Ocean & Coastal Management 69 (2012) 27–34

Contents lists available at SciVerse ScienceDirect

Ocean & Coastal Management

journal homepage: www.elsevier.com/locate/ocecoaman

# Experts' evaluation of concepts of Ecologically Sustainable Development applied to coastal ecosystems

Georgia Mavrommati [a,*], Clive Richardson [b]

[a] Center for Water Sciences, Michigan State University, 329 Giltner Hall, East Lansing, MI 48824, USA[1]
[b] Department of Economic and Regional Development, Panteion University of Social and Political Sciences, USA

ARTICLE INFO

*Article history:*
Available online 21 July 2012

ABSTRACT

With the broad aim of promoting the essential interdisciplinary research on sustainable development and contributing to the development of an operational bio-economic analysis, the present paper attempts to evaluate four representative approaches to Ecologically Sustainable Development (ESD) in the context of coastal ecosystems. These approaches are non-declining utility per capita, preservation of all the existing natural capital, preservation of the biological crucial levels, and conservation of the critical natural capital. They reflect contemporary dialogue and especially the tension between the schools of strong and weak sustainability. The evaluation was performed by the international community of coastal experts through responses to a questionnaire survey ($n = 99$).

It emerges that those approaches to ESD that integrate operational criteria and principles from natural sciences within the consideration of socioeconomic welfare are evaluated as more functional as well as scientifically more appropriate for defining the target of ESD in coastal ecosystems.



## 1. Introduction

A new field of sustainability science is emerging that seeks to understand how human and natural systems can coexist sustainably. Sustainability science rejects the traditional separation between sciences and calls instead for a 'synthesis' of sciences (Carpenter et al., 2009; Cummins and McKenna, 2010; Kates et al., 2001; Palmer et al., 2005; Weinstein et al., 2007). The present paper, inspired by the ideas of sustainability science, is intended as a contribution to interdisciplinary dialogue on Ecologically Sustainable Development (ESD), with particular reference to the case of coastal ecosystems. Two major sciences are involved, ecology and economics. Since the emergence of the issue of ESD, economists and ecologists have both attempted to define it scientifically and operationally. Nevertheless the two disciplines have generally worked in isolation (Ostrom and Cox, 2010).

With respect to ESD, Economics examines the conditions under which development can continue indefinitely. This is only to be expected because development is the focus of interest of modern (post-World War II) economists and is considered to be the 'engine' of economic process. The international literature on ESD has been influenced by the theories of economic growth resulting in the restriction of the notion of ESD within the boundaries and understanding of economic science (Wai-Yin and Shu-Yun, 2004). Conceptualizing ESD in terms of socioeconomic welfare appears to be attractive to the broader scientific community, politicians, decision makers and society as a whole. Within this framework, competing schools of thought have formed with regard to the operational interpretation of ESD and especially its application to policy making. The prevailing scientific paradigms are those of strong and weak sustainability, which will be discussed below.

In contrast, ecological approaches to ESD are defined mainly in terms of ecological criteria with little reference to social and economic needs. In this respect, natural scientists focus on the ecological dimensions of sustainability. Concepts such as 'ecosystem health', 'biological integrity', 'carrying capacity', 'stability' and 'thresholds' have been used extensively to define the operational content of ecological sustainability (Aarts, 1999; Callicott et al., 1999; Callicott and Mumford, 1997; Chu and Karr, 2001; Ives and Carpenter, 2007; Karr, 1991; Stevenson, 2011, 1997). The concept of planetary boundaries has been proposed which incorporates the role of 'thresholds in key earth system processes that exist irrespective of peoples' preferences, values, or compromises based on political and socioeconomic feasibility, such as expectations of technological breakthroughs and fluctuations in economic growth' (Rockstrom et al., 2009). Recent evidence reveals

* Corresponding author. Tel.: +1 517 930 4571; fax: +1 517 432 2789.
*E-mail addresses:* geomavro@msu.edu (G. Mavrommati), crichard@panteion.gr (C. Richardson).
[1] http://cws.msu.edu/.

0964-5691/$ – see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.ocecoaman.2012.07.016

that humans are now forcing a planetary-scale transition with unpredictable consequences for human well-being (Barnosky et al., 2012). The purely ecological considerations of ESD have been appreciated and adopted mainly by natural scientists who possess relevant experience in ecology and biology. Nevertheless, criteria proposed on ecological grounds could be incorporated into socio-economic approaches as components in a broader platform that aims not only to attain socioeconomic welfare but also to preserve the environmental, social and economic rights of current and future generations. The adoption of those criteria requires appropriate ethical standards in human society and less political resistance (Cairns, 2001).

The present essay attempts to contribute to the formation of research directions for defining and operationalizing ESD. Coastal ecosystems with their history of research and planning provide good conditions for an interdisciplinary approach. Recently, coastal ecosystems have been examined extensively in respect of the so-called Ecosystem Based Approach (EBA) and the provision of ecosystem services (Barbier et al., 2008; Enemark, 2005; Granek et al., 2010; Katsanevakis et al., 2011; Luisetti et al., 2011; Nobre, 2009). Long-standing policy making processes in the United States of America (USA) and the European Union (EU) ensure sufficient data on policy design, application and evaluation. The EU's Water Framework Directive and the Clean Water Act in the USA are examples of two advanced and up-to-date policies.

In the present study, certain indicative and representative ESD approaches were evaluated by coastal ecosystems experts coming from the natural sciences. This was a two-fold experiment. On the one hand, members of the international community of natural scientists working in coastal and marine ecosystems (marine ecologists, marine biologists and oceanographers) were asked to evaluate one new and three prevailing approaches to ESD in respect of their ability to define appropriate targets for ESD in the specific case of coastal ecosystems, and of their potential to inform policy design and decision making. On the other hand, the results of our survey might provide valuable insights to economists concerning the incorporation of elements from the natural sciences into economic thinking.

Recent research conducted in Germany concerned how neo-classical environmental and ecological economists involved in sustainability research think about the issues of sustainability and economics, and how they feel about the current scientific divide between strong and weak sustainability (Illge and Schwarze, 2009). One of the findings of that research is that the representatives of both schools of thought seem to share common concepts of ESD. Our study takes one further step forward by asking natural scientists to participate in the discussion on ESD. Our choice to limit the survey only to natural scientists among all coastal experts coming from various disciplines (economists, engineers, etc.) is inspired by the current call of the emerging field of sustainability science for the incorporation of the knowledge of natural sciences into the decision-making process (Clark and Dickson, 2003). Ultimately, our study facilitates the process of transferring the scientific knowledge of coastal experts to other scientists involved in ESD research.

The remainder of the paper is structured as follows. The following section reviews the literature on ESD and Section 3 presents in more detail the four ESD approaches that are evaluated in our international survey. Section 4 describes the survey research and its results, which are discussed in the concluding Section 5.

## 2. The concept of ESD: review of the literature

Any review of the contemporary literature on ESD will readily confirm that the field is dominated by approaches originating in the economic sciences. The socioeconomic aspects of ESD, especially the idea of social welfare, appear to attract greater interest than the purely ecological approaches. Development is one of the most fundamental concepts and objectives of economics. In this context, ESD is just a specific form of development, indicating that an economic system is functioning in a way that takes environmental prerequisites and constraints into account.

In broad terms, the dialogue concerning the different aspects of ESD has led to two opposing schools of thought: strong and weak sustainability. The main difference between the two paradigms is that strong sustainability rejects the fundamental assumption of weak sustainability, namely that natural capital can be substituted by human-made capital (Neumayer, 2010). In contrast, strong sustainability maintains that human-made capital can only be complementary to natural capital (Daly, 1996). *Strong sustainability* regards the preferences of future generations as being independent of the preferences of present generations. The preferences of future generations may take a different shape from those of the present, and may even be entirely unconnected with them. Because preferences in the future could be formulated quite differently from the present, a rational policy must aim to eliminate any restrictions that might hinder the formulation and fulfilment of future generations' preferences. Consequently ESD, presenting itself as a rational policy, must eliminate those restrictions whose causes lie in advanced environmental degradation and inexorable exploitation of natural resources, because they decrease the potential welfare that will be available to generations in times to come. Against this background, SD has been defined as development that ensures the existence of the natural environment which acts as a basis for human welfare (Costanza and Daly, 1992; Holden and Linnerud, 2007). Similarly, it has been stated that "sustainable development implies using renewable resources in a manner which does not eliminate, or degrade them, or otherwise diminish their usefulness for future generations. Sustainable development further implies using non-renewable mineral resources in a manner which does not unnecessarily preclude easy access to them by future generations" (Goodland and Ledec, 1987). Furthermore, it is argued that "sustainable utilization is a simple idea: we should utilize species and ecosystems at levels and in ways that allow them to go on renewing themselves" (Allen, 1980).

Taking a different direction, *weak sustainability* anticipates that the preferences of future generations will be similar to those of the present generation and will in any case be contingent on them. Furthermore, future preferences can be predicted by extrapolating the evolution of current and past preferences. An essential characteristic arising from this assumption is that future generations can substitute the fulfilment of preferences pertaining to the natural environment with the fulfilment of preferences pertaining to man-made assets, as long as one takes into account that such a substitution also holds true for both past and present generations. The assumption goes on to maintain that any utility foregone because of degradation of the natural environment can be substituted by the utility attained by using man-made assets and, since this substitution occurred in the past, it can continue in the future as well. It is thus implied that environmental degradation can continue if it is counterbalanced by other activities which increase welfare by an amount at least equal to the loss due to the degraded environment. In this context, the cornerstone of sustainable development is per capita utility. Pezzey firmly states that "our standard definition of sustainable development will be the criterion of a non-declining per capita utility, because of its self-evident appeal as a criterion of intergenerational equity" (Pezzey, 1989). Similarly, sustainable development is defined as a situation in which "the development vector increases monotonically over time" (Pearce et al., 1989).

Certain hybrid approaches, in the sense that they combine elements from both the strong and weak sustainability schools of