

## A NEW APPROACH TO RIPARIAN AREA EDUCATION IN ARIZONA

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Riparian areas are called "ribbons of life" because they are considered the most productive habitats in North America (Johnson et al. 1977; Chaney et al. 1990). These areas are transition zones (ecotones) between aquatic and terrestrial ecosystems. As a result they provide habitat for species from both aquatic and terrestrial ecosystems, as well as species that are unique to these areas. In the arid western United States riparian areas are estimated to make up less than 2 percent of the total land area (Ffolliott et al. 2004). Despite their small area, Patten (1998) says that the role of riparian areas is disproportionate to their size, particularly in the semi-arid regions of North America. This is mainly due to the many functions and values of riparian areas, which promote greater vegetative and wildlife diversity because of the greater water availability relative to the adjacent terrestrial uplands. Although many people use the terms functions and values interchangeably, they differ (Walbridge 1993). Brinson (1993) described a function as the "ecological, hydrological or other phenomenon that contributes to self-maintenance." In contrast, a value is "something of worth, desirable or useful to humans" (Mitsch and Gosselink 1993). As a result, functions of riparian areas are relatively constant through time whereas the values of riparian areas have changed through time and probably will change again in the future as the needs and beliefs of society change.

Some of the most important functions provided by riparian areas (Schultz et al. 2000) are fish and wildlife habitat (water, food, shelter, cover); filtration and retention of sediment and nutrients from terrestrial upland runoff or out of bank floods; re-

duction of chemical inputs from terrestrial uplands by immobilization, storage, and transformation; stabilization of stream banks and buildup of new stream banks; increase in water storage and recharge for subsurface aquifers; and reduction of floodwater runoff.

Society considers riparian areas to be very important because of their multiple use values (Clary and Booth 1993). Riparian areas play a major role in improving water quality, particularly by reducing nonpoint source pollutants and increasing water quantity. The public's value of water quality protection was recognized by the Clean Water Act of 1972 (amended 1977) and the subsequent development of the Total Maximum Daily Loads (TMDL) program by the U.S. Environmental Protection Agency to regulate water pollution.

Riparian areas are also essential for many endangered and threatened species. Seventy percent of the threatened and endangered vertebrates in Arizona depend on riparian habitat (Johnson 1989). The Endangered Species Act of 1973 (amended in 1988) was passed with the objectives of conserving threatened and endangered species and monitoring all listed species.

Domestic livestock are also attracted to riparian areas (Roath and Krueger 1982) for the same reasons that wildlife prefers riparian areas: high forage availability and abundance (Pinchak et al. 1991), water availability (Ames 1977), favorable summer temperatures, and moderate terrain. Ranching today still accounts for a significant portion of the agricultural economy of Arizona (approximately 25%; Ruyle et al. 2000).

Finally, riparian areas also have aesthetic values in addition to production-oriented values. Riparian areas are considered prime locations for recreational activities such as hiking, horseback riding, cycling, fishing, hunting, swimming, raft floating, boating, canoeing, bird and wildlife watching, picnicking, camping, and off-road vehicular traveling (Ffolliott et al. 2004).

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The great number of users and diverse perceptions of the importance and proper use of riparian areas makes managing these areas very complex and a top priority in every state. In addition, significant percentages of riparian areas are considered to be in degraded and non-functional condition (Ffolliott et al. 2004; National Research Council 2002). Riparian area destruction has varied throughout the regions of the United States, with southeastern and southwestern states probably receiving the greatest impact (National Research Council 2002). Finally, the National Research Council (2002) has also suggested that the lack of information on the status of riparian areas has limited effective management and that a comprehensive assessment should be implemented.

#### OBJECTIVES AND ACTIVITIES

In Arizona, as in many other states, there has been an urgent need for an outreach program to inform the public about riparian areas. In response to this need, an outreach program was devised with the objective of increasing the awareness and knowledge of the public on the importance of riparian areas, the processes that take place in riparian areas, and the human alterations that these areas have endured. The three main activities undertaken to meet the objective were educational workshops in selected counties, publication of educational materials, and development of a Web-based educational module.

The intended audience for this outreach program was the general public, including farmers, ranchers, public and private land managers, watershed partnerships, recreationists, and other riparian area users. All these groups have a vested interest in riparian areas and an interest in communicating with each other to successfully maintain and restore riparian areas.

#### EDUCATIONAL WORKSHOPS

The general theme for the workshops was to present broad and general topics on riparian areas, although the information was developed to be pertinent specifically for the riparian areas in Arizona. The outreach program provided basic background information for people who work in or are interested in riparian areas. All workshops in the various counties had the same topics and presenters. Planning committee members who finalized the topics consisted of scientists from the University of Arizona, Arizona State University's Polytechnic Campus, and the Agricultural Research Service, along with University of Arizona

Cooperative Extension county directors and agents. The final workshop agenda included the following topics:

1. Definition and Importance of Riparian Areas
2. Characterization of Riparian Areas
3. Hydrologic Processes in Riparian Areas
4. Fluvial Processes in Riparian Areas
5. Biological Processes in Riparian Areas – Habitat
6. Climatic Processes in Riparian Areas
7. Human Alterations to Riparian Areas

The first presentation provided various scientific and agency definitions of riparian areas, while further highlighting their importance with descriptions of their functions and values. In the second presentation, the basic characteristics of riparian areas were described, while also differentiating riparian areas from the adjacent terrestrial upland and aquatic systems. Wetlands and riparian areas were compared to each other. Hydrologic processes in riparian areas focused on the sources, distribution, and circulation of water on and below the earth's surface and in the atmosphere with an emphasis on their influence on riparian areas. In the presentation on fluvial processes in riparian areas, an introduction to the morphology of channels and floodplains was provided along with a description of stream processes in riparian areas. The presentation on biological processes described the riparian habitat, which is the summation of physical and biological processes occurring on several different spatial and temporal scales. In the climatic processes section, connections were made between the mechanisms that drive the climate of Arizona and the influence of climate on riparian areas. The last topic described how humans have impacted and altered riparian areas, directly and indirectly. These impacts cover a wide range of topics, mainly including hydrologic and geomorphic; agricultural; urban, recreational, and industrial; and other. The first six presentations were approximately half an hour each, and the last presentation was about an hour. The fact that the presenters had diverse backgrounds and worked with different institutions was one of the strengths of the workshops. Because one goal of the program was to provide information pertinent to Arizona's public, experts from Arizona were recruited.

Educational workshops were conducted in seven counties: Cochise (Sierra Vista), Coconino (Flagstaff), Gila (Globe), Graham (Thatcher), Mohave (Kingman), Santa Cruz (Tubac), and Yavapai (Prescott). These day-long workshops

lasted approximately 7 hours. The Cooperative Extension county agent or director was responsible for local arrangements. This was ideal because county agents/directors have daily contact with the local public and are thus aware of the individuals or groups who should attend the workshop because of their professions or interests. The public was informed about the workshops through advertisements in local newspapers, flyers, and email list-serves.

Participants were asked to provide written evaluations at the end of each workshop. These evaluations provided information on the success of the workshop in meeting our objectives. The evaluation form had three questions (Figure 1). The first focused on measuring the gain in awareness and knowledge as a result of attending the workshop. Participants indicated their knowledge level before the workshop and their knowledge level after the workshop. This was accomplished by using the stairstep method. The stair (a scale) had seven steps indicating an increase in knowledge level from zero to six. Participants placed the letter B on the step that represented their knowledge before the workshop and an A on the step representing their knowledge after the workshop.

Evaluations revealed that for the first six topics, 89 percent of the participants increased their knowledge by at least one level (Figure 2). For topic 7, human alterations, the knowledge levels of a significant portion of the participants (24%) remained the same. This indicates that workshop participants were aware of the impacts of humans on riparian areas, which was probably one of the reasons that the participants attended the workshop. Overall, the most significant increase in knowledge was for the processes in riparian areas. Ninety-five percent of the participants increased their knowledge by at least one level, 35 percent increased their level of knowledge by three to four levels, and 4 percent by five to six levels.

The other two questions were simple and straightforward: What were the strengths of the workshop? What could have been improved? Most participants responded that one of the strengths of the workshops was the quality of the presenters and the presentations. The presenters had diverse backgrounds and were interactive and open to answering questions. Many participants thought the workshops could have been improved if more local examples were presented, and this will be a focus in the future. The premise for this first set of workshops was to provide general information about riparian areas of Arizona. Another improve-

ment that many participants would have liked would have been to tie in more practical applications, and that will also be a focus of future workshops.

The numbers and backgrounds of the participants were documented to assess the diversity of the public participating in the workshops. This provides insight into the extent of public involvement and interest in riparian areas. There were 186 participants in the seven workshops—a very encouraging number—indicating significant interest. The attendance for each workshop varied widely, ranging from only 9 to a maximum of 59 participants.

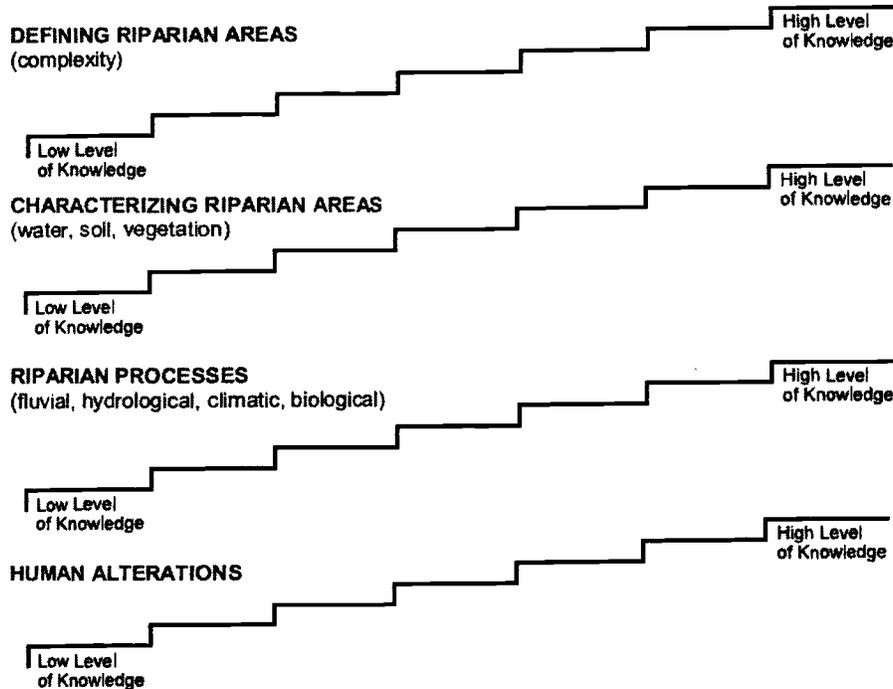
Overall, in every workshop the audience was very diverse. Workshop participants included agency employees (e.g. Bureau of Land Management, Forest Service, Natural Resource Conservation Service, Arizona State Parks, Arizona Game and Fish), professionals who deal with riparian areas (e.g. ranchers, miners), nongovernment organization employees (The Nature Conservancy), watershed partnerships, Master Watershed Stewards (trained volunteers in watershed management), and the members of the public with a general interest in riparian areas. The great diversity of the audience further increases our belief that many groups have a vested interest in riparian areas, and one success of the program was to bring these different groups together in one room.

An important first step in successfully maintaining and restoring riparian areas is to have all the different parties interested in riparian areas start communicating with each other. Most groups and individuals interested in riparian areas typically want the same thing—to have healthy and functional riparian areas. Riparian areas comprise a very small percentage of Arizona's landscape, and with the projected increases in population their importance and use and potential conflicts between user groups will surely increase over time. The best way to succeed in maintaining riparian areas and to meet public expectations for riparian areas is to enhance communication among the groups that use them or are interested in them. One significant group missing from the workshops was policy makers. Participants suggested that policy makers must be involved to maintain and restore riparian areas.

Another success of the workshops was to increase the public's awareness of available human resources (e.g. scientists, extension specialists, county directors/agents) who can address riparian area issues. These people can be very useful in the

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1. Please think back to your knowledge before this workshop and what it is now at the end of the workshop. For each topic listed below, place a **B** at the point where your knowledge was at *before* the workshop and an **A** where your knowledge is now, *after* the workshop.



2. What were the strengths of this workshop?

3. What could have been improved?

Figure 1. The evaluation form used to measure the success of the workshop.

future when riparian area issues arise for both participants and non-participants.

The workshops concluded with a discussion session. Participants were asked to answer key questions in order to identify future educational and research needs for riparian areas; these needs could be at the county or state level. This was a very important part of the workshops, as participants had the opportunity to express their personal opinions. Interacting with the audience is essential for a successful outreach program because it increases participant ownership in the workshop. In addition, the mission of cooperative

extension is to provide educational programming to meet the public's needs. The needs assessment information for the first set of workshops will provide the basis for a second set of workshops to be conducted in the future.

It is important to point out that although some educational and research needs overlapped between counties, there were also educational and research needs specific to each county. The following summary primarily includes the overlapping educational and research needs based on participant responses from all counties. The major educational needs were these:

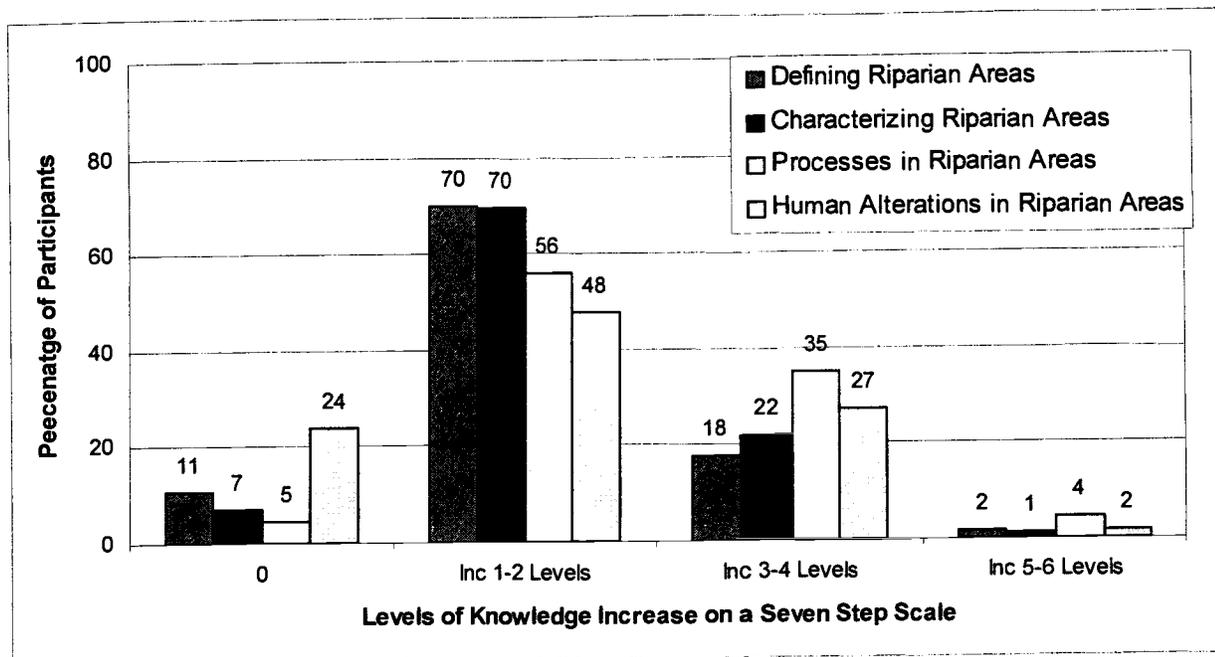


Figure 2. The percentage of participants who increased their knowledge at various levels by participating in the riparian workshops. The overall average was computed by the average of each county.

1. Develop a management session to discuss how to protect/restore riparian areas. Best management practices should be discussed and tied in with practical applications. The best management practices should address minimizing impacts from urbanization and recreation.

2. Explain proper monitoring techniques and practices for riparian areas.

3. Have workshops with riparian case studies (what has worked and what hasn't) from Arizona. These workshops should provide examples with tested practices. Provide more information on research and restoration projects and how people can get involved in restoration efforts.

4. Provide a venue or forum for facilitation and communication between groups. Specifically, provide a plan to help the various groups that have a vested interest in riparian areas to work together.

5. Provide a course for plant identification of obligate riparian species.

6. Include information on riparian areas in K-12 education.

7. Make the message on riparian issues easier to understand for the general public.

8. Provide more educational resource tools for Native American counties.

Responses to the needs assessment from the seven workshops will start to be addressed during the second set of workshops, which will focus on more local riparian issues and be more specific to each county. In addition, field trips will be part of the workshops because being on the ground can provide valuable insight. The major research needs based on the seven workshops were the following:

1. Develop a tool-kit for riparian systems, to include for example a monitoring protocol for the state of Arizona and methods for identifying the characteristics of high-quality riparian areas that should be preserved.

2. Determine what the desired and best potential conditions of riparian areas are.

3. Further research and evaluate the functionality of riparian exclosures and their effects on wildlife.

4. Study how watershed-scale management activities and disturbances impact riparian areas, and investigate the interconnections between the total area of the watershed and their riparian areas. Try to model the interconnections between riparian areas and watersheds.

5. Conduct more economics studies, for example on the cost/benefits of restoration projects, the

economics of riparian tourism, and the monetary value of riparian areas.

6. Explore methods to manage/mitigate major riparian invasive species.

7. Continue research for better riparian area classification (ecological sites) and identification. Enhance current mapping of the riparian areas of Arizona.

8. Study the impacts of using reclaimed water on riparian areas.

9. Increase riparian research projects in Native American counties.

10. Conduct more research in riparian areas that are being urbanized.

11. Conduct more studies on climate impacts (e.g. climate change, drought) on riparian areas.

#### EDUCATIONAL PUBLICATION

The educational publication "Understanding Arizona's Riparian Areas" was a supplemental resource for all participants of the workshops. The publication provides participants with a resource they can use in the future. The publication has seven chapters based on the seven topics of the presentations. The presenters of the specific topics in the workshops also wrote their specific chapters. The publication's total length is a little more than 100 pages. Currently, it has been submitted for review to the University of Arizona Cooperative Extension publications.

This educational publication will provide a great resource for the public interested in the riparian areas of Arizona. In the written evaluations many wrote that this publication was one of the strengths of these workshops. In addition, we have had many inquiries about the availability of the publication for purchase and for use as an educational resource. This publication will also help increase knowledge and awareness of riparian areas for the general public—our main objective.

#### EDUCATIONAL WEB MODULE

A Web-based educational module has been developed that draws on the materials and resources used in the educational workshops and the educational publication. As with the workshops and the publication, the Web module has seven chapters. The general idea is to use multi-media Web applications so learners will be presented with successive steps that introduce them to academic and practical information about riparian areas. Self-paced exercises will give learners practice with the concepts, and graphics and photographs will illustrate key points.

Early versions of the module were reviewed and evaluated by riparian experts and county agents and directors. The final version can be accessed at <http://ag.arizona.edu/extension/riparian/>. Access is free. The numbers of visitors to the Web site are continually monitored, and there is an online feedback form for visitor comments and evaluation. The completion of the Web module will be announced through various Cooperative Extension communication venues, and workshop participants who signed up to be informed about its completion will receive an email with the link. Almost all participants with Internet access, from all workshops, signed up to receive the link. This Web module serves as a resource for members of the public who were unable to participate in the workshop, as well as future professionals working in riparian areas. The Web module will have a long-term impact on the degree of knowledge and awareness about Arizona riparian areas. Finally, the goal is to continually update this Web module, which will include adding a section that illustrates successful case studies in riparian management.

#### CONCLUSIONS

Education is a powerful tool that should be utilized to its maximum potential. One of the missions of the University of Arizona Cooperative Extension and the School of Natural Resources is to provide information for the general public on key issues concerning natural resources—riparian areas are one such very important natural resource. Scientifically sound information was provided in three forms (workshops, publication, and Web module) that could be understood by most of the general public. The seven workshops significantly increased awareness and knowledge of riparian area issues and concepts (Figure 1) while the publication and Web module will provide resources about Arizona's riparian areas over the long term. Specifically, through the written evaluations (Figure 2) from the participants who attended the workshops, there was strong evidence that these workshops were successful at increasing knowledge levels. In addition, communication between the various groups with an interest in riparian areas has been achieved through the workshops. Finally, through the needs assessment discussion session of the workshops we have a better understanding of which issues future educational programs on riparian areas should address and the riparian research topics of interest to the public.

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