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Identifying critical natural capital

1. An introduction from the editors

1.1. The environmental challenge

All countries are now broadly aware of the need to take account of environmental issues in their policy making, and many have evolved complex and sophisticated procedures to accomplish this. At the same time it is clear that, in many parts of the world and across many different environmental dimensions, environmental degradation is still accelerating, with uncertain but potentially very serious implications. Across issue after issue the prognosis offered by the United Nations Environment Programme (UNEP)'s *Global Environmental Outlook* varied from worrying to potentially catastrophic:

- Climate change: 'expected results include ... an increase in extreme weather events and impacts on human health'.
- Nitrogen loading: 'the scale of disruption to the nitrogen cycle may have global implications comparable to those caused by disruption of the carbon cycle'.
- Chemical risks: 'the massive expansion' of chemical use throughout the world 'poses an increasing threat to the health of humans and their environment'.
- Biodiversity: 'forests, woodlands and grasslands are still being degraded or destroyed, marginal lands turned into deserts, and natural ecosystems reduced or fragmented. ... Reduced or degraded habitats threaten biodiversity at gene, species and ecosystem level'.
- Water: 'rapid population growth combined with industrialisation, urbanisation, agricultural intensification and water-intensive lifestyles, is resulting in a global water crisis'.
- Fish: 'the state of the world's fisheries has now reached crisis point'.
- Air pollution: 'urban air pollution is reaching crisis dimensions in most large cities of the developing world'.

While UNEP notes that awareness of these issues, and policy responses to counter them, have increased in recent years, they have so far not proved anything like commensurate to the problems. UNEP concludes: "If the new millennium is not to be marred by major environmental disasters, alternative policies will have to be swiftly implemented." (quotes from UNEP, 2000).

Despite European Union (EU) countries having had a longer and more substantial tradition of environmental policy making than many other parts of the world, the EU environment is subject to many of the same disturbing characteristics and trends noted by the UNEP report (EEA, 1998). In the European Environment Agency (EEA)'s major assessment *Environment in the EU at the Turn of the Century*, out of fifteen environmental categories or causes of concern:

- Only one current pressure on the environment (ozone depletion), and no forecast future pressure, was shown as having an adequate positive development.
- No current or future states were characterised as being adequately positive.
- Six forecasts of future pressures were forecast as having an 'unfavourable development', and a further four were too uncertain to predict.

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The EEA's overall assessment is of 'some progress, but a poor picture overall'. Apart from ozone-depleting substances, 'progress in reducing other pressures on the state of the environment has remained largely insufficient' and 'the outlook for most of the pressures is also not encouraging'. (EEA, 1999) Thus, despite all EU countries being committed in principle to sustainable development, it is clear that in practice most development is environmentally unsustainable. Moreover, notwithstanding the opportunities that undoubtedly exist for activities, developments and policy initiatives that could yield economic and social, as well as environmental benefits, it is clear that the dominant experience is still of trade-offs: economic benefits are still being achieved at the expense of environmental deterioration.

Such a situation suggests that more weight still needs to be given to environmental considerations across the whole spectrum of policy making, in both industrialised and less industrialised countries. But this then begs the question as to what criteria should be used, and how environmental issues should be framed with respect to other economic and social objectives, in order to increase the probability of environmentally favourable decisions being taken. Conceptualising the environment and its resources as natural capital is one approach to addressing this question.

1.2. Introducing natural capital

Natural Capital is a key concept in Ecological Economics, developed by pioneering ecological economists in the late 1980s (e.g. Costanza and Daly, 1992). Natural capital refers to the various ways that the environment powers production- and indeed supports most aspects of human existence. Natural capital provides a major extension of the concept 'land', one of the classical factors of production in economic theory. It has both nonrenewable and renewable dimensions, the latter including its generation of ecosystem services and other life-supporting functions (De Groot, 1992; Daily, 1997). The concept has helped in bringing environmental issues and concerns into economic thinking and decision-making. It has also effectively been used more broadly in science and policy to illuminate the fundamental role of resources and ecological life-support systems in societal development, and contributed to a world view of humanity and nature as co-evolving within the constraints of the biosphere (Norgaard, 1994; Berkes and Folke, 1998).

In November 1990, at a café in the central square of Siena, Italy, the theme of the upcoming ISEE conference in Stockholm in 1992 was discussed. The working title of the conference "Maintaining Natural Capital" did not really capture the essence of the issues to be raised. In an intense discussion Herman Daly suddenly proclaimed "Let's use 'Investing in Natural Capital' instead" (Jansson et al., 1994). The shift from maintaining (in essence preserving the stock of capital) to investing marked recognition of renewable natural capital as a dynamic entity that needs to be understood and actively managed. The shift gave credit to the fact that it is not sufficient to assume that if we only live on the rent of the natural capital stock it will be conserved. Instead we will have to find ways to value and manage the capacity of natural capital to generate and sustain the rent, actively adapt to the dynamic nature of complex systems and learn to live with uncertainty and surprise (Costanza et al., 1993; Levin, 1999; Carpenter et al., 2001; Limburg et al., 2002).

But how much natural capital do we need? Some still assume that a constant output of economic production can be maintained indefinitely through a high degree of substitutability between manufactured and natural capital, i.e. that natural capital inputs can be drawn down so long as manufactured-capital can be increased by functionally equivalent amounts. A high degree of substitution is implicit in the concept of weak sustainability (as discussed in Ekins et al., this issue).

Ecological economists generally emphasise the complementary relationship between manufactured and natural capital; that economic production is a work process that uses energy to transform materials into goods and services (Cleveland et al., 1984); that producing a manufactured-capital substitute requires input of natural capital (Costanza and Daly, 1992; Ekins, 1992) and that the multi-functional nature of ecosystems in sustaining socioeconomic development makes it difficult to substitute their life-support with manufactured-capital (Holling and Meffe, 1996)—strong sustainability arguments (Ekins et al., this issue).

There undoubtedly are many opportunities for mitigating resource depletion and environmental degradation through the substitution of manufactured-capital. However, a recent report on the actual decoupling from natural capital in economic development (Azar et al., 2002), commissioned by the Swedish Environmental Advisory Council as input to the World Summit on Sustainable Development in Johannesburg August 2002, revealed that in absolute terms there has been little decoupling from the use and abuse of natural capital. New measures of wealth are under development, indicating, in contrast to measures of GNP or the Human Development Index, that the poorest countries of the world have developed by depleting natural capital relative to their high population growth rates (Dasgupta and Mäler, 2001), very much as the old industrialising countries did during their phase of industrialisation and rapid population growth. Although complementarity limits but does not exclude substitution, it seems that opportunities for substitutions have been more limited than many people assume.

1.3. Critical natural capital: the CRITINC project

In what way and to what extent is natural capital critical in societal development? And how can we capture criticality to make better decisions? This special issue is about critical natural capital (CNC) and addresses those challenges. It evolved through a European Research project focusing on CNC (CRITINC) with researchers from France, Germany, Italy, the Netherlands, Sweden and the United Kingdom[1]. The first task of CRITINC's work programme was the derivation of a framework for the application of the strong sustainability principle and the identification of CNC. On the basis of this framework each institute then focused on some general aspect of CNC relevant to its country situation. This Special Issue contains a selection of the papers arising from this part of the work, dealing with CNC from several perspectives. There are contributions that develop a framework for CNC evaluation, that analyse current national approaches and indicators of the condition and state of natural capital, that address the socioeconomic and sociocultural implications of degradation of CNC, and that apply the CNC perspective in national assessments of environmental sustainability. Common to all papers is their focus on renewable CNC in societal development, an important focus in a biosphere increasingly driven by human action and in the light of the relatively larger amount of work that has been put into analyses of nonrenewable natural capital and sustainability.

Critical renewable natural capital is often defined as that part of the natural environment that performs important and irreplaceable functions. In the first contribution Ekins et al. seek to develop a classification of CNC, and its functions, so that 'environmental sustainability' can be more clearly defined in operational terms. According to De Groot et al., the second contribution, natural capital can be critical because of its societal significance without necessarily being threatened, or it can be critical when threatened, although it may not be vital to human welfare, or it can be both important and threatened. Deutsch et al. argue that criticality is related to erosion of resilience in complex social–ecological systems. They plea for monitoring ecosystem resilience and performance and building understanding of criticality into environmental indicators and management institutions to avoid undesirable state shifts. Chiesura and De Groot encourage a more complete accounting of the socio-cultural functions of CNC like health, recreation, amenity, education, heritage and the quality and sustainability of human life. The tension between the appreciation of socio-cultural values of natural capital and ecosystem contamination is analysed among

[1] The full title of the CRITINC project was 'Making Sustainability Operational: CNC and the Implications of a Strong Sustainability Criterion'. It was funded by (the then) DGXII of the European Commission, Project Number PL9702076 of the EU Environment and Climate RTD Programme—Theme 4: Human Dimensions Of Environmental Change.

French people in a cultural context in the contribution of Douguet and O'Connor. Finally, Ekins and Simon provide an application to the UK of the CNC framework. This involves classifying the characteristics of natural capital and the environmental functions to which it gives rise, and then defining standards of environmental sustainability for these functions.

Following the derivation of the CNC framework and its exploration from different perspectives, each CRITINC institute then applied the ideas underlying the framework in undertaking a case study of a particular issue of domestic concern as follows:

UK	River systems of conservation interest
France	Agricultural land and water resources
Germany	Forests
Italy	Air quality
Netherlands	Coastal wetlands
Sweden	Ecosystem functions in urban areas

These case studies may be found on the CRITINC website[2]. Their conclusions are briefly summarised in the Conclusion to this Special Issue.

Each paper in this Special Issue needed to be able to stand alone so that it could be independently assessed in the journal's peer-review process. This has inevitably resulted in a certain amount of repetition of the key ideas and concepts that are common to all the papers, although we have sought to minimise this in subsequent editing, and provide appropriate cross-references. Overall, we hope that the papers' consistency in their treatment of CNC, together with the diversity which they also illustrate—from conceptual development and framework creation to classification schemes and practical applications—will provide food for thought and contribute to the improvement and better management of the natural capital basis on which future social and economic development depends.

[2] http://www.keele.ac.uk/depts/spire/Working%20Papers/CRITINC/CRITINC%20Working%20Papers.htm.

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