University of Zurich[UZH]

University Research Priority Program Global Change and Biodiversity

Ecosystem Services

Terminology Brief Series

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Formal definitions

Ecosystem Services have been variously defined as:

… the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling.
Millennium Ecosystem Assessment, (World Resources Institute 2005)

The principal framework for expressing the "usefulness" of biodiversity is through the concept of ecosystem services. They illustrate the link between, on the one hand, the interactions of species with each other and with the physical environment; and on the other, the well-being of people, whether in terms of wealth, nutrition or security.
Convention on Biological Diversity (CBD), (https://www.cbd.int/iyb/doc/prints/factsheets/iyb-cbd-factsheet-ecoservices-en.pdf)

… the direct and indirect contributions of ecosystems to human well-being.
The Economics of Ecosystems and Biodiversity (TEEB), (Kumar 2010)

… the benefits human populations derive, directly or indirectly, from ecosystem functions.
(Costanza et al. 1997)

Ecosystem Services in the URPP GCB

There are a number of projects in the URPP GCB that use the ecosystem service concept to quantify the impacts of global change on society, and the feedback from humans to the environment. The concept is being used to integrate biophysical research with social science methodologies, such as using expert interviews to evaluate ecosystem service provision and to define the multiple values that people have for nature, using social media data to quantify recreational use and vegetation structure to measure CO_2 sequestration. The URPP GCB research in part focuses on the following questions:

Is biodiversity important for human well-being?

Is the provision of biodiversity a service in itself or does biodiversity fundamentally underpin all ecosystem services?

Can we define and quantify specific ecosystem service indicators?

How can we 'value' ecosystem services?

Is valuation of all services ethical or useful?

Is the field policy relevant and how is the research being used?

How can we best communicate the importance of biodiversity, healthy ecosystem functioning and the resulting ecosystem services to policy makers?

Background

The term ecosystem services was coined by Paul and Anne Ehrlich in 1981 (Braat and de Groot 2012; P. Ehrlich and Ehrlich 1981), drawing from earlier concepts of natural capital elucidated by the environmental economist E. F. Schumacher (Schumacher 1989). Gretchen Daily's book 'Nature's Services: Societal Dependence on Natural Ecosystems' and Paul Costanza's seminal 1997 paper, further elucidated and popularized the concept, facilitating its adoption in research, policy and practice (Costanza et al. 1997; Daily 1997).

Current Use

The Millennium Ecosystem Assessment (MA) orders ecosystem services into 4 categories:

provisioning services: the supply of goods of direct benefit to people, often with a clear monetary value, such as timber from forests, medicinal plants, and fish from oceans, rivers and lakes.

regulating services: the range of functions carried out by ecosystems, often of great value but generally not given a monetary value in conventional markets. They include regulation of climate through carbon storage and control of local rainfall, the removal of pollutants by filtering air and water, and protection from disasters such as landslides and coastal storms.

cultural services: not providing direct material benefits but contributing to wider needs and desires of society, and therefore to people's willingness to pay for conservation. They include the spiritual value attached to particular ecosystems such as sacred groves, and the aesthetic beauty of landscapes or coastal formations that attract tourists

supporting services: not of direct benefit to people but essential to the functioning of ecosystems and therefore indirectly responsible for all other services. Examples are soil formation and processes of plant growth.

Many frameworks, including the Common International Classification of Ecosystem Services (CICES) (Haines-Young and Potschin 2012), only use 3 categories and exclude supporting services. These are either included within regulating services or are considered as components of ecosystem functioning, such as photosynthesis, essential for primary productivity, from which we benefit in terms of crop and timber production, for example.

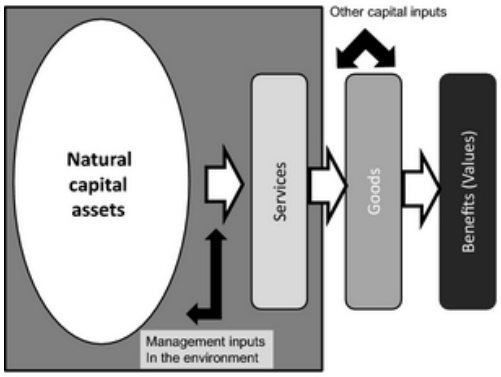

Figure 1: Conceptualisation of nature with specific assets that can be transformed to services, which then flow to people as goods that deliver benefits (income, enjoyment, health) At each stage there may be a need for other inputs – human or produced.

The Natural Capital Approach (figure 1) conceptualizes ecosystem services as assets obtained from the environment, that then require external inputs to become the goods that are beneficial to human well-being (Mace et al. 2015).

IPBES

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services was established in 2012 as a mechanism to provide scientific information in response to requests from policy makers. It assesses the state of biodiversity and the ecosystem services it provides to society, based on syntheses of current research. It is under the auspices of UNEP, UNESCO, FAO and UNDP, and administered by UNEP. The development of this science-policy interface for biodiversity and ecosystem services strengthens the role of the concept in science, policy and practice. IPBES is also working to integrate sustainability research and multiple

types of knowledge in its processes and reports, as illustrated in their conceptual diagram (figure 2), where ecosystem services are part of nature's benefits to people.

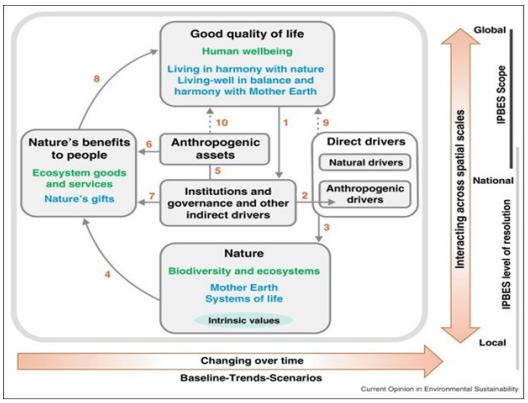

Figure 2: IPBES conceptual framework (Díaz et al. 2015)

Recognizing that nature is perceived and valued differently, a more pluralistic way of reflecting a diversity of values within the IPBES framework has been proposed (Pascual et al. 2017). The term "nature's contributions to people" (NCP) has been coined to recognize this diversity of values. NCP includes all positive (benefits), but also negative contributions (losses or detriments) that humans derive from nature. It still has clear links with the use of the term ecosystem services in the MA, and also encompasses concepts used in other knowledge systems.

Ecosystem Services and Environmental Ethics

A longer history of considering human dependency on ecosystems, from mostly natural scientists concerned with resource use and depletion, has largely framed the concept from a natural sciences perspective (Leopold 1949; P. R. Ehrlich 1970; Daily 1997). This gives rise to some epistemological and ethical concerns with the application and meaning of the ecosystem services concept (Dempsey and Robertson 2012), such as over-emphasis on economic valuation (McCauley 2006; Gómez-Baggethun et al. 2010; Silvertown 2015), a focus on quantitative natural science methodologies (Turnhout, Neves, and de Lijster 2014) and a largely abstract distinction between instrumental and intrinsic values (Chan, Satterfield, and Goldstein 2012).

For a utilitarian and/or pragmatic ethical theory the ecosystem service concept can be useful to illustrate that nature is useful – even essential – for humans and therefore valuable. This may convince people of the necessity of nature conservation programmes. However, various environmental ethicists and other critics find fault with the anthropocentric and utilitarian understanding of nature underlying the ES-model. They criticize the treatment of nature as a commodity, the blindness of the ES concept to the relationship of humans with the rest of nature (Kosoy and Corbera 2010; McCauley 2006; Soma 2006; Vatn 2000; Schröter et al. 2014). Moreover, the concept ignores the multiplicity of values in nature, which may not be reducible to strict instrumental values (Soma 2006; Kosoy and Corbera 2010; Vatn 2000; Schröter et al. 2014; Davidson 2013). Even from a pragmatic point of view, it has been criticized that this understanding of nature cannot warrant nature conservation in the long run. People might find non-natural alternatives to provide certain ecosystem services, which might be even more efficient than the natural ones, in such cases, the motivation to conserve nature would be lost (McCauley 2006; Chan et al. 2016; Pascual et al. 2017).

However, the concept is largely recognized as having application across research, policy and practice boundaries (Braat and de Groot 2012).

The URPP GCB also supports the work of IPBES.

Key background reference

"The Ecosystem Services Agenda: bridging the Worlds of Natural Science and Economics, Conservation and Development, and Public

and Private Policy." *Ecosystem Services* (Braat and de Groot 2012)

Useful Links

- http://www.naturalcapitalproject.org/what-is-natural-capital/
- http://www.teebweb.org/resources/ecosystem-services/
- https://www.cbd.int/
- http://www.un.org/sustainabledevelopment/sustainable-development-goals/
- http://www.ipbes.net/

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