Green infrastructure and land use in Europe: trends and challenges

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Green infrastructure: challenges overview

Assets

Functions

Multi-functionality

Ecosystem services

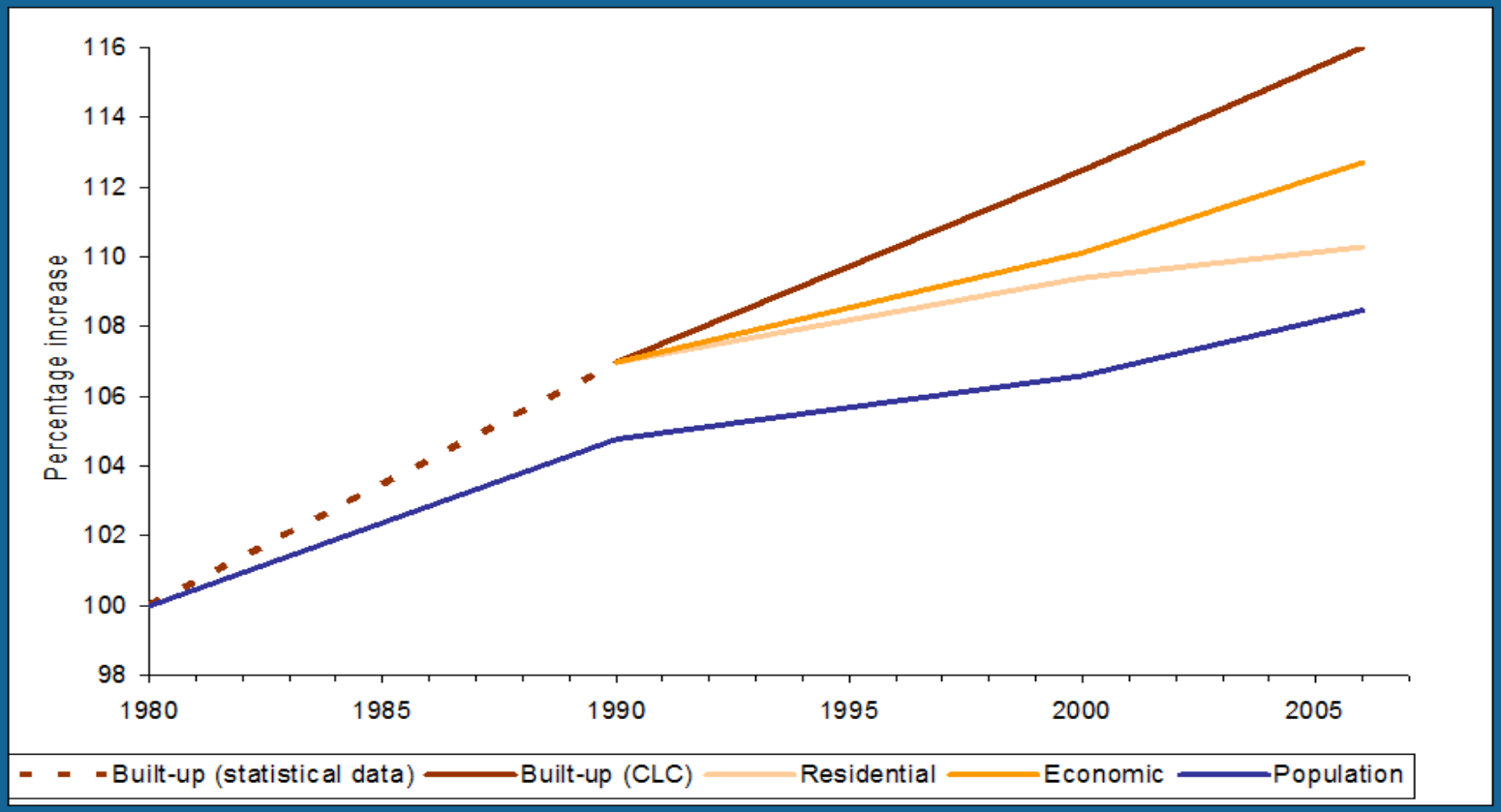
Connectivity

Land use changes in Europe

CORINE Land cover, EEA

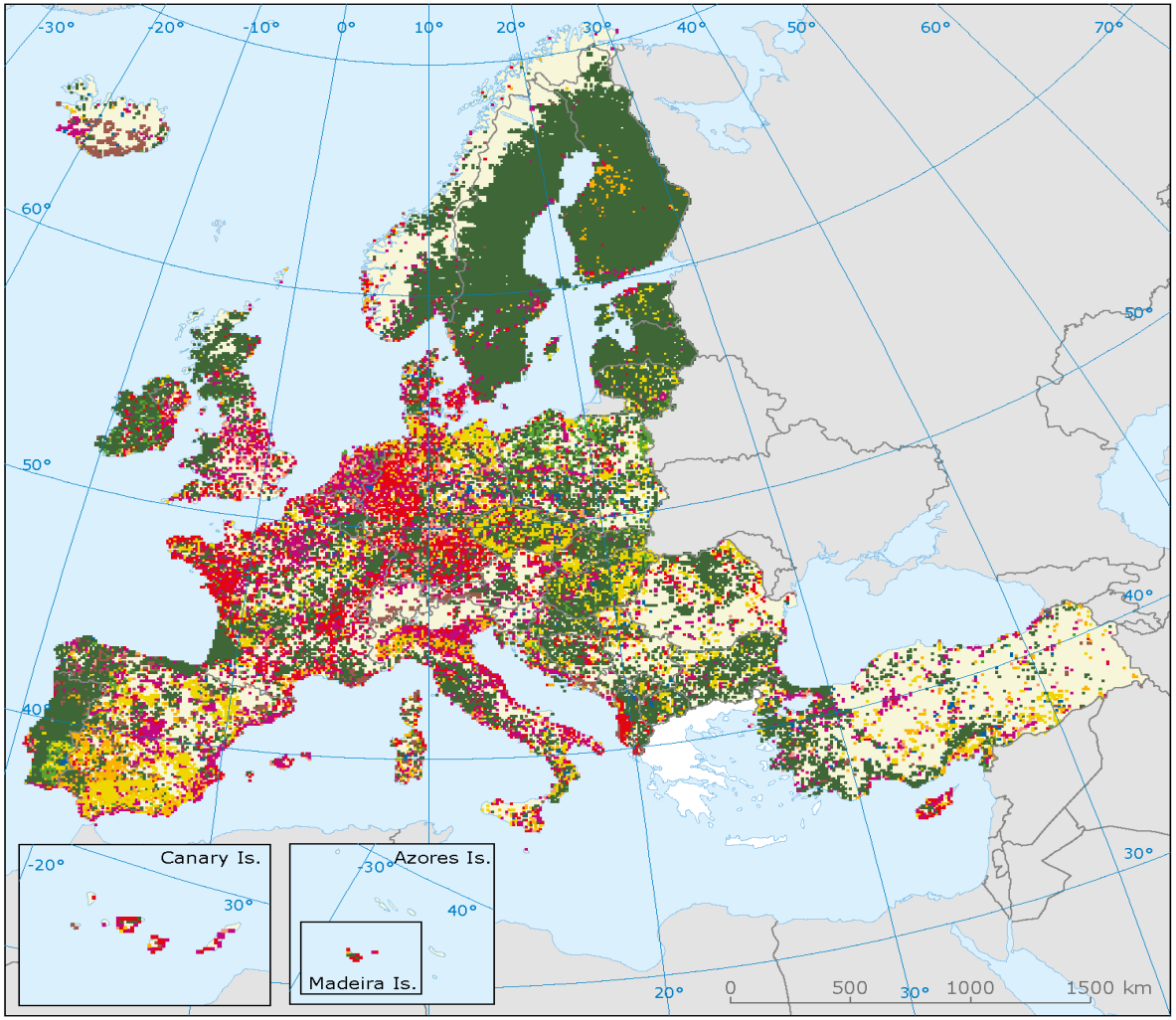
European Environment Agency

...but land take is increasing



Source: OECD (statistical data); CORINE Land Cover. Population data from Eurostat.

...and spatially widely distributed

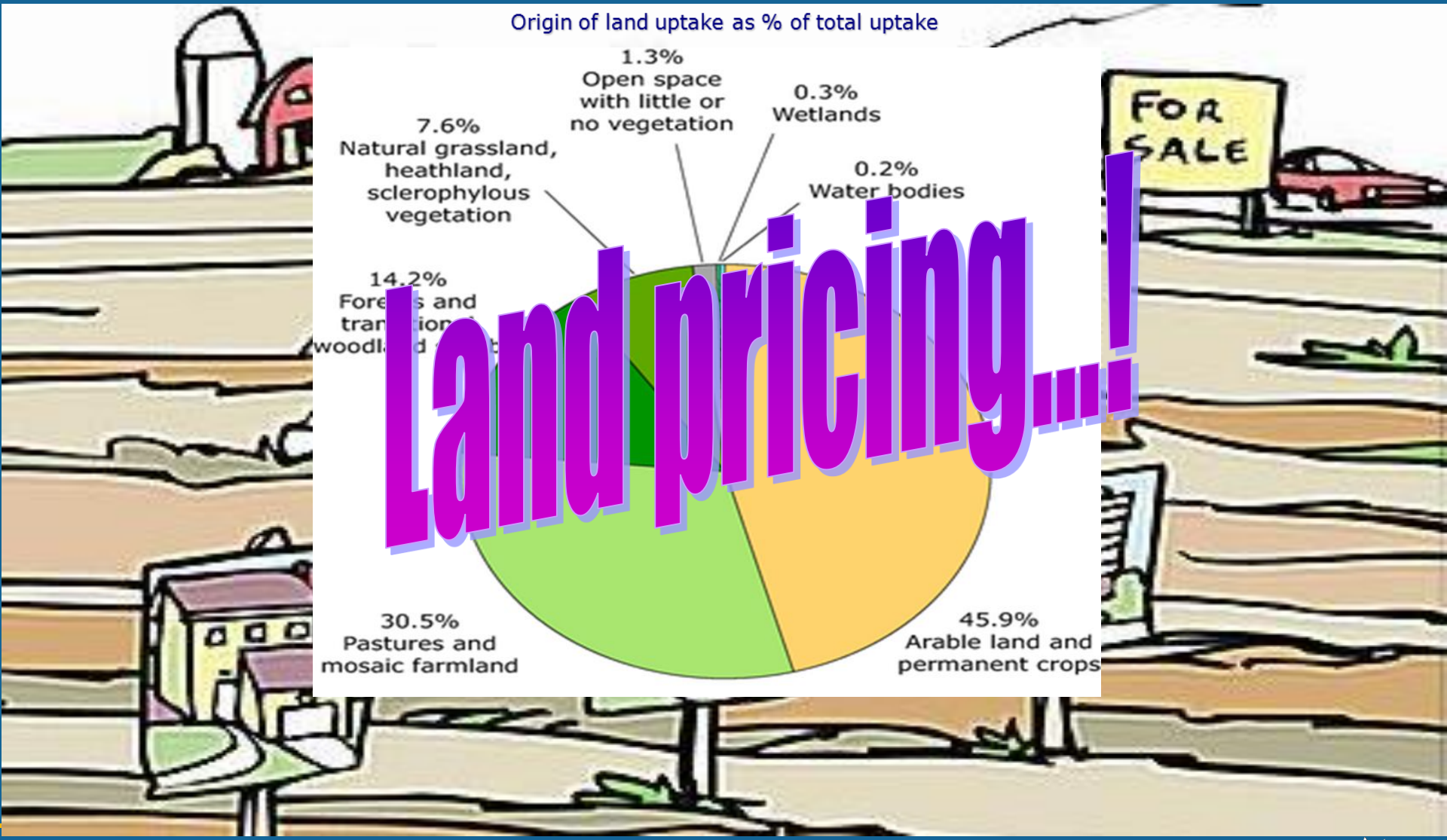


Drivers of change, 2000–2006

Dominant Land Cover Flow

- Urban land management (lcf1)
- Urban residential sprawl (lcf2)
- Sprawl of economic sites and infrastructures (lcf3)
- Agriculture internal conversions (lcf4)
- Conversion from forested & natural land to agriculture (lcf5)
- Withdrawal of farming (lcf6)
- Forests creation and management (lcf7)
- Water bodies creation and management (lcf8)
- Changes of Land Cover due to natural and multiple causes (lcf9)
- No data
- Outside coverage

Lost land cover due to land take in Europe



Planning and managing land take - lessons learned from Germany

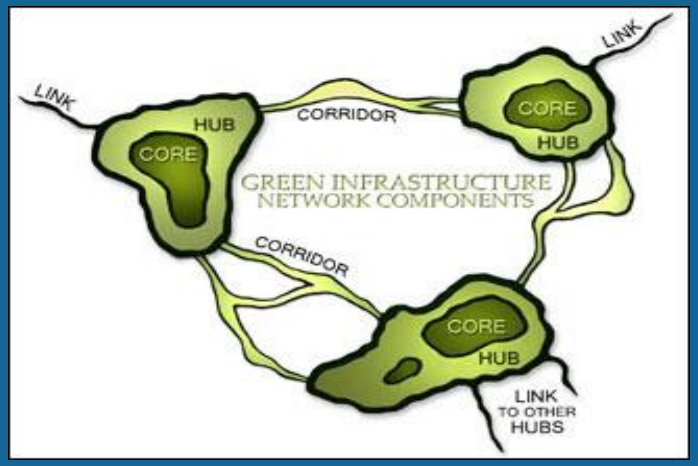
- By 2020, land take for new housing and transport developments is to be limited to 30 ha per day
- Situation from 1997-2000: 129 ha per day. Situation from 2007–2010: 87 ha per day
- The German approach is a twin-track strategy, comprising a mix of instruments :
  - Further strengthening inner urban development
  - Limiting new land take on the urban fringe
  - Space-saving housing developments with low levels of traffic
  - Enhancing the productivity of land
  - Land recycling
  - Taking soil qualities into account
  - Safeguarding open spaces
- Addressed primarily to the federal states (regional and sub-regional planning) and local authorities (development planning).

  The Federal Government supports their efforts through legislation (spatial planning law, urban development law); financial assistance and research programmes; and information

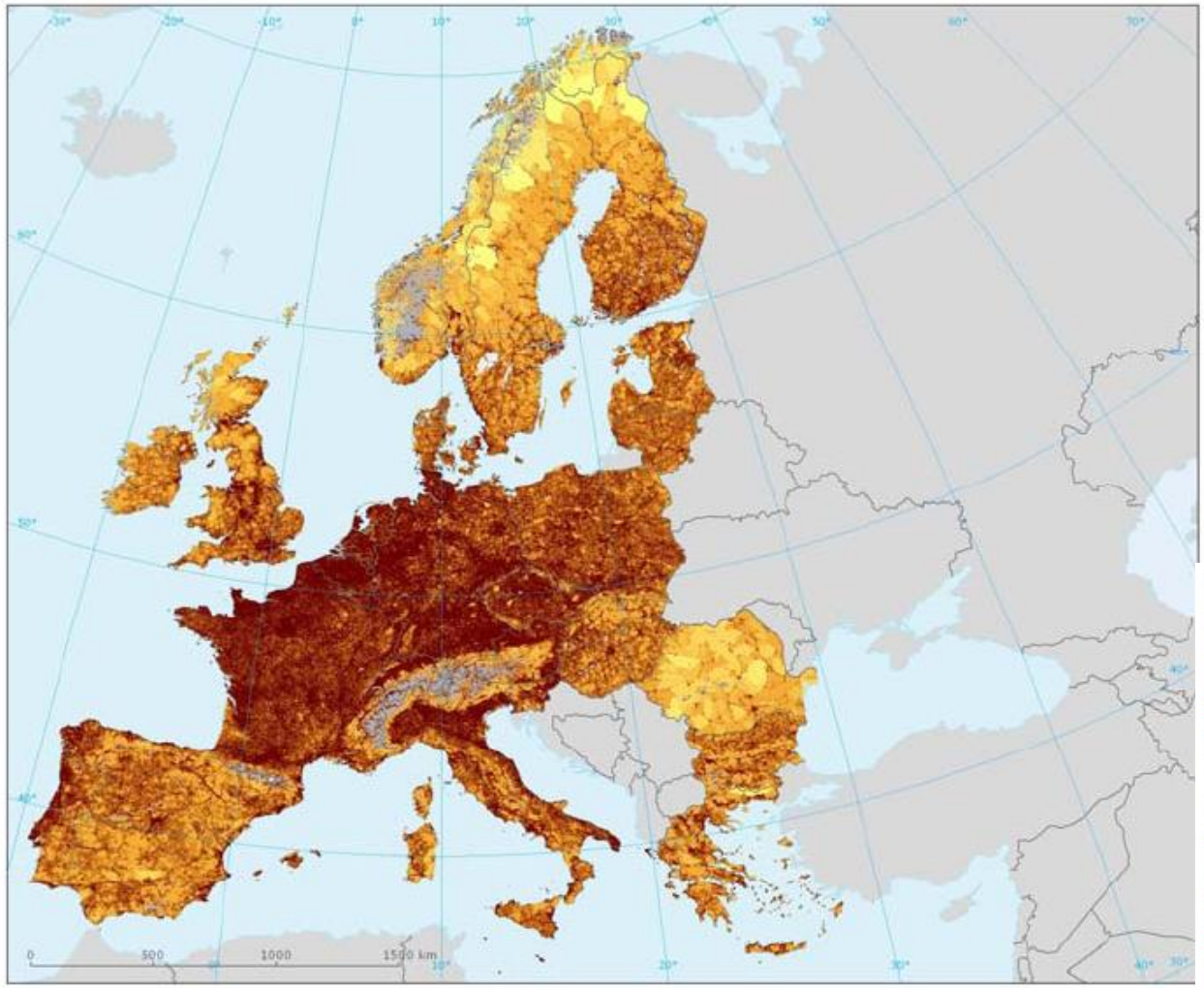
Source: National Sustainable Development Strategy (2002)

Now on to connectivity…

- Connectivity between different GI assets will help maximise the benefits that they generate.
- Connectivity can be visual or notional; however physical connections make the most impact.
- Connectivity can enhance public engagement with the natural environment, improve opportunities for biodiversity migration and assist in encouraging sustainable forms of travel.



Fragmentation high in Europe and augmenting…



Legend

Fragmentation per 1 km grid (2009)
FG-B2 (SEFF value)

- < 0,10 (low fragmentation)
- 0.10 - 0.25
- 0,25 - 0,50
- 0,50 - 1,00
- 1,00 - 5,00
- 5,00 - 10,00
- 10,00 - 25,00
- 25,00 - 50,00
- 50,00 - 100,00
- > 100 (high fragmentation]

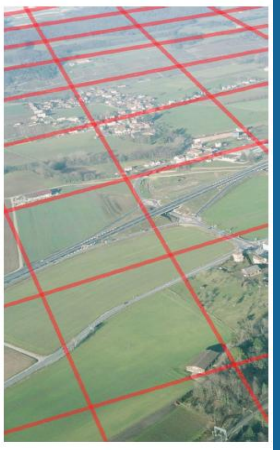


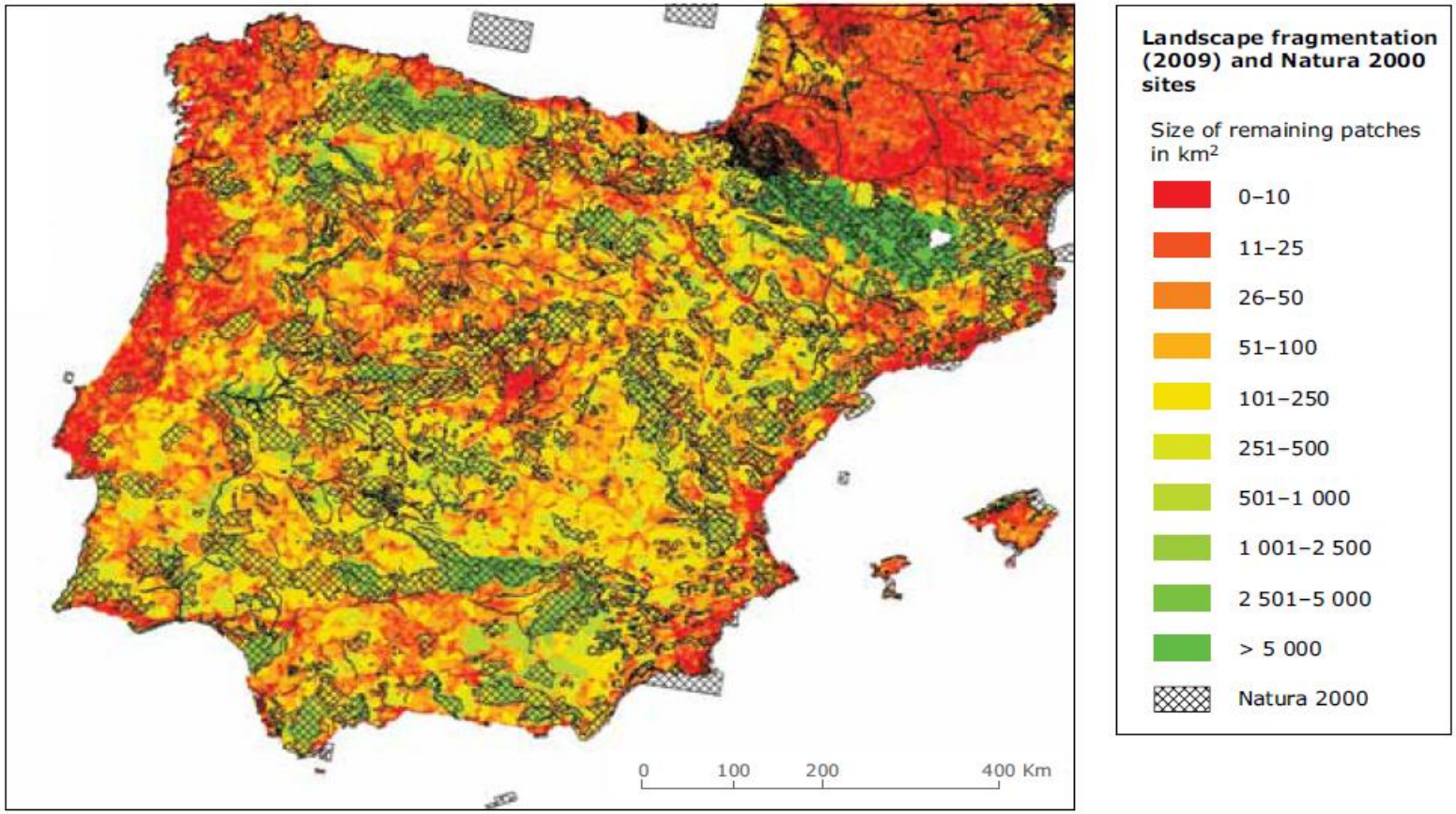
Figure 3.4: Map of effective mesh density values in a 1 km² grid for FG-B2 for 2009.

Benefits provided by green infrastructure

Topic area	Benefits	Reference					
		DG Environment (2010)	US EPA (2009)	Landscape institute (2009)	Natural England (2010)	Ahern (2007)	Benedict & McMahon (2006)
Biodiversity/ Species protection	Habitats for species			●	●	●	
	Permeability for migrating species	●		●		●	●
	Connecting habitats	●				●	●
Climate change adaptation	Mitigating urban heat island effect with evapotranspiration, shading and keeping free corridors for cold air movement			●	●	●	
	Strengthening ecosystems' resilience to climate change	●		●			
	Storing flood water and ameliorating surface water run-off to reduce the risk of flooding	●	●	●	●	●	●
Climate change mitigation	Carbon sequestration	●		●		●	
	Encouraging sustainable travel			●			
	Reducing energy use for heating and cooling buildings			●			
	Providing space for renewable energy, such as ground source heating, hydroelectric power, biomass and wind power			●		●	
Water management	Sustainable drainage systems - attenuate surface water run-off		●	●		●	●
	Groundwater infiltration		●			●	●
	Removal of pollutants from water (e.g. reed beds)		●	●			●
Food production and security	Direct food and fibre production on agricultural land, gardens and allotments			●			
	Keeping potential for agricultural land – food security (safeguarding of soil)						
	Soil development and nutrient cycle					●	●
	Prevent soil erosion	●		●			
Recreation, wellbeing and health	Recreation			●	●	●	●
	Sense of space and nature				●	●	●
	Cleaner air						●
Land values	Positive impact on land and property			●		●	●
Culture and communities	Local distinctiveness			●			
	Opportunities for education, training and social interactions			●	●	●	
	Tourism opportunities			●			

...impacting e.g. on Natura2000 connectivity...

Map 4.3 **Overlay of the Natura 2000 network with fragmentation geometry FG-A2 'Major and medium anthropogenic fragmentation', showing Spain and Portugal as an example**



Note: Many protected areas are located in regions that contain large unfragmented patches. River systems that are protected are visible as black lines. Depending on the particular objectives of a study, differing FGs are most suitable.

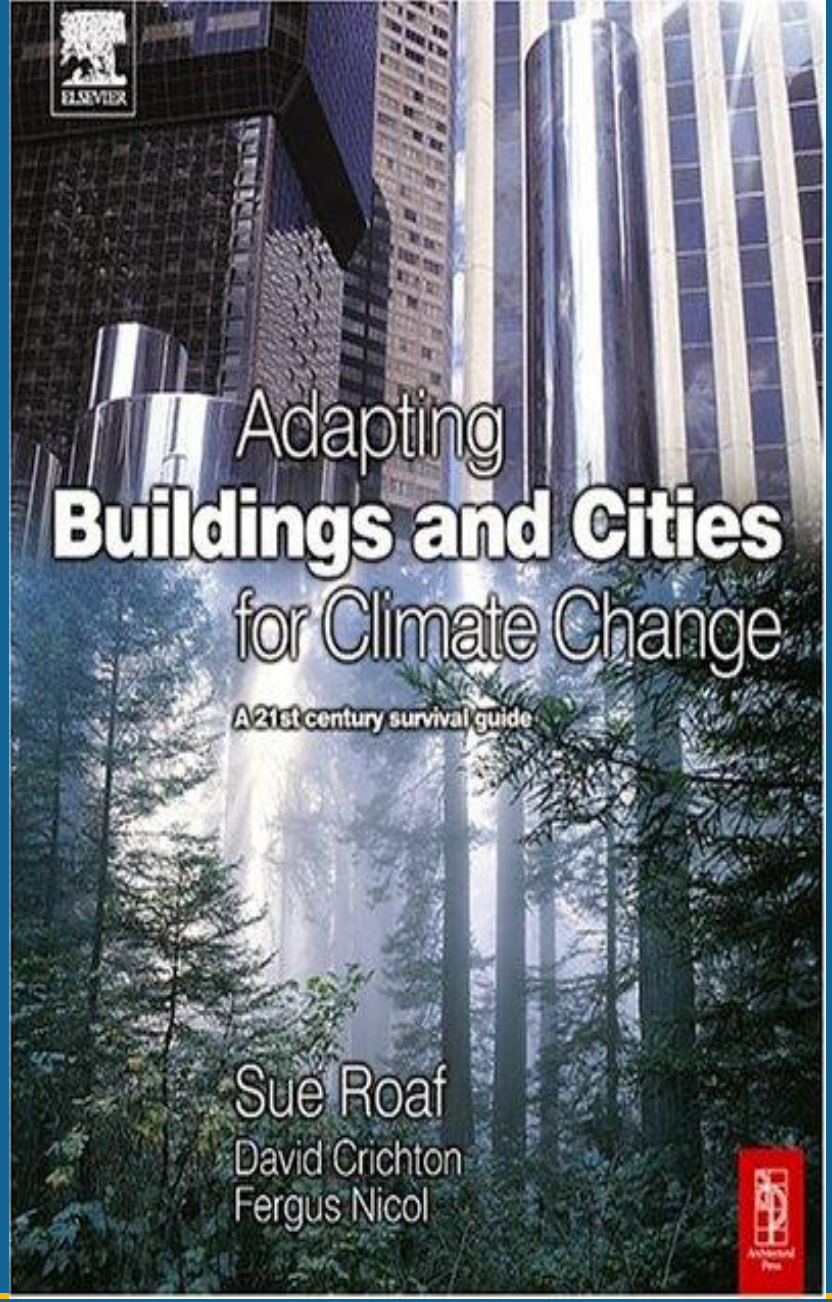
Source: EEA/FOEN, 2011.

The multi-functionality dimension

Functions:

- GI functions are the roles that assets can play if planned, designed and managed in a way that is sensitive to, and includes provision for, natural features and systems

- Each asset can perform different functions, a concept known as multi-functionality


ELSEVIER
Adapting
Buildings and Cities
for Climate Change
A 21st century survival guide
Sue Roaf
David Crichton
Fergus Nicol

Cool down… …air TREE concept!

Viva Madrid?

… real TREE in cities…

- Up to 10 C difference between peri-urban and central areas
- 100 m^2 of trees help reduce T by 1 C
- Green surfaces 10 C cooler than artificial ones

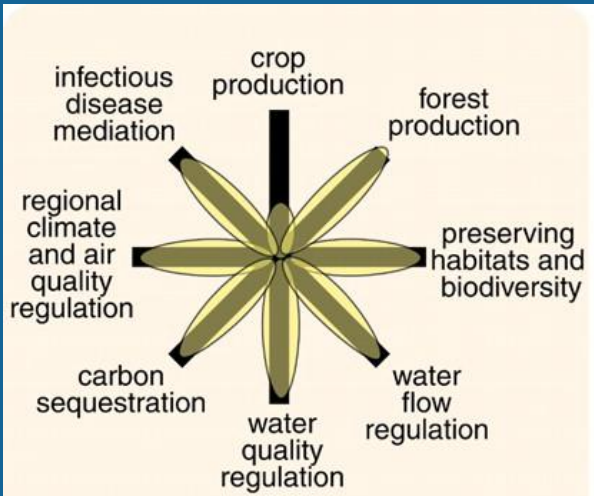
…but there is more…

...multifunctional services/benefits of urban forest and green areas for health

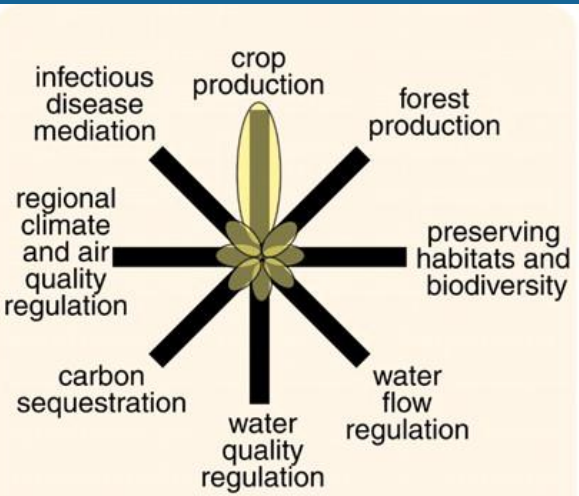
- Increased physical activity and reduced obesity
- Reduced stress levels and improvements in mental health
- Reductions in noise levels – which can improve mental and physical health
- Lower levels of violence and crime – which can reduce the risk of many health outcomes
- Improvements in hospital recovery times
- Increased social interactions which can help to improve overall well-being.
- Saving cost in the health sector
- Milan vertical forest: 900 trees eq. 10,000 m2 forest

Source: Faculty of Public Health London 2010

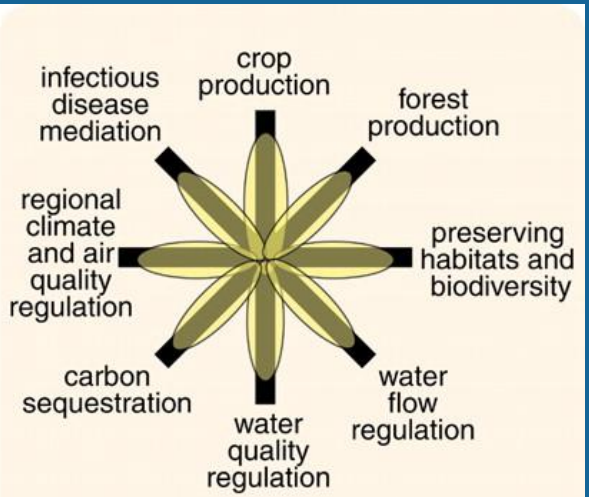
So, mostly a question of land use and ecosystem services



natural ecosystem



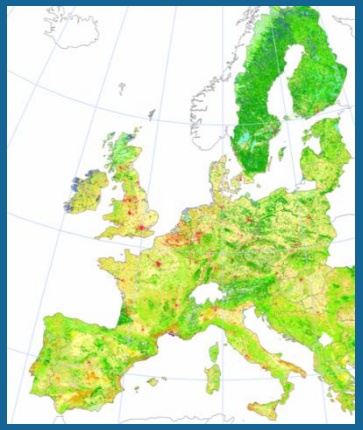
intensive cropland



cropland with restored ecosystem services

Source: Foley et al., 2005 *Science Vol. 309*

Natural capital: based on Ecosystem Accounting Landscape Ecological Potential as a proxy (1990-2000-2006)



Corine land cover map *(CLC is derived from satellite images)*

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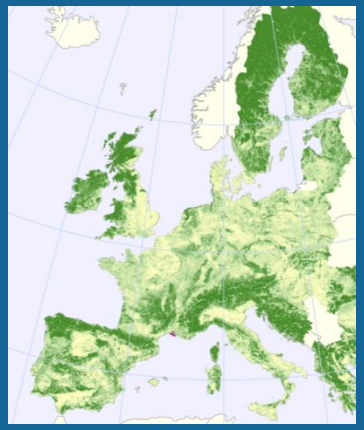

Green Landscape Index *(derived from CLC)*

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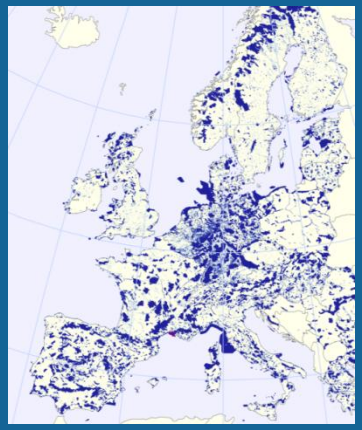

Nature Value (*Naturilis, derived from Natura2000 designated areas*)

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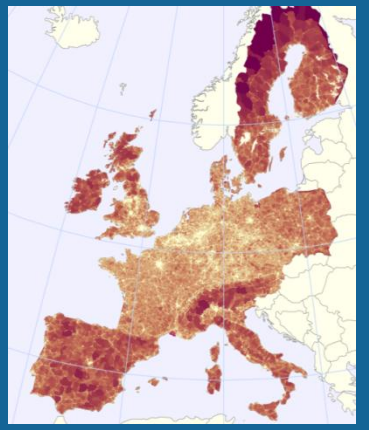

Fragmentation (*Effective Mesh Size (MEFF) derived from TeleAtlas Roads and CLC)*

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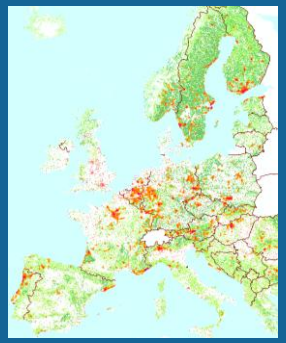
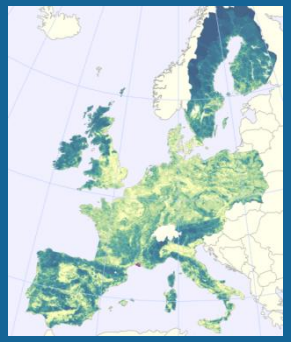


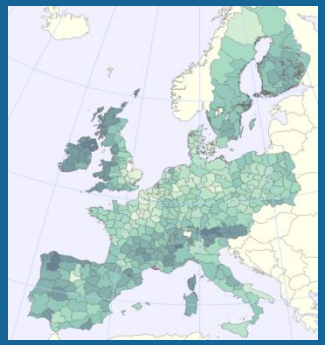
Landscape Ecological Potential (LEP+) 2000

➔



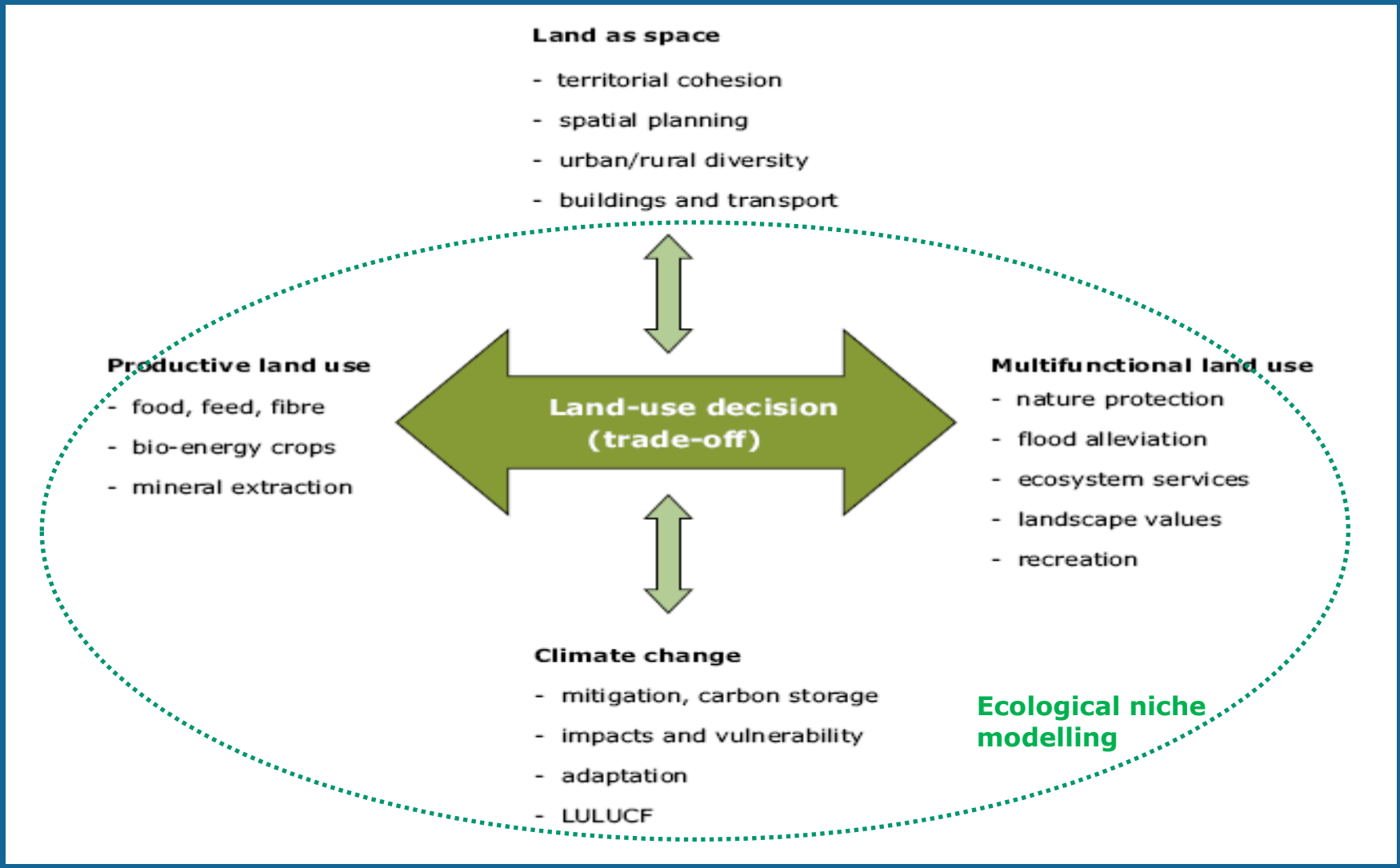
LEP+ by 1km² grid cell

and



LEP+ 2000 by NUTS 2/3

Need for conceptual framework for integrated land assessment



Thank you for your attention