

Ecosystem services and protected area management

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Ecosystem services are the goods and services from nature that deliver benefits to human wellbeing. They are essential for society and for human life and are appreciated by large groups of people. In this chapter we discuss five questions, taking into account that knowledge about ecosystem services is not widespread amongst site managers:

- Why should ecosystem services be included in management plans for (protected) nature areas?
- What can we use to classify ecosystem services?
- How can we identify, map and evaluate ecosystem services?
- How can we identify the beneficiaries of ecosystem services and turn them into stakeholders of (protected) nature areas?
- What are the important aspects of practical management and prioritisation of ecosystem services?

The answers to these questions are very much influenced by the contents of the EU-Life document [“Assessing ecosystems and their services in Life projects, a guide for beneficiaries”](#) (EASME, 2018). The application of this guidance is mandatory for the planning and reporting part of LIFE projects. The approach is, with some minor adaptations, useful for integrating ecosystem services in management plans for protected nature areas. ¹

Why should ecosystem services be part of management planning for nature?

Management plans for nature initially focus on the protection of nature for its own sake. Nature is valuable in itself and therefore worthy of protection. If this protection is done in the right way, nature will also remain capable of delivering many of the goods and services covered under the term “ecosystem services”. This is important for several reasons. Firstly, as mentioned above, ecosystem services are essential for society and for human life and/or are very appreciated by large groups of people. Therefore, there is a need to ensure that these services are sustained over the long term. Secondly, identifying ecosystem services could be a good way to discover relevant stakeholders and improving the link between site management on the one hand, and businesses, policy makers, governments (at different levels), and citizens on the other. This could increase the appreciation of, and understanding for nature and its conservation, and (if wanted) even help generate some additional funding. Therefore, when managing (protected) nature sites it is important to think about which ecosystem services are being delivered, how they can be managed and how they are integrated into the management planning.

The concept of Ecosystem Services came into wider use via the Millennium Ecosystem Assessment (MA, 2005)¹. The ‘bottom line’ message of the MA 2005 was that human activities exhaust our natural capital so quickly that it is no longer guaranteed that the earth will be able to support the life of future generations. Sustainable delivery of ecosystem services depends on the stable functioning of ecosystems. Biodiversity and abiotic conditions are considered to be the crucial factors in maintaining

¹ Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC. Copyright © 2005 World Resources Institute. <https://www.millenniumassessment.org/documents/document.356.aspx.pdf>

and enhancing this ecosystem stability. The protection of nature and its ecosystem services in nature sites is therefore vital not only for nature as such but also for human kind.

Protecting ecosystem services also provides important economic benefits. According to a European study, the benefits from the ecosystem services on Natura 2000 sites are estimated to be €200 to €300 billion each year. It is also estimated that there are between 1.2 to 2.2 billion visitor days to Natura 2000 sites each year, generating recreational benefits worth between €5 and €9 billion per annum.²

A dynamic relationship exists between nature and the socio-economic systems of society. In these dynamics, on the one hand there are drivers that negatively influence the condition of the ecosystems. Think of pressures like habitat conversion and degradation (e.g. by land conversion), the introduction of alien species, pollution and nutrition enrichment, over-exploitation, climate change and many more. Many of these pressures stem from human activities. On the other hand there are the goods and services provided by nature that positively influence society and its economy. For example, forest ecosystems can provide enjoyment for people and help in providing in their livelihood. At the same time, healthy forest ecosystems can reduce air pollution, purify water and help mitigate climate change through storing and capturing CO₂ while releasing, in return, fresh oxygen into the atmosphere. Further elaboration of this basic line of thought can be found at page 4-6 of EASME (2018).

Typology of ecosystem services: how can we classify them?

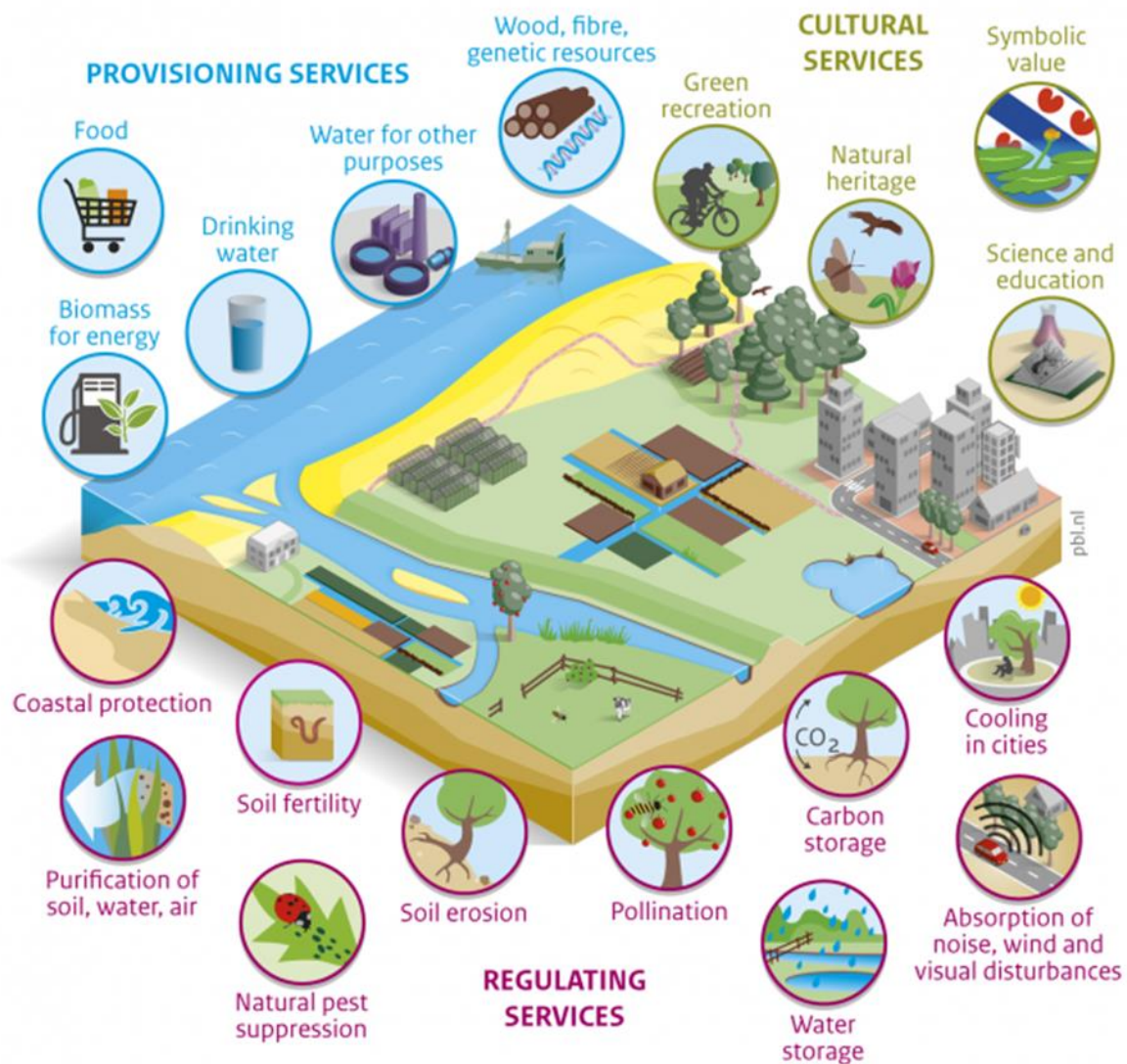
The concept of ecosystem services is a very broad one. The MA discerned four main categories of ecosystem services, i.e. provisioning, regulating, cultural and supporting services. Nowadays the Common International Classification of Ecosystem Services (CICES) is generally used within the EU for representing ecosystem services.

In the CICES classification, ecosystem services are defined as the contributions of ecosystems to human wellbeing. The latest version CICES (V5.1) comprises both biotic output and abiotic output derived from ecosystems. The classification structure of ecosystem services is organized (top-down) from Section (Provisioning, Regulation and Maintenance, Cultural) via Division (e.g. biomass for nutrition, materials, energy), Group (e.g. wild plants terrestrial and aquatic used for nutrition, materials or energy) to Class (e.g. wild plants terrestrial and aquatic used for nutrition). This structure is intended to create the option for aggregating ecosystem services at different levels. Furthermore, CICES V5.1 can be used as a reference table for the (qualitative) mapping of ecosystem services. It also presents "class types" which can be used as indicator types for assessing and quantifying ecosystem services. The complete classification is available as a spreadsheet on the [CICES website](#), together with a document for the technical guidance. In the CICES V5.1 spreadsheet, there is a cross reference to the foregoing version CICES 4.3. This cross reference can be of interest e.g. when using information resulting from LIFE projects.

Contrary to MA 2005, CICES does not recognize supporting services as being *ecosystem services*. Rather they are considered to be part of the structures, processes and functions of ecosystems. From the viewpoint of nature conservation, it should be clear that these "underpinning elements" are indispensable for assessing the condition of ecosystems and therefore are important for nature management planning. A number of ecosystem services are highlighted in the picture below:

² **The Economic benefits of the Environment Natura 2000 Network - Synthesis Report** (2013). http://ec.europa.eu/environment/nature/natura2000/financing/docs/ENV-12-018_LR_Final1.pdf

Examples of ecosystem services in the Netherlands



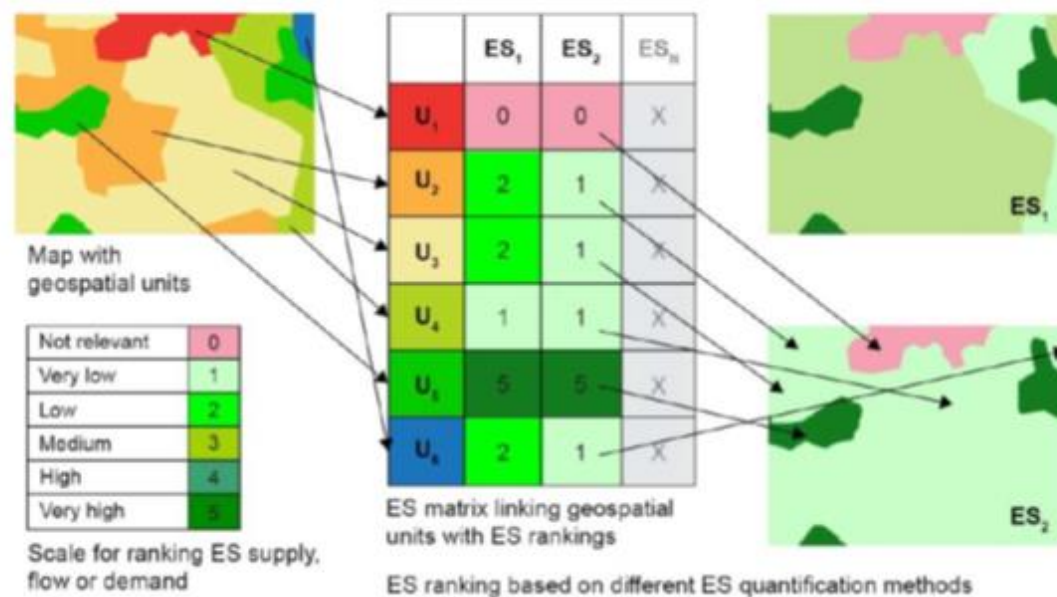
Source: PBL, WUR, CICES 2014

www.pbl.nl

How can we map and assess ecosystem services?

Mapping and assessing ecosystem services is indispensable for planning and executing management in nature areas. Following EASME (2018), the most practical approach is to build an ecosystem services matrix. In such a matrix, ecosystem services are linked to the “units” that deliver them. In general, ecosystem types can be considered to be the units delivering ecosystem services. The matrix allows for integrating all kinds of data related to ecosystem services. Thereby, these data may be of varying quality and different scientific disciplines and methods, and they may stem from data rich and data poor situations and also from different spatial and temporal scales. The picture below presents an overview of an ecosystem services matrix.

Overview of the ecosystem services matrix approach and resulting maps



This picture is taken from EASME (2018, page 7, source Burhard & Maes, 2017). It shows an example of an ecosystem services matrix and its links with spatial units (ecosystem types). The identified ecosystem services are listed in the upper row of the matrix. In the left column, the spatial units or reference units are listed. They describe the specific contexts relating to the ecosystem services and their assessment. The relevance of the ecosystem services in question is ranked on a scale from zero to five and indicated with colours.

Building an ecosystem service matrix consists of four steps in an iterative process:

1. Identification of relevant ecosystem types and assessment of their condition by characterising them in terms of surface or length, condition and trends underpinned with the relevant (more detailed) information and (subjective) judgements. For classification of ecosystem types and for indicators for assessing the ecosystem condition and the pressures that influence it, see EASME (2018) page 4/5 and 7-8. In some situations it might be necessary to refine or adapt these ecosystem types. If so, there are some 'translation tools' available in EASME (2018). An elaborated approach to mapping and assessment of ecosystem services can be found on the [website of MAES](#)³. From the mentioned reports the fifth technical report will be of most interest.
2. Analysis of the relations between the nature area(s) and the relevant beneficiaries/ stakeholders, e.g. the local community, visitors, farmers, administrators etc. The key questions are:
 - a. Which ecosystem services can be relevant for the planning and execution of nature management in this area and which stakeholders might influence them or be affected by them; and
 - b. Which pressures are related to these ecosystem services? In general, building a (qualitatively weighted list of (potential and real) ecosystem services and the pressures related to them with participation of important beneficiaries/ stakeholders can be a worthwhile activity. The starting point could be to use the CICES classification as a reference supplemented with the MAES-tables and/or the EASME

³ MAES is the EU-guidance for mapping assessment of Ecosystems and their Services related environmental accounting.

tables of ecosystem services and the respective ecosystem types combined with the relevant indicators.

3. Selection and quantification of relevant ecosystem services. In this regard there are two basic questions that need to be answered:
 - a. Which ecosystem services and related pressures should be taken into account for the planning and execution of the management of the nature area:
 - b. Which indicators are available for measuring the relevant ecosystem services and related pressures, and which means/ capacity/ resources are available for this part of the job?In this regard, the EASME/MAES tables for the ecosystem types and ecosystem services and related indicators can help.
4. Normalisation of the values of ecosystem services and their inclusion in the matrix. The normalisation step is mandatory for LIFE projects but not, of course, for management planning. It might be sufficient to include the qualitative and quantitative values in the matrix.

We should keep in mind that our knowledge of the functional relationships between human activities, natural capital, ecosystem services and human well-being is still very incomplete. Also, the interdependency between biodiversity and ecosystem services is only known in general patterns. Consequently, we cannot always expect accurate and specific information with a predictive value for every management planning situation. However, the line of thought presented above will help to identify the relevant issues at stake in real life situations related to nature management.

Help and support

The "Toolkit for Ecosystem Service Site based Assessment" (TESSA) is a well-documented tool that is freely available as long as the terms and conditions of use are not violated. It contains methods for the quantification of the ecosystem service classes that are considered to be common for many sites. In the terminology of TESSA, these are coastal protection services, water-related services (flood protection, water provision, water quality improvement), cultivated goods (crops, livestock, fish, timber), harvested wild goods (food, fibre, energy...), pollination services, global climate regulation (carbon storage, greenhouse gas fluxes) nature-based recreation and tourism and cultural services. TESSA is designed for a wide range of users, including non-experts, although some experience and / or training may be needed. The methods are designed for use in developed and developing countries and across all terrestrial and wetland habitats. There are no specific methods for the marine environment. A working link to TESSA is available from [IPBES](#).

Furthermore, you can find help for the mapping and assessment of ecosystem services on the EU-based [OPPLA platform](#). OPPLA aims to provide "a new knowledge marketplace"; a place where the latest thinking on ecosystem services, natural capital and nature-based solutions is brought together.

Additionally, the [ESMERALDA](#) (Enhancing ecoSystem sERvices mApping for poLicy and Decision mAKing) project should be mentioned here. ESMERALDA aims to deliver a flexible methodology to provide the building blocks for pan-European and regional assessments of ecosystem services. The work will support the needs of assessments in relation to the requirements for planning, agriculture, climate, water and nature policy. This methodology builds on existing EU projects and databases (e.g. MAES, OpenNESS, OPERAs, national studies), the Millennium Assessment (MA) and TEEB. ESMERALDA will identify relevant stakeholders and take stock of their requirements at EU, national and regional levels.

Valuing and monetising

There has been much discussion about expressing the value of ecosystems in monetary terms (mostly in euros, dollars or GBP). Therefore, the global UN programme on The Economics of Ecosystems and Biodiversity (TEEB) has propagated to present the economic value of nature by monetising the value of ecosystem services. This was seen as a necessity because otherwise these values would not be taken into account in public and private decision making. There are a number of methods for determining the economic value of ecosystems and their services. These may be based on: market prices; the added value of ecosystem services in production processes; the contribution to the value of surrounding assets (e.g. prices of houses); avoided costs (by using natural solutions instead of technical ones) or based on peoples willingness to pay for travelling to reach specific nature areas or to pay for different ecosystem services. Presenting economic values of nature areas in general can be of significant use in cost-benefit analyses, for discussions about budgets for nature conservation and, of course, when it comes to payments for ecosystem services delivered by nature areas. In recent years, the debate about monetary assessments has seen less attention, to the benefit of other kinds of valuation, including cultural and intrinsic values.

How can we identify the beneficiaries of ecosystem services and make them stakeholders of (protected) nature areas?

The management of nature areas can have a significant impact for the beneficiaries of ecosystem services. It is important to work with these beneficiaries and all important stakeholders in order to learn their interests and to reach supported decisions whereby it is clear how all the relevant interests are weighed. For more information on stakeholder involvement, visit the page on [stakeholder involvement](#).

How can we decide about prioritisation of ecosystem services and organise for their practical management?

Managing ecosystems in a sustainable way is the best way to achieve stable delivery of a range of ecosystem services. Generally speaking, we will always need trade-offs in management planning; these can be between planning objectives, between value frameworks, between stakeholders, and between groups of ecosystem services. Such trade-offs are often site-specific and scale dependent. In the case of conflicts between ecosystem services, the trade-offs and co-benefits should be analysed to allow the prioritisation of the services. Since the results of prioritisation could have serious implications for the planning and implementation of nature management, we should assess all the relevant factors – primarily area management goals (especially for nature protection), but also the stakeholder interests, available expertise/manpower and budget.

There are a lot of case studies in which the concept of ecosystem services has been applied to specific areas or specific situations. Some examples from OpenNESS are:

OpenNESS case studies

OpenNESS case studies were selected to allow real-world testing of the ecosystem service approach in relevant policy and management situations in different social-ecological systems and institutional and geographic contexts. The cases are linked with a wide range of EU regulatory frameworks such as the Water Framework Directive, Birds and habitats Directive and the Thematic Strategy on the Urban Environment. The case studies play a central role in OpenNESS research design which is based on an iterative cycle of methodological development and refinement, linked to the application in a set of real-world case studies. Some examples of case studies in which the ecosystem services concept has been applied are:

10. Ecosystem services in the multifunctional landscape of the Sierra Nevada, Spain <https://oppla.eu/casestudy/17247>

Objective

Assessing how the ecosystem service approach can be used to demonstrate problems in protected areas such as rural abandonment, land-use intensification and social conflicts emerging from strict conservation practices. Potential impacts and benefits • Increased awareness about the role of National Parks for human well-being in rural regions of the Mediterranean Basin;

17. Operationalising ecosystem services for an adaptive management plan for the Lower Danube River, Romania <https://oppla.eu/casestudy/17254>

Objective

Enhancing the effectiveness of the integrated and adaptive management planning and its implementation in the area. This will be done by mainstreaming the improved understanding, using operational tools regarding the concepts of natural capital and ecosystem services.

Potential impacts and benefits

- Better understanding of the relationships between long term dynamics of the biophysical structure and functions of natural capital and the supplied ecosystem services
- Maintaining and restoring of longitudinal and lateral connectivity of Lower Danube River Wetlands System, which is expected to recover conditions for migration, spawning and feeding of birds and fishes (e.g. sturgeons).
- Enhancing the stakeholders operational capacity to assess ecosystem services.

27. Mapping ecosystem services to support urban planning in the Barcelona Metropolitan Region <https://oppla.eu/casestudy/17264>

Objective

Foster sustainable urban planning and management through the integration of ecosystem services in existing decision-support tools, focusing on both the provision and the demand of the ecosystem services.

Lessons learned

Making Ecosystem Services maps fully operational requires a clear distinction between Ecosystem Services capacity, flow and demand. The differentiated spatial assessment of these three components can better inform planners and policy makers where Ecosystem Services are used unsustainably and where Ecosystem Services provision is failing to meet societal demand. One of the main problems related to the application of Ecosystem Services models (such as ESTIMAP) is availability of data.

21. Operationalising ecosystem services in the Sudoeste Alentejano e Costa Vicentina Natural Park, Portugal

<https://oppla.eu/casestudy/17258>

Objective

Supporting the design of policies and planning instruments to ensure the sustainable management of natural capital stocks and the delivery of critical ecosystem services in the Natural Park. Engaging local stakeholders and decision makers throughout the process to promote awareness raising and social learning.

Potential impacts and benefits

The work developed using the ecosystem services concept provides stakeholders with valuable knowledge and tools, such as maps showing the ecosystem services, that can be operationalised into some of the key policy instruments in place, such as the Natural Park management plan. The workshops and discussion sessions organised during this project increased the communication between stakeholders and created new bridges for cooperation. The partnerships developed with the local stakeholders provided more detailed and innovative assessments and revealed how academia and scientific research can work directly with and for society.

Lessons learned

The different methods applied may be useful to inform decision-making and planning, and to support participatory processes. Their complementarity provided more comprehensive assessments, as well as valuable knowledge through stakeholder engagement, whilst enhancing their awareness. This seems essential to manage the conflicts between promoters of economic activities and natural park authorities.

Case study multiple introducing integrated planning and multiple use of an area

Case study advocating ecosystem assessment and valuation (ESAV) in Bosut Forest Area (Servia) – integrating biodiversity and ecosystem services in natural resource uses and management