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## METHODS

# Relating the philosophy and practice of ecological economics: The role of concepts, models, and case studies in inter- and transdisciplinary sustainability research

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## ABSTRACT

We develop a general and unifying methodology for ecological economics which integrates philosophical considerations on the foundations of ecological economics with an adequate operationalization. We argue that the subject matter and aims of ecological economics require a specific combination of inter- and transdisciplinary research, and discuss the epistemological position on which this methodology is based. In accordance with this understanding of inter- and transdisciplinarity and the underlying epistemological position, we develop an operationalization which comprises simultaneous analysis on three levels of abstraction: concepts, (generic) models and case studies. This provides a systematic and integral view on ecological economics, and thus allows one to see the relationship between contributions to the field that have so far been perceived as very heterogeneous and largely unrelated. At the same time, this methodological framework may provide orientation for the further development of ecological economics.

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## 1. Introduction

While there exists a widely shared consensus about the subject matter and aims of ecological economics (EE), the field is characterized by a vast diversity and heterogeneity of seemingly unrelated approaches and contributions (Røpke, 2005). For example, a survey of the journal *Ecological Economics* reveals the extent of heterogeneity in different dimensions: (i) There is a wide spectrum of methodological approaches, including controlled experimental work, case studies, models, theories, conceptual foundation, and philosophical reflection. (ii) Some

contributions aim at positive analysis in the spirit of the natural sciences, i.e. describing facts and providing explanations, while others aim at normative, i.e. value based, policy recommendations. (iii) As far as motivation goes, there is the full range between purely cognitive interest, i.e. a science-immanent motivation to study questions from science and provide answers for science, and interest in practical action and solution, i.e. a motivation to link science and society at large. This heterogeneity of approaches and contributions seems to stand unrelated and, at times, is seen as an obstacle for progress of the field.

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In this paper, we develop a general and unifying methodology<sup>1</sup> for ecological economics which integrates philosophical considerations on the foundations of EE with operationalization. We philosophically deduce this methodology and specify an operationalization accordingly. Our aim is to lay out a systematic and coherent methodological framework for ecological economics, ranging all the way from basic philosophy of science to concrete operationalization. This provides a systematic and integral view on ecological economics, and thus allows one to see the relationship between contributions to the field that have so far been perceived as very heterogeneous and largely unrelated. At the same time, this methodological framework may provide orientation for the further development of EE.

We start with the definition of ecological economics and clarify its subject matter and aims. Based on these considerations, we reflect on the question of how to do ecological economics. We argue that the subject matter and aims of ecological economics require a specific kind of inter- and transdisciplinary research. Furthermore, we reflect on the adequate epistemological basis for EE, referring to considerations within the philosophy of science. In accordance with the philosophical considerations on the foundations of EE, we develop an adequate operationalization, which comprises simultaneous analysis on three levels of abstraction: (i) the level of concepts (ii) the level of models and (iii) the level of concrete case studies.

This integration of considerations on the philosophy of EE – its inter- and transdisciplinary character and its epistemological foundation – with a concrete operationalization by simultaneous analysis on three levels of abstraction – concepts, models and case studies – constitutes the original and innovative contribution that – we believe – this paper can make to the philosophy and practice of ecological economics.<sup>2</sup>

## 2. Ecological economics: subject matter and aims

Our starting point is the question (discussed in this section): What is ecological economics? From the answer to this question we will deduce (in Section 3) the answer to a second question: How to do ecological economics? This means that in defining EE we give priority to the subject matter and aims of EE. From this, its approach and methods are derived in a second step. This is in contrast, for example, to mainstream

<sup>1</sup> We use the term *methodology* in its original meaning, denoting the philosophical study of scientific method, i.e. how scientific methods work and how they should be used in science. This is in contrast to the more and more popular (but, strictly speaking, incorrect) use of the term “methodology” to denote simply one particular method.

<sup>2</sup> In practical terms, the methodology developed in this paper has proven operational and useful in a major inter- and transdisciplinary research project on the sustainable management of semi-arid rangelands. The results of these studies have been published in this journal and elsewhere (Faber et al., 2005; Frank et al., 2006; Baumgärtner, 2007; Baumgärtner and Quaas, 2007; Müller et al., 2007; Quaas et al., 2007; Quaas and Baumgärtner, 2008).

economics which is often defined purely by its methods (e.g. Robbins, 1935; Kirchgässner, [1991]2008). Our proceeding is in accordance with the origins of EE, as well as with the current shared belief of the scientists in this community. In both, EE has primarily been defined by its subject matter and aims, and on this basis it has been discussed which were the appropriate methods and approaches for EE (Proops, 1989; Costanza, 1991; Krishnan et al., 1995; Faber et al., 1996).

There are two central characteristics of EE. First, there is a fundamental consensus that EE aims to “study how ecosystems and economic activity interrelate” (Proops, 1989: 60). Thus, the subject matter of EE is the “relationship between ecosystems and economic systems in the broadest sense” (Costanza, 1989: 1). However, the aim of EE has never merely been a functional and descriptive analysis of this relationship. Within EE, the question has always been raised how this relationship can be organized in a sustainable manner. Thus, the second characterization of EE is that it understands itself as “the science and management of sustainability” (Costanza, 1991). This means in particular that EE is not only driven by a cognitive interest, i.e. an interest to understand and explain the world as it is, but also by an action interest, i.e. an interest to manage the world based on an idea of how it ought to be.

There is an ongoing, broad and diverse discussion about how exactly to define, conceptualize and measure sustainability (surveyed e.g. by Pezzey, 1992; Heal, 1998; Klauer, 1999; Neumayer, 2003), reflecting the breadth and diversity of ideas about (i) what exactly is the normative content of sustainability and (ii) how exactly can the structure and functioning of ecological-economic systems be described. The shared consensus in this discussion seems to be that sustainability – by any definition of the concept – requires sustaining nature, and its functioning and services for humans, over a long time into the future. This has implications for how socio-economic systems and their relationships with nature must be organized.

In summary, the subject matter of EE is the relationship between the economic and the ecological system, and its underlying central aim is to provide knowledge for a sustainable management of this relationship.<sup>3</sup>

## 3. Methodological implications: ecological economics is an inter- and transdisciplinary science

From the definition of ecological economics (Section 2) it follows in a straightforward way that EE is an inter- and transdisciplinary form of science, where *interdisciplinarity* is

<sup>3</sup> This definition of ecological economics focuses on ecological-economic systems, what we know about them and how we manage them. While this is a very encompassing and very widely accepted definition, we note that the field of ecological economics is still wider in that there are issues studied in the field of ecological economics that are not fully covered by this definition. Without denying the legitimacy of calling such studies “ecological-economic”, our analysis in this paper is exclusively based on the definition given in Section 2 and all of our results and conclusions are therefore restricted to “ecological economics” as defined here.

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