AN ABSTRACT OF THE FINAL REPORT OF

Tyler Barns for the degree of Master of Environmental Sciences in the Professional Science Master's Program presented on May 3, 2010.

Title: The Oregon Explorer Experience:

An Internship with a Statewide Geospatial Atlas

Internship conducted at:

Oregon Explorer in collaboration with the Institute for Natural Resources

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The Professional Science Master's program requires all graduates to complete an internship and prepare a descriptive report in lieu of a master's thesis. In 2009 I concluded a three-month full-time internship with the Institute for Natural Resources (INR). Oregon Explorer (OE) is a collaborative effort between INR and Oregon State University Libraries (OSUL); OE is a web-based digital library that provides information and geospatial data for the state of Oregon to natural resource decision-makers and practitioners. I worked as a geographical information systems (GIS) intern for Oregon Explorer. Developing and completing this internship, which focused on addressing a public need, provided me an opportunity to learn techniques such as business and communication skills, applications like ERDAS and Adobe Creative Suite 2, and software languages such as HyperText Markup Language (HTML), ArcIMS AXL, and Extensible Markup Language (XML). This report discusses my internship's scientific, ethical, and financial relevance as required by PSM degree guidelines. Additional background

information is provided on the development of GIS, the ethical implications of web-based geospatial information, emerging technologies associated with building and maintaining on-line media for the public, and other benefits I gained from my internship with Oregon Explorer.

THE OREGON EXPLORER EXPERIENCE: AN INTERNSHIP WITH A STATEWIDE GEOSPATIAL ATLAS

By

Tyler M. Barns

A FINAL REPORT

Submitted to

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In partial fulfillment of the requirements for the degree of

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Master of Science final report of Tyler M. Barns presented on May 3, 2010.

APPROVED:

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Major Professor, representing Name of Major

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I understand that my final report will become part of the permanent collection of the Oregon State University Professional Science Master's Program. My signature below authorizes release of my final report to any reader upon request.

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Tyler M. Barns, Author

Acknowledgements

The Staff of Oregon Explorer is a remarkable team of hard working individuals. I would like to thank everyone involved with Oregon Explorer and the Institute for Natural Resources. In particular I would like to call attention to Kuuipo Walsh, Marc Rempel, Kevin Johnsrude, Janine Salwasser, Ruth Vodracek, Matthew Gonzales, and Lisa Gaines.

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List of Acronyms

ANSI - American National Standards Institute

AXL – ArcIMS XML project file

COE – GIS Code of Ethics

DLCD – Oregon Department of Land Conservation and Development

ERDAS - Earth Data Resource Analysis System

ESRI - Environmental Systems Research Institute, Inc.

FGDC – Federal Geographic Data Committee

GIS – Geographic Information Systems

GIT – Geographic Information Technologies

HTML – Hyper Text Markup Language

HTTP – Hyper Text Transfer Protocol

INR – Institute for Natural Resources

ISO - International Organization for Standardization

NSDI – National Spatial Data Infrastructure

OSI – Open Source Initiative

P2P – Peer-to-Peer

ROC – Rules of Conduct

SWOT – Strengths, Weaknesses, Opportunities, and Threats Analysis

XML – Extensible Markup Language

1.0 SCIENTIFIC REPORT

1.1 INTRODUCTION

The Professional Science Master's (PSM) degree program combines scientific principles with communication and business skills. This program requires all graduates to complete an internship and prepare a descriptive report in lieu of a master's thesis. In 2009 I concluded a three-month full-time internship with the Institute for Natural Resources (INR) as a geographical information systems (GIS) intern for Oregon Explorer (OE). Oregon Explorer is a collaborative effort between INR and Oregon State University Libraries (OSUL). The Oregon Explorer[1] is a web-based digital library targeted for natural resource decision-makers and practitioners providing informational content and geospatial data for the State of Oregon.

The goal of the PSM program is to produce students who can bridge the gap between the business workplace and science. PSM students rely upon their course work in science, communications, business, professional development and a series of case studies and a full time internship to demonstrate the integration of the curriculum. The goal of my internship was to understand web-based GIS and advanced GIS applications in a working environment. I wanted to take the information from the classroom and apply it to "real world" situations.

In learning more about Oregon Explorer and the OE team, I researched their goals and objectives. Oregon Explorer strives to be Oregon's natural resource information clearinghouse where users can quickly find, retrieve, integrate and synthesize geo-referenced data. Additionally, I made it a personal goal to learn about how OE satisfied their goals thru their portals and tools and how OE operates as a business. Not only would this experience integrate PSM coursework with a "real world" working environment, but it would also allow for personal professional development. My supervisors also felt it necessary to include a secondary goal of gaining an understanding of subjects beyond web-based GIS. These secondary subjects are included as background information on the following topics: the development of GIS, the ethical implications of web-based geospatial information, emerging technologies associated with building and maintaining on-line media for the public, and other benefits I gained from my internship with Oregon Explorer. The following report discusses my internship in terms of its scientific, ethical, and financial relevance as required by PSM degree guidelines.

During this internship I learned about advanced GIS techniques including programming languages, open source GIS, and applied programs for web-based GIS servers to geospatial data.

[1] The Oregon Explorer: www.oregonexplorer.info

Work completed for Oregon Explorer's Hazards and Imagery Explorers collection provides public users with data that is otherwise unavailable, difficult to retrieve, or too large for current data media. My internship created many opportunities for future work with GIS and other online geospatial projects. For example, I am now able to work with web-based GIS applications, maintain various mapping services on networked servers, and update web content. As a result, these newly acquired skills increase my professional marketability and my abilities to perform more advanced GIS tasks. Additionally, as an OE staff member, I participated in staff meetings and became familiar with how user input influences the operational decision making process. User input guides the development of the Oregon Explorer portals and tools. Operational decisions made during staff meetings presented valuable On-the-job training and experience with regard to setting priorities and developing products for stakeholders.

Developing and completing an internship with Oregon Explorer provided me an opportunity to learn techniques such as business and communication skills and applications like Earth Data Resource Analysis System's (ERDAS) ER Mapper 7.2, Adobe's Creative Suite 2, Environmental Systems Research Institute's (ESRI) Arc Geographic Information Systems (ArcGIS) suite and Arc Internet Map Server (ArcIMS), and software languages such as HyperText Markup Language (HTML), Extensible Markup Language (XML), and ArcIMS XML project file language (AXL). Further application and software descriptions are provided in section 1.2, Methods and Materials. I used these skills daily to work in network engineering and server management, and with federal, state, and local agencies. Oregon Explorer has partnered with State of Oregon Departments (i.e., Department of State Lands and Department of Land and Conservation), the United States Geologic Survey, the Wetlands Conservancy, and the Oregon Natural Heritage Information Center. Through these partnerships I have expanded my professional development through the establishment of several contacts and multiple working relationships. Peers, colleagues, and contacts from OSU and partnering agencies could be useful as collaborative resources and a source of references or future employment. Aside from gaining an understanding of the personal and technical aspects of Oregon Explorer, I also experienced the difficulties of maintaining and providing network support for web-based geospatial data systems.

HISTORY OF WEB-BASED GIS

Geographical Information Science, or as Michael Goodchild termed it, "GIScience," combines the concepts of geomatics, geoinformatics, spatial information science, and geoinformation engineering (Longley, Goodchild, Maguire, & Rhind, 2005). GIScience and geographic information technologies (GIT) are increasingly being utilized to incorporate community involvement in research and development projects (Weiner, Harris, & Craig, 2002).

Historically, GIS programs were expensive and required a high level of training in order to operate them. Consequently, only institutions that had the money to invest in specialized software and specific training had the opportunity to use GIS often. In most decision making arenas, "spatial decision support systems have limited accessibility since they require proprietary stand-alone software installed in the users' local computers," in which case, participants have limited or no direct access to them (Peng, 2001). The inability for everyday citizens to gain access to GIS programs hinders their participation in the planning process (Peng, 2001). In addition, lack of access to GIS software also limits the ability of the general public to take advantage of geospatial data provided by federal, state, and local government agencies, or held in research institutions. While some argue that the current arrangement of GIS affordability creates a more elitist and antidemocratic user community (Peng, 2001). To resolve this issue, some feel the answer lies with utilizing the Internet and developing a web-based public participation system.

Web-based GIS has emerged to address the inequality among users. The advantage of this emerging technology is that it can allow a large number of users to access geospatial data using their internet browser, a simple and familiar interface. Additionally, users can access data from any internet-ready device. Oregon Explorer's Advanced Mapping Tool is an example of web-based GIS. Geospatial data is collected and maintained, and made available to the public through web mapping services created by GIS specialists. With the improved access that web-based GIS allows citizens also have the opportunity to provide feedback for program improvement. Oregon Explorer uses public comments and results from user testing to improve data accessibility and web design.

Web-based GIS allows non-experts to access data, communicate more easily, and provide support to decision makers (Lan, Martin, Froese, & Chao, 2009). Web-based GIS has been used, for example, in areas such as hazard planning, botanical research and cataloging, and planetary exploration. Today, web-based GIS technology is often used to provide hazard-preparation services because of its ease in handling, integrating, and visualizing diverse spatial data sets (Brimicombe, 2003). Web-based GIS interfaces vary depending on the needs of the organization. My internship solely dealt with Oregon Explorer's Hazards Explorer, which provides community leaders with geological hazards information and can be used to develop a hazard preparation plan. In Lan et al., (2009), the authors note, "in today's risk- adverse society, communities are expected to identify geohazards that affect their community and ideally prepare zoning maps based on these geohazards as part of their infrastructure risk management and emergency response plan" (Lan et al., 2009).

The Federal Emergency Management Agency (FEMA), for example used a web-based GIS to improve access to information that involves flood data. In 2003, FEMA documented the need for the development of a web-based GIS for hazard mapping, and identified a process to do so. Historically, FEMA's flood- boundary data was available only on paper maps, limiting its readership and effectiveness (Lowe, 2003). Lowe (2003) states that using the Internet to disperse federal, state, and local hazard data would improve access for FEMA's hazard map users. Access to this information will allow community hazard planners, insurance agencies, and concerned homeowners to gain information difficult to access.

A third example concerns the use of web-based GIS to improve scientists' documentation of the ranges of plants, and acts as a central database to store information about their characteristics. Historically, dried specimens, living plants, and seeds have formed the basis of the catalogue for all known plant species. Specialized metadata standards and information exchange protocols for web-based GIS have been developed by Oregon State University and the Biodiversity Research Center Informatics group at the University of Kansas Natural History Museum. The use of these new standards and protocols has standardized and improved the methods by which botanical data is stored and used (Greene & Minoura, 2007).

Lastly, a web-based GIS has been used to display information generated by the 2003 Mars Rover mission. Researchers at the Mapping and GIS Laboratory of Ohio State University found that this system was able to integrate multi-source spatial data to support planetary mission operations (Li, et al., 2007).

ETHICAL USE OF GIS DATA

Users of GIS have discovered that web-based GIS helps to involve the community in GIS technology. However, if a GIS does not enable this technological connection to occur, the program would be considered inadequate (Crampton, 1995). I define GIS ethics as the decision-making process whereby moral questions help determine what is right and wrong concerning the use of GIS. James Proctor of the University of California, Santa Barbara writes that ethics in science "typically involves reflection upon moral questions that arise in research, publication and other professional activities" (Proctor, 1998). Onsrud (1995) states that ethics is a "behavior desired by society that is above and beyond the minimum standards of behavior established by law…It is conduct to which we wish everyone would aspire for our mutual benefit"(Onsrud, 1995). As in science in general, the use of GIS to display scientific information requires careful moral consideration and documented protocols of data quality assurance.

In GIS, quality work is determined by how accurately the work maps the environment, how well it answers user-posed questions, and how well resources are utilized to get to that answer (Crampton, 1995). Ethical decisions occur in the development of GIS data, maps, and web-based GIS. Societal rules of conduct and codes of ethics aid in directing ethical behavior, and can be codified in statues or administrative regulations. The equivalent rules of conduct for the use and development of GIS consist of the regulations that make up the metadata and Federal Geographic Data Committee (FGDC) standards described below.

GIS Code of Ethics

The GIS Code of Ethics (COE) provides guidelines to professionals in the GIS community. The COE was developed by the GIS Certification Institute[2] and takes a deontological approach to considering the impacts our products have on others. Deontological theories "judge actions or policies insofar as they conform to rules or principles" (Shamoo & Resnik, 2009). Kantianism, Utilitarianism, and Virtue Ethics are ethical theories included in the Code. These theories suggest how one should act. Decisions should be made that cause no harm or result in the greatest good for the greatest number. Some theories rely on the establishment of moral agents to aid in determining what is right and what is wrong. Moral agents guide actions based on the Golden Rule. There are four fundamental principles GIS practitioners should strive to meet; these include: (1) obligations to society, (2) obligations to employers and funders, (3) obligations to colleagues and the profession, and (4) obligations to individuals in society (Institute, 2008).

Rules of Conduct

The GIS Certification Institute developed the GIS Rules of Conduct (ROC)[3]. "The Rules of Conduct is a set of implementing laws of professional practice that seek to express the primary examples of ethical behavior consistent with the Code of Ethics" (Institute, 2008). In order to maintain consistency with the COE the ROC have been developed to emphasize associations with each heading under the code. Numerous rules exist for each principle area. "The Rules of Conduct is a set of implementing laws of professional practice that seek to express the primary examples of ethical behavior consistent with the Code of Ethics" (Institute, 2008). Professionals in the field of GIS can refer to the ROC if they are concerned about displaying of certain types of data online.

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[2] The GIS Certification Institute provides the Code of Ethics on its website: http://www.gisci.org/code_of_ethics.aspx. Accessed 01/28/10.

[3] The GIS Certification Institute provides the Rules of Conduct on its website: http://www.gisci.org/Ethics_and_Conduct/rules_of_conduct.aspx. Accessed 01/28/10.

The Rules of Conduct and the Code of Ethics were developed to enable a GIS professional to govern the way in which GIS data is collected, created, and finally presented. Responsibility therefore lies in those who create the GIS, those who write the geospatial technology code, and those who compile the spatial data to adhere to the Code. Furthermore, it falls upon those individuals to be prudent in their work and to incorporate ethical principles in the infrastructure they help to create (Onsrud, 2008).

Ethics and Oregon Explorer

I sought to conduct my work in a way that promoted quality work as defined by the code of ethics and rules of conduct. The need for ethical decision-making during my internship was limited to posting metadata information on the site. Specifically, I made sure the FGDC required fields were completed. Metadata and FGDC standards are discussed in detail below.

There were instances during my internship when we had to make decisions about what data could be displayed. The Oregon Hazards Explorer includes spatial information about potential natural hazards (fire, flood, erosion, etc.) Users can create maps that illustrate a point on the map, overlay hazard layers, and create a report for that specific point. I believe this information could be used against an individual or group if, for example, they happen to be building a structure within an area prone to coastal erosion. An insurance agent, in theory, could use Oregon Hazards Explorer to increase fees for insuring such a structure. To compensate for the decision to provide this data, the Oregon Explorer team created a cautionary statement on the Hazards Reporting Tool that requires users to agree to a hold-harmless statement.

METADATA AND FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS

Metadata describes the attributes and content of data. Metadata is thought of as "data about data," and gives users a way to answer questions about the data without having firsthand knowledge of the work (Milstead & Feldman, 1999). Oregon Explorer is tasked with creating, maintaining, and posting metadata for data layers presented in the various mapping tools. University of Wyoming's Metadata Education Project suggests metadata (1) protects investments in data, (2) helps users understand data, (3) enables discovery, (4) limits liability, (5) can prevent embarrassing or expensive disasters, (6) is evidence of prudent data stewardship, (7) reduces workload associated with questions about data, and (8) cuts overall costs (Wyoming). Metadata is guided by numerous FGDC standards. These data standards aid in the development, sharing, consistency, and use of geospatial data.

The Federal Geographic Data Committee "develops geospatial data standards for implementing the NSDI [National Spatial Data Infrastructure], in consultation and cooperation with state, local,

and tribal governments, the private sector and academic community, and, to the extent feasible, the international community" (FGDC, 2008). There are four main FGDC endorsed standards categories: Content Standard for Digital Geospatial Metadata, Spatial Data Transfer Standard, Geospatial Positioning Accuracy Standards, and Geographic Information Framework Data Standard. Additionally, outside standards from International Organization for Standardization (ISO) and American National Standards Institute (ANSI) standards are available. All standards are available or accessible through the FGDC website[4].

BITTORRENT TECHNOLOGY

Besides editing metadata for OE, I created and posted BitTorrents on the Oregon Imagery Explorer. OE has recently included BitTorrents as an alternative to zip files for downloading entire county images. The process involves splitting files into small pieces, "bits," and sending the bits to users in "packets." This process allows multiple packets to be uploaded and downloaded from a number of sources, and in no particular order, making interfacing with the data quicker and easier. Flexibility on input structure in the peer-to-peer (P2P) setup has become highly popular for file sharing (Izal, G., Urvoy-Keller, G., Biersack, E., Felber, A., Al Hamra, A., & Garcés-Erice, L., 2004). Bram Cohen, who created this file distribution system, states, "when a file is made available using HTTP [Hyper Text Transfer Protocol], all upload cost is placed on the hosting machine. With BitTorrent, when multiple people are downloading the same file at the same time, they upload pieces of the file to each other" (Cohen, 2003). BitTorrent technology thus enables users to download and use GIS data more efficiently, and is not affected by intermittent connections.

A new vocabulary has been created to describe the BitTorrent process and community. New terms have been created to describe people using BitTorrent for file distribution. For example, OE staff could create a torrent, which includes an image file and associated metadata, and announce this torrent on several trackers. "Trackers" are similar to library catalogs. These people know where the data is housed and direct the user's request to the host. Users who wish to download this data use software, known as a "client," to communicate with the tracker. "Peers" are those individuals who have downloaded the data with the intent to distribute this data to others, a process known as "seeding." Those who have ceased to provide the data to the community are termed "leeches," a name that carries obvious negative connotations (Liogkas, Nelson, Kohler, & Zhang, 2008). Seeders commonly distribute data to users for up to several days after a download

[4] Federal Geospatial Data Committee standards website: http://www.fgdc.gov/standards/standards_publications/index_html. Accessed 01/27/10.

has been completed. In this situation, the more peers that participate in seeding, the more bit packets available to a new user.

To summarize, if a user wanted to download a county image using Oregon Explorer's Imagery Explorer BitTorrents, he/she would select a county they wish to download and the download process would begin. Opening the downloaded torrent with his/her BitTorrent client will start the process of communication between the tracker and other peers who may or may not be sharing the data.

OPEN SOURCE

According to the Open Source Initiative (OSI), "open source" does not necessarily imply access to the source code. Software distribution must meet ten criteria to be considered open source: (1) free distribution, (2) source code, (3) derived works, (4) integrity of the author's source code, (5) no discrimination against persons or groups, (6) no discrimination against fields or endeavor, (7) distribution of license, (8) license must not be specific to a product, (9) license must not restrict other software, and (10) license must be technology neutral. A detailed description is available through OSI's website[5].

Oregon Explorer is currently evaluating the feasibility of migrating to open source software. The purpose of the planned migration would be to improve navigation within and between portals, to allow for easier additions and maintenance, and to better enable the sharing of the Oregon Explorer technology at regional and national levels (Salwasser & Avery, 2010). Additionally, the migration to open source software could lower overhead operational costs and alleviate funding requirements.

During my internship I investigated how Oregon Explorer could migrate data from the current configuration to open source. Part of my investigation included opening a dialogue with open source specialists and the Portland PostgreSQL users group. My experience with the user group is discussed later in Section 2.2.

The use of open source software for web-based GIS is possible and is increasing in use. For example, the Web-Based Genetic Resources Management System (WebGRMS) prototype, a database of botanical data developed by Greene et al. (2007), is based on open source software. The authors used PostgreSQL and PostGIS, an open-source object-relational database and open source extension for GIS applications, to build WebGMRS (Greene & Minoura, 2007). Because

[5] Open Source Initiative website: www.opensource.org. Accessed 01/27/10.

WebGRMS was built using open source code, not only is it less costly, but WebGRMS is also supported by the open source community.

SKILLSET AND SOFTWARE

To accomplish the goal of my internship, I had to improve my GIS skills. Working with web-based GIS professionals would provide me with the application of GIS on the web. Although prior to Oregon Explorer I had taken several introductory and advanced GIS courses, I still lacked the knowledge to effectively work with web-based GIS applications. As an undergraduate in 2005, I gained experience with using ESRI's ArcGIS products, specifically ArcMap 8.3. After graduation, I worked as a field biologist and California Environmental Quality Act (CEQA) analyst at a small environmental consulting firm. Though I was not the GIS technician, I worked several hours a month on the GIS station. My formal GIS training began with courses offered at Oregon State University, specifically in Dr. Wright's Geographic Information Systems and Science (GEO 465/565) course. GIS course work at OSU was based on ESRI ArcInfo 9.3 (and subsequent updates).

In addition to my PSM degree I am pursuing a graduate level certificate in GIS. The certificate requires numerous core courses, such as Cartography and Remote Sensing, which, when taken together, allow students to develop skills pertinent to the GIS field. Using the skills I learned in GEO 565 and Advanced GIS (GEO 580), I was able to present myself as a competitive applicant for my internship with Oregon Explorer.

1.2 MATERIALS AND METHODS

WEB-BASED GIS

My work with OE required me to be familiar with vector and raster shapefiles, importing and exporting data to and from geodatabases, BitTorrent technology, multiple programming languages such as HTML, XML, and AXL, and the use of the ArcInfo toolbox for data management. I also maintained web-based services on several networked servers.

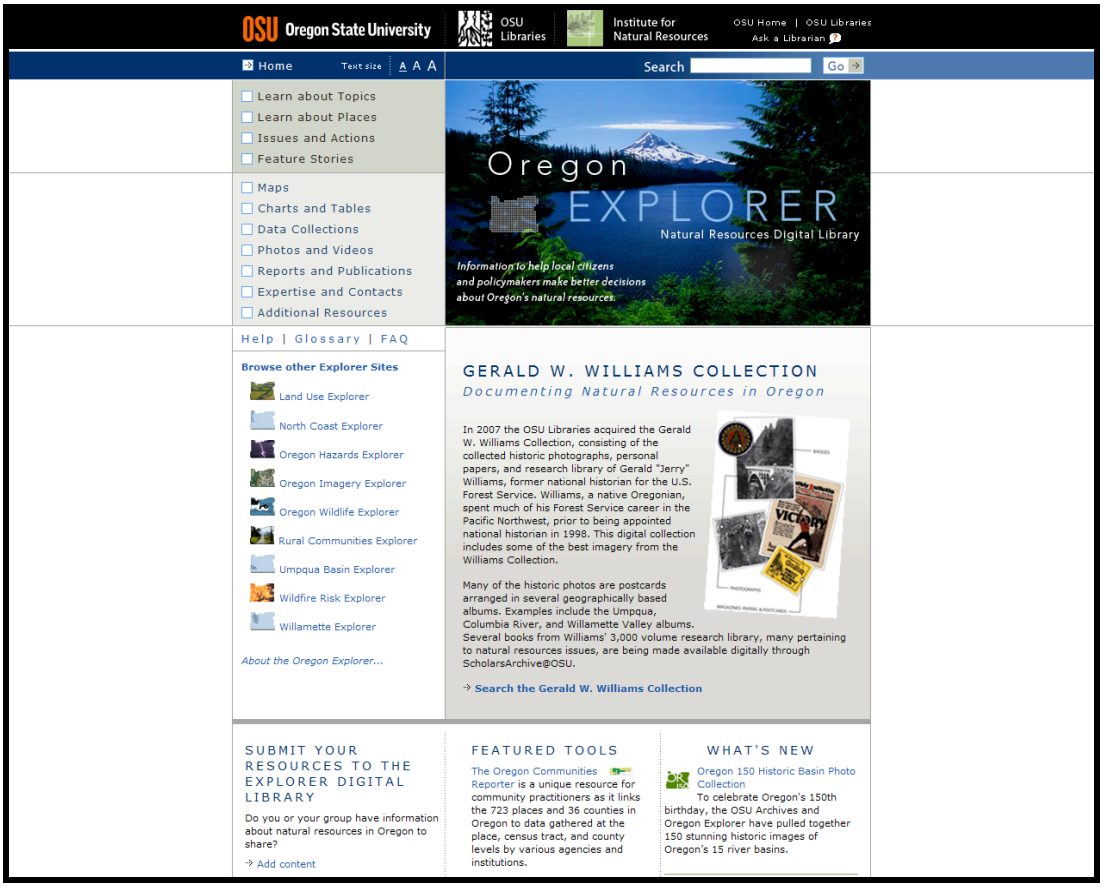
Working as an intern for Oregon Explorer provided me with experience working with a number of GIS and imagery software packages. Various tasks throughout the three-month period required me to learn and use ESRI's ArcIMS software, ERDAS ER Mapper 7.2, and Adobe Creative Suite 2. Additionally, I became familiar with website management software and web-servers such as MapServer and Apache Tomcat. ESRI's ArcIMS uses several files to associate data stored within Oregon Explorer's geodatabase and present them as services for use in web-based GIS applications. Oregon Explorer uses MapServer and Apache Tomcat to manage and

present the services created by ArcIMS. During the internship imagery software ER Mapper 7.2 and Creative Suite were used to format data for web display and dissemination.

Oregon Explorer is web-based GIS and as such the web interface is critical to usability. The Oregon Explorer home page has links to the various portals and reporting tools, including the mapping tool (**Figure 1**). OE applications, tools, and maps run from code files. These files are combinations of AXL, XML, HTML, and other files types associated with serving up the data. I worked on several files that directly influence usability. For example, the Advanced Mapping Tool on Oregon Explorer utilizes two distinct files to operate, one written in AXL and the other in XML.

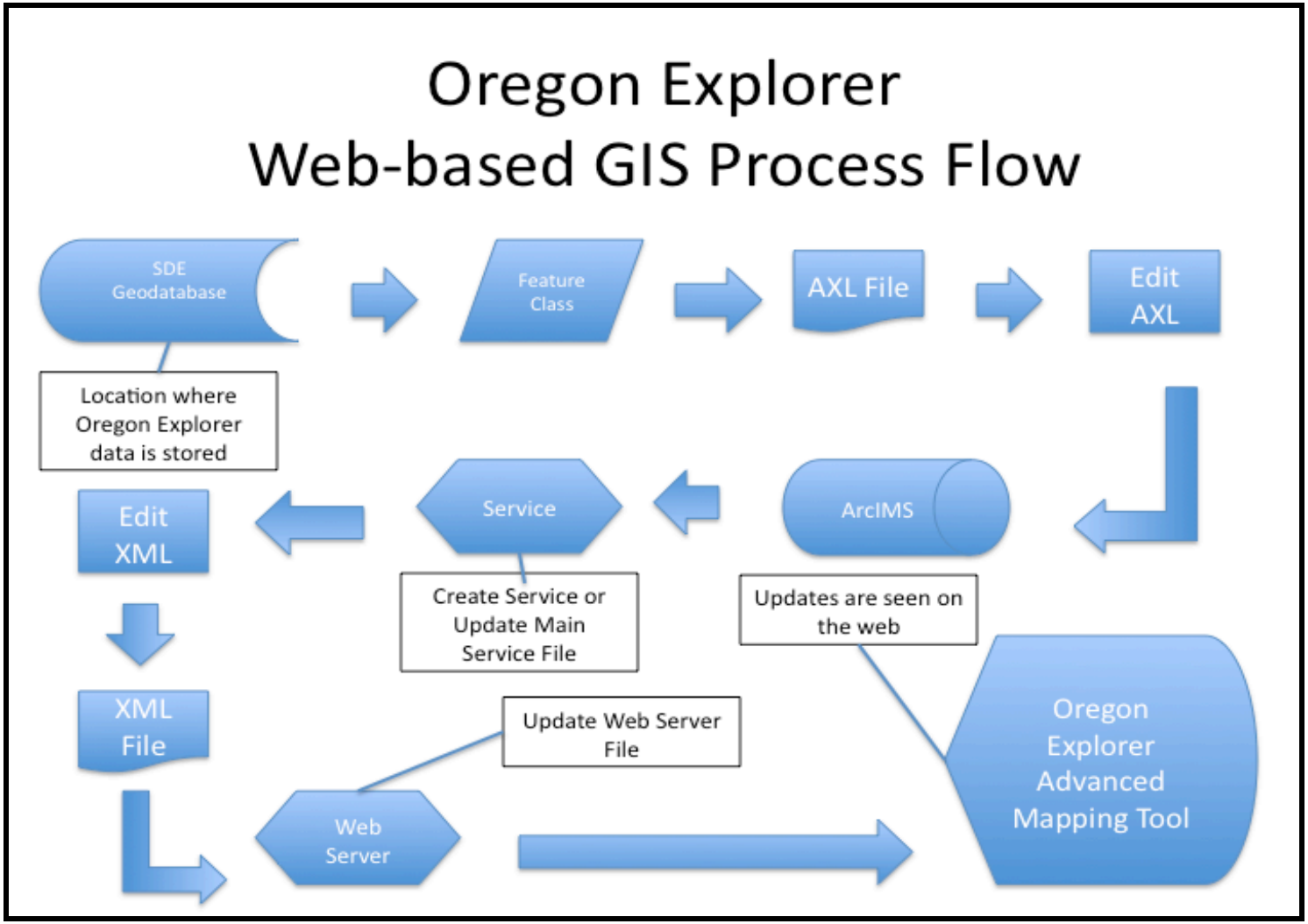
Oregon Explorer data held within a geodatabase is converted to AXL code. The AXL code however cannot be interpreted directly by the web server. This process requires a language that translates the AXL to a web-based GIS. In order for the web server and the GIS to talk, XML is used. Both XML and AXL files are required to view a service on Oregon Explorer's Advanced Mapping Tool. This process is illustrated in **Figure 2**.

Figure 1 – Oregon Explorer Homepage



I created several AXL files and modified the Oregon Explorer's main AXL file during my internship. These AXL files are uploaded into ArcIMS. ArcIMS is a web server and it creates services based on the code of the AXL file. Once I uploaded the AXL file into ArcIMS it could be used in the XML file. The XML file would call upon the service and then present the service as a map layer in the Advanced Mapping Tool. After several weeks of learning the various languages and the inner workings of ArcIMS I was able to manipulate the data housed within Oregon Explorer's web-based GIS.

Figure 2. Oregon Explorer Web-based GIS Process Flow



HAZARDS EXPLORER

The development of the Hazards Explorer built upon my knowledge of the AXL and XML languages. I took several feature classes (data layers) from the Oregon Explorer Geodatabase and manipulated the AXL code to represent the attributes and cartography a user would expect to see for that layer. For example, I used flood data provided by the Federal Emergency Management Agency (FEMA) and constructed a flood AXL file. This file was then edited to display various attributes of the data. Using cartographic principles I colored attributes such as 100- and 500-year flood hazards. This edited AXL was then uploaded to ArcIMS and started as a service. In learning about ArcIMS and its quirks, I found I needed to test each service before I copied that information into the larger OE AXL file. We created a separate testing site where I could test a live version of the data outside public view. This extra testing site allowed me to develop and verify several layers before I uploaded them to the mapping tool.

After editing and testing several iterations of the Hazards AXL file, I copied the code into the larger OE AXL and updated OE's ArcIMS service. Before my changes were viewable to the public through the website, I had to update OE's XML file. When I completed edits to the XML file and refreshed the web server, my updates to Oregon Explorer's Advanced Mapping Tool were complete.

IMAGERY EXPLORER BITTORRENT TECHNOLOGY

Oregon Explorer's Imagery Explorer allows users to download whole county images. This method involved downloading a compiled zip files for the county. This process was demanding on the server and required that users have long periods of uninterrupted Internet connection - if at any time during the download the connection were severed, the download would fail.

An alternative download option was made available when I used BitTorrent technology to share the imagery data. The home page for the Oregon Imagery Explorer now features a link to our BitTorrent download page (**Figure 3**).

Figure 3. Oregon Imagery Explorer Homepage

With the help of Matthew Gonzales, a Windows Network Server Manager, I created 36 BitTorrents and attached them to an image map on the Imagery Explorer Data, **Figure 4**.

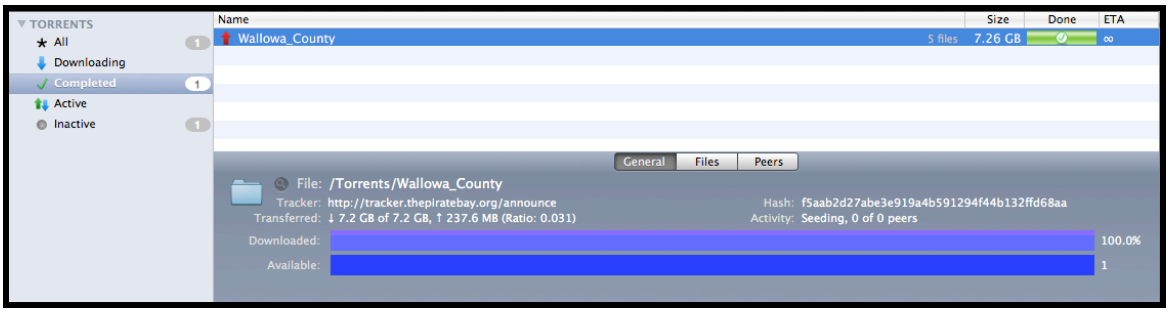
The creation of the BitTorrents began with the original 2005 0.5 meter aerial imagery. The imagery was then clipped to county boundaries using ERDAS ER Mapper 7.2. These files were large, ranging from 2 to 30 gigabytes in size, and generally took several hours to download.

Figure 4. **County Download Image Map**

I used µTorrent[6], a BitTorrent Client, to create my BitTorrents. The BitTorrent files include the county image and its associated metadata. Creating the BitTorrent files is only part of the process. After the files were stored in Oregon Explorer's external content folder, I announced the BitTorrents on several trackers. Trackers included PirateBay, Denis.Stalker, and OpenBitTorrent. **Figure 5** illustrates the µTorrent user interface.

[6] Utorrent is a BitTorrent client available at http://www.utorrent.com/. The client was used to create BitTorrents for the Oregon Imagery Explorer.

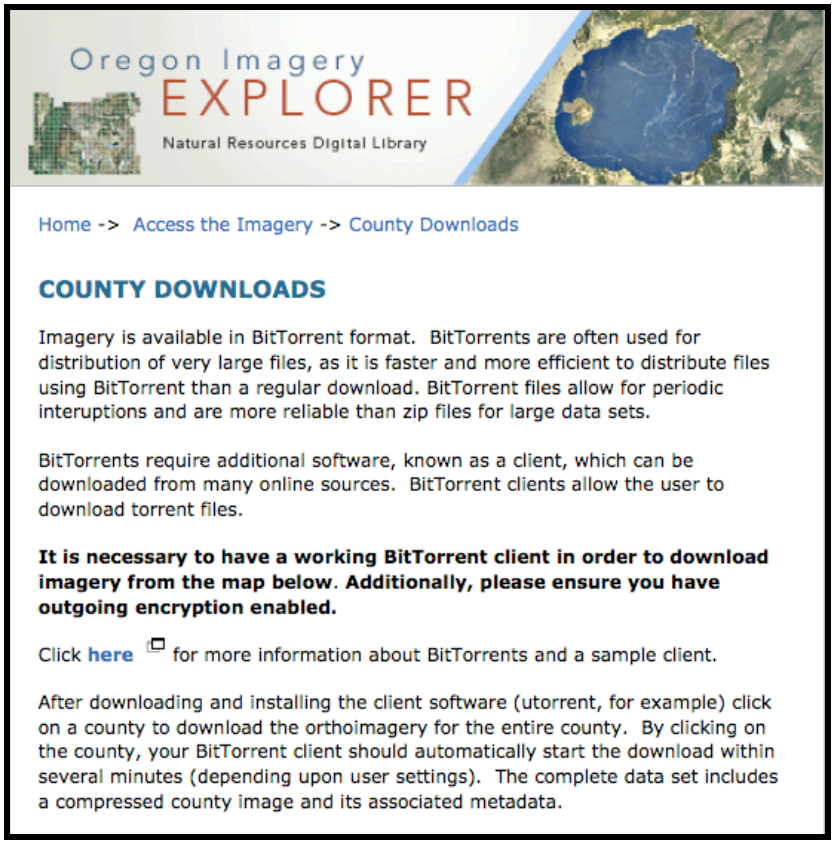
Figure 5 - µTorrent User Interface



µTorrent has two management consoles, one locally (my OE workstation) and one on the web. The web administrator console allows me or another OE staff member to update torrents remotely. The 36 county BitTorrents were uploaded from my workstation.

Many Oregon Explorer users are not familiar with BitTorrent technology. I wrote a preface for the technology and posted a link to µTorrent (**Figure 6**). Oregon Explorer users can refer to this page for information regarding BitTorrent technology or to download a BitTorrent client.

Figure 6 – Oregon Explorer Imagery Explorer BitTorrent Preface



1.3 RESULTS

As a result of my three-month internship with Oregon Explorer, I gained advanced GIS skills and knowledge that helped me complete Oregon Explorer's Hazards Explorer[7] and various smaller GIS-related tasks. In completing my secondary goal of background research I utilized new information and created BitTorrents for the Imagery Explorer[8].

SKILLS ACQUIRED

The internship with Oregon Explorer exposed me to advanced GIS applications, software, and computer languages. As a result, I was able to complete GIS tasks for the website such as layer configuration, network maintenance, creation and modification of websites, and the creation of BitTorrents. My knowledge of computer languages has expanded from minor experience with HTML to literacy in HTML, AXL, and XML. Using ArcInfo daily allowed me to explorer various methods and advanced GIS techniques that my prior course work had not covered. I am now a more confident GIS user and feel capable of taking these skills and applying them as a GIS professional.

HAZARDS EXPLORER

The Hazards Explorer is a web-portal that provides users with information about potential environmental hazards in their area. Hazard categories include flooding, geological hazards, and wildfire. The Hazards Explorer grew from a collaborative partnership between the Oregon Department of Land Conservation and Development (DLCD), INR, OSU libraries, and members of the Hazard/Preparedness Framework Implementation Team. This partnership culminated in the launch of the Hazards Explorer in June 2009 (Explorer, 2009).

Figure 7 illustrates the various hazard layers available through the Advanced Mapping Tool. The hazards are listed in the layer tree on the left side of the screen. By selecting the 100- and 500-year flood layers, for example, these hazards are displayed on the map. Flood hazards near Newport and the Corvallis waterfront, OR are illustrated in **Figure 8** and **Figure 9**. The layers I incorporated into the Advanced Mapping Tool were also included in the Oregon Hazards Reporter Tool (**Figure 10**, **Figure 11**, and **Figure 12**).

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[7] The Oregon Explorer Hazards Explorer is available at: http://www.oregonexplorer.info/hazards/. Accessed 01/28/10.

[8] BitTorrents for Oregon county imagery is available at: http://www.oregonexplorer.info/imagery/about/about.aspx?Res=21711. Accessed 01/28/10

Figure 7 – Hazard Layers Available in Advanced Mapping Tool

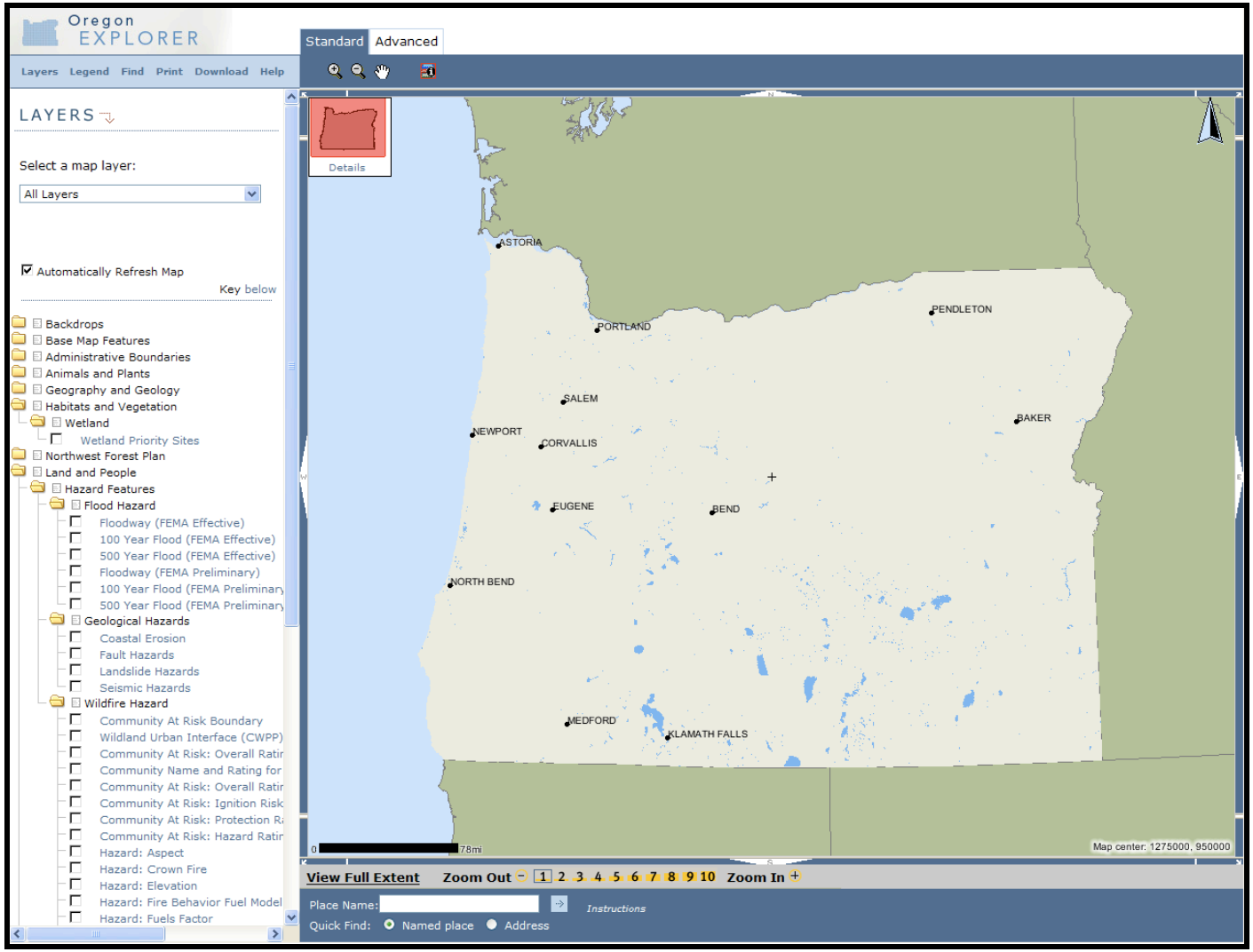


Figure 8 – Flood Hazards Around Newport, OR

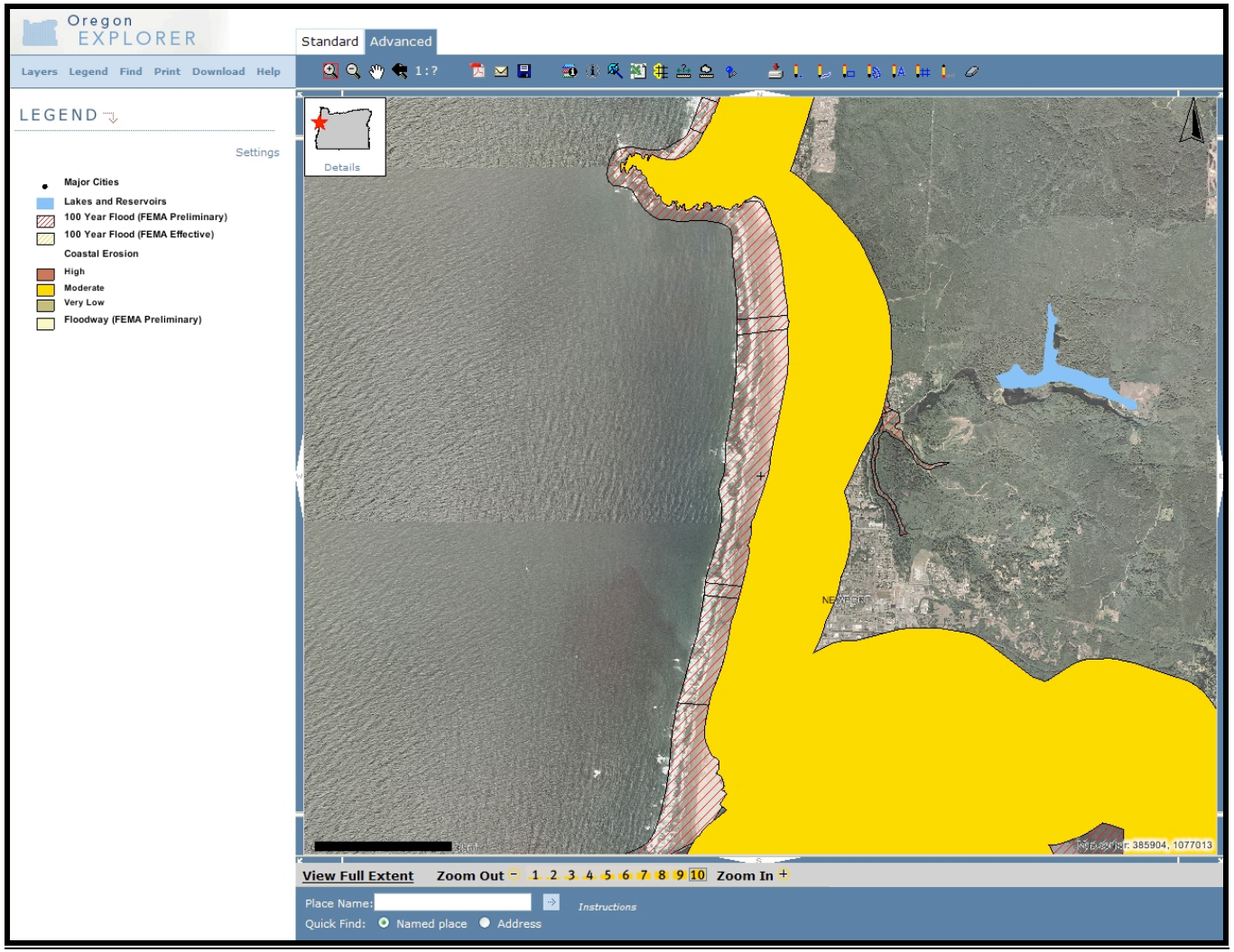


Figure 9 – Flood Hazards of the Corvallis Waterfront

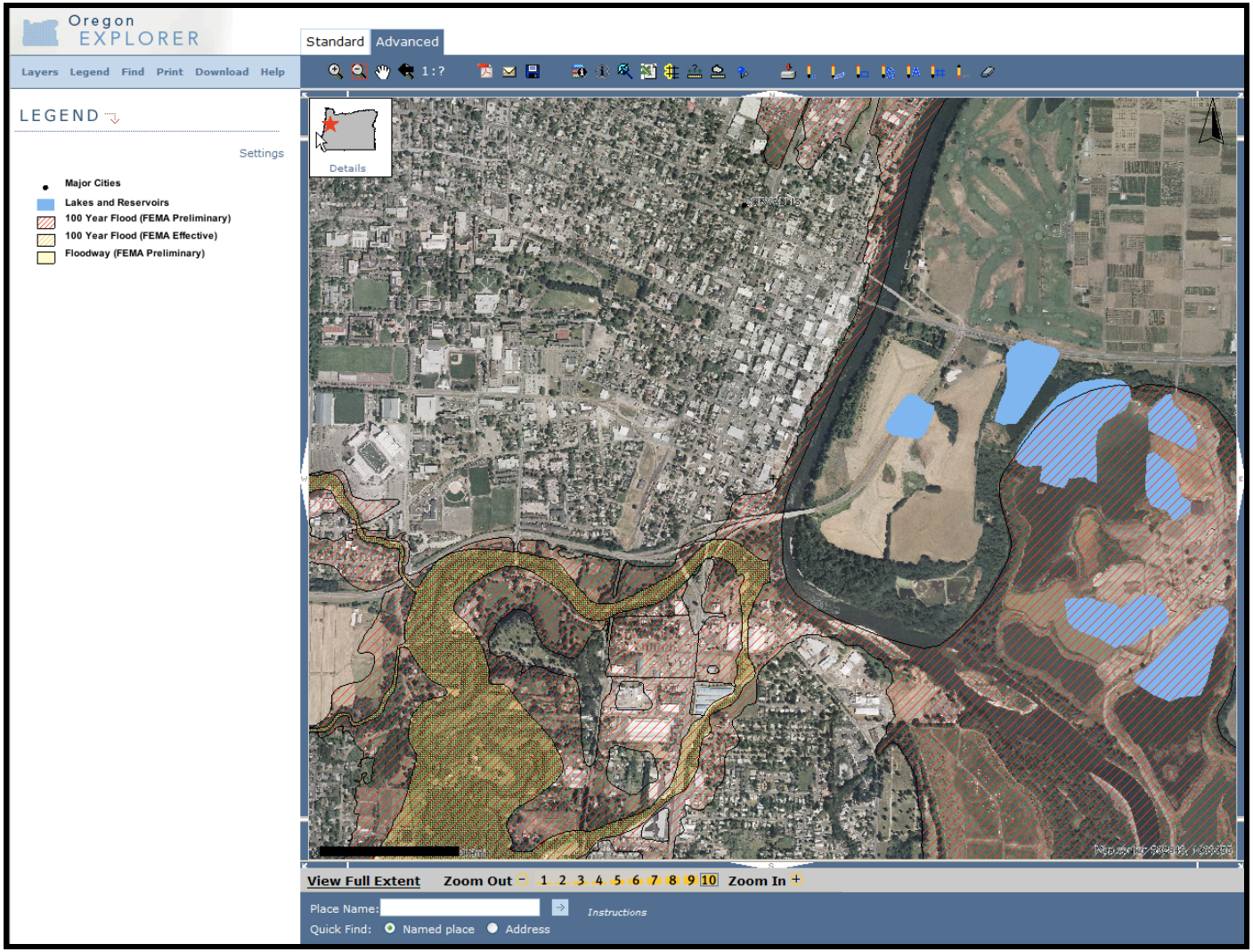


Figure 10 – Oregon Hazards Reporter Tool (Corvallis Waterfront)

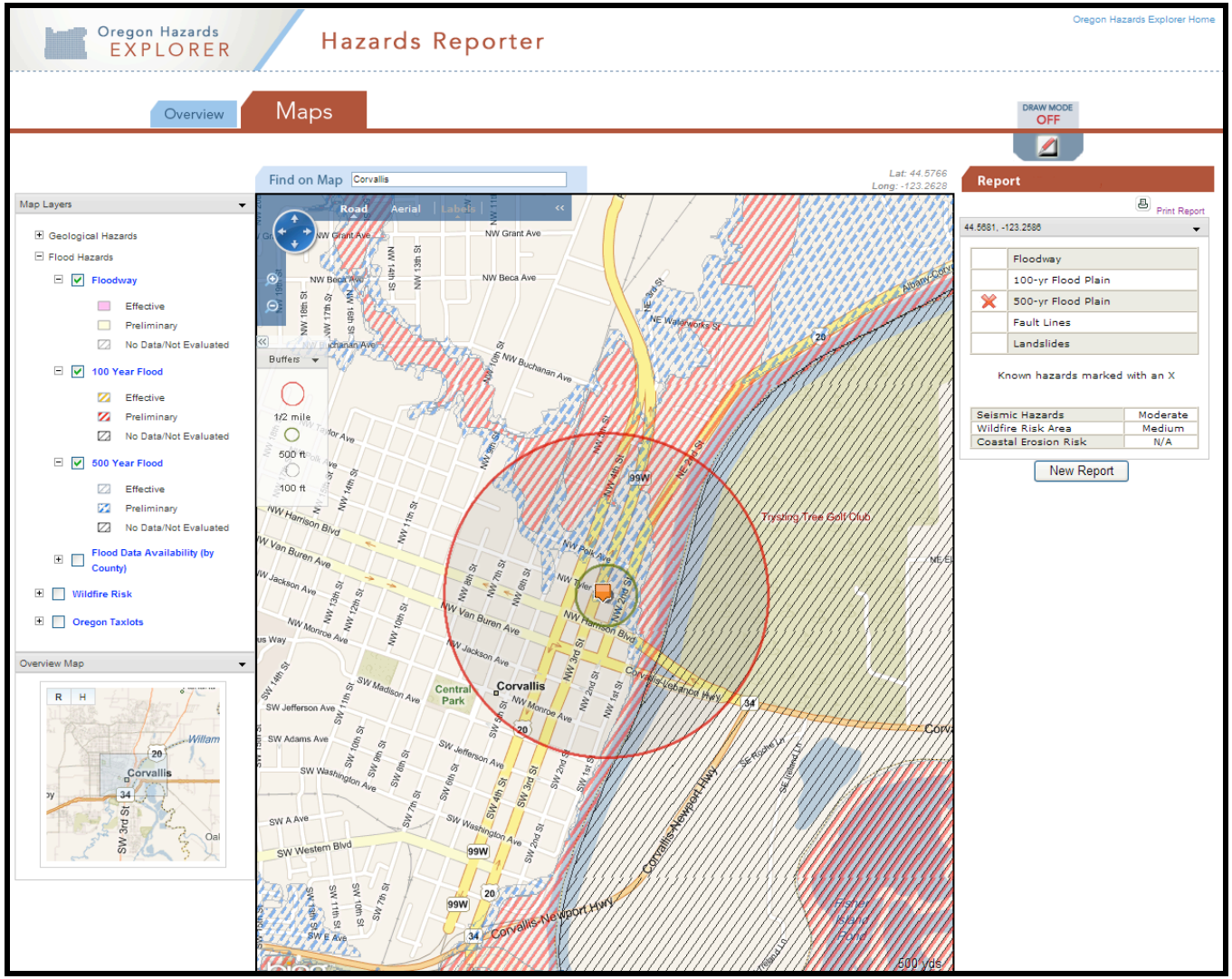


Figure 11 – Oregon Hazards Reporter Tool (Crater Lake)

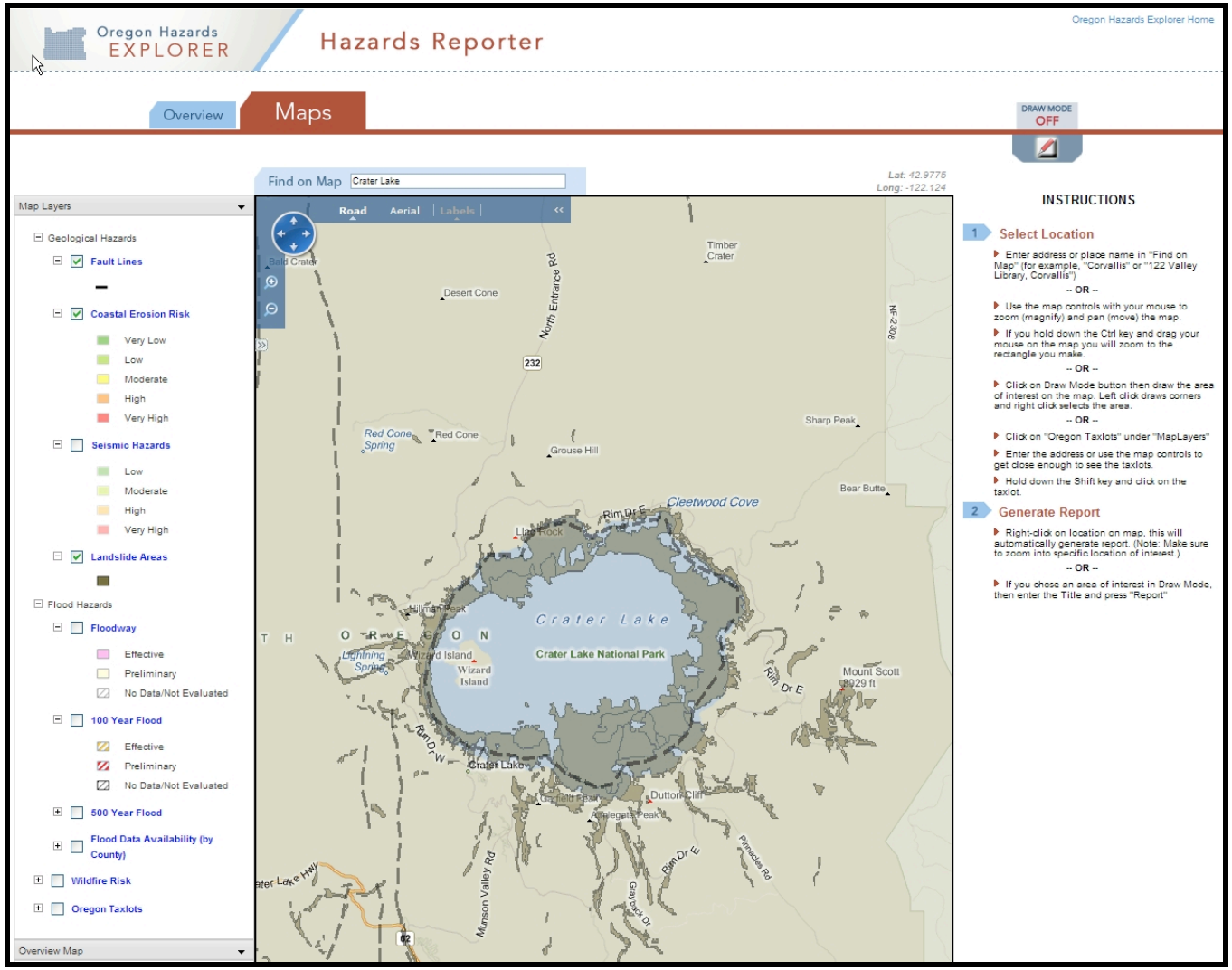
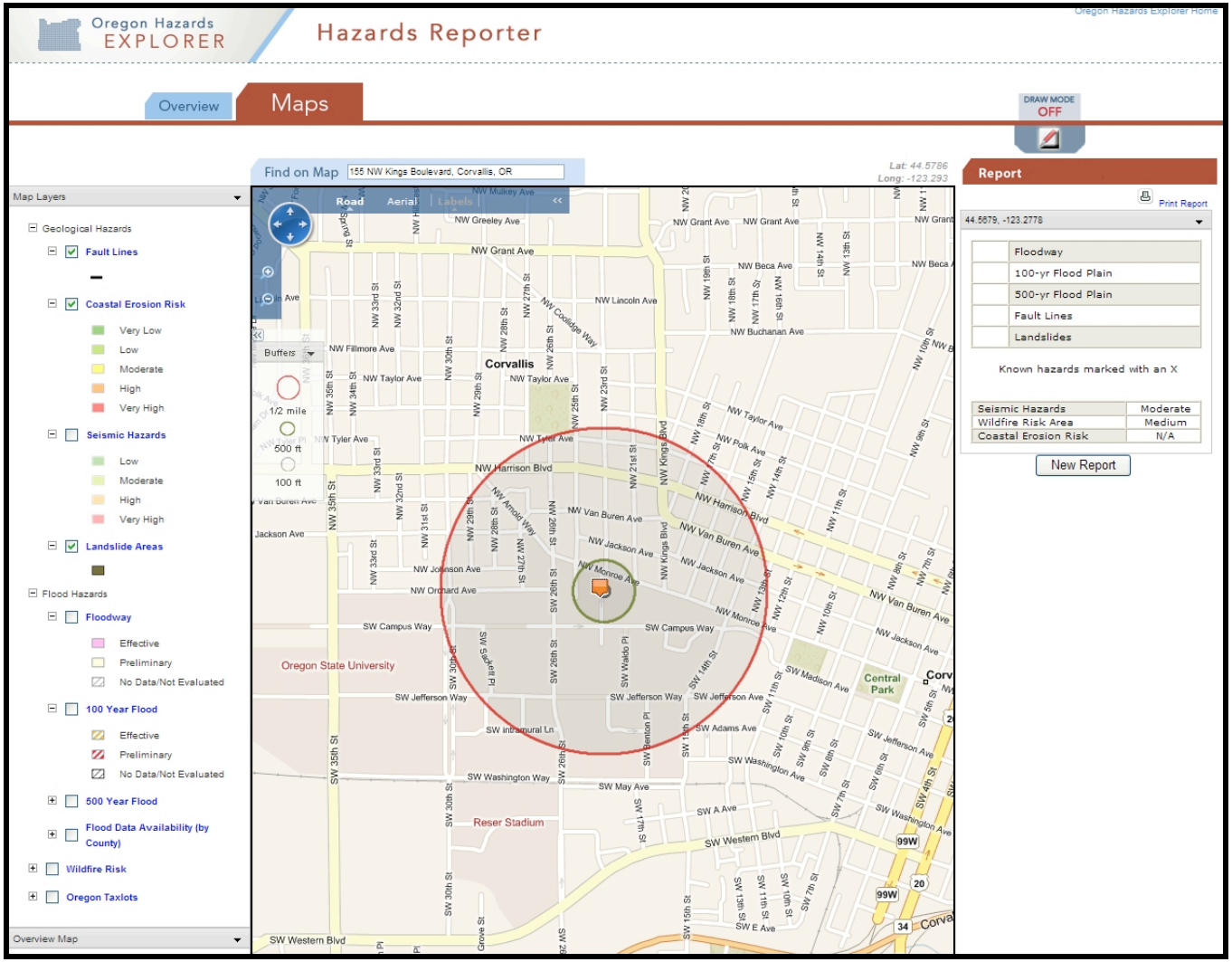


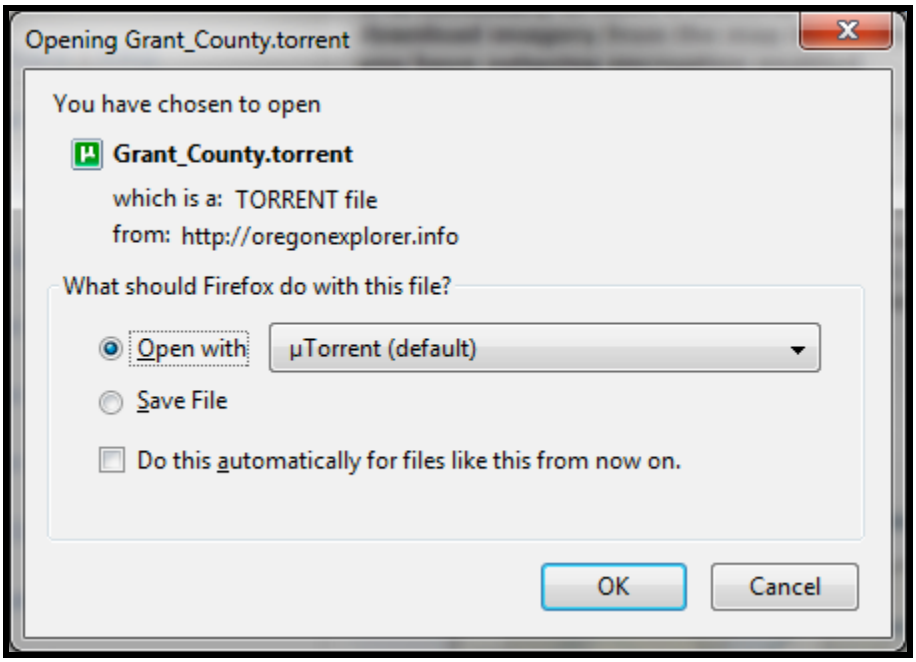
Figure 12 – Oregon Hazards Reporter (Oregon State University)



IMAGERY EXPLORER BITTORRENTS

Previously, Oregon Explorer used zip files for county image downloads. I provided an alternative method for downloading county images by using BitTorrent technology. Thirty-six torrent files are now linked to the county image map (figure 4). The torrent files include whole county images from the 2005 Aerial Images. As a result of my investigation into BitTorrent technology and its subsequent use, Oregon Explorer now provides its county images using this highly effective method of data delivery (**Figure 13**).

Figure 13 – BitTorrent Download Screen (Grant County)



1.4 DISCUSSION

The goal of my internship was to acquire more advanced knowledge of GIS and specifically web-based GIS. I have achieved my goal. In addition to the skills I have developed and the actual application of web-based GIS, I researched open source GIS, metadata and FGDC standards and the history of web-based GIS as a secondary internship goal.

In each state, there are several groups or organizations responsible for housing geospatial data. Oregon Explorer houses geospatial information for the state of Oregon, but is distinctive from similar groups in that Oregon Explorer also houses content information. Thus, OE can be thought of as a geospatial atlas.

The overall goal of Oregon Explorer is to provide users with instant, reliable data on natural resources. Users are able to open Oregon Explorer and retrieve content on any number of current

issues facing the state. Information and data I posted to the Advanced Mapping Tool for hazards, for example, is now readily available for users to view or download. For example, within three mouse clicks, a user can access hazard features for the state of Oregon (**Figure 14**). Likewise, if a user is interested in a local issue, portals such as the Umpqua Basin Explorer house content and data specifically pertaining to that geographic area. When users are able to directly access to reliable information they often save time and money, and come to respect the effort made by those who provide the data.

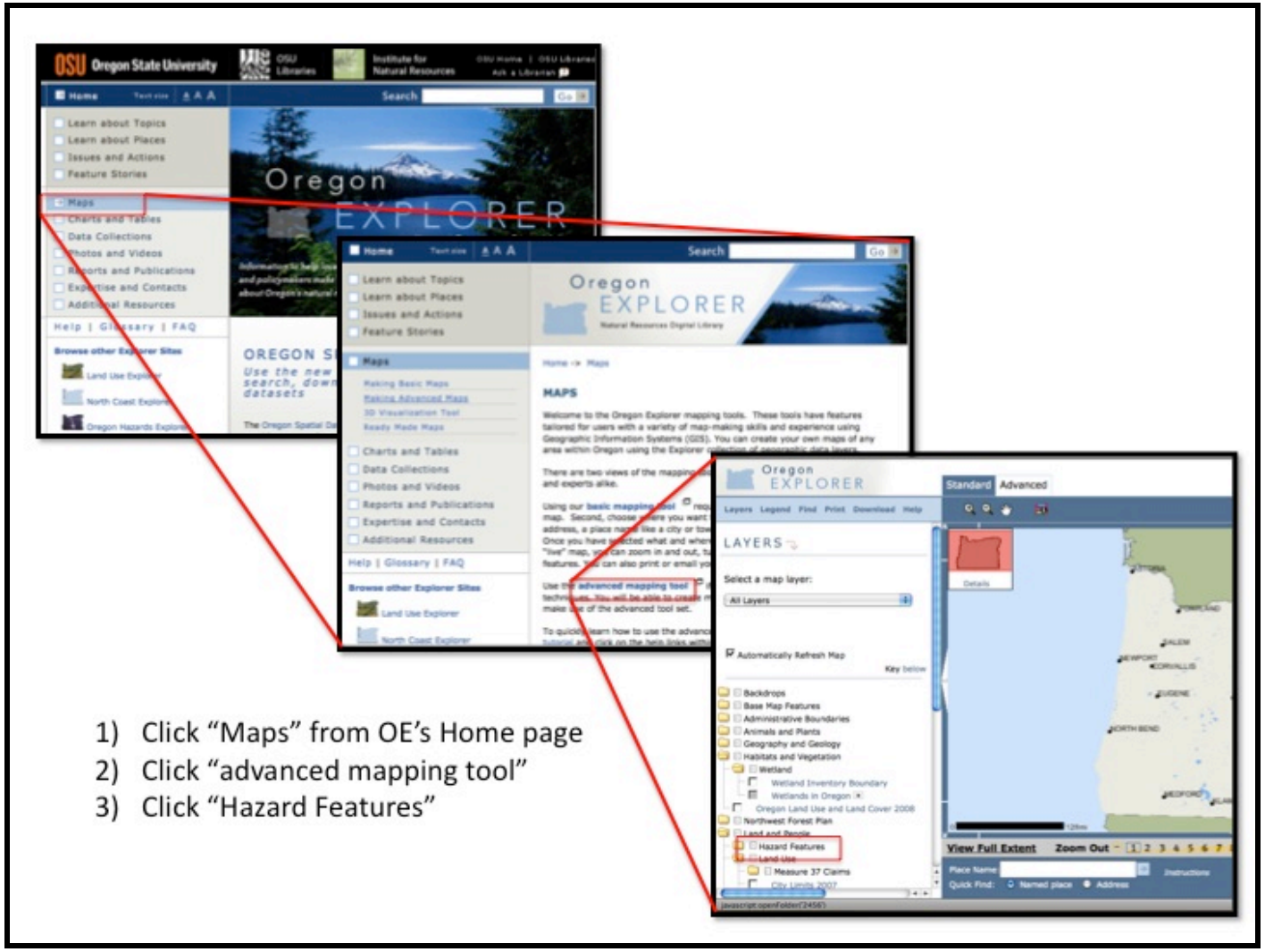
BitTorrents, as discussed above, break large data files into smaller packets and allow multiple users to upload and download data simultaneously, allowing for more efficient data interfacing. I have received compliments on OE's usage of BitTorrent technology and in one case I've acted as a consultant to a government agency interested in pursuing BitTorrent technology to serve their data.

1.5 CONCLUSION

The PSM program requires students to demonstrate the ingestion of their business, scientific and ethical coursework as well as professional skills. Internships are essential to illustrate an integration of these teachings. Through this internship I have met my program requirements by demonstrating the use of professional skills and improved capacity to complete advanced GIS related tasks. This internship created many opportunities for my future work with GIS and other on-line geospatial projects. Oregon Explorer provided specialized training that perhaps I would be unable to obtain had I worked for another institution. For example, I had the opportunity to collaborate with Mr. Matthew Gonzales, one of OSU's Windows Server Managers, to convert the Oregon Imagery Explorer's county download page to use BitTorrent file types. Users are now able to download entire county images much faster than in the past when the page used zip files. In another institution, perhaps, I would not have taken the initiative to research the feasibility of the implementation of BitTorrent technology or be given the opportunity to suggest how it could be done. After several meetings with my supervisors, who were receptive to my ideas, I was able to move forward with the conversion. Oregon Explorer is a small organization, and I believe that my suggestion may have not been received as well at a larger corporation.

Professionals, in most cases, have extensive knowledge of the work they complete. These professionals are often referred to as experts in their field. I attribute my improvement to the extensive hands-on training and collective knowledge of my co-workers and supervisors during this internship.

Figure 14 – Accessing Hazard Features using Advanced Mapping Tool



My experiences at Oregon Explorer have taught me a great deal about geospatial data and web-based applications. I found that this internship served as a fantastic opportunity to gain the skills and experience I require, both for my GIS certificate and for my future career. I was familiar with the use of GIS before this internship, but I gained an advanced knowledge of GIS software, web-based GIS, website design, and database maintenance at Oregon Explorer.

While the data may be simple in its methodology, I learned that the behind-the-scenes effort required for maintenance of a site is considerable. Because of this realization, I have new appreciation for the Oregon Explorer programmers. Through the Oregon Explorer internship I have greatly improved my GIS and web-based GIS mapping skills as well as gained a solid understanding of server network maintenance.

Additionally, I have gained a better understanding of network engineering, load balancing, and day-to-day operational issues that cause web-based applications to fail. Given that I personally overloaded the system several times, I have become adept at reviving a "crashed" server quickly. This internship has provided me with the ability to recognize problems, understand what and or whom they are affecting, and resolve those issues in a timely manner.

Due to the work done during my internship, the library has extended my employment at Oregon Explorer through June 2010. Work post-internship has included extensive data processing and website design for the Oregon Wetlands Explorer, the Deschutes Basin Explorer, and the Lakes Basin Explorer.

2.0 BUSINESS REPORT

2.1 DESCRIPTION OF THE BUSINESS

HISTORY OF OREGON EXPLORER

The Oregon Explorer was developed in response to conclusions of the *Oregon State of the Environment Report 2000.* The report found Oregon's existing environmental data collection and management system must be improved in order to more effectively measure current ecological conditions, trends, and risks (Salwasser & Avery, 2010). Seven years later the Oregon Explorer was launched as a collaborative effort between the Institute for Natural Resources and Oregon State University Libraries.

Oregon Explorer began with a basin portal prototype for the Willamette Valley. The effort was a joint venture between INR, OSUL, the University of Oregon and Defenders of Wildlife. The Willamette Basin Explorer prototype was launched in June of 1994 for public use and intended to provide detailed natural resource information to policy makers and local citizens. From its original prototype portal, Oregon Explorer has grown to house ten portals with an additional two portals scheduled for release later this year. For additional information regarding the development of the Oregon Explorer refer to Salwasser and Avery's *Developing the Oregon Explorer* (Salwasser & Avery, 2010).

My internship was focused on the development of the Oregon Hazards Explorer (originally launched in June 2009) and improvements to the Oregon Imagery Explorer (originally launched in October 2007). Other OE portals include: Land Use Explorer (November 2007), North Coast Explorer (February 2005), Oregon Wildlife Explorer (January 2008), Rural Communities Explorer (October 2008), Umpqua Basin Explorer (March 2006), Oregon Wetlands Explorer (November 2009), Wildfire Risk Explorer (October 2006), and the original Willamette Basin Explorer (June 2004)[9].

OREGON EXPLORER BUSINESS PLAN (2007)

The Oregon Explorer was developed to fill an information void. Federal, state, and local agency planners and private practitioners were at a loss for digital natural resource data. Individuals and agency representatives wanted a centralized location where resource data for the state could be provided.

[9] Dates provided by Kuuipo Walsh, Oregon Explorer GIS Analyst and GIS Intern supervisor. November 19, 2009.

Current technology is used to provide web-accessible natural resource information to a multitude of user types. Initially the Oregon Explorer was targeted to natural resource decision-makers at local, state, and federal levels. However, based on personal experience, users of the Oregon Explorer include educators, concerned citizens, students, and private industry[10].

The Oregon Explorer and its various portals are intended to provide various products and services requested by users, partners, and government agencies. Users would like to quickly "find, retrieve, integrate, and synthesize geo-referenced and well-organized documents, maps, spatial data, computer models, databases, spreadsheets, analytical results, video clips, audio clips, photographs, satellite imagery, presentation materials, and people contacts" (Oregon Explorer, 2007). Oregon Explorer has matured into a clearinghouse of content related to the natural resources of Oregon with a myriad of options available to users.

SWOT Analysis

A Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis has not been completed by INR or OSU. Using information presented in the Business Plan, I completed a SWOT analysis for Oregon Explorer.

The strengths of Oregon Explorer are derived from the pool of professionals the program can draw from. Oregon State is a land, sea, space and sun grant university, and its natural resource programs (Forestry, Oceanic and Atmospheric Sciences, and Agriculture) rank among the nation's best. The caliber and diversity of students and staff enables Oregon Explorer to utilize a pool of expertise "from computer science and web design to library cataloging, search and archiving to substantive knowledge in a wide array of academic disciplines" that combine for a one of a kind effort thus far not matched by any consulting firm or government agency (Oregon Explorer, 2007). Oregon Explorer's effectiveness stems from its ability to drawn upon its diverse parent organizations, including OSU Libraries, INR, state and local agencies, universities, and private foundations.

Weaknesses in the business are areas where risk becomes a factor in the continued existence of the program. Understanding the business aspects of a project the size of Oregon Explorer is critical to its long term survivability. A risk assessment was conducted to better identify potential hazards to the project. Five risk categories were defined in the assessment and include: (1) lack of long-term financial support, (2) inability to effectively market the Oregon Explorer and other Explorer series, (3) changes in executive leadership could influence support for Oregon Explorer

[10] Personal experience includes interactions with users from da Vinci Days, user feedback, comments, and questions during various presentations.

collaboration, (4) inappropriate application of the data – misuse or inaccurate characterization of natural resource information, which could reduce use, and lastly (5) lack of quality data could reduce use – high quality data as quantified by state and federal guidelines for accuracy (Oregon Explorer, 2007). Long-term financial support from both public and private funders along with the OSUL's and INR's commitment to continue collaborative work should allow for a prosperous Oregon Explorer.

Opportunities for Oregon Explorer include continued partnerships with diverse user groups, state agencies, and funding sources. As part of OE's extended financial planning, it is foreseeable that customers, such as business and government agencies, may become paying customers for specialized services. Specialized services include digitizing and/or archiving of hard copy natural resource documents (Oregon Explorer, 2007).

Threats are organizations that compete with Oregon Explorer for funding and users. The ability to draw upon such a large talent pool provides an advantage to Oregon Explorer. However, other digital libraries that provide access to natural resource data in a similar web-based fashion could be perceived as being in competition with Oregon Explorer. Potential competitors include: the Northwest Environmental Data Network[11], StreamNet[12], Klamath Waters Digital Library[13], Southern Oregon Digital Archives[14], and the National Biological Information Infrastructure Pacific Northwest Information Node[15] (Oregon Explorer, 2007). To combat the potential for competition, partnerships have been developed to divide work and allocate appropriate funds.

2.2 MARKETING

USER GROUPS

Needs Assessment

Staff members at Oregon Explorer conducted a needs assessment to guide the design, development, and content for Oregon Explorer and its associated web portals. Prior to selecting individuals to complete the assessment survey, the researchers questioned experts regarding sampling procedures and assessment development. From those discussions, the researchers sampled 35 users that represented academia, business, conservation groups, environmental

[11] Northwest Environmental Data Network. http://www.nwppc.org/ned/Default.asp. Accessed April 23, 2010.

[12] StreamNet. http://www.streamnet.org/. Accessed April 23, 2010.

[13] Klamath Waters Digital Library. http://klamathwaterlib.oit.edu/. Accessed April 23, 2010.

[14] Southern Oregon University, Southern Oregon Digital Archives. http://soda.sou.edu/. Accessed April 23, 2010.

[15] National Biological Information Infrastructure Pacific Northwest Information Node. http://www.nbii.gov/portal/server.pt/community/pacific_northwest/241. Accessed April 23, 2010.

consulting firms, extension services, government agencies, and watershed councils. The users were identified by how they used natural resource data; research, education, policy, planning, coordination, outreach, and assessment (Salwasser & Murray-Rust, 2002).

The assessment found users wanted to retrieve well organized, geo-referenced data within a reasonable amount of time (Salwasser & Murray-Rust, 2002). The assessment also ranked features of the Oregon Explorer that they most desired. From most requested to least, (1) search capability, (2) access to spatial data, (3) access to full text documents and reports, (4) immediate accessibility; and (5) access to synthesized information (Oregon Explorer, 2007).

Natural resource materials and information are housed in several locations. The assessment found most users rely on personal in-house collections, web sites, direct people contact, and agencies to retrieve their information. Interestingly, the 2002 assessment found only five percent of individuals assessed utilized university library collections as their primary source of information. Over 85% of those users stated they wanted more natural resource information made available. When asked what type of natural resource information users needed, responses included basic geospatial information at a 1:24,000 scale on the physical, biological and management features for Oregon (Salwasser & Murray-Rust, 2002).

In 2002, more than 90% of users were not able to use off the shelf resources to get the results they needed. Users wanted to integrate data layers and perform synthesis operations to effectively fill gaps in their data. Before Oregon Explorer was launched, the needs assessment found that a majority of the individuals using or requiring natural resource data were "not at all" familiar with the concept of a digital library (Salwasser & Murray-Rust, 2002). Oregon Explorer was developed to fill the role of providing users with natural resource information in a useable format where properly documented metadata and source material is provided.

daVinci Days Experience

This past summer I was able to participate in Corvallis' daVinci Days celebration[16]. daVinci Days is an arts and science festival that takes place in mid-July on the OSU campus. I participated in the creation and operation of Oregon Explorer's booth at the festival. I was responsible for explaining general information about Oregon Explorer's portals to festival attendees.

This event was a great experience and a welcome learning opportunity. I donated a Saturday afternoon to Oregon Explorer as a volunteer spokesman. I enjoyed displaying some of OE's

[16] The daVinci days celebration is an annual event. More information about the festival is available at the organizers website: http://www.davinci-days.org/. Accessed 01/28/10.

portals and tools to users throughout the afternoon. I recall several occasions when a user would stop by the booth and have no idea about Oregon Explorer or the content it could provide. I would give short two to four minute presentations about OE and the various types of information available. Many of the guests were educators, local citizens or other OSU students. However, there was a library duo from eastern Oregon that was so enthusiastic about OE and its capabilities that wanted an OE staff member to schedule a demonstration for their library. It was a great feeling to "watch" people learn about the hazards or wildlife or issues in their areas.

I was particularly proud of our digital display. During the event we allowed guests to explore our portal sites and print maps of interest from a laptop computer. I instructed several users how to discover hazards in their areas. The users would enter their address in the Hazards Reporter Tool and be able to print out a report all in about 10 minutes. I felt that most users had little knowledge of Oregon Explorer and this one on one time greatly improved OE's marketing and outreach effort.

PDX PostgreSQL

I developed a slide show and talk about Oregon Explorer for the Portland PostgreSQL Users Group Meeting held at OpenSourcery in NW Portland on July 22, 2009. PostgreSQL is an open source object-relational database system. The Portland based PostreSQL user group (PDX PostgreSQL) meets monthly to discuss current uses of the PostgreSQL system. In preparation, I circulated e-mails throughout the library staff compiling questions about Oregon Explorer's future migration to open source and included these in the presentation to the PostgreSQL group. After the meeting, I relayed the responses I gathered during the conference to Oregon Explorer staff through a memo and short presentation.

I used the opportunity to further my education about open source, promote Oregon Explorer to a diverse group of GIS users, and also to improve my presentation skills and professional network. I was surprised to learn that few knew about OE and that most were very enthusiastic to get more information. Several group members provided information that could help with OE's future migration to open source. The opportunity was afforded based on funding provided by Oregon Explorer and the OSU Library.

2.3 FINANCES

INTERNSHIP FINANCIAL ANALYSIS

I extended my internship to include the first 15 days of June for this financial assessment. During four months of full-time work I accrued 512 hours at a rate of $11.93 per hour. My gross pay for

the internship was $6,108.17 prior to taxes. According to OSU, I had $904.59 removed for deductions during that period. Therefore my net income was $5,203.58.

A full-time employment rate for my co-workers was not available. I therefore could not make a comparison of savings for Oregon Explorer. I believe that my rate of pay as an intern saved Oregon Explorer a considerable amount in additional funding. Although my costs of employment may be comparable to GIS Technician positions on average for the nation.

The goal of my internship was not to generate revenue for Oregon Explorer. I was to build my advanced GIS skills and apply them to the web-based GIS of Oregon Explorer. As such, my products are not only the hazards data now available for the Advanced Mapping Tool and the BitTorrents of the Imagery Explorer, but also the professional training I have received as a GIS intern.

OREGON EXPLORER FINANCIAL ANALYSIS

Oregon Explorer provides free access to natural resource digital data for the state of Oregon. Potential markets include specialization of services such as digitizing and/or archiving of hard copy natural resource documents for private businesses and government agencies or licensing of software created by Oregon Explorer staff (Oregon Explorer, 2007).

To date, Oregon Explorer has been funded through grants, OSU gift funds, and INR operation funds. Approximately $2,750,000 in investments will be used to develop system architecture, the ten basin portals, and other special topic portals for the Oregon Explorer (Oregon Explorer, 2007). A funding report was generated for Oregon Explorer Development and spans from June 2002 through August 2009[17].

Total funding for the seven-year period is made up from current and past grants. Current grants total $1,066,377, and past grants total $1,736,842, for a grand total of $2,803,219. A breakdown of current and past funding sources is provided in **Figure 15** and **Figure 16**, respectively.

[17] Funding Report for Oregon Explorer Development (6/1/2002 through 8/30/2009). Produced by Janine Salwasser and provided by Kuuipo Walsh (not in print).

Figure 15 – Oregon Explorer Current Funding Sources

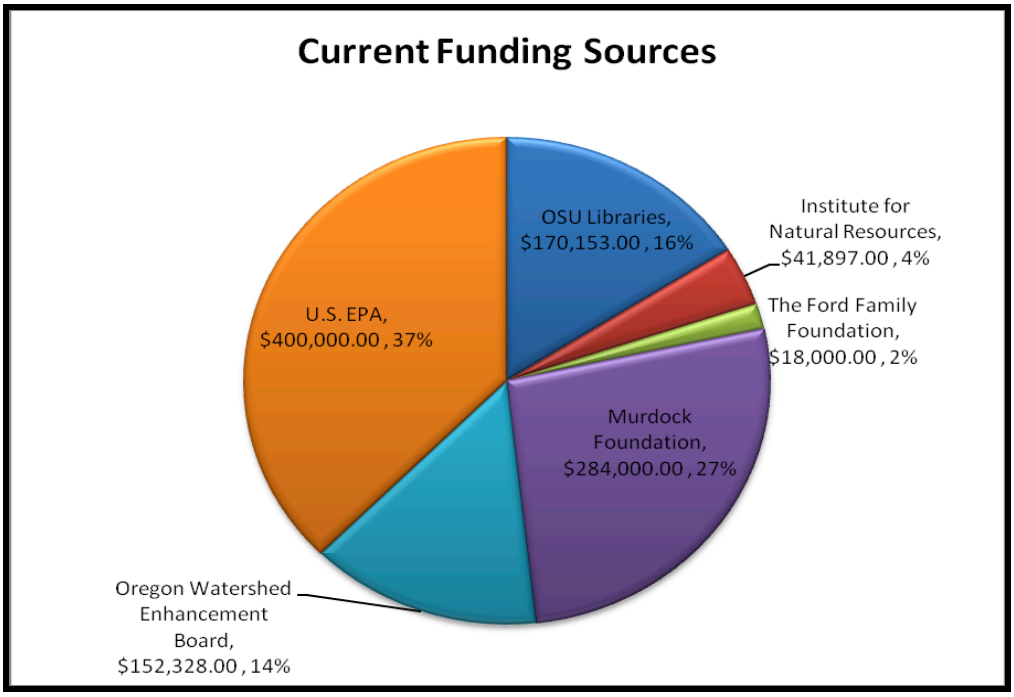
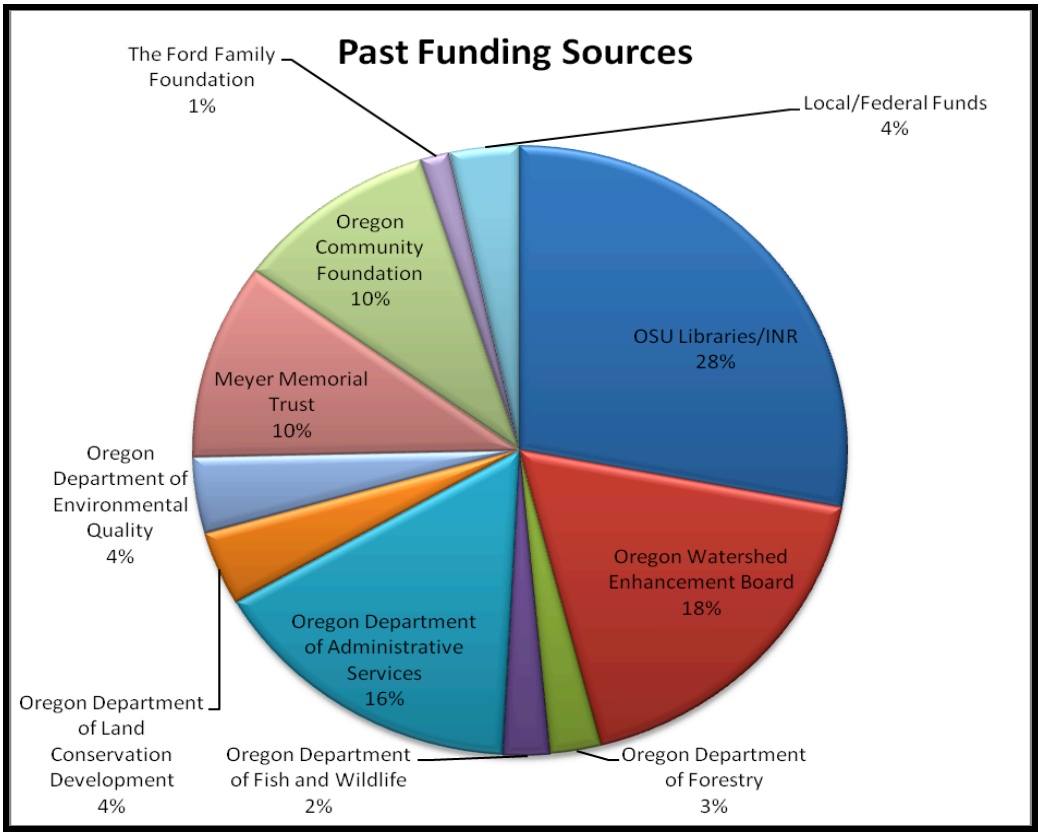


Figure 16 – Oregon Explorer Past Funding Sources



A majority of Oregon Explorer costs include expenditures for core Oregon Explorer operations and maintenance. However, in 2007 the revenue forecast included an estimated need of an additional $1.3 million/year to address the "back-log of natural resource information" (Oregon Explorer, 2007).

The projected income need was split into short-term revenue and long-term revenue. The Department of Administrative Services ($223,000), Oregon Watershed Enhancement Board ($112,500), Oregon Community Foundation ($175,000), and the Oregon Department of Fish and Game ($40,000) provided short-term revenue. Long-term revenue is anticipated to include funding from endowments, permanent Oregon legislative funding, permanent funding from the Department of the Interior, and funding from fees and subscriptions (Oregon Explorer, 2007).

2.4 MANAGEMENT/HUMAN RESOURCES

ABOUT THE STAFF

Kuuipo Walsh and Marc Rempel acted as my supervisors during the internship and I cannot thank them enough for their hard work and continued effort in my education. Along with their knowledge of GIS, I learned a great deal about business interactions and personal communication with stakeholders by following their examples. Kevin Johnsrude is Oregon Explorer's lead programmer and along with Marc the two of them combine for a formidable team and teaching force. I owe a great deal of my internship experience to their combined time and effort. Janine Salwasser was Oregon Explorer's marketing and outreach coordinator. She provided me with numerous ideas for da Vinci days, my PostgreSQL conference and a continual stream of enthusiasm. Running the behind the scenes operations and my "go to" for all things Windows related, Matthew Gonzales provided me with countless insights and suggestions for problem solving and last minute system revivals. Ruth Vodracek and Lisa Gaines acted as liaisons to the OSU Libraries and INR, respectively. Ruth provided input on a number of my ideas and set an example of leadership in a business setting. Lisa is a highly motivated, detail oriented, superbly organized director for INR who also acted as one of my summer internship supervisors.

2.5 CONCLUSION

Integration of science, business, and ethics is a key concept for the PSM program. Through my internship experience I have integrated these skills and learned several new skills through a hands-on approach to education. Interacting with users during the daVinci days celebration and presenting to the PDX PostgreSQL users group combined communication, business, and application based skills. The PSM program requires graduate students to complete several business courses as core requirements. I developed this assessment using the skills and techniques learned from course work and information from Oregon Explorer's budgetary meetings. In summation, my internship with Oregon Explorer has granted me the ability to approach various career opportunities with confidence.

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4.0 APPENDICES

4.1 INTERNSHIP JOURNAL

15 June

- 8:00-10:45 am: Continued work on Hazard Explorer layers; cleaning up layers within layer configuration and adding symbology to geological hazards. Additional work on clipping imagery from ORE_ecw;
- 10:45-12:00: Testing Hazard Explorer Website and Advanced Mapping Tool;
- 1:00-3:00: Continued working on imagery clipping; started .mxd for spatial portal
- 3:00 – 3:30: In Usability Testing meeting/discussion regarding Hazards Explorer
- 3:30 – 5:00: Discussions about FEMA flood data and work with Steve Lucker from DLCD. Had discussion with Ruth Vondracek – she was impressed with my interaction during the group testing session and with Steve and Chris Shirley.

16 June

- 8:00 – 9:00 am: Discussions with MR regarding spatial data map and e-mail write-up of post DLCD OHE Usability Testing Session conversation notes.
- 9:00 – 12:30: Map layers for Flood Data – converted 6 layers into 3 layers and incorporated symbology. Had to create on local drive then import into Geodatabase.
- 1:30 – 3:00: Continued flood data layers – issues with Geodatabase.
- 3:00 – 5:00: working on Spatial Data portal map layers.

17 June

- 8:00-10:00 am: Continued work on Hazard Reporter Tool layers – modifications made to mxd to allow for WMS correct legend format. Started new layers for spatial data portal in WGS 84.
- 10:00 – 12:30: Completed first draft of Spatial Data Portal Map layers.
- 1:30-3:00: Continued clipping of statewide imagery. Updated Spatial Data Portal Map.
- 3:00-5:00: Worked with Kevin to determine problems with servers – on-going issues with reliability. Helped Yao Yin with wetland explorer e-mail to John Bauer (Portland).

18 June

- 8:00 – 10:00 am: Had to problem solve ArcIMS issues with Marc; continued clipping process and had discussions with MR, KW, KJ, and MG regarding TB drive.
- 10:00 – 12:00: Worked on Flood Hazards FAQ document
- 1:00 – 2:00: Worked on Flood Hazards FAQ
- 2:00 – 3:15: In OE Weekly meeting. Phone call to Steve Lucker @ DLCD regarding metadata
- 3:15-5:00: Continued work on clipping and on FAQ document

19 June

- 8:00 – 12:00: Final FAQ for flood hazards and Bit Torrents. Received partial metadata from Steve Lucker @ DLCD for 100 year flood hazard.
- 1:00 – 5:00: Work with Bit Torrents and setting up uTorrent client services.

22 June

- 8:00 – 9:00: Continued clipping county images. Updated spatial data map for spatial data explorer.
- 9:00 – 10:30: Work was light – continued checking on clip.
- 10:30 – 11:30: OE weekly meeting; discussed project timelines and new tasks.
- 12:30 – 1:30: Worked on cleaning up Hazards Explorer and setting tasks.
- 1:30 – 4:00: Continued work on torrents and checking advanced mapping for errors. Finished cleaning up Hazards and inputted tool tip descriptions for Kevin.
- 4:00 – 5:00: More torrent work and work on uploading Metadata from Steve Lucker.

23 June

- 8:00 – 11:00: Combined and uploaded flood hazard metadata; updated Hazards working mxd to account for updates to flood data.
- 11:00- 12:00: Worked on BitTorrent organization
- 1:00 - 2:00: Updated Metadata for all hazards for spatial portal download
- 2:00 – 4:00: Hazards FAQ updates; BitTorrent work.
- 4:00 – 5:00: Phone call with William P. Steele of the USGS Pacific Northwest Seismographic Network. UW Geophysics Program, Box 351650, Seattle, WA 98195-1650 phone: 206-685-5880 email: bill@geophys.washington.edu
- Current Puget Lowland Investigations: UW Seismology Lab Coordinator website: http://www.pnsn.org/welcome.html. Regarding seismic hazard layers.

24 June

- 8:00 – 12:00: Working on seismic hazard updates
- 1:00 – 3:00: BitTorrents, hazard FAQs, and other metadata.
- 3:00 – 5:00: More hazards metadata and bit torrents.

25 June

- 8:00 – 5:00: Same hazards and clipping

26 June

- 8:00 – 5:00: Same hazards and clipping

29 June

- 8:00 -5:00: Finished up hazards reporter correction and have hazards advanced mapping tool layers ready for launch.

30 June

- 8:00 – 10:00: Continued work on clipping
- 10:00 – 12:00: Started work on interpolation of wildfire risk hazard for hazards explorer portal. Something new and exciting. Continued with clipping and imagery, as it was more important.

1 July

- 8:00 - 5:00: Worked on last minute bugs and fixes for hazards and clipping of imagery.

7 July

- New work on Oregon Explorer – transferring hazards to OE
- Worked on gathering information for ESRI Open Source and how we could work it out. Posted it to Wiki.
- Phone conversation with Dr. Andrew Meig with GeoScience regarding demonstration of hazard reporting tool and advanced mapping tool.

8-10 July

- Worked on clipping screen shots for da Vinci Days
- In talks about facebook page for OE – under OSU libraries
- Made edits to Umpqua Basin Explorers Advanced Mapping Tool layers for better visibility. – Kris Lyon from Partnership for the Umpqua Rivers

13 July

- Completed tasks involving spatial joins for points/lines/polygons for state of Oregon with respect to Watershed Councils and HUCs
- Completed content for OE facebook.

14-19 July

- da Vinci Days preparation
- da Vinci Days booth work included creating a book of screenshots, preparing the OE facebook webpage and volunteering over the weekend at the booth.
- Working with continual shutdowns from ArcSDE/ArcIMS and the issues associated with wetland data.

20-21 July

- More work on wetland data and getting the systems up and running (continually)
- Work on preparing for PDX OSGIS meeting
- Getting powerpoint presentation ready and learning more about OE milestones

22 July

- Went to Portland for PDX OSGIS group meeting
    - Learned a lot about where open source GIS can go and what people are currently using it for.
    - Asked several questions about migration from ArcSDE/ArcIMS to PostgreSQL and PostGIS.

        - The group provided great information and actual tools to use.
        - Made several contacts

23 July

- Worked on wetlands data workarounds for ArcIMS
- Post meeting notes write-up
- Helped users with Oregon Explorer Watershed downloads
- Started training Yao on ArcIMS (axl, xml)

27-31 July

- Worked extensively on HUC4 and WSCs for Marc's Spatial Data Explorer
    - Used ArcMap to convert to KML's for Bing Map
        - Worked well as long as we simplified the polygons
- Worked a lot with Yao on getting the wetland layers into OREAll and on the OE website
    - Training with axl and xml
- Located and posted shaded relief layer as a WMS for OE website
- Upgraded to ArcDesktop 9.3.1 – works with new .msd format for publishing map services

3 -7 August

- Finished Wetlands with Yao on Wednesday
- Continued work on Restoration Visualization tool for Marc
    - Spatial Joins Mergers, MSDs, etc.
- Work on MapServer – Migration options.

9-14 August

- OE staff meeting – nothing to report on
    - Made contacts with Cecilia Noyes from OWEB, and Mason Baine from Grande Ronde Model Watershed Project; regarding new data.
- Got updates to Wetlands Explorer from John Bauer
- Working with WFS's and trying to understand how they work with WMS and ArcGIS Services
- Set up new computer – hopefully better processing

17- 20 August

- OE staff meeting – nothing to report on
- Got updates to Wetlands Explorer from John Bauer and completed changes to website

23-28 August

- OE staff meeting – nothing to report on
    - Followed up with Mason Baine from Grande Ronde Model Watershed

- Working on Visual Basic Scripting through Field Calculator to fix querying problems for Marc with respect to multiple project numbers.
- Set up account on OSU ArcInfo list serve with questions.

4.2. PORTLAND POSTGRESQL PRESENTATION

Informing Natural Resource Issues with the Oregon Explorer

Portland PostgreSQL Users Group Meeting

Wednesday, July 22, 2009

Tyler Barns

Oregon State University Libraries

What is the Oregon Explorer?

- Natural Resources Digital Library
- Place-based resource
- Supports informed natural resource decision-making

www.oregonexplorer.info

Natural Resource Digital Library Users

- Natural resource decision-makers
- Public agencies
- Watershed council members
- Soil and water conservation district staff
- Local planners
- Extension agents
- Scientists
- Researchers
- Librarians
- Educators
- Students
- Media staff
- Citizen volunteers
- Landowners
- Interested public

Oregon Explorer Portals

Current

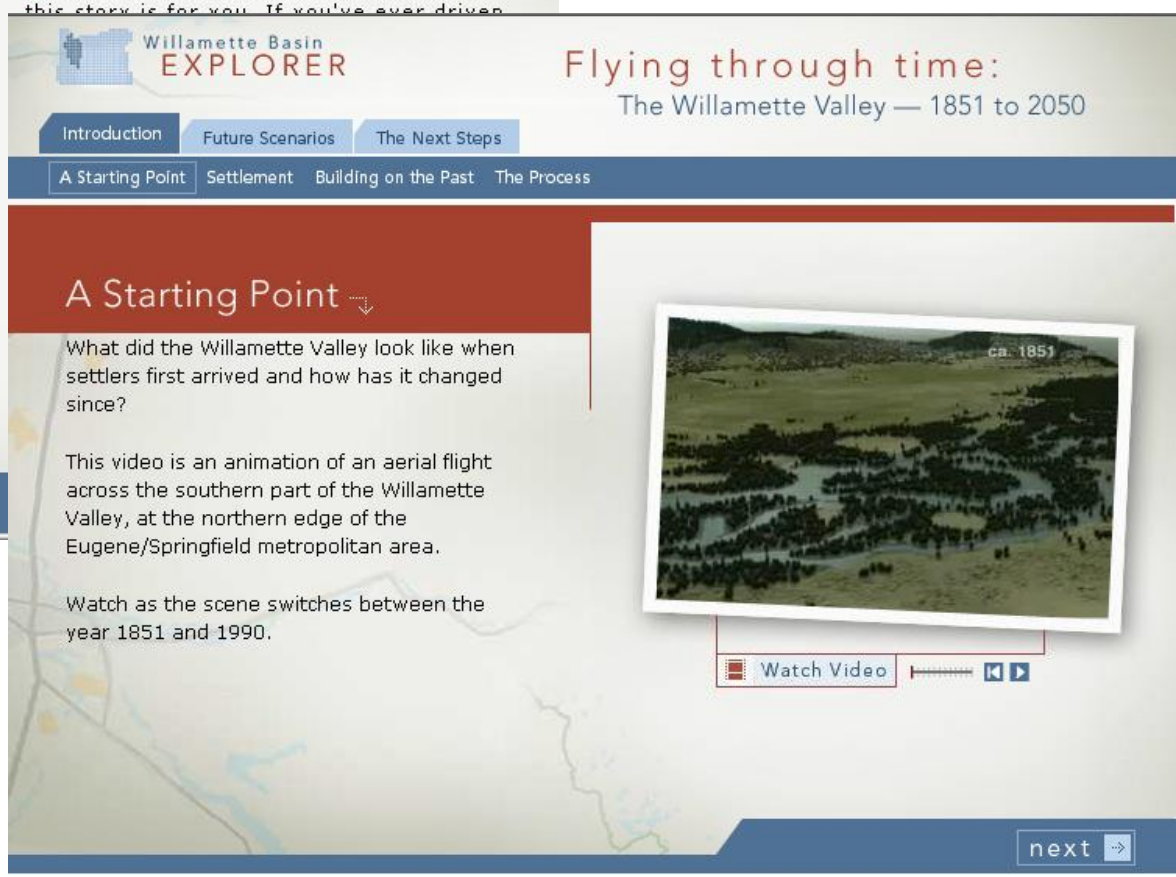
Browse other Explorer Sites

- Land Use Explorer
- North Coast Explorer
- Oregon Hazards Explorer
- Oregon Imagery Explorer
- Oregon Wildlife Explorer
- Rural Communities Explorer
- Umpqua Basin Explorer
- Wildfire Risk Explorer
- Willamette Explorer

About the Oregon Explorer...

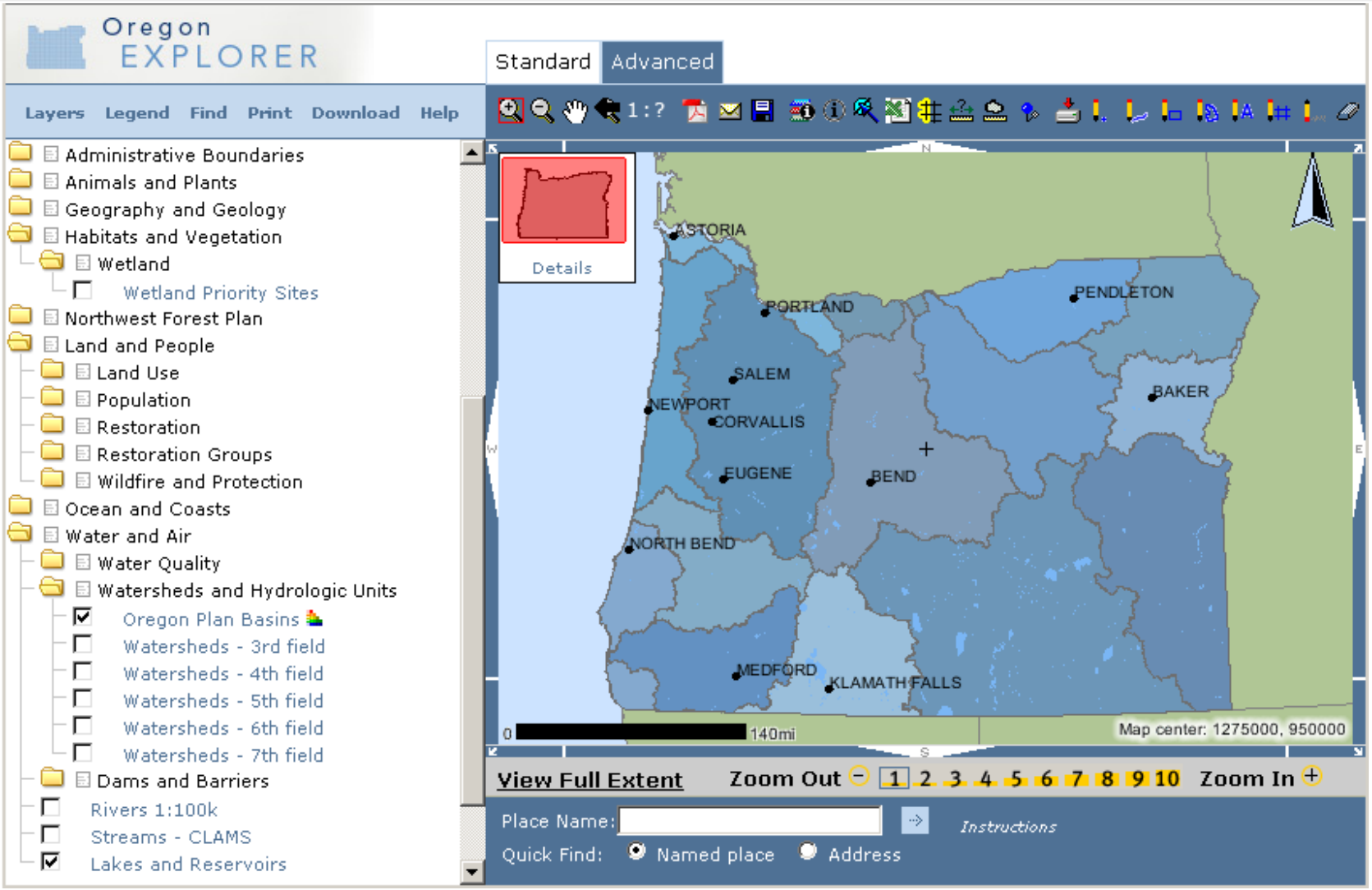
In Development

Multimedia Stories



Willamette Basin
EXPLORER

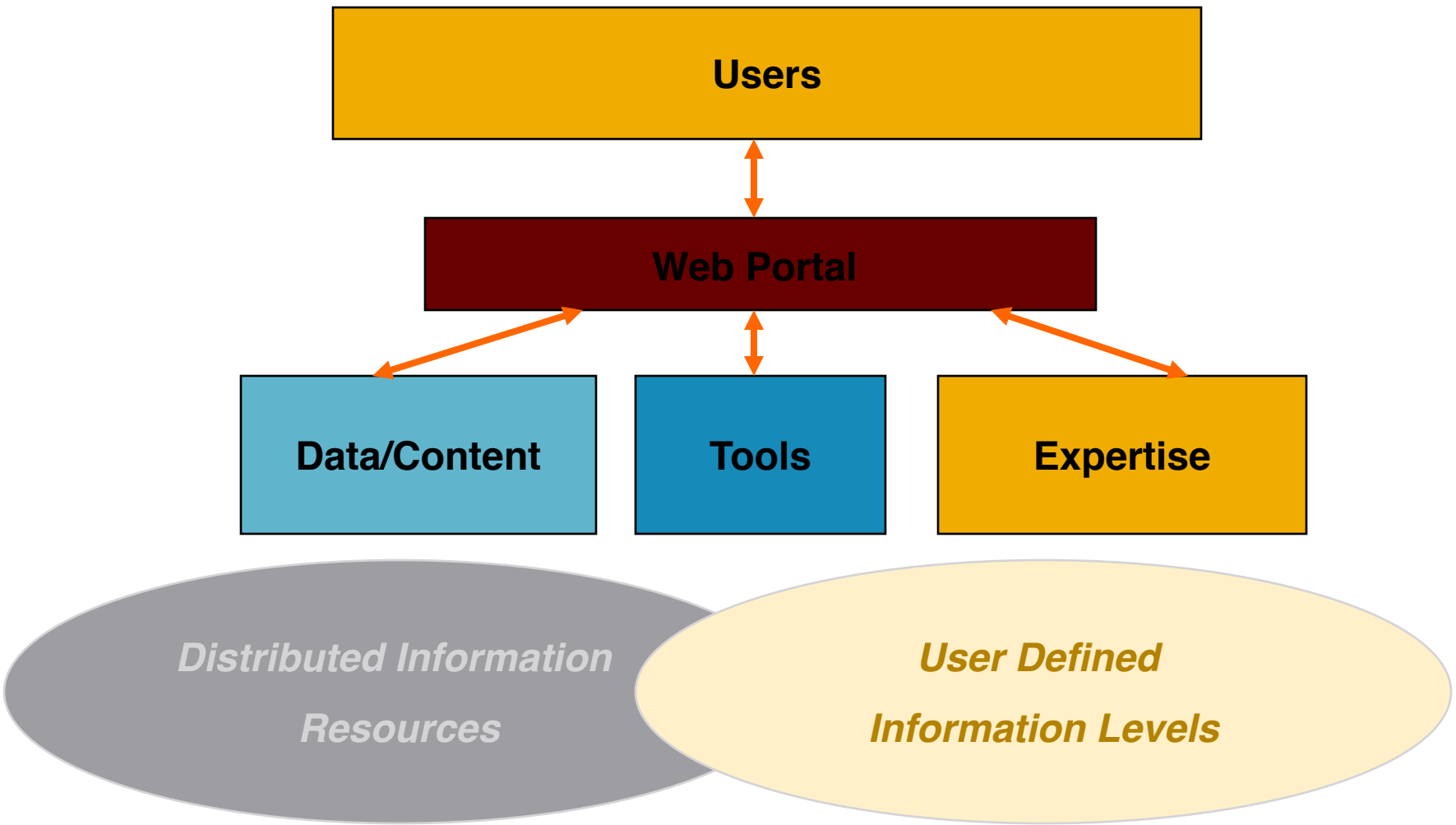
Mapping Tools: Basic and Advanced



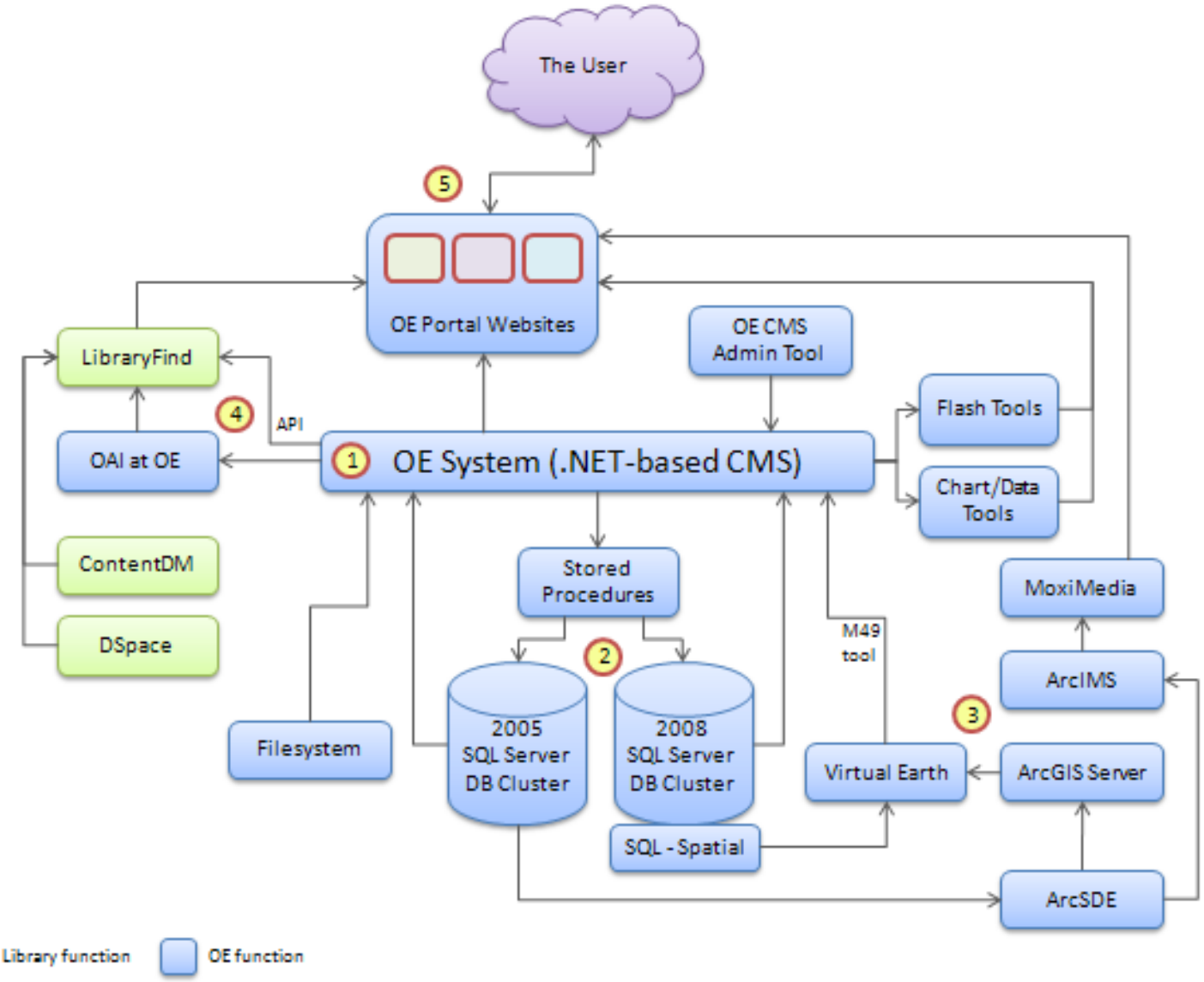
Oregon Explorer Usage Statistics

- Averaging just over 600 sessions per day in 2009
- Top 5 requested pages in 2009:
  - Advanced Mapping Tool
  - Crater Lake Information
  - Imagery (.5 meter DOQQ)
  - Oregon Communities Reporter Tool
  - Measure 49 Viewer

Digital Library Conceptual Framework



Current Digital Library System Architecture



Future System Architecture

Underway:

PostgreSQL

- *Reference Portal Migration*
  - *Umpqua Basin Explorer (Basin)*
  - *Wildlife Explorer (Topic)*
- *Data Portals*
  - *Spatial Data Library*
  - *Imagery Explorer (BitTorrents)*
- *ArcSDE Transition to Post GIS*
  - ***Batch Export***

PostGIS

To be used in conjunction with PostGIS on a Linux server

Questions to the Group

About PostgreSQL Migration:

- *Are there any tools currently available?*
  - *Batch-loading commands, tools, and/or scripts to move data from SDE to PostgreSQL;*
  - *Tools to complete a batch import of data?*
  - *Issues with migrations from ArcSDE/ArcIMS to Open Source?*
  - *Any work-arounds?*

- *Any known issues with PostgreSQL and PostGIS on a Linux server?*

Acknowledgments

Oregon Explorer Team
&
Portland PostgreSQL Users Group