

Increasing the uptake of ecosystem services research in decision-making and education: Follow-up discussion on the “Twenty years of ecosystem services research in Bulgaria”

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Abstract

Ecosystem services research in Bulgaria has been actively studying different aspects of this concept and its implementation. Although it is widely recognizable, the concept has still not been sufficiently implemented in Bulgaria’s decision-making process. Following the European and global initiatives for implementing biodiversity and ecosystem services (BES) into the decision-making process, we have identified the stakeholders’ perceptions regarding the possible initiatives for improving the uptake and the lack of sufficient education program coverage within secondary and higher education. In this short communication, we suggest practical priorities for the future development of BES activities enabling the uptake in Bulgarian education and policy.

Key words: Geography, IPBES, IPCC, policy, school, seeds of change, training, university

1. Background

A recent review paper presents an overview and analysis of the development of ecosystem services (ES) research in Bulgaria for the last two decades. In their work titled “Twenty years of ecosystem services research in Bulgaria: lessons learned and future directions from a geographical perspective” Nedkov et al. (2024) identify both achievements and research gaps in the ES studies conducted by Bulgarian geographers. Based on a broad literature review, and data analysis of the publications according to different characteristics (studied ES, methods used, presence or absence of international collaboration, etc.), the authors defined the main research priorities of the coming years which can trace the future directions of ES research in the country. Among the key research priorities, Nedkov et al. (2024) highlighted (i) the development of the spatial aspects in the methodological frameworks for mapping and assessment of ES, (ii) better use of GIS-based tools for mapping ES alongside models’ integration, and (iii) improvement of the publication’s quality and increase of the papers published in highly rated indexed journals.

Several global and European initiatives make the follow-up discussion on practical priorities imperative. Two decades of research legacy including national mapping and assessment of ecosystem conditions and services (MAES

framework; Maes et al. 2013) is a solid base that can be used for further development of more practical activities. With the recently adopted Nature Restoration Law (Regulation 2024/1991), along with the EU Biodiversity Strategy by 2030 (European Commission 2020), and the United Nations (UN) initiative on Sustainable Development Goals (UN 2015) questions for increasing the uptake in policy and practice are becoming hot topics among practitioners working on the biodiversity and ecosystem services (BES) field. The knowledge generated from the BES research can significantly contribute to tackling the five major drivers of the nature crisis globally (IPBES 2019, 2022) including climate change, pollution, land use change, invasive alien species, and overexploitation of resources.

Two important actions can contribute to increasing the uptake in policy and practice: individual involvement (JENA declaration 2024) and education for sustainable development at all levels. A key role in those practices is devoted to Geography as a long and distinguished research discipline and teaching human-environment relations (Meadows 2020). Encyclopedia Britannica (Johnston 2024) defines Geography as the study of the diverse environments, places, and spaces of Earth's surface and their interactions because it answers why things are as they are, and where they are. Those two answers are critically important when fighting the five major drivers of nature crisis globally. The importance of Geography for sustainability was recognized by the International Geographical Union (IGU) (Meadows 2020) and it is being implemented through its commissions and task forces. In this regard, lead geographers have discussed the possible contributions of geographical education to sustainability (Burbules et al. 2020; Fu 2020; Fu et al. 2021; Žalėnienė and Pereira 2021; Fu et al. 2022; Xu and Peng 2024) underlining its rapid high-technological development in geospatial systems and complex interdisciplinary studies in the era of Anthropocene (Gönençgil and Meadows 2024).

With that piece, we aim to explore the possibilities of increasing the uptake of BES research into policy and practice nationally. Achieving that aim will allow us to draw follow-up practical priorities for researchers and practitioners based on Nedkov et al. 2024 and contribute to the initiatives of IGU. In particular, we will analyze the visibility of the ES concept in the Bulgarian educational system and policy-making as an example through stakeholder consultation and literature review.

2. On the (in)visibility of ecosystem services concept in Bulgaria

This section presents the current state of ES coverage in Bulgaria in three aspects: stakeholders' perceptions about the concept's visibility in policy and society, the teaching of ES in schools and universities, and the practical usage of ES knowledge in policy. We used different sources of information to check whether the ES concept is well presented or not. For instance, we performed direct talks with stakeholders and searched online sources, educational programs, and literature.

2.1. Stakeholders perceptions

The stakeholder consultation was performed as part of the first thematic workshop of the EU-funded SELINA project held in Sofia, Bulgaria in March 2023 (SELINA 2023). Representatives from different Bulgarian science, business

and governmental institutions participated in an open talk aiming to identify the barriers and enabling factors for transformative change. All stakeholders identified several barriers and challenges to the successful integration of BES. Some of them highlighted (i) the lack of collaboration between different institutions, as well as between different individuals from science, business, etc.; (ii) the lack of capacity and political will, which was elaborated as a lack of political consensus regarding the goals, as well as (iii) a lack of knowledge in the legislative institution which induces the lack of involvement of stakeholders and real uptake. Another identified challenge is (iv) the lack of media coverage or poor science communication that obstructs the further implementation of BES.

The stakeholders identified several topics and initiatives for further facilitating the uptake of BES (Fig. 1). The key ones are education and the perspective for further implementation of BES into educational programs in Bulgaria, as well as additional training of school teachers and their knowledge of BES. Another topic related to the abovementioned is that Bulgarian schools need to be identified as stakeholders to fully participate and integrate into the process. Overall, the two main identified ways that could help the uptake of the BES into decision-making, identified by the stakeholders include the integration of the existing networks aiming to put ES into practice; and the integration of BES topics into the education process.



Figure 1. Topics and initiatives identified by Bulgaria stakeholders to further facilitate the BES uptake.

2.2. Overview of formal educational programs

The ecosystem services concept is being incorporated into different educational levels in Bulgaria, predominantly, in university master programs and specialized courses for PhD students. The following subsections present an overview of the state of the art.

2.2.1. Secondary education

We have reviewed the newly updated secondary educational programs for “Geography and Economy”, implemented in Bulgaria and starting from the school year 2024/2025. “Geography and Economy” starts as an independent subject from the 5th grade until the 10th grade for general education and after that, there is professional education in the 11th and 12th grades (MES 2023a). In 8th and 9th grade, students should know how to assess the environmental resource potential of the Earth and how to define the concept of sustainable development and explain global challenges (MES 2023b, 2023c). There are two other themes for the natural resources. The first one addresses exploring natural resources, as well as their geospatial distribution. The second theme considers the global challenges of our time (MES 2023b, 2023c), which includes the definition of the so-called resource-energy problem, as well as the environmental problem and how to resolve it. The students should also know what is the sustainable development concept (MES 2023b, 2023c). Overall, the term “ecosystem services” is not included in secondary educational programs.

2.2.2. Higher education

The concept of ecosystem services is introduced in university programs mainly as part of the Landscape Ecology discipline, but it has relatively limited coverage. It is introduced most likely as a dedicated lecture within the bachelor’s geographical programs in Sofia University “St. Kliment Ohridski” (Sofia University 2024a) and “St. Cyril and St. Methodius” University of Veliko Tarnovo, and Bachelor’s program “Ecology and Environmental Protection” at South-West University “Neofit Rilski” (2024a) and Konstantin Preslavsky University of Shumen (2024a).

All universities offer master’s programs that are being studied as a geographical discipline (under the 4.4. Earth Sciences research area) and have at least one specialized course about ES or a dedicated lecture within another discipline. Sofia University has a Master’s program “Landscape Ecology and Natural Capital” (Sofia University 2024b), in which the ecosystem (landscape) services are included as part of a specialized module for “Natural capital”. South-West University (South-West University “Neofit Rilski” 2024b) has a master’s degree

Table 1. Number of disciplines and courses devoted to ecosystem services at each level of higher education in Geography (Konstantin Preslavsky University of Shumen 2024a, 2024b; Sofia University 2024a, 2024b; South-West University “Neofit Rilski” 2024a, 2024b). Numbers with * refer to ES-related disciplines and courses where the term “ecosystem services” is not explicitly stated.

Institution	Bachelor	Master	PhD
Sofia University “St. Kliment Ohridski”	1*	1	1*
South-West University “Neofit Rilski”	1*	1	0
“St. Cyril and St. Methodius” University of Veliko Tarnovo	1*	0	0
Konstantin Preslavsky University of Shumen	2*	0	0
National Institute of Geophysics, Geodesy and Geography at the Bulgarian Academy of Sciences	0	0	1

in “Ecology and environmental protection” including a specialized course titled “Ecosystem services”. On the other hand, Konstantin Preslavsky University of Shumen (2024b) has a master’s degree in “Ecosystem management and conservation”, which is identified as a biological discipline while registered and accredited under the 4.3. Biological Sciences research area.

2.2.3. PhD courses

Sofia University has a specialized course for ES within the PhD program “Physical Geography and Landscape Ecology”.

The National Institute of Geophysics, Geodesy and Geography at the Bulgarian Academy of Sciences (NIGGG–BAS) is a research institute that does not offer bachelor’s or master’s degree programs. However, it offers specialized courses for ES within the PhD program “Physical Geography and Landscape Ecology”. The NIGGG–BAS has one special course throughout the Training Center of the Bulgarian Academy of Sciences for PhD students dedicated to different ES titled “Spatial analysis and assessment of ecosystem services using GIS-based tools” (Training Center of BAS 2024). The same course is adapted for master students in the English language and taught under different international exchange programs. Still, it is more or less introductory and focused on PhD students without or with little background in the field.

The other three universities—South-West University, University of Veliko Tarnovo, and Shumen University—do not offer specialized ES courses within their PhD programs covering Physical Geography and Landscape Ecology.

2.3. Overview of policy-related activities

Ecosystem services knowledge in Bulgaria is being incorporated in two directions. One is the national legislation and regional development plans. Another is the IPBES membership and involvement in Platform’s work program.

Bulgaria has officially implemented the ecosystem services concept in different legislative documents both on national and regional scales. For instance, nine types of public ecosystem benefits of forest areas and six ecosystem functions are specified in the Forestry Act (Bulgarian Law Portal 2024). Additionally, a pilot functional zoning of forests based on the law was done for the management plans in three out of 28 districts in the country—Montana, Smolyan, and Dobrich districts. The integration of cultural ecosystem services into forest-related legislation was proven as a useful tool at different levels of employment, education and cultural training (Zhiyanski et al. 2021). In 2023 the amendment to the Biodiversity Act in Bulgaria was adopted.

Bulgaria became an IPBES member in 2017 (IPBES 2017) and since then actively participated in different activities (capacity building workshops, assessment preparation, etc.). As a member state of the UN Region of Eastern European states, Bulgaria is eligible to nominate experts for different IPBES roles. Four experts participated in three assessments so far—one was a review editor of the Scenarios and models assessment adopted in 2016, another was a scoping expert for the Regional assessments, and two are lead authors in the ongoing Business and biodiversity assessment. One expert participated in the Biodiversity and Pandemics workshop held in 2020 (IPBES 2024a).

Potentially positive examples of urban planning and development at a local scale in Bulgaria are the two municipalities of Sofia and Burgas. Several BES-related projects and studies have been developed in recent years mainly about studying the effect of urban heat islands (UHI) (Sofiaplan 2019; Dimitrov et al. 2024), air quality regulation (Sarafova 2021; Borisova et al. 2024), and habitat maintenance (Semerdzhieva and Borisova 2021).

3. Ways forward: Discussion on the potential uptake of ecosystem services knowledge

3.1. Education priorities

The ecosystem services concept could be implemented in education via non-formal educational activities (extra-curriculum) led by trained experts. Evidence that researchers from academia have the highest potential to initiate such activities is drawn from the review of Nedkov et al. (2024) and the overview of the existing educational programs in this short communication. In particular, geographers from the Bulgarian Academy of Sciences and Sofia University could contribute most to the process, while they have already well-established courses for master's and PhD students. This contribution can be made in at least two directions—first by organizing non-formal educational activities with invited secondary schools, and second by developing training and workshops for school teachers. Similar trainings have already been implemented by university lecturers for non-formal activities on climate change topics (Sarafova 2023). Further training activities for students and teachers on BES could be supported by existing networks for researchers in Geography and BES, such as the Bulgarian Geographical Society, and the Bulgarian National Network at Ecosystem Services Partnership. Moreover, the process could support the uptake of relevant IPBES assessments (IPBES 2021) and make the bridge between school and university education (Hackenburg et al. 2023) especially if implemented in collaboration with representatives from the Eastern European states region.

Several approaches for ecosystem services research could be adapted for training secondary school students and teachers. The matrix approach as a universal assessment method and simplified mapping procedures in commercial and open-source GIS apps could be used as a starting point for developing such educational activities.

Additional efforts could be made to communicate and promote the BES concept with relevant decision-makers (e.g. the Bulgarian Ministry of Education and Science). These efforts can potentially end as a renewal of the formal educational programs to better align the school textbook contents with the relevant topics of BES and climate change, and support global initiatives for sustainability.

3.2. Decision-making priorities

Although Bulgaria had several experts, who participated in the IPBES, the Eastern European States region, of which Bulgaria is part is still not sufficiently presented within the network (Báldi and Palotás 2021). Further expanding the participation of Bulgarian researchers and scholars on different levels and dif-

ferent roles, within the IPBES would be beneficial for increasing visibility of the BES concept and its implementation in Bulgarian practices.

The generated experience from the Sofia and Burgas municipalities' works on the diverse aspects of ecosystem services and their implementation into urban planning should be taken into account in the decision-making on the local level and should be expanded into different ecosystem services, specific to each urban area. Such activities could highly contribute to the ideas of better integration between climate change, biodiversity and ecosystem services following the efforts of closer collaboration between IPCC (Calvin et al. 2023) and IPBES (2024b) as the biggest science-policy platforms on these topics. Extremely sensitive to the impact of climate change are ecosystems in mountain regions which necessitates the implementation of the National Climate Change Adaptation Strategy (Nikolova et al. 2021).

4. Key message

Increasing the uptake in decision-making and education necessitates coordinated activities on different levels across a wide range of stakeholders. A dedicated community of practice could enable the sustainable uptake that potentially leads to transformative change in policy and society. That community of practice will serve as a coordinator and communicator of biodiversity and ecosystem services knowledge through its members, who come from academia, business, policy, and society. Joint activities on education and training at all possible levels should be made to align with the relevant UN's SDGs, IPCC, and IPBES work programs in securing a better and sustainable world.

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Additional information

Conflict of interest

HP is the Managing Editor of JBGS, and VS is a Copy Editor. All co-authors are members of the Bulgarian Geographical Society.

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Author contributions

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Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.