Editorial

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Biographical notes: Andrea De Montis (Cagliari, Italy, 1967), civil engineer, is Assistant Professor at the University of Sassari, Italy. In 1996, he received a MSc degree in Economic Policy and Planning, at Northeasten University, Boston, MA, USA. He has been awarded the MA Horowitz Award for 'Excellence in Economics', earning the highest quality point average among the senior students of his academic year. In 2001, he has taken a PhD degree in Urban Planning from the University of Rome. His major research fields are evaluation, planning, decision and planning support systems for both urban and environmental governance.

Peter Nijkamp is Professor of Regional and Urban Economics and of Economic Geography at the Free University, Amsterdam. His main research interests cover plan evaluation, multicriteria analysis, regional and urban planning, transport systems analysis, mathematical modelling, technological innovation, and resource management with a focus on quantitative methods for policy analysis, as well as on behavioural analysis of economic agents. He has been former President of the European Regional Science Association and of the Regional Science Association International. He is also a Fellow of the Royal Netherlands Academy of Sciences, and has recently been Vice-president of this organisation. Since 2002 he has been President of the governing board of the Netherlands Research Council (NWO). He has published hundreds of scientific papers in international literature, and more than over 30 monographs and 50 edited volumes.

In her book published in 1962, Rachel Carson warned against the risks emanating from an overconsumption of natural resources. Throughout the 1950s, the diffusion of big-push approaches to economic development had been associated with the total faith manifested in the possibility of achieving growing standards of living by means of capital-intensive industrial production. Within the model of social and cultural

development, the environment was conceived as a system of inexhaustible stocks of raw materials. Its essential functions and interrelationships were not studied per se, but purely in the light of their instrumental value for production purposes. Environmental processes were seen as constant and taken for granted, rather than as dynamic and finely-tuned sequences.

After the well known 'The Limits To Growth' report in 1972 and the Brundtland definition of sustainable development in 1987, the Rio Summit in 1992 encouraged the inclusion of sustainable policies for the use of environmental resources in the agenda of numerous political institutions. Since then, many research efforts and meetings have addressed the need to clarify the importance of environmental assets for sustainable societies. The aim was to disseminate the consciousness that environmental public goods constitute an often-irreproducible domestic resource. The evolution of a variety of cultural movements and scientific researches connected to the so-called environmental question has clarified that natural ecosystems are grounded on processes that are characterised by instability, irreproducibility and irreversibility. Natural resources have to be conceived as a limited and delicate rich endowment owned by each nation.

Nowadays, three years after the Rio+10 summit held in 2002 in Johannesburg, there seems to be no doubt that the invaluable stock of natural resources has to be subjected to a process of management in order to assess sustainable patterns for its use. In other words – thinking ahead – while the relevance of natural assets is taken for granted, how can people plan their future in the light of correct governance of environmental goods?

Environmental management evolves in a permanently changing scenario, where many interested parties meet with the purpose of realising their goals and finding solutions or compromises. This framework is further complicated when non-institutional bodies, such as NGOs and voluntary associations, become involved in the process. In this case, many practices move from a governmental perspective to a governance-oriented schedule, and display attitudes towards bottom-up processes. Within this panorama, the environment has begun to play a crucial role in the agenda of politicians. Thus, planners have been experimenting with new approaches, by attempting to improve traditional tools, such as land-use analysis and zoning, to take into account contextual features of uses, cultures, images and feelings of local communities. So-called negotiative and communicative planning can be considered as novel pathways for a sustainable approach to environmental management. Activities such as audit and dialogue are now considered able to empower local societies by means of achieving awareness of natural resources endowment. The studies about the fuzziness and the instability of the environmental phenomena in space and time have increased. Research findings on the complexity of the ecosystems reveal how difficult decision making and planning might become in relation to environment-sensitive domains. While some sceptical observers claim that it is impossible to satisfactorily analyse these particular domains, many scientists believe that it is precisely this complexity that demands the development of tools that will aid the analyst and the politician alike in decision making and planning.

Against this complex background, environmental scientists and planners have increasingly become aware of the need for decision aid science, in order to retrieve, process and deliver relevant analysis and prompt answers. Parallel to this phenomenon, there has been a sharp increase in the demand of support tools for environmental management and planning.

In the past years, information technology (IT) has strongly evolved and integrated its features with an avalanche of software and internet applications. Many IT devices have been tested as tools for assisting and supporting either decision-makers in the domain of decision support systems (DSS), or planners in the domain of planning support systems (PSS). Many scholars are inclined to define – in a hard and information technology-driven sense – a PSS as a computer-based system, or an integration of many such systems, which is able to support judgement, evaluation and, thus, planning. Nevertheless, in a softer and procedure-driven sense of the word, a PSS should always be conceived in relation to entire processes, to decisional environments, and sometimes also to institutional settings, where planning activities are supported and therefore are able to evolve successfully. Hence the technological aspect of a PSS – its computerised engine – is only useful functionally if the related planning process evolves properly. A PSS can be defined as a system that embraces computer devices, institutions, procedures, officials, persons, citizens, and stakeholders, who collaborate in attaining changing tasks in planning.

Recently, we recognise a shift in interest in research from stand-alone to networks and often also to web-based planning support systems. This new cluster of tools, sometimes called communicative or collaborative planning support systems (CPSS), is thought to involve communities in the design of their own living environment. Second generation GIS, also known as public participation geographic information systems (PPGIS), are particularly suitable to enter the scheme of a CPSS, since they will be even more oriented to master communicative strategies, such as informal knowledge management, map interpretation and sketch planning. Even though there is still some scepticism among researchers about the absorption capacity of these tools, many successful examples show how CPSS, grounded on internet GIS online and virtual reality applications, may improve the understanding of local societies and the use of spatial information for environmental self-planning purposes.

Having said that, we do witness a renewed interest in multicriteria analysis among researchers and practioners, which will be likely to cope with situations marked by severe problems and non-structured, even informal knowledge. Within the studies on planning support tools, one of the leading research lines relates to the integration of multicriteria analysis with geographic information systems. In order to provide tools able to master the spatial, and sometimes also the temporal dimension within a multicriteria framework, many applications have been tested: often in a loose-coupling pattern, but rarely in a tight-coupling scheme. In other words, often decisional and planning systems consist of different computer programs, conceived as closed and independent modules. Within this setting, only external information flows are allowed between each module. It is still quite rare, however, to find a system that embeds several features and functions within a unique module, thereby enabling it to cope with spatial data management, multicriteria analysis, fuzzy set analysis, web-communication, information distribution and so forth.

With a view to these background remarks, the aim of this publication is to provide scientists, researchers and professional planners with a collection of recent advances in decision and planning support systems, designed for environmental management. Particular emphasis is devoted to systems, which specifically attempt to integrate multicriteria analysis and geographic information science. Fourteen contributions are included, the contents of which are summarised below.

In his paper, Malczewski focuses on a PSS based on the integration between spatial analysis and multicriteria evaluation. He discusses a powerful multicriterion method based on ordered weighted averaging, in the light of a possible integration with geographic information system. This framework is applied to a real-world environmental management problem supporting the development of watershed management strategies in the Cedar Creek watershed in Ontario, Canada.

Ron Janssen and Marjan van Herwijnen then discuss the functions of a commercially available computer program, the decision support toolkit DEFINITE, which primarily includes multicriteria methods, cost-benefit analysis and graphical evaluation methods. The flexibility and usability of this computer program is described by illustrating many applications in case studies of environmental planning in The Netherlands.

In the third paper, Andrea De Montis and Peter Nijkamp reflect on the impact of the so-called digital revolution on planning and propose experimentation, where multicriteria analysis is integrated with distributed spatial analysis within an interactive evaluation environment. Here, the experimental system 'Evaluating Tourism', a web-based multicriteria and multi-agent system, has been designed, to perform a collaborative evaluation of the territorial attitude towards tourism integrated development.

In the fourth contribution, Giuseppe Munda refers to sustainability planning support systems as mainly social decisional processes in a complex setting that require the use of a reliable set of representations. He attempts to assess a selection method of non-equivalent representations to choose appropriate descriptors, such as indicators and indexes. The multicriteria software in a fuzzy environment NAIADE is described and applied for the benchmarking of sustainability indicators in order to help real-world policy processes.

Richard Klosterman, Loren Siebert, Mohammed Ahmadul Hoque, Jung-Wook Kim and Aziza Parveen describe the use of a commercially available GIS-based planning support system, What if?™, to evaluate alternate growth management strategies for a declining region in the Midwestern part of the USA – the seven-county region surrounding Cleveland and Akron, Ohio.

PingSun Leung provides an up-to-date review of multiple-criteria decision-making (MCDM) applications in fishery management, drawing on his experience in developing MCDM models to assist policy decision-making both in Hawaii and in Norway. The author highlights two multi-objective programming models and two applications of the Analytic Hierarchy Process (AHP) that have been separately developed for Hawaii and Norway.

In their contribution, Eveline van Leeuwen, Caroline Rodenburg and Ron Vreeker aim to develop an evaluation framework that can be used in the assessment of urban green spaces, by means of criteria linked to the notion of quality of life. The evaluation tool applied is based on the Flag Model, a discrete multicriteria method that has been applied to the Leipzig 'District Park Reudnitz' against a set of benchmark values related to policy objectives highlighting the improvement of quality of life in the city of Leipzig.

Next, Eveline van Leeuwen, Ron Vreeker and Frank Bruinsma compare a number of evaluation techniques used in the appraisal of projects carried out in river basin areas. This meta-analysis is developed along the lines of rough set analysis, in order to compare the adopted evaluation techniques and the characteristics of projects carried out in different European river regions.

In the ninth paper, Chiara Maria Travisi, Peter Nijkamp, Marco Vighi and Paolo Giacomelli propose a pilot approach, able to explore pesticide worst-case hazard scenarios at different space-time scales, managing five ecotoxicological risk indices. Thereupon, the results are interpreted from the perspective of a decision support method, using the so-called critical threshold value approach.

In the next contribution, Michele Campagna, Andrea De Montis and Giancarlo Deplano present a summary of recent advances in the field of planning support systems. They propose a classificatory framework to explain the features and characteristics of each system, with reference to the processes, users and institutional bodies involved.

In the eleventh paper, John Mourmouris develops a methodological framework for the evaluation of alternative sites of waste treatment facilities. A multiple criteria decision-making (MCDM) approach is selected, as it is believed to be one of the most reliable tools for coping with such problems. This approach is based on the combination of two evaluation methods: the 'weighting sum method' and the 'Electre II outranking method'.

Christiane Boehner introduces a set of approaches to modelling the urban environment and the interaction of actors at different levels of decision-making and discusses a set of evaluation methods aimed at obtaining a more complete simulation of urban dynamics. These remarks are confronted with the translation of the conceptual models and of the decision space into decision support systems (DSS) information technology.

Next, Karen Fabbri proposes a tri-phase framework, called 'triple S', that integrates social research methods, scenario development, spatial impact simulation and the comparison of strategic alternatives. This system is applied to formalise decision-making over processes for integrated coastal zone management (ICZM). This formalisation is meant to promote shared responsibility, accountability and transparency, hence the justifiability of actions.

Finally, Thomas Hatzichristos and Maria Giaoutzi develop an evaluation methodology for landfill siting in one of the 27 prefectures of Egypt, in order to allow the introduction of transparency and efficiency within the decisional environment. The method adopted is based on a combination of GIS technology for the analysis and visualisation; fuzzy logic for the evaluation of the final results as well as the Delphi method for the determination of the membership functions.

Across the contents proposed in each contribution, it is possible to identify common research fields. For this reason, a few remarks should be highlighted.

First, a differentiation should be noted between decision and planning support systems (DSS and PSS). Many scientists believe that a decisional framework can be seen as a planning support system (PSS) in its proper sense, only if it displays a suitable spatial data management system. In this context, among the commercially available programs described in this issue, the application 'DEFINITE', developed by Janssen and van Herwijnen, should be classified as a decision support system, while the application 'what if?^{TM}', built by Klosterman et al., qualifies as a planning support system tout court.

Second, a number of contributions refer to cases where multicriteria analysis is applied as an aid to decision-making and planning in the field of environmental management. The variety of approaches adopted, such as: the ordered weighted averaging by Malczewski; the analytical hierarchy process by Leung; the outranking methods by Mourmouris; the flag method by Van Leeuwen et al. and the critical value threshold method by Travisi et al., all testify how multicriteria analysts are still able to

provide professionals with very useful advanced tools for the controversial practice of environmental planning.

Third, in many papers, the attempt to integrate GIS technologies within a wider decisional environment is emphasised. In some cases, GIS is coupled with multicriteria evaluation. The GIS-based tools shown by Malczewski, De Montis and Nijkamp, Klosterman et al., and Hatzichristos and Giaoutzi, are conceived to enable analysts to master geographically referred problems and also to communicate the results of their analyses by means of efficacious visual interfaces. Generally, these systems and other similar devices are sought to encourage participation of citizens, by means of visual interactive procedures. It is therefore possible to individuate a particular set of devices, which may be called interactive planning support systems (IPSS).

Fourth, in a few papers, by Klosterman et al., and by Janssen and van Herwijnen, closed computer programs are described, which are available in the market place. While in this publication much attention is paid primarily to research advances and applications, in these specific papers, the usability of programs, their level of user-friendliness and their adaptability to case study analysis, can be fully evaluated.

Fifth, since the instability and uncertainty of environmental phenomena require that adequate measurement system be incorporated into decisional and planning settings, in some papers attempts are made to integrate fuzzy and rough set theories. The integration has been performed either for comparative selection and meta-analytical purposes, such as in the Munda and the van Leeuwen et al. papers, or for the evaluation of specific environmental analysis results, such as in Hatzichristos and Giaoutzi.

Sixth, in some contributions, the main interest is focussed onto the classificatory description of decision as well as planning support systems for environmental management, such as in the Campagna et al., and in the Boehner contributions. In other cases, a review of different frameworks is presented as they represent relevant approaches in a particular decisional environment, such as in Leung and in van Leeuwen et al.