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Methodological and Ideological Options

The ecosystem service cascade: Further developing the metaphor. Integrating societal processes to accommodate social processes and planning, and the case of bioenergy

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ABSTRACT

The 'cascade model' of ecosystem service generation and valuation highlights the links between biophysical aspects/biodiversity and human well-being, in particular for the case of marginal changes, but does not include societal processes. Services seem to flow effortlessly from ecosystems to beneficiaries, as free gifts of nature. We integrate such processes, strengthening the model's applicability to non-incremental changes, and to landscape planning. A process analysis shows how use value attribution turns biophysical ecosystem functions into ecosystem service potentials which (except for 'final services') have to be mobilised to provide ecosystem services. Once appropriated, these services generate ecosystem benefits which may be commercialised, or not. The important role of use value attribution for the final (e)valuation of policies, plans and their expected outcome is illustrated by discussing different service potentials attributed to the same function, biomass provision, and the different bioenergy services resulting.
For the reverse use of the 'cascade' as 'stairways' for planning processes, the prevailing uncertainty requires legal and participative foundations for decision making, and an awareness of the potentially conflicting private and public interests involved. This reverse application combines with the 'cascade' to form a full cycle of ecosystem services generation and management.

1. Introduction

The terms, "ecosystem services" ESS[1] and "ecosystem functions" ESF have been defined in different ways in the literature; a consistent, generally accepted definition of what ESS are missing (Fisher et al., 2009). The diverging interpretations and use of the terminology have triggered attempts to develop a standardised approach (e.g. Seppelt et al., 2012), so far with limited success. In the meantime, at least a classification effort is under way, systematising the so far inconsistent use of the terminology (Haines-Young and Potschin, 2013). One of the systematising approaches developed for valuing incremental changes, with significant resonance in the literature, is the "cascade model" of ecosystem service generation and valuation (Haines-Young and Potschin, 2010, 2011; see also Fig. 1). We use it in this paper as a starting point, and develop it further in order to enhance its applicability to socio-economic processes leading to structural change or including the choosing between structurally different options.

1.1. Disputed Approaches

One explanation for the prevailing cacophony of assumptions and definitions lies in the interdisciplinary character of the research field, and the multitude of disciplinary traditions and terminologies this implies. Another one may be the historical roots of the concept (Gómez-Baggethun et al., 2010). Some 30 years ago conservationists started highlighting the value of biodiversity (in the traditional philosophical sense of "importance") to the human endeavour, a tradition that can be traced back to Aldo Leopold (1949). Hoping to better get their message across to decision makers with an economic background they bought into the language of environmental economics calling nature's contributions to human well-being "ecosystem services" and describing nature as the "natural capital stock" from which they flow. This was still the dominating position in the Millennium Ecosystem Assessment (MA) — the final report deliberately refrained

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[1] In much of the literature ecosystem services are abbreviated as ES. However, as in this paper we consistently use a 3 letter code for all stages of the process (not for the transformation steps), we do so for the services as well.

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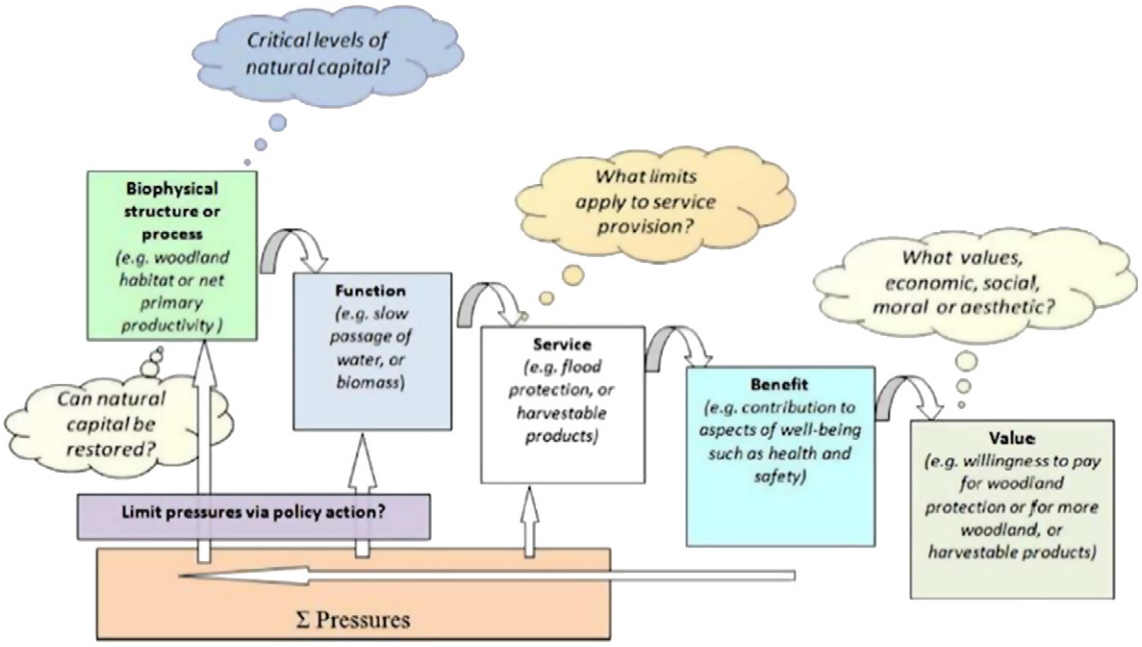

Source: Potschin, Haines-Young (2011), adapted after: Haines-Young,Potschin (2010).

Fig. 1. The Ecosystem Service Cascade as introduced by Potschin and Haines-Young (2011), the point of departure for this paper. Besides describing the flow from the ecosystem to human welfare, if contains a number of questions concerning human activities (policy, valuation) and decision criteria (limits), however without integrating them into the scheme.

from monetising the value of the ecosystem services it was highlighting (Norgaard, 2010).

In the meantime, the terminology has been taken as an ontology — the value is often no longer considered a metaphor but an economic term, measured in monetary units, and thus is a price (Chan et al., 2012; Potschin and Haines-Young, 2011). Particularly disputed questions concern:

- the relation of ecological measurement to economic value attribution is disputed: can we value what we have not measured, let alone not even recognised? and
- the applicability of monetary valuation processes to non-market goods: for instance asking for the willingness to pay presupposes the existence of a market for a non-market good, transforming the perceived character of the good analysed.

Non-economists have sometimes trouble understanding that economic values are measurements of subjective, not of objective usefulness and thus – as any perceived reality – social constructs (Helm and Hepburn, 2012; Sagoff, 2011; Spangenberg and Settele, 2010). Nonetheless the spreading of the ESS concept has in practice set the stage for equating ecosystem functions and service potentials (Braat and de Groot, 2012), considered as linearly correlated to ESS (in the case of marginal changes often rightfully so). Such ESS can have an exchange value and be traded within markets.

This tendency is seen with scepticism by a number of ecologists, ecological economists and planners (e.g. Chan et al., 2012; Potschin and Haines-Young, 2011), because "to look at biodiversity through a single exchange 'lens' leads to a false feeling of control and understanding which in turn contributes to neglecting other values that play an important role in biodiversity conservation" (Kosoy and Corbera, 2010, p. 1233). Another reason why ESS commodification has become contested over the last couple of years is that monetary valuation has to disembed individual services from the complex ecological networks sustaining them and of which they are constituted (Rees, 1999). Furthermore, doubts have been raised about the approach for systematic (Muraca, 2011; Spangenberg and Settele, 2010; Spash, 2008) and ethical reasons (Luck et al., 2012; Potschin and Haines-Young, 2011; Rozzi et al., 2012). Thus, at minimum combining such monetary with non-monetary valuation methods has been recommended (Farley and Costanza, 2010; Seppelt et al., 2012). Finally, according to ecological economists, the reliance on marginal valuation fails describing non-marginal, i.e. structural change (e.g. ecosystem collapse, or turning agricultural land into nature reserves, or vice versa). In particular in the vicinity of critical ecological thresholds and for irreversible system change monetary valuation does not help as regulatory mechanism (Braat and de Groot, 2012) and conservation should be price determining, not price determined (Farley and Costanza 2012).

Nonetheless monetisation, for all its problems, is necessary for calculating damage, replacement and avoidance cost. Such cost figures are needed ex post (when the damage has been done) for compensation payment finding by courts, and can be helpful ex ante to warn of potential economic impacts of disturbing ecosystem functioning. This in turn can be supportive for rising additional funds for conservation, or for defining a business case for conservation (Bayon and Jenkins, 2010; Daily and Matson, 2008; Sukhdev, 2009). However, these considerations suggest a limited scope for applying monetary valuation, wherever the assumptions of economic theory (including reversibility, economic rationality and full information) do not coincide with reality. A broader approach is needed to base policies and management decisions upon, overcoming the isolation from social process so far dominant in the ESS literature, taking agents, actions, interest and impacts into account (Kallis et al., 2013). Our suggestion on how to deal with these challenges is the core of Section 2. It is based on an ecological economics world view (Spangenberg, in press; Spash, 2012) including a non-deterministic understanding of the complex interaction of evolving social, political and environmental systems, including the multiplicity of values, their incommensurability (Martinez-Alier et al., 1998), the endemic uncertainty and the resulting post-normal decision situations (Funtowicz and Ravetz, 1993).

1.2. The "Cascade"

The "cascade" (Fig. 1) is a very useful general framework for classifying different steps of generating and allocating ESS and assigning non-