U.S./EUROPEAN PARTNERSHIPS IN COASTAL ATLASES AND COASTAL/OCEAN INFORMATICS

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Keywords: web GIS, data access, information management, decision-making, coastal informatics, coastal atlas, metadata, semantic interoperability

INTRODUCTION

While significant capacity in the last decade has been built in the field of coastal mapping via web-based atlases, as well as coastal/ocean informatics (the general study of the application of computer and statistical techniques to the management of coastal and ocean data and information), little has been done to take stock of the implications of these efforts or to identify best practices in terms of taking lessons learned into consideration (including the effective translation of science to coastal decision-making). This panel will share the results of two recent NSF-funded workshops: the first, held in Cork, Ireland in the summer of 2006, under the theme of "potentials and limitations of coastal web atlases," and the second, held at OSU the week before Coastal Zone '07, under the theme "building a common approach to managing and disseminating coastal data, maps and information." Both workshops brought together key experts from Europe, both coasts of the United States, and Canada to examine state-of-the-art developments in web-based coastal mapping and informatics, along with future needs in mapping and informatics for the coastal practitioner community. These workshops are intended to advance research in the field by providing recommendations for best practices in coastal web mapping and to develop a cadre of scientists who will play a leadership role in forging international collaborations of value to the participating nations. The Coastal Zone '07 panel will also discuss the initiation of a possible International Coastal Atlas Network.

BACKGROUND

Ireland's Coastal and Marine Resources Centre (CMRC, http://cmrc.ucc.ie), established in 1994, consists of a multidisciplinary group within the University College Cork (UCC) and carries a strong tradition in academic research, education, training, and consultancy. Its nineteen researchers have expertise in a variety of disciplines that help to facilitate understanding of the complex coastal environment. They are a leading institute in the whole of Ireland in integrated coastal zone management, and marine/coastal mapping and informatics. The centre is currently working on over 20 local, national, and European projects in the areas of geographic information systems (GIS), remote sensing, modeling, and internet technologies; coastal processes and seabed mapping; integrated coastal and marine area management; and marine mammals and seabirds.

The lead author (Wright) was hosted by the CMRC in October 2004 while on a Fulbright to Ireland. Wright and the CMRC are both involved in projects in the areas of marine and coastal mapping technologies such as geographic information systems (GIS), web mapping, and seafloor mapping, and used the Fulbright visit as an opportunity to share their knowledge and experience working in different parts of the world.

Of particular interest during the visit was exploring linkages between the Oregon Coastal Atlas or OCA (http://www.coastalatlas.net), and the Marine Irish Digital Atlas or MIDA (http://mida.ucc.ie) (Figure 1). The Oregon Coastal Atlas, an NSF- and NOAA CSC-funded collaboration of OSU with the state of Oregon's Ocean-Coastal Management Program, and the environmental organization Ecotrust, is an interactive map, data, and metadata portal for coastal resources managers and scientists, with additional outreach sections for the general public. The portal, powered primarily by Minnesota MapServer, enables users to obtain data, but also to understand its original context, and to use it for solving a spatial problem via online tools (powered by ESRI's ArcIMS or Arc Internet Map Server). Similarly, MIDA is a developing web-based coastal atlas of Ireland, powered also by Minnesota MapServer, to serve as a catalog of existing GIS data related to Ireland's coastal and marine areas, as well as an informational tool for the general public. The CMRC is also designing the web-based GIS component for the Data Integration System for Marine Pollution and Water Quality (DISMAR) project, in which data distributed among computers located across Europe are served together in a single online resource to aid in oil spill and algal-bloom disaster response.
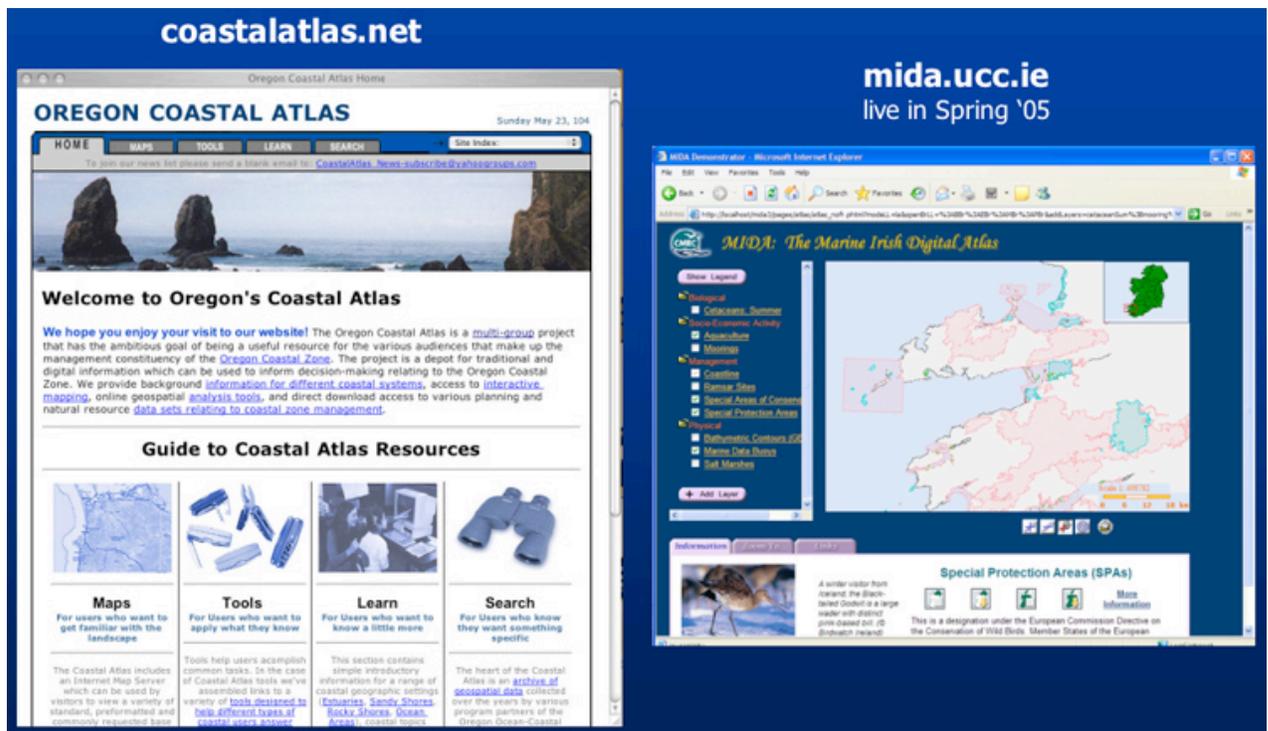
Figure 1. Screen shots of the opening pages of the Oregon Coastal Atlas (OCA), and the Marine Irish Digital Atlas (MIDA).

TRANSATLANTIC WORSHOPS
Funding was obtained from the National Science Foundation (NSF) to hold two joint workshops designed to identify common research priorities, and focused on specific areas of research collaboration. European efforts were funded in part by the Marine Institute of Ireland's Marine RTDI Networking and Technology Transfer Initiative under
Ireland's National Development Plan. The main objectives of these workshops were to:
- Quantify and qualify the strengths and weaknesses of coastal atlases as decision support systems for the Integrated Coastal Zone Management process.
- Identify a geo-spatial framework for the coastal zone.
- Describe novel and innovative activities in the uptake of geo-spatial tools by coastal managers.
- Agree upon a common ontology and thesaurus to facilitate database searches in Europe and North America.

U.S. and international co-organizers collaboratively designed the agendas around the above themes and invited colleagues from throughout Europe, from Newfoundland, Canada, and from Oregon and California to contribute to the workshop objectives by their presentations, software and web demos, and discussions.

Workshop #1, "Potentials and Limitations of Coastal Web Atlases," was held July 24-28, 2006 in Cork, Ireland. Workshop #2, "Coastal Atlas Interoperability," will be held July 16-20, 2007 in Corvallis, Oregon. Results of workshop #2 are not available at the time of this writing and will be reported in full at Coastal Zone '07. At workshop #1 expert delegates examined the current situation by studying a broad variety of existing coastal web atlases from Europe and the US. Various common issues were identified and discussed (e.g., institutional support, atlas design and usability, data accessibility, data and metadata compatibility, web-based tools for decision-support, etc.). See the main web site for the workshops at **http://workshop1.science.oregonstate.edu**.

RESULTS TO DATE: WORSHOP #1
Workshop #1 provided a valuable opportunity for those involved in coastal atlases directly or indirectly to learn about the different projects and discuss the diverse range of issues. A number of areas of commonality were discussed. Major results thus far include:

Guidelines for Atlas Development
Designing a coastal web atlas is a complex process. There are many factors that must be well thought-out before and during its development, such as atlas design and usability, technology behind the atlas, data content and user needs. As one outcome of this workshop, a set of guidelines were developed, based on the experience of participants, for anyone considering developing their own coastal web atlas - be it for an estuary, a state or a nation. The design and usability of an atlas are important for its success. An atlas should clearly communicate its purpose, be visually appealing, be kept as simple as possible, use efficient technology and management systems and have a flexible design to enable growth and change over time. Ultimately its success relies on the atlas users, so efforts should be made regularly to ensure it meets the needs of those users.

Strengths, Weaknesses, Opportunities and Threats Analysis
During workshop #1, four groups were composed to discuss issues related to atlas design, data, technology and institutional capacity. Each group focused its discussion by carrying out a Strengths, Weaknesses, Threats and Opportunities (SWOT) Analysis as it pertained to facilitating, developing and maintaining coastal atlases. This analysis was helpful in identifying key points in relation to atlas development. It was a useful approach for stimulating discussion and debate among the gathered experts and in helping to document the various experiences and opinions of the group members. More information is forthcoming in a final report.

Some Lessons Learned
It is vital to take advantage of expertise and develop links within the coastal atlas community to enhance collaboration, build on lessons learned and attempt to identify best practice. With the increasing number of atlases with a coastal and marine focus becoming available in recent years, there has been a concomitant growth of expertise in the area of online coastal atlas design and presentation so that by now a community of critical mass exists. Improving the collaboration within this community will be a valuable step for future atlas developments.

International and national legislation and regulation are driving not only a need for more and better data but also the requirement to make it publicly available. High quality spatial data underpins much of the policy implementation required by government. For example, LIDAR elevation data in coastal areas can be used to help identify coastal erosion and flooding risk.

Freedom of Information legislation and the development of a marine policy for the European Union are requiring government organizations to improve the visibility and accessibility of public-sector information. Web GIS can be an effective way to help in the implementation of such legislation. However, the erratic nature of funding supporting initial atlas developments can compromise maintenance and ongoing development of such resources. Many web GIS go out of date quickly because of the lack of resources for site maintenance. This can undermine both user and data supplier confidence. Funding is often tied to innovation and technology developments rather than user requirements and data delivery. The uncertainty surrounding funding also leads to leakage of expertise and personnel from projects. After initial proof of concept projects, there is a need to fund atlases on a long-term basis in order to guarantee their stability.

Consolidation of international standards and specifications is making atlas development easier. Open source and Open Geospatial Consortium (OGC) standards facilitate re-use of code and enhance data sharing, presentation and the development of advanced tools. Web Map Service (WMS) and Web Feature Service (WFS) protocols allow interoperability between distributed data servers. The ISO 19115/19139 metadata standards will continue to be important as they are now being adopted worldwide.

The recent emergence of Google Earth and other virtual globes has revolutionized public expectations with respect to geospatial data visualization. The coastal atlas/web GIS

community needs to evaluate the impact of such viewers on their own initiatives and determine if there is the potential to work with or incorporate elements of virtual globes in next version coastal atlases.

Efficient, flexible and easy to use spatial data management systems need to be put in place. As spatial data volumes increase, their management and delivery become more difficult. Users require fast response times, so it is imperative that coastal atlas developments can keep pace with such requirements. Network capacity may be a limitation that will need to be addressed in innovative ways. Database management systems must be put in place to keep track of metadata, data and associated information.

It is imperative that atlas development is responsive to the requirements and needs of the user community. Sometimes user needs are not prioritized by atlas developers. Users need robust, reliable systems that deliver data and information on time and in the required format for their needs. It is important not to oversell the ability of atlases or to make un-realistic claims. It is also vital to balance the exploration and implementation of new approaches and technologies against maintaining a stable and functioning system.

Coastal Atlases need to go beyond simple map visualization and offer a suite of analysis tools and value added outputs. In the next generation of coastal atlases it is important to go beyond simple interactive map presentation systems. A range of standard outputs, value-added products, the ability to carry out simple analyses and flexibility in generating user tailored outputs are required. Technologies such as XML, GML, geoRSS and content management systems can help in that process.

CONCLUSION:
While the results of workshop #2 are still forthcoming, it is already apparent that these workshops are giving rise to new collaborations and novel, innovative research, with great potential for:
- Creating and strengthening relationships between experts in the field of marine and coastal mapping in North America and Europe.
- Identification of state-of-the-art approaches to marine and coastal mapping and informatics in Europe and North America and publication of proceedings targeted towards expert audiences on either side of the Atlantic.
- Guidelines to the coastal/marine research community and resource decision makers on the development of coastal atlas projects, not only relevant on both sides of the Atlantic for the U.S., European, and Canadian partners involved, but with implications for global spatial data infrastructures and Internet mapping projects.

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