★ ESMERALDA ★

Road-map for ecosystem assessment with good practice examples – An integrated Ecosystem Assessment Framework

Milestone MS22

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Dissemination level
[Restricted to Project Consortium]

ESMERALDA

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 pan-European 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 1), namely policy, research, application and networking, which reflect the main objectives of EMSERALDA.
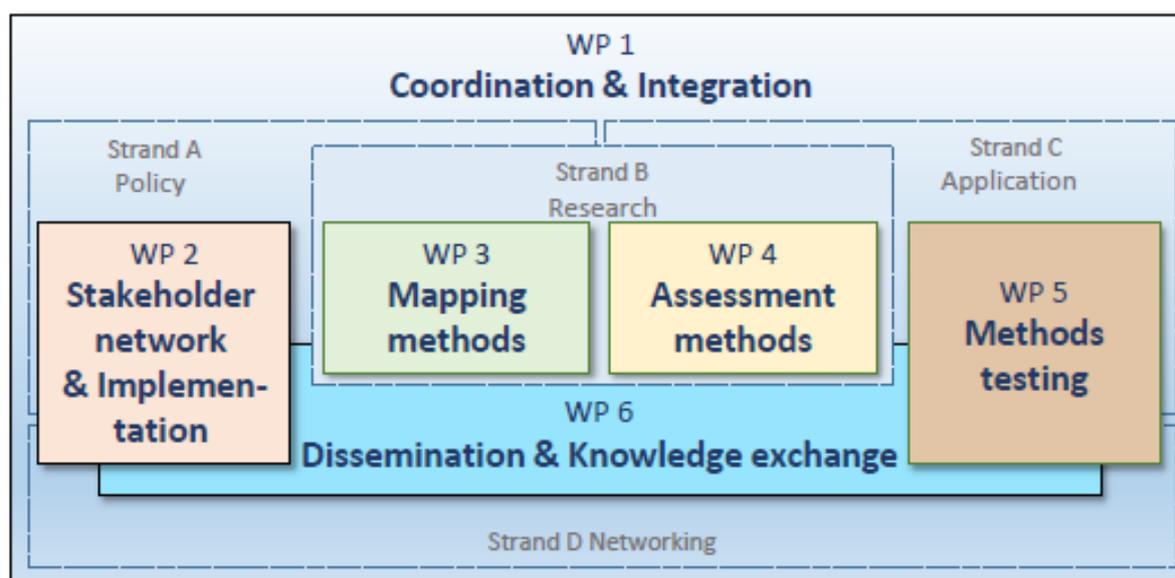
Figure 1: ESMERALDA components and their interrelations and integration within its four strands.

This report sits within work packages WP4 "Assessment Methods" and its milestone 22 as specified in the Description of Action for ESMERALDA. The focus of this milestone is to present a broad assessment framework. 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 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

The assessment process and frameworks used for ecosystem assessment is not well documented and seldom evaluated. The ESMERALDA framework for an integrated Ecosystem Assessment was developed in order 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 MA 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. Beyond the biophysical parameters at the core of the framework, emphasis is given to the inclusion of social and economic factors in order 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. Presented in this milestone report is the final framework, which has now been agreed upon by the members of ESMERALDA consortium. Further consultation through the use 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. This guidance will be written up in Deliverable 4.8 due at the end of the project life time (Month 42).

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1. Introduction

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 assessment are typically characterised by:

- Involve 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);

- Operate 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

- Present 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 are (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	If poorly designed and/or managed ecosystem assessments can be unnecessary (only re-stating the obvious), inappropriate (not capturing the essence of

can lead to institutional change and to changes in the discourse about the issue being assessed	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 assessment 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 assessment 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.

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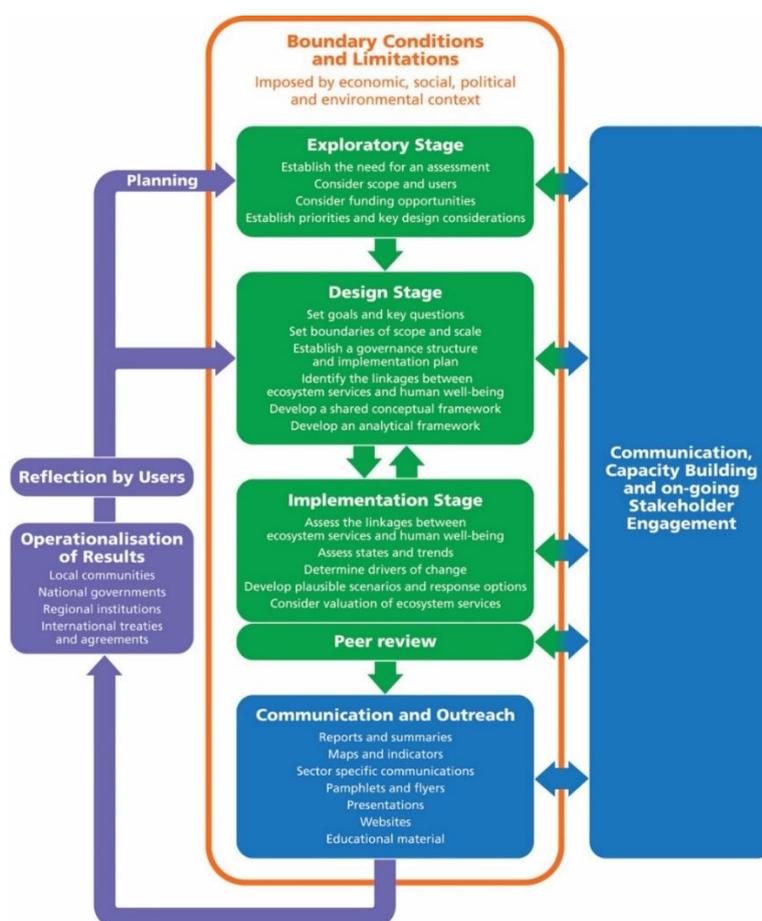
Figure 1.1. Ecosystem Assessment Framework (Ash *et al.* 2010)

This milestone 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.

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

The framework was drafted based on the ESMERALDA mapping framework whilst drawing on 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, 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.

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 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 1.2) (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.
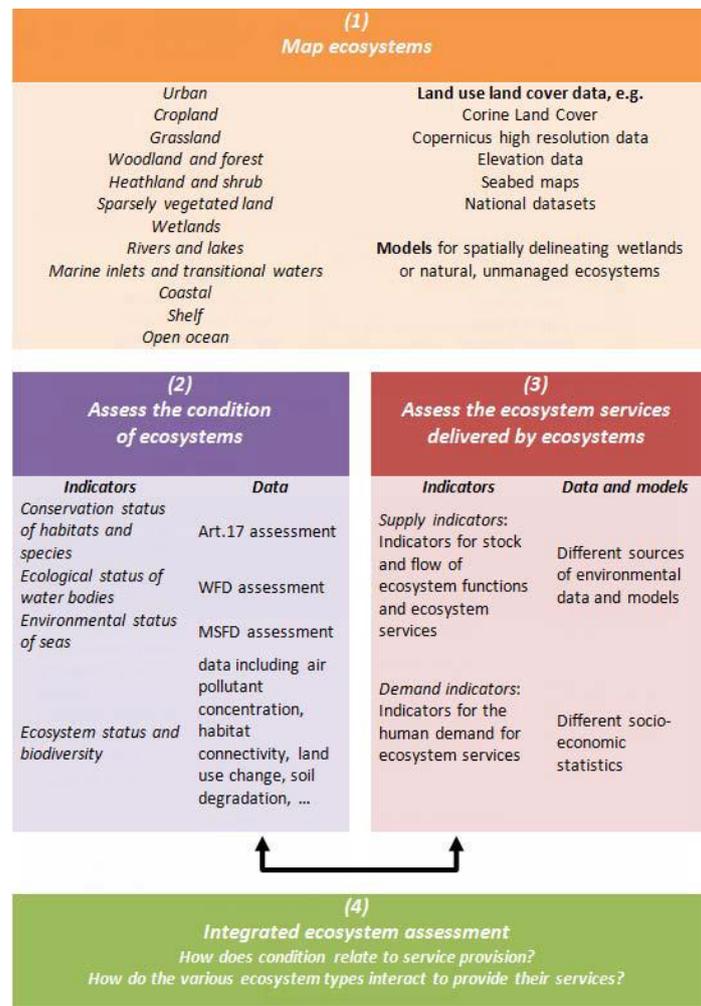
Figure 1.2. The common assessment framework that guided the work of ecosystem pilot cases within the MAES initiative in 2013-14 (European Commission, 2014b)

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The MAES initiative common assessment framework was further enhanced by Benjamin Burkhard in 2016 to develop an initial version of the integrated ecosystem assessment framework for ESMERALDA (Figure 1.3) 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 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.
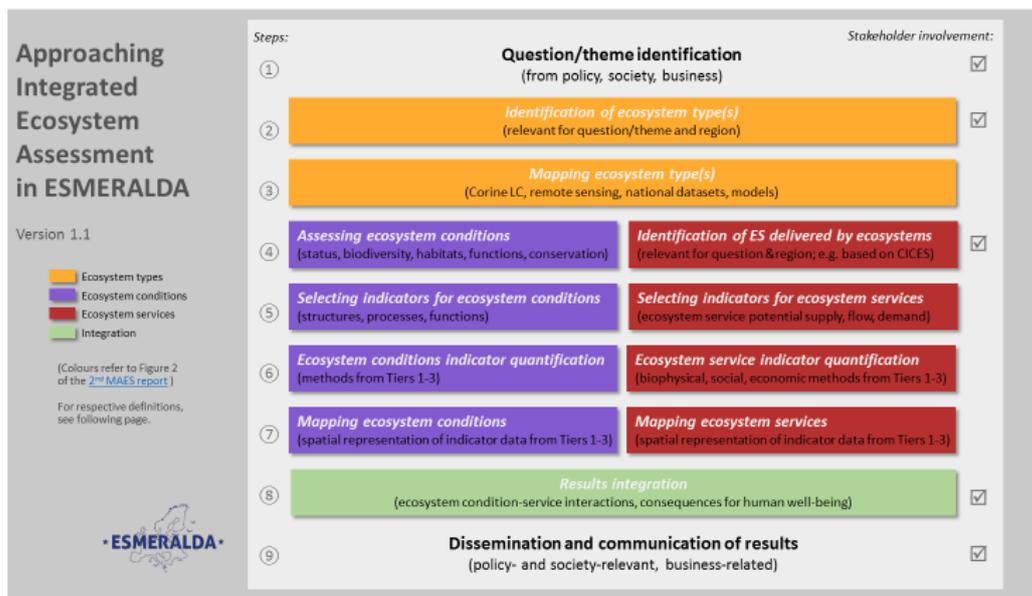
Figure 1.3. Approaching Integrated Ecosystem Assessment in ESMERALDA, Version 1.1 (Burkhard, B. et al., 2016, personal communication)

The next version of the framework (Figure 1.4) 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.

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Mandate for ecosystem assessment established
(e.g. EU Biodiversity Strategy, country level, restoration action plan, etc.)

Scoping of the assessment
(e.g. identification of policy relevant questions, scale, governance structures, capacity needs etc.)

Assessing changes in extent of ecosystems
(non-spatial data)

Identification of ecosystem type(s)
(relevant for question/theme and region)

Mapping ecosystem type(s)
(Corine LC, remote sensing, national datasets, models)

Assessment of ecosystem condition
(non-spatial data)

Assessing ecosystem conditions
(status, drivers, biodiversity, habitats, functions, conservation)

Identification of ES delivered by ecosystems
(relevant for question &region; e.g. based on CICES)

Understanding the values associated with ecosystem services held by different sections of society

Selecting indicators for ecosystem conditions
(structures, processes, functions)

Selecting indicators for ecosystem services
(ecosystem service potential supply, flow, demand)

Ecosystem conditions indicator quantification
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Ecosystem service indicator quantification
(biophysical, social, economic method)

Mapping ecosystem conditions
(spatial representation of indicator data)

Mapping ecosystem services
(spatial representation of indicator data)

Written assessment of ecosystem services (non-spatial data)

Integrating components of the assessment
(ecosystem condition-service interactions, consequences for human well-being, indigenous and local knowledge)

Understanding plausible futures
(Scenarios)

Assessing policy responses

Integration of assessment in its entirety, identification narrative and key messages, graphics

Societal responses to assessment findings
(e.g. natural capital accounting, action plans, polices, regulations education etc.)

Dissemination and communication of results
(policy- and society-relevant, business-related)

Stakeholder engagement and communication, peer review

Figure 1.4: 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.

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1.3. Defining 'integration' within integrated ecosystem assessments

An important element in the development of a flexible, integrated approach for ecosystem assessment, 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.

1.4. Structure of the report

The rest of this report details the process which was followed to develop the final assessment framework. This includes a timeline depicting the development process from the assessment framework's conception to its completion, and a summary of important contributions from the consultation process (Chapter 2). The final framework has now been agreed upon by the members of ESMERALDA executive board. Further consultation through the use of a survey and interviews will help develop guidance around this framework through the collation of good practice examples. This outlook activity, detailed in Chapter 3, is aimed at enhancing the framework's use as a tool to aid decision-makers across the EU member states.

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2. The Integrated Ecosystem Assessment framework as developed within ESMERALDA

2.1. The consultation process

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 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. 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)

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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 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 beyond 2020.
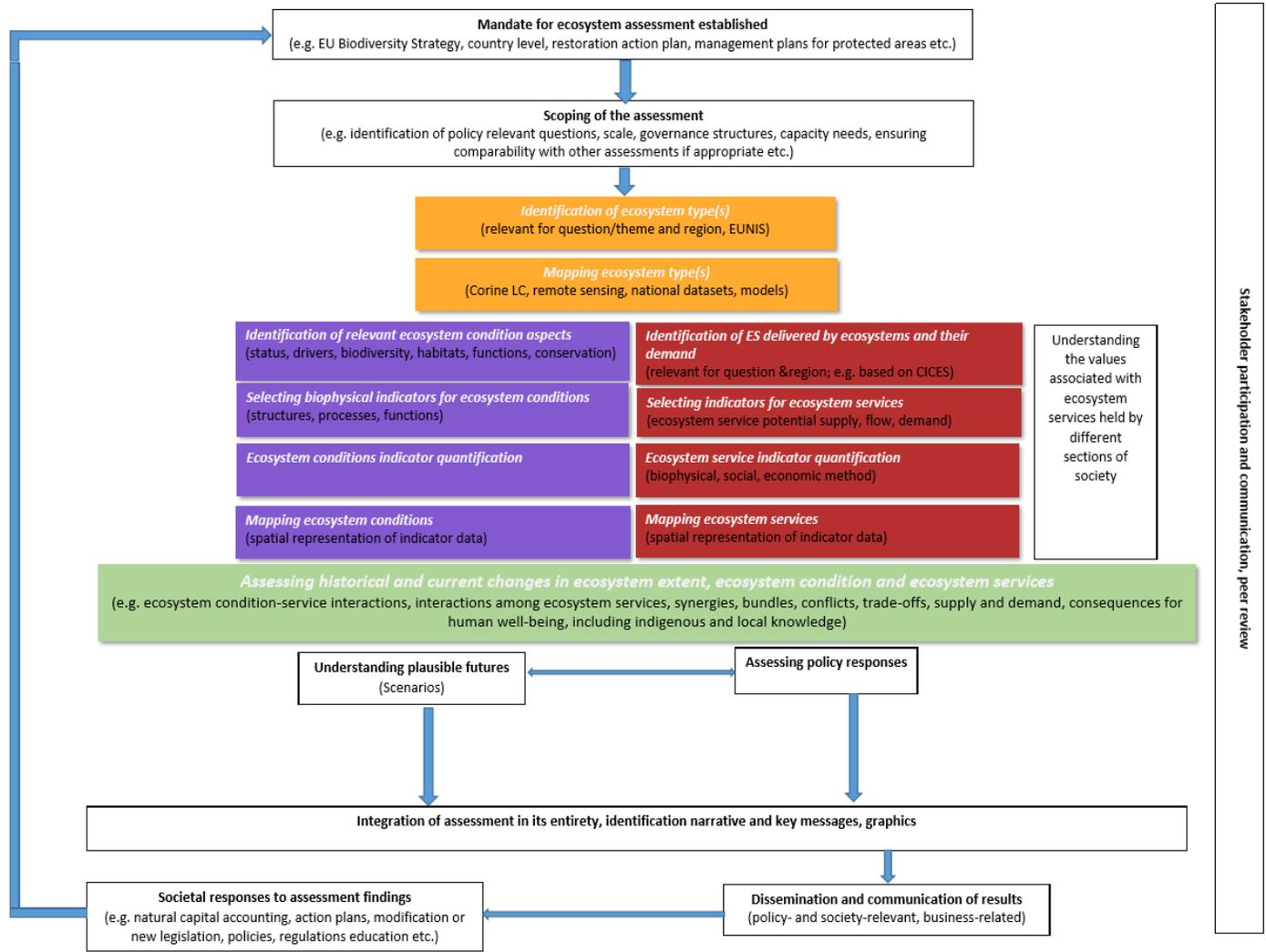
Figure 2.2. Towards an IEA framework in ESMERALDA drafted by Brown, C.; Potschin, M. and R. Haines-Young (2017) based on Burkard et al. (2016) and Maes, J. et al. (2014) 2nd Maes report – Final framework following consultation within the ESMERALDA Consortium

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3. Outlook: Consultation across the EU member states

3.1. 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 in order 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.

3.2. 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 socio-economic 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 sub-questions, 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*

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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/1FAIpQLSc5bojlbyI03q6ne-tyhfqqAWAKVEZu17JDlBj7T5OBKlsydw/viewform?usp=sf_link

3.3. 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.

3.4. 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'.

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- 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.

4. 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, anecdotal evidence 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.

5. Acknowledgements

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6. References

Ash, N., Blanco, H.; Brown, C. et al. [12 authors] (2010): Ecosystem and Human Well-Being – A Manual for Assessment Practitioners. Island Press, Washington, Covelo, London 264 pp.

Berghöfer, A.; Brown, C.; Bruner, A. et al. [18 authors] (2016): Increasing the Policy Impact of Ecosystem Service Assessments and Valuations - Insights from Practice. Helmholtz-Zentrum für Umweltforschung (UFZ) GmbH, Leipzig, and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Eschborn, Germany. 30pp. www.aboutvalues.net.

Booth, H.; Simpson, L.; Ling, M et al. [8 authors] (2012): Lessons learned from carrying out ecosystem assessments: Experiences from members of the Sub-Global Assessment Network. UNEP-WCMC, Cambridge.

Brown, C. (2017): Understanding integration in ecosystem assessments. Retrieved from Google forms: https://docs.google.com/forms/d/e/1FAIpQLSc5bojlbyI03q6ne-tyhfqqAWAKVEZu17JDlBj7T5OBKlsydw/viewform.

Díaz, S.; Demissew, S.; Carabias, J. ey al. [86 authors] (2015): The IPBES Conceptual Framework - connecting nature and people. Current Opinion in Environmental Sustainability 14: 1–16.

European Commission (2013): Mapping and Assessment of Ecosystems and their Services: An analytical framework for ecosystem assessments under Action 5 of the EU Biodiversity Strategy to 2020. European Union. ISBN 978-92-79-29369-6. doi: 10.2779/12398.

European Commission. (2014a): Mapping and Assessment of Ecosystems and their Services in the European Union (MAES). Publication Office of the European Union. doi:10.2779/77667.

European Commission. (2014b): Mapping and Assessment of Ecosystems and their Services: Indicators for ecosystem assessments under Action 5 of the EU Biodiversity Strategy to 2020. 2nd Report-Final February 2014. European Union. ISBN 978-92-79-36161-6. doi: 10.2779/75203.

European Commission. (2016): Mapping and Assessment of Ecosystems and their Services: Mapping and assessing the condition of Europe's ecosystems: Progress and challenges. European Union. ISBN 978-92-79-55019-5. doi:10.2779/351581.

European Commission (2018) Mapping and Assessment of Ecosystems and their Services: An analytical framework for mapping and assessment of ecosystem condition in EU. European Union. ISBN 978-92-79-74288-0 doi: 10.2779/055584

IPBES (2018): IPBES Guide on the production of assessments. IPBES/6/INF/17

Leadley, P.W.; Krug, C.B.; Alkemade, R. et al. [13 authors] (2014): Progress towards the Aichi Biodiversity Targets: An Assessment of Biodiversity Trends, Policy Scenarios and Key Actions. Secretariat of the Convention on Biological Diversity, Montreal, Canada. Technical Series 78, 500 pp.

Millennium Ecosystem Assessment (2005); Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC. World Resources Institute. ISBN 1-59726-040-1.

UNEP (2015): A Guide to Environmental Assessments, Nairobi, Kenya http://ecosystemassessments.net/resources/an-introduction-to-environmental-assessment.pdf

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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

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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

ESMERALDA, 2015. *ESMERALDA Country Fact Sheet: Finland (FI).* Available at: http://biodiversity.europa.eu/maes/maes_countries/finland. [Accessed 12/04/2016].

IPBES, 2016. *Towards A Sustainable and Genuinely Green Economy. The value and social significance of ecosystem services in Finland (TEEB for Finland).* Available at: http://catalog.ipbes.net/assessments/247. [Accessed: 12/04/2016].

Holmberg, M., Akujärvi, A., Anttila, S., Arvola, L., Bergström, I., Böttcher, K., Feng, X., Forsius, M., Huttunen, I., Huttunen, M. and Laine, Y., 2015. ESLab application to a boreal watershed in southern Finland: preparing for a virtual research environment of ecosystem services. *Landscape Ecology*, *30*(3): 561-577.

Jäppinen, J.-P. & Heliölä, J., 2015. *Towards a sustainable and genuinely green economy. The value and social significance of ecosystem services in Finland (TEEB for Finland). Synthesis and roadmap*. The Finnish Environment 1en/2015. The Finnish Ministry of Environment, Helsinki. 144 p.

SYKE, 2013. *National Assessment of the Economics of Ecosystem Services in Finland (TEEB Finland) – Synthesis and Roadmap.* Available at: http://www.syke.fi/en-US/Research__Development/Research_and_development_projects/Projects/National_Assessment_of_the_Economics_of_Ecosystem_Services_in_Finland_TEEB_Finland/National_Assessment_of_the_Economics_of_(16944). [Accessed: 12/04/2016].

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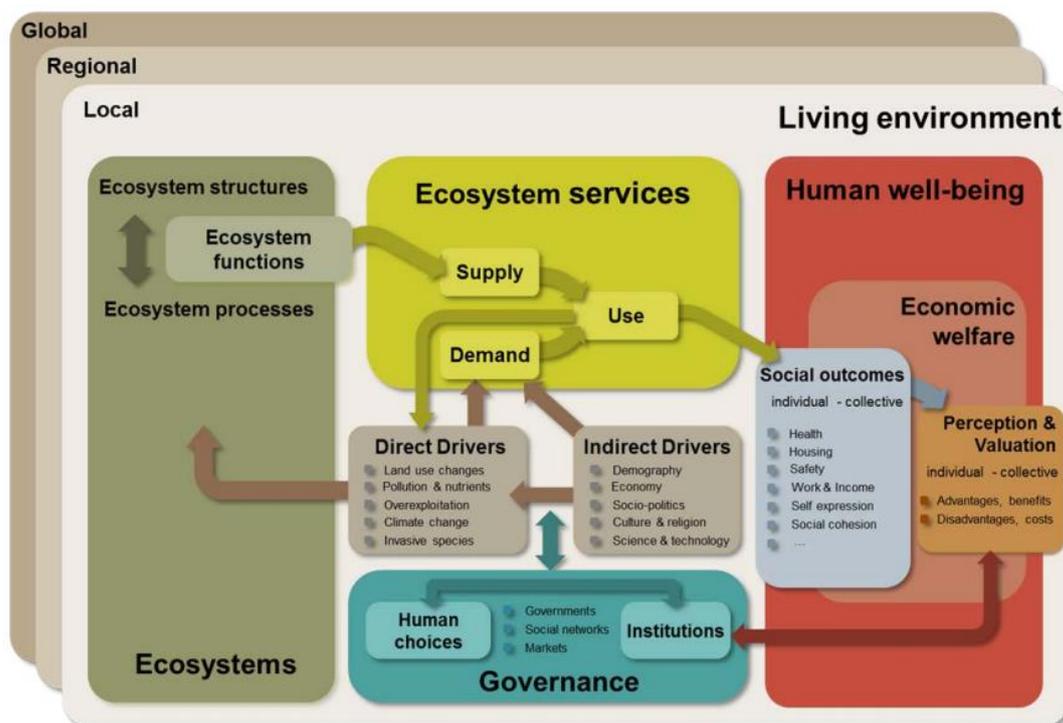
Figure 1. Ecosystem Service cycle (Stevens *et al.*, 2015)

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.

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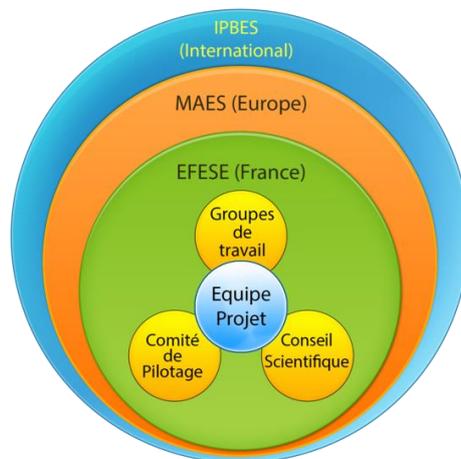
EFESE conceptual framework
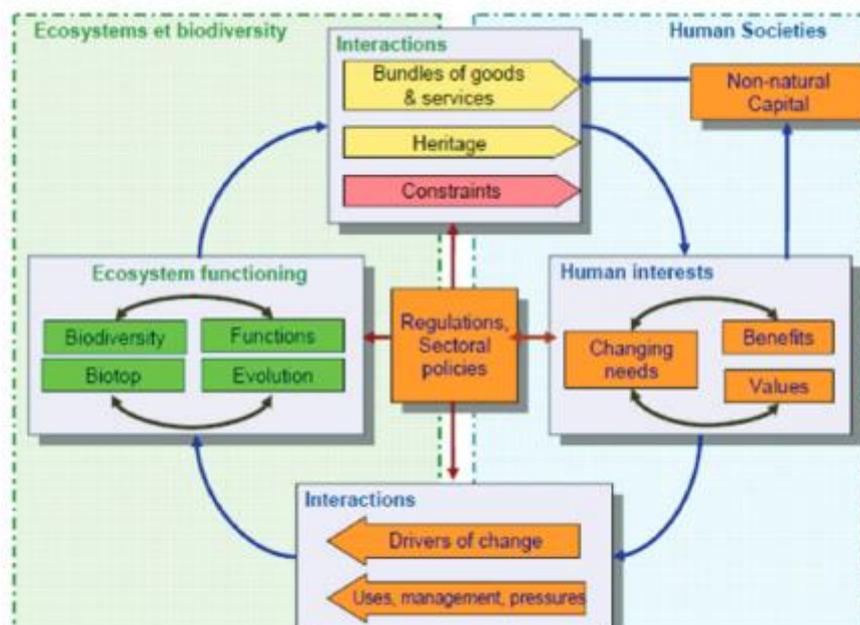
Table 2: Concordance table between MEA and EFESE typology of ES

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

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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).
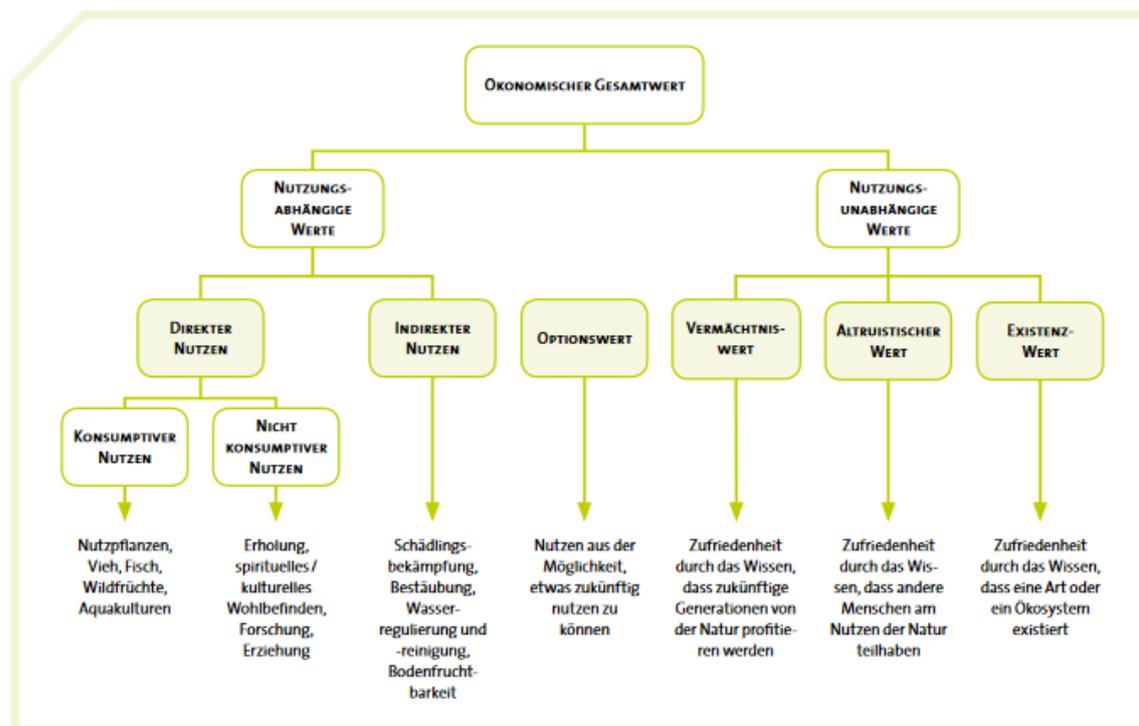
(Naturkapital Deutschland – TEEB DE, 2012)

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)

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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.

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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_133073-20151109154927.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_sheet_Netherlands.pdf.

The Government of the Netherlands 2015. *Atlas of Natural Capital*. Available at: http://www.atlasnatuurlijkkapitaal.nl/documents/1001696/1489993/ANK+brochure+EN/fdc0ae1f-7251-4419-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)
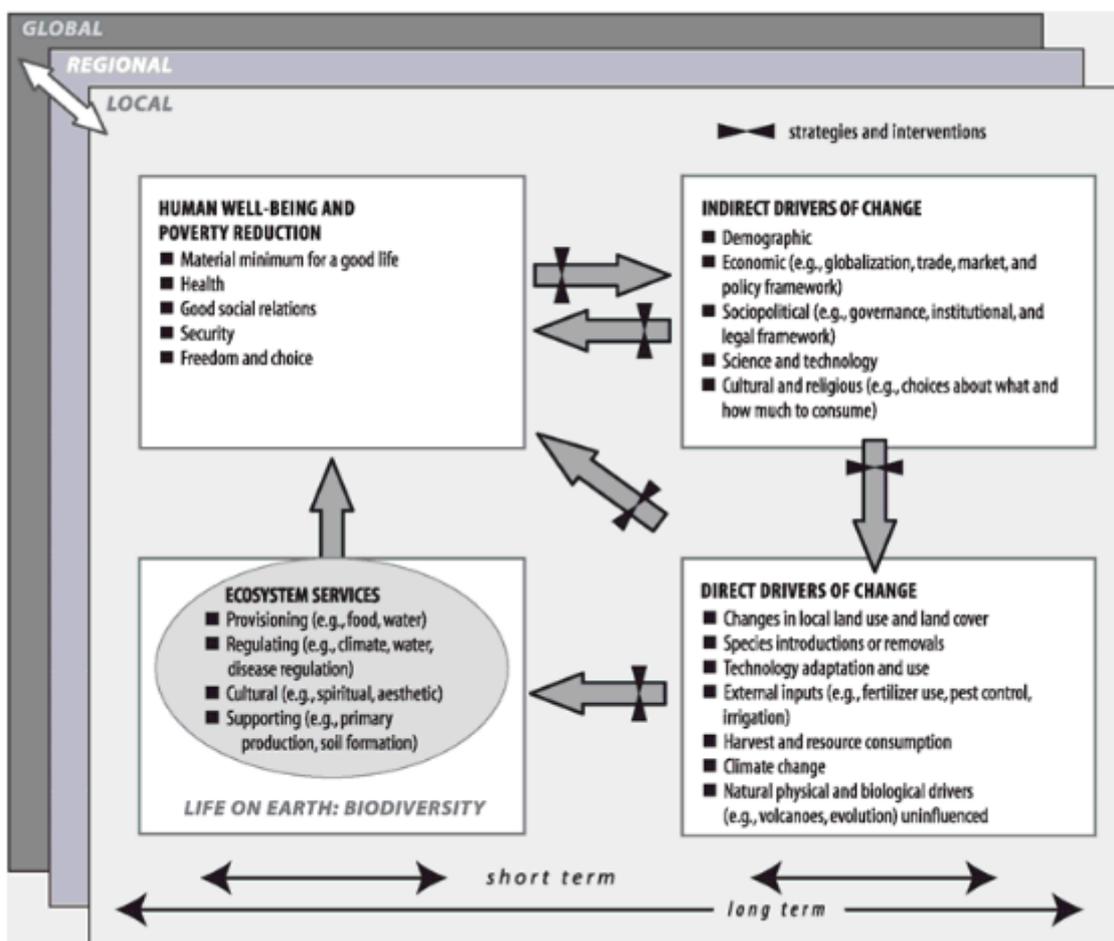

Figure 1. Conceptual Framework of the Millennium Ecosystem Assessment (MA 2003) (Pereira et al. 2004).

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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, non-governmental 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.

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Available at:
http://catalog.ipbes.net/system/assessment/52/references/files/146/original/ptMA_State_of_the_Assessment_Report.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

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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).
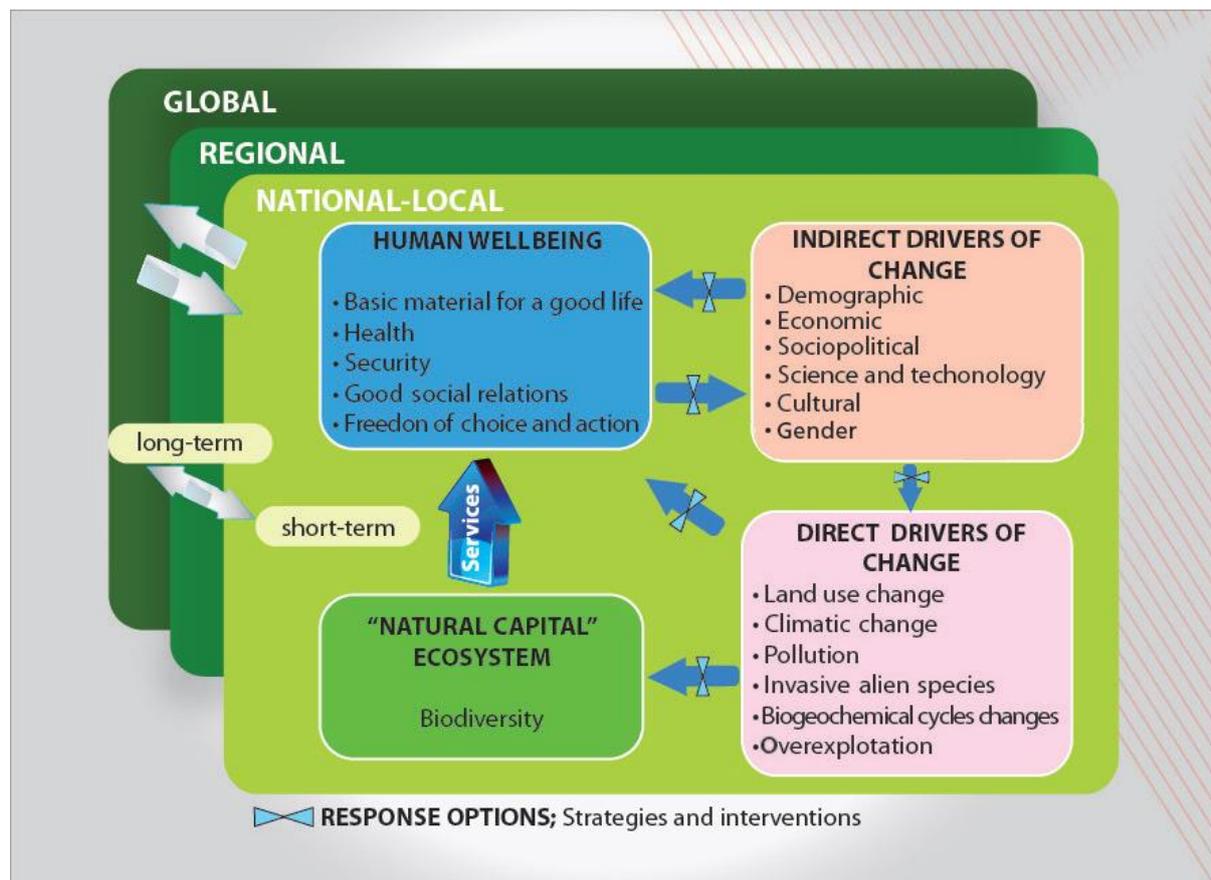

Figure 1. Conceptual Framework used in the Spanish National Ecosystem Assessment

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.
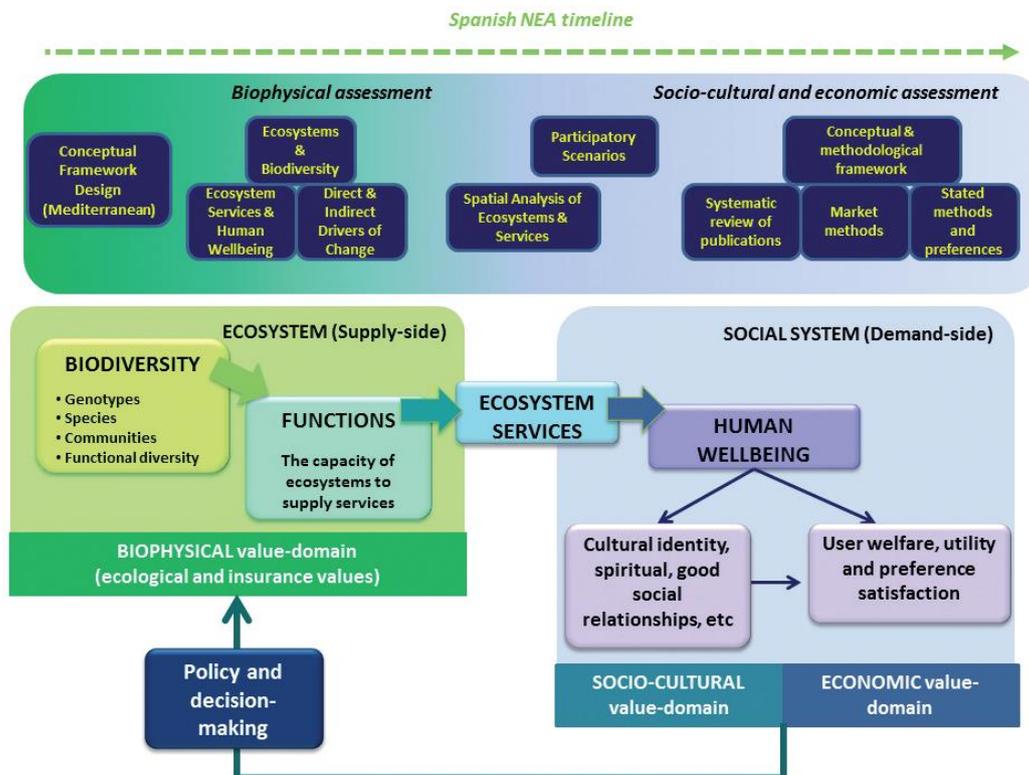
C. Purpose of the assessment

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; Santos-Martín *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

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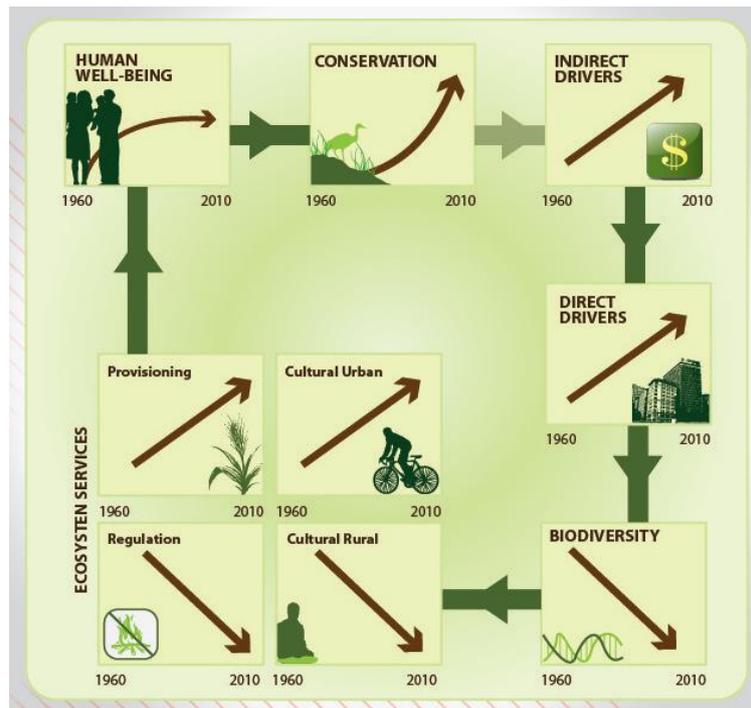
Figure 2. Taken from (Santos-Martín *et al.*, 2014).

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.

Santos-Martín, F. 2015. *ESMERALDA Country fact sheet: Spain (ES)*. Available at: http://catalogue.biodiversity.europa.eu/uploads/document/file/1323/Esmeralda_country_fact_sheet_Spain.pdf.

Santos-Martín, F., Martín-López, B., García-Llorente, M., Aguado, M., Benayas, J. and Montes, C. 2013a. Unraveling the Relationships between Ecosystems and Human Wellbeing in Spain. *PLoS ONE*, 8(9): e73249–e73249.

Santos-Martín, F., Montes, C., Martín-López, B., González, J.A., Aguado, M., Benayas, J., Piñeiro, C., Navacerrada, J., Zorrilla, P., García Llorente, M.G. *et al.* 2014. *Ecosystems and biodiversity for human wellbeing. Spanish National Ecosystem Assessment. Synthesis of key findings*. Available at: http://www.ecomilenio.es/.

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/case-study_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 2.1 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.
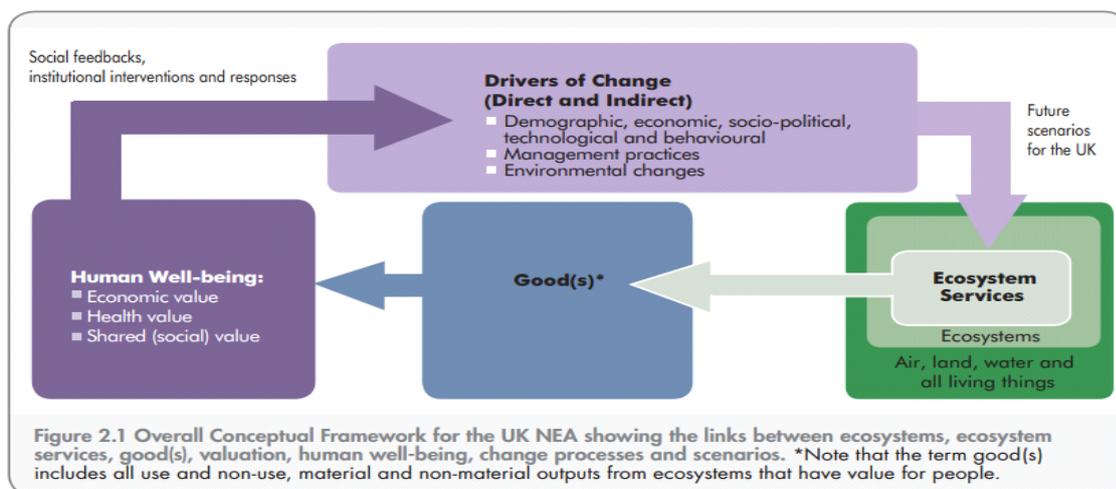
Figure 1. Overall Conceptual Framework for the UK NEA showing the links between ecosystems, ecosystem services, good(s), valuation, human well-being, change processes and scenarios. *Note that the term good(s) includes all use and non-use, material and non-material outputs from ecosystems that have value 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?*

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- *What constrains and enables the use of knowledge about our ecosystem services in decision-making?*
- *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).
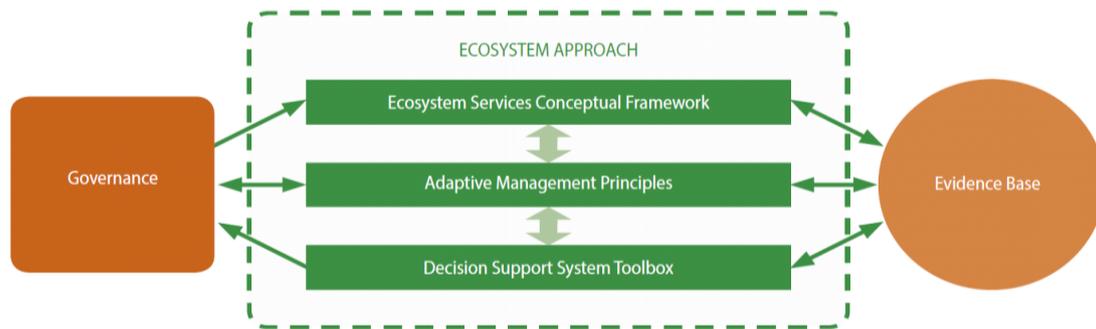
Figure 2. Illustration of the implementation of the Ecosystem Approach by using the UK NEAFO Ecosystem Services Conceptual Framework, Adaptive Management Principles and Decision Support System (DSS) toolbox (UK NEAFO, 2014).

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

Bateman, I.J., Mace, G.M., Fezzi, C., Atkinson, G. & Turner, K. 2011 Economic analysis for ecosystem service assessments. *Environmental and Resource Economics*, 48 (2). pp. 177-218. ISSN 0924-6460.

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.

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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/1FAIpQLSc5bojlbyI03q6ne-tyhfqqAWAKVEZu17JDlBj7T5OBKlsydw/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 well-being; 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)

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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?