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## From Rio to Johannesburg: The role of coastal GIS<sup>☆</sup>

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*Abbreviations:* CAC, computer aided cartography; CAD, computer applied design; CE, council of Europe; CHP, coastal human pressure indicator; CL, coastal length; CO<sub>2</sub>, carbon dioxide; CZMA, Coastal Zone Management Act; DC, digitalized cartography; DSS, decision support systems; DSR, driving force state response; EEZ, exclusive economic zone; ELC, European landscape convention; FAO, Food and Agriculture Organization of the United Nations; GDI, gender-related development index; GEM, gender empowerment measure; GESAMP, joint group of experts on the scientific aspects of marine pollution; GIS, geographical information systems; HDI, human development index; HPI, human poverty index; ICM, integrated coastal management; ICSU, International Union for Science; IGBP, International Geosphere-Biosphere Programme; IGU, International Geographical Union; IOC, Intergovernmental Oceanographic Organization; IPC, Internet Protocol Configuration; IPCC, Intergovernmental Panel on Climate Change; ISDR, International Strategy for Disaster Reduction; ISSC, International Social Science Council; IT, information technology; LCP, land/coastline pressure indicator; LS, land state's surface; LUCC, land use and land cover change; NGII, National Geographical Information Infrastructures; NIC, new industrialised country; PFI, political freedom index; TCP, Transmission Control Protocol; UCLA, University of California at Los Angeles; UN, United Nations; UNCED, United Nations Conference on Environment and Development; UNCLOS, UN Convention on the Law of the Sea; UNCSD, United Nations Commission on Sustainable Development; UNDP, United Nations Development Programme; UNEP, United Nations Environment Programme; UNESCO, United Nations Educational, Scientific and Cultural Organization; WCS, World Conference on Science; WHL, World Heritage List; WP, World population; WSSD, World Summit of Sustainable Development; WWW, World Wide Web

<sup>☆</sup>This article mirrors the approach of the paper that was presented in the CoastGIS 03: Integrating Information for Coastal Zone Management, 5th International Symposium on Computer Mapping and GIS for Coastal Zone Management, Genoa, Italy, October 16–18 2003.

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## Abstract

This paper discusses the evolving role of coastal GIS vis à vis: (i) the inputs from the 2000 *United Nations Millennium Declaration*, the 2001 *Road Map Towards the Implementation of the UN Millennium Declaration*, and the 2002 *Plan of Implementation* of the World Summit of Sustainable Development (WSSD); (ii) the changing approach to integrated coastal management; and (iii) the increasing use of indicators in this field. It concludes by proposing a multi-faceted approach embracing the ontological arena (changing coastal reality), the semiotic arena (role of representations) and the hermeneutical arena (production of signifieds from representations). Coastal GIS will increase in effectiveness as science is better able to deal with these arenas contextually.

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## 1. Emerging political approaches

Following the *UN Millennium Declaration* [1,2], which encouraged the design and operation of “environmentally integrated water management” by connecting fresh and marine waters, the World Summit on Sustainable Development (WSSD) outlined a thematically ample approach to coastal and ocean management. The WSSD emphasized that “oceans, seas, islands and coastal areas form an integrated component of the Earth’s ecosystem and are critical for global food security and for sustaining economic prosperity and well-being of many national economies, particularly in developing countries” [3]. This statement refers to an articulated range of concepts and operational guidelines where integrated coastal management (ICM) is regarded as the key tool for pursuing sustainable development in these environments, and interdisciplinary approaches are critical. The main recommendations proposed by this extended document include ecosystem-based management approaches, integrating decision-making processes, addressing ecological stress, optimizing the use of biomass for food security, mitigating conflicts between resource users, and strengthening responses to natural disasters and extreme events. Together with an ample and intense preparatory approach [4], these recommendations constitute the basis for designing the evolving demand for research. The need to protect indigenous cultures and, where possible, to apply indigenous approaches to resource use, are mentioned throughout. These newly designed inputs may be framed in a comprehensive, ideological context where the sustainable development principle is reconfirmed as it was enunciated in the 1992 UN Conference on Environment and Development (UNCED), namely as the contextual pursuit of (i) ecological integrity, (ii) economic efficiency, and (iii) social intra- and intergenerational equity.

These elements converge to show how closely the WSSD approach has mirrored the efforts that the United Nations has undertaken since the mid-1990s to implement effectiveness. Two such pathways are evident. First, effectiveness along the political pathway is expected to improve as a result of the establishment of more intense integration along the “vertical co-ordinate”—i.e., between intergovernmental and governmental organizations—as well as along the “horizontal co-ordinate”, i.e.

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