

## **Strengthening conceptual links between ecosystem services and sustainability**

Suitable themes:

2.3. Ecosystem services: debating, valuing, preserving and providing

7.16. Governing Ecosystem Services: Framing, processes, and underlying rationales

### **Summary**

Sustainability and ecosystem services are scientific concepts that are increasingly being used to describe, analyse and guide the relationship between humans and the environment. Yet, current ecosystem service assessments tend to ignore the explicit consideration of basic sustainability principles. We provide an overview of two conceptual links between both concepts. First, the merits of the ecosystem service concept to achieve sustainability, and, second, the incorporation of sustainability principles within the ecosystem service concept. Ecosystem service assessments can analyse appropriate ecological scales of ecosystem use, and macro-level sustainability of a region. Furthermore, allocative efficiency can be improved through monetary valuation of ecosystem services. In turn, sustainability principles, such as long-term continuance of ecosystems, renewability and inter- and intragenerational justice, need to be stronger incorporated in the ecosystem service concept. We suggest a 'conditional definition' of ecosystem services which includes sustainability principles. This emphasizes the normative character of the ecosystem service concept.

### **Abstract**

Sustainability and ecosystem services are scientific concepts that are increasingly being used to describe, analyse and guide the relationship between humans and the environment (Abson et al., 2014; Gómez-Baggethun et al., 2010). Over the years, both concepts have become more prominent on the research and policy agendas. The Sustainable Development Goals (UN, 2012) and the Aichi Targets of the Convention on Biological Diversity (UNEP, 2010) refer both sustainability and ecosystem services. The co-occurrence of both concepts in these agreements implies strong linkages (Abson et al., 2014), yet current ecosystem service assessments tend to ignore the explicit consideration of basic principles of sustainability. This leads to profound misconceptions of the notion of ecosystem services, for example by labelling unsustainable natural resource exploitation (e.g. digging for lignite or intensive livestock production) as ecosystem services.

Here, we provide an overview of the extent and characteristics of the conceptual links between ecosystem services and sustainability, which is so far missing in the literature. We synthesise the current state-of-the-art from the literature to illustrate two conceptual links: First, we explore the merits of the ecosystem service concept and its operationalisation for decision making to achieve the overarching goal of sustainability. Second, we explore how sustainability can be better considered within the ecosystem service concept, and its operationalisation and service assessments. We develop a conceptual framework, which shows the linkages between both concepts. The framework can be used to guide future ecosystem service research to inform decision making for achieving sustainability. Furthermore, our framework contributes to developing a conditional definition of ecosystem services which includes sustainability aspects.

The merits of the ecosystem service concept and its operationalisation can be related to three hierarchical goals of sustainability: ecological scale, fair distribution and allocative efficiency (Daly, 1992). The first goal, setting appropriate ecological scales, involves a societal choice on the extent of ecosystem conservation and sustainable ecosystem service use. To detect an appropriate ecological scale, ecosystem service assessments can determine whether the capacity of ecosystems to provide services is higher or lower than the actual use of services (Schröter et al., 2014). Ecosystem service footprint analysis is another tool for assessing the scale of ecosystem use as well as total demand for services of a region (Burkhard et al., 2012). Accounting schemes for ecosystem services on a macro-level are useful to monitor over time whether a region follows a weak or strong sustainability approach. The second goal requires societies to determine a fair intra- and intergenerational distribution of natural resources. Access to ecosystem services is often distributed unequally (MA, 2005). Ecosystem service assessments can reveal spatial and temporal ecosystem service flows from ecosystems to different beneficiaries, which can be used to analyse distributional justice. The third goal can be achieved once scales are established and fair distribution is achieved. Resources can be efficiently allocated to their best societal use to prevent wasting scarce resources. This could be assisted by economic valuation of ecosystem services. Market prices could, for instance, be corrected based on the value of ecosystem services gained through conservation

measures or lost through economic development. Furthermore, procedural justice in ecosystem governance can be guided by the ecosystem service concept in its role as a democratic platform to represent different values (Justus et al., 2009).

To strengthen the second conceptual link, sustainability principles and strategies need to be more strongly incorporated into different components of the ecosystem service concept. The principle of long-term continuance of a system that supports human wellbeing can be incorporated through indicators for ecosystem state, condition and resilience. The principle of renewability can be used to distinguish sustainable from unsustainable resource use. Aspects of inter- and intragenerational justice can be incorporated into choice and selection of services in assessments, in order to be able to assess fair benefit sharing from ecosystem services.

We conclude that sustainability principles should be stronger incorporated into the ecosystem services concept, which in turn can be used in order for ecosystem services to be a meaningful concept to achieve sustainability. Moreover, we suggest a revised definition of ecosystem services, containing several conditions. An ecosystem service needs to prevail over the long term and be renewable in human time scales. Ecosystem service assessments should take into account who actually benefits from the services – now and in the future, in human and potentially also non-human communities. Another condition is, therefore, that the use of a service is conducive to fair distribution.

Both sustainability and ecosystem services can be considered as ‘thick concepts’ – carrying descriptive and normative content (Roberts, 2013). Sustainability can be understood as describing long-term continuance of a system, but is only meaningful when this continuance refers to a normatively defined goal, such as long-term human (and potentially non-human) well-being and inter- and intragenerational justice. The concept of ecosystem services describes how ecosystems contribute to human wellbeing and, therefore, also involves normativity in the definition of what are valuable goods and services (Schröter et al., in press). Hence, when calling for a ‘conditional definition’ of ecosystem services, the descriptive part of the ecosystem service concept is restricted to only those uses of nature which are sustainable. As a consequence, our suggested conditional definition of ecosystem services further emphasizes the normative character of the concept.

## References

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