Stockholm Resilience Centre

Brief

November 2016

Eel fisher sortinghis catch in the Resö harbour. Photo credit: Andre Maslennikov/Azote

An analytical framework for assessing progress toward ecosystem-based management

While both practical implementation of Ecosystem-based management (EBM), and academic studies of such initiatives, has increased in the last decade there is a notable lack of systematic, critical assessment of EBM progress and outcomes that take both ecological and socioeconomic aspects into account in an integrated fashion. This is problematic given the increasingly important role of EBM as a guiding principle and goal in both policy and practice. Consensus exists on why it is good and desirable to aim for EBM but it seems the EBM concept itself has expanded at a pace higher than the knowledge of how to accomplish EBM has accumulated.

Stockholm Resilience Centre
Sustainability Science for Biosphere Stewardship

Stockholm University

A PARTNER WITH

GLOBAL ECONOMIC DYNAMICS AND THE BIOSPHERE
THE ROYAL SWEDISH ACADEMY OF SCIENCES

Fishing vessels moored in a Norwegian harbor. Photo credit: Martin Almqvist/Azote

About Ecosystem-based management

Broadly speaking, ecosystem-based management (EBM) seeks to adapt planning and management to the dynamics of whole ecosystems and has been promoted as an overarching strategy to handle the complexity of environmental challenges. Since its development in the 1990s it has become a key instrument of contemporary environmental policy and practice, recognized at a global level through the Malawi principles which guide the implementation of the Convention on Biological Diversity. It has also become one of the main guiding principles in environmental governance at national, regional, and local levels, such as Integrated Coastal Zone Management, ICZM and several European Union policies (e.g. the EU Water Framework Directive, the EU Marine Strategy Framework Directive, and the EU Landscape convention).

A tool for assessing progress towards EBM

This policy brief summarizes the key elements in a proposed generic framework for assessing EBM progress which considers both social and ecological outcomes. The analytical framework is generic and applicable to any kind of environment, but is illustrated using a coastal system as an example.

There are several advantages with the assessment framework: it provides a meaningful, transparent, and fairly robust assessment process for the multi-facet concept EBM. It also provides a basis for a refined analysis of how to improve EBM in any given case.The framework is intentionally limited in scope but can accommodate significant contextual variability and still deliver comparable results, across different EBM initiatives. Furthermore, it does not prescribe certain types of input data, nor does it prevent mixing different types of data sources and allows for the breaking out, and examination, of isolated parts of the assessment matrix. The framework can also be used to evaluate both single and multiple cases of EBM. Finally, it is also particularly useful for longitudinal studies of governance transformations that continually assess the progress in EBM, while simultaneously keeping monitoring key points for improvements.

Limitations

The assessment tool does not address all the principles of EBM (e.g. the Malawi Principles) but should be seen as one tool, in a larger toolbox, to be used when evaluating EBM.

When evaluating a single case, it is particularly important to interpret and define the assessment criteria and their different scores in a well-informed and context relevant way, making sure that definitions of what constitutes 'low', 'medium' and 'high' are discussed together with the assessment results.

A cross-case comparative analysis focusing merely on the differences between the cases is less reliant on a detailed discussion on why a certain degree of, for example, integration should be denoted 'high' or 'medium', but it is nonetheless important to define criteria so as to allow meaningful comparisons among cases.

Key conclusions

Achieving high scores for specificity and integration is the most difficult part of EBM.

Goals and measures are often defined on a scale that is not well aligned with the scale of the EBM target area. For example, identifying euthrophication as a key driver of system degradation and thus setting as a goal to reduce it, despite the fact that the factors causing eutrophication are beyond the scope of influence of the EBM initiative.

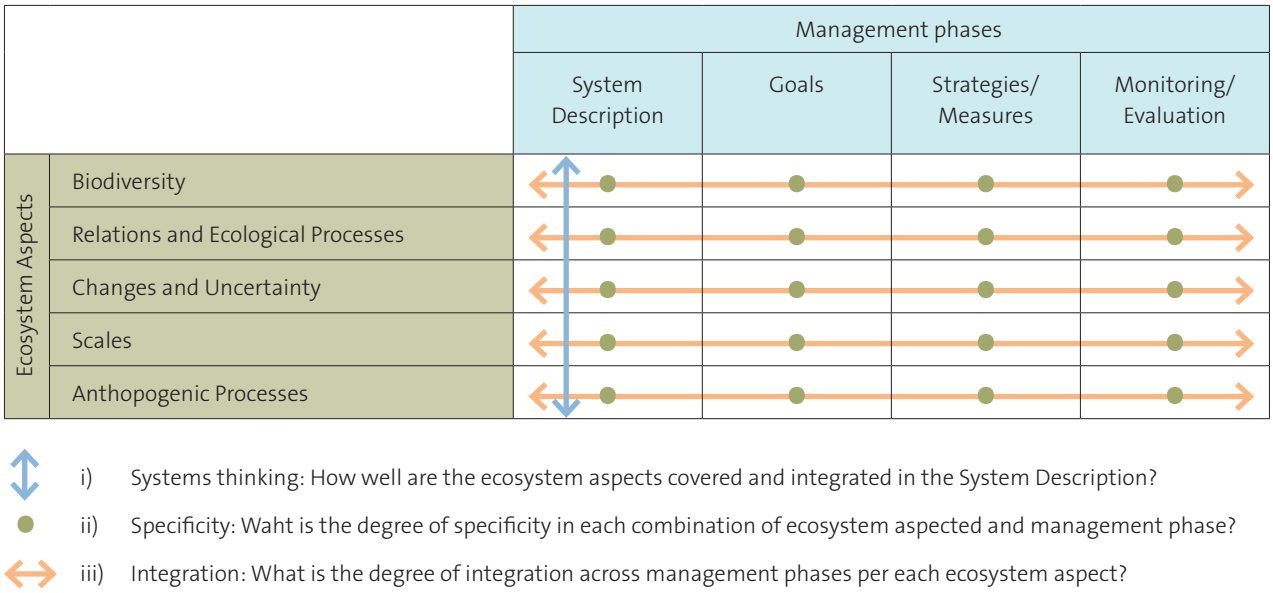

Figure 1: The EBM assessment matrix.

The framework in detail

The framework identifies five key ecosystem aspects of EBM which enjoy wide support among both academic and practitioners: (1) Biodiversity (genetic, species and biotopes), (2) Relations and Ecological Processes, (3) Changes and Uncertainty, (4) Scales (temporal and spatial), and (5) Anthropogenic Processes.

While these ecosystem aspects constitute the foundations of EBM, EBM is also a process with several different management phases in which different tasks are executed. A process-oriented approach to evaluating EBM is therefore needed to how understand how tasks of addressing the key ecosystem aspects are handled in different management phases – that is dealing with different tasks of defining and describing the social–ecological system, formulating management goals, selecting measures/strategies to achieve these goals, and indicators for monitoring. The framework identifies four phases: System Description, Goals, Strategies/Measures, and Monitoring/Evaluation.

The EBM assessment matrix (Figure 1) shows how the five ecosystem aspects can be evaluated in each of the four management phases on the basis of the degree of systems thinking, specificity and integration in the EBM process.

The assessment analysis step-by-step

The EBM assessment is organized into three steps;

(1) **Collecting and filling each cell in the assessment matrix with information.** This information can come from written records (e.g. reports, plans, meeting notes), interviews with key actors in the EBM initiative, or any combination of information sources.

(2) **Analyzing the matrix content using three guiding questions** (degree of A-systems thinking, B-specificity and C-integration in the EBM process). This will reveal strengths and weaknesses, gaps and linkages in present management.

A – In order for EBM to succeed it is essential to have a comprehensive understanding of the system to be managed. The management phase 'Systems Description' must therefore include descriptions of all ecosystem aspects including their interrelations. The first question therefore aims to capture this degree of systems thinking by asking: How well are the ecosystem aspects covered and integrated in the System Description (indicated by blue arrow in Figure 1)?

B – Another challenge in reaching EBM is to be clear about what is to be managed under each of the different ecosystem aspects and how. This is fundamentally an issue of specificity and thus our second analytical question used to interrogate the matrix is: What is the degree of content specificity in all ecosystem aspects and management phases? This question is used to evaluate the details of each of the matrix cells (indicated by green dots in Figure 1).

C –Having a good integrated system understanding and a high degree of content specificity for each ecosystem aspect to be managed is not sufficient to reach EBM. This detailed understanding must also inform the whole management cycle (including all its phases). In other words the System Description must be matched by the content and specificity across the management phases in a coherent and integrated way. This is a way

Fishing boats in the harbor from Henningsvaer. Photo credit: Sven-Erik Arndt/Azote

Management phases / Ecosystem aspects	a) Specificity				b) Specificity	c) Integration	d) Systems Thinking
	System Description	Goals	Strategies/ Measures	Monitoring/ Evaluation			
Biodiversity	high	high	medium	high	high	medium	medium
Relations and Ecological Processes	medium	medium	medium	medium	medium	medium	
Changes and Uncertainty	medium	low	medium	low	medium -	low	
Scales	medium	N/A	medium	N/A	medium -	low	
Anthopogenic Processes	high	low	high	medium	medium +	medium	
					medium (total average score)	medium - (average score)	

Figure 2: Summary of an example application of the assessment framework in the St Anna Missjö archipelago. For more information on how the assessment was done, the detailed information used and how it was interpreted, please see Borgström et al 2015.

of assessing integration of the individual ecosystem aspects across management phases, and is captured through the question: What is the degree of integration across management phases per ecosystem aspect? (indicated by red arrows across rows in Figure 1).

(3) **Developing contextualized examples and use these to score the overall progress of management toward EBM.** In this final step scores of 'high', 'medium' or 'low' are given for systems thinking, specificity, and integration. Generic criteria for the different scores (intended to be applicable across cases) are outlined in Table 1. However, to be useful these general criteria must be related to the specific context of the evaluated EBM process. This contextual information can be derived from the same data sources as Step 1 above. An example how the assessment framework can be applied and scored is shown for the St Anna Missjö archipelago in Figure 2.

Component	Score	Generic criteria	Contextualised Examples
Systems Thinking: How well the ecosystem aspects are covered and integrated in the system description (First column in Fig. 1)	H	All EAs are addressed in detail in the system description. Several linkages between the EAs are addressed.	The EA biodiversity is addressed at several levels (genetic, species and landscape), different relations in the system (e.g. food webs) are captured as well as essential processes (e.g. nutrient cycling, hydrological dynamic), different spatial and temporal scales are highlighted in relation to biodiversity, relations and processes. It is acknowledged and discussed how the system has and will be changing and what the key uncertainties in the system are. Several anthropocentric processes are identified and related to the described system dynamic.
	M	Most EAs are addressed in the system description, but to a varying degree of detail. Some linkages between the EAs are addressed.	One level of biodiversity is described while the others are just mentioned. The EAs relations and ecological processes are mentioned in general terms and relating to biotopes, for some species there are spatially and temporally explicit information. The EA change and uncertainty is mentioned but in general terms (e.g. the general lack of knowledge about populations). Many anthropocentric processes are addressed in detail but without clear connection to the ecosystem dynamic (e.g. tourism, forestry, recreation, pollution and transportation are presented regarding history, future prognosis and as problematic to other values in the system).
	L	A few EAs are addressed in the system description, which is formulated in general terms. Few linkages between the EAs are addressed.	The EA biodiversity is described only at one level (e.g. landscape) and relations are not addressed. Some ecological processes are mentioned in general terms (e.g. importance water fluctuations for fish spawning). There is no recognition of spatial or temporal scales. Change is mentioned in the introduction (e.g. importance of climate change) but not in the following system description. Several anthropocentric processes are addressed generally but not in relation to the ecosystem dynamic.
Specificity: The degree of content specificity in each combination of ecosystem aspect and management phase (Each cell in Fig. 1).	H	The degree of specificity is high for most EAs and MPs.	In the system description the EAs are described in detail (e.g. quantities, history, future trends, spatially explicit). There are overarching goals broken down into interim targets that are spatially and temporally explicit (e.g. sustainable fish populations, including defined populations goals per species and at certain times and places) and thereby enabling continuous monitoring. The measures are specific in what, where and when and also in terms of expected outcomes. There is a monitoring program that intends to follow the system in detail (e.g. changes in populations over time, nutrient leakage from certain sources).
	M	The degree of specificity varies across EAs and MPs.	Most EAs are presented in detail in the system description. Some goals are quantitative (e.g. level of nitrogen), whereas other are general (e.g. sustainable forestry). The measures are detailed, who is going to do what, when and where. The monitoring varies greatly in specificity, from high, e.g. monitoring the level of nitrogen at several points over time to low, e.g. no specific monitoring suggested for certain system aspects.
	L	The degree of specificity is low for most EAs and MPs.	Both EA and MPs are on average very generally formulated or there is a strong focus on one EA and/or MP. E.g. there is a general focus on nutrient cycling and eutrophication that is described in detail (history, future prognosis, spatial variations, anthropocentric sources, ecological consequences). The goal is to decrease nutrient leakage in certain places at certain times and a variety of measures are presented that are to be followed up by targeted monitoring.
Integration: The degree of integration across management phases per ecosystem aspect (each row in Fig. 1).	H	The content and specificity are matched across all MP for each EA.	EA and/or MP. E.g. there is a general focus on nutrient cycling and eutrophication that is described in detail (history, future prognosis, spatial variations, anthropocentric sources, ecological consequences). The goal is to decrease nutrient leakage in certain places at certain times and a variety of measures are presented that are to be followed up by targeted monitoring.
	M	The content and specificity are somewhat matched across some MPs for some EA.	For example all levels of the EA biodiversity addressed in the MP system description are targeted by goals at the same level of specificity. The goals are related to measures that are linked to the targeted biodiversity components. Finally there is a monitoring scheme that follows the progress towards the goals and the effectiveness of the measures over time.
	L	The content and specificity are not matched across all MPs per EA.	The content and specificity in how for example EA anthropocentric processes are described are not matched in the following MPs; the goals are general, the relation to measures unclear and there is no monitoring related to anthropocentric processes.

Table 1. Evaluation scheme. Generic criteria and contextualised examples explaining the scores used for evaluating the management progress toward EBM by the three overarching, analytical questions. EA= ecosystem aspect, MP= management phase (Fig. 1).

Notes

This policy brief draws on findings from a research project examining five coastal- and marine areas in Sweden. Specifically, it is based on:

Borgström, S., Bodin, Ö., Sandström, A., & Crona, B. (2015). Developing an analytical framework for assessing progress toward ecosystem-based management. Ambio, 44(3), 357–369.

The content behind this brief was conducted with the generous support from Stockholm University's strategic research programs BEAM and Ekoklim, as well as contributions to individual researchers via the research project BAMBI, funded by BONUS, the EU joint Baltic Sea research and development program, the Swedish research council Formas, and the Erling-Persson Family Foundation. Naturvårdsverket (Swedish Environmental Protection Agency) was also instrumental in providing knowledge and facilitating access to the EBM areas under study.

Disclaimer

The contents of this brief are the sole responsibility of the authors and can under no circumstances be regarded as reflecting the position of the funders listed above.

About us

Stockholm Resilience Centre advances research on the governance of social-ecological systems with a special emphasis on resilience - the ability to deal with change and continue to develop. The centre is a joint initiative between Stockholm University and the Beijer International Institute of Ecological Economics at The Royal Swedish Academy of Sciences.

The Global Economic Dynamics and the Biosphere programme (GEDB) is a five-year Academy research programme at the Royal Swedish Academy of Sciences addressing the economic dynamics of global change and its implications for a sustainable future. It is funded by the Erling-Persson Family Foundation."

For further information, please contact
Beatrice Crona
beatrice.crona@su.se
Stockholm Resilience Centre,
Stockholm University, SE – 106 91 Stockholm

Find more information at:
www.stockholmresilience.su.se
www.gedb.se