



Land use change and management of coastal areas: Retrospect and prospect



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ABSTRACT

The main features of the contributions to this special issue on Simulating Land Use Change in Coastal Areas, are synthesized. Three key themes for coastal zone research and management are identified. These relate to the need for (1) making new analytic techniques relevant to coastal zone management, (2) communicating results to the public without inhibiting civic participation through technological over-kill and (3) designing public policy cognizant of the special conditions under which land use change operates in coastal areas.

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1. Retrospect: synthesizing the contributions

This special issue integrates three themes. We look at particular processes (land use change) in unique environments (coastal zones) using a specific form of analysis (simulation). Of the three themes, the most fundamental relates to land use change. This change ignites very different conflicts to those generated in other (non-coastal) environments such as hinterlands or urban interiors. The difference can be attributed to a number of factors. First, the coastal zone is the area where both natural/ecological and social/economic forces combine most intensively. The land–sea interface is unique and the ‘supply’ of coastal land is limited physiographically. Second, the number of stakeholders interested in exploiting coastal areas is often greater than in other (non-coastal) places. This makes the stakes higher and the conflicts more intense. Third, given the nature of coastal zones, the alternatives for expansion and substitution are necessarily limited. While land reclamation is theoretically an option, in many locations high costs and physical limitations make this virtually untenable. This further intensifies pressures and makes the stakes higher still. Finally, certain forms of economic activity are coast-dependent. Like coal mines the location of ports, marinas, desalination and power plants are all inflexible. But unlike coal mines, they compete with hotels, residential development and ecological interests. This is because of the high opportunity costs of forfeiting a coastal location in the wake of limited alternatives. This is not generally the case, for

example, with respect to coal mines. The latter do not compete with tourism in areas of scenic beauty, due to an abundance of alternative tourist locations.

Collectively, these factors make coastal areas both unique and more complex than regular hinterlands. They also make the conflicts more intense. The papers in this collection highlight a variety of coastal settings in which land use change can occur. Coastal zones are not just the arena for battles between competing land uses as illustrated in the case study material presented for Italy, Israel and Portugal. They are also highly vulnerable ecosystems under pressure from habitat loss, erosion and an increasing frequency of storm surges and flooding, as described in the Belgian case. However, the intensity of the coastal conflicts is heightened when economic interests are at stake. For example, land use change that leads to the incursion of housing into natural open space is likely to inflame a more severe conflict than land use change that intensifies ecological risk such as land depletion or environmental degradation. This is underscored by the aggregate analysis of drivers of coastal land use conflicts across a variety of coastal locations worldwide, presented in this collection.

Table 1 provides a comparative synopsis of the key attributes of the contributions to this special issue. A variety of simulation approaches to coastal land use change in very different contexts and over different time periods, are presented. Despite this heterogeneity, all contributions converge on one of three target audiences for coastal zone management: political representatives (policy makers), practitioners (broadly conceived as ‘planners’ and consultants) and the public (local citizens and NGO’s). These three communities of interest have very different agendas. Nevertheless,

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Table 1
Key features of the contributions.

Study	Simulation approach	Target audience	Case study area	Simulation period	Use of simulation results
Bramati, Musella and Alleva	Econometric Modeling	Policy Makers	16 conflicts, 8 countries	1991–2010 (estimation period)	Probability assessment Coastal Scenarios (futures)
Morgado, Gomes and Costa	Artificial Neural Networks	Decision makers, informed public	Almada- Trafaria/ Corta da Caparica, Lisbon Portugal	2006–2022	Impact analysis
Felsenstein, Lichter and Ashbel	Micro-Simulation	Port and economic development planners Coastal safety planners	Haifa Port, Israel	2008–2038	Risk assessment
Canter, Vanderhaegen, Khan, Engelen and Uljee	Cellular Automata	Urban planners, decision makers	Brugge and Oostende coastal areas, Belgium, Civitavecchia coast, Rome, Italy	2010-2030	Inputs to Decision Support Systems
Montanari, Londei and Staniscia	Artificial Neural Networks			2006-2020	

the outcomes of the contributions presented here are likely to cross partisan community lines. While practitioners for example are naturally likely to find interest in impact and risk assessments, scenario building and the use of expert systems serve all three stakeholder communities. Additionally, we can expect that as technology allows increasingly universal access to information, the divisions between the different audiences and their ability to assimilate different kinds of outputs, will become increasingly blurred.

An attractive feature of simulation is its' visualization capacity. Aside from the aggregate study of 16 coastal conflict environments, all the other contributions to this special issue summarized in Table 1, convey their outcomes using different mapping capabilities. While the spatial resolution of the simulated outputs varies greatly from broad functional zones (as in the Israeli case) down to fine-grained grid cells (as in the Belgian case), in all contexts the medium for communicating anticipated spatial change is cartographic.

2. Prospects for coastal zone research and management

Spatial change in congested coastal environments affects land use composition to a greater degree than in equivalent less-congested environments. Furthermore, climate change exacerbates not only the risk but also the magnitude of floods and disasters in these heavily populated areas. This increases the need for integration of effective coastal protection and disaster management strategies. While the effectiveness of such policy strategies is an empirical question and one to which this special issue contributes, their adoption and future prospects is an issue of communication with both practitioners and the public. The work presented in this collection suggests that as development increasingly shifts towards coastal and off-shore locations, conflicts are expected to be accentuated even further. At the same time, the availability of new (spatial) data, simulation and visualization techniques is also growing rapidly. The tools and information that the research community is able to provide to the professional community and civic society do not lag far behind processes of land use change. For the former, the challenge is to provide tools that are not only novel but also accessible, comprehensible and applicable to the needs of end users.

Given the foregoing need for communication, what are the directions for future research on land use change in coastal zones and how can those be integrated in coastal management? Can we identify any common issues arising from the contributions to this special issue? We highlight three emergent themes and deal with each in turn.

2.1. Relevance of techniques to coastal zone management

This relates to the contribution of the simulation tools that underpin all of the foregoing studies, to the practice of coastal zone management. Many of them represent state of the art techniques and in that respect, are not readily packaged for the practitioner. Nevertheless, they still serve as a yardstick of what can be achieved and signal the kind of coastal zone management outputs that are possible. Decision support systems for coastal management are receiving a lot of attention (EEA, 2013). Our collection indicates where these may be going and how sophisticated simulation tools can be harnessed to this end. In this respect we showcase cutting edge tools for decision support.

2.2. Generating information and engaging the public

This collection includes two contributions that explicitly address public involvement in coastal management (the studies from Italy and Portugal). Other contributions show how new information can be created and implicitly be made available to the public (the contributions from Italy, Israel and Belgium). Both involve civic engagement enhanced through the judicious use of technology, either web-based and pc-based. In this respect, technology acts as the great information equalizer, facilitating greater public participation in coastal zone management. Ostensibly, increasingly sophisticated analytics and technology should generate much more information and therefore empower the public. However, the issue is whether this really leads to greater social inclusion. The many and varied stakeholders in coastal land use conflicts do not all have equal access to the mass of new tools and data generated. As such, the use of new technology to enhance public participation may serve to entrench a digital divide. For example, not all stakeholders in a coastal conflict are likely to feel equally at ease with the opportunities afforded by on-line scenario building. Technology can both enhance and inhibit public participation. Furthermore, the generation of new information and the opportunity to merge different information sources may lead to a misuse of this capability. It can encourage suggestive but spurious correlations, misidentifying association with causality. For example, associating coastal degradation with socio economic attributes such as income or educational attainment, implies a causal linkage which might not exist in reality.

2.3. Coastal management policy

Our various case studies highlight the uniqueness of coastal land use change contexts. This underscores the fallacy of adopting a 'one size fits all' approach to coastal management. The message

emerging from the various contributions relates to the need for tailor-made public response cognizant of the special conditions in which land use change operates. A general approach to coastal governance such as integrated coastal zone management (ICZM) may work as an organizing concept for development but as a hands-on guide to action, its utility is questionable. It has become a popular but cumbersome framework for policy formulation (McKenna et al., 2008; Portman et al., 2012). Aside from the various practical conventions that ICZM encourages (for example set back lines), it also endorses the practice of less tangible conduct such as consensus building inclusion and multi-level negotiations. This calls for modification in management culture and behavior and implies a much longer time horizon than tangible regulatory change.

The dynamics of such a process cannot be over-looked. This special issue emphasizes the importance of analyzing land use change and not just land use patterns in coastal areas. These dynamics can be both temporal and spatial. ICZM attempt to address the former usually with a time lag that leads to reactive rather than

proactive policy. Spatial change is even more complex to address in a regulatory framework as spatial effects are not bounded by a natural direction (before and after) as is the case with temporal dynamics. As such, land use change occurring at the coast can have impacts at locations ostensibly remote and unrelated to the initial point of interest (as illustrated in the Israeli case). This is an area of policy formulation that is not currently addressed and presents a challenge for future research.

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