Arizona Riparian Council

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Reclamation and Riparian: The Odd Couple?

Diane Laush, Bureau of Reclamation, Phoenix

Editors' Note: This is the first in a projected series of feature articles to be contributed by representatives of state and federal agencies that are significant players in the arena of riparian conservation and restoration. While individuals may be invited to prepare future submissions, we also encourage volunteers who wish to contribute to step forward in behalf of their agency.

I started work at the Bureau of Reclamation in November 1988 after having spent 10 years working for a variety of Federal and State agencies as a field biologist. I ended up at Reclamation as a result of a desperate attempt to get out of Iowa and back to Arizona. When I started I never expected to still be working there 13 years later. But I found out over time that Reclamation isn't always the evil agency it is typically perceived as. Like most organizations, it's as good as the people working there, and there are some dedicated folks at the various Reclamation offices. *(OK, I'll admit I'm probably biased after all these years.)*

This article is based solely on my perspective as a wildlife biologist and does not reflect official Reclamation policy. I will deal primarily with activities in the Phoenix Area Office (Phoenix), but I have included a little information from the Regional office in Boulder City, Nevada. There is little official coordination and/or communication among the biologists within the Lower Colorado River Regional Office and none between Regions. However, this could be an artifact of my particular duties that only revolve around projects done within the Phoenix office jurisdiction.

The majority of Phoenix's work in riparian habitat is mandated by requirements of the National Environmental Policy Act, Endangered Species Act, Clean Water Act, and other federal regulations. We have little funding to just "do good things" for riparian habitat. The special funding we have is split among projects that the biologists believe are important and can therefore include non-riparian issues such as mountain lion (*Felis concolor*) studies in Saguaro National Park and Pima pineapple cactus (*Coryphantha scheeri* var. *robustispima*) surveys.

Reclamation's mission has changed over the last few years, it is no longer a major construction agency. This is evidenced by the fact that when I was hired there were three full-time biologists and one supervisory biologist needed to fulfill the environmental compliance requirements for all the projects. For the last three years, I am the only full time project biologist and my supervisor works half-time on projects. We do however, have two additional biologists who were hired strictly to implement requirements under separate Section 7 Biological Opinions.

So, what is Reclamation actually doing now-a-days? We still are constructing federally mandated projects that usually require some sort of mitigation. However, not all of our projects occur in riparian areas or require mitigation of a riparian system. Although in some cases, we have elected to mitigate upland impacts by acquisition of riparian habitat. Where once the major construction activity was building dams, like New Waddell, now the primary construction projects are building fish barriers to protect native species. Reclamation's engineers find it ironic that they were criticized for building big dams, but now it is environmentally acceptable to build small dams (fish barriers). For the purposes of

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Inside This Issue

PRESIDENT'S MESSAGE

It's that time again for the Arizona Riparian Council Annual Meeting. The theme for this year is *Water Resources and Sustaining Riparian Areas*. The ARC Board has come up with a group of speakers for the morning session to discuss groundwater law and current issues. Recent developments will be discussed such as the development of new policies by agencies to deal with limited water resources and dilemmas facing cities and towns confronted with meeting the demands for water and sustaining riparian areas.

At the annual meeting we will also be electing the offices of Vice President and President. Yup, its been three years since you elected Janet Johnson and myself. Janet has decided not to run and I would like to give someone else the opportunity to be President of this very fine and honorable organization.

The Arizona Riparian Council began as an idea by Chuck Hunter and Duncan Patten to have an organization whose purpose was to provide the exchange of information on the status, protection and management of riparian systems in Arizona. The annual and fall meetings and the top-notch newsletter are testaments that this continues to be our purpose.

However, is the interest in riparian areas waning? The emphasis on protecting and maintaining riparian areas is not what is was in the early 1980's. At that time there was a national focus from several federal agencies which fueled the enthusiasm. The Bureau of Land Management formed the National Riparian Team to begin their analysis of "Proper Functional Condition of Riparian Areas." EPA and the Army Corps of Engineers were told to reconsider the three parameter approach for the identification of wetlands. And the Bureau of Reclamation was changing the focus of their agency from construction projects to restoration. At the state level, in 1985 riparian and in-stream flow issues were discussed by the Governor's Task Force on Recreation on Federal Lands. In 1988, the Commission of the Arizona Environment compiled information on assessing the values and management of riparian resources. Also, in 1988 State Parks developed the Arizona Wetlands Priority and Plan. And again in 1989, State Parks prepared the Statewide Comprehensive Outdoor Recreation Plans to determine the role of streams and wetlands in meeting Arizona's growing recreational needs. Governor Rose Mofford signed Executive Order 89-16 in 1989, which mandated the formation of the Governor's Riparian Habitat Task Force. The Task Force provided a state definition for riparian areas, initiated a classification system and prepared a draft Executive Order for protection of riparian areas. In 1991, Governor Mofford signed Executive Order 91-6, Protection of Riparian Areas which established an interagency Riparian Areas Coordinating Council comprised of various state agencies. This group wrote legislation which passed in 1992 forming the Riparian Area Advisory Committee. Comprised of state and federal agencies, RAAC analyzed existing state and federal regulatory and nonregulatory programs for the purpose of developing alternative strategies for protecting riparian areas. At the end of 1994, the recommendations of RAAC were not incorporated into any new rule making and were shelved. A glimmer of light was shown in 1994 when the Arizona Water Protection Commission was formed. I think we have all seen that light grow dimmer every year.

So is interest waning? Granted we don't have any Governor's Task Force or Commissions. Federal agencies seem to be fighting off law suits and state agencies are following knee-jerk reactions to the "issue of the moment." My interest in the Council has not waned. I still feel the Council is an effective organization. We need our members to be involved and to communicate the need to protect and maintain the valuable riparian areas in Arizona. If you are still interested then I ask you to participate in making the Council more active and effective. I plan to do a brainstorming session at the annual meeting and get your ideas on where the Council is going, where it should go, and what the future holds.

I have been honored to be the President of the Council. I look forward to continuing to work with the Council as co-chair of the Protection and Enhancement Committee. I know I will be expressing my ideas on where I think the Council is going at the annual meeting. I hope you will express your ideas, too. I hope to see you in April at the meeting in Wickenburg.

Kris Randall, President

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this article, I will concentrate on Reclamation activities that have some impact on riparian habitat.

HABITAT RESTORATION

Although the Phoenix Office has never planted cottonwoods (*Populus* spp.) and willows (*Salix* spp.), the Boulder City Office has. As part of the Lower Colorado River Multi-Species Habitat Conservation Plan, Boulder City has been purchasing Fremont cottonwood (*Populus fremontii*), Goodding willow (*Salix gooddingii*), coyote willow (*S. exigua*), honey mesquite (*Prosopis glandulosa*), and Arizona ash (*Fraxinus veluntia*) for various agencies (Arizona Game and Fish Department, Bureau of Land Management, and wildlife refuges) on the lower Colorado River over the last three years.

Besides supplying trees to agencies, the Boulder City Office has also planted several restoration sites. Twelve acres of riparian habitat were planted on an agricultural lease in coordination with a local farmer. A 40-acre site (former cornfield) on Cibola National Wildlife Refuge (NWR) was planted with 13,000 cottonwood, willow, and mesquite trees. On Imperial NWR, 18,000 trees were planted on a demonstration site. Unfortunately, tree survival on the Imperial site was poor, presumably from high salinity levels in the soil. This type of funding is expected to continue over the next few years.

In the early years, most of the Phoenix Office's restoration projects dealt with small (10-15 acres) plantings of mesquite. But the proposed modification to Roosevelt Dam provided Reclamation with the opportunity to improve habitat along Tonto Creek by providing funding to the Forest Service. The raising of Roosevelt Dam's crest by 77 feet would result in increased storage capacity within the reservoir and the loss of approximately 80 acres of riparian habitat located at the mouth of Tonto Creek.

Reclamation provided funding to the Tonto National Forest to build fences along Tonto Creek and implement a grazing program that would result in significant improvement in the condition of riparian habitat. The Tonto Creek Riparian Unit, completed in 1995, encompasses 18 miles of Tonto Creek upstream from Roosevelt Lake and measures 9,483 acres. Grazing was limited to between January 1 and March 1, with complete rest every third year. Prior grazing management had been year round.

Results of the monitoring study (in-house report, August 2001) indicated that the grazing strategy was successful and Reclamation's mitigation commitment was fulfilled. Unfortunately, the study also found that the upstream watershed was in an unsatisfactory condition and scouring floods would likely remove the vegetation on a periodic basis.

ENDANGERED SPECIES ACTIVITIES

Both Boulder City and Phoenix offices are engaged in numerous activities associated with the federally endangered southwestern willow flycatcher (*Empidonax traillii extimus*), as a result of Endangered Species Act requirements. Boulder City and Phoenix both received jeopardy opinions from the Fish and Wildlife Service for loss of flycatcher habitat in Lake Mead and Roosevelt Lake, respectively. (No habitat has yet been lost in Roosevelt due to low water levels in the lake.) Actions taken to benefit the southwestern willow flycatcher may either directly or indirectly benefit riparian habitat.

Boulder City is required to evaluate and document existing threats at southwestern willow flycatcher nest sites and develop and implement management strategies to alleviate those threats. Actions taken to alleviate overgrazing by livestock, recreational impacts, inundation of habitat or desiccation of habitat will ultimately benefit riparian habitat.

Brown-headed cowbird (*Molothrus ater*) trapping is another requirement that both offices must implement. Cowbird trapping indirectly benefits riparian habitat occupants by potentially reducing parasitism in the willow flycatcher as well as other neotropical migrants. However, it should be noted that in recent years the Arizona Game and Fish Department has found depredation to have greater impacts on southwestern willow flycatcher than parasitism at Roosevelt Lake and the San Pedro River (Paradzick et al. 2000, Paradzick et al. 2001, Arizona Game and Fish Department unpubl.).

HABITAT ACQUISITION

Habitat acquisition is another mitigation tool that Reclamation utilizes. Reclamation provided funds to The Nature Conservancy to purchase 820 acres of riparian habitat along the San Pedro River near Dudleyville, Arizona, pursuant to requirements of the Biological Opinion for Modified Roosevelt Dam (Roosevelt Opinion). The Dudleyville Preserve was purchased in 1996 and is managed by The Nature Conservancy for the benefit of the southwestern willow flycatcher. Construction of boundary fences, elimination of cattle grazing and restriction of off-road vehicle use have all combined to improve riparian habitat quality on the property.

The Roosevelt Opinion also required the establishment of a $1.25 million management fund to benefit the southwestern willow flycatcher. Reclamation is planning on using the money for acquisition of additional riparian habitat that is either currently or potentially suitable for the flycatcher.

Similarly, the Biological Opinion on the Transportation and

Delivery of Central Arizona Project Water to the Gila Basin (Gila Opinion) established a fund transfer from Reclamation to the Fish and Wildlife Service in the amount of $500,000 for 25 years. These funds are to be used for conservation actions (recovery and protection) for the spikedace (*Meda fulgida*), loach minnow (*Tiaroga cobitis*), Gila topminnow (*Poeciliopsis occidentalis*), razorback sucker (*Xyrauchen texanus*) or other listed or candidate fish species in the Gila Basin, and to control non-native fishes. Portions of this fund can be utilized to acquire parcels and/or easements for native fish protection and enhancement. Any acquisition for protection or enhancement of fish habitat would directly benefit the adjacent riparian habitat. To date, no parcels or easements have been acquired.

Habitat acquisition remains my personal choice of mitigation. I am familiar with the labor intensive process involved in setting up and running a revegetation site as I have personally worked on two revegetation sites along the lower Colorado River. Revegetation sites are expensive to maintain over the long term and frequently the results are less than hoped for. I prefer to purchase replacement habitat which I believe in the long run provides better habitat value for the money expended. The following two land acquisition examples were not required pursuant to ESA requirements, but were carried out pursuant to National Environmental Policy Act compliance.

Construction of New Waddell Dam in 1992 and the modification of Camp Dyer Dam on the Agua Fria River northwest of Phoenix, resulted in the loss of 22 acres of cattail (*Typha* spp.) wetland habitat. Reclamation acquired 80 acres of wooded wetland, known as Cook's Lake, as mitigation for this loss. Cook's Lake is located along the San Pedro River approximately 2 miles downstream from the confluence of Aravaipa Creek. In addition to the 80 acre parcel, Reclamation acquired an additional 70 acres of floodplain habitat as buffer.

Management of this parcel has been a continuing challenge for Reclamation. Land management responsibility is not part of Reclamation's mandate and we are inadequately staffed to provide the necessary oversight required to protect the site. As a result of the lack of onsite management, trespass cattle have been a continuing problem at Cook's Lake. Reclamation hopes to contract out the management responsibility for Cook's Lake this year and provide better protection for this valuable riparian habitat.

In September 2001, Reclamation purchased 160 acres of habitat along Posta Quemada Wash near Colossal Cave Park, Pima County, Arizona as mitigation for subjugation of approximately 1,584 acres of land on the Fort McDowell Indian Community (FMIC). The original mitigation (implemented in 1992) was the establishment of a preserve within the FMIC reservation. In April 2000 FMIC asked the Secretary of the Interior (SOI) to move the mitigation off-reservation. The farm project was part of FMIC's water settlement act legislation and they believed that, as such, they should not be responsible for mitigation. The SOI complied with the request and Reclamation was placed in the position of looking for replacement habitat.

The original mitigation property consisted of approximately 300 acres (½ mesquite and ½ upland Sonoran Desert scrub habitat). I originally wanted to replace the mitigation with acquisition of cactus ferruginous pygmy-owl (*Glaucidium brasilianum*) habitat. I met with Federal and County biologists from Tucson to inquire (1) if there were parcels of land for sale that met my mitigation needs and (2) would one of the agencies be willing to manage the property, at no cost, for Reclamation. During the meeting, the parcel on Posta Quemada Wash was mentioned. It was a high priority acquisition for Pima County due to its value as a wildlife corridor.

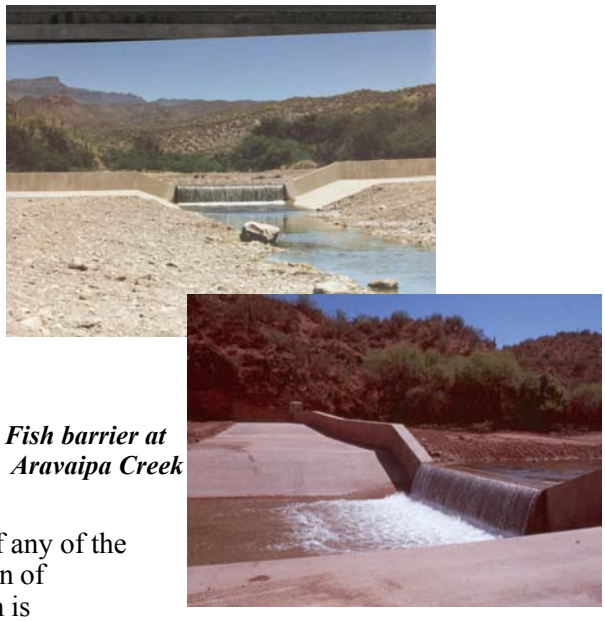
The parcel and the surrounding area had been identified by members of the Science Technical Advisory Team for the Sonoran Desert Conservation Plan as an area with high biodiversity. Three important habitat elements were present in the area (1) limestone habitat that supports unique and rare caves as well as endangered or sensitive cacti,(2) riparian vegetation that provides important habitat for migratory songbirds, and (3) a large block of unfragmented habitat that serves as an important corridor for plants and

Aerial view of Cook's Lake.

animals. Based on the opinion of these local experts, I believed that the habitat values provided by the Posta Quemada Wash parcel were greater than the value of the original mitigation site. Reclamation was able to negotiate the purchase of the property from the private landowner and Pima County will be responsible for the day-to-day land management duties.

In these changing times of smaller government and reduced funding levels, it is sometimes difficult to provide high quality mitigation. Reclamation (at least Phoenix) is moving away from small, isolated mitigation parcels and trying to develop mitigation opportunities in concert with other organizations or that complement existing preserves. In that respect, I have one final mitigation story that, as of yet, has no ending.

As I mentioned at the beginning of this article, the Phoenix Office will be constructing approximately nine fish barriers over the next 15 years. The fish barriers are required pursuant to an ESA reconsultation on the Gila Opinion. Despite the fact that the fish barriers themselves are a sort of "mitigation" for impacts to native fish; construction of the barriers will result in habitat impacts which Reclamation believes should also be mitigated. Impacts from these barriers range from less than one acre to 20 acres. I believe it would be a waste of federal money and time to provide mitigation at each barrier site. So I have proposed that all the mitigation be combined and performed in one location within the Gila River drainage basin. Reclamation is looking to acquire or place conservation easements on approximately 160 acres of riparian habitat as mitigation for construction of the fish barriers. We intend to complete this mitigation prior to December 2002. The mitigation will be implemented prior to construction of any of the barriers (with exception of Aravaipa Creek, which is completed). This is a new step for Reclamation's Phoenix Office. We have never mitigated a project so far in advance of the construction. However, we believe that the preservation of such a large parcel of land will provide much greater benefits than several smaller isolated mitigation projects. In addition, we hope that the one-time acquisition will also provide some cost savings to the Government.



Fish barrier at Aravaipa Creek

Reclamation has been viewed as being primarily responsible for much of the losses to riparian habitat due to dam construction. The agency is currently expending large sums of money to implement the requirements in biological opinions on native fish and the southwestern willow flycatcher. Reclamation's biologists are working hard to see that the money is spent on productive mitigation efforts. Only time will tell.

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WILD AND SCENIC RIVERS IN THE GRAND CANYON ECOREGION

Joel C. Barnes, Faculty, Prescott College

WHY DESIGNATE GRAND CANYON'S WATERS WILD AND SCENIC?

For those who experience the Grand Canyon intimately, the river and its tributaries come to represent the heart and soul of the place. These waterways are largely responsible for carving the Canyon's magnificent landscape over millions of years and, like a keystone species, these riparian corridors have evolved into a textbook example of a keystone habitat in that they support an unusually high percentage of the Canyon's biological diversity (Stevens et al. 1999). We also know that these waters have had a formative influence on the cultures who have explored the Canyon, from prehistoric hunter gatherers to hikers and boaters of the new

millennium. With estimates of Arizona's remaining healthy riparian habitat being low (Ohmart and Anderson 1986), Grand Canyon's waterways represent an extensive and relatively intact system of aridland riparian habitat. A living vestige of our Southwest natural and cultural heritage, they are prime candidates for Wild and Scenic River (WSR) designation.

That the Colorado River and its tributaries in and around the Grand Canyon have yet to be honored with WSR designation comes as a surprise to many, even those actively involved in river conservation. One could easily assume that the spectacular Grand Canyon Ecoregion contains the Southwestern gems of the National Wild and Scenic River System (NWSRS). In fact, WSR designation has eluded a number of our most notable wildland river systems here in the arid Southwest including the San Pedro, Agua Fria, Hassayampa and yes, the Grand Canyon's share of the Colorado. A glance at the continental distribution of the NWSRS reveals that the northwestern states, including Alaska, account for nearly half of the WSR rivers, many of which were being dammed, dredged, diked, diverted and degraded at an alarming rate throughout the mid-1900's. To lend balance to this history of use and abuse of our waterways, Congress created the NWSRS. In October of 1968, the freshly penned Wild and Scenic Rivers Act (henceforth, "the Act") pronounced,

> *It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. The Congress declares that the established national policy of dams and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes.* (IWSRCC 1999)

Photograph by Giancarlo Sadoti

The fact that the Colorado River and its tributaries in Grand Canyon are already protected by their national park status is cited by managers and conservationists alike as reasonable cause for not pursuing WSR designation to date. However, increasing pressures on the biological and social resources of our national parks have prompted a search for new strategies to protect and conserve federal rivers and streams. Several aridland national park units – Zion and Bryce National Parks and Natural Bridges National Monument – have recognized WSR designation as a viable conservation strategy for protecting their water resources, and have initiated WSR studies for selected waterways (USDI 1996, 2000). Indeed, the Act is potentially as significant to the water resources of parks as the Wilderness Act is to our land resources, and provides the most comprehensive legal protection available for the instream values of rivers.

Unfortunately, our very own Grand Canyon tributaries have joined the list of examples of park resources threatened by development beyond park boundaries. Impacts on these desert riparian jewels from regional groundwater pumping has been acknowledged by geohydrology experts, and despite commendable efforts to mitigate them, these threats are still very real (Barnes 1999). The delicate hydrologic regimes of these seeps, springs and low base flow tributaries will be compromised, as will the stability of the rich biological diversity they sustain. Increasing negative impacts on southwestern riparian systems from groundwater pumping are inevitable unless watershed scale conservation strategies are developed to mitigate them. In this light, WSR designation would add a critical layer of legal protection focused specifically on the water resources of Grand Canyon National Park (GCNP).

Over the past three decades, southwestern riparian systems have been identified time and again as an endangered ecosystem of North America (Ohmart and Anderson 1986, Noss 1997). These riparian ecosystems have continually suffered as water demands increase. This situation calls for a regional and systems approach to water resource conservation, one that recognizes the interconnections between arid land river systems and their surrounding watersheds. Thus, a successful conservation strategy for the waterways of GCNP should embrace a regional river system and watershed based approach to WSR designation, as opposed to

the segment-by-segment approach adopted in most WSR proposals. The segment-by-segment approach has proved to be a painfully slow political process, and overlooks the central ecological function of rivers in aridland ecosystems. A Grand Canyon Ecoregion WSR omnibus bill would protect a contiguous portion of the Colorado River system, dramatically increase protection of the region's biodiversity, and place these aridland waters at the heart of a regional conservation strategy. Such WSR omnibus bills have been successfully passed into law in Michigan, Oregon and Alaska (Raffensperger 1993).

What Would WSR Designation Do for the Ecoregion?

WSR designation in GCNP would mandate protection for the exceptional natural and cultural values of the Colorado River main stem and tributaries, particularly those "outstandingly remarkable values" (ORVs) identified in the eligibility and suitability steps of the WSR Study Process. The Act also recognizes preexisting types and levels of river recreation where they do not conflict with the existing goals of river management. However, the Act does not freeze the status quo in a river corridor when it is designated. Rather, the Act codifies a "nondegradation and enhancement policy" for all designated river areas, regardless of classification. These details are mentioned here to elucidate important differences and similarities between the Colorado River main stem and the tributaries in terms of the biopolitics of WSR designation and management.

For example, by identifying ORVs along the tributaries that are directly dependent upon existing base flows (e.g., riparian vegetation, wildlife and fish), the WSR study process could help set a legal stage for protecting future in-stream flows of the seeps, springs and tributaries in and around Grand Canyon. Since the Act acknowledges existing river management goals, designation would not impose any significant influence on the scheduled flows (essentially Glen Canyon Dam releases) of the Colorado River. The existence of Glen Canyon Dam would not violate the "free flowing" criterion of the Act (it isn't all that uncommon, particularly in the east, for dams to be just up or downstream of a WSR segment). More importantly, in regard to the Colorado River main stem, designation would finally put to rest any of the dam proposals that still roam the halls of Congress. The Act would provide the highest level of legal protection available to ensure that no dam projects from Washington would materialize in the Grand Canyon.

The Act's allowance of preexisting types and levels of river recreation where they do not conflict with the existing goals of the rivers management, could be interpreted to be in support the controversial status quo of commercial use on the river (including large motorized trips). However, popular interpretation of the Act states that WSRs are managed primarily for the values for which they were designated (IWSRCC 1999). Additionally, the Act codifies a nondegradation and enhancement policy for designated rivers, and directs administering agencies to improve conditions in river corridors where necessary. Therefore, identifying (in the WSR Study Process) the unique wilderness values that enhance river recreation on the Colorado River through Grand Canyon would establish important legislative and management connections between the park's (currently proposed) Wilderness and its Wild and Scenic Rivers.

The WSR Study Process

The WSR Study Process involves three steps – eligibility, classification, and suitability. For a waterway to be eligible for WSR designation it must be free flowing and exhibit one or more "outstandingly remarkable values" as described in the Act. Once a river or stream segment is determined to be eligible, it is then given a tentative classification of either "wild," "scenic," or "recreational." These categories reflect levels of development and natural conditions along a river segment. Finally, the suitability step evaluates the consequences of designation and the manageability of the river if it is designated, which would consider biological, political and economic factors.

Coordination, Cooperation, and Public Involvement

The collaborative process of WSR designation will encourage regional coordination and help build partnerships among federal and state agencies, tribal nations, NGOs, and commercial and private river users in the interest of the protecting the waterways of the Grand Canyon Ecoregion. The WSR study process also includes opportunities for public review and input on preliminary findings and decisions. During the eligibility step, any group or individual can submit nominations for rivers to be considered, as well as any information that would help in evaluating rivers already being studied. The Grand Canyon Ecoregion WSR preliminary findings of eligibility and classification will be presented to federal agencies and state, tribal and local governments, conservation and user groups, and the interested public for review and comments. Although no official time frame has been adopted by GCNP for this WSR Project, preliminary findings may be completed as early as Spring 2002.

At What Stage Is the GCNP WSR Project?

The bulk of the Research Partnership thus far has focused on

eligibility of the tributaries. Since September 1998, Prescott College has coordinated with GCNP resource staff to conduct four river-based and three land-based research trips to assess the resource values of selected tributaries. The overall research design and methods are based on existing WSR research and guidelines established by the Interagency WSR Coordinating Council. The objective of our field work is to conduct systematic qualitative assessments of the main stem and selected tributaries. These assessments use specific criteria to evaluate the resource values put forth in the Act. Each river research trip enlists 12 advanced undergraduate Prescott College students as research assistants organized into three research teams. One team evaluates the geology, geomorphology, and hydrology, another team evaluates the wildlife, vegetation and ecology, and the third evaluates the recreational, scenic, and cultural values of each tributary. Our river trips have embraced a dual agenda of conservation research and education. Visiting scientists and park resource staff present lectures on topics that inform our field work, and help students consider the biological, management, political and social implications of the project.

Exemplary students from past river research trips have been selected to conduct land based research trips of tributaries more accessible by foot trail. Three of these land-based trips have been completed thus far (October of 1999, March of 2000, and March of 2001). These trips employed essentially the same field research methods that were used in the river research. A series of week-long backpacking itineraries were developed to survey selected tributaries. The land-based research has made major contributions to the project, nearly doubling the total number of tributaries surveyed. The land and river field work has been supplemented by interviews with experts in relevant fields, as well as literature and GIS based research; much more work remains to be done in these areas. It is estimated that one or two more river research trips, and perhaps one more land based trip will complete the field work for the eligibility step of the WSR Study Process.

The classification step of the WSR Study Process should be relatively straight forward. Since the Colorado River and nearly all of the tributaries under study are within park boundaries and thus have little or no development along their shores, they will likely be classified as "wild."

After the eligibility and classification steps have been completed, a suitability analysis will be conducted in coordination with GCNP resource staff, federal and state agencies, and others to consider the implications of WSR designation from environmental, economic and management perspectives.

Documentation of the three steps of the WSR study process will comprise the GCNP WSR Study Report, which will likely be reviewed by NPS administration and the Secretary of Interior. As consideration for WSR designation in the Grand Canyon Ecoregion moves into the political arenas, public involvement will again be critical. The public support for Arizona Wild and Scenic Rivers that was generated from the statewide meetings held during January of 1993 is a fine example of the how public input can inform and influence the political process. Guided by sound science and open minds, the WSR designation process will help us all envision the future for one of the most extensive and relatively pristine, intact systems of arid land riparian habitat in the American Southwest.

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Editors' Note: This article is adapted from the River Management Society newsletter.

SPECIES PROFILE

CANYON TREEFROG

by Mike Demlong, Arizona Game and Fish Department, Phoenix

You're hiking in pristine riparian habitat in central Arizona, suddenly, you see a small rock jump! A rock jump? It can't be! Upon closer inspection you discover it's not a rock, but a frog! But not just any frog, it's a canyon treefrog (*Hyla arenicolor*) or in Spanish, ranita de canon.

Canyon treefrogs are one of the most commonly encountered amphibians in riparian habitats, and one of the most widely distributed amphibians in Arizona. They inhabit pinon-juniper and pine-oak forests, deserts, and semi-arid grassland ecosystems throughout Arizona. They range from the bottom of the Grand Canyon in the north, to the Huachuca Mountains in the south, and most everywhere in-between. Outside Arizona they can be found in western Colorado, southern Utah, western New Mexico, west Texas, and south into Mexico.

Arizona is home to many cryptically colored amphibians, so how can a nonherpetologist positively identify a canyon treefrog in the field or describe it to others? "It looks like a rock" is a suspicious and inadequate description, nor does it do justice to this splendid frog. Adult canyon treefrogs are relatively small, approximately 1 to 2 inches from the tip of their snout to their vent opening. They are one of the smaller species of amphibians native to Arizona. For those who are poor estimators of size, the largest canyon treefrog you might encounter is smaller than the width of a credit card.

Although they are commonly known as "frogs," the skin on their back (the dorsal surface) is mostly rough and "warty" like a toad, perhaps explaining why they are also referred to as treetoads. Skin color varies greatly between individuals and geographical populations. Dorsal colors range from brown, grayish, cream, olive-gray, sometimes even a little pinkish, and closely resemble the colors of the nearby rock formation. The specific epithet (Latin species name) for the canyon treefrog translates to "sand color" (*arenicolor*; *arena*=sand, *color*=color or tone). In addition to their cryptic ground color, they usually have irregularly shaped, darker colored blotches on their dorsal surface. Occasionally some individuals or entire populations may have no blotches. The underside (ventral surface) of canyon treefrogs, and many other amphibians, is light in color (white or cream). But the light ventral coloration in canyon treefrogs gradually transitions to bright yellow or orange on the hind legs, colors only visible when they move or jump. Adult males and females are similar in color and pattern, with the exception that males have a darkly colored (e.g., gray, black, or brown) throat area.

Still not sure if you have a canyon treefrog? Take a closer look at its feet. Like many other frogs and toads, canyon treefrogs have webbing between the toes on their hind feet but no significant webbing on their front feet. The definitive identification characteristic of canyon treefrogs is the large circular pads on the end of each toe. Humans with a vivid imagination claim the feet are "gremlin-like." These circular, adhesive pads allow them to climb vertical surfaces (e.g., boulders and trees). A useful adaptation for escaping potential predators, searching for prey or finding the optimal calling location.

Canyon treefrogs are riparian obligate species, never far from the vicinity of water. They live along temporary, intermittent, and permanent streams, springs, arroyos, rocky canyons, and tinaja pools. If water, large boulders, and bedrock pools are present, canyon treefrogs are likely living nearby. But to find one you'll have to be observant. In riparian areas they're often found clinging to the vertical face of a boulder, tucked inside a rock crevice, or on a tree trunk or

Canyon treefrog photo and U.S. distribution map are from the USGS's Online Checklist of Amphibians and Identification Guide found at http://www.npwrc.usgs.gov/narcam/idguide/.

limb, often within an arm's length. You practically have to put your foot or hand on them before they move, relying on their stealth coloration to avoid detection by predators.

On more than one occasion while hiking the appropriate habitat, I usually hear the male(s) calling before I see them. Males readily call during the day from rock crevices surrounding a pool of water. Listen for a series of abrupt short notes, described by some as sounding like the ba-a-a of a hoarse lamb or goat, the quack of a duck, or a single-pitched whirring sound. The call is often amplified and reflected by the acoustics of surrounding boulders or deep crevice the frog is hidden within. If you find a calling male, keep looking, other treefrogs of both sexes are likely nearby.

Canyon treefrogs are usually active from February or March to October or November, depending on air temperature and elevation. Air temperature, elevation, and precipitation events also stimulate the onset of their breeding season. Canyon treefrogs breed primarily during the monsoon season (July to September), but have been known to breed in the early spring (March). After attracting a receptive female with his advertisement or mating call, the male grasps her in amplexus, then fertilizes the female's eggs as they are released from her vent opening into the water. Females may lay 100 or more eggs in a single mass, which may be attached to submerged vegetation or debris, or float on the water surface. Each egg is composed of a clear jelly coat, surrounding a black embryo suspended in the center.

Depending on the water temperature in the pool, fertilized eggs hatch in less than two weeks, and tadpoles metamorphose into froglets in less than 2 months. In color and shape, juvenile canyon treefrogs look like miniature adults. Juvenile and adults frogs are much easier to identify as canyon treefrogs than their larvae (tadpoles). Differentiating between the larvae of frog and toad species is difficult without the aid of a good field guide and magnifying glass to examine their minute mouth parts. If you discover a pool of water with tadpoles in a boulder strewn stream or rocky canyon pool, there is a pretty good chance they are canyon treefrogs. Tadpoles from eggs laid late in the season may delay metamorphosis, overwintering as larvae and completing their life cycle the next spring. Canyon treefrog larvae are primarily herbivores, sometimes observed actively "grazing" on algae covered rocks or detritus at the bottom of the pool. Once they metamorphose into frogs, they become carnivores, feeding on a variety of terrestrial and winged insects and other invertebrates.

Although no specific studies have been conducted in Arizona, incidental observations suggest canyon treefrog populations are stable in Arizona. However, their conservation status could quickly change as they are susceptible to the same factors causing amphibian populations to decline worldwide (e.g., ozone layer depletion, pollution, chytrid fungus, habitat loss and degradation, introduction of non-native species). They are not federally listed as threatened or endangered, nor do they receive special conservation status from the Arizona Game and Fish Department. However, like other amphibians in Arizona, canyon treefrogs are offered some protection by Arizona Game and Fish Commission Order 41 (amphibians). Commercial trade in this species is prohibited in Arizona, but individuals with a valid fishing or combination license may collect up to 10 per year, or have a total of 10 in their possession for personal use. Canyon treefrogs are often kept as pets or used for educational purposes in schools, zoos, or museums. When properly housed and cared for these common frogs live for many years in captivity.

We can all help ensure canyon treefrogs remain common throughout their range, by continuing to advocate for healthy and naturally functioning riparian ecosystems.

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WATER RESOURCES AND SUSTAINING RIPARIAN AREAS

16th Annual Meeting, April 26-27, 2002

Rancho de los Caballeros
1551 S. Vulture Mine Road
Wickenburg, Arizona 85390

This year's annual meeting will be held in Wickenburg at the Rancho de los Caballeros (http://www.sunc.com/). The theme is *Water Resources and Sustaining Riparian Areas*.

- ★ Rich Campbell will cover some of Arizona's basic water law and its history;
- ★ Some policies set by various agencies to recognize the connection between surface and groundwater, e.g., one developed by the Tonto National Forest that is now being implemented regionally and may become national Forest Service policy;
- ★ John Munderloh will speak about the Prescott area and Verde River issues;
- ★ This plenary session will be followed by the general session of contributed papers and posters;
- ★ We are planning dinner for Friday evening at the Hassayampa Preserve;
- ★ There will be field trips in the Wickenburg area on Saturday.

We have requested a block of rooms at the Best Western Rancho Grande, 293 E. Wickenburg Way, Wickenburg, AZ 85390. The cost is $68 per person for a single or $78 for a double, plus tax. They'll hold the rooms at that rate until April 4th. Their toll-free number is 1-800-854-7235.

The Call for Papers is on our web site at *http://aztec.asu.edu/ARC/2002Call.pdf* to print out and submit or just submit online at *http://aztec.asu.edu/ARC/2002call.htm* Registration information will be sent out soon and will also be online as a pdf to print out and submit.

Hope to see you there!

ISSUES TO VOTE ON AT THE MEETING

At the 16th Annual Meeting of the Arizona Riparian Council we are to elect a new President and Vice President as Kris Randall stated in her President's Message (pg. 2). We also, after many years, have to decide on a dues increase and change in structure from just an individual membership to include an institutional membership that will allow an agency or business to designate specific individuals as members.

This increase in dues request is because of increases in the cost of the publication of this newsletter. Paper costs and postage have risen quite a bit since we raised our dues back in 1988 to $15. I know that people read it and enjoy it and want to keep publishing it, but.....

We are still one of the few purely volunteer organizations and do not receive any outside funding. Our only source of funds is through membership dues and meeting registrations. The Center for Environmental Studies provides a lot of my time that is devoted to the Council and that is greatly appreciated. All of the funds that we do receive are used to produce the newsletters and fact sheets, and conduct the Annual Meeting and the Fall Campout Get-Together.

Since we will be raising the dues it is an ideal time to please renew at the $15 rate before it increases. **Also, if dues are not paid this year you will no longer receive this newsletter.** So check your address on the newsletter. If it says Please Renew, 12/2001, or anything other than 12/2002, 12/2003, etc., you need to renew. Send your check made out to the Arizona Riparian Council to Cindy Zisner (address at end of newsletter). Please include your name, address, phone, fax, email, and how you can help the Council. If there isn't any designation please contact me at (480) 965-2490 or Cindy.Zisner@asu.edu and I'll check the records for you.

LEGAL ISSUES OF CONCERN

Richard Tiburcio Campbell, Law Offices of Withey, Tobin, Anderson & Morris, Phoenix

ARIZONA SUPREME COURT RULES IN FAVOR OF SUSTAINABLE RANGE STEWARDSHIP

On November 21, 2001, the Arizona Supreme Court held that the Arizona State Land Department (the Department) must consider restoration of range land as a legitimate use of Arizona school trust grazing land. *Forest Guardians v. Wells*, 34 P.3d 364; 2001 Ariz. LEXIS 206 (2001). As a result, State Land Commissioner Michael Anable must now determine whether Forest Guardians' high bids for a number of leases on thousands of acres of school trust grazing land, made for the express purpose of rangeland restoration, are the best use of the lands in regard to the school trust and its beneficiaries. If so, the Commissioner must accept the bids and issue the leases to Forest Guardians.

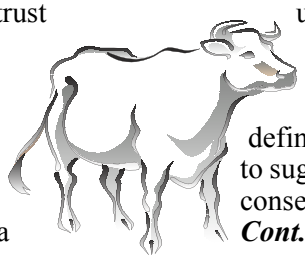
The events leading up to this decision involved Forest Guardians' 1997 application for 10-year leases of school trust grazing land in Coconino County, Santa Cruz County, and Pinal County. In Coconino County, one rancher applied to renew a lease to graze 85 head of cattle on 5,000 acres for $2,150. Forest Guardians's bid offer was nearly twice the amount.[1] In Santa Cruz County, Forest Guardians' bid was five times as high as the renewal bidder's offer of $50.16 per year for 162 acres of State-classified grazing land.[2] At no time did Forest Guardian express an intent to actually graze livestock on any of the state trust grazing lands. Rather, Forest Guardians proposed to "rest" the property from what it claimed was overgrazing, "thus making it more valuable for future grazing." Relying on the state and federal statutes controlling administration of the trust, the Department rejected the bids because they failed to demonstrate an intent to use the lands for the purpose for which they were classified. The Department advised Forest Guardians to apply for a reclassification of the lands to "commercial use" (the Department argued commercial use encompassed restoration use) and then bid for them. Forest Guardians refused to do so, citing the higher cost of leasing commercial use lands, and the case ultimately ended up before the Supreme Court on appeal, with Forest Guardians represented by the Arizona Center for Law in the Public Interest.

The Court's resolution of the issue required a review of the federal and state statutes controlling administration of the school trust. The federal Arizona-New Mexico Enabling Act (the Enabling Act), passed by Congress in 1910, authorized the formation of state governments in the Arizona and New Mexico territories. By the Enabling Act, Congress granted Arizona 10 million acres of land to be held in trust for the support of the State's schools.[3] Thus, the Department holds title to such lands as a Trustee. The Arizona Constitution Article X, §§ 1-11 incorporates the Enabling Act into state law.

The Enabling Act requires that all dispositions of trust land (by sale or lease) be made for not less than fair value. Trust lands may be leased for a 10-year term without prior advertisement and public auction pursuant to a 1950 amendment to the Arizona Constitution. However, all leases of trust land require that an application be filed.[4] Once the application is received, the Department reviews whether the property has been classified for a use consistent with the application. If not, the application is rejected, which is what the Department did with Forest Guardian's application after deciding that its bid for "non-use" of the land was inconsistent with the land's classification as grazing land.[5]

The Supreme Court disagreed with the Department's decision for a number of reasons. First, the Court found that Forest Guardians was not seeking to change the long-term use of the land from grazing to commercial use, thus its application was not inconsistent with the Department's classification of the lands in question for grazing purposes. The Court also found that conservation and restoration did not conflict with grazing use in general. Particularly persuasive to the Court was Forest Guardians' testimony and photographs of over-grazed school trust land (referred to as "moonscapes" by Forest Guardians). The evidence appeared to convince the Court that resting this land for a period of years, coupled with restoration activity (i.e., fencing off the land to livestock, human access, tree planting), was to the long-term benefit of future grazing lessees.[6]

The Department countered that Forest Guardians was simply trying to obtain the land at a grazing rate when non-use could command a higher rate if leased at commercial rates.[7] However, the Court found this argument inconsistent with the Department's adoption of regulations permitting a grazing lessee to apply for a non-use permit in order to rest the land.[8] Moreover, the Court found nothing in the Department's definition of commercial use to suggest it encompassed conservation and restoration



Cont. pg. 14 . . . . . Legal

NOTEWORTHY PUBLICATIONS

Jere Boudell, Department of Plant Biology, Arizona State University

Horton, J. L., Kolb, T. E., and S. C. Hart. 2001. Physiological response to groundwater depth varies among species and with river flow regulation. *Ecological Applications* 11(4):1046-1059.

Woody species in Southwestern riparian ecosystems are often phreatophytic. Trees such as *Populus fremontii* and *Salix gooddingii* need to stay in contact with groundwater or suffer dieback and eventual death. To maintain communities containing these trees, depth to groundwater must not exceed root depth. The invasive exotic *Tamarix chinensis* has been described as drought tolerant because it is able to exist in areas with greater depth to groundwater. This exotic has been found to establish in riparian areas that have experienced a disturbance in the natural hydrologic regime.

Horton et al. investigated the physiological condition of *P. fremontii, S. gooddingii,* and *T. chinensis* at sites along a water gradient of the dam-regulated Bill Williams River at the Bill Williams River National Wildlife Refuge in La Paz County and along the Hassayampa River at the Hassayampa River Preserve in Maricopa County. They selected seven transect sites along a losing reach at each river with site conditions ranging from perennial to ephemeral flow. Physiological measurements were collected monthly from June-August in 1997. Shoot water potential of terminal twigs was measured before dawn, at mid-morning, and at mid-afternoon. Leaf gas exchange of water vapor and CO_2 was measured at mid-morning and mid-afternoon. Before leaf senescence occurred, crown dieback was measured. The physiological characteristics of leaves and the canopy condition of each species were related to depth to groundwater (DGW).

Extremely dry conditions occurred during the summer the physiological measurements were collected. However, a marked difference in DGW and surface flow occurred at each site. A decrease in groundwater led to a decrease in water potential that ultimately led to increased canopy dieback and mortality in both *P. fremontii* and *S. gooddingii*. This mortality occurred when DGW increased above the 2.5-3 m range. However, *T. chinensis* did not experience mortality, but some water stress was detected. *P. fremontii* was more tolerant than *S. gooddingii* to increased DGW. Horton et al. were not able to detect differences between rivers in tree tolerance to increased DGW due to the presence of consistently shallow groundwater at the Bill Williams River during the time of study.

Horton et al. discuss the management implications of the results of their investigation. Altering the flow regime so that is out of sync with the timing of *P. fremontii* dispersal and in sync with the dispersal characteristics of *T. chinensis* supports the establishment of *T. chinensis* in altered riparian ecosystems. Due to characteristics of *T. chinensis* such as the ability to tolerate greater DGW it will become more competitive than *P. fremontii* and *S. gooddingii* in these altered systems. Horton et al. suggest that although river impoundment by dams does change the hydrologic regime of a river, perhaps it is the timing of flow releases from the dam that contributes to the degradation of riparian ecosystems.

George, T. L., and S. Zack. 2001. Spatial and temporal considerations in restoring habitat for wildlife. *Restoration Ecology* 9(3):272-279.

Spatial hierarchal scales influence habitat selection. Often, investigations focus on the smaller scale habitat characteristics rather than the larger characteristics. Both the larger and smaller scale habitat characteristics affect habitat selection by wildlife. To successfully restore wildlife habitat it is necessary to be mindful of this hierarchy.

George and Zack discuss hierarchal theory and habitat selection in their paper. The four main scales that affect habitat selection are regional, landscape, micro-, and macrohabitat scales. Habitat selection may vary both spatially and temporally. For example, in a relatively short time habitat selection may change in response to food availability, but regional selection is relatively stable over time. The larger-scale factors such as region or landscape limit the lower-scale factors such as foraging site. If the landscape scale is not appropriate, then the animal will not select a foraging site within the landscape even if the appropriate food is present. The authors suggest that restoration planners keep these rules in mind when planning a project.

Regional factors such as habitat loss and fragmentation will affect the distribution of wildlife. As an example, the authors discuss why wolves are not found in areas with higher road densities, but are found in areas with lower road densities. Landscape characteristics such as size, shape, and juxtaposition of patches also affect the distribution and abundance of wildlife. George and Zack discuss the habitat selection preferences of birds such as *Seiurus aurocapillus*, which are not found in habitats smaller than 3 ha. Macro- and microhabitat characteristics affect

habitat selection. It is at this scale that many habitat selection investigations have been conducted. Characteristics such as vegetation structure and composition, topographic features, and specific habitat elements of particular species are known to affect habitat selection. Finally, the authors mention that restored habitats must be self-sustaining for long-term restoration of wildlife.

In conclusion, George and Zack suggest that restoration practitioners be mindful of the interaction of regional and landscape characteristics as well as micro- and macrohabitat characteristics for successful long-term restoration of wildlife.

Legal . . . . . Cont. from pg. 12

uses, which brought into doubt the Department's advice to Forest Guardians to request a reclassification of the lands in question.[9] Furthermore, the Court openly questioned the policy wisdom of reclassifying the grazing lands for commercial use. "[T]he lands in question are far from having any use as sites for a Neiman-Marcus, a Wal-Mart, or a ski resort."[10]

Significantly, the Court noted that its decision only required the Department, pursuant to its fiduciary duty to the Trust, to "consider" the Plaintiffs bids.[11] "We are mindful that the high bid is not necessarily the best bid."[12] However, in the Court's opinion, the Department's "refusal to even consider whether Plaintiffs' offers were in the best interests of the trust was a clear violation of the fiduciary duties imposed by the state constitution."[13]

This case is significant for a number of reasons, not least of which is the fact that many of the grazing leases that the Department's Natural Resources Division's Range Section administers are expiring, and grazing leases account for 7,433,000 acres of school trust land in Arizona.[14] (The date and location of expiring grazing leases can be viewed on a County-by-County basis on the Department's website at *http://www.land.state.az.us*). By one estimate, 497 grazing leases in Pima County covering 205,068 acres will expire in 2002.[15] Forest Guardians reportedly has $50,000 committed toward leasing state trust grazing lands that encompass "biological hot spots."[16] Moreover, the case comes on the heels of similar attempts by conservation groups to bid for grazing leases on state lands in other Western states, including New Mexico[17] and Idaho[18]. Whether these circumstances could influence federal public lands grazing policy, where no auctions are held and fees are uniform, is an open question.

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1. 2001 Ariz. LEXIS 206 at *3.
2. *Id.* at *4.
3. Today the Trust controls approximately 9.4 million acres which represents thirteen percent of all the land in Arizona according to the Arizona State Land Department website: http://www.land.state.az.us/asld/htmls/aboutsld.html.
4. Arizona Revised Statute Section 37-281.
5. 2001 Ariz. LEXIS at *16.
6. *Id.* at *17-18.
7. *Id.* at *18-19.
8. *Id.* at *18, citing Arizona Administrative Code R12-5-70(O).
9. *Id.* at *17.
10. *Id.* at *17.
11. *Id.* at *27.
12. *Id., citing Havasu Heights Ranch & Dev. Corps. v. Desert Valley Wood Prod., Inc.,* 167 Ariz. 383, 392, 807 P.2d 1119, 1128 (App. 1990)("The 'best interest' standard does not require blind adherence.").
13. 2001 Ariz. LEXIS at *24.
14. Arizona State Land Department 1999-2000 annual report, cited in the Arizona Education Association's amicus brief in this case.
15. Mitch Tobin, "Giving Cattle the Boot," *Arizona Daily Star* (December 14, 2001).
16. *Id.*
17. In New Mexico, Forest Guardians also attempted to lease school trust grazing lands, as well as challenge the New Mexico State Land Department's administration of the trust. In *Forest Guardians v. Powell*, 24 P.3d 803 (App. 2001), the state court held that only the state's Attorney General, or the federal Attorney General, had the "standing" to challenge the enforcement of the trust. Thus, plaintiffs (Forest Guardians and individual New Mexico schoolchildren) attempt to sue to enforce the Trust in a more environmentally friendly manner was denied. Moreover, unlike in Arizona, the plaintiffs failed to appeal the denial of New Mexico State Land Department's lease applications.
18. *Idaho Watersheds Project v. State Bd. of Land Comm'rs*, 128 Idaho 761 (1996).

The Arizona Riparian Council (ARC) was formed in 1986 as a result of the increasing concern over the alarming rate of loss of Arizona's riparian areas. It is estimated that <10% of Arizona's original riparian acreage remains in its natural form. These habitats are considered Arizona's most rare natural communities.

The purpose of the Council is to provide for the exchange of information on the status, protection, and management of riparian systems in Arizona. The term "riparian" is intended to include vegetation, habitats, or ecosystems that are associated with bodies of water (streams or lakes) or are dependent on the existence of perennial or ephemeral surface or subsurface water drainage. Any person or organization interested in the management, protection, or scientific study of riparian systems, or some related phase of riparian conservation is eligible for membership. Annual dues (January-December) are $15. Additional contributions are gratefully accepted.

This newsletter is published three times a year to communicate current events, issues, problems, and progress involving riparian systems, to inform members about Council business, and to provide a forum for you to express your views or news about riparian topics. The next issue will be mailed in May, the deadline for submittal of articles is April15, 2002. Please call or write with suggestions, publications for review, announcements, articles, and/or illustrations.

Paul C. Marsh
Department of Biology
Arizona State University
PO Box 871501
Tempe, AZ 85287-1501
(480) 965-2977; FAX (480) 965-2519
fish.dr@asu.edu
or
Cindy D. Zisner
Center for Environmental Studies
Arizona State University
PO Box 873211
Tempe AZ 85287-3211
(480) 965-2490; FAX (480) 965-8087
Cindy.Zisner@asu.edu

The Arizona Riparian Council

Officers

Kris Randall, President . . . . . (602) 207-4509
randall.kris@ev.state.az.us
Janet Johnson, Vice President . . . . . (602) 225-5255
jjohnson/r3_tonto@fs.fed.us
Cindy Zisner, Secretary . . . . . (480) 965-2490
Cindy.Zisner@asu.edu
Theresa Pinto, Treasurer . . . . . (602) 506-8127
tmh@mail.maricopa.gov

At-Large Board Members

Matt Chew . . . . . Matthew.Chew@asu.edu
Julia Fonseca . . . . . (520) 740-6350
JFONSECA@dot.co.pima.az.us
Rodney Held . . . . . (602) 417-2400 X7012
rjheld@ADWR.STATE.AZ.US

Committee Chairs

Classification/Inventory
Roy Jemison . . . . . (505) 766-2017
rjemison@fs.fed.us
Education
Cindy Zisner . . . . . (480) 965-2490
Land Use
Marty Jakle . . . . . (602) 640-2720
Protection/Enhancement
Kris Randall . . . . . (602) 207-4509
Bill Werner . . . . . (602) 789-3607
bwerner@gf.state.az.us
Water Resources
Julie Stromberg . . . . . (480) 965-0864
jstrom@asu.edu

CALENDAR

Water Resources and Sustaining Riparian Areas, April 26-27, 2002, Wickenburg, AZ. Arizona Riparian Council 16th Annual Meeting. Call for papers deadline March 22, 2002. Contact Cindy Zisner, (480) 965-2490 or Cindy.Zisner@asu.edu for more information.

Incredible Rivers, Incredible Demands, May 1-4, 2002, Boise, ID. River Management Society meeting. Contact (406) 549-0514 or rms@river-management.org for more information.

Meeting Resource Management Needs, Fourth Conference on Research and Resource Management in the Southwestern Deserts, May 15-17, 2002, Tucson, AZ. Call for papers deadline January 14, 2002. Contact Bill Halvorson, (520) 670-6885 or halvor@srnr.ariona.edu for more information.

Scientific Issues Related to Management of Landfills in Arid and Semi-Arid Regions, June 7, 2002, Tucson, AZ. Meeting of the Arizona Hydrological Society. Call for abstracts. Visit their website for more information at www.azhyydrosoc.org.

BT5 1005
Center for Environmental Studies
Arizona Riparian Council
Arizona State University
PO Box 873211
Tempe, AZ 85287-3211

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