

## On the integration of science and management in coastal management research

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**Abstract.** This contribution presents an introduction to a series of papers on integrated scientific approaches presented at the San Feliu Euroconference on transdisciplinary coastal management research. Coastal management is a challenging area for the integration of social and natural sciences. The papers provide a basis for ongoing cross-disciplinary research.

**Keywords:** Coastal resource; Coastal zone; Socio-economics.

One of the basic objectives of this Special Feature is to promote the further integration of scientific knowledge and the sustainable management of coastal areas and associated natural resources. There are major challenges that must be faced by both the scientific community and the community of policy makers, planners and managers who play significant but very different roles in the process of coastal management. For the scientist there is the challenge of obtaining new knowledge. For the policy maker, planner and manager the challenge is to find solutions to problems which constrain the fulfilment of both short-term as well as longer term development objectives.

While these challenges appear to be quite different, they are, in fact, closely linked. To solve both short-term and longer-term problems the coastal management community needs reliable information on a range of social, cultural, economic and environmental factors. Such information is derived from accumulated knowledge and wisdom from both formal science and from the generations of people who have lived and worked in coastal areas.

The papers presented in this section illustrate the range of human impacts – the direct and indirect, small and large scale perturbations to the natural system – but more than this, they place human activities firmly within the coastal system. The need for collaboration between the natural sciences and the social sciences is evident in this context, but how far could, or should, this be achieved in current approaches to coastal management research? In most of the papers, the link between the social sciences and natural sciences is limited to the elaboration of a multidisciplinary study; to look at the role of economics or other value systems; or to implicit expectations of other fields to provide appropriate information. For example, some of the papers imply that the social sciences ‘should’ provide information on driving forces as inputs to predictive envi-

ronmental models; while natural scientists ‘should’ provide relevant information to inform decision making.

In these papers – principally by natural scientists – the social sciences are essentially treated as an extension of the natural sciences rather than sciences of equal stature and validity in their application to management processes. At the same time the authors strive to elucidate means to incorporate those human activities which affect, and are affected by, environmental changes. To this end, a variety of models are presented raising specific technical problems such as selection of appropriate temporal time scales. However, the challenge of overcoming the problem of integrating the different perspectives held by the social and natural sciences remains unfulfilled, as does the challenge of using the information they can yield to better inform the coastal management process in an effective way. Nevertheless the papers presented do help us to clarify the historical and contemporary pressures exerted by human activities on coastal systems and help to strengthen the foundations for cross-disciplinary research.

In the paper by *Cori* on the spatial dynamics of the Mediterranean the degree of historical change and ongoing trends in sectoral demand that are continuing to transform the Mediterranean coastal areas – including tourism, housing, traffic and industry are highlighted. The paper illustrates that these can be analysed at a variety of scales – for example, population dynamics are stronger at the micro level (smaller administrative units), while there are distinctly different trends between different countries. The author calls for better control of sectoral development processes and suggests that spatial planning should incorporate environmental issues. A tentative classification of coastal areas for the Northwest Mediterranean is presented based on key socio-economic parameters and suggests that “a classification of spatial dynamics including settlement-environment patterns can stimulate the implementation of integrated planning policies in the coastal belt of the Mediterranean region.”

*Capobianco* proposes an approach to integrated modelling of coastal change focusing on coastal land use and cover. Land use is regarded primarily as the result of decision processes, and has been principally the concern of social scientists; while land cover is primarily the result of geomorphological and ecological processes. The author

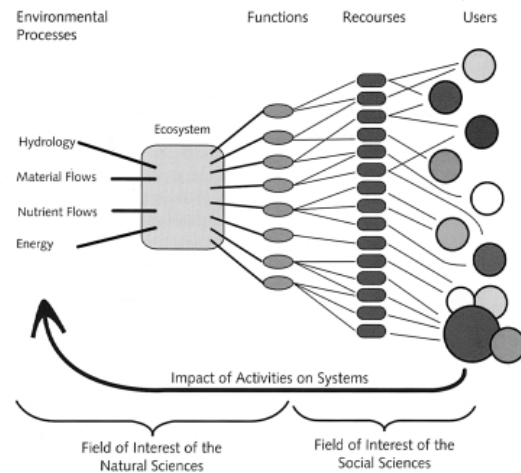
presents a spatial modelling framework which allows for the inclusion of any number of variables affecting land use change. Emphasis is put on linkages and feedbacks between the role of natural processes (geomorphological and ecological) and socio-economic processes. The concepts described are based on experience gained in three European deltas.

The MADAM project presented by *Berger et al.* has the objective of providing the scientific basis to enable the sustainable stewardship of the resources of the Caeté mangrove estuary in Northeast Brazil. This requires ... “an in-depth knowledge of the relevant institutional, cultural, social and political dynamics.”

After explaining the interdisciplinary research strategy, much of the paper describes the disciplinary components of the research – geography, biochemistry, ecology, and ‘socio-economics’. At this stage the work is multi-disciplinary rather than transdisciplinary – and highlights the important contributions based on specialist-disciplinary skills. The authors identify the respective shortcomings of the natural and social science models and propose the use of socio-economic/ecological risk assessment later in the study to overcome these shortcomings.

*Humborg & Kolle* suggest that ...“economics is the necessary link between the environmental issues that is being caused by human action and the deduction of an environmental policy that addresses the origins.” In the context of pollution, economics can be applied to select a cost-minimal solution for reaching a given goal; to deduce an optimal level of environmental quality where the marginal cost of pollution equals the marginal willingness to pay for an improvement in the state of the environment; or to determine the most efficient mixture of instruments for pollution control. The authors suggest that the predictive model is limited by the accuracy of the forecasting of forcing pressures – and this can only be estimated in cooperation with the social sciences.

We face formidable challenges associated with integration of disciplines. The papers presented in this section indicate that, as yet, there is no generic model to adopt as a common framework for integrating interactions and feedbacks between subsystems at different scales. Models which have been developed have a specific purpose and tight spatial, temporal and disciplinary boundaries are adopted in order to exclude factors which are external to the system being investigated. Transdisciplinary aspects are also restricted by overly rigid boundaries between disciplines. This creates ‘artificial lenses’ through which individual sciences view the world based on assumptions which may not be valid beyond a narrow scope of investigation. This suggests that we are in danger of ignoring the complexity of social, bio-chemical, geo-physical and economic factors associated with coastal systems; see Fig. 1.



**Fig. 1.** A marine ecosystem and the human activities sustained by the resources generated by that system.

There are many other issues that also need to be addressed such as: whether we need a common currency with which to compare factors from different sub-systems. As yet, such a common currency eludes us when comparing factors such as energy and economics; whether it is important to establish a common spatial or temporal scale; or whether it is important to establish a common purpose or set of objectives for developing a common framework for integrating different factors.

It is important to note that groups working on other forms of development planning are concerned with these issues. For example, Blood (1997) reporting on the Millbrook workshop on Integrated Regional Modelling, noted that, “A major outcome of successful integrated regional modelling would be improved decision making and applications”, and it is with this type of application which, in addition to scientific advancement, justifies interdisciplinary efforts in coastal management research. Arguably, it may be too soon to resolve these issues, which will unnecessarily constrain the innovation and creativity which are essential to allow us to move toward transdisciplinary thinking and improved communication.

## References

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