

Web Access to Watershed Management Data and Information **<http://ag.arizona.edu/OALS/watershed/>**

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ABSTRACT

The southwestern region of the United States has been the focus of a wide range of research efforts to learn more about the effects of natural and human induced disturbances on the functioning, processes, and components of the ecosystems found in the region. This research has been performed for more than 70 years in the Salt and Verde River Basins of Arizona specifically to evaluate the usefulness of selected vegetation management programs intended to increase water yields and other resource benefits. Through the U.S. Forest Service's Arizona Watershed Program, studies were conducted in mixed conifer, mountain grassland, ponderosa pine, pinyon-juniper, chaparral, and riparian vegetation types. To make the results of this research more widely available, a web site and accompanying database were developed which combined to make a unique reference and educational tool for disseminating research findings to scientists, educators, and land management professionals as well as the general public. The "Managing Arid and Semi-arid Watersheds" [<http://ag.arizona.edu/OALS/watershed/index.html>] provides a variety of background material about watershed management as well as an annotated bibliography of over 800 articles and reports. The site also includes extensive research data for the seven vegetation types found in the arid and semi-arid areas of the southwestern United States. A Web-based relational database incorporates a variety of factors about the studies including precipitation, air temperature and humidity, stream flow, suspended sediment, water quality, vegetation--both timber and range, and wildlife and allows the data to be searched and graphed.

AREA OF STUDY

The Central Arizona Highlands are a distinct biogeographic, climatic, and physiographic province that forms a diverse ecotone between the larger Colorado Plateau to the north and the Sonoran Desert ecoregions to the south. This region was chosen as the location for the Arizona Watershed Program because of the wide variety of vegetation types native to the area.

DESCRIPTION AND HISTORY OF THE BEAVER CREEK EXPERIMENTAL WATERSHED

Research studies were performed by the USDA Forest Service from 1930s to 1980s to evaluate the usefulness of watershed management techniques for increasing water yields and other multiple resource benefits within the Salt and Verde River Basins of Arizona in the United States. One area of study was the 275,000 acre Beaver Creek Experimental Watershed in north-central Arizona. This watershed is located in north-central Arizona, about 80 km (50 mi) south of Flagstaff, Arizona, in Coconino and Yavapai Counties. It was established in 1956 to study the influence of various vegetative manipulations of pinyon-juniper and ponderosa pine on water yield and to evaluate changes in livestock forage, timber production, wildlife habitats, recreational values, and soil movement.

A paired watershed approach was used to evaluate treatment responses. Two watersheds with similar characteristics, both physical and biological, were selected and measurements of streamflow, sediment production, water quality, vegetation, and animal use were made on each watershed before any treatment was applied. After a period of time, one watershed was selected for application of a management treatment and measurements continued on both the treated and control watersheds. There were 11 different kinds of treatments on Beaver Creek sub-watersheds: cabled, herbicide application, felling overstory trees, silvicultural thinning, regular one-third strip-cut, patch-cut, clearcut and grazing, clearcut, irregular strip-cut and thin, and heavy thinning. Information about each individual sub-watershed can be accessed through a clickable map.

Changes caused by management practices applied to the treated watersheds were evaluated by comparing post treatment values with pretreatment data, and with data from the control watersheds. All water-oriented studies on Beaver Creek were terminated by 1982, and final results of the initial treatment studies were reported on during the latter part of the 1980s

WEB PROJECT

The purpose of the web project is to bring to the public the knowledge and data gleaned from the Arizona Watershed Program, and particularly the Beaver Creek Watershed. The goal is to take the years of accumulated watershed management research and package it in a form that is useful to a broad spectrum of people. The challenge is to provide information that other researchers will find useful as well as information that teachers, students, public administrators, and the general public can use (See Figure 1).

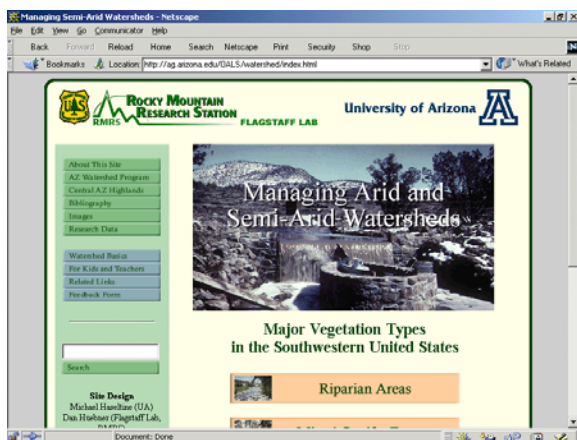


Figure 1. Managing Arid and Semi-Arid Watersheds Home Page

Begun in 1997, this project is currently in its third phase of building watershed resources for the web. The first phase collected and presented a description and history of the Arizona Watershed Project with photos and maps, as well as providing a searchable bibliography of the nearly 700 documents that resulted from the Program. The second phase resulted in converting 20 years of precipitation, weather, and stream data from the Beaver Creek Experimental Watershed into a format that could be presented on the web. The third phase, recently begun, will further develop GIS applications and graphing capabilities for the web and add watershed data representing additional vegetation types.

DATABASE DEVELOPMENT

All the research related data collected over two decades, ranging from stream flow to timber quality change, are managed in a relational database. The current implementation uses MS Access and will be migrated to an MS SQL server in the future. The web site provides flexible ways to access these extensive data (See Figure 2).

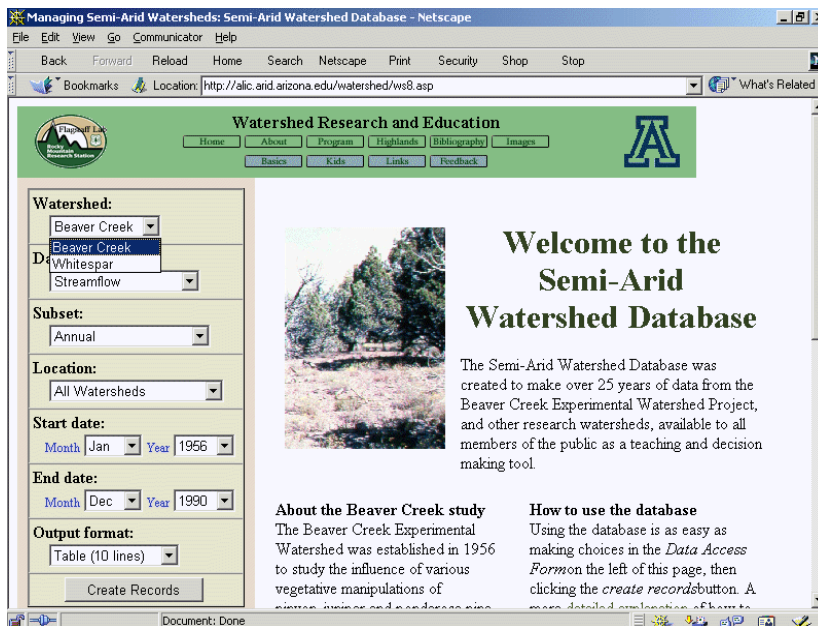


Figure 2. Watersheds Database Interface

MAP INTERFACE DEVELOPMENT

ESRI ArcIMS was employed to present data on the Internet map server. Information such as vegetation type, elevation, Landsat satellite images, and topological features can be visualized through the selection of different layers on the map. The example of the map server allows users to choose data layers and select features for presentation (See Figure 3).

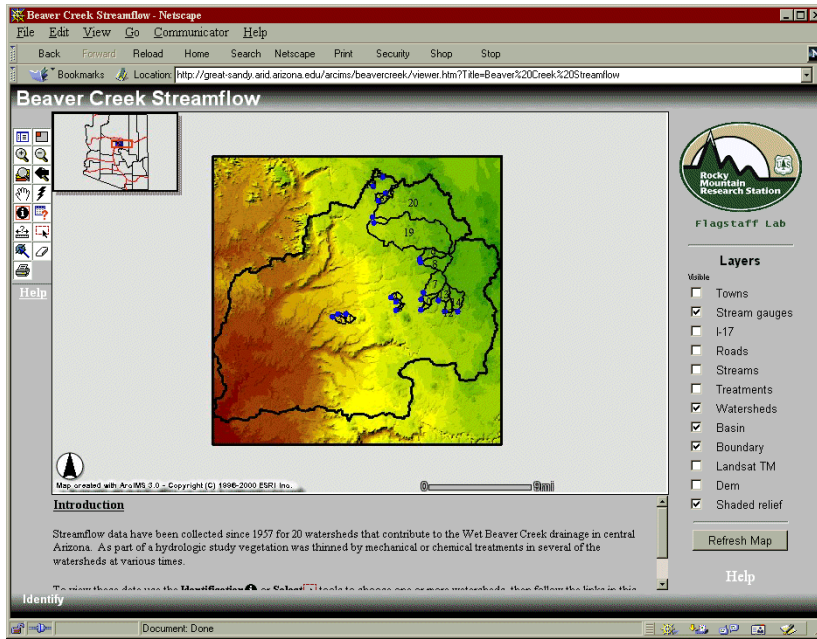


Figure 3. Map Interface to Beaver Creek Watershed Data

GRAPHING TOOL DEVELOPMENT

A new graphing tool is being developed using Java and JSP. The graphing tool allows flexible overlaying and parallel data comparison. The user can plot more than one type of data on the same graph and plot for one or multiple time periods. The user can choose between line, bar, and area charts, and has the option of a logarithmic scale (See Figure 4).

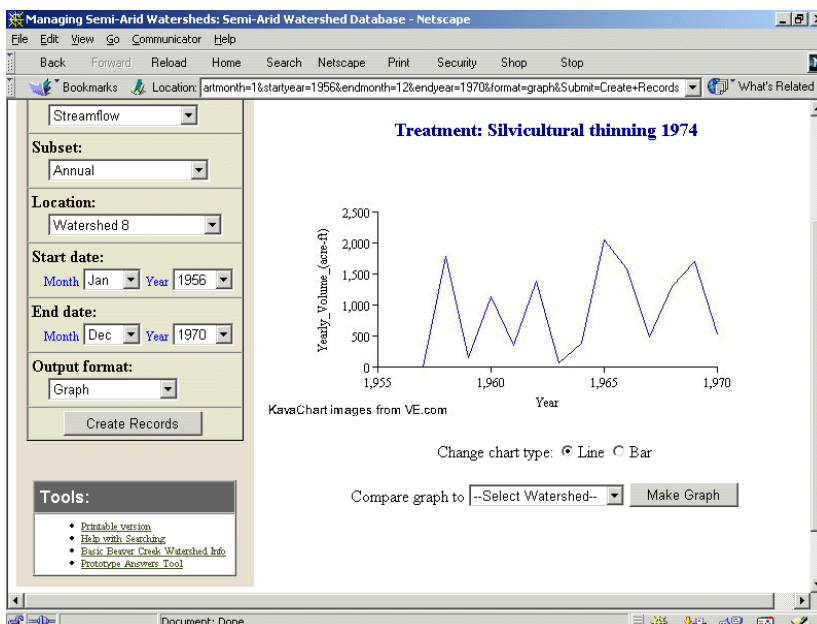


Figure 4. Preliminary Graph Interface