e109643. doi:10.1371/journal.pone.0109643  
<http://127.0.0.1:8081/plosone/article?id=info:doi/10.1371/journal.pone.0109643>

Figure 4. Agreement between the ecosystem service maps.



Schulp CJE, Burkhard B, Maes J, Van Vliet J, Verburg PH (2014) Uncertainties in Ecosystem Service Maps: A Comparison on the European Scale. PLoS ONE 9(10): e109643. doi:10.1371/journal.pone.0109643  
<http://127.0.0.1:8081/plosone/article?id=info:doi/10.1371/journal.pone.0109643>

# Trends in ecosystems and ecosystem services in the EU

Test of the MAES framework  
(typologies and indicators)

Trends at European scale  
between 2000 and 2010

Reference for a set of ecosystem  
services maps



JRC SCIENCE AND POLICY REPORT

## Mapping and Assessment of Ecosystems and their Services

*Trends in ecosystems and ecosystem  
services in the European Union between  
2000 and 2010*

Joachim Maes, Nina Fabrega, Grazia Zulian, Ana Barbosa, Pilar Vizcaino, Eva Iyits, Chiara Polce, Ine Vandecasteele, Inés Mari Rivero, Carlos Guerra, Carolina Perpiña Castillo, Sara Vallecillo, Claudia Baranzelli, Ricardo Barranco, Filipe Batista e Silva, Chris Jacobs-Crissoni, Marco Trombetti, Carlo Lavalle

2015



# Data

## Ecosystems:

crosswalk between MAES types  
and:

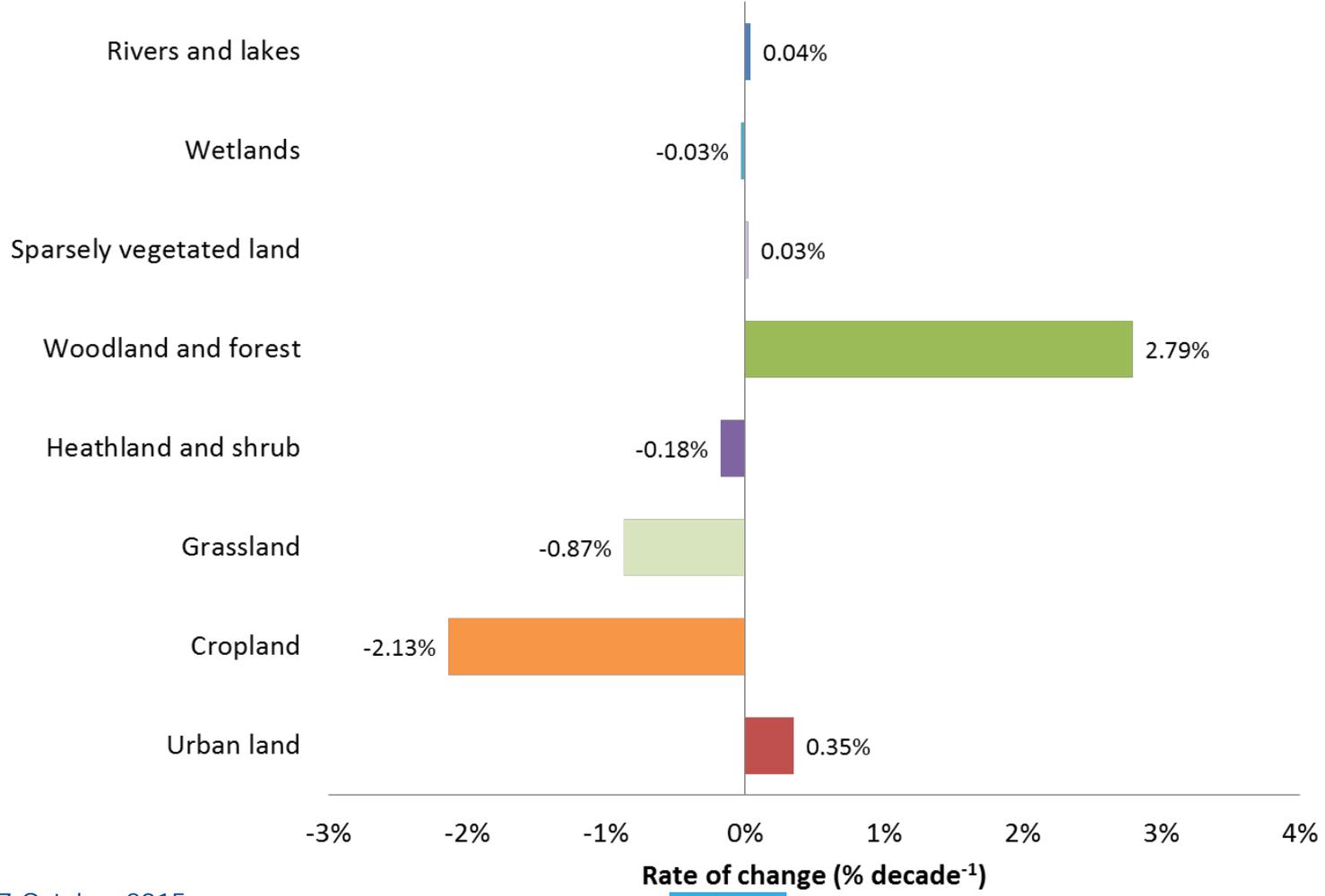
- Corine (2000, 2006)
- LUCAS (2009, 2012)
- MODIS (2001, 2006, 2010)
- LUISA (2006, 2010)

## Ecosystem services:

30 indicators

- Provisioning (15): Eurostat (CAPRI), Aquastat (FAO)
- Regulating (12): ESTIMAP (JRC model), Eurostat (+CAPRI), SPOT, Urban Atlas
- Cultural (3): ESTIMAP, Natura 2000

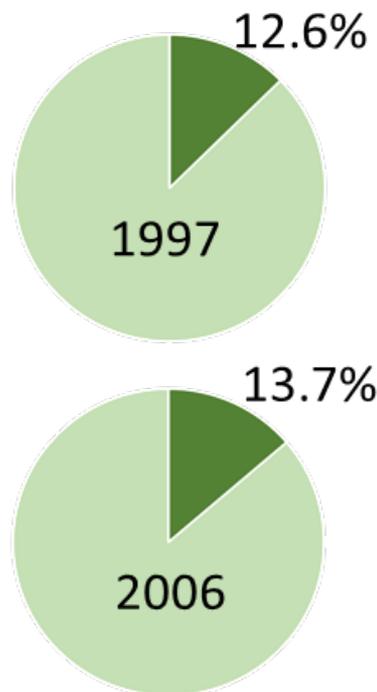
# Trends in ecosystems



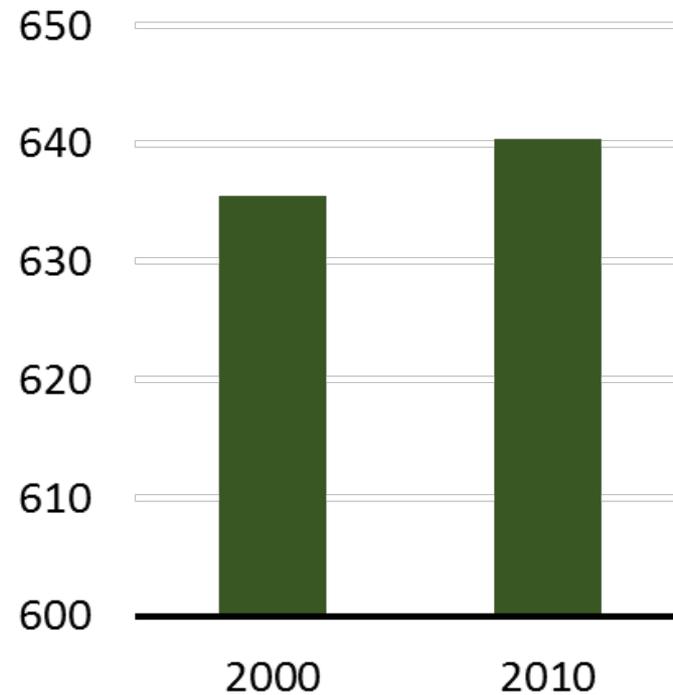
## Trends in ecosystem services

### *Air quality regulation in a sample of cities*

Share of green in cities (%)



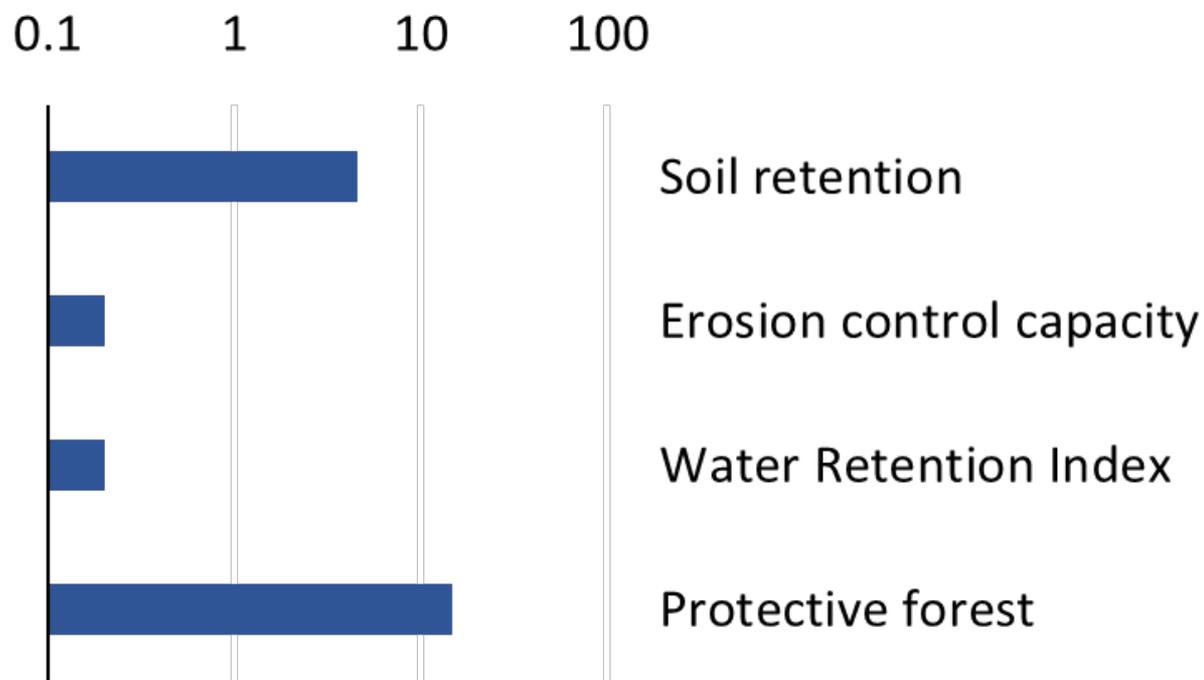
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# Trends in ecosystem services

## *Erosion control and water regulation*

% change between 2000 and 2010



## Trends in ecosystem services *Pollination and habitat maintenance*

% change between 2000 and 2010

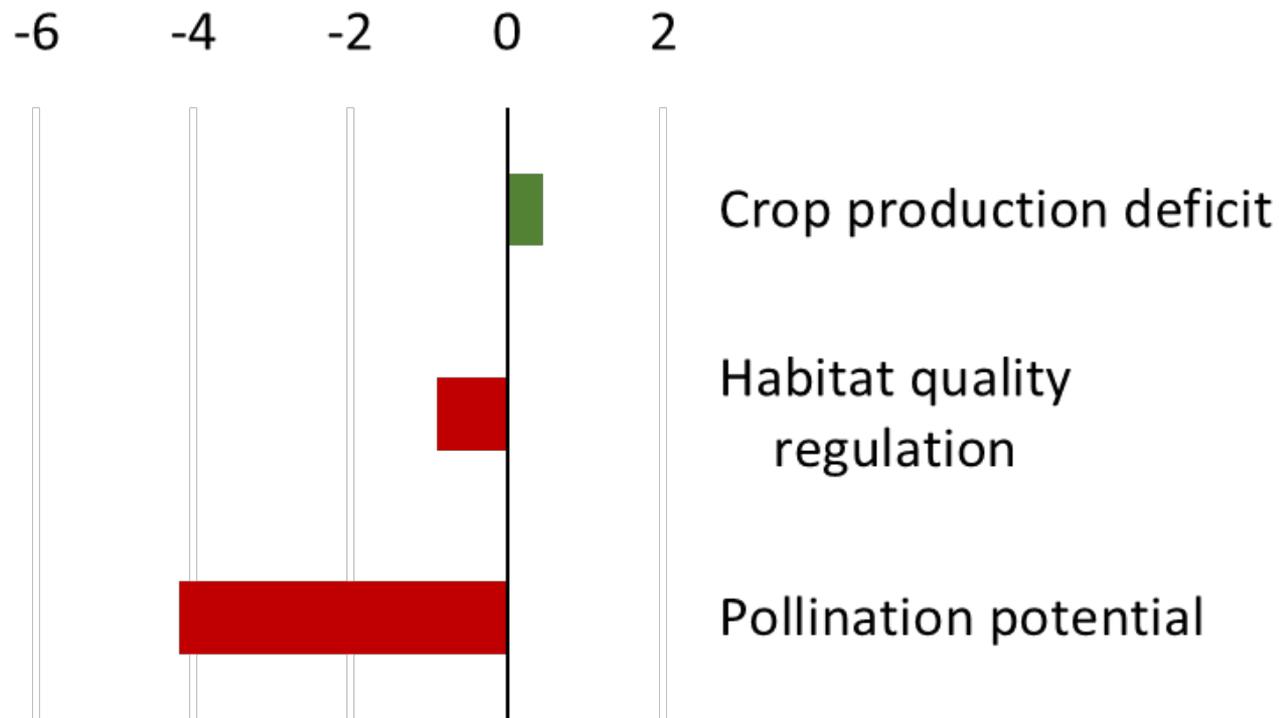


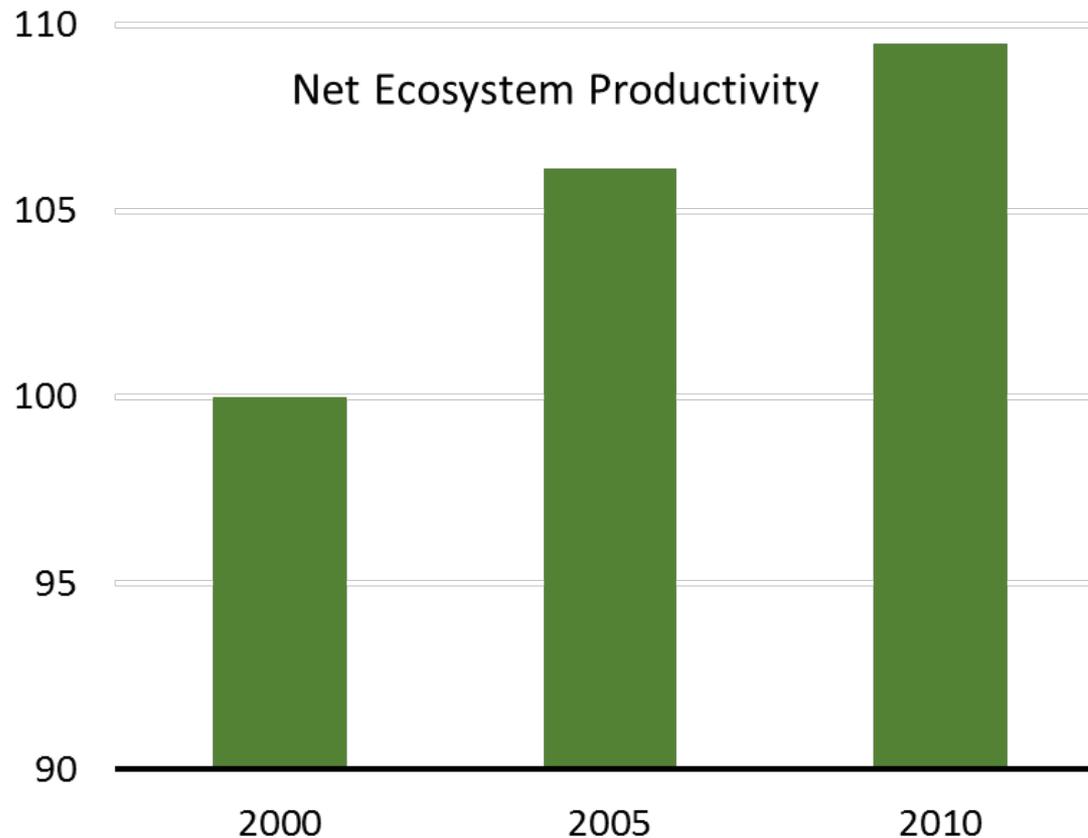
Table 8. Decadal change in ecosystem services per ecosystem.

	Indicator	Urban	Crop land	Grass land	Wood land and forest	Heath land and shrub	Bare land	Wet lands	Rivers and lakes
Provisioning	Harvested production		+7.7%						
	Agricultural Area		-1.9%						
	Total Organic Crop Area		+78.5%						
	Total timber Removal				+2.3%				
	<b>Indicator</b>	<b>Urban</b>	<b>Crop land</b>	<b>Grass land</b>	<b>Wood land and forest</b>	<b>Heath land and shrub</b>	<b>Bare land</b>	<b>Wet lands</b>	<b>Rivers and lakes</b>
	<b>Pollination Potential</b>		-4.1%	-26.8%	-27.7%	-40.6%			
Regulating and maintenance	Potential								
	Water Retention		+0.4%	-0.04%	-0.1%	-0.2%	+0.05%		
	Erosion control		+0.2%	+0.2%	-0.1%	+1.6%			
	Soil retention		+17.8%	-8.3%	+9.6%	-4.0%			
	NO <sub>2</sub> Removal	+0.8%							
	Urban Green	+1.2%							
	Net ecosystem productivity		+9.2%	+9.2%	+9.6%	+10.3%	+11.0%	+10.3%	
	Crop production deficit		+0.5%						
Habitat Quality					-0.9%				
Cultural	Recreation opportunity					+3.5			
	Special protection area					+87.7			
	Site of community importance					+63.4			

# Trends in ecosystem services

## *Climate regulation*

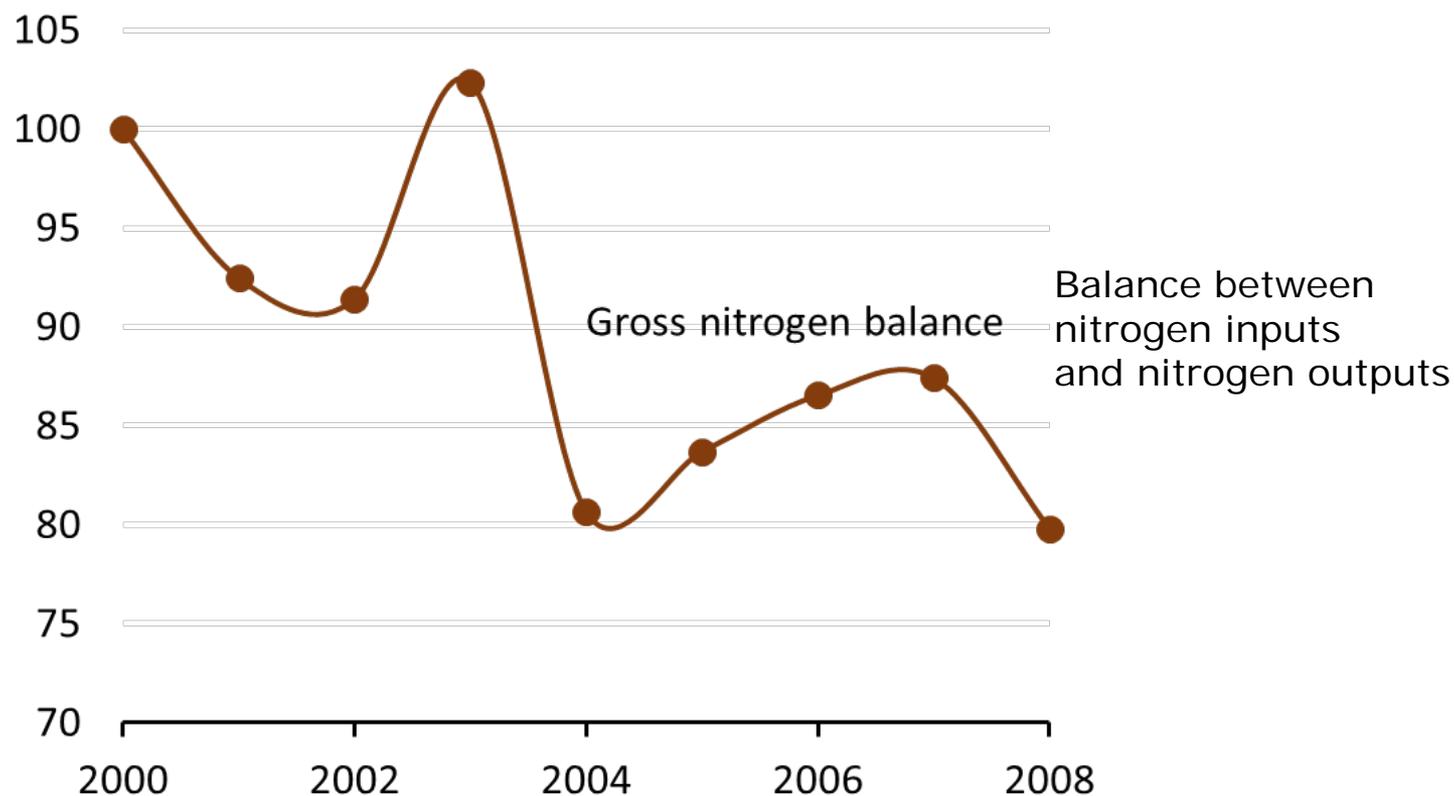
year 2001 = 100



# Trends in ecosystem services

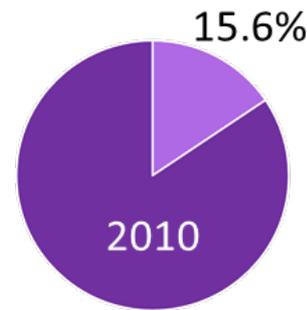
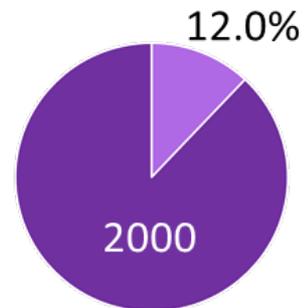
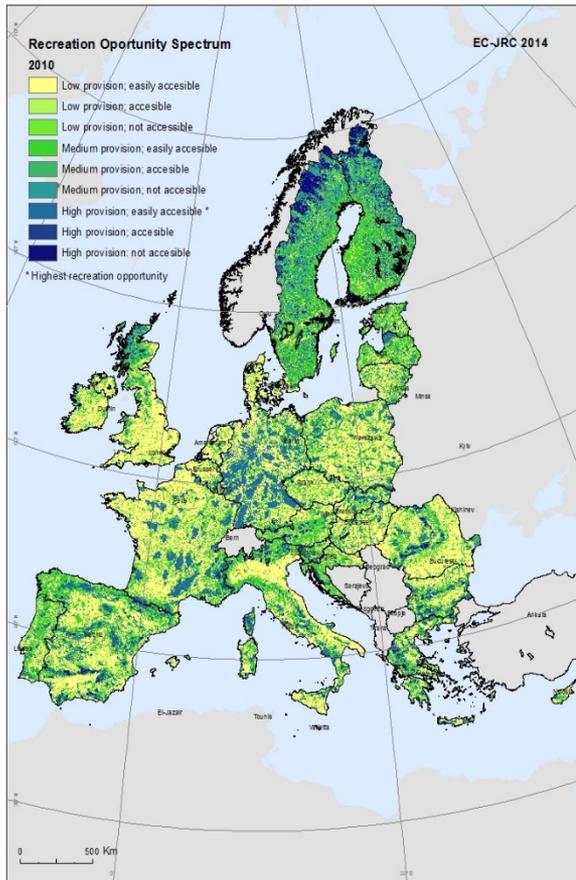
## *Soil quality maintenance*

year 2000 = 100

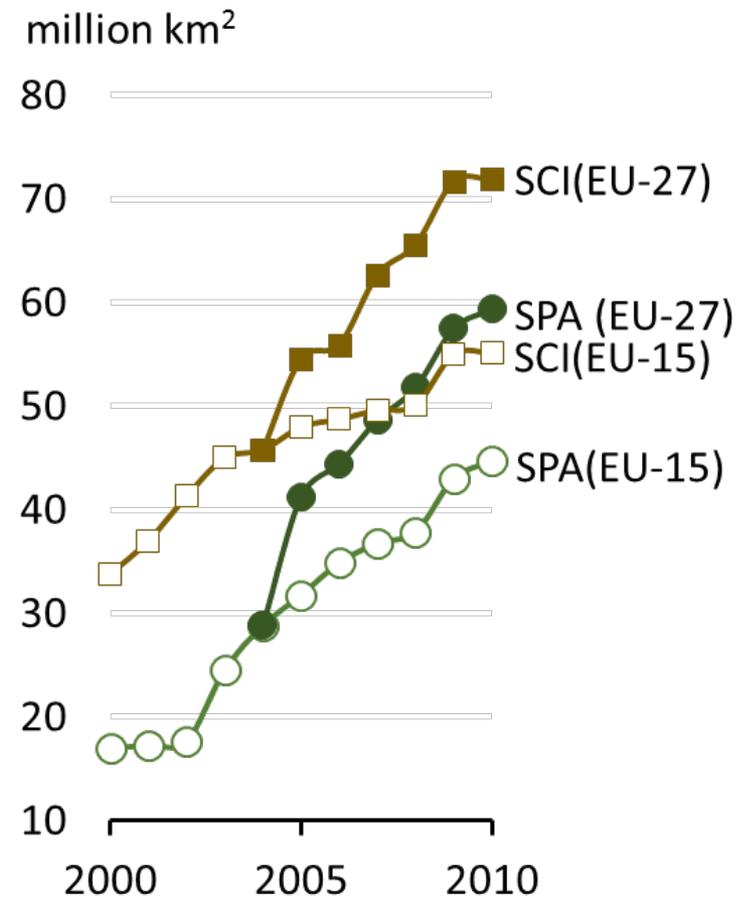


# Trends in ecosystem services

## *Nature-based recreation*



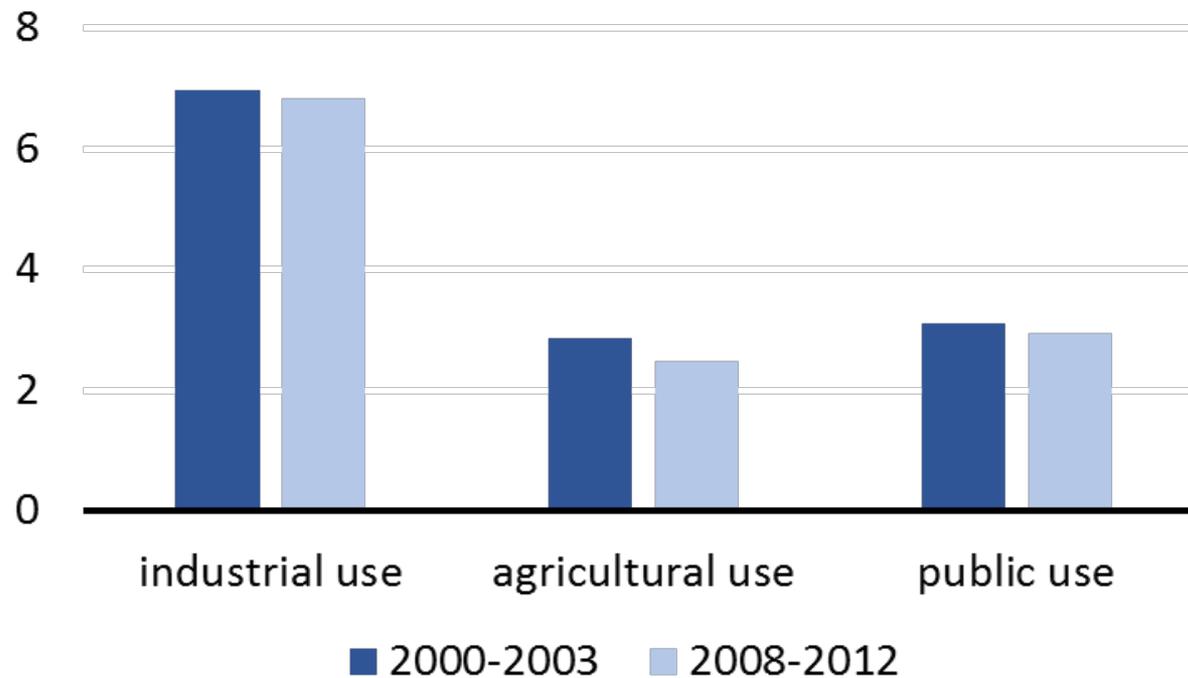
Accessible recreation opportunities (%)



# Trends in ecosystem services

## *Water*

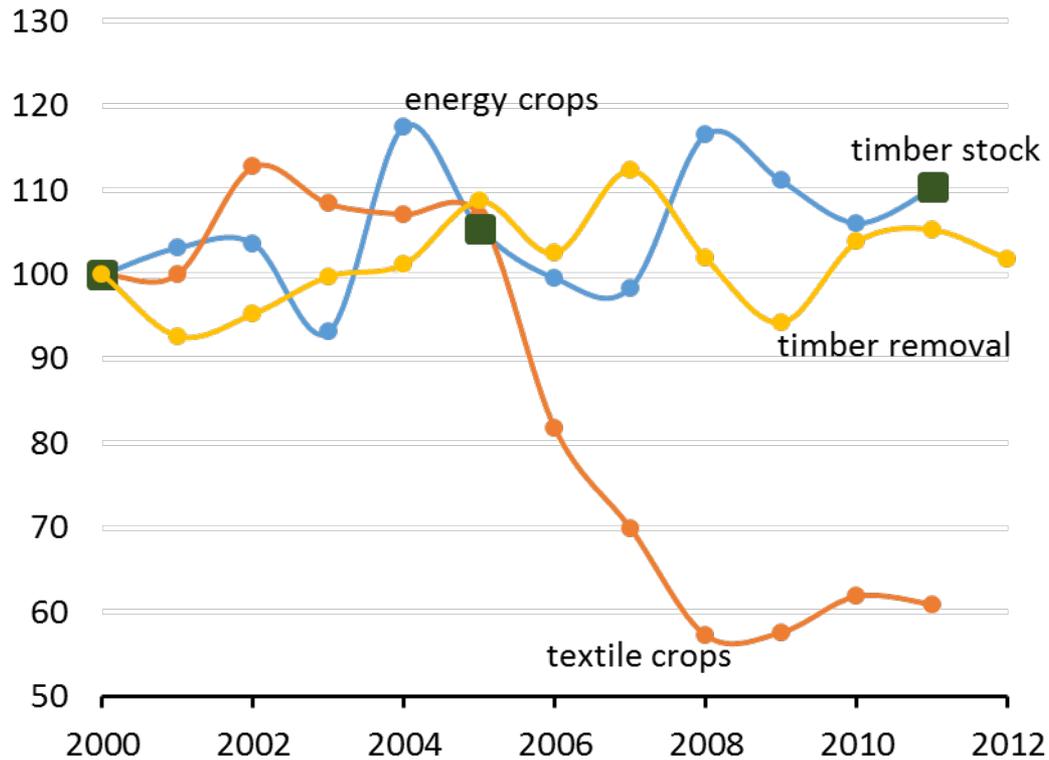
Proportion of renewable water use (%)



# Trends in ecosystem services

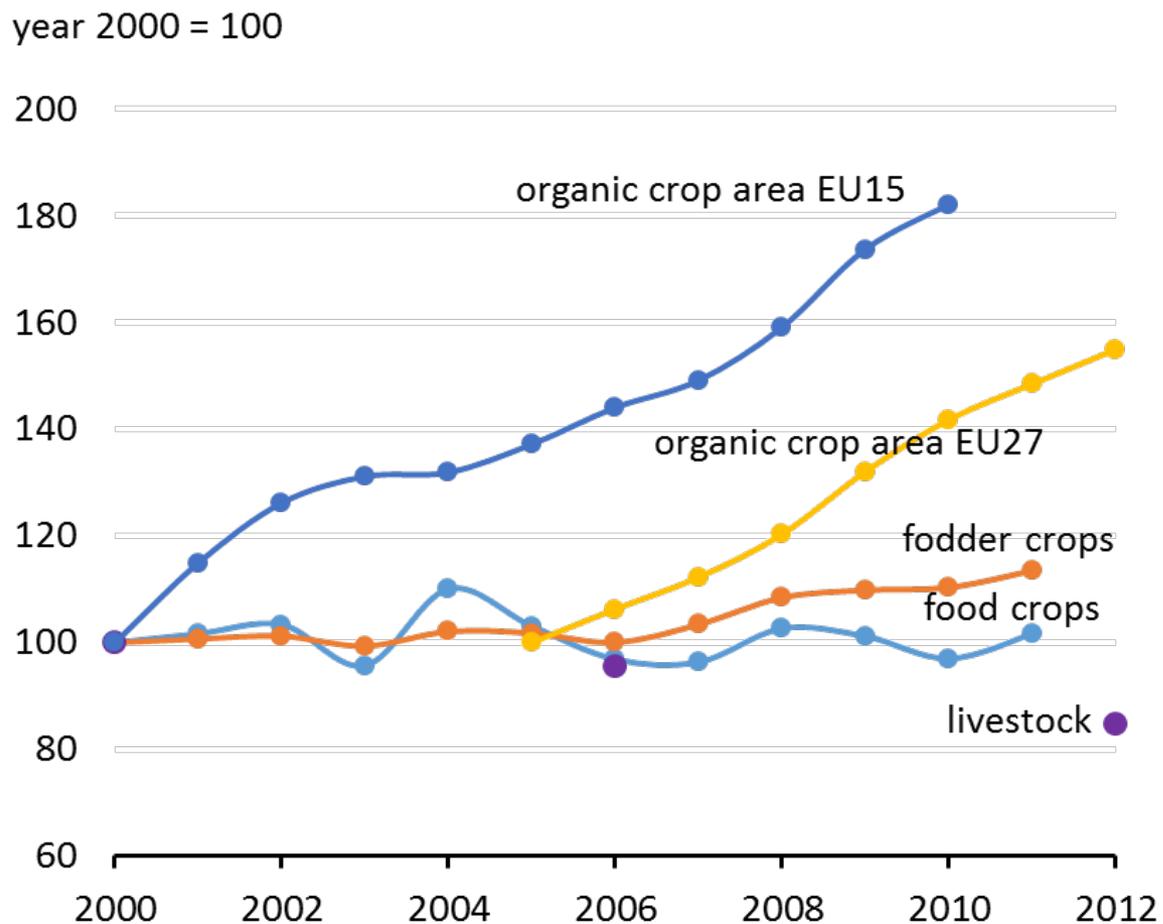
## *Materials*

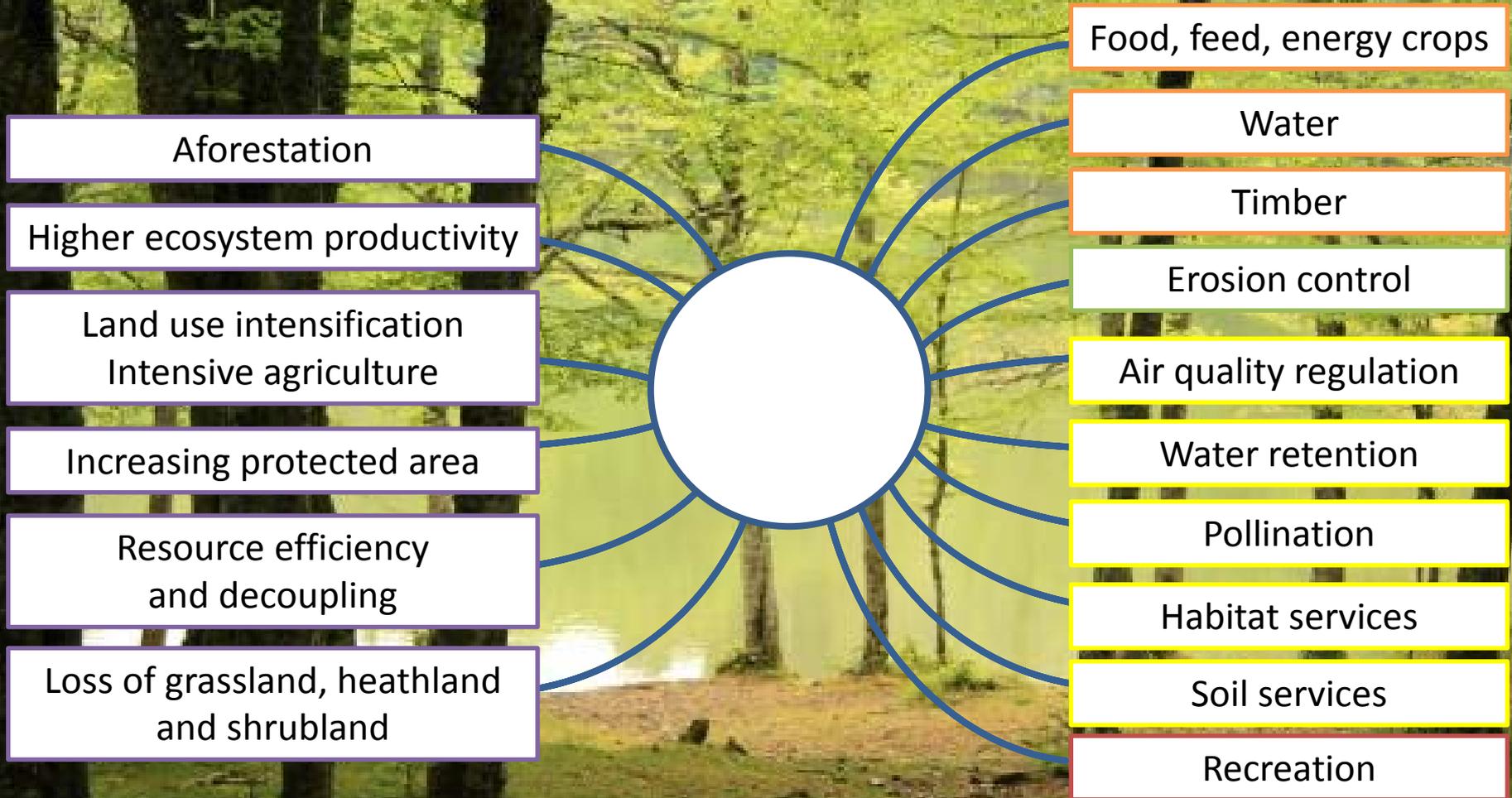
year 2000 = 100



# Trends in ecosystem services

## *Food and feed*





# Contrasting patterns at work at EU scale?

Urbanisation leads to increasing built up area (often on high quality cropland) but cities are getting greener.

Urbanisation leads to land abandonment in rural areas with decreases in local biodiversity but increases in regional delivery of ecosystem services (through afforestation).

More crops are grown on less land (despite increasing share of organic agriculture) which suggests land use intensification and inevitable loss of regulating ecosystem services.

More land is protected for conservation but biodiversity continues to decline.

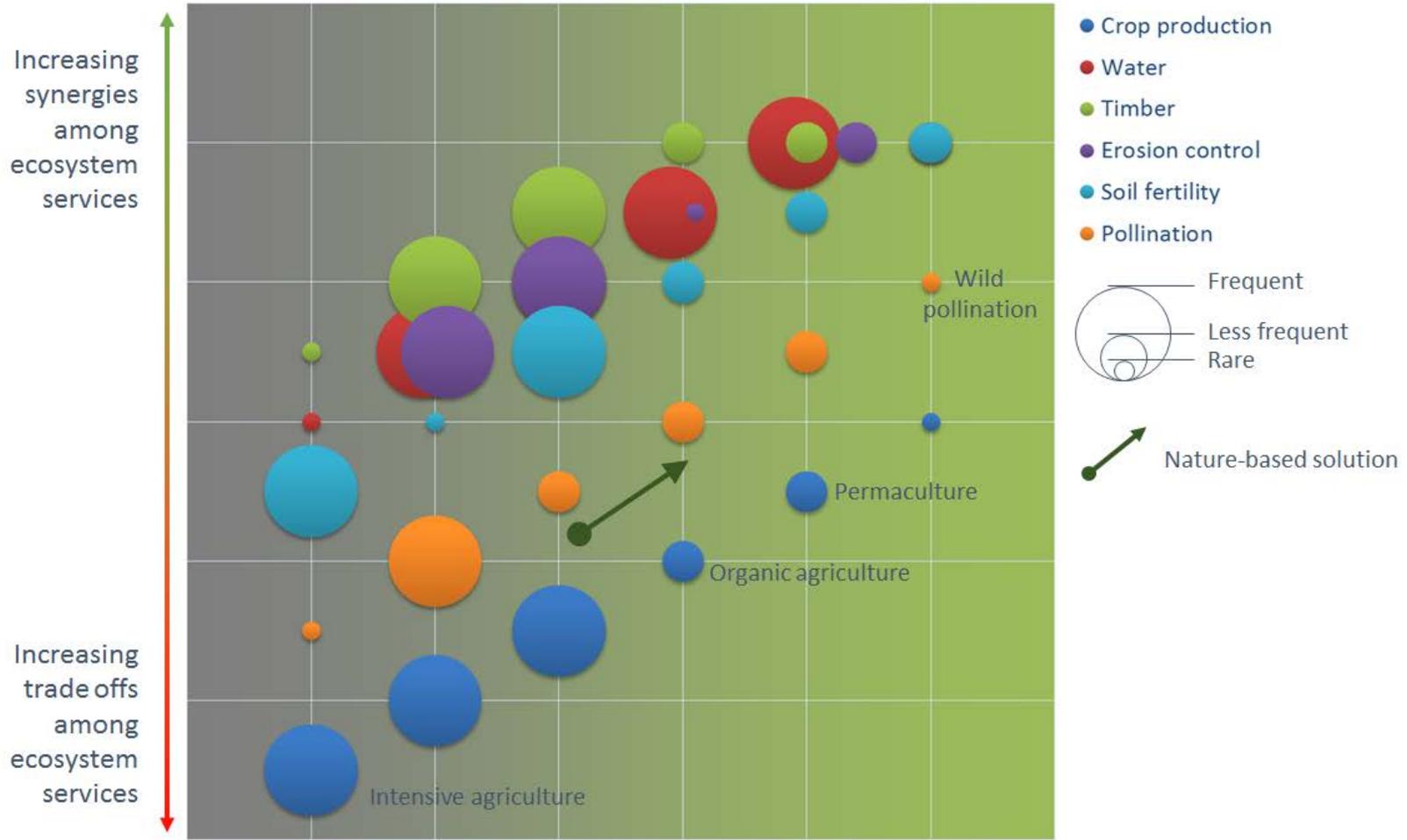
# Nature-based solutions and green infrastructure

Finding the right balance requires a policy mix (incentives, taxation, regulation, market mechanisms, at all policy levels) and community based methods, which in Europe anno 2015 still needs to deliver jobs and economic growth.

Nature based solutions: *living solutions inspired by, continuously supported by and using nature, which are designed to address various societal challenges in a resource efficient and adaptable manner and to provide simultaneously economic, social and environmental benefits*

“innovative green infrastructure”

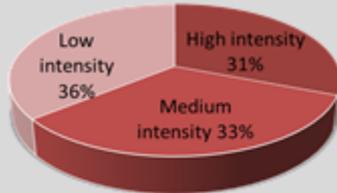
# Break down of the share of ecosystem service delivery over a gradient from technology based to nature based production systems



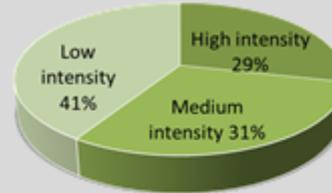
Present situation

Nature-based solutions

Socio-economic impact



Share of agricultural area managed by low, medium and high intensity farms (%)

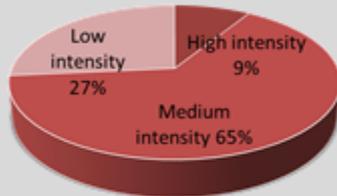


### Employment

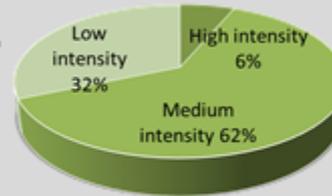
Business as usual



Nature-based scenario

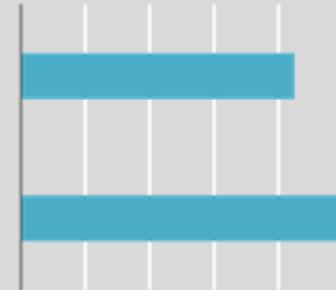


Number of stands assigned to different forest management approaches (%)

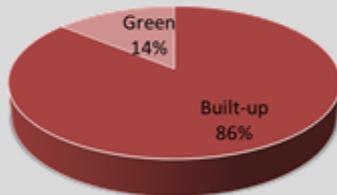


### Total net benefits from ecosystem services

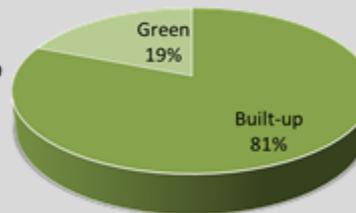
Business as usual



Nature-based scenario



Share of green and built-up area in cities (%)



Principles of a nature-based scenario

# Key assumption

The net benefits of nature-based solutions are built on the premise that enhancing the share of ecosystem-based energy in the total energy needed to deliver ecosystem goods and services is possible without losing output.

## Requirements

- Adaptation of economic subsidy schemes
- Consider larger temporal and spatial scales and integrate diverse values in CBA
- Ecological innovations and usage of the MAES knowledge base for application and operationalization

## Further information

Joint Research Centre Science Hub: <https://ec.europa.eu/jrc/>

MAES: <http://biodiversity.europa.eu/maes>

Green infrastructure: <http://ec.europa.eu/environment/nature/ecosystems/>

Nature-based solutions:

[https://ec.europa.eu/research/environment/index\\_en.cfm?pg=nature-based-solutions](https://ec.europa.eu/research/environment/index_en.cfm?pg=nature-based-solutions)