Ecosystem Services

Nature provides a wealth of services (ecosystem services - ES) to our economy and society, from the supply of food, clean air and water, to the regulation of the climate and protection against natural disasters. Without those services, life as we know it would not be possible. However, nature also has value in its own right, independent of human uses. This "intrinsic value" means that nature has value even if it does not directly or indirectly benefit humans. Provisioning Services consist of material products and goods received from ecosystems that are essential for human life e.g. nutrition, material and energy, more precisely biomass for nutrition, utility biomass, genetic resources, materials for energy, abiotic material including drinking water and water for non-drinking purposes, etc. (Mederly et al. 2020).

Regulation and Maintenance Services represent the benefits of regulating natural processes in ecosystems and the provision of other services such as regulation/mediation of flows (mass, liquid and gaseous), regulation of climate and air, regulation/moderation of natural disasters, regulation of pests and diseases, soil formation, regulation of life cycles, water cycles, etc. (Mederly et al. 2020).

Cultural Services describe all the non-material, and normally non-consumptive, outputs of ecosystems that affect the physical and mental states of people. This includes cultural identity and heritage, spirituality and religion, knowledge systems and education,

aesthetic experience, recreation and ecotourism and sense of place (Preston & RaudseppHearne 2017).

Slovakia

State of the Art on a national level

In Slovakia, the idea of ecosystem services, which refers to the benefits we get from nature, is still relatively new and not widely put into practice. The basic legal framework for nature protection is outlined in Act No. 543/2002, which was the first to define ES at a national level. This framework has been updated over time and now includes the concept of ES in various policies, including the Environmental Policy Strategy for Slovakia 2030. Even the Fisheries Act has recently incorporated the ES idea to help protect fish. Although this approach is gaining ground in Slovakia, it is mostly driven by international agreements. The next step is to expand it beyond just nature protection to other areas like land management, urban planning, and environmental impact assessments, which are crucial for securing EU funding.

The capacity of Slovakia's landscape to provide ES (as shown in Fig. 1 & 2 below) is highest in natural and semi-natural areas like forests, wetlands, grasslands, and agricultural land. Forests, covering over 38% of Slovakia, are particularly important in delivering ES. This research shows the vital role of mountainous and sub-mountainous areas in the country, especially in maintaining the health of ecosystems.

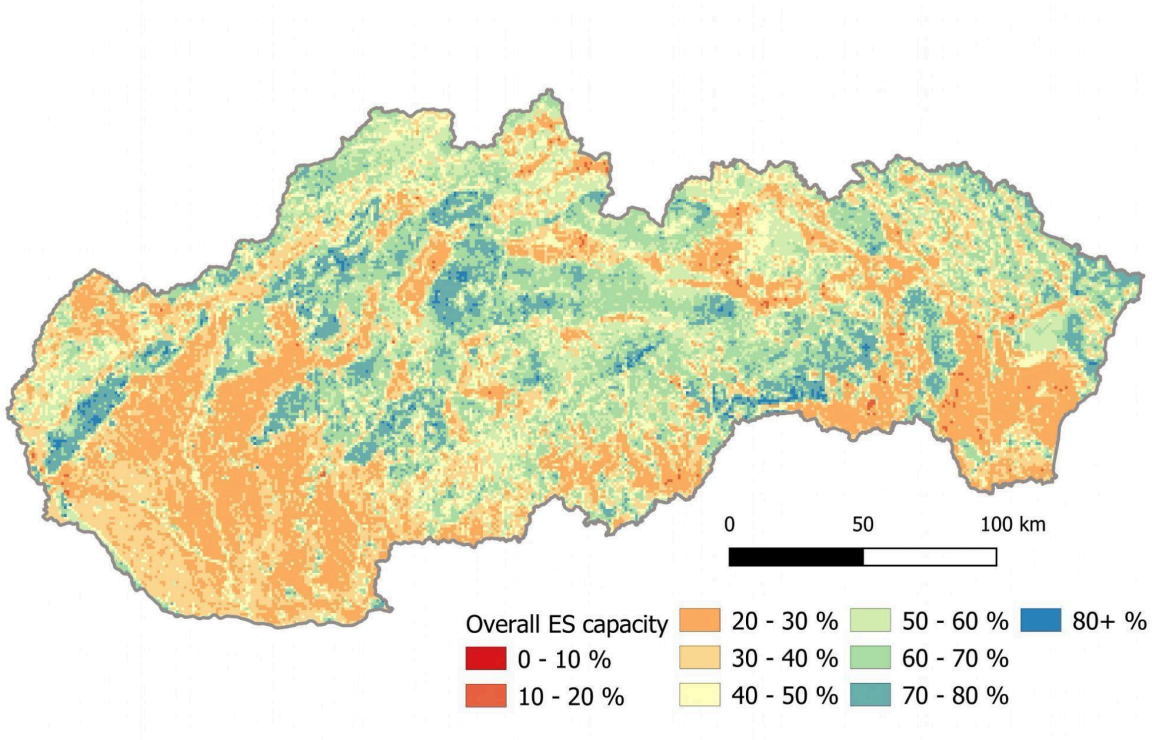

Fig. 1: The overall capacity of Slovakia’s landscape to provide ecosystem services (Mederly et al. 2020).

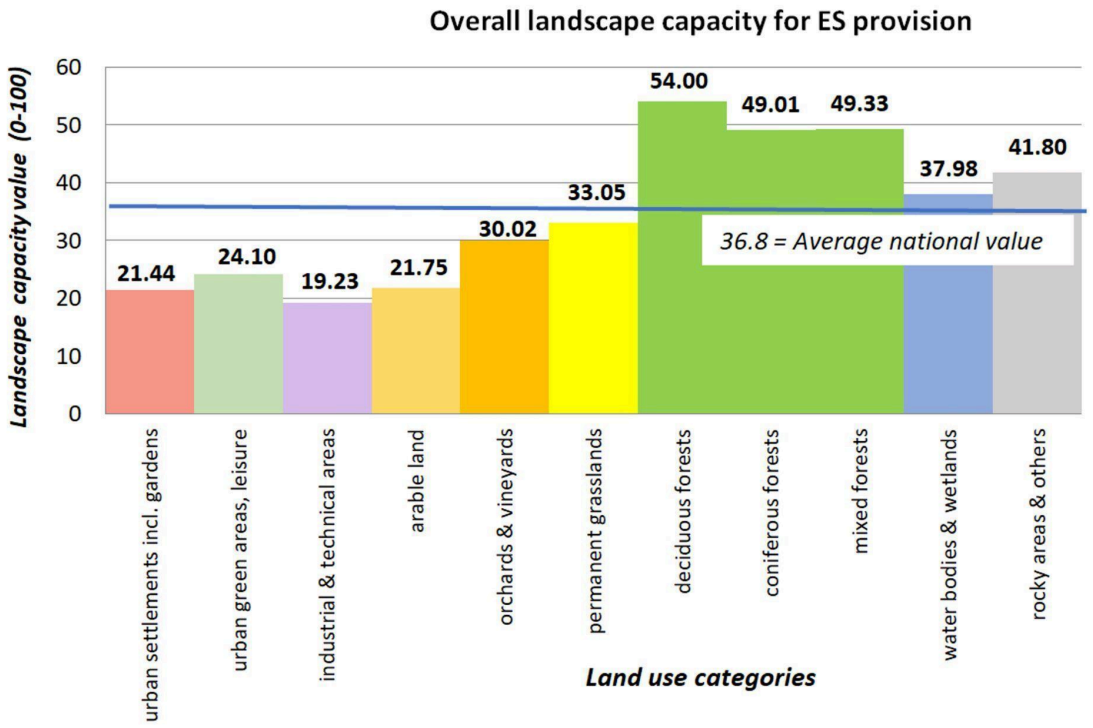

Fig. 2: The overall capacity of Slovakia's landscape to provide ecosystem services based on land use categories (Mederly et al. 2020).

Research on how ES are integrated into landscape planning at national, regional, and local levels shows significant issues. A study found that current planning often contradicts the goal of protecting nature, and the ES concept is generally missing from planning tools. The study suggests adopting an integrated approach based on ES, which could improve how decisions are made and balance human needs with the preservation of nature.

A pilot study on agroecosystem services (the benefits of farming and agriculture) was done to support Slovakia's National Biodiversity Strategy for 2020. The study carried out at seven locations across the country, found that agroecosystem services vary by geography, climate, and soil type. This research helps to better understand and manage agricultural land for long-term sustainability.

Ecosystem Services in Protected Areas

Protected areas in Slovakia play an essential role in conserving nature. A study assessed how Slovakia's ecosystems support species and biodiversity. The research found that **natural and semi-natural areas**, especially those in protected areas, are crucial for maintaining species diversity and the genetic health of plants and animals. Slovakia's national parks and other protected areas are vital tools for conserving the country's landscapes and biodiversity.

However, simply designating areas as protected isn't enough to stop biodiversity loss. Management plans must be developed for each protected area, and actions must be taken to ensure the survival of species and ecosystems. Protected areas also provide important economic and social benefits, such as recreation, tourism, and other ecosystem services that contribute to people's well-being.

Ecosystem service Supporting species and ecosystem diversity most significantly supports nature protection/conservation - this is evident in Fig. 3, which shows the relationship between the capacity of nature to provide this ecosystem service (axis y 0-70) and the importance of the area in terms of nature protection (axis x categories I-V). In line with Slovakia's goals for protecting nature and landscapes, the main benefit of this ecosystem service is improving conditions to help preserve the genetic diversity of plants and animals. It also supports the creation of suitable habitats and provides enough food and shelter for migrating species.

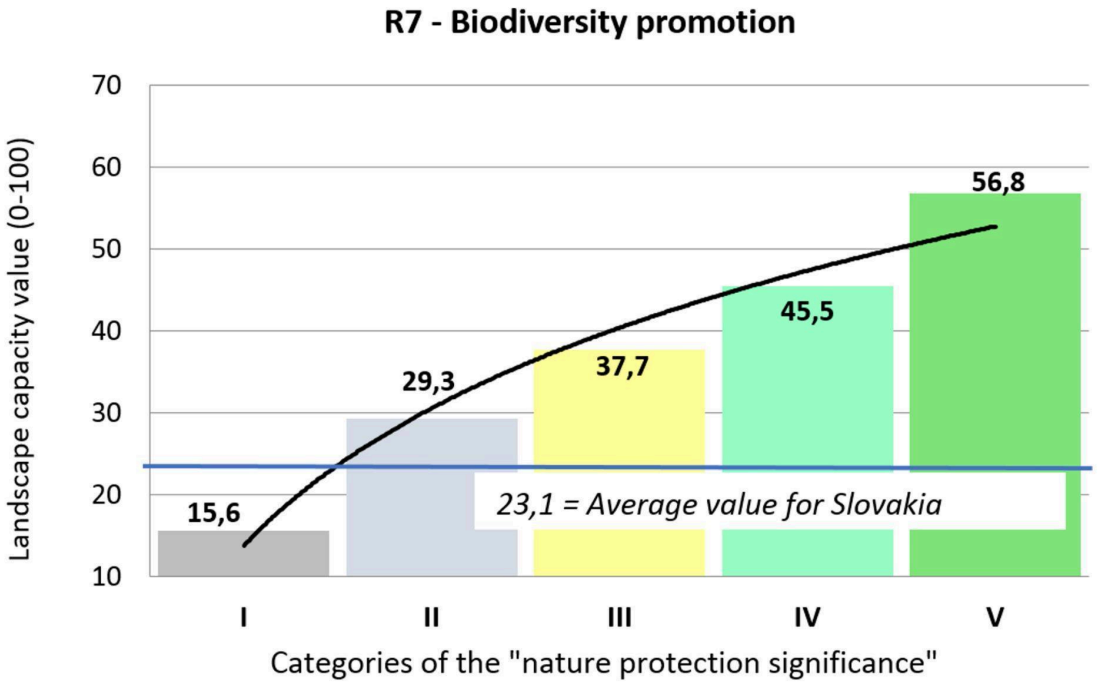

Fig. 3 Relationship of ***ES Supporting species and ecosystem diversity*** and the importance of the territory of Slovakia in terms of nature and landscape conservation.

Research from various national parks, like Veľká Fatra, Muránska Planina, and Tatra National Park, shows that these protected areas provide vital ecosystem services worth millions of euros and enhance the quality of life for local communities. For example, Veľká Fatra National Park generates about EUR 179 million annually from ecosystem services like tourism, while Muránska Planina contributes around EUR 10 million annually. The Tatra National Park has also been valued at approximately EUR 17.5 million based on visitor willingness to pay for park entry fees.

In addition to environmental and economic benefits, protected areas in Slovakia also offer **cultural ecosystem services**, such as recreation and spiritual value. Research shows

that mountainous landscapes in national parks provide the highest cultural value compared to other areas. These services are closely tied to the landscape and land cover, and mapping them can help improve nature conservation and land management decisions.

Slovakia has a lot of data and research on ecosystem services, especially related to forests and protected areas. However, these findings have not yet been fully integrated into management plans for protected areas. Based on existing research, it's clear that Slovakia's protected areas play a major role in providing a wide range of ecosystem services that benefit nature and people. Moving forward, it's important to continue developing and implementing these findings to better protect the country's natural resources and support sustainable land use.

Poland

State of the Art on a national level

While the Polish nature protection law doesn't specifically use the term "ecosystem services", it includes ideas that ecosystems benefit people. For example, laws about spatial management, nature conservation, and water management all recognize the importance of ecosystems for human well-being. This shows how the Polish legal system indirectly supports the idea of ecosystem services, even if the term itself isn't always used (Stępniewska et al., 2018b).

Polish experts observed that public debates about environmental issues in Poland were often discussed. Still, these discussions were mostly neutral and focused on how to maintain ecosystem services like **food, clean air, and water** for local communities. When it came to **cultural services** (like **recreation or health benefits**), there was more focus on what these services mean for people, although people didn't spend much time on these topics. The study showed that the ecosystem services concept is useful because it brings attention to important social issues and helps people think about potential conflicts. This is particularly important for protected areas in Poland, which are working on new environmental protection plans and need better ways to engage the public, ensure sustainability, and make policies that work for everyone.

An important conclusion of another article by a Polish expert is that there is a lot of potential to apply the ecosystem services concept in Poland, but there is also a lack of practical knowledge and little interest in using ecosystem services at the local level. This depends a lot on political decisions. A survey of professionals found that large international research projects are the main drivers for using ecosystem services. Including the ecosystem services concept in European Union strategic documents has been important for motivating local administrations to consider it (Stępniewska et al., 2018a).

The relationship between ecosystem services and conflicts was explored to understand the barriers to effective conservation. Maczka et al. (2021) looked at public consultations in Poland about Natura 2000 sites between 2010 and 2015. They found that cultural and provisioning ecosystem services (like food and recreation) caused the most conflict. People disagreed about how to use these services, but there was less conflict about the need to protect nature itself. The study also found that there were problems with the

public consultation process, mainly because there weren't clear procedures to keep track of feedback and learn from past mistakes.

Between 2010 and 2016, Lupa & Stępniewska (2019) studied the development of ecosystem services research in Poland. They found that the **number of research papers on ecosystem services was increasing**, especially those focusing on real-world examples and case studies. Researchers were also using more international classifications and terminology, making their findings more relevant for environmental management. The results highlight how research on ecosystem services is growing and could help shape how we manage ecosystems in the future.

In contrast, Tusznio et al. (2018) pointed out that applying the ecosystem services concept at the local level in Poland is challenging. They identified several issues: it's urgent to apply ecosystem services, but there are theoretical challenges, too. Participatory mapping (involving local people in discussions about ecosystem services) is a good way to engage communities, but there are limitations when it comes to including local representatives in the process.

From 2020 to 2023, a nationwide project in Poland aims to boost scientific research on ecosystem services and increase officials' awareness of how important ES are for people, the environment, and the economy. The project involved teams of researchers from various fields who developed indicators to measure the value of ecosystems in Poland, such as forests, urban areas, and agricultural lands. The project also focused on mapping and assessing ecosystem services at national, regional, and local levels, identifying the benefits, trade-offs, and synergies between services. The results were shared with stakeholders through workshops and seminars, and the findings will be published in a handbook to help with environmental management.

State of the Art within/related to PAs

Studies on ecosystem services in protected areas across Europe have grown between 2012 and 2023. Most of the research focused on land-based areas, like forests and national parks. These areas are typically categorized as IUCN (International Union for Conservation of Nature) types II and IV, meaning they are either set aside for protecting nature or for more sustainable use. The research used the Millennium Ecosystem Assessment (MEA) to classify these services, particularly focusing on what these areas supply. The most commonly mapped services were those related to **regulating the environment, maintaining natural systems, and cultural benefits**. Examples of ecosystem services include animals raised for food and plants grown for various purposes, as well as services that help maintain habitats and regulate the atmosphere. Cultural services often involve health-promoting activities or enjoying nature. Many studies relied on numbers and data, but some used more descriptive approaches. However, the review pointed out that many studies did not verify their results, which can affect the reliability of these mappings in protected areas.

A study from the Czech Republic looked at the benefits and challenges of Protected Landscape Areas (PLAs). PLAs are large areas that are protected by law to preserve nature, but they also face many challenges. The study identified three key areas: (1) the benefits

that managers believe these areas provide; (2) the challenges and trade-offs they face; and (3) the role of žt in helping with decision-making. The researchers interviewed 20 heads of PLA administrations and found that the benefits people most often mentioned were related to cultural activities and regulating natural systems. One of the **most important benefits was creating and maintaining habitats for wildlife**. The study also highlighted that different types of land management, like farming and forestry, can either help or hurt these benefits. Most of the respondents were hopeful that the ecosystem services framework could help in making better conservation decisions. The research confirmed that PLAs play an important role in preserving natural benefits and supporting conservation goals.

In Poland, a series of studies have focused on mapping and assessing ecosystem services in national parks:

- A study in Wigry National Park (Affek & Kowalska, 2017) asked people how often they used 45 different services and how well the park's ecosystems could provide 11 types of services.

- In Wielkopolski National Park, a 2021 study by Zydroń et al. found that many people were willing to pay to visit protected areas, showing that people are increasingly valuing nature and environmental protection.

- Another study in the Polish Carpathian Mountains (Boćkowski et al., 2024) looked at how people view national parks, like the planned Turnicki National Park. People who saw more benefits from nature were generally more supportive of national parks, while those who focused on material benefits like wood or water were more sceptical. For example, people who valued using wood for heating were less supportive of national parks than those who valued wildlife habitats or outdoor activities like hiking.

- A study in northeastern Poland (Sokół & Łaska, 2024) showed that protecting biodiversity in river valleys is key to maintaining high levels of natural services, like wetland protection and recreational spaces. They found that as land use increased, the benefits from these services started to decline.

- Pietrzyk-Kaszyńska et al. (2022) highlighted how important it is to involve local communities in mapping ecosystem services for better decision-making. They conducted workshops with 100 participants, including nature conservation experts and local leaders, to understand how different people view ecosystem services. The study found that both groups often had similar views on which services were most important. However, the way they mapped these services could vary depending on how they understood them. This shows that involving local people in mapping and planning can help make better decisions that reflect everyone's needs.

- Affek et al. (2022) presented ways to assess and map ecosystem services in cities across Poland. They looked at three types of services - provisioning, regulatory, and cultural, across 20 urban regions. For example, the city of Lublin was found to have the best potential for food production, while Częstochowa had a much higher unmet need for nature-based recreation compared to Olsztyn. These findings can help improve urban planning by mapping how different areas provide services that improve people's quality of life.

- In another study, Sylla (2024) used ecosystem accounting to evaluate services like crop provision, pollination, and nature-based tourism in the Sleza Landscape Park in Poland. Ecosystem accounting helps track how services contribute to both the economy and people's well-being. By comparing data from 2014 and 2021, this study showed how these **services can support local economies** and help in making conservation decisions.

- Finally, research has shown that **protected areas**, including national parks and Natura 2000 sites, are **crucial for preserving biodiversity** and **providing important ecosystem services.** These areas offer services such as tourism, wildlife watching, and air filtration, which have significant economic value. Researchers use tools like GIS (Geographic Information Systems) to evaluate the potential of forest ecosystems in protected areas. By properly assessing these services, we can make better decisions about managing these areas sustainably, ensuring that they continue to provide benefits to people and nature.

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