Report on "Multifunctional assessment methods and the role of map analysis - Using and Integrated Ecosystem Service Assessment Framework"

Deliverable D4.7

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Enhancing ecosystem services mapping for policy and decision making

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Preface

Mapping and the assessment of ecosystems and their services (ES) are core to the EU Biodiversity (BD) Strategy 2020. Specifically, Action 5 sets the requirement for an EU-wide knowledge base developed by Member States designed to be: a primary data source for developing Europe's green infrastructure; a resource to identify areas for ecosystem restoration; and, a baseline against which the goal of 'no net loss of BD and ES' can be evaluated.

In response to these requirements, ESMERALDA (Enhancing ecoSysteM sERvices mApping for poLicy and Decision mAking) aims to deliver a flexible methodology to provide the building blocks for panEuropean and regional assessments. The work will support the timely delivery of EU member states in relation to Action 5 of the BD Strategy, supporting the needs of assessments in relation to the requirements for planning, agriculture, climate, water and nature policy. This methodology will build on existing ES projects and databases (e.g. MAES, OpenNESS, OPERAs, national studies), the Millennium Assessment (MA), IPBES and TEEB. ESMERALDA will identify relevant stakeholders and take stock of their requirements at EU, national and regional levels.

The objective of ESMERALDA is to share experience through an active process of dialogue and knowledge co-creation that will enable participants to achieve the Action 5 aims. The mapping approach proposed will integrate biophysical, social and economic assessment techniques.

The six work packages of ESMERALDA are organised through four strands (see Figure P1), namely policy, research, application and networking, which reflect the main objectives of EMSERALDA.

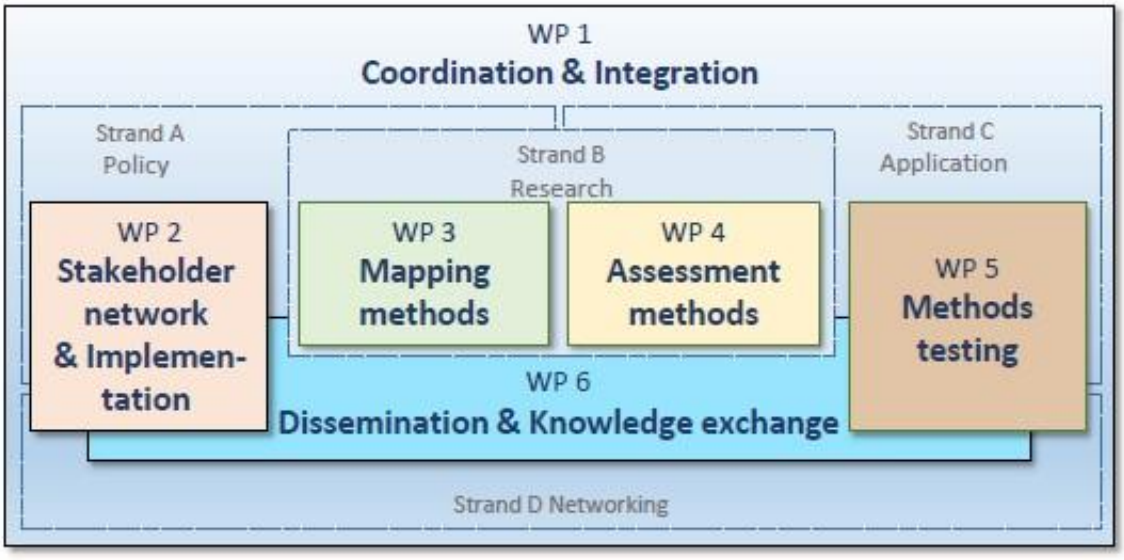

Figure P1: ESMERALDA components and their interrelations and integration within its four strands.

This report sits within work package WP4 "Assessment Methods" and its Deliverable 4.7 (draft) as specified in the Description of Action for ESMERALDA (2015). The focus of this report is to present a broad assessment framework and test it. The framework aims to illustrate the complete integrated assessment cycle for assessment practitioners. The framework also places in context the work being undertaken in ESMERALDA and 'Mapping and Assessment of Ecosystems and their Services' (MAES) within the other assessment activities such as scenarios and assessing policies. The final design of any integrated assessment is shaped through the questions which are being asked and the mandate provided for the assessment.

Summary

This is a draft to indicate what will be done in the final deliverable D4.8 (due in month 42), on the topic of integrated ecosystem assessment and mapping. The purpose is to set out the proposed content five months before the final version is due, so that feedback can be collected and considered in a timely way. The document will also familiarise authors of the individual sections with the overall framework so that a fully integrated text can be developed.

The process and frameworks used for ecosystem assessment are not well documented and seldom evaluated. The ESMERALDA framework for an integrated ecosystem assessment was developed to provide assessment practitioners and decision makers with a tool that enables them to flexibly bring together different activities of existing ecosystem assessment frameworks in an integrative way. With close alignment to the Millennium Assessment (MA, 2005) and MAES frameworks, this integrated ecosystem assessment (IEA) framework uses spatial approaches as a baseline to integration but extends this approach through links with non-spatial methodologies. The level and extent of integration is at the users’ discretion according to the level of data, time and resources they have available, as well as to the specific objectives of the assessment. Beyond the biophysical parameters at the core of the framework, emphasis is given to the inclusion of social and economic factors to ensure policy relevance.

Furthermore, the ESMERALDA framework places at its heart key mapping activities around ecosystem services which are fundamental to the work of MAES as well as ESMERALDA. The framework places the spatial element of analysis within the wider landscape of activities which are undertaken within an ecosystem assessment.

The consultation process on the Integrated Ecosystem Assessment framework has been internal to the project Consortium (see also Milestone 22 report, Brown et al., 2018). Presented in this deliverable report is the final framework, which has now been agreed upon by the members of the ESMERALDA consortium. Further consultation by means of a survey and interviews, e.g. with EU members states, will help develop guidance around this framework through the collation of good practice examples.

In a second step seven case studies will use and explore the ESMERALDA integrated ecosystem assessment framework and examine its suitability of their policy- and science-related questions. The individual contributions will discuss advantages and disadvantages of using a holistic approach to their issue compared to the approach that was initially applied.

A third block of work will look at the role of ecosystem classifications in an integrated ecosystem service assessment and mapping. It will examine the extent to which existing classifications such as ‘The Common International Classification for Ecosystem Services’ (CICES, Haines-Young and Potschin, 2018) can promote integration of the biophysical, social and economic assessment of services and the different ways that indicators can be made spatially specific. As a further dimensions of integration approaches to multi-functional ecosystem assessment and mapping will also be examined. The work will, wherever possible, draw on the case studies considered in part 2 of this report.

All the material will form parts of Deliverable 4.8 due at the end of the ESMERALDA project and in a shorter version for the on-line "Guidance on mapping and assessment of ecosystems and their services" that ESMERALDA will develop.

1. Introduction

By Claire Brown (UNEP-WCMC), Marion Potschin-Young (Fabis), Abigail Burns (UNEP-WCMC) and Andy Arnell (UNEP-WCMC)

1.1. Why is a framework needed?

Governments have long recognised that human well-being is dependent on healthy functioning ecosystems and the services they provide as set out in the global Aichi Targets and the Sustainable Development Goals. Despite this, ecosystems are being significantly reduced in extent and threatened with loss of function, putting at risk the ecosystem services they deliver (Leadley *et al.*, 2014). However, it appears that national policy setting and decision making processes still do not take into account biodiversity and ecosystem services. Ecosystem assessments apply the judgement of experts to existing knowledge generated from the scientific community (and other forms of knowledge) to provide credible answers to policy-relevant questions. And therefore, ecosystem assessments are a tool that can support the development of an evidence base that meets the needs of different sectors and encourages integration (Berghofer *et al* 2016; Ash *et al*. 2010).

Integrated assessments and specifically ecosystem assessments are not a new concept. Examples of such global efforts include the Millennium Ecosystem Assessment (2005), The Economics of Ecosystems and Biodiversity (TEEB), and of course the suite of assessments being undertaken by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). There are also a number of national efforts, especially in the EU Member States but also in countries such as Ethiopia, Cameroon, Viet Nam and Colombia. Common to all ecosystem assessments are the principles of credibility, legitimacy and relevance. Therefore, ecosystem assessments are typically characterised by:

- Involving governments and other stakeholders in the initiation, scoping, review and adoption of the assessment reports (this involvement promotes credibility, legitimacy and relevance at policy level);
- Operating through an open and transparent process, run by a group of experts that has a balance of disciplines, geography and gender. They use agreed conceptual frameworks, methodologies, and support tools and are subject to independent peer review (this process promotes credibility, legitimacy and relevance at scientific level); and
- Presenting findings and knowledge gaps that are policy relevant but not policy prescriptive, where the level of confidence and the range of available views are presented in an unbiased way (this approach promotes relevance at both scientific and policy level).

(IPBES Guide for Assessments 2018)

There are many benefits that can be realised by undertaking an integrated ecosystem assessment, however, ecosystem assessments are not always the appropriate tool to use. A selection of the advantages and disadvantages can be found in Booth *et al.* (2012); UNEP (2015); Berghofer *et al.* (2016):

Advantages of using an ecosystem assessment process	Disadvantages of using an ecosystem assessment process
Brings together experts from different disciplines and stakeholders around an issue or question	Can have little impact or resonate if not embed within a political or decision making process (e.g. have a mandate)
Demonstrating the benefits, risks and costs of different policy options	Can be costly and time consuming, requiring large amounts of resources
Influencing the goals, interests, beliefs, strategies, resources, and actions of interested parties which can lead to institutional change and to changes in the discourse about the issue being assessed	If poorly designed and/or managed ecosystem assessments can be unnecessary (only re-stating the obvious), inappropriate (not capturing the essence of an issue), or even counterproductive (leading debates in the wrong direction)
Identifying new research directions	
Strengthening the relationship between science and policy by providing the means through which science can inform decision making	
Providing an authoritative analysis of policy relevant scientific questions	

Underpinning all these assessments has been the creation of conceptual frameworks. In simplest terms a conceptual framework for an ecosystem assessment is a concise summary in words or pictures of the relationship between people and nature, including how those relationships are changing over time. Thus, such conceptual frameworks tend to be anthropocentric, as such assessments tend to focus on issues of human well-being and how this is shaped by the environment and how decision makers can change the trajectory of change (Ash *et al.,* 2010). Therefore, ecosystem assessments are inherently integrated (e.g. different data types, different sectors involved). Conceptual frameworks are often referred to as the scaffolding for an assessment, given their role in assisting in the organisation of the material within assessments (Diaz *et al.*, 2015).

However conceptual frameworks should not be confused, with the assessment process required to assess the interactions that they set out. The assessment process or framework which underpinned the MA, integrated ecosystem assessments more generally (see Figure 1.1), as well as IPBES, usually consist of four key steps. The steps are: i) exploratory (where the need or mandate for the assessment is articulated); ii) design or scoping (what will the assessment cover); iii) implementing the assessment; iv) communication and disseminating the findings of the assessment. Within each of these steps are a

number of activities and decisions which have to be made, including where and how integration will occur.

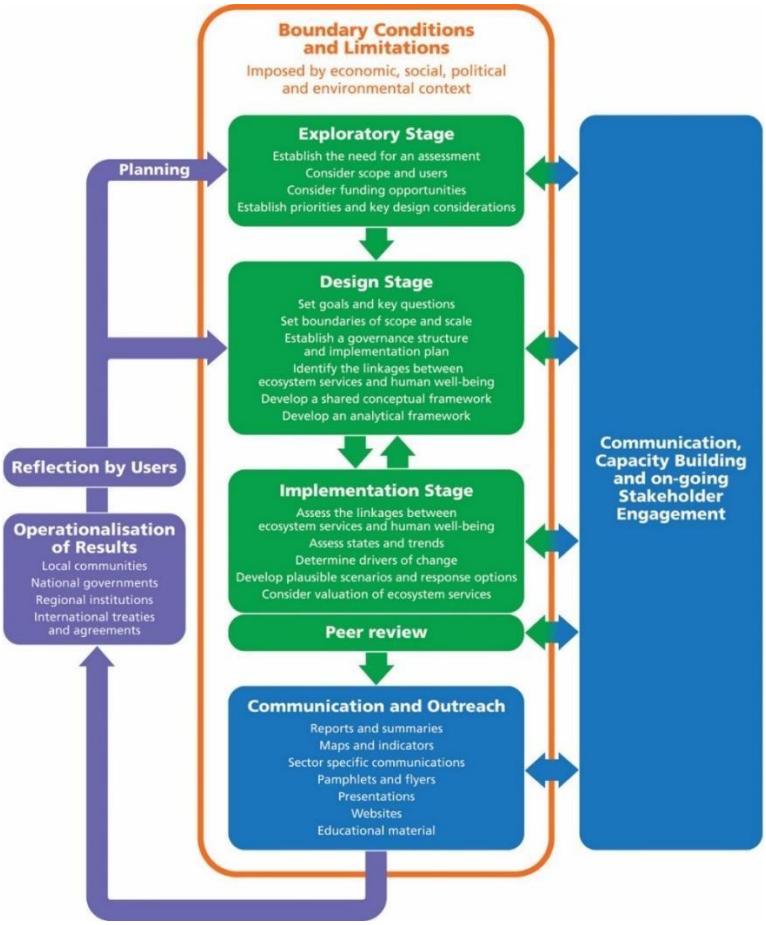

Figure 1.1. Ecosystem Assessment Framework (Ash *et al.* 2010)

This deliverable report presents and assessment framework which attempts to set out more comprehensively the different activities to be undertaken in implementing an assessment and indicating where decisions on integration should be made.

The remaining parts of Chapter 1 describe the background to the development of the idea of integrated assessment in ESMERALDA, and examine what the concept of 'integration' entails. Chapter 2 provides the results and analysis of a consultation exercise undertaken across member states on the material developed within the Project on integrated assessment; the material in which the consultation was based developed out of an initial framework developed in MAES, but which explicitly identified the wider dimensions of integrations. The aim of the consultation was to understand what elements of ecosystem assessment frameworks were useful or important to different users and develop a common understanding of integration within the assessment process by assessment practitioners. As a result, eight examples of good practice were identified and summarised as a way of reflecting on the different characteristics of the proposed integrated framework.

Chapter 3 reviews the application of the proposed integrated assessment framework in the context of seven local case studies. These were selected from the group of partners within the ESMERALDA consortium because their work involved some form of integration. The aim here was to test further the concept of integrated assessment developed in ESMERALDA, by examining the advantages and disadvantages of using the holistic approach proposed, compared to the approach that was initially

applied within the study; in other words its ‘added value’ of the evolving ESMERALDA integrated framework. A particular focus was on the extent to which the proposed framework was able to help address the types of policy questions that arise in the context of ecosystem service applications.

The final part of this deliverable focused on the role that classifications of ecosystem services can have in assessments, and in particular how they can facilitate integration of the biophysical and socio-economic aspects of assessments, and reflection on different kinds of value attributed to ecosystem services by different stakeholder groups. A key conclusion to emerge from Chapters 1-3 was that whatever else ‘integration’ involves, it must allow the trade-offs and synergies between services to be identified and examined critically under different policy assumptions. A key ste in such an analysis is the development of robust and meaningful indicators. Earlier work in ESMERALDA had looked at the way CICES might support such activities, and identified how, despite its focus on services, it could assist the development of indicators cross the ecosystem service cascade (i.e. relating to ecosystem structure, function, service, benefit and value). The version of CICES (V4.3) that was recommended as the basis of MAES has now been updated. The development of V5.1 was based partly on the work undertaken ESMERALDA, and so this final deliverable provides the opportunity to report on the new structure and, using the case study material presented Chapters 2 and 3, to reflect on how it might help to achieve the wider aims of integrated assessment.

1.2. Background to the integrated ecosystem assessment (IEA) framework

The proposed framework that formed the basis of consultation was drafted based on the MAES mapping framework and examples of best practice in ecosystem assessment (see Appendix A for Case Studies). It is an adaptation of the assessment framework developed in the Millennium Ecosystem Assessment (MA), published in 2005 (see Fig 1.2), and is closely aligned with the conceptual framework developed in 2013 as part of the Mapping and Assessment of Ecosystems and their Services (MAES) initiative within the EU Biodiversity Strategy to 2020 (see Fig. 1.3).

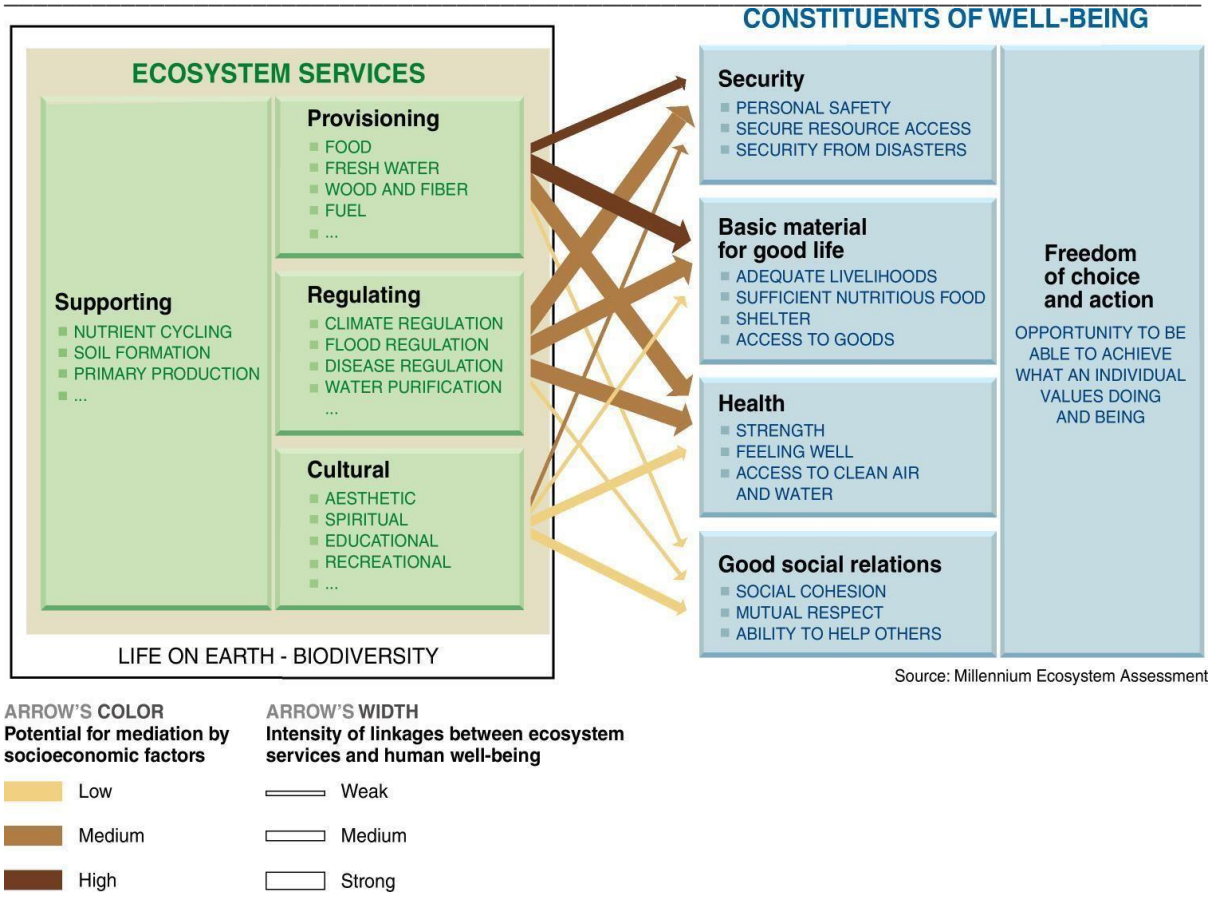

Figure 1.2. The Millennium Ecosystem Assessment Framework (MA, 2005)

The MAES framework was developed as an essential part of the EU Biodiversity Strategy to 2020 to ensure a consistent approach to ecosystem assessment across the EU. A key objective of the MAES initiative is to develop a comprehensive benchmark on the condition of EU ecosystems and the value of the services they provide by 2020 (European Commission, 2014a). The analytical framework is based on the DPSIR framework (Drivers, Pressures, State, Impact and Response), enabling characterisation of the link between human actions and environmental impacts. Importantly, the 'state' element of this framework refers to the condition of ecosystems. Understanding how ecosystem condition is affected by different pressures is an important element in designing policy responses (European Commission, 2016). The common conceptual framework and toolkit (see Fig. 1.3) developed under MAES can be used as a support tool by member states carrying out mapping and assessment activities. It proposes a common typology of ecosystem types and services that allow for consistency and comparison across scales (European Commission, 2013).

A series of ecosystem pilot cases were carried out by the MAES initiative in order to test the MAES analytical framework following its adoption in 2013. The work was based on a 4 step approach (Figure 1.3) (European Commission, 2014b). The analytical framework has been further enhanced by the identification of a comprehensive set of indicators for ecosystem condition (European Commission 2018). This framework purposely focuses on the spatial elements of an ecosystem assessment. This is a response to the policy context of which MAES is operating at within the
European scale and the existing assessment landscape (e.g. State of Nature Reporting). However, the European Commission recognise that the work undertaken within MAES should be adapted to suit the needs of the Member State in question.

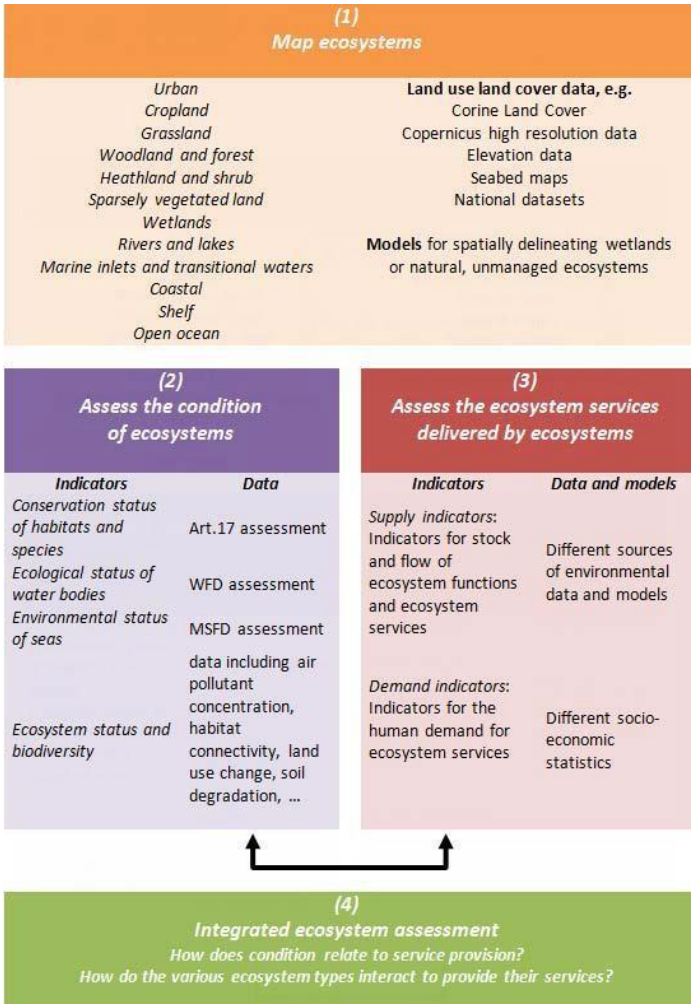

Figure 1.3. The common assessment framework that guided the work of ecosystem pilot cases within the MAES initiative in 2013-14 (European Commission, 2014b).

The MAES initiative’s common assessment framework was further enhanced by Burkhard in 2016 to develop an initial version of the integrated ecosystem assessment framework for ESMERALDA (Figure 1.4) which began to set out the steps required within the assessment process. Although this framework does highlight the role of mapping within assessments, it does not place it yet within the broad ecosystem assessment process such as valuation of ecosystem services, use of scenarios or the assessment of policies. These are essential elements that need emphasizing within an ecosystem assessment framework to ensure policy relevance of results.

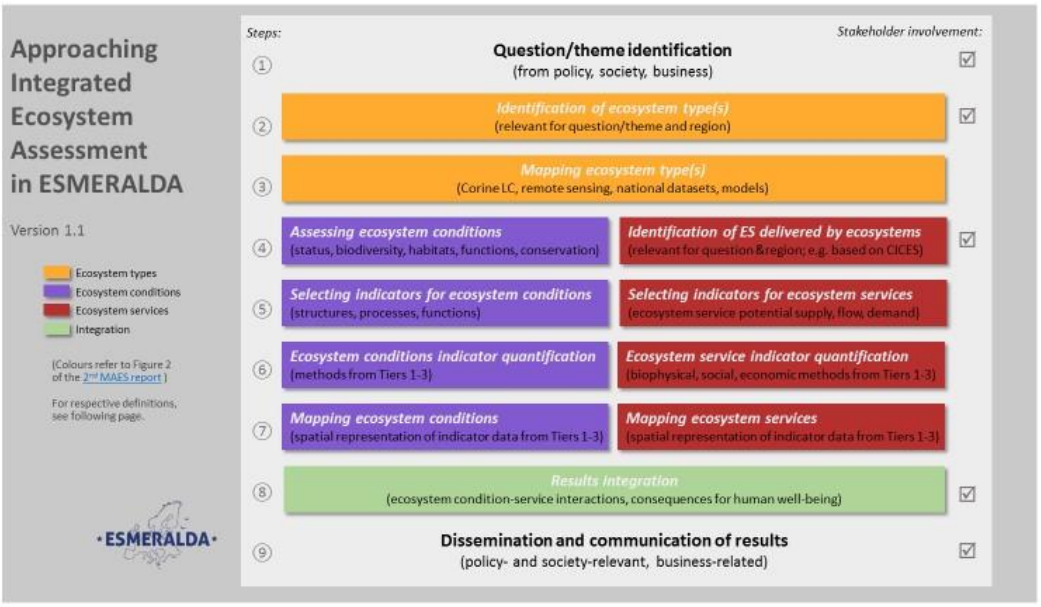

Figure 1.4. Approaching Integrated Ecosystem Assessment in ESMERALDA, Version 1.1 (Burkhard et al., 2016, personal communication).

The next version of the framework (Figure 1.5) placed the core mapping elements within the wider assessment process or framework, particularly with regard to enabling flexibility as to where integration takes place, as well as emphasizing the role mapping can play in leading, or forming the basis, of integration. This draft version, with explanatory text, was sent out to the ESMERALDA Executive Board for comment, and then the wider Consortium and Stakeholder network. The final version of the Assessment Framework can be found in this report as Figure 2.2.

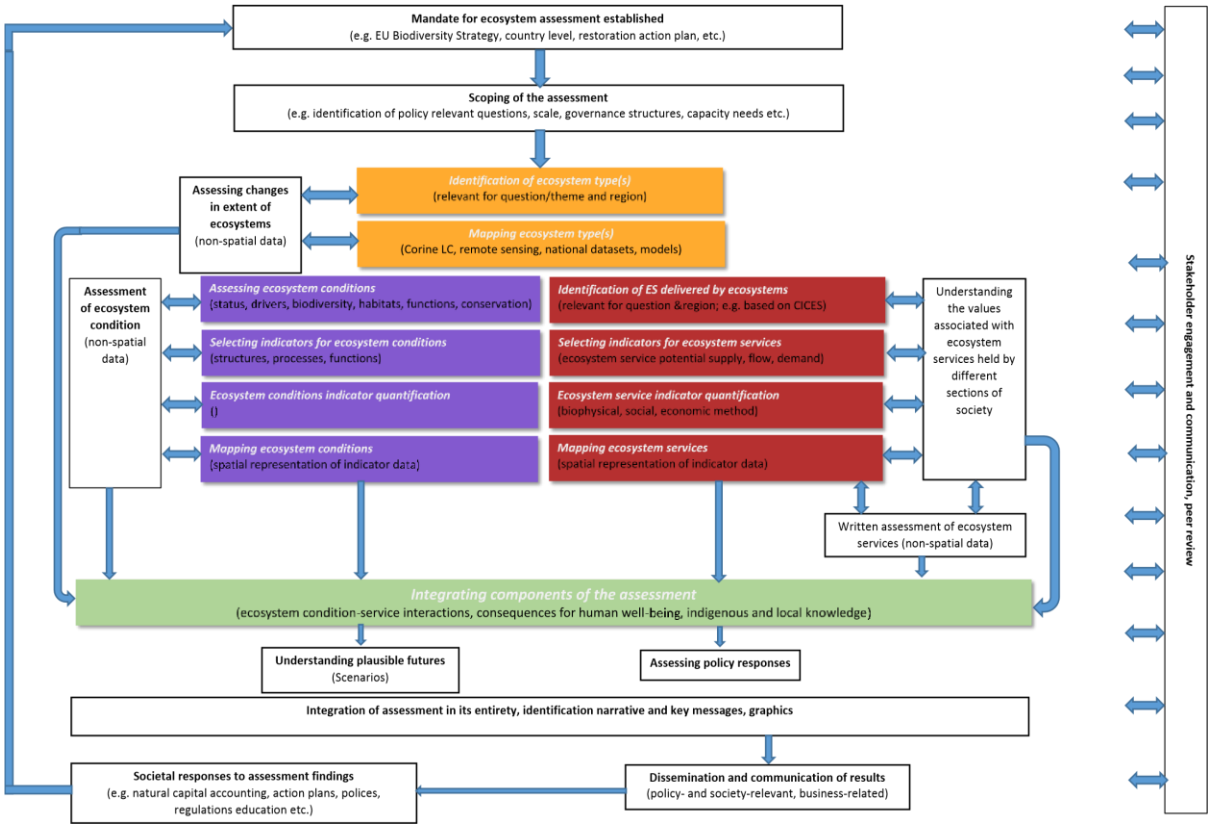

Figure 1.5: Towards an IEA framework in ESMERALDA drafted by Brown, C.; Potschin, M. and R. Haines-Young (2017) based on Burkard et al. (2016) and Maes, J. et al. (2014) 2nd Maes report for consultation within the ESMERALDA Stakeholder network and Consortium.

1.3. Defining ‘integration’ within integrated ecosystem assessments

An important element in the development of a flexible, integrated approach for ecosystem assessments, is to establish a common understanding of what an IEA entails. The level of integration within existing ecosystem assessments varies; but usually falls within i) combining, ii) interpreting and iii) communicating knowledge from diverse disciplines. For example integration may focus on biophysical elements; integrating ecosystem condition with the services that the ecosystem provides (e.g. MAES assessment framework). Others have extended integration to include socioeconomic information and links to human well-being (e.g. Millennium Ecosystem Assessment) and indigenous and local knowledge (e.g. IPBES Assessments). A number of assessment practitioner may use the word integration to refer to the inclusion of stakeholders within the assessment process and the overall governance structure that they are implementing. The extent and stage at which integration occurs will alter according to variables such as the policy question being asked and or available data, resources and tools. It should be noted that while it is generally assumed integration is a benefit, very few assessment processes are documented or evaluated.

This framework is designed to give the user flexibility as to when, where and to what extent they use integrated methodologies in their assessments. At the core of this framework, mapping ecosystem condition and ecosystem services forms the basis of integration, however extensions to this core aim to encompass other social and economic processes. An understanding of how users interpret and determine integration has been crucial in the development of the final framework. This understanding has been developed through extensive consultation with ESMERALDA stakeholders, described in more depth in Chapter 2.

2. The Integrated Ecosystem Assessment framework development process within ESMERALDA

By Claire Brown (UNEP-WCMC), Marion Potschin-Young (Fabis), Abigail Burns (UNEP-WCMC) and Andy Arnell (UNEP-WCMC)

2.1. The consultation processes

The aim of the consultation was to understand what elements of ecosystem assessment frameworks were useful or important to different users and develop a common understanding of integration within the assessment process by assessment practitioners. Specific questions asked of respondents included:

- What kind of integration needs to occur and where does it take place in the assessment process?
- How different does an integrated ecosystem assessment look compared to a non-integrated one?

The development of the assessment framework began in March 2017 and was finalised in January 2018 (Figure 2.1). After consultation at the ESMERALDA board meeting prior to March 2017, it was

agreed that the framework would be developed through consultation with the ESMERALDA stakeholder group, which included members of the scientific and administrative communities as well as representatives of private enterprises, and national and international funding bodies. ESMERALDA workshops provided a space for the framework to be presented, eliciting further discussion and comment. A final round of consultation was sought outside the ESMERALDA consortium within the broader community of assessment practitioners (e.g. the Sub Global Assessment Network).

Figure 2.1: Integrated ecosystem assessment framework consultation timeline. Blue: workshops where the framework was either discussed or presented and where comments were welcomed. Orange: consultation phases. Green: outputs.

2.2. The comments incorporated- why and how

Between March to October 2017, members of the ESMERALDA stakeholder group and Consortium were invited to provide written feedback on the framework. The comments, as well as how the authors of the framework responded to these comments, have been summarised below in Table 2.1 and 2.2. Some comments were not incorporated into the assessment framework graphic as they are deemed too complex for this sort of visual representation, however, they will be explored in more depth in the accompanying guidance text within Deliverable 4.8. For transparency, all comments and responses to these comments can be found in an excel file available under Task 4.4 on the ESMERALDA intranet.

Table 2.1. Themes from written comments received from the ESMERALDA consortium that were incorporated into development of assessment framework graphic, and how they were incorporated

Comment theme	How comment was incorporated into framework
Wording	Generally wording/terminology edits to improve clarity of the framework were incorporated
Layout	Generally, layout suggestions which improve clarity were incorporated (e.g. removal of many of the arrows)
Scoping stages	Incorporation of comments to ensure the scoping stage was sufficiently comprehensive
Non-spatial vs spatial data inclusion	Improved clarity over where spatial and non-spatial elements can be incorporated
Clarity over complexity of ecosystem condition	The complexity of defining ecosystem condition is represented to a degree sufficient for the purpose of this framework within the broader objectives of ESMERALDA

Location of assessment stage	The position of where in the framework the actual assessment takes place was made clearer and placed more appropriately (green box)
Improved clarity over wording within assessment stage	Wording suggestions, particularly for the green assessment box were considered carefully and incorporated to ensure flexibility in integration of different elements
Improved policy relevance	Suggestions which would ensure the wording in the framework would be more relevant to decision-makers were incorporated

Table 2.2. Themes from written comments received from the ESMERALDA consortium that were unable to be incorporated into development of assessment framework graphic but will be addressed within the associated text with Deliverable 4.8

Comment theme	Why comment was unable to be incorporated into framework graphic
Wording	Wording edits that were deemed to already be captured sufficiently were not incorporated
Layout	Layout suggestions which may impede clarity were not incorporated
Clarity over complexity of ecosystem condition	The complexity of defining ecosystem condition is represented to a degree, however this is not the focus of ESMERALDA and so therefore will require further work outside of the scope of this Deliverable
Insufficient incorporation of economic/valuation stages	Emphasis has been given to those processes upon which an economic value can be placed, this is clearly not everything.
Further substeps to enhance particular stages	Too many stages would be confusing. Further exploration of elements such as ecosystem types, pilot studies, policy responses, scenarios, and the use of spatial and non-spatial data will be further explored in guidance text (Del 4.8)

2.3. The Finalised Assessment Framework

The Integrated Ecosystem Assessment framework presented here builds on work that already exists, namely the MA, IPBES and MAES. However, it also introduces new ways of understanding to what constitutes an IEA, whilst taking into consideration the wider ESMERALDA project given its own specific objectives. Extensive stakeholder consultation has helped to shape the final version and it has now been agreed upon by the ESMERALDA board. The final integrated ecosystem assessment framework can be found in Figure 2.2.

The framework is not viewed as the totality of thinking in ESMERALDA on the notion of integrated assessment. This thinking is being developed further within Work Package 4 as a whole in order to ensure ESMERALDA outputs have relevance to EU Member States, and political traction also beyond 2020.

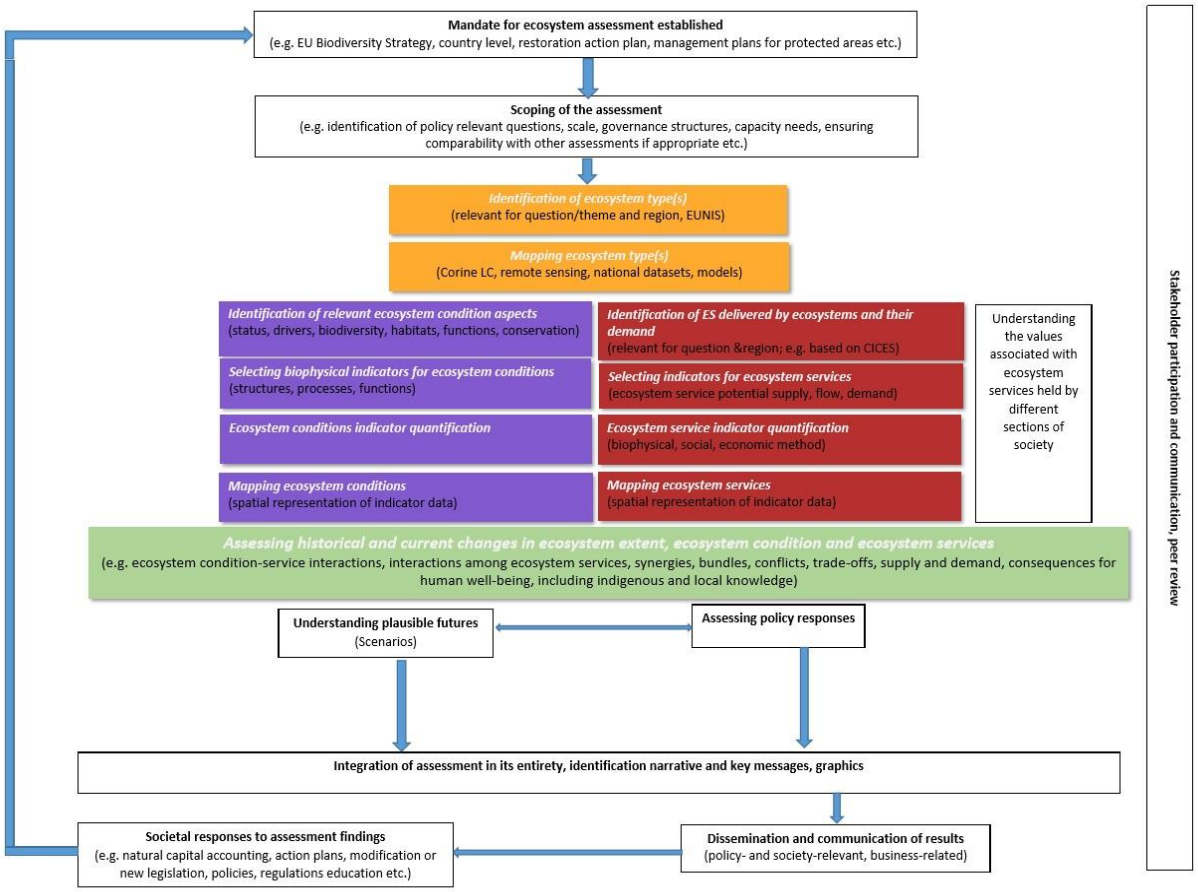

Figure 2.2. Towards an IEA framework in ESMERALDA drafted by Brown, C.; Potschin, M. and R. Haines-Young (2017) based on Burkard et al. 2016) and Maes, J. et al. (2014) 2nd Maes report – Final framework following consultation within the ESMERALDA Consortium.

2.4. Outlook: Consultation across the EU member states

2.4.1. Online consultation

One of the aims of ESMERALDA is to provide assistance to member states in integrated ecosystem assessment in order to help them deliver on Action 5 of the EU Biodiversity Strategy. In developing the integrated assessment framework and accompanying guidance, wider consultation - beyond the ESMERALDA project - was therefore required to develop a better idea of the specific needs of member states. This consultation was initiated through an online survey in an attempt to better understand how practitioners and policy-makers across the member states have carried out integrated ecosystem assessments in the past and what tools they have used. Results from this survey will provide a better understanding of how practitioners are interpreting and implementing the concept of integration in the context of ecosystem assessments. Identification of challenges and strengths in implementing integrated ecosystem assessments will also assist in the development of a flexible methodology, and guidance, around integration. It is hoped that the survey might also start the process of developing a portfolio of best practice case studies.

Engaging stakeholders across the member states, at a range of governance levels, will help develop a broader picture of how 'integration' is defined, ensuring the framework and associated flexible methodology the ESMERALDA project is developing is applicable to those practitioners who are currently carrying out these types of assessments.

2.4.2. Survey structure

To set the scene, the survey's introductory text explains an integrated ecosystem assessment as one that '*brings together data and information on biophysical ecosystem components with socioeconomic system components and the societal and policy contexts in which they are embedded. They investigate the links between ecosystem condition, habitat quality and biodiversity, how these affect the ability of ecosystems to deliver ecosystem services, and the consequences for human well-being. Integrated ecosystem assessments also explore these relationships under a range of future scenarios and possible policy options/responses for decision makers.*' (Brown, 2017).

The survey then goes into depth exploring aspects broadly associated with the following themes:

- Respondent characteristics; *the survey starts by asking respondents to describe the role that they have held within an assessment e.g. author/coordinator.*
- Overarching conceptual framework used; *questions 1 enables the respondent to identify the framework(s) that they have used to guide past assessments. A preliminary list of frameworks provided includes The Economics of Ecosystems and Biodiversity (TEEB), Mapping and Assessment of Ecosystems and their Services (MAES), Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Millennium Ecosystem Assessment (MA).*
- Rationale behind use of integrative methods; *questions 2 and 3 look into the reasons behind the respondent using, or not using, integrative methods.*
- Description of the assessment process; *questions 4 to 6 go into depth, with multiple subquestions, investigating the actual assessment process and approach to integration. Respondents are given an opportunity to elaborate on their definition of integration. Questions follow that attempt to elicit information on the types of data and economic methods used within assessments, as well as the extent to which stakeholders were engaged in a participatory process.*
- Added value of an integrated assessment (vs. non-integrative); *question 7 gives the respondent an opportunity to provide their perspective on the differences between integrated and non-integrated assessments, as well as the benefits, if any, of using an integrated approach.*
- Lessons learned; *question 8 asks respondents to identify any specific pointers to pass onto practitioners carrying out future assessments, and whether any further, non-monetary, resources would enhance integrated assessments moving forwards.*

Please see Appendix B for the full set of survey questions. The survey's user interface can be found at this link;

https://docs.google.com/forms/d/e/1FAIpQLSc5bojlbyI03q6netyhfqqAWAKVEZu17JDlBj7T5OBKlsydw/viewform?usp=sf_link

2.4.3. Respondents

During the first phase of this online consultation, the survey was sent to the MAES working group, the SGA Network and the ESMERALDA stakeholder group and Consortium. These contacts were targeted in order to provide the project team with a broad perspective, at an early stage, of interpretation and experience of integration within ecosystem assessments. This first phase of online consultation was open from December 2017 to January 2018 and elicited 15 responses. Respondents, although

providing useful and informative responses, were identified as not providing a broad enough insight into experiences of carrying out integrated ecosystem assessments from across the different member states. More engagement from country representatives was therefore deemed necessary, and a second phase of this consultation was established in which 45 MAES country contacts within member states were approached. This phase of the survey started in January 2018 and will come to an end on the 28th of February 2018 at which point results will be further analysed. If additional stakeholder input is deemed necessary, individual respondents may be contacted for interview. This approach will provide detailed accounts from those who have carried out integrated ecosystem assessments, as well as from authors of internationally recognised assessment frameworks.

2.4.4. Results to date

We cannot yet present the final outputs from the online consultation stage in this draft deliverable as feedback from a larger pool of respondents is required. In particular, it is important to secure more input from across Europe in order to develop the framework and accompanying guidance in a way most relevant to intended end-users. Therefore, the consultation will continue until the end of February to allow for stakeholder engagement from across all member states. However, some preliminary results (based on 15 respondents) from the first round of consultation are summarized below:

- From a list of assessment frameworks provided (TEEB, MAES, IPBES, MA, other), MAES is the most frequently used with 60% of respondents having used this framework to guide ecosystem assessment.
- Most frequently chosen reasons for using an integrated approach were 'to identify which ecosystem services are relevant for people' and 'to identify trade-offs among ecosystem services, stakeholder and ecosystem bundles'.
- Most frequently chosen reason for not using integrative methods was 'lack of time'.
- Definitions of 'integration' provided by respondents broadly touched on three themes: bringing together different methods and data from multiple sources; assessing the condition of- and changes in- ecosystem services; and linking biophysical and socio-economic parameters.
- Most common types of social data included were 'recreational use' and 'cultural'.
- From a list of economic valuation methods provided, 'market based methods' were chosen as being most frequently employed within integrated assessments.
- 70% of respondents used methods to engage stakeholders in the assessment process. However, throughout all stages of the assessment (exploratory, design, implementation, communication, and resulting decision-making), this engagement was in a consultative capacity rather than one in which stakeholders had decision-making powers.
- Stakeholders consulted throughout the assessment process included the private sector, public sector representatives from a range of governance levels, NGOs, researchers/research institutions, and local communities.
- From a list of tools and methods commonly used to engage stakeholders in decision-making processes, 'preference assessment' and 'multicriteria analysis' were chosen as being the most frequently employed within integrated assessments. 'Literature review' was the most commonly cited method by which stakeholder engagement tools were decided upon.
- All respondents agreed that an integrated approach adds value to the results of an ecosystem assessment. More targeted, comprehensive and policy-relevant results were recurring

reasons given for this. Adequate engagement of relevant stakeholders was repeated by many respondents as an important criteria of success.

- In comparing the differences between integrated and non-integrated assessments, it was highlighted that non-integrated assessments are still useful as a starting point for integrated assessments. Furthermore, non-integrated assessments also to provide a more focused assessment of one element depending on particular end-users’ needs. However, respondents emphasise that the holistic, multi-dimensional elements of integrated assessments make them invaluable tools for solving broader problems.
- Regarding lessons learned, emphasis is given to choosing the right level and type of assessment in light of stakeholder needs and the initial question asked. Actions such as a pre-assessment ‘quickscan’ to identify important issues, and involving the right people at an early stage are also advised.
- Further guidance, capacity building (including an improved ability for researchers to produce ‘useable knowledge’ within sustainable development (Clark, van Kerkhoff, Lebel, & Gallopin, 2016)), and the provision of best practice case studies are among the requirements put forward for improving future integrated assessments.

2.5. Conclusion

It is essential when designing an ecosystem assessment to consider how and where the concepts of integration will be considered. While assessment processes are not well documented or evaluated, the evidence that is available suggests that integration through the governance structure (inclusion of stakeholders), combining of different data sources and the use of tools allows for greater impact of the ecosystem assessment within decision making. What does emerge, however, is that they key contribution that the notion of integrated assessment provides is the ability to consider the synergies and trade-offs of a range of ecosystem services associated with one or more ecosystems. Overcoming the barriers and limitations of ‘siloed thinking’ is perhaps the main feature of the integrated frameworks in general and especially of the one proposed here. Without such crosssectoral thinking it is difficult to see how proper account of biodiversity and ecosystem services can be fully taken into account by decision makers.

2.6. Acknowledgements

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3. Using an integrated Ecosystem Assessment

3.1. Introduction

In this chapter seven case studies have been used to further explore the ESMERALDA integrated ecosystem assessment framework, and examine its suitability of their policy- and science-related questions (see draft policy questions available at time of submitting in Annex C). The individual contributions will discuss advantages and disadvantages of using a holistic approach to their issue compared to the approach that was initially applied. In the following some natal ideas are represented, which will be further discussed and fine tunes in the next EMERALDA workshop in Eger, Hungary in March 2018.

3.2. Ecosystem Condition and its role in an integrated ecosystem assessment

By **Philip Roche Sylvie Campagne (IRSTEA)**

3.2.1.**State of the art**

(also based on MAES EC report, Maes et al., 2018)

- Propose a contour for the ecosystem condition notion we will use

MAES Report: "*Ecosystem condition refers to the physical, chemical and biological condition or quality of an ecosystem at a particular point in time.* *Pressure refers to a human induced process that alters the condition of ecosystems."*

Roche and Campagne 2017: *"The notion of ecosystem 'condition' (including ecosystem health and ecosystem quality) is used and related to a more anthropocentric vision of nature [29–31], either as the state of the ecosystem in response to human pressures and disturbances or as* ***the ability to continue to provide services to people****.*

- Identify the potential indicators that could be mobilized

"For the purpose of MAES, ***ecosystem condition is usually used as a synonym for 'ecosystem state'.*** *It embraces legal concepts (e.g. conservation status under the Birds and Habitats Directives, ecological status under the Water Framework Directive and environmental status under the Marine Strategy Framework Directive) as well as other proxy descriptors related to state, pressures and biodiversity. Ecosystem condition is used to assess trends and set targets related to the improvement of environment health."*

We could make a list of type of indicators the most used and recommendations using the indicator template of the MAES report and a review of the literature we have made.

3.2.2. Testing Framework

- Explore the links between EC and ES:
  - How are ES related to EC?
  - Which components of EC are important for which ES?

- Provisioning ES vs Regulating ES vs Cultural ES vs EC?

➢ Policy questions and their potential links with EC. (selected questions)

Main policy questions related:

Knowledge requests: Questions for conceptual clarification and information needs. Examples are:

- What are ecosystem services?
- How are they linked to biodiversity and condition?

Policy support questions: How ES can be used to support policy making and implementation.

- Biodiversity policy

Application questions (how to implement ES based approaches and how can mapping ES support applications)

- How to set up an ecosystem accounting system?

Detailed policy questions:

- Farming already provides the ecosystem services that matter for our essential needs (food, energy)-why the fuss about the non-essential ones? (13th MAES meeting)
- How mapping of degraded ecosystems could contribute for MAES process? (13th MAES meeting)
- ES delivery is influenced by number of biotic and abiotic factors. What is the role of biodiversity among those factors? Would the ES Assessment really contribute to the biodiversity restoration/conservation? What would we do if we came to the conclusion that biodiversity conservation imposes (somewhere) a constraint to needed ES delivery? (13th MAES meeting)
- How can we secure and improve the continued and sustainable delivery of ecosystem services? (1st MAES report)
- Should the most valuable areas for ESs provision be taken into account as conservation priorities? (Esmeralda matrix) What can we take back as a mission to our MS agency and administration concerning ecosystem condition? Is there a clear target and date, some critical mass and incentive to convince the MS or region to spend efforts on it? (13th MAES meeting) Conceptual clarification

3.2.3 Discussion and recommendation

3.2.4 References

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3.3. Mapping and Assessment of Flood Regulation ES on Different Scales

By **Mariyana Nikolova and Stoyan Nedkov**

Outline

3.3.1. Research and policy background

In this part we will show how we can link different results and data sets at different scales in the context of integrated ecosystem services assessment and how to apply selected mapping and assessment methods in the cases study area at different scales and tiers.

Case study area

The case study area is located in Central Bulgaria and covers the central part of the Balkan Mountains (Stara Planina) and the surrounding areas. The spatial coverage is outlined by following both natural and administrative criteria including all the municipalities that have parts of their areas in the Central Balkan National Park. The establishment of Central Balkan biosphere reserve in 2017 under the Seville Strategy (UNESCO, 1996) which includes also the surrounding municipalities in its development zone, which contributes for further involvement of local administrations in the development of sustainable management of nature resources. The study area is part of mountain region, which suffers from a range of natural and economic disadvantages (e.g. demographic loss, remote areas, higher vulnerability), but it also provides key resources and ecosystem services (ES) to people and societies (water, renewable energy, protection against natural hazards, opportunities for tourism, cultural diversity etc.). Central Balkan and the protected areas in it are ‘hotspots of biodiversity’, containing many ecosystems with rather low anthropogenic influence, particularly at higher altitudes, often in protected areas. Mountain ecosystems are particularly fragile and subject to both natural and human drivers of change, which implies the need of better knowledge on their specifics for better conservation measures. Taking into account all these aspects, the area of Central Balkan National Park together with the surrounding municipalities was chosen as a case study for testing the methods in ESMERALDA project. The geographic structure of the new Biosphere Reserve consists of three functional zones:

a) a core area, which comprises the nine reserves of the existing Central Balkan National Park;
b) a buffer zone, which includes the rest of the National Park’s territory; and
c) a specifically created "development zone", which encompasses 80% of the area of the "Central Balkan Biosphere Reserve", and acts as a transition area between the National Park as a whole and the ecologically unregulated parts of the local municipalities.

The Biosphere Reserve’s development zone is made up of territories from the following municipalities: Karlovo, Troyan, Sevlievo, Pavel Banya and Anton. It is an area of geospatial integration of the ecological (conservation and protection) functions of the Central Balkan with the economic opportunities that the Park creates for the local population, including particular types of tourism and recreation services, forest- and mountain-related ES.

Policy context

The governance of the protected areas within the Central Balkan is defined in the Bulgarian Protected Areas Act and refers to the IUCN categorisation. The Bulgarian Protected Areas Act outlines all aspects of management, planning and protection of the territories. According to the Lima

Action Plan (2016-2025), a key role for the efficiency of biosphere reserves is their recognition as a source of ecosystem services and the provision of a long-term vision for the protection of these services. According to Tomova and Borisova (2018) Evaluation and mapping of ES contribute to:

1. Enlargement of the environmental information base and its decision making support functions, which go beyond the Natural Resources concept;
2. Deepening the role of the financial mechanisms in environmental policy and natural resources management; and
3. Raise the value of spatial and sectoral planning analyses and increase their sensitivity to landscape versatility.

A comprehensive identification and consideration of the dependence of the local population on the ES in the nearby areas makes valuation of the ES an important factor in sustainable landscape planning and territorial integration policy making (Borisova, 2013). As Grêt-Regamey et al. (2008) point out, appropriate selection and valuation of ES in a spatially explicit form facilitates the identification of the most beneficial locations for new development. Practical aplication of ES knowledge enables the territorial integration of interests, activities, policies, and overall governance. This, in turn, creates a basis for active management of ecosystems as service sources, while maintaining a sustained motivation of the local community and other stakeholders to cooperate in the process. The expected long-term outcome is to achieve simultaneous results in the natural, social, cultural, political, and economic aspects of sustainable development in the respective area. One of the key impacts of the mapping and assessment ES is that it is able to smooth the tensions that often arise between the mountain regions, protected areas and the administrators of the municipalities involved. The main challenge in terms of regional environmental policies and territorial strategies is to successfully combine the protection of natural assets and landscapes with ecosystem services and sustainable territorial development. The River Basin Management Plans and implementation of the EU Directives 60/200/EC and 60/2007/EC play key role in the flood risk management process but no one of these documents incorporate ecosystem services approach as crucial in the process of river basin management and flood regulation and mitigation. Examples for implementation of ES assessment and mapping of flood regulating services would contribute for better understanding of the capacity of nature and land use management to cope with flood hazard on all levels – region, basin and settlement.

Data availability and methods

Mapping and assessment of ES, as it is defined in the Biodiversity strategy to 2020, is a comprehensive process that builds on various individual tasks and their systematic integration. Therefore, an integrated and operational framework is needed to support and coordinate these activities (Burkhard et al., in print). The core of the integrated assessment is the common framework proposed by MAES which includes mapping of ecosystems, assessment of ecosystems condition and the services they provide (Maes et al., 2013). It is further developed by Burkhard et al. (in print) who provide step by step guidelines and incorporate also the policy and decision making context in the framework. The first part requires identification of research and policy questions that should be addressed, then comes the process of ecosystems identification, mapping of ecosystem condition and ecosystem services and finally, there is integration dissemination and communication of the outcomes (Burkhard et al., in

print). Our case study illustrated here is following this framework, but in section 3.3.4 we will also look at this in terms of the whole Integrated Ecosystem Assessment as framed within this deliverable and discuss similarities and differences in data needs. For mapping purposes, the investigations interpret the CORINE Land Cover 2012 classes (NRC, 2014) as geospatial units for identification of ecosystem types, classes, and sub-classes (Maes et al., 2013) and next - for valuation of the ES classes and class types (CICES v4.3)[1]. The tiered approach is promoted as an instrument to structure a variety of methods by assigning them to different complexity levels (Sieber et al., 2017; Gret-Regamey et al., 2015). Furthermore, the work is directed towards development of integrated and consistent assessment framework in which different mapping approaches and techniques can be embedded together with the policy context.

3.3.2. Mapping and assessment

The ecosystems types are basic units for ecosystem mapping on European scale. They correspond to the CLC and allow consistent assessment of terrestrial ecosystems from local to EU level. The assessment and mapping framework was adopted and further refined by the CICES classification version 4.3. The mapping and assessment framework was further developed with set of indicators latter in Maes et al. (2016). This framework is used in this study to map and assess the conditions and services provided by the ecosystems in the study area following four main steps:

1. Identification and mapping of ES types in the case study area
2. Selection of indicators for flood regulation ecosystem conditions (EC) and ecosystem services (ES) assessment
3. Selection of methods for EC and ES assessment and mapping of flood regulation capacity
4. Identification and initial ES mapping in the case study

On the regional level, Central Balkan area (Tier 1) mapping is for all relevant services and use Spreadsheet assessment method. On Municipality level (Tier 2) for the assessment of economic value of the ES is used Contingent valuation method. On watershed and local level (Tier 3) for mapping and assessment of the flood regulating ES is used Process based modelling method.

3.3.3. Results integration

The examples of mapping and assessment on different scales using a tiered approach provide good base for the interpretation of the results in respect to different policy questions (PQ) which as general are in close relation and mutual dependency. The results from assessment and mapping of the Central Balkan Biosphere Reserve would provide base for discussion on the question “Which are the most important ES provided, how they contribute to the sustainable economic development of local communities?”

Example from municipality of Karlovo demonstrate the economic value of ES which relates to the flood hazard resilience by different ways and actually the value of ES provided from the territory of Karlovo municipality is bigger than the damage cost avoided or benefit transphere. It can provide an answer to the PQ “How relevant is the authority and public willing to pay for certain land and ES management for reducing flood risk of the existing flood hazard”?

[1] While we are aware of the update of the Common International Ecosystem Service Classification version 5.1, in this case study we are still using version 4.3 as the bases for our investigation as set out in the DOA of ESMERADA. See www.cices.eu for CICES classes.

Example from Tier 3 level considering both biophysical mapping and assessment at watershed and city level. It can answer a PQ like "How scenario-based mapping of flood regulation ES can help the flood risk managers to choose optimal management decisions?" It is important question related to many different issues like planning, adaptation to climate change, investment efficiency etc.

3.3.4. Result integration and communication

An interpretation of the results in the context of the integrated ecosystem services assessment demonstrates how to apply selected mapping and assessment methods in the cases study area at different scales and tiers. In this process of basic importance are EU and national regulations, existing legislation which frames the policy of the government and local authorities, stakeholders attitude and public participation, social innovations etc. Focusing on flood regulating ES we intend to illustrate the role of ES approach as an important element of the flood hazard management on all levels.

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3.4. Using an Integrated Ecosystem Assessment approach for the EIA procedure under the Polish legal framework

By **Małgorzata Stępniewska, Damian Łowicki, Piotr Lupa, Andrzej Mizgajski** (UPOZ)

Outline

Until now, the term “ecosystem services” has not been presented in Polish legal acts. However, the current regulations allow for this approach (although not in a direct way) to be taken into consideration to a significant extent (Stępniewska et al., 2018). *The Polish experts are particularly in favour* of introducing the ES approach into the Environmental Impact Assessment (Stępniewska et al., 2017).

In Poland, the Environmental Impact Assessment (EIA) procedures are regulated by the Act of October 3, 2008 on providing information on the environment and environmental protection, public participation in environmental protection and on environmental impact assessment. The Act is a transposition of the Environmental Impact Assessment Directive. According to the Act, the consent for public and private projects that are likely to have significant effects on the environment (e.g. construction works or other installation) should be granted only after prior assessment of the likely significant environmental effects of these projects (EIA procedure). The assessment has to take into account the influence of the project on human health, quality of life, ensuring maintenance of the diversity of species and maintaining the reproductive capacity of the ecosystem as a basic resource for life.

The above provisions have significant potential for the introduction of the ES approach directly into the documentation drawn up within the EIA. It is possible to match the requirements specified in the Act for the EIA reports with concrete ES categories; e.g. identification of the impact on ecosystem components such as: fauna, flora, soil, water, air can be related to the influence on the structure and level of a large number of provisioning and regulating ES. On the other hand, describing an impact on material assets, cultural heritage and the landscape is related to a section of the cultural ES.

Main challenges for the integrating ES approach into EIA are issues of scope, scale, ES trade-offs and indicators. These challenges can be overcome by carrying out studies in a real decision making context. *Here we investigate* the possibility of using the Integrated Ecosystem Assessment approach for the EIA procedure on an example of road investment, which influences many kinds of ES. Many of the findings could be interesting for other countries, which implement the European Union law in the EIA in their own way.

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3.5. Prioritization of ecosystem services for the Hungarian national MAES

By **Ildikó Arany, Réka Aszalós, Anikó Kovács-Hostyánszki, Bálint Czúcz**

Outline

We will briefly describe the steps of the Ecosystem Services (ES) prioritization and selection process for the Hungarian national MAES, namely:

(1) compiling preliminary ES list based on stakeholder interviews,

(2) making that list consistent with the CICES-HU (the adaptation of CICES 4.3 to Hungarian ecosystems); and

(3) discussing this adapted list with expert groups with the aim of selecting priority ES for mapping and assessment.

We will then assess whether if exercises like such allow integration where necessary and if the framework of an integrated ecosystem assessment as developed within ESMERLADA would help making such work easier, namely, whether the ES prioritization and selection in Hungary, being a determinant phase of the whole MAES process, allowed cross-scale issues to be addressed and analyses across the biophysical, social and economic (monetary) domains to be linked up later on. We will also investigate how those decisions are made, e.g. on what level of consciousness.

3.6. Ecosystem based management as a transdisciplinary approach in the Lower Danube River System

By **Cristian Mihai Adamescu and Constantin Cazacu (UNIBUC)**

Outline

We combined ecosystem based management with a transdisciplinarity approach and ecosystem services in an attempt to explain the dynamics of management decision over more than 60 years in the Lower Danube River System (LDRS).

Land use changes had impacted many areas in Europe. Among the most impacted ecosystem types were the wetlands (European Commission, 1995) that lost 2/3 of the total surface, the remaining ones

being under constant pressures, leading to a significant reduction of size and connectivity. In the LDRS the change from natural systems and transformation into man-made and man-dominated systems occurred due to misuse or lack of understanding and knowledge (or all of the above) regarding the benefits that wetlands were providing to the local communities and not only (some of the positive effects are observed even on the littoral zone of the Black Sea).

At the time of the decision making about the important land use changes there was no consideration about the local people (despite the fact that all the changes were done in their name- but without really a consultation and a dialog with the local communities). The decision making process was based on skewed scientific knowledge and also not based on the interactions with local communities. The wetland benefit estimation was relaying very much on the productive capacity of the system neglecting other types of services like for e.g. the regulation capacity of the wetlands. The consequences were very important for the local people (less benefits, more concentration to certain people, and generalised poverty despite huge available resources) but also for the biodiversity conservation (changes in the land use, reduction of wetlands surface, impact on species and communities) and in general a lower capacity of the system to adapt to future changes. In the last 20 years new scientific interdisciplinary knowledge integration occurred and based on the specific frameworks (the emergence of protection areas like e.g. biosphere reserves, Natura 2000 sites) the approach had changed being more inclusive. A different approach in which people are actively involved in the decision system and in formulating the questions is needed.

In this chapter we will describe the current management situation in the Lowe Danube River System and will examine how the current ways of analysis would be different if the ESMERALDA Framework for an Integrated Ecosystem Assessment was used. Would it change approaches for the better, or would it make the task more difficult or complex?

3.7. Applying the Integrated Ecosystem Service Assessment Framework in a European small island state: challenges and opportunities.

By **Mario Balzan (MCAST)**

Outline

Globally small islands are characterised by a diverse range of conditions, but they are recognised as a special case for sustainable development because of their relatively small populations, highly sensitive economies, limited natural resources, restricted usable land area, isolation from and yet dependence on external market, high susceptibility to climate change, and constrained adaptation capacity and development options (Nurse et al., 2001). In addition, the limited availability of good quality data at the local scale together with the challenges of integrating environmental objectives in decision-making processes and of ensuring horizontal coherence across sectoral policies (Hirano, 2008; Roberts, 2010) may limit the implementation of ecosystem service approaches in small islands environments. In a recent review study that analysed literature about small island ecosystems and ecosystem services, most of studies investigated the management of island ecosystems and ecosystem services, and the pressures acting on these as a consequence of human drivers. Few studies carried out a biophysical quantification of ecosystem services, investigated their spatial variation and arising synergies and trade-offs, or assessed the socio-cultural and economic value of island ecosystem services (Balzan et al., in press).

Given this global context of challenges faced by small islands in achieving sustainable development, and in implementing ecosystem services approaches for environmental management and policymaking, this contribution will focus on and present the case-study of the Malta, a small island state and the smallest member state of the European Union. This contribution will present an overview of results obtained from recent studies that assess, map or value ecosystem services within the study area. First results demonstrate several significant positive interactions (synergies) between ecosystem services, and in general semi-natural habitats, agricultural and urban green spaces had a significant positive impact on ecosystem service delivery. The results are discussed in further detail within this contribution, limitations of these studies identified, and suggestions put forward for the application of the integrated ecosystem assessment framework to assess and map ecosystem services, develop methods that can be used for integrated landscape management and for policymaking that implements nature-based solutions for human well-being and sustainable development within the Maltese Islands.

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3.8. Reasoning the integration of economic mapping and assessment of ecosystem services into nature conservation policies (provisional)

By **Marta-Pedroso, C. & Laporta, L.** (provisional)

Outline

Although the establishment of Protected Areas (PA) is commonly related to the primary goal of biodiversity conservation, others benefits generated by such areas are often envisioned. The recognition of multiple benefits generated by PAs can be traced back to the creation of one of the oldest natural parks in the world. The Organic Act creating Yellowstone National Park on March 1, 1872, not only preserved the park's wonders "from injury or spoilation" and retained them "in their natural condition," but also set the area aside as a "pleasuring-ground for the benefit and enjoyment of the people." At least in Europe, nature conservation policies more than targeting pristine areas are directed at preserving human dominated landscapes shaped by low intensity agriculture and forestry, which are often called multifunctional as they provide to society more benefits than food and fiber. The Common Agricultural Policy (PAC), since the 1999 reform, does encompass many measures, representing a significant part of the ERFD (European Rural Development Fund,) devoted to preserve

biodiversity but also what has been called “cultural landscape”, perceived as source of aesthetic and spiritual enrichment.

Nature conservation policies represent costs to society and are implemented by governments acting as representatives of society preferences. Notwithstanding, there is increasing concern over the efficiency and effectiveness of such policies and associated public investment as, and despite environmental policy developments, many ecosystems are being degraded within the EU. Actually, this perception underlines the biodiversity proofing that applies to all sectoral policies in the EU, and which among others can be supported by Cost-benefit Analysis (CBA). CBA should therefore seek to identify the services affected and to quantify these effects as far as possible and value them in monetary terms. Since many of these impacts do vary spatially, due to the heterogeneity of ecosystems, linking biophysical and economic mapping and assessment is pivotal for nature conservation.

We illustrate below how to perform such integrated assessment using the case study of the natural park of S. Mamede (Portugal), while also discussing the potential and pitfalls of the approach for agri-enviornmental measures appraisal.

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4. Ecosystem Service Classifications and their role in Integrated Ecosystem Assessment

By **Roy Haines-Young** (Fabis) and **Balint Czúcz** (MTK ÖK)

4.1. Introduction

The introduction will set out the issues surrounding the use of classifications in ecosystem assessment, and the extent to which existing classifications of ecosystems and their functional characteristics can be linked to classifications of services, benefits and beneficiaries. Different approaches to the problem exist, ranging from CICES which provides a classification of services only, through to the US-EPA which in FEGS-CS which holds that the links between ecosystem and beneficiary needs to be specified to define different ecosystem service types. The extent to which CICES, through the cascade, can support the identification and mapping of the connections between the biophysical characteristics of ecosystems and the ways the different ecological outputs support human well-being socio-ecological will be presented as a critical issue to be explored in the Chapter.

As background this part of the deliverable will provide a short overview of CICES and its role in MAES, and outline the development of V5.1, which was released in January 2018 (Haines-Young and Potschin, 2018). The work in ESMERALDA make a contribution to the development of the new version and a

framework in which it can in the future be applied and further refined. The discussion will build on and finalise the initial work reported in ESMERALDA Deliverable 4.1.

4.2. Ecosystem Service Indicators along the Cascade

The cascade is the conceptual model that underpins CICES. It also provides a useful lens through which the focus of other attempts to classify ecosystem services can be viewed (see for example La Notte et al. 2017). As a number of authors have noted (e.g. Czúcz et al., 2018) that although CICES provides a classification of services, applications often use indicators from across the cascade elements to characterise the particular ecosystem output under investigation. Thus a range of indicators is often available for the same service. The extent to which this is a disadvantage or advantage in ecosystem assessment and mapping will be examined; the question of whether the cascade provides one way of developing integrated assessment approaches will therefore be critically explored.

Given that indicators from different points in the cascade can be identified, the cascade itself also potentially provides a way of linking biophysical, social and economic assessments of services. The extent to which this is possible will be examined by reviewing the work in ESMERALDA on biophysical, social and economic methods and the way they can be nested into current conceptual and classification frameworks.

4.3. Multifunctional assessment methods

While assessment and mapping often starts from an examination of individual services, many policy and management issues arise from the interactions between the ecological and social processes that impact or shape service output. Thus the extent to which existing approaches to classification allow or support the analysis of trade-offs and synergies between ecosystems services will be examined to understand better how multi-functional assessments can be undertaken and developed. Where possible the discussion will use the case study material presented in Part 3, and in particular the types of policy questions that arise in the context of the EU Biodiversity Strategy 2020 and MAES.

4.4. The role of Ecosystem Service classifications in Mapping and Spatial Analysis – A discussion

ESMERALDA Milestone 20 reviewed the extent to which ecosystem service indicators could be mapped and developed the concept of a 'spatial anchor' to describe the way they might be linked to specific locations. There are two main options for establishing this link: services can either be linked to the locations where they were produced (source ecosystems), or to the locations where they get eventually used (beneficiaries). Both approaches can be logical choices in certain contexts: studies which discuss sustainability thresholds inevitably need to map services at their source ecosystems, whereas a mapping of ES demand definitely requires a demand-anchor. Nevertheless, there has so far been relatively little reflection and guidance on which one to choose in a particular mapping context. This section will therefore develop the debate and make recommendations for how existing classifications can be used for mapping and spatial analysis within the context of MAES.

The discussion will conclude by examining the different dimensions of integration that are exposed by the review of ecosystem service classifications and how they fit into or shape overall assessment and mapping approaches. A particular focus will be the extent to which ecosystem service classifications

represent a ‘bottleneck’ in ecosystem service mapping (cf. Palomo et al., 2018). Where possible the discussion will use the case study material presented in Part 3.

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5. Discussion and recommendation

To follow in final version on the base of full material

6. General References

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Appendix A – Content

Appendix A: Case studies of integrated assessments in Europe

At set of assessments carried out in Europe, where analysed prior to the development of the framework to understand how assessment practitioners where addressing the concepts of integration. The case studies were developed in 2016 from publically available material for that particular assessment. Case studies for Finland, Flanders, France, Germany, Netherlands, Portugal, Spain and the UK are set out below.

Finland

A. Name of Assessment

Towards Sustainable and Genuinely Green economy - The value and social significance of ecosystem services in Finland (TEEB for Finland).

B. Conceptual Framework

Which Conceptual Framework did the assessment utilise (e.g. Millennium Ecosystem Assessment (MA), IPBES, TEEB, MAES or another)? Please include a graphic if the conceptual framework was developed specifically for the assessment.

In 2013, Finland conducted a two-year TEEB for Finland study which was based upon the framework of the EU's MAES project and international TEEB studies, in particular TEEB Nordic (Jäppinen and Heliölä, 2015). TEEB Finland was reported to have been implemented with close co-operation with other current national projects such as FESSI (the identification of national ecosystem service indicators) and Green Infra and EkoUuma (a method for assessment of green infrastructure based upon ecosystem services) (IPBES, 2016).

C. Purpose of the assessment

Why was the assessment being undertaken? Where policy relevant question established?

The assessment was undertaken in order to address the need to improve knowledge and understanding of ecosystem services in Finland as a concept in addition to the measurement and valuing or ecosystem benefits (SYKE, 2013). Support for ongoing policy processes, at both national and regional level, was a high priority in the project objectives. Particular emphasis was placed upon three main areas:

- Firstly, the development of national framework for the assessment and monitoring of ecosystem services, including identifying and establishing appropriate indicators.
- Secondly, the development of national policy and policy instruments to support a "truly green 'green' economy".
- Finally, the support for sustainable regional development via the implementation of green infrastructure. Consequently, the project contributes to Finnish commitments towards the global and EU Biodiversity Strategy by 2020 (SYKE, 2013).

In 2015, the scoping study 'Towards Sustainable and Genuinely Green economy - The value and social significance of ecosystem services in Finland' was published (https://helda.helsinki.fi/handle/10138/152815) as a roadmap for policy-makers.

D. Integration

In what sense was the assessment integrated? What was being integrated?

The assessment described main drivers and trends which affect provision of ecosystem services and proposes ecosystem service indicators (Jäppinen and Heliölä, 2015). The Helsinki-Uusimaa region was provided as an example of spatial assessment and mapping of ecosystem services and green infrastructure (Jäppinen and Heliölä, 2015).

The study provides recommendations for improved integration of ecosystem services into Finnish policy processes. These include insights into steering mechanisms for improved safeguarding of natural capital – including ecosystem services (Jäppinen and Heliölä, 2015). Scoping assessment on natural capital accounting and reviews the relationship between green economy and ecosystem services were included (Jäppinen and Heliölä, 2015).

The integration of a wide range of ecosystem services into a green economy was linked to ensuring an environmentally and socially sustainable green economy.

The TEEB for Finland assessed six systems and multiple ecosystem services including; four provisioning systems, five regulating systems, three supporting services/functions and one culture service (IPBES, 2016). The scope of the assessment included: drivers of change in systems and services; impacts of change in services on human well-being; options for responding/interventions to the trends observed; and explicit consideration of the role of biodiversity in the systems and services covered by the assessments (IPBES, 2016).

The TEEB for Finland consists of five main components (SYKE, 2013).

- *“Identifying Finland's most important ecosystem services and their indicators*
- *Assessing the current state and future trends of Finland's most important ecosystem services*
- *Providing insights to the economic value of the most important ecosystem services*
- *Providing insights on how to better integrate ecosystem services into decision-making*
- *Identifying the importance of ecosystem services and their role in promoting green economy*
- *Synthesis and recommendations.”*

How was integration achieved? How did the assessment approach reflect the need for integration?

The establishment of thematic expert working group for different Finnish ecosystems was noted in the TEEB Finland report, identifying indicators and current evidence. Complementary workshops were used to engage a broader range of stakeholders within the process (SYKE, 2013).

Stakeholder knowledge played a key role in the TEEB Finland. Stakeholders were heavily involved in the creation of TEEB Finland and the associated ecosystem service indicator (FESSI) project, including; administration, ministries, business, researchers, managers and NGOs. Local level case studies were provided by regional and local-level practitioners such as spatial and environmental planners, experts from various fields, NGO's, managers and even citizens (ESMERALDA, 2015).

Finland has an active role in the Soil MAES Pilot, contributes to EU Marine MAES with Deltares and Forest MAES. Finland is reported to be planning participation in Urban MAES (ESMERALDA, 2015). Virtual Lab applications have also been developed for integrated assessments and scenarios, using boreal watershed in southern Finland as a case study (Holmberg *et al.,* 2015).

The report also contains an assessment by IEEP and SYKE which investigates the ability to integrate ecosystem services and other natural capital within the national accounting system, entitled: 'Scoping assessment on policy options and recommendations for Natural Capital Accounting in Finland' (Jäppinen and Heliölä, 2015). TEEB Finland analysed opportunities for improvement of ecosystem service governance, including the relationship between ecosystem services and the development of a green economy in Finland. The project aimed to identify ways of integrating the value of ecosystem

services into the national accounting system, known as Natural Capital Accounting (NCA), adding to the values of provisioning services already integrated (Jäppinen and Heliölä, 2015).

From the national assessment, the 'Framework of National Ecosystem Service Indicators' website has been produced (www.biodiversity.fi/), including 112 indicators to date. Based upon the International Common International Classification of Ecosystem Services (CICES), 10 provisioning services, 12 regulating services and six cultural services have been selected.

Were any barriers to integration discussed?

Jäppinen and Heliölä (2015) noted that the legal system as a limiting factor which, in some cases, directly prohibits application of scientific knowledge and new concepts, including ecosystem services, and therefore suggesting the change of existing legislation within Finland. Currently, no official processes exist in order to achieve the incorporation of ecosystem services, biodiversity and other natural values into national accounting and reporting by 2020 (Jäppinen and Heliölä, 2015). It has also been noted that the knowledge of ecosystem processes and other regulating services in Finland is relatively poor. However, following this report, many processes are now being investigated (Jäppinen and Heliölä, 2015).

What evidence is there if any 'added value' in the integrated approach?

Informational and knowledge drawn from the study has been utilised in the implementation of the Finnish National Biodiversity Strategy and Action Plan (NBSAP) 2013–2020 'Saving Nature for People'. Furthermore, national actions related to the Convention of Biological Diversity's (CBD) Strategic Plan for Biodiversity 2011–2020 and the EU's Biodiversity Strategy 202, in particular ecosystem services and natural capital, have utilised such information and knowledge (Jäppinen and Heliölä, 2015). Jäppinen and Heliölä (2015) also note the revision of existing policies by the Finnish Government in a report entitled ' Intelligent and Responsible Natural Resources Economy'. The revision aims to enhance cross-sectoral policies in order to highlight Finland as a role model for sustainable natural resources economy in 2050 and states the assessment of ecosystem services is integral for this.

E. References

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Flanders

A. Name of Assessment

Flanders Regional Ecosystem Assessment (Flanders-REA). The first phase of this was NARA-T which describes the state and trends of ecosystems and their services in Flanders (Liekens *et al.*, 2015)

B. Conceptual Framework

Which Conceptual Framework did the assessment utilise (e.g. Millennium Ecosystem Assessment (MA), IPBES, TEEB, MAES or another)? Please include a graphic if the conceptual framework was developed specifically for the assessment.

The Ecosystem service cycle was used as a conceptual framework (Stevens *et al.*, 2015). Figure 1 below from (Stevens *et al.*, 2015) presents the framework.

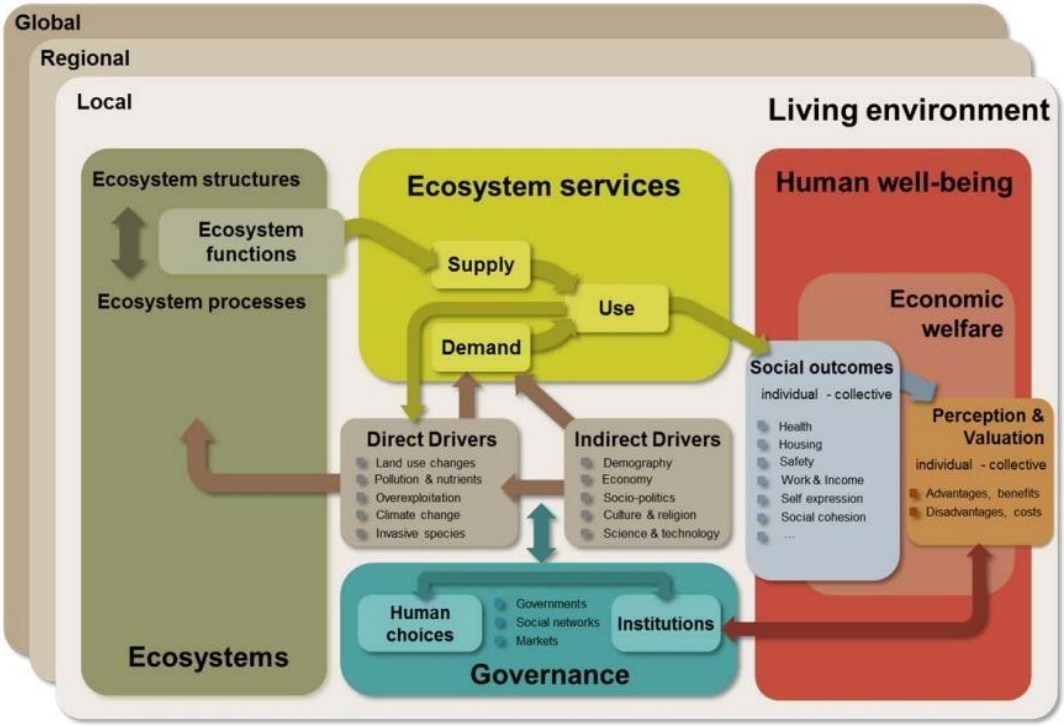


Figure 1. Ecosystem Service cycle (Stevens *et al.*, 2015)

C. Purpose of the assessment

Why was the assessment being undertaken? Where policy relevant question established?

The assessment set out to answer eight questions (Stevens *et al.*, 2015):

1. How do humans influence ecosystem services?
2. What are the state and trends in ecosystems and biodiversity?
3. What are the state and trends in ecosystem services?
4. What is the role of biodiversity for ecosystem services?
5. How do ecosystem services contribute to well-being?
6. How can we value ecosystem services?

7. What interactions exist between ecosystem services?
8. What are the characteristics of an ecosystem service-oriented policy?"

D. Integration

In what sense was the assessment integrated? What was being integrated?

The assessment integrated several elements, as it considered direct drivers of ecosystem change such as land use change as climate change (i.e. ecological elements) as well as indirect drivers including social, economic, cultural and technological factors (Stevens *et al.*, 2015). The assessment also considered the interaction between ecosystem services and how these are affected by supply and demand (Stevens *et al.*, 2015). The method to assign value to ecosystem services involved collaboration of ecologists, philosophers, economist and social scientists to take a broad value approach (Stevens *et al.*, 2015).

A broad-meta review method was used to cover the full extent of available knowledge on ecosystem service state and trends (Jacobs *et al.*, 2016).

How was integration achieved? How did the assessment approach reflect the need for integration?

The assessment considered the impact of ecosystem services, including provision services, regulating services and cultural services on human wellbeing (Stevens *et al.*, 2015). A broad value typology to assign value to ecosystem services was developed by a multi-disciplinary team of philosophers, ecologists, economists and social scientists and placed emphasis on the impact between biodiversity and people (Stevens *et al.*, 2015).

To assess the state and trends of ecosystem services, a broad meta-review was used to consider all available knowledge on the topic (Jacobs *et al.*, 2016). All of the information on 16 ecosystem services were considered 'data units' which were organized and compared, regardless of their nature, and a confidence score was assigned to each reference so that data units of different types could be compared (Jacobs *et al.*, 2016). Data on biophysical and socio-economic proxies was mapped to provide maps on the supply, demand, use and value of ecosystem services (Liekens *et al.*, 2015).

Stevens *et al.* (2015) discussed the fact that government policy focuses on the supply of ecosystem services but noted that policy affecting other areas such as education, spatial planning and health and well-being should consider ecosystem services.

A tool to value of ecosystem services in Flanders has been developed and has been made available to the public so that it can be used by a variety of stakeholders such as land managers, local and national authorities, NGOS and members of the public to assess the socio-economic importance of ecosystems (Liekens *et al.*, 2015)

Were any barriers to integration discussed?

Stevens *et al.* (2015) noted the complexity of assigning value to ecosystem services and how no method can combine all value types that is used consistently in all scientific disciplines.

Jacobs *et al.* (2016) considered that the separate maps produced for the Flanders regional assessment 'contain useful information' but noted that aggregation and comparison of multiple services was difficult as combined maps were difficult to interpret. It was also noted that although the team

responsible for the assessment was interdisciplinary, further expertise was required from elsewhere, and as this had not been foreseen, experts were required to work on a *pro-bono* basis. (Jacobs *et al.*, 2016).

What evidence is there if any ‘added value’ in the integrated approach?

Jacobs *et al.* (2016) noted that ‘science-policy cooperation, networking and building trust was a critical success factor for the Flanders REA’.

E. References

Jacobs, S., Spanhovea, T., De Smet, L., Van Daelea, T., Van Reetha, W., Van Gossuma, P., Stevens, M., Schneiders, A., J.Panis, Demolder, H. *et al.* 2016. The ecosystem service assessment challenge: Reflections from Flanders-REA. *Ecological Indicators*, 61: 715–727.

Liekens, I., Stevens, M., Staes, J., Bertrand, G., Maebe, L., Généreux, C., Pipart, N. and Engelbeen, M. 2015. *ESMERALDA Country fact sheet: Belgium (BE)*. Available at: http://catalogue.biodiversity.europa.eu/uploads/document/file/1301/Esmeralda_country_fact_sheet_Belgium.pdf.

Stevens, M., Demolder, H., Jacobs, S., H., M., Schneiders, A., Simoens, I., Spanhove, T., P., V.G., Van Reeth, W. and Peymen, J. 2015. *Flanders Regional Ecosystem Assessment: State and trends of ecosystems and their services in Flanders. Synthesis. Communications of the Research Institute for Nature and Forest*. Brussels.

France

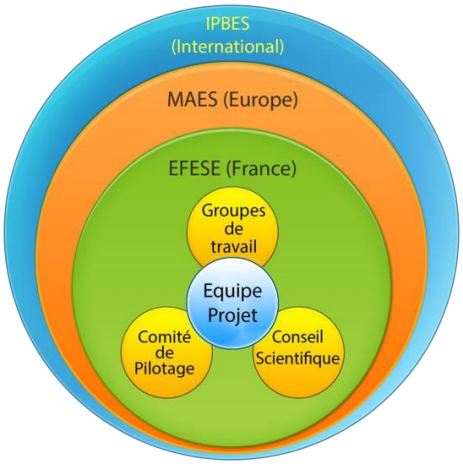
A. Name of Assessment

EFESE (Evaluation française des écosystèmes et des services écosystémiques)

B. Conceptual Framework

Which Conceptual Framework did the assessment utilise (eg Millennium Ecosystem Assessment (MA), IPBES, TEEB, MAES or another)? Please include a graphic if the conceptual framework was developed specifically for the assessment.

The conceptual framework used for the assessment is based on the MAES framework



EFESE conceptual framework

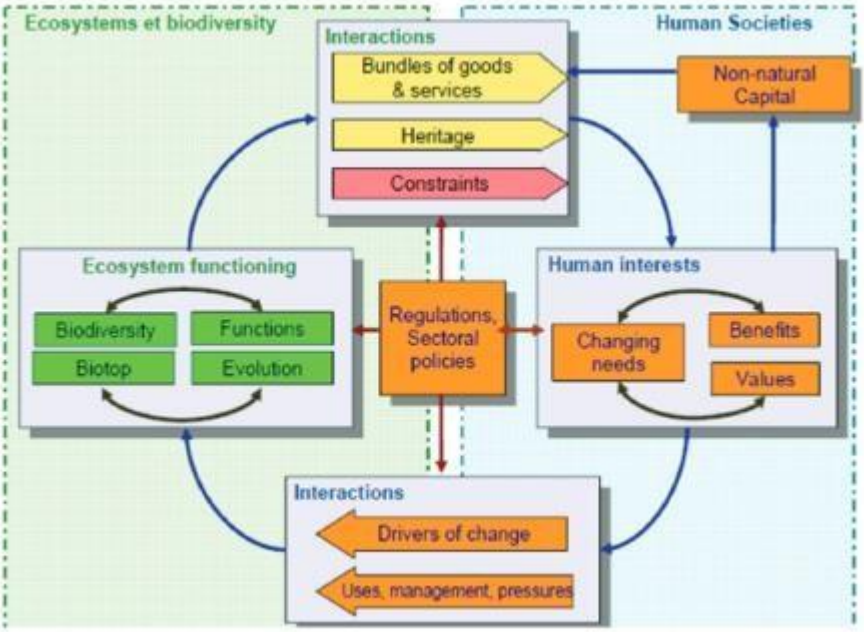


Table 2: Concordance table between MEA and EFESE typology of ES

MEA (2005)	EFESE	Method used to value
Supporting services	Ecological functions	Biophysical indicators
Provisioning services	Goods	Biophysical and monetary indicators (direct market value)
Regulation services	Regulation services	Biophysical and monetary indicators (cost based methods)
Cultural and spiritual services	Cultural services (measurable benefits)	Non-monetary and Monetary indicators (direct market values and revealed preferences)
	Natural heritage (non-measurable benefits, intrinsic value)	Identification, geolocalisation

(Roche et al. 2015)

C. Purpose of the assessment

Why was the assessment being undertaken? Where policy relevant question established?

The objective of EFESE is to assess and map the main types of ecosystems and their services. The work is carried out in order to contribute to achieving the targets of the National Biodiversity Strategy and EU biodiversity strategy, and also to the National Strategy for Ecological Transition Towards Sustainable Development. It is also aims at supporting the elaboration of different sectoral biodiversity strategies and plans, and specific action plans for species conservation such as wild pollinators. (Roche et al. 2015)

D. Integration

In what sense was the assessment integrated? What was being integrated?

There are five Working Groups (WG) that focus on different ecosystems:

- Forest,
- Wetlands & freshwater,
- Marine coastal ecosystem,
- Agro-ecosystem and
- Urban ecosystems

Scientific and technical committee and steering committee involving stakeholders have been set up.

Also, a process has been launched to look at values that are not well taken into account in current work which tends to focus on economic assessment. Issues that will be explored concern less tangible benefits such as spiritual and mental wellbeing. (Roche et al. 2015)

How was integration achieved? How did the assessment approach reflect the need for integration?

Working groups focusing on different ecosystems were formed with the aim to produce outputs (e.g. map of wetlands, report on what can be done in urban and case-studies, map and assessment of some ecosystem services such as pollination). A steering committee, that gathers all stakeholders, has been set up in 2013. Each stakeholder is also represented among the ecosystems WG. All reports have to be validated by the scientific committee, the steering committee, and the ministry before publication. As the project involves different stakeholders, the involvement of the private sector is planned. The aim is to promote the project but also to know which actions the business is taking on ecosystems services, and how to integrate the natural capital in corporate accounting in the longer run. (Roche et al. 2015)

Were any barriers to integration discussed?

The assessment aims at also exploring less tangible benefits such as spiritual and mental wellbeing. Experience has shown that it is difficult to communicate these issues and therefore one priority is on easy to use indicators for decision making process. (Roche et al. 2015)

E. References

Roche, P., Puydarrieux, P., Darses, O., Kervinio, Y., Kochert, T. and Mauchamp, L. 2015. ESMERALDA country fact sheet: France (FR) (2015). Available at: http://catalogue.biodiversity.europa.eu/uploads/document/file/1307/Esmeralda_country_fact_sheet_France.pdf

Germany

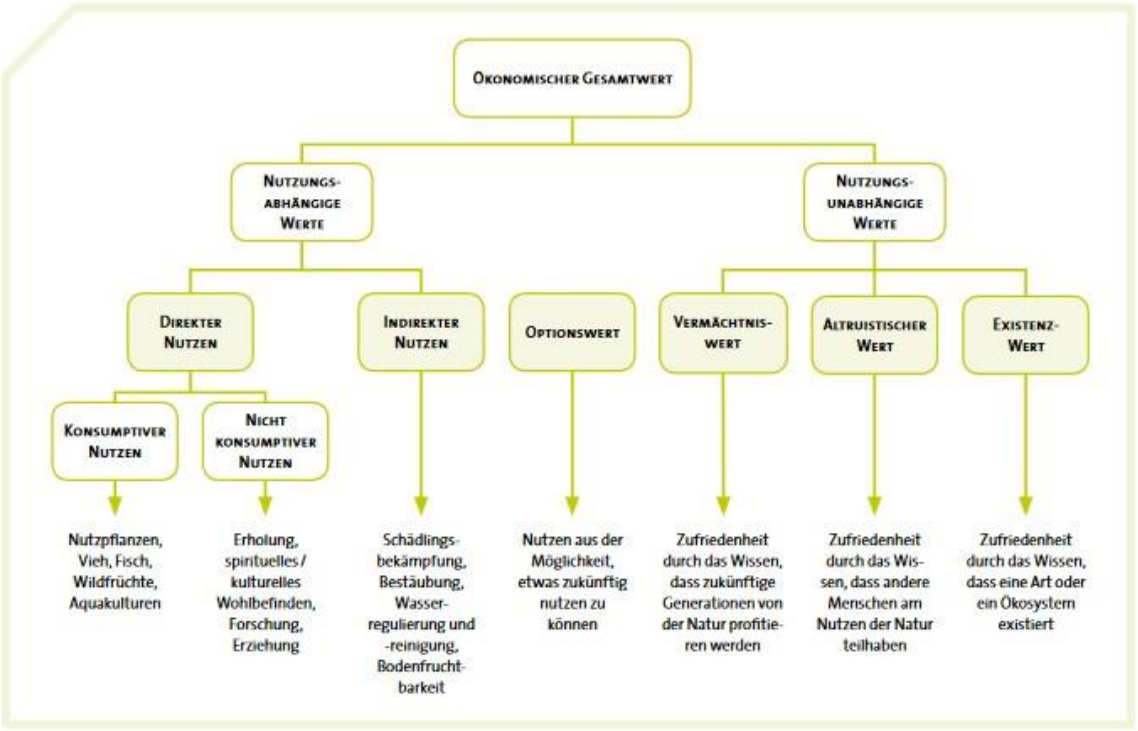
A. Name of Assessment

Natural Capital Germany- TEEB DE

B. Conceptual Framework

Which Conceptual Framework did the assessment utilise (eg Millennium Ecosystem Assessment (MA), IPBES, TEEB, MAES or another)? Please include a graphic if the conceptual framework was developed specifically for the assessment.

The assessment utilises the conceptual framework of "The Economics of Ecosystems and Biodiversity" (TEEB) (IPBES, 2012).



(Naturkapital Deutschland – TEEB DE, 2012)

C. Purpose of the assessment

Why was the assessment being undertaken? Where policy relevant question established?

Natural Capital Germany – TEEB DE: Naturkapital Deutschland is the national follow-up study to the international TEEB study "The Economics of Ecosystems and Biodiversity", which analysed the interactions between nature's services, value added by economic activity, and human wellbeing. »Natural Capital Germany – TEEB DE« aims to make nature's potential and services more transparent and visible by adopting an economic perspective. (Dietrich et al. 2015)

The main aim of the project "Natural Capital Germany" is to gather existing knowledge about nature and its benefits. Additionally, a network will be established and processes initiated that will make a contribution towards valuing nature and incorporating its services better in future decisions. (Naturkapital Deutschland – TEEB DE, 2012).

The objective of TEEB-DE is to collect existing evidence on social and economic importance of ecosystem goods and services and to identify and analyse trade-offs between different land management strategies and policy goals. It is also of importance to promote good practices and

successful cases of biodiversity conservation and ecosystem management and to synthesise lessons for policy makers, administrators and business.

(Dietrich et al. 2015)

D. Integration

In what sense was the assessment integrated? What was being integrated?

The Ecosystem Services indicators are discussed with stakeholders from different sectors (forestry, agriculture, statistical office, water management etc.) and the scientific community. The aim is to have complete data sets on the national scale, comparing at least two points in time.

Additionally, indicator sets for the conditions of ecosystems are being developed. An internal preparation of a study to integrate ecosystem services in national environmental accounting systems is one of the core activities of the BMUB and BfN. The main subject of the project is a scoping study and an in depth analysis of non-monetary and monetary approaches for selected items of ecosystem services and capital. (Dietrich et al. 2015)

How was integration achieved? How did the assessment approach reflect the need for integration?

The assessment involved consultation with several stakeholder groups including policy and administration groups, conservationists, business and science (IPBES, 2012). To assure a successful implementation of the TEEB-DE process, different workshops are carried out since 2011. The aim is to present cases, evaluate existing practices and to provide recommendations. Two workshops are planned in 2016 with the objectives to transfer of ESS knowledge as well as the economic perspective on ecosystem services in rural and urban areas. Climate aspects such as nature-based climate protection and climate adaptation are also being considered. **E. References**

Dietrich, K., Ekinci, B., Schweppe-Kraft, Grunewald, K., Albert, C., Bernd Hansjürgens, B., Burkhard, B. (editors). 2015. ESMERALDA country fact sheet: Germany (DE). Available at: http://catalogue.biodiversity.europa.eu/uploads/document/file/1308/Esmeralda_country_fact_sheet_Germany.pdf

IPBES 2012. Natural Capital Germany- TEEB DE. Available at: http://catalog.ipbes.net/assessments/35.

Naturkapital Deutschland – TEEB DE. 2012. Der Wert der Natur für Wirtschaft und Gesellschaft – Eine Einführung. München, ifuplan; Leipzig, Helmholtz-Zentrum für Umweltforschung – UFZ; Bonn, Bundesamt für Naturschutz. Available at: http://catalog.ipbes.net/system/assessment/35/references/files/274/original/Naturkapital_TEEBDE_WertNaturWirtschaftGesellschaftEinfuehrung.pdf?1352384711

Netherlands

A. Name of Assessment

The Dutch Atlas of Natural Capital (ANK)

B. Conceptual Framework

Which Conceptual Framework did the assessment utilise (e.g. Millennium Ecosystem Assessment (MA), IPBES, TEEB, MAES or another)? Please include a graphic if the conceptual framework was developed specifically for the assessment.

The conceptual framework used for the assessment is based on the ecosystem services cascade model, the TEEB framework and the UK National Ecosystem Assessment (IPBES, 2015)

C. Purpose of the assessment

Why was the assessment being undertaken? Where policy relevant question established?

The Dutch Atlas of natural capital identifies the services that natural capital can provide and provides information for a variety of stakeholders including governments, business, community organisations and local governments as all the information and contains elements of the DPSIR framework (The Government of the Netherlands, 2015). The Government of the Netherlands (2015) reported that the atlas is structured to allow business and governments to use to for decision making for optimal social benefit.

The aims of ANK is to 'provide all the information needed for sustainable decision-making by 2020' (IPBES, 2015). With the information, it is possible for decision makers to take steps to optimize sustainable use of ecosystem services (Breure *et al.*, 2014)

D. Integration

In what sense was the assessment integrated? What was being integrated?

The ANK integrates several elements as it provides maps on ecological services as well as social and economic benefits of services (ANK, 2015). ANK also provides maps from a variety of different sources that are publically available (ANK, 2015).

How was integration achieved? How did the assessment approach reflect the need for integration?

The maps provide data on a variety of ecosystem services which include provisioning services, regulating services, abiotic resources as well as cultural resources including green recreation, natural heritage, science and education (ANK, 2015). The ANK is made up of maps from various sources and is intended to be used for decision making by groups with different viewpoints including businesses, farmers, policy-makers and planners (Scholten *et al.*, 2015).

Were any barriers to integration discussed?

No information on barriers to integration was found.

What evidence is there if any 'added value' in the integrated approach?

The ANK website provides several real life examples of when information on a host of ecosystem services can be applied; these are diverse (they include regional planning, regulation disease and improving urban rainwater drainage) and show that decision-makers require information from different elements including social, economic and ecological to make informed sustainable decisions (ANK, 2015).

E. References

ANK 2015. *Atlas Natuurlijk Kapitaal*. Available at: http://www.atlasnatuurlijkkapitaal.nl/en/home.

Breure, A., de Nijs, T. and Rutgers, M. 2014. *Digitale Atlas Natuurlijk Kapitaal: Nederland werkt in 2014 aan de*

National Ecosystem Assessment (NEA). Available at: http://repository.ubn.ru.nl/bitstream/handle/2066/133073/pubversion_2066_133073201511091549 27.pdf?sequence=1.

IPBES 2015. *Atlas Natural Capital*. Available at: http://catalog.ipbes.net/assessments/248.

Scholten, L., Mulder, S., Petz, K., van Egmond, P., de Nijs, T. and de Groot, D. 2015. *ESMERALDA Country Fact Sheet: Netherlanda (NL)*. Available at:http://catalogue.biodiversity.europa.eu/uploads/document/file/1316/Esmeralda_country_fact_she et_N etherlands.pdf.

The Government of the Netherlands 2015. *Atlas of Natural Capital*. Available at: http://www.atlasnatuurlijkkapitaal.nl/documents/1001696/1489993/ANK+brochure+EN/fdc0ae1f-72514419-bdf7-afaf58a7a1d8?version=1.0.

Portugal

A. Name of Assessment

The Portugal Sub-Global Assessment (ptMA)

B. Conceptual Framework

Which Conceptual Framework did the assessment utilise (e.g. Millennium Ecosystem Assessment (MA), IPBES, TEEB, MAES or another)? Please include a graphic if the conceptual framework was developed specifically for the assessment.

The Portugal Sub-Global Assessment analyses the condition of ecosystem services in Portugal, recent trends in those services, available policy responses, and scenarios for the next 50 years, following the conceptual framework of the Millennium Ecosystem Assessment. (Pereira et al. 2004)

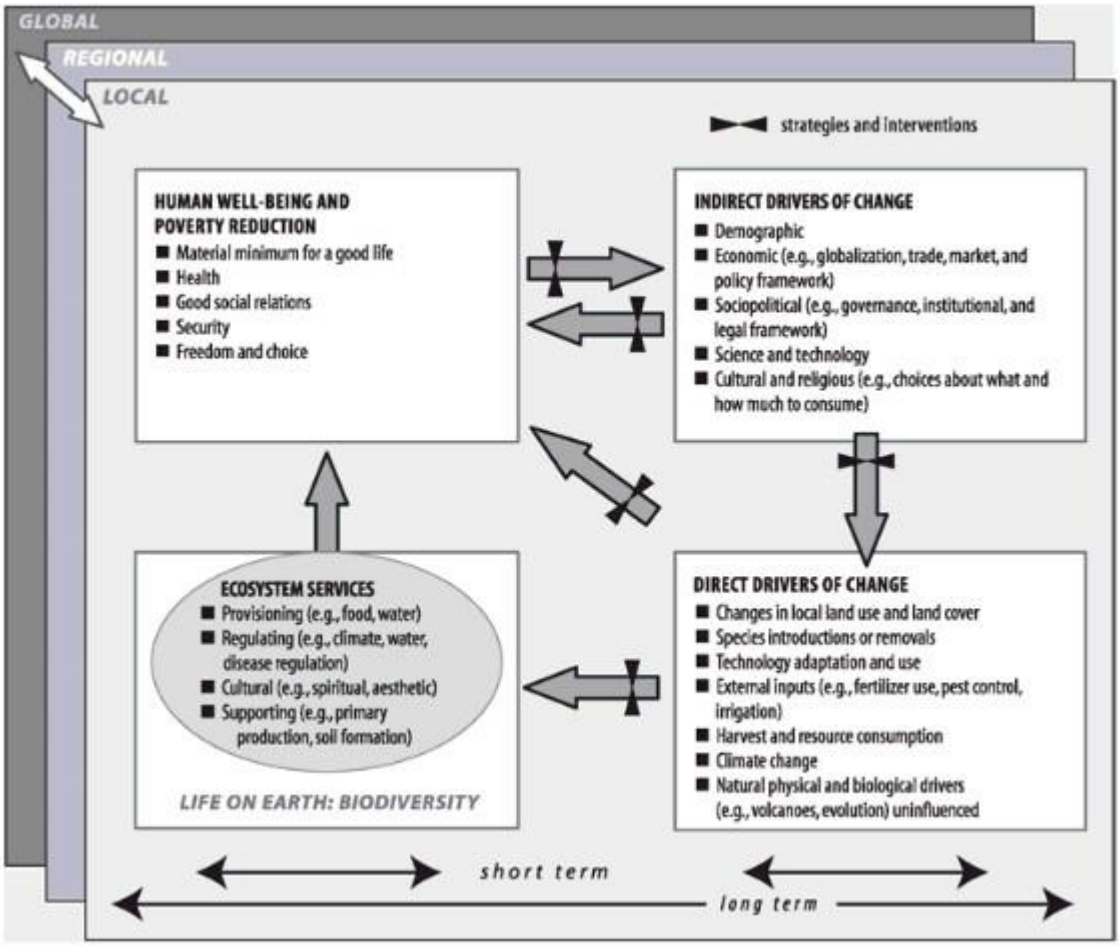


Figure 1. Conceptual Framework of the Millennium Ecosystem Assessment (MA 2003) (Pereira et al. 2004).

C. Purpose of the assessment

Why was the assessment being undertaken? Where policy relevant question established?

The assessment was undertaken to provide a critical assessment of the current state of knowledge concerning the consequences of ecosystem changes for human well-being and to respond to the information needs of a group of users representing different sectors of the society, including national and local government, non-governmental organizations, agriculture and industry, and civil society. Also of importance was the establishment of a scientific basis to enhance the management of ecosystems, in order to improve conservation and sustainability (IPBES, 2012).

D. Integration

In what sense was the assessment integrated? What was being integrated?

The assessment is composed of a research team and a group of users which are both the primary receivers of the information to be produced and stakeholders of the ecosystems to be assessed. The research team has over thirty scientists from the natural and social sciences. The users are both the primary receivers of the information to be produced and stakeholders of the ecosystems to be assessed. They represent different sectors of society, including national and local government, nongovernmental organizations, agriculture and industry. (Pereira et al. 2004)

How was integration achieved? How did the assessment approach reflect the need for integration?

Users have been engaged since the beginning of the assessment and played a primary role in choosing scales, case studies at each scale, drivers and ecosystem services. They expressed interest in following the progress of the scientific work very closely, so that they could provide feedback, which has been achieved by having users participating in the research team meetings. Users have been extremely active in scenario building and in the qualitative assessment of conditions and trends of ecosystem services. In a few cases, users are providing the leading scientists for chapters of the assessment. As the assessment work progressed, it became apparent that for the community assessment of Sistelo, both the National Park and the local community are users of the assessment. Even though no representatives of that community have been formally invited to the research team meetings, the community has been involved in the assessment through a set of participatory approaches. (Pereira et al. 2004)

Were any barriers to integration discussed?

Pereira et al. noted that establishing, interdisciplinary teams, with social scientists, natural scientists and policy-makers, to analyse the relations between ecosystem services and human well-being, is crucial for an assessment like this one since the concept of ecosystem services is still new to many biologists and environmental scientists. This poses two major difficulties. First, it requires scientists to change their frame of mind to an anthropocentric perspective. Second, it requires scientists to familiarize themselves with tools for the valuation of ecosystem services, including economic tools.

E. References

Pereira, H.M., Domingos, T. and Vicente, L. (editors). 2004. Portugal Millennium Ecosystem Assessment: State of the Assessment Report. Centro de Biologia Ambiental, Faculdade de Ciências da Universidade de Lisboa. Available at: http://catalog.ipbes.net/system/assessment/52/references/files/146/original/ptMA_State_of_the_Assessment_Repor t.pdf?1349903875

IPBES. 2012. Portugal Millennium Ecosystem Assessment. Available at: http://catalog.ipbes.net/assessments/52 http://catalog.ipbes.net/system/assessment/52/references/files/147/original/ptMA_User_Needs_en.pdf?1349903875

Spain

A. Name of Assessment

The Spanish National Ecosystem Assessment (SNEA) (Santos-Martín *et al.*, 2014).

B. Conceptual Framework

Which Conceptual Framework did the assessment utilise (e.g. Millennium Ecosystem Assessment (MA), IPBES, TEEB, MAES or another)? Please include a graphic if the conceptual framework was developed specifically for the assessment.

The Spanish NEA adapted the Driver-Pressure-Sate-Impact-Response (DPSIR) framework (Wilson *et al.*, 2014;Santos-Martín *et al.*, 2013). Figure 1 below, taken from Santos-Martín *et al.*, (2014), shows the conceptual framework used for the Spanish National Ecosystem Assessment (SNEA). The authors noted that it was modified from the Millennium Assessment and that it represents a change in Spanish

conservation policies as it combines the intrinsic value of nature with ecosystem services- linking ecosystems with human wellbeing (Santos-Martín *et al.*, 2014).

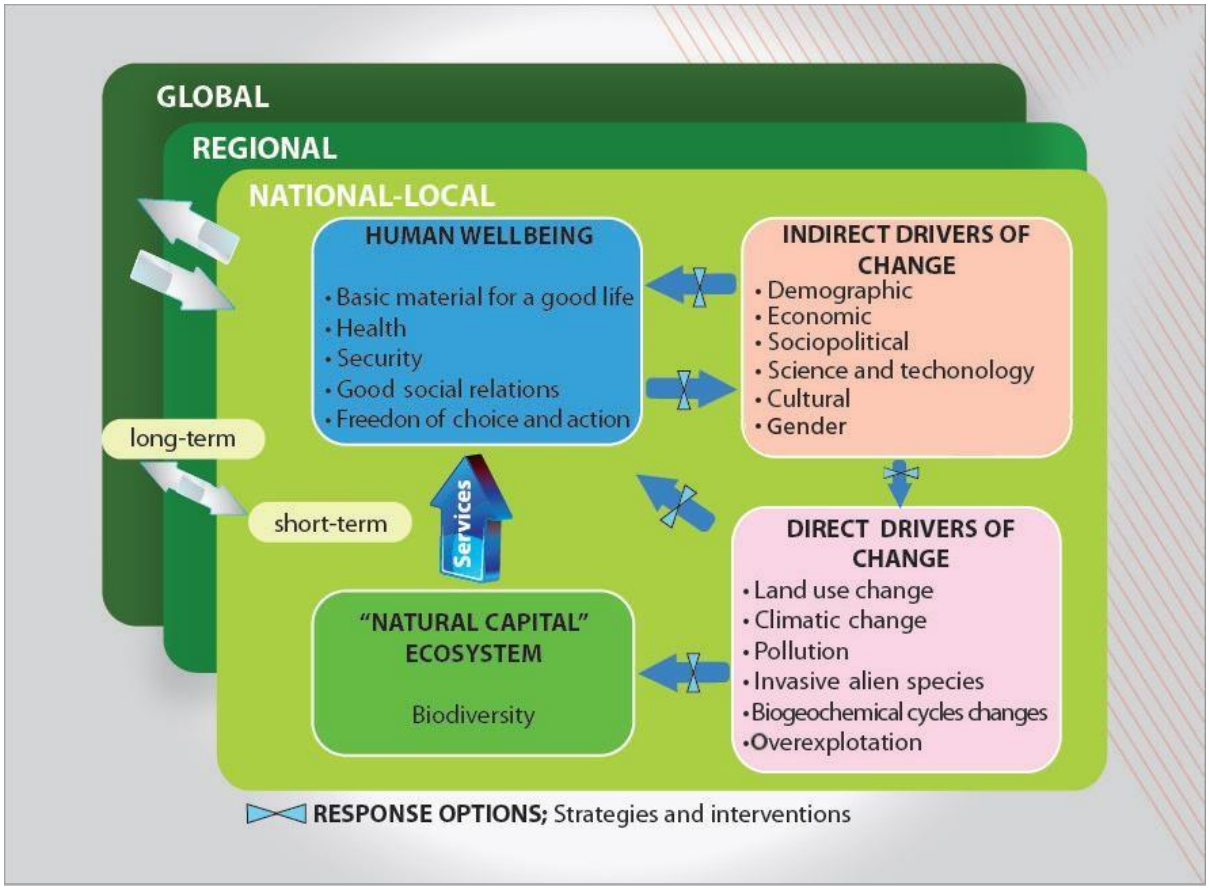
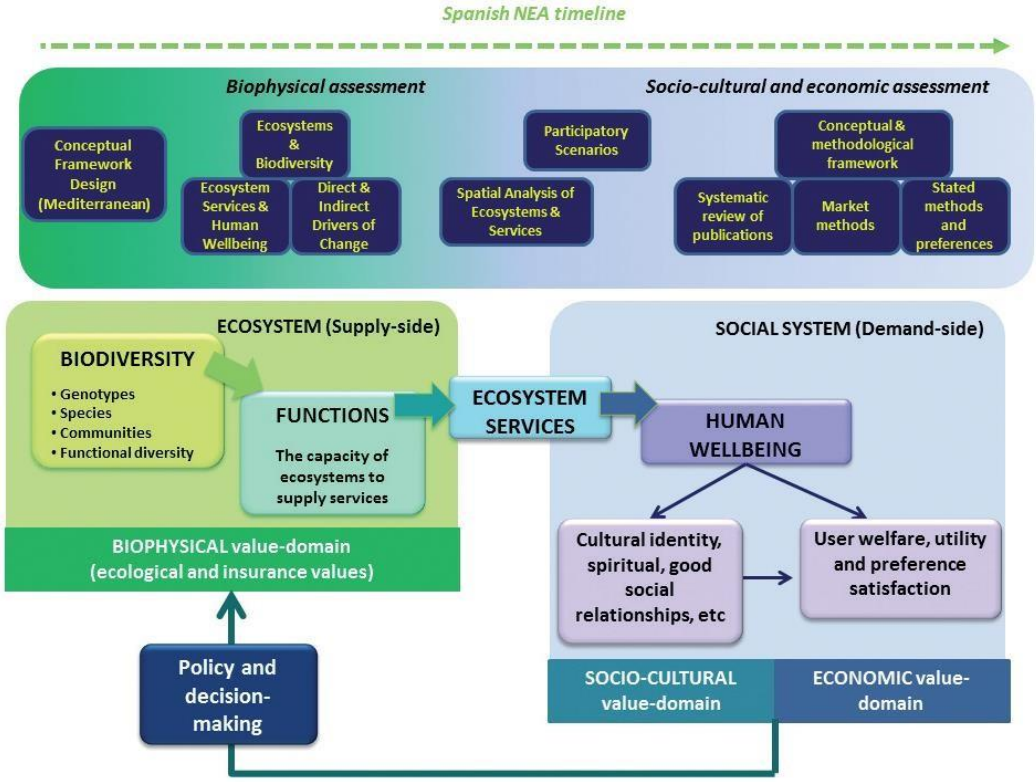


Figure 1. Conceptual Framework used in the Spanish National Ecosystem Assessment

Santos-Martín *et al.* (2014) noted that the conceptual framework was based on six components: Ecosystem, Biodiversity, human wellbeing, ecosystem services, direct drivers of change and indirect drivers of change.

The following figure, also from Santos-Martín *et al.* (2014) shows the framework used for assessing ecosystem services.



C. Purpose of the assessment

Why was the assessment being undertaken? Were policy relevant question established?

The goal of the assessment was to 'lay a foundation for a new generation of environmental policy in Spain by evaluating and providing to society, including stakeholders from a variety of sectors, 'the interdisciplinary information on the consequences of changes in aquatic and terrestrial ecosystems and the loss of biodiversity for human well-being over the last five decades in Spain' (Santos-Martín *et al.*, 2014). The assessment is also expected to increase awareness of Spanish society, including the business sector, of the importance of biodiversity and ecosystem services (Montes *et al.*, 2012). The assessment evaluated the direct and indirect effects that the ecosystem services have on human wellbeing (Santos-Martín *et al.*, 2013a)

The project also aimed to address several policy questions, all of which are listed in Table 1 below and to 'build a common language between scientists and policy makers' (Santos-Martín *et al.*, 2014).

Table 1. Policy questions addressed by The Spanish National Ecosystem Assessment (taken from (Santos-Martín *et al.*, 2014)

How is biodiversity changing in Spain?

What is the status of trends occurring in Spanish ecosystems and the services they provide to society?

What are the main direct drivers of change for Spanish ecosystems and their services?

What are the underlying causes of ecosystem degradation in Spain?

How do ecosystem services affect human wellbeing, and who are the beneficiaries?

How can we integrate a multiscalar approach into national ecosystem assessments?

What is the Spanish public´s current understanding of ecosystem services, and how can we communicate our main results?

How might ecosystems and their services change in Spain under plausible future scenarios?

How can we initiate a transition to socio-ecological sustainability in Spain?

The assessment aimed to show that ecosystems and biodiversity make up the Natural capital of Spain and to show the link between nature and society by focusing on the relationships between ecosystems biodiversity and human wellbeing (Santos-Martín *et al.*, 2014).

D. Integration

In what sense was the assessment integrated? What was being integrated?

The project involved integration of elements as well as the processes, by involving collaboration from stakeholders from different sectors.

A total of 818 indicators were used in the assessment were used in the assessment which included biophysical, socioeconomic, cultural and socio-political indicators (Santos-Martín, 2015; SantosMartín *et al.*, 2014). The assessment collaboration of scientists from biophysical and social sciences from over 20 universities as well involvement from other groups including the government, NGOs and the private sector (Santos-Martín, 2015).

How was integration achieved? How did the assessment approach reflect the need for integration?

The project integrated economic, social and environmental information by combining biophysical assessment with a future scenario exercise and spatial explicit analysis that considered biodiversity, ecosystem services as well as socioeconomic variables analysing the economic and social value of ecosystem services (Santos-Martín, 2015).

Furthermore, the project involved integration of 60 researchers from different disciplines across over 20 universities and research centres as well as involvement from the government, NGOS and the private sector (Santos-Martín *et al.*, 2014; Santos-Martín, 2015). The project involved collaboration from a variety of interest groups, to contribute ideas, provide information and spread the results (Santos-Martín *et al.*, 2013b). Furthermore, a communication unit formed part of the team, responsible for disseminating results to stakeholders and users and to help incorporate the user's needs and requests into the assessment (Santos-Martín *et al.*, 2013b).

Were any barriers to integration discussed?

Santos-Martín *et al.*, (2014) noted that it was a challenge to integrate results obtained at different spatial scales using the same conceptual approach but different assessment methodologies.

What evidence is there if any 'added value' in the integrated approach?

The SNEA provided data that could address policy needs at global, EU and national levels (Wilson *et al.*, 2014). Wilson *et al.*, (2014) noted the potential for governmental and non-governmental entities to participate in the same goals and strategies proposed by the SNEA. (Santos-Martín *et al.*, 2013a) noted that there was insufficient institutional response to address the drivers of biodiversity loss and

that integration of biodiversity conservation into economic and landscape policies was required. The integration of ecological and social scientists, the government, NGOs and the business sector in the assessment, may help to achieve this.

Santos-Martín *et al.*, 2014) represented the ‘integrative results’, showing the losses of biodiversity and the drivers responsible as a figure (see Figure 2 below). They reported that the SNEA promoted a paradigm shift to not only address the effects of loss of biodiversity, but also consider the causes including socio-political factors that can lead to the loss of biodiversity (Santos-Martín *et al.*, 2014). Santos-Martín *et al.*, (2014) argued that the indirect drivers of the loss of biodiversity and degradation of ecosystems are the result of decisions of many different stakeholders and that new environmental policies should address these factors in order to halt the rate of loss. This is exemplified by the fact that two factors that both combine social, political and environmental change (the change from rural to urban and the abandonment of traditional agricultural society in the 1960s and consolidation of the urban society in the 1970s and 1980s) explained 68% of the variability from the 40 indicators used (Santos-Martín *et al.*, 2014).

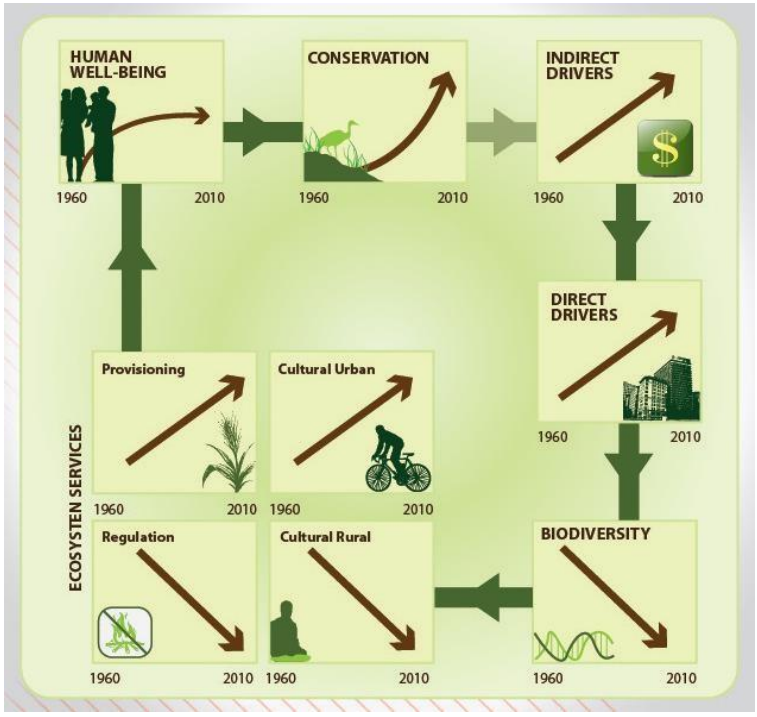


Figure 2. Taken from (Santos-Martín *et al.*, 2014).

E. References

Montes, C., Santos, F., Martín-López, B., González, J., Aguado, M., López-Santiago, C., Benayas, J. and Sal, A.G. 2012. La Evaluación de los Ecosistemas del Milenio en España. Del equilibrio entre la conservación y el desarrollo a la conservación para el bienestar humano. In: Secretaría General Técnica and Ministerio de Agricultura Alimentación y Medio Ambiente (Eds.). *Evaluación de los ecosistemas del milenio en España*. Madrid, Spain. 2–12.

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Santos-Martín, F., Palomo, I., Zorrilla, P., García-Nieto, A.P., García Llorente, M., Martín-López, B., López-Piñeiro, T., Benayas, J. and Montes, C. 2013b. *From project 'Mapping of Ecosystems and their Services in the EU and its Member States (MESEU)'*. Available at: http://biodiversity.europa.eu/maes/maes-catalogue-of-case-studies/casestudy_meseu_spain_disclaimer.pdf.

Wilson, L., Secades, C., Narloff, U., Bowles-Newark, N., Mapendembe, A., Booth, H., Brown, C. and Tierney, M. 2014. The Role of National Ecosystem Assessments in Influencing Policy Making. *OECD Environment Working Papers*, 60.

United Kingdom

A. Name of Assessment

UK National Ecosystem Assessment (NEA)

B. Conceptual Framework

Which Conceptual Framework did the assessment utilise (eg Millennium Ecosystem Assessment (MA), IPBES, TEEB, MAES or another)? Please include a graphic if the conceptual framework was developed specifically for the assessment.

The UK National Ecosystem Assessment (NEA) utilised the Millennium Ecosystem Assessment (MA), producing a conceptual framework (Figure 1) adapted from Bateman *et al.* (2011) and Mace *et al.* (2011) (IPBES, 2016).

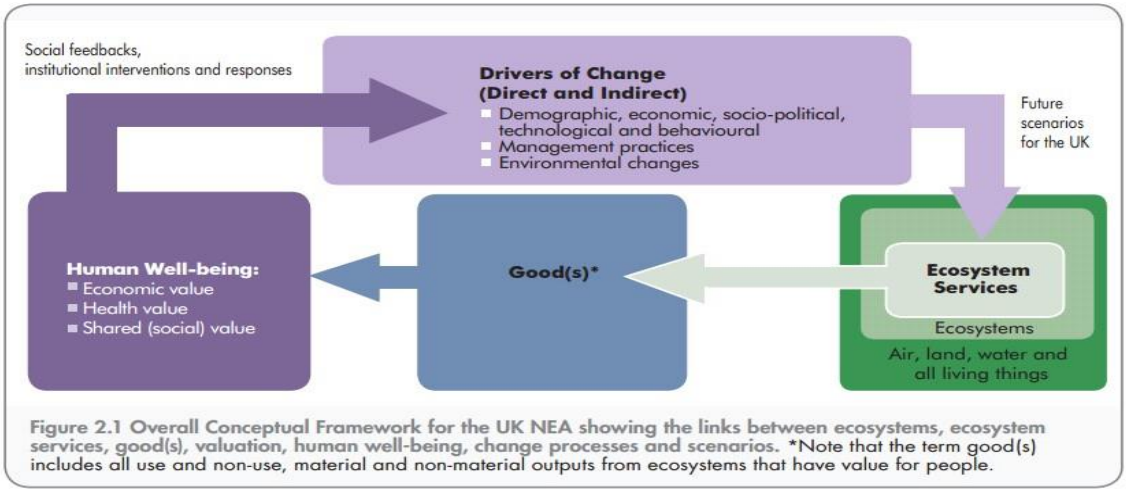

Figure 1. Overall Conceptual Framework for the UK NEA showing the links between ecosystems, ecosystem services, good(s), valuation, human well-being, change processes and scenarios. *Note that the term good(s) includes all use and non-use, material and non-material outputs from ecosystems that have value for people (Mace *et al.*, 2011).

C. Purpose of the assessment

Why was the assessment being undertaken? Where policy relevant question established?

The UK NEA was completed in 2012 with a follow-on project (UK NEAFO) reported in 2014. The objectives of the assessment were three-fold:

- “*To produce an independent and peer-reviewed UK National Ecosystem Assessment for the whole of the UK.*
- *To raise awareness of the importance of the natural environment to human well-being and economic prosperity.*
- *To ensure full stakeholder participation and encourage different stakeholders and communities to interact and, in particular, to foster better inter-disciplinary cooperation between natural and social scientists, as well as economists*” (IPBES, 2016).

Key policy-related questions addressed by the UK NEAFO (2014) include:

- *"What response options might be used to improve policy and practice for the sustainable delivery of ecosystem services?*
- *What constrains and enables the use of knowledge about our ecosystem services in decisionmaking?*
- *How can we embed the Ecosystem Approach and an Ecosystem Services Framework into effective advice and tools for improved policy and decision-making?"*

D. Integration

In what sense was the assessment integrated? What was being integrated?

The NEA assessed eight systems and 13 species groups in addition to ecosystems services and functions including; six provisioning services, nine regulating services, four supporting services and one cultural service (IPBES, 2016). A variety of different tools and processes were used including; modelling, geospatial analysis, indicators, scenarios, economic valuation and social (non-monetary) valuation (IPBES, 2016).

Conceptual framework, methodologies and tools were developed for use by different stakeholders (including government, private sector, NGO’s) in order to inform and improve decision-making (UK NEAFO, 2014). The basis of the conceptual framework is the processes which link human societies, and associated well-being, with the environment.

How was integration achieved? How did the assessment approach reflect the need for integration?

Short reports were tailored to specific audiences and end users (including: national government departments, government agencies, local authorities, the general public, businesses, environmental non-governmental organisations, and the research community) summarising the actions to be taken for implementation of the ecosystem services framework and enable sustainable benefits (IPBES, 2016).

The integrated approach outlined by the UK NEAFO (2014) between governance and evidence-based science includes three main areas (see also Figure 2):

- Production of an updated Ecosystem Services Conceptual Framework
- Production of Adaptive Management Principles, enabling responses to inform policy- and decision-making to be flexible as knowledge increases
- Implementation of a Decision Support System (DSS) Toolbox which aids decision-makers in the navigation and access of existing tools and materials
- Use of a Balance Sheet Approach in order to collate, analyse and present appraisal evidence

The report provided an enhanced understanding of the economic and social values of nature, supporting the inclusion of natural capital in the National Accounts of the UK and development of products and tools to enable the Ecosystem Approach (IPBES, 2016). Via integration, four areas were highlighted and investigated; economic analysis, cultural ecosystem services, future ecosystem changes and tools and supporting material required for the communication of findings of the report to a diverse range of audiences (IPBES, 2016).

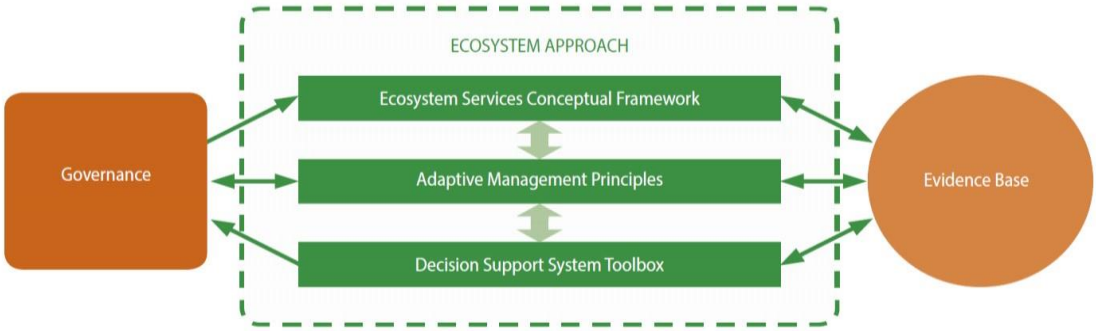

Figure 2. Illustration of the implementation of the Ecosystem Approach by using the UK NEAFO Ecosystem Services Conceptual Framework, Adaptive Management Principles and Decision Support System (DSS) toolbox (UK NEAFO, 2014).

Were any barriers to integration discussed?

THE UK NEAFO (2015) identifies barriers which prevent embedding the ecosystem services framework into decision-making. Measures to enable this include; improvements to integrated datasets, an increase in accessible projects for language and demonstration, stronger leaderships, enhanced communication across sectors and actors and use of mechanisms which connect interacting policies.

What evidence is there if any 'added value' in the integrated approach?

UK NEAFO (2014) states that, although gaps in knowledge regarding ecosystems exist, the utilisation of the UK NEA and UK NEAFO enable more informed decisions to be made, and with beneficial outcomes. Furthermore, although incomplete, evidence suggests that ecosystem services *do* support economic sectors, regional and national wealth creation and employment (UK NEAFO, 2014).

The report concludes, as one of its seven key findings, that the integration of ecosystem services knowledge into appraisals of projects, programmes and policy is critical for decision making (UK NEAFO, 2014). If taken into consideration at the early stages of policy development, the knowledge could provide wider benefits for society (UK NEAFO, 2014).

E. References

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IPBES. 2016. *United Kingdom (UK) National Ecosystem Assessment*. Available at: http://catalog.ipbes.net/assessments/1. [Accessed: 12/04/2016].

Mace, G.M, Bateman, I.J., Albon, S., Balmford, A., Brown, C., Church, A., Haines-Young, R., Pretty, J.N., Turner, K., Vira, B. and Winn, J. 2011. Conceptual Framework and Methodology. In: *The UK National Ecosystem Assessment Technical Report.* UK National Ecosystem Assessment, UNEP-WCMC, Cambridge.

UK NEAFO - UK National Ecosystem Assessment, Follow on. 2014. The *UK National Ecosystem Assessment: Synthesis of the Key Findings*. UNEP-WCMC, LWEC, UK.

Appendix B: ‘Understanding integration in ecosystem assessments’ survey questions

An overview of questions as presented in the online survey ‘Understanding integration in ecosystem assessments’ available at: https://docs.google.com/forms/d/e/1FAIpQLSc5bojlbyI03q6netyhfqqAWAKVEZu17JDlBj7T5OBKlsydw/viewform?usp=sf_link

1. Which overarching conceptual framework did you use to guide your assessment? (Tick all that apply

2. Did you use integrated methods in your ecosystem assessment?

   2.1 If you did not use integrated methods, what were your reasons for not doing so? (Tick all that apply)

3. Why did you choose to use an integrated approach to your ecosystem assessment? (Tick all that apply)

4. In the context of the assessment you carried out, how did you interpret 'integration'?

   4.1 Did you include social, economic and environmental information in your assessment?

   4.2 What types of social data did you collect? (Tick all that apply) 4.3 What types of economic methods did you use? (Tick all that apply)

5. Did you use a consultative process, engaging external stakeholders?

   5.1 At what stage(s) of the assessment did you involve external stakeholders? Who did you involve? And in what capacity?

   i. At what stage(s) of the assessment did you involve external stakeholders? Who did you involve? And in what capacity?

   ii. Design stage (i.e. determine user needs; establish governance structure; choose temporal and spatial scale; consider different knowledge systems)

   iii. Implementing work programme (i.e. assess ecosystem services and human wellbeing; determine drivers of change; develop plausible futures; develop response options)

   iv. Developing output and communicating findings (i.e. assess ecosystem services and human well-being; determine drivers of change; develop plausible futures; develop response options)

   v. Decision-making/using assessment results

6. Which specific tools or methods, or combination thereof, did you use to involve external stakeholders? (Tick all that apply)

6.1 How did you decide on the tool(s) you used? (Tick all that apply)

7. In your opinion, did using an integrated assessment approach add value to the outcomes / lead to better results?

7.1 Have you also undertaken non-integrated assessments?

7.2 Based on your experience of doing non-integrated assessments, what would you say are the major differences to the integrated assessments?

7.3 How would you evaluate your experience of integrated vs. non-integrated assessments?

8. What lessons did you learn from the integrated assessment process? What pointers would you pass on to the future assessments?

8.1 Is there anything (e.g. resources, guidance, training, other) that would improve future integrated assessments or would make them easier to implement?

Appendix C: ‘ESMERALDA Policy Questions’

ESMERALDA Policy questions (developed by Joachim Maes and colleagues, draft 15.11.2017)

Ecosystem assessments usually start with a set of policy questions. Also the MAES initiative organised a workshop in December 2012 to formulate a number of broad policy questions which justified the development of a knowledge base. ESMERALDA tries to link these questions to the flexible mapping and assessment methodology. To this end, a second survey of policy questions was organized during the 13th working group MAES meeting on 16 March 2017. Besides, project partners have been able to submit policy questions when submitting case study information. So prior to the meeting 82 policy questions were collected

Methodology

The 82 questions served as basic material for the session. Participants of the session were asked to work in pairs of two people. Each pair was given a policy question. Next every pair had to mark (for yes and for no) on the card on which the question was printed whether or not scientific tools, methods or procedures are available which can give a direct answer to the question. Following an agreement between both participants, a next question was handed over until all questions were marked. In a next round, two pairs were grouped and the conclusions of each pair were reviewed another pair of participants. In case of contrasting conclusions a discussion resulted in a final conclusion or in no conclusion.

Classification of policy questions

An analysis of the submitted questions led to the following five groups: knowledge requests, policy support questions, technical and methodological questions, questions about resources and the governance of implementation of ES based approaches, and applications (Table 1). This classification can serve as a basis to link methods to policy questions.

Table 1. Classification of policy questions

- **Knowledge requests:** Questions for conceptual clarification and information needs. Examples are:
    - What are ecosystem services; o How are they linked to biodiversity and condition; o What are the trends of ecosystem services?
- **Policy support questions**: How ES can be used to support policy making and implementation.
    - Agricultural policy o Biodiversity policy o Spatial planning o Impact assessment o Disaster risk reduction o Economic policy
- **Technical and methodological questions**: Questions for specific technical details of mapping ecosystem services:
    - Spatial scale:
        - ✦ How to use data which collected at other spatial scales than the scale of assessment.
    - Uncertainty:

- ✦ How to address conceptual and scientific uncertainty (e.g. role of biodiversity in providing ecosystem services)
- ✦ How to address data uncertainty o Priority and preferences:
- ✦ How to set priorities when selecting ecosystem services for assessment/management/ including priorities based on preferences of stakeholders

- ○ Other technical support questions
  - ✦ Which methods are available to map, quantify and assess specific ecosystem services

- **Questions on resources and responsibilities.** Questions about governance and resources o What are the costs and resources needed
  - ○ What can be an organizational or institutional setting to implement an ES based approach.
- **Application questions** (how to implement ES based approaches and how can mapping ES support applications) o How to set up payments for ES o How to set up an ecosystem accounting system o What are the cost and benefits of restoring ecosystems and enhancing services o How to best communicate about ES

Linking the classification to specific methods and tools of ESMERALDA

Not all policy questions can be directly linked to a specific method, tool or procedure to map or assess ecosystem services.

- The broad **knowledge requests** would need to be translated into sets of more specific questions in order to find a matching method. Typically they can be addressed by conceptual models which clarify the links between different components of the social-ecological system. Such an approach can then help target specific methods for more specific questions.
- **Policy support questions** coming from sectoral policies could in principle be linked to specific ecosystem services and thus to specific methods.
- ESMERALDA could certainly couple **technical support questions** to specific methods and to ESMERALDA case studies.
- **Questions on governance and resources** related to implementation may fall out the scope of ESMERALDA. We are not really collecting data to address these questions.
- **Application questions** could possibly be matched with case studies but also with specific methods.

Table. Linking policy questions to tools and methods. This is still to be done but perhaps I need a list of the final methods compendium

Questions	**Biophysical methods**	**Economic methods**	**Social methods**
Knowledge requests			
Policy support questions			
Agricultural policy			
Biodiversity policy			
Spatial planning			
Impact assessment			
Disaster risk reduction			
Economic policy			
Technical and methodological questions			
Spatial scale:			
Uncertainty (conceptual, model, data, scenario)			
Priority and preferences:			
Other technical support questions			
Questions on resources and responsibilities			
Costs			
Resource needs			
Governance			
Application questions (how to implement ES based approaches and how can mapping ES support applications)			
How to set up payments for ES			
How to set up an ecosystem accounting system			
What are the cost and benefits of restoring ecosystems and enhancing services			
How to best communicate about ES			

Table 2. List of policy questions

Policy question (in brackets the source of the questions)	Comment for grouping	ESMERA LDA can provide an answer	ESMERA LDA cannot provide an answer	No conclusion	Biophysical method	Economic method	Social method
How can the ecosystem service concept be made relevant and find its entry into the development of the next CAP? (13th MAES meeting)	sectoral policy (CAP)	x					
What are ecosystem services farmers could be paid for?	Application of payments	x					
How can we link different result and data sets at different scales (i.e. EU, National, Local)? (13th MAES meeting)	Scale (upscaling and downscaling)	x					
Which are the priority ES that need to be mapped & assessed? (13th MAES meeting)	Priority setting	x					
How can MAES shape patterns of development through • Informing strategic spatial land use plans • Supporting assessments of impacts of individual developments? (13th	Sectoral policy (land planning) (impact assessment)	x					

MAES meeting)							
Where to get an independent measurement of ES flows to validate our calculations/ models predicting ES delivery? (13th MAES meeting)	Data (field observations)/uncertainty	x					
Why different methods for mapping & valuing ES will provide different results(13th MAES meeting)	Uncertainty			x			
How can the data & knowledge gained through MAES/ Maes-type projects be used by local planners – eg where to put a new housing development or road? (13th MAES meeting)	Policy support (planning)	x					
How might ecosystems & ES change under plausible future scenarios? (13th MAES meeting)	Technical Uncertainty	x					
Farming already provides the ecosystem services that matter for our essential needs (food, energy)-why the fuss about the nonessential ones?	Clarification (concept)	x					

(13th MAES meeting)							
How mapping of degradated ecosystems could contribute for MAES process? (13th MAES meeting)	Policy support (biodiversity)		x				
How can member states contribute to development of pilot studies? Is it possible to provide technical support for them? (13th MAES meeting)	Technical (technical support)	x					
How can we better communicate the social benefits of nature based solutions into decision making? What kind of information will be recognized? (13th MAES meeting)	Technical (communicating ES)	x					
Why should we invest in measuring carbon stocks if they do not have real-life economic value? (13th MAES meeting)	Costs/resources Clarification (concept)	x					
How can the lack of knowledge on ESS production functions be addressed within the MAES process? (13th MAES meeting)	Technical Uncertainty		x				

What is needed to come to innovative integration of social and natural science to really show, assess and value the importance of a healthy natural & physical environment to human health? (13th MAES meeting)	Conceptual clarifications		x				
How will ministries that use or influence natural capital (transport, energy, economy) uptake MAES information/scientific information in order to improve sectorial policies? (13th MAES meeting)	Policy support (sectoral)	x					
What is necessary to bridge all that is known on ESD in the scientific community to the policy domain? (13th MAES meeting)	Technical (communication)		x				
How can health benefits of ecosystem services be valued in such a way that decision making on spatial planning is influenced? (13th MAES meeting)	Policy support (planning)	x					

On the long term, is there a third assessment round on ES foreseen to determine trends with higher reliability and link these to political/economic conditions and decisions? (13th MAES meeting)	Uncertainty			x			
What is the public's current understanding of ES? (13th MAES meeting)	Uncertainty Communication	x					
ES delivery is influenced by number of biotic and abiotic factors. What is the role of biodiversity among those factors? Would the ES Assessment really contribute to the biodiversity restoration/conservation? What would we do if we came to the conclusion that biodiversity conservation impose (somewhere) a constraint to needed ES delivery? (13th MAES meeting)	Uncertainty and conceptual clarification		x				
What can we take back as a mission to our MS agency and administration concerning ecosystem condition? Is there	Conceptual clarification		x				

a clear target and date, some critical mass and incentive to convince the MS or region to spend efforts on it? (13th MAES meeting)							
The cost-benefit analysis is an appropriate tool to handling Ess and valuing such bundles. Is this work to be taken up within MAES? (13th MAES meeting)	More information	x					
What are the main risks of trade-offs between provisioning services e.g., in the context of agriculture and the “nature relevant” services like pollination, recreation, maintaining biodiversity? (13th MAES meeting)			x				
How can the national approach to ESS valuation be reconciled with the need to value cross-border ESS like migratory species support? (13th MAES meeting)	Scaling	x					

How can we use MAES/MAES-type work to determine optimisation of land use/ where restoration should occur? Some folk suggest modelling but the information required is very burdensome. - is here a suite of different questions (like a flow chart) that could be need to help policy-makers come to the right (or an) answers? (13th MAES meeting)	Policy support (planning and biodiversity) Technical support questions			x			
What institutional set-up is envisaged for MAES work formal reporting by MS, having in mind that monitoring needs also the allocation of resources? (13th MAES meeting)	Resources/Costs		x				
How is the "intrinsic value of nature" as addressed in 7th EAP and BD strategy to 2020, captured with "elsewise" utilitarian approach of ecosystem services? (13th MAES meeting)	Conceptual clarification			x			
Ecosystems that are not commercially interesting tend to	Technical Priority setting		x				

be subject to more pressures by, i.e. land grab and fragmentation. Will the MAES pilots develop priority measures to address this (i.e. by prioritising their ESS?) (13th MAES meeting)							
Provisioning services are best developed in terms of indicators and the easiest to communicate to policymakers and business. Are there measures planned to overcome the potential bias as Ess perception is surely another business opportunity to "Harvest from nature" without sustainable management? (13th MAES meeting)	Technical Priority setting			x			
What can we take back as MS representatives on ES accounting? What are the envisioned useful applications on MS level? What are the envisioned appl at EU level potentially impacting the MS? (13th MAES meeting)	Applications accounting			x			

How can MAES inform the spatial targeting of expenditure to conserve and enhance ecosystems? (13th MAES meeting)	Resources and costs	x					
How, if at all, will ES approach be linked/aligned/matched with typology of Nature Based solutions that will be developed / with over arching conceptualisation of nature's values within IPBES(13th MAES meeting)	Conceptual clarification	x					
How to harmonize across the EU the prioritization of ecosystem services which are selected by national stakeholders(13th MAES meeting)	Technical Priority setting		x				
What are the current state and trends of the EU's ecosystems and the services they provide to society? (1st MAES report)	Knowledge requests	X					
What are emerging trends and projected future state of the EU's ecosystems and the services they provide to society? How is this currently affecting human well-being and what are the	Knowledge requests	X					

projected, future effects to society? (1st MAES report)							
What are the key drivers causing changes in the EU’s ecosystems and their services? (1st MAES report)	Knowledge requests		X				
How does the EU depend on ecosystem services that are provided outside the EU? (1st MAES report)	Knowledge requests	X					
How can we secure and improve the continued and sustainable delivery of ecosystem services? (1st MAES report)	Knowledge requests	X					
How do ecosystem services affect human well-being, who and where are the beneficiaries, and how does this affect how they are valued and managed? (1st MAES report)	Knowledge requests	x					
What is the current public understanding of ecosystem services and the benefits they provide (some key questions could usefully be included in the 2013 Eurobarometer on	Knowledge requests	x					

Biodiversity)? (1st MAES report)							
How should we incorporate the economic and non-economic values of ecosystem services into decision making and what are the benefits of doing so (question to be addressed 2020)? And what kind of information (e.g. what kind of values) is relevant to influence decision-making? (1st MAES report)	Technical support question (methods)	x					
How might ecosystems and their services change in the EU under plausible future scenarios - What would be needed in terms of review/revision of financing instruments? (1st MAES report)	Knowledge requests Costs and resources			x			
What are the economic, social (e.g. employment) and environmental implications of different plausible futures? What policies are needed to achieve desirable future states? (1st MAES	Knowledge requests Conceptual clarification			x			

report) (1st MAES report)							
How have we advanced our understanding of the links between ecosystems, ecosystem functions and ecosystem services? More broadly, what is the influence of ecosystem services on long-term human well-being and what are the knowledge constraints on more informed decision making (1st MAES report)	Knowledge requests Conceptual clarification			x			
How can MAES assist MS in assessing and reviewing the priorities to be set for ecosystem restoration within a strategic framework at sub-national, national and EU level? (1st MAES report)	Priority setting	x		x			
How can MAES help to assess and review the design of prioritisation criteria for restoration and at which scale to get significant benefits in a cost-effective way (e.g. relevance for biodiversity;	Resources	X					

extent of degradation of ecosystems and the provision of key ecosystem services)? (1st MAES report)							
How can MAES help to provide guidance and tools to support strategic deployment of green infrastructure in the EU in urban and rural areas to improve ecosystem resilience and habitat connectivity and to enhance the delivery of ecosystem services at Member State and sub-national level? (1st MAES report)	Technical support questions	x		x			

How to foster synergies between existing and planned initiatives at local, regional or national levels in Member States, as well as how to promote further investments, thereby providing added value to Member States action? (1st MAES report)	Scale issues			x			

Do the measures generate social benefits? (Esmeralda matrix)	Application How to measures lead to benefits	x					
How high are costs of landscape degradation? How to protect landscape? (Esmeralda matrix)	Costs and resources	X					
What is the economic value of nature (bird watching) and what is its contribution to tourism management.	Knowledge request	x					
"What do nature and water have to do with economics?" (Esmeralda matrix)	Knowledge request	x					
Are people have preferences for heathland restoration or river restoration. (Esmeralda matrix)	Setting priorities	x					
Can habitats, important for providing different ecosystem services and biodiversity benefits, meet the growing needs of agricultural production or demands from society for recreation and open space amenities? (Esmeralda matrix)	Knowledge request	x					
How can we use ecosystem services	Technical support Uncertainty			x			

for future vision building of a region? (Esmeralda matrix)							
How much to invest in forest management (Esmeralda matrix)	resources	x					
How to achieve economically viable grassland	Resources			x			
management while maintaining biodiversity? (Esmeralda matrix)	Application (cost benefit)						
How can the ES approach be integrated into planning and EIA processes? (Esmeralda matrix)	Policy support Planning	x					
how to integrate and use lessons from work on the concept and valuation of eco-system services in practical management, and how to integrate this in an overall framework of ecosystem management,	Policy support Planning	x					
how to map water quality-related ESs necessary for the implementation of specific measures in different planning levels (Esmeralda matrix)	Policy support planning			x			
How to protect against flood risks resulting from tidal	Policy support (disaster risk reduction)			x			

waves. (Esmeralda matrix)							
In response to these figures, the I–O model developed below is used to answer the following question: what would be the ecological and economic impact of precautionary measures applied to fish habitats while still respecting the principles that environmental damage should be rectified at the source and that the polluter should pay? (Esmeralda matrix)	Applications Costs and benefits Payments		x				
Is there a positive preference for habitat restoration in coniferous forests (Esmeralda matrix)	Priorities and preferences	x					
Should the most valuable areas for ESs provision be taken into account as conservation priorities? (Esmeralda matrix)	Costa and benefits			x			
To assess the strengths and weaknesses of an ESS approach to support decisions in				x			
integrated pond to provide a generic monetary value							

function to assess the public benefits of amenity (Esmeralda matrix)							
What are possible impacts of planned sea uses on ecosystem service supply? (Esmeralda matrix)	Spatial planning	x					
what are the most important actual and wanted ess (Esmeralda matrix)	Priorities and preferences			x			
What are trade-offs between different landscape scenarios? (Esmeralda matrix)	Uncertainties Technical support: which methods are available	x					
What environmental factors are most important for people who want to move out from the city? How to protect landscape? (Esmeralda matrix)	Priorities			x			
what social benefits will the plan bring about? (Esmeralda matrix)	Applications Costs and benefits	x					
Where further improvement in land use should be targeted to strengthen the supply of analysed ES? (Esmeralda matrix)	Spatial planning	x					
Where are optional areas for specific land use that have not been realized so far? (Esmeralda matrix)	Spatial planning Technical support questions	x					

whether or not aquatic vegetation removal in the study area gives full cost recovery (Esmeralda matrix)	Cost and benefits	x					
which are emphasised as particular priorities in current development policy and/or seen as major areas of opportunity for future economic growth (Esmeralda matrix)	Policy support Planning Growth			x			
Which measures protect against flooding having the highest BC-ratio	Costs and benefits	x					