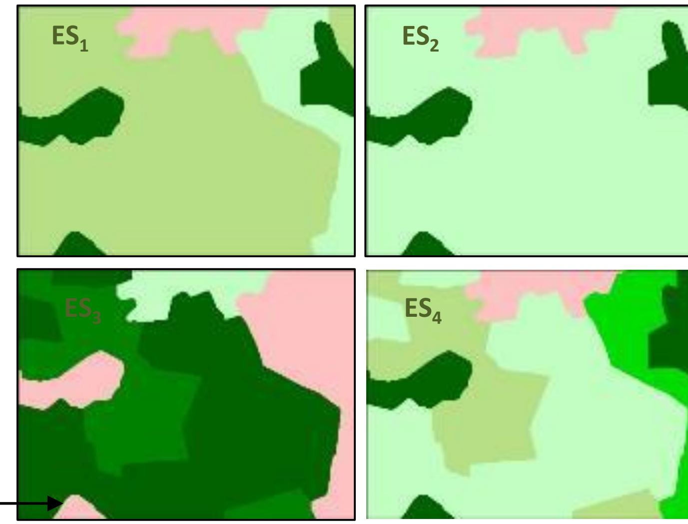
Ecosystem service “matrix”

Geospatial units
e.g. land use/cover map

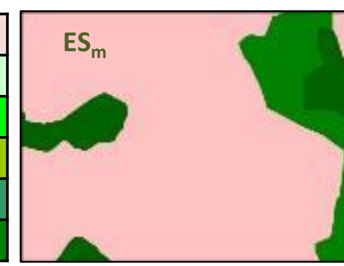
Matrix model

	ES_1	ES_2	ES_3	ES_4	ES_5
LU_1	0	0	1	0	0
LU_2	2	1	4	2	1
LU_3	2	1	5	1	1
LU_4	1	1	0	3	1
LU_5	5	4	0	5	3
LU_6	2	1	0	5	1

Ecosystem service maps



NO RELEVANT SUPPLY	0
VERY LOW SUPPLY	1
LOW SUPPLY	2
MEDIUM SUPPLY	3
HIGH SUPPLY	4
VERY HIGH SUPPLY	5

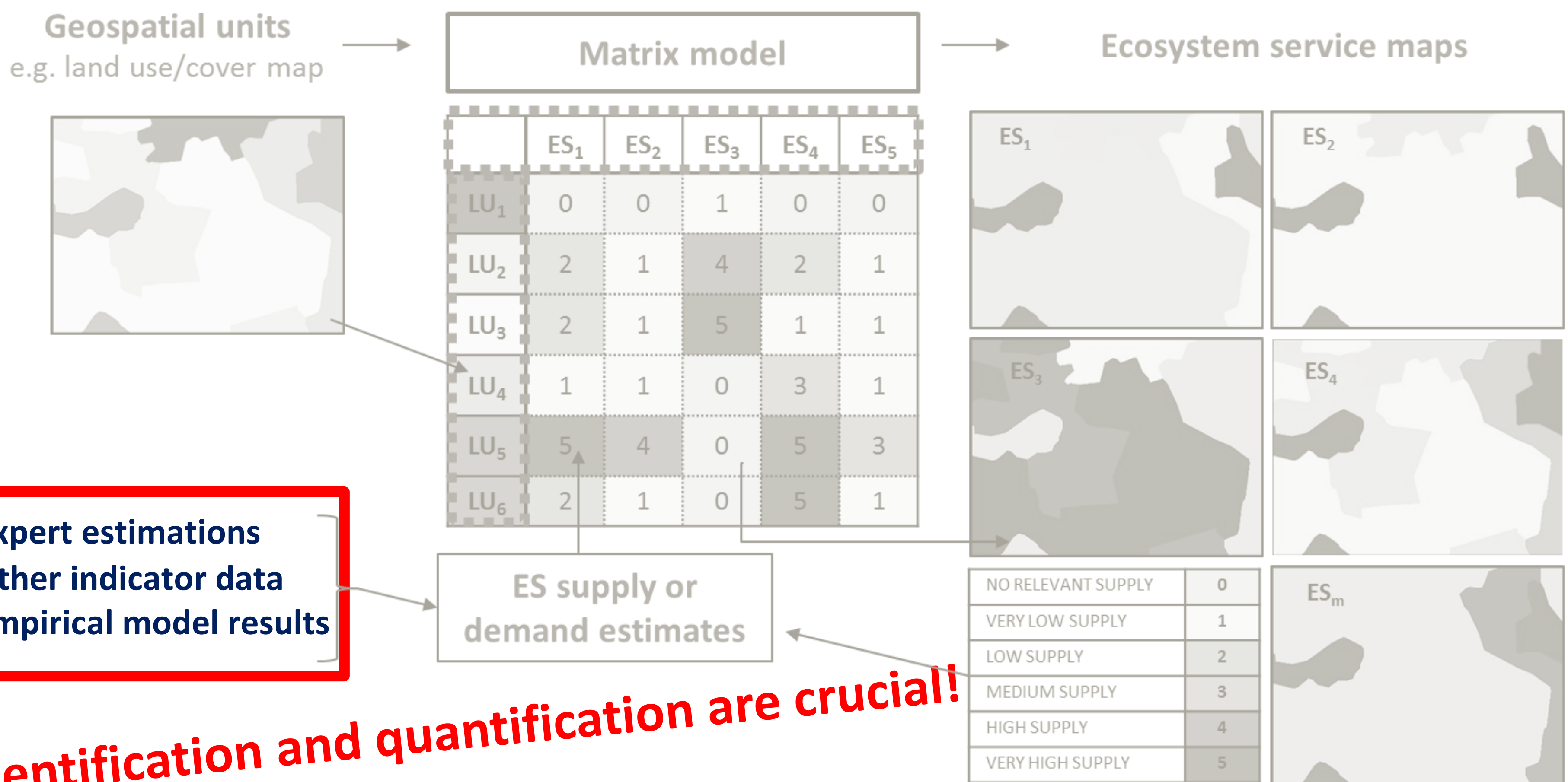


Expert estimations
Other indicator data
Empirical model results

ES supply or demand estimates

after Burkhard et al. (2009, 2012, 2014, 2017);
Jacobs, Burkhard, Van Daele, Staes & Schneides (2015) – *Ecological Modelling*

Ecosystem service “matrix”

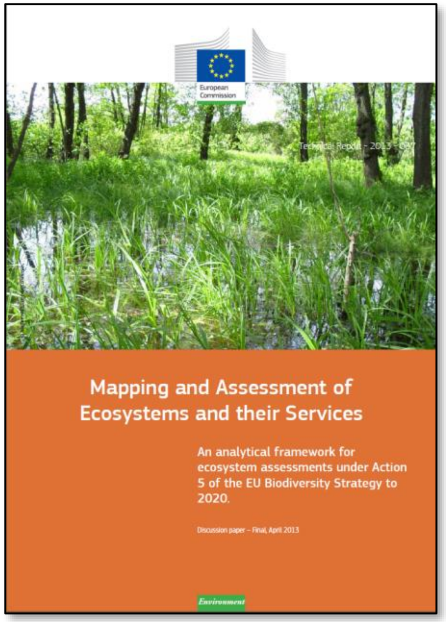


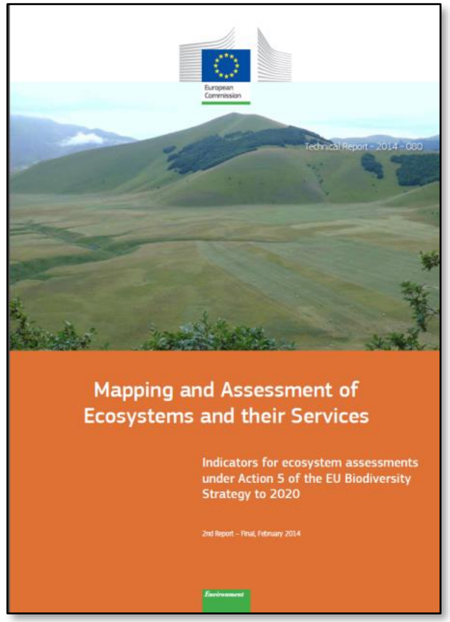
	ES$_1$	ES$_2$	ES$_3$	ES$_4$	ES$_5$
LU$_1$	0	0	1	0	0
LU$_2$	2	1	4	2	1
LU$_3$	2	1	5	1	1
LU$_4$	1	1	0	3	1
LU$_5$	5	4	0	5	3
LU$_6$	2	1	0	5	1

NO RELEVANT SUPPLY	0
VERY LOW SUPPLY	1
LOW SUPPLY	2
MEDIUM SUPPLY	3
HIGH SUPPLY	4
VERY HIGH SUPPLY	5

Expert estimations
Other indicator data
Empirical model results

Identification and quantification are crucial!





EU MAES Working group

Mapping and **A**ssessment of **E**cosystems and their **S**ervices

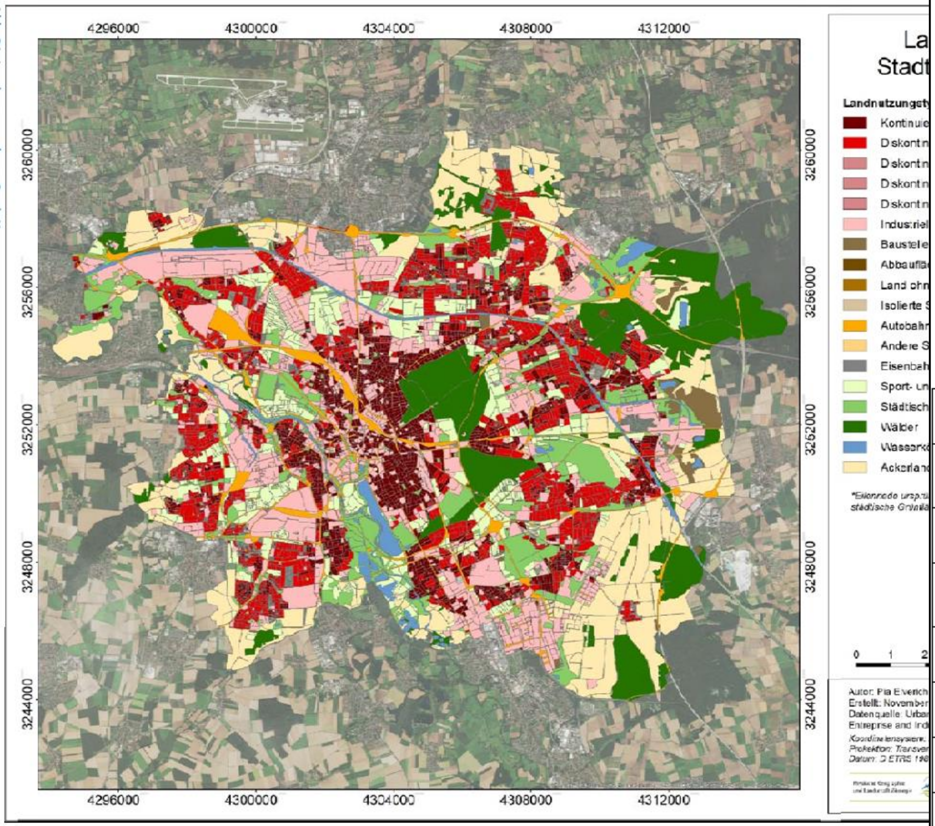
1st and 2nd report (2013, 2014)

http://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/pdf/MAESWorkingPaper2013.pdf
http://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/pdf/2ndMAESWorkingPaper.pdf

Expert estimations
Other indicator data
Empirical model results

Tiered approach for ES mapping

- **Tier 1:** rather simple, e.g. land cover-based
- **Tier 2:** more complex, e.g. statistics-based
- **Tier 3:** complex, e.g. model-based

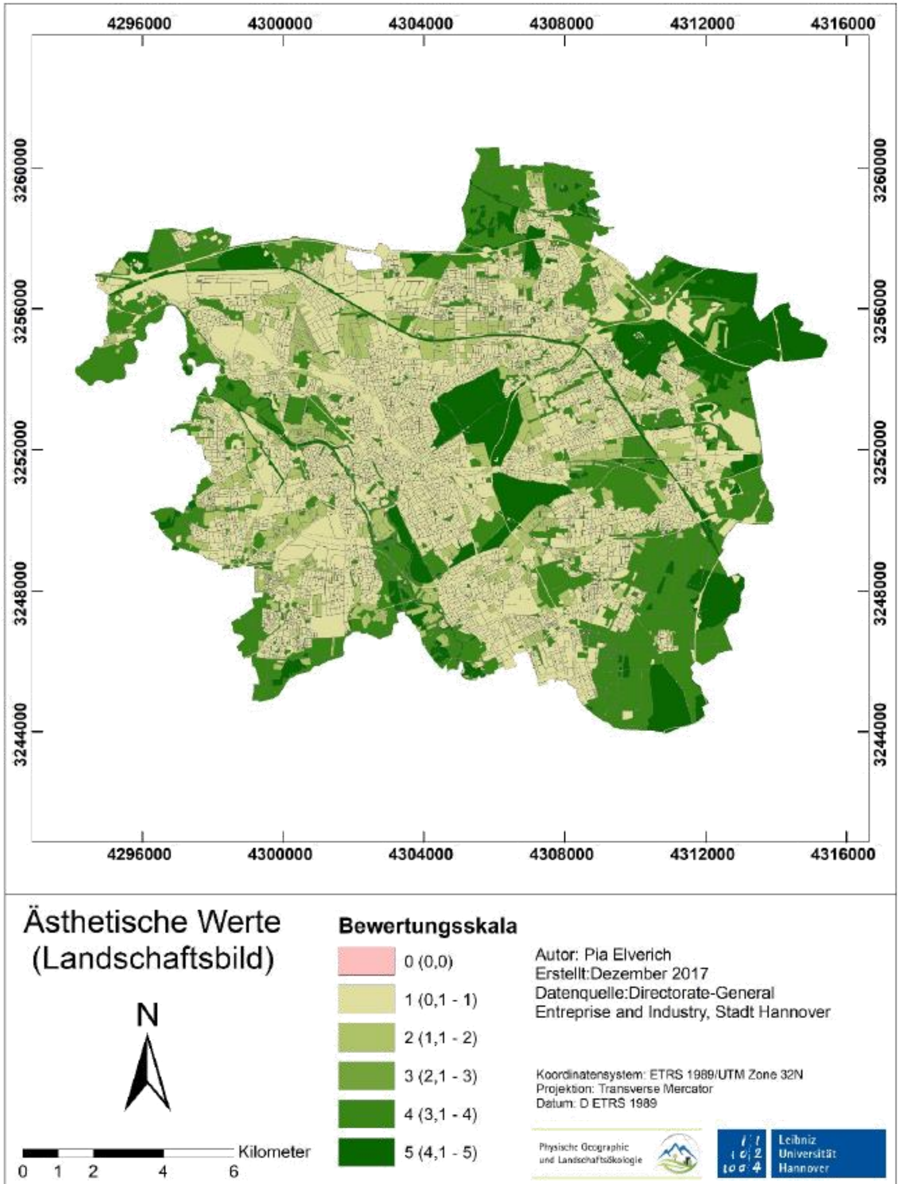


Median:

Landnutzungstyp	*Ökosystemleistungen* Versorgungsleitungen	Nahrungs-und Futterpflanzen	Regulierende Leistungen	Luftqualitätsregulation	Klimaregulation (Lokal)	Lärmschutz	Erhaltung der biologischen Vielfalt (Biodiversität)	Bestäubung	Kulturelle Leistungen	Ästhetische Werte (Landschaftsbild)	Erholung und (Öko-)Tourismus	Bildung (Forschung)	Identifikation
Kontinuierliches Stadtgefüge (> 80%)		0		0	0	0	0	0		0	0	0	2
Diskontinuierlich dichtes städtisches Stadtgefüge (50% - 80%)		0		1	1	1	1	1		1	0	1	3
Diskontinuierliches Städtgefüge (<10% -50%)		1		2	2	2	2	3		2	2	1	2
Industrie, Kommerzielle, Öffentliche, Militärische und Private Einheiten		0		0	0	0	0	0		0	0	1	1
Baustellen, Abbauflächen und Deponien		0		0	0	0	1	1		0	0	1	0
Straßen- und Gleisnetz		0		0	0	0	1	1		0	0	0	0
Sport- und Freizeitanlagen		2		3	3	2	3	3		2	5	2	4
Städtische Grünflächen		0		4	4	4	3	3		4	5	4	5
Ackerflächen + naturnahe Flächen + Feuchtgebiete		5		3	4	3	4	4		4	4	4	3
Wald/Forst		0		5	5	5	5	4		5	5	4	4
Wasserkörper		0		2	5	1	4	1		5	5	4	4

n = 10; Elverich (2018)

- **Tier 1:** rather simple, e.g. land cover-based



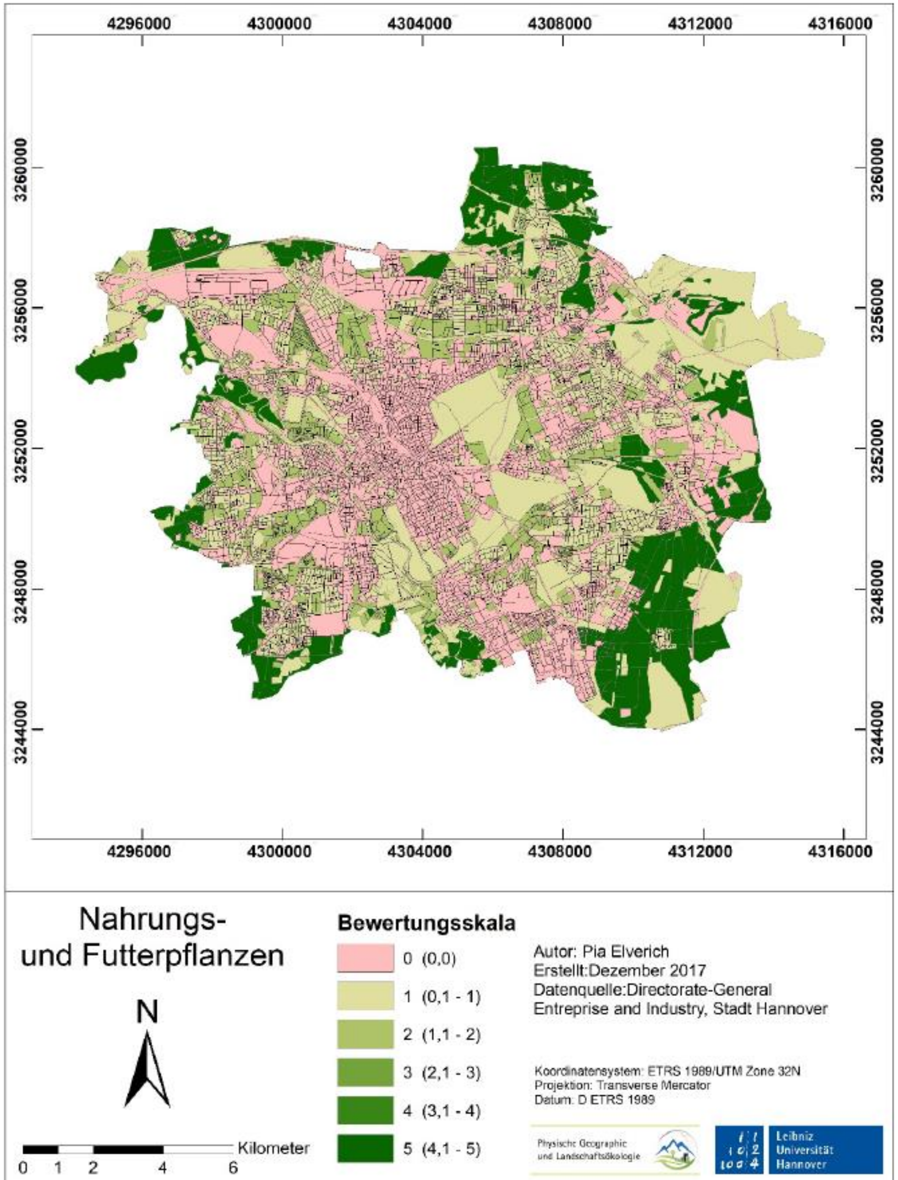
Median:

Landnutzungstyp	Versorgungsleistungen	Nahrungs-und Futterpflanzen	Regulierende Leistungen	Luftqualitätsregulation	Klimaregulation (Lokal)	Lärmschutz	Erhaltung der biologischen Vielfalt (Biodiversität)	Bestäubung	Kulturelle Leistungen	Ästhetische Werte (Landschaftsbild)	Erholung und (Öko-)Tourismus	Bildung (Forschung)	Identifikation
Kontinuierliches Stadtgefüge (> 80%)		0		0	0	0	0	0		0	0	0	2
Diskontinuierlich dichtes städ-tisches Stadtgefüge (50% - 80%)		0		1	1	1	1	1		1	0	1	3
Diskontinuierliches Städtgefüge (<10% -50%)		1		2	2	2	2	3		2	2	1	2
Industrie, Kommerzielle, Öf-fentliche, Militärische und Pri-vate Einheiten		0		0	0	0	0	0		0	0	1	1
Baustellen, Abbauflächen und Deponien		0		0	0	0	1	1		0	0	1	0
Straßen- und Gleisnetz		0		0	0	0	1	1		0	0	0	0
Sport- und Freizeitanlagen		2		3	3	2	3	3		2	5	2	4
Städtische Grünflächen		0		4	4	4	3	3		4	5	4	5
Ackerflächen + naturnahe Flä-chen + Feuchtgebiete		5		3	4	3	4	4		4	4	4	3
Wald/Forst		0		5	5	5	5	4		5	5	4	4
Wasserkörper		0		2	5	1	4	1		5	5	4	4

Ökosystemleistungen

n = 10; Elverich (2018)

★ **Tier 1:** rather simple, e.g. land cover-based



Median:

Landnutzungstyp / *Ökosystemleistungen*	**Versorgungsleitungen**	Nahrungs- und Futterpflanzen	**Regulierende Leistungen**	Luftqualitätsregulation	Klimaregulation (Lokal)	Lärmschutz	Erhaltung der biologischen Vielfalt (Biodiversität)	Bestäubung	**Kulturelle Leistungen**	Ästhetische Werte (Landschaftsbild)	Erholung und (Öko-)Tourismus	Bildung (Forschung)	Identifikation
Kontinuierliches Stadtgefüge (> 80%)		0		0	0	0	0	0		0	0	0	2
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Diskontinuierliches Städtgefüge (<10% -50%)		1		2	2	2	2	3		2	2	1	2
Industrie, Kommerzielle, Öffentliche, Militärische und Private Einheiten		0		0	0	0	0	0		0	0	1	1
Baustellen, Abbauflächen und Deponien		0		0	0	0	1	1		0	0	1	0
Straßen- und Gleisnetz		0		0	0	0	1	1		0	0	0	0
Sport- und Freizeitanlagen		2		3	3	2	3	3		2	5	2	4
Städtische Grünflächen		0		4	4	4	3	3		4	5	4	5
Ackerflächen + naturnahe Flächen + Feuchtgebiete		5		3	4	3	4	4		4	4	4	3
Wald/Forst		0		5	5	5	5	4		5	5	4	4
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n = 10; Elverich (2018)

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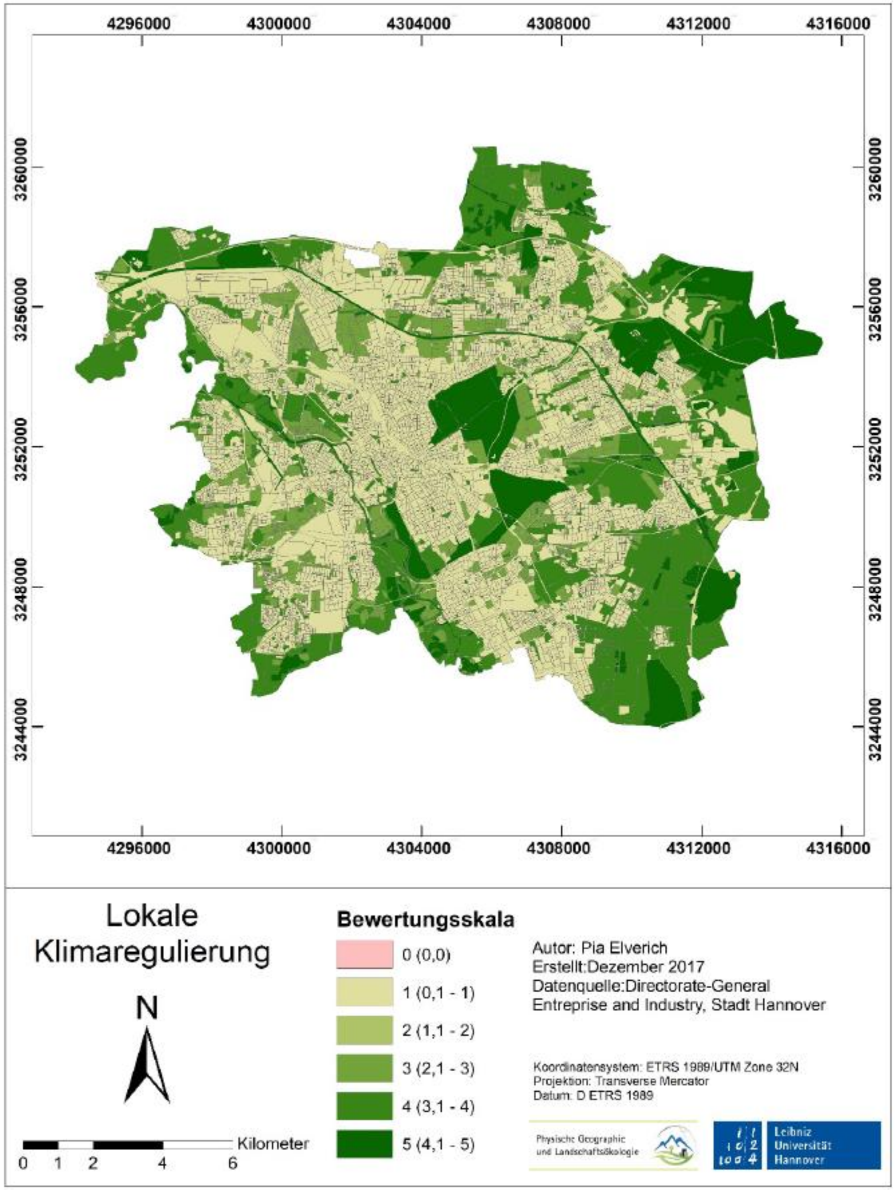

Median:

Landnutzungstyp / *Ökosystemleistungen*	**Versorgungsleistungen**	Nahrungs-und Futterpflanzen	**Regulierende Leistungen**	Luftqualitätsregulation	Klimaregulation (Lokal)	Lärmschutz	Erhaltung der biologischen Vielfalt (Biodiversität)	Bestäubung	**Kulturelle Leistungen**	Ästhetische Werte (Landschaftsbild)	Erholung und (Öko-)Tourismus	Bildung (Forschung)	Identifikation
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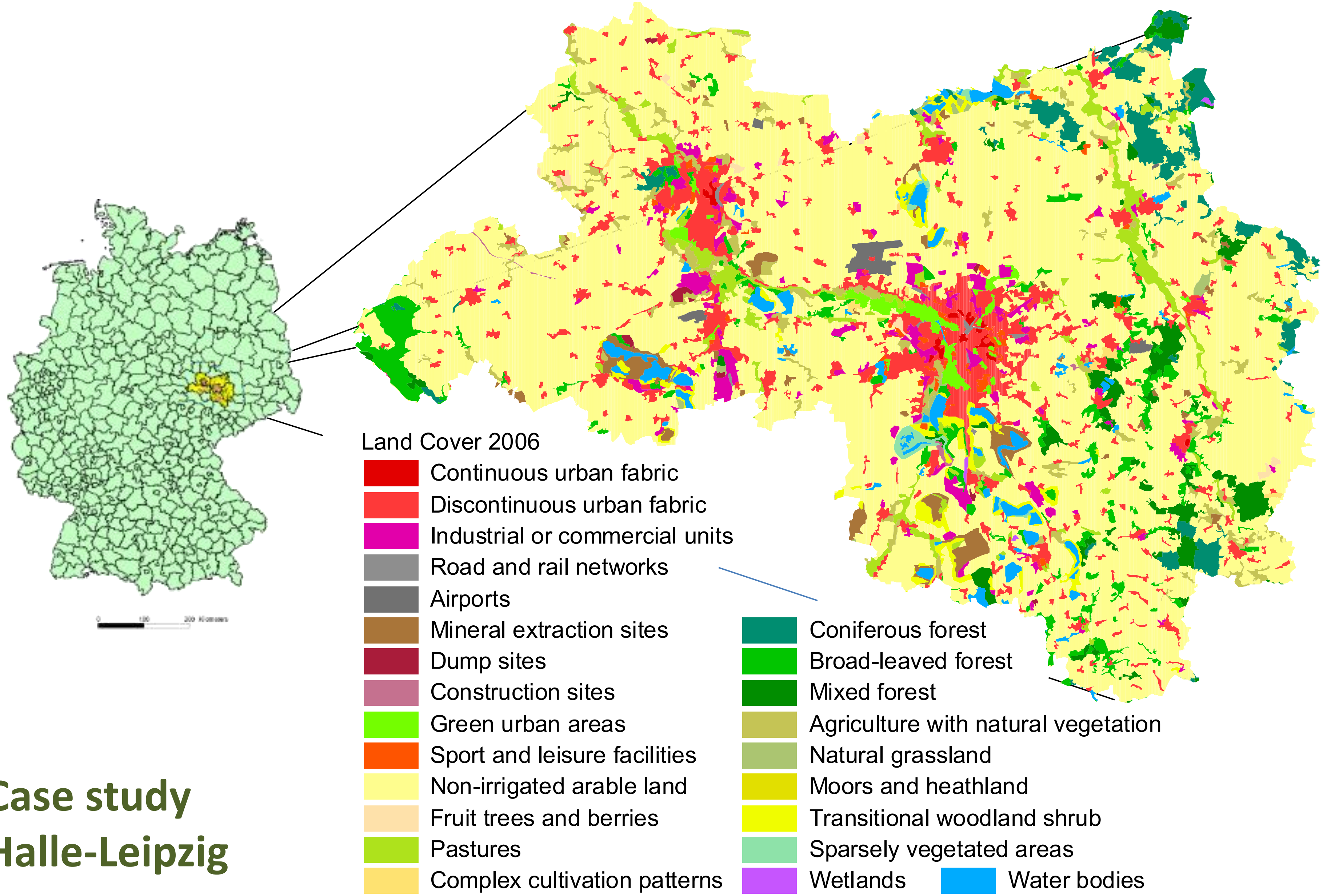
Diskontinuierlich dichtes städtisches Stadtgefüge (50% - 80%)		0		1	1	1	1	1		1	0	1	3
Diskontinuierliches Städtgefüge (<10% -50%)		1		2	2	2	2	3		2	2	1	2
Industrie, Kommerzielle, Öffentliche, Militärische und Private Einheiten		0		0	0	0	0	0		0	0	1	1
Baustellen, Abbauflächen und Deponien		0		0	0	0	1	1		0	0	1	0
Straßen- und Gleisnetz		0		0	0	0	1	1		0	0	0	0
Sport- und Freizeitanlagen		2		3	3	2	3	3		2	5	2	4
Städtische Grünflächen		0		4	4	4	3	3		4	5	4	5
Ackerflächen + naturnahe Flächen + Feuchtgebiete		5		3	4	3	4	4		4	4	4	3
Wald/Forst		0		5	5	5	5	4		5	5	4	4
Wasserkörper		0		2	5	1	4	1		5	5	4	4

n = 10; Elverich (2018)

★ **Tier 1:** rather simple, e.g. land cover-based

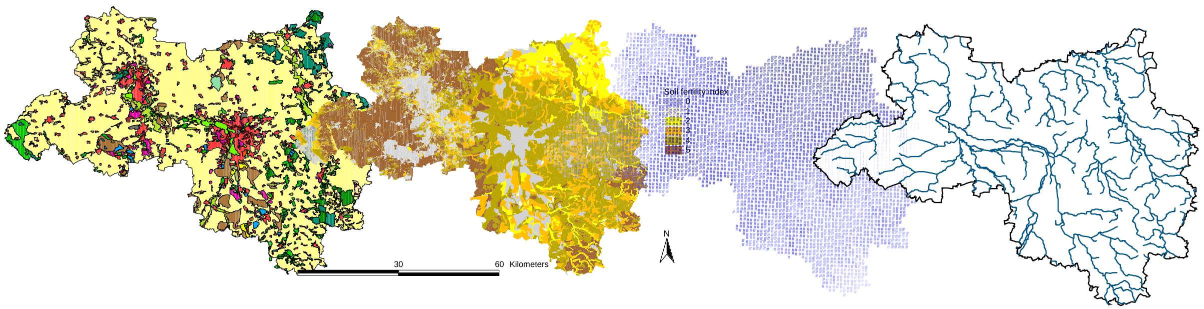


Case study Halle-Leipzig

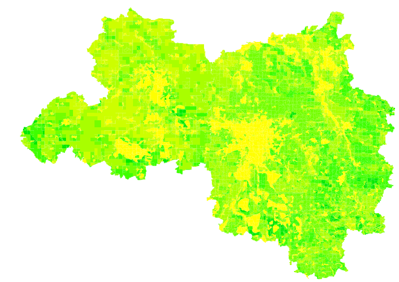
Burkhard, Kroll, Nedkov & Müller in *Ecological Indicators* (2012)

⋆ **Tier 2:** more complex, e.g. statistics-based

Land cover data + soil data + climate data + hydrological data + statistics = Ecosystem service maps



Population	Community
123789	4567844
3457656	5798365
3456465	4564576
3456567	4657467

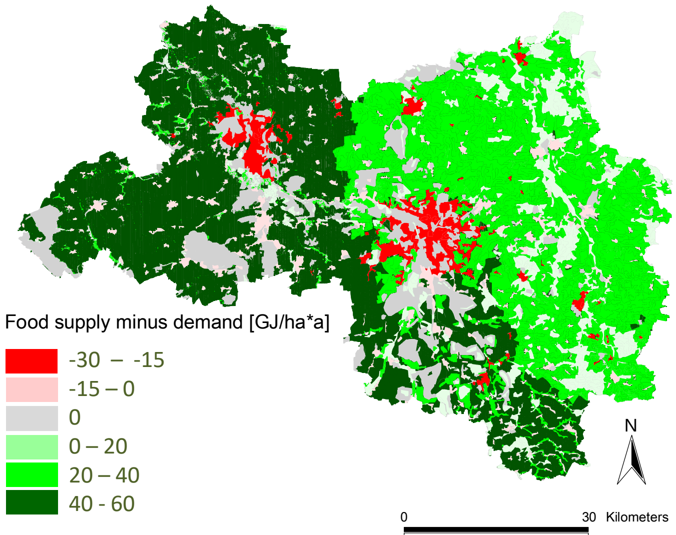


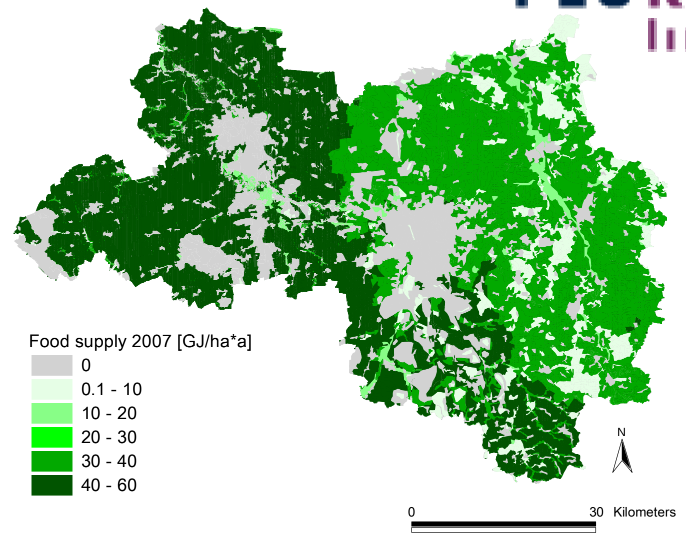
Dump sites
Construction sites
Green urban areas
Sport and leisure facilities
Non-irrigated arable land
Fruit trees and berries
Pastures
Complex cultivation patterns
Broad-leaved forest
Mixed forest
Agriculture with natural vegetation
Natural grassland
Moors and heathland
Transitional woodland shrub
Sparsely vegetated areas
Wetlands
Water bodies

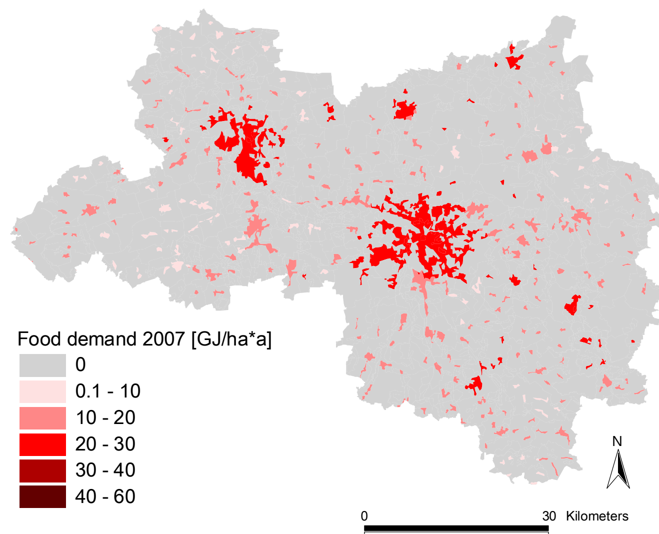
Case study Halle-Leipzig

Burkhard, Kroll, Nedkov & Müller in *Ecological Indicators* (2012)

★ **Tier 2:** more complex, e.g. statistics-based







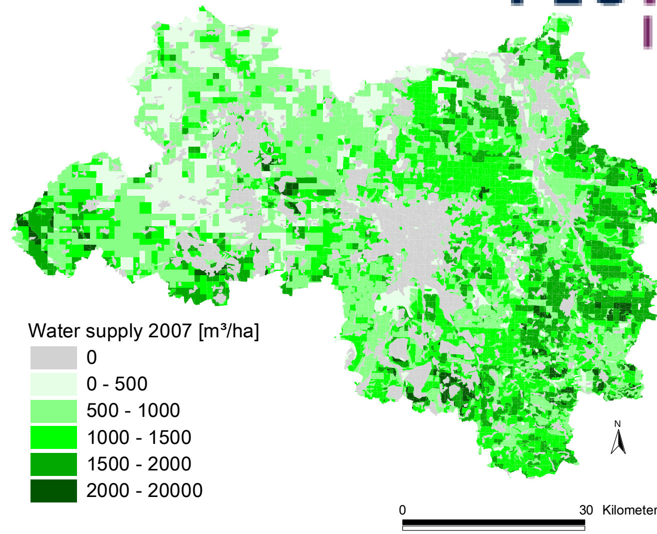
Case study Halle-Leipzig

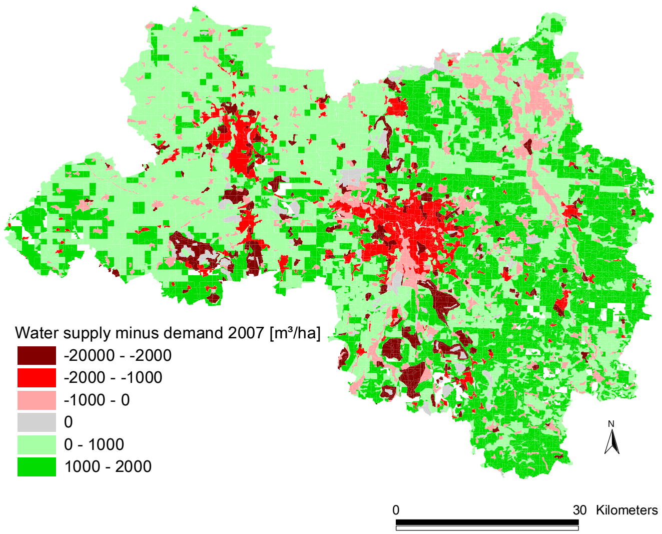
Provisioning ES “Food” supply and demand 2007

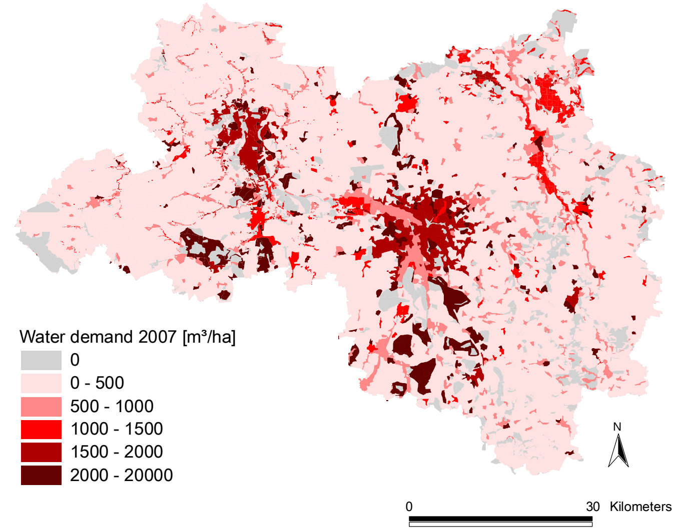
Kroll et al. (2010); Kroll et al. (2012) - *Land Use Policy*

- **Tier 2:** more complex, e.g. statistics-based

PLUREL







Case study Halle-Leipzig

Provisioning ES "Water" supply and demand 2007

Kroll et al. (2010); Kroll et al. (2012) - *Land Use Policy*

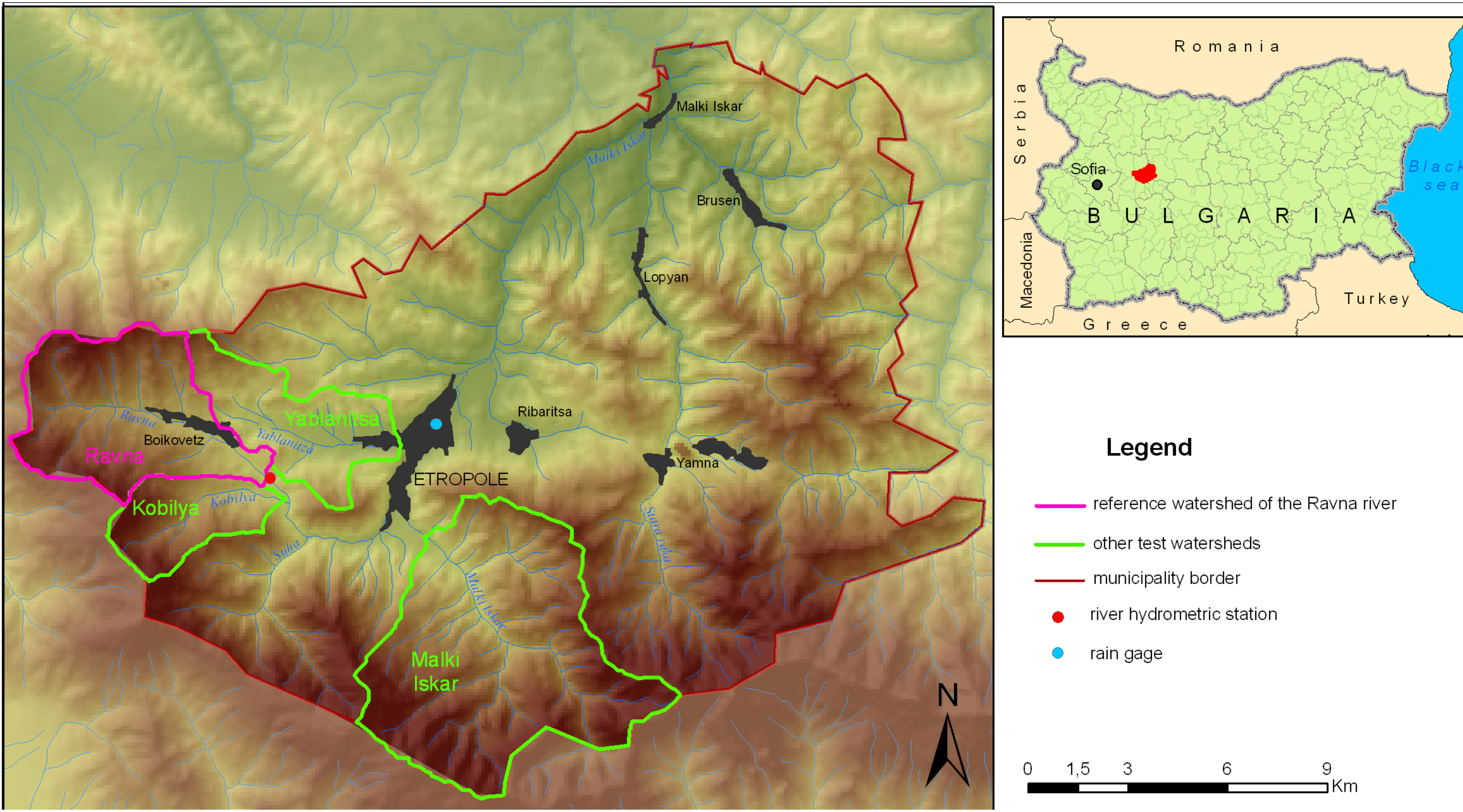
★ **Tier 2:** more complex, e.g. statistics-based

Case study Malki Iskar, Bulgaria

Nedkov & Burkhard in *Ecological Indicators* (2012)

★ **Tier 3:** complex, e.g. model-based

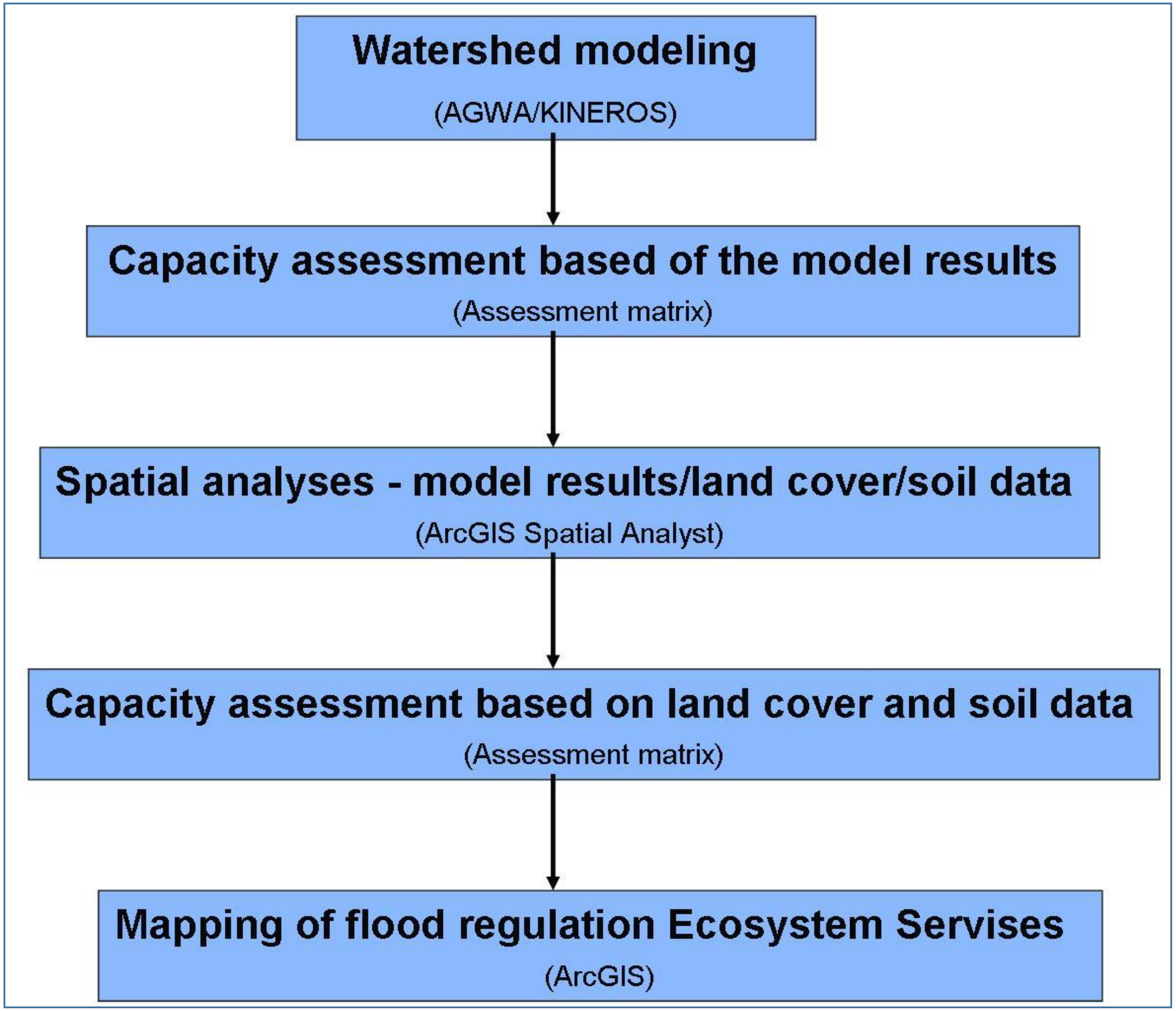
Case study Malki Iskar, Bulgaria



Nedkov & Burkhard in *Ecological Indicators* (2012)

★ **Tier 3:** complex, e.g. model-based

Case study Malki Iskar, Bulgaria



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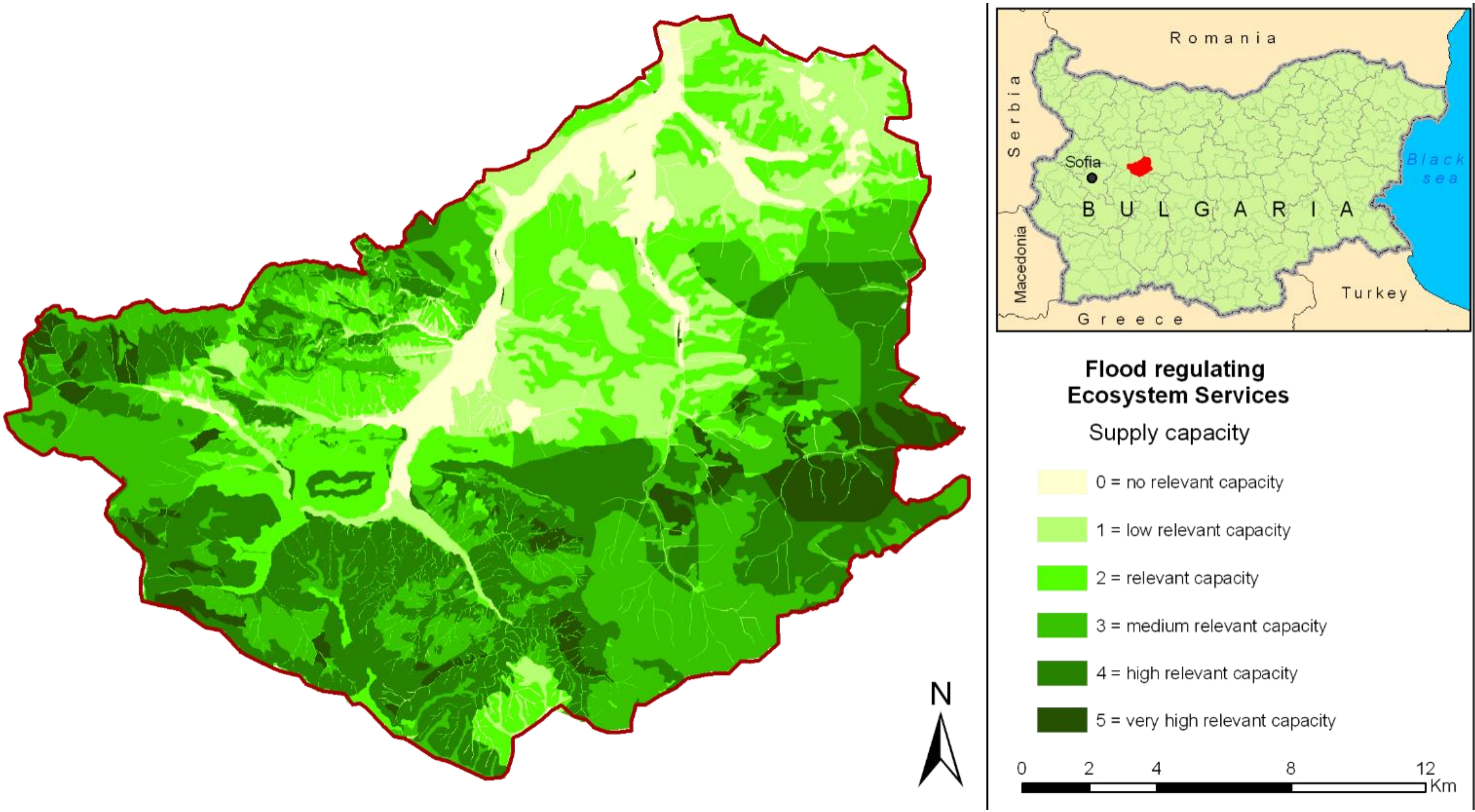

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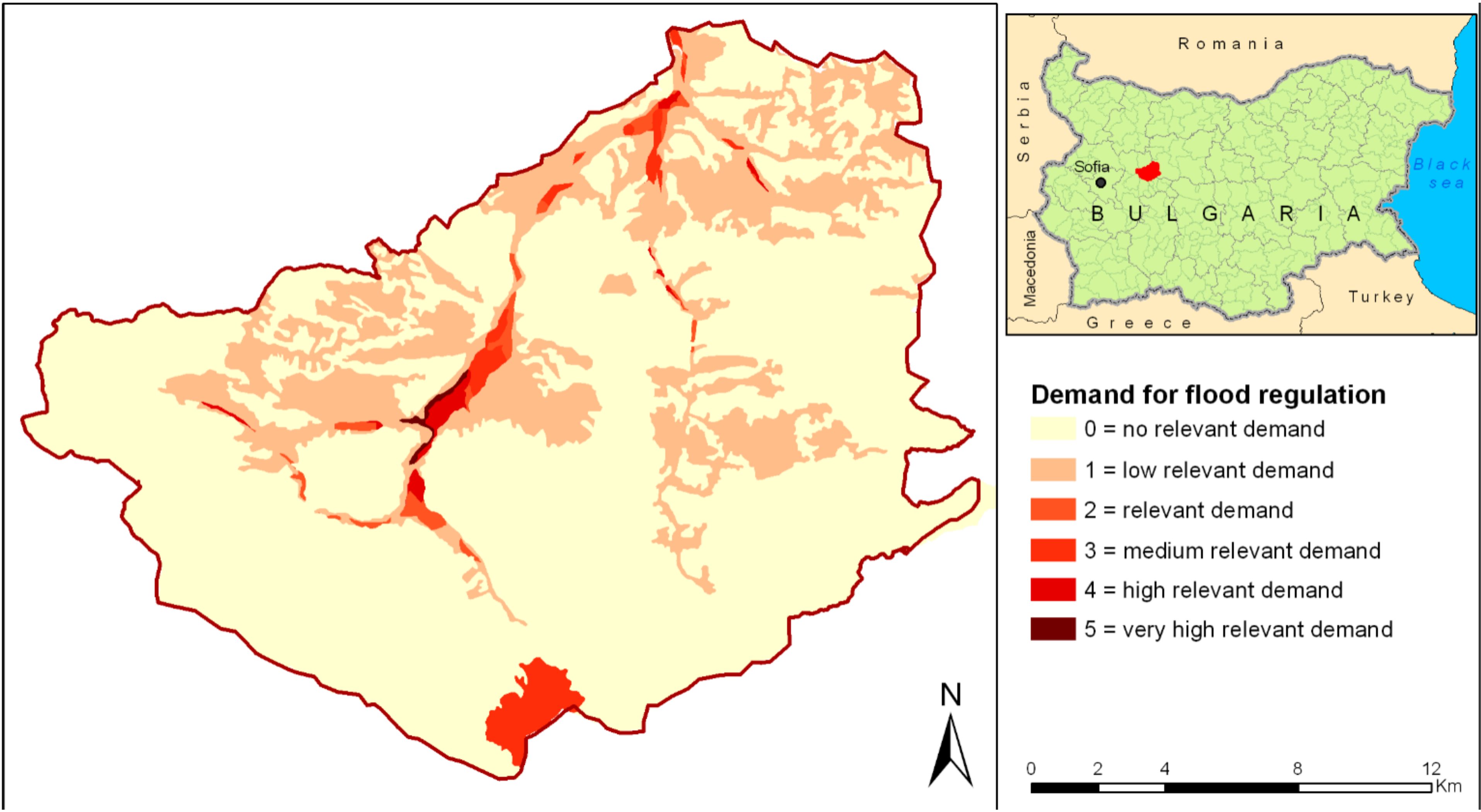

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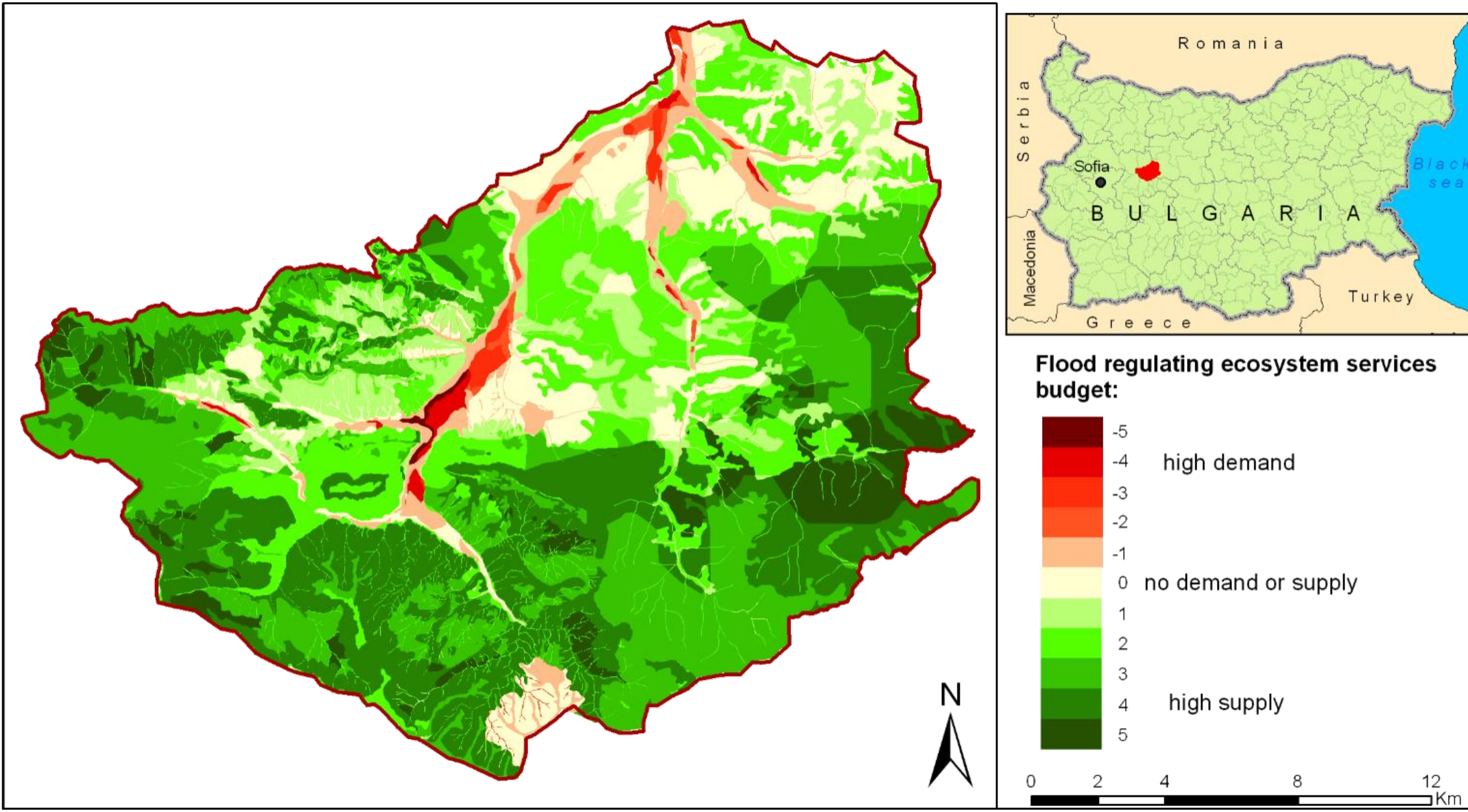

Nedkov & Burkhard in *Ecological Indicators* (2012)

★ **Tier 3:** complex, e.g. model-based

ES potential matrix

hypothetical European "normal" landscape in summer (before the harvest period).

Ecosystem service potential: the hypothetical maximum yield of ecosystem services

Regulating services

Land cover	Global climate regulation	Local climate regulation	Air quality regulation	Water flow regulation	Water purification	Nutrient regulation	Erosion regulation	Natural hazard regulation	Pollination	Pest and disease control	Regulation of waste
Continuous urban fabric	0	0	0	0	0	0	2	0	0	1	0
Discontinuous urban fabric	0	0	0	0	0	0	1	0	1	1	0
Industrial or commercial units	0	0	0	0	0	0	2	0	0	1	0
Road and rail networks	0	0	0	0	0	0	1	0	0	0	0
Port areas	0	0	0	0	0	0	3	3	0	1	0
Airports	0	0	0	0	0	0	1	0	0	1	0
Mineral extraction sites	0	0	0	0	0	0	0	0	0	0	0
Dump sites	0	0	0	0	0	0	0	0	0	0	2
Construction sites	0	0	0	0	0	0	0	0	0	0	0
Green urban areas	2	2	2	2	2	2	2	1	2	2	2
Sport and leisure facilities	1	1	1	1	1	1	1	0	0	1	1
Non-irrigated arable land	1	2	1	2	0	1	0	1	1	2	2
Permanently irrigated land	1	3	1	1	0	1	0	1	1	2	2
Ricefields	0	2	1	1	0	1	0	0	1	1	2
Vineyards	1	1	1	1	0	1	1	0	1	1	1
Fruit trees and berries	2	2	2	2	1	2	2	2	5	3	2
Olive groves	1	1	1	1	1	1	1	0	1	2	2
Pastures	2	1	0	1	0	1	1	1	0	2	4
Annual and permanent crops	1	2	1	1	0	1	2	1	1	2	2
Complex cultivation patterns	1	2	1	1	0	1	1	1	2	3	2
Agriculture & natural vegetation	2	3	2	2	2	2	2	1	2	3	2
Agro-forestry areas	2	2	2	2	2	2	3	1	3	3	3
Broad-leaved forest	5	5	5	3	5	5	5	4	4	4	4
Coniferous forest	5	5	5	3	5	5	5	4	4	4	4
Mixed forest	5	5	5	3	5	5	5	4	4	5	5
Natural grassland	5	2	0	1	3	4	5	1	1	1	2
Moors and heathland	3	4	0	2	3	3	2	2	2	2	3
Sclerophyllous vegetation	2	2	1	1	1	2	1	1	2	2	3
Transitional woodland shrub	2	2	1	1	1	2	1	1	2	2	3
Beaches, dunes and sand plains	0	0	0	1	1	1	0	5	0	1	1
Bare rock	0	0	0	0	1	0	2	1	0	0	0
Sparsely vegetated areas	0	1	0	1	1	1	1	1	0	1	1
Burnt areas	0	1	0	0	0	0	0	0	0	0	1
Glaciers and perpetual snow	3	4	0	5	0	0	0	0	0	1	1
Inland marshes	2	2	0	3	2	4	1	4	1	2	3
Peatbogs	5	4	0	4	4	4	2	3	2	3	4
Salt marshes	1	1	0	1	1	2	1	4	1	2	2
Salines	0	3	0	0	0	0	0	0	0	1	1
Intertidal flats	1	1	0	1	1	1	1	5	0	2	3
Water courses	0	1	0	3	3	3	0	3	0	3	5
Water bodies	1	2	0	5	2	3	0	3	0	3	5
Coastal lagoons	1	1	0	4	2	3	0	4	0	3	5
Estuaries	1	0	0	3	3	3	0	3	0	3	5
Sea and ocean	3	3	0	1	2	3	0	0	0	3	5

Provisioning services

Land cover	Crops	Biomass for energy	Fodder	Livestock (domestic)	Fibre	Timber	Wood Fuel	Fish, seafood & edible algae	Aquaculture	Wild foods & resources	Biochemicals & medicine	Freshwater	Mineral resources*	Abiotic energy sources*
Continuous urban fabric	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Discontinuous urban fabric	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Industrial or commercial units	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Road and rail networks	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Port areas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Airports	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mineral extraction sites	0	0	0	0	0	0	0	0	0	0	0	0	5	3
Dump sites	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Construction sites	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green urban areas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sport and leisure facilities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-irrigated arable land	5	5	5	0	5	0	0	0	0	1	3	0	0	2
Permanently irrigated land	5	1	2	0	4	0	0	0	0	1	3	0	0	1
Ricefields	5	1	2	0	0	0	0	0	0	0	0	0	0	0
Vineyards	4	1	0	0	0	0	1	0	0	0	0	0	0	0
Fruit trees and berries	4	1	0	0	0	2	2	0	0	0	2	0	0	0
Olive groves	4	1	0	0	0	2	2	0	0	0	2	0	0	0
Pastures	0	1	5	5	0	0	0	0	0	2	0	0	0	5
Annual and permanent crops	4	2	4	1	5	0	0	0	0	1	1	0	0	2
Complex cultivation patterns	4	2	2	1	4	0	1	0	0	1	2	0	0	1
Agriculture & natural vegetation	3	3	2	2	4	1	1	0	0	2	1	0	0	1
Agro-forestry areas	2	3	2	3	2	3	3	0	0	2	1	0	0	0
Broad-leaved forest	0	1	1	0	1	5	5	0	0	5	3	0	0	0
Coniferous forest	0	1	1	0	1	5	5	0	0	5	3	0	0	0
Mixed forest	0	1	1	0	2	5	5	0	0	5	3	0	0	0
Natural grassland	0	1	2	3	0	0	0	0	0	5	1	0	0	2
Moors and heathland	0	1	1	1	0	0	2	0	0	2	1	0	0	0
Sclerophyllous vegetation	0	1	1	1	1	2	2	0	0	1	3	0	0	1
Transitional woodland shrub	0	2	1	1	1	1	2	0	0	1	1	0	0	1
Beaches, dunes and sand plains	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Bare rock	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Sparsely vegetated areas	0	0	0	1	0	0	0	0	0	1	0	0	0	2
Burnt areas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glaciers and perpetual snow	0	0	0	0	0	0	0	0	0	0	0	5	0	0
Inland marshes	0	0	4	2	0	0	0	0	0	1	0	0	0	0
Peatbogs	0	2	0	0	0	0	0	0	0	1	2	1	0	0
Salt marshes	0	0	2	2	0	0	0	0	0	1	0	0	0	0
Salines	0	0	0	0	0	0	0	0	0	0	2	0	2	0
Intertidal flats	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Water courses	0	2	0	0	0	0	0	3	0	4	0	5	0	3
Water bodies	0	1	0	0	0	0	0	4	5	4	0	5	0	1
Coastal lagoons	0	1	0	0	0	0	0	4	5	4	1	0	0	0
Estuaries	0	2	0	0	0	0	0	4	5	4	1	0	0	1
Sea and ocean	0	4	3	0	0	0	0	5	5	4	3	0	1	3

Cultural services

Land cover	Recreation & tourism	Landscape aesthetics & inspiration	Knowledge systems	Religious & spiritual experience	Cultural heritage & cultural diversity	Natural heritage & natural diversity
Continuous urban fabric	3	3	2	2	1	0
Discontinuous urban fabric	3	2	2	2	2	0
Industrial or commercial units	0	0	0	0	2	0
Road and rail networks	0	0	0	0	1	0
Port areas	1	2	0	0	1	0
Airports	0	0	0	0	0	0
Mineral extraction sites	0	0	2	0	1	0
Dump sites	0	0	0	0	0	0
Construction sites	0	0	0	0	2	0
Green urban areas	3	3	1	0	2	1
Sport and leisure facilities	5	1	0	0	1	0
Non-irrigated arable land	1	1	2	0	3	0
Permanently irrigated land	1	1	2	0	3	0
Ricefields	1	1	2	0	3	0
Vineyards	3	2	3	0	5	0
Fruit trees and berries	3	2	2	0	4	1
Olive groves	2	2	2	0	4	0
Pastures	2	2	2	0	3	1
Annual and permanent crops	1	1	2	0	3	0
Complex cultivation patterns	2	2	2	0	3	0
Agriculture & natural vegetation	2	2	3	1	3	3
Agro-forestry areas	2	2	2	0	3	2
Broad-leaved forest	5	5	5	3	4	5
Coniferous forest	5	5	5	3	4	4
Mixed forest	5	5	5	3	4	5
Natural grassland	3	4	5	1	3	3
Moors and heathland	4	4	5	1	2	4
Sclerophyllous vegetation	2	3	4	1	2	4
Transitional woodland shrub	2	3	4	1	2	2
Beaches, dunes and sand plains	5	4	4	1	3	2
Bare rock	2	3	3	2	2	1
Sparsely vegetated areas	1	1	3	0	2	1
Burnt areas	0	0	2	0	0	0
Glaciers and perpetual snow	5	5	4	0	0	1
Inland marshes	1	2	3	0	2	2
Peatbogs	3	2	3	0	2	4
Salt marshes	3	2	3	0	2	2
Salines	2	2	3	0	4	0
Intertidal flats	4	2	3	0	2	2
Water courses	4	4	4	2	3	3
Water bodies	5	4	4	2	3	3
Coastal lagoons	3	4	4	0	2	3
Estuaries	3	4	4	0	2	3
Sea and ocean	4	5	5	2	3	3

*abiotic outputs from natural systems (after CICES)

scale for assessing ES supply:

- 0 = no relevant potential
- 1 = low relevant potential
- 2 = relevant potential
- 3 = medium relevant potential
- 4 = high relevant potential
- 5 = very high relevant potential

Burkhard et al. (2014) - *Landscape online*.

ES flow matrix

hypothetical European "normal" landscape in summer (before the harvest period).

Ecosystem service flow: actually used ecosystem services in a particular area within a given time period.

	Regulating services	Global climate regulation	Local climate regulation	Air quality regulation	Water flow regulation	Water purification	Nutrient regulation	Erosion regulation	Natural hazard regulation	Pollination	Pest and disease control	Regulation of waste	**Provisioning services**	Crops	Biomass for energy	Fodder	Livestock (domestic)	Fibre	Timber	Wood Fuel	Fish, seafood & edible algae	Aquaculture	Wild foods & resources	Biochemicals & medicine	Freshwater	Mineral resources*	Abiotic energy sources*	**Cultural services**	Recreation & tourism	Landscape aesthetics & inspiration	Knowledge systems	Religious & spiritual experience	Cultural heritage & cultural diversity	Natural heritage & natural diversity
Continuous urban fabric		0	0	0	0	0	0	2	0	1	1	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		3	2	2	2	1	0
Discontinuous urban fabric		0	0	0	0	0	0	1	0	2	1	0		0	0	1	0	0	0	0	0	0	0	0	0	0	1		2	1	2	2	2	0
Industrial or commercial units		0	0	0	0	0	0	2	0	1	1	0		0	0	0	0	0	0	0	0	0	0	0	0	0	1		0	0	0	0	2	0
Road and rail networks		0	0	0	0	0	0	1	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	1	0
Port areas		0	0	0	0	0	0	3	3	0	1	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	2	0	0	1	0
Airports		0	0	0	0	0	0	1	0	0	1	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Mineral extraction sites		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	3	1		0	0	1	0	0	0
Dump sites		0	0	0	0	0	0	0	0	0	0	2		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Construction sites		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	1	0
Green urban areas		2	2	2	2	2	2	2	1	2	2	2		0	0	1	0	0	0	0	0	0	0	0	0	0	0		3	3	1	0	2	1
Sport and leisure facilities		1	1	1	1	1	1	1	0	0	1	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0		4	1	0	0	1	0
Non-irrigated arable land		1	2	1	2	0	3	0	1	3	2	2		0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	1	1	0	1	0
Permanently irrigated land		1	3	1	3	0	3	0	1	3	2	2		0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	1	1	0	1	0
Ricefields		0	2	1	4	0	3	0	0	1	1	2		0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	1	1	0	2	0
Vineyards		1	1	1	1	0	1	1	0	2	1	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	1	2	0	4	0
Fruit trees and berries		2	2	2	2	1	2	2	2	3	3	2		0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	1	1	0	3	1
Olive groves		1	1	1	1	1	1	1	0	2	2	2		0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	2	2	0	3	0
Pastures		1	1	0	1	0	1	1	1	1	2	4		0	0	4	2	0	0	0	0	0	0	0	0	0	0		2	2	2	0	2	1
Annual and permanent crops		1	2	1	2	0	2	2	1	2	2	2		0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	1	1	0	2	0
Complex cultivation patterns		1	2	1	2	0	2	1	1	3	3	2		0	0	1	0	0	0	0	0	0	0	1	0	0	0		2	2	1	0	2	0
Agriculture & natural vegetation		1	3	2	2	1	2	2	1	2	3	2		0	0	1	0	1	0	1	0	0	0	1	0	0	1		2	2	2	1	2	1
Agro-forestry areas		1	2	2	2	1	1	3	1	2	3	3		0	0	0	1	1	1	1	0	0	0	1	0	0	0		2	2	1	0	2	1
Broad-leaved forest		4	5	5	3	4	5	5	3	1	4	4		0	1	1	0	1	1	1	0	0	1	1	0	0	0		4	4	4	2	2	4
Coniferous forest		4	5	5	3	4	5	5	3	1	4	4		0	1	1	0	1	1	1	0	0	1	1	0	0	0		4	4	4	2	2	3
Mixed forest		4	5	5	3	4	5	5	3	1	5	5		0	1	1	0	1	1	1	0	0	1	1	0	0	0		4	4	4	2	2	4
Natural grassland		2	2	0	1	3	4	5	1	2	1	2		0	0	2	1	0	0	0	0	0	1	1	0	0	0		3	4	4	1	2	2
Moors and heathland		2	4	0	2	3	3	2	2	2	2	3		0	1	1	0	0	0	1	0	0	1	1	0	0	0		3	4	4	1	1	3
Sclerophyllous vegetation		1	2	1	1	1	2	1	1	1	2	3		0	0	1	0	0	1	1	0	0	1	0	0	0	0		2	3	4	1	1	3
Transitional woodland shrub		1	2	1	1	1	2	1	1	1	2	3		0	1	1	0	1	1	1	0	0	1	1	0	0	0		2	3	4	1	1	1
Beaches, dunes and sand plains		0	0	0	1	1	1	0	5	0	1	1		0	0	0	0	0	0	0	0	0	0	1	0	0	0		5	4	4	1	1	1
Bare rock		0	0	0	0	1	0	2	1	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	3	3	1	1	1
Sparsely vegetated areas		0	1	0	1	1	1	1	1	0	1	1		0	0	0	1	0	0	0	0	0	0	0	0	0	0		1	1	2	0	1	1
Burnt areas		0	1	0	0	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	2	0	0	0
Glaciers and perpetual snow		3	4	0	3	0	0	0	0	0	1	1		0	0	0	0	0	0	0	0	0	0	0	1	0	0		2	4	3	0	0	1
Inland marshes		2	2	0	2	2	4	1	4	1	2	3		0	0	2	1	0	0	0	0	0	0	0	0	0	0		1	2	3	0	1	1
Peatbogs		4	4	0	3	4	4	2	3	2	3	4		0	2	0	0	0	0	0	0	0	0	1	0	0	0		3	2	3	0	1	3
Salt marshes		0	1	0	1	1	2	1	4	1	2	2		0	0	2	1	0	0	0	0	0	0	0	0	0	0		3	2	3	0	1	1
Salines		0	2	0	0	0	0	0	0	0	1	1		0	0	0	0	0	0	0	0	0	0	2	0	2	0		2	2	3	0	3	0
Intertidal flats		1	1	0	1	1	1	1	5	0	2	3		0	0	0	0	0	0	0	0	0	0	0	0	0	0		4	2	3	0	1	1
Water courses		0	1	0	3	3	3	0	3	0	3	5		0	0	0	0	0	0	0	2	0	2	0	2	0	2		4	4	3	1	2	2
Water bodies		1	2	0	3	2	3	0	3	0	3	5		0	0	0	0	0	0	0	2	2	3	0	2	0	1		5	4	3	1	2	2
Coastal lagoons		1	1	0	2	1	3	0	4	0	3	5		0	0	0	0	0	0	0	2	2	2	0	0	0	0		3	4	3	0	1	2
Estuaries		1	0	0	2	3	3	0	3	0	3	5		0	0	0	0	0	0	0	2	2	2	0	0	0	0		3	4	3	0	1	2
Sea and ocean		2	3	0	1	1	3	0	0	0	3	5		0	1	1	0	0	0	0	3	2	3	2	0	1	1		4	5	3	1	2	2

*abiotic outputs from natural systems (after CICES)

scale for assessing ES supply:

- 0 = no relevant flow
- 1 = low relevant flow
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- 3 = medium relevant flow
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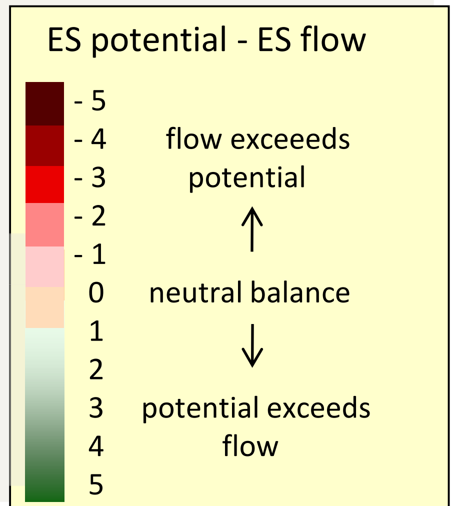
ES potential - ES flow matrix

hypothetical European "normal" landscape in summer (before the harvest period).

	Regulating services	Global climate regulation	Local climate regulation	Air quality regulation	Water flow regulation	Water purification	Nutrient regulation	Erosion regulation	Natural hazard regulation	Pollination	Pest and disease control	Regulation of waste	Provisioning services	Crops	Biomass for energy	Fodder	Livestock (domestic)	Fibre	Timber	Wood Fuel	Fish, seafood & edible algae	Aquaculture	Wild foods & resources	Biochemicals & medicine	Freshwater	Mineral resources*	Abiotic energy sources*	Cultural services	Recreation & tourism	Landscape aesthetics & inspiration	Knowledge systems	Religious & spiritual experience	Cultural heritage & cultural diversity	Natural heritage & natural diversity
Continuous urban fabric		0	0	0	0	0	0	0	0	-1	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	1		0	1	0	0	0	0
Discontinuous urban fabric		0	0	0	0	0	0	0	0	-1	0	0		1	0	-1	0	0	0	0	0	0	0	0	0	0	0		1	1	0	0	0	0
Industrial or commercial units		0	0	0	0	0	0	0	0	-1	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Road and rail networks		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Port areas		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Airports		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Mineral extraction sites		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	2	2		0	0	1	0	1	0
Dump sites		0	0	0	0	0	0	0	0	0	0	0		0	1	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Construction sites		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	1	0
Green urban areas		0	0	0	0	0	0	0	0	0	0	0		0	0	-1	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Sport and leisure facilities		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	0	0	0	0	0
Non-irrigated arable land		0	0	0	0	0	-2	0	0	-2	0	0		5	5	5	0	5	0	0	0	0	1	3	0	0	2		0	0	1	0	2	0
Permanently irrigated land		0	0	0	-2	0	-2	0	0	-2	0	0		5	1	2	0	4	0	0	0	0	1	3	0	0	1		0	0	1	0	2	0
Ricefields		0	0	0	-3	0	-2	0	0	0	0	0		5	1	2	0	0	0	0	0	0	0	0	0	0	0		0	0	1	0	1	0
Vineyards		0	0	0	0	0	0	0	0	-1	0	0		4	1	0	0	0	0	1	0	0	0	0	0	0	0		1	1	1	0	1	0
Fruit trees and berries		0	0	0	0	0	0	0	0	2	0	0		4	1	0	0	0	2	2	0	0	0	2	0	0	0		1	1	1	0	1	0
Olive groves		0	0	0	0	0	0	0	0	-1	0	0		4	1	0	0	0	2	2	0	0	0	2	0	0	0		0	0	0	0	1	0
Pastures		1	0	0	0	0	0	0	0	-1	0	0		0	1	1	3	0	0	0	0	0	2	0	0	0	5		0	0	0	0	1	0
Annual and permanent crops		0	0	0	-1	0	-1	0	0	-1	0	0		4	2	4	1	5	0	0	0	0	1	1	0	0	2		0	0	1	0	1	0
Complex cultivation patterns		0	0	0	-1	0	-1	0	0	-1	0	0		4	2	1	1	4	0	1	0	0	1	1	0	0	1		0	0	1	0	1	0
Agriculture & natural vegetation		1	0	0	0	1	0	0	0	0	0	0		3	3	1	2	3	1	0	0	0	2	0	0	0	0		0	0	1	0	1	2
Agro-forestry areas		1	0	0	0	1	1	0	0	1	0	0		2	3	2	2	1	2	2	0	0	2	0	0	0	0		0	0	1	0	1	1
Broad-leaved forest		1	0	0	0	1	0	0	1	3	0	0		0	0	0	0	0	4	4	0	0	4	2	0	0	0		1	1	1	1	2	1
Coniferous forest		1	0	0	0	1	0	0	1	3	0	0		0	0	0	0	0	4	4	0	0	4	2	0	0	0		1	1	1	1	2	1
Mixed forest		1	0	0	0	1	0	0	1	3	0	0		0	0	0	0	1	4	4	0	0	4	2	0	0	0		1	1	1	1	2	1
Natural grassland		3	0	0	0	0	0	0	0	-1	0	0		0	1	0	2	0	0	0	0	0	4	0	0	0	2		0	0	1	0	1	1
Moors and heathland		1	0	0	0	0	0	0	0	0	0	0		0	0	0	1	0	0	1	0	0	1	0	0	0	0		1	0	1	0	1	1
Sclerophyllous vegetation		1	0	0	0	0	0	0	0	1	0	0		0	1	0	1	1	1	1	0	0	0	3	0	0	1		0	0	0	0	1	1
Transitional woodland shrub		1	0	0	0	0	0	0	0	1	0	0		0	1	0	1	0	0	1	0	0	0	0	0	0	1		0	0	0	0	1	1
Beaches, dunes and sand plains		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	1	0		0	0	0	0	2	1
Bare rock		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	1	0		0	0	0	1	1	0
Sparsely vegetated areas		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	0	0	0	2		0	0	1	0	1	0
Burnt areas		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Glaciers and perpetual snow		0	0	0	2	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	4	0	0		3	1	1	0	0	0
Inland marshes		0	0	0	1	0	0	0	0	0	0	0		0	0	2	1	0	0	0	0	0	1	0	0	0	0		0	0	0	0	1	1
Peatbogs		1	0	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	1	0	0		0	0	0	0	1	1
Salt marshes		1	0	0	0	0	0	0	0	0	0	0		0	0	0	1	0	0	0	0	0	1	0	0	0	0		0	0	0	0	1	1
Salines		0	1	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	1	0
Intertidal flats		0	0	0	0	0	0	0	0	0	0	0		0	1	0	0	0	0	0	0	0	1	0	0	0	0		0	0	0	0	1	1
Water courses		0	0	0	0	0	0	0	0	0	0	0		0	2	0	0	0	0	0	1	0	2	0	3	0	1		0	0	1	1	1	1
Water bodies		0	0	0	2	0	0	0	0	0	0	0		0	1	0	0	0	0	0	2	3	1	0	3	0	0		0	0	1	1	1	1
Coastal lagoons		0	0	0	2	1	0	0	0	0	0	0		0	1	0	0	0	0	0	2	3	2	1	0	0	0		0	0	1	0	1	1
Estuaries		0	0	0	1	0	0	0	0	0	0	0		0	2	0	0	0	0	0	2	3	2	1	0	0	1		0	0	1	0	1	1
Sea and ocean		1	0	0	0	1	0	0	0	0	0	0		0	3	2	0	0	0	0	2	3	1	1	0	0	2		0	0	2	1	1	1

*abiotic outputs from natural systems (after CICES)



Burkhard et al. (2014) - *Landscape online*.

ES demand matrix

hypothetical European "normal" landscape in summer (before the harvest period).

	Regulating services	Global climate regulation	Local climate regulation	Air quality regulation	Water flow regulation	Water purification	Nutrient regulation	Erosion regulation	Natural hazard regulation	Pollination	Pest and disease control	Regulation of waste	Provisioning services	Crops	Biomass for energy	Fodder	Livestock (domestic)	Fibre	Timber	Wood Fuel	Fish, seafood & edible algae	Aquaculture	Wild foods & resources	Biochemicals & medicine	Freshwater	Mineral resources*	Abiotic energy sources*	Cultural services	Recreation & tourism	Landscape aesthetics & inspiration	Knowledge systems	Religious & spiritual experience	Cultural heritage & cultural diversity	Natural heritage & natural diversity
Continuous urban fabric		4	5	5	4	5	1	1	5	1	5	3		5	5	1	5	3	3	1	5	5	5	5	5	4	2		4	4	3	4	4	4
Discontinuous urban fabric		3	5	5	5	4	2	1	4	2	4	2		4	4	2	4	3	3	1	4	4	4	5	5	3	3		4	4	3	3	2	3
Industrial or commercial units		5	2	5	4	5	3	1	5	1	3	4		3	5	1	3	5	5	4	4	4	4	5	5	5	5		1	1	4	1	3	1
Road and rail networks		4	2	4	4	0	0	3	4	0	2	1		1	4	0	1	0	2	0	0	0	0	0	1	2	0		2	2	1	1	1	0
Port areas		3	2	2	5	3	0	4	5	0	5	2		1	5	0	1	2	5	2	2	2	1	1	3	3	1		2	2	2	1	2	0
Airports		5	2	4	1	2	1	1	5	0	5	1		1	5	0	1	1	1	0	1	1	1	1	3	2	1		1	1	1	1	1	0
Mineral extraction sites		1	0	0	2	4	0	4	3	0	0	3		0	3	0	0	1	2	0	0	0	0	0	2	1	0		0	0	0	0	0	0
Dump sites		2	2	2	0	3	0	0	5	0	4	5		0	1	0	0	0	0	0	0	0	0	0	2	0	0		0	0	0	0	0	0
Construction sites		1	2	1	2	2	2	2	3	0	1	2		0	4	0	0	4	4	0	0	0	0	0	2	4	1		0	0	0	0	0	0
Green urban areas		0	3	2	2	0	0	0	2	2	3	1		0	1	0	1	0	0	0	0	0	0	0	2	0	0		4	4	2	0	2	1
Sport and leisure facilities		0	3	3	1	1	0	0	3	0	3	1		0	1	1	1	1	1	0	2	2	2	3	3	1	1		3	3	1	0	2	0
Non-irrigated arable land		2	2	1	2	0	3	3	2	3	4	3		0	1	0	0	0	0	0	0	0	0	1	0	0	0		0	0	1	0	1	0
Permanently irrigated land		2	2	1	2	5	3	2	2	3	4	3		0	1	0	0	0	0	0	0	0	0	1	5	0	0		0	0	1	0	1	0
Ricefields		3	2	1	5	5	3	2	2	1	4	3		0	1	0	0	0	0	0	0	0	0	1	5	0	0		0	0	2	0	3	0
Vineyards		1	3	1	1	4	3	5	3	2	4	2		0	1	0	0	0	1	0	0	0	0	2	4	0	0		0	0	2	0	3	0
Fruit trees and berries		1	2	1	1	2	3	1	3	3	4	2		0	1	0	0	0	1	0	0	0	0	2	3	0	0		0	0	2	0	2	0
Olive groves		1	2	1	1	2	3	1	3	2	4	2		0	1	0	0	0	0	0	0	0	0	2	1	0	0		0	0	2	0	2	0
Pastures		3	1	1	1	2	3	1	2	1	4	4		0	1	5	0	0	1	0	0	0	0	1	2	0	0		0	0	1	0	1	0
Annual and permanent crops		1	1	1	1	2	5	1	3	2	3	2		0	1	0	0	0	0	0	0	0	0	1	1	0	0		0	0	1	0	1	0
Complex cultivation patterns		1	1	1	1	2	5	1	2	3	3	2		0	1	0	0	0	0	0	0	0	0	1	1	0	0		0	0	1	0	1	0
Agriculture & natural vegetation		1	1	1	1	2	3	1	1	2	3	2		0	1	0	0	0	0	0	0	0	0	1	2	0	0		0	0	1	0	1	0
Agro-forestry areas		1	1	1	1	2	3	1	2	2	3	2		0	1	0	0	0	0	0	0	0	0	1	2	0	0		0	0	1	0	1	0
Broad-leaved forest		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Coniferous forest		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Mixed forest		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Natural grassland		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Moors and heathland		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Sclerophyllous vegetation		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Transitional woodland shrub		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Beaches, dunes and sand plains		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	0	0	0	0	0
Bare rock		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Sparsely vegetated areas		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Burnt areas		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Glaciers and perpetual snow		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Inland marshes		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Peatbogs		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Salt marshes		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Salines		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Intertidal flats		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Water courses		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Water bodies		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Coastal lagoons		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Estuaries		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Sea and ocean		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0

*abiotic outputs from natural systems (after CICES)

Ecosystem service demand: ecosystem services currently consumed or used in a particular area over a given time period, not considering where ecosystem services actually are provided.

scale for assessing demands:

- 0 = no relevant demand
- 1 = low relevant demand
- 2 = relevant demand
- 3 = medium relevant demand
- 4 = high relevant demand
- 5 = very high relevant demand

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ES flow-demand matrix

hypothetical European "normal" landscape in summer (before the harvest period).

	Regulating services	Global climate regulation	Local climate regulation	Air quality regulation	Water flow regulation	Water purification	Nutrient regulation	Erosion regulation	Natural hazard regulation	Pollination	Pest and disease control	Regulation of waste	Provisioning services	Crops	Biomass for energy	Fodder	Livestock (domestic)	Fibre	Timber	Wood Fuel	Fish, seafood & edible algae	Aquaculture	Wild foods & resources	Biochemicals & medicine	Freshwater	Mineral resources*	Abiotic energy sources*	Cultural services	Recreation & tourism	Landscape aesthetics & inspiration	Knowledge systems	Religious & spiritual experience	Cultural heritage & cultural diversity	Natural heritage & natural diversity
Continuous urban fabric		-4	-5	-5	-4	-5	-1	1	-5	0	-4	-3		-5	-5	-1	-5	-3	-3	-1	-5	-5	-5	-5	-5	-4	-2		-1	-2	-1	-2	-3	-4
Discontinuous urban fabric		-3	-5	-5	-5	-4	-2	0	-4	0	-3	-2		-4	-4	-1	-4	-3	-3	-1	-4	-4	-4	-5	-5	-3	-2		-2	-3	-1	-1	0	-3
Industrial or commercial units		-5	-2	-5	-4	-5	-3	1	-5	0	-2	-4		-3	-5	-1	-3	-5	-5	-4	-4	-4	-4	-5	-5	-5	-4		-1	-1	-4	-1	-1	-1
Road and rail networks		-4	-2	-4	-4		0	-2	-4		-2	-1		-1	-4		-1		-2						-1	-2			-2	-2	-1	-1	0	
Port areas		-3	-2	-2	-5	-3		-1	-2		-4	-2		-1	-5		-1	-2	-5	-2	-2	-2	-1	-1	-3	-3	-1		-1	0	-2	-1	-1	0
Airports		-5	-2	-4	-1	-2	-1	0	-5		-4	-1		-1	-5		-1	-1	-1		-1	-1	-1	-1	-3	-2	-1		-1	-1	-1	-1	-1	0
Mineral extraction sites		-1			-2	-4		-4	-3			-3			-3			-1	-2						-2	2	1				1			
Dump sites		-2	-2	-2		-3			-5		-4	-3			-1										-2									
Construction sites		-1	-2	-1	-2	-2	-2	-2	-3		-1	-2			-4			-4	-4						-2	-4	-1						1	
Green urban areas		2	-1	0	0	2	2	2	-1	0	-1	1			-1	1	-1								-2				-1	-1	-1		0	0
Sport and leisure facilities		1	-2	-2	0	0	1	1	-3		-2	0			-1	-1	-1	-1	-1		-2	-2	-2	-3	-3	-1	-1		1	-2	-1		-1	
Non-irrigated arable land		-1	0	0	0		0	-3	-1	0	-2	-1			-1									-1					1	1	0		0	
Permanently irrigated land		-1	1	0	1	-5	0	-2	-1	0	-2	-1			-1									-1	-5				1	1	0		0	
Ricefields		-3	0	0	-1	-5	0	-2	-2	0	-3	-1			-1									-1	-5				1	1	-1		-1	
Vineyards		0	-2	0	0	-4	-2	-4	-3	0	-3	-1			-1				-1					-2	-4				2	1	0		1	
Fruit trees and berries		1	0	1	1	-1	-1	1	-1	0	-1	0			-1				-1					-2	-3				2	1	-1		1	1
Olive groves		0	-1	0	0	-1	-2	0	-3	0	-2	0			-1									-2	-1				2	2	0		1	
Pastures		-2		-1	0	-2	-2	0	-1	0	-2	0			-1	-1	2		-1					-1	-2				2	2	1		1	1
Annual and permanent crops		0	1	0	1	-2	-3	1	-2	0	-1	0			-1									-1	-1				1	1	0		1	
Complex cultivation patterns		0	1	0	1	-2	-3	0	-1	0	0	0			-1	1								0	-1				2	2	0		1	
Agriculture & natural vegetation		0	2	1	1	-1	-1	1	0	0	0	0			-1	1		1		1				0	-2		1		2	2	1	1	1	1
Agro-forestry areas		0	1	1	1	-1	-2	2	-1	0	0	1			-1		1	1	1	1				0	-2				2	2	0		1	1
Broad-leaved forest		4	5	5	3	4	5	5	3	1	4	4			1	1		1	1	1			1	1					4	4	4	2	2	4
Coniferous forest		4	5	5	3	4	5	5	3	1	4	4			1	1		1	1	1			1	1					4	4	4	2	2	3
Mixed forest		4	5	5	3	4	5	5	3	1	5	5			1	1		1	1	1			1	1					4	4	4	2	2	4
Natural grassland		2	2		1	3	4	5	1	2	1	2				2	1						1	1					3	4	4	1	2	2
Moors and heathland		2	4		2	4	3	2	2	2	2	3			1	1				1			1	1					3	4	4	1	1	3
Sclerophyllous vegetation		1	2	1	1	1	2	1	1	1	2	3				1			1	1			1						2	3	4	1	1	3
Transitional woodland shrub		1	2	1	1	1	2	1	1	1	2	3			1	1		1	1	1			1	1					2	3	4	1	1	1
Beaches, dunes and sand plains					1	1	1		5		1	1												1					4	4	4	1	1	1
Bare rock						1		2	1																				2	3	3	1	1	1
Sparsely vegetated areas			1		1	1	1	1	1		1	1					1												1	1	2		1	1
Burnt areas			1				1					1																			2			
Glaciers and perpetual snow		3	4		3						1	1													1				2	4	3			1
Inland marshes		2	2		2	2	4	1	4	1	2	3				2	1												1	2	3		1	1
Peatbogs		4	4		3	4	4	2	3	2	3	4			2									1					3	2	3		1	3
Salt marshes			1		1	1	2	1	4	1	2	2				2	1												3	2	3		1	1
Salines			2								1	1												2		2			2	2	3		3	
Intertidal flats		1	3		1	1	1	1	5		2	3																	4	2	3		1	1
Water courses		1	1		3	3	3		3		3	5									2		2		2		2		4	4	3	1	2	2
Water bodies		1	2		3	2	3		3		3	5									2	2	3		2		1		5	4	3	1	2	2
Coastal lagoons		1	1		2	1	3		4		3	5									2	2	2						3	4	3		1	2
Estuaries		1			2	3	3		3		3	5									2	2	2						3	4	3		1	2
Sea and ocean		2	3		1	1	3				3	5			1	1					3	2	3	2		1	1		4	5	3	1	2	2

*abiotic outputs from natural systems (after CICES)

ecosystem services balances:

- 5
- 4 demand exceeeds supply
- 3
- 2
- 1

0 neutral balance

1
2
3 supply exceeds demand
4
5

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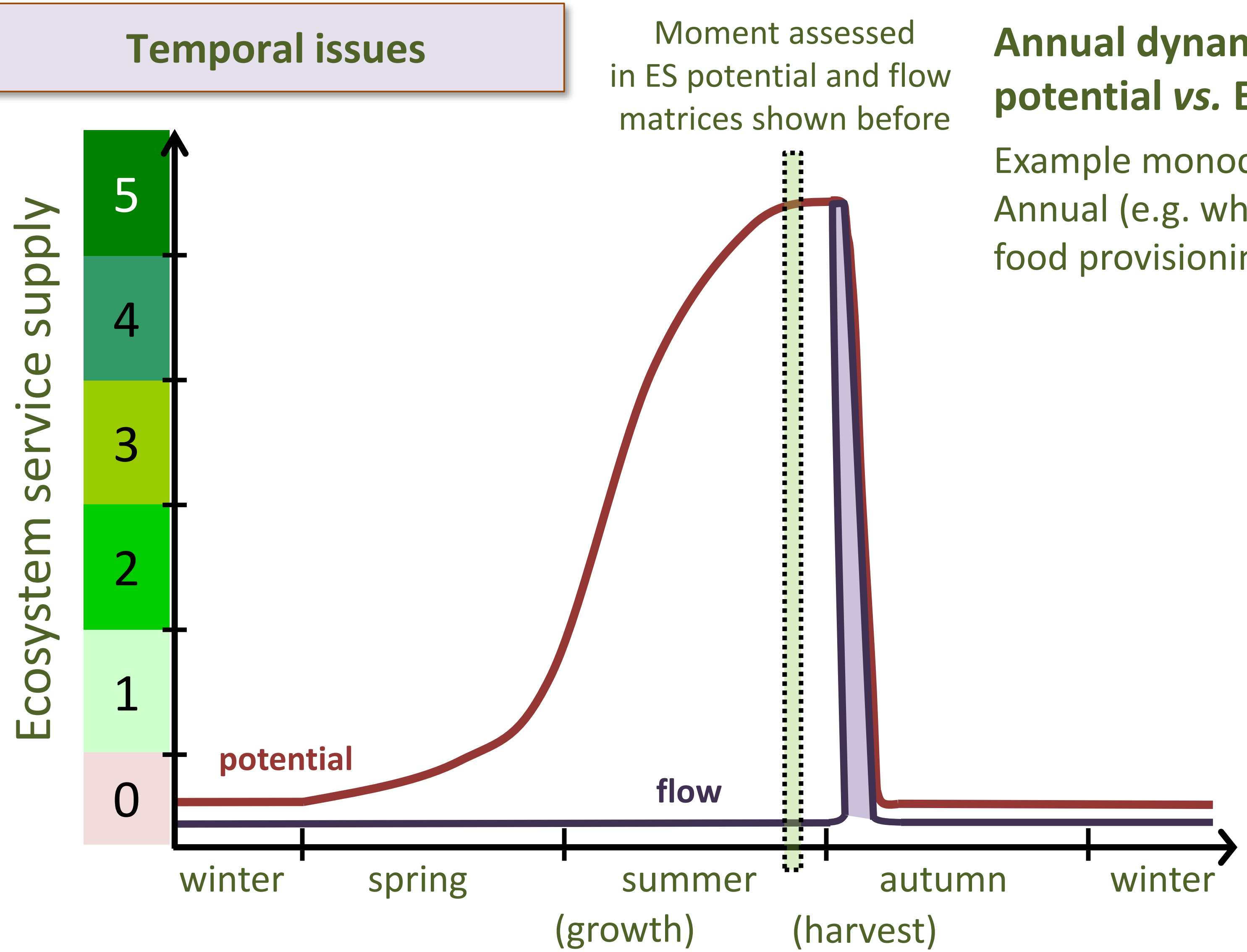
Temporal issues

Annual dynamics of ES supply potential *vs.* ES flow

Example monoculture summer Annual (e.g. wheat) crop-related food provisioning ES

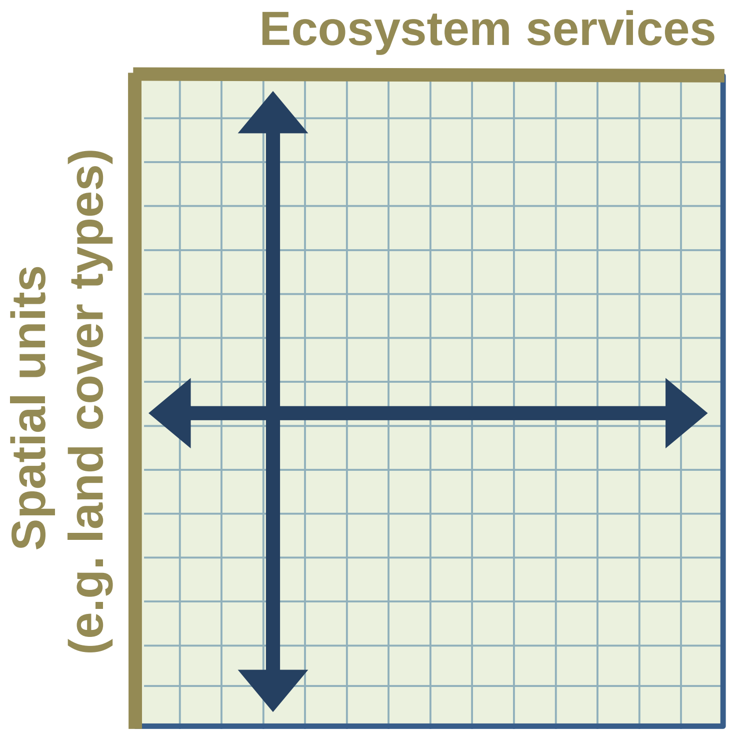


Burkhard et al. (2014) - *Landscape online*.

Quantification issues

Relative comparisons of assessment values in the matrix model:

- Vertical (within ecosystem service types)
  → works quite well
- Horizontal (within spatial units)
  → still problematic



Problem: **How do the 0-5 values relate to each other?**

Burkhard et al. (2014) - *Landscape online*.

Burkhard et al. (2014) - *Landscape online*.

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