Report from Workshop on 'Customisation of CICES across Member States'

Held at European Environment Agency (EEA)

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Milestone 19

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with contribution from

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1. Aim of the workshop and background

The aim of the workshop was to take stock of the experience gained in using the current version of the Common International Classification of Ecosystem Services (CICES V4.3) for accounting, mapping and assessment, and to advise on the objectives for any future revision and the development of guidelines to help people apply it effectively within the context of ESMERALDA and the EU MAES process ('Mapping and Assessment of Ecosystems and their Services'). The workshop drew on the interim results from the current consultation on CICES that was due to be completed in April 2016. The survey has been designed to help draw out key user input for further developing CICES, given that the current version was published in 2013 and that considerable experience had now been built up in the user community. The aim of the meeting was therefore to use the initial outcomes of the survey to help define some of the options that can be developed in any future revision of CICES, and to identify how changes could help meet user needs. The meeting also aimed to scope the kinds of guidelines that might be needed to support the use of CICES (more information can be found in the background paper circulated before the workshop in Appendix 1)

The workshop was organised by University of Nottingham (WP4 leader on Ecosystems Service Assessment Methods) and hosted by the European Environment Agency. This report constitutes Milestone 19 for the ESMERALDA Project. Eighteen experts from ten different European countries attended the meeting; they included members of the ESMERALDA consortium as well as members of the wider ecosystem service community; all had some experience in using CICES or had worked on classification issues (Appendix 2 for details).

2. Structure of the Workshop

The workshop focused on two main areas for discussion. The first sought to draw on the experience of using CICES by those attending the meeting, and to reflect on some interim results from the on-going survey of CICES applications. The second looked at CICES as an indicator framework and some of the key messages that can be taken forward in developing guidelines for using the current or revised version of the classification in the future. These two areas provide the structure for this report.

A copy of the full workshop agenda is provided in Appendix 3. Copies of the presentations made at the workshop are found in the appendix 7):

3. Using CICES: building on experience

3.1. Initial presentations and briefings

The focus of the workshop on CICES, and the experience that people have had in using it, arose because it has been adopted as the ecosystem service classification framework to be used in MAES. In ESMERALDA the ambition is to use the classification to develop the contextual framework based for communicating ecosystem service issues within the user community, and in particular to help document the range of mapping proxies and metrics that can be used for mapping and assessment purposes (ESMERALDA DoA). The workshop was held at roughly mid-way in the user survey for CICES so as to reflect on some key issues and strategies as part of the build-up to the later workshops in ESMERALDA that will develop and test assessment frameworks.

Roy Haines Young presented some interim outcomes from the CICES survey. At the time of the meeting roughly 100 people had responded. The majority said they were working in the area of 'mapping and ecosystem assessment' purposes; roughly two-thirds said they were CICES users. Amongst those who did not use CICES in their work, the typologies of the MA and TEEB were the most frequently cited alternatives.

Amongst those who used CICES the responses suggested that most people found CICES relatively simple to use. When asked to identify its advantages the key characteristics were regarded as its clarity, detail, coverage, the opportunity if offered for standardisation, and the conceptual framing provided by the ecosystem services cascade model. The disadvantages that were identified included:

- the difficulty of separating ecosystem functions from services;
- difficulties of application in an ecosystem service accounting framework;
- its complexity;
- apparent difficulties of application in place-based studies;
- ambiguity of the naming and classification of cultural services; and,
- the fact that the boundary between ecosystem and human production processes is not always clear.

Given that these were interim results it was not appropriate to consider them too much in detail, but instead reflect on whether these kinds of strengths and weaknesses were also identified by those attending the workshop and what attendees thought might be helpful in any future revision. This theme was taken up by **Erik Stange**, who reported on his work with case study partners in the OpenNESS Project[1], which had also adopted CICES as common ecosystem service classification framework.

The work in OpenNESS has sought to examine whether the CICES terminology and structure was found to be adequate, or whether the case studies needed to devise their own classification. It has also sought to identify what indicators the case studies have used to assess ecosystem services stocks and flows, benefits, beneficiaries, values etc. and how these fitted into the CICES framework. It was found that some case studies have relied heavily on CICES at the earliest stages as a tool for identifying ecosystem services at class level for their study area, and then afterward mostly as a

[1] http://www.openness-project.eu/

reference. Other case studies have used it for standardization in a research context, but not as a communication tool with stakeholders.

Echoing the results of the survey, it was found that the OpenNESS case studies also indicated that there were difficulties surrounding the classification of cultural ecosystem services because measurable attributes did not align well with the CICES classes. There was particular difficulty in distinguishing between experiential and physical use of setting and species. In addition there were some semantic conceptual issues related to the use of the term 'culture' for some case studies, who argued that to some extent ***all*** services have a cultural dimension.

A key finding from the OpenNESS study was that a variety of metrics were used to measure services, and that they often involved indirect, rather than direct measures of services. These indirect (proxy) measures were often used, for example, to quantify stocks and flows, or benefits rather than services; the OpenNESS work highlighted the use of the cascade model in this context.

The need to consider how different kinds of metrics could be associated with each service class in CICES was an issue that was also considered in the internet survey reported on by Roy Haines-Young. The interim results suggested that the majority of respondents would find it helpful if the classification of services was linked to typologies for benefits and beneficiaries, as well as to ecological functions. The survey also highlighted that there was a need for providing examples of how services are measured at class level.

In a final briefing before the breakout groups, Eva **Royo Gelabert** provided some insights in the use of CICES in the marine context; a copy of her background paper is provided in Appendix 4. In summary many of the points made echoed those in the other presentations. There was a need, for example, to clarify the distinction between underpinning ecological functions (intermediate services) and services delivered by marine ecosystems, and the distinction between benefits and services. It was also noted that a number of the services listed in CICES were not relevant for the marine environment, and so customisation was needed when using the classification in this context. There was also a need to look at the hierarchical nature of the classification and the way it references marine processes and especially their capacity to supply ecosystem services. Work on CICES in the marine realm/context also highlighted a potential problem with the 'dual nature' of CICES (assessment and accounting) that seems to lead to the exclusion of too many (intermediate) services (i.e. ecological functions) that were in this sense not 'accountable'; this was considered to prevent a meaningful assessment of core functions of natural capital.

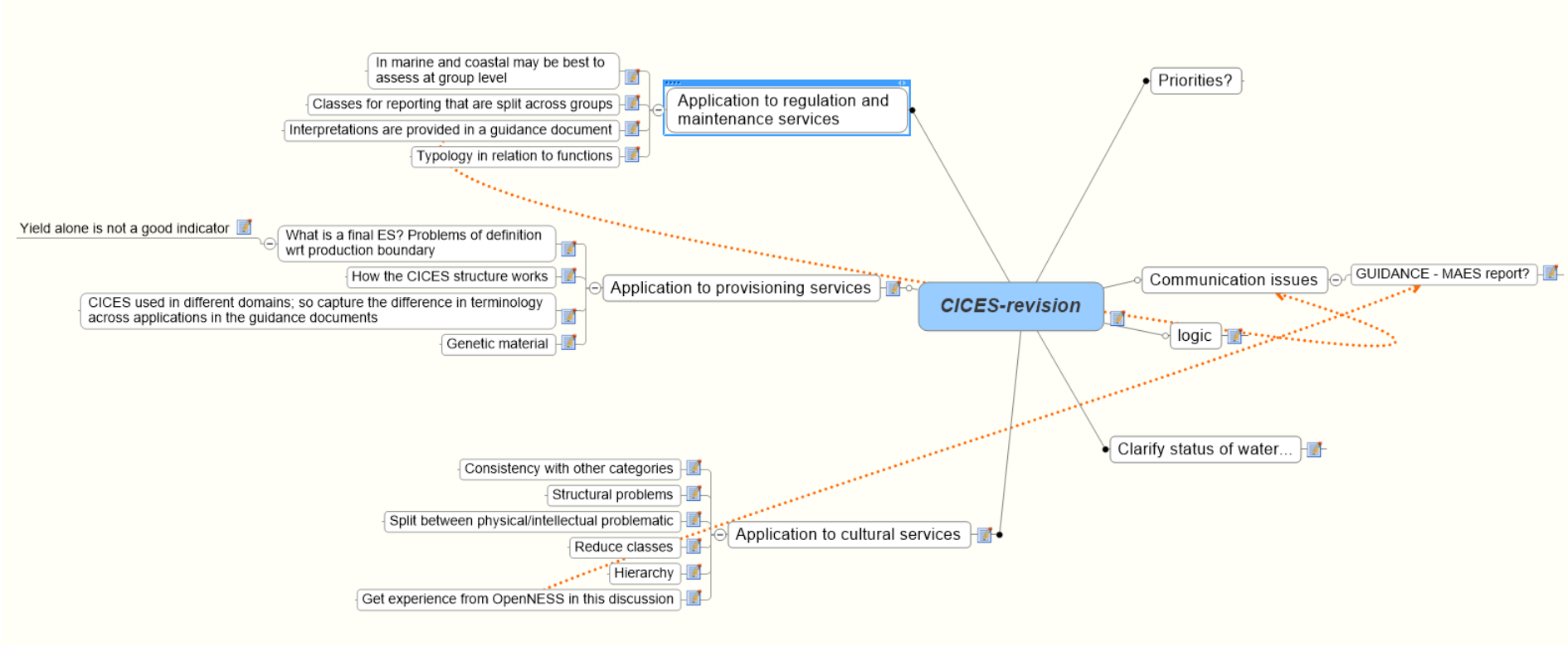
3.2. Breakout sessions and their outcomes

Following the initial round of discussion three breakout sessions were organised to consider the structure and logic of CICES; provisioning, regulation and maintenance and cultural services were considered in separate groups. The outcomes are summarised in the mind-map shown in Figure 1. This Figure provides the main heading for the summary that follows. Full notes on the mind map are found in Appendix 5. The key points that emerged from the breakout session were:

- That all three groups identified the need for better guidance in using CICES both in its current form and especially if there is a revision. It was suggested that any guidance could usefully be provided in the form of a MAES report rather than a specific ESMERALDA product.

- In terms of ***provisioning services*** it was noted:
    - that many people start at the class level rather than the groupings at the higher levels in the hierarchy, and so there should be some attempt to make the descriptors less abstract. It was also suggested that it should be recognised that the classification is used in different domains and so there should be some attempt to reflect this in potential alternative terminologies; for example there might be scientific descriptors as well and more popular terms as equivalents;
    - that it was sometimes difficult to construct production functions as well as specifying the production boundaries. One solution that was suggested involved looking at the ration of energy input to energy output, as a way of estimating the contribution that 'nature' has made to an ecosystem output. This approach might provide a short-cut in constructing a production function in terms of identifying the 'contribution of nature'; and
    - that CICES needed a numbering system to make it easier to use.
- For ***regulation and maintenance services***, it was noted that:
    - it might be useful to make guidance context- (biome) specific – e.g. guidance for marine applications; have examples of services per biome;
    - the place of water in the classification needed to be clarified in any guidance;
    - in the marine context assessments might best be made at the group level and so better guidance was needed here also; and
    - in the marine context, do not remove services that are potentially 'intermediate' even if the goal is to focus on 'final services'.
- For ***cultural services***, it was noted that:
    - there was a pressing need to clarify the terminology in relation to the service/benefit distinction;
    - the cultural dimension of all services needed to be explained as part of clarifying what cultural services are;
    - the split between physical and intellectual at the group level was unclear, and that some other formulation such as 'proximal' and 'remote' interactions might be more helpful; scale might provide another potential approach;
    - in terms of definitions it was suggested that it might be worth stressing that these kinds of service ***shape*** our cultural environment, and that in terms of descriptors 'active' or 'doing' terminology might be used; and
    - the hierarchy in relation to cultural services may need to be reconsidered – the question was posed as to whether it had to follow the kind of structure used for the other sections.

Figure 1: Mind map summarising reports from first breakout session (Further notes in Appendix 5)



4. Using CICES as an indicator framework

4.1. Initial presentations and briefings

The initial presentations focussed on reviewing the ways in which CICES was being used to create indicator frameworks or metrics that could be used in mapping and assessment work.

Fernando Santos Martín provided a summary of the results of a survey that had been made in the context of ESMERALDA, which was designed to look at how member states were approaching the mapping and assessment challenges, and in particular where the emphasis of work lay; about 60 case studies have been looked at (See Appendix 7 for presentation; see also Milestone 15 of ESMERALDA[2]). It was found that not only did methodologies of mapping and assessment vary across Member States, but also that knowledge of the ES concept and classification systems used differed. However, in terms of the classification system used CICES was the most frequently applied. Regional scale applications were also the most common. In terms of the focus of the studies the majority (49%) looked at the biophysical dimension and on the capacity of ecosystems to supply services.

The survey used CICES to identify which services were being assessed most widely. Within provisioning the top three were cultivated crops, fibres & other materials and ground water. For regulating and maintenance services the most common were global climate regulation, flood protection and filtration/sequestration. Within the cultural services section the most frequently assessed were aesthetic, physical use of landscape and seascapes, and heritage.

Assessments tended to use a mix of qualitative *and* quantitative measures of service outputs. The range of indicators based on CICES that were identified within MAES were reviewed, and it was suggested that while many are available, only few of them could be used for reporting under Action 5 of the EU Biodiversity Strategy. In terms of the general conclusions that could be drawn for CICES, however, it was noted that:

- The use of CICES is less evident for marine or freshwater ecosystems. Some conceptual difficulties can be encountered for example in regulating services;
- There are few good quality indicators that correlate with CICES, all the rest are proxies;
- When assessing one ecosystem, CICES users refer to other ecosystems as providers of the services (i.e. ground water). It might be necessary to develop an integrated approach across connected ecosystems;
- Difficulties in distinguishing between the supply and the demand side of ecosystem services classification;
- It seems also difficult to include some indicators that are more associated to ecosystem functions and ecosystem benefits. It might be useful to integrate these dimensions in CICES; and
- Maybe CICES should also clearly acknowledge other uses than accounting.

[2] Santos-Martin F. et al. (2016): Individual consortium interviews to assess the status of their mapping and assessment activities Milestone 15. EU Horizon 2020 ESMERALDA Project, Grant agreement No. 642007.

Laura Mononen provided an overview of the work undertaken in Finland on National Ecosystem Service Indicators to Promote Sustainable Use of Ecosystems, which has used the cascade model and CICES as its framework (see Appendix 7). CICES was used to identify the nationally most relevant ecosystem services; altogether 28 ecosystem services were selected; it was found that CICES included many ES groups that were not applicable in Finland, but that it did provide a list from which a relevant set could be identified. The study was of particular interest in the context of the workshop because it showed how a range of proxy measures across the ecosystem service cascade could be used to make an integrated assessment of each service, and that indeed an integrated approach was necessary to get a full picture of the status and trend of the service. The way the approach has been operationalised through a web-based tool[3] was described. In terms of taking the work forward, the role of Essential Biodiversity Variables (EBVs) from Earth Observation data are being considered as a way to monitor biodiversity and ecosystem services.

In the final background presentation **Christian Albert** (see Appendix 7) reviewed the experience of using CICES in Germany in the context of the scoping work for a German National Ecosystem Assessment (NEA-D) as well as TEEB-DE, the work on indicator development, assessment and valuation of cultural ecosystem services, and the development of a River Basin Ecosystem Services Index. All the applications represent work at the science-policy interface and concern assessment rather than accounting issues. It was found that CICES was able to support the selection of indicators and services as a reference classification. However, a number of issues were identified, including the blurring of the boundary between services and benefits, the distinction between stock and flow measures, and the apparent overlap between provisioning and regulating services in the context of water. The presentation moved on to consider the need for indicators more generally, and the point was made that it is useful to differentiate potential from actual supply, and to clarify the role of expert-based approaches and uncertainties in situations where there is insufficient information. In the more specific context of any revision of CICES it was suggested that key issues that might be addressed included resolving the problem of human input in relation to provisioning services (i.e. clarification of the production boundary issue); the interactions between provisioning and regulation and maintenance services; and, in the context of cultural ecosystem services clarification around the strong influence of human inputs. For cultural ecosystem services it is suggested that there is a need for visual landscape metrics plus separate indicators for landscape capacities to provide opportunities for specific activities.

4.2. Breakout sessions and their outcomes

In the breakout sessions that followed people were asked to consider CICES from the perspective of providing an indicator framework, and to reflect further on what kind of revision might be needed for the future; as before the groups were split between provisioning, regulating and maintenance and cultural services but in the reports back rapporteurs were asked to reflect on cross-cutting issues that could inform the next stages of work. The outcome is summarised in Figure 2 (full notes of the session are found in Appendix 6):

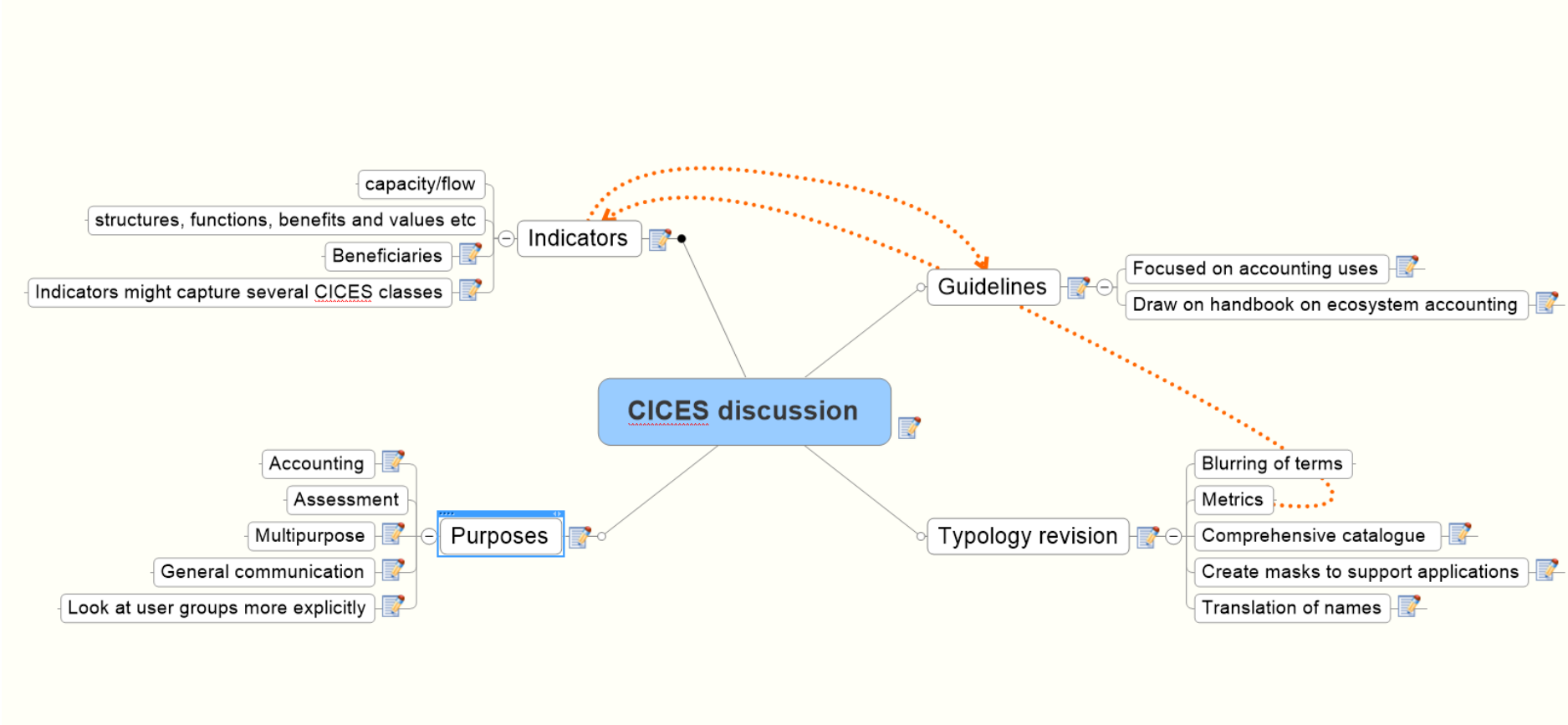
- **Typology revision:** the discussion confirmed that there was a need for revision of the current version of CICES, or at least the clarification of terms etc. so that it can be applied more easily; for example in the area of carbon sequestration (a function) and global climate change

[3] http://www.biodiversity.fi/ecosystemservices/

regulation (a service). The blurring of terms is a particular issue that needs to be worked on. It was suggested that it would be worthwhile looking again at how other classifications handled such issues, particularly where linkage or integration of systems/information was needed; for example in relation to the IUCN classification of protected areas. It was felt however, that the role of CICES as a translator should be maintained and strengthened, and that perhaps it could also help translate between application contexts as well as between ecosystem service classification systems. The idea of 'application masks' was suggested as an option in relation to this; there could for example be 'CICES masks' that could be applied in different biomes (e.g. marine) as well as different types of application (e.g. accounting, assessment etc.).

- **Indicators:** in terms of using CICES as an indicator framework, it was generally confirmed that while ecosystem services are the focus, indicators across the range of variables included in the cascade, for example, would be needed in different applications and that their relation to the CICES classes could be clarified. There was a particular need to help people differentiate or assess ecosystem service supply and demand metrics. However, it was suggested that if indicators are suggested it should be stressed that they are <u>not</u> part of the definition of the service, and only represent examples; in this sense the CICES should not be presented as a comprehensive indicator framework. People should be able to apply CICES independently of any indicator framework.

Figure 2: Mind map summarising reports from second breakout session (Further notes in Appendix 6)



- **Purposes:** while it was recognised that CICES can support a variety of different tasks (accounting, assessment, communication, scoping), it was argued that its origins lie in the EU/EEA accounting work, and the needs accounting work at EU-level and the UN system of environmental-economic accounting (SEEA EEA) need to be considered; any revision should ensure that as a minimum, the ability to support accounting applications was maintained. There was some concern that the focus on accounting might make CICES to restrictive and undermine its multi-purpose use. However, it was stressed that accounting is much more than monetary valuation, and that applications linked to biophysical and social measures can be supported, and this could be emphasised in any set of guidelines.
- **Guidelines:** a key message to emerge from all discussions was the need to provide guidelines to users of CICES. In many respects some of the current problems of application arise from the lack of guidelines for the current version. The strong recommendation from the group was that rather than developing the guidelines ***after*** the revision process had been completed, the development of guidelines should be seen as ***part of*** that processes of revision. In this way issues could be identified early on and strategies for overcoming them presented in a more transparent way. It was recommended that the work undertaken by the EEA and ESMERALDA in the short term should provide a 'road-map' for the development of these guidelines. Although the guidelines might eventually be published as a MAES Report, it was felt that web-based support was probably also needed.

5. Conclusions

While this workshop is part of a wider process that will lead to recommendations for the revision of CICES, its key conclusions about the importance of guidelines, and the contribution that developing those guidelines would make to the revision process itself, is a valuable and significant one. The group saw that the work on the guidance document during 2016 could be a way of taking thinking about CICES forward. The idea of also making the guidelines specific to different application contexts was valuable. In the longer term the group felt that there was potential for using CICES operationally as a database tool, and as a way of developing integrated applications across a number of different areas. Thus in revising CICES and preparing guidance its role as a way of communicating ideas in a general way especially for stakeholders etc. should not be overlooked, and that an attempt should be made to design it around different layers of complexity to suit different purposes (underpinned by multiple-nomenclatures and mapping of correspondences etc.).

6. Acknowledgements

The organisers and the ESMERALDA consortium gratefully acknowledge the support that the EEA provided hosting this workshop.

Appendices

Appendix 1: "Categorisation systems: The classification challenge" A background paper by Roy Haines-Young and Marion Potschin

Appendix 2: Participants list of workshop

Appendix 3: Invitation and Agenda of workshop

Appendix 4: "Customisation' of CICES for the marine environment". Internal paper building on material commissioned by the European Environment Agency, March 2016, European Environment Agency. Summary by E. Royo Gelabert

Appendix 5: Notes on the mind map from the first breakout session (Figure 1)

Appendix 6: Notes on the mind map from the second breakout session (Figure 2)

Appendix 7: **Presentations**

A7.1 Roy Haines-Yung

A7.2 Erik Stange

A7.3 Fernando Santos Martín

A7.4 Laura Mononen

A7.5 Christian Albert

A7.6 Benjamin Burkard

Appendix 1:
Categorisation systems: The classification challenge

Roy Haines-Young and Marion Potschin[4][5]

Introduction

Categorising and describing ecosystem services is the basis of any attempt to measure, map or value them. It is the basis of being transparent in what we do, so that we can communicate our findings to others, or test what they conclude. So fundamental is the need to be clear about how we classify ecosystem services that it might seem that it is an issue that must be already well and truly resolved. The aim of this chapter is to suggest that this might, in fact, not entirely be the case, and that the way we categorise ecosystem services is something that still represents a challenge.

A number of different typologies, or ways of classifying ecosystem services are available, including those used in the *Millennium Ecosystem Assessment* (MA) and *The Economics of Ecosystems and Biodiversity* (TEEB), and a number of national assessments, such as those in the UK, Germany and Spain. The problem with them is that they all approach the classification problem in different ways, and so they are not always easy to compare. In order to try to partly overcome this 'translation problem', the *Common International Classification of Ecosystem Services* (CICES)[6] was proposed in 2009 and revised in 2013 (Haines-Young and Potschin 2013; Potschin and Haines-Young 2016). This represents yet another way of categorising services. This chapter will draw on our experience in developing CICES, not to argue that it is better than any other system, but to reflect on the difficulty of designing a classification system that is simple and transparent to use. We will argue that the problem of classification is still worth working on – and it is certainly not something that can be taken for granted. We would encourage everyone to think about it when they embark on any kind of analysis involving ecosystem services. The conclusion that we would like to advance is that the ecosystem service community probably need to develop a number of different classifications or typologies that can be used to name and describe all the elements in the cascade that we described in Chapter 2.3, namely: the ecosystem or habitat units that give rise to the ecosystem services of interest, the ecological functions that are associated with them, as well as the benefits and beneficiaries whose well-being is dependent on the output of services, and of course the values that people assign to these benefits.

What are ecosystem services?

Many people work with the definition of ecosystem services used in the MA which describes them simply as the benefits that ecosystems provide to people (MA, 2005). Others, however, follow the definition of TEEB which views them as the direct and indirect *contributions* of ecosystems to human well-being (De Groot et al., 2010). If we read these definitions carefully then it is clear that they are

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[4] If you use this briefing paper – please cite as Haines-Young, R. and M. Potschin (2016): Categorisation systems: The classification challenge. CEM working Paper No 15. Available at: http://www.nottingham.ac.uk/cem/WorkingPapers.html. A much shorter version will be published in Burkhard, B. and J. Maes: Mapping Ecosystem Services, Pensoft (to be published 2016)

[5] Centre for Environmental Management, School of Geography, University of Nottingham, Nottingham NG7 2RD, UK and Fabis Consulting Ltd., The Paddocks, Chestnut Lane, Barton In Fabis, NG11 0AE, UK.
Corresponding author: Roy.Haines-Young@Nottingham.ac.uk

[6] www.cices.eu

quite different in terms of what they take services to be: according to TEEB, services *give rise* to benefits, whereas or the MA they are the same thing. To add to this confusion we might note that both categorisations take the ideas of 'services' and 'goods' to be synonymous. Unfortunately, not everyone follows looks at things in his way. For example, in the UK National Ecosystem Assessment (UK NEA) (Mace et al., 2011), 'goods' and 'benefits' are taken to be identical, representing categories of things that people assign value to; they taken to be quite distinct from services, which are seen as the ecosystem outputs from which goods and benefits are derived (Mace et al., 2012).

Do these differences in the way we categorise ecosystem services, goods and benefits really matter? Well, it depends on one's perspective. Some have argued that one of the important characteristics of the field of ecosystem services is that many different disciplines have come together to explore the insights that the concept offers for understanding the relationships between nature and society. It is this diversity that explains the different approaches that people have taken to categorising ecosystem services. They have also argued that the multiple interpretations that people bring to the concept is especially important, because it is a 'boundary object', that is an idea that can be adapted to represent different perspectives while retaining some sense of continuity across these different viewpoints (Abson et al., 2014).

Boundary objects are especially important in multi- or trans-disciplinary situations, because they create the space in which novel discussions and research interactions can occur. The dynamic, multi-faceted nature of the ecosystem service community is certainly part of its fascination. However, these 'boundary objects' are not much use when it comes to the problem of naming, describing and measuring things apparently as fundamental as 'ecosystem services'. When we start to think about this issue, then we start to appreciate the alternative perspective on the problem of whether the differences in the way differences in the way we categorise ecosystem services, goods and benefits really matters. This is the one that we will explore in the rest of this chapter.

The Common International Classification of Ecosystem Services (CICES)

CICES has not solved all the problems of categorising ecosystems services, but it is a useful framework against which the problems of categorisation can be discussed. However, before we do so, its basic structure and approach needs to be described. The classification is shown in Table 1.

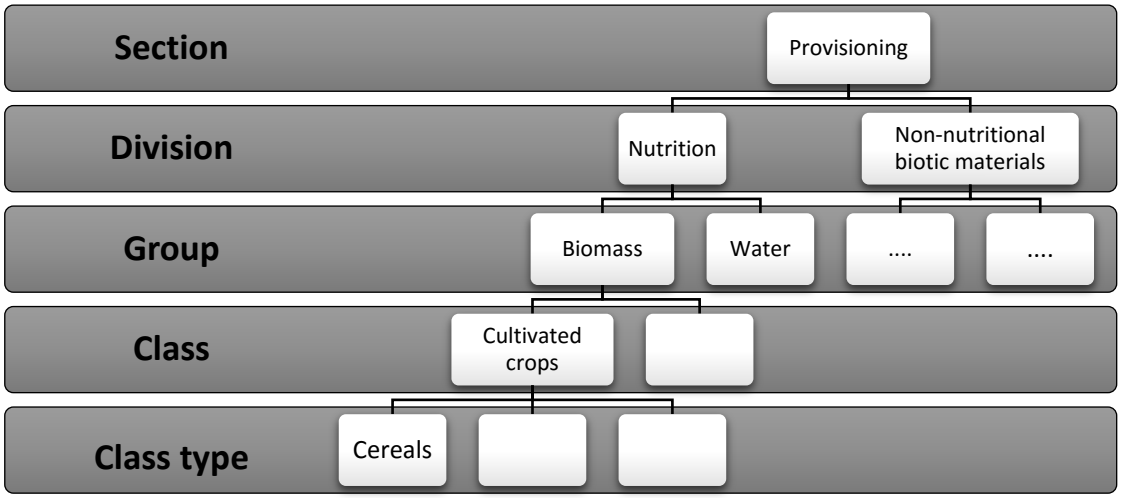
CICES was original developed as part of the work on the system of integrated environmental and economic accounting (SEEA) led by the United Nations Statistical Division (UNSD), but it has been used by the wider ecosystem services community to help define indicators of ecosystem services, or map them. In designing it the intention was to provide a way of characterising 'final services', namely those that sit interface between ecosystems and society. In this sense it follows the definition used in TEEB, namely that these final services are the things from which goods and benefits are derived. However, it did try to use as much of the terminology that was already widely employed, and so used the categorisation of 'provisioning', 'regulating' and 'cultural' services that were made familiar by the MA and an overarching framework.

Table 1: The Common International Classification of Ecosystem Services (CICES, V4.3)

CICES V4.3					
Section	**Division**	**Group**	**Class**	**MA**	**TEEB**
Provisioning	Nutrition	Biomass	Cultivated crops	Food	Food
			Reared animals and their outputs		
			Wild plants, algae and their outputs		
			Wild animals and their outputs		
			Plants and algae from in-situ aquaculture		
			Animals from in-situ aquaculture		
		Water	Surface water for drinking	Water	Water
			Ground water for drinking		
	Materials	Biomass	Fibres and other materials from plants, algae and animals for direct use or processing	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources
			Materials from plants, algae and animals for agricultural use		
			Genetic materials from all biota	Genetic materials	Genetic materials
		Water	Surface water for non-drinking purposes	Water	Water
			Ground water for non-drinking purposes		
	Energy	Biomass-based energy sources	Plant-based resources	Fibre	Fuels and fibres
			Animal-based resources		
		Mechanical energy	Animal-based energy		
Regulation & Maintenance	Mediation of waste, toxics and other nuisances	Mediation by biota	Bio-remediation by micro-organisms, algae, plants, and animals	Water purification and water treatment, air quality regulation	Waste treatment (water purification), air quality regulation
			Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals		
		Mediation by ecosystems	Filtration/sequestration/storage/accumulation by ecosystems		
			Dilution by atmosphere, freshwater and marine ecosystems		
			Mediation of smell/noise/visual impacts		
	Mediation of flows	Mass flows	Mass stabilisation and control of erosion rates	Erosion regulation	Erosion prevention
			Buffering and attenuation of mass flows		
		Liquid flows	Hydrological cycle and water flow maintenance	Water regulation	Regulation of water flows, regulation of extreme events
			Flood protection	Natural hazard regulation	
		Gaseous / air flows	Storm protection		
			Ventilation and transpiration		
	Maintenance of physical, chemical, biological conditions	Lifecycle maintenance, habitat and gene pool protection	Pollination and seed dispersal	Pollination	Pollination
			Maintaining nursery populations and habitats		
		Pest and disease control	Pest control	Pest regulation	Biological control
			Disease control	Disease regulation	
		Soil formation and [illegible]	Weathering processes	Soil formation (supporting services)	Maintenance of soil fertility
			Decomposition and fixing processes		
		Water conditions	Chemical condition of freshwaters	Water regulation	Water
			Chemical condition of salt waters		
		Atmospheric composition and climate regulation	Global climate regulation by reduction of greenhouse gas concentrations	Atmospheric regulation	Climate regulation
			Micro and regional climate regulation	Air quality regulation	Air quality regulation
Cultural	Physical and intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings]	Physical and experiential interactions	Experiential use of plants, animals and land-/seascapes in different environmental settings	Recreation and ecotourism	Recreation and tourism
			Physical use of land-/seascapes in different environmental settings		
		Intellectual and representative interactions	Scientific	Knowledge systems and educational values, cultural diversity, aesthetic values	Inspiration for culture, art and design, aesthetic information
			Educational		
			Heritage, cultural		
			Entertainment		
			Aesthetic		
	Spiritual, symbolic and other interactions with biota, ecosystems, and land-/seascapes	Spiritual and/or emblematic	Symbolic	Spiritual and religious values	Information and cognitive development
			Sacred and/or religious		
		Other cultural outputs	Existence		
			Bequest		

In CICES provisioning services are the material and energetic outputs from ecosystems from which goods and products are derived. Regulating services categories all the ways in which ecosystems can mediate the environment in which people live or depend on in some way, and benefit from them in terms of their health or security, for example. Finally, the cultural category identified all the non-material characteristics of ecosystems that contribute to, or are important for people's mental or intellectual well-being. As Table 1 shows, CICES is hierarchical in structure, splitting these major 'sections' successively into 'divisions', 'groups' and 'classes'. Figure 1 illustrates how this works.

Figure 1: The hierarchical structure of CICES illustrated with reference to a provisioning service (cultivated crops - cereals) (after Potschin and Haines-Young, 2016).



The hierarchical structure was designed to deal with the fact that in working with ecosystem services different people were working at different thematic and well as spatial scales; with this kind of structure it was intended that users could go down to the most appropriate level of detail that they require, but then group or combine results when making comparisons or more generalised reports. There was also an attempt to make it more comprehensive than the classifications used by the MA or TEEB, and so include categories such as biomass based energy that were not explicitly included in these typologies. The broader range of categories at the detailed class level was intended to enable translations between different systems to be made; a simple prototype tool for helping people cross reference some of the more widely used classification systems has, for example, now been developed[7]. Table 1 also shows the equivalences between CICES and the MA and TEEB categories.

In order to build a generally applicable classification the higher categories in CICES were intended to be exhaustive, in the sense that they were sufficiently general to cover all the things that people recognise as ecosystem services in the broadest sense. We recognised from the outset, however, that the system also ought to be open-ended to allow users to nest what was particularly relevant to them into the system at some level. Thus the class types were not specified; instead the assumption

[7] Available at: http://openness.hugin.com/example/cices

was that, given the general structure, users could place the specific things that they were measuring or interested into one of the existing classes.

Facing the Challenges of Categorisation

As we argued in our introduction, it is not our intention here to 'sell' CICES as *the* way to categorise ecosystem services. Rather it was our intention to daw on the experience of developing the current version to highlight the challenges that the task of classifying ecosystem services still poses.

The first challenge working on CICES showed us how difficult it is to categorise 'final ecosystem services'. These according to Boyd and Banzaf (2007) are the 'end-products of nature', who argue that it is important to define them clearly to avoid the problem of 'double counting' when we value; more formally these authors suggest they 'are components of nature, directly enjoyed, consumed, or used to yield human well-being'. The implication is that we should avoid trying to value the processes or ecosystem components that underpin them, not because they are unimportant, but because their value is already embodied in this final output. The difficulty this posed when working on CICES was that it was clear that, to some extent, what constituted a final service was context dependent. Take the cases of the regulating service categorised in CICES as 'pollination'. On the face of it, it looks like a things that has more of an underpinning or supporting role rather than being a 'final service'. However, on closer scrutiny the answer is 'it depends'; certainly *pollination* it an important input to a number of provisioning services such as fruit production. However, encouraging *pollinator species* in our gardens, whether they benefit us by pollinating our fruit or not, can also be regarded as a final service. In this context, pollinators are another iconic group of species that we want to conserve or encourage, like farmland birds, for example. The point here, in relation to CICES is that the list of services in the classification are more a set of *potential* final services and whether they are or are not has to be determined by the circumstances in which the classification is being applied. There probably is no definitive list of things that we can unambiguously categorise as 'final services'. Any future version of CICES would have to help people navigate some of these issues when they seek to describe and measure ecosystem services.

A second challenge that we faced in designing CICES, and which would have to be resolved by those designing any alternative, concerns the scope of any classification. During the consultation processes that gave rise to CICES there was considerable debate about whether abiotic ecosystem outputs like wind or hydropower, or minerals like salt, should be categorised as 'ecosystem services'. In the end, the augment that the category 'ecosystem services' should be restricted to those ecosystem outputs that were dependent on living processes won the day. The telling point was that a key feature of the concept was that it helps make the case for the importance of biodiversity, and to include other things that are not dependent on living processes would dilute it. The problem is, of course, that these abiotic ecosystem outputs are not unimportant, discussion of them will still involve trade-offs etc., and in any case lay people often do not see the different between these products of nature and those dependent on biodiversity.

The point about scope that can be illustrated from the example of CICES is that to some extent these kinds of decision are arbitrary, and have to be guided by the kinds of purposes that people want to apply the system too. The arbitrary nature of these decisions is illustrated, for example, by the place of water in CICES. Water is indeed an abiotic ecosystem output – but it is included in the classification as a provisioning service. Water quantity and quality of water can be *regulated* by living

processes and these kinds of thing ought to feature somewhere in the classification. However, strictly speaking living processes do not 'produce' water, and so it probably be in the classification as a provisioning service. However, the people consulted felt it was too important not to be included.

The final challenge that we encountered in designing CICES that is worth sharing, is the difficulty that people have (including us sometimes) in distinguishing services and benefits. The distinction is a difficult one to make because it involves deciding where the 'end-product of nature' is transformed into a good, product or benefit as a result of human action of some kind. Take the case of crops standing in a field. In CICES, these would be regarded as a final ecosystem service because they are still connected to the ecological processes associated with the farmed landscape that produced them. That crop can then be turned into a product by harvesting it; in other words the end-product of nature crosses what could be terms the 'production boundary'. While many ecosystem service applications also regard crops in a field as examples of a provisioning service, this is at odds with those developing accounting applications. According to the concepts underpinning the System of Integrated Environmental and Economic Accounts (SEEA), for example, outputs like crops, plantation timber, and aquaculture, are considered *benefits* produced as a combination of final ecosystem services and human inputs; according to the way national accounts are constructed only things whose growth is dependent on *natural* processes can be categories as an ecosystem service[8]. The difficulty that this seems to pose for us is that at a time when we are seeking to make sure that the value of nature is fully taken into account, the criterion of reliance 'natural processes' would seem to exclude much of what goes on across the majority of landscapes not only in Europe but also elsewhere. Agro-ecosystems my not be *natural*, but they do still depend on *ecological* processes, and so it is this dependency or connection that perhaps we should emphasise and take account of.

The way that the SEEA attempts to categorise ecosystem services is perfectly legitimate and rational, given the perspective of the people. The point we want to make is noting the issue is that classification systems inevitably depend on the ways the groups involved view the world; the paradigms that they inhabit. Reflecting on the design of the current version of CICES we conclude that we need to be much clearer developing a terminology that distinguishes services from the benefits that are associated with them in different situations, and that probably we need a more comprehensive system for categorising benefits as well as services. The example of the 'FEGS' system developed by the US-EPA (Landers et al., 2016) suggests that there may scope in looking at the way services, benefits and beneficiaries are aligned in different classification systems, so that a more complete picture can be established. Since it is clear that the 'end-products of nature' can give rise to multiple benefits, and that different groups may value in different ways, future categorisation systems probably need to be much more sophisticated in the way they help us to conceptualise these things.

Using CICES – Taking Stock

In this chapter we have used CICES to explore some of the challenges that we need to face when developing systems for categorising ecosystem services. These systems are complex, and experience suggests that they will need to be developed in an iterative way, using experience to find out what work where and how naming conventions and definitions can be improved. While we have used

[8] See for example, http://unstats.un.org/unsd/envaccounting/seeaRev/eea_final_en.pdf

CICES to illustrate some of these issues, it is important not to overlook the fact that it is a system that 'works' and has been used effectively.

For example, CICES forms part of the mapping framework designed to support the EU's Biodiversity Strategy to 2020 (Maes et al., 2014, 2016); the second report of the Mapping and Assessment of Ecosystem Services (MAES) uses the CICES classes to identify a range of indicators that can be used for mapping and assessment purposes[9]. Elsewhere, a number of papers have appeared in the peer reviewed scientific literature that have either used CICES or commented upon it as part of their methodological discussion.

CICES has, for example, been used as the basis of the German TEEB study (Naturkapital Deutschland – TEEB DE, 2014) as well as the German National Ecosystem Assessment, NEA-D (Albert et al., 2014). It has also been refined at the most detailed class level to meet the requirements of ecosystem assessment in Belgium (Turkelboom et al., 2013). Mononen et al. (2015) used CICES to develop an indicator framework at the national scale in Finland. These kinds of application suggest that the detailed class level in CICES can be useful as building block from broader reporting categories, the advantage being that these broader categories are themselves defined in a transparent way.

At the case study level, Saastamoinen et al. (2014) have used it to classify ecosystem services associated with the boreal forests of Finland. Accounting applications include those of Schröter et al. (2014). Elsewhere, CICES has been used to look at the basis for developing or comparing indicators of ecosystem service supply and demand; examples include the work of Castro et al. (2014), Kosenius et al. (2013), von Haaren et al. (2014) and Tenerelli et al. (2016). The latter used CICES as a way of categorising crowdsourced indicators, derived from go-sources images, for cultural ecosystem services for mountain ecosystems. In other work, Bürgi et al. (2015) have used CICES to examine how ecosystem service output had changed for a Swiss landscape since about 1900; the classification framework was used to code the reports from archive sources about whether things that we would now regard as ecosystem services were documented as important in past periods.

While the applications of CICES suggest that the current framework is appropriate for many uses, it is also clear that we need to think carefully about how such systems can be developed. For example, the work of Armstrong et al. (2012) and Liquete et al. (2013), suggest that it may need to be adapted to ensure that it is suitable for the assessment of marine and coastal ecosystems, or integrated more closely with typologies for describing underlying ecosystem function. It is the case that marine interests were probably under-represented in the consultations that led to the current version.

Thus while the current version of CICES clearly works for many purposes, given the importance of categorising ecosystem services in clear and transparent ways, the development of this and other systems needs to be reviewed constantly as our needs and concepts evolve (see Maes, 2016). They are essential tools for our mapping and assessment work. Crossman et al. (2013) for example, has suggested that a classification, such as CICES, might form as part of a more general systematic approach or 'blue print' for mapping and modelling ecosystem services. Busch et al. (2012) have also argued that it is important to develop classification systems, such as CICES, that are 'geographically and hierarchically consistent' so that we can make comparisons between regions, and integrate detailed local studies into a broader geographical understandings. Our concluding point is, that

[9] see also: http://biodiversity.europa.eu/maes/#ESTAB (accessed 30/01/2016)

whether CICES has a role to play or not, these kinds of system will not build themselves. We need to be aware of the challenges that the categorisation of ecosystem services still poses, and the fact that we have only just started to address them.

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Appendix 2: Workshop on:

"Customisation of CICES across Member States"

Participants

Name	Affiliation
Christian Albert (via skype)	Leibniz University of Hannover/Germany
Mario Balzan	Malta College of Arts, Science and Technology
Benjamin Burkhard	University of Kiel/Germany
Bálint Czúcz	MTA ÖK/Hungary
Markus Erhard	EEA/Denmark
Eva Royo Gelabert	EEA/Denmark
Roy Haines-Young	CEM, University of Nottingham/UK
Alessandra La Notte	University of Turin/Italy
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Jan-Erik Petersen	EEA/Denmark
Tobias Plieninger	University of Copenhagen/Denmark
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Erik Stange	NINA/Norwegian Institute for Nature Research
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Nihat Zal	EEA/Denmark

Apologies

Jessica Alvsilver	Swedish Environmental Protection Agency
Andrew Church	University of Brighton/UK

Sander Jacobs INBO/Belgium

European Environment Agency

Appendix 3:

Workshop on: "Customisation of CICES across Member States"

Invitation

Date: 25 and 26 February 2016 (lunch to lunch)

Location: European Environment Agency (EEA), Kongens Nytorv 6, 1050 København K, Denmark

Room 8.1.1 (Auditorium) (How to find EEA: http://www.eea.europa.eu/address.html)

Background

The workshop is part of the EU H2020 funded project "ESMERALDA" (http://www.esmeralda-project.eu/) and organised by University of Nottingham (WP4 leader on Ecosystems Service Assessment Methods) and hosted by the European Environment Agency.

Aim of the workshop

The aim of the workshop is to take stock of the experience gained in using CICES V4.3 for mapping and assessment, and to advise on the objectives for any future revision and the development of guidelines to help people apply it effectively. The workshop will draw on interim results from the current consultation on CICES that will be completed in April 2016 (see www.cices.eu). The outcomes of the meeting will help define some of the options that can be developed in the revision process and how changes can help meet current user needs.

Costs

There is no registration fee and all conference costs, incl. lunch/coffee breaks plus conference dinner are covered by ESMERALDA. If you are not an ESMERALDA partner we are unfortunately not able to reimburse your travel costs. We are however very interested to exchange ideas and hope that you will be able to join us in Copenhagen. Information on accommodation is attached.

For further information, please contact:

Marion.Potschin@Nottingham.ac.uk or Roy.Haines-Young@Nottingham.ac.uk for this Workshop or Joanna.Karlsen@eea.europa.eu for any local or EEA related questions.

Agenda

Thursday 25th February 2016

12.30 - 13.00	Arrival and joint lunch (sandwiches etc. available in front of the auditorium/R.8.1.1)
13.00 - 13.30	**Welcome and introductions**
	Introduction to the workshop - Marion Potschin (Chair)
	Welcome by the Host – Jan-Erik Petersen
	"Tour de Table"
	Brief overview of ESMERALDA – Benjamin Burkhard
13.30 - 14.00	Revising CICES: Key issues and interim results of consultation – Roy Haines-Young
14.00 - 14.15	Using CICES – Evidence from OpenNESS Case Studies – Erik Stange
14.15 - 14.30	CICES Logic: Key questions for the break-out groups – Roy Haines-Young
14.30 - 15.30	Break Out Group A: Provisioning Services
	Break Out Group B: Regulating Services
	Break Out Group C: Cultural Services
15.30 - 16.00	Coffee/Tea
16.00 - 16.30	Outcomes from break-out groups
16.30 - 17.30	Closing discussion: O**bjective(s) for Revising CICES**

Friday 26th February 2016

9.00 - 9.15	Using CICES as an indicator framework – Roy Haines-Young
9.15 - 9.30	CICES applications across the member states, evidence form ESMERALDA – Fernando Santos Martín
9.30 - 9.45	National Ecosystem Service Indicators: The Finnish Experience – Laura Mononen
9.45 - 11.00	Breakout Groups – Developing Service Metrics
11.00 - 11.30	Tea/coffee
11.30 - 12.00	Outcomes from breakout groups
12.00 - 12.45	Revising CICES and Developing Guidelines: Next steps
12.45 - 13.30	Lunch / departure

Appendix 4:

'CUSTOMISATION' OF CICES FOR THE MARINE ENVIRONMENT

POINTS FOR ESMERALDA CICES REVIEW WORKSHOP

EEA, 25-26 February 2016

ERG, DRAFT 3, 080416

If you use any material from this paper, please cite as: Royo Gelabert, E., '*Customisation' of CICES for the marine environment.* Internal paper building on material[10] commissioned by the European Environment Agency, March 2016, European Environment Agency.

For more information/follow-up, please contact:

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Aim

Share a 'customisation' of CICES for the marine environment with the ESMERALDA team for a review of CICES. This has been carried out in the context of developing (by Culhane *et al.* (unpublished)) and using a framework and methodology to deliver an EU-level, 'top down', EU-law/policy relevant, qualitative, 'supply-side' (capacity based[11]) marine ecosystem services (MES) assessment. The approach builds on the conceptual and common assessment frameworks in Maes et al. (2013, 2014).

[10] This material is:

- Chaniotis, P., Royo Gelabert & Doria, L. *Lessons learned through considering the application of CICES (v4.3) in a marine context.* Internal paper under development, European Environment Agency and European Topic Center on Inland, Coastal and Marine waters.
- Culhane, FE, White, LJ, Robinson, LA, Scott, P, Piet, G, Miller, DCM, van Overzee, HMJ & Frid, CLJ, unpublished, *Development of an operational EU policy-based marine ecosystem (services) assessment framework.* Deliverable 9: Report to the European Environment Agency from the University of Liverpool. December 2014. University of Liverpool, UK. ISBN: 978-0-906370-90-2: pp. 432.

[11] The approach is:

a) Species-based but knowing what the species 'do' in their habitats and hence it comes up with a series of 'marine ecosystem components' that cover all the biotic stocks and where the 'capacity' part of ecosystem services 'cascade model' (structures/processes/functions) is implicit per component.
b) 'Capacity' ('supply')-based but it is NOT 'pure supply'. Thus, it also considers the potential for service use = the possibility for the service being used (but not the actual service use, which is part of the 'demand' according to the EEA's 2015 State of Europe's Seas Report) => So it considers a sort of 'pre-demand' by ascertaining whether there would be a service flow or not.

It is based on using Member State information on ecosystem condition reported at the EU-level as part of the implementation of relevant EU law and policy (e.g. Marine Strategy Framework Directive/MSFD, Water Framework Directive, Habitats Directive, Common Fisheries Policy/CFP), rather than directly using actual MES assessments (national, regional, global); although other information is also used. The assessment is, therefore, from a 'supply- side' perspective, i.e. based on ecosystem capacity (although it also includes the notion of the potential for service use).

A summary of the above-mentioned framework can be found in Box 7.2 of the EEA 2015 'State of Europe's seas' Report (http://www.eea.europa.eu/publications/state-of-europes-seas). And a limited application of some of the elements from the framework in the EU-level, 'top down', EU-law/policy relevant, qualitative, 'supply-side' MES assessment in Table 7.3 of the same Report. Note that that table as well as Table 7.1 have an 'extraction' (the latter) and an attribution to marine ecosystem components (the former) of the services of relevance to the marine environment from CICES. However, our thoughts since have evolved, so these tables are a bit obsolete.

This paper 'cuts and pastes' information from internal EEA-ETC/ICM papers, which draw from and add to the original Culhane *et al.* (unpublished) work. It. It also contains list of thoughts/statements/conclusions for a CICES marine application in general, as well as for the different CICES service categories. This list is mostly 'shorthand' formatted as bullet points paragraphs so it is not very 'pretty' nor easy to follow/understand. I will provide more (oral) information at the EEA meeting on the ESMERALDA review of CICES if needed.

A. General

1. *Service generation* => Biological/ecological mediation of the services means that biota involvement *other than the biota which is the service in the case of provisioning (e.g. wild fish) or cultural services* is required. In turn, this means that the interaction of that specific animal (wild fish) or plant/algae with the abiotic marine environment does not 'count' as biological/ecological mediation.

2. *Intermediate services* => Too many for marine in the R&M section. E.g. nursery, seed and gamete dispersal (pollination), chemical composition of seawater, sediment nutrient cycling (decomposition and fixing processes in soil) => A 'way out', rather than choosing, is to note that:
    a. Final/intermediate 'label' is contextual
    b. Alternative human intervention can be found (but not always) determining final 'label'
    c. Examples of contexts where service is 'final' can also be found (but not always)
    d. Nesting of intermediate services within CICES possible/helpful
    e. Double-counting can be avoided (this could also apply to the 'cultivated crops') => This should occur at the point that an assessment is undertaken (and the specificities of that context will then determine the final/intermediate 'label'). See also point A.5

3. *Blurring of service/use/benefit boundary in the CICES 'names'* => Not restricted to some cultural services (e.g. recreation and leisure used by others then CICES) but extend to other Divisions, e.g. Climate regulation, Flood protection, Nutrition => Cannot be used as an 'excuse' to change cultural services names.

4. *(Culhane et al, (unpublished) (also called UoL work or Report in this paper) and EEA 2015 'State of Europe's Seas' Report criteria for exclusion of marine 'services' from CICES into an EU-level service capacity (supply-side) assessment framework based on information from the implementation of EU-policy (building on Maes et al., 2014):*
    a. Not relevant for the marine environment, namely cultivated crops, reared animals, water, mechanical energy, storm protection, chemical condition of freshwater, => Out
    b. Marine contribution negligible compared to other biomes e.g. micro and regional climate regulation of forests versus marine ecosystems (saltmarsh plants). Same with weathering processes => Out
    c. Marine biotic contribution negligible compared to abiotic marine environment[12], e.g. pollutant/waste dilution (Dilution by atmosphere, freshwater and marine ecosystems) is physical (and the possible biotic component does not work 'in tandem' with the abiotic to achieve that). Same with Hydrological cycle and water flow maintenance => Out
    d. CURRENT use = No experimental use e.g. marine liquid biofuels (only lab research now) => Out
    e. No ecosystem uses/outputs protected by EU and global law (this affects whales dolphins, seals, certain sea and water birds, sharks, and reptiles), e.g. no whale meat provisioning in the EU. But known national exemptions considered, e.g. seal cullings in Sweden

5. *Contravening the hierarchical nature of CICES at the Class level*: There is only one Class 'Animal-based energy' under the 'Mechanical energy' Group => No hierarchy. Nevertheless, the class and group are not relevant in a marine context.

6. *Problems with the 'dual nature' of CICES (assessment and accounting) leading to the exclusion of too many services (not 'accountable'), which prevents a meaningful assessment of natural capital (services)*
    a. The CICES classification has to serve both ecosystem accounting and assessment purposes – The reason that CICES is based on the 'final' outputs or products from ecosystems that are directly consumed, used or enjoyed by people is to try to avoid the issue of 'double counting' when carrying out ecosystem accounting, and/or monetary valuation of ecosystem services. Thus, for example one could end up 'adding up' the value of direct and indirect contributions from the underpinning ecological functions to the same benefits. For this reason, in applying CICES, Maes et al. (2014) advise that it is not appropriate to use the same indicator more than once as a proxy for an ecosystem service; but rather use the hierarchical structure of CICES to aggregate ecosystem services to a higher level for which suitable indicators may be available.
    b. This 'principle' is problematic from a marine ecosystem services assessment based on ecosystem capacity perspective – as the same marine ecosystem components may deliver different and multiple services. In addition, we have also detected several potentially intermediate services in CICES. All this would then limit the number of services that can be accounted for to avoid 'double counting' to the real 'final' ones or to those not delivered by the same marine ecosystem components.
    c. In addition, there may be a disconnect between information 'needs' to support both accounting and assessment processes. For example, ecosystem accounting needs a

[12] We have an issue with 'Seed and gamete dispersal', which – in the marine environment – is very much less important than pollination. Biota such as turtles (and birds) do it with seasgrass seeds but the bulk of it could be deemed as 'physical' linked to water circulation. At the same time, the biota role may be important in 'closer' areas (which is where seagrasses live anyway) but that may be applicable to the dilution service too and we've 'discarded' that one.

significant amount of quantitative and well spatially resolved data, which is not available across all ecosystem types at the EU-level when considering, in particular EU-policy based information, which then further limits the number of services that can be accounted for. However, existing information on marine ecosystem condition at the EU level would allow qualitative marine ecosystem services assessments (cf. Culhane et al, unpublished).

d. Finally, applying the hierarchical structure of CICES to aggregate ecosystem services to a higher level when suitable indicators may not be available could result in the use of indicators that are not specific enough to make an assessment of a given service (e.g. deviating significantly from the premise of the supply side state/service relationship).
e. One solution could be clearly label which services are relevant for (a service capacity and for a service use) assessment and which for accounting purposes in a marine context. This would be rather than just remove marine ecosystem services from CICES on the premise that they are not 'final' and there would be 'double counting' in a valuation (linked to service use) and accounting context (linked to 'final' services). Thus, that would grossly misrepresent the overall assessment of marine ecosystem capacity for service delivery.

B. Provisioning

1. *In situ aquaculture*: Linked to A.1 above => Other biota must support the biota that are the service (e.g. cultured algae), and those can be found (even if difficult for algae and fish in cages; ranched fish and shellfish ok). Is that biota support 'significant'? – unclear but it is not as extreme as the 'cultivated crop' issue. If biota that are the service themselves (e.g. cultured fish) are 'counted' towards the biological/ecological mediation, this should then also apply to the wild ones.

2. *Seawater*:
    a. Different from freshwater, where the volume/quantity (this is provisioning) is not biologically/ecologically mediated => No provisioning water (it's an abiotic output when e.g. drinking water from seawater desalination, sweater used to cool power plants) => No raw material (either).
    b. What is biologically/ecologically mediated is the quality of seawater, e.g. chemical composition of seawater (the natural balance of oxygen, carbon and nutrients as a result of biological/ecological processes) leading to the marketing of medicinal and cosmetic seawater sprays based on certain chemical composition of seawaters (e.g. in Brittany; see http://www.sinomarin.com/sinomarin_2.htm in particular the 'The sea water of Cancale, Brittany, France' section under the 'Seawater' tab; also http://www.susanciminelli.com/seawater.html). Therefore, 'balanced seawater' could be seen as a type of 'biotic product'. As such, the biological/ecological mediation of the condition of seawater (i.e. chemical condition of salt waters) would, therefore, represent a 'final' service.

3. *Materials*:
    a. Materials for agricultural use: Add 'aquaculture'
    b. Differentiation is ambiguous between 'Agricultural and aquaculture' and 'Genetic material', where live biota ('seed') taken from the sea and grown in a lab is Genetic material, and live biota taken and use to stock aquaculture farms (without intermediate culturing) are 'Agricultural and aquaculture'

c. But is live biota taken and use to stock aquaculture farms really 'aquaculture spat' or a 'biotic output/product' => cf. pp A8 in Haines-Young and Potschin (2013)

4. *Energy:* Biomass-based energy sources => Ni current use of taking live biota for burning – as fuels (but past use, sand eels in DK). But dead biota (seagrass) can be taken. Also experimental liquid biofuel production but does not qualify for 'current use' so would be 'scientific research'.

C. Regulation and maintenance

1. *Intermediate services* issue: See point A 'General' above.

2. *Mediation waste, toxics and other nuisances*
   a. Stuff here is anthropogenic (natural stuff under chemical condition of sea
   b. Overlap between bioremediation/etc. and filtration/etc. This is because the (anthropogenic) toxics (e.g. heavy metals) or waste (e.g. oil, sewage effluent) inputs and processes can occur concurrently or consecutively, e.g. bacteria may process solid organic wastes into dissolved nutrients ('bio-remediation by micro-organisms, algae, plants and animals'), which are then sequestered by phytoplankton ('filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals'). Basically, the ecological processes/functions involved in delivering these services are inherently linked and separating them in practice, in order to carry out an assessment, is problematic. A more natural split would be to have one 'Waste and toxics removal' service comprising different services based on the type of material/substance that is removed from the environment without (via filtration/sequestration/storage/accumulation) or with transformation into a new product (via breakdown/bio-remediation). The removal (storage or treatment) of the waste material or toxic substance would then be considered to be one main benefit.
   c. Biota versus ecological mediation of filtration/sequestration/storage/accumulation => Service only mediated by biota (the fact that they live in and interact with the ecosystem is 'accidental') => No need for ecosystem mediation class. See also point A.1 above.

3. *Mediation of flows*: Erosion prevention (Mass stabilisation and control of erosion rates)/Sediment retention (Buffering and attenuation of mass flows)/Flood protection => Same ecological structures/ecosystem components supporting them (e.g. seagrass, macroalgae). And same benefit in the case of Erosion prevention and Sediment retention because both involve the accumulation and stabilisation of marine sediments as well as the attenuation of wave energy to both prevent erosion and buffer sediment movements. => Combine into one service = 'Erosion prevention and sediment retention'.

4. *Maintenance of physical, chemical, biological conditions*
   a. Lifecycle maintenance, habitat and gene pool protection
      i. *Nursery service*:
         1. See Liquete et al (2015) (http://www.sciencedirect.com/science/article/pii/S1470160X15006986) and the: Argumentation in section 4.1 including 'For instance, when the estimation of fisheries Maximum Sustainable Yield ignores the effect of nursery grounds, it may lead to fisheries collapse. Even in relatively

complete assessments (e.g. fish stocks assessments), it is difficult that an analysis of fisheries captures the relevance and value of the nursery function if this is not an explicit objective of the study'.

2. The conclusion below it: 'Nursery habitats are crucial for the maintenance of fisheries (e.g. Jackson et al., 2015), but we have not read a single study adding the monetary value from "maintenance of nursery populations and habitats" and that of "food provisioning", i.e. counting twice the same benefit. Instead, the indicators used to characterize the delivery and benefit from the nursery function are different from those of fisheries (e.g. Table 2). When it comes to economic valuation, the results from "maintenance of nursery populations and habitats" should be only used to estimate what share of the total fishing value ultimately depends on specific nursery habitats. Even if those monetary values cannot be added, they are extremely important to make the case for the protection of essential habitats, to justify conservation investments or to regulate conflicting human activities'.
3. Our conclusion is that it can be counted as a final service if considering the value associated with particular benefits (e.g. food and recreation). We agree with Liquete et al.'s (2015) view on how the economic valuation can be linked back to the importance of the different habitats in the supply flow (e.g. the share of the total value of a fishery that can be linked to each habitat that provides nursery areas for the relevant commercial species.
4. Thus, in an assessment that captures the full capacity of the ecosystem to supply services, where that assessment should be able to trace back the link to the STATE of the relevant ecosystem components. If you only consider the nursery service in terms of its contribution already captured under the state of seafood components, you cannot trace back to the state of the actual habitats that supply the nursery habitats. SO it is important that you still have a service that captures how the state of the actual habitats that provide nursery habitats are. That is way we suggest to do in our assessment and this supply/capacity should be captured separately to the state of recruited adults that contribute supply to seafood. This is the supply side assessment part.
5. See also Hattam et al (2015) http://www.sciencedirect.com/science/article/pii/S1470160X14004580 who follow a different angle than that of Liquete et al (2015) as it is about 'management' of the human activities drawing on the services => If these activities can be managed directly, the implication is that the relevant services are final.

ii. *Gene pool protection* needs its own Class (it is only in the Group)

D. Cultural services

1. *Definition/names*

a. The definition13 of and the service names should refer to the services, i.e. the non-material final outputs that arise from the presence of living elements such as species, habitats, ecosystems and seascapes => the interactions with the biota in certain environmental settings allowing them (e.g. presence – linked to their state - of whales in coastal waters making whale watching possible); rather than also including services uses/activities (e.g. whale watching) and/or benefits (e.g. recreation via/from whale watching activities) => BUT real CICES names are meaningless to the public, i.e. they really are confusing/difficult to interpret when referring to (e.g.) experiential interaction services (which is why they are wrong in the first place). Keep them?. See also point A.3.
b. 'Experiential us of marine plants, animals, etc.' and 'Physical use of marine plants, animals, etc.' under 'Physical and experiential interactions' are not 'separable' => Moving up to the Group level and using 'Recreation and leisure' instead (but see point above).

2. *Decoupling of service supply and service demand:* As a result of point D.1.a, and for the relevant cultural services, there would be a (certain) decoupling of service supply (presence of biota linked or not to their state) and service demand (use). Basically, cultural services rely on the abundance, distribution and health/state of all marine biota populations as these underpin the possibility of human interactions with the biota (= the service), upon which several human activities are built (make the interactions possible), and which also depend (i.e. whether humans take up the activities leading to biota interactions or not) on other factors (e.g. traffic/roads, parking, weather). This (certain) decoupling has not been expressed in this exactly same way in the UoI Report.

   As a consequence, the actual biota (presence linked or not to their state) (supply) is not such a good 'indicator' of the potential use of the service as is in other cases (i.e. demand is less coupled to supply than in other cases; where this coupling is a premise for a services assessment based on supply). Thus, the degree to which activities associated with cultural uses of the marine environment rely on (the presence/state of) the ecosystem is variable, other factors are also important. It follows that an assessment of marine cultural ecosystem services focussing on the state/condition of ecosystem components (supply-side) may not be as informative as that of other services in terms of providing knowledge towards managing the impacts from service demand = maintaining ecosystem capital (which 'goes against' one of the premises for the UoL work).

[13] E.g. *Physical and intellectual interactions with marine plants, algae, animals, ecosystems, and seascapes* = Marine biota/ecosystem provision of opportunities for recreation and leisure as well as intellectual, emotional, and artistic development that can depend on a particular state of marine/coastal ecosystems (or where this can enhance it).

Appendix 6: CICES-revision

Notes referring to Mind Map in Figure 1

- Classifications have to be ridged - not flexible
- Notion of a reference classification - derived classifications or related - but make links back, example ISIC in Europe.
- Does CICES strive to become a standard...

Priorities?

Communication issues

1.1 GUIDANCE - MAES report?

- Or product from ESMERALDA
- Clarify via short definitions

logic

- Uneven hierarchy - but only necessary changes
- Have a look at this....

Clarify status of water...

- Inclusion in more or less a convention
- Need to clarify this via a briefing paper

Application to cultural services

- Working group in MAES could provide input specifically on cultural services - can be useful here? See J- E? Also Pam Berry who has proposed this.
- Also IEK?
- Compare with treatment in FEGS?

1.2 Consistency with other categories

- Active nature of provisioning and regulating = try 'shaping' as a ding verb for cultural.
- These are the aspects of ecosystems that shape our cultural environment

1.3 Structural problems

- Disentangle benefits from service somehow
- Settings/species provide opportunities for recreation/sense of place....

- Structure needs to reworked, does it have to follow the others....e.g. leave out one of the level
- Use the blueberry example (yield) plus cultural use
- Keep the term 'cultural' but provide guidelines and clear definition.

1.4 Split between physical/intellectual problematic

- Proximal or distant? Not sure how to carry this forward

1.5 Reduce classes

- But perhaps be explicit about how it links to benefits..

1.6 Hierarchy

- In other sections you have classes that are exclusive and not overlapping but in CICES they are not always so easily distinguished
- Split via scale? (e.g. landscapes/seascapes species etc.)

1.7 Get experience from OpenNESS in this discussion

- See also: GUIDANCE - MAES report?
- Especially for the urban group - who are almost exclusively looking at cultural

Application to provisioning services

- Additive... rather than major revision. but structure does need to be looked at.

1.8 What is a final ES? Problems of definition wrt production boundary

- The problem of the crop in the field...
- Not practical to identify the ecological production function - is it a practical thing?
- Solution based on energy input to energy output...to estimate the share that nature has...in the contribution etc. Shot cut to production function in terms of identifying contribution of nature

1.8.1 Yield alone is not a good indicator

- [redacted]- blueberry example

1.9 How the CICES structure works

- Second level is not useful as an entry point, many people start with classes, make the structure less abstract, type of use may not be necessary if you add beneficiaries at the end.

1.10 CICES used in different domains; so capture the difference in terminology across applications in the guidance documents

- Need to make sure that grouping and names allow for multiple uses
- Capacity of ecosystems to provide flows,
- Scientific and popular names (Filter)

- Have numbering system to identify classes etc. (experience in Hungary)

1.11 Genetic material

More informational than material output? Can they be related like the others?

Application to regulation and maintenance services

1.12 In marine and coastal may be best to assess at group level

- retain class level because they provide transparency
- Give guidance on how to assess and report to make structure flexible

1.13 Classes for reporting that are split across groups

- e.g. Pollination and Pest Control in Malta

1.14 Interpretations are provided in a guidance document

- See also: Communication issues
- Filter CICES according to focus of the study - e.g.. marine, freshwater, table
- Tables per BIOME

1.15 Typology in relation to functions

Don't remove potential 'intermediate' service hem from the typology...

- A list pf potential final services....
- See examples in marine paper on nursery function

Appendix 6: CICES discussion

Notes referring to Mind Map in Figure 2

- Conceptualised/operationalised as a database tool...
- Guidance document is a key way of taking CICES thing forward...
- Stress the similarities between the marine and Terrestrial/Germany experience...

1 Guidelines

- Take account of what is in all the other elements
- Road map to develop guidance... and evolutionary structure
- Guidance is part of the revision process not the end product describing the revised...

1.1 Focused on accounting uses

- Would be useful to be clear in guidance on how it is used in an accounting framework
- Then people can use it flexibly in other applications

1.2 Draw on handbook on ecosystem accounting

- Cannot use ecological production functions exclusively
- Examine how accounts relate to the cascade framework?

2 Typology revision

- Need to clean up the terminology,
- E.g. climate regulation and carbon sequestration
- E.g. bridging supply/capacity through to demand - but policy may only focus on the middle. So what will the indicators tell us - have to be clear what the indicators are indicating
- Look at how other classifications are implemented e.g.. IUCN classification of protected areas..... think of CICES as a common language/reference Experience suggests that it should be top down
- Maintain the framework aspect of the translator...can it be a translator between contexts as well as classification system....

2.1 Blurring of terms

2.2 Metrics

- See also: Indicators

2.3 Comprehensive catalogue

- BUT not how to assess

2.4 Create masks to support applications

- By biome (e.g. marine)
- By application type e.g. accounting and assessment....

2.5 Translation of names

- How to apply in local national context....

3 Indicators

- See also: Guidelines
- Keep indicator suggestion separate from the classification - use them as examples of how to use the system....Cannot be comprehensive
- Don't imply that the indicators are part of the definition of the class etc. Make it clear that this no how to implement CICES etc.
- Use it in the guidance etc.
- Should not bias people in terms of whether the focus on supply/demand etc. or values
- Can people still apply CICES independently of the indicator framework?
- E.g. bridging supply/capacity through to demand - but policy may only focus on the middle. So what will the indicators tell us - have to be clear what the indicators are indicating

3.1 capacity/flow

3.2 structures, functions, benefits and values etc.

3.3 Beneficiaries

- Link this in narrative form....
- Cross check against the FEGS list etc.

3.4 Indicators might capture several CICES classes

- Link this to what makes a good indicator....
- Explore overlap
- Cross check against the FEGS list etc.

4 Purposes

- EU accounting system, Commission and EuroStat see SEEA as the overarching methodology
- This is a minimum requirement
- Guidelines should open up other possibilities beyond accounting
- Accounting sets minimum structure - and assessment is much wider
- Mask to help CICES to be applied flexibly
- Does accounting present a limitation and generate negative reactions - cf IPBES
- Accounting is more than monetary valuation - this has to be stressed in the guidelines etc.

4.1 Accounting

- DG environment may want £

4.2 Assessment

4.3 Multipurpose

- This is an advantage of the system - can cross reference sectors etc.
- Bridging function
- How would we construct a mask to help with this

4.4 General communication

- Also a role of communicating ideas in a general way especially toward stakeholders etc.
- Layers of complexity to fit purposes?
- Multi-nomenclature and correspondences....

4.5 Look at user groups more explicitly

- Identify what can be done achieved with CICES in different contexts...
- Link this to paper structure!
- What is needed to make it fit for purpose for these different uses and what would it take to make it a European Standard etc.

Appendix 7: Presentations

Customisation of CICES across Member States

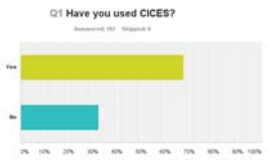
ESMERALDA Milestone no 19
25-26th February, 2016, Copenhagen

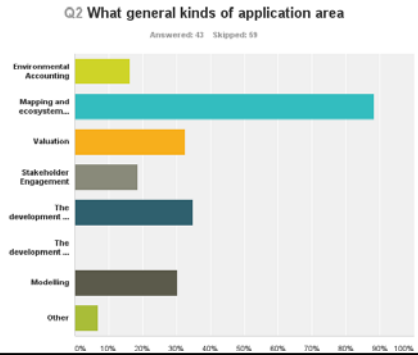
WP4 on "Ecosystems Service Assessment Methods"

Roy Haines-Young and Marion Potschin,
Centre for Environmental Management,
School of Geography,
University of Nottingham UK

1

Types of application

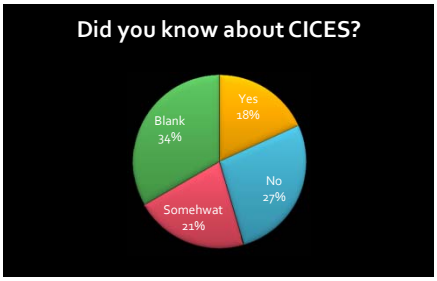


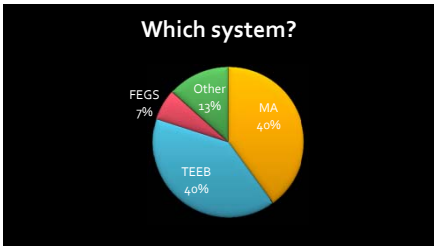


- Citizen mapping of ecosystem services using MapNat smartphone App.
- Development of the app with a focus on urban recreation
- In the conceptual framing of ES and their inter-relationships
- Creating a list of ecosystem services
- Considering ecosystem service types as part of research projects, e.g. in designing case study templates and questionnaires.

2

Those who did not use CICES…

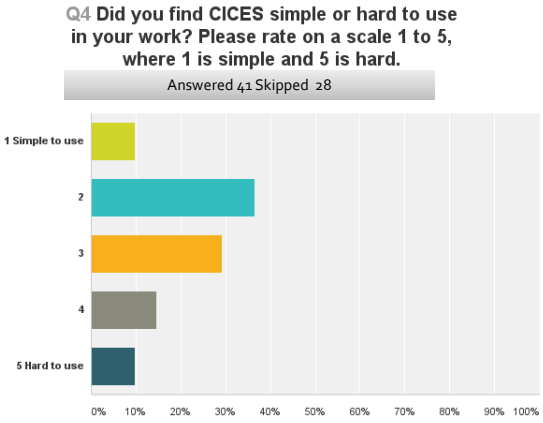




33 responses out of 102

3

CICES – Ease of Use?



4

CICES – Ease of Use?

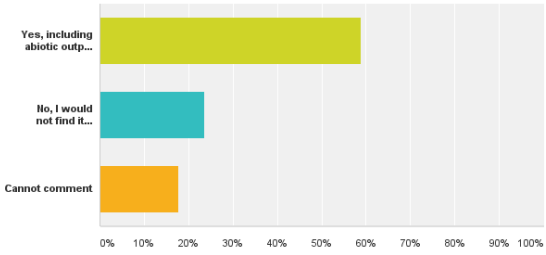
ADVANTAGES	DISADVANTAGES
▪ Clarity ▪ Detail ▪ Coverage ▪ Standardisation ▪ Conceptual framing (cascade)	▪ The difficulty on separating ecosystem functions from services ▪ Categories used have little or nothing to do with an accounting framework ▪ Complexity ▪ Difficult to apply to place based studies ▪ Cultural services need revision ▪ The boundary between ecosystem and human production processes is not always clear ▪ ….

5

Developing CICES: Abiotic outputs?

Q13 A number of people have suggested that one way to develop CICES is to include an equivalent classification of the abiotic outputs from ecosystems - to cover such things as wind, hydropower, salt, etc. Do you agree?

Answered: 51 Skipped: 51



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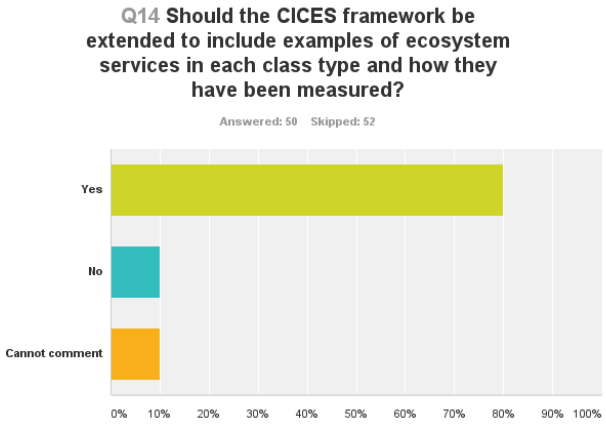
Developing CICES: Examples?



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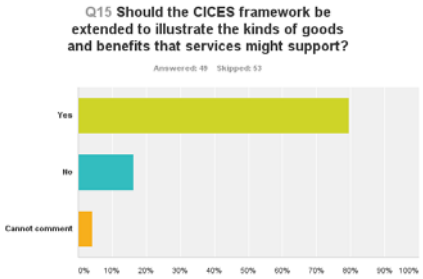
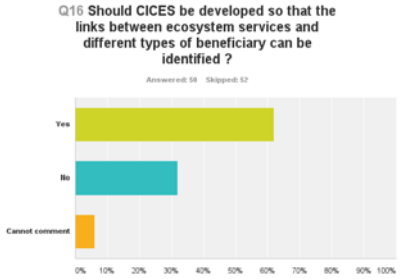
Developing CICES: Benefits and beneficiaries?





8

Structure of workshop based on initial consultation responses

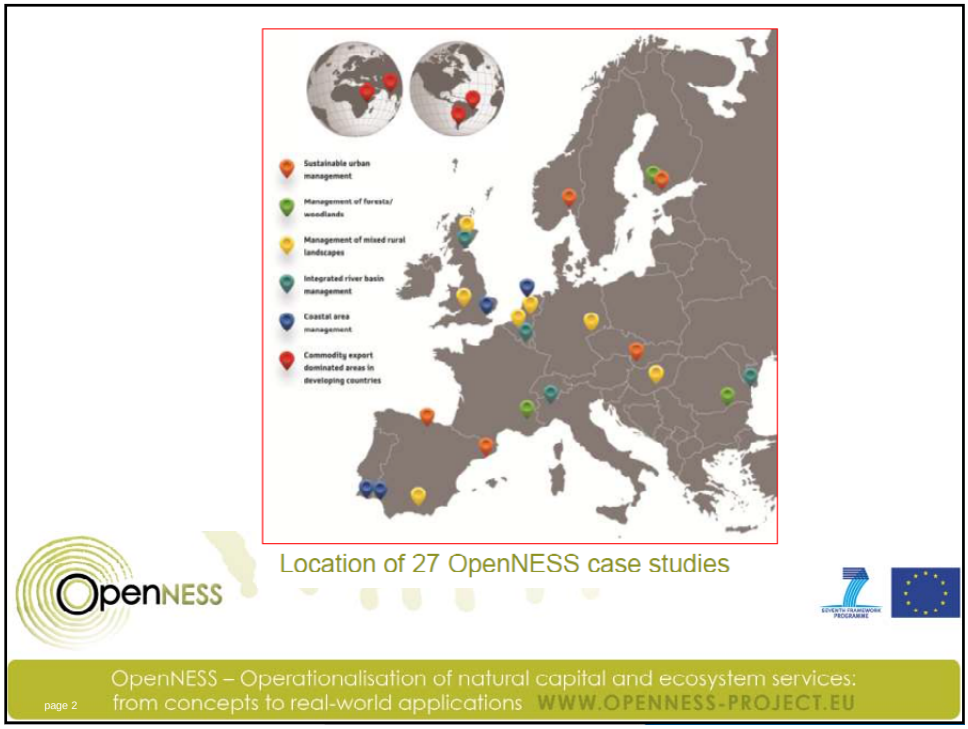
- Today
  - Advantages/Disadvantages
  - Structure/Logic

- Tomorrow
  - Linking to structures processes and functions
  - Linking to benefits and beneficiaries
  - Next steps

9

10


OpenNESS
CICES classification – from global to local
OpenNESS reseach initiative
NINA: Erik Stange
UNOTT: Conor Kretsch, Marion Potschin and Roy Haines-Young


Sustainable urban management
Management of forests/ woodlands
Management of mixed rural landscapes
Integrated river basin management
Coastal area management
Commodity export dominated areas in developing countries
OpenNESS
Location of 27 OpenNESS case studies
page 2
OpenNESS – Operationalisation of natural capital and ecosystem services: from concepts to real-world applications WWW.OPENNESS-PROJECT.EU

Key questions

1. Is our assessment of cases'(CS) focal ES accurate?

2. Is the CS utilising CICES as a tool within their research?
   (a) At what point in the research, and is it linked specifically to certain research methods or tools?
   (b) Is CICES terminology and structure adequate, or have CS seen a need to devise their own version?

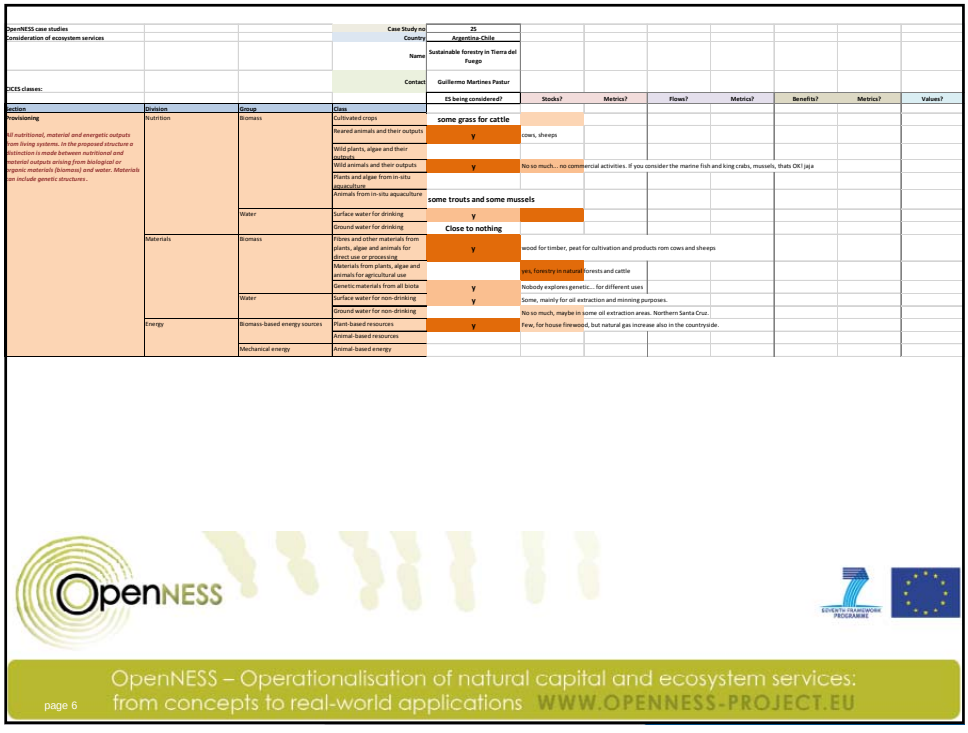
OpenNESS
page 4
OpenNESS – Operationalisation of natural capital and ecosystem services: from concepts to real-world applications WWW.OPENNESS-PROJECT.EU

Key questions (cont.)

3. Where do CS see a need for additional support?

4. Have alternative versions been devised on a location- / case-specific basis only, or applicable more widely?

5. What indicators have they used to assess ecosystem services stocks and flows, benefits, beneficiaries, values etc).



OpenNESS case studies			Case Study no	25							
Consideration of ecosystem services			Country	Argentina-Chile							
			Name	Sustainable forestry in Tierra del Fuego							
CICES classes:			Contact	Guillermo Martines Pastur							
			ES being considered?		Stocks?	Metrics?	Flows?	Metrics?	Benefits?	Metrics?	Values?
Section	Division	Group	Class								
Provisioning	Nutrition	Biomass	Cultivated crops	some grass for cattle							
All nutritional, material and energetic outputs from living systems. In the proposed structure a distinction is made between nutritional and material outputs arising from biological or inorganic materials (biomass) and water. Materials can include genetic structures.			Reared animals and their outputs	y	cows, sheeps						
			Wild plants, algae and their outputs								
			Wild animals and their outputs	y	No so much... no commercial activities. If you consider the marine fish and king crabs, mussels, thats OK! jaja						
			Plants and algae from in-situ aquaculture								
			Animals from in-situ aquaculture	some trouts and some mussels							
		Water	Surface water for drinking	y							
			Ground water for drinking	Close to nothing							
	Materials	Biomass	Fibres and other materials from plants, algae and animals for direct use or processing	y	wood for timber, peat for cultivation and products rom cows and sheeps						
			Materials from plants, algae and animals for agricultural use		yes, forestry in natural forests and cattle						
			Genetic materials from all biota	y	Nobody explores genetic... for different uses						
		Water	Surface water for non-drinking	y	Some, mainly for oil extraction and minning purposes.						
			Ground water for non-drinking		No so much, maybe in some oil extraction areas. Northern Santa Cruz.						
	Energy	Biomass-based energy sources	Plant-based resources	y	Few, for house firewood, but natural gas increase also in the countryside.						
			Animal-based resources								
		Mechanical energy	Animal-based energy								

Regulation & Maintenance *All the ways in which living organisms can mediate or moderate the ambient environment that affects human performance. It therefore covers the degradation of wastes and toxic substances by exploiting living processes. Regulation and maintenance also covers the mediation of flows in solids, liquids and gases that affect people's performance, as well as the ways living organisms can regulate the physico-chemical and biological environment of people.*	Mediation of waste, toxics and other nuisances	Mediation by biota	Bio-remediation by micro-organisms, algae, plants, and animals					
			Filtration/sequestration/storage/ accumulation by micro-organisms, algae, plants, and animals					
		Mediation by ecosystems	Filtration/sequestration/storage/ accumulation by ecosystems					
			Dilution by atmosphere, freshwater and marine ecosystems					
			Mediation of smell/noise/visual impacts					
	Mediation of flows	Mass flows	Mass stabilisation and control of erosion rates	y				
			Buffering and attenuation of mass flows		All the ecosystems have buffers...			
		Liquid flows	Hydrological cycle and water flow maintenance	y				
			Flood protection		Also in some areas are important, specially forests.			
		Gaseous / air flows	Storm protection					
			Ventilation and transpiration					
	Maintenance of physical, chemical, biological conditions	Lifecycle maintenance, habitat and gene pool protection	Pollination and seed dispersal					
			Maintaining nursery populations and habitats	y				
		Pest and disease control	Pest control					
			Disease control					
		Soil formation and composition	Weathering processes					
			Decomposition and fixing		All the ecosystems made this...			
		Water conditions	Chemical condition of freshwaters	y				
			Chemical condition of salt waters		Here, terrestrial ecosystems influence over all the food chain in some aquatic ecosystems (e.g. lakes)			
		Atmospheric composition and climate regulation	Global climate regulation by reduction of greenhouse gas	y				
			Micro and regional climate regulation		All the ecosystems made this...			

Cultural *All the non-material, and normally non-consumptive, outputs of ecosystems that affect physical and mental states of people.*	Physical and intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings]	Physical and experiential interactions	Experiential use of plants, animals and land-/seascapes in different environmental settings	y	A little.	
			Physical use of land-/seascapes in different environmental settings	y	A little.	
		Intellectual and representational interactions	Scientific		It is important here	
			Educational		It is important here	
			Heritage, cultural	y	A little.	
			Entertainment	y	A lot.	
			Aesthetic	y	A lot.	
	Spiritual, symbolic and other interactions with biota, ecosystems, and land-/seascapes [environmental settings]	Spiritual and/or emblematic	Symbolic			
			Sacred and/or religious			
		Other cultural outputs	Existence	y	A lot.	
			Bequest	y	A little.	

1. Is our assessment of their consideration of ES accurate?

Regulatory & Provisioning: some changes have been suggested, but in some cases these may indicate CS misunderstanding of the class (e.g., Patagonia, Costa Vincentina)

Cultural: Tends to be more inaccurate

2. Are CS using CICES as a tool?

- Some have relied heavily on CICES at the earliest stages as a tool for identifying ES classes in their CS area, afterward mostly as a reference.
- Others may use it for *standardization in a research context,* but not as a communication tool with local stakeholders

2a. At what point? Linked to certain research methods or tools?

Patagonia: in research design "fill an important gap in existing knowledge"; will later link to mapping & indicator development.

Costa Vincentina: at early stages of stakeholder engagement and continually thereafter as a reference, occasionally as a communication tool; will be linked to mapping & indicator development.

Others often used CICES in parallel or after ES identified

2b. Is CICES terminology and structure adequate?

CICES not sufficient for cultural ecosystem services. Measurable attributes of cultural services do not align with CICES classes.

Difficulty delineating between *experiential* and *physical* use

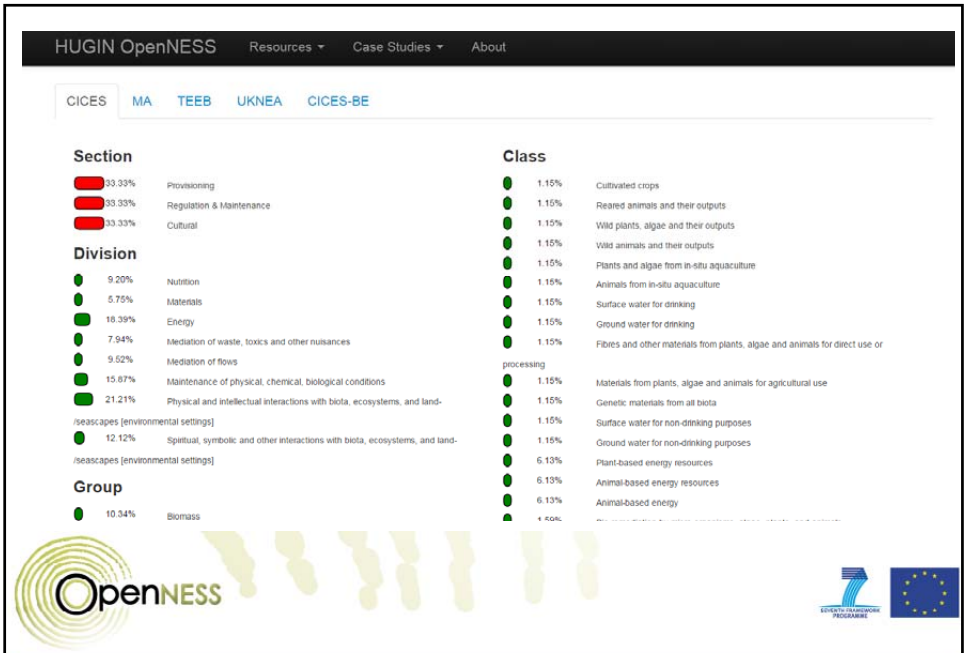
Also: semantic/conceptual issues related to the term "culture"

3. (Where) do they see a need for additional support?

Patagonia: CICES hierarchy is intuitive, “far more simple than other classifications” they reviewed.

Costa Vincentina: Additional support would be useful for using CICES as a communication tool.

Cairngorms: would like a table with *units*



4. Have alternative versions been devised? On what basis?

Vague interest in specific versions for Argentina and Portugal.

Suggestions for rephrasing. E.g., *"Maintaining nursery populations and habitats"* (maintaining biodiversity) = *"wildlife support"*

Urban specific phrasing (e.g. Barcelona)

5. What indicators are used: stocks, flows, benefits, values etc?

Patagonia: Focus is on stocks and values

Costa Vincentina: Wide range of indicators developed in collaboration with local stakeholders.

Cairngorms: stocks (dimensionless recreation activity opportunity) and value (£/person/ha/yr).

5. What indicators are used: stocks, flows, benefits, values etc?

ES	Unit	Cascade category
Timber	Volume/ha/yr	flow
Hay	Volume/ha/yr	flow
Ragweed control	Spp occurrence probability	stock
Recreation potential	Ordinal (unitless)	benefit
Honey production	Uncertain, possibly Quickscan (unitless)	Stock/flow
CO_2 flux	Kg/ha/yr	flow
Bird habitat	Ordinal (unitless)	Stock/flow

ES	Indicator	Quantification unit	Main data sources*
Food provision (provision-ing)	Crop production (supply)	kg edible crop production / ha	Agriculture yield statistical data (year 2013) Regional land cover dataset (year 2013)
	Livestock production (supply)	Livestock units / km^2	Agriculture census data (year 2009)
	Population density (demand)	Inhabitants / ha	Population census tracts dataset (year 2011)
Global climate regulation (regulating)	Carbon sequestration (supply)	kg C / ha	National forest inventories data (years 1990 and 2001) Various regional spatial datasets (different sources)
	Carbon emissions (demand)	kg C / ha	Municipal Sustainable Energy Action Plans (SEAPs) (year 2012)
Air purification (regulating)	NO_2 dry deposition velocity (supply)	mm / s ha	Regional land cover dataset (year 2013) Average wind speed data (Regional environment database)
	NO_2 concentration levels (demand)	µg NO_2 / m^3 (annual mean)	Air quality data from BMR monitoring stations (year 2013) Various regional spatial datasets (different sources)
Erosion control (regulating)	Erosion control capacity (supply)	Dimensionless (0-5)	Expert-based data (Burkhard et al., 2012) Regional land cover dataset (year 2013)
	Land erodability (demand)	Dimensionless (0-3)	Land erodability dataset (SITxell - Geographic Information System for the Network of Open Areas in the province of Barcelona)
Outdoor recreation (cultural)	Recreational potential index (supply)	Dimensionless (0-1)	Various regional spatial datasets on habitat naturalness, protected natural areas and water features (different sources)
	Recreational demand index (demand)	Dimensionless (0-5)	Population census tracts dataset (year 2011) Various regional spatial datasets (different sources)

CICES going local:

Ecosystem services classification adapted for a highly populated country

Francis Turkelboom (INBO), Perrine Raquez (UNamur), Marc Dufrene (ULg), Leander Raes (UG), Ilse Simoens (INBO), Sander Jacobs (INBO/UA), Maarten Stevens (INBO), Rik De Vreese (VUB), Jeroen Panis (ANB), Martin Hermy (KULeuven), Marijke Thoonen (INBO), Inge Liekens (VITO), Corentin Fontaine (UNamur), Nicolas Dendoncker (UNamur), Katrien van der Biest (UA), Jim Casaer (INBO), Hilde Heyrman (VLM), Linda Meiresonne (INBO) and Hans Keune (BBPT/INBO)

NON-PRINT ITEMS

Abstract

Multiple classification systems for ecosystem services (ES) make comparison and integration between studies and assessments very difficult. With the fast-growing number of ecosystem services assessment and valuation studies, there is a need to identify general agreed definitions and to design a 'common base' that enables comparisons between ecosystem services assessments at different places. The recently developed 'Common International Classification for Ecosystem Services' (CICES) is aiming to fill this gap. One of the advantages of the CICES approach is that it allows adjustment to local conditions. Via an iterative consultation round with Belgian experts - from administrations, policy support units and research centres - CICES has been adapted to the needs of a highly populated country where multi-functional land use is very common. The goal of CICES-Be is to introduce a common reference base for ecosystem services in Belgium, which is locally adapted and compatible with an international standard.

Key differences in CICES-Be:

- Added some categories (fire prevention/control, invasive species control, disease control, moderation of diseases by exposure to nature)
- Divided biomass production for nutrition by origin (terrestrial, freshwater, marine)
- Mediation of waste, toxins, and nuisances reorganized by type of service

Key differences in CICES-Be:

- Cultural services reassessed based on interpretations of services vs benefits

Enhancing ecosystem services mapping for policy and decision making

CICES applications across the member states

Fernando Santos-Martín and Laura Mononen

ESMERALDA

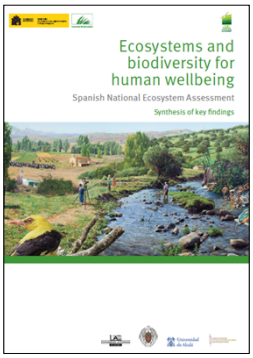
EU Horizon 2020 Coordination and support action

ESMERALDA

CICES applications across the member states

- The situation in the EU, is that a vast majority of Member States are currently in the process of implementing or developing mapping and assessment activities which can be considered part of Action 5.

UK NEA, 2011



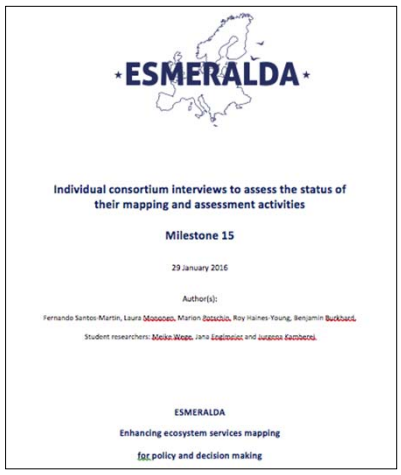
Spanish NEA, 2013

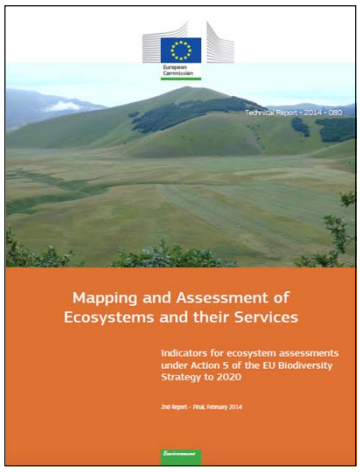
Flander REA., 2015

Customisation of CICES across Member States, Copenhagen, 26 February 2016

CICES applications across the member states

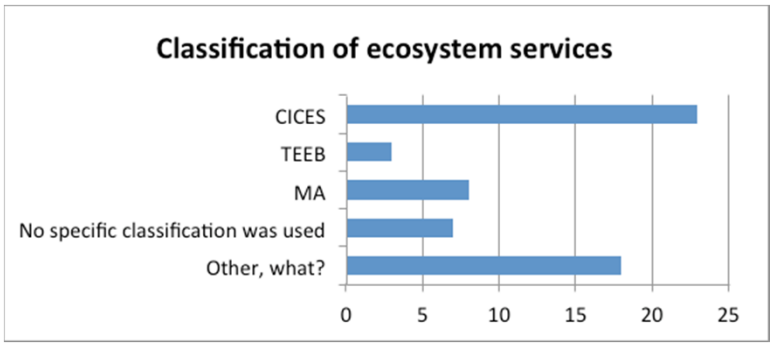
- At the EU level significant work has been done in order to ensure consistent approaches and help Member States in their assessment activities.





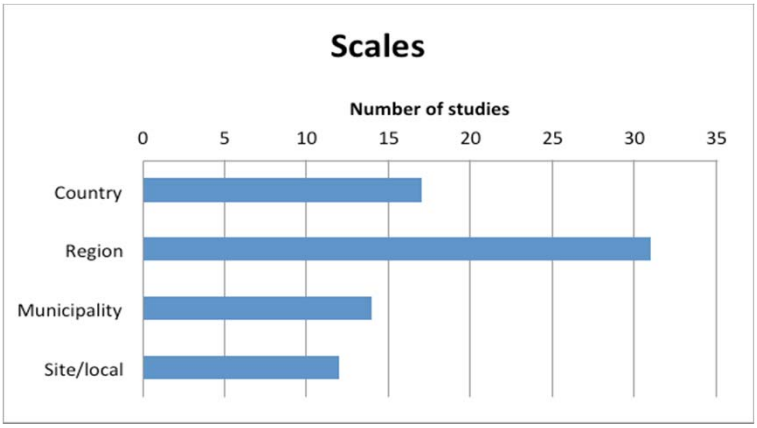
CICES applications across the member states

- Not only the methodologies of mapping and assessment **varied across Member States in Europe** but also the knowledge of the ES concept and classification systems used.
- CICES was the most used classification system.



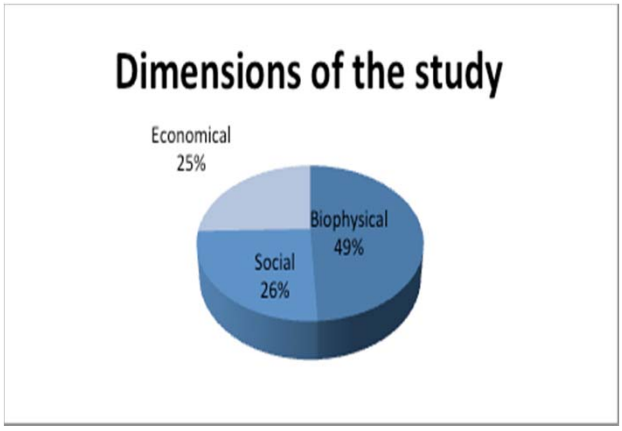
CICES applications across the member states

- CICES facilitates comparisons of assessments of ecosystem services across ecosystems and between the different Member States and at different scales.



CICES applications across the member states

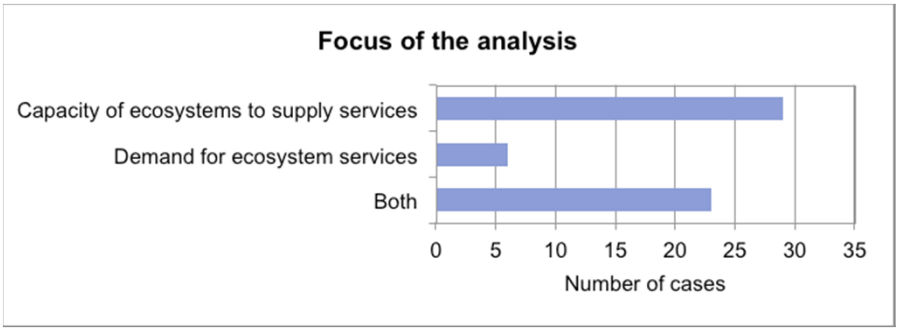
- CICES can be applied biophysical assessment studies but also to valuing economical dimensions or social preference by different stakeholders.



Customisation of CICES across Member States, Copenhagen, 26 February 2016

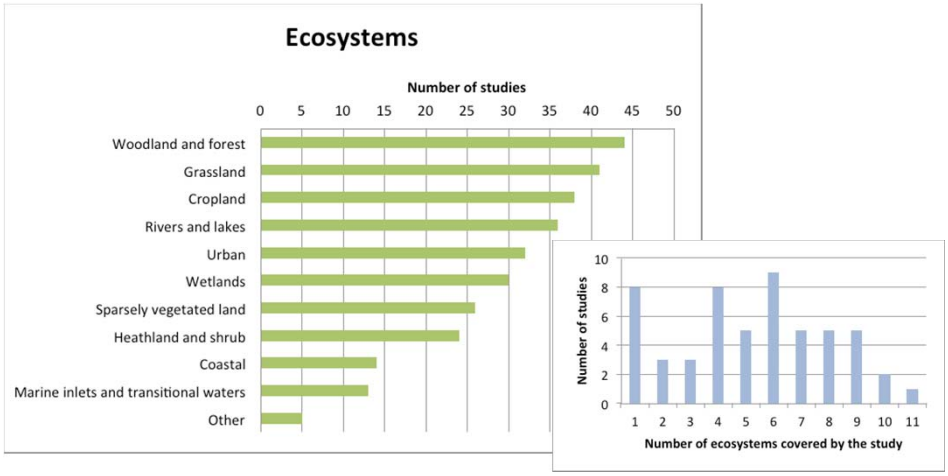
CICES applications across the member states

- Majority of studies that use work on the supply side. Some users encountered difficulties in distinguishing between the supply and the demand of ecosystem services when reporting indicators under the CICES.



CICES applications across the member states

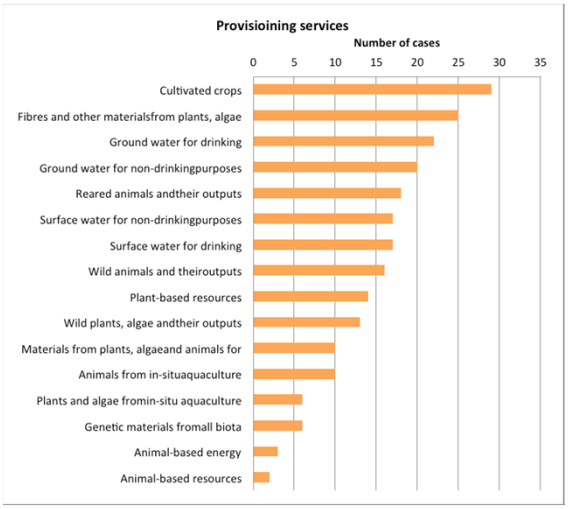
- Applying the CICES classification for marine or freshwater ecosystems is less evident.



Customisation of CICES across Member States, Copenhagen, 26 February 2016

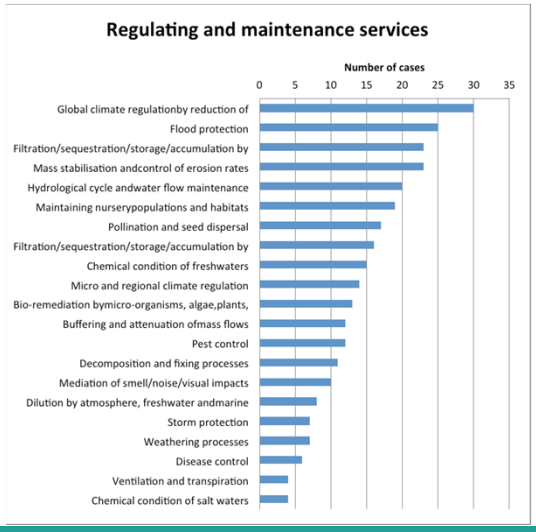
CICES applications across the member states

- The most common provisioning ecosystem services assessed using CICES are the one delivered by agriculture and those associated to water.



CICES applications across the member states

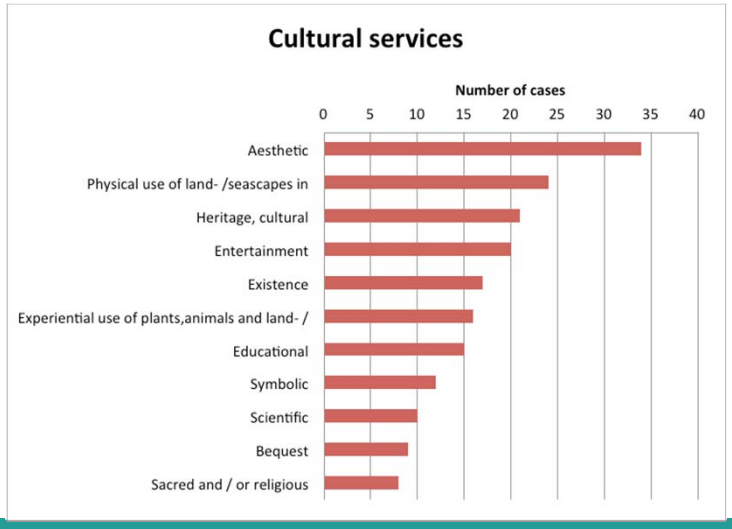
- For regulating services many classes are not relevant while some classes lead to difficulties in proper interpretation.



Customisation of CICES across Member States, Copenhagen, 26 February 2016

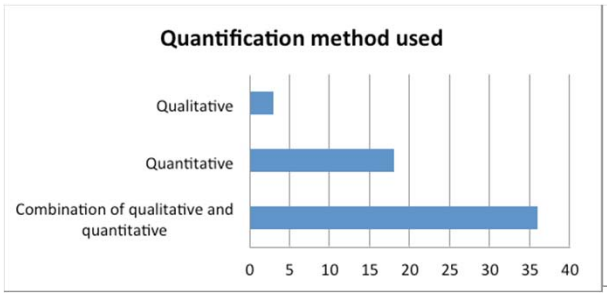
CICES applications across the member states

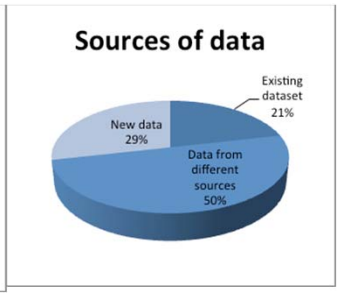
- Cultural services is often difficult to conceptualize. Specially the “intangible” (intellectual and spiritual) dimension.



CICES applications across the member states

- A combination of qualitative and quantitative methods is the most common technique using CICES and most of the studies used data from different sources.





CICES applications across the member states

- The pilot studies of MAES contributed indicators, which can be used for mapping and assessing biodiversity, ecosystem condition and ecosystem services according to the CICES v4.3.

Mapping and Assessment of Ecosystems and their Services

INDICATORS FOR ECOSYSTEM ASSESSMENTS UNDER ACTION 5 OF THE EU BIODIVERSITY STRATEGY TO 2020

Agro-ecosystems **Forests** **Freshwater ecosystems** **ecosystems**

What indicators and data are available to map ecosystems and assess their biodiversity, condition and their services?

CICES applications across the member states

The ecosystem pilots have for the first time tested the CICES classification to collect EU-wide and national indicators to map and assess ecosystem services.

Table 5. Indicators for provisioning services delivered by forests

Division	Group	Class	Indicators
Nutrition	Biomass	Cultivated crops	
		Reared animals and their outputs	• Meat production (Iberian pig species) • Meat consumption (Iberian pig species) • Number of individuals (Iberian pig) • Meat production (reindeer) • Meat consumption (reindeer) • Number of individuals (reindeer)
		Wild plants, algae and their outputs	• Distribution of heathlands and other habitats for bees • Distribution of plants important for honey production • Distribution of wild berries, fruits, mushrooms (NFI plot data) • Distribution of wild berries (modelling) • Honey production → Honey consumption • Wild berries, fruits and mushroom harvest
		Wild animals and their outputs	• Amount of meat (hunting) • Value of game • Hunting records (killed animals)
		Plants and algae from in-situ aquaculture	
		Animals from in-situ aquaculture	
	Water	Surface water for drinking	• Total supply of water per forest area (modelling) • Area of forest dedicated to preserve water resources • Surface water supply per forest area (at river basin level) • River discharge → Reservoir water (proxy) • Population and per capita water consumption
		Ground water for drinking	None
Materials	Biomass	Fibres and other materials from plants, algae and animals for direct use or processing	• Forest biomass stock • Forest biomass increment • Forest for timber, pulp wood, etc. production • Commercial forest tree volume & harvesting rates • Trees (presence): cork oak for cork & pines for resins • Tree species (timber trees) • Wood consumption (industrial roundwood, fuelwood) + Consumption of cork and resins
		Materials from plants, algae and animals for agricultural use	• Distribution of foraging areas in forest; estimate of grassland/shrubland (NFP) • Marketed forage
		Genetic materials from all biota	• Distribution of plants species with biochemical (pharmaceutical uses • Raw materials for medicines
	Water	Surface water for non-drinking purposes	***Same as for drinking purposes***
		Ground water for non-drinking purposes	
Energy	Biomass-based energy sources	Plant-based resources	• Wood fuel stock (fraction of forest biomass stock) • Wood fuel production (fraction of forest biomass increment) • Distribution of trees for wood production • Fuel wood consumption
		Animal-based resources	
	Mechanical energy	Animal-based energy	

Table 8. Indicators for provisioning services delivered by agro-ecosystems.

Division	Group	Class	Cropland	Grassland
Nutrition	Biomass	Cultivated crops	• Yields of food and feed crops (tonha; ton dry matterha; MJha) • Food and feed crop area (ha)	• Yields (tonha; ton dry matterha; MJha) • Grassland area (ha)
		Reared animals and their outputs	• Livestock data (LUHa, Tonyr/region)	
		Wild plants, algae and their outputs		
		Wild animals and their outputs	• Wild game bag data (merged with forest ecosystems) • Wild game population estimates	
		Plants and algae from in-situ aquaculture		
		Animals from in-situ aquaculture		
	Water	Surface water for drinking	• High Nature Value farmland	
		Ground water for drinking	• Areas important for groundwater abstraction in agro ecosystems	
Materials	Biomass	Fibres and other materials from plants, algae and animals for direct use or processing	• Yields of fibre crops (tonha; ton dry matterha; MJha) • Fibre crop area (ha) • Manure (tonyr)	
		Materials from plants, algae and animals for agricultural use		
		Genetic materials from all biota	• Yields of crops used for medicinal and cosmetic purposes (tonha; ton dry matterha; MJha) • Area of crops used for medicinal and cosmetic purposes (ha)	
	Water	Surface water for non-drinking purposes	***See freshwater ecosystems***	
		Ground water for non-drinking purposes	***See freshwater ecosystems***	
Energy	Biomass-based energy sources	Plant-based resources	• Yields of energy crops (tonha; ton dry matterha; MJha) • Energy crop area (ha) • Biofuel, biodiesel, bioethanol (kToe)	• Yields of grassland for energy production (tonha; ton dry matterha; MJha) • Grassland for energy area (ha)
		Animal-based resources	• Energy from manure treatment systems	
	Mechanical energy	Animal-based energy		

Customisation of CICES across Member States, Copenhagen, 26 February 2016

CICES applications across the member states

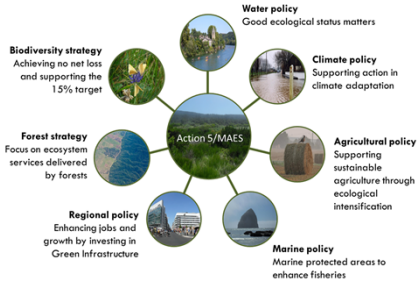
- Lots of indicators are available to use in CICES however a limited share of the indicators for ecosystem are widely available and ready to use for reporting under Action 5 of the EU Biodiversity Strategy.

		Forests	Agro-ecosystems (cropland and grassland)	Freshwater ecosystems (rivers, lakes, ground water, and wetlands)	Marine ecosystems (Marine inlets and transitional waters, coastal zones, shelf ecosystems, and open ocean)
Provisioning services	●	13	9	6	0
	●	18	8	12	3
	●	7	3	8	0
	●	0	0	0	2
Regulation and maintenance services	●	5	8	5	13
	●	15	14	22	1
	●	30	6	7	4
	●	13	0	11	3
Cultural services	●	0	1	3	1
	●	6	12	12	1
	●	10	6	22	0
	●	0	0	2	5
Total number of indicators		117	67	110	33
Share of green indicators	●	15%	27%	13%	42%

CICES applications across the member states

CICES as classification for ecosystem services in the EU

- CICES enables operationalization of ecosystem services and facilitates mainstreaming to other policies.
- The hierarchical structure facilitates comparisons of assessment across, ecosystems, scales and MS.
- It is very useful to bundle services at class level
- It also allow links to other classificiation systems such as the MA, TEEB, MS classifications.



Customisation of CICES across Member States, Copenhagen, 26 February 2016

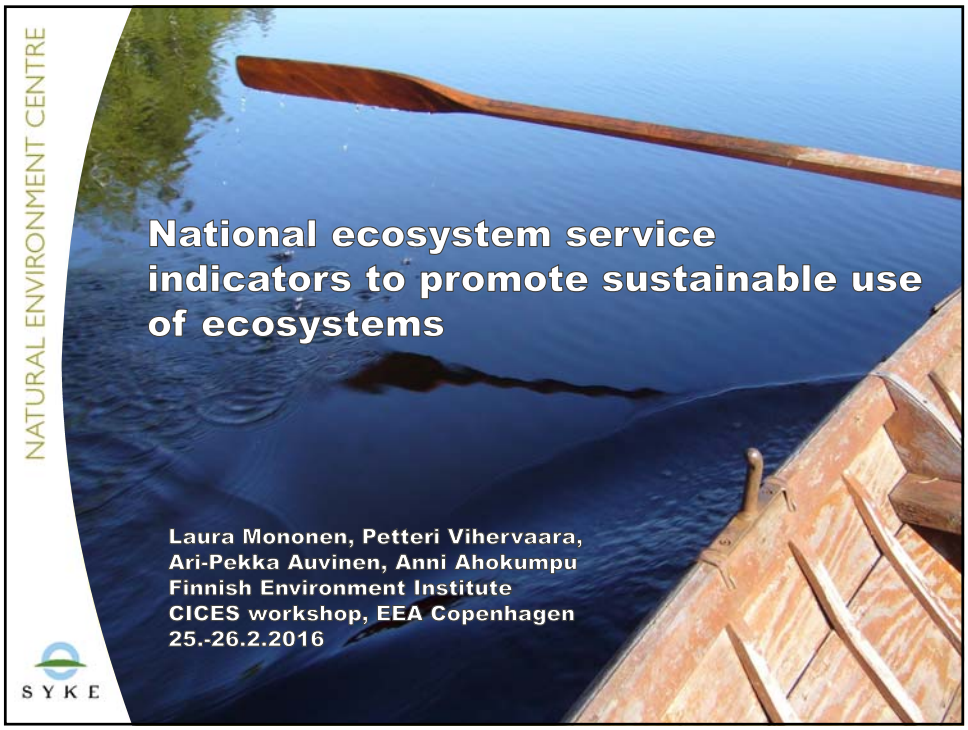
Some issues that would help CICES to be more useful

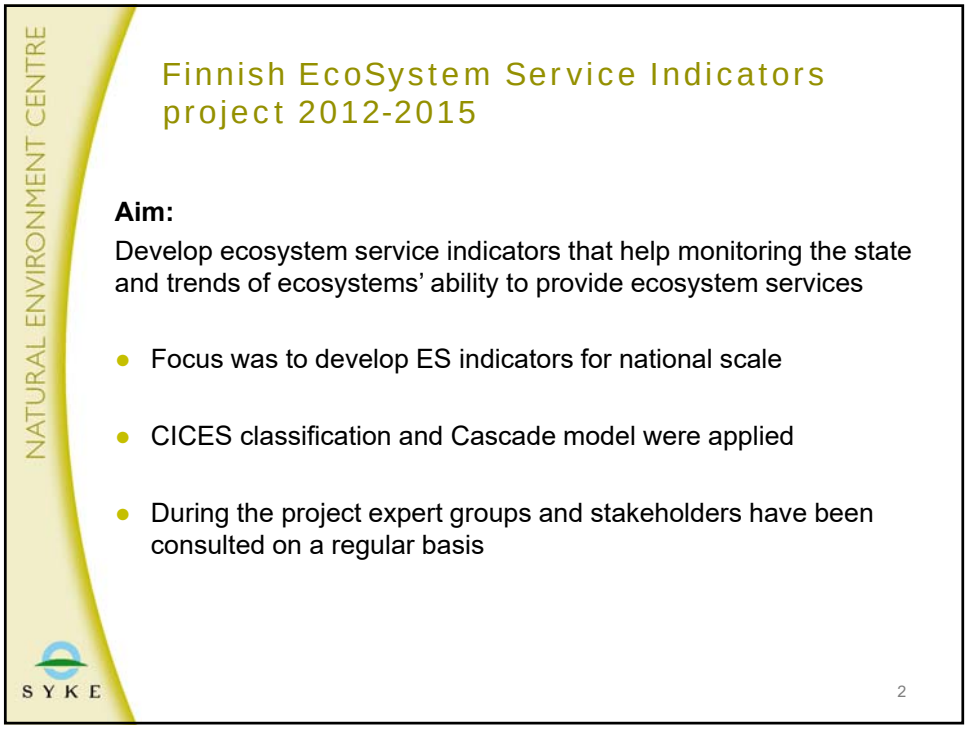
- The use of CICES is less evident for marine or freshwater ecosystems. Some conceptual difficulties can be encountered for example in regulating services.
- There is few good quality indicators that correlates with CICES, all the rest are proxies.
- When assessing one ecosystem, CICES users refer to other ecosystems as a provider of the services (i.e ground water). It might be need to develop an integrated approach across connected ecosystems.
- Difficulties in distinguishing between the supply and the demand side of ecosystem services classification.
- Also difficult to include some indicators that are more associate to ecosystems functions and ecosystem benefits. It might be useful to integrate these dimensions in CICES.
- Maybe CICES should also clearly acknowledge other uses than accounting.

THANKS!

Fernando Santos-Martín

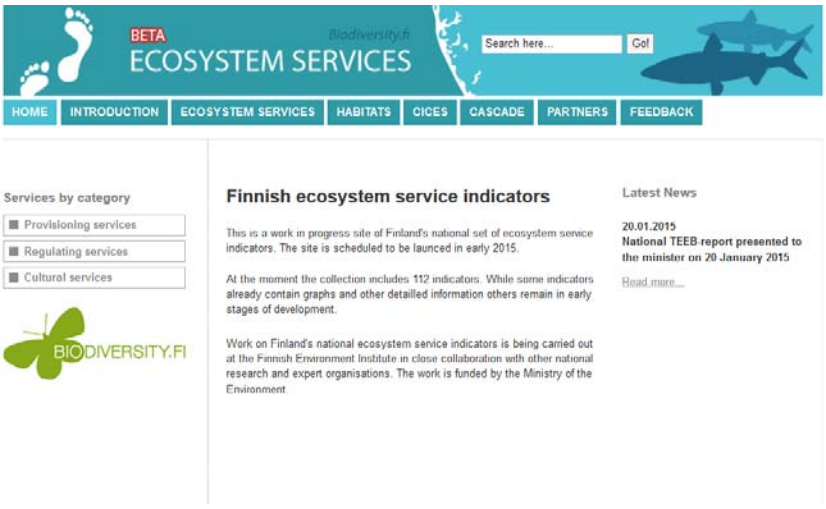
Email: fernando.santos.martin@uam.es


NATURAL ENVIRONMENT CENTRE
National ecosystem service indicators to promote sustainable use of ecosystems
Laura Mononen, Petteri Vihervaara,
Ari-Pekka Auvinen, Anni Ahokumpu
Finnish Environment Institute
CICES workshop, EEA Copenhagen
25.-26.2.2016
SYKE


NATURAL ENVIRONMENT CENTRE
Finnish EcoSystem Service Indicators project 2012-2015
Aim:
Develop ecosystem service indicators that help monitoring the state and trends of ecosystems' ability to provide ecosystem services
Focus was to develop ES indicators for national scale
CICES classification and Cascade model were applied
During the project expert groups and stakeholders have been consulted on a regular basis
SYKE
2

NATURAL ENVIRONMENT CENTRE

http://www.biodiversity.fi/ecosystemservices/



SYKE

3

NATURAL ENVIRONMENT CENTRE

CICES

- CICES was used to identify nationally the most relevant ecosystem services
- In total 28 ecosystem services were selected
- Notes:
  - CICES included many ES groups that were not applicaple in Finland
  - However, most of the site specific ESs were included in the examples part and were detected quite easily

SYKE

4

Sec.	Div.	Group	ES
Provisioning services	Nutrition	Biomass	Berries and mushrooms
			Game
			Reindeer
			Fish and crayfish
			Crops
			Reared animals
		Water	Clean water
	Materials	Biomass	Wood
			Genetic material
	Energy	Biomass b. res.	Bioenergy

Sec.	Div.	Group	ES
Regulating and maintenance services	Mediation of waste, toxics and other nuisances	Mediation by biota	Mediation of waste and toxins
			Air quality
		Mediation by ecosystem	Water filtration
			Nutrient retention
			Noise reduction
	Mediation of flows	Mass flows	Erosion control
		Liquid flows	Water retention
	Maintenance of physical, chemical and biological conditions	Lifecycle maintenance, habitat and gene pool protection	Pollination
			Nursery habitats
		Soil formation and composition	Soil quality
			Nitrogen uptake
		Atmospheric composition and climate regulation	Climate regulation

Sec.	Div.	Group	ES
Cultural services	Physical and intellectual interactions with biota, ecosystems and land-/seascapes	Physical and experiential interactions	Recreation
			Nature tourism
		Intellectual and representative interactions	Science and education
			Nature-related heritage
			Landscape
			Arts and popular culture

NATURAL ENVIRONMENT CENTRE

Cascade model was applied to cover information for all stages of the ecosystem flow

ECOSYSTEM SERVICE

ECOSYSTEMS & BIODIVERSITY | **HUMAN WELL-BEING**

STRUCTURE (& PROCESS)
Biophysical structures that create the basis for the functioning of the ecosystem.

Spatial perspective.

FUNCTION
Functioning of the ecosystem that is needed to produce ecosystem services.

Temporal perspective.

BENEFIT
The used share of the potential of ecosystem services.

Benefit as experienced by humans.

VALUE
The economic, social, health or intrinsic value of the benefit.

Monetary and non-monetary valuation.

SYKE

6

NATURAL ENVIRONMENT CENTRE

Provisioning services

Structure:
Required habitat (ha) and/or organisms (n)

Function:
Productivity, inputs from outside the ecosystem (feeding, fertilizers, management etc.)

Benefit:
Utilized share of the total harvest

Value:
Economic, social, health and intrinsic

Flickr: © Patrik Jones

SYKE

NATURAL ENVIRONMENT CENTRE

Reindeer

1. Structure	2. Function	4. Benefit	5. Value
Reindeer pastures (ha) - area and quality of lichen grounds, open mires - alpine habitats, forests, mires	Reindeer population (n), birth rate (%) - incl. assessment of sustainability (need for supplementary feeding).	Culled reindeer (kg) - benefit both in terms of meat and reindeer as an element of landscape	Economic: Sales of reindeer meat (€) Social: Employment (n) Intrinsic Heath

Flickr: © Patrik Jones

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NATURAL ENVIRONMENT CENTRE

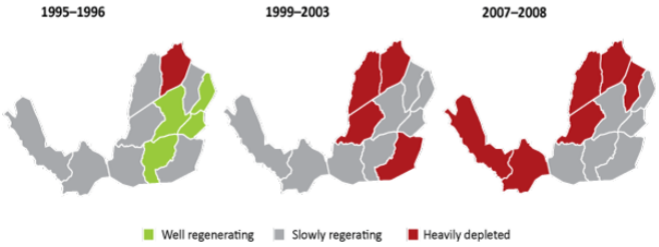
Example

Structure: Reindeer pastures

The reindeer management area covers the northern part of Finland including Lapland and parts of Northern Ostrobothnia and Kainuu. The area equals about one third of the land area of Finland. The main nutrition sources for reindeer are dwarf shrubs and leaves of bushes and young trees in summer and lichens, *Alectoriaceae sp.* and wavy hair-grass (*Deschampsia flexuosa*) in winter.

NORTHERN PART OF THE REINDEER MANAGEMENT AREA

The vastest lichen pastures grow in the northernmost Finland and their state has been deteriorating. Yet in 1995–1996 the reindeer pastures were mostly either well or slowly regenerating in the twelve northernmost reindeer pastoral districts. Only in one district the pastures were heavily depleted. In a decade the situation declined significantly. In 2007–2008 the lichen pastures were heavily depleted in six districts and in other six districts the regeneration speed had slowed down. In none of the twelve districts were the lichen pastures well regenerating.



SYKE

9

NATURAL ENVIRONMENT CENTRE

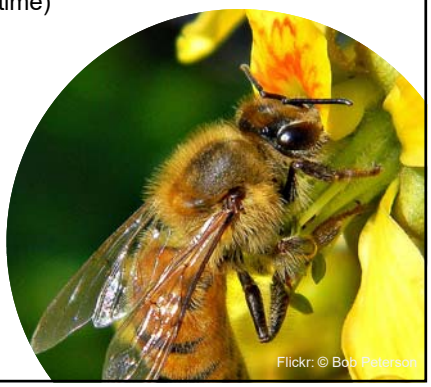
Regulating and maintenance services

Structure:
Required habitat qualities, area of suitable habitat (ha), required species assemblage

Function:
Functioning of the process (unit/area/time)

Benefit:
Improvement of quality

Value:
Often avoided costs that arise from compensating for the compromised functioning of the service



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NATURAL ENVIRONMENT CENTRE

Pollination

1. Structure

Pollinator nesting and foraging habitats (ha)

- area and quality - suitable field verges, meadows etc.

2. Function

Pollination (events/time)

- number/density of pollinators, activity

4. Benefit

Increase in yield (kg/ha)

- proportion of yield attributable to pollinators

5. Value

Economic: Improved production (€)

Health
Intrinsic
Social

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NATURAL ENVIRONMENT CENTRE

Cultural services

Structure: Quality as experienced by people, preferences, accessibility

Function: Change/continuity as experienced by people (considering time scale)

Benefit: Measured as number of visits, times used, number of work(s) produced etc.

Value:
Economic, social, health and intrinsic values

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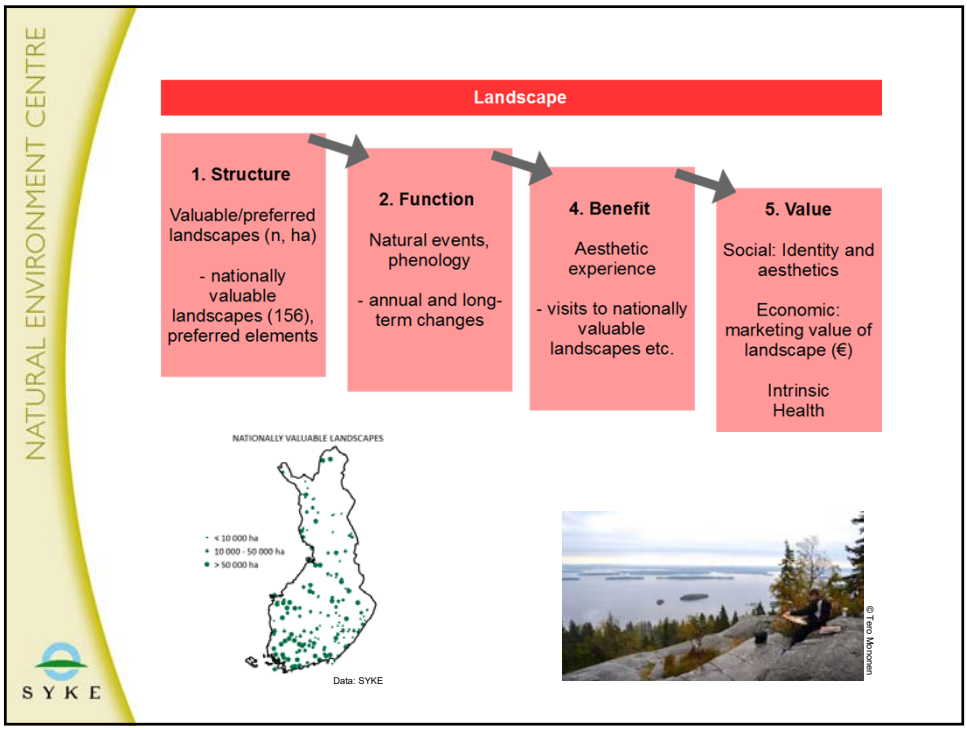

			ES	1. Structure	2. Function	4. Benefit	5. Value
Provisioning services	Nutrition	Biomass	**Berries and mushrooms**	Berry and mushroom habitats (ha)	Yield production (kg/A or kg/ha/A)	Harvest (kg)	Sales, picking income (€), berry and mushroom pickers (n, %), health and intrinsic values
			Game	Game habitats (ha)	Game population (n), wildlife richness	Game bag (kg)	Game bag (€), social, health and intrinsic values
			Reindeer	Reindeer pastures (ha)	Reindeer population (n), reindeer birth rate (%)	Culled reindeer (kg)	Sales of reindeer meat (€), employment (n), intrinsic and health values
			Fish and crayfish	State of surface waters (qualitative scale), stream fragmentation	Population dynamics of commercially used fish and crayfish	Total catch (kg)	Total catch (€), employment (n), health and intrinsic values
			Crops	Area under crop cultivation (ha)	Nutrient dynamics (kg/ha), use of fertilizers and pesticides (kg/ha)	Harvest (kg)	Agricultural income (€), employment (n), health and intrinsic values
			Reared animals	Number of animals (n), area of pastures (ha)	Nutrient and energy uptake Organic vs. conventional	Animal products (kg, l)	Agricultural income (€), employment (n), health and intrinsic values
		Water	**Clean water**	Undisturbed habitats and aquifers (ha)	State of surface water and groundwater (qualitative scale)	Use of raw water (m^3)	Value of domestic, irrigation and process water use (€), health, social and intrinsic values
	Materials	Biomass	**Wood**	Managed forests (ha)	Growing stock increment, effect of management (m^3/year)	Roundwood removals (m^3)	Roundwood trade (€), employment (n), health and intrinsic values
			Genetic material	Number of varieties (n), area of gene reserve habitats (ha)	Breeding, genetic variance, evolution	Breeding and discovery potential, gained benefit	Genetic variance and evolution, economic value of modified organisms (€), intrinsic, social and health values
	Energy	Biomass b. en.res.	**Bioenergy**	Area under bioenergy crops (ha)	Annual growth of biomass (tons/ha/year)?	Harvest (m^3), energy content (PJ)	Produced energy (€), employment (n), health and intrinsic values

			ES	1. Structure	2. Function	4. Benefit	5. Value
Regulating and maintenance services	Mediation of waste, toxics and other nuisances	Mediation by biota	**Mediation of waste and toxins**	Ecosystem, soil organisms	Decomposition, mediation or storage of waste by biological, biochemical or biophysical processes	Improvement of water and soil quality	Health value, avoided costs of waste management (€), social and intrinsic values
			Air quality	Urban green infrastructure (ha)	Retention of small particles	Improved air quality	Health values of clean air, avoided medical costs (€), social and intrinsic values
		Mediation by ecosystem	**Water filtration**	Undisturbed habitats and aquifers (ha)	Groundwater production (recharge rate, mm/ha/year)	Groundwater and surface water quality	Value of groundwater stock and high quality surface water (€), health impacts, social and intrinsic values
			Nutrient retention	Undisturbed habitats (ha)	Nutrient retention rate	Improved water and soil quality (qualitative scale)	Avoided costs of fertilizer use and water protection measures (€), social, health and intrinsic values
			Noise reduction	Vegetation in urban areas (ha)	Acoustic absorption	Reduced noise level	Health values of reduced-noise environment, avoided medical costs (€), social and intrinsic values),
	Mediation of flows	Mass flows	**Erosion control**	Undisturbed soils (ha)	Particle retention rate	Avoided erosion, improved water quality	Avoided costs of fertilizer use (€), high quality surface water (€), social, intrinsic and health values
		Liquid flows	**Water retention**	Undrained habitats, vegetation type and cover (ha)	Detention time (per habitat type, natural vs. modified)	Flood and flow control (natural levelling of flow)	Avoided costs of flood prevention and avoided damages (€), health, social and intrinsic values

				1. Structure	2. Function	4. Benefit	5. Value
Regulating and maintenance services	Maintenance of physical, chemical and biological conditions	Lifecycle maintenance, habitat and gene pool protection	**Pollination**	Pollinator nesting and foraging habitats (ha)	Pollination	Increase in yield (kg/ha)	Improved production (€), health, intrinsic and social values
			Nursery habitats	Area and state of nursery habitats (n, ha)	Shelter and nutrition (measured as reproduction success)	Viable populations	Avoided costs of stock replenishment and other management measures (€), intrinsic, social and health values
		Soil formation and composition	**Soil quality**	Functional diversity of soil organisms	Cycling of substances	Soil quality	Avoided costs of soil improvement (€), increased harvest (€), health, intrinsic and social value
			Nitrogen uptake	Nitrogen-fixing vegetation (ha)	Nitrogen fixation rate	Improvement of nutrient balance and soil quality	Avoided costs of fertilizer use (€), health, intrinsic and social values
		Atmospheric composition and climate regulation	**Climate regulation**	Carbon-storing habitats (ha)	Carbon balance, sequestration rate	Climate regulation, stable climate	Avoided costs of negative climate impacts (€), intrinsic, health and social values of stable climate

			ES	1. Structure	2. Function	4. Benefit	5. Value
Cultural services	Physical and intellectual interactions with biota, ecosystems and land-/seascapes	Physical and experiential interactions	**Recreation**	Preferred natural areas (ha), accessibility	Natural events, phenology	Recreation, experience; People participating in recreational activities (n, %)	Avoided medical costs (€), health value, people participating outdoor-activities (n), intrinsic value
			Nature tourism	Preferred natural areas (ha), accessibility	Natural events, phenology	Employment (n), recreation, experience	Tourism revenue (€) , health value, employment (n), intrinsic value
		Intellectual and representative interactions	**Science and education**	Areas of particular interest (ha)	Natural events, phenology	Source of knowledge	Social, economic, intrinsic and health value of knowledge and innovations
			Nature-related heritage	Cultural heritage in natural landscapes (n)	Natural events, phenology	Cultural continuity	Social, intrinsic, economic and health values of nature-related cultural heritage.
			Landscape	Valuable/preferred landscapes (n, ha)	Natural events, phenology	Aesthetic experience	Identity and aesthetics, marketing value of landscape (€), intrinsic and health values
			Arts and popular culture	Emblematic species and landscapes (n)	Natural events, phenology	Aesthetic experience, recreation	Marketing value (€), identity and aesthetics, intrinsic and health values of cultural representations

NATURAL ENVIRONMENT CENTRE

National ecosystem service assessments in Finland

- TEEB for Finland -Towards Sustainable and Genuinely Green Economy - The value and social significance of ecosystem services in Finland) 2015
- Finland's national ecosystem services 2012-2014 http://www.biodiversity.fi/ecosystemservices/
- MAES work started in 2015, some maps have already been prepared and will be updated to the website

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Overview of the future

- In March 2016, the official national MAES network will be set up
  - The Ministry of the Environment has committed to support MAES work until 2020
- Insurance value
- Natural Capital Accounting
- Essential Biodiversity Variables (EBVs) have been considered from the perspective of Earth Observation products and how they could contribute to both biodiversity and ecosystem service monitoring

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Biodiversity.fi ECOSYSTEM SERVICES

More information:

http://www.biodiversity.fi/ecosystemservices/

Mononen, L., Auvinen, A.P., Ahokumpu, A.L., Rönkä, M., Aarras, N., Tolvanen, H., Kamppinen, M., Viirret, E., Kumpula, T. and Vihervaara, P., 2016. National ecosystem service indicators: Measures of social–ecological sustainability. *Ecological Indicators*, *61*, pp.27-37.

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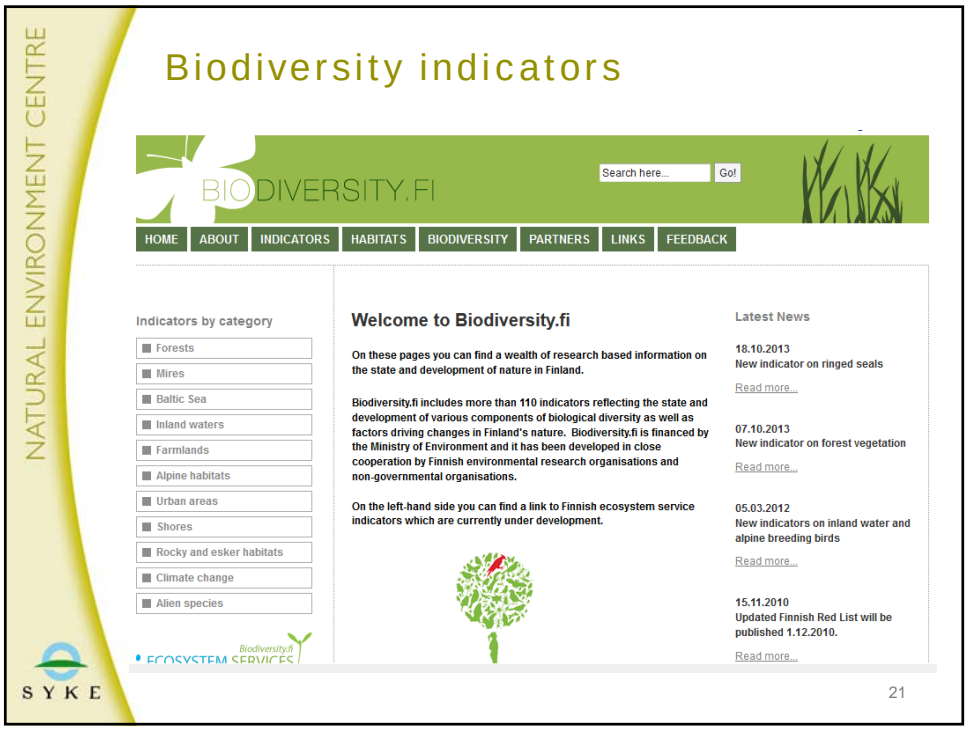
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Inland waters
Farmlands
Alpine habitats
Urban areas
Shores
Rocky and esker habitats
Climate change
Alien species
Welcome to Biodiversity.fi
On these pages you can find a wealth of research based information on the state and development of nature in Finland.
Biodiversity.fi includes more than 110 indicators reflecting the state and development of various components of biological diversity as well as factors driving changes in Finland's nature. Biodiversity.fi is financed by the Ministry of Environment and it has been developed in close cooperation by Finnish environmental research organisations and non-governmental organisations.
On the left-hand side you can find a link to Finnish ecosystem service indicators which are currently under development.
Latest News
18.10.2013
New indicator on ringed seals
Read more...
07.10.2013
New indicator on forest vegetation
Read more...
05.03.2012
New indicators on inland water and alpine breeding birds
Read more...
15.11.2010
Updated Finnish Red List will be published 1.12.2010.
Read more...
SYKE
21

Enhancing ecoSysteM sERvices mApping for poLicy and Decision mAking

Benjamin Burkhard
Kiel University

EU Horizon 2020 Coordination and support action

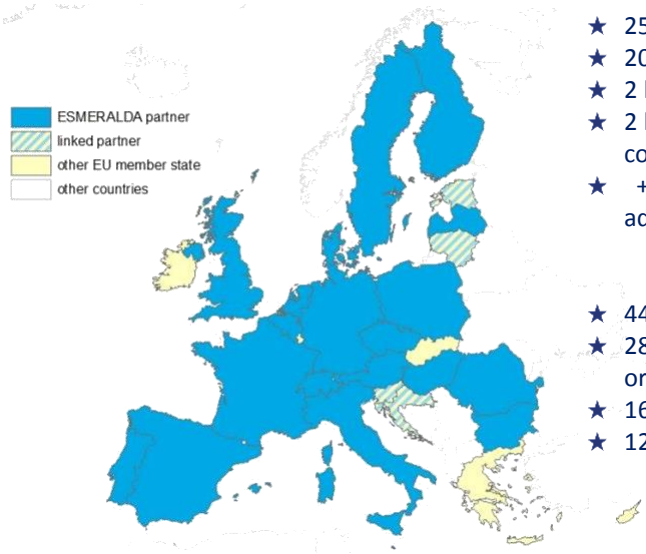
ESMERALDA background and targets

- ESMERALDA is a **Support & Coordination Action** to support EU member states in their tasks related to Biodiversity Strategy Target 2 Action 5
- Builds on/**co-operates** with e.g. MAES, OpenNESS, OPERAs, MESEU, TRAIN, …

ESMERALDA targets:

- **Ecosystem Services (ES) mapping and assessment strategies** for EU member states
- Deliver a '**flexible methodology**' for pan-European, national and regional ES mapping and assessment
- Test this methodology in case studies across European regions and themes
- **Mobilise all relevant actors** from science, policy, practice and society involved in ES
- **Enable actors in all EU member states** to fulfil their tasks of EU BD Strategy's Target 2 Action 5 / Mapping and Assessing Ecosystem and their Services

ESMERALDA consortium



- ★ 25 project partners
- ★ 20 European countries
- ★ 2 linked Baltic countries
- ★ 2 linked western Balkan countries
- ★ + further member states addressed already

- ★ 44 % university partners
- ★ 28 % state or other superior organisations
- ★ 16 % from other academia
- ★ 12 % SMEs

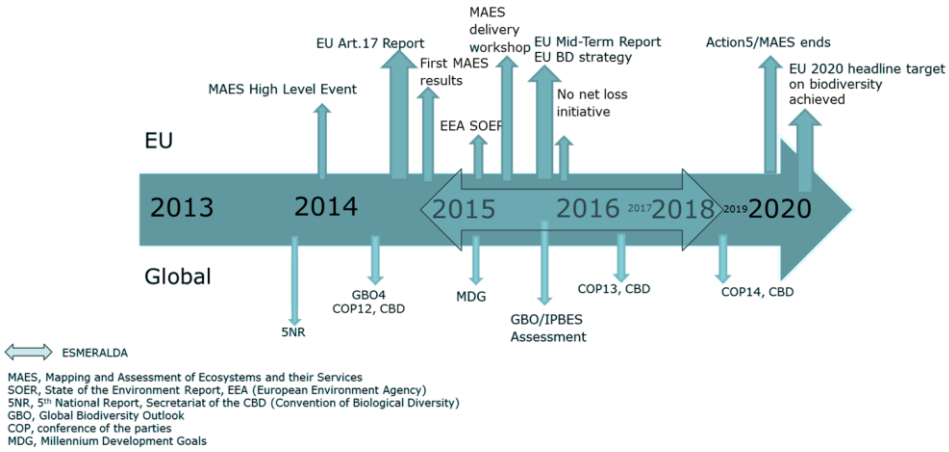
ESMERALDA consortium

No	Participant organisation name	Lead contact	Code	Country
1	Christian Albrechts University Kiel	Benjamin Burkhard	CAU	DE
2	Finnish Environment Institute	Leena Kopperoinen	SYKE	FI
3	University of Madrid	Fernando Santos	UAM	ES
4	University of Nottingham	Marion Potschin	UNOTT	UK
5	University of Trento	Davide Geneletti	UNITN	IT
6	Pensoft	Lyubomir Penev	PENSOFT	BG
7	Free University of Amsterdam	Roy Brouwer	VU	NL
8	Flemish Institute for Technological Research	Steven Broekx	VITO	BE
9	Bulgarian Academy of Sciences	Stoyan Nedkov	NIGGG BAS	BG
10	Global Change Research Centre	David Vačkář	CVGZ	CZ
11	Foundation for Sustainable Development	Rudolf de Groot	FSD	NL
12	ETH Zürich	Adrienne Grêt-Regamey	ETH Zurich	CH
13	Baltic Environmental Forum	Anda Ruskule	BEF	LV
14	Regional Environmental Centre	Sasa Solujic	REC	HU
15	Hungarian Academy of Sciences	Bálint Czúcz	MTA OK	HU
16	Instituto Superior Técnico	Cristina Marta-Pedroso	IST	PT
17	University of Bucharest	Adamescu Cristian Mihai	UB	RO
18	UNEP WCMC	Neil Burgess	WCMC	UK
19	Paris-Lodron University Salzburg	Hermann Klug	PLUS	AT
20	University of Poznan	Andrzej Mizgajski	UPOZ	PL
21	Institute for Environmental & Agricult. Science & Research	Sandra Luque	IRSTEA	FR
22	Malta College of Arts, Science and Technology	Mario Balzan	MCAST	MT
23	University of Copenhagen	Tobias Plieninger	UCPH	DK
24	Naturvårdsverket	Hannah Östergård	SEPA	SE
25	Joint Research Centre	Joachim Maes	JRC	EU

ESMERALDA timeline

- ★ **Project start: 01.02.2015**
- ★ **Project duration: 42 months**

Timeline showing the integration of ESMERALDA in related EU and global activities:



MAES, Mapping and Assessment of Ecosystems and their Services
SOER, State of the Environment Report, EEA (European Environment Agency)
SNR, 5th National Report, Secretariat of the CBD (Convention of Biological Diversity)
GBO, Global Biodiversity Outlook
COP, conference of the parties
MDG, Millennium Development Goals

ESMERALDA results from 1st phase

1st phase: Identification of relevant **stakeholders** and stocktaking, collecting and linking **existing approaches** for ES mapping and assessment, creating links to existing **related projects** and **databases**;

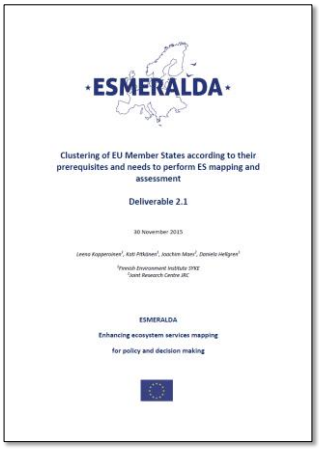
ESMERALDA Stakeholder Workshop

on ecosystem service mapping and assessment in EU member states at national level - Identified gaps and possible solutions-

13-16 October 2015, Riga, Latvia

ESMERALDA results from 1st phase

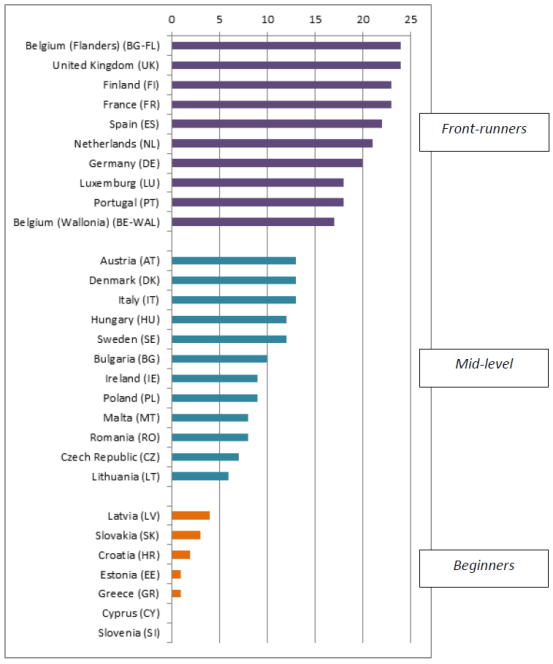
1st phase: Identification of relevant **stakeholders** and stocktaking, collecting and linking **existing approaches** for ES mapping and assessment, creating links to existing **related projects** and **databases**;



Deliverable 2.1 (Nov 2015): Clustering of EU Member States according to their prerequisites and needs to perform ES mapping and assessment.

Public report, available at:
http://esmeralda-project.eu/documents/1/

ESMERALDA results from 1st phase



Scores of each EU member state and their placement in the three clusters (ESMERALDA 2015)

ESMERALDA results from 1st phase

		BE-FL	UK	FI	FR	ES	NL	DE	LU	PT	BE-WAL
1. MAES status	MAES implemented	y	y	y	y	y	y	y	y	y	y
	Policies supporting MAES	n	y	-	y	y	n	n	-	y	y
	National MAES report	y	n	y	n	y	n	-	y	n	n
2. Networking, stakeholder involvement	National platform available	y	y	y	y	y	y	y	n	y	y
	Central administration	y	y	y	y	y	y	y	y	y	y
	Governmental institutes	y	y	y	y	y	y	y	y	y	y
	Regional administration	y	y	y	y	y	-	y		y	y
	Science	y	y	y	y	y	y	y	y	y	y
	NGOs	y	y	y	y	y	y	y		y	y
	Business	y	y	y	y	y	y	-	y	y	y
	Local communities	y	y	y	y	y	y	y	-	y	y
3. Resources available	Financial resources	y	y	y	y	n	y	y	y	n	n
	Human resources	y	y	y	y	y	y	y	y	n	n
4. Status of national assessment work	National scale assessments	y	y	y	y	y	y	y	y	y	y
	Selection of ES	y	y	y	y	y	y	y	y	y	y
	Prioritization of ES or classification (e.g CICES)	y	y	y	y	y	y	y	y	y	y
	Indicator framework	y	y	y	y	y	y	y	y	y	n
	Data identified	y	y	y	y	y	y	y	y	y	n
	EU Directive reporting indicators & data	y	n	-	y	-	n	y	y	y	n
5. Status of mapping	National scale maps on ES	y	y	y	y	y	y	y	y	n	n
	National scale maps on ES or habitats	y	y	y	n	y	y	-	y	n	n
6. Status of data	A national clearing house with data on MAES	y	y	n	n	y	y	-	n	n	y
	Data available	y	y	y	y	y	y	y	y	y	y
	Data compatible	y	y	y	y	-	y	y	n	n	y
	Data streamlined	n	y	y	y	-	n	n	n	n	n
7.	Case studies available	y	y	y	y	y	y	y	y	y	y
8.	Nation-wide mapping and assessment project planned for 2016 or beyond	-	-	-	-	-	-	-	-	-	-
	Final score	24	24	23	23	22	21	20	18	18	17

Score sheet of front-runner countries
(y = yes, n = no, - = unknown)
(ESMERALDA 2015)

ESMERALDA working phases

1st phase: Identification of relevant **stakeholders** and stocktaking, collecting and linking **existing approaches** for ES mapping and assessment, creating links to existing **related projects** and **databases**;

2nd phase: Development of the **multi-tiered ES mapping and assessment methodology**;

ESMERALDA Work Package 4 "Assessment methods":

The overall objective of WP4 is to develop an **integrated and consistent assessment framework** in which different mapping approaches and techniques can be embedded. This will be achieved by:

- ⋆ Developing a contextual framework based on **CICES** for communication ES issues with the user community;
- ⋆ . . .
- ⋆ . . .
- ⋆ Developing guidelines for a flexible, integrated assessment methodology that is tested in WP5.

ESMERALDA working phases

1st phase: Identification of relevant **stakeholders** and stocktaking, collecting and linking **existing approaches** for ES mapping and assessment, creating links to existing **related projects** and **databases**;

2nd phase: Development of the **multi-tiered ES mapping and assessment methodology**;

3rd phase: **Testing** the developed methodology in representative thematic and biome-oriented **Workshops** and **Case studies** across EU member states;

Case studies representative for:

- The variety of natural and socio-economic conditions in EU Member States
- The variety of cross-EU themes relevant for ES
- The geographical regions and biomes of the entire EU

ESMERALDA working phases

1st phase: Identification of relevant **stakeholders** and stocktaking, collecting and linking **existing approaches** for ES mapping and assessment, creating links to existing **related projects** and **databases**;

2nd phase: Development of the **multi-tiered ES mapping and assessment methodology**;

3rd phase: **Testing** the developed methodology in representative thematic and biome-oriented **Workshops** and **Case studies** across EU member states;

4th phase: Feedbacks from ESMERALDA stakeholders and other relevant user groups, **methodology improvement**;

5th phase: Producing **tailored and flexible solutions** for ES mapping and assessment for policy and decision making;

6th phase: Safeguarding the **implementation** of project results in the context of the BD Strategy and Horizon 2020, including strategies for long-term implementation beyond ESMERALDA

Workshop on: "Customisation of CICES across Member States" EEA Copenhagen 25.02.-26.02.2016

Thank you for your attention!

Contact: bburkhard@ecology.uni-kiel.de

http://esmeralda-project.eu/

This project receives funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 642007.

Introductory remarks

- **CICES application in Germany**
  - Scoping Study for a NEA
  - Natural Capital Germany - TEEB-DE
  - MAES in Germany (indicator development, assessment and valuation of CES)
  - River Basin Ecosystem Services Index
- **Particular perspective**
  - Developed in science-policy exchange
  - Assessment rather then accounting
  - Indicator development rather than classification critique
  - Clear focus on nature conservation (in line with MAES), but less cross-sectoral orientation
  - Economic valuation as aspired output, but only if supportive for nature conservation


Christian Albert, Benjamin Burkhard, Sabrina Daube, Katharina Dietrich, Barbara Engels, Jakob Frommer, Martin Götzl, Adrienne Grêt-Regamey, Beate Job-Hoben, Roger Keller, Stefan Marzelli, Christoph Moning, Felix Müller, Sven-Erik Rabe, Irene Ring, Elisabeth Schwaiger, Burkhard Schweppe-Kraft und Henry Wüstemann

Empfehlungen zur Entwicklung bundesweiter Indikatoren zur Erfassung von Ökosystemleistungen

Diskussionspapier

Albert et al. (2016), *BfN Skripten*


ARTICLE IN PRESS

Ecological Indicators

Towards a national set of ecosystem service indicators: Insights from Germany

Albert et al. (2016), *Ecological Indicators*

Where does CICES work?

- **CICES supported systematic and comprehensive selection of indicators in Germany**
  - Scoping Study for a National Ecosystem Assessment: CICES as reference classification for scoping the empirical basis
  - Naturkapital Deutschland – TEEB-DE: Development of a German version of CICES
  - Implementation of MAES: New interpretation, adaptation of CICES (e.g. Marzelli et al. 2014, Albert et al. 2016)
  - River Ecosystem Services Index (RESI): Currently develops adaptation for river basins
- **CICES successfully established as major reference classification**

How could CICES be improved?

- **Similar challenges identified as other research teams**
  - Blurring of service/use/benefit boundary (cf. CICES for marine ES)
  - Need to clarify current delivery (flow) and future potentials (stock) (cf. potentials and actual use, Maes et al. 2016)
  - Need for differentiated ES indicators (cf. Moronen et al.)
    - to enable investigating causes of changes, avoid misinterpretations
    - Example: Water purification ES if the amount of natural contaminant reduction is used as an indicator for water purification, increasing values would not necessarily indicate an enhanced self-purifying

How could CICES be improved?

- **1. Focus on most relevant indicators and avoid overlaps**
  - High number of indicators difficult to communicate and to comprehend
  - Overlaps between some provisioning and regulting ES (e.g. drinking water and water purification)
- **2. Focus on the current and potential future supply of ecosystem services regardless of actual use**
  - Do not forget about the stock of natural capital or stock of ecosystem capital

Albert et al. (2016), *Ecological Indicators*

How could CICES be improved?

- **3. Need for indicators to consider supply and demand**
  - At best, indicators for supply, demand, and changes in human well-being

Reasons

  - Future options need to be considered
  - Location of demand often strongly influences ES value
  - If demand is unconsidered, changes in ES could be misinterpreted and economic valuation is hampered

Example

  - Recreation opportunities near urban areas

Albert et al. (2016), *Ecological Indicators*

How could CICES be improved?

- **4. Indicators should differentiate between natural contributions and human contributions**
  - In our case: only potentials without human contributions
- **5. Suggest appoaches for cases of insufficient information**
  - Use expert-based approaches in cases where
  - Trying to be explict about uncertainties

Albert et al. (2016), *Ecological Indicators*

How could CICES be improved?

- **6. Comments on ES categories**
  - **Provisioning services:**
    - Problems of human input
  - **Regulating & maintenance services:**
    - Interactions with provisioning services
  - **Cultural services:**
    - Many CES difficult to distinguish and to assess due to data needs and strong influence of human input
    - suggestion: an indicator for „visual landscape“ plus seperate indicators for landscape capacities to provide opportunities for specific activities

Albert et al. (2016), *Ecological Indicators*

CICES "Section"	CICES "Division"	Ecosystem Services	Supply Indicators (using: ecosystem services potentials as a proxy)	Demand Indicators
Provisioning Services 1*)	Nutrition Materials Energy	Providing food and bio-energy from fields	Natural fertility of arable soils	2*)
		Providing fodder from grasslands	Proportion of grasslands in agricultural areas (contribution to animal production)	2*)
		Providing timber products	Timber stocks (sustainable yield by logging)	2*, 4*)

Background: Preliminary set of ecosystem service indicators as suggested by Marzelli et al. (2014a) and supplemented by additional expert consultations and literature considerations.

Explanations:

1*) The suggested indicators do not address ecosystem services supply as the combination of natural and human contributions to ecosystem services generation as this might be contradictory to nature conservation purposes. Instead, indicators for ecosystem services potentials are used. This is particularly relevant for provisioning ecosystem services. For more detailed explanation, please see the manuscript text.

2*) Global supply and demand patterns, spatial localisation difficult and not required in this context.

3*) Relationship between water retention and reduced damage currently only inaccurately modelled in Germany.

4*) The indicator "area of grasslands used for fodder production" would be, of course, more targeted on fodder production, whereas the "proportion of grasslands" can better help to point out additional grassland services e.g. for freshwater supply, erosion mitigation or cultural services more explicitly. A decision between alternatives should be based on a test of the whole set.

Albert et al. (2016), *Ecological Indicators*

CICES Section	CICES "Division"	Ecosystem Services	Supply Indicators (using: ecosystem services potentials as a proxy)	Demand Indicators
Regulation & Maintenance Services	Regulation (decomposition, sequestration, etc.) of toxins and waste	Regulating water quality by waterways	Naturalness of river beds and floodplains	Current water quality below water quality standards
		Regulating groundwater quality	Proportion of forest and grassland	Proximity of drinking water wells, water protection areas
			Protection of soils and geological layers	
	Mediation of flows	Mitigating erosion	Proportion of area with a certain minimum ground coverage by continuous vegetation cover	Active floodplains, areas of steep slopes, areas with sandy soils (easily blown away when dry)
			Proportion of natural and semi-natural small structures in the agricultural landscape	
		Mitigating flood hazards	Water retention capacity in flood plains	3*)
	Maintenance of physical, chemical, biological conditions	Facilitating pollination and biological pest control	Proportion of natural and semi-natural small structures in agricultural landscapes	Proportion of arable crops demanding insect pollination
		Storing greenhouse gases	Surfaces of drained / rewetted peatlands	2*)
		Mitigating greenhouse gas emissions	Contribution of land use change and forestry	2*)
		Regulating local climate and air quality	Proportion of green spaces in settlement areas	Degrees of population density, settlement extent, exposure to air pollutants and adverse urban climate effects

Albert et al. (2016), *Ecological Indicators*

CICES Section	CICES "Division"	Ecosystem Services	Supply Indicators (using: ecosystem services potentials as a proxy)	Demand Indicators
Cultural Services	Physical and intellectual interactions with biota, ecosystems, and landscapes	Providing opportunities for recreation	Recreational functions of variable ecosystem characteristics (e.g. naturalness, diversity, privacy, supply of specific uses)	Degree of population density, proximity to settlement centres, and designated recreational regions
		Providing opportunities for recreation in urban areas	Proportion of green spaces in urban areas, accessibility of urban green areas	Degree of population density and settlements of certain size

Background: Preliminary set of ecosystem service indicators as suggested by Marzelli et al. (2014a) and supplemented by additional expert consultations and literature considerations.

Explanations:

1*) The suggested indicators do not address ecosystem services supply as the combination of natural and human contributions to ecosystem services generation as this might be contradictory to nature conservation purposes. Instead, indicators for ecosystem services potentials are used. This is particularly relevant for provisioning ecosystem services. For more detailed explanation, please see the manuscript text.

2*) Global supply and demand patterns, spatial localisation difficult and not required in this context.

3*) Relationship between water retention and reduced damage currently only inaccurately modelled in Germany.

4*) The indicator "area of grasslands used for fodder production" would be, of course, more targeted on fodder production, whereas the "proportion of grasslands" can better help to point out additional grassland services e.g. for freshwater supply, erosion mitigation or cultural services more explicitly. A decision between alternatives should be based on a test of the whole set.

Albert et al. (2016), *Ecological Indicators*

Enhancing ecoSysteM sERvices mApping for poLicy and Decision mAking

Benjamin Burkhard
Kiel University

EU Horizon 2020 Coordination and support action

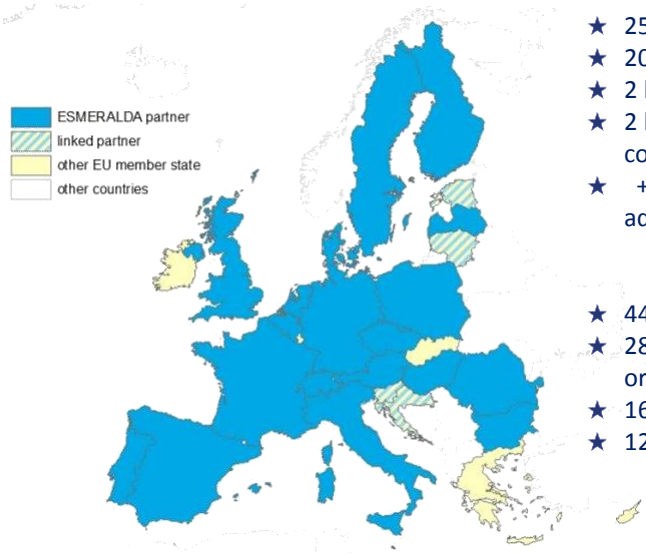
ESMERALDA background and targets

- ESMERALDA is a **Support & Coordination Action** to support EU member states in their tasks related to Biodiversity Strategy Target 2 Action 5
- Builds on/**co-operates** with e.g. MAES, OpenNESS, OPERAs, MESEU, TRAIN, …

ESMERALDA targets:

- **Ecosystem Services (ES) mapping and assessment strategies** for EU member states
- Deliver a '**flexible methodology**' for pan-European, national and regional ES mapping and assessment
- Test this methodology in case studies across European regions and themes
- **Mobilise all relevant actors** from science, policy, practice and society involved in ES
- **Enable actors in all EU member states** to fulfil their tasks of EU BD Strategy's Target 2 Action 5 / Mapping and Assessing Ecosystem and their Services

ESMERALDA consortium



- ★ 25 project partners
- ★ 20 European countries
- ★ 2 linked Baltic countries
- ★ 2 linked western Balkan countries
- ★ + further member states addressed already

- ★ 44 % university partners
- ★ 28 % state or other superior organisations
- ★ 16 % from other academia
- ★ 12 % SMEs

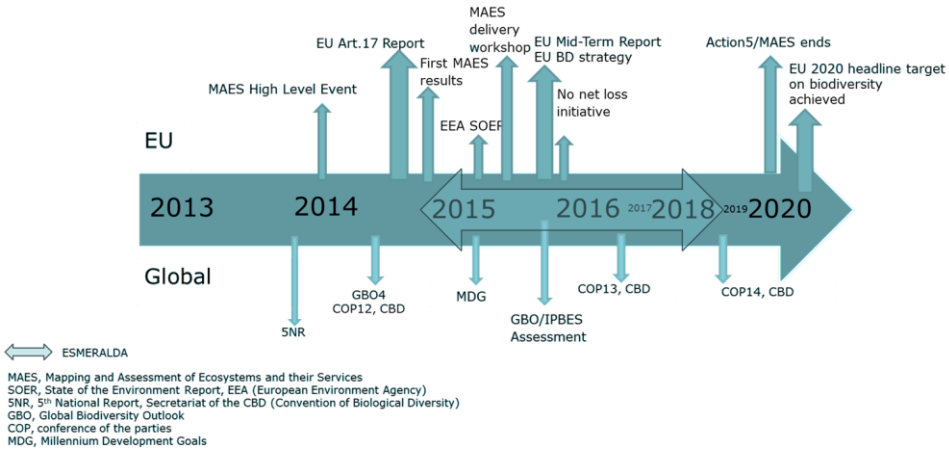
ESMERALDA consortium

No	Participant organisation name	Lead contact	Code	Country
1	Christian Albrechts University Kiel	Benjamin Burkhard	CAU	DE
2	Finnish Environment Institute	Leena Kopperoinen	SYKE	FI
3	University of Madrid	Fernando Santos	UAM	ES
4	University of Nottingham	Marion Potschin	UNOTT	UK
5	University of Trento	Davide Geneletti	UNITN	IT
6	Pensoft	Lyubomir Penev	PENSOFT	BG
7	Free University of Amsterdam	Roy Brouwer	VU	NL
8	Flemish Institute for Technological Research	Steven Broekx	VITO	BE
9	Bulgarian Academy of Sciences	Stoyan Nedkov	NIGGG BAS	BG
10	Global Change Research Centre	David Vačkář	CVGZ	CZ
11	Foundation for Sustainable Development	Rudolf de Groot	FSD	NL
12	ETH Zürich	Adrienne Grêt-Regamey	ETH Zurich	CH
13	Baltic Environmental Forum	Anda Ruskule	BEF	LV
14	Regional Environmental Centre	Sasa Solujic	REC	HU
15	Hungarian Academy of Sciences	Bálint Czúcz	MTA OK	HU
16	Instituto Superior Técnico	Cristina Marta-Pedroso	IST	PT
17	University of Bucharest	Adamescu Cristian Mihai	UB	RO
18	UNEP WCMC	Neil Burgess	WCMC	UK
19	Paris-Lodron University Salzburg	Hermann Klug	PLUS	AT
20	University of Poznan	Andrzej Mizgajski	UPOZ	PL
21	Institute for Environmental & Agricult. Science & Research	Sandra Luque	IRSTEA	FR
22	Malta College of Arts, Science and Technology	Mario Balzan	MCAST	MT
23	University of Copenhagen	Tobias Plieninger	UCPH	DK
24	Naturvårdsverket	Hannah Östergård	SEPA	SE
25	Joint Research Centre	Joachim Maes	JRC	EU

ESMERALDA timeline

- ★ **Project start: 01.02.2015**
- ★ **Project duration: 42 months**

Timeline showing the integration of ESMERALDA in related EU and global activities:



MAES, Mapping and Assessment of Ecosystems and their Services
SOER, State of the Environment Report, EEA (European Environment Agency)
SNR, 5th National Report, Secretariat of the CBD (Convention of Biological Diversity)
GBO, Global Biodiversity Outlook
COP, conference of the parties
MDG, Millennium Development Goals

ESMERALDA results from 1st phase

1st phase: Identification of relevant **stakeholders** and stocktaking, collecting and linking **existing approaches** for ES mapping and assessment, creating links to existing **related projects** and **databases**;

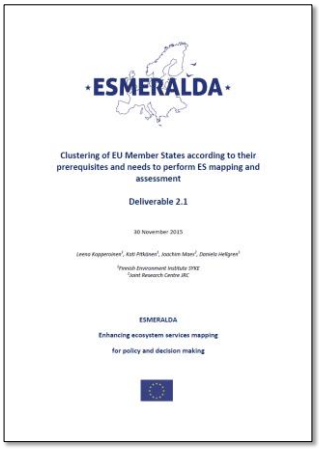
ESMERALDA Stakeholder Workshop

on ecosystem service mapping and assessment in EU member states at national level - Identified gaps and possible solutions-

13-16 October 2015, Riga, Latvia

ESMERALDA results from 1st phase

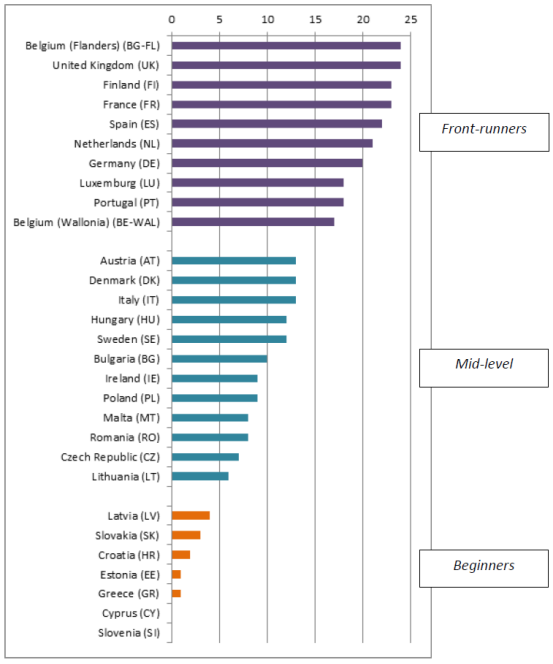
1st phase: Identification of relevant **stakeholders** and stocktaking, collecting and linking **existing approaches** for ES mapping and assessment, creating links to existing **related projects** and **databases**;



Deliverable 2.1 (Nov 2015): Clustering of EU Member States according to their prerequisites and needs to perform ES mapping and assessment.

Public report, available at:
http://esmeralda-project.eu/documents/1/

ESMERALDA results from 1st phase



Scores of each EU member state and their placement in the three clusters (ESMERALDA 2015)

ESMERALDA results from 1st phase

		BE-FL	UK	FI	FR	ES	NL	DE	LU	PT	BE-WAL
1. MAES status	MAES implemented	y	y	y	y	y	y	y	y	y	y
	Policies supporting MAES	n	y	-	y	y	n	n	-	y	y
	National MAES report	y	n	y	n	y	n	-	y	n	n
2. Networking, stakeholder involvement	National platform available	y	y	y	y	y	y	y	n	y	y
	Central administration	y	y	y	y	y	y	y	y	y	y
	Governmental institutes	y	y	y	y	y	y	y	y	y	y
	Regional administration	y	y	y	y	y	-	y		y	y
	Science	y	y	y	y	y	y	y	y	y	y
	NGOs	y	y	y	y	y	y	y		y	y
	Business	y	y	y	y	y	y	-	y	y	y
	Local communities	y	y	y	y	y	y	y	-	y	y
3. Resources available	Financial resources	y	y	y	y	n	y	y	y	n	n
	Human resources	y	y	y	y	y	y	y	y	n	n
4. Status of national assessment work	National scale assessments	y	y	y	y	y	y	y	y	y	y
	Selection of ES	y	y	y	y	y	y	y	y	y	y
	Prioritization of ES or classification (e.g CICES)	y	y	y	y	y	y	y	y	y	y
	Indicator framework	y	y	y	y	y	y	y	y	y	n
	Data identified	y	y	y	y	y	y	y	y	y	n
	EU Directive reporting indicators & data	y	n	-	y	-	n	y	y	y	n
5. Status of mapping	National scale maps on ES	y	y	y	y	y	y	y	y	n	n
	National scale maps on ES or habitats	y	y	y	n	y	y	-	y	n	n
6. Status of data	A national clearing house with data on MAES	y	y	n	n	y	y	-	n	n	y
	Data available	y	y	y	y	y	y	y	y	y	y
	Data compatible	y	y	y	y	-	y	y	n	n	y
	Data streamlined	n	y	y	y	-	n	n	n	n	n
7.	Case studies available	y	y	y	y	y	y	y	y	y	y
8.	Nation-wide mapping and assessment project planned for 2016 or beyond	-	-	-	-	-	-	-	-	-	-
	Final score	24	24	23	23	22	21	20	18	18	17

Score sheet of front-runner countries
(y = yes, n = no, - = unknown)
(ESMERALDA 2015)

ESMERALDA working phases

1st phase: Identification of relevant **stakeholders** and stocktaking, collecting and linking **existing approaches** for ES mapping and assessment, creating links to existing **related projects** and **databases**;

2nd phase: Development of the **multi-tiered ES mapping and assessment methodology**;

ESMERALDA Work Package 4 "Assessment methods":

The overall objective of WP4 is to develop an **integrated and consistent assessment framework** in which different mapping approaches and techniques can be embedded. This will be achieved by:

- ⋆ Developing a contextual framework based on **CICES** for communication ES issues with the user community;
- ⋆ . . .
- ⋆ . . .
- ⋆ Developing guidelines for a flexible, integrated assessment methodology that is tested in WP5.

ESMERALDA working phases

1st phase: Identification of relevant **stakeholders** and stocktaking, collecting and linking **existing approaches** for ES mapping and assessment, creating links to existing **related projects** and **databases**;

2nd phase: Development of the **multi-tiered ES mapping and assessment methodology**;

3rd phase: **Testing** the developed methodology in representative thematic and biome-oriented **Workshops** and **Case studies** across EU member states;

Case studies representative for:

- The variety of natural and socio-economic conditions in EU Member States
- The variety of cross-EU themes relevant for ES
- The geographical regions and biomes of the entire EU

ESMERALDA working phases

1st phase: Identification of relevant **stakeholders** and stocktaking, collecting and linking **existing approaches** for ES mapping and assessment, creating links to existing **related projects** and **databases**;

2nd phase: Development of the **multi-tiered ES mapping and assessment methodology**;

3rd phase: **Testing** the developed methodology in representative thematic and biome-oriented **Workshops** and **Case studies** across EU member states;

4th phase: Feedbacks from ESMERALDA stakeholders and other relevant user groups, **methodology improvement**;

5th phase: Producing **tailored and flexible solutions** for ES mapping and assessment for policy and decision making;

6th phase: Safeguarding the **implementation** of project results in the context of the BD Strategy and Horizon 2020, including strategies for long-term implementation beyond ESMERALDA

Workshop on: "Customisation of CICES across Member States" EEA Copenhagen 25.02.-26.02.2016

Thank you for your attention!

Contact: bburkhard@ecology.uni-kiel.de

http://esmeralda-project.eu/

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