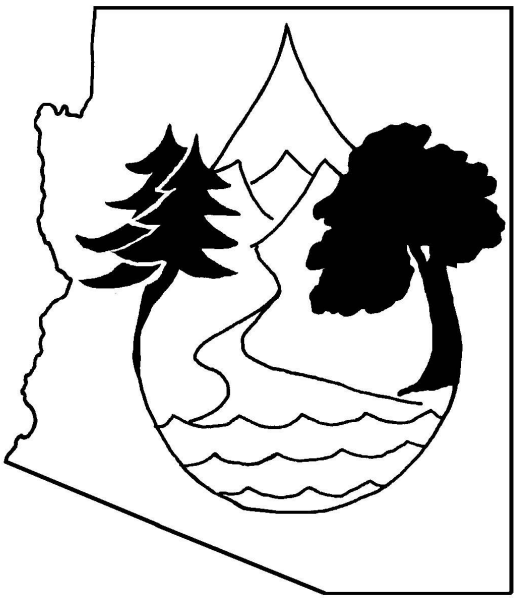
EIGHTH ANNUAL MEETING OF THE ARIZONA RIPARIAN COUNCIL

Phoenix Zoo

May 6-7, 1994

RIPARIAN CONSERVATION IN THE 1990'S



PROGRAM AND ABSTRACTS

1994

ARIZONA RIPARIAN COUNCIL
EIGHTH ANNUAL MEETING
PHOENIX ZOO, PHOENIX, ARIZONA
May 6-7, 1994

Friday, May 6

8:00-9:00 Registration
8:45 Welcome
9:00-9:20 **Eva Patten**, The Nature Conservancy, Arizona Chapter, ***Riparian Area Advisory Committee (RAAC) Update***
9:20-9:40 **Ed Fox**, Arizona Department of Environmental Quality, ***Arizona Department of Environmental Quality's Role in Riparian Protection***
9:40-10:00 **Duane L. Shroufe**, Arizona Department of Game and Fish, ***Arizona Game and Fish Department's Role in Riparian Protection***
10:00-10:20 **Rita Pearson**, Arizona Department of Water Resources, ***Arizona Department of Water Resources' Role in Riparian Protection***

10:20-10:40 BREAK

10:40-11:00 **Joseph M. Feller**, College of Law, Arizona State University, ***Riparian Protection Through a BLM Administrative Appeal: The Comb Wash Case***
11:00-11:20 **Mark Heitlinger**, The Nature Conservancy, Arizona Chapter, ***The BIOTA Project — Community Involvement and Prior Planning as Biodiversity Protection Tools***
11:20-11:45 **Rey Stendell**, National Biological Survey, ***The National Biological Survey's Role in Riparian Issues***

11:45-1:00 LUNCH

AFTERNOON TECHNICAL SESSION

1:00-1:20 **Keith Duncan**, New Mexico State University, ***Spring Lake, NM — A Saltcedar Control Case Study***
1:20-1:40 **Julie Stromberg**, Ron Tiller, Leigh Hedrick, Joelle Don de Ville, William Swenson, and Sandy Montoya, Center for Environmental Studies, Arizona State University, ***Consequences of Groundwater Decline for Riparian and Wetland Vegetation along the San Pedro River***
1:40-2:00 **Nancy Brian** and Peter G. Rowlands, Colorado Plateau Research Station, National Biological Survey, ***Canyon Bottom Species and Vegetation Dynamics in the Dewatered Creek Bed of Walnut Canyon National Monument, Arizona***
2:00-2:20 **Duncan T. Patten** and Julie C. Stromberg, Center for Environmental Studies, Arizona State University, ***Vegetation Response to Channel and***

Sediment Changes Along the Hassayampa River Following the 1993 Winter Floods

2:20-2:40 **John N. Rinne,** Rocky Mountain Station Southwest Forest Science Complex, USDA Forest Service, ***Fishes and Fines in Forest Streams: West Fork Allotment, Apache-Sitgreaves National Forest, Arizona***

2:40-3:00 BREAK

3:00-3:20 **Barbara Tellman**, Water Resources Research Center, University of Arizona, ***Don't Dig a Well Near My Stream! Groundwater Pumping Vs. Streamflow in Eighteen Western States***

3:20-3:40 **Leticia Vionnet** and Thomas Maddock III, Department of Hydrology and Water Resources, University of Arizona, ***The Impact of Groundwater Development in the Stream-Aquifer Relationship***

3:40-4:00 **Julia Fonseca**, Pima County Flood Control District, ***Water Rights for Cienega Creek Natural Preserve, Pima County, Arizona***

4:00-4:20 William M. Phillips, Department of Geosciences, University of Arizona; Julia Fonseca, Pima County Flood Control District; Frederick N. Robertson, and **Laurie Wirt**, US Geological Survey, Water Resources Division, ***Origin of Water to Springs at Bingham Cienega, Lower San Pedro Basin, Arizona***

4:20-4:40 **Patti R. Fenner**, Cave Creek Ranger District, Tonto National Forest; Janet Eubanks, Fountain Hills High School; Jeff Griswold, Carol Savin; North Canyon High School; Scott Underwood and Adrienne Gibson, Cactus Shadows High School, ***High School Cooperative Adoption of a Desert Stream***

4:40-5:00 **David Robbins**, Arizona Constructed Wetlands, ***Constructed Wetlands for Wastewater Treatment — Project Update***

5:00 BUSINESS MEETING

7:00 DINNER AT THE ZOO

8:00 **Jeff Williamson**, Deputy Director, Phoenix Zoo, **The Zoo and Conservation of Riparian Areas**

POSTER **Carla Fuller-Danforth,** Pima County Flood Control District, ***Pima County Proposed Riparian Habitat Legislation and Habitat Mapping***

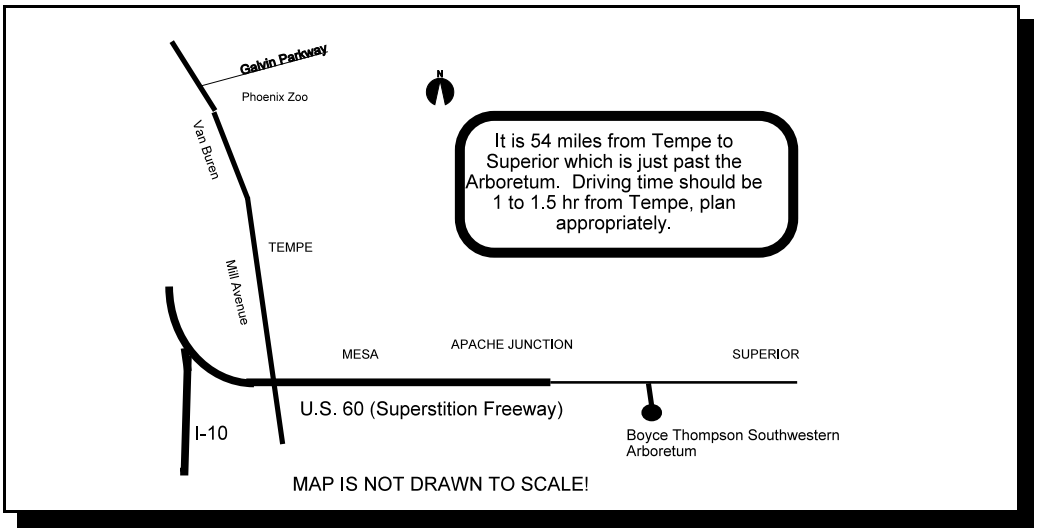
PLEASE, IN THE SPIRIT OF CONSERVATION AND RECYCLING, WHEN YOU'RE FINISHED WITH YOUR NAME TAG WOULD YOU PLEASE RECYCLE IT BY GIVING IT TO CINDY ZISNER, RATHER THAN DISCARDING IT.

Saturday, May 7

FIELD TRIPS

THERE IS A $3 PER PERSON CHARGE FOR THE BOYCE THOMPSON ARBORETUM. PLEASE REMEMBER TO BRING YOUR OWN LUNCH AND DRINKS!

8:45 AM	Convene at Boyce Thompson Arboretum and divide into three groups to car pool to field trip sites.
9:00 AM	We will be leaving **ON TIME** from the Boyce Thompson Arboretum parking lot for respective sites.
12:00 NOON	Picnic lunch (**DON'T FORGET YOURS**) at the Arboretum with Director Bill Feldman speaking to us about riparian issues affecting the Arboretum.



FIELD TRIP CHOICES

QUEEN CREEK, Kris Randall, Trip Leader

PINTO CREEK, Russ Haughey, Trip Leader

ARNETT CREEK, Roy Jemison, Trip Leader

BRIAN, N., and P. G. ROWLANDS. Colorado Plateau Research Station, National Biological Survey, Northern Arizona University, PO Box 5614, Flagstaff, AZ 86011. ***Canyon bottom species and vegetation dynamics in the dewatered creek bed of Walnut Canyon National Monument, Arizona.***

While studying the impacts of hydrological change on the past and present vegetation along the canyon bottom of the dewatered Walnut Canyon, we discovered that the plant community has partitioned the corridor into four distinct associations. Walnut Canyon presently experiences winter-spring "floods" at the rate of one every seven to nine years from overflow of upstream reservoirs following high winter snowfall and spring rains. Catastrophic floods during the summer monsoonal storms also occur from massive slope and tributary runoff, not from reservoir overflow, but these events are rare. Flood flows are insufficient to scour the streambed (Fig. 1) and act only as acute disturbance whereby different plant associations select for different substrates (Fig. 2). Former scour holes and pool deposits are invaded by weedy species and herbs (mullein, brome grasses, etc.). The dewatered, rocky streambed is colonized by disturbance-adapted, thicket formers which sprout freely from stumps and roots (New Mexico locust and Arizona rose) and raised, rocky bars resembling "islands" in the channel are dominated by red osier dogwood. The rocky, raised terraces bordering the dewatered stream are dominated by upland tree species (Rocky Mountain juniper, Douglas fir, and ponderosa pine). Invading species establish themselves, are thinned by the next dam overflow, and the cycle begins anew. Associations seen in the field for both species-by-species and plot-by-plot comparisons are confirmed by TWINSPAN, a divisive classification and DECORANA, an ordination procedure.

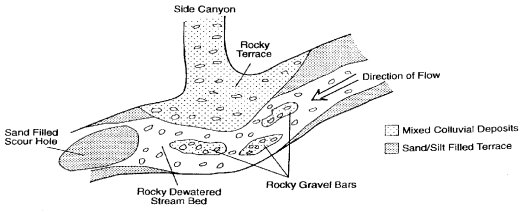


Figure 1. Diagrammatic illustration of the origins of the canyon bottom substrate.

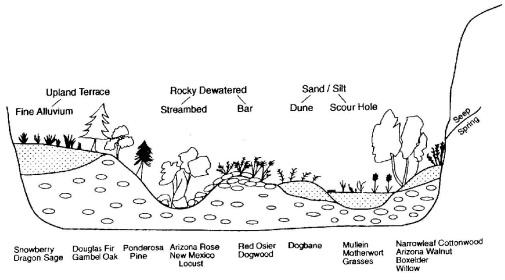


Figure 2. Diagrammatic illustration of the canyon bottom vegetation and substrate selection.

DUNCAN, K. W., Brush and Weed Specialist, New Mexico State University, 67 E. Four Dinkus Road, Artesia, NM 88210. ***Spring Lake, NM — A Saltcedar Control Case Study.***

Saltcedar growing in two, 13-acre dry lakes near Artesia, New Mexico, was aerially sprayed with a fixed-wing aircraft on August 8, 1989. Imazapyr was applied at 1 lb/A in a total volume of 7 gpa with 0.25% v/v Activator surfactant and 0.25% v/v Nalcotrol. The two dry lakes are approximately 100 yards apart and were permanent spring-fed lakes prior to invasion of the saltcedar.

On August 15, 1989, a 2-inch diameter hole was hand augered into the bottom of one of the two lakes. The hole was bored to a depth of 19.5 feet and a 20-foot joint of PVC pipe inserted into the hole. A removable cap was placed over the end of the pipe to prevent moisture or debris from entering the hole from above ground. A soil sample was removed from the bottom of the hole and soil moisture determined gravimetrically. Soil samples were collected and soil moisture determined at approximately 60-day intervals for 12 months.

An attempt was made to collect soil samples in October 1990, 14 months after application. However, the water table had risen to a point where water occupied the bottom 3 feet of the hole. Beginning in October 1990, the depth of the water table was monitored at 30-day intervals. The monitoring data indicate the water table at Spring Lake rose from a depth of >20 feet below the soil surface to the surface within 34 months after application.

On September 28, 1992, saltcedar canopy reduction was visually estimated to be 99%, while saltcedar mortality was determined by stem counts to be 95%.

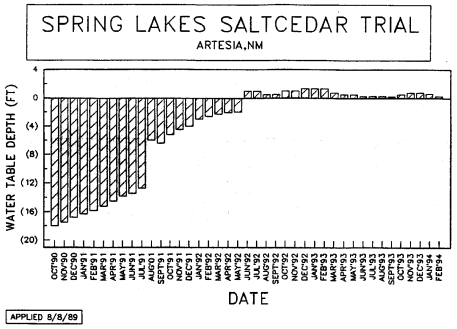


Figure 1. Water changes at Spring Lake, New Mexico, since treatment with imazapyr in August 1989.

FELLER, J. M., College of Law, Arizona State University, Box 877906, Tempe, AZ 85287-7906.
Riparian protection through a BLM administrative appeal: the Comb Wash Case.

Livestock grazing is a leading cause of riparian degradation in the western United States. Experience has shown that many damaged riparian areas will repair themselves without human intervention if they are relieved of livestock grazing.

On lands managed by the US Bureau of Land Management (BLM), livestock grazing may take place only where authorized by a permit issued by the BLM. In issuing a grazing permit, the BLM must comply with the National Environmental Policy Act (NEPA) and the Federal Land Policy and Management Act (FLPMA). NEPA requires the BLM to evaluate and consider the environmental impacts, including effects on riparian areas, of the grazing authorized by the permit. FLPMA, through the principle of "multiple use," requires the BLM to consider the harms and benefits of the grazing and to determine whether, on balance, the issuance of the permit is in the public interest.

The Comb Wash Allotment in southeastern Utah contains over 50 miles of stream riparian areas in five canyons. These five canyons are rich in natural scenery, recreational opportunities, and archaeological sites as well as potential riparian habitat. All of these resources have been degraded by cattle grazing in the canyons.

In 1991, the National Wildlife Federation, the Southern Utah Wilderness Alliance, and Joseph Feller filed an administrative appeal in the Department of the Interior challenging the BLM's decision to continue to authorize cattle grazing in the five canyons on the Comb Wash Allotment. On December 20, 1993, Administrative Law Judge John Rampton, Jr., issued a decision on the appeal.

Judge Rampton ruled that the BLM had violated NEPA by authorizing grazing on the Comb Wash Allotment without preparing an environmental impact statement (EIS) that evaluates the environmental consequences of the grazing. He also ruled that the BLM had violated FLPMA by failing to determine whether grazing in the five canyons on the allotment is in the public interest. Judge Rampton prohibited the BLM from authorizing further grazing in the canyons unless and until the BLM complies with NEPA and FLPMA.

Judge Rampton's decision is currently under appeal to the Interior Board of Land Appeals (IBLA).

FENNER, P. R.[1], J. EUBANKS[2], J. GRISWOLD[3], C. SAVIN[3], S. UNDERWOOD[4], and A. GIBSON[4], [1]Cave Creek Ranger District, Tonto National Forest, PO Box 5068, Carefree, AZ 85377; [2]Fountain Hills High School, Fountain Hills, AZ; [3]North Canyon High School, Phoenix, AZ; and [4]Cactus Shadows High School, Cave Creek, AZ. ***High school cooperative adoption of a desert stream.***

Three high schools in the Phoenix metropolitan area have joined with the Tonto National Forest in a stream monitoring program for the Cave Creek and Seven Springs drainages. Fountain Hills, Cactus Shadows, and North Canyon High School biology and chemistry classes have adopted three separate segments of these streams, and worked with the Cave Creek Ranger District to develop a comprehensive stream monitoring program. Each class visits its site on a monthly basis to measure streamflow, conduct chemical tests, and sample macroinvertebrates. This year we have formalized the partnership with a Challenge/Cost Share Agreement; we have also applied for a Heritage Grant with the Arizona Game and Fish Department to purchase monitoring equipment. Cave Creek is a major hub for numerous activities on the National Forest, such as grazing, scenic and off-highway driving, camping, birdwatching, and hunting. It also flows through or near three developed campgrounds, a Forest Service Administrative site, a ranch headquarters, and two mines. The federally endangered Gila topminnow has been transplanted into Seven Springs, and migrated into suitable habitat in Cave Creek.

Benefits of the monitoring program for the Forest Service include collection of reliable data on the following attributes of the streams:

- Water chemistry tests detect potential excessive nutrient enrichment from livestock management, effectiveness of buffer areas in protecting water quality after prescribed burns, safety of stream water for various levels of human contact in the campground areas;

- Macroinvertebrate monitoring twice a year was a recommendation of the U.S. Fish and Wildlife Service to monitor effects of a prescribed burn on water quality in Cave Creek. It is also a standard for monitoring streams that is called for in the Tonto Land and Resource Management Plan. Presence of various classes of macroinvertebrates will not only indicate effects of the burn, but will also help the Forest Service to evaluate progress in recovery of these historically depleted drainages.

- Streamflow is being measured in Seven Springs and Cave Creek monthly as a requirement of obtaining instream flow rights for wildlife and riparian vegetation. This is the second stream for which the Tonto National Forest has applied for instream flow rights. The purpose of this is to prevent any future diversions from damaging the riparian community.

FONSECA, J., Pima County Flood Control District, 201 N. Stone, 4th Floor, Tucson, AZ 85701.
Water rights for Cienega Creek Natural Preserve, Pima County, Arizona.

In 1993, a certificate was issued by the Arizona Department of Water Resources (ADWR) to protect base flows in part of the Preserve. The original instream flow application 33-89090 was submitted by Winston-Wheeler Trust in 1983. This application constrained the amount, beneficial use, location of use and priority date for the eventual certificate. The original application garnered three protests, which delayed consideration of the application for nine years and resulted in agreements with some protestants.

In the meantime, the District filed water rights claims to supplement the protection which might be offered by an instream flow permit. Documentation supporting the claims was submitted through the Gila River adjudication process to protect subflows, extend the location of protection, establish and earlier priority date, and add recreational use as a beneficial use. The validity of those claims will be determined by adjudication.

In order to receive an instream flow water right from ADWR, the District documented the availability of requested flows during claimed periods of beneficial use. The amounts requested are based on monthly median flows measured at the US Geological Survey's (USGS) continuous recording gage at Vail (09484600), adjusted for the skewing influence of storm runoff events. The gage is located downstream of the instream flow reach. Measurements within the instream flow reach compare favorably to a 15-year record at the downstream USGS gage.

Monthly median flows are need to maintain the existing diversity of wildlife, including aquatic wildlife. The creek is home to a native fish species known as the longfin dace (*Agosia chrysogaster*), as well as stream-dependent birds, reptiles, amphibians, crustaceans, and mollusks. A narrative approach was used to demonstrate that the flows requested are beneficial to wildlife.

FULLER-DANFORTH, C., Pima County Flood Control District, 201 N. Stone Avenue, Tucson, AZ 85701-1207. ***POSTER. Pima County proposed riparian habitat legislation and habitat mapping.***

In late 1991, the Pima County Board of Supervisors (BOS) directed staff to begin development of regulations which would provide protection of certain riparian habitats within the county. The vegetation inventory maps produced to support proposed riparian habitat legislation utilize satellite imagery and are based upon a definition and classification system for riparian habitat specific to Pima County developed by SWCA, Inc., Environmental Consultants. The mapping technology was developed by the University of Arizona Advanced Resource Technology Program (UA-ART).

SWCA's classification system is based on total vegetation volume (TVV) and contained five classes: (1) hydro and mesoriparian and (2-5) xeroriparian classes A-D. The hydroriparian and mesoriparian habitat were determined by indicator species and dominance. The xeroriparian habitats were subdivided based upon structural characteristics. Class A was assigned TVV >0.85 m^3/m^2, Class B was TVV between 0.85 m^3/m^2 and 0.675 m^3/m^2, Class C was TVV between 0.675 m^3/m^2 and 0.5 m^3/m^2, and Class D having TVV <0.5 m^3/m^2. The lower value was chosen because it represents the upper limits of the majority of upland habitats in the Sonoran Desertscrub and Semidesert Grasslands Biomes, which cover most of Pima County.

A combination of techniques were used to produce the vegetation inventory maps. These maps provide a useful understanding of the distribution and relative habitat value of riparian habitat within Pima County. Limitation of the data include: (1) pixel size of the Landsat image restricts the precision of identifying lateral and, in some cases, the linear extent of riparian habitats, especially in narrow canyons. (2) UA-ART, under contract to the Arizona Game and Fish Department (AGFD), mapping hydro and mesoriparian habitats, based upon species composition using videographic techniques. These data were only along perennial streams identified by AGFD. The classification of the vast majority of the habitat in Pima County utilized satellite imagery. The satellite image was based upon the amount of vegetation and does not distinguish between high value xeroriparian, hydroriparian, and mesoriparian. As a result, many areas of hydroriparian and mesoriparian along portions of the major rivers in Pima County have been mapped as "Class A" xeroriparian on the inventory maps. (3) Identification of watercourses on which to map and classify riparian habitat utilized the following data sources: (a) US Geological Survey topographic maps; (b) stream centerline data produced by Pima County Flood Control District; and (c) visual identification based upon vegetation patterns.

Procedures have been developed for detailed mapping suitable for implementing riparian habitat protection regulations. The detailed habitat maps will be produced delineating habitat classes chosen through a political process. Once the level of riparian habitat protection is determined by the community, lateral and linear extent of the habitat classes will be delineated. Mapping procedures have also been developed to distinguish the hydro and mesoriparian habitats from the xeroriparian Class A habitat. A decision by the BOS on the ordinance content, adoption process, and implementation is expected in June 1994.

HEITLINGER, M., The Nature Conservancy, Arizona Chapter, 300 E. University Boulevard, Suite 230, Tucson, AZ 85705. ***The BIOTA Project — community involvement and prior planning as biodiversity protection tools.***

The BIOTA Project provides a structure for all interested parties (public and private) to participate in a process to identify a set of key areas for biodiversity conservation. The project has no policy, regulatory, or statutory purpose. Conservation actions are not part of the BIOTA Project, although it should set the stage for subsequent conservation progress. The BIOTA Project is a method to identify and evaluate biologically important places, conducted by cooperating groups, with extensive communication and public involvement.

The BIOTA Project uses the most comprehensive biodiversity information and analytical tools available: the Heritage Data Management System (Arizona Game and Fish Department) and the Gap Analysis Program (US Fish and Wildlife Service/University of Arizona). The Project taps other pertinent information as well. This information is used to identify "key areas" that contain concentrations of biodiversity values, including:

- representative biological communities
- rich diversity of plants and animals
- populations of endangered wildlife

Since both these databases are being developed nationwide, this type of analysis might eventually be performed in other states and ecoregions.

PATTEN, D. T., and J. C. STROMBERG, Center for Environmental Studies, Arizona State University, Box 873211, Tempe, AZ 85287-3211. ***Vegetation response to channel and sediment changes along the Hassayampa River following the 1993 winter floods.***

The 1993 winter floods along the Hassayampa River at the Nature Conservancy's Hassayampa River Preserve included two back-to-back, long-duration flooding events, each at about the 25-year recurring level. Unlike short-duration, low-magnitude floods, these flooding events created continuous erosional and depositional processes that removed many of the middle-aged cottonwoods and willows, scoured the floodplain, created new sediment deposits and ultimately established new channel locations for the river. Using cross-sections of the floodplain, surveyed before the 1993 floods, we can show the changes in channel geomorphology and describe how new characteristics of the floodplain have created changes in riparian vegetation. Our long-term cross-sections were mostly degraded by the floods, although a few locations ended up with a meter or more of sand accumulation. The erosional/depositional processes created three types of broad, channel floodplains. These are characterized by their height above the water table and therefore the type of pioneer vegetation. The lowest type is within a few centimeters of the water table and thus continuously wet. These areas have been invaded by obligate wetland species, such as cattails and rushes, creating "cienega" areas within the channel. Another type is at elevations between the first few centimeters and about 50 cm to 1 m above the water table. The higher zone of this type was invaded by cottonwood seedlings, while dense stands of saltcedar and willow seedlings invaded the lower zone, a consequence of the timing of seed dispersal and river recession. Various herbaceous species also invaded these zones. Broad sediment deposits higher than 50 cm to 1 m above the water table became too dry for invasion of wetland or obligate riparian species and remained mostly unvegetated after the first growing season following the flood. More xerophytic vegetation, such as burrobrush, is invading these areas. Smaller, future flooding events are expected to cause gradual sediment aggradation within the present channel, creating a more constricted channel and elevated terraces adjacent to the channel, returning the floodplain to its pre-1993 flood appearance.

PHILLIPS, W. M.[1], F. N. ROBERTSON[2], L. WIRT[2], and J. FONSECA[3]. [1]Department of Geosciences, University of Arizona, Tucson, AZ 85721; [2]US Geological Survey, Water Resources Division, Tucson, AZ 85719; and [3]Pima County Flood Control District, 201 N. Stone, Tucson, AZ 85701. ***Origin of water to springs in Bingham Cienega, lower San Pedro Basin, Arizona.***

Field measurements and isotopic analyses of water collected in 1993 from a spring in Bingham Cienega and a nearby well on the Bingham Ranch were compared with data from a previous investigation to evaluate sources of water to the cienega. The springs create a rare marsh riparian habitat that includes mesquite and ash woodlands and a variety of wildlife. Improved understanding of the hydrologic flow system is needed to effectively manage water use near the cienega. The hydrogeology of the alluvial basin near the cienega is complex and is known to include a floodplain aquifer, an adjoining shallow water table aquifer, and a deeper, underlying regional aquifer that is confined throughout most of the eastern part of the basin. The southern extent of the confined aquifer is near the Bingham Cienega area. The samples collected from the spring and the shallow well in 1993 (Table 1) have lower values of pH, temperature, and bicarbonate than samples collected earlier (Robertson 1992) from two deeper wells — one at Bingham Ranch and one 6 km north. Values of 4.2 and 5.5 tritium units for the spring and the shallow well, along with the field measurements indicate a recent (less than about 15 years) water having a nearby source in either the San Pedro floodplain aquifer or the water table aquifer. The value of <0.3 tritium unit and the ^{14}C-determined ages of 5.200 to 10,600 years for water from the two deeper wells indicate that the water is from the regional aquifer and, as interpreted from the water chemistry by Robertson (1992), originates near the Galiuro Mountains to the east. The altitude of the spring sampled in Bingham Cienega is considerably higher than that of the river channel and, along with the observation that the deeper Bingham Ranch well No. 2 is no longer flowing, suggests that water to Bingham Cienega has a local nearby source, probably near the Santa Catalina Mountains to the west. Thus, although the Bingham Cienega has flowing springs similar to well No. 2 on Bingham Ranch, these two waters apparently have different origins.

Table 1. Field and isotopic data of water near the Bingham Ranch, lower San Pedro Basin, Arizona.

Site	Location	Date Sampled	Depth Below Land Surface (m)	^{3}H (TU)	Dissolved Solids (mg/L)	pH	Temperature (°C)	HCO_3 (mmol/L)	^{14}C Ground-water Age
[1]Bingham Cienega	D-11-1826BBB	11-11-93	0.2	[2]4.2	276	7.4	18	1.82	-------
[1]Bingham Ranch well No. 1	D-11-1826BBC	11-11-93	8	[2]5.5	354	7.5	19.2	2.09	-------
[3]Bingham Ranch well No. 2	D-11-1826BBC	8-30-81	107	--	312	8.5	21.5	2.4	5200
[3]Well 6 km north of Bingham Ranch	D-11-1803CDC	7-11-82	118	<.3	293	8.3	26.5	2.4	10,600

[1]Analysis by the Laboratory of Isotope Geochemistry, University of Arizona.
[2]Detection limits 0.7; standard deviation ±0.4 tritium units (TU).
[3]Robertson, P. N. 1992. Radiocarbon dating of groundwater in a confined aquifer in southeast Arizona. *Radiocarbon*, vol. 34, no. 3, p. 664-676.

RINNE, J., USDA Forest Service, Rocky Mountain Station Southwest Forest Science Complex, 2500 S. Pineknoll Drive, Flagstaff, AZ 86001. ***Fishes and fines in forest streams: West Fork Allotment, Apache-Sitgreaves National Forest, Arizona.***

Fine sediment and fishes were sampled during 1993 on Centerfire and Boggy creeks, Apache-Sitgreaves National Forest, Arizona. Analyses of preliminary data indicate both substantial amounts and linear patterns of fine sediments (<2 mm) in both streams. Numbers and biomass of the native Apache trout (*Oncorhynchus apache*) and speckled dace (*Rhinichthys osculus*) vary linearly and suggest inverse and direct relations, respectively, to sediment levels. Relevance of these data to that from other streams on the Forest and Fort Apache Indian Reservation and to proposed laboratory research on sediment effects on Apache trout spawning success will be discussed.

ROBBINS, D., R.S., Arizona Constructed Wetlands, 535 E. Comanche Street, Flagstaff, AZ 86001. ***Constructed wetlands for wastewater treatment — project update.***

An update of a constructed wetlands project in northern Arizona is presented. In October 1992, The Transition Zone Horticultural Institute (The Arboretum at Flagstaff), in conjunction with Arizona Constructed Wetlands, wrote a grant and obtained funding through the Environmental Protection Agency under the 319(H) Clean Water Act demonstration project grant program to construct an onsite wetlands for wastewater treatment. This project will provide original research on the function of specific native Arizona plants and their abilities in evapotranspiration and nutrient uptake from domestic wastewater. We are interested in maximizing nutrient removal during operation in the cold winter months typical in northern Arizona. We will test several varieties of sedges (*Carex* spp.), willows (*Salix* spp.), cattails (*Typha* spp.), and bulrushes (*Scirpus* spp.). Additionally, the microbiological community will be studied to determine which organisms are most beneficial to the treatment process and how to operate the wetlands system to enrich for these organisms. We will test a theory that constructed wetlands can be controlled on a microbiological scale to maximize treatment efficiency by adjusting loading and recirculation rates, and species composition. We will quantify wetland plant species for their ability to provide a root biomass conducive for microbial growth of those organisms deemed to be beneficial. Detailed are the innovative constructed wetland design parameters used in this project that are modifications of the currently accepted Tennessee Valley Authority (TVA) criteria.

SHROUFE, D. L., Director, Arizona Game and Fish Department, 2221 W. Greenway Road, Phoenix, AZ 85023-4399. ***The Arizona Game and Fish Department's role in riparian protection.***

The Arizona Game and Fish Department's role in the protection of riparian resources is guided by our mission and legislative mandate — to conserve, maintain, and enhance wildlife resources for Arizona. Because our perspective is driven by interest in the wildlife support functions provided by riparian ecosystems, our interest goes beyond the streamside vegetation. It encompasses the entire transition zone from aquatic to terrestrial habitats. There are at least six important ways to achieve our mission:

INVENTORY. In 1992, the Department initiated a massive project to inventory the current condition and extent of riparian areas statewide. The inventory is ongoing and combines the use of satellite imagery and aerial videography with field data collection to create maps of riparian vegetation. These data will provide baseline information to assess future changes in condition and extent of riparian vegetation. From both field surveys and GIS, a wealth of data will exist to aid in classifying riparian areas. While the impetus for this inventory was to provide data to support legislative action, the Department will also be applying the data to long-term monitoring programs.

FUNCTIONALITY AND VALUATION. Assessing the functions and values of riparian areas in the arid Southwest is critical to our understanding of these ecosystems. The Department is currently working to develop a systematic approach to evaluate the functions and values of riparian areas. This approach should assist all of us in prioritizing efforts for riparian protection, conservation, and enhancement.

MITIGATION AND COMPENSATION. While valuation is difficult we must deal with it on a daily basis. In our work with federal and state agencies, we must evaluate the effects of land and water development proposals on wildlife and wildlife habitats. We regularly suggest alternatives to avoid or mitigate impacts on riparian resources. In some cases, avoidance or mitigation is impossible, and in those cases we seek in-kind compensation for the projected losses. Where our work with other agencies undertaking development activities may sound negative or adversarial, that is rarely the case. Instead, it is a professional, cooperative approach to objectively evaluate proposals.

COOPERATION. Our work with land-managing agencies is not limited to evaluation of their proposals. An important part of our relationship with land and water managing agencies is dedicated to identifying joint opportunities to work in concert for on-the-ground protection or enhancement of riparian areas.

ACQUISITION. With the advent of the Heritage Fund, the Department, along with Arizona State Parks, has had the opportunity to acquire sites that provide important wildlife habitat for very sensitive species. The acquisition of the Wenima and White Mountain Hereford properties was heavily influenced by the presence of sensitive species supported by riparian habitats.

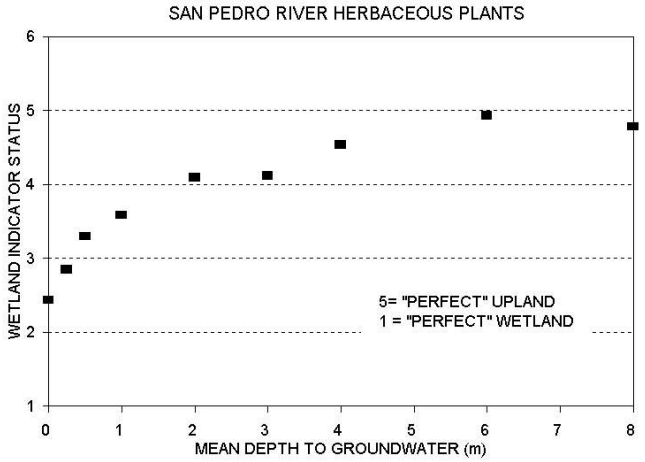
REGULATION. Lastly, the Department actively participates in the Riparian Area Advisory Committee, whose mandate is to explore legislative options available for protection of riparian areas. This is a complex and controversial assignment; one that none of the participants takes lightly. Although it is still uncertain what the Committee's ultimate recommendation will be, both regulatory and incentive measures are being considered.

STENDELL, R. C., Director, National Ecology Research Center, 4512 McMurry Avenue, Fort Collins, CO 80525-3400. ***The National Biological Survey's role in riparian issues.***

Creation of the National Biological Survey (NBS) was Secretary Babbitt's highest priority when he took office in January 1993. The NBS has been reality since November 1993 when the FY 1994 Budget was passed. The biological research staff of seven Department of the Interior (DOI) bureaus have been consolidated into the NBS, which will be the biological arm of the DOI. A primary mission of the NBS will be to assess the status of the Nation's biological resources. The new bureau will have research, inventory and monitoring, and information/technology services functions. The organization will be administered through four ecoregions. Arizona is part of the Mid-continent Ecoregion with headquarters planned for Denver. The National Ecology Research Center (NERC) is 1 of 12 research centers that transferred from the Fish and Wildlife Service to the NBS. NERC has a diverse mission and staff expertise. The primary mission for the Center is NBS activities in montane and arid land habitats. The Center maintains a National capability in instream flow, air quality impacts, and socio-economic research development, and technical assistance. NBS activities in riparian habitats in Arizona will be mentioned.

STROMBERG, J. C., R. TILLER, L. HEDRICK, J. DON DE VILLE, W. SWENSON, and S. MONTOYA, Center for Environmental Studies, Arizona State University, Box 873211, Tempe, AZ 85287-3211. ***Consequences of groundwater decline for riparian and wetland vegetation along the San Pedro River.***

Groundwater decline within the San Pedro River floodplain is a possible future consequence of increased reliance on regional groundwater by nearby municipalities. Effects of large-scale groundwater declines are easily demonstrable in riparian communities. More intensive study is required to detect and predict subtle changes over time. Vegetation, soil, and hydrology data collected from the San Pedro Riparian National Conservation Area were analyzed to predict such incremental changes. Ordination showed that depth to groundwater and soil moisture holding capacity (a variable related to clay content of the soil) were the two primary variables influencing plant community composition. As groundwater declines, changes in the abundance of individual species can be predicted, as can the relative abundance of plants classified by their probability of occurring in wetlands. These predictions can be refined by incorporating the effects of soil texture into the groundwater-wetland indicator response curve. For example, at a given depth to groundwater, coarse soils support fewer wetland species than do fine-textured soils. Response curves quantify the extent to which the abundance of wetland plants changes as the clay content of the soil changes. These response curves are useful for predicting direct effects of groundwater decline on herbaceous plant composition, and for predicting potential consequences of loss of fine sediments that may result when riparian floodplains lose woody vegetation and their functional ability to trap fine soil particles.



TELLMAN, B., Water Resources Research Center, University of Arizona, 350 N. Campbell Avenue, Tucson, AZ 85719. ***Don't Dig a well near my stream! Groundwater pumping vs. streamflow in eighteen Western states.***

Groundwater pumping has had severe effects on surface water flow in Arizona and elsewhere in the arid West. Arizona is unusual among Western states in that there are no mechanisms in the water law to regulate new pumping either to protect senior surface water rights or to protect streamflow. A 1993 Arizona Supreme Court decision further exacerbated the problem.

Thirteen other Western states do have mechanisms to integrate management of groundwater pumping and surface water flow. Further, some of them integrate instream flow programs into the overall conjunctive management system.

This paper examines the mechanisms used in those other Western states to integrate regulation of groundwater pumping with protection of surface water rights. It further examines how many of those states also have mechanisms to protect streamflow itself by limiting new pumping which would reduce streamflow.

Finally, this paper offers some explanations of why the water-rich states such as Washington, Oregon, and Alaska tend to have well-integrated programs, while many of the water-poor states, such as Arizona, Texas, and California do not.

VIONNET, L., and T. MADDOCK III, Department of Hydrology and Water Resources, University of Arizona, Tucson, AZ 85721. ***The impact of groundwater development in the stream-aquifer relationship.***

Many areas in the southwestern United States are faced with the dilemma of sustaining groundwater development to support growing populations and economic development and, at the same time, protecting the few riparian ecosystems still remaining. The upper San Pedro River Basin is just one example of this situation. The San Pedro River has its headwaters near the town of Cananea in the Republic of Mexico, and enters the United States close to the town of Palominas, in the State of Arizona. Within the Mexican side of the watershed, a well field provides groundwater for mining and agricultural activities. Municipal and agricultural water demands stress the aquifer system within the United States. A pristine riparian corridor, the San Pedro Riparian National Conservation Area, habitat of numerous vegetation and wildlife species, originates at about 4 miles north of the International Border and parallels approximately 35 miles of the river. Its existence is dependent on the availability of river flows as well as near surface water tables.

A numerical model has been developed to analyze the effect of groundwater pumping on the overall hydrology of the Upper Basin, and in particular, on the stream-aquifer interaction process. The model was calibrated over a 48-year period from 1941 up to 1988. Results from the simulations showed a progressive decline of the regional water table and a lateral expansion of the cone of depression around Sierra Vista-Fort Huachuca toward the river. The transfer of water from the aquifer to the stream has also been altered as a consequence of groundwater pumping. Currently, the calibrated model is being used as a prediction tool. In this sense, different pumping scenarios and water management strategies are being analyzed. The relationship between aquifer and stream has been clearly established and the debate about the upper San Pedro Basin water issues still continues and is far from being over.

NOTES