

# Increasing Efficiency of Information Dissemination and Collection through the World Wide Web

Daniel P. Huebner<sup>1</sup>, Malchus B. Baker, Jr.<sup>2</sup>, and Peter F. Ffolliott<sup>3</sup>

**Abstract.**—Researchers, managers, and educators have access to revolutionary technology for information transfer through the World Wide Web (Web). Using the Web to effectively gather and distribute information is addressed in this paper. Tools, tips, and strategies are discussed. Companion Web sites are provided to guide users in selecting the most appropriate tool for searching and promoting Web sites, and to help users maximize the potential of the Web.

---

## Introduction

Immediate access to scientific literature has been a dream of researchers, managers, and educators (Lawrence and Giles 1998). The greatest benefit the World Wide Web provides over traditional print media is its immediacy (Hilf 1998). Excitement surrounding Web use is pervasive as professionals discuss their successful use of the World Wide Web. However, excitement quickly turns into frustration for those unfamiliar with the technology. This paper is about helping people effectively use of the World Wide Web.

---

## About the World Wide Web

The World Wide Web (WWW, Web, or W3) is the universe of network-accessible information, the embodiment of human knowledge (World Wide Web Consortium 1997). As of December of 1997, an estimated minimum of 320 million Web pages existed (Lawrence and Giles 1998). If, as some estimates suggest, the Web doubles in size every 4 months (Tyner 1998), there are over 20 billion Web pages as of March 2000. To view all these pages at a rate of 1 per second would take 450 years! With

---

<sup>1</sup> *Biological Technician, Rocky Mountain Research Station, U.S. Department of Agriculture, Forest Service, Flagstaff, AZ*

<sup>2</sup> *Research Hydrologist, Rocky Mountain Research Station, U.S. Department of Agriculture, Forest Service, Flagstaff, AZ*

<sup>3</sup> *Professor, School of Renewable Natural Resources, University of Arizona, Tucson, AZ*

this volume of Web pages, it is expected that information exists on nearly any topic. Indeed, the Web mirrors the diversity of information subject matter and quality present worldwide. One can find publications, software, data, images, bibliographies, insight, and treasure in copious quantities on the Web.

Unfortunately, this tremendous quantity of information is not well organized. However, there are excellent tools available to help connect users and the information they seek.

---

## Locating Information

It is difficult to learn the Web in a high-pressure, time stressed, environment where every moment must result in immediate productivity. Successful Web application requires an investment in “play time.” to become familiar and comfortable with it. Often, this “play” environment, which pays large dividends in the long-run, is unavailable at work. Alternatives include exploration through a home account, or use of public access systems at libraries. However you manage to “play” on the Web, feel free to explore and experiment. Go everywhere. Mouse click on everything. Make mistakes. Make serendipitous discoveries. The time invested in this discovery “play” period will be extremely beneficial in your future ability to effectively access needed information.

Once you are comfortable with the Web and the use of a browser (software that allows access to the Internet), consider how to find specific information. Some excellent resources and powerful tools have been developed for this purpose. Two types of tools that help in the information quest follow.

## Subject Guides

Subject guides are hierarchically organized indexes of subject categories that allow users to browse through lists of Web sites by subject in search of relevant information (Tyner 1998). Subject guides are “moderated”, that is, there are people who decide if a site is relevant before a

link is added. Because of the human involvement in this selection process, relevancy is high, but subject guides index only a very small fraction of the information available on the Web.

Using a subject guide is similar to looking through the yellow pages. To look for hydrology organizations one might start with the broad category **science**. Within that broad category find a sub category **hydrology** and then a sub category **Institutes** below this. Under **Institutes** might be listings for the National Weather Service, Hydrologic Research Laboratory, Utah Water Research Laboratory, and the Instituto Mexicano de Tecnologia del Agua.

Some subject guides are general, like Yahoo (<http://www.yahoo.com>) and Magellen (<http://www.magellen.com>). The top-level categories of these general subject guides are broad like arts and humanities, business and economy, computers and internet, or education. These general guides are useful to locate popular or common information. Other subject guides, like Hydrology Web, which links to sites that are relevant to hydrology, (<http://etd.pnl.gov:2080/hydroweb.htm>), are specialized. Because there are thousands of specialized subject guides, clearinghouse sites exist to help users access them. Examples include Argus Clearinghouse (<http://www.clearinghouse.net/>) and The WWW Virtual Library (<http://www.vlib.org>).

Subject guides work well for exploring resources about a broad topic area. If the desired information is specific, like water-yield data on the Beaver Creek watersheds in north central Arizona (Baker 1999), search engines are the Web tool of choice.

## Search Engines

Search engines build an index or data base from existing Web pages and provides users with the ability to query the index. To build the index, search engines deploy software “robots” that automatically index the contents of a Web page. Then, the “robot” indexes the Web pages that are linked to the first page and on through cascading myriads of linked pages. Because of the automation that search engines employ, they index more of the Web than do subject guide. A larger index means that more pages relating to a narrow or focused topic are found and delivered. However, because search engines index innumerable pages, a large percent of them may lack relevancy. This is especially true if the query is overly broad.

From the user’s perspective, all search engines work in a similar way. Users submit terms (**percolation soil**) or a phase (**beaver creek evaluation study**) to the search engine, which compares them to the index of Web sites it has built and returns links to pages considered relevant. No search engine indexes the entire Web. In fact, different

search engines vary in what they index, how much they index, and how frequently they update the index. Not all Web pages can be indexed by a search engine. Some pages are blocked to public access (e.g., intranet pages) and some pages are temporary in nature (e.g., results from data base queries). The largest search engines index only 1/3 of the “indexable Web pages” (Lawrence and Giles 1998). Because of the varying sizes and the methods used by different search engines, users will obtain different results when issuing the same query to a variety of engines. If your search is unsuccessful, try a different engine or a Web tool that submits your query to many search engines simultaneously like DogPile (<http://www.dogpile.com>) or Metacrawler (<http://www.go2net.com/>).

For details on the use of specific search engines, check the online documentation, under “Help”, of your Web software. Just as the Web is very dynamic so are its search engines. An excellent resource for tracking the latest changes and advances is Search Engine Watch (<http://www.searchenginewatch.com>). An online guide helps assist users in selecting appropriate search tools for various types of searches (<http://www.rms.nau.edu/guides/search/>).

Table 1 demonstrates how a search for information on water-yield data from the Beaver Creek evaluation study might unfold. The requested information is specific, so using a search engine will yield more appropriate results than a subject guide. AltaVista (<http://www.altavista.com>) is used for this example.

---

## Distributing Information

---

When deciding whether the Web is the appropriate medium for information distribution, consider that less than 3% of the world’s population has access to it. This limitation does not diminish the Web’s significance as a revolutionary technology tool. Remember the printing press had a great impact on world communication even though most Europeans were illiterate at the time of its invention (Hilf 1998).

If the Web is a suitable medium to disseminate your information, consider how to put information on the Web so others can easily access it. This topic is not addressed here, as the how-to varies depending on organizational affiliation and so on. Its best to contact the computer system administrator or a colleague who has worked through the details, and have them assist you while getting started. The challenge is in developing the content rather than the nuts and bolts of the technical issues and language.

## Tips for Efficient Web Searches

- **Stay focused.** The nature of Web searching ensures access to links of interesting Web pages that are irrelevant to the search. Exploring these pages derails the search and diminishes productivity. Users can mark interesting pages for later perusal using the browser's bookmark feature, which is explained under "Help."
- **Be persistent.** If the first, second, and third strategies do not work, try a fourth, fifth, and sixth. Try the same search a month later. Remember, the Web is a dynamic environment where persistence will increase the likelihood of success.
- **Be inventive.** If there is no success with the suggested, usual tool, try one that is designed for something else. For example, you might find a person using a general search tool after failing with a tool designed specifically for this purpose.
- **Use right-side truncation of the Web address to find parent pages.** Often a search leads to a page well below the site's home page. Deleting some of the address will move you up toward the site's main page. For example, at [www.rms.nau.edu/publications/rm\\_gtr\\_295/chapter9.html](http://www.rms.nau.edu/publications/rm_gtr_295/chapter9.html), if you delete `chapter9.html`, you go to the publications main page. Truncate further to [www.rms.nau.edu](http://www.rms.nau.edu), and you go to the organization's main page.
- **Learn the features of specific search tools for greater efficacy.** Search tools describe specific features through their "Help" link.
- **Do not consider any listings to be comprehensive.** Comprehensive does not exist in the the Web world.
- **Understand and accept that the Web is huge and unorganized.**
- **Enjoy the process.**

Table 1. A search for information on water-yield data from the Beaver Creek evaluation study.

Typed into Query Box	Plain English	Results
beaver creek	the word <b>beaver</b> and the word <b>creek</b> occur on the page.	16,973 pages match the query, full of links to Beaver Creek resorts (for example, in Vail, CO and Michigan), Beaver Creek software company, etc. Query is much too broad. Try searching for the exact phrase "beaver creek evaluation study"
"beaver creek evaluation study"	the phrase <b>beaver creek evaluation study</b> occurs on the page	No document matches the query. Query is too narrow. Remove the quotes to search for pages that have these words in them without the requirement that they are next to each other (a phrase).
beaver creek evaluation study	the word <b>beaver</b> and the word <b>creek</b> and the word <b>evaluation</b> and the word <b>study</b> occur on the page	Relevant pages start showing up in results, most refer to the "beaver creek watershed." Try the phrase "beaver creek watershed"
"beaver creek watershed"	the phrase <b>beaver creek watershed</b> occurs on the page	Good relevance, links to Beaver Creek watershed history, data, publications, etc. Add the phrase "water yield" to focus the search.
+ "beaver creek watershed" + "water yield" <b>water yield</b> must occur	the phrase <b>beaver creek watershed</b> must occur and the phrase <b>water yield</b> must occur	Success. Sites that discuss water yield on the Beaver Creek study area

After investing in putting information on the Web, users must be able to find it. Several approaches follow that will help increase the use and thus, the value of your Web pages. In addition, an online guide is available to assist users in promoting their Web sites (<http://www.rms.nau.edu/guides/promotion/>).

Take advantage of search engines. To control the way search engines list your site and to help boost your ranking on results pages, use meta tags. Meta tags contain information about a Web page but are hidden from the viewer. See the Alta Vista help page ([http://www.altavista.com/av/content/addurl\\_meta.htm](http://www.altavista.com/av/content/addurl_meta.htm)) for a good explanation of meta tag use in Web pages. Once meta tags have been added submit pages to the major search engines. The best way to ensure that your pages are indexed by a search engine is to explicitly add them rather than to wait for the "robots" to stumble upon them.

Attach the address of Web pages to communications with colleagues. This includes e-mail messages, business cards, and other printed matter. It is sometimes useful to make a business card that highlights a web site. The familiar and convenient business card is often the easiest way for an interested person to go back to the office with your web site address.

Submit information about your web page, including the address, to topic news letters and mailing lists. Contact Web masters that maintain listings of links to similar sites, and ask them to add a link to your Web site; offer to do the same for their sites.

---

## Summary

---

Subject guides are useful when you are "looking around" and do not have specific information needs. Search engines are best to find specific information. Use of many different search engines gives the most comprehensive results. An online guide helps users select the appropriate

tool to use for a particular search (<http://www.rms.nau.edu/guides/search/>). When using Web pages to distribute your information, actively promote them. An online guide provides links to references on promoting your Web pages (<http://www.rms.nau.edu/guides/promotion/>).

---

## Acknowledgments

---

The authors wish to thank Linda M. Ffolliott, Information Systems Specialist, College of Agriculture, University of Arizona, Tucson, Arizona, and David W. Huffman, Research Specialist, School of Forestry, Northern Arizona University, Flagstaff, Arizona for their comprehensive, technical reviews of this paper.

---

## Literature Cited

---

- Baker, Jr., Malchus B. 1999. Compiler. History of watershed research in the Central Arizona Highlands. USDA Forest Service, Research Paper RMRS-GTR-29.
- Hilf, Bill. 1998. Media Lullabies: The Reinvention of the World Wide Web. [Online] Available: [http://www.firstmonday.dk/issues/issue3\\_4/hilf/](http://www.firstmonday.dk/issues/issue3_4/hilf/) [1999, May 5].
- Lawrence, S. and Giles, C. L. 1998. Searching the World Wide Web. *Science* 280:98. April 3, 1998.
- Tyner, Ross. (1998, December 1-last major update). Sink or Swim: Internet Search Tools & Techniques. [Online]. Available: <http://www.ouc.bc.ca/libr/connect96/search.htm/> [1999, May 5].
- World Wide Web Consortium. (1997). About the World Wide Web, [Online]. Available: <http://www.w3.org/WWW/> [1999, May 5].