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ECOSYSTEM SERVICES IN THE DANUBE REGION

Authors:
Badura, Marianne; Schmidleitner Anita; Tupikin, Oleksii
blue! advancing european projects GbR - Munich, Germany - www.the-blue.net

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Report Cover Sheet

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Author(s) (Family Name, First Name)	Badura, Marianne Schmidleitner, Anita Tupikin, Oleksii
Performing Organisation (Name, Address)	blue! advancing european projects GbR Brienner Straße 48, Hofgebäude 2 DE- 80333 München blue! advancing european projects
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List of Abbreviations

ASP	Alpine Space Programme
BAU	Business As Usual (Scenario)
BD	EU Biodiversity Strategy
BT	Benefit Transfer (Method)
CBD	Convention on Biological Diversity
CICES	Common International Classification of Ecosystem Services
CNPA	Carpathian Network of Protected Areas
DTP	Danube Transnational Programme
EECCA	Eastern Europe, Caucasus and Central Asia (countries)
EFRD	European Funds for Regional Development
ETC-SIA	European Topic Centre for Spatial Information and Analysis
EU	European Union
ENI	European Neighbourhood Initiative
ES / ESS	Eco-system Services
ESMERALDA	Enhancing Ecosystem Services Mapping for Policy and Decision Making
EUNIS	European Nature Information System
EUSALP	EU Strategy for the Alpine Region
EUSDR	EU Strategy for the Danube Region
FAO	Food and Agriculture Organization of the United Nations
MAES	Mapping and Assessment of Ecosystem Services
MEA	Millennium Ecosystem Assessment
MESEU	Mapping of Ecosystems and their Services in the EU (and its Member States, 2013-2015)
NGO	Non-Governmental Organization
PA	Priority Area
PAC	Priority Area Coordinator
SEE	South-Eastern Europe
SEM	Sustainable Ecosystem Management
SOC	Soil Organic Carbon
TEEB	The Economics of Ecosystems and Biodiversity

Summary

The study introduces the concept of ecosystem services (ES), shortly reflects on its history and the most important publications which introduced the idea in the late 1990ies and at the beginning of the century with the Millenium Ecosystem Assessment (MEA) and the TEEB study (The Economics of Ecosystems and Biodiversity). It reflects the classification systems which have been used and describes the Common International Classification of Ecosystem Services (CICES) which by now has achieved a standard status at European and international level. The concept of ecosystem services has meanwhile been integrated in many concepts and strategic papers on how to better and sustainably organize the use of natural resources. It is important to indicate that the EUSDR and the Danube Transnational Programme already consider certain ecosystem services in their funding priorities.

However, at present the concept is mainly used to defend natural assets against further economic exploitation instead of pro-actively balance the availability of natural resources now and for the future against short-term economic interests of countries, regions or single companies. The present study analysed more than 60 documents, all results from ES assessments in the overall Danube area or reports on the situation of ES assessment in the Danube region countries. The findings show (a) a limited acceptance of study results and of integration into decision-making (as they may hinder particular economic developments) and (b) a heterogeneous picture of methodologies applied in the last 10-15 years with a strong tendency to be more homogeneous in the last 5 years, which is mainly due to the EU-wide MAES (Mapping and Assessment of Ecosystems and their Services) process.

Only the Czech Republic has achieved a complete assessment of ES for its national territory, all other countries in the Danube area have substantial gaps. Austria and Germany are on a good way, in most other countries many regional studies are available with very interesting results (e.g. in Slovakia, Bulgaria, Hungary or Romania). In some countries, the methodological discussion on ecosystems and related services or indicators has been ongoing for many years without coming to a final conclusion. Most of the countries complain about a lack of financial and human resources to systematically carry out the task of a national assessment.

The majority of ES assessments cover territories with a special designation status, e.g. protected areas, high nature value areas, etc. The pro-active approach of assessing full territorial units in order to gain knowledge about the ES available and to use this information in a precautionary way for better preparing strategic decisions is rare. Some municipalities or smaller regions have carried out such a type of assessment, mostly by using a participatory approach and by integrating stakeholders and the population. This approach seems to be the most promising one as it helps to create acceptance and appreciation for the services of nature. An assessment at national level is useful for the expert community, but difficult to communicate to the wider public. The concept of ES is rather abstract and only concrete examples create the necessary understanding for balancing short-term economic interests with the long-term perspective of ecosystems and their services.

Within the Priority Areas of the EUSDR many options exist where ES can be integrated into considerations on strategic developments, e.g. for waterways and transport, for spatial planning and infrastructure development or for the creation of tourism destinations. The objective for all Priority Areas must be to ensure the availability of ES also for the future. The most important ones may be the supply of fresh water, biomass and nutrition, climate regulation, recreational values and the beauty of landscapes and nature in the Danube area. In order to achieve this, several options exist: PA06 should promote the concept and available results to all Priority Areas of the EUSDR for consideration in their Action Plans. The DTP should intensify its integration of ES into the funding priorities beyond 2020. The economic development of the Danube area should not lead to detrimental impacts on natural assets which cannot be reversed and which , in the end lead to negative economic impacts.

1 Introduction and subject of the analysis

"The Danube is 2,857 km long, and up to 1.5 km wide, with depths of 8 metres in places. On the basis of its gradients, it can be divided into three sub-regions. The Upper Basin extends from the source of the Danube in Germany to Bratislava in Slovakia. The Middle Basin is the largest of the three sub-regions, extending from Bratislava to the dams of the Iron Gate Gorge on the border between Serbia and Romania. The lowlands, plateaus and mountains of Romania and Bulgaria form the Lower Basin of the River Danube. Finally, the river divides into three main branches, forming the Danube Delta, which covers an area of about 6,750 km^2." (Tucker et al. 2010, 18) This geographical description of the Danube does not cover what the Danube and the Danube region are all about:

- It provides huge floodplains, which are used for cultivating crops and grazing cattle.
- It offers large wetland areas, which retain water in case of flood events, which purify water from nutrients and regulate the local and regional climate.
- The Danube area is covered by huge forest areas preventing natural hazards, flood events or landslides, and offering habitats to many different animal and plant species.
- It is an area, which is visited by many people because of its natural beauty, the excellent potential for outdoor activities and its interesting cultural heritage.

Altogether, the Danube area is one of the most diverse and richest areas in natural assets in Europe.

The EU Biodiversity Strategy (BD) foresees an EU wide mapping and assessment of ecosystems and their services (ES) in order to better inform decision makers on the value of natural assets and biodiversity. Action 5 of the BD sets the requirement for an EU-wide knowledge base designed to be a primary data source for developing Europe's green infrastructure and a resource to identify areas for ecosystem restoration. The EU wide process on assessing ES takes place in many different initiatives and projects, e.g. the MAES Working Group, the projects MESEU, OpenNESS, OPERAs or most recently ESMERALDA, just to mention some of them.[1]

The information on ecosystem services, their availability and benefits are of great importance for the future structural development of the region in order to both providing options for economic development and for preserving the natural values. The EUSDR has already considered some ecosystem services in its current Cooperation Programme and Funding Priorities, in particular those related to regulation services, e.g. water retention or climate regulation.

The task of this study is to elaborate a more detailed overview on the main types of ecosystem services in the Danube area and their level of assessment. It is further the task to investigate whether there are 'ES hotspots' with an outstanding importance for the overall region and to give recommendations on how to consider ecosystem services in the future within all Priority Areas of the EUSDR, in particular for further planning and investment decisions.

The study relies on a desk research of existing studies and ongoing initiatives and summarizes the outcomes both per countries of the EUSDR and in a comparative analysis. A map on the study areas illustrates the geographical coverage of ES assessment. As there are many regional initiatives and small studies ongoing, this study cannot give a complete picture of all results which are presently available, but covers the most recent level of assessment without being complete.

[1] http://www.esmeralda-project.eu/ - 29.08.2018

2 Definition of ES in a European Union wide process

2.1 History of ES analysis

One of the first and most important studies on ES is the Millennium Ecosystem Assessment (MEA 2005) which has been elaborated together with more than 1.300 experts and scientists from 95 countries. The main objective of MA was to describe the status quo and trend of ecosystems and their services at global level, and to show their influence on human well-being. The main findings showed that 15 out of 24 ES (about 60%) were under pressure, showing a degraded status quo. The MA was one of the first international studies on ES, thus paving the way for further scientific analysis of the topic and bringing it to the agenda of political debate. According to MA the concept of ES is a dynamic one and should constantly be developed and adapted to regional or local conditions. By applying the concept, a constant review and validation of methods and results should be provoked. The concept of ES should furthermore be used to communicate the need of protecting and conserving natural ecosystems and their services towards the wider public, to science and to political decision makers.

Based on the decision of environment ministers from the governments of the G8+5 countries[2] during their meeting in Potsdam, Germany, in 2007, the process of analysing the global economic benefit of biological diversity, the costs of losing biodiversity and the failure to take protective measures versus the costs of effective conservation (Sukhdev et al., 2010) was launched.

As a next step in the European work on ES was the elaboration of the TEEB (The Economics of Ecosystems and Biodiversity) study (TEEB 2010). It evaluates and, if possible, calculates the economic benefit of ES for explaining the value of nature's services and the loss in case natural ecosystems are degraded or destroyed. Nature is considered as capital stock and its benefits as dividends, which are available for society. Thus, conserving the natural capital provides the opportunity to deliver the services to future generations as well.

In 2011, the signatory parties to the Convention on Biological Diversity (CBD) adopted a new plan to stop the loss of biodiversity until 2020. This plan includes the so-called Aichi biodiversity targets (CBD 2011), which are 20 ambitious targets to stop biodiversity loss and to ensure a healthy environment providing services to the people. As a next step, the EU, being a signatory party to the CBD, proposed the EU Biodiversity Strategy to 2020 "Our life insurance, our natural capital: an EU biodiversity strategy to 2020". It includes the long-term vision of protecting and restoring Europe's biodiversity and its ecosystem services by 2050 and it refers in several of its 6 targets and 20 actions to ecosystem services.

In particular, Target 2 aims to maintain and enhance ecosystems and their services (see chapter 2.2).

In parallel the scientific discussion has been ongoing on developing the methodology for an EU wide mapping and assessing of ES, which has been dealt with by the EU wide working group on the mapping and assessment of ecosystems and their services (MAES). Two typologies have been developed to assess both

(a) the ecosystem types which are considered relevant to provide services,

(b) the classification of ecosystem services.

The ecosystem types have been classified according to the European Nature Information System (EUNIS), which includes a habitat classification (similar to Natura2000 types). The ecosystem types are used for mapping and assessing under Action 5 of the Biodiversity Strategy.

[2] The G8+5 include the heads of government from Canada, France, Germany, Italy, Japan, Russia, the United Kingdom and the United States plus the heads of government from Brazil, China, India, Mexico and South Africa (as emerging economies).

As for the ES, the European MAES Working Group proposed an adopted version of the Common International Classification of Ecosystem Services (CICES), which is applied at European level. The CICES (v4.3) classification comprises three different main categories

- Provisioning services
  (a) basic or supporting services (e.g. soil formation, photosynthesis, nutrient cycles, etc.)
  (b) goods for markets (e.g. nutrition & water, raw materials, energy)
- Regulation and maintenance services (e.g. local climate effects, carbon sequestration, risk prevention, prevention of soil erosion and soil fertility, pollination, mediation of waste, toxics and other nuisances etc.)
- Cultural services (z. B. aesthetic appreciation, spiritual experiences, intrinsic value of nature, social functions, cultural identity, etc.).

Meanwhile the updated version of CICES v5.1 is available at the European website: https://cices.eu/ .

For the EU, CICES is under the leadership of the EEA and its classification shall be linked to the national accounts (VGR). It is foreseen to extend the national accounts by including as well ecosystem services gathered by satellite data, thus further developing towards a 'System of Economic and Environmental Account' (SEEA). (https://cices.eu/ - assessed 23.06.2018)

The conceptual framework, which has been developed for the EU, is meant to support the future assessments of ES on national or regional levels. The detailed methodological framework and background information to the European conceptual model can be found in different publications, and is illustrated in the following figure:

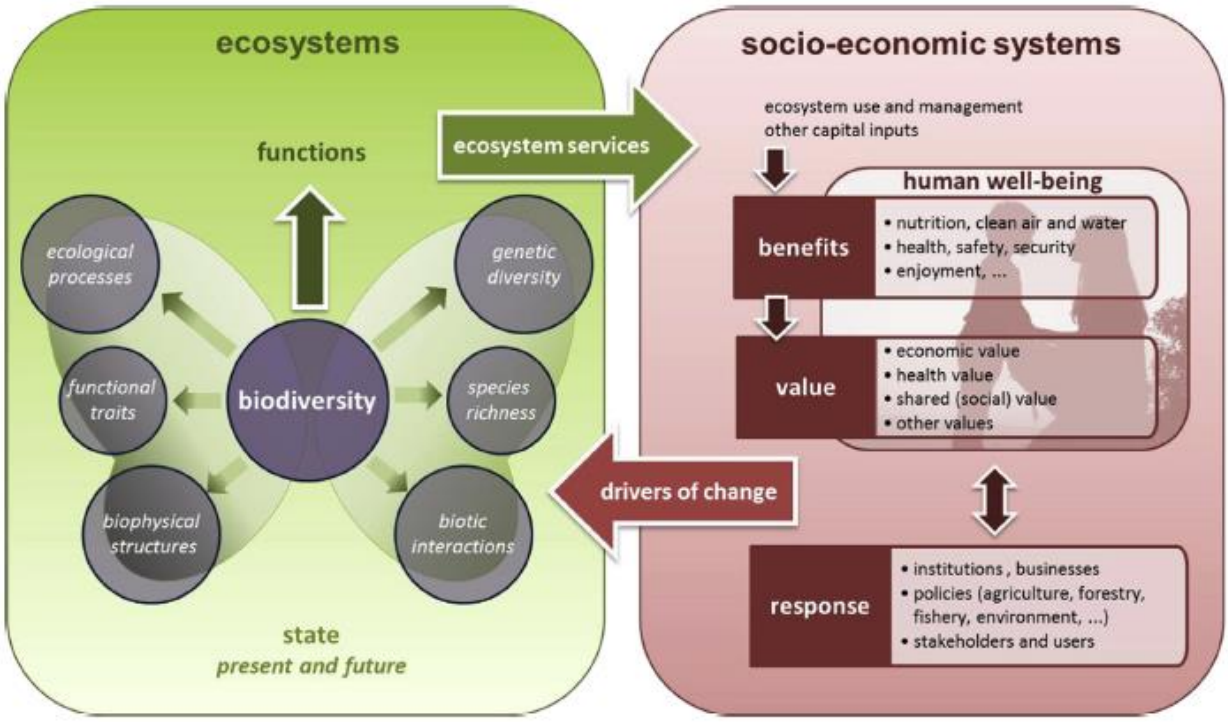


Figure 1: Conceptual framework for EU and national ecosystem assessments under Action 5 of the EU Biodiversity Strategy to 2020

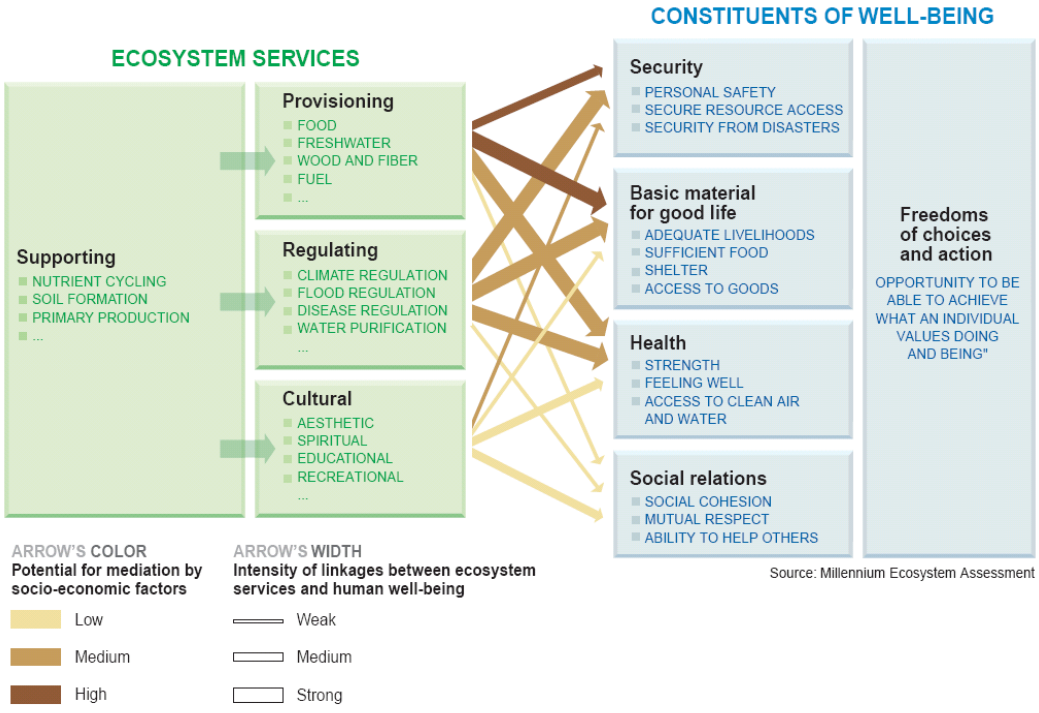
Source: J. Maes et al./EcosystemServices 17 (2016) 14–23, p. 16

The framework intends to link the state of ecosystems, the level of biodiversity and the services provided to human well-being (Maes et al. 2016).

As described above, European policies have started to integrate the concept of ecosystem services in different policies during the last decade. They are integrated both in the mainstream funds of the EU including the Funds for Regional Development (EFRD) and other environmental programmes. In the EUSDR and its Priority Areas, the concept of ecosystem services has already been considered for the current Cooperation Programme. It requests for example a reduction of fragmentation of bio-geographical areas and natural habitats, the creation and preservation of coherent transnational ecological corridors or a coordinated management of risks due to climate change. All these aspects are directly linked to other priority areas, which are invited to use the concept of ecosystem services as well in order to develop future-oriented projects and initiatives. The DTP specific objectives 2.1 to 2.3 make particular reference to different ecosystems services and explain the potential application of the concept in more detail in the priority axes of the DTP[3] (see chapter 5).

2.2 Interaction of ES and constituents of well-being

The EU conceptual framework underpins the supply side of ES, i.e. the functioning of ecosystems. Complementary to it, the richness in biodiversity underpins /forms the baseline for the existence of ES. It is important to assume that ecosystem services cannot be regarded as single and self-standing service, many ES can only be provided from a complex and functioning network of ecosystems.



Source: MEA (2005)

[3] Danube Transnational Programme 2014-2020 (INTERREG V-B DANUBE), Section 4

2.3 Linking global sustainability goals with ES and the EU Biodiversity Strategy

The present chapter shortly summarizes the links between global sustainability goals and the concept of ES in the EU in order to provide background information for the different valuation approaches chosen in the different countries and studies of the Danube area.

The Aichi Targets providing the framework for sustainable development with relevance for the mapping and assessing of ES are the following:

Aichi targets with reference to ecosystem services

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use

Target 8

By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

Target 10

By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Target 11

By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services

Target 15

By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Target 14

By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable. [Source: https://www.cbd.int/sp/targets/#GoalD – assessed 04.11.2018]

Based on the **Aichi Targets**, the EU Biodiversity Strategy formulated the following vision, targets and actions for halting the loss of biodiversity:

> **2050 vision**
>
> By 2050, European Union biodiversity and the ecosystem services it provides — its natural capital — are protected, valued and appropriately restored for biodiversity's intrinsic value and for their essential contribution to human wellbeing and economic prosperity, and so that catastrophic changes caused by the loss of biodiversity are avoided.
>
> 2020 headline target
>
> Halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss.

Source: 'Our life insurance, our natural capital: an EU biodiversity strategy to 2020' (EC COM 2011)

EU Biodiversity Target 2: Maintain and restore ecosystems and their services

By 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15% of degraded ecosystems.

EU Biodiversity Target 6: Help avert global biodiversity loss

By 2020, the EU has stepped up its contribution to averting global biodiversity loss.

Action 5: Improve knowledge of ecosystems and their services in the EU

> 5) Member States, with the assistance of the Commission, will map and assess the state of ecosystems and their services in their national territory by 2014, assess the economic value of such services, and promote the integration of these values into accounting and reporting systems at EU and national level by 2020.

2.4 An overview on the MAES process in Europe

As described above, the EU wide mapping and assessment of ES is a constantly ongoing process with different levels of implementation in the single EU Member States. The following map gives an overview on the availability of MAES reports for the different countries.

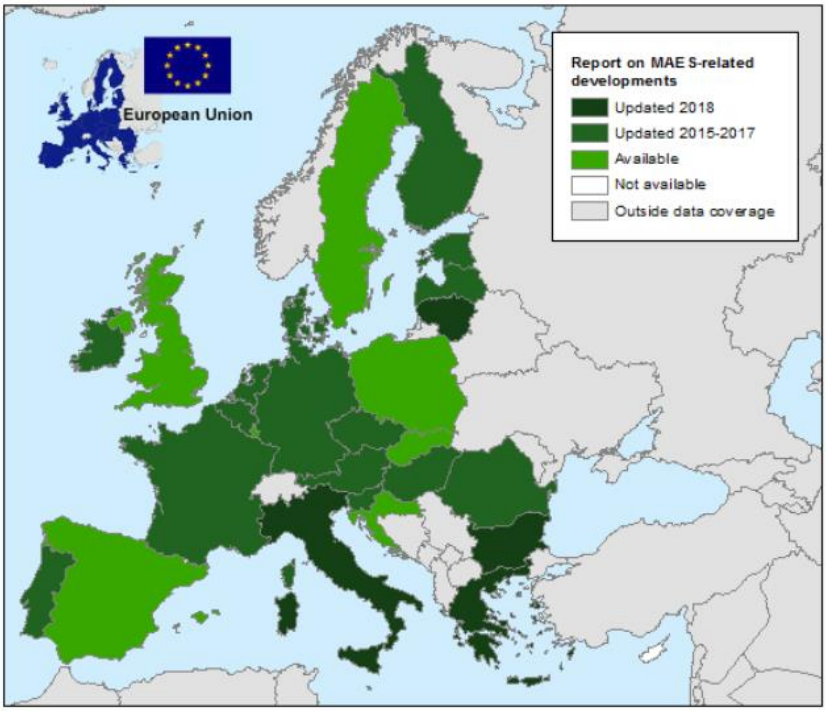


Figure 2: Overview on EU Member States and their status of MAES reporting (Source: https://biodiversity.europa.eu/maes/maes_countries - Access: May 23, 2018)

The MAES reports have been analysed as one basic source of information for the present study. They have been elaborated at the beginning of the Horizon 2020 project ESMERALDA in 2015. They are available for download from the biodiversity information system for Europe (BISE) at the single country pages.

The most recent publication on the status of MAES in all EU Member States was published in March 2018[4].

The next figure shows the MAES barometer, which illustrates how far the process of MAES in the different European countries has developed since 2015, when the ESMERALDA project started with a baseline assessment. The assumption was that the main outcomes of the ESMERALDA project can substantially contribute to a better information of decisions based on ES. Meanwhile the project has been finished and the outputs can be downloaded at the relevant website.

Amongst others, the following results have been elaborated[5]:

- "an overview of the state of ES mapping and assessment in EU member states

[4] Kopperoinen, L., Varumo, L. & Maes, J. (2018). Final stocktaking of EU member state needs. Deliverable 2.3 EU Horizon 2020 ESMERALDA Project, Grant agreement No. 642007.

[5] http://www.esmeralda-project.eu/documents/1/– assessed on October 10, 2018

- a flexible methodology and tiered approach for ES mapping, valuation, accounting and assessment
- methods for developing high quality and consistent information on the condition of ecosystems and their services"

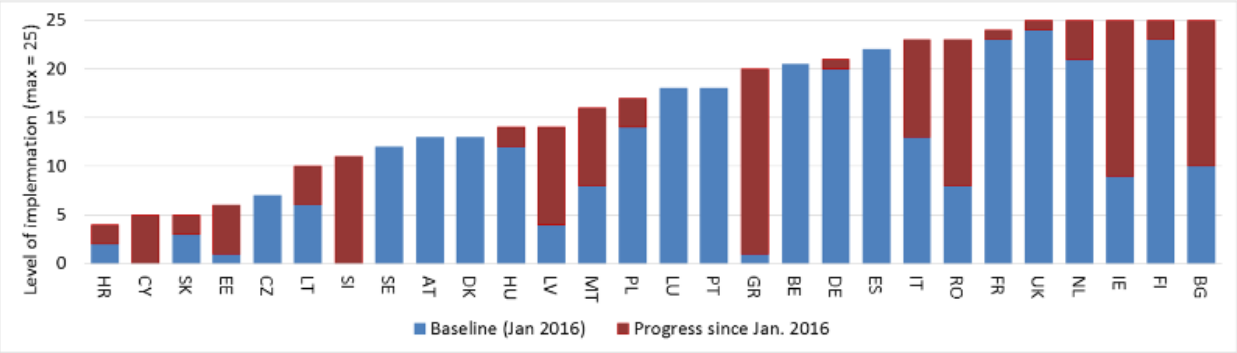


Figure 3: MAES barometer - Implementation status of MAES in the EU Member States 2016-2018 (Source: MAES barometer within MAES explorer, status 09/2018 – assessed 02.11.2018)

2.5 ESMERALDA project

The ESMERALDA (Enhancing Ecosystem Services Mapping for Policy and Decision Making) project has been funded under the EU Horizon 2020 programme (grant agreement No. 642007). Its main task was the mapping and assessment of ecosystems and their services as core elements to the EU Biodiversity (BD) Strategy within the EU countries. ES shall be provided as often as possible in order to make informed decisions. Action 5 of the EU BD strategy sets the requirement for an EU-wide knowledge base designed to be a primary data source for developing Europe's green infrastructure. It is as well foreseen as a resource to identify areas for ecosystem restoration and to represent a baseline against which the goal of 'no net loss of BD and ES' can be evaluated.

To answer these requirements, ESMERALDA aimed "to deliver a flexible methodology to provide the building blocks for both pan-European and regional assessments" (see below). During the previous years, a lot of work on ES has been carried out, and is still ongoing, at EU level mostly in the project initiatives MAES, OpenNESS, OPERAs or MESEU.

The ESMERALDA project united 25 partners from 20 European countries from February 2015 until August 2018 (42 months). One of the tasks in work package (WP) 2 (task 2.1: Stakeholder identification and initial analysis) of activities was to prepare so-called 'country fact sheets'. The fact sheets summarize the status quo of ES analysis in the different countries of the EU.

The information in the fact sheets is based on the previous relevant work on ecosystem mapping and assessment activities as well as on policy and research activities per country.

Further information on the project and its results can be found under:

http://www.esmeralda-project.eu/showpage.php?storyid=11754 – access May 29, 2018

The following country chapters use the most recent information from the ESMERALDA project on ES mapping in the EU countries and refers additionally to previous studies in that field both for the national as well as for the regional level.

To give an overview, the two following figures show the different clusters regarding the level of achievement of mapping of ecosystem services in EU countries. The scores per country indicated are based on a set of criteria like status of mapping, progress in policy implementation, stakeholder involvement or resources spent (for detailed description of the methodology see Kopperoinen et al. 2016). The information has been visualized in two figures, the first one showing the progress of EU countries related to implementation of policy and networking with stakeholders (x) and the progress in mapping ES (y). The second one lists the EU countries according to the overall score reached in both topics.

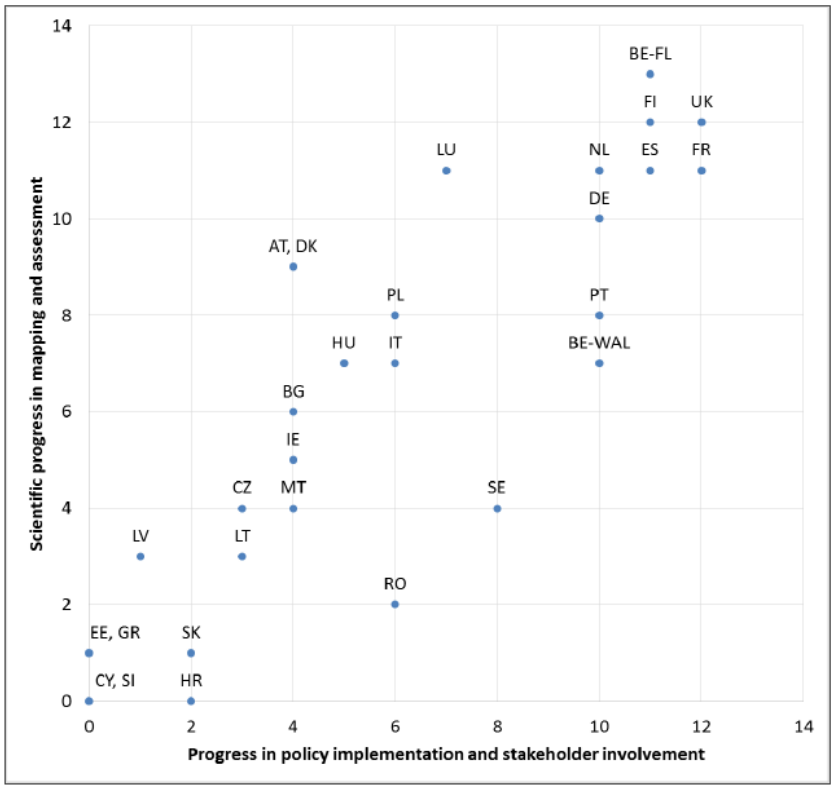


Figure 4: Assessment of EU member states on their progress related to policy implementation and stakeholder networking and progress made in MAES research (Kopperoinen et al. 2016, p.8)

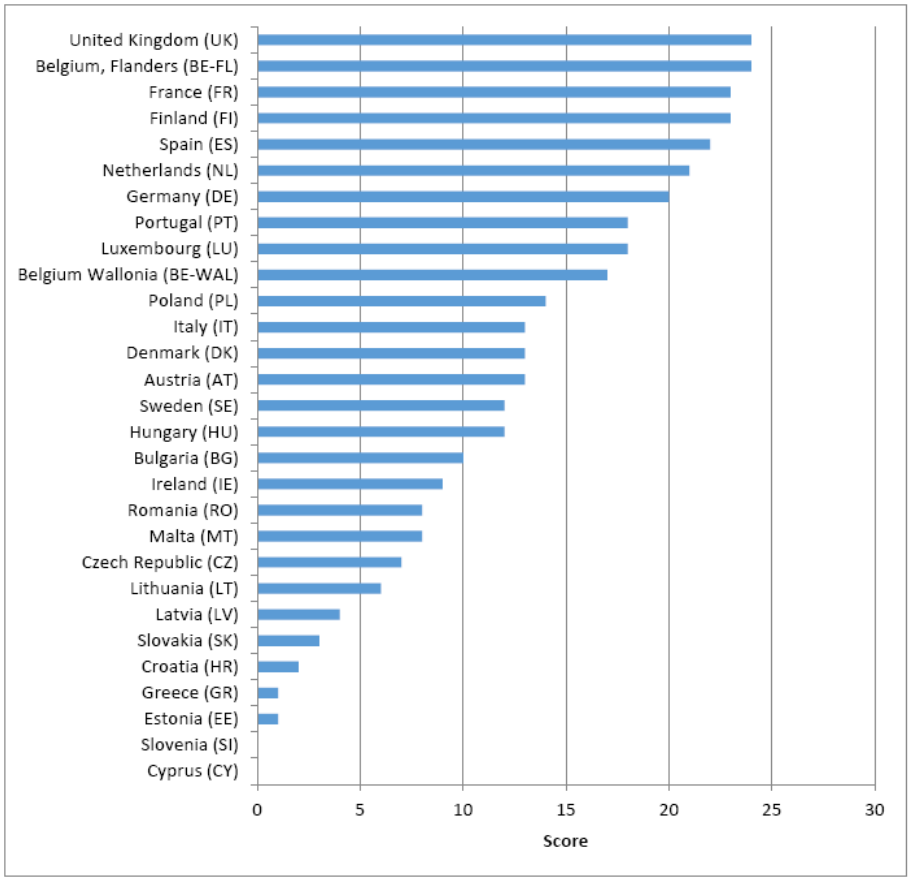


Figure 5: Score of EU countries on their level of progress in policy implementation and stakeholder involvement and MAES related research (Kopperoinen et al. 2016, p.7)

According to the two figures, most of the countries of the Danube area remain in the lower part of the score. Germany (20), Austria (13), Hungary (12), Bulgaria (10) and Romania (8) are the countries with the highest progress in interlinking policy and research on ES.

The reasons further indicated for the low scoring of the Eastern European countries compared to the North-Western European countries were amongst others:

- Lack of engagement and coordination of authorities from different levels and sectors for MAES
- Need for harmonization of different sectoral policies
- Non-acceptance of the EU Biodiversity strategy as binding and urgent objective
- Need for further resources (both for staff and financial ones)
- Difficulties to communicate the complex ES concept to decision makers and the public

3 Classification and valuation methods of studies in the research area

3.1 General aspects – compatibility with MAES and Natura2000 viewer

The MAES process at EU level provides a comparable methodological approach for future assessments of ES in the Danube area. Many studies in the past, however, have been carried out by applying a wide set of diverging methods and classification schemes for ecosystems and their services.

The present study follows the description and classification of ES according to MAES and uses the most recent classification of ecosystem services (CICES v5.1). The maps produced comply with the data standards of the Natura 2000 viewer. However, this study does not aggregate single ES data for analysis or calculation purposes. The maps included as annexes are created by using GIS cartography (ArcGIS).

The present chapter gives an overview on the studies found in literature which have been carried out in the research area, and the different classification and valuation methods applied. In a first step, the results for the countries of the EUSDR area are displayed, in a second step the results of the ENI and IPA countries will follow. The information is structured per country in an alphabetical row for EUSDR and ENI/IPA countries.

The first sub-chapter reflects on the multi-national studies carried out in the EUSDR area. The following sub-chapters shortly explain and summarize the studies per country or region(s), which have been published during the last 5-10 years, depending on their availability in English language for those countries the language is not spoken by the authors of the study and without being complete per country. The structure of the country wise chapters follows the principle:

- Information on the status quo of national ES assessments, indicating the classification method, on contributions to the MAES process at EU level and, if available, on a preview on next steps within the EU-wide ES assessment foreseen until 2020
- Information on regional studies, indicating the area or region which has been assessed, the classification method used and a short summary of the results.

The potential to be included in the hot spot areas of ES in the EUSDR territory will be assessed in the next step by overlaying protected areas with the map collecting the regions where ES studies have been carried out.

The detailed results are summarized in an overview table (in MS Excel format) which is included as annex 04 to this study (EUSDR_ESS_study_2018_PA06_ANNEX04.xlsx).

3.2 Multi-national studies

On multi-national level different studies have been carried out, referring to the large ecosystems of the EUSDR area (for detailed information on the studies' authors please refer to the list of references):

3.2.1 Valuing and conserving ecosystem services: a scoping case study in the Danube Basin (Tucker et al. 2010)

The Danube River Basin is the second largest in Europe, it covers a total of 801,463 km^2 and includes the territories of 19 countries from Albania to Ukraine. The study relies on a semi-quantitative estimation of ES, taking heterogeneous data sets from the different countries, expert opinion and different previous studies in the Danube region into account.

The main findings of the study are the following: The Danube provides a wide range of different goods and services (provisioning: fish, reeds, crops; regulating: water purification, flood management; cultural: recreation, tourism). Estimates cited in the study range from €250 to €1,354 per hectare of the

lower Danube wetlands per year. Including the role of wetlands in flood management would increase figures by approx. 500 Euro per year, outweighing the income from agricultural land in Eastern Europe (estimated at approximately €450/hectare without agricultural subsidies (see p. 24).

The study identified five key ES for the Danube river basin of which the main outcomes are described below: (1) river fish production, (2) water provisioning and purification, (3) flood storage on the Danube floodplain, (4) climate regulation, carbon sequestration and storage and (5) nature-based tourism and recreation.

(1) River fish production

Freshwater fisheries in the Danube Delta are of particular importance and still provide a major form of employment and income to the local population, although yields of fisheries have substantially declined in the past 10-20 years. Given the overall increase in fish consumption and the export of "key value-added products of fisheries in the Danube Basin (e.g. caviar)"which are mainly sold to global markets, there is a potential to increase the economic value and local employment created by further sustainable exploitation of the Danube fish resources. To achieve this, it is important to stop and even reduce over-exploitation of fish stocks, nutrient emissions in the floodplains or morphological alterations like dams, etc. The fact that there is no detailed economic estimation does not mean that there is no negative impact.

(2) water provisioning and purification,

The Danube is widely used for providing fresh water (incl. drinking) water, about 40% directly use the river water (after natural purification steps). 60% of the population is supplied with drinking water from the different ground water bodies in the Danube River Basin. Water abstractions, high nutrient load of agricultural areas (which are likely to increase in number and intensity) in the catchment and barriers to the rivers patency and flooding areas are the existing risks to the ES of water provisioning and purification. Moreover, it is very difficult to estimate value of the ES due to data gaps (e.g. on the links between the status of the water related ecosytems or the true prices of providing drinking water) or different water pricing approaches in the single countries.

(3) flood storage on the Danube floodplain,

From the source to its delta, the Danube has lost about 70% of its natural floodplains over the last 150 years (UNDP/GEF, 1999 in Tucker et al. 2010, p.44) by the construction of dykes (embankments) or by infilling them to raise land levels above flood levels. If considering all ecosystem services of floodplains including fish production, carbon sequestration and tourism, the average economic value of floodplains in the lower Danube region is estimated to be approx. €500 per ha (Schwarz et al, 2006 Tucker et al. 2010, p.45). Compared to average capital restoration costs of about 5,000 €/ha after flood events, the restoration of floodplains seems to be worthwhile. However, the lack of detailed cost schemes for different uses and their benefits, technical and political difficulties in implementing large-scale flood plain restoration measures etc. prevent them from being carried out. Moreover, "the relationship between flood mitigation benefits from floodplain restoration and overall floodplain ecosystem service values is unclear." (Tucker et al. 2010, p.45).

(4) climate regulation, carbon sequestration and storage

In the Danube area, significant changes in land use occurred over the past two decades due the changes in agriculture, in infrastructure and settlement development or due to demographic developments. In total by 2010, the socio-economic value of carbon sequestration carried out by the soils, grasslands, wetlands and forests was unlikely to deteriorate, as there were considerable re-afforestation areas being in all countries of the EUSDR. "However, the ongoing losses of Soil Organic Carbon (SOC) through soil erosion, and in particular from flooding, are a major threat to the area's carbon storage capacity." (Tucker et al. 2010, p. 50)

(5) nature-based tourism and recreation

The possibility to offer tourism products heavily depends on the natural and cultural assets of a region. The services provided by nature and landscape can rather concretely be estimated by the amount of money spent by the tourists to visit a site (in contrary to the ES of e.g. carbon sequestration which is of global importance, but locally difficult to assess). The countries in the EUSDR do have highly attractive landscapes, however, they may lack the availability of tourist offers and infrastructure due to different reasons, in particular for foreign tourists (flight connections, etc.). According to the study, it was not possible to compare overall data for the income generated by tourism in the Danube area. Instead, some case studies were used to show the potential for nature-based tourism, e.g. by using data on overnight stays in the different regions. As a general result, the study indicates a substantial economic value of nature-based tourism in the DRB and a high potential for further development. The reasons for tourists' choices to visit certain places should, however, further be investigated to allow for targeted recommendations and actions in that respect.

The study proposes a matrix on policy recommendations and proposals how to increase the influence of ES on policy decisions for all five key ES described above. Although the study dates from 2010, this overview may serve as instructive basis for further action, as it is rather detailed and well-elaborated.

Main conclusions of the study (shortened):

- It is obvious that the Danube region is rich in ecosystem services without being able to fully quantify them. It is therefore recommended to take a 'precautionary approach' to the conservation of ecosystem services in order to avoid damage which may be difficult or impossible to reverse.
- Better and deeper knowledge of ES is needed to be able to better inform decisions, in particular those with long-term impacts on ecosystems.
- Not all ES can be fully captured in economic markets and communicated to decision makers or the public. Therefor a more comprehensive view on conservation strategies and their dissemination to society is needed.

3.2.2 Initiatives related to mapping and assessment of ecosystems and their services in EECCA and SEE countries (Burbidge et al. 2015)

The study gives an overview on the status quo of ES mapping and assessment and their integration into biodiversity policy in Central and Eastern Europe. Based on a meeting in Batumi (Georgia) in 2013, a questionnaire was sent to representatives of 17 countries asking for information on whether national or regional assessments are ongoing, how ES are classified and how decisions are informed by ES. The outcome of the study was a very heterogeneous picture from the EECCA (Eastern Europe, Caucasus and Central Asia) and SEE (South-Eastern European) region:

- None of the countries at that time had a national assessment completed nor in an advanced stage ongoing.
- Only 7 countries had started first initiatives on a national level.
- For the EUSDR space the countries of Moldova, Montenegro and Serbia had reached an intermediate level of ES assessment.
- The studies carried out in the single countries use different methods and ES classifications.

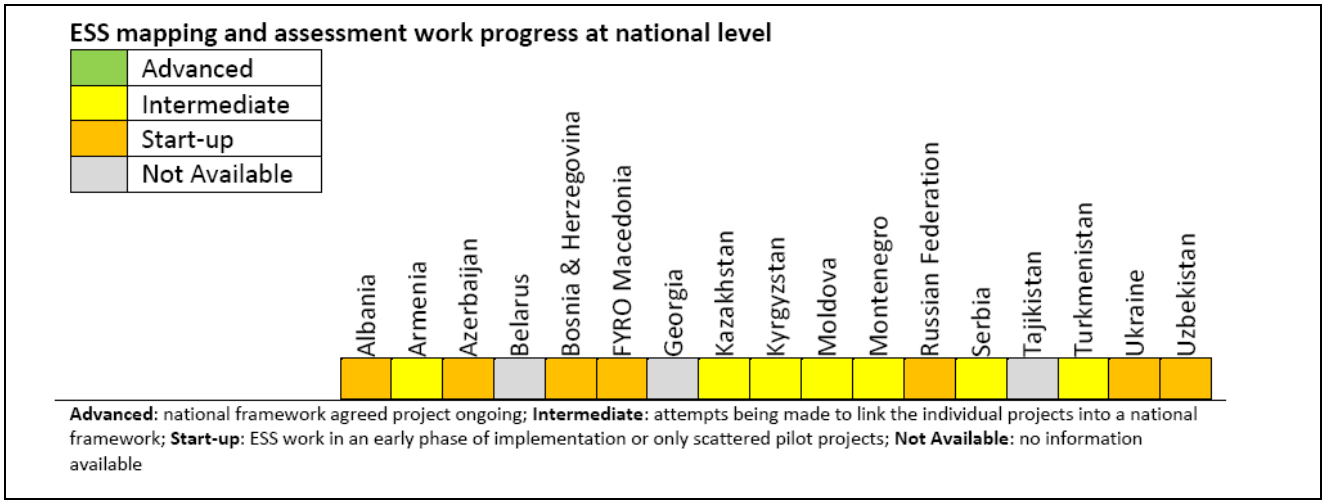


Figure 6: ES mapping and assessment work progress at national level (Source: Burbidge et al. 2015)

3.3 Austria

3.3.1 National level studies

In Austria, several studies on certain ES at national level have been carried out with the objective to make conclusions for the process at national level. The most important ones are those on ES and agriculture (Götzl et al. 2011), ES and forests (Götzl et al. 2015). Moreover, a study on the economic importance of ES has been undertaken (Schwaiger et al. 2015) in order to investigate how the political processes may be based on the concept of ES.

According to the MAES factsheet, in Austria there is a clear political positioning towards the ES analysis and mapping, however, the process of streamlining existing ES approaches and experts on the national scale in Austria is still ongoing. In Austria, basic research activities have been carried out such as the development of biodiversity indicators and a national wide mapping of ecosystems based on the EUNIS classification (105 classes from level 2 to 4; spatial resolution of 10 x 10 meters. The mapping and assessing of ecosystems and their services is also part of the 'Austrian Strategy on Biological Diversity 2020+' which was published in 2014.

Another interesting contribution was the national analysis to the project COIN – Cost of Inaction. (http://coin.ccca.at/), which examined the costs of climate change and its effects on two ecosystem services (pest control and pollination). On European scale, Austria participated in the MESEU project, the creation of the Map of European ecosystem types based on the EUNIS classification and the ecosystem assessment as part of ETC-SIA (European Topic Centre for Spatial information and Analysis).

The general mapping within MAES according to Target 2 of the EU Biodiversity strategy, however, has not yet been accomplished. The study elaborated by the Austrian Federal Agency for Environment is currently under review by the Austrian Ministry for Sustainability and Tourism and will probably be available for public use by the end of 2018. According to information from the authors of the study the following indicators / ES have been elaborated:

(1) Provisioning services: production of plant-based raw materials; wild animals for commercial use: fish for commercial use, timber increment for forest purposes, use of biogenic resources for renewable energy production; provisioning of drinking water from ground water and underground water sources;

(2) Regulating services: erosion protection; avalanche protection, flood prevention; pollination by insects; water purification potential of rivers; CO2 storage; fertile soils for agricultural and forest land use;

(3) Cultural services: recreation potential

(4) Biological diversity: Existence of natural diversity at species, gene and habitat level

As a general approach, the ES assessment is not intended to exactly monetarize the services and their values, but to assess their quantitative and spatial availability and cartographic visualization. [6]

Classification scheme for the national assessments: CICES (v4.3)

3.3.2 Studies at regional level

Mapping and assessing of a set of ecosystem services on a regional level has interalia been conducted within the following case studies:

3.3.2.1 Case studies Römerland Carnuntum" and "Oststeirisches Kernland"

Framework: within project MUFLAN, see Bartel et al. 2013

Study area: "Römerland Carnuntum", Pongau and "Oststeirisches Kernland", Austria

ES classification scheme: description of the level of the landscape's ability to provide ecosystem services, defined as function for production, regulation, recreation or as habitat or carrying function (following basically CICES approach).

Methods applied: valorization of ESS or landscape functions by summarizing GIS based analytical and statistical data from different sources

Main results: The different landscapes are described ranging from 1 to 5 in their ability to provide different landscape functions. The goal is to identify the potential for regional development and valorization of rural areas. The study delivered regional maps indicating the landscape functions for the different regional objectives (e.g. energy, regional labour market, etc.)

3.3.2.2 Case study "Mapping the value of ecosystem services: A case study from the Austrian Alps"

Framework: within project recharge.green, Alpine Space Programme 2007-2013, see Paletto et al. 2015

Study area: Leiblachtal (47° 33′ 21″ N, 9° 45′ 11″ E) is located in the north-western part of Vorarlberg (Austria), near the border to Germany. Subdivided in five municipalities, population of approximately 14,000 inhabitants, total area of 51 km^2.

ES classification scheme: CICES

[6] Oral information from Austrian Environmental Agency – 07.09.2018

Methods applied: valorization by market prices (provisioning services), benefit transfer (BT) method (cultural services), market price for regulating services (for carbon storage) and replacement cost method (protection against natural hazards).

Main results: provisioning services range between 200 €/ha year and 1,400 €/ha year; regulating services have also important economic values, but are strongly localized in specific areas (i.e. protective forests against natural hazards), economic values of cultural services are influenced by the preferences of tourists and varies between 5 €/ha year to 60 €/ha year.

3.3.2.3 Case study "Fließstrecken der Mur - Ermittlung der Ökosystemleistungen – Endbericht"

Study area: catchment area of the river Mur in Styria, Austria

ES classification scheme: CBD 2006

Methods applied: valorization of ES by using replacement costs method, travel cost method, contingent valuation and benefit transfer method

Main results: The study summarizes ES amounting from 93 to 132 million Euro/year for the Mur river, most of which are coming from recreational values of the river for tourists and people from the region, followed by biodiversity and species protection values. It has to be underlined that the sum of ES indicated represents the lower limit of ES as the estimation was using conservative assumptions. The sum of ES evaluated is considerable and belongs to the goods under public responsibility and public ownership. In consequence, the results of the study must lead to a much more prudent management of natural resources by the responsible institutions in order not to waste these public assets.

The authors underline that it is not possible to valorize all aspects of nature by ES, leading to a strongly biased evaluation to the disadvantage of nature when it comes to balancing ES against for example new construction projects. The argument of employment by new construction projects is a short-term argument as nature and ES available at the site are destroyed for ever. The authors recommend that from the viewpoint of national accounting ES values have to be considered much stronger.

3.4 Bulgaria

3.4.1 National level studies

In Bulgaria, an overall mapping and assessment of ecosystems and ecosystem services outside NATURA 2000 at EUNIS 3 level took place between 2009 and 2014 (funded by the European Economic Area Financial Mechanism 2009–2014 through programme BG03 Biodiversity and Ecosystem services).

The mapping and assessment was carried out by several parallel ongoing projects, of which each mapped and assessed one or two of the 9 following ecosystem types in Bulgaria, in detail:

- Freshwater Ecosystem Services Mapping and Assessment in Bulgaria, assessing as well marine ecosystems (FEMA)
- Wetland Ecosystem Services Mapping and Assessment in Bulgaria (WEMA)

"This project is needed to provide the ecological and biodiversity scientific basis for assessment of ecosystem services of wetlands in Bulgaria, which are not directly associated with freshwater bodies, do not belong to the coastal marine areas and are situated outside NATURA2000 network. The objec-

tive of a project is to organize and analyze ecological and biological scientific information on wetland ecosystems outside the Natura 2000 network in Bulgaria. The collected information will be integrated into the Information System of the National Biodiversity Monitoring System of the Executive Environment Agency. …

Object of mapping and assessment of the condition and services provided were the following subtypes of "terrestrial wetlands" ecosystems: 1. Valley mires, poor fens and transition mires (D2); 2. Base-rich fens and calcareous spring mires (D4); 3. Sedge and reedbeds, normally without free-standing water (D5).

The main results are:

- "Terrestrial Wetlands" ecosystems identified and mapped through GIS and field studies;
- The condition of identified ecosystems is assessed by direct measurement or analysis of available data on plant and animal diversity, soils, waters, fires, dumping-grounds and invasive species;
- Assessed provisioning, Regulating/Maintenance and Cultural ecosystem services;
- Individual maps of sub-types of ecosystems, their condition and the ecosystem services they provided; …"
  https://eeagrants.org/project-portal/project/BG03-0020 - assessed 16.10.2018

The project outcomes were partly published e.g. as scientific article "Analysis of Ecosystem Services of Wetlands along the Bulgarian Section of the Danube River" by Pelianov et al. (2014). The abstract of the article is integrated below:

"This investigation covers five wetlands situated on the Bulgarian section of the Danube River floodplain and four – on Danube islands. The significance of 12 different ecosystem services was assessed and plotted on six- point scale, using both reference data and interviews of local stakeholders. For the wetlands on the floodplain a comparison was made between the period before the 1940s and their current state. The potential ecosystem services after the implementation of measures for rehabilitation or conservation of the selected wetlands were also evaluated. Natural resources (e.g. fish, reedbeds, flooded meadows, floodplain forests), nutrient reduction and carbon retention were identified as the main types of ecosystem benefits and services provided by the wetlands on the Bulgarian section of the Danube River floodplain before the 1940s (at natural flooding regime). Currently the ecosystem services provided by these wetlands are limited mainly to the development of education or research activities. At present, albeit to a much lesser extent than in the past, the main ecosystem benefits provided by wetlands on the Danube islands are the natural fish resources used by the local community. After eventual rehabilitation or conservation and appropriate management of the wetlands on the Danube River floodplain an increase could be expected mainly in the ecosystem capacity for the development of tourism and recreational activities, education or research activities, nutrient trapping and carbon retention. Significant increase in the exploitation of natural resources seems hardly possible."

- Assessment and mapping of grassland ecosystems condition and their services in Bulgaria (IBER-GRASS) - http://grasslands-ecoservices-bg.eu/index.php/en/documents-menuen/results-menuen/57-data-on-grassland-ecosystems-collected-and-prENIred-for-uploading - 16.10.2018
- Mapping and assessment of sparsely vegetated land ecosystem services in Bulgaria (SPA-Ecoservices) – no results online available yet
- Towards better Understanding the Ecosystem Services in Urban environments trough assessment and mapping (TUNESinURB) - http://tunesinurb.org/en/2015/09/16/the-project-

envisages-the-publication-of-three-scientific-articles-in-refereed-journals/ - assessed 16.10.2018

- Ecosystem services mapping and assessment of heathland and shrubs in Bulgaria outside NATURA 2000, assessing as well cropland ecosystems and forests (SHE-BG)
- Ecosystem services mapping and assessment in the Bulgarian forest territories outside NATURA 2000 network (FOR OUR FUTURE). - http://fofproject.bg/en/pages/activity-34-scientific-results - assessed 16.10.2018

Besides the above-mentioned contents, the different projects undertook additional activities to further investigate more ecosystem types, notably an assessment of so-called Ecological Focused Areas (EFAs) in two pilot locations, urban mapping in two pilot cities, and a socio-economic assessment of the ecosystem services available in heathland and shrubs.[7] The direct publications from these 9 projects could not all be identified online.

The most important ES identified for Bulgaria are (MESEU, 2015):

- Maintenance of life cycles of migratory species (including nursery services)
- Regulation of water flows (e.g. natural drainage, irrigation and drought prevention)
- Climate regulation (including carbon sequestration, influence of vegetation on rainfall, etc.):

Project PDP02 - Methodological Support for Ecosystem Services Mapping and Biophysical Valuation (MetEcoSMap): it created the methodological framework for assessment and mapping of ecosystem conditions and ecosystem services in Bulgaria (peer reviewed by MAES members). The framework has been based on the national typology of ecosystems combining CORINE Land Cover (CLC) classes with the European Nature Information System (EUNIS) habitat classification types. The project tested the framework's landscape level mapping and assessment components. Water-related ecosystems (both fresh water and marine) follow the indicator system of the Water Framework Directive and Marine Strategy Framework Directive to ensure compatibility with EU classifications in different legislative fields. The project performed data collection for running the ESTIMAP pollination model for Bulgaria. By April of 2017, the Ministry of Environment has produced a national methodology for evaluation and mapping of the major ecosystem types (according to MAES 2013) and the services they provide (CICES v4.3). The process of integrating their values into the country's accounting and statistical systems is still ongoing.

The project 'Improving the Bulgarian Biodiversity Information System' (IBBIS) ensured the data collection back-end for all projects in the EU programme BG03, including mapping and assessment projects and some other projects that may inform ecosystem monitoring (for example the 'East and South European Network for Invasive Alien Species' which serves as a tool to support the management of alien species in Bulgaria (ESENIAS-TOOLS)).

According to the author of one ES study published in 2017, however, concrete economic assessments of ES in Bulgaria are still limited to individual research initiatives, such as the studies from Dimitrova et al. 2015; Assenov et al. 2016; Ivanova et al. 2016. By involving relevant stakeholders, e.g., local authorities, citizens, businesses, NGOs or public authorities, the studies always have as well an instructive character such as promotion activities or education of the public (Boulov et al. 2017).

[7] https://biodiversity.europa.eu/maes/maes_countries/bulgaria - assessed 29.05.2018

3.4.2 Regional studies

3.4.2.1 Regional study 'Economic value of ecosystem/landscape goods and services in the municipalities of Rudozem and Banite'

(Assenov et al. 2009)

Study area: Northern Part of Bulgaria within the Rhodopy Mountains in the municipalities Rudozem and Banite

ES Classification scheme: according to Millennium Ecosystem Assessment (2005)

Methods applied: Contingent valuation/ market price method

Main results: The study was undertaken in the framework of "The Mountain – models of socioeconomic and cultural development". "In the presented study of ecosystem/landscape goods and services in Rudozem and Banite municipalities, the contingent valuation method is applied by authors through a survey conducted among 121 respondents, respectively as follows: 56 respondents in Rudozem and 65 respondents in Banite. The results regarding the regulating, cultural and supporting ecosystem/landscape services for the region of Smolyan almost coincide in value with another similar study using the transfer method (Zervoudakis et al., 2007), carried out in all municipalities of the Rhodope Mountains. The regulating, cultural and supporting ecosystem services in the comparison study are defined at 5259 BGN/ha/year, a value which is very close to 5284 BGN/ha/year defined by the current study."[8]

The following main conclusions were formulated:

- "People living close to nature are ready to pay more for the protection of the ecosystem/landscape goods and services and this is confirmed by the comparison with the results of Gorna Arda."
- The current investigation, conducted among residents of the municipalities of Banite and Rudozem also proved to have an educational benefit for the local population.
- The average values, concerning regulating, cultural and supporting ecosystem/landscape services, are perceived close enough to their real dimensions.
- The conducted evaluation of the ecosystem/landscape services in two of the Rhodopean municipalities can be used as a base for extension of the research's range and is also a premise for modeling the landscape planning of both municipalities. (p.125/p.134)

More detailed information on how the local policy level has been influenced, however, is not provided.

3.4.2.2 Mapping and assessment of ES in Central Balkan area in Bulgaria at multiple scales

(Nedkov et al. 2018)

Study area: It is situated in Central Bulgaria, it covers the central part of the Balkan Mountains ('Stara Planina' and Pirin mountains) and the surrounding areas. In more detail, it covers the 9 surfaces of municipalities, including 82 settlements with a total population of approx. 130,000 people. The Central

[8] Assenov, A., Borissova, B.; Grigorov, B.; Bozhkov P. (2009): 'Economic value of ecosystem/landscape goods and services in the municipalities of Rudozem and Banite'. Published in: Annual of Sofia University "St. Kliment Ohridski" Faculty of Geology and Geography. Book 2 – Geography Volume 109; p.117-136.

Balkan National Park is part of the PAN Parks network, which is one of the largest and the most valuable protected areas in Europe (category 2 by IUCN).[9]

ES Classification scheme: according to CICES (4.3)

Methods applied: flood hazard assessment, scientific research on water related ES in the Northern part of Central Balkan National Park, an analysis of the potential to provide ES which form the current and future basis for local economy and social welfare, a pilot valuation of the ES provided by the forests and an assessment of the ES provided by the urban ecosystems in Bulgaria, excluding the NATURA 2000 zones. All ES information was collected in a GIS and mapped according to the MAES typology applied in Bulgaria, further developed (at level 3) and linked with the EUNIS classification of habitat types and the national standards for each ecosystem type (e.g. the urban ecosystems in correspondence with the national concept for spatial development 2013 – 2025 (developed by the Bulgarian Ministry of Regional Development).

The following table shows the ES selected for the pilot case study (incl. the assessment methods chosen). The study covers all different classes of ES from provisioning, to regulating and cultural services. ES valorization was mainly done by GIS-based spatial analyses.

Table 0.3. Overview of the ES and related mapping and assessment methods in the Bulgaria case study

Ecosystem Service selected for mapping and assessment	B	S	E
1.1.2.1 Surface water for drinking*	x		
1.2.2.1 Surface water for non-drinking purposes	x		
2.2.2.2 Flood regulation	x		
2.3.5.1 Global climate regulation	x		
2.3.5.2 Micro and regional climate regulation	x		
3.1.1.1 Experiential use of plants, animals and land/seascapes			x
3.1.2.5 Aesthetic*		x	

* ES selected for further discussion during ESMERALDA workshops 5 in Madrid;
B = biophysical methods; S = socio-cultural methods; E = economic methods.

Figure 7: Overview on ES selected for mapping and assessment in Stara Planina (Central Bulgaria) pilot case study (Nedkov et al. 2018, p. 8)

Main results: The study calculated the values for the above-mentioned ES by applying GIS-based spatial analyses. The outcomes are mostly indicators for the status of the single ES or in some cases, they can directly be used to quantify some ES. The dissemination of results upon the local stakeholders (in particular the municipalities involved) was used to instruct the audience on the concept of ES and to enrich the scientific discussion in Bulgaria on ES (e.g. with the Bulgarian Academy of Sciences and Sofia University St. Kliment Ohridski). The maps of the study can be viewed at: https://www.researchgate.net/figure/Maps-of-ecosystem-services-in-the-Central-Balkan-case-study-area-based-on-expert_fig3_325687781 (assessed 30.10.2018)

[9] Geneletti D, Adem Esmail B, Cortinovis C (2018) Identifying representative case studies for ecosystem services mapping and assessment across Europe. One Ecosystem 3: e25382. https://doi.org/10.3897/oneeco.3.e25382

3.4.2.3 GIS-based Valuation of Ecosystem Services in Mountain Regions: A Case Study of the Karlovo Municipality in Bulgaria (Boulov et al. 2017)

The study constitutes a concrete test case for a GIS-based mapping and valuation of ecosystem services model

Study area: It covers the "eponymous off-Balkan valley", with the Balkan mountain range to the North and the Sredna Bora mountains to the South. The Karlovo Municipality is part of the South Central Region (NUTS 2 level) of Bulgaria and covers 1% (1.044 km^2) of the Bulgarian territory, with 27 settlements and a total population of 50 016 people. The study area is a typical Bulgarian mountain municipality and the goal is to address the opportunities, challenges and limitations of the practical application of the ecosystem services concept. The study assesses the Total Economic Value (TEV) of the ES in the administrative unit of Karlovo Municipality and offers recommendations for improvement of the municipal ecosystem services utilization.

ES Classification scheme: according to CICES (4.3)

Methods applied: GIS based mapping of ecosystems and their related services, based on Corine Land Cover classification, information from Natura2000 habitat types, field research carried out in 2016 and further statistical data from Bulgarian national sources and an assessment of forest ES in the Central Balkan National Park (see Dimitrova et al. 2015).

Summary of the study: The study comes to the conclusion that the estimated TEV of the selected and currently utilized ES in the Karlovo Municipality is close to €115 million, most of which are produced by the agricultural use of the valley bottom. The highest share of ES are represented by cultivated crops, rearing animals and global climate regulation. Other ES are surface water for drinking and genetic material from biota. Further geospatial analysis revealed multi-functional ES hotspots, with up to 8 ES classes out of a total of 11 in the overall municipal territory. Broad-leaved and mixed forests turned out to be the most important ecosystem subclasses in this respect. The multi-functionality is mainly based on the mountain characteristics of the study area and at the same time the main asset of the study area. Problems were recognized in the availability of data to evaluate other than provisioning ES. Assumptions were sometimes generalized for strategic purposes, provoking weaknesses in case of concrete statements for the territory. The study arguments for more detailed field work in order to gather empiric data for further analyses and transfer to other regions.

3.5 Croatia

3.5.1 Studies at national level

3.5.1.1 Freshwater study and Croatian Strategy and Action Plan for the Protection of Biological and Landscape Diversity (NBSAP)

Croatia launched the first study for Freshwater Ecosystem Services (Pithart et al. 2014) according to the International Millennium Ecosystem Assessment (MA) in 2014. It used the list of ES from TEEB study (2010) and focused on water management and on lowland river ecosystems and services. Some ES were evaluated for the whole Danube basin area in the territory of Croatia and as well for the pilot study areas on the Drava River, the Nature Parks Vransko jezero and Velebit according to the data available. The goal was to compare different management scenarios for the freshwater resources in the Northern Croatian floodplains.

Methods applied: combination of geographic analysis using GIS tools and analysis of cost-benefit analyses (for freshwater study)

ES Classification scheme for freshwater study: according to TEEB 2010

Summary of the study: The figures of the freshwater study showed considerable values for different freshwater related ES, e.g. 277 USD/ha/year for fish harvest, 2.5 billion USD for floodplain forests with an annual harvest worth 73 million USD, drinking water for 3 million people, etc.) The project contributed to the prENIration of the revision of the Croatian NBSAP and supported the work of prENIring a national project of mapping and assessing the state of ecosystems and their services within the national territory (foreseen to be financed through ESI funds 2014-2020, no results available by now).

The Esmeralda project (Deliverable 2.2) points out that "With almost 37% of the country covered by Natura 2000, the country can contribute in relevant ways to ongoing discussions on how to reconcile conservation approaches with approaches based on ecosystem services." It indicates as well that Croatia should be better integrated in the MAES process at EU level and is a potential candidate for a common regional assessment with Slovenia, Greece and other Balkan states. In 2016, a Habitat Map of terrestrial habitats for the entire state territory of the Republic of Croatia has been prENIred, serving as a basis for the project of mapping and assessment of ecosystems and their services (MESEU, 2015). Moreover, ES and their services have been indirectly integrated in the Croatian Strategy and Action Plan for the Protection of Biological and Landscape Diversity (NBSAP) already in 2008 and in the revised version of September 2015.

3.5.1.2 Mapping and Assessment of Ecosystems and their Services in Croatia" (Sjajno j.d.o.o. 2015)

As part of the study "Drafting the baseline study of confirmed ecosystem values in Croatia, with an assessment of costs due to losses, and a guidebook for practical ecosystem accounting", a conceptual framework has been elaborated with the title "Mapping and Assessment of Ecosystems and their Services in Croatia" (Sjajno j.d.o.o. 2015). It defines both the country's ecosystems and the indicators to evaluate their status and thus deriving the relevant ecosystem services. The systematic national assessment, however, has not yet been carried out.

3.5.2 Regional studies

Since 2013, three projects in Croatia were dealing with the economic valuation of biodiversity, where ecosystem services were used as a tool for sustainable management of nature conservation areas, in detail the study on the Nature Park Vransko jezero and Velebit as well as on the river Drava. These three studies have been included in the study on freshwater resources mentioned above.

3.6 Czech Republic

3.6.1 Studies on national level

"CZ carried out habitat mapping by field survey. Data were complemented by remote sensing, so the ecosystem mapping is completed. Information on structure and functions of semi-natural habitats together with other data sources (agro-environmental schemes, WFD etc.) could be utilised in order to estimate condition of ecosystems. Study on ecosystem services was completed 2013. Either biophysical quantities or socio-economic values were derived for 17 services on the basis of benefit/value transfer. All the work has been delivered by scientists and experts and is not recognized by policy-

makers so far. Outcomes still wait for implementation. Policy support also needed to get data from sectors. Important to highlight why this work is useful outside biodiversity community."

https://biodiversity.europa.eu/maes/maes_countries/czech-republic - 24.05.2018

3.6.1.1 Pilot National Assessment of Ecosystem Services (Vačkář, D. 2016; Geneletti et al. 2018)

Summary of the study: The Czech pilot ES assessment and mapping followed the worldwide mainstreaming and establishment of global and sub-global assessments within the framework of the Millennium Ecosystem Assessment to contribute to the knowledge on the state of the environment and the sustainable management of natural capital in the Czech Republic. The objective of the pilot study was to map ecosystems within the territory of the country and to assess the value of ES provided by nature in the Czech Republic. A preceding pilot study conducted for the Czech Nature Conservation Agency and the European Topic Centre on Biodiversity (ETC), focused on the benefits provided by grasslands in the Czech Republic (Hönigová et al., 2011). The pilot assessment in the present case study, however, was the first overall assessment of ES provided by the diverse ecosystem types across the Czech Republic. As a general statement, the authors say that "… the ES concept is still not widely used and valued among the majority of policy-makers, beneficiaries and practitioners in the Czech Republic, so further dissemination and communication would be recommended."

Methods applied: A set of different methods for both national and regional scales was applied with the goal to further enable application into effective policy responses in order to stop future ES degradation. In detail, the bookkeeping model was developed for long-term carbon accounting (grasslands), biophysical assessment of livestock provision capacity, carbon sequestration (InVEST model), erosion control, invasion regulation, water flow regulation, waste treatment and recreation/aesthetic quality (ESTIMAP) was applied, and outcomes summarized for the whole country based on the ecosystems mapped. The value per hectare is indicated in the table below.

ES Classification scheme: according to CICES (4.3), original assessment based on Millenium Assessment

Table 0.6. Final ES values employed

Ecosystem Service category	Service	Average value (in EUR per ha)
Provisioning	Biomass provision	421.39
	Fish provision	107.54
	Game provision	9.91
	Non-timber provision	57.23
	Timber provision	6912.09
	Water provision	32.43
Regulating	Air quality regulation	266.33
	Climate regulation	4015.78
	Disturbance regulation	8456.19
	Erosion regulation	5766.57
	Nutrient regulation	200.10
	Pest control	7.31
	Pollination	1378.76
	Water cycle regulation	1373.14
	Water quality regulation	1210.67
Cultural	Aesthetic value	5971.94
	Recreation	2190.52

Figure 8: Ecosystem services in EUR per ha for the Czech Republic (Source: Vačkář, 2016)

3.6.1.2 Integrated assessment of ecosystem services in the Czech Republic (Frelichová et al. 2014)

Study area: Czech Republic

ES Classification scheme: according to CICES (4.3)

Methods applied: A set of different methods has been applied to respond to the different needs of ES valuation for the different habitat types, in detail: avoided cost method, benefit transfer, contingent valuation, emission trading scheme, insect pollination economic value, land expectation value, meta-analysis, marginal abatement costs, direct market pricing, net production, net value added, social costs of carbon, damage costs, replacement costs, payments for ecosystem services, property value, consumer and producer surplus, travel cost method

Main results: The study aimed to identify and value all ecosystem services delivered in the Czech Republic. To estimate the total value of Czech ecosystems, a geographically specific database of ecosystem service values was developed. The structure of the assessment follows the 6 ecosystem types selected (agricultural ecosystems, grasslands, forests, aquatic ecosystems, wetlands and urban areas) of which 17 ecosystem services are delivered. The ecosystem types were further classified into 41 ecosystem categories based on a habitat approach. A specific literature review was conducted to fill the database with biophysical and economic values of the ecosystem services selected. The database elaborated consists of more than190 values of ecosystem services, approximately 50% of them has been used for a benefit transfer calculation of the total ecosystem values in the Czech Republic. The surveys and figures from literature were transferred to the Czech habitat types and for each ecosystem type the average value of ES was summed up (per hectare). As a last step, the total values per hectare of individual ecosystem services were integrated into the consolidated layer and visualized as a map for the whole country.

The resulting average value of ecosystem services in the Czech Republic represents 1.5 the current national GNP (gross national product).

3.6.2 Studies at regional level

3.6.2.1 Economic value of ecosystem services in Protected Landscape Areas in the Czech Republic (Daněk et al. 2017)

Study area: Czech Republic

ES Classification scheme: according to MA (2005), TEEB (2013), and CICES (4.3)

Methods applied: benefit transfer method

Main results: The study aims to explore spatially explicit economic values of ecosystem services provided by ecosystems and habitats in 25 Protected Landscape Areas (PLAs) in the Czech Republic. For three selected PLAs (Beskids Mountains, Český les Mountains and Odra River Basin) a more detailed view was taken into the composition of ES. A combination of the Consolidated Layer of Ecosystems of the Czech Republic (CLES) and the EKOSERV database allowed the authors utilize the ecosystem and economic valuation data in a specific geographic context using a GIS-based approach. The total value of ecosystem services in all 25 PLAs reached € 51 billion/year, with the surface area significantly influencing the total average value of a particular PLA. When transformed to value per unit area, the values varied from €1.2 to €6.5 million/km2/year. The results suggest a dominant role of forest ecosystems in the composition of the economic value provided by ecosystem services in the PLAs. Economic valuation of benefits provided by protected areas can help to realize the social importance of these sites and to support policy and decision making processes.

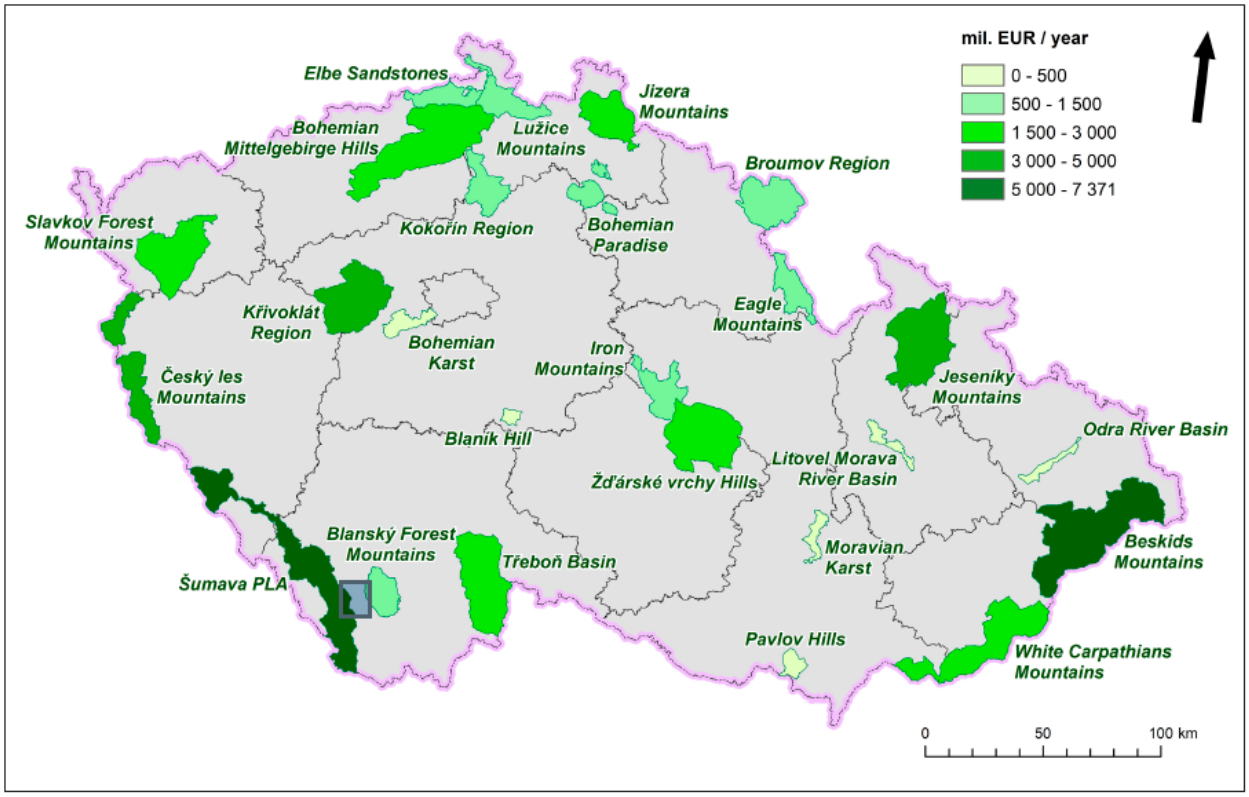


Figure 9: Total monetary value of ecosystem services in protected landscape areas per year in Czech Republic (2017)

3.7 Germany

3.7.1 Studies on national level

In Germany the National Agencies for Nature Conservation (BfN) and for Environment (UBA) have carried out different assessments of ES at national level under the header 'The Economics of Ecosystems and Biodiversity – TEEB', mainly focusing on specific topic, e.g. for urban areas, for rural areas, for climate protection, for companies, etc.

The most important ones are listed below – they can be downloaded from the website of the BfN under the following link: https://www.bfn.de/themen/oekonomie/naturkapital-teeb-de.html

- Naturkapital Deutschland - TEEB DE (2016): Ökosystemleistungen in der Stadt - Gesundheit schützen und Lebensqualität erhöhen
- Naturkapital Deutschland - TEEB DE (2016): Ökosystemleistungen in ländlichen Räumen. Grundlage für menschliches Wohlergehen und nachhaltige wirtschaftliche Entwicklung
- Naturkapital Deutschland - TEEB DE (2014 & 2015): Naturkapital und Klimapolitik – Synergien und Konflikte.
- Naturkapital Deutschland - TEEB DE (2013): Die Unternehmensperspektive - Auf neue Herausforderungen vorbereitet sein.
- Naturkapital Deutschland - TEEB DE (2012): Der Wert der Natur für Wirtschaft und Gesellschaft - Eine Einführung.

3.7.2 Studies on regional level

On regional level many different studies have been carried out. A few of them dealing with ES in different types of landscapes including urban areas are indicated below and may serve as examples for study approaches and current values of important ES.

3.7.2.1 Ökonomischer Wert von Seen und Feuchtgebieten (2013) (Früh, Simon; Gattenlöhner, Udo; Hammerl, Marion; Hartmann, Tobias; Megerle, Heidi; Spaich, Fabian & Hörmann, Stefan)

Summary: The authors of the study elaborate on the economic and societal value of lakes and marshlands and want to make companies and authorities aware of the importance of ES. The paper assesses the ES of lakes in general and in particular based on the example of the lake Bodensee. Apart from the ES themselves methods for financing of the protection of water ecosystems are discussed. Based on the analysis, the authors give recommendations to companies and authorities on how to protect these ecosystems.

Study area: Bodensee
Methods applied: Market price method, travel cost method (revealed preferences), qualitative evaluation, questionnaire

ES Classification scheme: Millennium Ecosystem Assessment

Main ES assessed:

- Provisioning services: drinking water, fish
- Regulating services: climate, water purification, erosion and flood protection
- Cultural services: recreation, tourism, cultural activities, education
- Supporting services: biodervisity, sedimentation, nutrient cycle

Main results: Stakeholders in the region profit in many ways from the ES of the Bodensee, but do not contribute to their protection, as they are not aware of how much they depend on these services. Climate change will severe the protection of ES further. As local authorities do not have enough financial means to provide the necessary protection of ES, new ways of financing have to be found and tested in the Bodensee region and elsewhere.

3.7.2.2 Mapping ES dynamics in an agricultural landscape in Germany (2016) (Burkhard, Benjamin; Kruse, Marion & Müller, Felix)

Summary: The study is mapping and assessing existing ES in the Bornhöved lakes district in Schleswig-Holstein.

Study area: Bornhöved lakes district, Schleswig-Holstein

Methods applied: data derived from Corine land cover data; ATKIS (Authorative Topographic-Cartographic Information System)

ES Classification scheme: Millennium Ecosystem Assessment; CICES

Main ES assessed:

- Provisioning services: cultivated crops, reared animals, plant-based energy sources
- Regulating services: climate regulation, erosion and flood protection, pollination and seed dispersal
- Cultural services: education, aesthetic

Main results: "The land cover pattern in the area has been rather constant in the last decades. However, significant changes in agricultural land use regarding crop rotation are obvious. This is mostly due to policy changes in Germany that have been heavily promoting and supporting the use of renewable energy since the past years. Resulting impacts were analyzed by land use change detection and statistical analyses of resulting changes in ES supply and demand. The increasing cultivation of energy plants (such as maize or rapeseed) for biomass generation has caused changes especially within provisioning ES (e.g. Figure 0.2). Their supply shows a shift from fodder (and partly food) production towards biomass for energy. The increasing cultivation of maize has further effects on biodiversity, regulating and cultural ES."

3.7.2.3 Ökosystemleistungen in Berlin: Klimaregulation und Erholungsfunktion auf städtischer Ebene (2013) Kabisch, Nadja & Larondelle, Nele & Haase, Dagmar

Summary: The study gives an overview over the most important existing ES which are air quality and climate regulation as well as recreation services in Berlin. Based on the indicator evaporation, the potential of carbon sinks and sealing should show how parks and green areas contribute to ES which are important for the quality of life of the citizens. The study is part of the URBES project (Urban Ecosystem Services and Biodiversity - URBES, www.urbesproject.org; 2011-2014 under the EU grant ERA-NETBiodivERsA) – ES and biodiversity in urban areas

Methods applied: spatial and indicator-based analysis and calculation of selected ES (based on Corine Landcover)

Study area: Berlin

ES Classification scheme: Millennium Ecosystem Assessment;

Methods applied: calculation and visualization of air quality and climate regulation; data based on values from CORINE Landover the EEA Urban Atlas; buffer analysis with ArcGIS 10.0

Main ES assessed:

- Regulating services: air quality, climate regulation
- Cultural services: recreation

Main results: The center of Berlin is mostly sealed and can contribute therefore less to ES than the outer areas and the large parks of the inner city. Compared to other large cities in Europe like Vienna, Madrid, Warschau, Budapest or Paris Berlin can provide its citizens well with ES due to the large quantity of parks, forest and water. The authors argue that the contribution of green and water areas need to be taken into account more seriously for urban planning, as they influence the ES and therefore the quality of life in cities.

3.7.2.4 Inwertsetzung von Ökosystemdienstleistungen -Eine objektive Bewertung auf lokaler Ebene - Remscheid (Sieberth Lukas, 2017)

Summary: The study aims to detect ES of forests in general. Therefore, the MAE classification scheme was applied on a local example, the forest area of Remscheid. The author argues, that the same method is applicable for similar studies on other forest areas to further elaborate the ES service functions of forests.

Study area: Remscheid

ES Classification scheme: Millennium Ecosystem Assessment;

Methods: Own calculation method

Main ES assessed:

- Provisioning services: wood, water, animals, Christmas trees
- Regulating services: erosion protection, climate regulation, air filtration, carbon sink, O2-production, protection against noise,
- Cultural services: recreation, health
- Supporting services: biodiversity, wildlife protection

Main results
The calculated value of the forest area of Remscheid is 26,6 million € per acres, resulting into 11,785 € per hectare. Worth noticing are the services of recreation (62%), water retention (12%) and biodiversity (10%) that account for 84% of the total value of the forest.

3.8 Hungary

3.8.1 Studies at national level

3.8.1.1 Studies at national level / MAES status

"A detailed national habitat mapping took place in HU between 2003 and 2006. Quality of natural and semi-natural habitats (ecosystem state) was also assessed and mapped. Despite their age these data could be a valuable basis for a MAES-HU. Most initiatives for a national ES assessment so far have come from the science side. Initiatives at the national scale did not receive financing so far. The organization of a national MAES board is still in progress. The Environment and Energy Efficiency Operational Program for 2014-2020 includes a special measure dedicated among others to the mapping and evaluation of ecosystem services at the national level. A new project management team (…) was set up at the Nature Conservation DENIrtment, Ministry of Agriculture in August 2015. The team started to develop the project documentation, consortium agreements etc. during September-October 2015. The project will be launched latest at the beginning of 2016 and will last for maximum 5 years."

"Most of the existing case studies were primarily project or funding-driven and they were coordinated and conducted by scientists. Accordingly, the scientists coordinating the case studies did their best to identify the most relevant questions and publish the results and lessons learned. There are no plans for scientific analysis at the national level yet."

(https://biodiversity.europa.eu/maes/maes_countries/hungary - 24.05.2018)

As described, a national inventory on ES for the whole territory of Hungary is not yet available, however, several ES have been assessed in various regional projects:

- food provision: crop, animal, wild food, honey (Tisza, Kiskun region),
- production of raw materials: timber and hay (Tisza, Kiskun region),
- medicinal resources (Tisza),
- water quality regulation (Tisza, Danube, Nagykörű fl oodplain polder, Gömör-Torna karst region),
- water flow regulation (Tisza),
- soil quality regulation (Tisza),
- habitat and population maintenance (genetic resources, birds) (Tisza, Kiskun region)
- pollination (Lendület region),
- pest control (Tisza),
- disease control: ragweed pollen (Kiskun region),
- decomposition (Lendület region),
- climate regulation: urban, global (Kiskun, Szeged region),
- recreation (Tisza, Kiskun, Szeged region),
- aesthetic value (Tisza),
- cultural heritage (Tisza)

(Tisza: Petz et al. 2012; Kiskun: Kelemen et al 2015; Lendület: Kovács-HostyánszKy et al 2011, Bereczki et al 2014; Szeged: TB; Gergő Gábor Nagy, Veronika Kiss 2011)

3.8.1.2 "Borrowing services from nature. Methodologies to evaluate ecosystem services focusing on Hungarian case studies" – a compendium of different case studies on ES in Hungary

Authors/Editors: Gergő Gábor Nagy, Veronika Kiss for CEE web (2011)

Summary: The publication collects different very interesting case studies on how to evaluate and valorise landscape functions and related ecosystem services. It refers both to the physical and social values of ecosystems and provides valuable information on the state of the art of ES valuation in Hungary. As is stated there the assessment of land use and ecosystems in Hungary dates from 2007 and for up to date results would need to be repeated. A national assessment of ES according to a common methodology is still pending.

Study area: Hungary, different regions; methodological aspects at national level

ES Classification scheme: CICES

Methods: GIS based assessment of physical and empirical data, contingent valuation, choice experiment, etc.

Main ES assessed:

- Provisioning services: crops, wood, biomass, timber, fish, food, medical plants, energy, etc.
- Regulating services: soil function, climate regulation, water retention, flood protection, nutrient regulation, groundwater recharge, etc.
- Cultural services: recreation, health, aesthetic values. intrinsic value of biodiversity

Main results: The publication comprises different thematic studies on ES and provides assessment results for different ES classes. As it elaborates as well methodological aspects of ES valuation it may serve as helpful basis for the design of further studies both at regional and national level.

3.8.2 Studies on regional level

3.8.2.1 Fostering pro-biodiversity business in the Bükk National Park (ECOKARST project)

Summary: One regional pilot study is ongoing in the project "Ecosystem services of karst protected areas – driving force of local sustainable development (ECOKARST)", funded by the EU Territorial Co-operation Programme to promote the opportunity to use the natural heritage of protected areas as an economic development factor. The ECOKARST project aims at contributing to the protection and sustainable development of karst bio-regions in the Danube region based on their valued ecosystem services, including the Bükk National Park in Hungary. The raised awareness and sustainable management of karst ecosystems across the Danube region are the basis for supporting local development. For more information see: http://www.interreg-danube.eu/approved-projects/eco-karst

"Bükk National Park - a part of the Northern Mountain Range of Hungary – was established in 1977 and covers 43 thousand hectares. It is mainly managed and utilized as forest (94%) and, to a smaller extent, as grassland (3.4%), meadow and pasture. Almost 98% of the national park is state owned, with two forestry companies as managing organizations in charge and the remaining area is managed by the Bükk National Park Directorate. The subject of the case study, however, is the wider local socio-ecological system containing low-intensity areas of settlements, arable lands, grasslands, vineyards and orchards adjacent to the National Park territory, reflecting the significance of these land uses and the opportunities offered by them to involve business and citizens. The process of mapping and assessing ES in the pilot areas is still ongoing. The assessment will be a basic resource for the discussion on increasing pro-biodiversity business opportunities in the region."

Study area: Bükk National Park

ES Classification scheme: according to CICES (4.3)

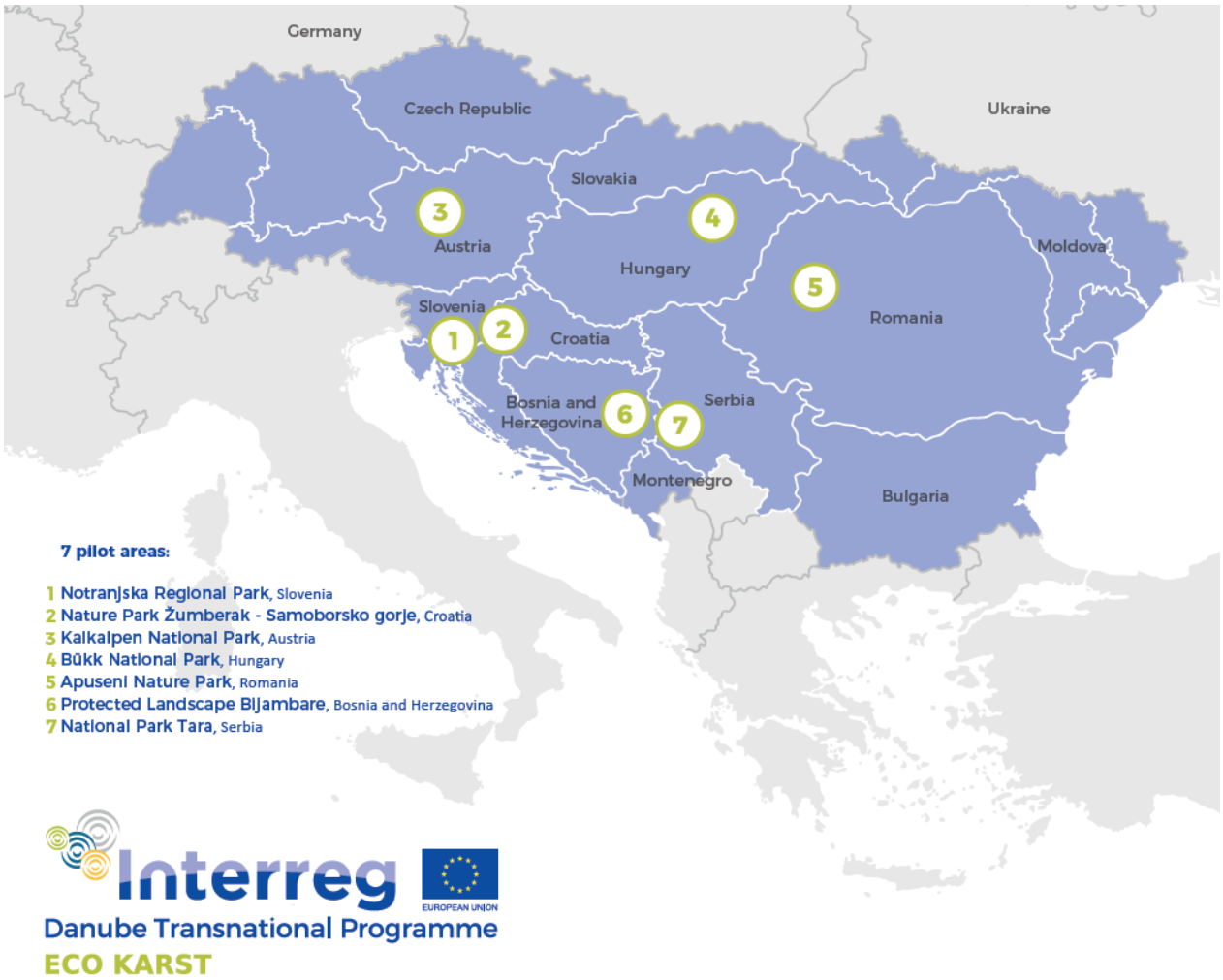
Methods: different valuation methods, study ongoing

Main ES assessed:
According to the findings of the ECO-Karst project the following ES are most relevant for the karst areas in the Danube region:

- drinking water - filter and buffer for pollution
- nature conservation, fertile areas rich in biodiversity
- role of the karstic forests in climate regulation (including carbon sequestration)
- tourism - natural beauty of landscapes and wildlife, specific features as caves and rock formations

Main results: not yet available; it is foreseen to integrate the maps on ES into the actions plans of the protected areas investigated, they will not be available as independent documents. The action plans will be ready by end of February 2019.

The following map shows the case studies in pilot regions carried out in the ECO-Karst project:



Source: http://www.interreg-danube.eu/uploads/media/approved_project_public/0001/12/cf052eeb6fb999365b1bc7b6ad4daf848d27a474.pdf

Figure 10: Map of ECO-Karst pilot regions with ES studies

3.8.2.2 **Ecosystem services in Hungarian Karst areas** (Kiss Marton et al., 2011)

Summary of the study: "Ecosystem service assessments provide a new and effective methodology in environmental management with several good experiences worldwide. In our study, we surveyed the services of a special landscape type, the karst areas in Hungary. Special characteristics of the karsteco-system are the high vulnerability and the three-dimensional and very fast processes. The importance of karsts is indicated primarily by drinking water provision, but they provide several other services with high economic value like soil formation, habitat function, timber production, climate regulation, recreation and aesthetic value." The study explains the relationship between the availability of ecosys-tem services in Hungarian karst areas and the socio-geographical and socio-economic impact ES can provide. It points out that the sustainable use of ES in Hungarian karst areas is not satisfactory and should be improved by better protecting the ecologic functions of the karst areas and incorporating them into the regional development processes.

Methods applied: descriptive

ES Classification scheme: descriptive classification

3.8.2.3 Managing the current and future supply of ecosystem services in the Hungarian and Romanian Tisza River Basin (Petz K. et al. 2012)

Summary of the study: The study assessed "… how ecosystem services are represented in policy measures, recognized by people and affected by weather extremes, all of which are reflected in land and water management. Our research focused on the Hungarian and Romanian regions of the Tisza River Basin. The analysis showed a complex relationship between these three factors and the provision of ecosystem services." The study explains that the relationship between the ecosystem service concept and decision-making processes or regional development is still poorly integrated in both Hungary and Romania.

Overall, the supply of ecosystem services is similar in the two countries. However, the results also show differences between services and countries. Although the two regions share similar environmental conditions, they have variations in ecosystem services recognition and supply, which may emerge from the different social, political and institutional settings. In Romania, the provisioning services of food and raw materials tend to be appreciated more, while in Hungary, the regulating and cultural services (mainly recreation and ecotourism) tend to have a higher appreciation. "We attribute this difference to the greater direct reliance on provisioning services in Romania and to the more widespread knowledge on the role of floodplains in water regulation and the stronger need to address water-related risk in Hungary. We conclude that the ecosystem service approach can contribute to a better understanding of the role and influence of the different factors involved on ecosystem service supply in the Tisza River Basin. We suggest that the supply of ecosystem services could be enhanced and diversified by better integrating them into policy and management plans. Although our analysis was mainly qualitative, it shows that local people's recognition and regional and national policy perspectives are important aspects of ecosystem service analysis. Information about people's specific relationships with their surroundings, for example, can be used to establish better, location-specific management plans."

Methods applied: ecosystem function analysis

ES Classification scheme: according to Millennium Assessment (2005)

Main ES assessed:

- provisioning services (food, raw materials, genetic and medicinal resources);
- regulating services (water regulation, water purification, natural hazard regulation, pest regulation, soil quality regulation);
- cultural services (recreation and ecotourism, aesthetic value and cultural value)

3.9 Romania

3.9.1 Studies at national level

In Romania, different ES mapping and assessment initiatives and projects have been carried out, mostly as part of the European MAES process. The following projects are supposed to be the most relevant ones (see MAES Factsheet, 2015):

"Demonstrating and promoting natural values to support decision-making in Romania" (Short title: Nature4Decision-making – N4D), which has been implemented with funds from the EEA/Norwegian Financial Mechanism 2009-2014, the duration of the project was from: 03/2015 to 04/2016.

The main components of Nature4Decision-making (N4D) included:

1) A biophysical mapping and assessment of key ecosystems and their services; major results were achieved regarding the mapping of ecosystems at national level with the outcome of a "Ecosystems classification in Romania EUNICE 3".

2) A baseline economic valuation of key ecosystem services which are relevant for public environmental policies, i.e. for biodiversity, climate change, fishing and aquaculture, agriculture and sustainable development, transport, energy, regional development, tourism, marine and forest areas. In addition, an inventory of the responsible institutions, an institutional map and a questionnaire to identify institutional needs related to the MAES process were elaborated. The goal was to assess the level of integration of the concept of ES in public policy for 2014-2020 and to develop recommendations on how to integrate the results of ES and biophysical mapping in decision-making processes.

The main outcomes are summarized in the following table:

Category	**Value**	**Unit**	**Source**
Nature-based products (medical and aromatic herbs, drinking water)	731 156	EUR	INS, 2017
Commercial hunting products	1 329 445	EUR	INS, 2017
Commercial fishing products	2 498 322	EUR	INS, 2017
Bee products (honey, etc.)	2 230	EUR	INS, 2017
Other valorisation of products and services *	10.907.170	EUR	INS, 2017
Nature-based tourism	160-300	millions-EUR	Qualified estimations
Carbon sequestration	92-250	millions EUR	Short-term market prices

* Other valorisation of products and services include "wood carbon trade, use of further raw materials with valuation according to current legal regulations; income from trade with horses, agricultural products and cereals "(INS, 2017)

Table 1: Economic valorization of main ES in Romania (adapted from MAES 2015)

3) A development of a DSS - Decision Support System for use of MAES results into policy and decision-making.

At practical level, the establishment of a national working group on Ecosystem Services was part of the project. This working group is still active and is available in case of questions or project initiatives on ES in Romania. Its members come from the Ministry of Environment, the University of Bucharest UB-RCSES, Romania; Forest Research and Management Institute – ICAS, Romania

More information can be found at: http://maesromania.anpm.ro

https://biodiversity.europa.eu/maes/maes_countries/romania - 24.05.2018

Different pilot studies have been selected under the EEA grants for financing (start date foreseen was March 2016 (http://eeagrantsmediu.ro/proiecte/15); these studies 'could act as case studies for in-depth analysis of ecosystem services in different areas of Romania'.

3.9.2 Studies at regional level

At regional level in Romania, different studies have been undertaken, mainly in the Carpathian mountain regions and the estuary areas and floodplains of the Danube or other big rivers. The Danube itself has been subject to the multi-national studies explained in chapter 3.1.

3.9.2.1 Assessment of the Contribution of Ecosystems in Protected Areas to Sector Growth and Human Well Being in Romania

Authors: Bogdan Popa; Camille Bann

Summary: "The Carpathian Network of Protected Areas (CNPA) is comprised of 285 protected areas that cover 31,978 km2. However, this network of Protected Areas (PAs) is considered to be not sufficient in terms of scale, connectivity and management to prevent the irreversible loss of biodiversity in the Carpathian ecoregion. PAs of the Carpathian mountains face a range of pressures including the overexploitation of forest resources through logging, poaching, habitat degradation and fragmentation caused by the construction of roads, houses and tourism infrastructure that is not properly planned and developed (Project Document, 2009). Furthermore, the Carpathian PAs are underfunded. For example, the 5 Romanian PAs selected for study by this project received around €950,000 in funding in 2010, while €1,600,000 is considered to be necessary to meet basic needs and around €2,550.000 to optimally manage the sites (UNDP 2011). This study sets out the economic and social arguments for the Romanian CNPAs. More specifically the study aims to generate evidence of how a sustainably managed CNPAs supports productivity in key sectors such as tourism, forestry and industry, using key indicators such as employment, tax revenue, foreign exchange earnings and equity aspects. The study also seeks to demonstrate the costs associated with unsustainable management. This evidence will be used to convince public and private decision-makers of the importance of PAs to growth and productivity in key sectors of the Romania economy and to the welfare of the population in general. Such evidence will provide part of the rationale for better PA financing. The study also demonstrates the application of the Sector Scenario Analysis (SSA) approach to PA ecosystems, as an approach that can be replicated at other sites across the network." (adapted)

Study area: Apuseni Nature Park, Maramures Mountains Natural Park, Piatra Craiului National Park, Retezat National Park, Vanatori Neamt Natural Park

ES Classification scheme: CICES

Methods: avoided damage costs (for erosion, carbon sequestration and flood events in forest and alluvial plains), statistical and GIS data based calculation (agriculture), avoided water treatment costs, Sector Scenario Analysis (SSA)

Main ES assessed:

- Provisioning services: water supply, food / agricultural products, wood and Non Timber Forest Products, energy
- Regulating services: erosion protection, climate regulation (including greenhouse gases), water storage and retention related to disaster mitigation, nutrient retention
- Cultural services: spiritual, religious, cultural heritage; education, recreation and ecotourism, landscape and amenity; biodiversity (non-use values)

Main results:

"The Net Present Value (NPV) of Sustainable Ecosystem Management (SEM) (based on the present value of sustainable ecosystem management minus the present value of business as usual (BAU)) for the 5 sites is estimated at €518 million. The cumulative benefit of SEM for all five protected areas is €2,794 million (i.e. the total benefit of SEM relative to BAU over 25 years). This can be viewed as the benefit of SEM or the cost to the economy of continuing with BAU.

There are 21 major protected areas (12 national parks and 10 nature parks) included in the Romanian Carpathian Network of Protected Areas (CNPA). Based on the analysis of the ecosystems of the 5 pilot protected areas it is possible to derive very high level estimates of the value of sustainable ecosystem management for the Romanian CNPA system as a whole. Scaling up the values for the 5 pilot areas to the whole network, based on the number of hectares and assuming that the 5 pilot sites are representative of the whole area, provides SEM with a NPV of €1,685 million (and cumulative value of around €9,000 million over BAU)." (adapted)

The study proves that sustainable ecosystem management provides goods and services in considerable amounts which often overweigh the short-term benefits of exploiting single resources (such as timber in this case).

3.9.2.2 How much are nature's gifts worth? Summary study of the mapping and assessment of ecosystem services in Natura 2000 sites of the NIRAJ-TÂRNAVA MICĂ region

From 2016 onwards, different case studies have been selected for financing by the EEA. The case study on Niraj-Tarnava Mica region was one of those studies.

Authors: Arany, Ildikó, Czúcz, Bálint, Kalóczkai, Ágnes, Kelemen, Atilla Márton, Kelemen, Katalin, Papp, Judith, Papp, Tamás, Szabó, Linda, Vári, Ágnes, Zólyomi, Ágnes

Study area: Niraj-Tarnava Mica region (Centre region of Romania)

ES Classification scheme: Millennium Ecosystem Assessment // CICES

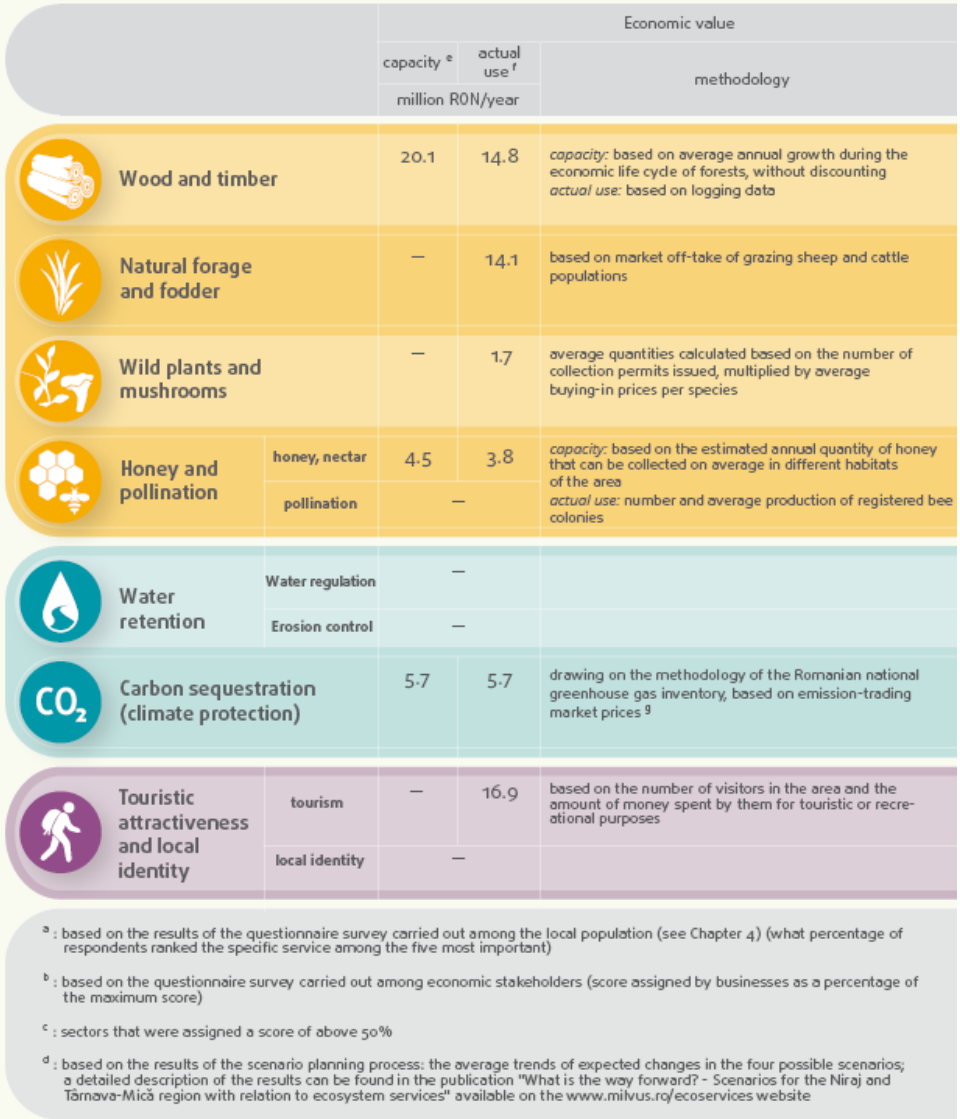
Methods: biophysical assessment of data, socio-economic surveys

Main ES assessed:

- Provisioning services: wood and timber, natural forage and fodder, wild plants and mushrooms, honey and pollination
- Regulating services: water retention (water regulation and erosion control), carbon sequestration (climate protection)
- Cultural services: touristic attractiveness and local identity
- Supporting services: biodiversity, wildlife protection

Main results:

The following figure illustrates the general capacity for ES in the region and the real quantity of ES used. It shows that provisioning and cultural services are intensively 'used' in the region Niraj-Tarnava Mica, whereas information on water regulating services is difficult to obtain.



		Economic value		
		capacity [e]	actual use [f]	methodology
		million RON/year		
Wood and timber		20.1	14.8	*capacity:* based on average annual growth during the economic life cycle of forests, without discounting *actual use:* based on logging data
Natural forage and fodder		–	14.1	based on market off-take of grazing sheep and cattle populations
Wild plants and mushrooms		–	1.7	average quantities calculated based on the number of collection permits issued, multiplied by average buying-in prices per species
Honey and pollination	honey, nectar	4.5	3.8	*capacity:* based on the estimated annual quantity of honey that can be collected on average in different habitats of the area *actual use:* number and average production of registered bee colonies
	pollination	–		
Water retention	Water regulation	–		
	Erosion control	–		
Carbon sequestration (climate protection)		5.7	5.7	drawing on the methodology of the Romanian national greenhouse gas inventory, based on emission-trading market prices [g]
Touristic attractiveness and local identity	tourism	–	16.9	based on the number of visitors in the area and the amount of money spent by them for touristic or recreational purposes
	local identity	–		

[a]: based on the results of the questionnaire survey carried out among the local population (see Chapter 4) (what percentage of respondents ranked the specific service among the five most important)

[b]: based on the questionnaire survey carried out among economic stakeholders (score assigned by businesses as a percentage of the maximum score)

[c]: sectors that were assigned a score of above 50%

[d]: based on the results of the scenario planning process: the average trends of expected changes in the four possible scenarios; a detailed description of the results can be found in the publication "What is the way forward? - Scenarios for the Niraj and Târnava-Mică region with relation to ecosystem services" available on the www.milvus.ro/ecoservices website

Figure 11: Key results of the social and economic valuation of ecosystem services (Source: Arany et al. 2017, p.32)

3.9.2.3 Managing the current and future supply of ecosystem services in the Hungarian and Romanian Tisza River Basin

Authors: (Petz K. et al. 2012)

Summary: see chapter 3.7.2.3

3.9.2.4 Fostering pro-biodiversity business in the Apuseni Nature Park (ECOKARST project)

Summary: One regional pilot study is ongoing in the Apuseni Nature Park within the project "Ecosystem services of karst protected areas – driving force of local sustainable development (ECOKARST)", funded by the EU Territorial Cooperation Programme to promote the opportunity to use the natural heritage of protected areas as an economic development factor. The ECOKARST project aims at contributing to the protection and sustainable development of karst bio-regions in the Danube region based on their valued ecosystem services, including the Apuseni Nature Park in Romania. The raised awareness and sustainable management of karst ecosystems across the Danube region are the basis

for supporting local development. For more information see: http://www.interreg-danube.eu/approved-projects/eco-karst

ES Classification scheme: according to CICES (4.3)

Methods: different valuation methods, study ongoing

Main ES assessed:
According to the findings of the ECO-Karst project the following ES are most relevant for the karst areas in the Danube region:

- drinking water - filter and buffer for pollution
- nature conservation, fertile areas rich in biodiversity
- role of the karstic forests in climate regulation (including carbon sequestration)
- tourism - natural beauty of landscapes and wildlife, specific features as caves and rock formations

Main results: not yet available; it is foreseen to integrate the maps on ES into the actions plans of the protected areas investigated, they will not be available as independent documents. The maps and action plans will be ready by end of February 2019.

3.10 Slovakia

3.10.1 Studies on national level

On May 14, 2014 workshop "Ecosystem services – their mapping and evaluation in Slovakia" was held in Bratislava. Its main aim was to present ongoing activities on MAES at local/regional levels and to discuss possible ways how to proceed in meeting target 2 of the EU Biodiversity Strategy 2020 at the national level. Over 45 experts took part. Presentations are available (mainly in Slovak language) on http://www.minzp.sk/sekcie/temy-oblasti/ochrana-prirody-krajiny/ekosystemove-sluzby/.

"On September 10th, 2014 Government of the Slovak Republic approved Action Plan on implementation of the Updated National Strategy for Biological Diversity by 2020. Document includes several activities on MAES, it is available in Slovak on http://www.minzp.sk/files/oblasti/ochrana-prirody-a-krajiny/biodiverzita/1_vlastny_ap-biod_aug_2014.pdf.

Following previous meetings with relevant institutions, the working group on MAES in Slovakia ("MAES-SK") was established from experts and representatives from various sectors of state and scientific institutions (agriculture, forestry, water, nature conservation, climate, geology, etc.). Its first meeting was on August 6th, 2014 and second on September 12th, 2014. The aim of the working group is methodological coordination of the work to fulfil the goals on the national level outgoing from the EU Biodiversity Strategy 2020 (mapping of ecosystems, inventory of ecosystem services etc.).

Furthermore, expert workshop "Ecosystem services: assessments and beyond" was held in Bratislava on Oct 22nd, 2014. Ministry of Environment of the Slovak Republic organized it in cooperation with the European Environment Agency (EEA). More than 18 participants from a range of areas, including academic institutions, Slovak Environment Agency, State Nature Conservancy of the Slovak Republic took part. The main objective of the workshop was to provide an update on research on the assessment of ecosystem services. Three case studies were presented: "Ecosystem services of inland waters in the Slovak Republic – results to date"; "Ecosystem services in research of the Institute for Landscape Ecology, Slovak Academy of Science" (assessments of rural-urban areas and agricultural land used in a

traditional way); and "Ecosystem services: institutions and policies". The workshop was followed by a discussion on further directions and cooperation in the assessment of ecosystem services in Slovakia.

We would like to note that ecosystem services are important also for the work of the other international conventions, e.g. Ramsar Convention on Wetlands, as it was discussed on the 8th European Ramsar Meeting in Austria (October 2014), where SK took part and actively involved."

https://biodiversity.europa.eu/maes/maes_countries/slovakia - 24.05.2018

In 2014, the following document was published, named "Valuation of Ecosystem Services in Carpathian Protected Areas with focus on Slovakia – Guidelines for rapid assessment" (Považan, Kadlecik, Getzner). The elaboration of these guidelines was financed by UNDP, GEF SGP and was meant to instruct nature conservation administration staff on how to conduct quick assessments of ES in protected areas. The methodology used is based on WWF guidelines and follows in principle the CICES classification scheme for ES.

3.10.2 Studies on regional level

3.10.2.1 **On the valuation of ecosystem services in Muranska Planina National Park** (Považan Radoslav et al., 2015)

Summary of the study: The study detects and values existing (non-market) ecosystem services in the Muranska Planina National Park (Muran Plateau). The park is located in the Inner Western Carpathians at the border of central and eastern Slvoakia. The plateau with 20 318 hectares was declared as National Park in 1997. Most of the National Park is currently classified as a Site of Community Importance (SCI) within the Natura2000 system of protected areas. About 30 000 tourists visit the park every year.

Methods applied: Basic collection of data, questionnaire survey (willingness to pay (WTP) entry fee and willingness to accept restrictions (WTA)), market price method, reference values related to replacement / avoided costs

ES Classification scheme: Different monetary evaluation methods based existing assessment studies were applied and adjusted to the local and / or national conditions

Main ES assessed:

- Provisioning services: Forest products, agriculture, hunting, water supply
- Regulating services: water retention, flood protection, carbon sequestration,
- Cultural services: recreation
- Supporting services (none)

Main results: "The significance of (non-market) ecosystem services in Muránska Planina National Park (NP), Slovakia, can be valued at about EUR 10 million per year. However, the ecosystem services of the park provided in terms of forestry, agriculture and tourism are smaller than in other Slovak NPs. The study nevertheless underlines the important ecosystem services that Muránska Planina NP provides for the regional and national economy, and how it contributes significantly to human well-being." (Povazan et al. 2015)

3.10.2.2 Value of Ecosystem Services in Mountain National Parks. Case study of Vel'ka Fatra National Park (Považan Radoslav et al., 2014)

Summary of the study: The Vel'ka Fatra National Park is located in central Slovakia along the Vel'ka Fatra mountain range in the west Carpathians and has a size of 40,371 ha. The study selected and valued ecosystem services of the park and compared to two other national parks in the broader region: Slovenský raj (Slovakia) and Tatra (Poland). All three studies follow the same methodological approach.

Methods applied: market price method, hedonic prices or travel costs, avoided costs (revealed preferences) as well as willingness to pay or accept (WTP/WTA; contingent valuation, choice experiments, contingent behavior (stated preferences)

ES classification scheme: according to WFF guidelines indicating types of values (direct use value, bequest value, etc.)

Main ES assessed:

- Provisioning services: Forest products, agriculture, hunting, (fresh) water supply, medicinal resources
- Regulating services: water retention, flood protection, carbon sequestration, erosion control
- Cultural services: recreation
- Supporting services: none

Main results: "In total, Veľká Fatra annually provides ecosystem services worth EUR 179 million (about EUR 4,400 per hectare). The national park secures manifold ecosystem services such as recreational benefits (use values) for roughly 500,000 visitors per year, and a range of non-use values (e.g., existence and bequest values) for the Slovakian population. In comparison, ecosystem services at Vel'ká Fatra are fewer than the benefits of the other national parks due to the smaller recreational benefits. However, the results of the study ascertain that Veľká Fatra provides important ecosystem services for the Slovakian economy as a whole. With its services the park generates value, which contributes significantly to people's well-being and the national economy." (Svadja et al. 2014)

The ecosystem services supplied by soil in relation to land use

3.11 Slovenia

3.11.1 Studies on national level

"In Slovenia ES assessments have been carried out mainly on a local level. There was also a study in which selected ES were evaluated on a national level, with traditional economic methods and sustainable ecosystem methods, based on ES data arising from land use:

- Economic valuation of ecosystem services for designing policies of sustainable use of forest resources (Doctoral dissertation, Anže Japelj), http://www.digitalna-knjiznica.bf.uni-lj.si/gozdarstvo/dd_japelj_anze.pdf
- Developmental and Protective Evaluation of Ecosystem Services of Slovenia (Master thesis, Suzana Vurunić), http://geo.ff.uni-lj.si/pisnadela/pdfs/magB_201510_suzana_vurunic.pdf"

The Institute of the Republic of Slovenia for Nature Conservation is partner in the on-going Interreg project Alpine Space: Alpine Ecosystem Services – mapping, maintenance and management (AlpES) that will last from December 2015 to December 2018. The AlpES project's overall objective is to intro-

duce ecosystem services as a regional/transnational environmental governance framework and train and support the AlpES target groups in understanding, valuing and managing them (with Slovenian Ministry for the Environment and Spatial Planning as observer of the project).

In Slovenia, the topic of ecosystem services is still rather unknown. Stakeholders have some basic knowledge, but an overall concept is still missing. The goal of the AlpES project is to speed up the process of understanding the ES concept, in particular for those areas within the Alpine Space area.

An important part of the project for Slovenia will be a calculation of the indicators for mapping and assessment of ecosystem services relevant for the Alpine space area. In the AlpES eight ecosystem services will be assessed and indicators will be developed and later tested in pilot regions. With the input of more detailed national data a first Slovenian map of ecosystem services will be developed and the indicators will be tested in the pilot region (Primorsko-notranjska statistična regija), leading to a first regional mapping of ecosystem services in Slovenia.

In addition, the mapping of non-forested habitat types based on national standardized methodology is ongoing (70% of the first cycle is already completed), based on land use data of forested and agricultural areas (with continuous updates in 4 year cycles).

https://biodiversity.europa.eu/maes/maes_countries/slovenia - 24.05.2018

3.11.2 Studies on regional level

Several studies on regional level have been carried out, including the above mentioned of the AlpES project. Some of them are described below in more detail.

3.11.2.1 Ecosystem Services Evaluation in the Škocjan Caves Regional Park (2011)

Summary of the study: The present study is a very detailed assessment for the area of the Škocjan Caves Regional Park. The Škocjan Caves Regional Park is a nationally protected area, located in the south-western Slovenian Municipality of Divaca on the Karst Plateau. It belongs to the Natura 2000 and the EUROPARC network and is listed as Ramsar site, as first underground wetland. The Škocjan Caves belong to the UNESCO natural Heritage Sites. They represent the only natural monument in Slovenia in the "Classical Karst" region, which attracts approx. 100,000 tourists per year from all over the world.

The study develops two scenarios (1) Keeping the status-quo of management of the regional park and (2) Making use of the potential of ES

The result is the following, expressed in monetary terms: (1) 12.85 million Euro for 2011 versus (2) 14.77 million Euro

The authors underline that the Škocjan Caves (and the Regional Park) provide essential educational value, provide local employment. They contribute to the benefit of all people in the region and are not only generating a profit for the Regional Park body itself. Based on the results of the study, the authors recommend to extend and increase the tourism offer in the area and to elaborate a detailed marketing analysis as well as a detailed investment program based on it.

Methods applied: market price method, avoid damage cost approach, zonal travel cost method, descriptive approach

ES Classification scheme: according to Millenium Ecosystem Assessment (2005) including biodiversity as a service

Main ES assessed:

- Regulating services (air quality, climate, water, natural hazard and erosion prevention, water purification, waste treatment, disease regulation, pest regulation, pollination)
- Cultural services (cultural diversity, ethical, spiritual and religious services, educational values, inspiration, aesthetic values, social relations, sense of place, cultural heritage values, recreation and tourism)
- Supporting services (none)

3.11.2.2 Ecosystem Services Evaluation in the Notrajnska Regional Park, Slovenia (2018)

Authors: Slovenian State Forest Service, Notrajnska Regional Park administration

Summary: One regional pilot study on ES assessment in the Slovenian Notrajnksa Regional Park is ongoing in the project "Ecosystem services of karst protected areas – driving force of local sustainable development (ECOKARST)", funded by the EU Territorial Cooperation Programme to promote the opportunity to use the natural heritage of protected areas as an economic development factor. The ECOKARST project aims at contributing to the protection and sustainable development of karst bioregions in the Danube region based on their valued ecosystem services, including the Notrajnska Regional Park in Slovenia. The raised awareness and sustainable management of karst ecosystems across the Danube region are the basis for supporting local development. For more information see: http://www.interreg-danube.eu/approved-projects/eco-karst

The Notrajnska Regional Park has a surface of 222 km^2 including "…mountain peaks with breathtaking views, colourful meadows, an intermittent lake, natural bridges, mystical underground world, crystal-clear streams and magical forests…" (https://www.notranjski-park.si/en/nature/natural-sights). The subject of the case study, however, is the wider local socio-ecological system containing low-intensity areas of settlements, arable lands, grasslands, the Lake Cerknica, orchards, river gorges and caves adjacent to the Regional Park territory, reflecting the significance of these land uses and the opportunities offered by them to involve business and citizens. The process of mapping and assessing ES in the pilot area of Notrajnska Regional Park is still ongoing. The results of the mapping will be available by February 2019 and will be integrated in the management plan of the Regional Park. The assessment will also be a basic resource for the discussion with stakeholders and citizens on increasing pro-biodiversity business opportunities in the region.

Study area: Notrajnska Regional Park

ES Classification scheme: according to CICES (4.3)

Methods: different valuation methods, study ongoing

Main ES assessed:
According to the findings of the ECO-Karst project the following ES are most relevant for the karst areas in the Danube region:

- drinking water - filter and buffer for pollution
- nature conservation, fertile areas rich in biodiversity
- role of the karstic forests in climate regulation (including carbon sequestration)
- tourism - natural beauty of landscapes and wildlife, specific features as caves and rock formations

Main results: not yet available; it is foreseen to integrate the maps on ES into the actions plans of the protected areas investigated, they will not be available as independent documents. The maps and action plans will be ready by end of February 2019.

3.12 Bosnia & Herzegovina

3.12.1 National level studies

By now, no national assessment of ES has been undertaken, instead there are few research activities at regional or local level. The discussion on how to apply the ES concept together with first studies, however, have been started within academia and research institutions of BiH. The goal is to bring the topic closer to the relevant stakeholder groups and to the wider public.

Within the 5th National Report to the United Nations Convention on Biological Diversity of Bosnia and Herzegovina (Oprašić S. et al. 2015) an overview is given on the main relevant ES for BiH. The figure below shows the type and status of ES, the source of information and an estimation on their importance and development (trend) in the future for BiH country:

Category of services	Benefits	Trend	State	Importance	Source
Provisioning services	Food, timber, fuel, genetic resources, potable water, natural medicines, etc.	Favourable in the present conditions	☺	Economic potentials: agriculture, exploitation of forests, organic production, traditional medicine, aquaculture, hunting, fishing, etc.	The First (2009) and the Fourth (2010) National reports to UNCBD; State of the Environment Report of Bosnia and Herzegovina (2012)
Regulating services	Air-quality regulation, climate regulation, water regulation, water purification, waste dilution, disease control, control of epidemics, regulation of natural disasters.	Unfavourable, with an increase in direct pressures	☹	Potential human and economic damage: human health, damage to forestry, agriculture, water management, civilian and social protection, tourism	Second National Communication of Bosnia and Herzegovina under the UN Framework Convention on Climate Change, 2013); Risk Assessment of Bosnia and Herzegovina regarding Natural and other Disasters (2011)
Cultural services	Cultural, spiritual and religious values, knowledge system, educational values, inspiration, aesthetical values, social relations, development of the sensitiveness for place, cultural heritage values, recreation and eco-tourism.	Favourable with additional investments	☺	Economic potentials: tourism development, quality of education, improvement of human health, development of social values.	State of the Environment Report of Bosnia and Herzegovina (2012)
Supporting services	Primary production of organic matter, flow of nutrients, land forming, pollination,	Unfavourable with an increase in direct pressures	☹	Potential human and economic damage: human health, damage to forestry, agriculture, water management, civilian and social protection, tourism.	State of the Environment Report of Bosnia and Herzegovina (2012); Second National Communication of Bosnia and Herzegovina under the UN Framework Convention on Climate Change, 2013);

"In addition to the information cited above, few studies and assessments were conducted within the framework of various projects and most of them are linked to certain locations. When it comes to protected areas, the trend of economic valorisation has just appeared in BiH. Perception that protection of nature does not yield economic profit has been present here to date and the advantage is given to projects that have the so-called 'existential importance' while natural resources are being irreversibly destroyed in the process with short-term financial effects. (Information on Protected Natural Areas of the Sarajevo Canton, 2007)." (Oprašić S. et al. 2015) As a consequence

3.12.1.1 Ecosystem Services Evaluation in the Protected Landscape Park Bijambare, Bosnia-Herzogovina (2018)

Authors: Administration of Protected Landscape Park Bijambare, Project team ECOKARST

Summary: One regional pilot study on ES assessment in the Slovenian Notrajnksa Regional Park is ongoing in the project "Ecosystem services of karst protected areas – driving force of local sustainable development (ECOKARST)", funded by the EU Territorial Cooperation Programme to promote the opportunity to use the natural heritage of protected areas as an economic development factor. The ECOKARST project aims at contributing to the protection and sustainable development of karst bioregions in the Danube region based on their valued ecosystem services, including the Notrajnska Regional Park in Slovenia. The raised awareness and sustainable management of karst ecosystems across the Danube region are the basis for supporting local development. For more information see: http://www.interreg-danube.eu/approved-projects/eco-karst

The Bijambare Landscape Park has a surface of approx. 370 km^2. The Landscape Park is situated in the northeastern slopes of the Canton Sarajevo near Nisici highland. Being situated in the karstic region there are many karst phenomena such as karstic depressions, sinkholes and, most importantly, 6 popular caves which can be visited. The reserve is attractive for spelaeology, hiking, cycling, horse-riding, picnic, mountaineering, alpinism, fishing, hunting, skiing, collecting of medical herbs and mushrooms, etc. As for the other pilot regions, the process of mapping and assessing ES in the pilot area of Bijambare Landscape Park is still ongoing. The results of the mapping will be available by February 2019 and will be integrated in the management plan of the Bijambare Landscape Park. The assessment will also be a basic resource for the discussion with stakeholders and citizens on increasing probiodiversity business opportunities in the region.

Study area: Bijambare Landscape Park

ES Classification scheme: according to CICES (4.3)

Methods: different valuation methods, study ongoing

Main ES assessed:
According to the findings of the ECO-Karst project the following ES are most relevant for the karst areas in the Danube region:

- drinking water - filter and buffer for pollution
- nature conservation, fertile areas rich in biodiversity
- role of the karstic forests in climate regulation (including carbon sequestration)
- tourism - natural beauty of landscapes and wildlife, specific features as caves and rock formations

Main results: not yet available; it is foreseen to integrate the maps on ES into the actions plans of the protected areas investigated, they will not be available as independent documents. The maps and action plans will be ready by end of February 2019.

3.13 Moldova

3.13.1 Studies on national level

3.13.1.1 The Economic Value of Ecosystem Services in Republic of Moldova (Popa Bogdan, 2013)

Summary of the study: The aim of the study is to identify and quantify the economic benefits provided by Moldova's biodiversity, including ecosystem services. The authors created two scenarios: a baseline scenario Business as usual (BAU) and Sustainable Ecosystem Manaement (SEM). The comparison of the two scenarios regarding several sectors of the economy (tourism, forestry, agriculture, water supply, disaster risk management, fishing) shows the contribution of ecosysystem services to the economy.

Methods applied: Sector Scenario Analysis Comparison between Business as Usual (BAU) and Sustainable Ecosystem Management (SEM); Willingness to pay, direct value, avoided damage cost; Direct revenues from tourists (fees, expenditures on food and accommodation)

ES Classification scheme: Millennium Ecosystem Assessment (MA 2005) framework

Main ES assessed:

Provisioning services: Forestry, fishing, water supply

Regulating services: natural disaster risk reduction and climate change mitigation

Main results: The value of ecosystem services in tourism, forestry, agriculture, fishing, water supply, climate change and disaster mitigation are estimated at just under $21,986 million in 2011.

3.13.1.2 Possible Scenarios of Ecotourism Evolution in the Republic of Moldova from the Perspective of Ecosystem Services (Popa Bogdan, 2014)

Summary of the study: "By using the Sector Scenario Approach, the present paper aims to fill an important gap of information regarding ecotourism activities connected with the management of protected areas in the Republic of Moldova. The paper captures the economic value of landscape as ecosystem service and assesses the development perspective of this sector by comparing "business as usual" and "sustainable ecosystem management" scenarios, giving also information regarding the effect of the ecotourism across the economy of the Republic of Moldova." (Popa/Bogdan 2014)

Methods applied: Sector Scenario Analysis Comparison between Business as Usual (BAU) and Sustainable Ecosystem Management (SEM);Revenues from Ecotoursim in Protected Areas; WTP

ES Classification scheme: Scenario comparison based on revenues from Ecotourism

Main ES assessed: Cultural services: recreation and tourism

Main results:

"The present value (PV) under BAU for the ecotourism in the Republic of Moldova is $51.9 million." "The total cumulative (additional) value (over 25) to the tourism sector as a result of moving to SEM from BAU is around $14.3 million"

3.14 Montenegro

3.14.1 Studies on national level

For Montenegro, a technical report from 2013 is available, which identifies and groups the ES for Montenegro and describes the relationships towards biodiversity protection and sustainable development. The figures indicated as ES for Montenegro are based on data which were only partly available, leading to a calculative transfer of values for the whole country. It is described as "the most comprehensive attempt of national evaluation of biodiversity and ecosystem services". A complete and systematic evaluation of economic values of biodiversity and its services is not yet available. The figures indicated in the report represent the the net present value of selected biodiversity and ecosystem services to the Montenegrin economy which can be reached, if the revised Action Plan on Biodiversity (NBSAP) is implemented from 2011 to 2020. The ES amount to just under €7.4 billion.

The current status of ES is also described in the National Biodiversity Strategy with the Action Plan for the Period 2016 – 2020.

3.14.1.1 Montenegro: the economic value of biodiversity and ecosystem services (Emerton 2013)

Summary of the study: The report's goal is to identify, describe and assess the economic value of ecosystem services in Montenegro. Further, it identifies needs to incorporate economic valuation into the revised "National Biodiversity Planning to Support the implementation of the CBD 2011-2020 Strategic Plan in Montengro" (NBSAP). Therefore, the economic values of ES were analyzed for a baseline scenario and for a scenario when the NBSAP is successfully implemented.

Methods applied: market price method, avoid damage cost approach

ES Classification scheme: Common International Classification of Ecosystem Services (CICES)

Main ES assessed:
Provisioning services: wild foods and fodder, wood-based biomass and energy

Regulating services: pollinating and seed dispersal, maintenance of on-farm soil structure and fertility, watershed protection, coastal protection, carbon sequestration

Cultural services: recreation

Main results:

"The baseline value of selected biodiversity and ecosystem services to the Montenegrin economy is estimated at €982 million from 2011-2020 […]. Provisioning services (wild foods and fodder, wood-based biomass and energy) contribute an estimated €169 million or 17%, regulating and maintenance services (on-farm soil fertility and pollination, watershed and coastal protection, carbon sequestration) €276 million or 28%, and cultural services (landscape and nature-based recreation) €537 million or 55% […]. (Emerton, 2013, p. 23)

Ecosystem service	Baseline value (€ mill)
Wild foods & fodder	114.42
Wood-based biomass & energy	54.39
Pollination & seed dispersal	28.69
Maintenance of on-farm soil structure & fertility	0.41
Watershed protection	47.81
Coastal protection	1.34
Carbon sequestration	197.50
Landscape & nature-based recreation	537.28
Total	981.83

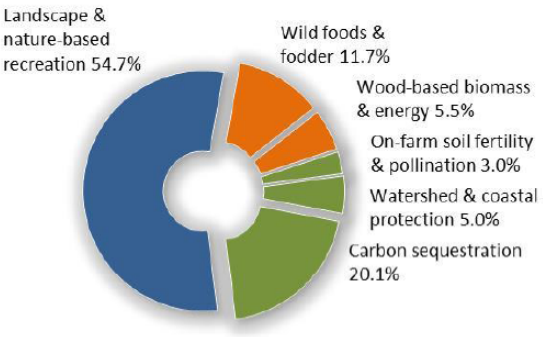


Figure 12: Overview on ES from 2011-2020 in Montenegro (Source: Emerton, 2013)

3.14.2 Studies on regional level

3.14.2.1 **Economic evaluation of the Tara River** (Mrdak 2005)

Summary of the study: The study describes and summarizes the direct income from fishing, angling and rafting at the Tara river in Montenegro. The income is considered as income generated by eco-tourism as huge parts of the river valley are protected area (e.g. National Park 'Durmitor', etc.) It is based on interviews and data from the responsible associations and agencies which are offering the services for tourists.

Methods applied: Economic value assessment of two main activities: fishing and rafting

ES Classification scheme: no ES, calculating economic value only for tourism

Main ES assessed: cultural services (recreation)

3.15 Serbia

3.15.1 Studies on national level

3.15.1.1 **Assessment of the economic value of environmental degradation in Serbia** (Jantzen et al.2004)

Summary of the study: "In the period February – July 2004 a project has been undertaken to assess the "Economic Value of Environmental Degradation in Serbia". Main objective of the study is to quantify as much as possible the economic damage of environmental degradation in Serbia. Other than in most Central & Eastern European Countries, during the 90-ties no attempt has been made to improve the environment in Serbia, leading to high levels of pollution around the country."

Methods applied: Benefit transfer method

ES Classification scheme: own classification scheme

Regulating services: climate, water, waste management, soil erosion, noise

Main findings: Total damages to environment range from € 861 million to about € 2.5 billion per year. This is equivalent to 4.7% to 14% of Serbian GDP (assumed to be € 18.3 billion per year). Annual per capita damages can be assessed at € 115 in the low estimate and € 342 in the high estimate. This is in line with results of the EU study on benefits (Ecotec) where average per capita benefits of accession to EU (environmental legislation) is estimated at between € 100 (low) and € 520 per year (high)

3.15.2 Studies on regional level

In Serbia, several studies on regional level have been conducted, two of them are indicated below. The first one covers the ES of the Tara National Park, the second one is part of the ECOKARST project, which has already been mentioned for some other SEE countries.

3.15.2.1 Rapid Assessment of Ecosystem Services, their Values and Potential Financing Mechanisms for Tara National Park, Serbia

Author: Vesna Maksimović, WWF Danube-Carpathian Programme Office in Serbia (Transfer project in the framework of the Klaus Toepfer Fellowship Programme 2015-2017)

Summary of the study: "Financing of protected areas (PAs) in Serbia comes partly from the State Budget and mostly from other revenues of PA managers and is usually criticized as insufficient. In order to secure funding, PA managers are obliged to use natural resources commercially. This creates a conflict of interest since, in many PAs, one entity is responsible for conservation and commercial exploration of natural resources.

Tara National Park (NP) is a typical forest area with highly preserved, diverse and productive forest ecosystems which cover about 75% of the park's territory. However, the PA manager (Public Enterprise "Tara National Park") is legally obliged to manage forest resources, and forestry activities (timber sale) generate around 80-85% of the annual budget of the PA manager. This leads to a continuous degradation of forest ecosystems and is not consistent with long term biodiversity conservation. In order to secure the future ecological integrity of forest ecosystems of Tara NP, the PA manager must turn to different sustainable financing mechanisms, based on the use of other ecosystem services (ES). The choice of ES strongly depends on available markets. Provisioning ES have direct use values and are convenient to trade, but non-use regulating and cultural services often cannot be marketed. The failure to account for the Total Economic Value (TEV) (sum of use and non-use values) of ES has been a significant factor in their continuing loss and degradation.

The main objective of this transfer project (TP) was to present to the PA manager a detailed and up-to-date overview of all ES provided by forest ecosystems of Tara NP, as well as an overview of new potential financing mechanisms for the PA manager based on these ES. In order to determine which ES could be explored as a new potential source of income, a rapid ES assessment was performed, by applying the participatory approach."

Methods applied: Willingness to pay/ participatory approach

ES Classification scheme: CICES (4.3)

Main ES assessed: biodiversity, carbon sequestration, freshwater, (eco-)tourism and recreation

- Provisioning services (freshwater)
- Regulating services (carbon sequestration)
- Cultural services (biodiversity, recreation and tourism)
- Supporting services (none)

Main findings: The study was able to identify some potential alternative sources of income for the management of the protected area. For example, the monetary valuation of carbon sequestration shows that the annual value of harvested timber within the NP, which is managed by the PA administration, amounts to approximately € 1,656,721 in carbon credits. In addition to this source of income, the value for tourism and recreation, which has already been used to a certain extent, will be further increased by developing a tourism offer for sustainable brown bear watching.

3.16 Ukraine

3.16.1 Studies at national level

For Ukraine, no systematic assessment of ES at national level is available. Similar to other EU neighbouring countries, for Ukraine the 5th National Report of Ukraine to the Convention on Biological Diversity presently is the main source of information on biodiversity and ecosystem services. Explicit information on the status of ES in Ukraine is, however, not included in the report. (https://www.cbd.int/doc/world/ua/ua-nr-05-en.pdf - assessed 04.10.2018)

3.16.2 Studies on a regional level

3.16.2.1 **Evaluation of forest ecosystem services provided by forests of Ukraine and proposals on PES mechanisms** (Soloviy 2016)

Summary of the study: The study is based on a social-economic research regarding forest ES in two regions in Ukraine: the Dnipropertovsk and Lviv oblasts. Further it assesses the use of forest watersheds for water supply as possible institutionalized forest ecosystem service with the example of the watershed within the National Nature Park "Pivnichne Podillia" that is situated on the territory of Brody, Buz'k and Zolochiv districts of Lviv region

Methods applied Questionnaire based on Willingness to Pay (WTP); contingent valuation

ES Classification scheme: Millennium Ecosystem Assessment; TEEB

Main ES assessed:

- Provisioning services: water supply, forest products (wood and food)
- Regulating services: climate balance, water balance, soil erosion protection, pollination, composition of atmosphere, regulation of climate and regional hydrological balance, water supply, erosion prevention, formation of soil, nutrient circulation, absorptive capacity, pollination, support of biodiversity, and sources of wood and food.

Main results: "In both regions residents would accept the introduction of mandatory special payments, in Lviv region this indicator scored 6% higher than in Dnipropetrosvk. Willingness to voluntarily work for support and improvement of forest hydrological services has been stated by 18.7% of respondents in Lviv region and 16% in Dnipropetrosvk region. In regards to payments – most people both in Dnipropetrosvk (33.3%) and in Lviv (28%) regions were willing to pay 100 UAH/year. In Lviv region more respondents expressed support to establishment of a special authority, which would work on supporting and improving of forest ecosystem services nationally."

4 Comparative analysis of ES valuation in the research area

The EUSDR space encompasses many areas with diverging natural characteristics and assets: the Carpathian mountain range from almost sea level up to Alpine levels of altitude with rough climatic conditions, the Danube lowlands with continental climatic conditions, the hilly mountainous areas (Balkan, corridors between the Alps and Carpathians or the Dinarides, etc.) and last but not least the Mediterranean and the Black Sea.

A truly harmonized overview on the present ES valorisation in the Danube Programme area is not possible as the data and methods applied are too heterogeneous. A total of about 65 studies and documents (including the ESMERALDA fact sheets) have been reviewed and analysed which are presented in an overview table (see annex 4). The table indicates the research area, the types of ES, the classification scheme and the valuation methods applied etc. It has to be pointed out that it was not in all cases possible to have a deep insight into single studies due to language problems (Romanian, Slovenian). In addition to the regional case studies, some studies summarizing the ES situation have been validated as well and conclusions from these studies feed into the comparative evaluation (ECNC 2015; Geneletti et al. 2018)

The following figures compare and illustrate the information drawn from the studies listed in annex 4 (countries in alphabetical order and grouped according to EU-28 and Eastern European ENI partner or EU accession countries). The first figure gives an overview on the total number of studies per country and on their level of investigation, either at national or regional level.

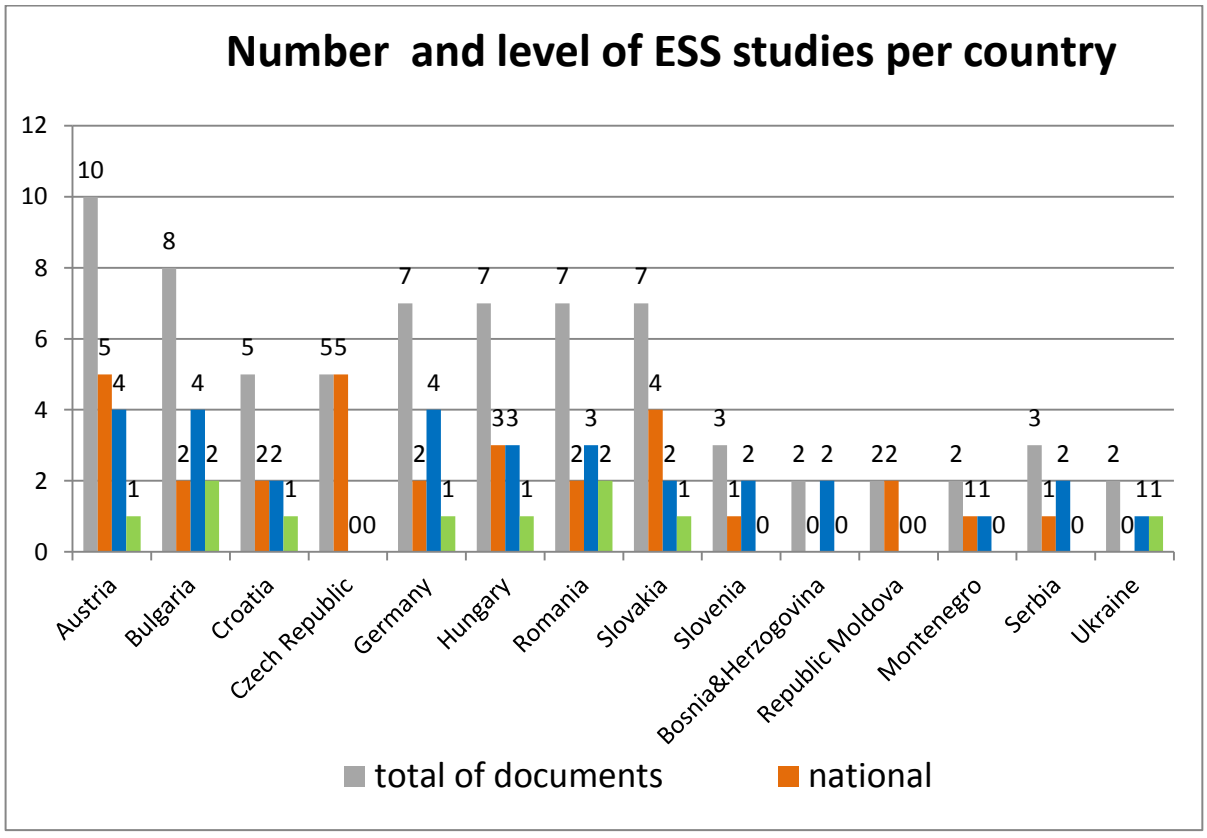


Figure 13: Number and territorial level of ES study/document per country in the EUSDR

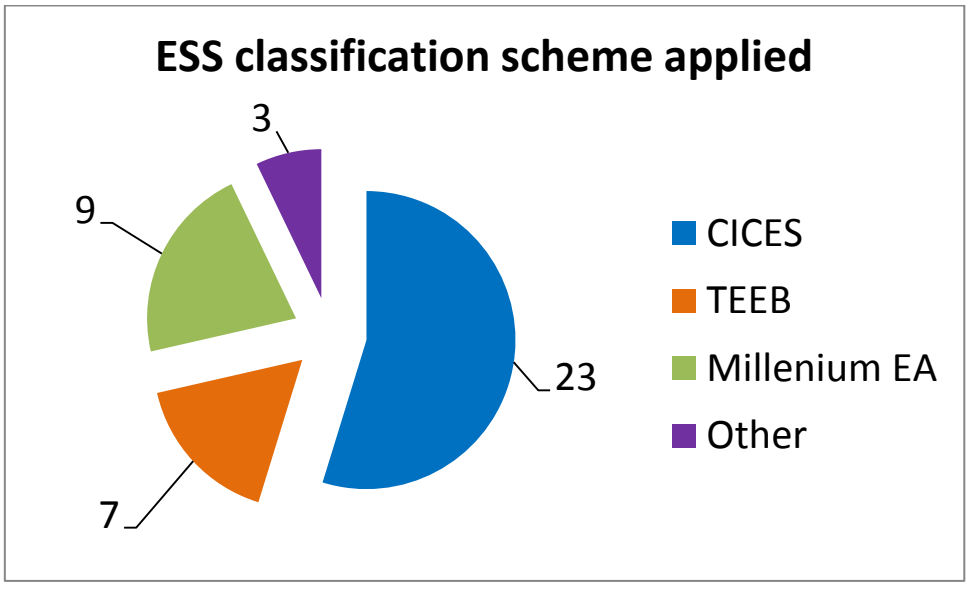
For all countries of the Danube area at least some studies could be identified, mostly between 2 and 6 studies, with an increasing trend to further studies in the last 3 years. The list is not complete as the process is ongoing. The mapping and assessment process has been developed at best in the Czech Re-

public, followed by Austria and Germany. The Czech Republic is the only country, which presently has a complete and full assessment of ES for its country. In Austria, the results of the national ES assessment have been announced for December 2018. In Germany, several guidance documents have been elaborated how to evaluate ES for agricultural areas or urban areas or how to integrate the concept in entrepreneurial decisions. Moreover, a national report on how to integrate ES in climate protection policy is available.

Bulgaria, Croatia, Hungary, Romania, Slovakia and Slovenia have mostly carried out their national assessments of ecosystems and defined a methodology within the MAES process to carry out the ES assessment as a next step, some of them are partly ongoing.

Within the different EU accession or ENI countries both Montenegro and the Republic of Moldova have well elaborated national concepts and documents on ES dating from 2013. For Montenegro the study provides information on the potential of several selected ES for the period from 2011-2020, thus supporting the "National Biodiversity Planning to Support the implementation of the CBD 2022-2020 Strategic Plan in Montenegro" (see chapter 3.13.1.1.). The study on Republic of Moldova follows the concept of scenario analysis (Business as usual [BAU] versus Sustainable Ecosystem Management [SEM]). For Moldova another study reveals the ES potential of eco-tourism for the whole country.

A clear trend to harmonization is recognizable with regard to the classification scheme applied for the assessments. The following figure gives an overview on the type of ES classification scheme used (CICES, MEA, etc.) in the single national or regional studies (n=42) which have been selected for the present study:



From the 42 studies truly assessing and calculating ES in the Danube area, most of them apply the European wide standard of CICES classification (23), with a clearly increasing trend in the last 2-3 years. Depending from the date of elaboration, mostly v4.3 of the CICES classification is used.
Moreover, the EU-wide process of mapping of ecosystems and their services (MAES) according to common standards has been considered and is applied in all countries, however, at diverging levels of implementation.

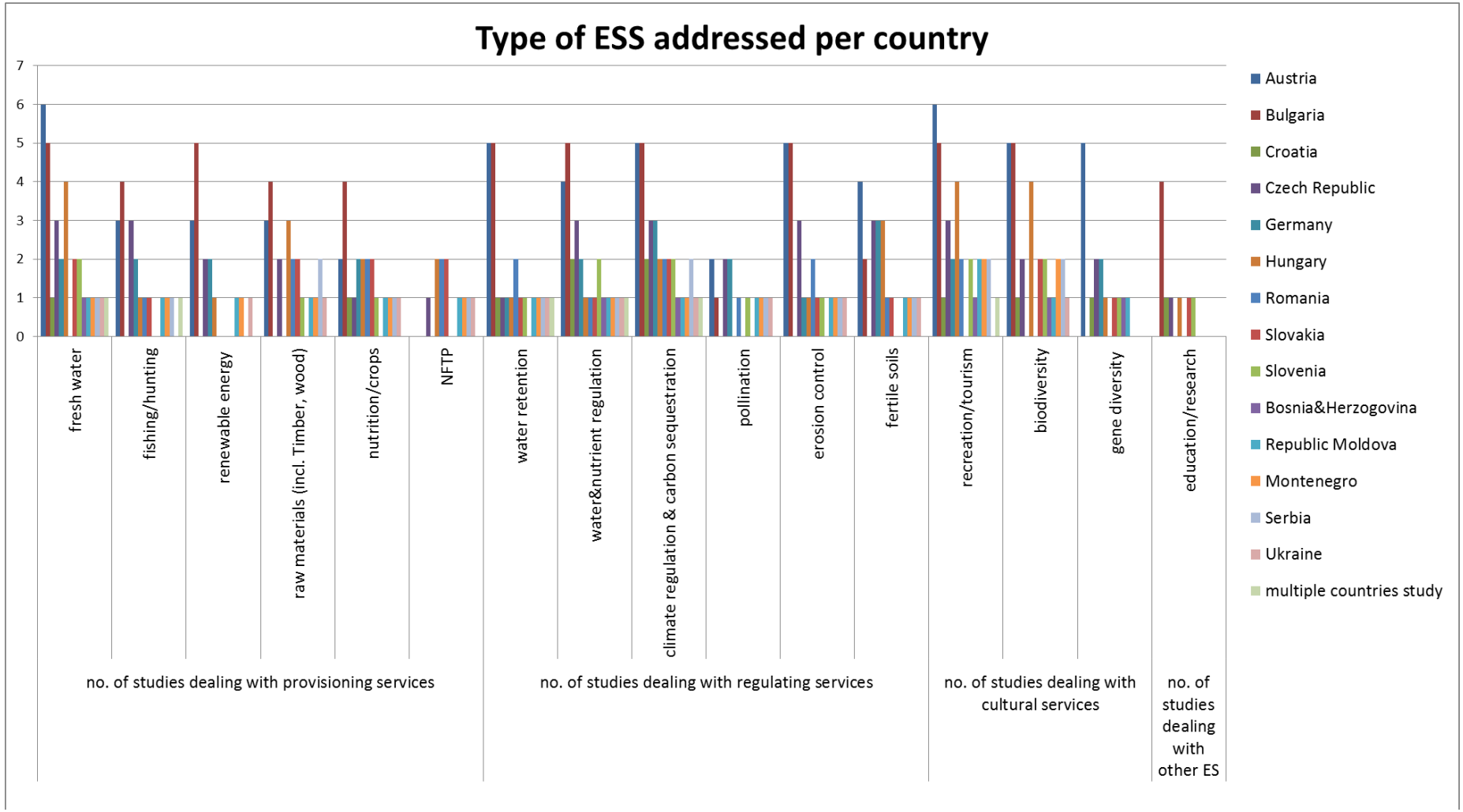


Figure 14: Type of ecosystem service addressed per country

The above figure gives a detailed overview on the type of ES assessed per country by the selected studies. The majority addresses the 'classical' ES like fresh water, water retention, climate and nutrient regulation or recreation and tourism. The topic of pollination has been included in studies of the recent 3-4 years only.

When comparing the settings and results of the single studies the following conclusions can be drawn:

- Starting point and motivation in most countries are the valorization of ES in protected areas or all types of 'high nature value areas' (independent from their specific national protection status). Only few regional studies deal with areas outside Natura 2000 or protected areas such as municipal or regional territories. Moreover, areas with specific characteristics are also often addressed, e.g. the Danube and its floodplains and wetlands, karst areas, etc. This information, however, can be transferred to other regions and thus provide information for the overall Danube region.
- Most of the studies cover a region or part of a region, only few countries have a national assessment, which covers the whole national territory. This is the case for the Czech Republic. Other countries are working on it and have almost finished it like Austria or partly Germany. In Bulgaria, Romania, Slovakia and Slovenia (in alphabetical list) the national assessment processes are ongoing, but it is not clear when they will be finished.
- The national ES valorisations follow the methodology described by the European MAES process, which is based on the EU wide harmonized mapping of different land use and habitat types (Corine Landcover, EUNIS classification). Furthermore, so-called 'habitat services' are considered within the valorisation of ES which are of importance for migratory species and their different requirements (e.g. as nurseries), for the global or regional gene pool, for the resilience of the habitat type as such and for the preservation of the habitat to provide provisioning services.
  For every country, in addition, regionally specific circumstances or framework conditions are considered for the national assessment by taking regional studies into consideration. Thus, a too general valorisation approach is avoided.
- The picture of ES valorisation in the EU-28 and further Danube countries, however, remains still quite heterogeneous (see figure 3) and the methods applied for previous (regional) valuation of ES differ considerably, in particular within those studies finished until 2012/13. Starting with 2014/15, the MAES process at European level helped to harmonize the ES study approaches and meanwhile most of the recent studies apply the CICES classification (v4.3 or more recent). Not all studies make arithmetic calculations of values, some only identify and describe the potential of ecosystem services offered by natural areas.
- Viewing from the outside by analysing the available literature, long time periods for the process of mapping and methodology development have been spent in some countries, which seem too long for not yet having more concrete results. In some countries, it seems that the academic discussion about methodological aspects prevents tangible results, which could be used for feeding into the strategic planning level of the respective countries, in particular at national level.
- During the MAES process, a survey among national experts revealed several obstacles to a more efficient and quick assessment, amongst others a considerable lack of appropriate data, a lack of human and financial resources, a lack of coordination of the process at national level and a lack of engagement of authorities from different levels and sectors etc. (see Burkhard & Viinikka 2016).

- Studies often face the dilemma of either using accessible but less detailed data or labour intensive and more precise data (which still would have to be gathered and for which funds are not available). As a consequence, results risk to be not detailed enough or risk to be questioned by stakeholders due to the weak data situation.
- People at local level appreciate ecosystems and their services differently depending from the country in which the study has been carried out (see Petz et al. 2012).
- Visible and tangible ecosystem services (e.g. services from arable land like food or other crops and timber from forests) are recognized and appreciated much more by the wider public and by stakeholders than abstract ones, like carbon sequestration, water or nutrient regulation by wetlands.
- Wetlands in general are often considered as "unpleasant, non-productive and difficult to access" (see Petz et al. 2012), their ecosystem services risk to be underrated at local level.
- The best way to create awareness on ES and acceptance of their valorisation at local level is to carry out a participatory process in the research area. If such a participation process is neglected, the concept remains abstract for most people and thus the results do hardly feed into decision-making.
- A publication summarizing the experiences with ES in the South Eastern European Space concludes that "…that the studies in Greece and Bulgaria were for the most part conducted by academia while in other countries (Serbia, Turkey, etc.) they were predominantly conducted by development agencies and ministries. Overall, this shows a lack of attention or appreciation of the concept of ecosystem services within academia, governments and authorities, natural resource management agencies, and environmental NGO. This is generally due to the fact that the issue and concept of ES is still relatively unknown in the region."
  The study indicates as well that there is a "preference of short term profit over long term interest". As a general statement, it states that either governments are reluctant to the designation of protected areas or, "planned infrastructure, energy and transport projects pose threats to these areas and to biodiversity". (National Greek, Bulgarian, Serbian ESP networks, 2016)
- Most of the studies selected have been carried out for a region in one single country, cross-border studies can hardly be found. The reason for it can only be supposed to be a lack of regional integrated management of natural resources, of cross-border cooperation and funding possibilities for this type of study.

5 Description of selected areas in the Danube area with high level of ES (‚ES hot spots')

5.1 How to define an 'ES hot spot'?

The previous chapters showed the great diversity of studies and approaches to assess the spectrum of natural habitats and their services in the Danube and Carpathian area. As described in the introductory chapter, the main reason for Priority Area 6 to investigate the current situation on ES along the Danube, is to find out whether there are hot spots of ES in the Danube area which have to be considered for further planning and investment decisions.

As described in chapter 4, the picture of ES assessed is very diverse and a mere harmonization in terms of summarizing all areas where for example recreation values or water retention capacity have been assessed does not reflect the whole information available from the selected studies. It is rather possible to create relations between types of habitats, landscapes or natural areas and ecosystem services provided.

Therefore, the 'ES hot spots' in the Danube area are described by the current study, both in a quantitative as well as in a qualitative way. Thus, the study is trying to summarize the findings from the selection of studies and to explain future fields of action for further research on and use of ES for decision making.

'Hot spots' in the present study are thus defined according to the following criteria:

(a) Thematic hot spots, by type of ES investigated

(b) Territorial hot spots, by type of area investigated (e.g. mountains, rivers, wetlands, forests, etc.)

(c) Quantitative ES hot spots, by value of ES identified (per ha)

To (a): Approximately 80% of the studies evaluated deal with landscapes beyond urban areas and agricultural territories (except grassland), which provide services useful for human well-being, e.g. fresh water, provision of wood or nutrition, water retention, recreation, etc. Most of the territories assessed belong to the category of protected areas, to the category of areas with high natural values or to areas with another designation status (like 'quiet areas' or protected forest reserves). Only few refer to areas outside of protected areas or urban territories.
This pre-selection of areas with some sort of designation status already implies one thematic 'hot spot' of ES assessment in the past and for the future:

> How to characterize and valorise high nature value areas in order to improve the arguments for future protection and conservation? How to describe the value of natural areas and landscapes in order to unglue financial and human resources for protected areas management?

The studies have a different focus on types of ES, for instance when assessing protected areas or wetlands the main ES addressed are within the regulating services (green), if regional or municipal questions have to be answered, the main focus will mostly be set on provisioning services (blue) or cultural services (yellow) like recreation or tourism. Another thematic hot spot for the Danube area would therefore refer to the question:

> How to include an ES assessment into standard decision-making processes for the different stakeholder groups?

Here, exchange and use of available results from other projects and specific studies may be used (e.g. from other Interreg cooperation areas).

The most important ES within the selected studies are those related to climate regulation and carbon sequestration (including both local and global level), recreation and tourism and the provision of fresh water. At a second level of importance, the ES relating to provision of raw materials and nutrition (including fishing and hunting) can be found as well as water retention, water and nutrient regulation, erosion control and soil formation. Within the field of cultural ecosystem services, the second important services refer to the conservation of biodiversity, followed by gene diversity and educational or research services.

The figure below underlines as well that the most important ES are those which are clearly related to human well-being in terms of having all goods available (water, crops, raw material, recreation) which are needed for a beneficial life of humans.

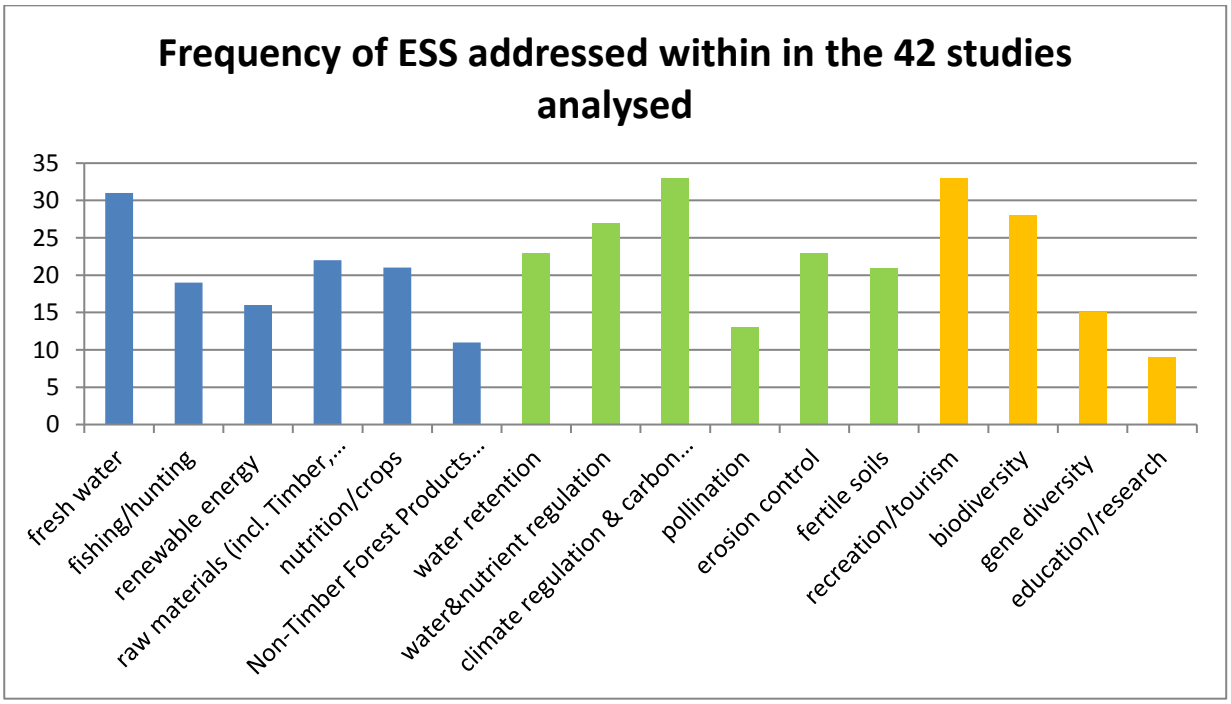


Figure 15: Type of ES assessed by the selected studies

As a comparison, the project AlpES (Alpine Space Programme 2014-2020) selected the following ES as the most important ones for the Alpine region:

Provisioning:	Surface water for drinking with minor or no treatments Biomass production from grassland Fuel wood
Regulating:	Filtration of surface water by ecosystem types Protection of areas against avalanches, mudslides and rockfalls CO2 sequestration by forests and bogs
Cultural services:	Outdoor recreation activities (including enjoyment and willingness to preserve) Symbolic alpine plants and animals, landscapes

Source: http://www.alpine-space.eu/projects/alpes/en/about/about/alpes-selected-ecosystem-services - assessed 18.10.2018

The following table shows the most important ES in protected areas as they have been selected by the ECO-Karst project, which has also been indicated in the previous chapters on ES assessments per country. It is obvious that the main focus is on provisioning services, tourism and recreational activities.

	Apuseni NP, Romania	Bijambare PA, BiH	Bükk NP, Hungary	Kalkalpen NP, Austria	Notrjanska RP, Slovenia	Tara NP, Serbia	Zumberak NP, Croatia
Provisioning services	water quality protection (pollutant removal, drinking water quality)	water quality protection (pollutant removal, drinking water quality)	water quality protection (pollutant removal, drinking water quality)	water quality protection (pollutant removal, drinking water quality)	water quality protection (pollutant removal, drinking water quality)	water quality protection (pollutant removal, drinking water quality)	water quality protection (pollutant removal, drinking water quality)
	timber and firewood	timber and firewood	timber and firewood		timber and firewood	timber and firewood	timber and firewood
	hay, fodder / output of grazing livestock	hay, fodder / output of grazing livestock	hay, fodder / output of grazing livestock	hay, fodder / output of grazing livestock	hay, fodder / output of grazing livestock		hay, fodder / output of grazing livestock
	Non-timber forest products: medicinal herbs, mushrooms and forest fruits	Non-timber forest products: medicinal herbs, mushrooms and forest fruits	Non-timber forest products: medicinal herbs			Non-timber forest products: medicinal herbs, mushrooms and forest fruits	Non-timber forest products: medicinal herbs, mushrooms and forest fruits
	hunting (wild game)				fishing and hunting (wild fish and wild game)	fishing (wild fish)	hunting (wild game)
		agricultural crops	agricultural crops				agricultural crops
		honey			honey		
Regulating services				erosion prevention			
	carbon sequestration and storage		carbon sequestration and storage	carbon sequestration and storage	carbon sequestration and storage	game/honey/grazing – to be decided	
Cultural services		education and awareness raising		education and awareness raising	education and awareness raising	education and awareness raising	cultural, religious, archeological heritage
	touristic attractiveness of nature	touristic attractiveness of nature	touristic attractiveness of nature	active recreation alpine pasture recreation	touristic attractiveness of nature	touristic attractiveness of nature	touristic attractiveness of nature

Table 2: Ecosystem services selected for assessment by the ECO-Karst project (unpublished)

To (b): The following map illustrates the territorial coverage of the study areas within the Danube area (see also the complete map in Annex 1 in which the areas of investigation are described in detail):

Figure 16: Geographical coverage of selected studies on ES in the EUSDR

The map shows that the type of territory, which is subject to a study on assessing ecosystem services, mainly belongs to the following categories:

- Rivers including their floodplains and wetlands (the Danube river as most important connecting element in the EUSDR, tributary rivers like Tisza, Sava, Mur, etc. with high importance for their regions/countries
- Protected areas with different protection regimes (Natura2000, nature conservation, landscape areas, nature parks, regional parks, retention areas, quiet areas, forest reserves, etc.), many of them in coastal, mountain or at least mountainous areas.
- Forest areas (in particular in the Carpathian mountain range)
- Areas with particular landscape features (e.g. karst areas)
- Areas with an interesting potential for tourism and recreation
- Areas with a clear administrative boundary (for defining the future development of the village, city or region)

To (c): When it comes to the need to express the monetary value for ecosystem services, many different approaches have been used. The most common expression is the Total Economic Value (TEV) of an area, it has been realized either as an overall sum for a country (e.g. for Montenegro or the Romanian protected areas) or as sum per year and hectare (for a single ES or a territory).

The following table gives an exemplary overview on the TEV of study areas, which have been assessed. Most of the studies listed here cover a comprehensive set of ES including all types, provisioning, regulating and cultural services, only few studies restrict the selection of ES to few ones. The detailed information on the results can be drawn from the single studies, which are indicated in the chapter 'References'.

		TEV (Total Economic Value) in €	TEV (Total Economic Value) in € for a particular territory/year
1	*Tucker/Beckmann 2010 (minimum scenario): Valuing the Danube (ES in the river basin) if included: role of wetlands in flood protection +500EUR/ha/year*	*250 €/ha/year or 750€/ha/year*	
2	*Beckmann/Tucker 2010 (maximum scenario): Valuing the Danube (ES in the river basin) if included: role of wetlands in flood protection +500EUR/ha/year*	*1,354 €/ha/year or 2,104€/ha/year*	
3	*Ing-Marie Gren, Klaus-Henning Groth†, Magnus Sylve´n‡ (1995): Economic values of Danube floodplains*	*374 (ECU)/ha/year*	*ECU 650 million*
4	*Radoslav Považan, Michael Getzner, Juraj Švajda (2014): Slovensky ray, SK*	*10,964 €/ha/year*	
5	*Radoslav Považan, Michael Getzner, Juraj Švajda (2014): Vel'ka Fatra, SK*	*4,437 €/ha/year*	
6	*Radoslav Považan, Michael Getzner, Juraj Švajda (2015): Muranska planina National Park, SK*	*497 €/ha/year*	
7	*Boian Koulov , Ekaterina Ivanova , Bilyana Borisova, Assen Assenov, Aleksandra Ravnachka (2017): GIS-based Valuation of Ecosystem Services in Mountain Regions: A Case Study of the Karlovo Municipality in Bulgaria*	*1,107 €/ha/year*	*115,55,783€ for the municipal territory*

		TEV (Total Economic Value) in €	TEV (Total Economic Value) in € for a particular territory/year
8	*Assen Assenov, Bilyana Borissova, Borislav Grigorov, Petko Bozhkov (2015): Economic value of ecosystem/landscape goods and services in the municipalities of RUDOZEM and BANITE; here: Rudozem municipality*	*3,593 BGN/ha/year (= 1.837€)*	
9	*Koulov et al (2017).: here:Banite municipality*	*4,214 BGN/ha/year (= 2.155€)*	
10	*Getzner, Michael et al. (2011): "Fließstrecken der Mur - Ermittlung der Ökosystemleistungen" - in detail: Total value of recreation and leisure activities at the Mur river per year*	*239 – 424,000 EUR for unregulated river sections per km, and 185 - 238,000 EUR for regulated river sections*	*104 million € for the whole river /year*
11	*Emerton, Lucy (2013): Montenegro: the economic value of biodiversity and ecosystem services - Technical Report*		*7.4 billion € for the whole country*
12	*Bogdan, Popa; Bann, Camille (2014,90): An Assessment of the Contribution of Ecosystems in Protected Areas (PAs) to Sector Growth and Human Well Being in Romania (p.90)*		*9,084 million € /25 years cumulative value for all PAs*

Table 3: Selection of monetary ES values in the Danube area

The values indicated in table 2 vary considerably, which underlines the need to have a close and individual look on the setting of a study and the questions, which had to be answered by the study. The high variability of the monetary values is both due to the individual characteristics of the territories and the type of economic valuation method used. In order to achieve tangible results for local or regional planning purposes, it is therefore important to investigate ecosystem services,

(a) which refer to the local or regional situation,
(b) which refer to local and regional price levels or
(c) which are the result of a local or regional participatory approach.

5.2 Discussion of 'ES hot spots'

As we have seen, the values of ES presented in the tables depend largely from the characteristics of the study and the methods used. The monetary values in table 2 underline as well, that the ES concept is an anthropocentric one:

It produces the highest (monetary) values for those ecosystem services
- which are relating to types of land use with human activities (forest, arable land),
- which provide services that would have to be organized artificially by society (e.g. water purification),
- which avoid damages to manmade infrastructure (flood prevention) or
- which bring direct benefit to economic players (tourism, recreation).

Together with the fact, that values, which are more difficult to evaluate (e.g. bequest values, non-use-values) have not been analysed very often, the picture remains incomplete. These values are, if at all, considered indirectly, in most cases by analysing the values for recreation and tourism,

biodiversity or landscape beauty. As a consequence it is not simple to clearly identify spatial explicit 'ES hot spots' for the Danube area.

The ES concept in most cases has not been applied to prepare pro-active decisions on sustainable use of natural resources, but to defend existing natural areas against pressure by further economic use leading to a decrease in ecosystem services of these areas. For example, it is worth noticing, that many studies deal with the valorisation of existing protected areas for the reason of justifying the funds, which are at present invested for managing and conserving them. The scenario 'Business as usual' (BAU) is used as a proxy to explain how their management currently works and compare the alternative scenario of 'Sustainable Ecosystem Management' (SEM) to it. The SEM scenario reflects the (monetary) value which could be achieved, if the protected areas were sustainably managed, which very often, is not the case. As examples, the management practice of protected areas in Serbia or Romania may serve where the PA administration is obliged to generate its income partly from the protected areas itself. This situation leads to the fact that areas with a very high potential of ES ('ES hot spots') are systematically degrading (see Bogdan 2013, 2014; Maksimović 2017).

Beyond spatial or thematic 'ES hot spots', it would therefore be an important task of all EUSDR PACs to develop a better understanding of the ES concept and to ensure its integration into future planning decisions on investment and development. Planning decisions taken by public authorities and elected governments must consider at least a mid-term perspective, i.e. the availability of ES and their preservation for future generations must be one of the major goals in territorial and spatial planning.

Ecosystem services are essential values, which are provided to all parts of society, they help to ensure good living conditions for all citizens. Thus, future development should start to consider and apply the 'Sustainable Ecosystem Scenario' for the natural resources in the whole Danube area (see Popa et al. 2014). Only in rare and justified cases, the provision of ecosystem services should be balanced against short-term benefits (for private persons/companies). This approach requires a change in paradigm, using the ecosystem service concept as a general management approach in all priorities of the EUSDR and related sectorial policies.

In order to prevent further degradation and reduction of ES provision, it would be important, to communicate the values of the existing protected areas (and all other natural assets) according to the 'Sustainable Ecosystem Management' scenario when it comes to their future management. This approach will help to create huge benefits at mid- and long-term perspective for the overall Danube region and the countries in the Danube area.

5.3 Relations between ES and EUSDR priority areas

The EUSDR heads for a comprehensive way to support EU sustainability goals on the one hand and economic development on the other hand. Within the framework of territorial cooperation, environmental protection and sustainability of actions plays an important role. However, many EU Member States lag behind the goals for e.g. biodiversity conservation, reduction of GHG emissions, waste recycling, clean air, revitalization of wetlands and rivers or soil fertility, just to mention some examples.

In that context, the concept of ES

- can be used as an instrument to explain the value of nature and natural resources for a better understanding of the long-term perspective for sustainable and structural development within the EU and the Danube area.
- can be a helpful interface for communicating environmental benefits to stakeholders and for creating progress in environmental policies.

The basic target behind the ES concept is "...to label the benefits that humans derive from natural ecosystems and biodiversity in order to include their value into decision-making frameworks." (Braat and de Groot in Hermelingmeier et al. 2015). This sentence very well reflects the core goal of the present study: to find out how the concept of ES can feed into strategic decision-making within the priority areas of the Danube Strategy (EUSDR), which are the following:

Figure 17: Priority areas of the EUSDR

(Source: http://www.danube-region.eu/about/priorities - 25.06.2018)

If connecting the different ES to the priority areas, it turns out that many services provided by natural areas are of huge importance for economic sectors and activities. The following table illustrates the potential connections between ES and EUSDR Priority Areas (own classification):

	1A	1B	2	3	4	5	6	7	8	9	10	11
	Waterways mobility	Rail-road Air Mobility	Sustainable Energy	Culture & Tourism	Water Quality	Environ-mental Risks	Biodiversity& Landscapes	Knowledge society	Competitive-ness of Enterprises	People & Skills	Institutional Capacity & Cooperation	Security
Type of ESS												
Provisioning services												
fresh water	X		X	X	X		X	X	X	X	X	X
fishing/hunting				X			X					
renewable energy			X					X	X	X	X	X
raw materials (incl. timber, wood)			X					X	X	X		X
nutrition/crops			X	X	X		X		X	X	X	X
Non-Timber Forest Products				X			X		X	X		
Regulating services												
water retention	X	X			X	X	X				X	
water&nutrient regulation					X				X		X	X
climate regulation & carbon sequestration			X	X	X	X	X		X		X	X
pollination			X	X			X			X		
erosion control	X	X			X	X	X			X		X
fertile soils			X	X	X	X	X			X		
Cultural services												
recreation/tourism	X	X		X			X	X	X	X	X	
biodiversity			X	X	X	X	X	X	X	X	X	
gene diversity			X	X	X	X	X	X	X	X		
education/research								X	X	X	X	X

Table 4: Relations between ecosystem services and EUSDR Priority Areas (own illustration)

The table shows that the Priority Areas of the Danube Strategy are based on different sets of ecosystem services, just to pick out some of them:

- Priority 1A and 1B benefit from water-related ES and some regulating services, which help to ensure the quality of water and a sufficient quantity of water for rivers (and people).
- Priority 2 relies on fertile soils in forests and croplands for availability of wood and biomass, on sufficient quantity of water, and richness in gene and biodiversity.
- Priority 6 benefits from the availability of fresh water resources or fertile soils. It needs water regulation and carbon sequestration, pollination and gene diversity for well-functioning and resilient ecosystems.
- Priority 8 builds on the availability of all kind of resources (water, raw materials, fertile soils, etc.) which are used by enterprises to produce goods and services.

5.4 How to integrate ES into EUSDR priority areas?

The work of the EUSDR Priority Areas and PA Coordinators can be inspired very much by knowledge about the concept of ecosystem services, about its opportunities and its limits. As examples from different studies show, the level of acceptance for using the ES concept increases in all cases, if people are integrated in the process of selecting the relevant ES and into later on decision-making processes. The same rule applies for the Priority Area Coordinators: it would be useful to inform them on the most important ES within their PA/sector, e.g. by the present study or a common workshop organized by PA06 and examples on how ES can influence decision-making within their Priority Area.

Further knowledge from expert panels can be looked for in case of specific or important decisions which have to be taken within a Priority Area. At EU level, there are several options on integrating expert knowledge:

(1) One option to gather information on ES and biodiversity aspects at policy level is to get involved with the IPBES platform, i.e. the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), with more than 100 governments participating. It provides scientific information on ES and related topics to requests of policymakers (www.ipbes.net).

(2) At European level, a valuable tool for organizing ES assessment processes at different levels is available, the so-called MAES explorer, developed by the ESMERALDA project (see chapter 2.5). It provides guidance, arguments and methodological support for many different stakeholder or research questions, which have to be answered by an ES assessment. It delivers also information on how to conceptualize the framework settings for an assessment in a region or country.

For more detailed information see: http://www.maes-explorer.eu/

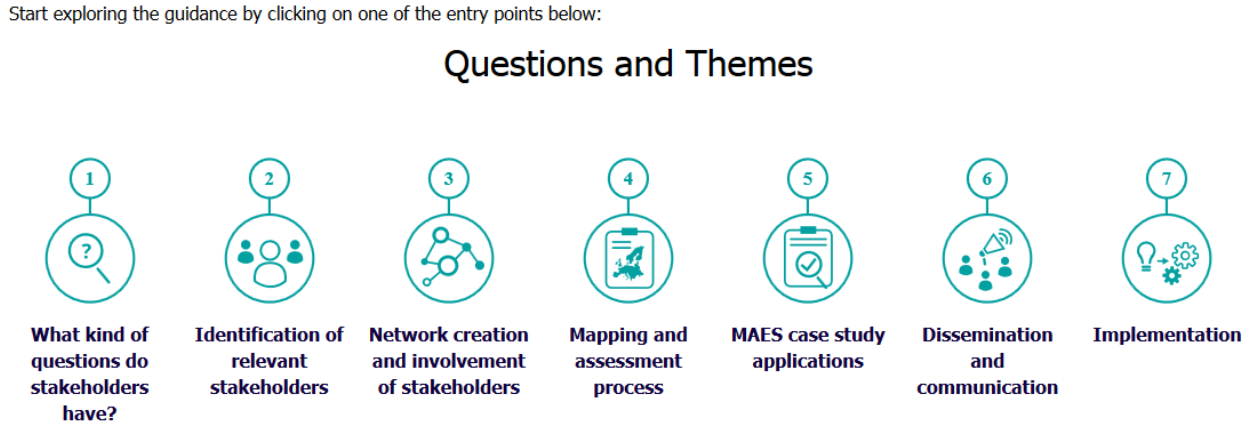


Figure 18: Screenshot of MAES explorer at www.maes-explorer.eu (HOME)

For the EUSDR and the DTP, an active exchange with the team who has developed the MAES explorer is recommended. Within the consortium, extensive experience at expert level is available on the potentials of integrating the ES concept into different key sectors.

The MAES catalogue moreover informs about interesting case studies which may serve as blueprints for best-practice examples or further studies in the Danube area (see: https://biodiversity.europa.eu/maes/maes-catalogue-of-case-studies - assessed 03.11.2018)

For the single Priority Areas, the following options can be reviewed in order to further enhance the awareness on the ES concept and to mainstream its application in projects as well:

- To integrate some ecosystem services and their preservation or consideration into the Action Plans of the different Priority Areas, which are currently under development.
- To shape the future funding priorities of territorial cooperation along the Danube by actively selecting the most important ES for the Danube area (in the opinion of the programme bodies); this approach has already partly been realized for the current DTP.

- To ensure the reflection of the ES potential by the new DTP 2021-2027 during the ex-ante evaluation and by the strategic environmental assessment of the Cooperation Programme
- To inform the Priority Area Coordinators on the type of ES relevant for their priority area and on best-practice options to conserve the potential of ES within their fields of activity or, alternatively, to integrate ES assessments into future projects
- To label project applications which reflect on the ES potential or produce valuable data in that field

At programme operating level, the best option would be a scenario where the Priority Areas and the PA coordinators are willing to accept and apply the ES concept as a precautionary planning tool:

- to better understand complex relations of natural areas and resources, and
- to prepare sound and pro-active information for strategic (investment) decisions.

5.5 Examples for ES integration at different decision making levels

As described in chapter 4, the setting of an ES assessment largely depends from the key motivation for carrying out a study, from the stakeholder or research questions to answer and last but not least from the quality of data at the level of investigation. In case an assessment is conducted, there are two main types of ES assessment, which can be defined as follows:

> (a) assessment at strategic level, in order to decide how and to what extent it is recommended to integrate the need for environmental protection in other policies or in single sectors, or
> (b) assessment at implementation level, in order to find out how to deal with the development of a region or the exploitation of resources in a particular area in the future.

The EUSDR targets primarily the strategic level, but has the capacity to reach the implementation level when it comes to concrete projects with pilot regions (for example see project ECO-KARST). Impact and influence on investment and planning decisions within the Priority Areas of the Danube Strategy are thus possible at every decision making level. However, attention should be paid to possible distortions of an ES assessment due to data quality and framework setting when considering it within a policy making process. The quality of information which is used for the assessment is of great importance for the outcomes and should not be neglected.

The following examples from the selected case studies illustrate both the links of ES to the strategic as well as to the implementation level of investment and planning decisions:

Example 1:

Decision makers at different levels are "…facing increasing pressure on funding, tend to allocate less financial resources to Protected Areas (PAs) and generally to biodiversity conservation relative to other sectors, which are perceived to be more productive in development terms. Therefore, biodiversity conservation specialists face a challenge in communicating the linkages between biodiversity conservation and the wider welfare benefits to communities and the economy in general." (Bogdan, 2013 for Moldova)

The results of many of the selected studies show that the ES provided by protected areas widely justify the funds dedicated for their management. If they are managed by applying the concept of 'sustainable ecosystem management' (SEM) instead of following 'business as usual' (BAU), they would even be able to provide much more services than at present (Bogdan 2013, 2015; Maksimović 2017). The following table shows what ES from sustainably managed protected areas can contribute in the opinion of the authors to the goals of EUSDR priorities:

	2	3	4	5	6	7	8	9	10
	Sustainable Energy	Culture& Tourism	Water Quality	Environ-mental Risks	Biodiversity& Landscapes	Knowledge society	Competitive-ness of Enterprises	People& Skills	Institutional Capacity & Cooperation
Type of ESS									
Provisioning services									
fresh water	X	X	X		X	X	X	X	X
fishing/hunting		X			X				
renewable energy	X						X	X	X
raw materials (incl. timber, wood)	X						X	X	
nutrition/crops	X	X	X		X		X	X	X
Non-Timber Forest Products		X			X		X	X	
Regulating services									
water retention			X	X	X				X
water&nutrient regulation			X						X
climate regulation & carbon sequestration	X	X	X	X	X				X
pollination	X	X						X	
erosion control			X	X	X			X	
fertile soils	X	X	X	X	X			X	
Cultural services									
recreation/tourism		X			X	X	X	X	X
biodiversity	X	X	X	X	X	X	X	X	X
gene diversity	X	X	X	X	X	X	X	X	
education/research						X	X	X	X

Table 5: Ecosystem services provided by sustainably managed ecosystems and/or protected areas (SEM)

Example 2:

"Landscape beauty" is an ecosystem service that is generally regarded as a "free" resource by the tourism sector. Other sectors are working with or in the resource landscape as well, e.g. key sectors like agriculture, forestry, transport, construction, energy etc., leading to conflicting goals of different sectors and insufficiently co-ordinated actions with negative effects on the resource 'landscape beauty' and the potential for the tourism and recreation sector; the amount of ecosystem services which can be provided decreases accordingly.

The knowledge about the availability and the amount of ecosystem services provided by beautiful landscapes may contribute to achieve a better integration of (conflicting) policy goals, with informed decisions in spatial- and landscape planning. Public bodies responsible for decisions in spatial planning can thus better balance which type of development a municipality, region or country is heading for. Two case studies serve as reference examples of successfully using the ES concept to gather basic information for deciding upon the development pathway of the territorial unit in question (local (1) and interregional (2)):

(1) The study "GIS-based Valuation of Ecosystem Services in Mountain Regions: A Case Study of the Karlovo Municipality in Bulgaria" contributed to clarify methodological aspects for application within the Bulgarian expert community on the ES concept. It was, however, able to "…enlarge the currently available information and knowledge basis that support geospatial planning and sustainable development of the Karlovo Municipality." (Koulov et al. 2017, p.23)

(2) The study on the Tisza river basin in Hungary and Romania concludes "…that the analysis of ecosystem services in relation to climate-related weather extremes, policy measures and people's recognition can contribute to a better management of the Tisza River Basin. We suggest that a better incorporation of ecosystem services in policy and management strategies could enhance and diversify the ecosystem service supply. A further quantification of ecosystem services can, therefore, provide a base for targeted and integrated planning and improved regional policy making." (Petz et al. 2012).

Example 3:

At policy level, the concept of ecosystem services can widely be used for all environmental policies, which do not have legally binding enforcement mechanisms. The implementation of these policies is in many cases supported by providing additional information on the benefits of related ecosystem services.

To give an example: The overall goal of the Water Framework Directive is to achieve the good ecological status of surface and groundwater bodies. All EU Member States are obliged to achieve this goal, however, the implementation mechanisms are part of the national legislation and can be adapted to national or regional conditions. Implementation is possible by legally binding regulations, such as the cross-compliance measures of the CAP. Alternatively, implementation can be supported by single measures enhancing different types of ecosystem services, without being legally binding. For example, designating riparian stripes along rivers does not only prevent further pollution of surface water bodies by pesticides or nutrients, it also provides valuable linear structures for ecological connectivity and pollinating insects with positive effects on nearby crops.

6 Recommendations for methodological integration of ES into investment and planning decisions of the EUSDR

In this chapter, some recommendations are given on how to integrate ES into investment and planning decisions of the EUSDR. The selected studies are showing that natural areas in the Danube region provide millions of Euro of ecosystem services per year, without having the exact number in all cases. According to TEEB estimations, for example, the global amount of ES reaches some 100 trillion € per year (see WWF 2018).

At EU level, every programme and policy is required to create favourable effects for the environment and related ecosystem services. It is therefore important to define the types of ecosystems and related services per funding priority of the EUSDR, which have to be preserved first and most.

This selection process should be linked to the ongoing mapping of ecosystems (MAES) in the Danube countries and can provide spatial explicit areas which have a particular focus on the desired ecosystem services. Projects increasing the availability of the desired ES can be given priority for funding. It would be even possible to pre-define spatially explicit areas in which projects providing certain ecosystem services are particularly supported.

The DTP specific objectives 2.1 to 2.3 make particular reference to different ecosystems services and explain the potential application of the concept in more detail in the priority axes of the Danube Transnational Programme (DTP).[10] Priority Area 06 plays an important role in that context, as it coordinates both the actions within the PA and negotiates the concept of ES for decision-making with and within other Priority Areas.

To give some examples:

- The Danube and other rivers floodplains are essential for climate regulation, water retention or water purification. Projects supporting the coordinated approach within a river catchment (Danube or tributary) to increase the water retention capacity are given priority by evaluating them with some extra points within the application procedure.
- Forest mountain areas provide key ES for natural risk prevention, water purification and recreation. Projects supporting sustainable forest use or sustainable forest-based tourism offers receive extra points in the process of project evaluation for corresponding to the desired ES criteria of the application form.

Most of the studies analysed represent single country studies, there is a lack of cross-border ES assessment for questions, which concern two or more countries. Following the approach of the DTP, …"The variety of natural environment, the socio-economic differences and cultural diversity of the various parts of the area may be perceived as major challenges but actually represent important opportunities and unexploited potential." (DTP 2014, p.2). Therefore, a reflection on potential areas for cross-border assessments is recommended.

[10] Danube Transnational Programme 2014-2020 (INTERREG V-B DANUBE), Section 4

A closer look to the conclusions and recommendations of certain studies delivers interesting proposals on how to integrate ES into investment and planning decisions of the EUSDR, as for example (see Beckmann et al. 2010):

- Ensure integrated spatial plans which consider the availability and potential of ES
- Remove incentives for the unsustainable use of ecosystems and their services
- Promote multi-functional land use to help providing ES instead of using land for narrow economic needs
- Conceptualize, develop and run ES markets for those ES which can be traded, e.g. climate regulation, forest ES, wetland mitigation etc. with payment mechanisms (making use of well-functioning examples from Canada/British Columbia, Australia or the UK, see for example the 'Georgia Environmental Restoration Association at: http://www.garestoration.org/?q=node/4)) and its wetland mitigation banks.

Moreover, some more general recommendations can be formulated on how to foster ES in programming and projects along the Danube:

- Make the chapters on sustainability of ERDF mainstream programmes more concrete in terms of how ES are valorized and used as arguments for preserving their availability. Make a concretization of those chapters obligatory for all regional and cross-border programmes.
- Integrate ES into all mainstream programmes of the EU!
- Use the core set of 4 indicators identified by the MAES report (2018) as binding framework for not deteriorating the situation by new programmes (reducing fragmentation, reducing the impact of nutrients, improving service provision by terrestrial ecosystems, increasing the SOC (Soil organic carbon) stock in soils).
- Investigate which and how existing legislation can easily be adopted to consider ES in case of legal decisions (e.g. Strategic Environmental Assessment, urban development processes, etc.) - start with small and easily understandable steps!
- Make use of existing tools to assess ecosystem services, e.g. from the ESMERALDA project or the "PoliciES"[11] project (conducted in Bulgaria) – do not waste too much time with methodological questions but start with easy and small steps to preserve natural areas and their ability to provide ES.

Two statements from the TEEB 2009 report and the WWF report (Tucker et al. 2010, p.71) may conclude the present study and illustrate the key problems of the ES concept:

"The evident but unquantified importance of ecosystem services in the [Danube] region supports the rationale for taking a precautionary approach to the conservation of ecosystem services. This is because poor decisions based on incomplete economic analyses with a short-term focus may have detrimental impacts on ecosystems and their services that are permanent or very difficult to reverse; resulting in long-term and significant economic impacts." (TEEB 2009 in Tucker et al. 2012, p. 71).

[11] PoliciES developed a tool to put the forest ecosystem services and biodiversity information in a company's own software solution, providing the opportunity to assess the impact of forestry management on ES and biodiversity.

"The development of strategies and measures for ecosystem services does not require a revolutionary approach to conservation. As discussed in Section 4.1, most of required key policy instruments already exist and are able to conserve ecosystems, habitats and species if they are implemented more effectively and faster (Kettunen et al, 2010). But policy instruments need to be better integrated to encourage multi-functional land use that supports all ecosystem services rather those driven by short-term and narrow economic needs. This will require a focus on governance and institutions, and increased communication and integration across the different sectors."

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Regional and national studies on Ecosystem Services

Legend

- 1, River Mur in Steiermark (Austria)
- 2, Leiblachtal in Vorarlberg (Austria)
- 3, Rudozem and Banite (Bulgaria)
- 4, Karlovo municipality (Bulgaria)
- 5, Danube Floodplains and islands (Bulgaria)
- 6, Danube and Sava floodplains (Croatia)
- 7, Bodensee (Germany)
- 8, Bornhöved lakes district (Germany)
- 9, Berlin (Germany)
- 10, City forest in Remscheid (Germany)
- 11, Centre of Szeged (Hungary)
- 12, Tisza River (Hungary and Romania)
- 13, Karst Areas (Hungary)
- 14, Tara River (Montenegro)
- 15, Niraj-Târnava Mică region (Romania)
- 16, Tisza River (Hungary and Romania)
- 17, Muranska Planina National Park (Slovakia)
- 18, Vel'ka Fatra National Park (Slovakia)
- 19, Škocjan Caves Regional Park (Slovenia)
- 20, Dnipropertovsk- Lviv- Nature Park Pivnichne Podillia (Ukraine)
- 21, Kalkalpen National Park (Austria)
- 22, Nature Park Žumberak-Samoborsko gorje (Croatia)
- 23, Bükk National Park (Hungary)
- 24, Apuseni Nature Park (Romania)
- 25, Notranjska Regional Park (Slovenia)
- 26, Bijambare Protected Landscape (Bosnia and Herzegovina)
- 27, National Park Tara (Serbia)
- 28, Maramures Mountains Natural Park (Romania)
- 29, Piatra Craiului Nature Park (Romania)
- 30, Retezat National Park (Romania)
- 31, Vanatori Neamt Natural Park (Romania)
- 32, Römerland Carnuntum- Pongau- Oststeirisches Kernland (Austria)
- 33, Central Balkan area (Bulgaria)
- 34, Economic values of Danube Floodplains
- 35, Valuing the Danube Results of a scoping study on ecosystem services in the Danube River Basin
- 36, Czech Republik Pilot National Assessment of ES
- Natura 2000 sites
- Danube

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Ecosystem Services in the Danube region

Regional studies on Ecosystem Services Zoom in Danube region

Legend

- 1, River Mur in Steiermark (Austria)
- 2, Leiblachtal in Vorarlberg (Austria)
- 3, Rudozem and Banite (Bulgaria)
- 4, Karlovo municipality (Bulgaria)
- 5, Danube Floodplains and islands (Bulgaria)
- 6, Danube and Sava floodplains (Croatia)
- 7, Bodensee (Germany)
- 8, Bornhöved lakes district (Germany)
- 9, Berlin (Germany)
- 10, City forest in Remscheid (Germany)
- 11, Centre of Szeged (Hungary)
- 12, Tisza River (Hungary and Romania)
- 13, Karst Areas
- 14, Tara River (Montenegro)
- 15, Niraj-Târnava Mică region (Romania)
- 16, Tisza River (Hungary and Romania)
- 17, Muranska Planina National Park (Slovakia)
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Annex 1: Overview on ESS studies in the Danube Area

EU-27 countries

	Country	Level	Study area	Year	Title of the study	Author(s)	ESS analysed	Assessment method(s)	Classification
1	**Austria**	regional	Fluss Mur in der Steiermark (290km)	2011	Fließstrecken der Mur - Ermittlung der Ökosystemleistungen Endbericht	Getzner, Michael; Jungmeier, Michael; Köstl, Tobias & Weiglhofer, Stefanie	Provisioning (Fishing, water supply, biodiversity (gene pool)) Regulating (local climate regulation, hazard control by water retention) cultural services (recreation, inspiration, aesthetic values) recreation values	Eigene Bewertungsansätze, Bewertungsansätze aus der Literatur („Benefit transfer“) sowie die Ergebnisse einer Repräsentativumfrage steirischer Haushalte im Einzugsgebiet der Mur	„TEEB“ („The Economics of Ecosystems and Biodiversity“)
2	**Austria**	regional	Leiblachtal in Vorarlberg	2015	Mapping the value of ecosystem services: A case study from the Austrian Alps	Paletto Alessandro; Geitner Clemens; Grilli Gianluca; Hastik Richard; Pastorella Fabio & Rodrìguez Garcìa Laura	provisioning services (wood biomass) regulating (erosion control, water retention) cultural services (recreation, tourism, aesthetic value)	Economic valuation approach: - cultural services: Benefit Transfer (BT) method: - provisioning services: market prices - regulating services were evaluated using different economic valuation methods: market price for the carbon storage and replacement cost method for the protection against natural hazards	CICES
3	**Austria**	regional	Kalkalpen Nationalpark	2018	Ecosystem services of karst protected areas - driving force of local sustainable development	ECO-Karst project	Provisioning services (drinking water) Regulating services (filter and buffer for pollution, climat regulation, carbon sequestration) Cultural services (tourism, natural beauty of landscapes and wildlife, biodiversity)	diverse methods	CICES
4	**Austria**	regional	Römerland Carnuntum, Pongau, Oststeirisches Kernland	2013	Aktionsprogramme zur multifunktionalen, kologisch optimierten Nutzung von Landschaft und Umweltressourcen	Andreas Bartel, Bernhard Ferner, Alexandra Freudenschuß, Helmut Gaugitsch, Sigbert Huber, Nikolaus Ibesich, Christian Kolesar, Christoph Lampert, Robert Konecny, Harald Payer, Bernhard Schwarzl, Katrin Sedy, Katrin Seuss, Alexander Storch, Michael Weiß, Peter Zulka	landscape function for production, regulation, recreation or as habitat or carrying function (following basically CICES approach)	valorization of ESS or landscape functions by summarizing GIS based analytical and statistical data from different sources	CICES (approach adapted)
5	**Austria**	national	Austria	2015	Esmeralda: Country Fact Sheet: Austria (AT)	Esmeralda: Hermann Klug and Michael Weiss (ed.)		None	CICES
6	**Austria**	national	Austria	2018	ESS assessment for Austria (unpublished, announced for end of 2018)	Götzl, Martin; other authors (direct contact with author)	(1) Provisioning services: production of plant-based raw materials; wild animals for commercial use: fish for commercial use, timber increment for forest purposes, use of biogene resources for renewable energy production; provisioning of drinking water from ground water and underground water sources; (2) Regulating services: erosion protection; avalanche protection, flood prevention; pollination by insects; water purification potential of rivers; CO2 storage; fertile soils for agricultural and forest land use; (3) Cultural services: recreation potential (4) Biological diversity: Existence of natural diversity at species, gene and habitat level	diverse methods	CICES (Common International Classification of Ecosystem Services)
7	**Austria**	national	Wald in Österreich	2015	Ökosystemleistungen des Waldes - Erstellung eines Inventars für Österreich	Götzl, Martin; Schwaiger, Elisabeth; Schwarzl, Bernhard & Sonderegger, Gabriele	Provisioning services (nutritition, raw materials, non-forest timber products, drinking water and water supply) Regulating services (soil development, climate regulation, flood control, avalanche control, erosion control, carbon sequestration) Cultural services (biodiversity, genetic diversity)	Das Konzept der finalen Ökosystemleistungen nach BOYD & BANZHAF (2007) konzentriert sich auf die Messbarkeit von ÖSD und stellt klar definierte sowie standardisiert messbare Verrechnungseinheiten („units“) in den Mittelpunkt, die eine Definition und Zählung der finalen ÖSL in physikalischen Einheiten anstrebt.	Millenium Ecosystem Assessment and CICES
8	**Austria**	national	Österreich	2011	Ökosystemleistungen und Landwirtschaft. Erstellung eines Inventars für Österreich	Götzl, Martin; Schwaiger, Elisabeth; Sonderegger, Gabriele & Süßenbacher, Elisabeth	Provisioning services (nutritition, raw materials, drinking water and water supply) Regulating services (soil development, climate regulation, flood control, avalanche control, erosion control) Cultural services (biodiversity, genetic diversity)	Erstellung eines Inventars bzgl. finaler Ökosystemleistungen im Bereich Landwirtschaft, basierend auf Arbeiten des Schweizer Bundesamts für Umwelt	TEEB (The Economics of Ecosystems and Biodiversity)
9	**Austria**	nationa & regional	disperse, at country level	2014	Ökosystemleistungen messen - bewerten - kommunizieren	Österreichische Bundesforste	Provisioning services (wirtschaftliche Leistungen) Trink- & Brauchwasser, fruchtbarer Boden für die Landwirtschaft, Holz, Bestäubung, Wild & Fische, wertvolle Natur- & Kulturlandschaften für die kommerzielle Nutzung im Tourismus, erneuerbare Energien) Regulating services for health (Ruhe, natürliche Dunkelheit, lokale Klimaregulation, Erholungsleistung, Identifikation mit der Landschaft, Naturbeobachtung) Regulating services for safety (Erosions-, Hochwasserschutz,Speicherung von CO2) Cultural services: natural biodiversity	Für geplante Erhebung der Ökosystemdienstleistungen der Bundesforste: Erhebung und Auswahl von 17 relevanten Ökosystemleistungen und Entwicklung von 50 Bewertungsindikatoren.	TEEB
10	**Bulgaria**	regional	Rudozem and Banite, Bulgaria	2016	Economic value of ecosystem/landscape goods and services in the munincipalities of Rudozem and Banite	Assenov, Assen; Borissova, Bilyana; Grigorov, Borislav & Bozhkov, Petko	provisioning services (water supply commercial fishing and hunting, timber, fresh water, crops, regulating services (regulation of discharge, flood prevention, nutrient reduction, erosion control, climate regulation, carbon sequestration) cultural services (biodiverstiy, recreation, tourism, education and research activities)	"In the presented study of ecosystem/landscape goods and services in Rudozem and Banite municipalities, the contingent valuation method is applied by authors through a survey conducted among 121 respondents, espectively as follows: 56 respondents in Rudozem and 65 respondents in Banite."	Millenium Ecosystem Assessment
11	**Bulgaria**	regional	Karlovo municipality, Bulgaria	2017	GIS-based Valuation of Ecosystem Services in Mountain Regions: A Case Study of the Karlovo Municipality in Bulgaria	Koulov Boian , Ivanova Ekaterina , Borisova Bilyana , Assenov Assen, Aleksandra Ravnachka	provisioning services (water supply commercial fishing and hunting, timber, fresh water, crops, regulating services (regulation of discharge, flood prevention, nutrient reduction, erosion control, climate regulation, carbon sequestration) cultural services (biodiverstiy, recreation, tourism, education and research activities)	only terrestrial ecosystems are considered ;The structure of the assessment involves five ecosystem classes (level 2 in MAES 2013): Urban, Cropland, Grassland, Woodland & Forest, Sparsely Vegetated Areas and 11 ecosystem sub-classes (level 3 in MAES 2013), represented by respective CLC Classes	CICES
12	**Bulgaria**	regional	Danube Floodplains and some Danube islands	2014	Desk research and data driven evaluation of wetland related ESS at the Bulgarian side of the Danube floodplains and some Danube islands	Luchezar Pehlivanov, Radka Fikova, Nevena Ivanova, Roumen Kalchev, Stefan Kazakov, Milena Pavlova, Svetla Doncheva	provisioning (water supply (including for irrigation), use of natural resources, commercial fishing and poaching, forestry, cattle grazing etc., agriculture and aquaculture) regulating services (regulation of discharge (including tributaries), flood prevention, reduction of suspended matter, nutrient reduction, removal of dissolved toxic substances, erosion control, carbon retention) cultural services (recreation, including angling and hunting; tourism, education and research activities)	Willingness to pay (stakholder interviews);	CICES
13	**Bulgaria**	regional	Central Balkan mountain area	2017	Mapping and assessment of ES in Central Balkan area in Bulgaria at multiple scales	Stoyan Nedkov & Bilyana Borisova	provisioning services (water supply commercial fishing and hunting, timber, fresh water, crops, regulating services (regulation of discharge, flood prevention, nutrient reduction, erosion control, climate regulation, carbon sequestration) cultural services (biodiverstiy, recreation, tourism, education and research activities)	“The identification of ecosystem types is based on the MAES (…). Each ecosystem type was divided in subtypes based on the specific natural conditions in Bulgaria and the availability of spatial data. The final version of the typology includes altogether 58 ecosystem subtypes at level 3 which number varies from 3 to 16 between the different ecosystem”	MAES classification
14	**Bulgaria**	national	Bulgaria	2015	Esmeralda: Country Fact Sheet: Bulgaria	Esmeralda: Radoslav Stanchev, Stoyan Vergiev, Kremena Gocheva, Stoyan Nedkov and Svetla Bratanova-Doncheva (ed)		None	CICES

15	**Bulgaria**	national	Bulgaria	2014	Mapping and assessment of ecosystems and ecosystem services outside NATURA2000 at EUNIS 3 leivel (2009-2014)	9 different authors/sub-projects (e.g. FEMA, WEMA, IBER-GRASS, SPA-Ecoservices, TUNESinURB, SHE-BG, For our future)	Provisioning services (fresh water, raw materials, biomass) Regulating services (water and climate regulation) Cultural (recreation, inspiration, aesthetic values)	according to EU indicator systems (e.g of WFD, Marine Strategy FD and of other legislative fields)	CICES v4.3
16	**Croatia**	regional	Danube and Sava floodplains	2014	Study of Freshwater Ecosystem Services in Croatia	Pithart, David; Petrov Rančić, Ivana; Kutleša, Petra & Duplić, Aljoša	Provisioning services (timber, biomass energy, fish production, game production, fresh water for drinking and irrigation, agricultural production) Regulating services (flood regulation, balance of erosion and accumulation, nutrient retention, water purification, carbon sequestration, local climate regulation, draughtmitigation, water storage Cultural (esthetic value of landscape, recreation, tourism, naive art inspiration, raw materials for local crafts, habitats for indigenous breeds)	Identification of relevant ESS shadow project method, based on the comparison with the cost of technical structure (the proposed accumulation) that would provide a comparable flood storage volume in Croatia. nutrient retention - replacement cost method (analysing the cost of artificial removal of nutrients by wastewater treatment stations different method for different ESS	TEEB
17	**Croatia**	regional	Nature Park Žumberak - Samoborsko gorje	2018	Ecosystem services of karst protected areas - driving force of local sustainable development	ECO-Karst project	Provisioning services (drinking water) Regulating services (filter and buffer for pollution, climat regulation, carbon sequestration) Cultural services (tourism, Cultural services (recreation, tourism, aesthetic values)	diverse methods	CICES
18	**Croatia**	national	Croatia	2015	Esmeralda: Country Fact Sheet: Croatia (HR)	Esmeralda		Stakeholder identification and initial analysis of activities. The initial analysis draws upon information collected by Esmeralda project partners and previous relevant work on ecosystem mapping and assessment activities and policy and research activities in connection to that.	CICES
19	**Croatia**	national	Croatia	2015	Mapping and assessment of ecosystems and their services in Croatia	Sjajno j.d.o.o. for consulting and services		Croatian Ecosystem Map was created based on Corine Land Cover Map	CICES
20	**Czech Republic**	national	Czech Republic	2014	Integrated assessment of ecosystem services in the Czech Republic	Frélichová, Jana; Vačkář, David; Pártl, Adam; Loučková, Blanka; Harmáčková, Zuzana V. & Eliška, Lorencová	Provisioning services (timber, crops, NTFP, hunting, drinking water) Regulating services (erosion, climate regulation, pest control, carbon sequestration) Cultural services (recreation, tourism, natural beauty of landscapes)	Basic value transfer , which is considered to be the best option for an initial assessment of ecosystem services values	CICES
21	**Czech Republic**	national / regional	protected areas of Czech Republic	2017	Economic value of ecosystem services in Protected Landscape Areas in the Czech Republic	Daněk, Jan; Vačkář, David & Krkoška Lorencová, Eliška	Provisioning services (timber, crops, NTFP, biomass, fishing, hunting, drinking water) Regulating services (air quality, climate regulation, disturbance, erosion control, nutrient and pest control, pollination, water quality, groundwater recharge) Cultural services (recreation, tourism, aesthetic values)	Based on the existing ecosystems and environmental conditions in the Czech Republic, a selection of 18 relevant services was made	TEEB
22	**Czech Republic**	national	Czech Republic	2016	Czech Republic Pilot National Assessment of ES	Vačkář, David (Coordinator)	Provisioning services (cultivated crops, wild plants, wild animals, fresh water, groundwater recharge) Regulating services (climate regulation, nutrient control, erosion control, water cycle, flood protection, pollination, water purification, groundwater recharge) Cultural services (recreation, tourism, aesthetic values)	"As its main data source, the CLES used a Habitat Mapping Layer initially produced to provide Natura 2000 site identification. It was then further combined with Corine Land Cover 2006, Urban Atlas, the Czech ZABAGED data (Fundamental Base of Geographic Data) and other specific data on waters (DIBAVOD)."	CICES (MAES)
23	**Czech Republic**	national / regional	Czech Republic	2011	Valuing Ecosystem Functions and Services in the Czech Republic	Seják, Josef; Cudlín, Pavel; Pokorný, Jan; Zapletal, Miloš; Petříček, Václav; Guth, Jiří; Chuman, Tomáš; Romportl, Dušan; Skořepová, Irena; Vacek, Václav; Vyskot, Ilja; Černý, Karel; Hesslerová, Petra; Včeláková-Burešová, Renata; Prokopová, Marcela; Plch, Radek; Engstová, Barbora & Štěrbová-Stará, Lenka	none	Biotope valuation method; Energy-water-vegetation-based method for valuation of ecosystem services;	Other (own method)
24	**Czech Republic**	regional	Czech Republic & Slovakia	2014	Ecosystem Services – Examples of TheirValuation Methods in Czech Republic and Slovakia	Sarvasova, Zuzana & Kovalčík, Miroslav & Dobšinská, Zuzana & Šálka, Jaroslav & Jarský, Vilém	none	Literature Review	none
25	**Germany**	regional	Bodensee	2013	Ökonomischer Wert von Seen und Feuchtgebieten	Früh, Simon; Gattenlöhner, Udo; Hammerl, Marion; Hartmann, Tobias; Megerle, Heidi; Spaich, Fabian & Hörmann, Stefan	provisioning services (drinking water, commercial fishing) regulating services (micro-climate regulation, water purification,flood prevention, erosion control) cultural services (recreation, tourism, education) supporting services (biodiverstiy, sedimentation, nutrient control)	Zur Schätzung des Erholungswerts des Bodensees wurde eine vereinfachte „Travel Cost"-Methode angewandt. Dieses Verfahren gehört zu den sogenannten „Revealed Preferences"- Methoden"	Millennium Ecosystem Assessment:
26	**Germany**	regional	Bornhöved lakes district, Schleswig-Holstein	2016	Mapping ES dynamics in an agricultural landscape in Germany	Burkhard, Benjamin; Kruse, Marion & Müller, Felix (Coordinators)	provisioning services (cultivated crops, plant biomass for cattle, renewable energy) regulating services (erosion control, nutrient and pest control, pollination, climate regulation) cultural services (recreation, education) supporting services	Corine land cover data ATKIS (Authorative Topographic-Cartographic Information System) No economic mapping and assessment methods were applied.	Other (own method) CICES classficiation
27	**Germany**	regional	Berlin	2013	Ökosystemdienstleistungen in Berlin: Klimaregulations- und Erholungsfunktion auf städtischer Ebene	Kabisch, Nadja & Larondelle, Neele & Haase, Dagmar	Regulating services (air quality, climate regulation) Cultural services (recreation)	Berechnung und Visualisierung der Luftreinhaltung und Klimaregulation im Rahmen der regulierenden Ökosystemdienstleistungen sowie die Erholungsfunktion; CORINE Landcover und Urban Atlas der Europäischen Umweltbehörde (EEA) als Datengrundlage zur Berechnung der Indikatoren Berechnungsmethode: u.a. empirische Studienwerte, Pufferanalyse mit ArcGIS10.0,	CICES
28	**Germany**	regional	Wald im Stadtgebiet Remscheid (75km²)	2017	Inwertsetzung von Ökosystemdienstleistungen - Eine objektive Bewertung auf lokaler Ebene - - Remscheid - Eine Studie im Auftrag der Waldgenossenschaft Remscheid eG	Sieberth, Lukas	Basisleistungen Versorgungsleistungen (Holznutzung, Wasser, Wildbret, Weihnachtsbäume/Schnittgrün) Regulationsleistungen (Erosionsschutz, CO2-Adsorption O2-Produktion, Lärmschutz, Staubfilterleistung, Luftbefeuchtung, Kleinklimatische Wirkungen des Waldes auf landwirtschaftliche Flächen, Wald und Siedlungswert) Kulturelle Leistungen (Erholungswert Erholungseinrichtungen Gesundheitsförderung Artenschutz / Biodiversität Waldkultur)	Eigene Berechnungsverfahren	Millennium Ecosystem Assessment:
29	**Germany**	national	Germany	2012	Der Wert der Natur für Wirtschaft und Gesellschaft – Eine Einführung	Naturkapital Deutschland – TEEB DE-Koordinationsgruppe	none	None	TEEB

30	**Germany**	national	Germany	2017	Germany's Ecosystem Services – State of the Indicator Development for a Nationwide Assessment and Monitoring	Grunewald Karsten , Syrbe Ralf-Uwe , Walz Ulrich , Richter Benjamin , Meinel Gotthard , Herold Hendrik, Marzelli Stefan	none	none	CICES
31	**Hungary**	regional	Centre of Szeged, South-East Hungary	2015	Evaluating climate-related ecosystem services of urban tree stands in Szeged (Hungary)	Kiss, Màrton; Takács, Ágnes & Gulyás, Ágnes	Regulating services (Carbon storage and sequestration Air pollution removal)	i-Tree Eco model Structural characteristics of the urban forest	Other (own methods)
32	**Hungary**	regional	Tisza River in Hungary and Romania	2012	Managing the current and future supply of ecosystem services in the Hungarian and Romanian Tisza River Basin	Petz, Katalin; Minca, Elena L.; Werners, Saskia E. & Leemans, Rik	provisioning services (food, raw materials, genetic and medicinal resources); regulating services (water regulation, water purification, natural hazard regulation, pest regulation, soil quality regulation); cultural services (recreation and ecotourism, aesthetic value and cultural value)	ecosystem function analysis: tool to break down complex ecosystem processes into tangible ecological functions and services, and subsequently to analyse all their relationships to different drivers selected factors: 'policy measures', 'people's recognition' and 'weather extremes', because they are relevant for the region and its management; interviews	Millennium Ecosystem Assessment:
33	**Hungary**	regional	Karst Areas Hungary	2011	Ecosystem Services in Hungarian Karst Areas	Kiss, Márton & Tanács, Eszter & Ilona, Barany	Provisioning services (drinking water, timber) Regulating services (soil formation, climate regulation, carbon sequestration) Cultural services (recreation, tourism, aesthetic values, biodiversity)	"The study is based, besides other literature sources, on the previous results of karst ecological studies at University of Szeged" ; descriptive methods	Other (own methods)
34	**Hungary**	regional	Bükk National Park	2018	Fostering pro-biodiversity business in the Bükk National Park	ECO-Karst project	Provisioning services (drinking water) Regulating services (filter and buffer for pollution, climate regulation, carbon sequestration) Cultural services (tourism, natural beauty of landscapes and wildlife, biodiversity)	diverse methods	CICES
35	**Hungary**	national		2015	Esmeralda: Country Fact Sheet: Hungary	Esmeralda: Bálint Czúcz, András Báldi and Katalin Petz (editors)		None	CICES
36	**Hungary**	national	Hungaria	2011	Borrowing services from nature. Methodologies to evaluate ecosystem services focusing on Hungarian case studies	Nagy, Gergő G. & Kiss, Veronika (Editors)	provisioning (crops, timber, fresh water, energy, biomass, medical plants, crops, etc.) regulating services (soil function, climate regulation, water retention, flood protection, nutrient and pollutant regulation) cultural services (intrinsic value of biodiversity, recreation, aesthetic values)	GIS based assessment of physical and empirical data contingent valuation choice experiment assessment of landscape functions and landcover	Different
37	**Romania**	regional	Niraj-Târnava Mică region (catchment area of the river)	2017	How much are nature' gifts worth? Summary study of the mapping and assessment of ecosystem serveices in NATURA2000 sites of the NIRAJ-TÂRNAVA MICĂ region	Arany I., Czúcz B., Kalóczkai Á., Kelemen A. M., Kelemen K., Papp J., Papp T., Szabó L., Vári Á., Zólyomi Á.	Provisioning services (wood and timber, natural forage and fodder, NTFP, honey) Regulating services (pollination, water retention, soil erosion control, climate regulation and carbon sequestration, soil fertility) Cultural services (tourism, local identity, habitat naturalness and landscape diversity)	Rafting – number of tourists was calculated, number of rafting days + indirect values as in fishing.	CICES
38	**Romania**	regional	Tisza River in Hungary and Romania	2012	Managing the current and future supply of ecosystem services in the Hungarian and Romanian Tisza River Basin	Petz, Katalin; Minca, Elena L.; Werners, Saskia E. & Leemans, Rik	provisioning services (timber, wood, fishing, hunting, crops, NTFP) regulating services (water regulation and purification, groundwater recharge, soil fertility, water retention, flood prevention, nutrient reduction, erosion control, pest control, climate regulation, carbon sequestration) cultural services (aesthetic values, biodiverstiy, recreation, tourism, genetic resources, education, cultural heritage)	ecosystem function analysis: tool to break down complex ecosystem processes into tangible ecological functions and services, and subsequently to analyse all their relationships to different drivers selected factors: 'policy measures', 'people's recognition' and 'weather extremes', because they are relevant for the region and its management; interviews	Millennium Ecosystem Assessment:
39	**Romania**	regional	Apuseni Nature Park	2018	Ecosystem services of karst protected areas - driving force of local sustainable development	ECO-Karst project; Gattenlöhner Udo, Pfeiffer Andrea , Volles Ronja	Provisioning services (drinking water) Regulating services (filter and buffer for pollution, climat regulation, carbon sequestration) Cultural services (tourism, natural beauty of landscapes and wildlife, biodiversity)	Guidance document	CICES
40	**Romania**	regional	Maramures Mountains Natural Park; Piatra Craiului Nature Park; Retezat National Park; Vanatori Neamt Natural Park;	2012	An Assessment of the Contribution of Ecosystems in Protected Areas to Sector Growth and Human Well Being in Romania Improving the Financial Sustainability of the Carpathian System of Protected Areas (Pas)	Bogdan Popa; Camille Bann	provisioning services (food, crops, timber, wood products, NTFP, energy, hydropower) regulating services (water regulation and purification, soil erosion and regulation, water retention, flood prevention, nutrient reduction, climate regulation, carbon sequestration) cultural services (aesthetic values, biodiverstiy, recreation, tourism, genetic resources, education, spirtitual and cultural heritage)		CICES
41	**Romania**	national	Romania	2015	Esmeralda: Country fact sheet: Romania	Esmeralda: Cristian Mihai Adamescu and Constantin Cazacu (editors)			CICES
42	**Romania**	national	Romania	2017	Assessment of Ecosystems and Ecosystem Services in Romania Demonstrating and promoting natural values to support decision-making in Romania	NEPA, NINA, ROSA, WWF Romania	none	biopyhysical mapping, economic valuationof key ecosystems; one output of the project is the still existing working group on ESS in Romania.	CICES
43	**Slovakia**	national	Slovakia	2017	Potential of Agroecosystem Services. The Case of Slovakia	Makovníková, Jarmila; Pálka, Boris; Širáň, Miloš; Kanianska, Radoslava & Kizeková	none	Mapping unit combining four input layers: slope topography, climate units, soil texture and usage of land	Calculation with weighted average of the potential of each agroecosystem service for the territory of the Slovak Republic, which is characteristic for the spatial aggregate of functional unit
44	**Slovakia**	regional	Muranska Planina National Park	2015	On the valuation of ecosystem services in Muranska Planina National Park (Slovakia)	Považan. Radoslav; Getzner, Michael & Švajda, Juraj	provisioning services (water supply, hunting, crops, timber, fresh water, NTFP) regulating services (water retention, flood prevention, erosion control, climate regulation, carbon sequestration) cultural services (recreation, tourism)	Basic collection of data, questionaire survey Monetary value based on existing assessment studies were ajusted to the local and / or national conditions	CICES
45	**Slovakia**	national	1) polluted area (inorganic contamination); 2) non polluted area (without the inorganic contamination); 3) area threatened by erosion; 4) abandoned land; 5) low productive land; 6) productive land	2017	The ecosystem services supplied by soil in relation to land use	Makovníková, Jarmila; Kanianska, Radoslava& Kizekov, Miriam	provisioning services (cultivated crops) regulating services (soil fertility, soil carbon stock) In the analysis of the suitability of the area in terms of recreational usage, the altitude, inclination, drainage, precipitation, temperature (climate) and their distance to the roads were taken as basis. Five categories of agroecosystem to provide outdoor recreational activity were determined: 1 = very low, 2 = low, 3 = medium, 4 = high and 5 = very high relevant capacity.	The basis for analysing the potential for the provisioning agroecosystem services was a point value (BH) of productive potential. The BH value is a basis for the rationalization and environmental exploitation of natural resources of a particular territorial unit and its value in Slovakia ranges from 0 to 100. Six agricultural study areas, each of them with two different land use categories (arable land and permanent grasslands) located in various natural conditions of Slovakia	Other
46	**Slovakia**	regional	Vel'ka Fatra National Park	2014	Value of Ecosystem Services in Mountain National Parks. Case study of Vel'ka Fatra National Park (Slovakia)	Švajda, Juraj & Getzner, Michael & Považan, Radoslav	provisioning services (timber, fresh water, NTFP) regulating services (flood prevention, erosion control, climate regulation, carbon sequestration) cultural services (biodiverstiy, recreation, tourism)	Methods are based on deriving environmental values depending on the preferences of private households and/or companies. methods of deriving values from markets (revealed preferences elicited, e.g., by costs) and direct surveys (stated preferences) based on the willingness to pay or accept. The first step of ascertaining use and non-use values consists of a collection and assessment (quantification) of the existing ecological data on ecosystem services of Veľká Fatra, and on a geographical assignment of the relevant national park region	CICES

47	**Slovakia**	national		2015	Esmeralda: Country Fact Sheet: Slovakia	Esmeralda; Eva Streberová, Alica Šedivá and Rastislav Rybanič (editors)			CICES
48	**Slovakia**	national	Slovakia	2015	Ecosystem Assessement Process in Slovakia	Rybanič, Rastislav	none	MAES framework methodology	CICES
49	**Slovakia**	national	Carpathian Protected Areas	2014	Valuation of Ecosystem Services in Carpathian Protected Areas with focus on Slovakia - Guidelines for rapid assessment -	Považan, Radoslav; Kadlečík, Ján & Getzner, Michael	none	The first step of ascertaining use and non-use values consists of a collection and assessment (quantification) of the existing ecological data on ecosystem services of the protected area, and on the geographical (spatial) assignment of the relevant protected area region. The second step consists of linking the qualitative information to prices to create	CICES
50	**Slovenia**	regional	Škocjan Caves Regional Park	2011	Ecosystem Services Evaluation in the Škocjan Caves Regional Park	Actum, d.o.o. Zujo, Jasmina Marinsek, Miha	Provisioning services (food, fibre, minerals and fuels, fresh water, biochemicals, genetic resources) Regulating services (air quality, climate, water, natural hazard and erosion prevention, water purification, waste treatment, disease regulation, pest regulation, pollination) Cultural services (cultural diversity, ethical, spiritual&religious services, educational values, inspriation, aesthtetic values, social relations, sense of place, cultural heritage values, recreation and tourism	market price method avoid damage cost approach zonal travel cost method descriptive approach	Millennium Ecosystem Assessment (2005) including biodiversity as service
51	**Slovenia**	regional	Slovenian karst region Notranjska Regional Park	2018	Ekosistemske storitve kraških zavarovanih območij	Ildikó Arany, Réka Aszalós, Béla Kuslits, Eszter Tanács	Provisioning services (drinking water) Regulating services (filter and buffer for pollution, climate regulation, carbon sequestration) Cultural services (tourism, natural beauty of landscapes and wildlife, biodiversity)		CICES
52	**Slovenia**	national		2015	Esmeralda: Country Fact Sheet: Slovenia	Esmeralda Branka Tavzes and Gregor Danev (editors)			CICES
	Multiple country studies								
53	**Multiple Countries (Germany, Austria, Slovakia, Hungary, Croatia, Bulgaria, Romania, Ukraine)**	regional	Danube Floodplains	1995	Economic values of Danube Floodplains	Gren, Ing-Marie; Groth, Klaus-Henning & Sylve´n, Magnus	Provisioning (food supply) Regulating (water purification, biodiversity, flood control, wind protection)	Market price for products Recreation Value (travel costs, expenditures for hunting) Floodplains as Nutrient sink (replacement cost method for associated cost savings obtained in other sectors)	Other
54	**Multiple Countries (Lower Danube Basin: Romania, Bulgaria)**	regional	Danube Floodplains		Valuing the Danube Results of a scoping study on ecosystem services in the Danube River Basin	Beckmann, Andreas & Tucker, Graham	Provisioning (fisheries, water) Regulating (water purification, climate regulation, flood prevention, soil formation, carbon storage) Cultural (tourism, recreation)	„The study identifies key ecosystem services and their sources, flows and beneficiaries; quantifies them, where possible in terms of social and economic values (…)“	TEEB
	EU neighbourhood countries								
55	**Bosnia & Herzogovina**	national	Hutovo blato Nature Park	2014	Fifth National Report to the United Nations Convention on Biologica Diversity of Bosnia Herzegovina	Oprašić, Senad & Cero, Mehmed	none	Protected Area Benefits Assessment Tool (PA-BAT)	Millennium Ecosystem Assessment 2005
56	**Moldova**	national	Moldova	2013	The Economic Value of Ecosystem Services in Republic of Moldova	Popa, Bogdan	all potential types of Provisioning, Regulating, Cultural, Supporting Services	Sector Scenario Analysis (Tourism, Forestry, Agriculture, Water supply, Disaster risk management, Fishing) Comparison between Business as Usual (BAU) and Sustainable Ecosystem Management (SEM) Multiple evaluations: Willingness to pay, direct value, avaoided damage cost	Millennium Ecosystem Assessment (MA 2005) framework
57	**Moldova**	national	Moldova	2014	Possible Scenarios of Ecotourism Evolution in the Republic of Moldova from the Perspective of Ecosystem Services	Popa, Bogdan	Cultural services (recreation and tourism)	Direct revenues from tourists (fees, expenditures on food and accommodation) for BAU Comparison Business as usual (BAU) and Sustainable Ecosystem Management (SEM) - main increase for SEM scenario is the increased number of tourists	CICES
58	**Montenegro**	national	Montenegro	2013	Montenegro: the economic value of biodiversity and ecosystem services	Emerton, Lucy	Provisioning services e.g. water supply regulating, supporting and cultural services		CICES
59	**Serbia**	regional	Tara National Park	no year	Rapid Assessment of Ecosystem Services, their Values and Potential Financing Mechanisms for Tara National Park, Serbia	Maksimović, Vesna	provisioning services (timber) regulating services (climate regulation, carbon sequestration) cultural services (biodiverstiy, recreation, tourism)	survey, participatory approach	CICES
60	**Serbia**	national	Serbia	2004	Assessment of the economic value of environmental degradation in Serbia	Jantzen, Jochem & Pešic, Radmilo	Provisioning services (crops, biomass, fish, game, NTFP, drinking water) Regulating services (air quality, filter and buffer for pollution, climate regulation, carbon sequestration, nutrient and pest control, pollination, groundwater recharge, water quality) Cultural services (tourism, natural beauty of landscapes and wildlife)	benefit transfer method During the project period it was investigated all kinds of methods to assess damages. This includes the valuation of more “traditional” environmental problems like: - air pollution related damages, focussing on health related problems, acidification and damage to crops. These include air pollutants like CO2, SO2, NOx, NH3, fine particles (PM10) and VOC - water pollution, focussing on eutrophication; - waste: damages due to uncontrolled landfilling of waste (leading to the emissions of methane and CO2, both greenhouse gases).	Other (own methods)
61	**Bosnia & Herzogovina**	regional	Protected Landscape Bijambare	2018	Ecosystem services of karst protected areas - driving force of local sustainable development	ECO-Karst project	Provisioning services (drinking water) Regulating services (filter and buffer for pollution, climate regulation, carbon sequestration) Cultural services (tourism, natural beauty of landscapes and wildlife, biodiversity)	diverse methods	CICES
62	**Serbia**	regional	National Park Tara	2018	Ecosystem services of karst protected areas - driving force of local sustainable development	ECO-Karst project; Ildikó Arany, Réka Aszalós, Béla Kuslits, Eszter Tanács	Provisioning services (drinking water) Regulating services (filter and buffer for pollution, climate regulation, carbon sequestration) Cultural services (tourism, natural beauty of landscapes and wildlife, biodiversity)	diverse methods	CICES
	EU-27, outside Danube area								
54	**Latvia**	National	Marine ecosystems		Application of the marine ecosystem services approach in the development of the maritime spatial plan of Latvia	Kristina Veidemane, Anda Ruskule, Solvita Strake, Ingrida Purina, Juris Aigars, Sandra Sprukta, Didzis Ustups, Ivars Putnis & Andris Klepers		marine waters under the jurisdiction of Latvia including internal marine waters, territorial waters and the exclusive economic zone (EEZ); pelagic (4 levels) and benthic (6 levels)	HELCOM Underwater Biotope and Habitat (HELCOM HUB) classification system (HELCOM; Common International Classification of Ecosystem Services (CICES v4.3)

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