

Watershed Restoration

Prepared by Steve Alnwick for the Western Governor's Association

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Note: There is a tremendous amount of information available on GIS Activities related to Watersheds and Watershed Restoration at the Federal, State and Local levels. GIS Activities overlap and interrelate, and at the local level they tend to be very specific to the needs of the user. What is presented here is a synopsis of Federal activities, followed by selected State level activities (which include Federal participation in some cases) and finally a compilation of sites titled "Worth a Look."

I. FEDERAL ACTIVITIES

1. U. S. Environmental Protection Agency

1a. WATERS

Watershed Assessment, Tracking & Environmental Results (WATERS) is an integrated information system for the nation's surface waters. The EPA Office of Water (OW) has various programs that store data in associated databases. These databases are separately managed with little coordination among them.

Under WATERS, the program databases are connected to a larger framework. This framework is a digital network of surface water features known as the National Hydrography Dataset (NHD). By linking to the NHD, one program database can reach another, and information can be shared across programs.

<http://www.epa.gov/waters/about/index.html>

There are several tools that are available to use with WATERS.

- EnviroMapper for Waters -described below
- WATERS Expert Query Tool - a web-based application that allows you to create your own queries to display or extract data
- NHD Toolkit - a collection of ArcView extensions. Included is the National Hydrographic Dataset Reach Indexing Tool (NHD-RIT) which allows users to georeference surface water data using the NHD.
- Web-based Reach Indexing Tool (WebRIT) - the internet mapping version of the NHD-RIT).

<http://www.epa.gov/waters/tools/index.html>

1b. EnviroMapper

EnviroMapper is a Web-based interactive mapping tool for viewing and querying environmental information. This application allows users to zoom in to an area, or enter a state, county, city, ZIP code, or **watershed** to view environmental data from EPA's Envirofacts Warehouse.

EnviroMapper allows you to generate maps of your geographic area that contain environmental information stored in EPA's Envirofacts Warehouse. The type of environmental information includes: Superfund sites, drinking water, toxic and air releases, hazardous waste, and water discharge permits. You can also view this information in context by adding map features to your map, including major roads, railroads, churches, hospitals, schools, populated places, counties, states, streams, streets, water bodies, watersheds, rivers, and federal lands.

Available at: http://www.epa.gov/enviro/html/em/em_faq.html

1c BASINS 3.0 (Better Assessment Science Integrated Nonpoint Sources)

BASINS is a multipurpose environmental analysis system for use by regional, state, and local agencies in performing watershed and water quality based studies. This new software makes it possible to quickly assess large amounts of point source and nonpoint source data in a format that is easy to use and understand. Installed on a personal computer, BASINS allows the user to assess water quality at selected stream sites or throughout an entire watershed. It is an invaluable tool that integrates environmental data, analytical tools, and modeling programs to support development of cost-effective approaches to environmental protection.

The U.S. Environmental Protection Agency's water programs and their counterparts in states and pollution control agencies are increasingly emphasizing watershed and water quality-based assessment and integrated analysis of point and nonpoint sources. Better Assessment Science Integrating point and Nonpoint Sources (BASINS) is a system developed to meet the needs of such agencies. It integrates a geographic information system (GIS), national watershed and meteorologic data, and state-of-the-art environmental assessment and modeling tools into one convenient package.

Originally released in September 1996, BASINS addresses three objectives: (1) to facilitate examination of environmental information, (2) to provide an integrated watershed and modeling framework, and (3) to support analysis of point and nonpoint source management alternatives.

Available at: <http://www.epa.gov/waterscience/basins/basinsv3.htm>

1d Surf Your Watershed

Surf Your Watershed is a service to help you locate, use, and share environmental information about your state and watershed. May be a little elementary but has a number of useful state and local links.

<http://www.epa.gov/surf/>

2. USDA Forest Service

2a. NRIS Water

<http://www.fs.fed.us/emc/nris/water>

In the early 1990s, a team of people from all Forest Service Regions began work on a national Oracle-based relational database for natural resource data, including aquatic resource information.

After a review that modified scope and redirected the team's efforts, the Washington Office and Regional Directors developed a corporate resource implementation plan, which triggered the establishment of the NRIS Water Team, located in Corvallis, Oregon.

In June 2000, the Ecosystem Management and Coordination (EMC) and the Watershed, Wildlife, and Fisheries (WFW) staffs cosponsored a Water Resource Mapping Meeting. Based on the recommendations from this meeting the Forest Service has adopted the National Hydrography Dataset (NHD) spatial model for its Core GIS Data Standard for streams and waterbodies.

Version 1.0 of the NRIS Water module consists of four submodules linked together by a user-friendly navigation system and organized geographically using the nested hierarchy of Hydrologic Unit Codes (HUCs). The submodules are:

Aquatic Inventory (AI) supports "core attributes" reflecting three hierarchical levels of the riverine system – valley segments, stream reaches and channel units. The core attributes describe national or Forest Service-wide data elements needed for the classification, mapping and monitoring of aquatic ecosystems at multiple scales.

Aquatic Biota (AB) describes aquatic fauna communities in streams and lakes, providing users with the ability to identify and track miles of streams and acres of lakes occupied by Threatened, Endangered and Sensitive (TES) aquatic species.

Water Uses Tracking System (WUTS) tracks water uses and associated structures. Correlating water rights information to water uses provides the means to monitor the status of

water rights administrative or judicial processes.

Watershed Improvement Tracking (WIT) provides a means to inventory, plan, implement and monitor watershed improvement projects either individually or at the watershed level. The Water module provides users with the ability to: 1) share data across disciplines; 2) provide the core data necessary to develop integrated ecological classifications; 3) produce a variety of standardized and ad hoc reports and maps using a variety of report generators; 4) generate data about their data, maps or photos; and 5) export or import data external to the Water application, and transfer data to corporate applications for further analysis. System functionality incorporated in the Water module includes: 1) a dynamic linkage between the database and GIS, providing users with an integrated numeric/geographic toolset for data exploration and management; 2) built-in security to ensure that only authorized individuals enter, validate, modify, and delete data; 3) a design that allows access using client/server technology at sites throughout the Forest Service network; and 4) query tools that allow users to ask their own questions in a dynamic and flexible manner.

2b. NRIS Tools: Resource Information Analysis Tools

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www.fs.fed.us/emc/nris/Tools

The Forest Service Natural Resource Information System Tools Module (NRIS Tools) is a system of Oracle database/Geographic Information System (GIS) applications and analysis tools designed to implement corporate data standards and promote integrated management of resource information. Tools includes software to analyze and present information from the various NRIS modules at multiple geographic scales, both within and across administrative and jurisdictional boundaries. These include maps, graphs, images and related data about ecosystems, uses and rights, and ecosystem restoration projects.

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client/server technology at sites throughout the Forest Service network. Currently, the Tools module consists of a series of products linked together by a user-friendly navigation system and organized at a variety of geographic scales.

The products are:

- **GIS Foundation** is a user-friendly navigation system used to standardize the basis for all of the NRIS modules to portray geographic information. This is a collection of Oracle tables, views, forms and procedures that provides the means for storing the relationships between spatial and tabular data. It also offers predefined display options and allows easier and more in depth program and project use of the databases and associated analytical tools.
- **INFORMS** allows the linking of database and GIS applications for input and analysis of project level information. This information is essential to the NEPA analysis process required for management activities on all federal lands.
- **ETools** provides analysis of terrestrial ecological communities based on vegetation and soils characteristics. It provides users with analysis tools, interpretation and report generators. ETools mediates the dataflow between the database and analysis and reporting tools.
- **Ecosystem Management Decision Support (EMDS)** is an application that assists users in completing ecosystem assessments at a variety of scales from site to regional. It is also used to integrate ecologic, economic, and social information from ongoing watershed assessments to prioritize management and restoration activities across landscapes, basins, or regions. EMDS allows the development of interactive presentations to stakeholders to facilitate explanation of alternatives, assumptions, and decisions made. It has been used in the Pacific Northwest as a monitoring tool to cover large landscapes or regions.
- **Access Tool** provides users with an ad hoc query tool so they can design reports from a variety of databases and required analysis tools.

3. U.S. Geological Survey

<http://water.usgs.gov/GIS/huc.html>

3a. NHD (National Hydrography Dataset)

<http://nhd.usgs.gov>

The National Hydrography Dataset (NHD) is a comprehensive set of digital spatial data that contains information about surface water features such as lakes, ponds, streams, rivers, springs and wells. Within the NHD, surface water features are combined to form "reaches," which provide the framework for linking water-related data to the NHD surface water drainage network. These linkages enable the analysis and display of these water-related data in upstream and downstream order.

The NHD is based upon the content of USGS Digital Line Graph (DLG) hydrography data integrated with reach-related information from the EPA Reach File Version 3 (RF3). The NHD supersedes DLG and RF3 by incorporating them, not by replacing them. Users of DLG or RF3 will find the National Hydrography Dataset both familiar and greatly expanded and refined.

Some NHD Applications are:

- **NHD Watershed**

Developer: Peter Steeves, U.S. Geological Survey

Current Version: 1.

Software Environment: Same as the NHD ArcView Toolkit

Purpose: NHD Watershed is an ArcView (3.x) extension that enables users to delineate a watershed from any point on any NHD reach in a fast, accurate, and reliable manner. The application works in 8-digit subbasins (formerly known as "cataloging units") where appropriate supporting data layers have been collected and preprocessed. NHD Watershed was developed using the NHD ArcView Toolkit and, for this reason, users intending to run the NHD Watershed application should be familiar with the Toolkit. The ArcView 3.x Spatial Analyst extension (version 2.0) is required to delineate watersheds from any point on any NHD reach. Without Spatial Analyst, watershed delineation can only be performed upstream from an NHD reach confluence.

- **NHD West Fork Cedar River Demo**

Developer: NHD Support Team, U.S. Environmental Protection Agency

Current Version: 3.03

Software Environment: ArcView 3.0a or 3.1 for Windows 95/98/NT

Purpose: The West Fork Cedar River demo is an example of how the NHDinARC format of the NHD data, can be used to build water resources applications. The demo is an ArcView application and is contained in a tarred and compressed file. The format and organization of the NHDinARC data is referred to as its schema. Note that the West Fork Cedar Demo was built using data that is in a schema version that is slightly older than the current schema which is described under Technical References and found in the data that is available under Data.

3b. Hydrologic Unit Maps

The United States is divided and sub-divided into successively smaller hydrologic units which are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system.

The USGS maintains a **List of Hydrologic Units** as well as **Paper Maps** and a **Digital Spatial Data Set**.

- **List of Hydrologic Units**

Download the text-formatted list of hydrologic units names and numbers from USGS Water-Supply Paper 2294. in either the original format or in tab-delimited format.

- **Paper Maps**

A single-sheet hydrologic unit map of the U.S. is available published at a scale of 1:3,500,000 and the map measures 41- by 58-inches. This map is part of The National Atlas of the United States of America series. "Hydrologic Units" is available from USGS at a cost of \$7.00 per sheet. Its stock number is TUS5681. The "Hydrologic Units" atlas map supersedes both the "Hydrologic Unit Map of the United States, East" (GHU0057-1T) and the "Hydrologic Unit Map of the United States, West" (GHU0057-2T). Additional information regarding this map is available at: <http://www.nationalatlas.gov/atlasmap.html>.

- **Digital Spatial Data Sets**

This is a sophisticated coverage with extensive documentation. Attribute tables show hydrologic unit names and flow direction among cataloging units. The coastline of the U.S. is included and land/water polygons are distinguished. Unofficial offshore extensions of cataloging units are shown. The coverage was developed for work on the National Water Summary.

The coverage is available on line, at no charge, via links from the metadata file. It may be retrieved as a single file for the entire U.S., or by Water Resources Region. The data for this large coverage was originally collected for the Geographic Information Retrieval and Analysis System (GIRAS) at a scale of 1:250K. Some areas, notably major cities in the west, were recompiled at a scale of 1:100K. The coverage was compiled to provide the National Water Quality Assessment (NAWQA) study units with an intermediate- scale river basin boundary for extracting other GIS data layers.

II. STATE LEVEL ACTIVITIES

1. Idaho One Plan

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This is a multi-agency project that uses computer technology to combine a myriad of government regulations and current best management practices into a single plan. It will provide data and downloadable software enabling growers to develop a single conservation farm plan that will be pre-endorsed by the various regulatory agencies. This is still a work in progress.

[Http://www.oneplan.org/about.htm](http://www.oneplan.org/about.htm)

2. (CLAMS) Coastal Landscape Analysis and Modeling Study

<http://www.fsl.orst.edu/clams/>

The Coastal Landscape Analysis and Modeling Study (CLAMS) is a joint research effort of the USDA Forest Service, Pacific Northwest Research Station, Oregon State University, College of Forestry and the Oregon Department of Forestry. The goal of CLAMS is to develop and evaluate concepts and tools to understand pattern and dynamics of provincial ecosystems such as the Oregon Coast Range and to analyze the aggregate ecological and socio-economic consequences of different forest policies and strategies across multiple ownerships of the province. The six major objectives of the project are to:

- 1.Characterize the spatial pattern and history of ecological and socio-economic components of the Coast Range;
- 2.Develop ecological and socio-economic models, measures and linkages (Figure1);
- 3.Develop spatial policy evaluation tools and data for use by technical specialists;
- 4.Project aggregate effects of current and selected alternative forest policies on key resources and outputs;
- 5.Evaluate consequences of alternative fundamental strategies to natural resource management;
- 6.Synthesize multi-scale assessments and provide information for joint learning among stakeholders.

These objectives will be met through development of a compatible set of spatial data bases and spatial simulation models. Vegetation and physical conditions of the province will be characterized with GIS models that use LANDSAT imagery, 10m digital elevation models and climate and geology data.

3. EAMS Ecosystem Management Decision Support

<http://www.fsl.orst.edu/emds/>

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The Ecosystem Management Decision Support (EMDS) system is an application framework for knowledge-based decision support of ecological assessments at any geographic scale. The system integrates state-of-the-art geographic information system (GIS) as well as knowledge-based reasoning and decision modeling technologies in the Microsoft Windows® (hereafter, Windows) environment to provide decision support for a substantial portion of the adaptive management process of ecosystem management.

The EMDS extension to ArcMap consists of the six components. For practical purposes, the EMDS Project Environment can be thought of as a supervisory component of the extension that manages the activities and interactions of the other components (see EMDS System Components) within the ArcMap environment. The EMDS Project Environment also is the primary component of the extension with which a user interacts to set up assessments, analyses, and scenarios, all of which are organized within a tree view of project structure. ArcMap itself provides the resource manager with a powerful GIS environment in which to visualize, create, process, and display spatial information. It is in ArcMap where a user assembles all the necessary data layers to be processed by the NetWeaver logic engine, and ArcMap handles all EMDS spatial displays. More generally, however, because EMDS is implemented as an ArcMap extension, all the spatial processing power inherent to ArcMap, and any of its other available extensions, is available to the EMDS user.

4. BLM Oregon/Washington

<http://www.or.blm.gov/gis/>

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http://www.or.blm.gov/gis/projects/water_resources/index.asp

Oregon/Washington BLM has created an integrated approach for aquatics information and is promoting consistent standards and protocols for managing hydrographic information across our organization. These efforts are in support of many initiatives including the Northwest Forest Plan, fish consultations under the Endangered Species Act, the Oregon Plan for Salmon and Watersheds, compliance with the Clean Water and Safe Drinking Water Acts, and assisting Watershed Councils in Oregon.

This Oregon/Washington BLM project is part of a much larger collaboration between State and Federal agencies in the Pacific Northwest. The objective of this larger effort is to create a high quality 1:24,000 scale hydrography framework dataset that is co-managed and web-accessible via a server at the Regional Ecosystem Office (REO). The clearinghouse application and database have been installed at the REO. Oregon/Washington. BLM will populate and maintain the hydrography framework layers on the clearinghouse sever for watersheds containing BLM jurisdiction. This is a multi-year effort. The overall intent of the Hydrography Framework Clearinghouse is to allow update and maintenance by partner agencies in the Pacific Northwest and to provide access for a variety of government and private users. Additional information on the Hydrography Framework.

Clearinghouse can be viewed at the following web address:

<http://www.reo.gov/gis/projects/Hydro/index.htm>

Oregon/Washington has implemented this project in several phases which include 1) conversion of existing data sources to an interim BLM data standard format; 2) field training, certification and update; 3) routing for dynamic segmentation; 4) linkage to the Aquatic Resource Information Management System (ARIMS); 5) conversion to the interagency standard and subsequent insertion into the Hydrography Framework Clearinghouse.

Additionally BLM has created a Hydrographic Handbook. The primary purpose of this handbook is to provide a description of our implementation of the hydrographic data model. The document contains information on a variety of topics related to this theme and it is available at the site below.

ftp://ftp.or.blm.gov/gisweb/pdf/hydbook_2.pdf

5. CALWATER

<http://www.ca.nrcs.usda.gov/wps/calwater/>

"CALWATER" is a spatial dataset of watersheds in California, developed by an Interagency Watershed Mapping Committee. For many years, the NRCS and other State and Federal agencies, have been working with this committee to map the watersheds and hydrologic units in the State of California. This web site documents the history and current status of this

interagency effort.

Calwater is still the official California Watershed map. It is the "best available data" for most uses. However, in its present form it does not meet the FGDC Watershed Boundary Dataset mapping standards. The Calwater committee is working to try and bring the Calwater linework into compliance with these standards, and then label these watersheds with BOTH the existing State system, and the Federal system. Ideally, sometime in the future, you will be able to click on a watershed in Calwater and read the name and number of that watershed in both the State and Federal systems. We'll keep you posted on the progress...

III. WORTH A LOOK

Special thanks to John Kendrick, USDA in Idaho, for providing most of these links.

Northwest Power Planning Council

<http://www.nwcouncil.org/>

EPA > Watershed Initiative

<http://www.epa.gov/owow/watershed/initiative/>

EPA > Polluted Runoff (Nonpoint Source Pollution) > Funding Opportunities

<http://www.epa.gov/owow/nps/funding.html>

EPA > Watersheds > Watershed Projects

<http://www.epa.gov/owow/watershed/projects.html>

Water Quality Information Center

<http://www.nal.usda.gov/wqic/>

National Watershed Network

<http://www.ctic.purdue.edu/KYW/nwn/nwn.html>

National Watershed Coalition

<http://www.watershedcoalition.org/index.html>

Features | NRCS

<http://www.nrcs.usda.gov/technical/efotg/>

Technical Resources

<http://www.id.nrcs.usda.gov/tech.htm>

newpage

http://www.id.nrcs.usda.gov/soils/soils_main.htm

Idaho Snow Survey Home Page

<http://www.id.nrcs.usda.gov/snow/index2.htm>

National PLANTS Database

http://plants.usda.gov/home_page.html

Welcome to StreamNet On-line!

<http://www.streamnet.org/>

AgriMet - The Pacific Northwest Cooperative Agricultural Weather Netw

<http://mac1.pn.usbr.gov/agrimet/>

Water Quality Program for the Department of Environmental Quality

<http://www.deq.state.id.us/water/water1.htm>

National Marine Fisheries Service Northwest Regional Office

<http://www.nwr.noaa.gov/>

Columbia Basin Fish and Wildlife Authority

<http://www.cbfwa.org/>

Farm Bill 2002 Title II Conservation

http://www.usda.gov/farmbill/conservation_fb.html

USDA Online Service Centers

<http://forms.sc.egov.usda.gov/eforms/default1.htm>

EPA > Total Maximum Daily Loads

<http://www.epa.gov/OWOW/tmdl/index.html>