Biodiversity and ecosystem services: complementary visions on natural capital?

Anik Schneiders, Toon Van Daele,
Wouter Van Landuyt, Wouter Van Reeth

BEES – 24/3/2011

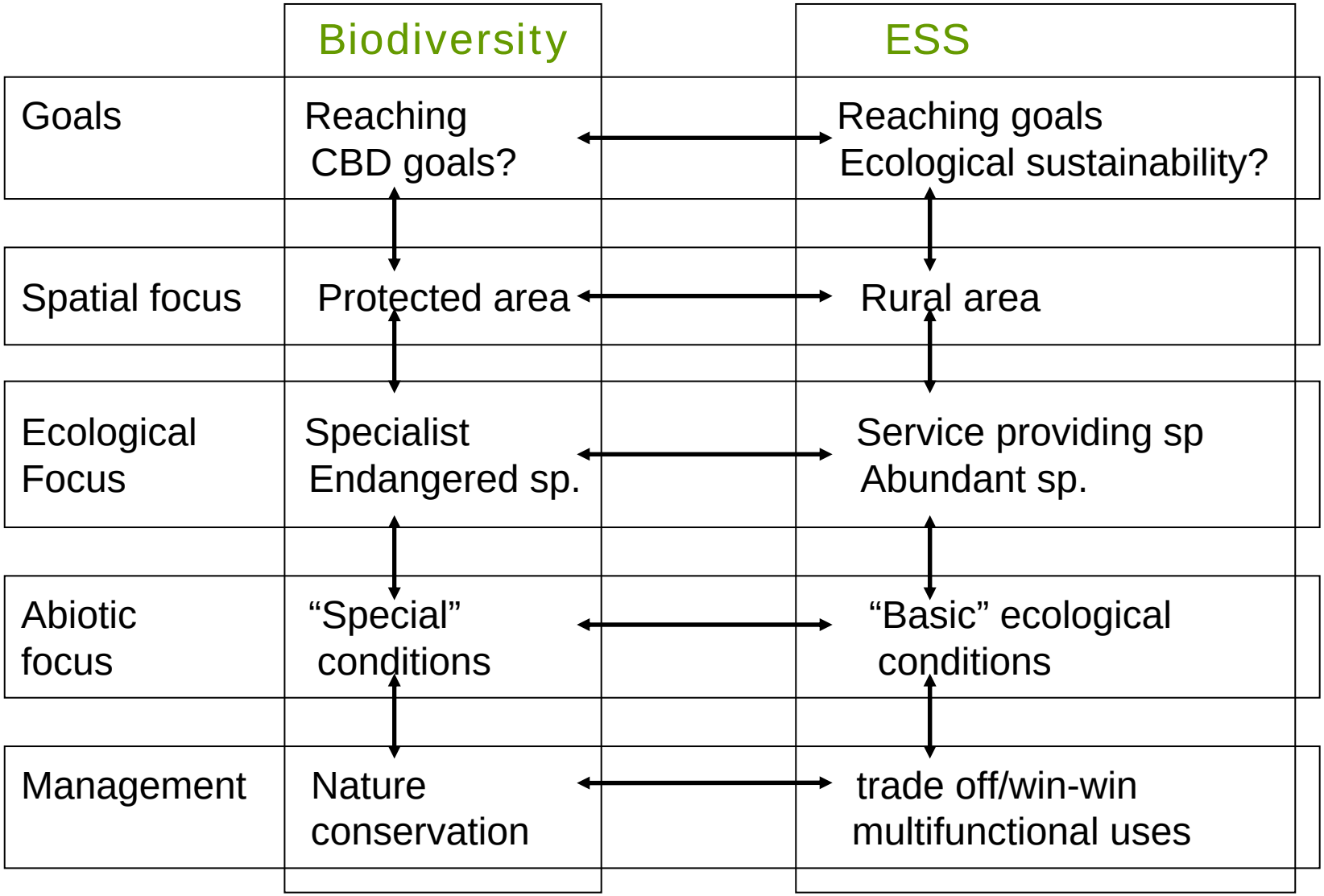
inbo
Instituut voor Natuur- en Bosonderzoek
Research Institute for Nature and Forest

www.inbo.be

Biodiversity and Ecosystem Services

- Part I: comparing basic assumptions
  Policy context
- Part II: comparing spatial relationships
  Biodiversity – ESS – land use intensity
  Case study : Flanders
- Part III: present – future relationships
  Theoretical framework
- Part IV: ecosystem management
  Nature conservation & adaptive management

Part I: comparing “basic assumptions”



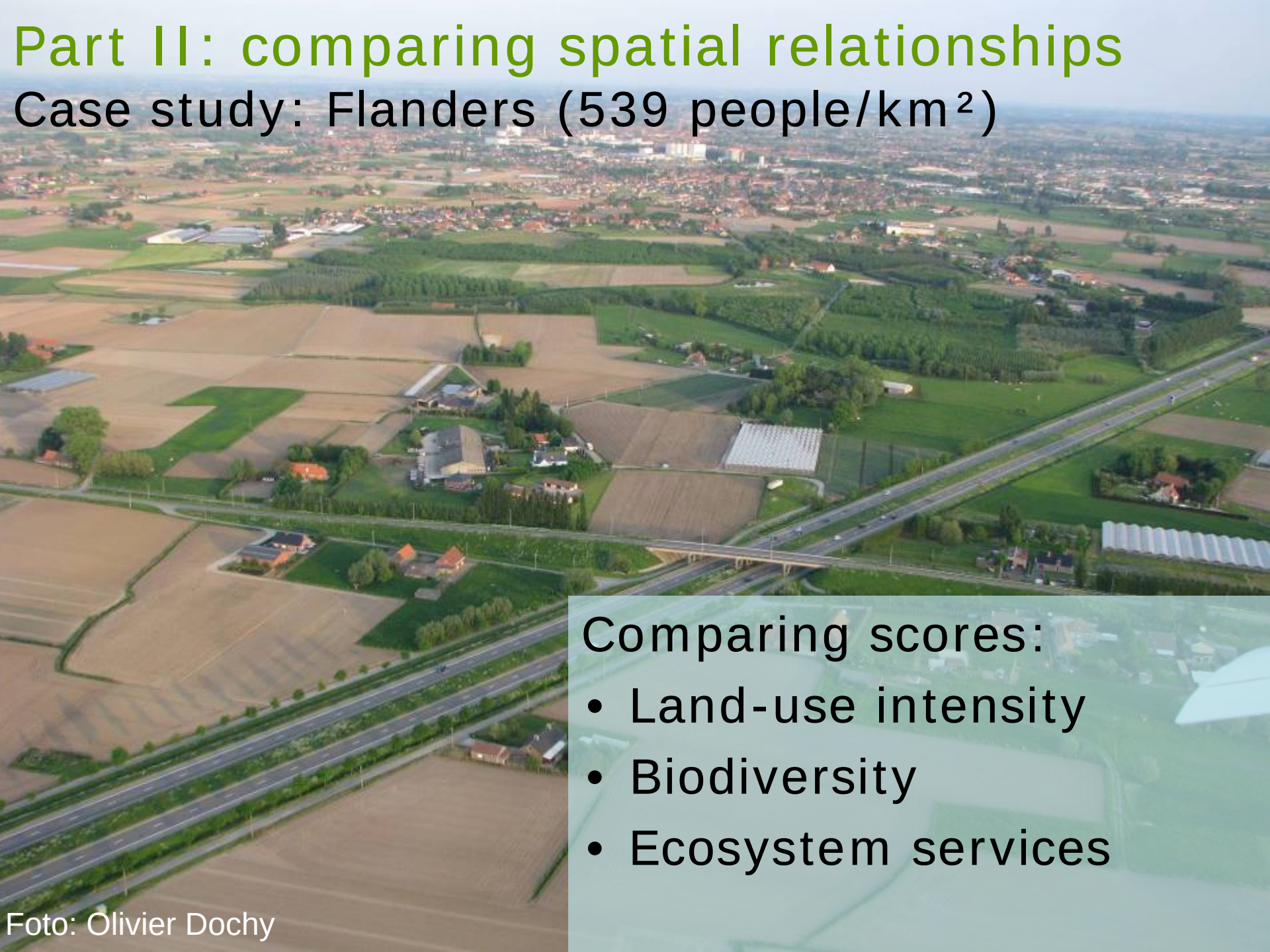
Part I: comparing “basic assumptions”

Examples of scoring systems

Biodiversity: “intrinsic”		**ESS:** “human support”
RL species	vs	“important” ESP
Species richness/diversity	vs	Structural & functional diversity
Completeness	vs	# functional groups # species within a funct. group
Integrity and naturalness	vs	healthy ecosystem

Part II: comparing spatial relationships

Case study: Flanders (539 people/km²)



Comparing scores:

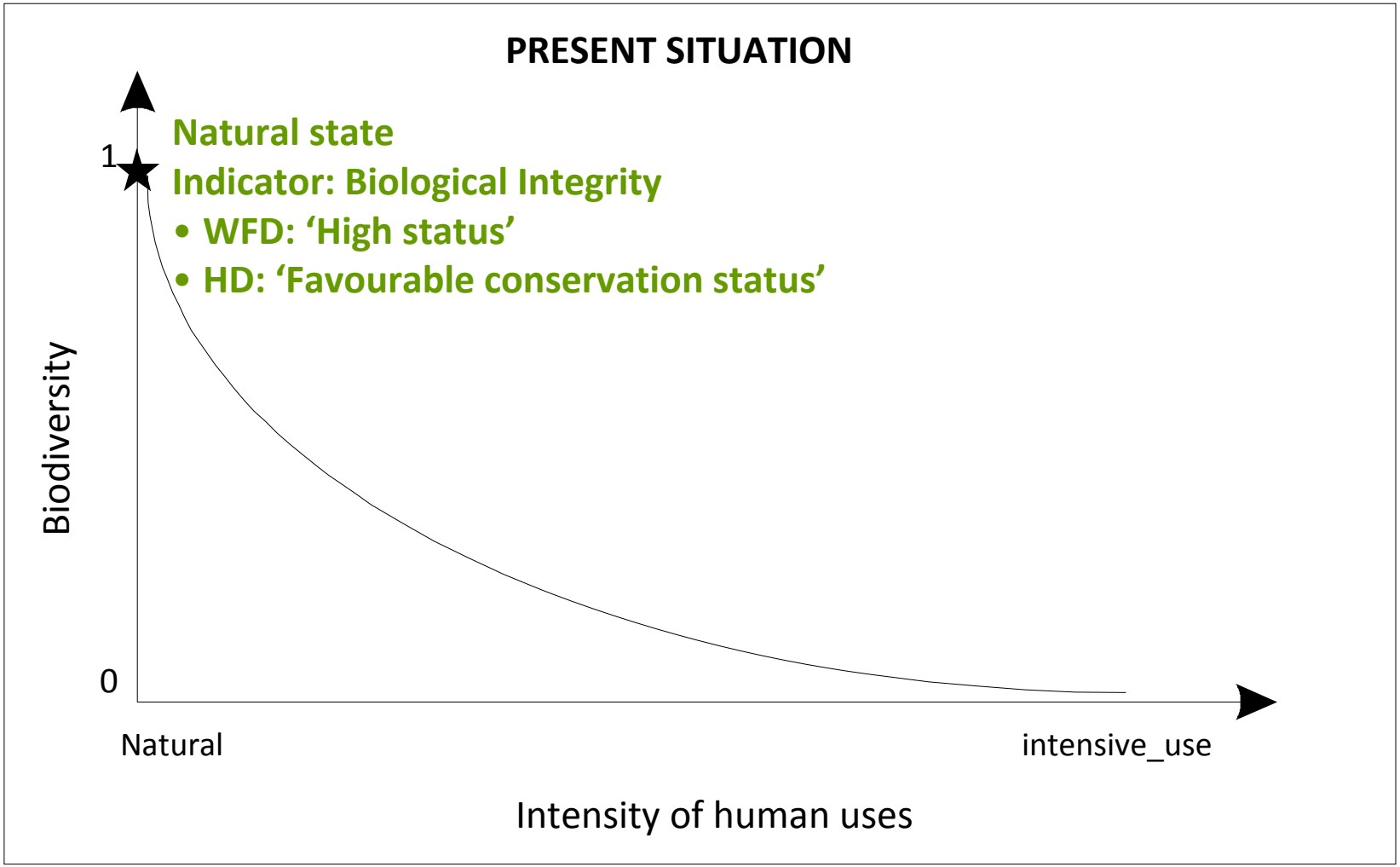
- Land-use intensity
- Biodiversity
- Ecosystem services

Foto: Olivier Dochy

Biodiversity and Ecosystem Services

- Part I: comparing basic assumptions
  policy context
- Part II: comparing spatial relationships
  Biodiversity – ESS – land use intensity
  Case study : Flanders
- Part III: present – future relationships
  Theoretical framework
- Part IV: ecosystem management
  Nature conservation & adaptive management

Part II: comparing spatial relationships



Part II: comparing spatial relationships

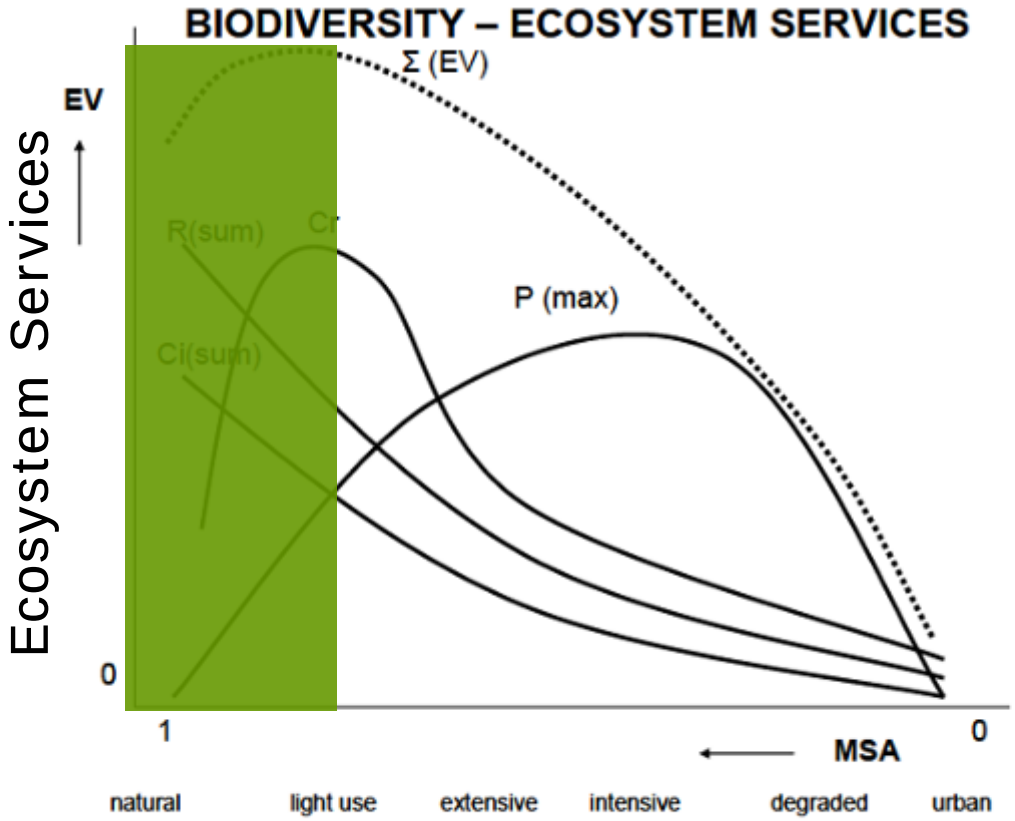
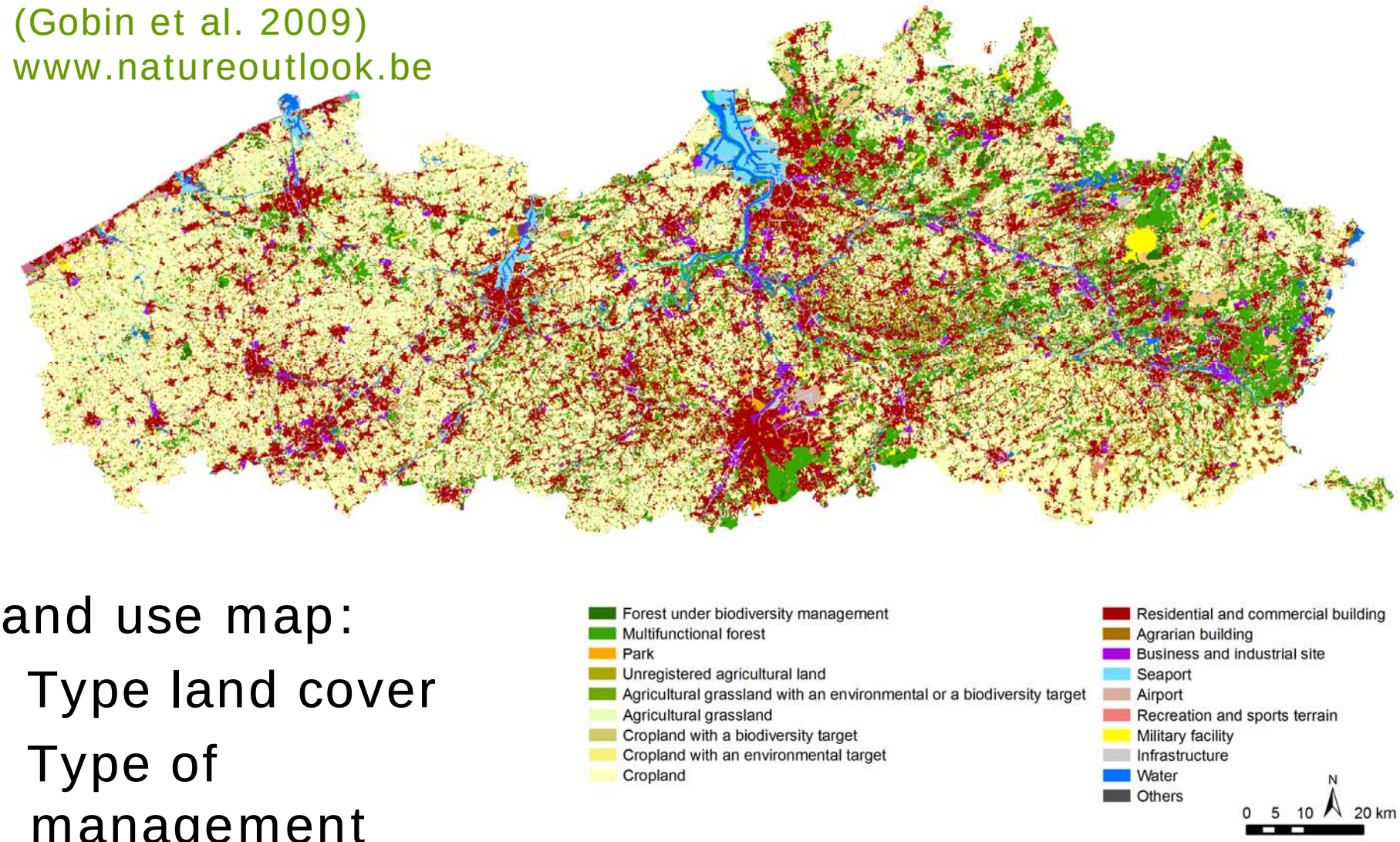


Figure 5.5 Generalised functional relationships between ecosystem service level and degree of land use intensity (decreasing MSA values)

The Cost of Policy Inaction: The case of not meeting the 2010 biodiversity target
L. Braat & P. ten Brink (eds.)

Part II: comparing spatial relationships

Land use model Flanders
(Gobin et al. 2009)
www.natureoutlook.be



Land use map:

- Type land cover
- Type of management

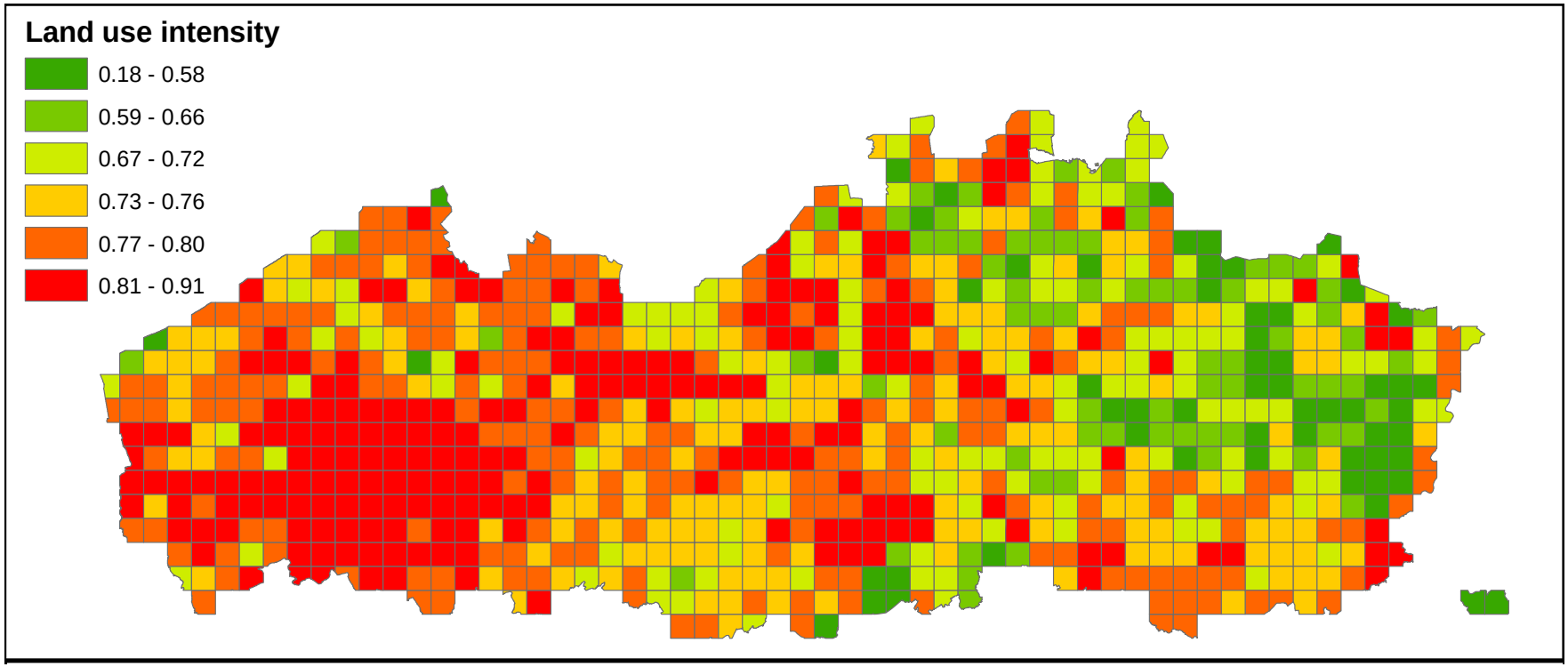
Part II: comparing spatial relationships

Score 1: land use intensity score

Land use type	Land use Intensity
Protected and/or managed semi-natural areas	0.1
Non protected and/or managed semi-natural areas	0.2
Forest (with forest management)	0.3
Open water	0.4
Agriculture with nature measurements	0.4
Parks	0.5
Military terrain	0.5
Agriculture with environmental measurements	0.6
Recreational areas	0.7
Agricultural areas	0.8
Build up areas, factories and commercial zones	0.9
Infrastructure, port areas and airports	1.0

Part II: comparing spatial relationships

Land use intensity score (4 X 4 km²)



Part II: comparing spatial relationships

Score 2:

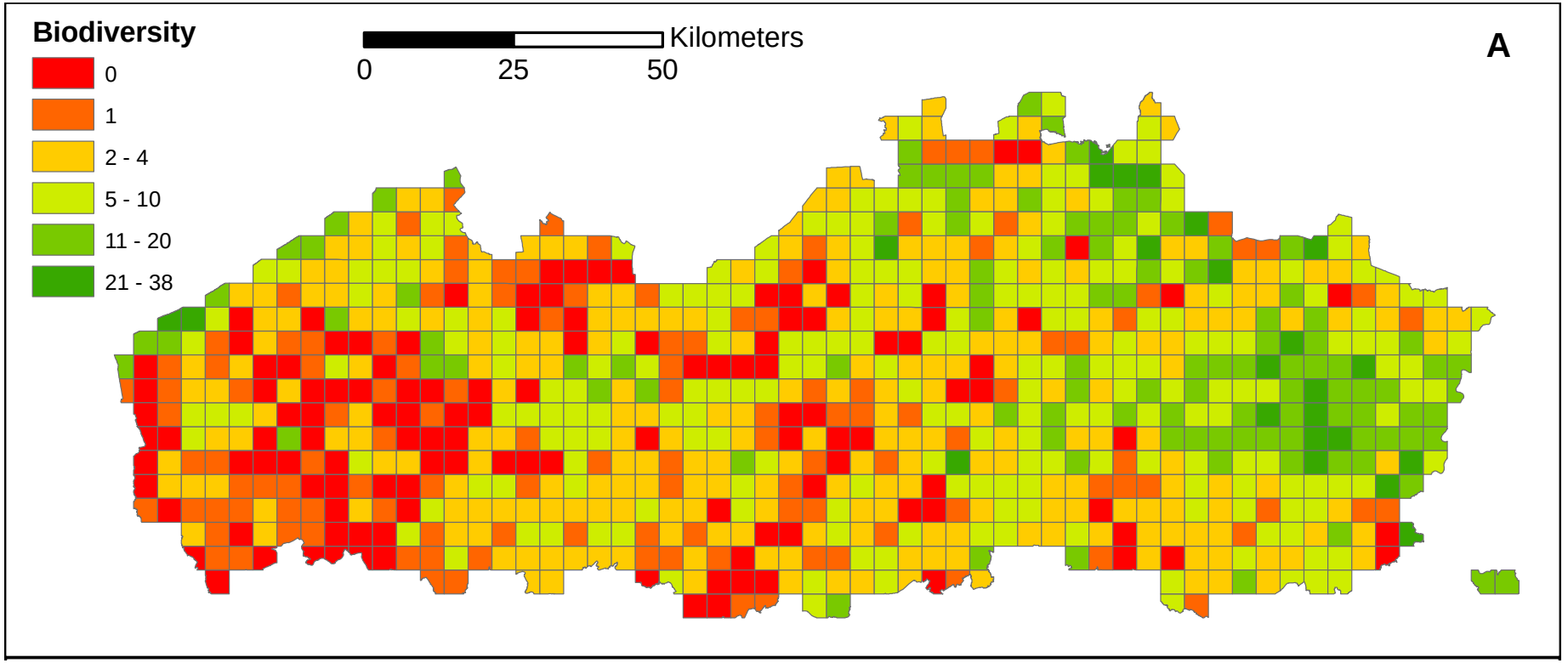
Biodiversity score:

- Endangered species:
- **Amount of Red List plant Species**

Foto: Yves Adams

Part II: comparing spatial relationships

Biodiversity score: Amount of Red List Plant Species (4X4 km²)

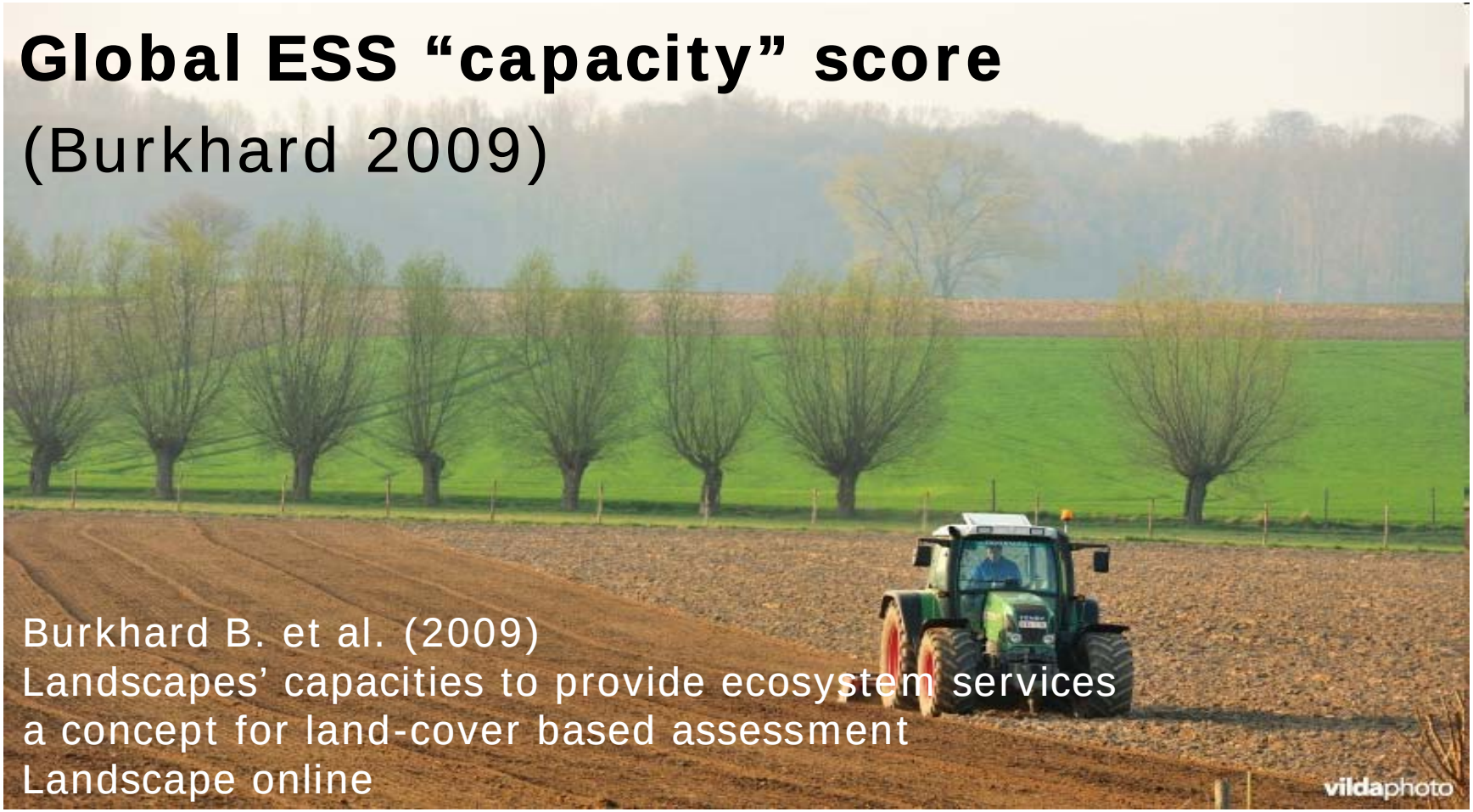


Part II: comparing spatial relationships

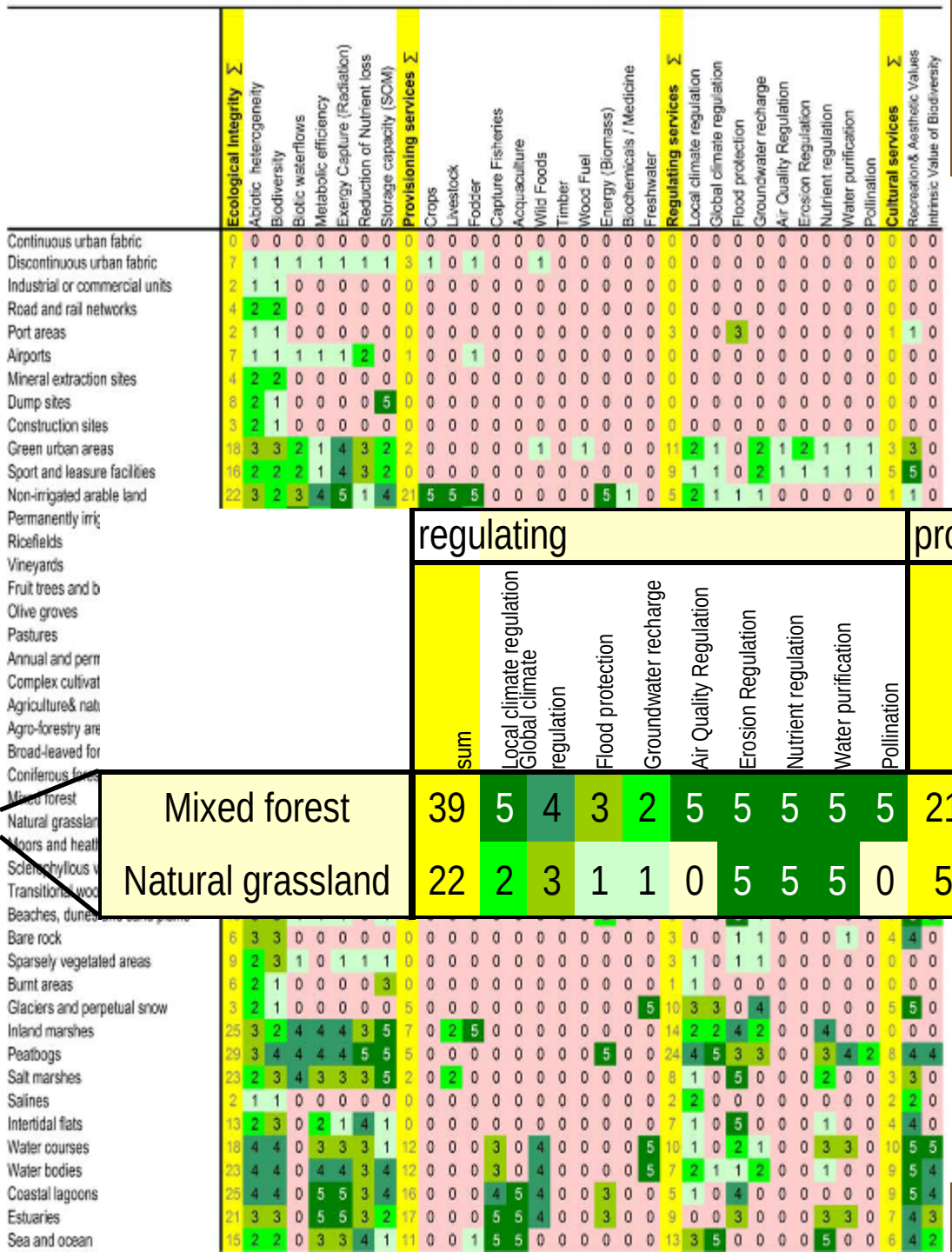
Score 3: ESS score:

Global ESS “capacity” score

(Burkhard 2009)



http://www.landscapeonline.de



	regulating											provisioning												cultural		
	sum	Local climate regulation	Global climate regulation	Flood protection	Groundwater recharge	Air Quality Regulation	Erosion Regulation	Nutrient regulation	Water purification	Pollination	sum	Crops	Livestock	Fodder	Capture Fisheries	Acquaculture	Wild Foods	Timber	Wood Fuel	Energy Biochemicals / Medicine	Freshwater	sum	Recreation& Aesthetic Values	Intrinsic Value of Biodiversity
Mixed forest	39	5	4	3	2	5	5	5	5	5	21	0	0	1	0	0	5	5	5	1	5	0	10	5	5
Natural grassland	22	2	3	1	1	0	5	5	5	0	5	0	3	0	0	0	2	0	0	0	0	0	6	3	3

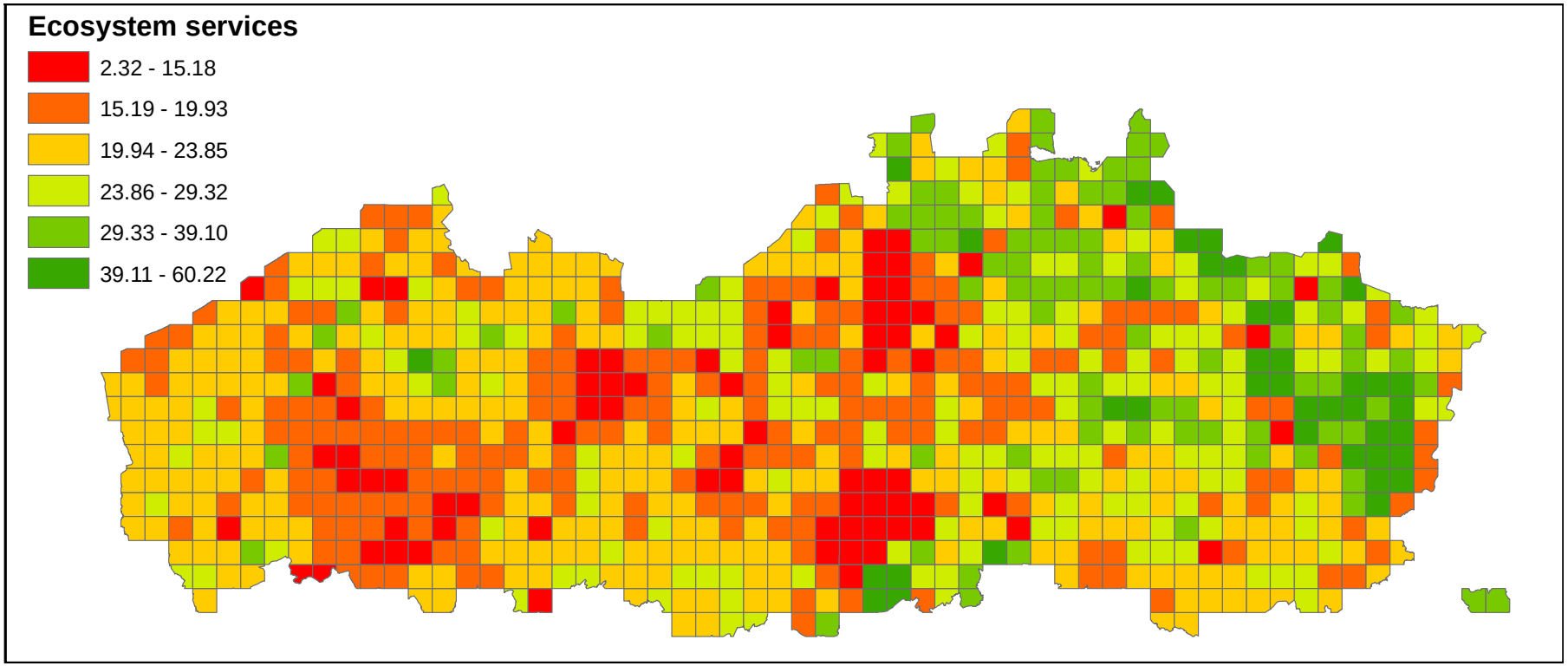
Part II: comparing spatial relationships

Ecosystem score: Global score (Burkhard 2009)

Land use	Regulating	Provisioning	Cultural	Weighted total	Total
Amount of services scored	N=9	N=11	N=2	N=22	N=22
high nature value grassland (no biodiversity management)	22	5	6	43	33
Marshes (no biodiversity management)	14	7	0	16	21
Heath (no biodiversity management)	20	10	10	60	40
Beaches and dunes (no biodiversity management)	6	2	7	32	15
Residential and commercial fabric	0	0	0	0	0
Agricultural fabric and infrastructure	0	3	0	2	3
Business and industrial site	0	3	0	2	3
Port area	3	0	1	6	4
Airport	0	1	0	1	1
High nature value grassland (biodiversity management)	22	5	6	43	33

Part II: comparing spatial relationships

ESS capacity score

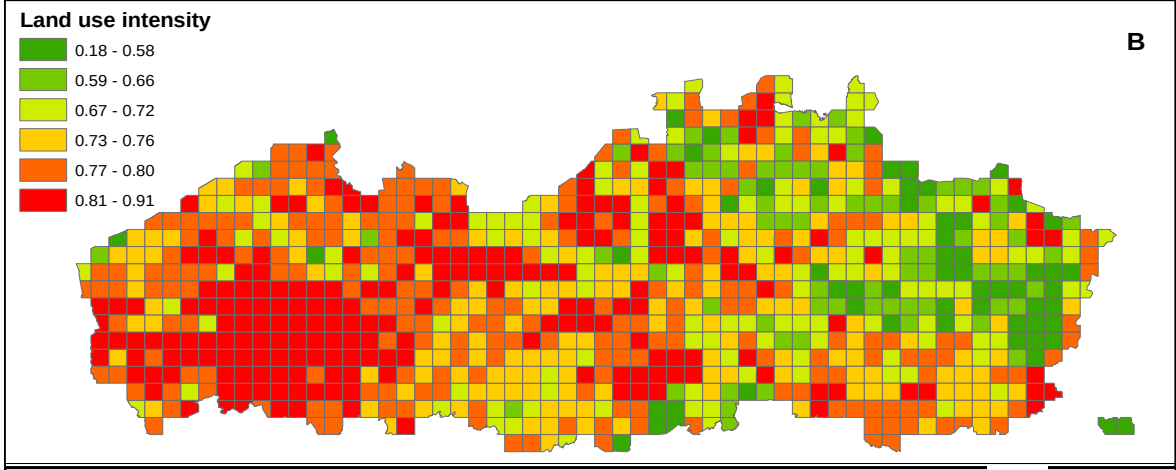


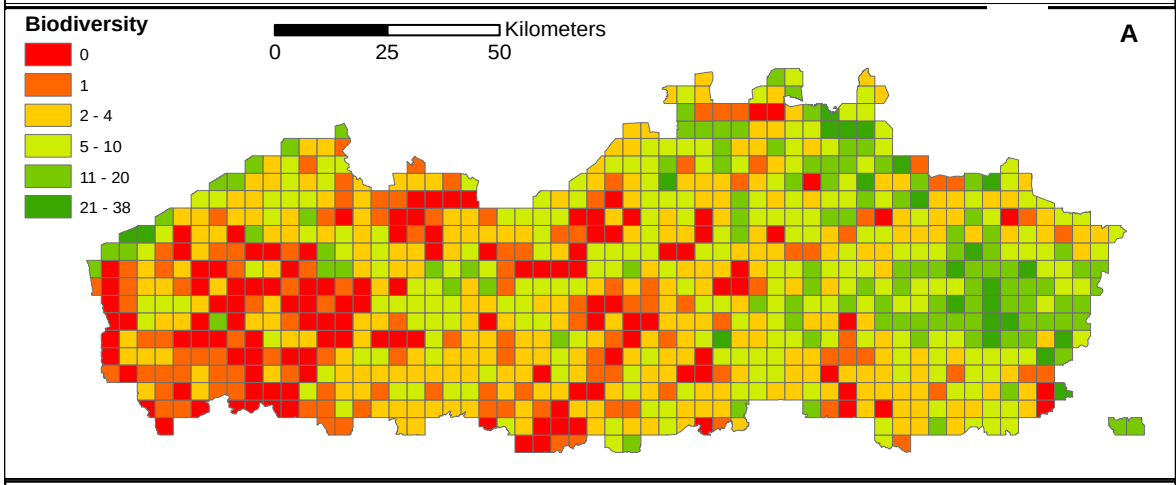
Land use intensity score

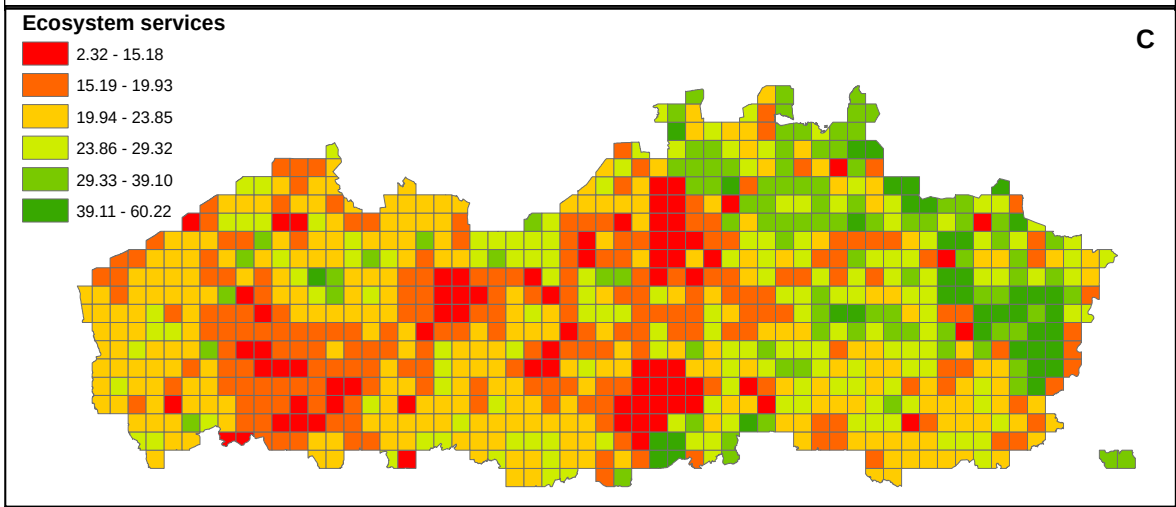
Biodiversity score

Ecosystem services score

Grid unit: 4X4 km²

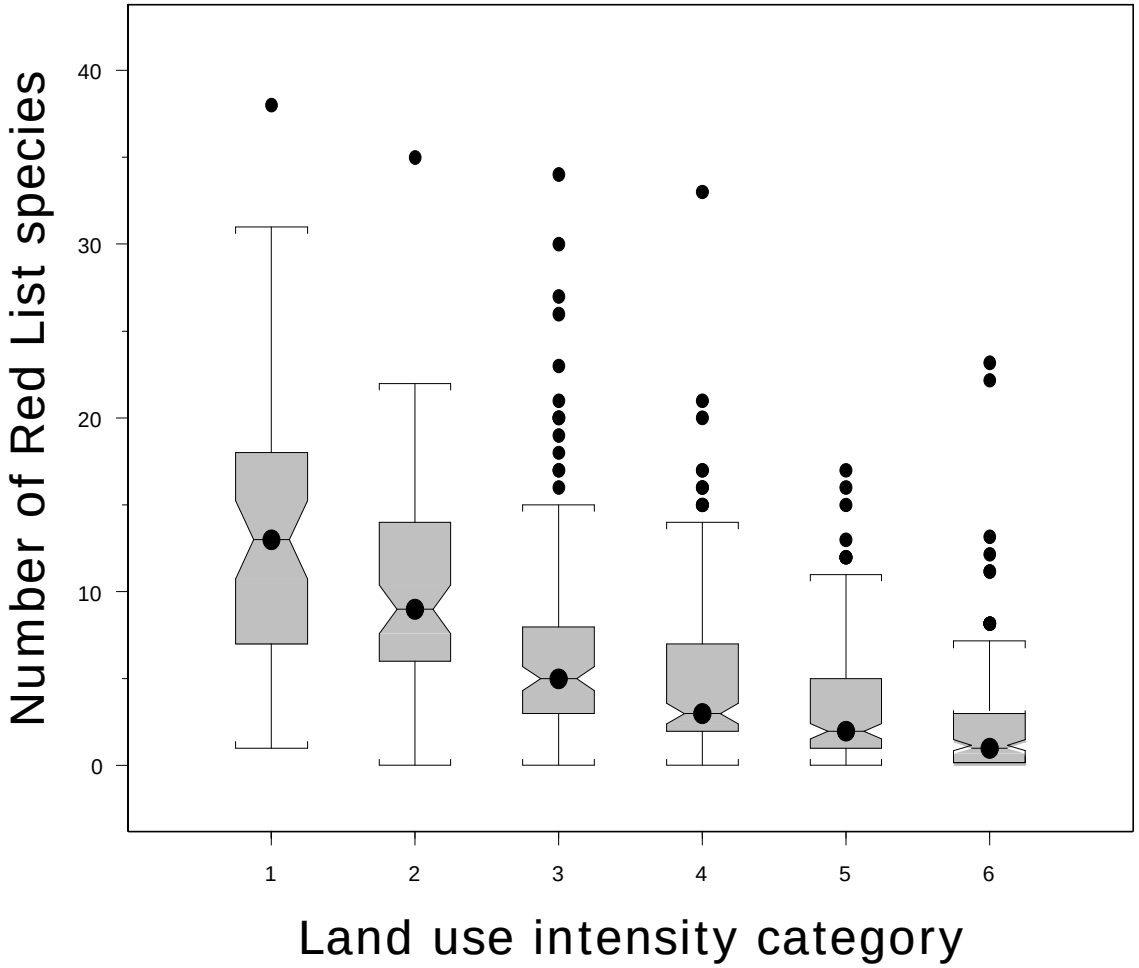






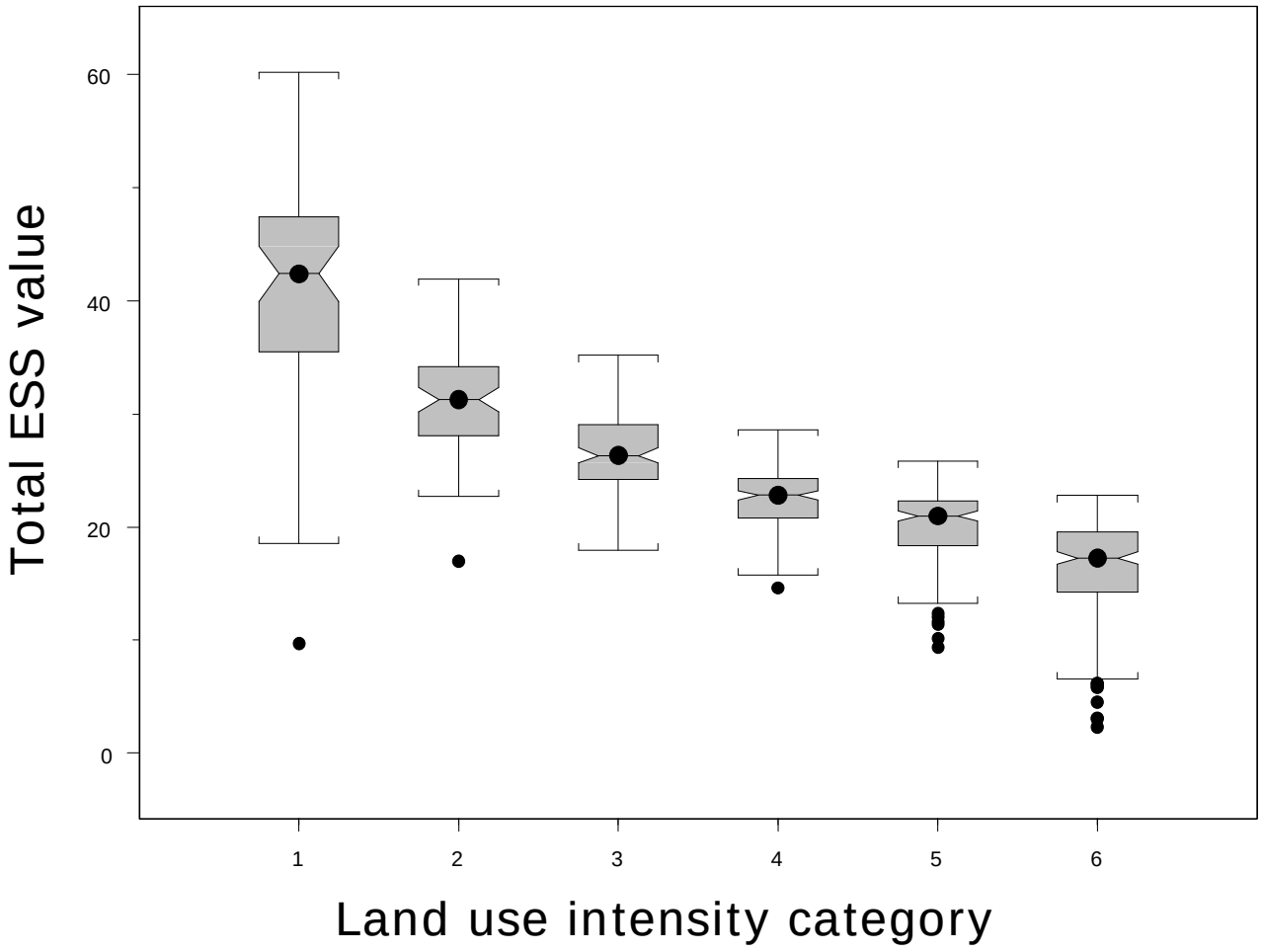
Part II: comparing spatial relationships

Correlations: land use intensity & biodiversity



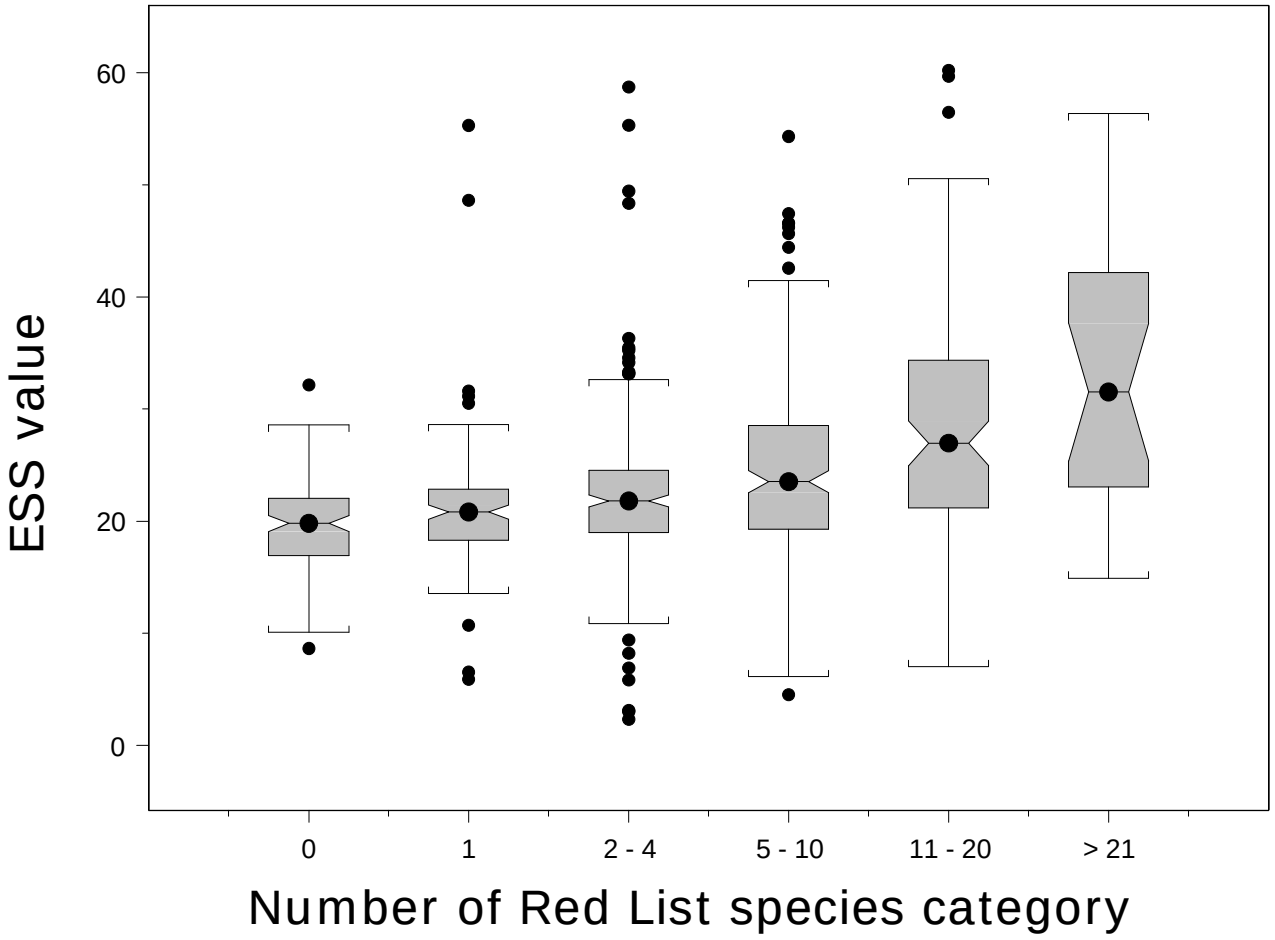
Part II: comparing spatial relationships

Correlations: land use intensity & ESS



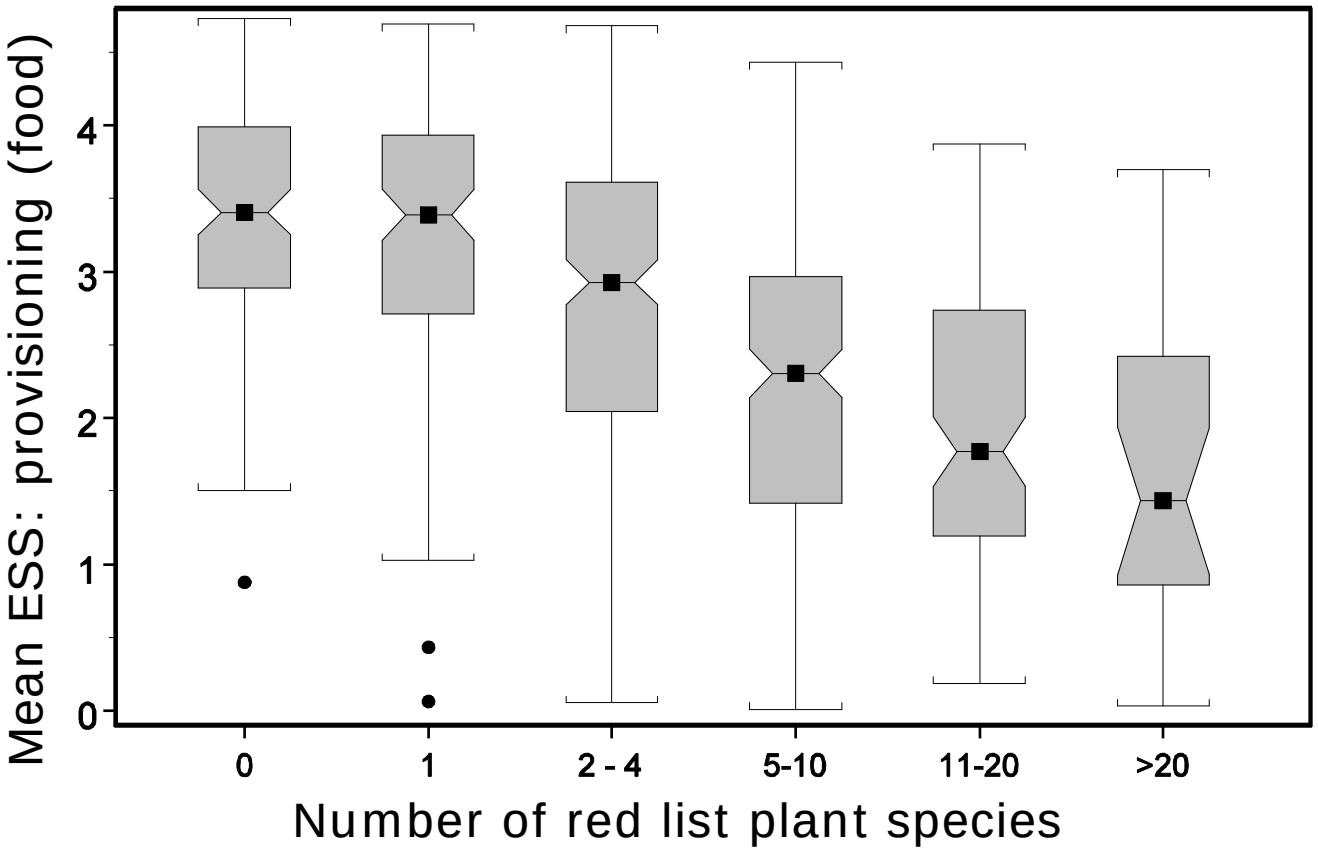
Part II: comparing spatial relationships

Correlations: biodiversity & ESS



Part II: comparing spatial relationships

Correlations: biodiversity & provisioning ESS (food)



Part II: comparing spatial relationships

Correlations:

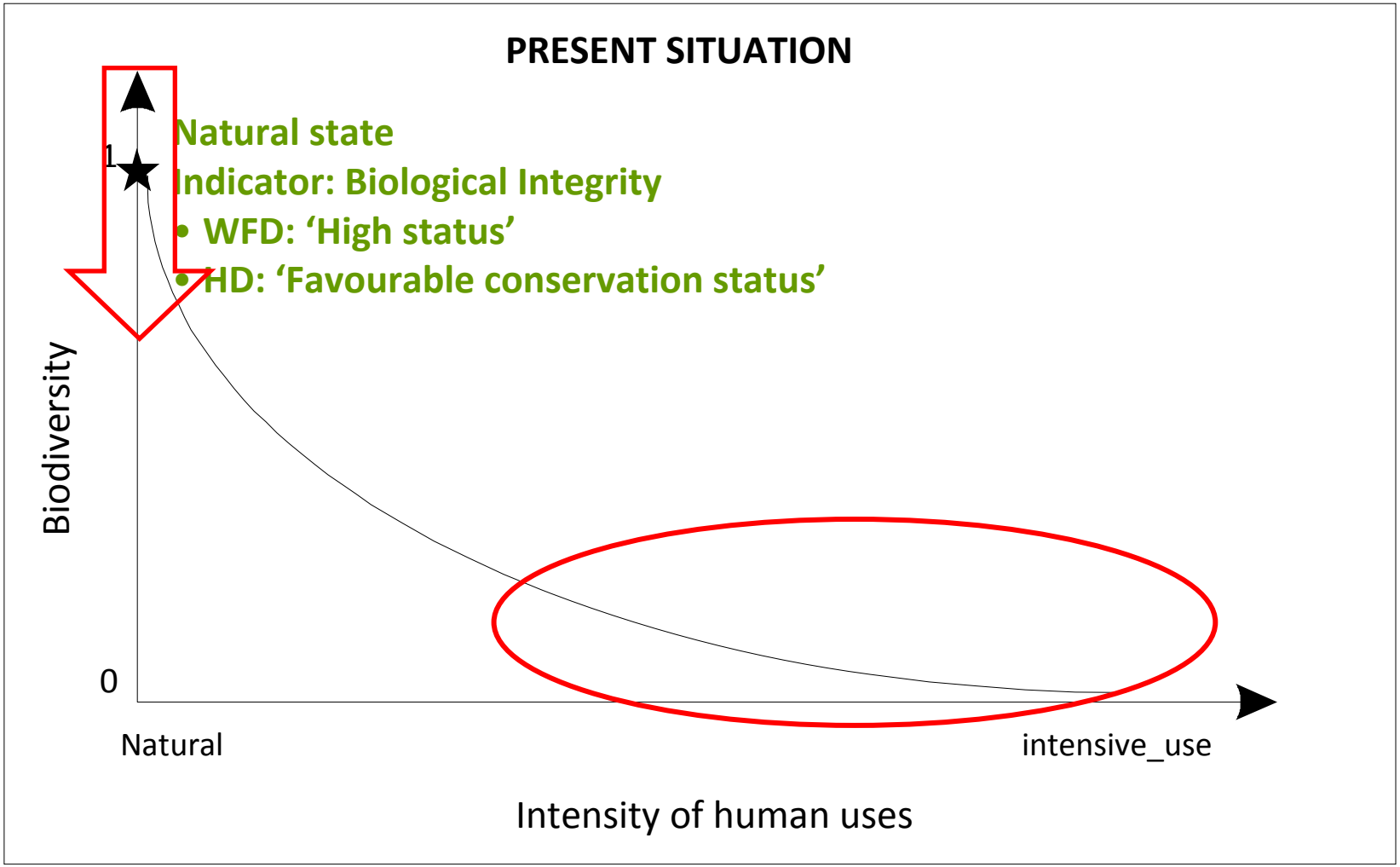
Spearman rank correlation matrix (* = p-value < 0.001)

	Biodiversity: Number of RL species	Land use intensity	ES scores				
			Cultural services	Provisioning (food)	Provisioning (non food)	Regulating services	Total weighted ES
Biodiversity	1	**-0.58 ***	0.58 *	**-0.47 ***	0.23 *	0.45 *	0.36 *
Land use intensity		1	**-0.92 ***	**0.36 ***	**-0.68 ***	**-0.92 ***	**-0.84 ***
Cultural ES			1	**-0.54 ***	0.59 *	0.88 *	0.76 *
Provisioning (food) ES				1	0.16 *	-0.22 *	0.01
Provisioning (non-food) ES					1	0.83 *	0.94 *
Regulating ES						1	0.93 *
Total weighted ES							1

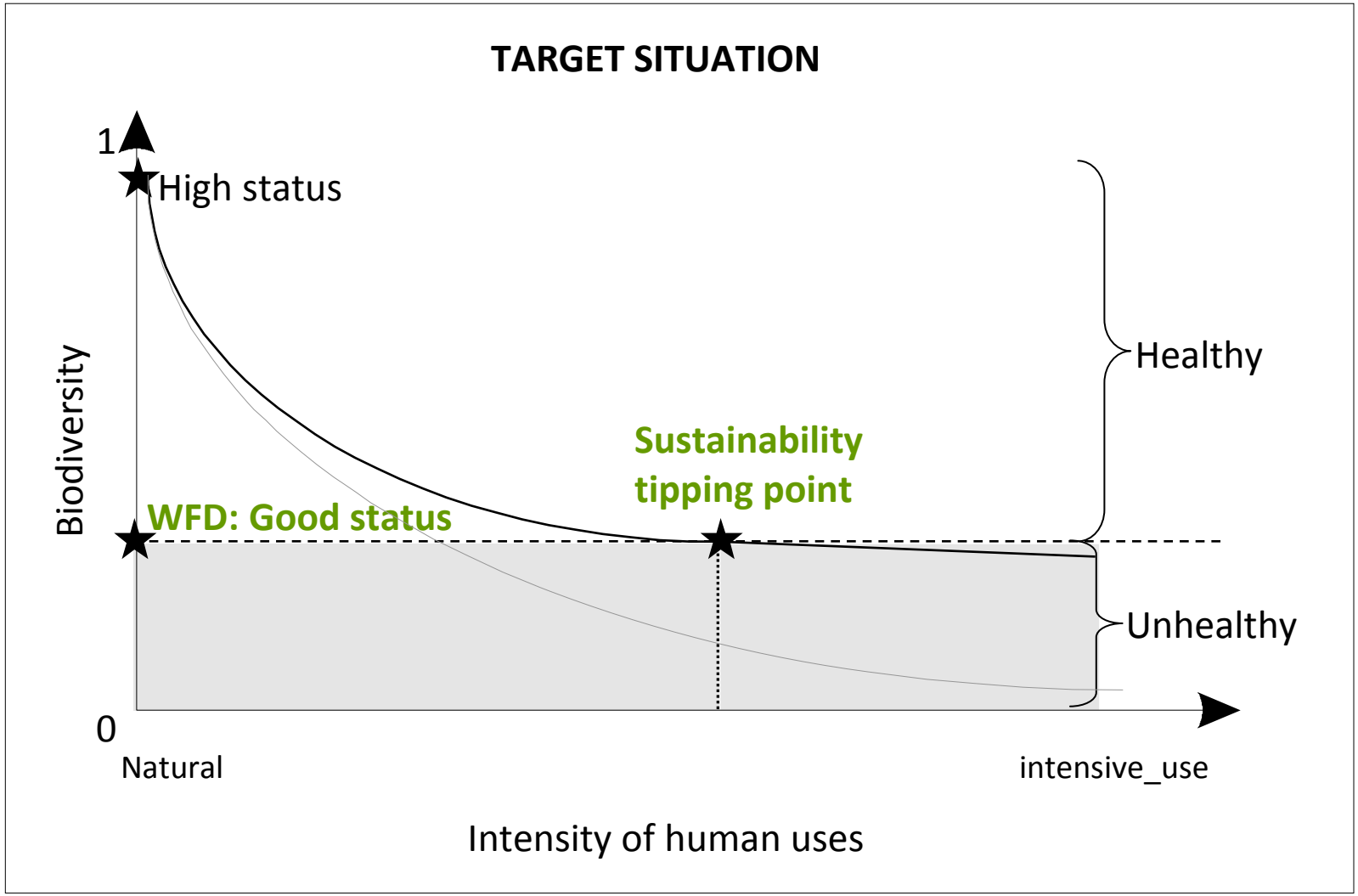
Biodiversity and Ecosystem Services

- Part I: comparing basic assumptions
  Policy context
- Part II: comparing spatial relationships
  Biodiversity – ESS – land use intensity
  Case study : Flanders
- Part III: present – future relationships
  Theoretical framework
- Part IV: ecosystem management
  Nature conservation & adaptive management

Part III: present – future relationships



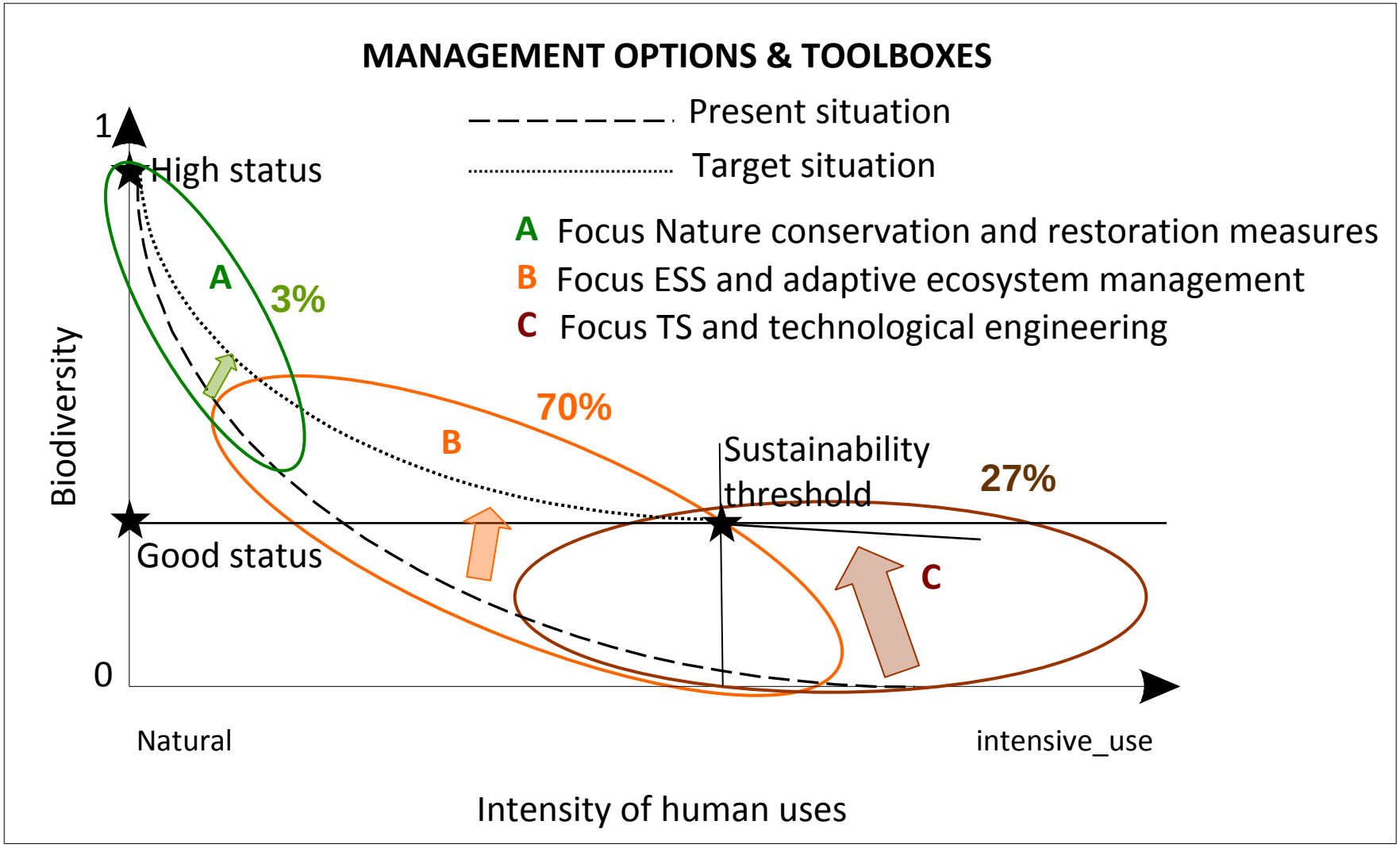
Part III: present – future relationships



Biodiversity and Ecosystem Services

- Part I: comparing basic assumptions
  Policy context
- Part II: comparing spatial relationships
  Biodiversity – ESS – land use intensity
  Case study : Flanders
- Part III: present – future relationships
  Theoretical framework
- Part IV: ecosystem management
  Nature conservation & adaptive management

Part IV: ecosystem management



	Protected areas	Rural areas	Intensive used and urbanised areas
Focus	Nature conservation	Ecosystem management	Technological engineering
Primary goal	Protect or restore species, habitats and ecosystems	Sustain or restore ecosystems based on the services they provide	Introduce technological solutions to reduce human impact on and dependence of external ecosystems
ES functioning	(Semi-)Natural	Semi-Natural	Man-made
Focal Species	Endangered species	Service providing species	Cultivated species
Focal species characteristics	Rarity, vulnerability, diversity, completeness, integrity, etc.	Producers, pollinators, predators, nitrogen fixators, air filters, etc.	Air filters, green infrastructure for well being, etc.
Species richness	High	Moderate to high	Low to moderate
Species loss	'Status quo' or restoration wanted	Species loss possible	Species loss presumable
Ecological quality (EQ) range	Focus on 'high' EQ and special conditions	Focus on 'basic' EQ	Focus on human health
Abiotic preconditions	Abiotic functions related to biodiversity goals	Abiotic functions related to human uses	
Valuation	Intrinsic values	Functional values	
Use	Multifunctional human use under special preconditions (e.g. soft recreation, FSC-labelled forestry)	Multifunctional human use as a basic option	

conclusions

Case Flanders

- Even in a very densely populated area:
  - Global decline of biodiversity related to intensification
  - General congruence of biodiversity and ecosystem services
- Biodiversity – provisioning services (food production): trade-off expected

Present and target situation:

- Both concepts are complementary
- **Zonation of "high" and "good" status** can create win-win situations for biodiversity and ESS.
- Within **multifunctional areas** trade-offs will be inevitable but should be based on ecosystem knowledge of both biodiversity and ES.

(data) New indicators are necessary:

- Biodiversity:
  - completeness (different scales)
  - Hot spots based on species richness coïncidence
  - Aquatic systems: IBI
- ESS: mapping tools linked land use map and outlook 2030

Part III: present – future relationships

Thank you for your attention ☺
www.natureoutlook.be

Foto: Yves Adams