Action 5 Implementation Plan

Deliverable 1.7

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Enhancing ecosystem services mapping for policy and

decision making

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Preface

ESMERALDA has been a Coordination and Supporting Action aiming at helping EU member states to fulfil their obligations under the EU Biodiversity Strategy Target 2, Action 5. Action 5 asks all EU member states to "*map and assess the state of ecosystems and their services in their national territory by 2014, assess the economic value of such services, and promote the integration of these values into accounting and reporting systems at EU and national level by 2020*". In order to fulfil these tasks, ESMERALDA has been organised around four major project strands i) Policy, ii) Research, iii) Application and iv) Networking. These four strands, their implementation, work and outcomes have been coordinated by the integration activities of Work Package (WP) 1 (specifically Task 1.5). The four strands in ESMERALDA integrate the six WPs that work through four key activity phases 1) Networking and stakeholder involvement, 2) Developing flexible tools for mapping and assessment, 3) Testing of the methodology at multiple scales for multiple users, and 4) Guidance and methodologies to provide tailored solutions for policy implementation.

All phases have successfully been implemented with high levels of interactions and cross-linkages as well as high commitment of the ESMERALDA partners in all 28 EU member states, Switzerland, Norway and Israel during the 42 months of the project. Based on the outcomes of the six ESMERALDA Work Packages working along the four project stands during the different project phases, comprehensive recommendations for successful implementation of Action 5 in EU member states can be provided with this report. Additionally, all relevant ESMERALDA outcomes have been made accessible on the Open Access platform ESMERALDA MAES Explorer (http://www.maes-explorer.eu/) providing guidance on MAES implementation for a broad variety of stakeholders and users.

Summary

Action 5 of the Target 2 of the EU Biodiversity Strategy 2020 asks all EU member state to map and assess ecosystems and their services within their national territories. This encompasses many and diverse process elements, related actions and people. The Coordination and Support Action ESMERALDA has aimed at supporting EU member states with the implementation of Action 5/MAES (Mapping and Assessment of Ecosystems and their Services).

This Deliverable D1.7 report describes in a seven-step framework the key components of successful MAES implementation. The process starts with the formulation of MAES-relevant questions from policy, society and business and the identification of relevant stakeholders. In the next step, networks at different levels and including stakeholders from diverse backgrounds (different scientific disciplines, policy, practice) should be created in order to carry out the activities. Then the actual ecosystem services mapping and assessment process starts, for which ESMERALDA has identified a broad set of methods. The methods include approaches from biophysical, social and economic sciences as well as methodologies for their integration in a tiered approach. The work in case studies on various spatial scales is recommended as another step of MAES implementation before the results should be disseminated and communicated applying user-oriented language and channels. At the end of a successful MAES process, the implementation in decision making by policy, society or business in order to answer the questions asked at the first step should take place with focus in halting biodiversity loss and safeguard ecosystem services and human well-being.

The material presented in this Deliverable D1.7 report on the Action 5/MAES implementation plan is available open access online in the ESMERALDA MAES Explorer. This report is illustrating the basic structure of the ESMERALDA MAES Explorer based on the seven-step MAES implementation plan. Additional information, further examples and direct links to the materials, reports and publications can be found online at: http://www.maes-explorer.eu/ .

1. Introduction

Action 5 of Target 2 of the EU Biodiversity Strategy to 2020 asks all EU member states to "*map and assess the state of ecosystems and their services in their national territory by 2014, assess the economic value of such services, and promote the integration of these values into accounting and reporting systems at EU and national level by 2020*". ESMERALDA, a Coordination and Support Action funded under the Horizon 2020 programme for research and innovation of the European Commission, has been developing comprehensive materials about Mapping and Assessment of Ecosystems and their Services (MAES) during the last 3,5 years.

This Deliverable D1.7 report provides guidance, which explains the process of how to implement MAES in all EU member states as required by Action 5. MAES is setting up the knowledge base on ecosystems and ecosystem services in EU countries and demonstrates how to use this knowledge in policy and decision-making at different levels of governance. ESMERALDA has been working closely together with the MAES Working Group[1] of the EU to develop guidance that has been tailored to the member states' needs. All relevant ESMERALDA outcomes, including reports, country facts sheets, case study fact sheets, ecosystem services mapping and assessment methods application cards, numerous open access scientific publications (including a textbook on Mapping Ecosystem Services), have been made available in the ESMERALDA MAES Explorer[2]. The ESMERALDA MAES Explorer also includes the ESMERALDA MAES Methods Explorer, a searchable ecosystem services mapping and assessment methods data base created based on the outcomes of the comprehensive methods reviews in ESMERALDA Work Packages 3 and 4, which were complemented by information collected from ESMERALDA Consortium members and during ESMERALDA Workshops. Thus, the ESMERALDA MAES Explorer is an operational Open Access on-line collection that can be used to support MAES [in the following, we will use MAES synonymously with Action 5] implementation and related applications in EU member states and other interested countries.

The implementation and application of MAES is a process that involves various components, methods and people. ESMERALDA has been built to be able to cover and to integrate these various aspects within the four major project strands i) Policy, ii) Research, iii) Application and iv) Networking. Related tasks have been carried out in the six ESMERALDA Work Packages and during the four subsequent project action phases 1) Networking and stakeholder involvement, 2) Developing flexible tools for mapping and assessment, 3) Testing of the methodology at multiple scales for multiple users, and 4) Develop guidance and methodologies to provide tailored solutions for policy and decision making implementation. These phases can be seen as an iterative process with elements that build upon each other. However, in reality and also during ESMERALDA, most of the processes were running in parallel with high levels of interaction.

In the following, the Action 5 implementation plan will be elaborated more in detail. All material can be found online in the ESMERALDA MAES Explorer.

[1] http://biodiversity.europa.eu/maes
[2] http://www.maes-explorer.eu/

2. Action 5 implementation steps

ESMERALDA suggests a MAES implementation plan consisting of 7 subsequent and interlinked steps (Figure 1). Depending on the state of MAES implementation in the respective EU member state, region or site, stakeholders can enter the implementation process (and approach related guidance material in the ESMERALDA MAES Explorer) at each of the 7 steps.

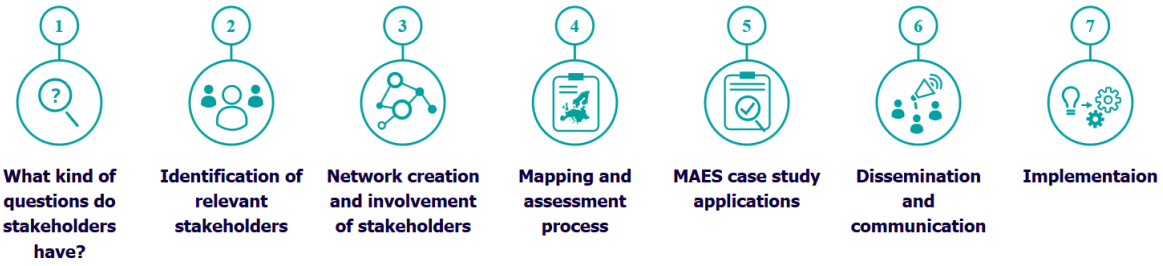

Figure 1: The 7-step MAES implementation plan developed by ESMERALDA.

The process starts with (1) the questions that stakeholders have and which (probable) can be answered by MAES. In the subsequent step, (2) relevant stakeholders, for instance from science, policy or society, that are in a position to deal with these question need to be identified and a respective network needs to be created involving the stakeholders (3). After that, the actual mapping and assessment process (4) can be started, for which sufficient knowledge about methodological and data aspects of MAES are mandatory. A good way to test MAES approaches and/or to bring them into practice is via case studies (5). A proper and user-oriented dissemination and communication of ecosystem service mapping and assessment outcomes (6) is necessary for their implementation (7) in decision making in policy, business and practice.

In the following, we will go through the different steps and provide some more detailed information and references to further ESMERALDA material. All material can be found online in the ESMERALDA MAES Explorer.

2.1. MAES implementation step 1: What kind of questions do stakeholders have?

Policy-makers, stakeholders or scientists often ask why the EU has a dedicated action on mapping and assessing ecosystems and their services. Behind this question is actually a request for different types of knowledge and support which can be linked to an adaptive policy cycle (Figure 2). In ESMERALDA, emerging MAES-relevant questions have been grouped into (see also Maes et al. 2018):

- **Knowledge requests** (e.g. *Are Europe's ecosystems healthy enough to continue supplying ecosystem services*?),
- **Policy support questions** (e.g. *Can river basin plans be included in ecosystem services approach*?),
- **Questions about resources and the governance of implementation** of ecosystem services-based

approaches (e.g. *Are there examples of a successful payments for ecosystem services scheme*?),
- **Applications** (e.g. *How can ecosystem service maps be implemented in land use planning*?), and
- **Technical and methodological guidance questions** (e.g. *What kind of methods can be used to include ecosystem services in policy impact evaluations*?).

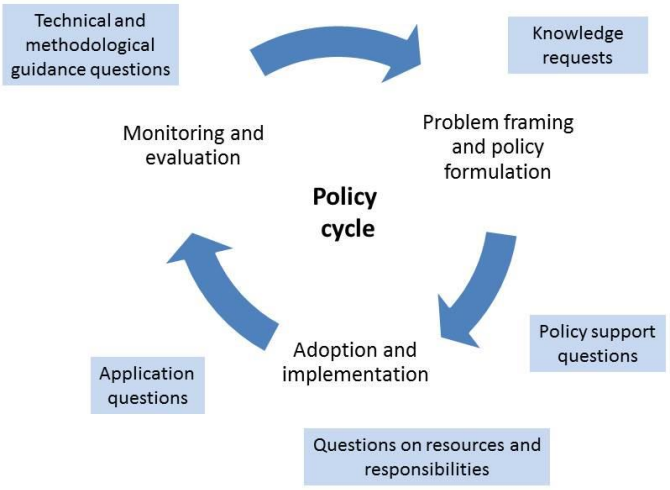

Figure 2: Adaptive policy cycle in relation to groups of questions identified in ESMERALDA (from Maes et al. 2018).

Knowledge requests are questions which ask for conceptual clarification; they describe information needs, usually at the start of the policy cycle.
- What are ecosystem services?
- How are ecosystem services linked to biodiversity and ecosystem condition?
- What are the current trends of ecosystem services?
- What is the value of Europe's ecosystem?

The reports by the working group MAES on Mapping and Assessment of Ecosystems and their Services are essential sources of information to start ecosystem assessments in Europe. The following reports are currently available for download:

- An analytical framework for ecosystem assessments under action 5 of the EU biodiversity strategy to 2020: discussion paper – final, April 2013
- Indicators for ecosystem assessments under action 5 of the EU biodiversity strategy to 2020: 2nd report – final, February 2014
- Mapping and assessing the condition of Europe's ecosystems: progress and challenges: 3rd report - final, March 2016
- Urban ecosystems: 4th report – final, May 2016
- An analytical framework for mapping and assessment of ecosystem condition in EU: discussion paper – final, February 2018

Further MAES-relevant information can be found online at the following websites:
- Natural Capital Accounting: http://ec.europa.eu/environment/nature/capital_accounting/index_en.htm
- Green Infrastructure: http://ec.europa.eu/environment/nature/ecosystems/index_en.htm
- EU Action Plan for nature, people and the economy: http://ec.europa.eu/environment/nature/legislation/fitness_check/action_plan/index_en.htm

Policy support questions are questions which frame the use of ecosystem services as a concept to support a particular policy objective. These can include policies which have a positive or a negative impact on ecosystem services or which regulate the use of natural resources including agricultural policy, climate policy, biodiversity policy, spatial planning, impact assessment, disaster risk reduction and economic policy. Questions about resources and responsibilities relate to governance of ecosystem services and ask what organizationally can possible be done or within an institutional setting to implement an ecosystem services-based approach. Questions also include questions about human capacity and financial resources which are needed to carry out ecosystem assessments or to ensure that ecosystems and their services are integrated into decision making.

Application of ecosystem services mapping questions are 'how to' questions focusing on implementation of approaches and how to use mapping and assessment outputs to support policy implementation. Examples of such questions are:

- How do I set up a payments for ecosystem services scheme?
- How do I establish an ecosystem services accounting system?
- What are the cost and benefits of restoring ecosystems and enhancing services?
- How do I best communicate the importance of ecosystem services?
- What impact do ecosystems have on my living environment?

Technical and methodological questions ask for specific technical details of mapping ecosystem services. Commonly addressed issues are spatial scale, uncertainty, the appropriate use of certain methodologies, priority setting and preferences. Besides in the ESMERALDA MAES Explorer, further information can also be found at the following websites that provide guidance on ecosystem services:

- http://www.guidetoes.eu/
- http://www.aboutvalues.net/method_navigator/
- https://oppla.eu/

2.2. MAES implementation step 2: Identification of relevant stakeholders

The first step in the identification of stakeholders and linkages between them is to identify the focal issue which influences the range of stakeholders to be included and their basic interests. The most obvious stakeholders can usually be easily identified after that. The less obvious stakeholders can be further identified by, for example, media and document analysis, focus group discussions and key-informant interviews.

2.2.1. Relevant fields of interest

Owners of land and water areas, managers of ecosystems, users or beneficiaries of ecosystem services, people suffering from trade-offs between the provision and use of different ecosystem services, and those who have the power to govern the supply and use of ecosystem services, have different interests. For a successful ecosystem service mapping and assessment, the different interests should be identified and their representatives engaged.

Some examples include:

Stakeholder	Fields of interest
Resident	Desirable living environment; access to outdoor recreation; clean drinking water; food; protection from natural hazards; etc.
Spatial planner	Functional urban/regional grey, green and blue (infra)structure; spatial organisation of recreational opportunities; cost-efficiency; intensification of construction; provision of locations for economic activities; etc.
Decision maker	Ensuring consideration of the public interest; fulfilment of interests of voters; reasoned distribution of public money for different needs; individual preferences; etc.
Entrepreneur	Successful entrepreneurship in terms of sustained income; satisfaction of the needs of customers; profitable location; etc.
Non-governmental organisation	Safeguarding of specific common interests such as nature conservation, hunting, outdoor recreation, etc.
National ministries	National law-making; monitoring of the successfulness of legislation in the field of the ministry in question; response to international requirements e.g. from EU and global agreements; etc.
International organisations	Safeguarding or enhancing the implementation of interests of specific fields globally
Multinational corporation	Producing income for owners and shareholders of the corporation; safeguarding sustained income; etc.

2.2.2. Stakeholders on different scales

Two scales are mainly important when considering who are the right stakeholders when mapping and assessing ecosystems and their services: ecological scale and institutional scale. Ecosystem services are generated at a range of ecological scales and are supplied to stakeholders at a range of institutional scales. Stakeholders at different scales may benefit from and value ecosystem services differently based on, for example, their dependence on the examined services for livelihoods. In addition, it is necessary to identify scales and stakeholders to avoid potential conflicts between different scales because the demand for specific ecosystem services in one scale may restrict the use of the same or other ecosystem services on another scale. Different policy questions also relate to different ecological and institutional scales:

Examples of institutional scales and stakeholders:

Local	Local residents; land and water area owners; residents' associations; enterprises; schools; kindergartens; politicians; etc.
Municipal	Municipal practitioners and decision-makers; enterprises; residents; non-governmental organisations; etc.
Regional	Regional planners and decision-makers; municipalities; non-governmental organisations; residents; lobbyists; etc.
National	Ministries; national agencies and organisations of different sectors and interests; research institutes; universities; big companies; etc.
Global	International organisations; multinational corporations; etc.

Examples of ecological scales and stakeholders

Habitat	Land or water area owner; manager of the area; nature protection agency; etc.
Ecosystem	Land or water area owner; manager of the area; nature protection agency; etc.
Watershed	Water supply and sewerage system; land and water area owners; fishers; residents; flood protection officials; rescue services; etc.
Biome	Policy-makers across national borders; international organisations; multinational corporations; etc.
Globe	All human beings; global organisations and initiatives, e.g. United Nations, World Health Organisation, IPBES, IPCC, The International Union for Conservation of Nature, etc.

More information about scales and stakeholders can be found in Hein et al. (2006).

2.2.3. Why engage stakeholders?

Stakeholder identification and engagement is important in many ways:

- To understand the interplay of different actors.
- To identify trade-offs in ecosystem service provision and use.
- To avoid conflicts by acknowledging various stakes and interests.
- To assess and map areas providing ecosystem services.
- To assess and map socio-cultural and economic values related to ecosystems and their services.
- To assess and map flows of ecosystem services and the source and benefiting areas.
- To shed light on realisation of environmental justice.
- To give voice to more fragile population groups.
- To evaluate past, ongoing and planned activities in an area.
- To locate and gather all relevant data.
- To identify problems causing environmental degradation and loss of biodiversity and ecosystem services.
- To come up with sustainable solutions.

More about national level stakeholder knowledge for the purpose of evaluating ecosystem service mapping and assessment activities in EU member states has been elaborated in the following ESMERALDA Deliverable reports:

- D2.1 Clustering of EU Member States
- D2.2 Overview of gaps and recommendations
- D2.3 Final Stocktaking of EU member state needs

All reports are downloadable from the ESMERALDA MAES Explorer.

ESMERALDA also developed the “MAES barometer” which is updated twice per year together with the MAES Working Group meetings and which gives and overview on the state of MAES implementation in EU Member states (Figure 3; see ESMERALDA Deliverable D2.1 report for details on the method).

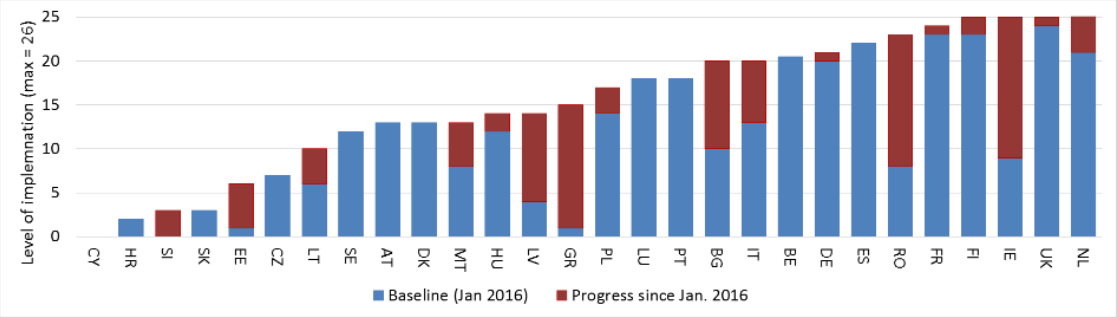

Figure 3: ESMERALDA MAES barometer from March 2018.

2.3. MAES implementation step 3: Network creation/Involvement of stakeholders

A national or regional, active network on ecosystem services, biodiversity or natural capital formed by scientists, policymakers and practitioners can enhance considerably the successful implementation of MAES at national and regional levels. Therefore it is worthwhile to check for existing networks or stakeholder support groups in EU countries or to create a new network and to find solutions to enhance successful update of MAES.

2.3.1. Existing networks

The following list gives an overview on existing networks on ecosystem services and natural capital in Europe (hyperlinked country names link directly to the respective network):

Albania	Finland	Luxembourg	Slovakia
Austria	France	Macedonia (FYROM)	Slovenia
Belgium	Germany	Malta	Spain
Bosnia and Herzegovina	Greece	Montenegro	Sweden
Bulgaria	Hungary	Netherlands	Switzerland
Croatia	Iceland	Norway	Turkey
Cyprus	Ireland	Poland	United Kingdom
Czech Republic	Italy	Portugal	England
Denmark	Latvia	Romania	Scotland
Estonia	Lithuania	Serbia	Israel

2.3.2. Stakeholder support groups and country fact sheets

In the first project phase, ESMERALDA developed country fact sheets that contain basic information about the implementation of MAES in the EU member states including key stakeholders. The following list gives an overview on the country fact sheets of EU member states (hyperlinked country names link directly to the country fact sheet):

Austria	Cyprus	Finland	Hungary	Lithuania	Poland	Slovenia
Belgium	Czech Republic	France	Ireland	Luxembourg	Portugal	Spain
Bulgaria	Denmark	Germany	Italy	Malta	Romania	Sweden
Croatia	Estonia	Greece	Latvia	Netherlands	Slovakia	United Kingdom

MAES related developments in the EU countries are reported and updated on BISE[3].

[3] http://biodiversity.europa.eu/

2.3.3. Creating a network

ESMERALDA encourages networking at national or regional level through the Ecosystem Services Partnership[4] (ESP). ESP helps stakeholders set up a national network or brings them in contact with existing networks. Detailed information on how to create an ESP network can be found here: http://www.maes-explorer.eu/page/145. Also OPPLA [5] can be harnessed to become part of a community of practise on natural capital, ecosystem services and nature-based solutions. The business and biodiversity platform[6] is a specific network for the private sector. It helps businesses with integrating natural capital in their practises.

2.3.4. Solutions for improved uptake of MAES

Key recommendations developed by ESMERALDA are based on i) Joining forces, ii) Meet and map and iii) Network (see Figure 4).

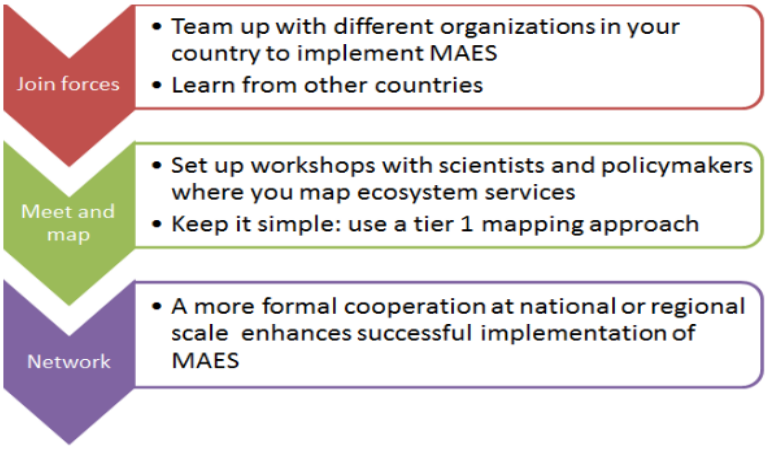

Figure 4: Key recommendations for improved uptake of MAES in EU member states.

How to justify mapping and assessment of ecosystems and their services in EU countries?

Arguments for justifying mapping and assessment of ecosystems and their services in EU countries include:

- Legal arguments
  - The EU Biodiversity Strategy and Action 5 are subscribed by the European Parliament and the European Council and all countries have committed to do the work.
  - Ecosystem services appear in other legislation as well such as the Action plan for nature, people and the environment and the EU pollinators initiative. EU and national legislation for ecosystem services should be screened.
  - Coming EU policies should be anticipated and the importance of ES shown in regard

[4] http://es-partnership.org/
[5] https://oppla.eu/
[6] http://ec.europa.eu/environment/biodiversity/business/index_en.htm

to them.
    - Down-scaling of EU objectives to the national level, hence integrating national priorities is a good strategy.
- Communicating benefits and solutions
    - Problem-based solutions are easier to explain
    - MAES products can be related to the following agendas: (1) relevance for growth agenda, (2) solve outstanding social problems, and (3) being environmentally and socially competitive.
    - Money talks. Ecosystem services losses can be put into an economic context. Cost-effectiveness is a good argument for implementing MAES as a way to find solutions to social problems.
    - Linking ecosystem services to nature conservation and to long-term problems in social situation − such as poverty − it makes the explanation easier.
    - Contrasting examples like how much money it takes to restore services and contrast that in what difference it makes if we could give the same sum to work against poverty.
    - Measures to make one good mapping exercise instead of many smaller diverse mapping and assessment projects. It is more cost-efficient.
    - Collection of local case studies, good strategy if resources are limited.
    - Demonstration of added values and comparison of options, e.g. grey vs green solutions.
    - Communication of long-term benefits.
    - Focus on agro-ecosystems, because benefits are evident.
    - In urban ecosystems, connection of MAES with public health issues.
    - MAES use for addressing national challenges (saliency of MAES).
    - MAES is an opportunity to show what is valuable in a spatially explicit way, highlighting trade-offs.
- Contacting the right people
    - High level influential people to be approached with understandable examples.
    - Reaching decision-makers and high-level stakeholders and awareness-raising on the necessity and utility of MAES.
    - Government contacts or people who have good government contacts.
    - Communication at different levels of public administration, using personal relationships as channels.
- Ecological arguments
- Competition with other countries
    - MAES barometer (see Figure 3) to situate the level of implementation in each country relative to other countries
- Use examples
    - Demonstrating the benefits of MAES. What advantages can be derived from its application. Good case study examples of application.
    - Smaller case studies can be used as arguments.
    - Appealing case studies on impact assessment with and without ecosystem services.
    - Communication of benefits and solutions (economic benefits and solutions for social problems).
- Involving different actors to the process
    - Involvement of other than environmental ministries into the steering committees or in the evaluation. Commitment needs starting high up throughout, e.g. involving the ministry early.
    - Inclusion of different actors in the steering committees of MAES projects at different levels.

- Prioritization of regional and local authorities.
- Integration of stakeholders' viewpoints in the process.
- Focus of the assessment on the users' needs.
- Communication of benefits of MAES to stakeholders by using their own language and concepts (appealing to their interests).
- Awareness-raising in the society.
- Engagement of opinion leaders, famous influential people.

More information on solutions to enhance MAES in EU countries can be found in ESMERALDA Deliverable D2.2 (Ecosystem service mapping and assessment gaps in EU member states and recommendations to overcome them) report. All reports are downloadable from the ESMERALDA MAES Explorer.

How to enhance communication about ecosystem services?

Tips for enhancing communication about MAES and ecosystem services include:

- Provision of examples, success stories, excursions
  - Success stories to communicate how mapping and assessment of ecosystem services can make a difference.
  - Invitation of high-level stakeholders and decision-makers to informal occasions or excursions where it is possible to more visibly show off what ecosystem services really mean.
  - Best practice examples of sustainable use of ecosystems and ecosystem services.
  - Set of slides with European case studies.
- Usage of other communication tools: ambassadors, maps, high level events
  - Involvement of ambassadors - champions - who help deliver the message.
  - Mapping ecosystem condition as a means for communication.
  - Organisation of a high level event, linking to international setting to gain prestige, and inviting the top-level speakers also from abroad.
  - Maps themselves could be provocative and stimulate discussion.
  - Usage of MAES reports (methodologies, frameworks), Mapping Ecosystem Services book (Burkhard and Maes 2017) and ESMERALDA reports
- Business involvement
  - Involvement of industries, relevant networks for this exist, e.g. the biodiversity and business platform[7]
  - Big companies should see the values of actions worth taking.
  - Collaboration with companies in safeguarding ecosystem services (e.g. the Finnish ecosystem hotel concept).
- Start from easy language and terms
  - It is not easy to explain the whole concept of ecosystem services; so some easily understandable services should be chosen to start with. The ecosystem service cascade model and an example of a local ecosystem service can be used to present what ecosystem structures and processes create that service and what valuable benefits that service can provide.
  - Language of the actual end-users of ecosystem services (e.g. in case of farmers the numeral values for different land use types) should be used.
  - Maybe nature-based solutions as an alternative term to ecosystem services can be used when suitable.

[7] http://ec.europa.eu/environment/biodiversity/business/index_en.htm

- National language should be used in the outcome.
- Messages should be targeted to specific audiences; given perceived complexity of ecosystem services it can be challenging.

- Large masses can be approached, different groups, from the bottom to up
  - Broad Awareness-raising involving large masses.
  - Broadcasting messages from many directions.
  - Approaching both sides: decision-makers (talking about the votes) and local people as well.
  - Organisation of autumn festivals.
  - Communicating first at the bottom and then education of the whole society.
  - Communication in an attractive way and in simple language, starting at the schools and kindergartens.
  - Talks to stakeholders at different levels.
  - Explanation of ecosystem services at different administrational levels and across sectors.
- Usage of communication experts and popular and social media
  - Usage of trained professionals in communication for awareness-raising.
  - Involvement of sociologists and usage of social behavioural methods for awareness-raising of ecosystem services to make social influence (e.g. the effect in reduction of energy consumption when individuals are informed that the neighbour does better than they themselves and also spends less money by switching off the light).
  - Creation of a new clear communication strategy of MAES, among DGs and members states.
- Involvement of end-users, interactive, making people feel that their voice is heard
  - Steps for awareness-raising: inform (education), involve, get familiar with the concept.
  - Connection of the ESMERALDA MAES Explorer with the end-user.
  - Engagement of all sectors from the very beginning of MAES: supervising board, partnerships, media, citizen science.
  - Convincing sectors that they are experts in the field and making them feel they are listened to.
  - Involvement of different authorities.
  - Building a network of stakeholders as soon as possible because it provides legacy and ability. The network can be built at different levels.
  - Usage of translators for stakeholders at different levels.
  - Ensuring appropriate participatory structures and processes.
  - Creating a stakeholder plan for mapping ecosystem services (like in Sweden).
  - Carrying out the work with stakeholder groups (like TEEB scoping study in Finland, IPBES panel in Sweden, or Ireland Natural capital forum, which engaged journalists, academics and scientists).
  - Looking how the stakeholder engagement has been implemented and learning from the experience.
- Communication of benefits, problems and solutions
  - Ecosystem services expressions in terms of problems and solutions.
  - Arrangement of campaigns for demonstrating added values of ecosystem services and comparing options in favour of the green solutions.
  - Explanations that champions have lower costs and can have long-term benefits.
  - Examples of how MAES can help specific groups (e.g. farmers use better their land, decision-makers resolve policy conflicts, cities can have better quality of life).

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recommendations to overcome them) report. All reports are downloadable from the ESMERALDA MAES Explorer.

How to enhance capacity to implement mapping and assessment of ecosystems and their services?

Tips for capacity building developed within ESMERALDA focus specifically on:

- Training, education, need of skilled people (training for students and officials)
  - Capacity building needs to be institutionalised, not just be a responsibility of individuals. Find 'champions' for support.
  - Standardisation of capacity building.
  - Inclusion of ecosystem service assessment and mapping into university curricula.
  - Arrangement of summer schools, not only for students but also for teachers.
  - Meeting the needs for knowledge, finding the right kind of technical people.
  - Integration of the ecosystem service topic into school curricula, e.g. school exercises about assessing local ecosystem services' condition.
  - Development of materials for secondary schools, for teaching about ecosystems and biology. To enable this, presentations and seminars for teachers can be arranged.
  - Arrangement of university courses and master programs about ecosystems and their services, involvement of students into projects.
  - Arrangement of qualification courses for the employees in public administration.
  - Identification of specific needs of training.
  - Development of educational programs at universities.
- Guidance, handbooks/manuals, FAQs, online resources
  - Check the material provided in the ESMERALDA MAES Explorer
- Workshops, seminars
  - Organisation of national workshops on how to make the right justifications at national level.
  - Organisation of seminars with local communities about how ecosystem service assessments are used in practice.
  - Organisation of practical workshops with funding, involving policy-makers (very few are both scientist and policy-makers).
- Integration of knowledge, transdisciplinarity
  - Economists and ecologists shall learn to speak common language, capacity of decision-makers shall be build.
  - Integration of economists' and ecologists' knowledge. Improvement of education capacity and guidance how to get the two topics together.
  - Usage of an interdisciplinary approach to come to a real integration of knowledge.
  - Thinking future stages of MAES, (i.e. accounting), hence communication to newly-involved scientific communities (statisticians) in their own language, beyond biophysical aspects.
  - Better focus on real interaction in synthesis activities.
- Examples, learning from others, knowledge exchange
  - Real example studies with benefits where ecosystem services were mapped or assessed, monitoring of the development of these projects (ex post evaluation).
  - Mobility of researchers between countries, to foster exchange of data, knowledge and experience.
  - Learning from others.
  - Starting community of practitioners (become acquainted with such networks e.g. in

Flanders, Belgium[8] and in Poland).

Which kind of support can be expected from experts to map and assess ecosystems and their services?

Support options include:

- Data related recommendations
  - Data should be kept with its source; recalculation if necessary.
  - Data and indicators from other policies to increase their ownership.
  - Considering using EU-wide data for covering the capacity (combination of EU and member state datasets).
  - Identification and use of case-specific real data, open source data, safeguarding of data availability.
- Institutional recommendations, resources, guidance
  - Enhancement of INSPIRE coordination.
  - Making newly produced geo-services available also for BISE.
  - Provision of technical guidance to administrational work.
- Methodological and research recommendations
  - Development of specific models.
  - More research with clear concepts and reliable data.
  - Specification of standards (scale, detail level, type of ecosystem services).
  - Explicit showing of spatial and temporal trade-offs between ecosystem services.
  - Standardisation to allow member state comparison.
  - Research on social perception of ecosystem services.
- Mapping recommendations, scale issues
  - Maps with compatible data and data sources.
  - Upscaling of data or maps at national scale (tests at regional scales).
  - Multi-scale approaches: use of production functions links biophysical assessment to economic value.
  - Definition of minimum sets of ecosystem services to be mapped and assessed.

More information on solutions to enhance MAES in EU countries can be found in ESMERALDA Deliverable D2.2 (Ecosystem service mapping and assessment gaps in EU member states and recommendations to overcome them) report. All reports are downloadable from the ESMERALDA MAES Explorer.

2.4. Mapping and assessment process

The ecosystem services mapping and assessment process is the technical/methodological core of MAES. Mapping refers, in this context, to the spatial delineation of ecosystems as well as their condition and the services they supply through the spatial integration of a wide range of methods and data sets. Assessment includes the analysis and review of (existing) information derived from research for the purpose of helping someone in a position of responsibility to evaluate possible actions or think about a problem. In ESMERALDA, the focus was on ecosystem services mapping and assessment, less on ecosystem types, condition or accounting, the other relevant parts for MAES.

[8] https://www.biodiversity.be/3949

ESMERALDA developed a 'flexible methodology' for ecosystem services mapping and assessment providing the building blocks for regional, national and pan-European assessments. This methodology has been built on existing research, related projects, methods and databases. The results of the comprehensive ESMERALDA review of existing studies can be explored by the MAES methods Explorer, a searchable online database as well as the detailed Methods Documentations of biophysical, economic and social methods and possible Methods Integration. Finally, ESMERALDA is providing a useful overview of selected Methods' Applications and links to the ESP Visualisation tool, an online platform where ecosystem service maps can be shared.

2.4.1. ESMERALDA MAES Methods Explorer

Database: Identifying and recording the relevant and correct method for ecosystem services mapping and assessment is not trivial. Therefore, one of the aims of ESMERALDA was to create a database of existing studies on mapping and assessing ecosystems and their services and highlight several attributes to the ecosystem as well as the methods, scale, ecosystem type, ecosystem service categories etc. This database forms the basis for the MAES methods Explorer. Currently the database consists of 883 entries describing case studies were ecosystem service-relevant methods have been described in their context. Further examples can be entered via the online questionnaire at: https://www.webropolsurveys.com/S/85E71B9D58A30304.par

The **ESMERALDA MAES Methods Explorer** provides a simple yet powerful interface for searching the database. The user can search for examples or methods by filtering the dataset by various attributes - such as ecosystem service, ecosystem type, policy question covered etc. From here the user will be linked to further information. The ESMERALDA MAES Methods Explorer offers multiple entry points into the dataset to make it easier for first time users to explore the dataset in meaningful ways by providing preconfigured filters. For example to every case study booklet there has is a filter to select similar items to the topics covered in the case study booklet.

Link to the ESMERALDA MAES Methods Explorer: http://database.esmeralda-project.eu

CICES: Following its adoption for the MAES initiative in general, ESMERALDA used the Common International Classification of Ecosystem Services (CICES) V4.3 to identify of the ecosystem services considered in each case study. To ensure consistency within the database the services that each study focused on were cross referenced to one of the CICES classes, whether the original work used the classification or not. Although CICES V4.3 has now been revised, and as of January 2018 Version 5.1 has been made available (see www.CICES.eu), it was decided to continue to use the original version for the analysis in ESMERALDA. This was done so as to bring the work to a swift and efficient conclusion. The two versions of CICES are fully compatible and a simple lookup-table between them is available at the class level. Therefore the translation to the new version can either be applied by the user or built into the database at a later stage when updates occur.

2.4.2. ESMERALDA Methods' documentation

The flexible methodology proposed integrates social, economic and biophysical ecosystem services mapping and assessment methods. ESMERALDA provides a set of three individual reports explaining

of the main social, economic and biophysical methods for mapping and assessment of ecosystem services. These reports address the challenge of improving the applicability of these methods with specific examples, particularly with respect to the MAES process and the ESMERALDA case studies.

All reports can be downloaded directly from here: http://www.maes-explorer.eu/page/100

Deliverable D3.1 provides an overview of the main **social methods** for mapping and assessment of ecosystem services. Social methods principally involve to measure individual and collective preferences in order to support the operationalization and further development of the ecosystem services concept. As such, social methods operate on the right side of the ecosystem services cascade model to quantify the benefits to humans.

Deliverable D3.2 provides an overview of **economic methods** for mapping and assessing ecosystem services, which principally involve measuring the economic value of ecosystem services, including spatial variations, and structuring this information to support decision making and the design of policy instruments. As such, economic methods operate on the right side of the ecosystem services cascade model to quantify the benefits to humans.

Deliverable D3.3 provides an overview of **biophysical mapping** and assessment methods for ecosystem services and their use in ecosystem assessments. It has been part of ESMERALDA Work Package 3, and together with reports of social methods (D3.1) and economic methods (D3.2), it describes the key elements of a flexible ecosystem assessment methodology.

2.4.3. ESMERALDA Methods integration

In addition to these reports, Deliverable D3.4 report on **interlinkages between methods** focuses on the integration of these different perspectives on ecosystem assessments. ESMERALDA provides a potential link to integrate information from social, economic and biophysical methods. Deliverables D3.1, D3.2 and D3.3 specifically provide guidance on social, economic and biophysical methods for mapping and assessment of ecosystem services. Deliverable 3.4 provides guidance on how social, biophysical and economic methods can be linked within an ecosystem service assessment and on methods for integrating information outputs across disciplinary domains. It also provides an overview of the most important linking and integrating methods while giving guidance on when to use each of these methods. Examples used in this report are inspired on the case studies of the ESMERALDA programme as well as additional cases that demonstrate the nature of the methods.

Transdisciplinary ecosystem service mapping and assessments have to integrate the state and functionality of ecosystems and their biodiversity as base for understanding the supply of ecosystem services, on the one hand, and for identifying the socio-economic system components and ecosystem services-related supply and demand patterns, on the other. This requires flexibility in methods, which can be achieved **tiered approaches** from simple (Tier 1) to complex (Tier 3) methods. A tiered approach is able to combine less sophisticated, expert- and land cover-based approaches, and the use of existing ES indicator data, with more complex and comprehensive modelling frameworks (Figure 4). Depending on data and resources available, the most suitable approach can be chosen. The MAES Methods Explorer is promoting these processes by providing support in methods selection.

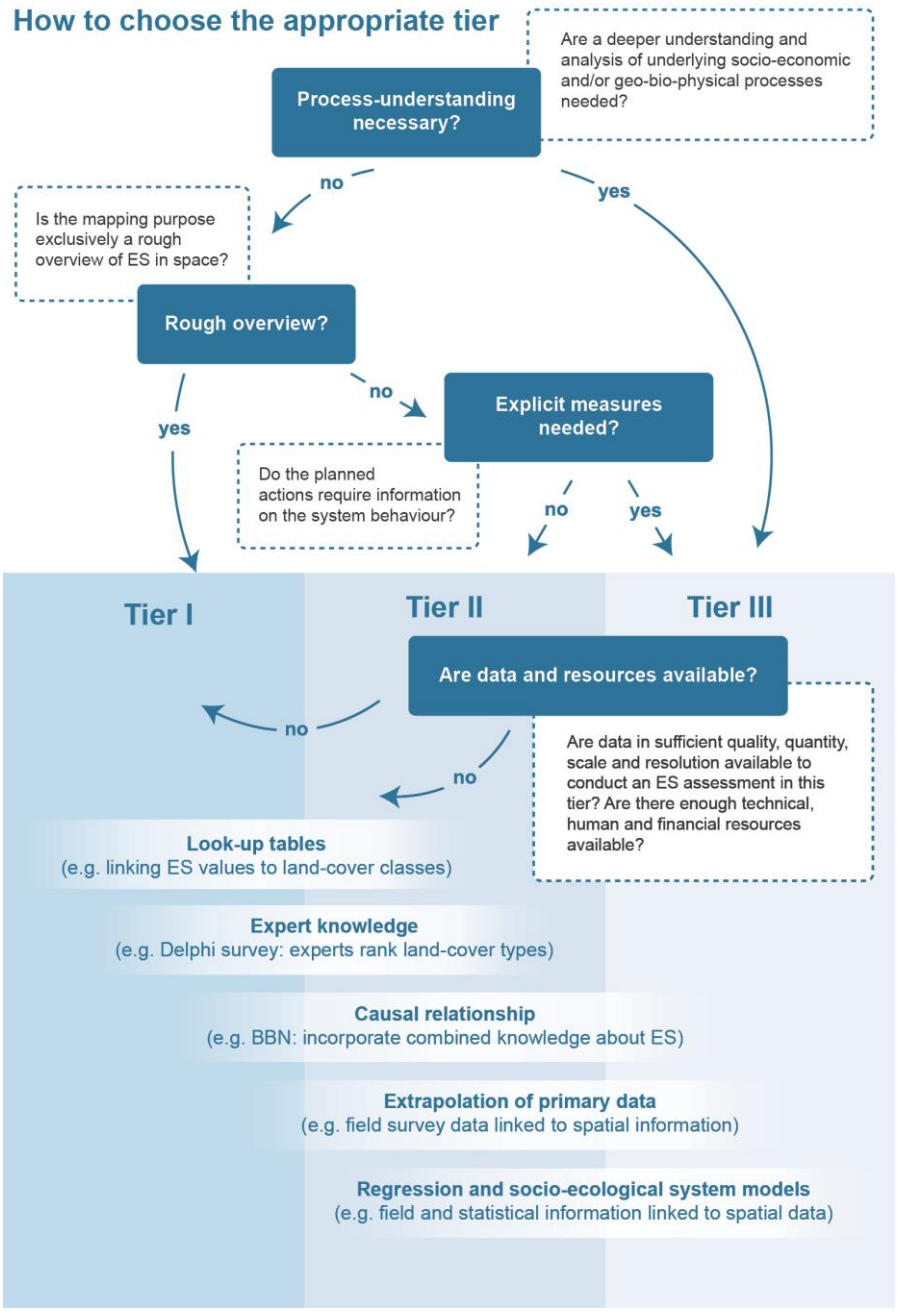

Figure 4: Tiered approach for selecting methods for ecosystem services mapping and assessment (Source: Grêt-Regamey et al. 2017).

Based on the conceptualisation of a **tiered approach** for classifying ecosystem service mapping and assessment methods, we adapt that framework to provide guidance on the selection of social, economic and biophysical mapping and assessment methods. In order to provide practical guidance, the intention is to assign each method to one of three tiers reflecting the accuracy, detail, technical capacity and data requirements. For example, methods that produce information with a high level of accuracy and detail but have high technical and data requirements are assigned to tier 3. The assignment of mapping and assessment methods to a specific tier, however, is not straightforward since each method can be applied with varying degrees of complexity to produce information with varying degrees of accuracy and detail, largely dependent on the availability of data and resources for

conducting the analysis. Nevertheless, we have attempted to make generalisations regarding the accuracy and complexity of each method (Weibel et al. 2018).

The Open Access textbook "Mapping Ecosystem Services" (Burkhard and Maes 2017) provides further comprehensive overviews of above-mentioned methods, the tiered approach and their application.

2.4.4. ESP Visualization tool

The ESP-Visualisation tool (ESP-VT) is an interactive knowledge platform that allows users to share information on ecosystem services maps, data and mapping methods. ESP-VT is a joint initiative of the Ecosystem Service Partnership's Working Groups on Mapping and Modelling ES, developed and supported by the Joint Research Centre of the European Commission (JRC-EC) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) of Australia Drakou et al. 2015).

Direct link to ESP-VT: http://esp-mapping.net/Home/

2.5. Ecosystem services mapping and assessment case study applications

The ESMERALDA case studies are working examples in which mapping and assessment of ecosystem services has been applied to address specific decision problems. The selected case studies are representative of:

- the variety of existing conditions across the EU, in terms of data availability, spatial scale, levels of implementation of EU 2020 targets, and expertise and experience in ES mapping and assessment;
- the geographical regions and biomes of the entire EU, including marine areas and the outermost regions;
- the variety of cross-EU themes relevant for ecosystem services, such as agriculture, green infrastructure, natural protected areas, forestry strategy, water, business and industry sectors, and health;
- the variety of policy and planning processes that can be used to mainstream ES in real-life decisions, such as spatial and land use planning, water resource management, flooding under the EU climate adaptation action, energy policy, strategic environmental assessment, protected area planning.

Case Study Booklets (describing the process of mapping and assessment of ES) and Method Application Cards (synthesizing the main characteristic of the applied methods) illustrate the ESMERALDA case studies. The Case Study Booklets present information about the main stages of the MAES process, following the structure of the "Guidance on Ecosystem Service Mapping and Assessment" - from the identification of the policy question to the involvement of stakeholders, to the dissemination and implementation of the results. The Method Application Cards, for each analysed ES, detail the applied method in terms of its data, and resources requirement, links and dependency on other methods, collaboration level needed, and spatial scale of application, among others.

All case study booklets can be downloaded directly from the MAES Explorer's case study section at: http://www.maes-explorer.eu/page/overview_of_esmeralda_case_studies

ESMERALDA Case Study Booklets:

Country	Case study title	Scale	Ecosystem services (CICES v4.3 class)
Belgium	Mapping green infrastructures and their ES in Antwerp	Local	Filtration/sequestration/storage/accumulation by ecosystems (2.1.2.1) Physical use of land- /seascapes in different environmental settings (3.1.1.2)
Bulgaria	Mapping and assessment of ES in Central Balkan area at multiple scales	Regional	Surface water for drinking (1.1.2.1) Aesthetics (3.1.2.5)
Czech Republic	Pilot national assessment of ecosystem services	National	Surface water for drinking (1.1.2.1) Global climate regulation by reduction of greenhouse gas concentrations (2.3.5.1) Entertainment (3.1.2.4)
Finland	Green infrastructure and urban planning in the City of Järvenpää	Local	Educational (3.1.2.2)
Germany	Mapping ES dynamics in an agricultural landscape in Germany	Local/ regional	Plant-based [energy] resources (1.3.1.1) Buffering and attenuation of mass flows (2.2.1.2) Educational (3.1.2.2)
Hungary	Fostering pro-biodiversity business in the Bukk National Park	Local/ regional	Animals reared to provide nutrition, fibers and other materials (1.1.1.2, 1.2.1.2) Touristic attractiveness of nature (3.1.1.1, 3.1.1.2)
Italy	ES mapping and assessment for urban planning in Trento	Local	Micro and regional climate regulation (2.3.5.2) Physical use of land- /seascapes in different environmental settings (3.1.1.2)
Latvia	Mapping marine ecosystem services in Latvia	National	Wild plants, algae and their outputs (1.1.1.3) Maintaining nursery populations and habitats (2.3.1.2) Experiential interactions + Physical use of landscapes /seascapes in different environmental settings (3.1.1.1, 3.1.1.2)
Malta	Assessing and mapping ES in the mosaic landscapes of the Maltese Islands	Local/ regional	Reared animals and their outputs (1.1.1.2) Pollination and seed dispersal (2.3.1.1)
Nether-lands	ES-based coastal defence	Local	Flood protection (2.2.2.2) Experiential use of plants, animals and land-/seascapes in different environmental settings (3.1.1.1)
Poland	ES in Polish urban	Local/	Filtration/sequestration/ storage/accumulation

	areas	regional	by ecosystems (2.1.2.1) Physical use of land / seascapes in different environmental settings (3.1.1.2)
The Azores	BALA - Biodiversity of Arthropods from the Laurisilva of Azores	Local	Pollination and seed dispersal (2.3.1.1) Maintaining nursery populations and habitats (2.3.1.2)
Spain	Spanish national ecosystem assessment	National /local	Cultivated crop (1.1.1.1) Surface water for drinking (1.1.2.1)
Sweden	Ecosystem services in Northern Sweden	Local/ regional	Reared animals and their outputs (1.1.1.2) Experiential (physical) use of plants, animals and landscapes (3.1.1.1, 3.1.1.2)

Further case studies can be found from the **OpenNESS (**http://www.openness-project.eu/cases) and the **OPERAs** (http://operas-project.eu/exemplars) EU FP 7 projects.

Method Application Cards: Guidelines and recommendations about the ESMERALDA Methods Application Cards can be found in ESMERALDA Deliverable report D5.4 (Guidelines and recommendations to support the application of the final methods by policy and decision makers as well business and public sectors).

All method application cards can be downloaded directly from the MAES Explorer's methods section at: http://www.maes-explorer.eu/page/ecosystem_services_and_applied_methods

Ecosystem services and applied methods:

Country	Ecosystem services (CICES v4.3 class)	Applied method	Alternative method
Belgium	Filtration, sequestration/storage/accumulation by ecosystems (2.1.2.1)	Spatial proxy method (expert scoring)	
	Physical and intellectual interactions with environmental (3.1.1.2)	Spatial proxy method (expert scoring)	
Bulgaria	Surface water for drinking purpose (1.1.2.1)	Process-based models (SWAT)	
	Aesthetics (3.1.2.5)	Photo Elicitation Surveys	
Czech Republic	Entertainment (3.1.2.4)	Integrated modeling frameworks (ESTIMAP)	Hedonic pricing method
	Global climate regulation by reduction of greenhouse gas concentrations (2.3.5.1)	Integrated modeling frameworks (InVEST)	Value (benefit) transfer
	Surface water for drinking (1.1.2.1)	Value (benefit)	Net factor

		transfer	income
Finland	Educational (3.1.2.2)	Participatory GIS	
	Integration of Green infrastructure and infill development	Integrated modelling framework (Spatial Multi-Criteria Decision Analysis) *	
Germany	Plant-based [energy] resources (1.3.1.1)	Spatial proxy models	Replacement cost
	Buffering and attenuation of mass flows (2.2.1.2)	GISCAME	Bayesian belief network
	Educational (3.1.2.2)	Narrative assessment	
Hungary	Animals reared to provide nutrition, fibres and other materials (1.1.3.1, 1.1.3.2)	Spatial proxy method (Rule-based matrix model)	
	Touristic attractiveness of nature (3.1.1.1, 3.1.1.2)	Spatial proxy method (Rule-based matrix model)	
Italy	Micro and regional climate regulation (2.3.5.2)	Process-based models	
	Physical use of land-/seascapes in different environmental settings (3.1.1.2)	ESTIMAP recreation model	
Latvia	Wild plants, algae and their outputs (1.1.1.3)	Spatial proxy models	
	Maintaining nursery populations and habitats (2.3.1.2)	Spatial proxy methods (Spreadsheet)	State & Transition model
	Experiential interactions + Physical use of landscapes/seascapes in different environmental settings (3.1.1.1, 3.1.1.2)	Integrated modeling frameworks (Multi-criteria ES assessment model)	Integrated modeling frameworks (InVEST)
Malta	Reared animals and their outputs (1.1.1.2)	Preference assessment	
	Pollination and seed dispersal (2.3.1.1)	Spatial proxy models + field data	Spatial proxy methods (Spreadsheet method)
Netherands	Flood protection (2.2.2.2)		Process based modelling (KINEROS flood modelling)
	Experiential use of plants, animals and land-/seascapes in different environmental settings		Spatial proxy method

	(3.1.1.1)		(recreation based on green typology)
Poland	Filtration/sequestration/storage/accumulation by ecosystems (2.1.2.1)	Spatial proxy models	Replacement cost (marginal abatement costs)
	Physical use of land-/seascapes in different environmental settings (3.1.1.2)	Spatial proxy models	Choice modelling
Portugal, Azores	Pollination and seed dispersal (2.3.1.1)	Macro-ecological models	
	Maintaining nursery populations and habitats (2.3.1.2)	Macro-ecological models	
Spain	Cultivated crop (1.1.1.1)	Market price methods	
	Surface water for drinking (1.1.2.1)	Integrated modeling frameworks (InVEST - Water Supply model)	
Sweden	Reared animals and their outputs (1.1.1.2)	Participatory GIS	
	Experiential/physical use of plants, animals and landscapes (3.1.1.1, 3.1.1.2)	Integrated modelling framework (Integrated monitoring data GAM-modelling framework)	

Dissemination and Communication

An appropriate and efficient dissemination and communication of (often complex) scientific findings to potential users from policy and decision making is at the core of each successful science-policy-society interface. The ESMERALDA approach followed a rigorous plan for dissemination and exploitation of results based on strong stakeholder engagement and networking, regular stakeholder-oriented project Workshops across EU member states, a strong connection of the project partners and the international research community, collaboration with key projects on ecosystem services in Europe, teaming up with the MAES working group, an embedded connection with the Ecosystem Services Partnership (ESP), harnessing of knowledge-sharing options with existing platform such as BISE, ESP or OPPLA based on an open data policy and direct interactions with the main users.

2.5.1. Science-policy interface

Scientific knowledge is a very common ingredient of policy making, and science is often called upon to provide solutions to societal problems.

Science-policy interfaces are social processes which encompass relations between scientists and other actors in the policy process, and which allow for exchanges, coevolution, and joint construction of

knowledge with the aim of enriching decision-making. They are implemented to manage the intersection between science and policy. Science-policy interface aims to bring scientific research into policymaking and has been rapidly gaining recognition and importance in global environmental governance (Figure 5).

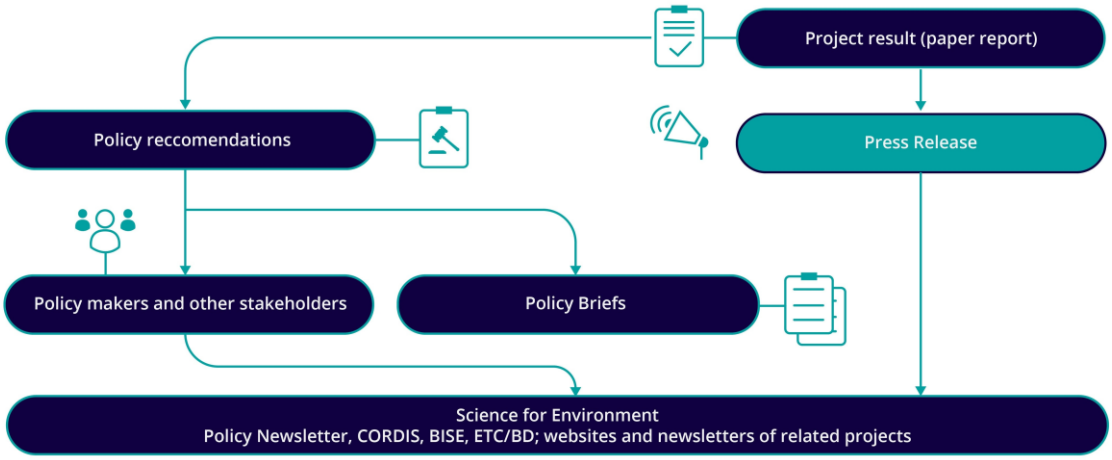

Figure 5: Exemplary pathway of a science-policy interaction.

2.5.2. Policy briefs

Policy briefs are concise papers that address urgent environmental problems and derive from contemporary research usually carried out within the frames of large-scale projects. Often a policy brief is a secondary document derived from a scientific paper, published in academic journal.

Main characteristics of a policy brief:

- A policy brief should begin with a short summary of the existing problem, an assessment of the current situation, and concludes with recommendations. It may contain also critiques to existing policies or relevant case studies that support suggested measures. Ideally, the policy brief should be between 2 and 4 pages.
- The title should be concise and clear for non-specialists. The title will always show up in RSS feeds and mailing lists, therefore it should be easily understandable and attractive.
- A summary should explain in a concise manner the main point of the PB. The executive summary aims to convince the reader further that the brief is worth in-depth investigation. The summary is usually also included in RSS feeds and mailing lists, thus it should be very clear and straightforward. There must be no links in the Summary text.
- A list of 5-6 keywords that are most relevant to the brief should be provided.
- A short text outlining the policy relevance of the policy brief should be added. This may include reference to a particular international and national legislative acts, laws or conventions.
- Environmental problems the brief is relevant to shall be listed, for instance: Climate Change, Land-use change, Decline of pollinators, Fragmentation of habitats.
- The problem should be described to convince the audience that an environmental issue exists

and outline its current status by providing historical overview and the actions/reactions to it.
- Recommendations section with concrete proposals of how the failings of the current management, policy, governance or educational approaches need to changed should be included.
- A publication date shall be added and a list with all sources used in the brief needs to be included.

Examples of Policy briefs can be accessed directly in the ESMERALDA MAES Explorer at: http://www.maes-explorer.eu/page/116

2.5.3. White papers

A white paper is a persuasive, authoritative, in-depth report on a specific topic that presents a problem and provides a solution. Marketers create whitepapers to educate their audience about a particular issue, or explain and promote a particular methodology. They are advanced problem-solving guides.

Good white paper are based on:

- Catch people right off the beginning with the introduction. People's interest are raised, and they are informed what they are going to accomplish by reading your white paper. This means writing a summary of the white paper and including an organized list of topics.
- Writing a white paper is not the same as writing a blog. A business writing style is necessary. A white paper's length is at least 2-4 pages.
- White papers are great tools for generating credibility. It should be made sure that the white paper is organized and well thought out so that it will create a natural and genuine interest in the topic.
- Typically, whitepapers require at least an email address for download.

Examples of White papers can be accessed directly in the ESMERALDA MAES Explorer at: http://www.maes-explorer.eu/page/117

2.5.4. Relevant platforms and networks

In the following, a set of relevant platforms with the latest solutions that can help innovate and communicate scientific topics across Europe is provided.

The **Biodiversity Information System for Europe (BISE)** is a single entry point for data and information on biodiversity supporting the implementation of the EU strategy and the Aichi targets in Europe. Bringing together facts and figures on biodiversity and ecosystem services, it links to related policies, environmental data centres, assessments and research findings from various sources. It is being developed to strengthen the knowledge base in support of the implementation of the EU biodiversity strategy and the assessment of progress in achieving the 2020 targets.
https://biodiversity.europa.eu/

OPPLA is an open platform that is designed for people with diverse needs and interests - from science, policy and practice; public, private and voluntary sectors; organisations large and small, as well as

individuals. Its purpose is to simplify how we share, obtain and create knowledge to better manage our environment.
https://oppla.eu/

Science for Environment Policy is a free news and information service published by Directorate-General Environment, European Commission. It is designed to help the busy policymaker keep up-to-date with the latest environmental research findings needed to design, implement and regulate effective policies.
http://ec.europa.eu/environment/integration/research/newsalert/index_en.htm

For reaching further out, the following services can be harnessed:

- Eurekalert!: https://www.eurekalert.org/
- CORDIS Wire: https://ec.europa.eu/commission/index_en
- Horizon Magazine: https://horizon-magazine.eu/

2.5.5. Reach out to society

"Effective communication, better science." Scientific work benefits society but not all of it reaches a wide audience. In order to make valuable information visible to the world, it is necessary to raise scientific awareness around issues, research and outcomes. From providing tangible information to building and enhancing scientific interest, reaching out to society is crucial to increase the impact of science and connect it to the lives of people (Figure 6).

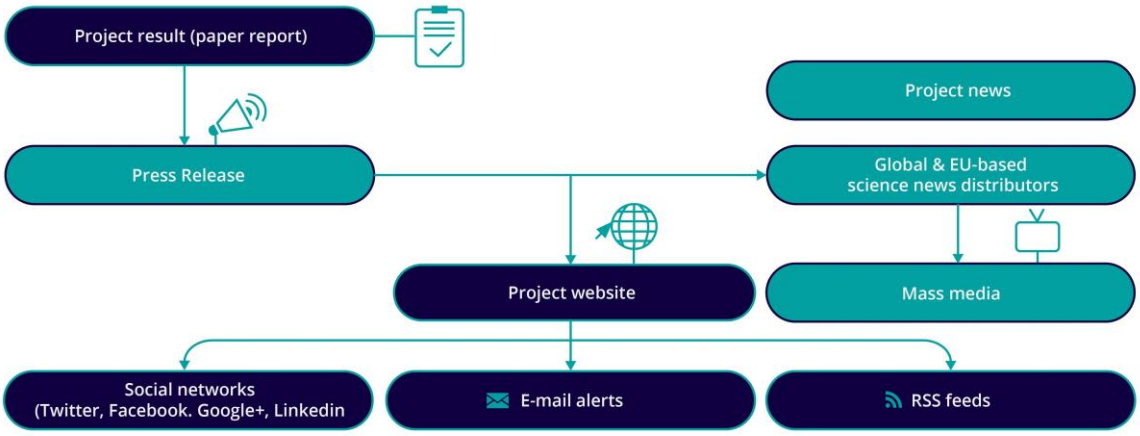

Figure 6: Exemplary pathway of a science-society interaction.

2.5.6. Press releases

A press release should be newsworthy to the audience and contain valuable information to the reader. It is intended for a wider audience of journalists and non-specialists, so the text shall be kept simple and technical terms and jargon be avoided. When writing a press release, the following should be considered:

- The title should be clear and concise for non-specialists. The title will always show up in RSS feeds and mailing lists, therefore it should be easily understandable and attractive.
- Using complex scientific terminology should be omitted where possible, since it provides a barrier for the general public to understand the text. Even if using scientific names is considered important, a vernacular name should be added as well.
- Where necessary, jargon should be explained.
- Quotes and links should be added. The quotes are usually a statement from the leading author(s). Links can be given for anything considered an important addition to the PR;
- A mention at the beginning of the text of the authors' names with their affiliations is considered standard practice. Linking the authors' and institution's names to their profiles and/or websites is also possible;
- The ideal size of the main body is approximately 2600 characters (with spaces). If the press release warrants a longer text, it is suggested that to post the complete version somewhere else and a link to it to be inserted into the PR, thus keeping it within the word limit. While a press release text length is always subject to individual consideration, it is strongly encouraged to keep it as concise, neat and simple as possible.

Examples of Press released papers can be accessed directly in the ESMERALDA MAES Explorer at: http://www.maes-explorer.eu/page/119

2.5.7. Blog posts

Creating a blog post is a way to reach out to broad audience outside traditional media and present scientific topics in an engaging way.

When writing a blog post, the following should be considered:

- To write in a captivating style, using active voice, images and quotes;
- Usage of storytelling, rather than academic writing;
- Putting a focus on why this is significant and what it means for the research field;
- To keep paragraphs short and not exceeding 800 words in general.

Examples of Blog posts can be accessed directly in the ESMERALDA MAES Explorer at: http://www.maes-explorer.eu/page/118

2.6. Implementation

The EU Horizon 2020 Support and Coordination Action ESMERALDA gained broad experience on how to implement MAES and its different components (including stakeholder involvement, mapping and assessment process, case study applications and results dissemination) in all EU member states and associated countries. Based on that experience, recommendations on MAES implementation can be provided related to the various ESMERALDA products and other relevant sources.

2.6.1. Implementation in policy and decision making

The ESMERALDA case studies cover various policy areas relevant at EU level: nature conservation; climate, water and energy, marine policy, natural risk, urban and spatial planning, green infrastructures, agriculture and forestry, business, industry and tourism, and health.

The following ESMERALDA case studies are good working examples of the implementation of ES mapping and assessment in different policy and decision-making contexts:

Italian case study - ES mapping and assessment for urban planning in Trento - ES mapping and assessment for urban planning in Trento: Initially scientifically driven, the aim of the study gradually shifted towards producing relevant knowledge to support the local administration in drafting the new Urban Plan for the city of Trento. Among other issues, the study produced a spatial analysis of key urban ecosystem services, and tested the use of this information to prioritise brownfields redevelopment, by comparing the benefits of alternative greening scenarios. The continuous interaction with stakeholders in the public administration during the process of ES mapping and assessment facilitated the consideration of the results into the ongoing urban planning process.

Latvian case study - Mapping marine ecosystem services in Latvia. It was performed within the development of the national Maritime Spatial Plan (MSP) for Latvian territorial waters and EEZ. The results were used to assess the possible impacts of different sea use scenarios, and to identify the optimum sea use solution from ecological and socio-economic perspectives, including suitable areas for locations of new uses - offshore wind farms and marine aquaculture farms. Moreover, the results are included in the strategic environmental assessment (SEA) of the proposed MSP solutions.

Polish case study - ES in Polish urban areas: Commissioned by the Ministry of the Environment, the main purpose of the study was to identify the spatial structures of ecosystems in the 10 largest urbanized areas in Poland and compare them in terms of their potential for providing services. The results of the study served to draw recommendations for spatial planning on local and sub-regional levels.

Swedish case study - ES mapping and assessment in the Vindelälven-Juhtatdahka river valley, northern Sweden: The mapping and assessment of ES has been put in the context of planning and implementing sustainable development across a large-scale biotic transition. The focus is on reindeer husbandry-related businesses aiming to integrate natural and cultural values in territorial planning. With the direct anchorage with the County Administrative Board of Västerbotten and the Municipality Boards involved in the UNESCO MAB-process, the study contributes to regional and local ES understanding and use as input data in territorial planning. This is crucial for exploring and solving conflicts, and understanding potential synergies between reindeer husbandry and other land uses.

More case study examples and information on applied ecosystem services mapping and assessment methods can be found in the ESMERALDA MAES Explorer: http://www.maes-explorer.eu/page/5

2.7. MAES implementation in EU Member states

The EU Horizon 2020 Support and Coordination Action ESMERALDA gained broad experience on how to implement MAES and its different components (including stakeholder involvement, mapping and assessment process, case study applications and results dissemination) in all EU member states and associated countries. Based on that experience, recommendations on MAES implementaton can be provided related to the various ESMERALDA products and other relevant sources.

The following ESMERALDA Deliverable reports provide relevant information on how to implement MAES in EU Member states and the states of MAES implementation in the different countries:

- D1.7 - Action 5 implementation plan (this report)
- D2.2 - Overview of gaps and recommendations
- D2.3 - Final Stocktaking of EU member state needs

All reports can be directly accessed via the ESMERALDA MAES Explorer: http://www.maes-explorer.eu/page/120.

A broad body of knowledge and initiatives relevant for implementation of MAES are available and can be used when implementing MAES in a country, region or case study. A selection of relevant links is provided here:

- EU Biodiversity Strategy: http://ec.europa.eu/environment/nature/biodiversity/comm2006/2020.htm
- MAES Working Group: http://biodiversity.europa.eu/maes
- European Commission Guidance on the implementation of ecosystem services (tbd)
- OpenNESS document library: http://www.openness-project.eu/library

3. Supporting material

The ESMERALDA MAES Explorer supports the implementation of Action 5 in EU Member states. It is a living library, linking and making ESMERALDA outcomes available online and open access. It has been launched at the final ESMERALDA project Conference in June 2018 in Brussels. A leaflet (Figure 7-8) was produced to introduce the Explorer and to provide a short overview of the “Establishment of operational on-line database and support mechanisms for EU MS authorities” (ESMERALDA Deliverable 2.4).

Figure 7: Leaflet (front side) introducing the ESMERALDA MAES Explorer (launched in June 2018).

Figure 8: Leaflet (rear side) introducing the ESMERALDA MAES Explorer (launched in June 2018).

Besides the ESMERALDA reports, also numerous Open Access publications have been produced by the ESMERALDA consortium. Many scientific articles were collected in the ESMERALDA Special Issue "Mapping and Assessing Ecosystem Services: Methods and Practical Applications" in the journal One Ecosystem.

4. Conclusions and outlook

The implementation of Action 5 of Target 2 of the EU Biodiversity Strategy is a complex process that involves many different aspects, people and approaches. ESMERALDA developed an implementation plan based on seven consecutive steps, beginning with relevant questions and the identification of stakeholders and continuing with the creation of a network and the activation of the stakeholders. Having the right people in the right place at the right time is significantly determining the success of a complex measure like Action 5/MAES. The next steps are related to the ecosystem services mapping and assessment process itself and present experience from the comprehensive reviews of relevant methods, their application in a broad set of real-world case studies and the experience collected during various cross-European thematic ESMERALDA Workshops. An appropriate and user-oriented dissemination and communication of (often complex) scientific findings is key for successful implementation in decision making – the last two steps of the ESMERALDA seven-step Action 5 implementation plan.

The plan forms the conceptual and structural base for the ESMERALDA MAES Explorer – an open access online tool that provides guidance on the process of mapping and assessment of ecosystems and their services to users from policy, science and society. All ESMERALDA public reports, case study fact sheets, methods application cards, the ESMERALDA MAES Methods Explorer and many other project outcomes are available open access from the ESMERALDA MAES Methods Explorer.

The ESMERALDA project will actually end in July 2018, but plans to maintain the pan-European and very active network and to keep its products alive have been elaborated in due course. In the frame of ESMERALDA Deliverable D2.5, a "Business plan to sustain network beyond ESMERALDA" was developed. The business plan acknowledges that implementing MAES and Action 5 requires a community of practise and stakeholders at national and EU levels, which involves policy, science and practice. The D2.5 report concludes that the Ecosystem Services Partnership ESP has relevant and proven capacity to create and maintain respective national networks, which can directly support MAES. The same reason was also important when ESMERALDA decided that the ESP online platform will be harnessed to host the ESMERALDA MAES Explorer and the ESMERALDA MAES Methods Explorer after the project has ended. The latter decision was taken after several meetings and discussions in the context of ESMERALDA Milestone 31 (Meetings with Stakeholders, e.g. DG ENV, EEA to discuss inter-operability of ESMERALDA outputs into OpenNESS/OPERAs Common Platform and BISE).

The implementation of Action 5 is not finished yet and there are further opportunities available to harness ESMERALDA outcomes and the network for supporting MAES. There are, for instance, two new EU projects starting in 2018: MOVE (Facilitating MAES to support regional policy in OVerseas Europe: mobilizing stakeholders and pooling resources) and MAIA (Mapping and Assessment for

Integrated ecosystem Accounting). MAIA is a new Coordination and Support Action on phase 2 of Action 5 on natural capital accounting. Both projects will have access to ESMERALDA outcomes and can build their respective MAES implementation activities on the outcomes.

5. Acknowledgements

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6. References

Burkhard B, Maes J (Eds) (2017) Mapping Ecosystem Services. Advanced Books. https://doi.org/10.3897/ab.e12837

Drakou, E.G., N.D. Crossman, L. Willemen, B. Burkhard, I. Palomo, J. Maes, S. Peedell (2015) A visualization and data-sharing tool for ecosystem service maps: Lessons learnt, challenges and the way forward, Ecosystem Services. Available at http://dx.doi.org/10.1016/j.ecoser.2014.12.002

Grêt-Regamey, A., B. Weibel, S-E. Rabe & B. Burkhard (2017) A tiered approach for ecosystem services mapping, In: Burkhard, B. & J. Maes (Eds.): Mapping Ecosystem Services. Pensoft Publishers, Sofia: 213-217.

Hein, L., van Koppen, K., de Groot, R.S., van Ierland, E.C. (2006) Spatial scales, stakeholders and the valuation of ecosystem services. Ecological Economics 57:209-228. doi:10.1016/j.ecolecon.2005.04.005

Maes J, Liekens I, Brown C (2018) Which questions drive the Mapping and Assessment of Ecosystems and their Services under Action 5 of the EU Biodiversity Strategy? One Ecosystem 3: e25309. https://doi.org/10.3897/oneeco.3.e25309

Weibel B, Rabe S, Burkhard B, Grêt-Regamey A (2018) On the importance of a broad stakeholder network for developing a credible, salient and legitimate tiered approach for assessing ecosystem services. One Ecosystem 3: e25470. https://doi.org/10.3897/oneeco.3.e25470