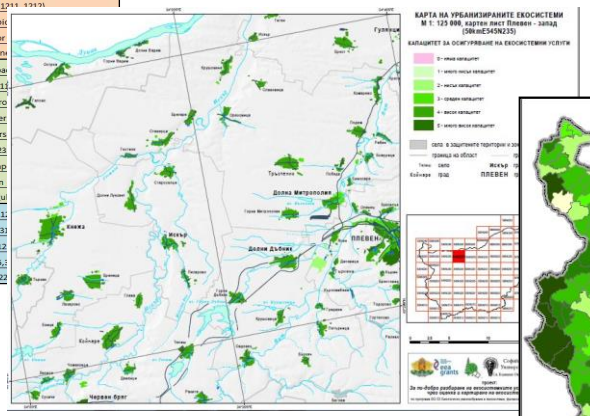
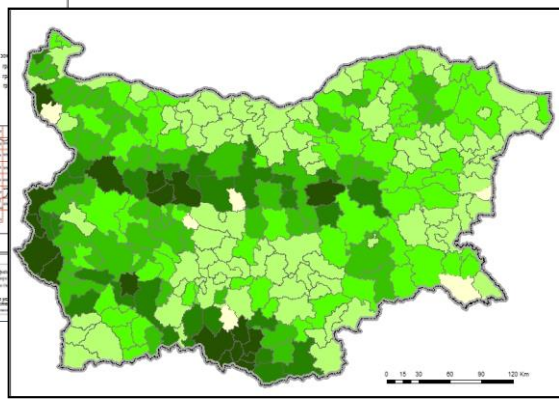
Mapping and Assessment of Ecosystem Services in Bulgaria: progress and challenges

Ecosystem structure	Biotic Heterogeneity	Plant diversity
		Animal diversity
		Habitat diversity
		Invasive species
		Other biotic heterog
	Abiotic heterogeneity	Soil heterogeneity
		Hydrological heterog
		Air heterogeneity
		Geomorphological h
		Other abiotic hetero
Ecosystem processes	Energy budget	Energy balance (cap
		Entropy production
		Metabolic efficiency
		Other energy budget
	Matter budget	Matter balance (inpu
		Element concentrati
		Efficiency measures
	Water budget	Water balance (inpu
		Water storage
		Other state indicator
		Efficiency measures

Section	Division	Group	Class (codes CICES)
Provisioning	Nutrition	Biomass	P1. Cultivated crops (1111)
			P2. Reared animals and their outputs (1112)
			P3. Wild plants, algae and their outputs (1113, 1115)
			P4. Wild animals and their outputs (1114, 1116)
	Materials	Water	P5. Ground water for drinking (1122)
			P6. Surface water for non-drinking purposes (1221)
			P7. Ground water for non-drinking purposes (1222)
		Material	P8. Fibres and other materials (1211, 1212)
			P9. Genetic materials from all bio
	Energy	Biomass-based energy sources	P10. Plant and animal-based resources for
			P11. Animal-based mechanical ene
Regulating and maintenance	Mediation 1	Mediation by ecos.	R1. Regulation of pollution and other impa
	Mediation of flows	Mass flows	R2. Mitigation of erosion (2211
		Liquid flows	R3. Water flow maintenance and flood pro
		Gaseous / air flows	R4. Regulation of air flows and atmospher
	Maintenance of physical, chemical, biological conditions	Lifecycle maint. etc	R5. Pollination and seed dispers
		Pest and disease cntr	R6. Pest and disease control (23
		Soil formation	R7. Regulation of soil formation and comp
		Atmospheric and climate regulation	R8. Global climate regulation
			R9. Micro and regional climate regu
Cultural	Physical and intellectual interactions	Physical interactions	C1. Recreation (3111,311
		Intellectual and representative	C2. Scientific and Educational (3
			C3. Cultural heritage (312
	Spiritual, symbolic and other	Spiritual	C4. Aesthetic and spiritual (3125,
		Other cultural outputs	C5. Existence and bequest (322





Stoyan Nedkov, Svetla Bratanova-Doncheva, Miglena Zhiyanski, Bilyana Borisova, Mariyana Nikolova, Kremena Gocheva

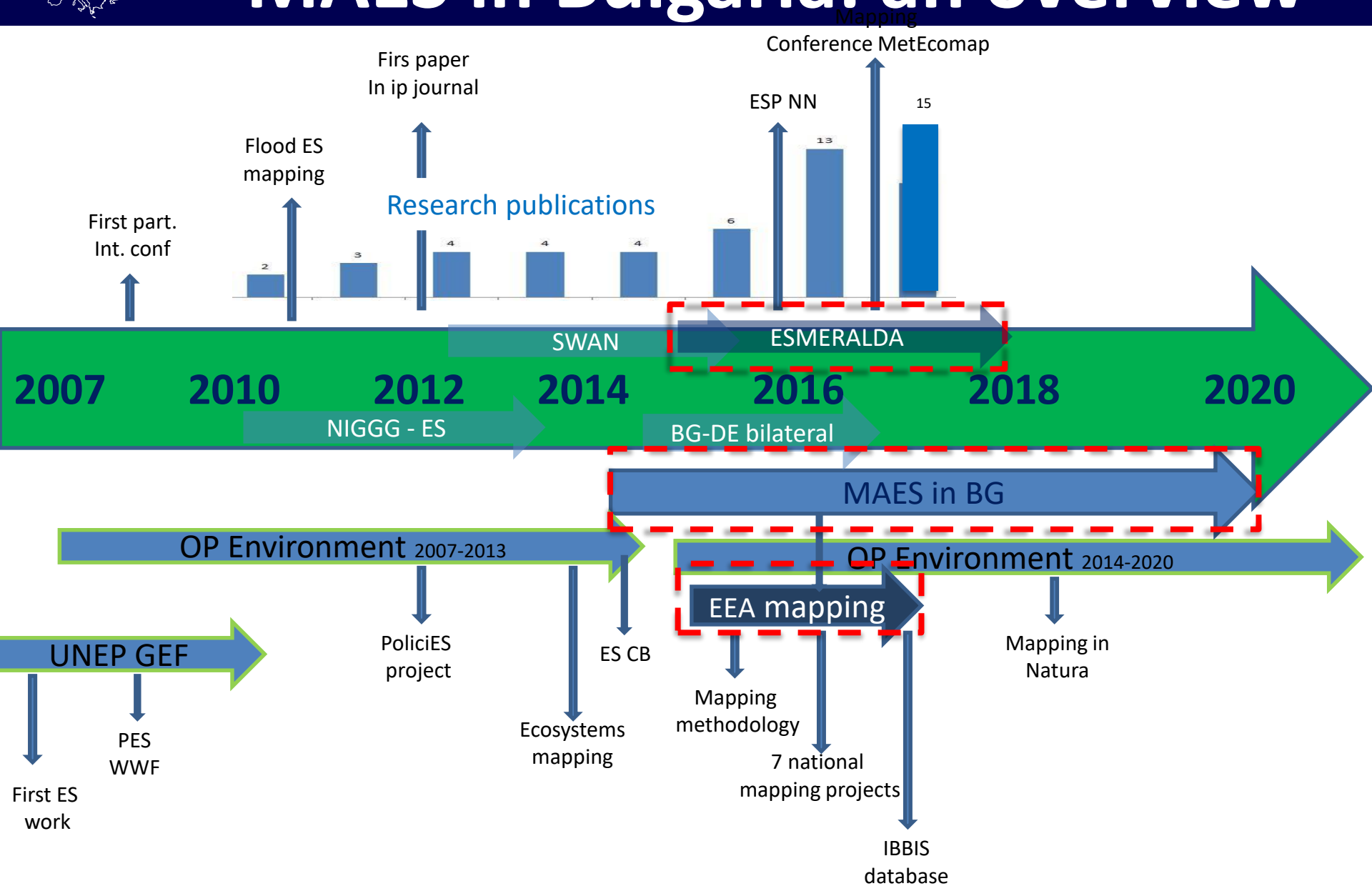
NIGGG-BAS, IBER-BAS, FRI-BAS, SU-Sofia

EU Horizon 2020 Coordination and support action

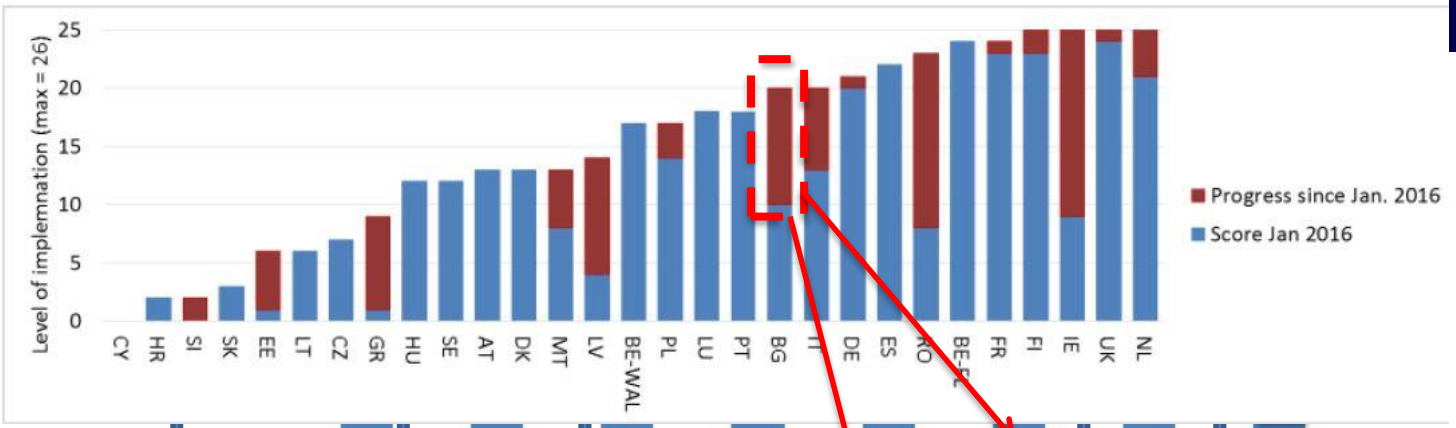
Content

1. MAES in Bulgaria: an overview
2. Methodological framework and mapping activities
3. Implementation in policy
4. Challenges and steps forward

MAES in Bulgaria: an overview



Progress of EU member states on MAES



SWAN

ESMERALDA

2007 2010 2012 2014 2016 2018 2020

NIGGG - ES

BG-DE bilateral

MAES in BG

OP Environment 2007-2013

OP Environment 2014-2020

EEA mapping

UNEP GEF

First ES work

PES WWF

PoliciES project

Ecosystems mapping

ES CB

Mapping methodology

7 national mapping projects

IBBIS database

Mapping in Natura

MAES in Bulgaria: timeline

2014

- First mapping as part of PAF
- Preliminary mapping based on existing data; funded by OP Enviornment
- Start of EEA national mapping

2017

- Development of methodological framework (MetEcoSMapproject)
- Mapping and biophysical assessment outside NATURA2000 (7 projects)
- Funded by EEA FM 2009-2014

2018-2019

- Methodology for monetary valuation of ES – development and implementation
- Plans for funding by EEA 2014-2021 and OP Environment 2014-2020 (mapping within NATURA2000 zones)

2020

- Incorporation into national accounts
- Funding depends on various financial sources' planning and programming

MAES in Bulgaria: Who?

1. **State institutions**

   Ministry of Environment and Water – EEA, NSNP

   Ministry of Agriculture – EFA

2. **Academic**

   IBER-BAS, NIGGG-BAS, FRI-BAS

   Sofia University

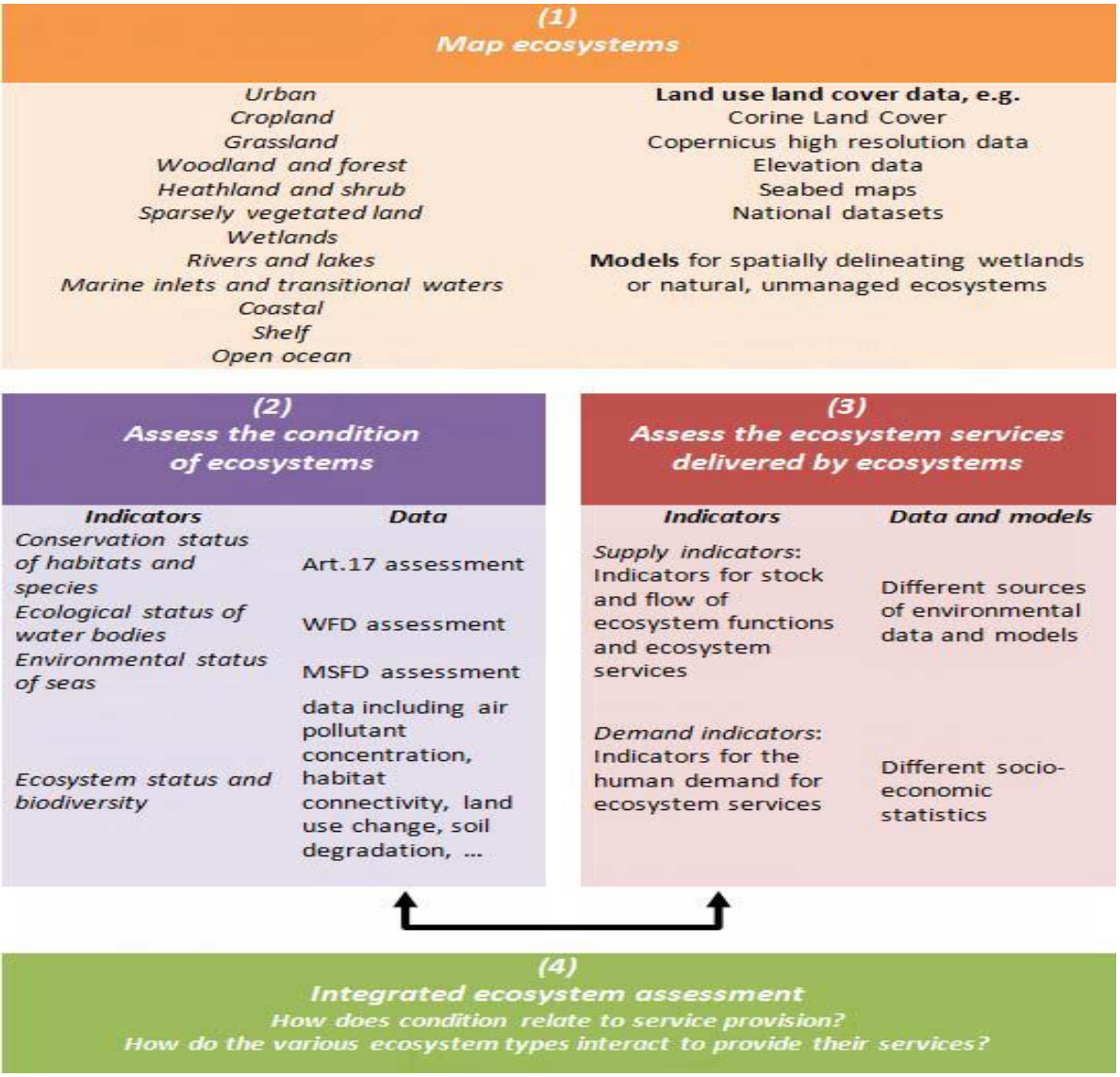
3. **NGOs**

   REC Bulgaria; Biodiversity foundation;
   Club Economica; …..

4. **Bussines**

   RESAC; Eko Innovation Ltd,
   Geographica ltd; …..

Methodological framework



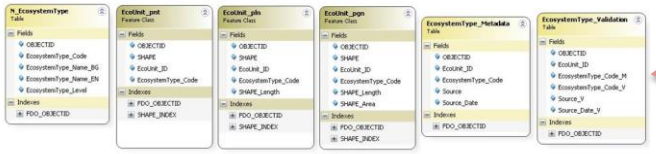
MAES framework

(Maes et al. 2013

ESMERALDA

(Burkhard, 2015)

Methodological framework



Level 1	Level 2	Level 3 (EUNIS 2) BG specific
Terrestrial	Urban	J1 – 10 (10 subtypes)
	Cropland	1 – 5 (5 subtypes)
	Grassland	1-5 (5 subtypes)
	Woodland and forest	G1-4 (4 subtypes) (level 4)
	Heathland and shrub	F2,3,9 (3 subtypes)
	Sparsely vegetated land	1 – 5 (5 subtypes)
	Wetlands	D1,4,5 (3 subtypes)
Fresh water	River and lakes	C, J, X (16 subtypes)
Marine	Marine inlets and transitional waters Coastal areas Shelf	1 – 8 (8 subtypes)

METHODOLOGY FOR ASSESSMENT AND MAPPING OF URBAN ECOSYSTEMS THEIR CONDITION AND THE SERVICES THAT THEY PROVIDE IN BULGARIA

Part B1

ES Types (Level 1/ Level 2)	Methodology Part
Terrestrial/ Urban	**B1**
Terrestrial/ Cropland	B2
Terrestrial/ Grassland	B3
Terrestrial/ Woodland and forest	B4
Terrestrial/ Heathland and shrub	B5
Terrestrial/ Sparsely vegetated land	B6
Terrestrial/ Wetlands	B7
Fresh water/ River and lakes	B8
Marine/ Marine	B9

Document history

Date	Version	Action	Prepared	Approved
21.01.2015	01	General content	Team of experts	Working group
30.01.2015	02.1	ES and ESS mapping	Team of experts	Working group
20.02.2015	02.2	Revisions in tables for ES and ESS	Team of experts	Working group
14.12.2015	02.2'	Revisions in text, tables for ES and ESs	Team of experts	Working group
13.10.2016	02.2'	Revisions in text, tables for ES and ESs, including mapping	Miglena Zhiyanski, Svetla Doncheva, Stoyan Nedkov, Margarita Mondeshka, Nadezhda Yarlovska, Vassil Vassilev, Bilyana Borissova, Nesho Chipev, Kremena Gocheva	

Ecosystem structure	Biotic Heterogeneity	Plant diversity
		Animal diversity
		Habitat diversity
		Invasive species
		Other biotic heterrogeity
	Abiotic heterogeneity	Soil heterogeneity
		Hydrological heterogeneity
		Air heterogeneity
		Geomorphological heterogeneity
		Other abiotic heterogeneity
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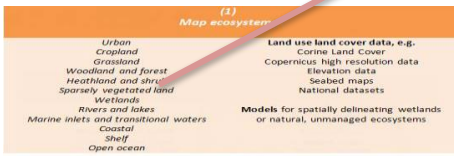
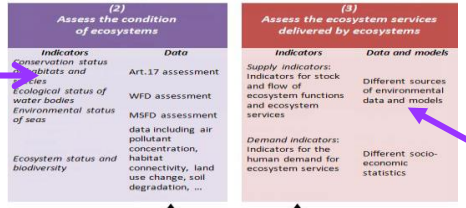
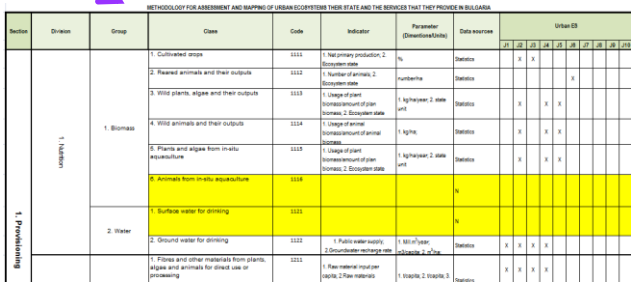
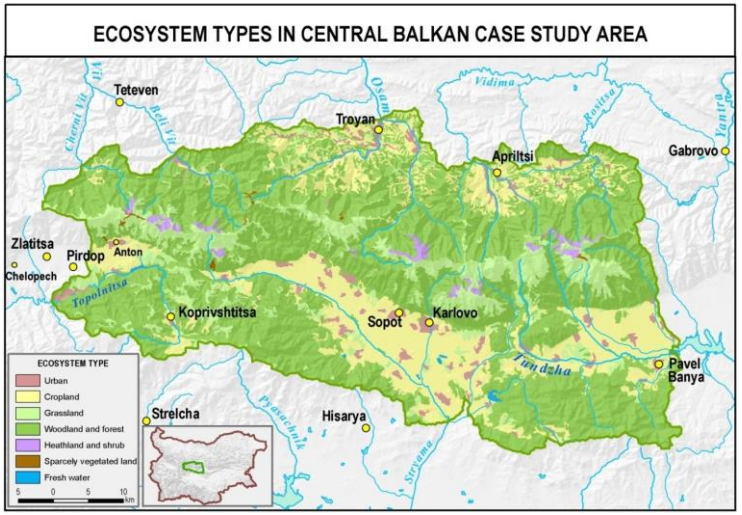
		Entropy production
		Metabolic efficiency
		Other energy budget indicators
	Matter budget	Matter balance (input, output)
		Element concentrations
		Efficiency measures
	Water budget	Water balance (input, output)
		Water storage
		Other state indicators
		Efficiency measures

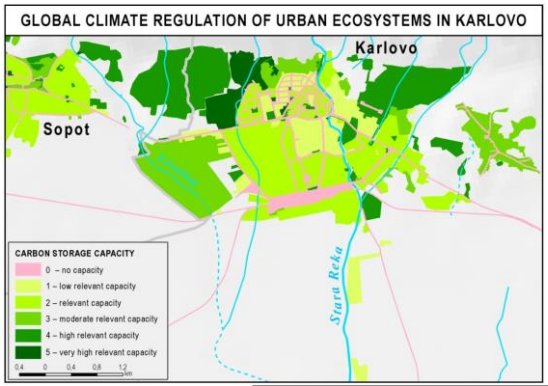


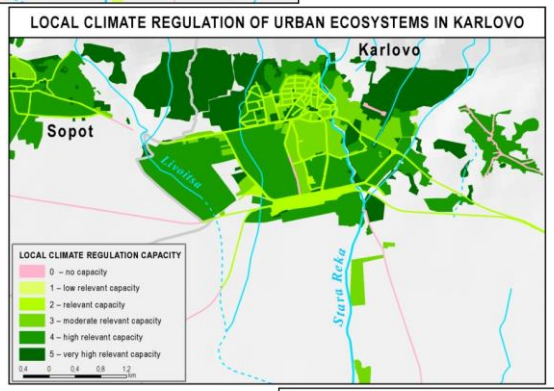


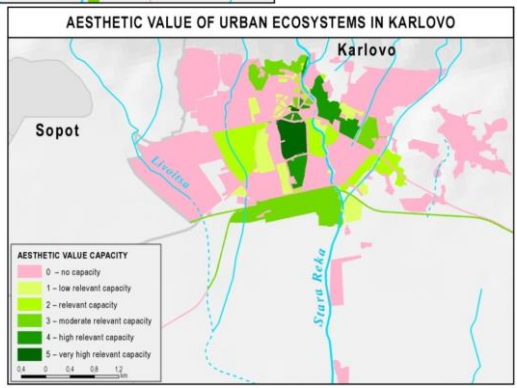


ESMERALDA case study









Ecosystem Service selected for mapping and assessment	Methods			Scale	Tier	Activity
	Biophysical	Socio-cultural	Economic			
1.1.2.1 Surface water for drinking	x			1,3	2-3	2,5
1.2.2.1 Surface water for non-drinking purposes	x			1,3	2-3	2,5
2.2.2.2 Flood regulation	x			3	3	1,5
2.3.5.1 Global climate regulation	x			1	2	5
2.3.5.2 Micro and regional climate regulation	x			1	2	5
3.1.1.1 Experiential use of plants, animals and land/seascapes			x	1	2	3
3.1.2.5 Aesthetic		x		1	2	5

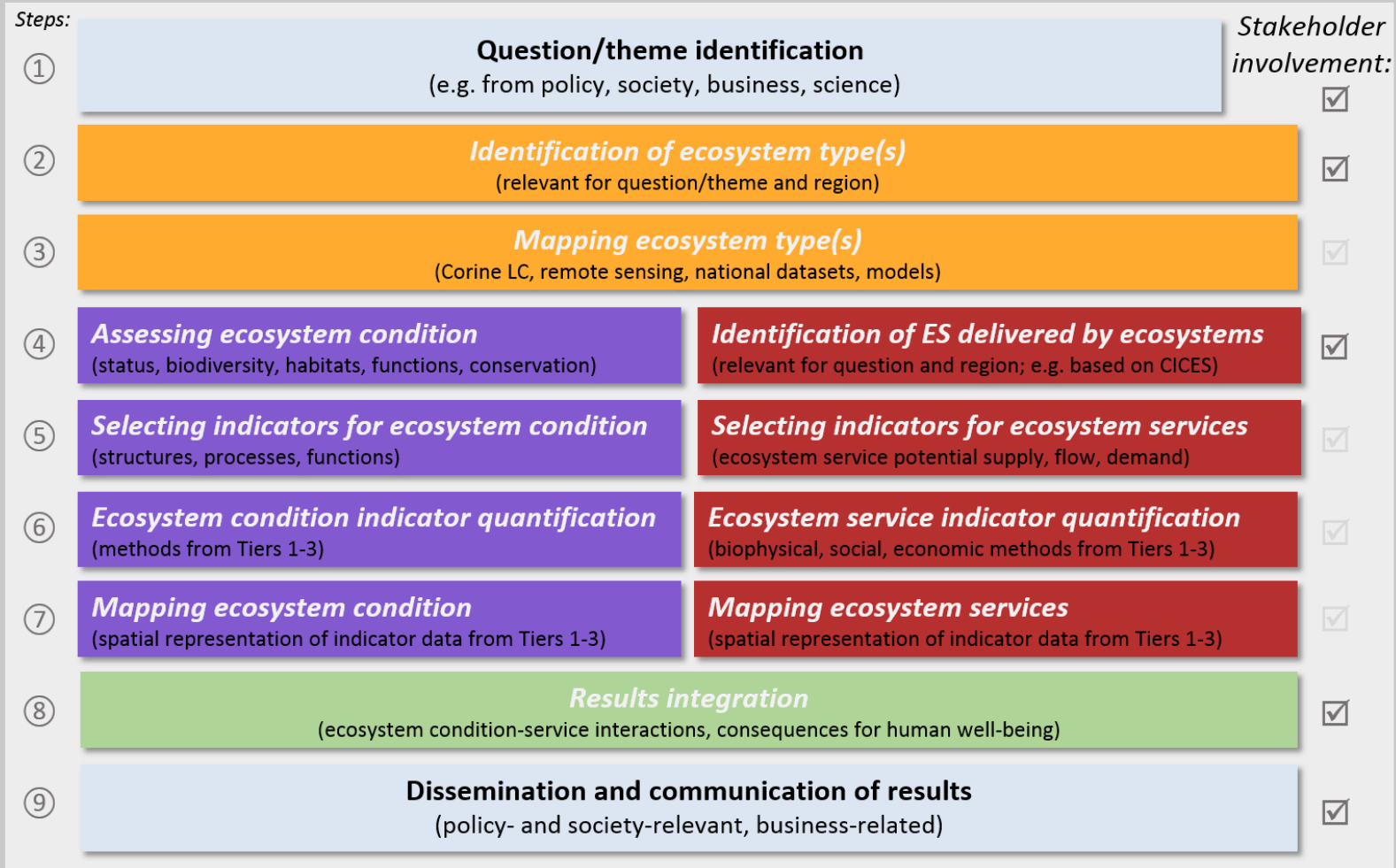
ESMERALDA case study

Policy relevance

1. **Flood hazard assessment –** Natural risk prevention
2. **Water regulation services assessment -** Sustainable resource management, Land use management
3. **Mountain Municipalities –** ES hotspots & trade-offs; ES utilization to support local spatial planning; Increasing of public understanding
4. **Economic value of ES, provided by forest in NP –** Sustainable resource management; Promotion of small and medium Enterprises
5. **Urban ecosystems assessment –** Urban planning & Spatial development

Methodological framework

Framework for integrated **M**apping and **A**ssessment of **E**cosystems and their **S**ervices (**MAES**)



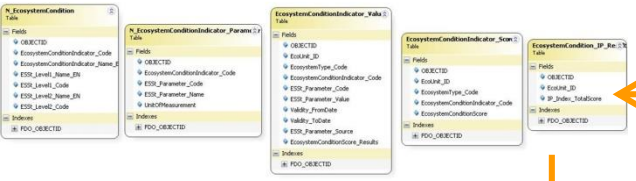
Ecosystem types
Ecosystem conditions
Ecosystem services
Integration

(Colours refer to Figure 2 of the 2nd MAES report)

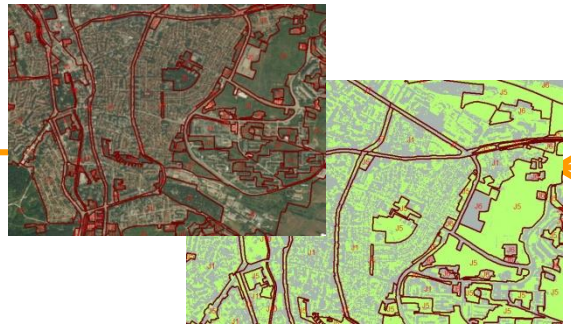
For respective definitions, See article text.

Mapping activities

Ecosystems database



Ecosystems delineation



Urban typology

L.1	L. 2	Level 3
Terrestrial	Urban	J1. Residential and public areas of cities and towns
		J2. Sub-urban areas
		J3. Residential and public low density areas
		J4. Recreation area outside cities and towns
		J5. Urban green areas (incl. sport and leisure facilities)
		J6. Industrial sites (incl. commercial sites)
		J7. Transport networks and other constructed hard surfaced sites
		J8. Extractive industrial sites (incl. active underground mines and active opencast mineral extraction sites, and quarries)
		J9.Waste deposits
		J10.Highly artificial man made waters and associated structures

Ecosystems condition

Ecosystem structure	Biotic Heterogeneity	Plant diversity
		Animal diversity
		Habitat diversity
		Invasive species
		Other biotic heterrogeity
	Abiotic heterogeneity	Soil heterogeneity
		Hydrological heterogeneity
		Air heterogeneity
		Geomorphological heterogeneity
		Other abiotic heterogeneity
Ecosystem processes	Energy budget	Energy balance (capture, storage)
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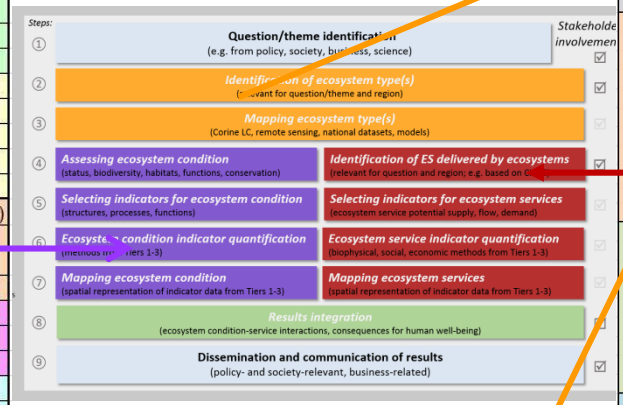
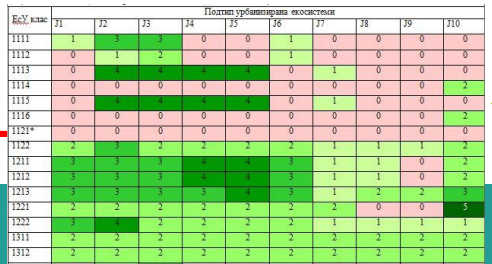
		Other state indicators
		Efficiency measures

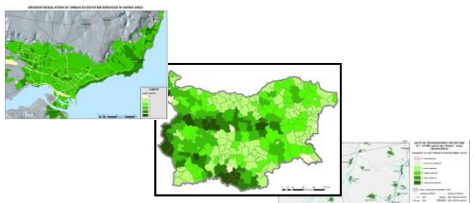


Ecosystem services

Section	Division	Group	Class (codes CICES)
Provisioning	Nutrition	Biomass	P1. Cultivated crops (1111)
			P2. Reared animals and their outputs (1112)
			P3. Wild plants, algae and their outputs (1113, 1115)
			P4. Wild animals and their outputs (1114, 1116)
	Materials	Water	P5. Ground water for drinking (1122)
			P6. Surface water for non-drinking purposes (1221)
			P7. Ground water for non-drinking purposes (1222)
		Material	P8. Fibres and other materials (1211, 1212)
			P9. Genetic materials from all biota (1213)
	Energy	Biomass-based energy sources	P10. Plant and animal-based resources for energy (1311,1312)
			P11. Animal-based mechanical energy (1321)
Regulating and maintenance	Mediation 1	Mediation by ecos.	R1. Regulation of pollution and other impacts (2121,2122,2123)
	Mediation of flows	Mass flows	R2. Mitigation of erosion (2211,2212)
		Liquid flows	R3. Water flow maintenance and flood protection (2221,2222)
		Gaseous / air flows	R4. Regulation of air flows and atmospheric risks (2231,2232)
	Maintenance of physical, chemical, biological conditions	Lifecycle maint. etc	R5. Pollination and seed dispersal (2311)
		Pest and disease cntr	R6. Pest and disease control (2321,2322)
		Soil formation	R7. Regulation of soil formation and composition (2331,2332)
		Atmospheric and climate regulation	R8. Global climate regulation (2351)
			R9. Micro and regional climate regulation (2352)
Cultural	Physical and intellectual interactions	Physical interactions	C1. Recreation (3111,3112)
		Intellectual and representative	C2. Scientific and Educational (3121,3122)
			C3. Cultural heritage (3123)
	Spiritual, symbolic and other	Spiritual	C4. Aesthetic and spiritual (3125,3211,3212)
		Other cultural outputs	C5. Existence and bequest (3221,3222)

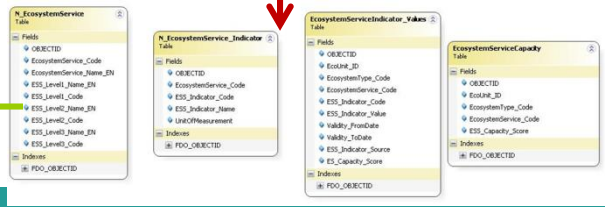
ES assessment





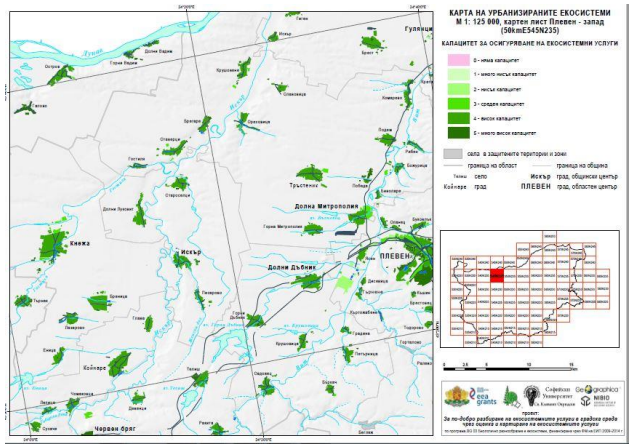
ES maps

ES database

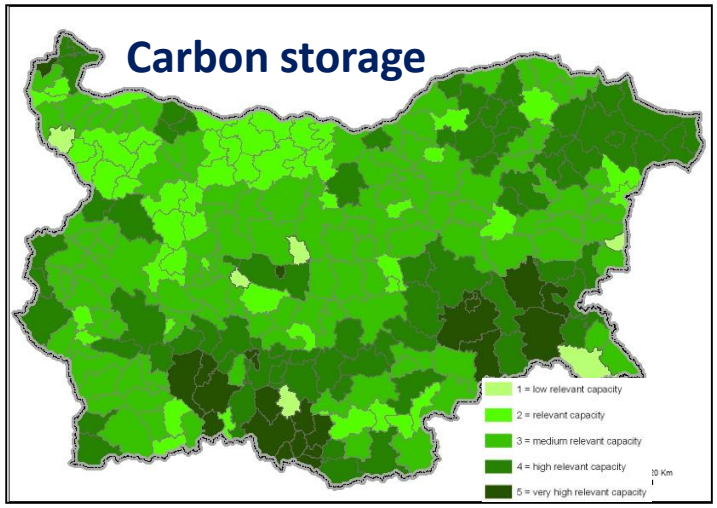


Mapping activities

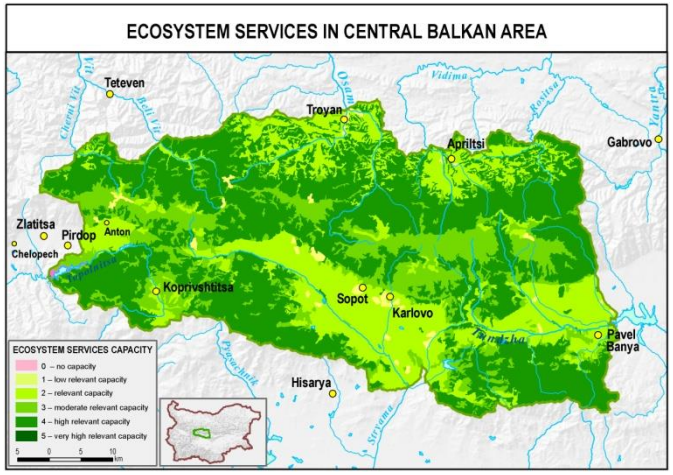
Large scale mapping at national level
77 map sheets



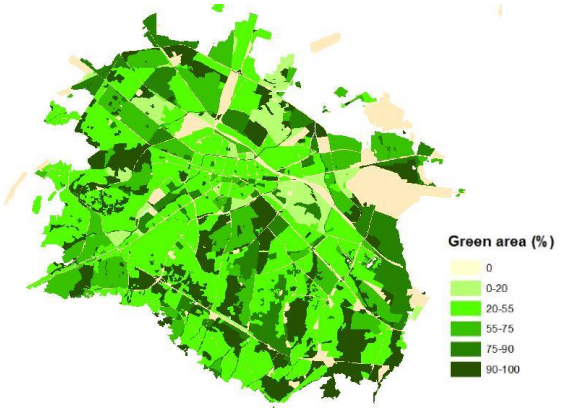
Small scale mapping - national level



Middle scale mapping - case study

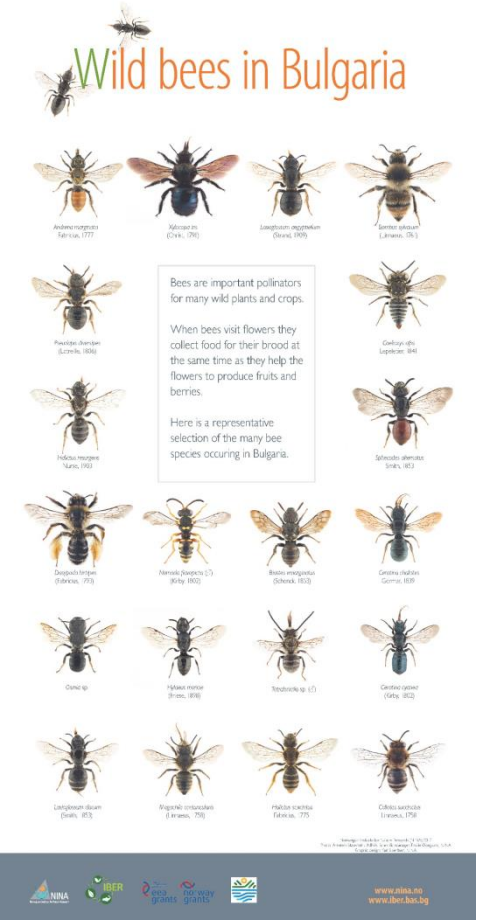


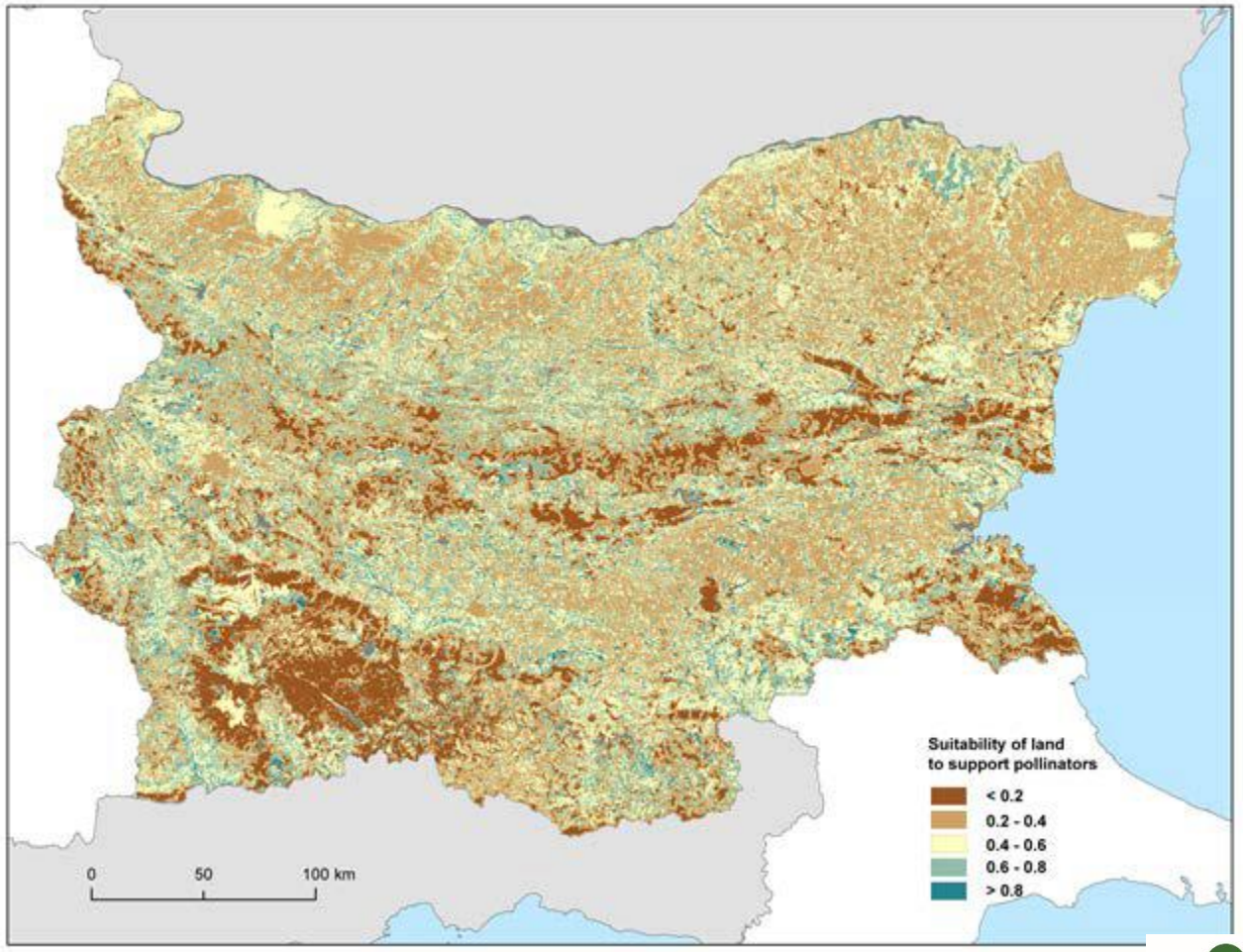
Large scale mapping - city level



Mapping activities

Pollination services in Bulgarian rural landscapes





National level ESTIMAP map of habitat capacity to support pollination services

Mapping activities

Overview of mapping activities per ecosystem type

Ecosystem type	Subtypes	Condition Indicators	Condition indicator assessed	Ecosystem services	Ecosystem services assessed
Urban	11	23	15	27	21
Cropland	5	14	14	48	37
Grassland	6	10	10	19	13
Forest	4 (28)	9	9	35	20
Heatland	3	11	8	20	20
Sparcely	6	23	6	48	11
Wetland	4	24	11	16	8
Rivers and lakes	16	11	11	25	25

Implementation in policy

Ministry of Environment and Water

- Climate change adaptation strategy ☺
- Air quality regulation 😐
- Biodiversity protection low ☹

Ministry of Agriculture Food and Forestry…

- National strategy for forests ☺
- Forestry low ☺

Ministry of finance

- Ecosystem accounting ☹

Implementation in policy

National climate change adaptation strategy

5. Use the 'invisible ecosystems' for adaptation and human benefit	**5.1 Sustainable use of ecosystem services**	5.1.1 Sustainable use of genetic resources for resilience	H	Corporate funding (incl. venture capital); Economic instruments and environmental state aid funded by post-2020 programmes and national budget	LT	Medium (12.2025)	1) Legal framework set up and environmental state aid/funding from post-2020 programmes made available for R&D on climate resilient production of provisioning services using local genetic resources 2) Improved climate resilience of at least 50% of all managed ecosystems (agriculture, fishery, forestry, urban) in the most vulnerable territories by using genetic resources for boosting biodiversity and introducing new sorts, breeds, growing practices	No specific use of local genetic resources is made for CC resilience and sustainable agricultural practices
		5.1.2 Cultural ecosystem services for recreation and education	M	Corporate and SME support funding (incl. venture capital); Economic instruments and environmental state aid funded by post-2020 programmes and national budget	MT	1) Short (12.2021) 2) medium (12.2025)	1) Awareness of cultural ecosystem services is common among recreation professionals 2) The protection and nourishing of landscapes and ecosystems providing cultural ecosystem services is part of the corporate culture, subject to volunteer labeling scheme(s)	No specific awareness efforts and no corporate labeling schemes

Implementation in policy

Forest ecosystems and their services

NATIONAL STRATEGY FOR THE DEVELOPMENT OF THE FOREST SECTOR IN THE REPUBLIC OF BULGARIA 2013 – 2020

- MEASURE 4.4: Establishment of conditions for sustainable and compensational use of the ecosystem services provided by the forest territories

FOREST LAW

Art. 248. (2) Public ecosystem benefits from the forest territories are:

1. protection against soil erosion, avalanches and floods;
2. guaranteeing the quantity and quality of water;
3. maintaining biological diversity;
4. screening, noise and pollutants absorption, micro-climate maintenance;
5. providing conditions for recreation and tourism;
6. maintaining the traditional landscape;
7. protection of the natural and cultural heritage;
8. protection of infrastructure objects and facilities;
9. slowing down and regulation of the influence from the climate changes.

Challenges

Research perspective

- Gaps and overlaps between datasets of different ecosystem types
- Lack of common understanding of ecosystem services concept and methods
- Some discrepancies between experts from different ecosystem types

Challenges

Policy perspective

- Changes of people at key positions in the MEW
- The implementation of ES in environmental policy is still not satisfactory
- There is no permanent leading and coordination body of the process

Steps forward

- Development of the ESMERALDA stakeholders network into working community of practice
- Mapping of ecosystems and their services in NATURA 2000 zones
- Development of methods and implementation of ecosystems accounting

Thank you for your attention

EU Horizon 2020 Coordination and support action