Republic of North Macedonia
Ministry of Environment and Physical Planning

Promoting Sustainable Land Management through Strengthening Legal and Institutional Framework, Capacity Building and Restoration of Most Vulnerable Mountain Landscapes

Land utilization and ecosystem services valuation for forest and grasslands ecosystems in the pilot sites in the north-western part of North Macedonia

Balkan Nature Talks Conference
10-11.10.2024, Vienna International Centre

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MACEDONIAN ECOLOGICAL SOCIETY

General information

To support the municipalities of Jegunovce, Zhelino, Saraj, Gazi Baba, Arachinovo, and Lipkovo, as well as the Ministry of Environment and Physical Planning, in their efforts for sustainable land management, sustainable forest management, and land degradation neutrality through the assessment of ecosystem services for **forest** and **grassland ecosystems**, thereby contributing towards development of better management and development plans

5 subtypes of ecosystems ***(broadleaf forests, coniferous forests, riparian forests, lowland grasslands and mountain grasslands)***

Duration 13 months (2022 –2023 – implemented majority of activities). Prolonged in 2024 for additional communication of results

Macedonian ecological society

Multi stakeholders approach - national and international experts from various fields (biodiversity, plant communities, ecosystems, landscape, forestry, erosion, hydrogeology, GIS, economy) municipalities, private sector, NGOs, local communities etc.

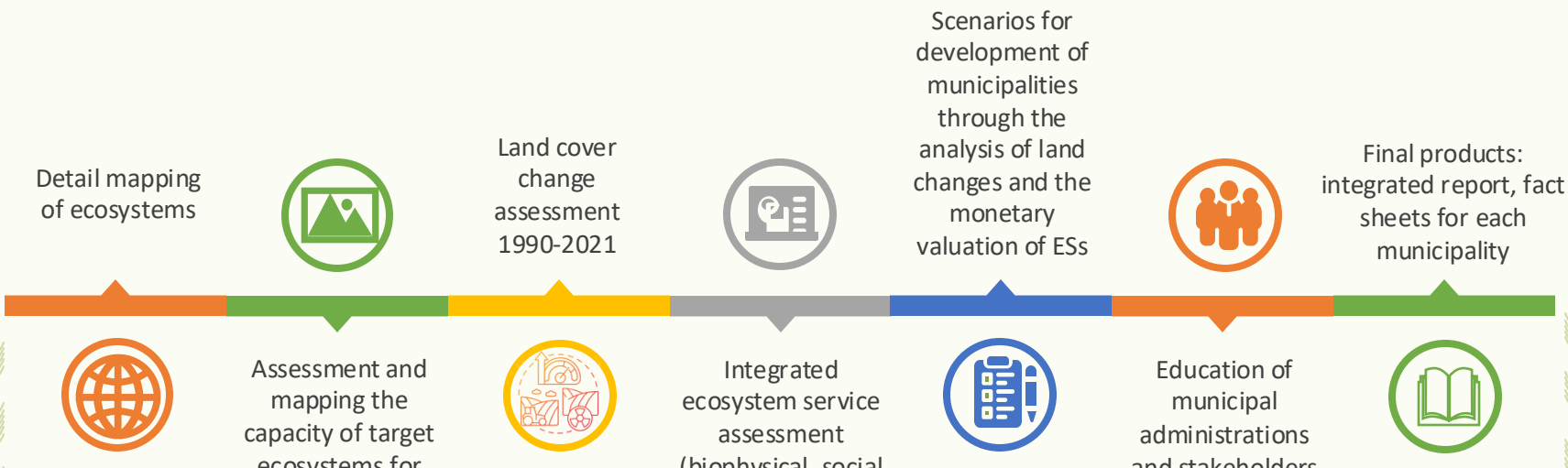
Area of interest

6 municipalities – 5 rural and 1 urban

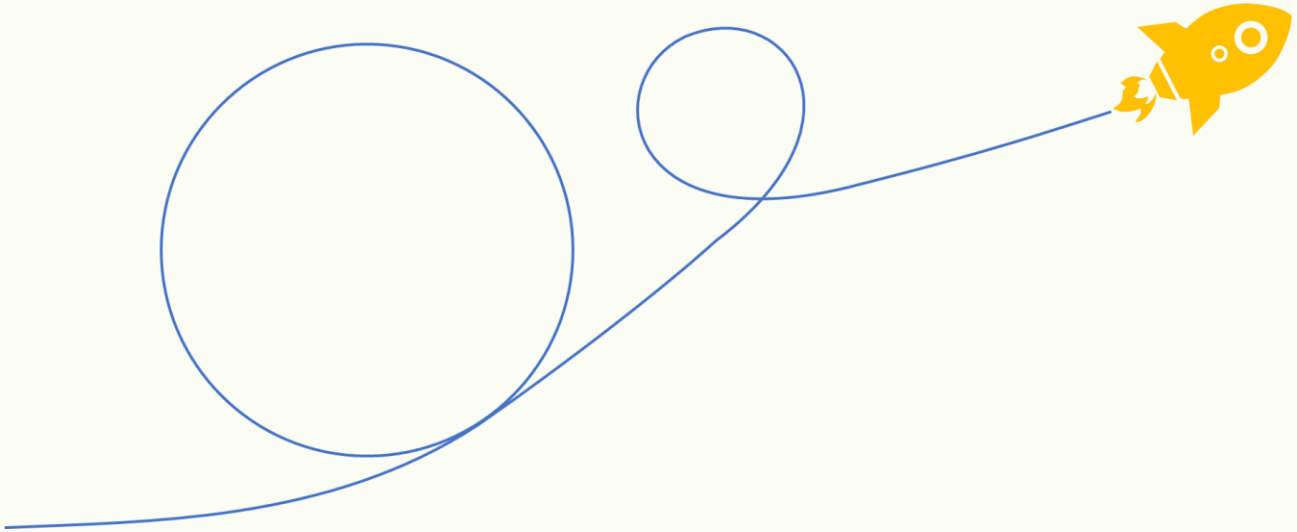
~ 1000 km^2

- Agriculture remains one of the most vital economic sectors in the region, supplying food and employment for the local rural population
- Many areas face significant challenges, including land degradation and widespread erosion, largely due to deforestation. Frequent floods exacerbate these issues by triggering landslides.
- Over the past three decades, changes in land use have also impacted soil fertility.
- North West region is particularly vulnerable to climate change, which further intensifies the problems of land degradation

Activities

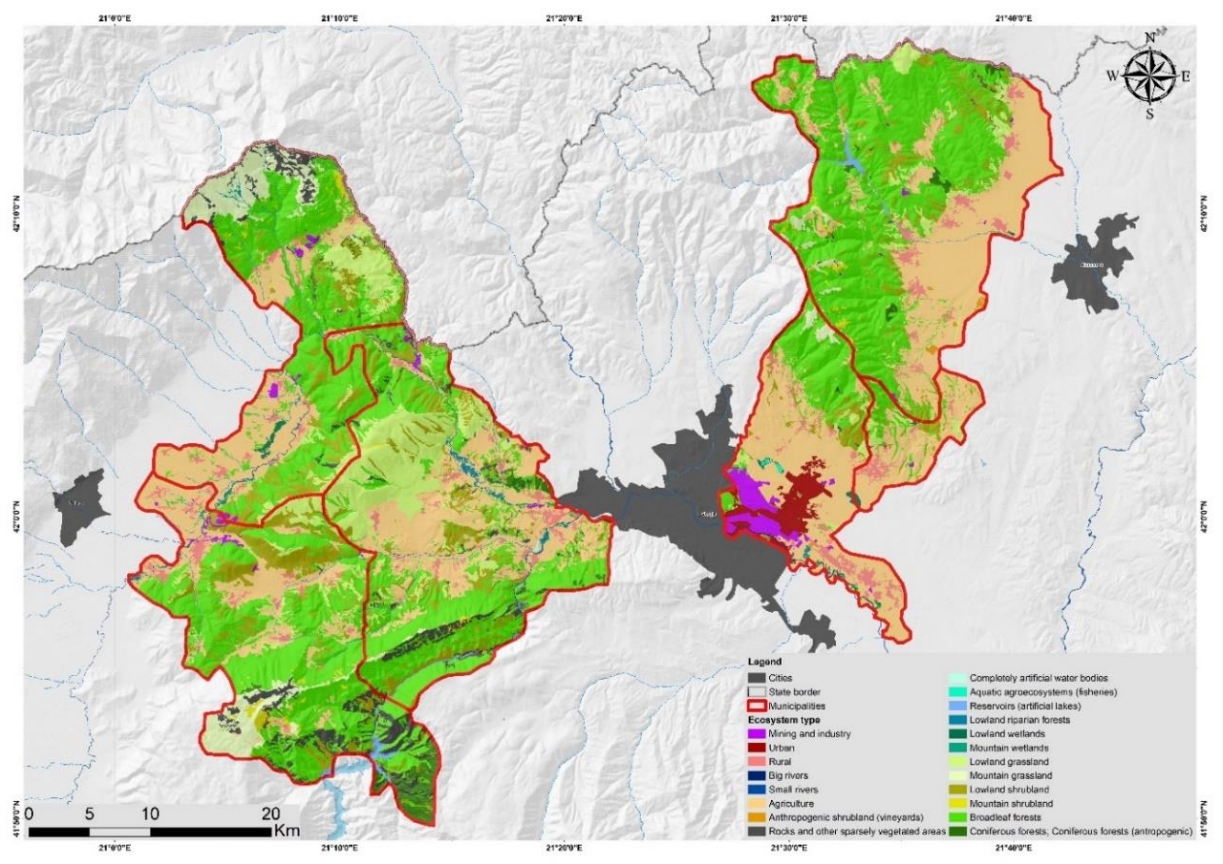

Detail mapping of ecosystems
Assessment and mapping the capacity of target ecosystems for providing ecosystem services
Land cover change assessment 1990-2021
Integrated ecosystem service assessment (biophysical, social and economic)
Scenarios for development of municipalities through the analysis of land changes and the monetary valuation of ESs
Education of municipal administrations and stakeholders about the concept of ESs
Final products: integrated report, fact sheets for each municipality

Achieved results



Ecosystems’ condition

Detailed map of ecosystems



21 subtypes of ecosystems, 998 km^2

(95% of the all subtypes in the country)

The most dominant ecosystem types in all Municipalities are the broadleaf forests (398 km^2) and the agriculture (279 km^2), followed up by lowland grasslands (84 km^2).

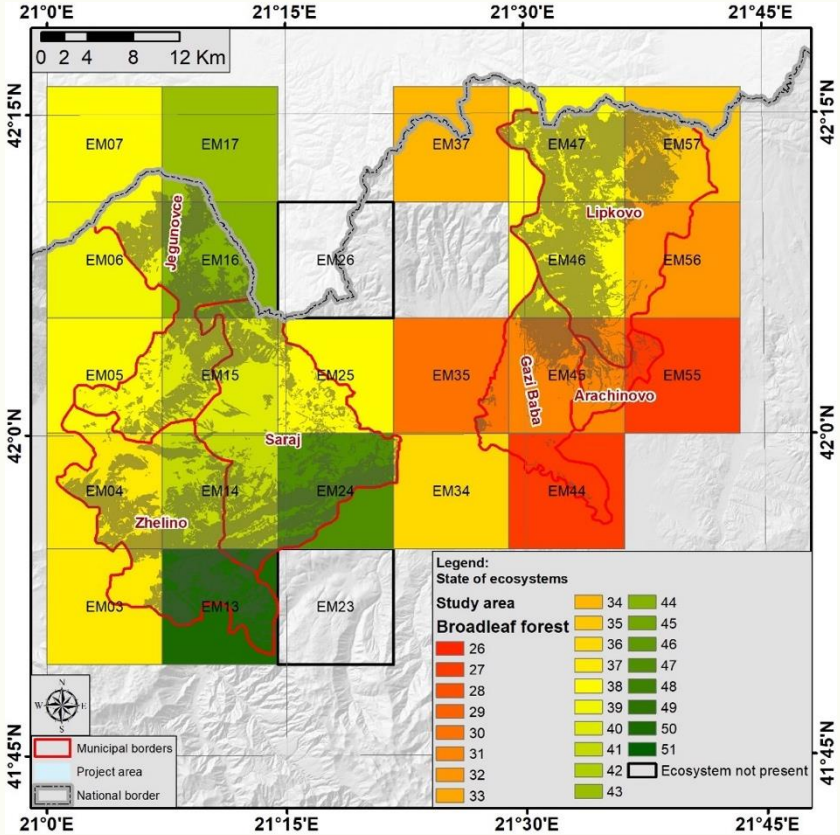
Most of the identified categories (19 out of 21) were present in Jegunovce Municipality, while the least (10) were in Arachinovo Municipality.

Assessment and mapping ecosystems' condition

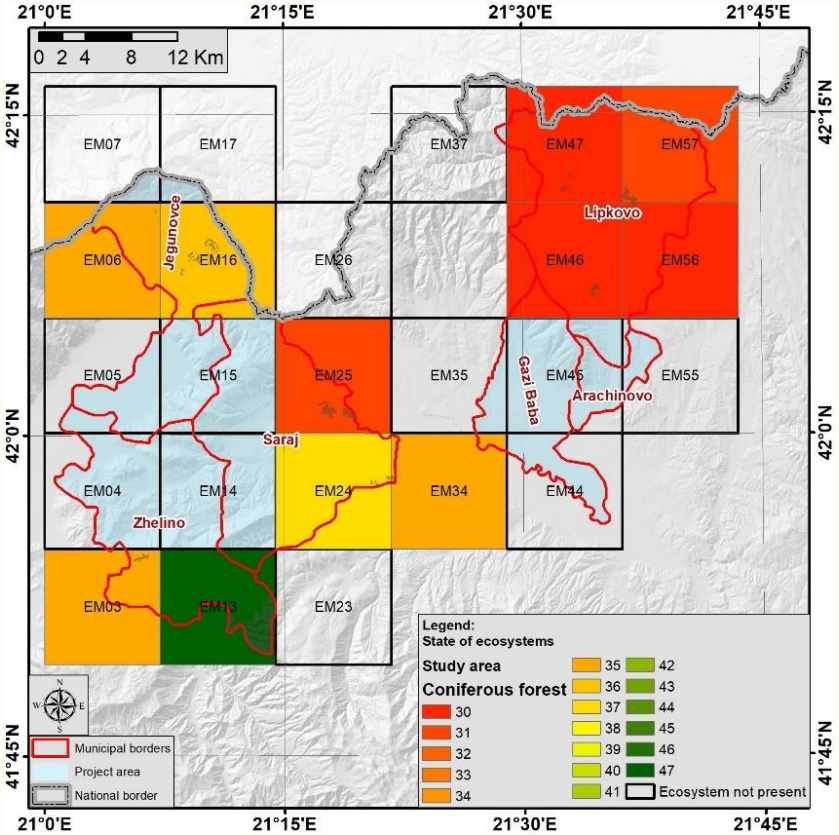
- In line with the methodological assessement conducted on national level which was based on MAES guidelines
- Team of experts from filelds of biodiversity, ecosystems, hydrogeology, erosion and GIS.

- Indicators and parametres from national assessment were reviewed (addition of new parameters, replacement of existing ones and setting new indicators and parameters)
- 21 indicators and 38 parameters (13 indicators and 19 parameters compare to national assessment)

Assessment and mapping ecosystems' condition

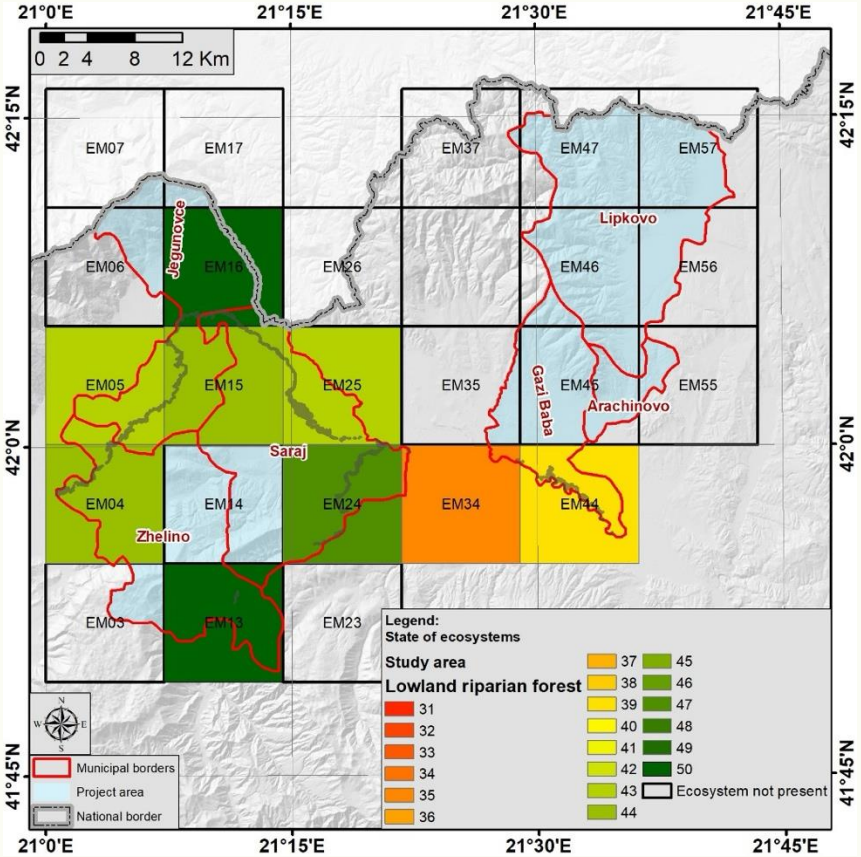


Broadleaf forests



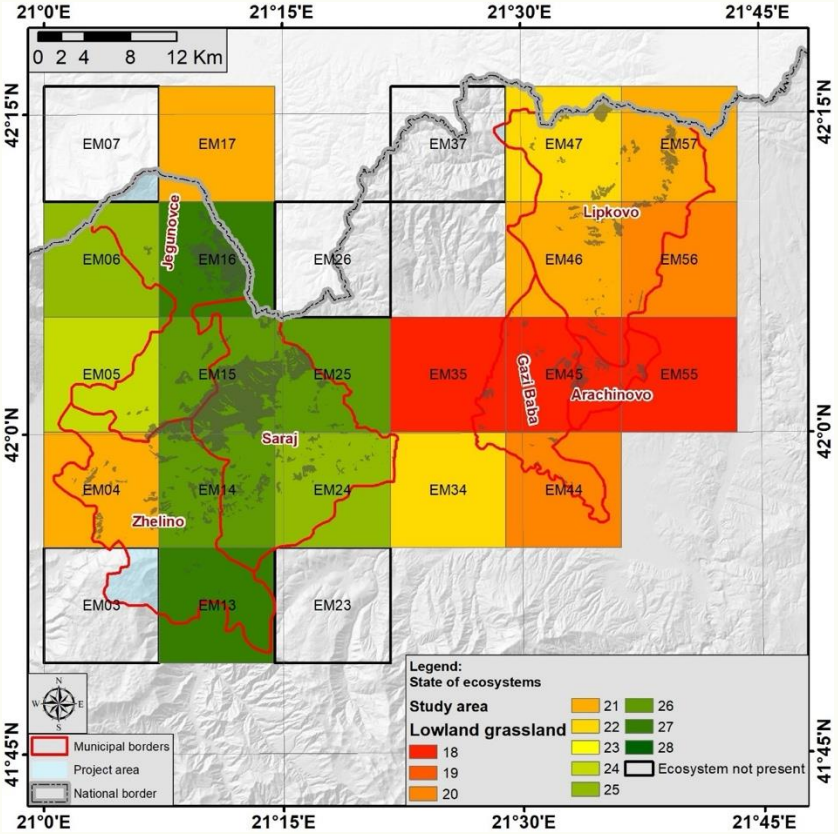
Coniferous forests

Assessment and mapping ecosystems' condition

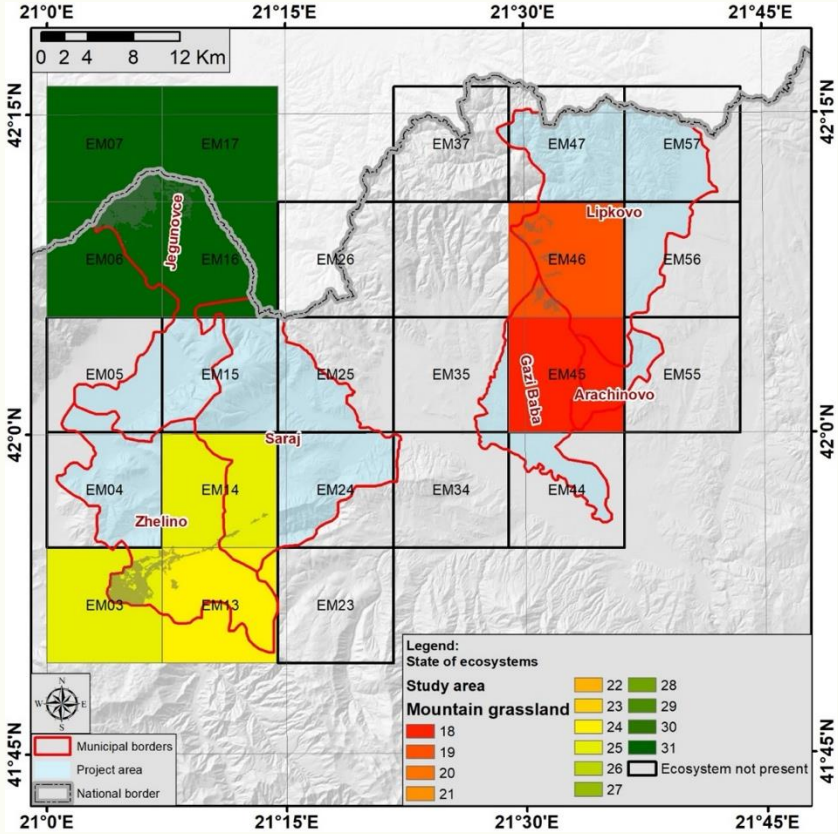


Riparian forests

Assessment and mapping ecosystems' condition



Lowland grasslands



Mountain grasslands

Land cover change assessment

1990-2021

Land cover change assessment

Covering period of 30 years

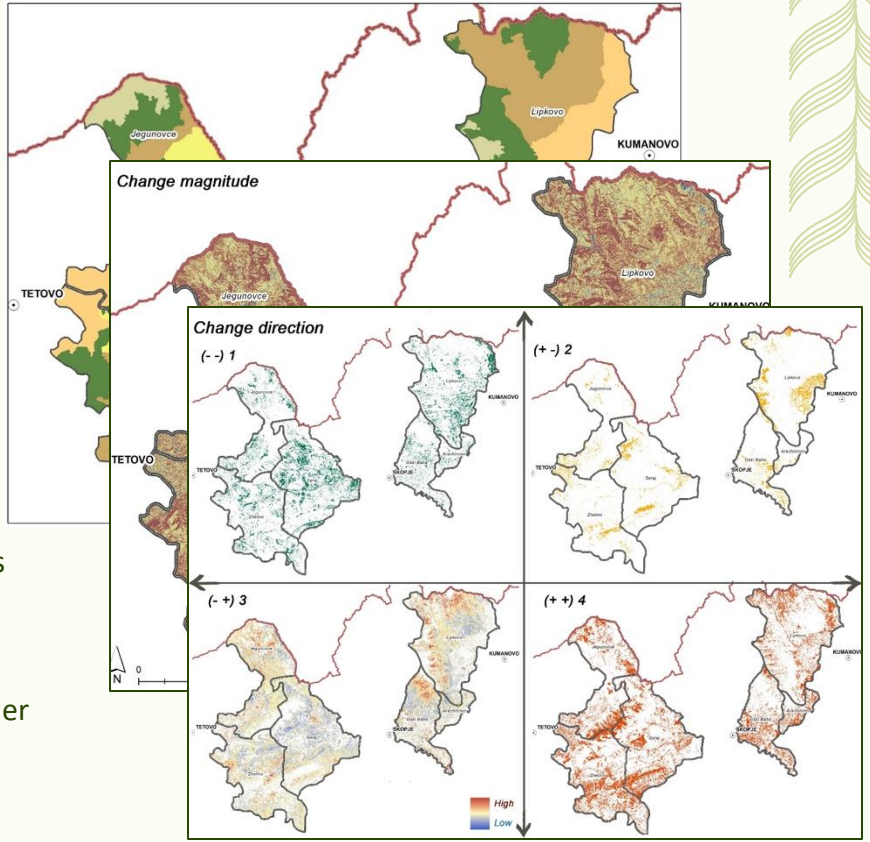
Made by classification and categorization of satellite images from 1990 and 2021

The results were interpreted taking into account the character of the landscape (Melovski et al. 2019), which unites natural, historical, social-economic and cultural features of a given area.

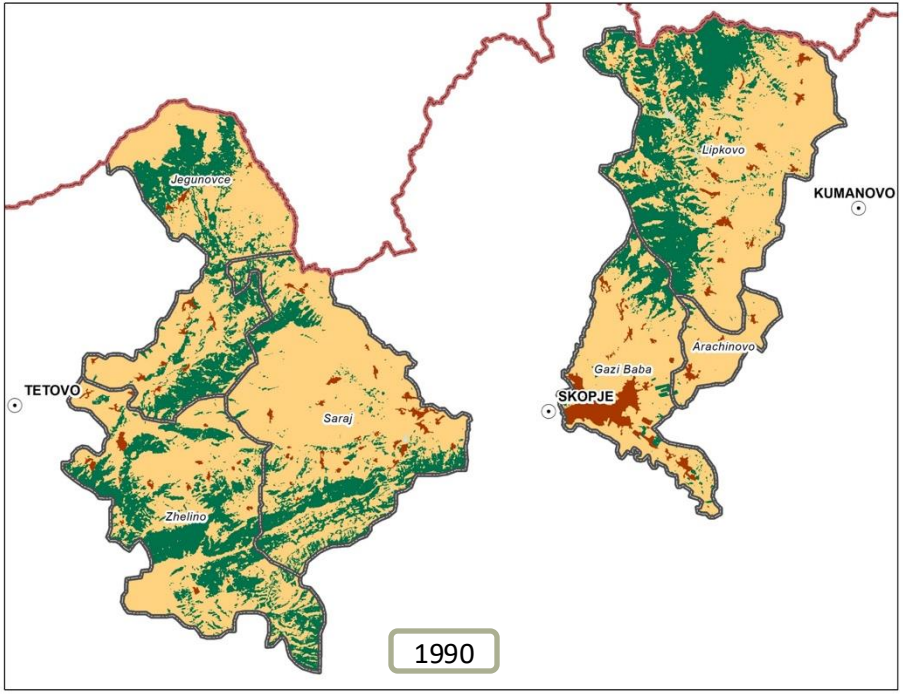
The rate of change is calculated:

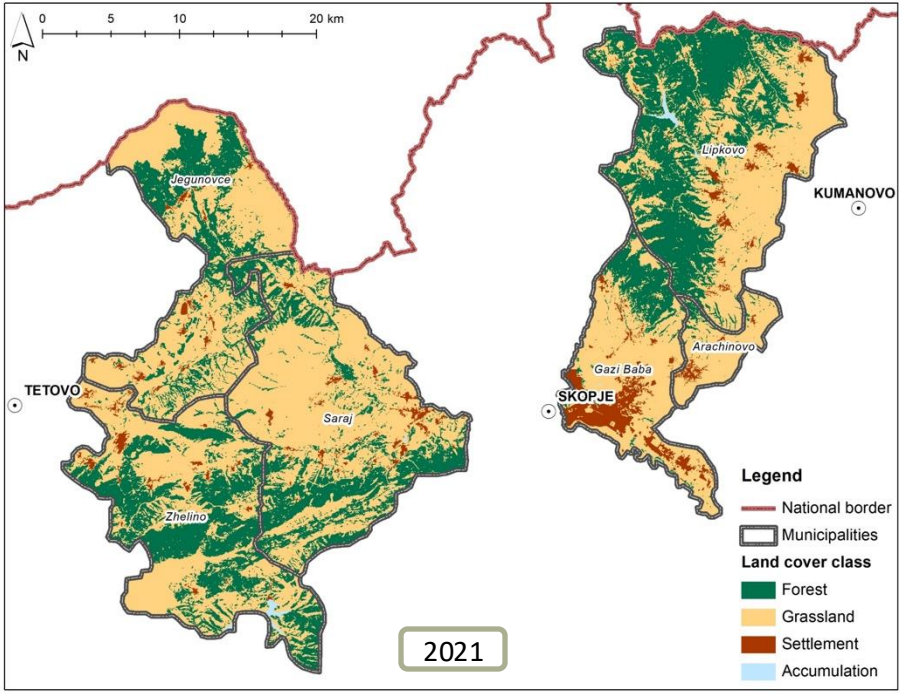
Pre-classification change detection - at the level of spectral analysis (magnitude of change and character - direction of change)

Post-classification change - method analyses the change in spatial distribution of identified land cover classes (in relation to 5 land cover classes at the level of 6 municipalities)



Land cover change assessment





The area is generally characterized ***by a low rate of change*** of 0 to 0.14

Land cover change assessment

Municipality Year	Arachinovo 1990/2021 ha	Gazi Baba 1990/2021 ha	Jegunovce 1990/2021 ha	Lipkovo 1990/2021 ha	Saraj 1990/2021 ha	Zelino 1990/2021 ha
Broadleaf forests	↑61/238	↑1401/1864	↓5670/5159	↑8659/11440	↑4602/6392	↑6488/7540
Coniferous forests			↑7/51	↑18/190	↑106/164	↑719/723
Lowland grasslands	↓2956/2763	↓7595/6826	↑9166/9595	↓14604/11528	↓17872/15986	↓12186/10869
Mountain grasslands	↓74/32	↓556/431	↓2469/2449	↓1092/1000		↓356/313
Total	**↓3090/3033**	**↓9552/9120**	**↓17312/17253**	**↓24373/24158**	**↓22580/22542**	**↓19749/19445**
Relative change (%)	- 1,9%	- 4,7%	- 0,3%	- 0,9%	- 0,2%	- 1,6%
Total relative change of the whole area						**- 1,2%**

Land cover change assessment

Highest absolute change

Observed in grasslands (-7.15%), followed by an increase in the area of forest ecosystems (+6.04%) and an increase in built-up land - settlements (+0.85%).

Highest relative change

Observed in reservoirs (+386.7%), followed by settlements (+27.1%), then forest ecosystems (+21.75%) and reduction of grasslands (-10.35%).

The highest annual rate of change

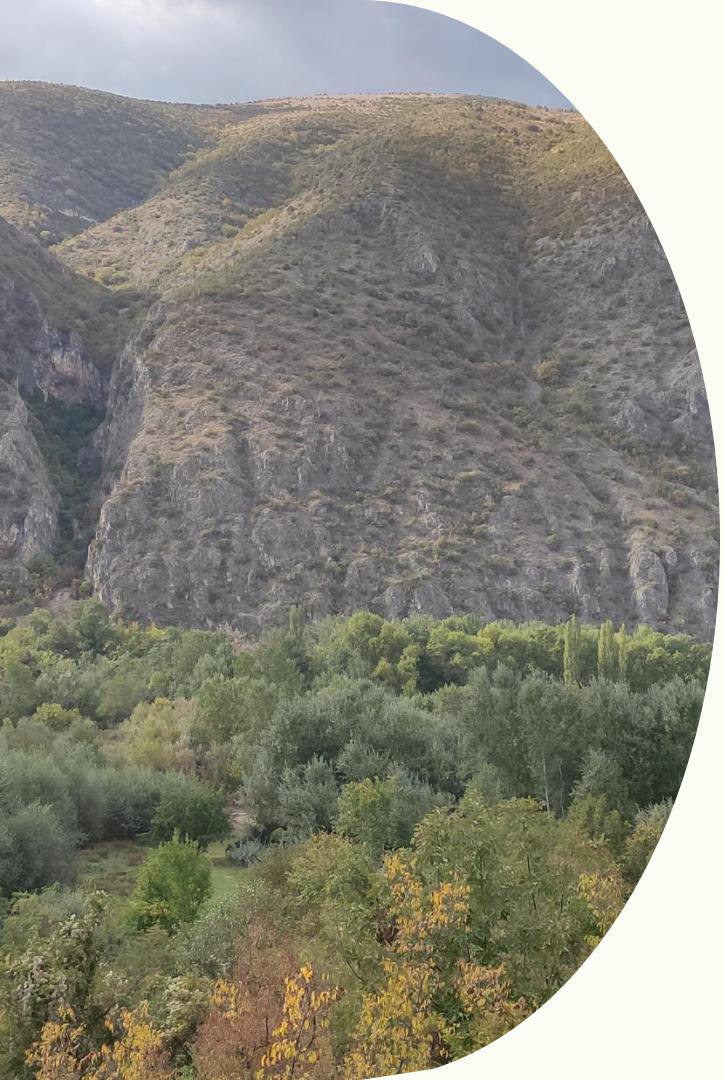
Observed in settlements (+0.77%), followed by forest ecosystems (+0.63%) and grasslands (-0.35).

The changes are most evident in rural areas

As a result of **abandonment of extensive agriculture** (fields and meadows) (-4.43%) and successive growth with coppice forests (+4.23%). In the areas of **mountain pastures**, there is a decrease in grasslands- pastures (-0.35%) and a successive increase in the area under forests (+0.36%), as a result of the **abandonment of traditional grazing and afforestation practices**.

Reduction of areas under high quality old forests

Especially in the upper part of the forest border (-0.15%)

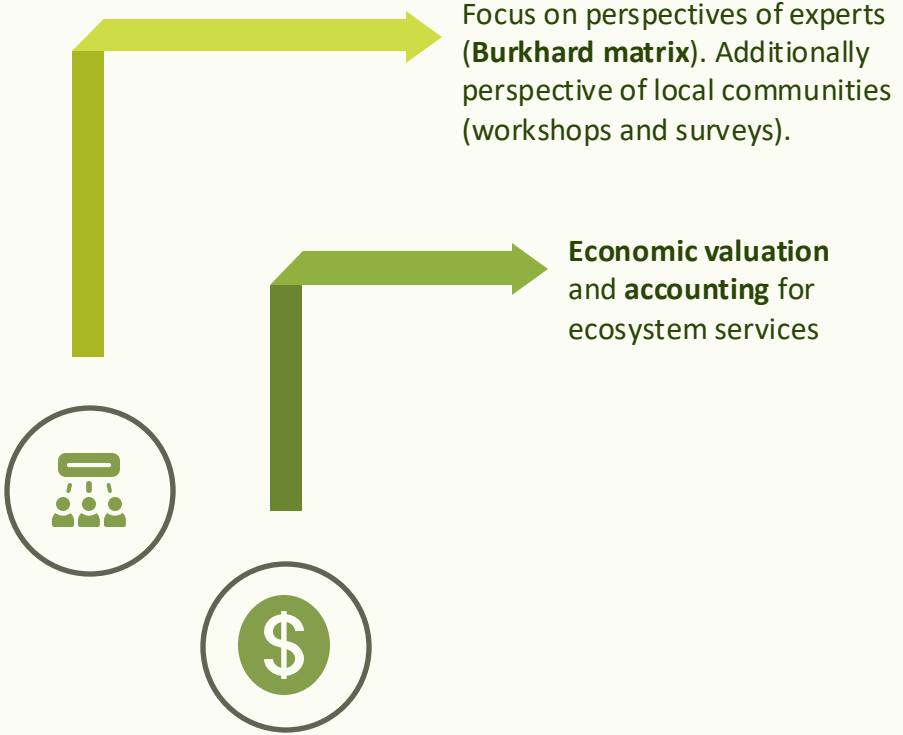


Ecosystems’ capacity to provide ecosystem services

Mapping and assessment of ecosystem services

14 ecosystem services analyzed from all three categories:

1. Provisioning
   - ✓ Food
   - ✓ Biomass (timber, firewood, stone)
   - ✓ Drinking water
   - ✓ Irrigation water
2. Regulating
   - ✓ Flood control
   - ✓ Erosion control
   - ✓ Water filtration
   - ✓ Air quality regulation
   - ✓ Climate regulation
   - ✓ Carbon sequestration
3. Cultural
   - ✓ Recreation and tourism
   - ✓ Art inspiration, spiritual enjoyment
   - ✓ Beautiful landscapes
   - ✓ Opportunities for education and science

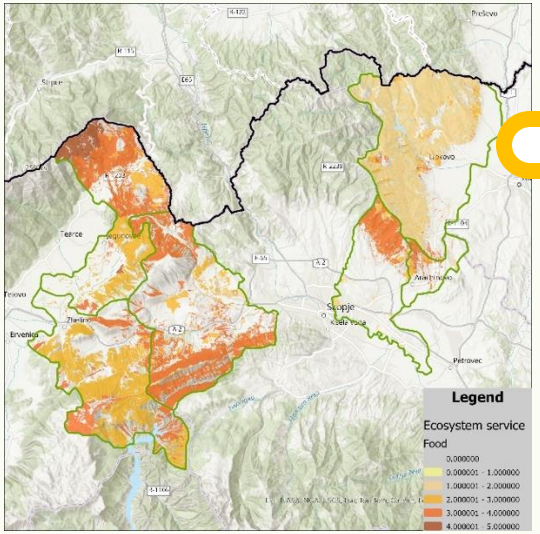


Burkhard matrix – experts assessment

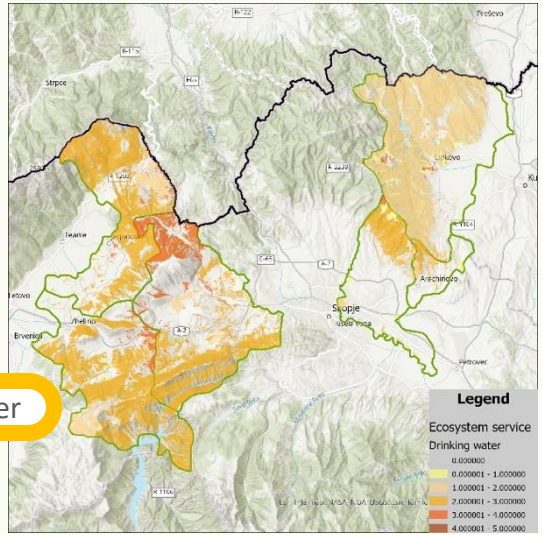
UTM	Ecosystem services																													
	Provisioning								Regulating										Cultural											
	1		2		3		4		5		6		7		8		9		10		11		12		13		14			
EM03	a	2.8	a	2.9	a	2.1	a	1.4	a	3.8	a	3.8	a	3.1	a	3.5	a	3.0	a	3.1	a	3.3	a	2.9	a	3.3	a	2.9		
	b	1.3	b	1.4	b	1.3	b	1.1	b	1.4	b	1.8	b	1.4	b	1.4	b	1.3	b	1.6	b	1.9	b	1.6	b	2.0	b	1.5		
	e	3.8	e	1.1	e	1.8	e	1.1	e	1.8	e	2.4	e	2.1	e	2.0	e	2.5	e	1.9	e	3.6	e	3.5	e	4.3	e	3.1		
EM04	a	3.8	a	4.1	a	3.0	a	2.9	a	4.1	a	4.4	a	4.1	a	4.1	a	3.6	a	4.0	a	3.9	a	3.5	a	4.0	a	3.8		
	c	1.6	c	1.6	c	1.8	c	2.3	c	2.9	c	2.6	c	2.0	c	2.0	c	2.8	c	2.1	c	2.5	c	2.1	c	2.4	c	2.8		
	d	2.0	d	0.6	d	0.9	d	0.8	d	1.0	d	1.0	d	1.0	d	1.0	d	1.4	d	1.1	d	1.9	d	1.8	d	2.3	d	2.0		
EM05	a	2.6	a	3.0	a	2.4	a	2.3	a	2.9	a	3.1	a	2.9	a	2.9	a	3.0	a	2.9	a	3.0	a	2.5	a	2.9	a	2.9		
	c	1.6	c	1.8	c	2.0	c	2.5	c	3.4	c	3.1	c	2.4	c	2.4	c	3.1	c	2.4	c	2.8	c	2.5	c	2.9	c	3.1		
	d	2.3	d	0.5	d	1.3	d	1.1	d	1.3	d	1.4	d	1.6	d	1.6	d	1.6	d	1.5	d	2.0	d	1.9	d	2.4	d	2.1		
EM06	a	3.5	a	3.6	a	2.9	a	2.8	a	3.8	a	3.8	a	3.6	a	3.6	a	3.6	a	3.6	a	4.1	a	3.1	a	4.3	a	3.8		
	b	0.8	b	1.3	b	0.9	b	0.9	b	1.0	b	1.1	b	1.1	b	1.0	b	1.0	b	1.4	b	1.4	b	1.0	b	1.4	b	1.0		
	d	1.8	d	0.8	d	0.9	d	0.8	d	1.0	d	1.1	d	0.9	d	0.9	d	1.0	d	0.8	d	1.9	d	1.4	d	1.9	d	1.9		
	e	4.4	e	1.8	e	2.3	e	1.5	e	2.8	e	3.4	e	2.9	e	2.6	e	3.0	e	2.4	e	4.3	e	3.9	e	4.4	e	3.9		
EM07	a	1.9	a	2.3	a	1.8	a	1.6	a	1.9	a	2.3	a	1.9	a	1.9	a	1.9	a	2.0	a	2.8	a	2.6	a	2.9	a	2.5		
	e	3.8	e	1.5	e	2.1	e	1.5	e	2.5	e	2.8	e	2.5	e	2.4	e	2.5	e	2.0	e	3.8	e	3.6	e	3.9	e	3.3		
EM13	a	4.0	a	4.3	a	3.0	a	2.8	a	4.0	a	4.3	a	3.9	a	3.8	a	3.8	a	3.8	a	4.0	a	4.0	a	4.1	a	4.1		
	b	2.9	b	3.5	b	2.8	b	2.1	b	3.6	b	3.9	b	3.4	b	3.3	b	3.4	b	3.4	b	3.9	b	3.8	b	4.3	b	3.9		
	c	1.0	c	1.1	c	1.4	c	1.4	c	1.6	c	1.5	c	1.4	c	1.1	c	1.5	c	1.3	c	1.8	c	1.6	c	2.0	c	1.8		
	d	1.4	d	0.5	d	0.4	d	0.4	d	0.8	d	0.8	d	0.5	d	0.5	d	0.6	d	0.5	d	1.6	d	1.5	d	1.6	d	1.4		
	e	2.1	e	1.1	e	1.1	e	1.0	e	1.6	e	1.6	e	1.1	e	1.1	e	1.3	e	1.1	e	2.4	e	2.3	e	2.6	e	2.1		
EM14	a	3.9	a	4.3	a	3.3	a	2.8	a	4.1	a	4.3	a	4.0	a	3.9	a	3.5	a	3.8	a	3.9	a	4.0	a	4.1	a	4.0		
	d	2.9	d	1.4	d	1.5	d	1.5	d	1.8	d	1.9	d	1.9	d	1.8	d	2.0	d	1.8	d	2.4	d	2.4	d	2.6	d	2.4		
	e	1.8	e	0.6	e	1.1	e	1.0	e	1.4	e	1.5	e	1.3	e	1.1	e	1.1	e	1.0	e	2.1	e	2.0	e	2.4	e	2.0		
EM15	a	3.6	a	3.9	a	3.3	a	2.8	a	3.9	a	3.9	a	3.8	a	3.5	a	3.4	a	2.9	a	3.5	a	3.6	a	3.8	a	3.8		
	c	1.3	c	1.6	c	2.0	c	2.3	c	2.5	c	2.5	c	1.9	c	1.9	c	2.4	c	1.9	c	2.5	c	2.1	c	2.4	c	2.5		
	d	4.3	d	2.0	d	2.3	d	2.0	d	2.4	d	2.8	d	2.5	d	2.4	d	2.8	d	2.4	d	3.1	d	3.1	d	3.5	d	3.6		
EM16	a	3.9	a	4.3	a	3.6	a	3.0	a	4.1	a	4.1	a	4.3	a	4.3	a	3.9	a	4.0	a	4.3	a	4.3	a	4.4	a	4.0		
	c	1.4	c	1.5	c	1.8	c	2.1	c	2.5	c	2.4	c	1.6	c	1.8	c	2.3	c	1.6	c	2.1	c	2.0	c	2.3	c	2.1		
	d	2.7	d	1.4	d	2.0	d	1.6	d	2.3	d	2.0	d	1.9	d	2.1	d	2.3	d	1.9	d	2.8	d	2.8	d	3.0	d	3.0		
	e	2.1	e	1.0	e	1.4	e	1.0	e	1.6	e	2.0	e	1.7	e	1.6	e	1.9	e	1.3	e	2.9	e	2.6	e	3.0	e	2.6		
EM17	a	2.3	a	2.5	a	2.1	a	2.0	a	2.3	a	2.5	a	2.4	a	2.4	a	2.1	a	2.3	a	2.9	a	2.8	a	3.1	a	2.5		
	d	0.9	d	0.5	d	0.6	d	0.5	d	0.6	d	0.8	d	0.6	d	0.6	d	0.8	d	0.6	d	1.0	d	1.0	d	1.1	d	1.3		
	e	2.8	e	1.3	e	1.6	e	1.3	e	1.8	e	2.1	e	1.8	e	1.6	e	2.0	e	1.5	e	3.0	e	2.9	e	3.0	e	2.4		
EM23	a	0.4	a	0.4	a	0.1	a	0.1	a	0.4	a	0.4	a	0.4	a	0.4	a	0.3	a	0.4	a	0.5	a	0.4	a	0.3	a	0.3		

UTM	Ecosystem services																													
	Provisioning								Regulating										Cultural											
	1		2		3		4		5		6		7		8		9		10		11		12		13		14			
EM24	a	3.8	a	3.8	a	3.0	a	2.6	a	3.9	a	4.1	a	3.8	a	3.5	a	3.6	a	3.4	a	3.8	a	3.8	a	4.1	a	3.8		
	b	1.8	b	1.9	b	1.5	b	1.3	b	1.6	b	1.8	b	1.5	b	1.6	b	1.6	b	1.8	b	2.0	b	1.9	b	2.3	b	1.8		
	c	1.9	c	2.0	c	2.6	c	2.8	c	3.4	c	2.8	c	2.5	c	2.5	c	3.0	c	2.5	c	3.0	c	2.9	c	3.0	c	2.8		
	d	2.1	d	1.1	d	1.4	d	1.1	d	1.9	d	1.9	d	1.9	d	1.9	d	2.1	d	2.0	d	1.9	d	2.4	d	2.5	d	2.4		
EM25	a	2.5	a	2.6	a	2.9	a	2.1	a	3.0	a	3.1	a	2.6	a	2.5	a	2.8	a	2.6	a	2.9	a	2.8	a	3.0	a	2.9		
	b	2.0	b	2.1	b	1.5	b	1.4	b	1.9	b	2.1	b	2.0	b	2.0	b	1.9	b	2.0	b	2.5	b	2.1	b	2.5	b	2.0		
	c	2.4	c	2.5	c	3.5	c	3.1	c	3.9	c	3.1	c	3.3	c	3.0	c	3.4	c	3.0	c	3.3	c	3.4	c	3.6	c	3.8		
	d	2.1	d	1.4	d	2.1	d	1.8	d	1.9	d	2.1	d	1.8	d	1.8	d	2.1	d	1.9	d	2.5	d	2.5	d	2.9	d	3.1		
EM34	a	1.5	a	1.4	a	0.9	a	1.1	a	1.8	a	2.0	a	1.6	a	1.4	a	1.1	a	1.6	a	1.9	a	1.3	a	1.6	a	1.6		
	b	1.1	b	1.1	b	0.8	b	0.8	b	0.9	b	1.0	b	0.9	b	0.9	b	0.8	b	1.0	b	1.1	b	0.8	b	1.0	b	0.8		
	c	0.9	c	1.0	c	1.0	c	1.0	c	1.5	c	1.3	c	1.0	c	1.1	c	1.3	c	1.1	c	1.3	c	0.9	c	1.4	c	1.4		
	d	1.0	d	0.6	d	0.3	d	0.3	d	0.5	d	0.8	d	0.4	d	0.4	d	0.8	d	0.5	d	0.8	d	0.5	d	0.5	d	0.6		
EM35	a	1.6	a	1.6	a	1.1	a	1.0	a	1.8	a	2.0	a	1.8	a	2.0	a	1.4	a	1.6	a	2.8	a	2.3	a	1.9	a	2.3		
	d	1.3	d	0.5	d	0.8	d	0.6	d	0.9	d	1.1	d	1.0	d	1.3	d	1.3	d	1.1	d	1.9	d	1.4	d	1.5	d	1.5		
EM37	a	1.5	a	1.8	a	1.3	a	1.0	a	1.8	a	1.9	a	1.5	a	1.4	a	1.4	a	1.5	a	1.8	a	1.6	a	2.0	a	1.7		
EM44	a	1.1	a	1.1	a	0.6	a	0.8	a	1.4	a	1.6	a	1.3	a	1.1	a	0.9	a	1.1	a	1.8	a	1.1	a	1.3	a	1.4		
	c	1.8	c	1.9	c	2.3	c	2.6	c	3.0	c	2.5	c	2.3	c	2.3	c	2.6	c	2.3	c	2.6	c	2.4	c	2.8	c	2.5		
	d	1.4	d	0.5	d	0.6	d	0.5	d	0.8	d	0.9	d	0.6	d	0.6	d	0.8	d	0.8	d	0.9	d	1.1	d	1.4	d	1.3		
EM45	a	3.6	a	3.8	a	3.0	a	2.8	a	3.8	a	4.0	a	3.4	a	3.4	a	3.3	a	3.3	a	3.6	a	3.6	a	3.8	a	3.4		
	d	2.1	d	0.8	d	1.1	d	1.0	d	1.8	d	1.9	d	1.6	d	1.6	d	2.0	d	1.8	d	2.1	d	2.0	d	2.1	d	2.3		
	e	1.3	e	0.4	e	0.5	e	0.5	e	0.9	e	1.0	e	0.6	e	0.6	e	0.9	e	0.6	e	1.0	e	0.9	e	1.1	e	1.1		
EM46	a	3.9	a	4.0	a	3.3	a	3.1	a	4.0	a	4.1	a	3.5	a	3.3	a	3.1	a	3.5	a	3.4	a	3.5	a	3.8	a	3.8		
	b	1.6	b	1.6	b	1.1	b	1.1	b	1.5	b	1.9	b	1.4	b	1.4	b	1.5	b	1.8	b	2.0	b	1.9	b	2.1	b	2.3		
	d	2.1	d	0.9	d	0.9	d	0.8	d	1.6	d	1.6	d	1.1	d	1.0	d	1.5	d	1.1	d	1.4	d	1.4	d	1.6	d	1.6		
	e	2.1	e	0.9	e	0.9	e	0.9	e	1.6	e	1.6	e	1.3	e	1.5	e	1.4	e	1.1	e	2.0	e	1.6	e	2.0	e	1.9		
EM47	a	3.9	a	4.0	a	3.1	a	3.0	a	4.1	a	4.0	a	3.8	a	3.8	a	3.8	a	4.1	a	3.6	a	3.8	a	4.0	a	4.0		
	b	1.6	b	1.5	b	1.3	b	1.3	b	1.4	b	1.8	b	1.4	b	1.5	b	1.5	b	1.6	b	2.0	b	1.9	b	2.1	b	1.9		
	d	2.3	d	0.8	d	1.3	d	1.0	d	1.9	d	2.0	d	1.6	d	1.5	d	2.0	d	1.8	d	2.3	d	2.1	d	2.5	d	2.4		
EM55	a	1.6	a	1.6	a	1.1	a	1.0	a	1.9	a	2.1	a	1.6	a	1.4	a	1.8	a	1.9	a	1.5	a	1.6	a	1.5				
	d	1.5	d	0.5	d	0.6	d	0.6	d	1.1	d	1.3	d	0.9	d	0.9	d	1.0	d	1.1	d	1.5	d	1.3	d	1.5	d	1.4		
EM56	a	1.6	a	1.6	a	1.5	a	1.4	a	2.0	a	2.3	a	2.0	a	2.0	a	1.9	a	2.1	a	2.1	a	1.6	a	1.9	a	1.6		
	b	1.4	b	1.4	b	0.8	b	0.8	b	1.1	b	1.5	b	1.1	b	1.3	b	1.1	b	1.5	b	1.6	b	1.1	b	1.6	b	1.1		
	d	1.4	d	0.5	d	0.6	d	0.5	d	1.1	d	1.1	d	0.8	d	0.6	d	0.9	d	0.8	d	1.1	d	0.9	d	1.5	d	1.1		
EM57	a	3.6	a	3.6	a	2.6	a	2.6	a	3.6	a	3.8	a	3.4	a	3.5	a	3.4	a	3.6	a	3.4	a	3.5	a	3.6	a	3.4		
	b	1.6	b	1.8	b	1.1	b	1.1	b	1.6	b	2.0	b	1.6	b	1.6	b	1.6	b	1.9	b	2.5	b	2.3	b	2.4	b	2.3		
	d	2.1	d	0.8	d	1.3	d	1.0	d	1.8	d	1.9	d	1.5	d	1.4	d	1.9	d	1.8	d	2.0	d	1.9	d	2.1	d	2.1		

Burkhard matrix – 8 experts scored the capacity of each ecosystem type represented within one grid cell for provisioning of 14 different ecosystem services. At the end, **final matrix** was produced integrating the separate matrices.

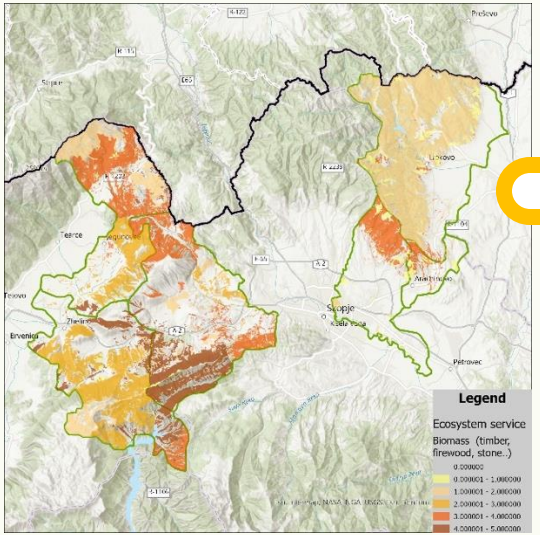


Food

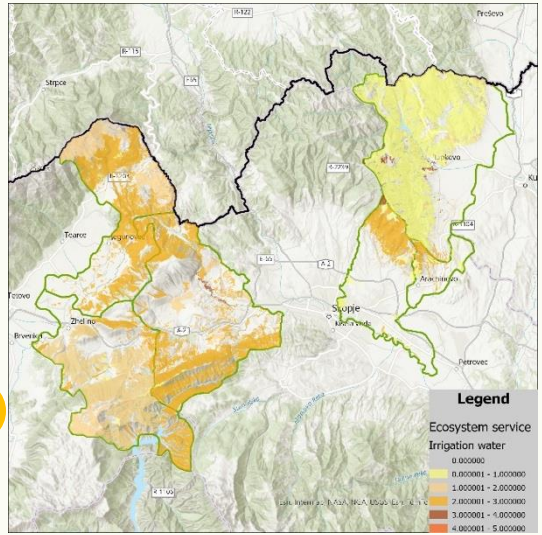


Drinking water

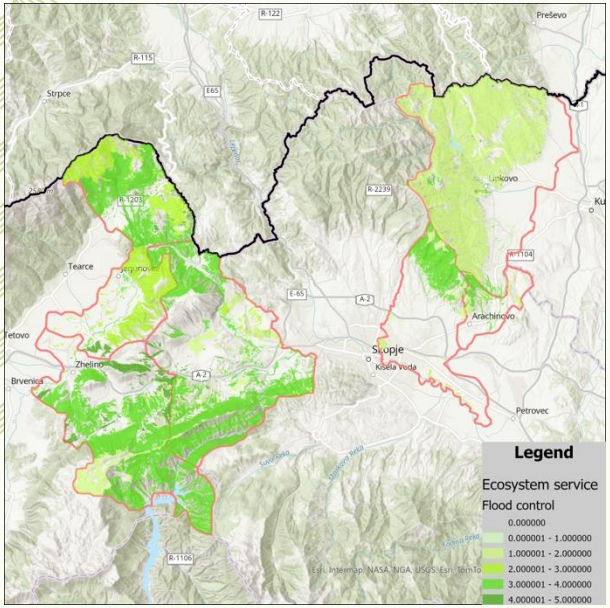
Provisioning

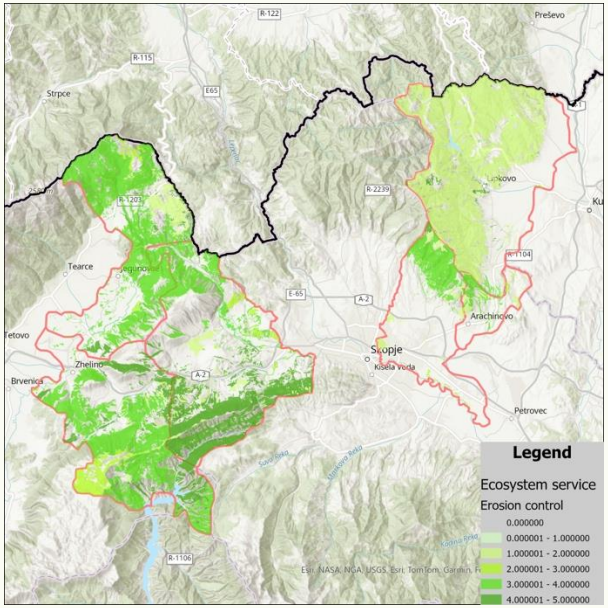


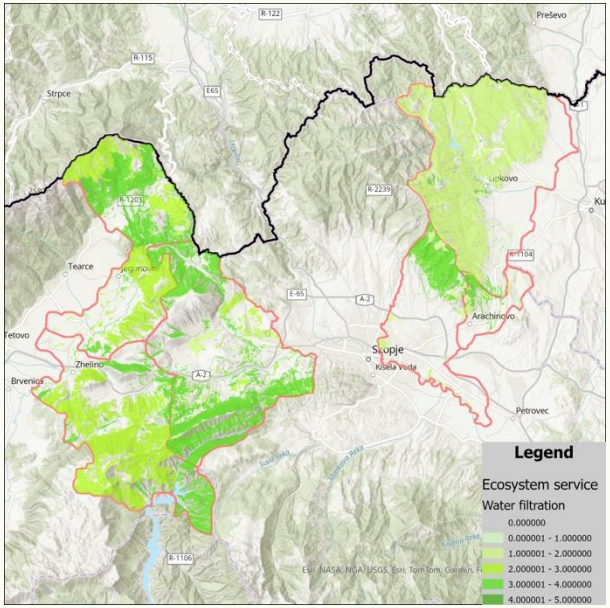
Biomass



Irrigation water





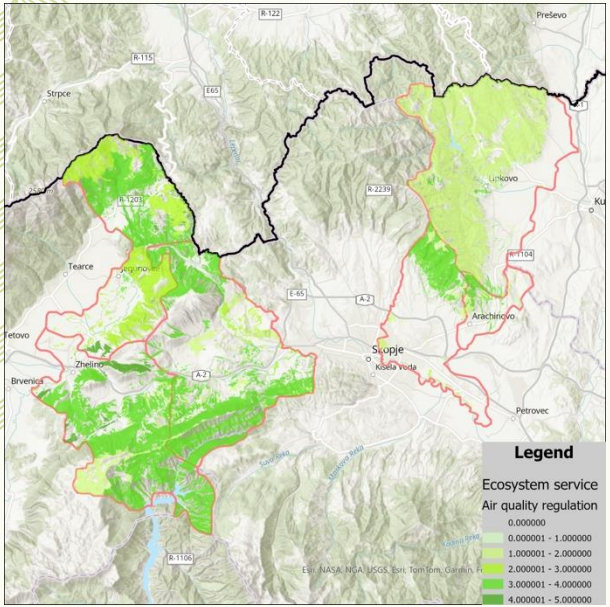


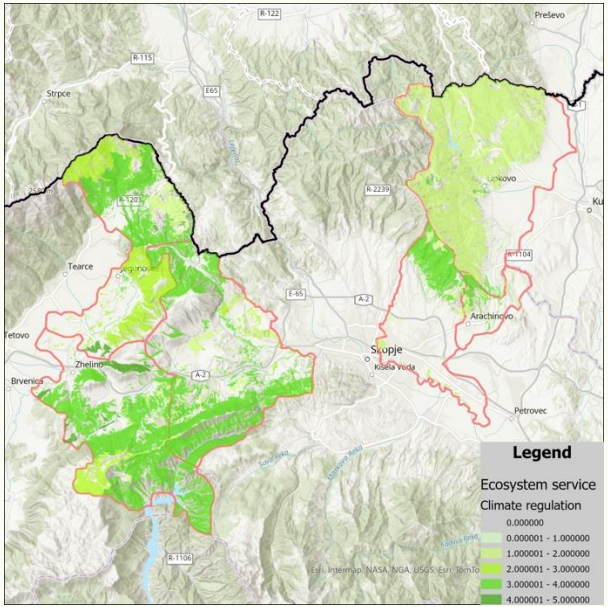
Flood control

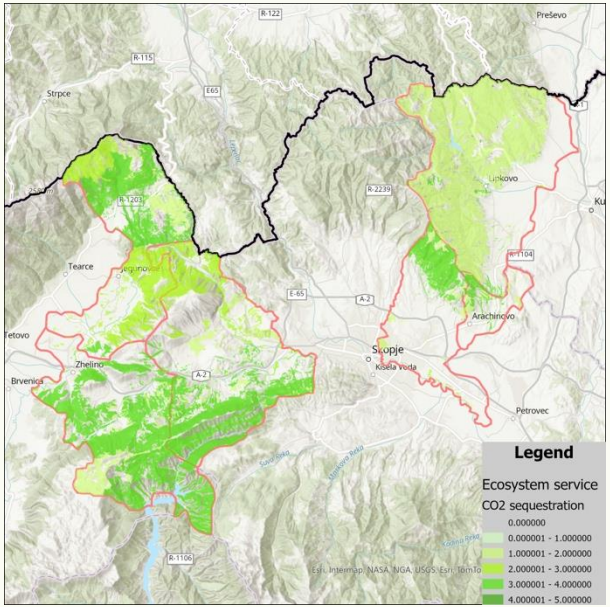
Erosion control

Water filtration

Regulating







Air quality regulation

Climate regulation

Carbon sequestration

Regulating

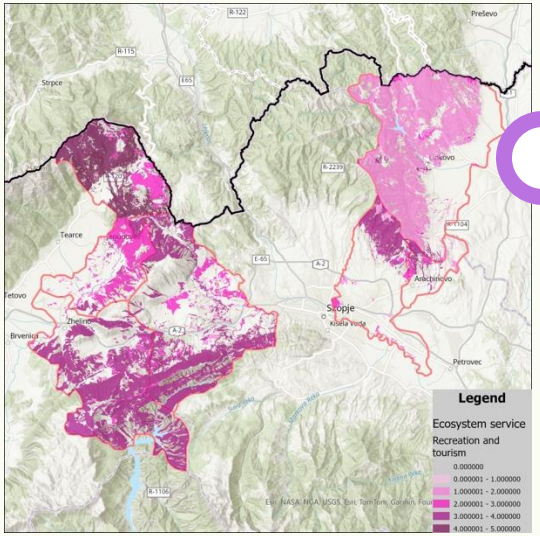
Recreation and tourism

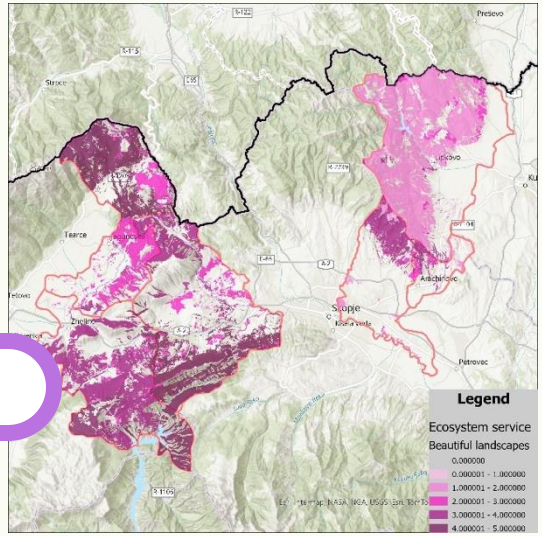
Beautiful landscapes

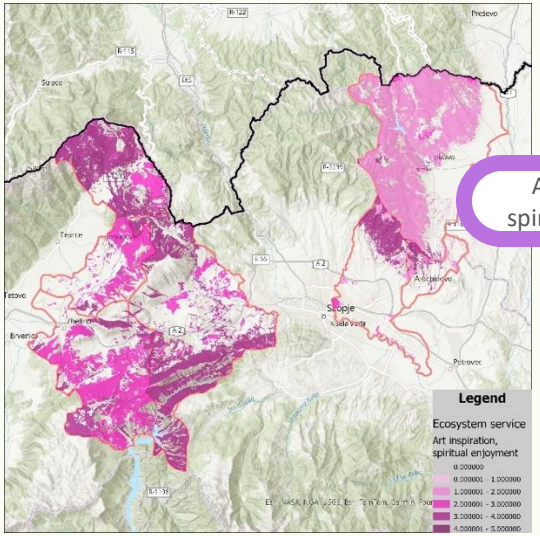
Cultural

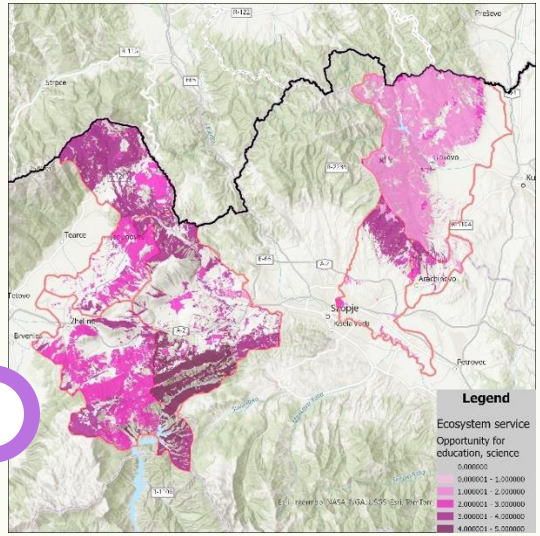
Art inspiration, spiritual enjoyment

Education, science









Economic valuation of ecosystem services

First case study where extensive economic evaluations of ESs have been made using established international methods

Total economic value (TEV) for ESs provided by forests and grasslands in six pilot municipalities

Applied value-change method with the help of scenarios, during which a projection was obtained for the monetary gains/losses from ESs for 30 years from now.

Faced with many challenges and adaptations in applying the methods and values

How to obtain economic value data in a country where there are no consistent bases?

What we managed to do and find to calculate TEV with national economic experts

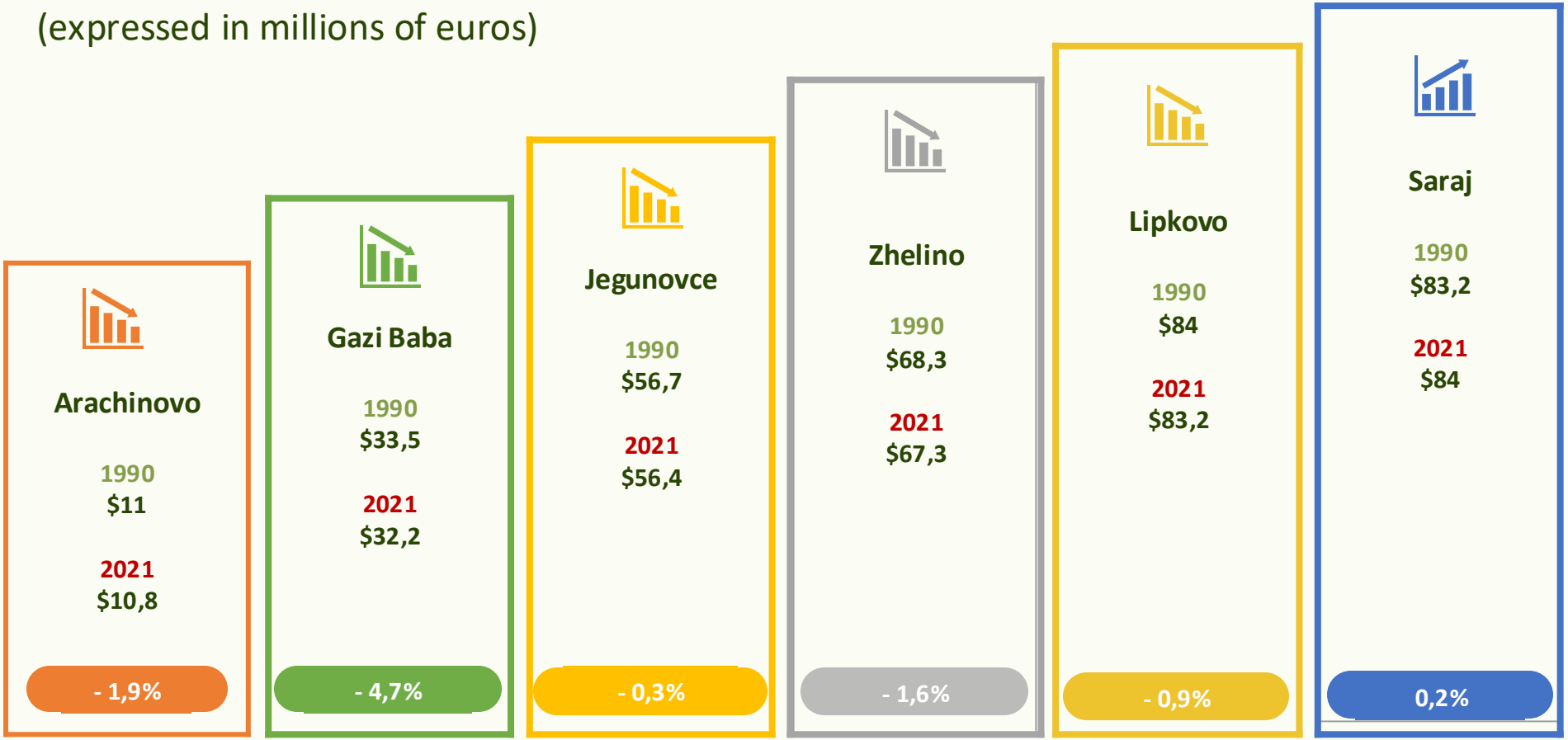
Data from the State Statistics Office, FAO and other conducted studies The available data contributed to the calculation or calibration of 7 ESs from the provisioning and regulation category with calculations expressed in EUR/ha/year

Compromise and use a combination of two sets of data – national and ESVD base

What was offered as a practical solution by the international experts involved

Due to the lack of available data for a more accurate monetary assessment of as many ESs as possible, as well as the specificity of the project, which requires a projection only for grasslands and forests, we had to refer to the suggestions given by the international experts included in the team.
Data from the ESVD database were used for those ESs for which the greatest similarities were found in already existing studies from other countries with a similar climate-geographical setting.

Total economic value of ESs provided by forests and grasslands by municipality for 1990 and 2021 (expressed in millions of euros)



Increased value of regulating services

1

Regulatory services experienced a slight increase in value (4.5%), mainly due to improvements in forest cover

This increase could potentially reduce the effects of climate change and other disturbances, be nefiting communities by reducing infrastructural and social damage, as exemplified by flooding in municipalities such as Gazi Baba an d Arachinovo in 2016.

Negative impacts

2

However, some regulatory services have reduced value, such as air quality regulation and water flow regulation, which can negatively impact communities dependent on these services for clean drinking water, safety, and health.

The loss of climate regulation has negative global effects, leading to significant damages that are challenging to restore.

Lack of information

3

Assessments are based only on changes in area, not changes in ecosystem quality

There are indications that the quality of several natural ecosystems has declined over time, which may lead to a greater difference in economic value than is currently shown

Limited data

4

The lack of data on the actual use of ecosystem services in 1990 complicates the analysis. It is uncertain whether provisioning services were used more or less, and whether regulatory services were then more or less important

These uncertainties highlight the need for improved data collection and monitoring efforts to better understand changes in ecosystem services over time

Scenarios development

Normative scenarios – BaU vs Green scenario

NPV – net present value for the period from 2021 to 2050

The net present value is calculated based on two scenarios or development options – BaU vs. Green

To calculate the NPV, changes in the area of the 4 ecosystems as well as the provisioning capacity had to be taken into account. For both, an annual rate of change was modeled with a time horizon of 30 years (between 2021 (t=0) and 2050 (t=29)).

NPV is calculated using projections of the annual flows of the total package of ecosystem services from a given ecosystem (ie, TEV) over 30 years at a specified discount rate.

The discount rate expresses the preference between the value of money today and in the future. A high discount rate means we place a lower value on future costs and benefits For the purposes of this study we used a discount rate of 5%

It is not possible to proceed with analyzes of net present value and creation of scenarios, without prior good organization of ESs, monetary valuation and calculation of TEV

Main findings from both scenarios in monetary units

Overall, the net present value from 2021 to 2050 is over **USD 3.8 billion** for the "business as usual" scenario and nearly **USD 3.85 billion** for the "green" scenario

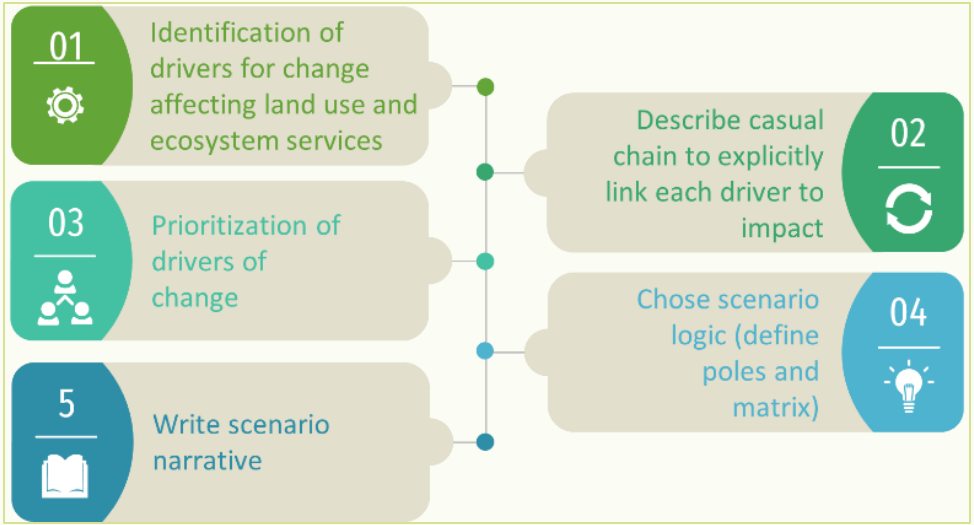
The green scenario increases the NPV by approximately $40 million (1.1%) over 29 years, with an approximate increase of $1.4 million per year

The difference in NPV is positive for most ecosystems, indicating that expanding natural land cover and improving its quality is beneficial to the communities involved.

Coniferous forests are the only ecosystems for which the total value decreases by 0.2%.
This reduction is persistent.
The green scenario is countered by a larger reduction in coverage, but it is still shown that the size of the coverage affects the ESs value more prominently than the increase (doubling) of quality.

Exploratory scenarios

- Participatory process that made it possible to hear the perceptions, perspectives, interests and values of the various interested parties in relation to the further development of the municipality.
- At the same time, it was possible to strengthen the capacities and increase the awareness of interested parties about what they could gain and what they could lose in terms of ecosystems and services that are obtained from them according to the different scenarios.
- An exercise that creates space for open discussion, facing specific problems, identifying possible solutions, initiating collaborations and synergies, etc.



Conclusions and recommendations

- ✓ In North Macedonia, both urban and rural land can be semi-natural to natural!
- ✓ 13 natural ecosystems in an area only 30 km from Skopje!
- ✓ Ecosystems are subject to continuous changes due to various pressures, necessitating regular updates to the mapping of ecosystem types to reflect current conditions accurately.
- ✓ Broadleaf forests in areas such as the Multipurpose Area Jasen and Suva Gora Mountain show excellent condition, thanks to limited anthropogenic pressure and conservation efforts.
- ✓ Coniferous forests, mainly planted for erosion control programs, show very poor to poor condition, particularly in areas where they were artificially planted

Regular updates

Priority areas for conservation

Addressing anthropogenic pressures

- ✓ The municipalities of Jegunovce, Zhelino, and Saraj have higher capacities for Food, Materials, Drinking Water, and Irrigation Water. The distribution of these services is largely influenced by the presence of forests. For example, Carbon Sequestration and Erosion Control follow the distribution of forests, with Saraj municipality showing the highest capacity for Erosion Control.

  → **Focus on forest conservation and restoration**

- ✓ Land cover change assessment highlights the complex interplay between land management practices, urbanization, and ecological changes, emphasizing the need for sustainable land management strategies to mitigate negative impacts on biodiversity and ecosystem services

  → **Sustainable urban planning**

  Sustainable tourism

- ✓ Including all ecosystem services in these impact assessments is essential to understand the full importance of nature to people

  → **Integrated ecosystem services assessment**

- ✓ Monetary valuation of ES shows the substantial benefits humans receive from nature
- ✓ From 1990 to 2021 the monetary value in almost all municipalities decreases, indicating a lack of protection
- ✓ Regulating ecosystem services are most valuable and provide the largest societal welfare, but are usually invisible or ignored
- ✓ It is important to note that nature has non-instrumental and intrinsic values and that economic valuation as has been conducted in this report should be seen as an additional piece of information in decision making, not a replacement of these non-monetary values.

Prioritizing conservation efforts and assessing the cost-effectiveness of different management strategies

Recognition of regulating ecosystem services

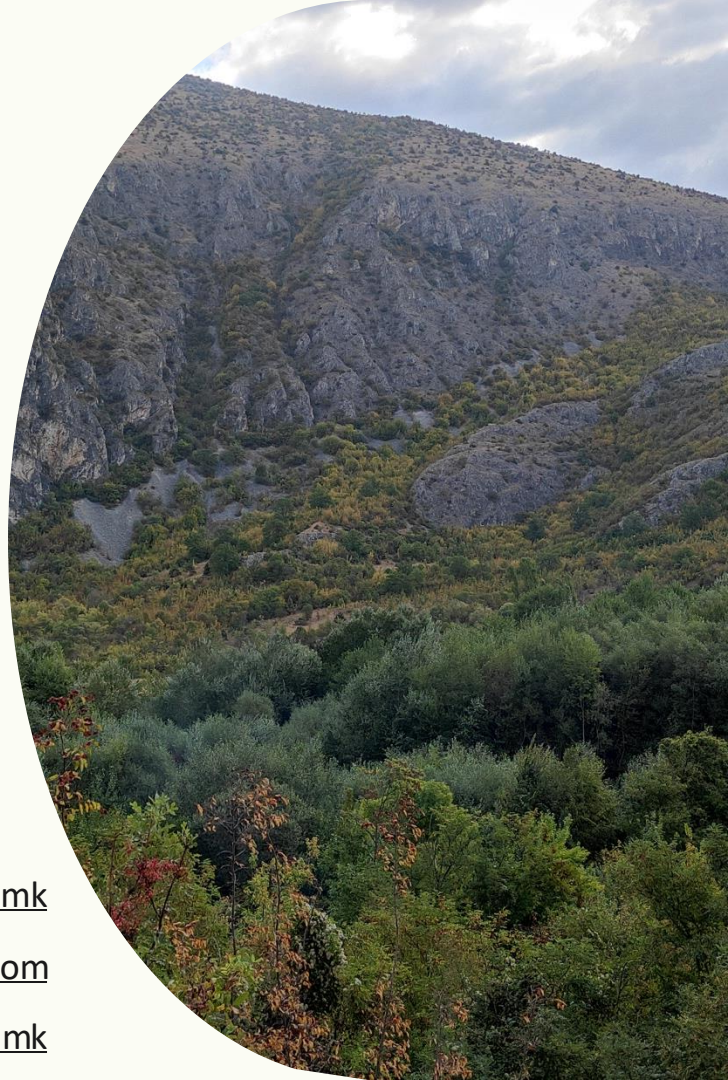
Incorporating non-monetary values

But also…….

- **Addressing data limitations and uncertainties**
- **Continuously evaluating the outcomes of different scenarios and learning from experience**
- **Tradeoff and synergies**
- **Capacity building and raising public awareness**

Investing in nature pays off!

Thank you
Danke schön
Ви благодарам!



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