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Perspective

Searching for the place of biodiversity in the ecosystem services discourse

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ABSTRACT

With the growing popularity of the ecosystem services concept, the question of how biodiversity and ecosystem services are related to one another has increasingly been raised. Among other things, this entails asking whether or not biodiversity itself is an ecosystem service. Such questions are important for conservation planning, as they require clarification of whether ecosystem services protection replaces or complements biodiversity conservation. The answers given up to now have been equivocal. In our paper we demonstrate that, in order to analyse the role of biodiversity in the ecosystem services discourse, it is not enough to address only the way they are related to one another in biophysical terms. Instead, their interconnectedness needs to be discussed from additional, albeit rarely addressed, perspectives: a definitional one, a value-based perspective, and a strategic perspective. In seeking to bring into sharper relief the conceptual relations between biodiversity and ecosystem services we distinguish between a didactic motive, an item conservation motive, and a resource protection motive. Within the didactic motive, the aim of linking biodiversity to ecosystem services is generally to show that "life on earth" in its abundant variety is of existential value to human beings. The item conservation motive relates to particular ecological components (e.g. species) which are to be protected in their identity. Finally, the resource protection motive focuses on the role of ecological components as resources for humans. These motives imply fundamentally different ideas about biodiversity, values and place dependence. Adding these perspectives and clarifying motives to the analytic process can help avoid misunderstandings and enable research to be focused on more specific and answerable questions. It can also serve to avoid the potential drawbacks entailed by conservation strategies that are based on overly simplified assumptions regarding the relation between biodiversity and ecosystem services.

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1. Introduction

Biodiversity and ecosystem services are both important management and conservation targets. The concept of ecosystem services (ES) has become highly popular in many fields of research as well as in policy contexts, partly as a result of the Millennium Ecosystem Assessment (MA) (2005). ES are now an important element of several policy-related documents, such as the EU biodiversity strategy to 2020 (EC, 2011), the TEEB (2010) study, or the Aichi Targets of the Convention on Biodiversity (CBD). In these documents, the concept is used not the least as an argument for the need to protect biodiversity. With this new emphasis on ES the question arises ever more frequently whether biodiversity, as another major target of (environmental) policies, is an ecosystem service itself, or whether it leads to the provision of ecosystem services, i.e. is a necessary basis for these. More specifically, it is unclear to what extent there is an overlap between conservation objects when protecting ES and biodiversity. These questions are important for conservation planning, as they require clarification on whether the protection of ES replaces or complements biodiversity conservation.

Our very objective is thus to clarify the possible roles of biodiversity within ES contexts. We do this by first exposing the complexity of this question and then again narrowing it down, in order to arrive at a limited number of motives. Relating to these motives is conducive to clarifying the relation between biodiversity and ecosystem services. The point of departure guiding our analysis is the following: When searching for the place of biodiversity in the ES discourse it is not enough to address the empirical relations between biodiversity and ES in a biophysical sense alone, which in the following we will call the biophysical perspective. Instead, the relation between biodiversity and ES can and should also be discussed from a definitional perspective, a values-based perspective, and – most neglected of all – a strategic perspective. By perspectives we here mean specific aspects involved in this question, which need to be considered more explicitly. In the following, we begin by elaborating these different perspectives, which render the relation between biodiversity and ES much more complex than is often thought. We show that this relation can be conceptualized according to a variety of – largely implicit – motives for applying the biodiversity–ES link, bringing together the different perspectives in a simple framework. Finally, we highlight the consequences of our discussion for the ongoing debate about ES and biodiversity and for the conceptual clarification and development of evaluation criteria for biodiversity and ES.

2. Multiple perspectives on the relation between biodiversity and ecosystem services

Much research on the relation between biodiversity and ES has been focused on the biophysical perspective, i.e. on the question of how, in biophysical terms, parts of ecosystems (components and processes) – and biodiversity – lead to, produce, or are ES (see e.g. Balvanera et al., 2006; Luck et al., 2009; Harrison et al., 2014). Answering this question, however, also requires taking into account the other perspectives, which we will now discuss in detail.

2.1. Definitional perspective

There are no generally agreed upon meanings or definitions for either "ecosystem services" or "biodiversity".

2.1.1. Ecosystem services

According to the widely shared general notion of ES, ecosystems are beneficial to humans. This means that certain specific features of ecosystems contribute to human well-being (Fig. 1). A considerable number of conceptual frameworks (Bateman et al., 2011; Potschin and Haines-Young, 2011; Bastian, 2013) are applied to delimit "ecosystem services" from, say, structures and processes or benefits. According to the United Kingdom National Ecosystem Assessment (UK NEA, 2011), for example, ecosystem processes (e.g. primary production) lead to (final) ecosystem services (e.g. trees, standing vegetation, peat) which, partly by means of human input, are developed into goods (e.g. food, fibre, timber); these in turn possess a value for humans (in monetary terms as well as in terms of health and social values) (see Fig. 2, which largely follows the UK NEA framework).

The answer to the question as to whether biodiversity is an ES inter alia depends on whether ES proper are defined as ecosystem components and processes that lead to benefits, or as goods and benefits themselves (as in the MA definition). Mace et al. (2012), for example, suggest that biodiversity might be found in different compartments of the ES conceptual framework; in other words, it may be a part of "ecosystem processes" or of "final ecosystem services" or indeed of "goods" (Fig. 2). For example, pollinator diversity leads to ES (in the definition they use) and apples – as part of biodiversity – are ES; biodiversity (represented by charismatic species) might be considered a good (or benefit) in itself that can be said to be based on ES and the processes that support them. For some authors, however, the benefits themselves are defined as ES.

This diversity of understandings of what constitutes an ES is only one problematic point, however. A further obstacle to clearly positioning biodiversity within ES discourses arises with the concept of biodiversity itself.

2.1.2. Biodiversity

"The" biodiversity concept is a very broad one that encompasses a great variety of phenomena (see e.g. CBD, 1992; Magurran, 2004; Mayer, 2006; Maclaurin and Sterelny, 2008). One important divide is that between an emphasis on the number of species, habitats etc. (most prominent here: species richness) and the property of being different (Solbrig, 1991, p. 17) (expressed e.g. as β-diversity). Alongside number and variation of units, biodiversity can also relate to singular units (e.g. single species or ecosystems). There are probably few conservationists who would think that extinction does not matter as long as species richness remains constant (e.g. through species introduction or immigration). And for many conservationists the uniqueness of each species (or gene, ecosystem etc.) is a reason to protect them.

The meanings of biodiversity described above according to number, difference or singular units are all common meanings of "biodiversity" held by scientists as well as non-scientists (Buijs et al., 2008). These are not the only meanings, however. Biodiversity also includes functional diversity (functional types of organisms and their traits; e.g. Cadotte et al., 2011). In a broad sense, biodiversity is equated simply with "(living) nature", as Takacs (1996) has elaborated, or with "life on earth" (cf. in the iconic MA scheme; MA, 2005, p. vi).

To conclude, this heterogeneity of definitions of biodiversity means that it becomes difficult to find a general answer regarding the causal role of biodiversity in ES production. Such an answer may turn out to be merely trivial, as some aspect of biodiversity – if we accept the full breadth of the definitions – is always related to the delivery of ES (in the various ways demonstrated convincingly by Mace et al., 2012). This leads to the question of how biodiversity should be specified for concrete issues in the field of ES research and application.

Due to these definitional ambiguities, then, the question of whether biodiversity begets ecosystems and their services or whether ecosystems beget biodiversity (see Walker, 1992; Jax, 2010) cannot be answered in general terms, even in the biophysical sense. The answer depends on how biodiversity and ES and the relationship between them are conceptualized — and this in turn depends significantly on the values-based perspective adopted.

2.2. Values-based perspective

2.2.1. Ecosystem services

Ecosystem services are always conceptualized in relation to human well-being. This implies that values, by necessity embedded in any