The Arizona Riparian Council Newsletter

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The Santa Cruz River at San Xavier - Problems and Riparian Restoration Potential

Barbara Tellman and Mary G. Wallace, University of Arizona

"From its situation, the place is destined to become the capital of this central region - a region of charming oases, and rich mineral wealth." This is how Julius Froebel in 1854, described the region around the San Xavier del Bac Mission - now about seven miles south of downtown Tucson. He described "A broad plain, mostly in a wild state of nature, covered with grass, bushes, and groves of algarobbia [mesquite]..." He goes on to describe rich agricultural lands producing wheat, squash, corn and many other crops.

Such luxuriant growth had led Father Kino to choose the site for a mission in 1692. The existence of two flowing springs made this an ideal location for a year-round community, self-sufficient in agricultural crops and with enough forage for cattle and horses. He predicted that the land was wealthy enough to support a large city of over 4,000 souls, although he feared that too many cattle had already been introduced, threatening the viability of the region.

A "bac" is a region where the river comes up from its underground course to flow on the surface for a while. This is just what the Santa Cruz River did near San Xavier, having gone underground for most of the year somewhere north of Tubac. The river again went underground before it reached downtown Tucson, to reemerge again, fed by a dependable spring. San Xavier residents can remember a perennial spring at the foot of Black Mountain in the early 1900s.

Today, the only "bacs" on the Santa Cruz River are manmade and appear at the Nogales and Roger Road wastewater treatment plants. The river once again goes underground somewhere south of Green Valley. The springs are gone. The huge mesquite bosques, visible as recently as the 1960s are gone. The cottonwood forest is gone.The lush oases around the two springs in the San Xavier region are also gone, as is most of the agriculture. The river is deeply incised near the mission and subject to massive erosion during flow events on the river. In January 1993 some 80 acres of land were washed away in a few days.

Sinkholes Appear

In the past few years, an alarming phenomenon has been observed. Over 500 sinkholes have appeared in the San Xavier District of the Tohono O'odham Nation, along the river near the mission. These holes range in size from one to forty feet wide and up to twenty feet

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Inside This Issue

President's Message

Julie Stromberg

Riparian potential- what is it and how do we achieve it?

There is a push these days to manage for "fully functioning" or "properly functioning" riparian areas, or stated another way, for riparian ecosystems with a high degree of "biotic integrity" or in "good ecological health." For example, the Bureau of Land Management (BLM) is making a concerted effort to return a large percentage of riparian areas to their fully functioning condition, and the U.S. Forest Service is hoping to attain proper function of riparian areas under their jurisdiction. What do these terms actually mean and how do we know when these conditions have been achieved?

The BLM has published a document that describes a process for assessing "proper functioning condition" (Prichard 1993). Areas that meet such a definition must have adequate vegetation, landforms and large woody debris to perform functions such as dissipating flood flows, filtering sediment, and developing channel characteristics that provide habitat for fish production, etc. However, this just begs the question: What is "adequate" ?

One way to define a fully functional state is by using antithetic reasoning; in other words, defining it not by what it is but by what it isn't. A fully functioning riparian area could be defined as one in which riparian functions are not impaired by water use practices such as groundwater pumping or river damming, or by land use practices such as floodplain clearing or cattle grazing, or even more indirectly and difficult to detect, by watershed land uses. By this definition, in order to determine when a riparian area is functioning below its optimum or has reduced biotic integrity, we need to have a reference for comparison.

A series of reference or benchmark watersheds that are managed for their natural values (i.e., in which human impacts from various land or water uses are minimal) would enable us to determine what a healthy riparian ecosystem should look and act like. The benchmark watersheds would ideally represent all of the varying types of riparian communities (although this may not be realistically possible for some types). Under these conditions, we would have an opportunity to determine the potential of each type to support plant and animal communities of varying species diversity, age class diversity, density, and cover; as well their ability to provide animal habitat, stabilize stream banks, improve water quality, recharge groundwater, moderate flood flows, recover after floods, and perform other functions. These systems would serve as benchmarks against which riparian areas managed for other purposes or impacted by various activities could be compared, realizing of course, that every riparian zone and watershed is unique in some respect.

This idea is not new. Lee and Gosselink (1988) for example, called for establishment of "reference data sets" developed for another regionally threatened wetland type, bottomland hardwood forests. More recently, Doppelt et al. (1993) have called for passage of a National Riverine and Riparian Conservation Act that, among other things, would establish a nationwide system of "Watershed Biodiversity Management Areas and Benchmark Watersheds." Not only would these areas provide a high degree of protection for critical riparian sites, these benchmark watersheds could serve as sources of material for riparian restoration efforts and also help to guide management of other riparian areas. Similar in principle is an idea proposed by Drs. Carl and Jane Bock, who have called for establishment of a program of large federal livestock exclosures (FLEX) encompassing 20% of public rangelands that would "re-impose on the western American landscape something like the environmental mosaic formerly maintained by natural ecological forces" (Bock et al. 1993).

In our own state, the Arizona Game and Fish Department (AGFD 1993) has indicated the need to identify reference systems as a means of assessing the functionality of riparian areas. Although some of us intuitively believe we can detect reduced functional potential or know a healthy system when we see one, without a reference system we really can't know for sure.

We also will never truly know the historical potential of many of our rivers. For example, portions of Aravaipa Creek today support magnificent riparian habitat, but history tells us of a greater past potential. In 1867, for example, "luxuriant vegetation fill[ed] up the space between the walls... forming in many places an impenetrable thicket.." (Hall and Bammann 1987). Reference watersheds won't restore the past, but could allow for a better future for the riparian ecosystems that sustain us in so many ways.

Some might consider this an unrealistic approach. However, with cooperation among various private and public groups, including local land owners, state and federal agencies, and academia, it should be possible to work towards identification and establishment of benchmark watersheds as well as towards identification of "sister" watersheds that are similar in geomorphology, hydrology and other ways to the reference areas.

A few potential reference watersheds come readily to mind, such as Bass Canyon on the Arizona Nature Conservancy's Muleshoe Preserve, or the headwaters of Salome Creek in the Sierra Ancha Wilderness Area. Establishment of some benchmark watersheds may require a great deal of cooperation among diverse land owners, but if nothing else, this may lead to fruitful discussion about riparian management.

These and many other ideas for riparian protection are put forth in the three recently published State Agency riparian reports mandated under State Law ARS 45-101 (The Riparian Protection Act). As these reports indicate, the "paradigm shift" to incorporate ecological principles into land and water management is well underway.

Riparian Area Advisory Committee (RAAC) Update

Riparian protection strategies continue to be the aim of the RAAC and the three state agencies assigned to develop protection strategies. Three reports have been submitted:

1. The Department of Environmental Quality studied activities that impact riparian areas;
2. Arizona Game and Fish issued its first inventory of perennial streams, based on videography and computerized mapping techniques (See page 11); and
3. The Department of Water Resources issued its study of groundwater-surface water relationships using case studies and vegetation indicator methods.

The RAAC has until July to digest and evaluate these reports and produce its own report and recommendations. For this purpose, AGFD has provided funds to allow the committee to hire a consultant to summarize riparian protection strategies as a basis for those recommendations. Public meetings will be held around the state during the spring.

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See pages 12-13 for brief reviews of some of these references.

Ecosystem Profile

Julie Stromberg
ASU Center for Environmental Studies

Fremont Cottonwood-Goodding Willow Forests Part I

When many of us visualize a riparian area, often what comes to mind is a gallery forest of Fremont cottonwood (*Populus fremontii)* and Goodding willow (*Salix gooddingii*) trees. Along low elevation desert rivers in Arizona, these species grow with honey and velvet mesquite within the Sonoran or Subtropical Riparian Forest type. These forests have undergone much loss and degradation, and grow with varying degrees of "health" along such rivers as the Hassayampa, lower Salt, lower Verde, Santa Maria, Big Sandy, Bill Williams, and lower Colorado rivers.

At higher elevations (above about 1000 m or 3300 ft) these tree species grow with warm-temperate mixed broadleaf trees including Arizona walnut (*Juglans major*) and velvet ash (*Fraxinus velutina*) to form the Fremont cottonwood-Goodding willow series of the Warm Temperate Interior Riparian Deciduous Forest (Brown 1982). Examples of this type can be found along the upper Santa Cruz River, upper San Pedro River, Sonoita Creek, middle Verde River, and others. Most of these rivers are threatened in one way or another. Riparian maps produced by the Arizona Game and Fish Department show the limited extent of cottonwood-willow forests in Arizona.

Fremont cottonwood-Goodding willow forests are best developed along low gradient alluvial desert rivers, where flow is perennial and groundwater is less than about 3 m (10 ft) below floodplain surface. The existence of a wide alluvial aquifer allows the cottonwood and willow trees to grow within the floodplain at great distances from the active channel. Although Fremont cottonwood and Goodding willow grow in close association along such rivers, careful inspection reveals they have slightly different "niches" within the riparian zone. Goodding willow is classified as an obligate wetland plant while Fremont cottonwood is a facultative wetland plant (Reed 1988), although both are riparian obligates. In comparison to Fremont cottonwood, Goodding willows are slightly less tolerant of drought, more tolerant of inundation, and require slightly shallower water tables.

The germination strategies of the two species are designed to favor these differences. Both are wind pollinated species that have male flowers on one tree and female flowers on another, and that produce thousands of tiny wind-dispersed seeds that survive for only a few weeks in spring. However, Goodding willow disperses its seeds somewhat later in spring than Fremont cottonwood. As water tables recede during spring, the moist seedling establishment zone also recedes. As a consequence, Goodding willow seedlings establish on floodplain terraces that are closer to the channel and water table than those on which cottonwoods establish. This produces a zonation in which bands of cottonwoods grow adjacent to bands of willow (often with much intermixing).

These subtle ecological differences become exaggerated on hydrologically altered streams. In past years on the Bill Williams and Colorado Rivers, for example, dam management resulted in sustained high flows that created unnaturally prolonged inundation stress. This caused selective mortality of Fremont cottonwoods, and resulted in greater relative (not absolute) abundance of Goodding willow and saltcedar (*Tamarix chinensis*). At the other moisture extreme are streams that have been diverted or pumped. These streams often support more cottonwood trees than willow trees.

A high ratio of Fremont cottonwood to Goodding willow trees can be interpreted as an index of lower water availability, because of the greater sensitivity of willows to water stress. Along the upper Santa Cruz River, for example, Fremont cottonwoods far outnumber Goodding willow in areas where ground water is pumped from the floodplain aquifer but is not replenished by effluent. Such areas occur adjacent to river reaches in which stream dewatering has completely eliminated the riparian forests.

Reduction of Goodding willow, then, can serve as an "early warning" indicator of riparian stress by indicating that hydrologic conditions (i.e. groundwater tables and soil moisture) were not suitable for the more drought-sensitive member of the riparian association. Loss of this species has significant consequences for ecosystem function. With regards to wildlife habitat, for example, witness the Southwestern willow flycatcher, a species that has been proposed for listing as an endangered species and whose habitat requirements are partially revealed in its name.

Another indication of loss of function within Fremont cottonwood-Goodding willow riparian forest is an overabundance of riparian scrub, composed of species such as burro brush (*Hymenoclea monogyra*). The upper San Pedro supports one of the best remaining examples of the higher elevation cottonwood-willow type, intermixed with extensive amounts of riparian scrub, perhaps due to past disturbances. Without suitable "reference sites" it is difficult to determine the "normal" abundance of scrub relative to riparian forests and the normal fluctuation of both types over time.

Yet another indication of loss of function is loss of age structure diversity and in particular absence of young age classes. Fremont cottonwood and Goodding willow are both disturbance-adapted pioneer species that establish in abundance only after floods. To establish, both species require short periods in which water tables are near or above the floodplain surface followed by a period in which water tables decline by less than 3 cm per day to no more than 1 m below the soil surface by summer's end. During flood years, groundwater is sufficiently high to sustain seedlings during their early life stage.

On rivers affected by groundwater pumping, water tables often decline too rapidly in spring and summer to allow for seedling survivorship. (Other factors include grazing and ORV use.) There will be too few young trees to replace old trees as they die. Saltcedar often then replaces the cottonwoods and willows. Like many exotics it is tolerant of many disturbances and stresses, including drought, deep water tables, and high salinity, and can displace the native species on dewatered floodplains. Examples of such incipient replacement can be seen on intermittent reaches at the lower end of the San Pedro Riparian National Conservation Area. This may forewarn of larger-scale replacement of the native forests by saltcedar, such as has already occurred on lower reaches of the San Pedro, Gila and other rivers where dewatering together with saline irrigation return flows and/or river damming have created conditions that favor nonnative species.

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Part 2- Floods, succession and climatic fluctuations - in the Spring Issue

Cottonwoods, Willows and Saltcedars - A View From the (Hopefully) Distant Past

"The word is pronounced as though spelled free-at-o-fite, with accent on the at. In the Southwest it is pronounced with auxiliary hisses of loathing, disgust, and possibly frustration. The hisses are especially fervent in New Mexico and Arizona, but all the irrigation states are united in their hatred.

Phreatophytes are worthless plants, mainly trees such as salt cedars and cottonwoods and willows, that consume water from underground which would otherwise be available for irrigation.

In 14 states phreatophytes use at least 25 million acre-feet annually and produce nothing but trouble. If they were not there probably 15 million feet of this water could be pumped from wells, diverted from streams or impounded in reservoirs for crop production....

And the problem is getting worse. Phreatophytes are infesting more and more land, encroaching on reservoirs, choking river beds, depleting water supplies of established irrigation districts, and creating new flood hazards for large areas that include such important cities as Albuquerque and Phoenix..."

Ernest Douglas. Phreatophytes: Water Hogs of the West. 1954. *Land Improvement* pp 3-12.

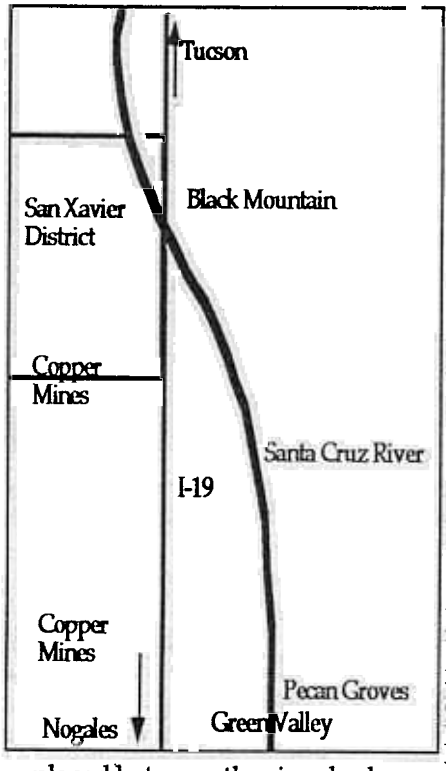
San Xavier from page 1
deep. They often appear suddenly. Farm Manager, Clifford Pablo said one was discovered when a man on a horse fell into one, another when a tractor plunged downwards. As we walked through the area, Pablo warned us to stay away from the sides of the holes.

Tribal Chairman, Austen Nuñez, told us that all attempts to revive agriculture in the area will be halted until the reason for the sinkholes has been found and the area is safe again for people and farm equipment. A consultant has mapped the holes in the agricultural region, but further work is needed to determine the cause.

Steve Slaff, of the Arizona Geological Survey, says there are a number of possible causes - all of them of human origin. Historic groundwater pumping is a definite possibility. In 1992 the mines (ASARCO) pumped about 20,000 acre feet (af) just south of the area. Agriculture (FICO) used another 30,000 af farther south along the river. The City of Tucson has a major well field to the east of the region, but with the arrival of CAP is no longer pumping there.

Other contributing factors could be the loss of the great mesquite bosques in the region. As the trees died from a falling water table, the spaces formerly occupied by their roots became empty as the roots rotted away. This would leave voids in the form of tunnels (and the holes often connect as if they had underground tunnels.)

Another possibility is alteration of the floodplain. The river seldom overflows its banks as it did normally in the old days when the course was shallow. Even if it did, its ability to flow over the floodplain is greatly reduced by I-19, the freeway to Nogales. This road was



placed between the river bed and its floodplain. Two bridges further constrict the river's course. Complex underlying geology could explain the tunneling effect, if the tunnels in fact lead under the freeway to the riverbed. Piping may also be occurring where water is traveling to a much lower water level beneath the river.

A final possibility could be soil compaction caused by alternate wetting and drying of the soils in farming operations. Alluvial soil such as this often contains a mixture of clay and sand, with the clay forming tiny bridges between sand particles during dry periods, when the land would be solid. When the soil is moistened, these bridges tend to collapse leading to breakage. (See Slaff's book, mentioned on page 13 for a good description of this phenomenon.) The area has not been farmed for several years, but the land has been kept tilled in preparation for a return to farming when CAP water is available.

The answer to the question of what caused the sinkholes is likely to be a combination of one or more of the above factors. If it is truly subsidence due to pumping, it will be the first documented case in the Tucson Valley.

Riparian Habitat Restoration?

Historic photos in the tribal office are a sad reminder of what once was. It is probably impossible, even with abundant water, to return the land to its previous state. Nuñez, however, has ideas for riparian restoration. Under the Southern Arizona Water Rights Settlement (SAWRSA), the district has rights to 76,000 af of water annually from several sources. The CAP aqueduct has been completed to the area but deliveries have not begun. There is disagreement between the San Xavier District and the Tohono O'odham Nation on how best to use that water. Agriculture in the area will not be reopened, at least until the sinkhole problem is solved. Nuñez would like to see CAP water used to restore riparian habitat. A recharge project in the river south of the mission,

including recreation of a cottonwood-willow forest along the river, using inflatable dams and other structures. This would be a challenge, given the present deeply incised nature of the channel. Other possibilities include an artificial wetland, simulating previous conditions where the springs were, recreational (e.g., birding) ponds or lakes, and release of sall amounts of CAP water to the various tributaries leading to the river itself. Commitment of San Xavier residents, the availability of of CAP water and of Bureau of Reclamation environmental mitigation funds could make some of these ideas a reality. If done in cooperation with other entities, recharge credits could be obtained to contribute to the basin's water balance.

If pumping is a major causative factor for the sinkholes, this issue will surely rise in the current negotiations underway about the terms of SAWRSA. Although strong advocates for CAP, neither the mines nor the pecan growers have been willing as of yet to buy CAP water. This could be the push they need to share in the burden of balancing the basin's water supply. The San Xavier District (separate geographically from the main Tohono O'odham Nation) has never felt that they were treated fairly in SAWRSA and recently voted to begin the process of separation from the Nation. Further, in January 1993, 32 landowners on San Xavier filed suit against the City of Tucson, FICO and ASARCO: protesting terms of SAWRSA.

Riparian habitat restoration could be one positive step in the not too distant future if all parties involved joined in a mutually beneficial project. The availability of a CAP Riparian Trust Fund, along with more than enough CAP water could make all the difference.

Mary Wallace and Clifford Pablo watch Steve Slaff descend into one of the smaller holes.

The sinkholes will probably not go away and the river won't soon resemble Froebel's "rapid brook, clear as crystal, and full of aquatic plants, fish and tortoises of various kinds...," but something positive could be created.

Ed Note: "Sinkhole" is not an accurate term, but it is the best we have at this point.

Upper Santa Cruz River Monitoring Results Coming In

In previous issues, we have described the volunteer Friends of the Santa Cruz River (FOSCR) water quality monitoring efforts occurring on the Upper Santa Cruz River. Preliminary results look very encouraging for the effluent dominated stream. Fecal coliform, ammonia, phosphorus and BOD all appear highest immediately below the effluent discharge point (but within State limits). Nitrite/nitrate levels are highest a bit farther downstream as ammonia is converted into these compounds. The levels drop considerably as the water moves downstream over and through sand, rock and vegetation. The distance within which all these levels drop is much shorter than would be expected from models of this cleansing process reported in the water quality literature.

Samples were also tested for the presence of metals. With only two exceptions, the amounts were below State standards. In May, copper and cadmium exceeded these standards. Neither was high enough to threaten human health.

This information was taken from *The Flow*, newsletter of FOSCR. For more information, call Sherry Sass at (602) 398-9093.

Theses and Dissertations

Survey of Selected Western State Programs for Improving Arizona's Evolving Riparian Protection Program
Virginia Norcross Coltman

Arizona's riparian areas, the "ribbons of green" within and adjacent to drainageways, are some of the richest ecosystems in the state. Riparian areas have diminished drastically in number due to human and natural causes, and are considered Arizona's most threatened natural community.

In the arid Southwest, riparian areas perform important ecological functions and provide benefits similar to those of wetlands in more humid regions of the country. Yet no single federal law has been enacted to protect wetlands and riparian resources. The Clean Water Act is the principal law regulating wetlands, but it fails to encompass the protection of most riparian areas.

In the absence of federal protection, Arizona is in a key position to influence and develop protective strategies. Recent Arizona legislation has elevated the importance of riparian issues and formed the Riparian Area Advisory Committee (RAAC), charged with developing recommendations for a comprehensive riparian protection program for the state.

The thesis study was conducted to assist the RAAC decision-making process by evaluating riparian protection programs in five selected western states. A mail survey, conducted with the assistance of the Arizona Department of Environmental Quality, solicited the opinion of key experts in these states about the effectiveness of their programs. The study was successful in developing an understanding of three important areas of riparian protection: how selected states approach key issues impacting riparian areas in Arizona; what successes and failures the states have had in implementing specific protection strategies; and which strategies should be included in a comprehensive riparian protection program. The thesis defines the data collection method and documents the survey results. The body of data contained in this thesis forms a body of data to assist the RAAC process in developing a comprehensive riparian protection program.

Citizen Participation in Environmental Decisionmaking: A Study of Two Arizona Cities.
Donna Isaac Gelfand

This thesis examines citizen participation in environmental decisionmaking by studying two cases in Arizona. Flagstaff and Scottsdale, in April and February 1991 respectively, passed legislation for the protection of sensitive lands. These laws used different approaches to community involvement during the planning process. Citizen participatory techniques can invite community involvement, at all levels, or it can be a superficial exercise. The two case studies reflect this divergence of tactics.

The hypothesis of this study is that citizen participation can make a difference in environmental decisionmaking. It was assumed at the outset that Scottsdale pursued its process of environmental legislation with more open-ended citizen participation,to achieve its Environmentally Sensitive Lands Ordinance (ESLO). Another starting assumption was that to enact the Land Development Code (LDC), Flagstaff's process was more closed and limited in its efforts to involve citizens. These assumptions proved to be incorrect. However, the results of the Scottsdale and Flagstaff processes are two important pieces of environmental legislation, which will serve as examples for future municipal level environmental protection in the state.

As this study shows, a shift occurred in environmental values nationwide prompted by the continued loss of natural and nonrenewable resources. This, in turn, prompted a public outcry for greater conservation and preservation of the environment. Through this shift in perception, communities began to take an increasingly active role in determining the quality of the environment. The case studies reflect the national shift at a local scale. While both the LDC and the ESLO are specific implementation tools, they are indicative of local level policies to achieve environmental regulations.

These theses were presented to the Department of Planning in the College of Architecture and Environmental Design, Arizona State University.

Arizona State Parks News

Matt Chew
Arizona State Parks

Santa Cruz River Project Meetings Continue

Arizona State Parks is continuing to organize monthly meetings of the Santa Cruz River Corridor Project. At the November meeting, local river protection efforts deferred to international topics including the North American Free Trade Agreement (NAFTA) and related border issues. Speakers included representatives of a diverse selection of interested organizations: Jeff Land of the Border Ecology Project; Jose Matus of the Arizona Border Rights Commission; Carlos Nagel of the Friends of Pronatura; and Rebecca Bregen of the Arizona-Mexico Commission.

The December meeting focused on water rights and land use management issues, with presentations by Frank Krupp, General Manager of the Santa Cruz County Flood Control District; John Maynard of the Santa Cruz County Planning and Zoning Department; and Dennis Parker of the Pima County Natural Resource Conservation District.

The effluent-dominated Santa Cruz River supports an extensive and vigorous cottonwood-willow riparian community. The population of the area (as well as local support for river corridor protection) is presently diffuse. Significant residential developments along the river in Arizona and potentially massive population increases and infrastructure development in Nogales, Sonora are expected in the coming decade. Santa Cruz River Corridor Project meetings are held at the offices of Rio Rico Properties. For information on upcoming meetings contact Matt Chew at Arizona State Parks 602) 542-2148.

Whither the Rivers Assessment?

Arizona State Parks and the National Park Service have redoubled efforts to complete the Arizona Rivers Assessment. The project has been the innocent victim of "that sounds simple enough" optimism, and of personnel turnover trauma at the Arizona agency. There is, once again, a Streams and Wetlands Coordinator (Matt Chew). Final revisions of the data base and report text are under way. See the spring issue for an update on this project.

BLM Issues Draft of Gila Box Plan

Jeff Burgess

The Bureau of Land Management's (BLM) Safford District office has released its draft interdisciplinary activity plant/environmental assessment (IAP/EA) for the Gila Box Riparian National Conservation Area (NCA). The area, located northeast of Safford, consists of the Gila River and other perennial streams flowing through scenic, steep-walled desert canyons. Congress declared the area a riparian NCA in 1990.

The BLM's preferred alternative calls for prohibiting sand rails from driving in the Gila River in the NCA and also for reducing the number of designated roads along Bonita Creek, an important tributary, but it continues to allow livestock grazing along half of the 38 miles of perennial desert streams within the NCA.

The BLM prohibited grazing in the nearby San Pedro Riparian NCA in 1989 but it is proposing to allow it to continue in the Gila Box because it will "reduce the impact of the NCA designation upon the allotments."

The BLM's unwillingness to eliminate grazing along all of the NCA's streams may be related to the fact that the Gila Box lies within U.S. Rep. Kolbe's district. Kolbe has been a leader of the opposition to public lands grazing reform.

Another factor may be Gov. Symington's opposition to public lands management reform. His appointee to the Advisory Committee, was a rancher with permits for four of the ten grazing allotments in the NCA.

Call Jonathan Collins, NCA coordinator, at 602 428-4040 if you have questions.

Although the official comment period is closed, BLM officials say that letters to the Advisory Committee will be considered. There are only two members left out of the original seven - Tanna Thornburg (Arizona State Parks) and Dr. Pete Hawkins (U. of A.). Five new appointments have not yet been approved in Washington. Letters may be sent c/o

Margaret Jensen, Gila Resource Area Manager
BLM Safford District
711 14th Ave
Safford AZ 85546,

with a copy to Ms. Jensen for BLM.

Conferences and Meetings

The Future of America's Rivers

Duncan Patten, ASU Center for Environmental Studies

On November 4-7, 1993, the conservation organization American Rivers sponsored a conference on "The Future of America's Rivers." The purpose of this conference, held on the 25th Anniversary of the National Wild and Scenic Rivers Act, was (1) to review current national river policy and shape the direction of future river protection, (2) to celebrate the anniversary of the Wild and Scenic Rivers Act, and (3) to enhance grassroots river protection efforts. The conference was aimed at decision makers at all levels, including federal, state, and local agencies, and national, state and local conservation organizations. The themes of the conference were (1) watershed/ecosystem approach to policy decisions, (2) state and local partnership roles, (3) the need for river restoration, and (4) public awareness of the threats to rivers.

The conference program used a mixture of plenary sessions and policy session workshops. The plenary sessions included presentations by many federal agency directors, deputy directors and assistant administrators. For example, one session included Mollie Beattie, Director of the USFWS, Jim Baca, Director of BLM, Bob Perciasepe, Asst. Administrator, EPA Office of Water, as well as representatives from the US Forest Service and the National Park Service. Another session included Dan Beard, Commissioner of Bureau of Reclamation, Elizabeth Moler, Chair, Federal Energy Regulatory Commission, and a representative from the U.S. Corp. of Engineers.

The policy session workshops were organized into five concurrent sessions: National River Protection, River Science and Technology, Tools for Grassroots Advocacy, New Directions, and River Conservation on the Ground. While it was impossible to attend all sessions, there was a general theme throughout the workshops of using our present knowledge and protection activities as the basis on which to develop future protection strategies for America's rivers. The specific topics of the concurrent workshop sessions will give a clearer sense of the conference.

National River Protection. Future of the Wild and Scenic Rivers Act; Maximizing the Wild and Scenic Rivers Act; Wild and Scenic River Management: Current Status of the National System; Using the Clean Water act to Protect Rivers; and Aquatic Ecosystems and the Endangered Species Act.

River Science and Technology. Economic Values of River Protection; The Biological Significance of Aquatic Ecosystems; Connections between Rivers and their Watersheds; Watershed Restoration; and The Imperfect Science of Instream Flows.

Tools for Grassroots Advocacy. Organizing a River Conservation Campaign; Directing Media to Protect Rivers; Developing New Funding Approaches for Rivers; Addressing Environmental Opposition; and New Coalition Building.

New Directions. Protecting Fish and their Habitats; Reform Dam Operations; After the Flood of '93: Integrating River Protection Mechanisms; New Protection Strategies for Instream Flows; and Federal Land Management and the Watershed.

River Conservation on the Ground. Model Watershed Planning Efforts; Greenways and Land Trusts - the River Connection; Urban River Restoration; State River Protection; and Future River Protection.

Although I expected a meeting of this type to be a typical "preaching to the choir" meeting, I was left with a feeling of hope for rivers and riparian areas. The new bureaucrats and agency heads seem to be truly concerned with the present status of our rivers and watersheds. They sense an urgency for taking actions that will begin to reverse some of

the long-term management activities of their agencies that have resulted in deteriorated riverine ecosystems. The workshops created much discussion about using our present level of knowledge about aquatic species, riparian ecosystems, instream flows and watersheds to develop programs for river protection and restoration. It also became apparent that we must continue to learn more about the connections among the various watershed and riverine parameters to develop stronger evidence for the landscape protection approach needed to restore and protect rivers and riparian areas into the future.

The concept of watershed and riparian management was emphasized throughout the conference. Rivers are a product of the inputs from the surrounding landscape and therefore to protect rivers, we must ensure that riparian areas and watersheds are protected and/or managed properly. Buffer strips along rivers were not considered the best approach to river protection. Also, appropriate instream flows for both aquatic and riparian components of the riverine system were emphasized as critically important to long-term protection of America's rivers.

This type of conference which blended science, policy, and advocacy is an important step towards developing the synergistic relations necessary for producing a strong national policy on protection and management of river and riparian resources.

Arizona Riparian Council Fall Get Together

Cindy Zisner
ASU Center for Environmental Studies

Almost 60 people attended the Fall Campout Get Together this year (October 9-10,1993) at the Empire Ranch-Cienega Creek Conservation Area. The weather was very cooperative and it was perfect for camping. We started at the Ranch Headquarters with invited speakers describing how their various agencies evaluate riparian areas.

Ruth Valencia and Richard Winstead from the Arizona Game and Fish Department explained how the Department was conducting the statewide riparian inventory and mapping of perennial streams. The maps were prepared by digitizing information from satellite and videographic images into a computer geographic information system. Once created, the maps are checked for accuracy by ground truthing the vegetation associations.

Mike McQueen from the Safford District, Bureau of Land Management, talked about the Bureau's Ecological Site Inventory technique for evaluating riparian areas. This involves the use of an interdisciplinary team to evaluate the hydrologic, vegetational, wildlife, and soil parameters in each hydrologic section of a stream. Areas with similar measurements are grouped as ecological sites and a narrative is written about the parameters of each site. These descriptions are then added to riparian inventory maps being prepared in the district. In addition to the parameters already measured, age, class structure, plant density, and plant diversity will be added. Once all of this has been accomplished, every 10 years sites can be re-evaluated to determine trends in condition as they relate to management activities.

Completing this portion of the program were Chuck Duncan, Mark Hocken and Denis Humphrey from the U.S. Forest Service, Coronado National Forest, Safford District. They explained how they use a modified version of RASES (Riparian Area Survey and Evaluation System) in conjunction with Rosgen's Stream Classification System. They have also standardized repeat photography for their district to evaluate the quality and changing condition of the riparian area.

Following these presentations, people were on their own to explore the area. We had a delicious evening meal prepared by Tom Ohmart of Cultural Caterers and sponsored by Steven W. Carothers of SWCA, Inc. Many thanks to both of them. After dinner, we all returned to the Ranch Headquarters for a talk by Julia Fonseca from the Pima County Flood Control District about the history and present status of the Pima County Cienega Creek Preserve which is located southeast of Tucson and was established as a farsighted solution to controlling flooding downstream in Tucson.

On Saturday morning members enjoyed field trips to the Cienega Creek Preserve and the Nature Conservancy's Patagonia-Sonoita Creek Preserve.

Noteworthy Publications

Pat Ellsworth
Section Editor

BOOKS

Bates, S.F., D.H. Getches, L.J. MacDonnell, and C.F. Wilkinson. 1993. Searching Out the Headwaters: Change and Rediscovery in Western Water Policy. Island Press. 230 pp.

The authors discuss implementation of a water policy for the new West using market economics, regulation, broad-based use of scientific knowledge, and full public participation.

Caduto, M.J. 1990. Pond and Brook: A Guide to Freshwater Environments. University Press of New England. 288 pp.

This is an excellent resource for anyone engaged in environmental education for children.

Checchio, E. and B.G. Colby. 1993. Indian Water Rights: Negotiating the Future. Water Resources Research Center, University of Arizona. 93 pp.

This is a well-written and balanced overview of the history and process of Indian water rights negotiations. It describes the concerns of interested parties, stages in the process, settlement components, and case studies. Numerous references are included.

Doppelt, B., M. Scurlock, C. Frissell, and J. Karr. 1993. Entering the Watershed: A New Approach to Save America's River Ecosystems. Island Press. 510 pp.

This book represents a two-year project by The Pacific Rivers Council to develop federal policy alternatives. It recommends a national ecosystem-based watershed restoration initiative based on principles of watershed dynamics, ecosystem function and conservation biology.

Gunderson, D.R. 1993. Surveys of Fisheries Resources. John Wiley & Sons. 288 pp.

The author considers the biology of the species of interest, statistical design, and selection of appropriate survey technology.

Lyon, J.G. 1993. Practical Handbook for Wetland Identification and Delineation. Lewis Publishers. 208 pp.

The author defines wetlands, describes their functions, and presents techniques for characterizing wetlands and assessing their extent.

Marble, A.D. 1992. Guide to Wetland Functional Design. Lewis Publishers. 234 pp.

The author presents an approach to wetland design based on the Wetland Evaluation Technique (WET).

Moshiri, G.A. 1993. Constructed Wetlands for Water Quality Improvement. Lewis Publishers. 560 pp.

This is a virtual encyclopedia, helpful to anyone using constructed wetlands to improve water quality.

Satturlund, D.R. and P.W. Adams. 1992. Wildland Watershed Management. John Wiley & Sons. 448 pp.

This is the second edition of an advanced text intended for those who are not hydrology specialists.

Ward, J. 1992. Aquatic Insect Ecology: Biology and Habitat. John Wiley & Sons. 496 pp.

The author provides a detailed analysis of the evolution and habitat of aquatic insect communities.

Wilkinson, C.F. 1993. Crossing the Next Meridian: Land, Water, and the Future of the West. Island Press. 320 pp.

Ed Marston of *High Country News* wrote: "As a result of the ongoing transformation of the West's economic base and of the last election, there is a chance that the federal statutes governing the West's resources can now be changed. If those changes are to occur, there must be broad understanding of the region's natural resource issues, and *Crossing* is the perfect primer to achieve that understanding..."

ARTICLES

Ellingson, S.B. and M.R. Sommerfeld. 1992. Ionic composition of high conductance waters of the arid Southwest. *J. Arizona-Nevada Acad. Sci.* 26:156-170.

Fisher, S.G. 1992. Quitobaquito Springs revisited. *J. Arizona-Nevada Acad. Sci.* 26: 70-87.

Grimm, N.B. 1992. Biogeochemistry of nitrogen in Sonoran Desert streams. *J. Arizona-Nevada Acad. Sci.* 26: 139-155.

Minckley, W.L. 1992. Three decades near Cuatro Cienegas, Mexico: photographic documentation and a plea for area conservation. *J. Arizona-Nevada Acad. Sci.* 26: 89-118.

Wood, D.J., S.G. Fisher, and N.B. Grimm. 1992. Pools in desert streams: limnology and response to disturbance. *J. Arizona-Nevada Acad. Sci.* 26: 171-179.

These five articles are from a special issue of the Journal of the Arizona-Nevada Academy of Science dealing with the limnology and aquatic biology of the Southwest. For copies of the journal contact Dr. Stephen Williams, Dept. of Biology, Glendale Community College, Glendale, AZ 85302.

Bozek, M.A., L.J. Paulson, G.R. Wilde, and J.E. Deacon. 1991. Spawning season of the razorback sucker, *Xyrauchen texanus*, in Lake Mohave, Arizona and Nevada. *J. Freshwater Ecol.* 6: 61-73.

Peak spawning occurred from January through March when water temperature ranged from 10 to 15 C.

Demarais, B.D., T.E. Dowling, and W.L. Minckley. 1993. Post-perturbation genetic changes in populations of endangered Virgin River chubs. *Conservation Biology* 7: 334-341.

The authors report substantial genetic change in the Virgin River chub after accidental exposure to a piscicide intended to eradicate an exotic species.

Farnsworth, E.J. and J. Rosovsky. 1993. The ethics of ecological field experimentation. *Conservation Biology* 7: 463-472.

Ethical issues exist when individuals, populations, species, or ecosystems are modified or harmed in the course of scientific study. This article urges ecologists and philosophers to discuss these issues, with the goal of developing a consistent ethical foundation for field research.

Frissell, C.A. 1993. Topology of extinction and endangerment of native fishes in the Pacific Northwest and California (U.S.A.) *Conservation Biology* 7: 342-354.

The author finds that the "simultaneous decline of numerous taxa in basins not afflicted with dams or diversions suggests that cumulative damage to aquatic habitats caused by logging, grazing, urbanization, and other land uses plays a major role in icthyofaunal impoverishment."

Karr, J.R. 1991. Biological ntegrity: a long-neglected aspect of water resource management. Ecological Applications 1: 66-84.

Although a perception of biological degradation stimulated legislation on water quality, that biological focus was submerged in the effort to find easily measured physical/chemical surrogates. Currently there is renewed interest in assessing water quality by means of biological monitoring. Ecologists can contribute significantly to this effort.

Mason, W.T., Jr. 1993. Tally rack: an inexpensive counting device. *J. Freshwater Ecol.* 8: 189-191.

This article describes an inexpensive, lightweight counter based on the abacus concept. It has applications for lab and field.

Nelson, S.M., R.A. Roline, and A. M. Montano. 1993. Use of hyporheic samplers in assessing mine drainage impacts. *J. Freshwater Ecol.* 8: 103-110.

Data indicate that hyporheic sampling is an important component in the assessment of macroinvertebrate communities impacted by heavy metals.

BOOKLET

Slaff, S. 1993. Land Subsidence and Earth Fissures in Arizona. Arizona Geological Survey. 24 p.

An excellent layman's introduction to this complex subject. Order from 845 N. Park Ave. Tucson AZ. $4.50 plus postage.

News Briefs

White Mountain Hereford Ranch Belongs to All of Us

Arizona Game and Fish has finalized purchase of the White Mountain Hereford Ranch described in the Autumn issue of this newsletter. Heritage Funds paid $2.9 million of the $3.7 purchase price for the 1,362 acre property. Along with the land came buildings suitable for multiple uses and extensive water rights. Also included was a 18,000 acre grazing allotment which AGFD waived to the Forest Service with the stipulation that the riparian areas be protected and that grazing not be allowed during the winter elk season. The area will be managed for the needs of a dozen threatened or endangered species on the property, including the spinedace and bald eagle. Archaeological sites in the property will probably be managed by Arizona State Parks.

Mt. Lemmon Highway Threatens Riparian Area

Continued widening of the Mt. Lemmon Highway (in the Catalina Mountains north of Tucson) by the Forest Service threatens a major riparian community along Bear Canyon. This will be the final phase of the widening project (a 5-year effort) and the most difficult. The canyon here is narrow and botanical experts fear that any further widening (including extensive blasting and fill) will destroy a unique riparian habitat which contains the only occurrence of *Populus angustifolia* in the Catalina Mountains; a grove of exceptionally large *Cupressus arizonica* (including the national champion specimen - 20' in circumference and 95' tall); extremely large specimens of *Quercus rugosa*; the lowest elevation record for *Acer negundo*; and many indicator species. Three groups have requested that the Forest Service do a biological survey before proceeding with any further road planning. Letters in support of this should be sent to Tom Quinn, Santa Catalina District Ranger, U.S. Forest Service, Federal Building, Tucson AZ 85701. For information on the protection efforts, contact Bob Zahner at 602 578-1639.

BLM Wild and Scenic River Update

The Bureau of Land Management (BLM) has found 260 river miles suitable for Wild and Scenic River designation. These include stretches of the Virgin River, Paria River, San Pedro, Cienega Creek, Aravaipa Creek, Gila River, and others - thirteen rivers in all. Copies of the report are available for review at numerous sites throughout the state, including American Rivers, State agencies, the Forest Service and BLM offices. Copy fees are charged for those wishing their own copies from BLM offices. There will be more opportunities for public comment in coming months. Contact Steve Knox at the Safford District Office of BLM at 602 428-4040.

Interim Legislative Committee on Flooding

Look for major requests for state funds for flood control in the next legislature. An Interim Legislative Committee has made recommendations on flood damage repair and flood control projects. They are requesting more than $8 million to match federal funds. Some of the expenditures recommended include flood warning systems, channelization projects, relocation efforts, flood-proofing of homes, and purchase of flood-prone land.

According to the *Capitol Times*, Rep. Overton asked why the draft legislation didn't include dams, which "state and local officials said would be helpful to prevent flood damage." He was told that the state doesn't have jurisdiction to request dams from the Army Corps of Engineers, only local governments. So language was added offering state support to local governments for such efforts. Rep. Conner pointed out that current environmental regulations make dam building too difficult, although channelizing the Gila River would also require federal permits and probably set aside of land to make up for any removal of animal habitat as a result of channelization.

A new state employee would be added to the Arizona Department of Emergency and Military Affairs as a full-time mitigation officer, "That's the way FEMA is going.," said Barbara Corsette, Acting Mitigation Officer. "They're really pushing mitigation."

Ed. Note: When I requested a copy of the study and report from the committee co-chairs, I was told that there was no report, but was given a **very brief** preliminary summary.

Streambed Ownership

The first consultant reports are in, discussing streambed navigability at the time of Arizona statehood. (See the Autumn Issue of this newsletter.) In the case of the Salt River, the results are startling, to say the least.

While the CH2M Hill Report clearly urges caution in interpreting the data, they say "Prior to statehood, streamflow rates were sufficient to support rich riparian vegetation, fish and beaver populations, and extensive prehistoric irrigation systems...." Exploitation of the river was underway by 1912, but the river was still navigable at some times of the year. Full color maps indicate the probability that thousands of acres of urban Maricopa County fall within the 1912 floodplain, including valuable commercial properties and homes.

A public hearing will be held on February 14 (Statehood Anniversary!). Contact the State Land Department for details.

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

The purpose of ARC is to provide for the exchange of information on the status, protection, and management of riparian systems in Arizona. The term "riparian" includes vegetation, habitats or ecosystems that are associated with bodies of water or are dependent on the existence of perennial, intermittent, 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 are $10. Additional contributions are gratefully accepted.

This newsletter is published three times a year to communicate current events, issues, problems, and progress involving Arizona's riparian systems, to inform ARC members about Council business, and to provide a forum for you to express your views or news about riparian topics. The Spring Issue will be mailed in May, with the deadline for submittals April 1, 1994. Please call or write with suggestions, publications for review, announcements, articles, and/or illustrations. Information on computer disk (any type) or via E-Mail is preferred.

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Annual dues are $10.

Calendar

April 6-8 Issues and Technology in the Management of Impacted Wildlife. Glenwood Springs CO. Thorne Ecological Institute. 303 499-3647.

April 22-23. Wetlands: Environmental Gradients, Boundaries and Buffers. Niagara Falls, Ontario. University of Waterloo. 519 885-1211 Ex. 5244.

June 12-15. Annual Conference of the National Association of Environmental Professionals. New Orleans LA. 202 966-1500.

May 6-7. Annual Meeting of the Arizona Riparian Council. Phoenix AZ. Call for Papers. - abstracts due April 1, 1994. Call Cindy Zisner at 602 965-2490.

Sept. 19-20 Biology and Management of the Madrean Archipelago. Tucson AZ. Call for Papers - abstracts due January 31, 1994. Coronado National Forest. Leonard deBano. 602 670-4552..

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