System of Environmental Economic Accounting

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Background paper

Session 3b: Ecosystem condition

Issues note on the relationship between Ecosystem Condition and Ecosystem Services

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Issues Note for the SEEA EEA Forum of Experts (2019, Glen Cove):
Relationship between Ecosystem Condition and Ecosystem Services

The purpose of this note is to propose a practical distinction between two key concepts, ecosystem condition and ecosystem (service) capacity, and to discuss the relationship between these two concepts. In the early ecosystem service assessments these two terms were used more or less interchangeably, however we argue that in SEEA EEA they should be clearly distinguished.[1] Even if ecosystem condition and capacity share several key similarities (e.g. they are both characterised by indicators, tied to specific ecosystem assets), their roles in the SEEA EEA accounts are markedly different.

- According to the proposed account structure (Fig 2.1 in DP2.1) the characteristics that should be considered in the context of the **ecosystem condition** accounts should be **primary, direct properties** (of the studied ecosystems) often from direct measurements, which reflect the state of the ecosystem in a '**multifunctional**' way (the characteristics considered can influence the supply of several ES, but they are not directly 'tied' to any specific ES).[2]
- On the other hand, **ecosystem (service) capacity** should be considered as a **derived property** of the ecosystem reflecting the 'usefulness' of an ecosystem **with respect to a specific ES** (~'instrumental characteristics'). Capacity indicators are typically derived from primary data using complex methodologies (biophysical models, stakeholder preferences, etc.) and they are typically quantified in the natural units of the underlying ES (which creates a link to the supply and use tables).[3]

Furthermore, in the proposed SEEA EEA structure (Fig 2.3 in DP2.1) there is a third type of 'relevant information', which is closely related to both condition and capacity: **ancillary data**. We propose that this category should cover any kind of data that is considered relevant for the ecosystems and/or their services, but **does not meet the criteria** to be used as a condition indicator, and cannot be considered as an ES capacity indicator.

The main relationships between these three categories can be summarized as follows:

- (on a conceptual level): capacity is between condition and services: capacity is influenced (limited) by condition, and is limiting the supply/use of ES
- (on a practical level): condition indicators, together with ancillary data are the input data to ES capacity models

[1] MA talks about the "condition" of specific ES in a way which makes it clear that they in fact refer to the capacity of the ecosystems to supply these services (e.g. "...the condition of food production would reveal ... the underlying capability of the ecosystem to maintain production…", MA, 2003: p64). This created a long standing ambiguity in the use of these two terms.
[2] These considerations are reflected in many of the criteria set out in DP 2.3 (state orientation, framework conformity, reliability…).
[3] In other words, condition describes the state of ecosystems in general terms (~from an intrinsic perspective), whereas capacity indicators describe the 'state' with respect to a specific ES (~an instrumental perspective).

Accordingly, ES capacity models (and the underlying deep knowledge of the ES modelling community) can be a very important resource for setting up the condition accounts in a meaningful way.[4] The definitions discussed above can help users to decide in practical cases which data set should go in which category ("OK there is an indicator here, it seems to be relevant, but should it be ecosystem condition or ancillary data?").[5]

Based on the '**functional relationships**' between the primary characteristics of ecosystems, and their capacity to supply various services, it is possible to **draw a 'map'** between ecosystem characteristics and services (Fig. 1). In such a map, each link means that a characteristic influences the capacity (of the ecosystem) to supply an ES. There are several potential ways of creating such maps: extracting information from the ES models themselves (supported by the expert knowledge upon which these models rely), or performing a systematic review of the scientific literature.[6] This kind of mapping can be very informative for policy purposes:

- visualizes the connections between condition and services (gives a simple visual summary of complex ecosystem processes);
- can help in communicating the importance of condition and its maintenance (protection, restoration) towards policy and the general public;[7]
- gives an overview of the impacts of degradation (or regeneration) in any particular condition indicator;
- offers an opportunity to verify and improve the ES models currently used;[8]
- can highlight 'relevant' gaps in environmental data streams (characteristics of the ecosystems that are not monitored despite having a big influence on a high number of ES…).[7]

Figure 1 shows an example for such a mapping exercise. The figure is based on a systematic review focusing of functional relationships between ecosystem characteristics and ES capacity in European

[4] Also from a data management perspective: all the characteristics that are needed for ES capacity modelling have to be collected (stored, handled...) anyway. Luckily, these data can also be a good starting point for the selection of indicators (see also Chapter 3.3 in DP 2.3).

[5] For example, if the indicator relates specifically to a single ES (especially if it was computed specifically for that ES) then consider it as a capacity indicator. For capacity indicators thus the only criterion is that they should represent the ES that they stand for as much as possible. Otherwise, if the indicator meets the criteria for condition indicators, then it should be considered a condition indicator. Finally if the indicator does not meet any of the criteria, then it should be considered ancillary data. (See also the new Chapter 3.3 in DP 2.3).

[6] This second option is particularly interesting, as it can be based on scientific evidence. There is a very high number of recent scientific studies that aim at exploring functional relationships between the characteristics of some ecosystem(s) and the availability/supply of a specific ES. Given that ecosystem services has become a major topic in the last two decades, a very high fraction of (applied) ecological research (including related fields, like agriculture, forestry, geography, hydrology…) has turned towards formulating and testing hypotheses in terms of ecosystem services. This gives ample opportunities for creating meaningful syntheses -- a topic that has not been explored too much yet.

[7] ...by creating an instrumental argument for intrinsic values (which is a strong evidence-based argument if the systematic review approach is applied)

[8] The last two points are only valid if a systematic review approach is applied

terrestrial ecosystems. (The details of this systematic review exercise are shown in Czúcz et al. (2018)[9], while some other results of this exercise are highlighted in Chapter 3.3 of DP 2.3.)

Recommendations

- SEEA EEA should clearly and consistently distinguish ecosystem condition and ecosystem (service) capacity, these terms should not be used interchangeably. Condition indicators should always be primarily intrinsic (i.e. 'multifunctional'); whereas capacity indicators should be primarily instrumental (i.e. always connected to a specific ecosystem service).
- There are numerous selection criteria for condition indicators (as discussed in DP 2.3), but for capacity indicators probably a single selection criterion should be enough: Capacity indicators should give a good representation of the ecosystem service that they stand for (the best indicator scientifically available and technically feasible). This single criterion already guarantees a concise (one for each ES in focus) and relevant final set of ES capacity indicators. (If there is need for such a 'final set' for any of the SEEA EEA accounts.)
- Not all 'intrinsic indicators' (i.e. relevant ecological/environmental data) should be considered as condition indicators. The criteria and guidelines discussed in DP 2.3 can provide an operative approach for the selection of condition indicators. The final set of condition indicators in any account should be streamlined (the few relevant indicators with minimal redundancy) and transparent (the selection process is well-documented).
- The functional relationships between ecosystem characteristics and services should be synthesized in many ecosystem types globally. (This is a research gap mostly beyond the scope of UNSD / SEEA EEA.)

[9] Czúcz, B., Götzl, M., Schwaiger, E., Sonderegger, G., & Condé S. (2018): Fact sheets on ecosystem condition: a synthesis. ETC/BD report to the EEA. https://www.eionet.europa.eu/etcs/etc-bd/products/etc-bd-reports/etc-bd-report-12-2018-fact-sheets-on-ecosystem-condition

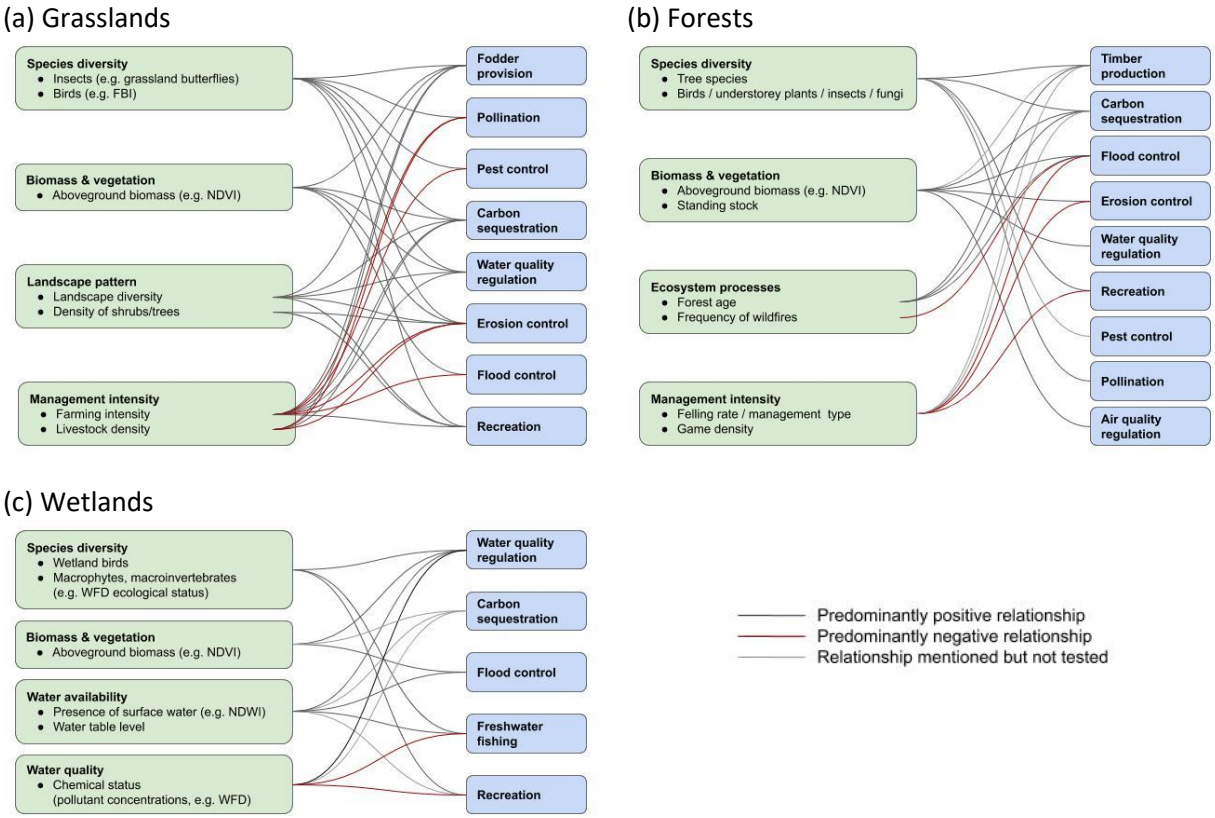

Figure 1. A map of functional relationships between ecosystem characteristics and ecosystem service capacities in three terrestrial ecosystem types in Europe (based on Czúcz et al., 2018) . The ecosystem characteristics (in green boxes) are linked to the studied ES (in blue boxes) with documented relationships in the papers reviewed, and the links are colored according to the dominant direction found. Characteristics are grouped according to the ECI classes proposed in DP 2.3, and for some of the characteristics condition indicators are also proposed (in parentheses).