Coastal Informatics:
Web Atlas Design and Implementation

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Chapter 6
Oregon, USA

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ABSTRACT

This coastal web atlas case study for Oregon, USA, featuring the Oregon Coastal Atlas (OCA), describes a web site where people interested in coastal and marine information for the Oregon coast can find, learn about, and utilize data about the various resources and management issues in the Oregon coastal zone. The OCA currently hosts an archive of over 3,700 individual coastal data layers (including orthophotographs) and serves a variety of static and dynamic map products as well as informational tools focused on coastal places and topics.

INTRODUCTION AND OVERVIEW

The Oregon Coastal Atlas (OCA) is multi-group project established by a partnership between the Oregon Coastal Management Program (OCMP), Oregon State University (OSU) Department of Geosciences, and Ecotrust, a non-governmental organization based in Portland, Oregon. The project group formed in the year 2000, received funding in the fall of 2001, and launched the Atlas on the Internet in December 2002. A major revision of the website interface was undertaken in 2007 resulting in the current version of the OCA which launched in March 2008 and is visible at http://www.coastalatlas.net. As a relatively mature Coastal Web Atlas (CWA) the Oregon Coastal Atlas project has encountered and overcome many technical and institutional challenges and has incorporated many lessons learned into its current design and approach. The Atlas currently hosts an archive of over 3,700 individual coastal data layers (including orthophotographs) and serves a variety of static and dynamic map products as well as informational tools focused on coastal places and topics.

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Original Motivation

The original motivation for the OCA was to make it easy to search for and retrieve datasets and information products produced by management projects in the Oregon Coastal Zone. Such data may have been collected by any of the many partner local, state, or federal agencies that participate in the federally-funded OCMP. Prior to the debut of the OCA, such data and all the related project supporting information accumulated largely in the hard copy and disk (actually often floppy disk, CD or tape) archives of the OCMP or partner agencies and as such were virtually inaccessible to the intended audience of program partners, other key coastal zone constituents, and the generally interested public. Thus the project was initially designed to address the problem of finding and sharing data products from past projects and also to ensure that data stored on older forms of digital media were migrated into current formats so as not to become technologically trapped in the past. In the process of addressing this original need, the project team realized that the archive of data would be an asset to a wider audience if paired with informational products and tools that could make the data contained in the archive more accessible to non-experts. As a result, the design of the OCA (Figure 1) evolved to address both the needs of GIS specialists, as well as non-specialists seeking to explore a special topic of coastal management concern (e.g., a local planner or resource manager) or simply learn about the Oregon coast (e.g., a coastal visitor).

Funding

The project received initial seed funding from National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center, which afforded the OCMP the opportunity to form partnerships with OSU Geosciences and Ecotrust to develop the OCA project idea and apply for further funding to implement the concept on a coastal zone wide scale. In late 2001, the project secured key funding from the National Science Foundation (NSF) to fund the project's three-way partnership for three years. This base funding was augmented by various special project funding from other sources such as Federal Geographic Data Com-

Figure 1. Home page of the Oregon Coastal Atlas as visible at http://www.coastalatlas.net/

mittee (FGDC), e.g., for metadata development, and early adoption of Web Map Service (WMS) services. When the initial development grants expired in 2005, the project underwent a transition in which the OCMP eventually assumed the primary stewardship role and incorporated the OCA project into its standard ongoing portfolio of services to coastal management constituents. This assured that the project would continue to be maintained and grown over time.

Project Scope

The OCA covers the entire Oregon Coastal Zone, which encompasses all coastal watersheds except those of the Columbia, Umpqua and Rogue rivers on the terrestrial side, and the 3-nautical-mile territorial sea plus an ocean stewardship area that extends seaward to the toe of the continental slope, on the marine side. Data are not cut at these boundaries however, so if a data set is larger, it is allowed to extend outside of this zone. For regional context, the extent from (-132^{O}W, 39 ^{O}N) to (-116 ^{O}W, 53 ^{O}N) is the full footprint of the displayed area of interest in the OCA online map interface.

The target audiences are the decision makers and constituents of the Oregon coastal zone. These are comprised of local planners, state and federal agency staff, tribal governments, researchers, consultants, and interested citizens.

DATA COLLECTION

The initial focus for the OCA data collection was to "rescue" data sets that had accumulated and were mostly unused in the OCMP archives. In most cases these data were archived in paper file folders that consisted of hard copy reports and project notes (the project metadata), often with digital data attached via a floppy disk or data tape. In many cases, there was a fear that as hardware technology changed, even the OCMP would be unable to access the digital files due to lack of access to appropriate media/drive hardware.

All data that had been acquired in full or in part by federal Coastal Zone Management (CZM) funds passed through OCMP were potential candidates for inclusion. Digital data that fit these criteria existed in the OCMP archives dating back to the mid-late 1980s. In some cases hard copy data in photo print or table format existed back into the early 1970s. In addition, data continued to be accumulated through the 1990s and first decade of the 21st century in various digital formats.

In all the cases, the data in question were collected as part of the normal course of implementing the Oregon CZM program and answering the interdisciplinary management-based questions that CZM entails. This was the "bar of relevance" that a data set had to meet in order to be considered for migration into the OCA archive. Since various management issues wax and wane in importance over time, the total archive ranges from data relating to broad topics such as estuary or ocean planning, to data for more site-specific topics such as coastal erosion and habitat restoration. In all, the archive now comprises over 3,700 individual data layers of both vector and raster data types.

In terms of data origin, some data were collected directly by OCMP, while other data were collected by partner agencies using CZM (and other) funds. In some projects, data collected were entirely new, while in other projects, complimentary data were assembled from accessible public sources (usually federal sources such as NOAA or USGS). In all cases, the data in the archives were considered to be publicly funded and thus eligible to be included in a more publicly accessible venue, with the important caveat that the distribution format includes detailed metadata to convey the original project credits, conditions, background information, and intent.

SYSTEM DESIGN

When it came time to design the architecture of the OCA, the first question the project team had to answer was "how to organize all this data and information so that it makes sense to our audience?" This question quickly led to another: "who are our audiences, and how will they need to use this information?" It was answering this second question that really helped formulate the overall design of the OCA. The resulting design has, for the most part, been well received and proved durable, having remained relatively unchanged through system upgrades over the years.

As the project developed in the early stages, it became apparent that the data archive itself was an opportunity to illustrate the resources of the coastal zone and to raise awareness of some of the management challenges common in coastal areas. Since GIS was not a particularly common tool in the intended audience, providing the data in downloadable GIS file formats would likely address only the needs of specialized users. For users without access to a GIS, it was important to make the data sets available via a map interface that would not be too difficult to use, and allow for personalized maps to be made and exported for offline use. For certain data sets that were expected to be of high interest due to wide public applicability (such as beach access locations and beach water quality results), the team felt that they would be more frequently used if a simple tool were developed that could be used to easily repeat common lines of inquiry. Locations of high interest along the coast could be profiled with texts and photographs and grouped with informational items about common coastal management topics into a section that could inform casual browsers of coastal information. These ideas for different modes of accessing the coastal data in the archive eventually played a strong role in the system design of the OCA.

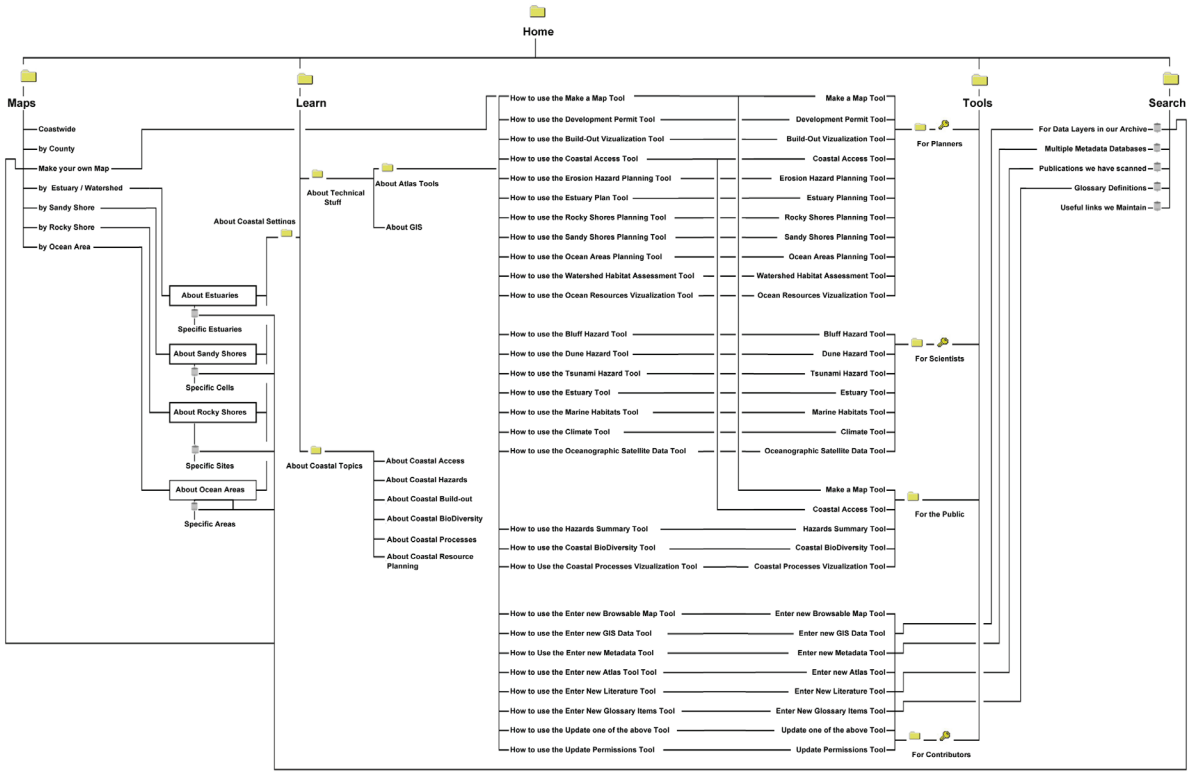
As stated in the project goals, the intended audiences for the OCA were the "decision makers and various constituents" of the Oregon coastal zone. This is obviously a broad cross section of potential users, some of whom could be expected to be more technology-savvy than others. The project was starting with a product, geospatial data, that had potential to be useful to many people, but which was typically packaged in GIS data formats that were inaccessible to non-specialists. This distinction between GIS specialist and non-specialist was a fundamental division in the OCA audience types. Further, the non-specialist audience consisted of several significant sub-types such as planners/ resource managers and researchers, in addition to the more general public. In order to serve the specialist customers, it was important to organize and document the archive data and make it easy to retrieve. The strategy to serve the various non-specialist customers was to derive useful information products from the data, and to offer various mechanisms (tools) for accessing certain data types that would need to be repeatedly accessed to answer specific types of questions.

In order to meet the needs described above, the project team developed a four-pronged information architecture organized around functions that the project team determined would best meet the needs of the various levels of audience the OCA would need to serve. The four functional branches of the architecture named Maps, Tools, Learn, and Search, were used to shape the user interface and navigation scheme of the site design. An early project diagram from 2002 (Figure 2) illustrates the anticipated types of content that could eventually fill the architecture. It is interesting to compare this diagram with the direction the project subsequently took.

Search

Once the conceptual system architecture was devised, the first task was to inventory the data in the archives, standardize it, and create a searchable database so that a catalogue of the OCA data holdings could be published. This entailed: (1) sifting

Figure 2. Original OCA information architecture diagram from 2002, showing the four main branches of the site and potential content. The architecture is interesting to look at in comparison to the actual direction the project has taken.



through paper archives, (2) accumulating digital data from the various forms of aging media, (3) transforming the data into a consistent geographic projection so that the various data layers could be used together easily, and (4) meticulously organizing the original project information from the paper archives into FGDC-compliant metadata to accompany the GIS data files.

This question of metadata became a central early focus of the OCA project. A majority of the initial data in the archive did not have any type of consistent documentation and therefore such documentation needed to be created before the data could be widely shared. Metadata is important because it documents not only the origins of a data set, in terms of authorship and institutional stewardship, but also the methods of data creation, original intended use of the data, and the possible appropriateness of the data for future uses. In the United States the standard for geospatial metadata is established by the Federal Geographic Data Committee (FGDC), and so this was the standard to which all of the OCA metadata were composed. A "Don't Duck Metadata" grant from the FGDC enabled the OCA partnership to train and employ a cadre of metadata interns to work through the metadata backlog that was preventing the data in the OCA archive from being shared. Gradually the collection was made available as the documentation was completed.

Each data set collected and documented was zipped along with metadata, and basic information metrics were entered into a simple database from which a searchable interface was ultimately created. Early internal versions of the archive database were constructed in Microsoft Access,

but the web accessible version of the archive is built with the MySQL database. Vector data were shared as shapefiles, and raster data (which in OCA are primarily orthophoto images and base maps) were shared as GeoTiffs. In Oregon, a state Geographic Information Council (OGIC) sets state-wide data standards for framework spatial data and, as a result, all data in the archive are shared in the Oregon Geographic Information Council's standard Lambert projection.

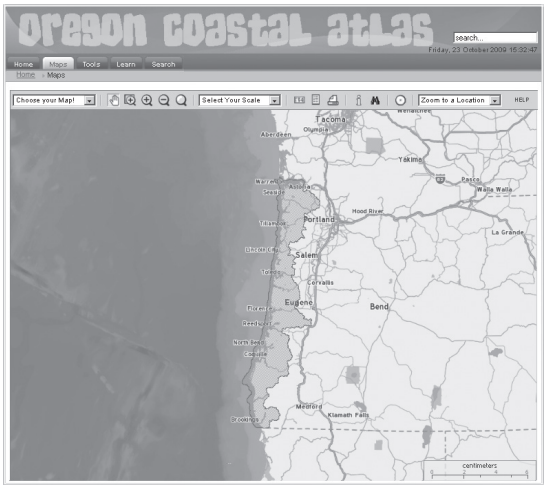
The search section visible on the current version of the OCA remains largely unchanged from the initial implementation of the function. As such, it is the oldest portion of the current interface and upgrades in its functionality are being considered. When the OCA debuted in 2002 there were around 300 individual data layers in the searchable archive. In late 2009 the number of data layers has grown to over 3,700. This order of magnitude increase has led to a need to enhance the performance of the Search functions available to users to ensure that the most relevant results are always returned. Several mechanisms are being explored to improve the Search function, among them the possible implementation of GeoNetwork Open Source. Among other benefits, the switch to GeoNetwork Open Source would allow for search to be implemented against complete XML metadata records, as opposed to the simple "discovery" metadata that is currently utilized when a search is performed.

Maps

The second step in the OCA project implementation was to build the most obvious of the information products: the Maps section. Maps created with the main Map tool are of use to any user who does not have a ready way to access raw GIS files. In the first version of the OCA, the maps section was composed of an interactive map powered by Minnesota MapServer that allowed the user to browse maps of the Oregon coast composed from a predefined set of background and overlay layers. The pre-packaged standard data could be supplemented with data from the searchable archive, and the map user could compose a custom PDF of their area of interest for download and later use. The second version of the OCA maps, implemented in 2007, extended the map interface options to include a thematic map selection function. This allowed for the presentation of collections of data sets organized around informational themes or focused landscape settings. Currently there are nine focused collections in place with three more in the current planning stages. For technical reasons (primarily speed) it is preferable to have a larger number of data collections with a smaller number of data sets per collection, than the reverse.

The first version of the maps interface was based on portions of the GMap PHP MapScript sample application interface created by DM Solutions Group, and employed a relatively static HTML interface with minimal JavaScript to ensure the widest possible cross-browser compatibility and cater to the slow web-connection speeds that were prevalent on the Oregon coast at the time. The second version of the OCA maps (Figure 3) maintained the majority of the original mapping functions but wider adoption of web standards by browser manufacturers and improved connections speeds made it possible to significantly upgrade the map interface itself. Implementing a JavaScript-based interface that utilized cached tiles to provide a more interactive user experience did this. This second version of the OCA map interface is based on ka-Map, an early JavaScript API for developing highly interactive web-mapping interfaces also developed by DM Solutions. The ka-Map API has been superseded by the highly popular OpenLayers JavaScript API for map interfaces that has attracted many talented open source developers. Within OCA, the OpenLayers API is being used for several Learn and Tool features that require embedded interactive maps and the main OCA map interface is planned to be revised around an interface that incorporates OpenLayers. At present,

Figure 3. The main OCA Map interface is based on the Ka-Explorer interface, which was developed for the Food and Agriculture Organization of the United Nations (FAO-UN) by Lorenzo Becchi and Andrea Cappugi (www.ominiverdi.org)



however, the OCA main map page continues to operate with the Ka-Explorer interface because it provides the basic tools needed for map navigating, is easy for users, and benefits from wide cross-browser compatibility.

Learn

The third step of OCA construction involved assembling the beginnings of the Learn section, which was intended to be targeted towards visitors who would be exploring the contents of the Atlas via texts and pictures. The intention was that these users would be best served by providing them with basic information that introduced them to the various topics and locations that the OCA covered, thereby providing an alternative pathway to the contents of the data archive. Initially, the contents of the Learn section were fairly sparse, limited mainly to discussion, pictures and maps of the main geographic settings covered: estuaries, sandy shores, rocky shores and ocean areas. However as the project team anticipated, the Learn section has grown over time to cover a variety of interesting data sets.

Significant additions to the Learn section have come from a variety of sources. Over the years the OCMP has been fortunate to host several NOAA Coastal Management Fellows and the products of Fellowship projects have helped to fill in the information contained in the OCA Learn section. Examples include Estuaries (Chad Nelson, Tanya Haddad), Sandy Shores (David Revell), Rocky Shores (Laurel Hillmann) and various Ocean topics (Andy Lanier). Additionally, special programs of the OCMP, such as the coastal hazards program, have posted information in the Learn section about topics such as coastal shore protective structures. Lastly, additional useful data sets have come from other agencies that have programs of wide interest to the coast-visiting public. These agencies have approached OCMP to host products in the Learn section as a way to receive wider attention and distribution for their information. Examples of such hosted information include: beach water quality information from the Department of Human Services BEACH program and rapidly moving landslide hazard risk information from the Department of Geology and Mineral Industries. Both these data sets are extremely popular amongst OCA users. The beach water quality information gets more traffic in the summer months, while the landslide risk information is most popular during the wet months of December and January.

Tools

Last but not least, the Tools section was assembled. Each of the various tools featured in the Tools section was constructed to perform a specific task, usually on a specific type of coastal data. In the first version of the OCA the tools section contained links to a variety of tools around the Internet that were of interest to users working on the Oregon coast. In addition, a number of tools were constructed by the project team to address

a variety of common coastal zone management questions. This generation of tools was partially documented in Haddad *et al.* (2005). The tools ranged in complexity from very basic reporting tools to more complex tools designed with geospatial analyses performed by ArcIMS. The experience of the OCA project with this first generation of tools was mixed with many lessons learned. Primary among these lessons was that simple tools that were easy to construct (e.g., reporting tools) often were the most popular with users and received the most traffic while more specialized and complex tools, the most difficult to construct and maintain, had limited audiences due to content and interface issues. Eventually, as the first iteration of the OCA project morphed into the second, many of these more complex experimental tools were simply not migrated into the new framework.

In the current (2009) OCA Tools section, only a few tools were actually constructed by the OCA project team. Most were simply documented and linked to by the OCA in order to give OCA users a catalogue of coastal-specific geospatial applications. Like the Learn section, the Tools section started out fairly sparsely populated with an expectation that both the OCA constructed tools and the wider links to tools created by other entities would grow over time. This has largely been the case. In recent years a wide variety of interesting geospatial tools relating to coastal management issues have been constructed by various federal and academic entities, and links to such products are added to the OCA Tools sections as they become available.

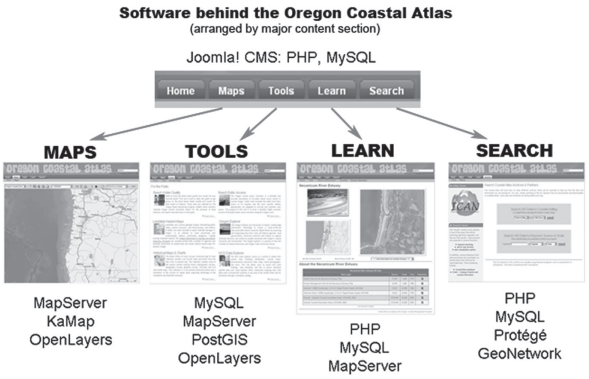
An additional important feature that the Tool section provides is the option for the user to filter the listed tools by the primary audience type for which the tool is appropriate. The four main audience types are: the Public, Planners, Researchers and Contributors. Tools listed in the catalogue are tagged to fall into one or more of these bins by the OCA administrator based on internal OCMP user evaluations. Users of the OCA see all available tools, or can select the appropriate tool based on the audience type to which they feel they belong.

Technologies Used

The current version of the OCA is built mostly on an open source set of software (Figure 4). The web server employed is the popular Apache. The primary database is MySQL, accessed via PHP scripts. The majority of the non-geospatial content is organized by the open source content management system (CMS) Joomla! A CMS is employed because it is a simple mechanism for controlling what content is publicly published on the website. Information can be brought online or taken offline fairly quickly with a CMS and permission can be granted to multiple content creators, editors, publishers and administrators so that the task of maintaining a project can be distributed among a wide variety of partners. When the first phase of the OCA project came to a close facing an uncertain funding future, the transition to an off-the-shelf CMS allowed the project staff to contract gracefully without impairing the site administration and allowed for a framework where distributed contributors could remain active.

From a technical perspective, Joomla is a CMS framework written in PHP that organizes web content utilizing the MySQL database that can be extended in functionality via user-created components, modules and plug-ins. In the OCA, the Maps section of the OCA is implemented as an instance of the PHP and JavaScript open source ka-Map ka-Explorer interface, embedded into Joomla. The various maps served in the map interface are simply a collection of MapServer text-based map files that are displayed via ka-Map. Similarly, the discovery metadata that are part of the primary search function are examples of content managed via a user-created extension to Joomla. In contrast the materials in the Learn and Tools sections of the OCA are managed almost exclusively by the Joomla "core" functions.

Figure 4. The software behind the various branches of the Oregon Coastal Atlas architecture



Future Directions

In the immediate future, the section of the OCA interface most likely to evolve further is the Search section. Currently, only discovery metadata are managed in the OCA extension to Joomla, as opposed to entire metadata records. The full metadata records are available when clicking on the results of a search but the results are served from flat files rather than from within the Joomla MySQL database. This is likely to be an area where the OCA is improved in the in the near future as a result of the project's involvement with the International Coastal Atlas Network (ICAN) and anticipated OCA implementation of the GeoNetwork Open Source product. GeoNetwork is specifically designed for metadata management that would enable the OCA to serve both basic discovery metadata and full XML FGDC and ISO-compliant metadata records. A full transition of the OCA data catalogue to GeoNetwork will also allow the catalogue to be searched externally by any entity capable of consuming a Catalogue Service for the Web (CSW) feed.

Looking further forward, an exciting new avenue of OCA development has been the project's involvement with the emerging ICAN. The Oregon Coastal Atlas team has participated in ICAN since its inception and through this involvement has begun work on development of a comprehensive Oregon Coastal Zone Management Ontology based on the catalogue of coastal zone management data in the existing OCA archive. Participation in the ICAN prototype has also entailed an initial installation of GeoNetwork open source to facilitate sharing of a portion of OCA catalogue. As this prototype information-sharing framework stabilizes, the OCA plans to transition the full data catalogue and to utilize more aspects of the GeoNetwork product to deliver links to data and metadata as well as OGC services and KML products to users, in order to keep pace with emerging user capabilities.

USAGE OF THE ATLAS

Server logs give a picture of the usage of the OCA and reveal some interesting information. The monthly statistics generated between March 2008 and August 2009 enable some basic metrics to be calculated. On average, the current version of the OCA receives about 13,945 visits per month resulting in about 280,475 page views per month. These visits come from an average of 3,695 unique visitors per month, of which an average of 1,127 return to the site more than once during the course of the month. About 16% (average of 176) of these returning visitors actually visit the OCA more than 10 times per month, demonstrating some utility

of the OCA products to the audience of coastal management constituents.

Table 1 shows OCA log statistics and illustrates the monthly variability that exists over time. For example, March 2008 marked the launch of the newly updated OCA and the publicity surrounding the upgrade resulted in some higher than average traffic for a time. More significantly, the month of January 2009 shows a huge increase in web site traffic far outside of the typical range. The explanation for this anomaly is that severe winter storms over the 2008 Christmas holiday period resulted in high run-off in the early New Year and several instances of landslides in the Coast Range Mountains. Because the OCA features a data set of potential rapidly moving landslide risk zones published by the Department of Geology and Mineral Industries, several news outlets that reported on the January landslide events, including the state-wide *Oregonian* newspaper and at least one local television station (KATU channel 2), mentioned the OCA as a resources for landowners interested in learning more about landslide risk. Both these news outlets also put a link to the OCA on their respective websites, resulting in over 1,250 direct referrals to the website from just 3 external links. Instances such as these illustrate the power of conventional media as drivers of traffic to destinations on the web and show that projects such as the OCA can be introduced to many additional users if broadly advertised.

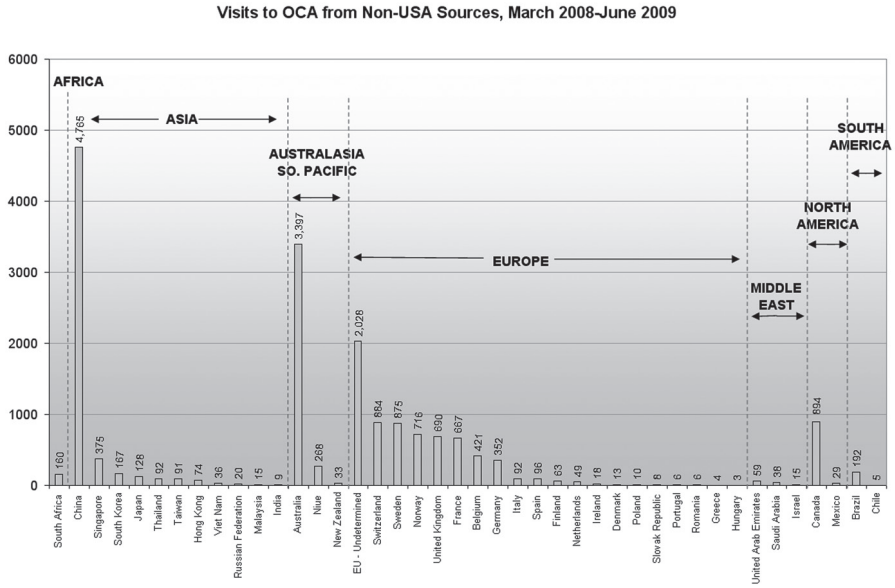
User Origins

Traffic to the OCA is predominantly from within the United States and only an average of 8% of the traffic per month to the OCA is from non-U.S. countries. Among U.S. states, the west coast is dominant, comprising about 75% of average monthly traffic. Other top ten high-traffic states of

Table 1. Oregon Coastal Atlas monthly server statistics from March 2008–August 2009

Date	Hits	Page Views	Visits	Percent International	Unique Visitors	Returning Visitors	Returned 10 or more times
Mar-08	331,675	257,517	13,963	9.40	5,182	1,866	135
Apr-08	259,033	184,303	15,701	5.85	4,510	1,746	250
May-08	254,994	177,971	14,073	4.96	4,039	1,560	185
Jun-08	275,579	191,283	12,925	5.61	3,224	1,122	169
Jul-08	289,162	200,471	12,282	6.17	3,467	1,113	127
Aug-08	312,398	221,026	11,240	7.01	2,977	882	105
Sep-08	248,739	171,284	8,541	7.79	2,530	645	117
Oct-08	270,225	196,615	11,640	10.85	3,124	788	107
Nov-08	228,595	151,809	13,678	12.05	3,239	1,039	129
Dec-08	233,691	156,221	11,720	14.12	3,107	891	106
Jan-09	1,732,600	1,434,650	15,752	10.54	6,056	1,256	159
Feb-09	302,291	207,412	11,047	14.09	3,041	844	115
Mar-09	394,509	265,422	12,860	13.14	3,658	993	121
Apr-09	376,172	255,107	13,607	12.03	3,601	1,203	163
May-09	356,628	229,068	17,695	4.85	3,810	1,021	261
Jun-09	366,718	260,340	15,704	4.16	3,180	870	260
Jul-09	386,797	263,741	20,257	4.42	4,084	1,199	314
Aug-09	326,992	224,313	18,322	4.22	3,689	1,244	345

Figure 5. Visits to the Oregon Coastal Atlas from outside the United States



origin include Virginia, Arizona, South Carolina, the District of Columbia, Massachusetts, Texas, Colorado, New Jersey and North Carolina. A chart showing the distribution of visits from other countries over 15 months is presented in Figure 5.

Utility to Users

Beyond demonstrating that the OCA is a repeat destination for a core group of users, server logs also reveal that the project also serves as a valuable resource for casual web browsers seeking information about the Oregon coast and various coastal management-related topics. This can be documented by examining the distribution of search phrases typed into search engines that refer users to the OCA. Figure 6 illustrates an 8-month sampling of the most frequent search phrases used in the Google search engine. For clarity the three most common phrases (*Oregon Coastal Atlas*, *Coastal Atlas* and *Oregon Coast Atlas*) are excluded from the diagram.

Figure 6. Distribution of search terms used on Google that led users to the Oregon Coastal Atlas. Size of phrase in the above image is weighted by the frequency of the search phrase. Graphic created with the online tool at www.wordle.net. Images created by the Wordle web application are licensed under a Creative Commons Attribution 3.0 U.S. License.

CONCLUSION

The Oregon Coastal Atlas is considered a successful project in terms of satisfying the original project goals of making it simpler for users to find, understand, and utilize data about the various resources and management issues in the Oregon coastal zone. Due to the long duration (7-8 years) of the project, many lessons were learned about the difficulty of serving such information via the web and efforts were made to incorporate some of those lessons into the current version of the OCA web product. Anecdotal feedback has implied that the revisions have resulted in an Atlas that is easier to use with a more productive CWA experience for users. At present, the project has no way to quantify this effect.

Challenges encountered over time have included both technical (e.g., low cross-browser compatibility in the early days and slow internet connection speeds at the coast) and institutional issues (e.g., initial project funding was limited in duration and when expended led to a period of transition while more permanent stewardship was established in the Oregon Coastal Management Program). Time has improved many of the original technical challenges (e.g., better browsers and faster connection speeds) while others (e.g., complex analysis tools built on proprietary software) have been avoided in the second generation OCA to simplify ongoing maintenance. Institutional stability has been achieved with a commitment from the Oregon Coastal Management Program to incorporate the OCA project into its standard ongoing portfolio of services to coastal management constituents, which assures that the project will continue to be maintained and grown over time.

The project's involvement with the emerging International Coastal Atlas Network (ICAN) has enhanced the development of new features and has strengthened the project by providing a potential direct mechanism for feeding OCA products into regional, national and international coastal information networks.

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KEY TERMS AND DEFINITIONS

Coastal Web Atlas: A collection of digital maps and datasets with supplementary tables, illustrations and information that systematically illustrate the coast, oftentimes with cartographic and decision support tools, all of which are accessible via the Internet. Also known as web atlas, digital atlas, digital coastal atlas.

Atlas Interoperability: The ability to interrogate two or more unrelated atlas systems and potentially exchange metadata, images, vector and raster data.

Coastal and Marine Information: Both spatial and non-spatial information regarding the coastal and marine areas of a region or country.

Integrated Coastal Zone Management: A dynamic, multi-sectoral approach to managing the coast which takes into account social, economic and environmental concerns of all parties with an interest in the coastal space.

Metadata: Information that fully describes or documents a dataset, such as its geographic coverage, quality, completeness, accuracy, etc. are a "pedigree" of sorts for a data set and helps you to judge its "fitness for use" or reliability, thereby helping one to use it more appropriately and efficiently. Metadata allow a potential user, for comparative purposes, to understand how the data were collected. They also provide the all-important details of how you can actually obtain the data in question, or who best to contact. Data that do not have accompanying metadata are often hard to find, difficult to access, troublesome to integrate, and perplexing to understand or interpret.

OCA: Oregon Coastal Atlas.

Spatial Data Visualization: The ability to view digital data with a spatial dimension in a