EIGHTEENTH MEETING OF THE ARIZONA RIPARIAN COUNCIL

Estrella Mountain Community College
Avondale, Arizona
March 12-13, 2004

The Lower Gila River: Then and Now

PROGRAM AND ABSTRACTS
2004

Eighteenth Annual Meeting
Arizona Riparian Council
Estrella Mountain Community College
Avondale, Arizona
March 12-13, 2004

THE LOWER GILA RIVER:
THEN AND NOW

FRIDAY, March 12

7:00-10:00	**Registration**
8:30-8:45	**Welcome** – Jeff Inwood, President
8:45-9:15	**History and Cultural Use of the Gila River System,** Wendy Bigler, Arizona State University
9:15-9:45	**Riparian Habitats and Wildlife in the Lower Gila River Region West of Phoenix,** Tom Hildebrandt, Arizona Game and Fish Department
9:45-10:00	**BREAK**
10:00-10:30	**Watercourse Master Plans in Maricopa County,** Doug Williams, Flood Control of Maricopa County
10:30-11:00	**Impacts of Growth on Sustainability of Riparian Areas,** Bill Werner, Arizona Game and Fish Department
11:00-11:45	**Panel Discussion**
11:45-1:00	**LUNCH**
1:00-1:30	**ARC News and Announcements**
1:30-2:00	**The Application of the Public Trust Doctrine to the Lower Gila River.** Joseph Feller and Joy Herr-Cardillo.
2:00-2:15	**5000 Years of Tamarisk in 15 Minutes**. Matt Chew.
2:15-2:30	**Rio Salado Habitat Restoration Project, Phoenix, Arizona: Water Supply Development Summary**. Gary M. Gin, Andrew Messer, D. G. Blair Linford, and Gary Corbell.

2:30-2:45 **Preliminary Investigation of Microclimate on the Rio Salado Project.** Anthony J. Brazel, Wendy Bigler, Jeremy Callaway, Alan Church, Matt Conley, Donna Hartz, Brent Hedquist, Heather Kinkade-Levario, Shourasen Roy, Nancy Selover, and Jian Zhang.

2:45-3:00 **BREAK**

3:00-3:15 **Riparian Vegetation Community Development along the Effluent-Receiving Salt River near Phoenix, Arizona.** Roy J. Marler, Duncan T. Patten, and Juliet C. Stromberg.

3:15-3:30 **Quantitative Study of Riparian Vegetation Changes on the Verde River, 1934 to Present.** Craig Sommers, Liz Payson, and Aleta Powers.

3:30-3:45 **Cottonwood-Willow Stand Structure on Regulated and Unregulated Reaches of the Verde River, Arizona.** Vanessa Beauchamp and Juliet C. Stromberg.

3:45-4:00 **Riparian Vegetation Water Needs: Stressor-response Model for Assessing Riparian Ecosystem Condition, Case Study of the San Pedro River, Arizona.** Sharon Lite and Juliet Stromberg.

4:00-4:15 **Water Desalinization Plant: Is It for Arizona, the Western United States, the World – Or Is It a Mirage Dancing in the Desert?** Brad Vandermark.

4:15-4:30 **Revegetating Abandoned Farmland in the Cienega Creek Natural Preserve, Pima County, Arizona.** David Scalero and Julia Fonseca.

4:30-4:45 **A Boater's View of the Gila River.** Tim Flood.

4:45-5:00 **Water Resources Committee Report**. Julia Fonseca.

Saturday, March 13

TRES RIOS TOUR DESCRIPTIONS

All fees payments are to be made at the Festival, the Arizona Riparian Council is not collecting fees for field trips.

Dawn (6:30 AM Sat) Wildlife Tours A & B
Four-hour guided tour of five "hot spots" along the Gila River and vicinity. Offered early morning Saturday. A and B tours visit the same sites in reverse order. Hot spots include Tres Rios "Hayfield," Tres Rios "Cobble," B&M Wildlife Area, Sonoran Desert site, and Jackie's Lake. Attractions may include various wading birds, ducks, cormorants, winter and migrating land

birds, wintering raptors, mammal tracks, turtles, riparian, and desert habitat. ($15 fee and pre-registration required, transportation provided.)

Arlington to Gillespie Dam Canoe Float
Guided casual float through willows and cattails down main channel of Gila River. About 5 hours roundtrip, 2.5 hours on the water. Offered for serious naturalists early morning Saturday, and for the novice midday on Saturday. Attractions may include Yuma Clapper Rail (endangered bird), many herons, egrets, white pelicans, marsh wrens, ducks, cormorants, various wintering and migratory land birds, beaver, muskrat, deer, and riparian habitats. ($40-45 fee and pre-registration required, transportation provided.)

Nature Watching Stations A, B, and C
Stations with spotting scopes, bird books, water, and interpretive volunteers. Buses run about every half hour. Open all day Saturday and Sunday. Station A is at the B&M Wildlife Area, on levee southeast of the bridge. Station B is at the Buckeye Canal Dam. Station C is at the Tres Rios Demonstration Site. Attractions include riparian habitats and wildlife for continuous viewing. (No fee, open continuously.)

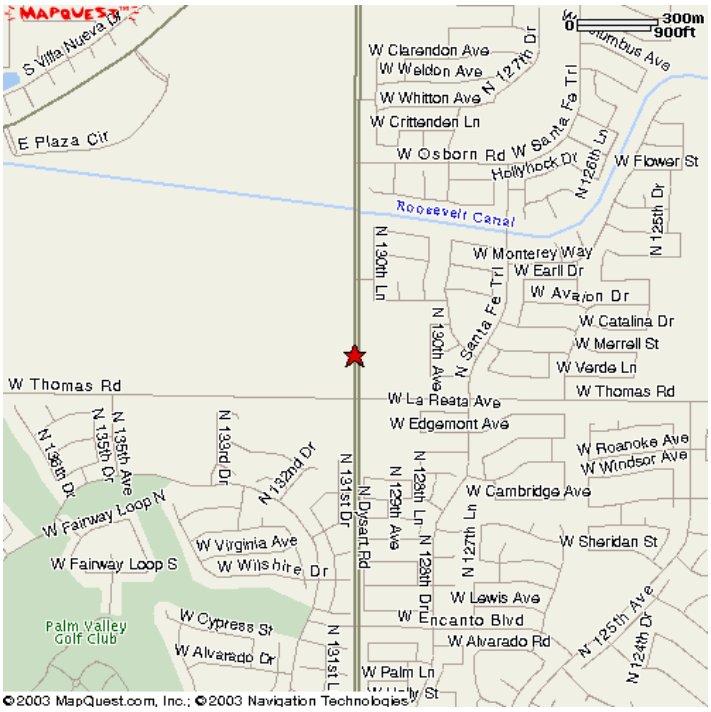
Estrella Mountain Park Nature/Cultural Heritage Interpretive Walk
An hour-and-a-half guided walking tour of desert and mountain habitat areas to view Sonoran Desert plants, wildlife, geology, and Native American rock art. (Several tours daily; free, first-come registration limited enrollment per group.)

Beginning Birding Instructional Tour
Two-hour walking tour of Estrella Mountain Regional Park and nearby Gila River areas with instructor. Learn basic skills of binocular use, bird finding, and identification of local habitat types and values. Offered three times daily on Saturday and Sunday. Free, first-come registration-limited enrollment per class. Limited number of binoculars and other materials provided or bring your own.

Fishing Clinic
Instructional clinic for youth and adults. Learn about warm-water fishing in central Arizona, i.e., which fish are present, how to catch them, clean them, and prepare them for the table. Fishing equipment provided, no licenses required. Free, first-come registration-limited enrollment per class, transportation provided.

MAPS

Location of Estrella Mountain Community College.



Location of Best Western Phoenix Goodyear Inn and Hoot and Howl Sports Bar.

Directions from Estrella Mountain Community College go south on Dysart, turn right onto Thomas, turn left onto Litchfield Park.

Directions to Festival from Best Western. Continue south on Litchfield Park Road to MC 85, turn right, go to Bullard Ave turn left, continue to Vineyard Ave and turn right. There are signs directing you to Estrella Mountain Park.

ABSTRACTS

(Abstracts are ordered alphabetically by first author.)

BEAUCHAMP, V. B., and J. C. STROMBERG. School of Life Sciences, Arizona State University, PO Box 874601, Tempe, AZ 85287-4601. ***Cottonwood-willow stand structure on regulated and unregulated reaches of the Verde River, Arizona.***

Cottonwood (*Populus* sp.) and willow (*Salix* sp.), the dominant overstory species in western riparian forests, are disturbance-adapted species with narrow germination windows. Changes to flood cycles often lead to a decrease in recruitment success and survival of these species. This research investigates the effects of damming on the flow regime of a river managed for urban and agricultural water supply, and on the structure and composition of riparian cottonwood-willow forests downstream from the dam. Fifty-five years of stream gage data were used to compare flow regimes on unregulated and regulated reaches of the Verde River, in central Arizona. The species composition, stem density and basal area of cottonwood (*P. fremontii*) and willow- (*S. gooddingii* and *S. exigua*) dominated stands were compared in above and below dam reaches. Dam operation has decreased peak flows and flow variability, shifted the timing of high flows, and increased summer base flows. However, regulated reaches along the Verde still experience spring floods in very wet years, allowing for periodic cottonwood and willow regeneration. Cottonwood and willow stem density was not different between above and below dam reaches in sapling (1-10 year) and mature (11-54 year) stands, but cottonwood stem density in old-growth (55+ year) stands was higher in unregulated reaches ($P < 0.01$). Flow regulation has altered other attributes of the riparian vegetation. For example, some measures of tree and shrub richness varied between reach types. Also, stem density of salt cedar (*Tamarix ramosissima*), a stress-tolerant, reproductively opportunistic species, was higher in regulated reaches, for sapling classes only (5.82 ± 2.15 stems/m^2 vs. 0.03 ± 0.03 stems/m^2, $P < 0.001$).

BIGLER, W. Department of Geography, Arizona State University, PO Box 87-0104, Tempe, AZ 85287-0104. ***History and cultural use of the Gila River system***.

The historical ecology of the Gila River to a large extent is a history of a human-manipulated environment. The Akimel O'odham (Pima) and their ancestors farmed the Middle Gila River from at least as early as 400 A.D., creating a mosaic of irrigation ditches and fields. Indigenous approaches to river management can provide important cultural insights into how people successfully inhabit a dynamic environment for centuries. My research examines 1860-1920 Akimel O'odham interactions with the Gila River – a time of tremendous environmental and social change. Upstream Euro-American farmers diverted virtually the entire river by 1880 to water their fields. This depletion of stream flow, combined with drought, resulted in the near-collapse of Akimel O'odham traditional farming. A recently rediscovered set of 34 statements of tribal elders transcribed in 1914 gives a rare glimpse into how the Indians approached river management and responded to environmental change. These documents reveal that the Akimel O'odham had an extensive oral tradition of recounting flood hazards in the Gila. Additionally,

they could adapt to environmental and social changes by moving and establishing new canal systems and fields. Combined with a set of fine-scaled maps and historical photographs, these documents provide a glimpse into the challenges posed by living with a dynamic river.

BRAZEL, A. J.[1], W. BIGLER[2], J. CALLAWAY[2], A. CHURCH[2], M. CONLEY[2], D. HART[2], B. HEDQUIST[2], H. KINKADE-LEVARIO[2], S. ROY, N. SELOVER[2], AND J. ZHANG[2]. [1]Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104; and [2]student participants and support team for Geography Climatology Seminar Fall 2003, Arizona State University, Tempe, AZ 85287. ***Preliminary investigation of microclimate on the Rio Salado Project.***

In Fall 2003, an Arizona State University (ASU) class project involved collaborating with ongoing researchers, J. Stromberg and J. Poznik of Plant Biology at ASU and Walter Kinsler of the City of Phoenix, to design a short-term microclimatic measurement project at the ongoing riparian construction site on the Rio Salado Project, at the general location of the Salt River and Central Avenue in Phoenix. At this location several young communities of cottonwood, willow, and mesquite have been sampled for growth characteristics during spring-summer 2003 by J. Poznik. For just before the implementation of Tempe Town Lake and up to now, microclimate has been monitored adjacent to and surrounding Tempe Town Lake by the senior author and N. Selover, as well as diurnal temperatures and humidities downstream of Tempe Town Lake in the river bottom at several sites toward the airport's location. The Fall 2003 short-term class project presented an opportunity to compare upstream characteristics in an undeveloped stretch with the emerging riparian development at the Central Avenue location, and to consider possible partnering with the City on continued monitoring. We observed soil and air temperature, and air humidity diurnal variations on a 5-minute time interval for the period from mid-October through end of November – a time of 100°F+ days in the above-normal October 2003 period to rapid cool down into the month of November 2003. Soil moisture was sampled at the beginning and end of the sampling period at several locations. Due to logistical restrictions on the construction site, we did not sample in the Low Flow Channel. Instead we sampled: (a) near the top of the river bank along a slope of willow trees, (b) on a general terrace in a depression near a small pond, and (c) on the edge of the terrace toward mid-channel among mesquite trees. Initial results indicate very large dew point temperature differences among the three sites – comparable to gradients around Tempe Town Lake, with lower values in the mesquite community and highest values immediate ly surrounding the pond. The subtle topographic depression differences on the terrace surprisingly caused several degrees of cool air ponding on several clear, calm nights. Well-defined wind regime shifts during the diurnal period influenced microclimatic differences at exposed and protected places at the site. We are encouraged to further develop an ongoing monitoring platform to serve the City that would be useful for vegetation assessment and human comfort for visitors to the site.

CHEW, M. School of Life Sciences, Arizona State University, PO Box 874601, Tempe, AZ 85287-4601. ***5000 years of tamarisk in 15 minutes***.

Most of us know saltcedar when we see it, but few of us are aware of its intimate association with the development of human civilization, its religious significance, medical uses, and how it came to be dominant and demonized in the Southwest. Tamarisk has played a role in Sumerian epics, Egyptian mythology, Homer's Illiad, Hippocrates, Zoroastrianism, the Bible, the Koran, and medieval herbal medicine. Find out what Aldo Leopold thought of tamarisk, and how a Phelps-Dodge tamarisk removal research project on the Gila River led to the construction of Horseshoe Dam on the Verde River. This talk is based on *The Tangled Tale of Tamarix: A Study in Status* first presented at the Southwest Colloquium for the History and Philosophy of the Life Sciences, and currently in revision for the *Journal of the History of Biology*.

FELLER, J.[1], and J. HERR-CARDILLO[2]. [1]College of Law, Arizona State University, PO Box 877906, Tempe, AZ 85287-7906; and [2]Arizona Center for Law in the Public Interest, 18 E. Ochoa, Tucson, AZ 85701. ***The application of the Public Trust Doctrine to the lower Gila River.***

For many decades most of the lower Gila River has been dry most of the time, its water and that of its tributaries diverted upstream for agricultural, municipal, and industrial uses. However, administrative proceedings currently underway could lead to a legal determination that would create a possibility of returning water to the river. Under the public trust doctrine, the state holds navigable waterways in trust for the use and benefit of the public. In *National Audubon Society v. Superior Court* (1983) (the Mono Lake case), the California Supreme Court held that public trust uses include recreation, wildlife conservation, and environmental protection, and that the state has the power and the duty to reexamine old water rights and consider whether they should be modified to protect public trust values. The Arizona Supreme Court has not yet been asked to decide whether to adopt the holdings of the Mono Lake case in Arizona, but Arizona courts have held that the public trust doctrine applies to Arizona rivers that were navigable when Arizona became a state in 1912. Furthermore, the Arizona Supreme Court has held that the public trust doctrine is a constitutional limitation on the legislature's power and has rejected an attempt by the legislature to exempt water rights from the public trust doctrine.

The Arizona Navigable Stream Adjudication Commission (ANSAC) is charged with determining, by June 30, 2003, whether the Gila River and other Arizona waterways were navigable in 1912. The Commission is holding hearings in each of the six Arizona counties crossed by the Gila. The hearing in Pinal County was March 9, 2004, in Florence. The hearing in Maricopa County has not yet been scheduled.

Although ANSAC itself will make no decisions about water rights, water use, or water flows, its determination regarding navigability could create the possibility of instream flows on the lower Gila River. If the Commission determines that the Gila was navigable in 1912, then the public trust doctrine will apply to the river, and the state arguably could be required to reconsider existing water allocations in order to provide instream flows in the river for the benefit of

recreation, wildlife, and the environment. Such reconsideration could be undertaken administratively, by the Arizona Department of Water Resources, or judicially, by the court in the ongoing adjudication of water rights in the Gila River and its tributaries. Judicial implementation of the public trust doctrine could be facilitated by the filing of a claim in the adjudication, either by the state or by a public interest organization, on behalf of the public trust.

FLOOD, T. Friends of Arizona Rivers. tjflood@att.net. ***A boater's view of the Gila River.***

Few people visit or explore the Gila River or its riparian corridors. This presentation will highlight some natural and recreational boating attributes of the river seldom shown or appreciated. It also presents photographs of the navigability of the Gila River and its major tributaries during the flows of 1992-1995.

FONSECA, J. Pima County Flood Control District, 201 N. Stone Ave., Tucson, AZ, 85701. Julia.Fonseca@dot.pima.gov. ***Water Resources Committee Report***

The Water Resources Committee is a standing committee of the Arizona Riparian Council. Its purpose is to generate information and recommendations on managing water resources as they affect aquatic and terrestrial parameters in riparian systems. Julia Fonseca is the current Chair; Juliet Stromberg, former Chair, continues as a member.

Committee members are particularly interested in the connections between water policy and aquatic and riparian protection. Active projects of the committee include:

1. State Drought Plan–Mike Block and others have provided input to the State Drought Plan on behalf of ARC's interests.
2. Input to Active Management Areas (AMAs)–AMA are used to regulate groundwater use in many areas of the state. Riparian concerns need representation. ARC is seeking representation for the water needs of riparian areas in discussions in the AMA Groundwater User's Advisory Councils.
3. Input to The Nature Conservancy's state-wide freshwater assessment–this effort, led by Jean Marie Haney, will identify riparian systems which are threatened by diversion of surface water or groundwater. Members of the committee have volunteered to help locate information sources and also with publicizing the results.
4. Identifying tools which local communities in Arizona can use to protect water resources needed for riparian areas–Julia Fonseca has prepared an outline for proposed content of a webpage.

The group also provides input to the Board on water resource management for the Santa Clara Cienega/Colorado River. Joe Feller is monitoring the Clean Water Act revisions. In addition, Jean Marie Haney and Jim Lombard have contributed newsletter articles about water resource issues.

GIN, G. M.[1], A.MESSER[2], B. LINFORD [1], AND G. CORBELL.[3] [1]URS Corporation, 7720 N 16th St, Ste 100, Phoenix, AZ 85020; [2]URS Corporation, 2333 Wetmore, Ste 611, Tucson, AZ, 85705; and [3]Welenco Inc., 4601 Mattnick Drive, Bakersfield, CA 93313. ***Rio Salado Habitat Restoration Project, Phoenix, Arizona: Water supply development summary.***

The "Phoenix Reach" of the Rio Salado Habitat Restoration Project (Rio Salado Project) is sponsored by the U.S. Army Corps of Engineers (USACE) and City of Phoenix (City). The project area consists of a 5-mile stretch of the Salt River within the City of Phoenix between 19th Avenue and Interstate 10. Prior to land development in the City, the Salt River was one of the few perennial riparian areas in this region, with cottonwood, willow, and mesquite habitats that supported a variety of wildlife species. As development progressed and upstream dams were constructed to control water flow and distribution, portions of the habitat and wildlife along the Salt River continued to degrade to its present state as a dry riverbed with sparse vegetation. Present and historic land use along the Salt River has included landfill operations, gravel mining, and varied industrial and commercial activities.

In 1994, the United States Congress authorized the USACE to review data and reports to determine whether flood damage protection, environmental protection, and habitat restoration were advisable for portions of the Salt River. In 1998, a Feasibility Report and Environmental Impact Statement were completed by the USACE (1998) and recommendations for restoration of the Salt River Habitat were provided. Several of the USACE recommendations included:

- The shallow aquifer of the Upper Alluvial Unit (UAU) will be the designated source of water for the project;
- Six water supply wells will be installed to the bottom of Subunit A of the UAU; and
- An estimated water supply demand of 6 to 12 million gallons per day will be required to support habitat restoration, numerous wetland ponds, and a low-flow channel within the Salt River.

The objective of the Rio Salado Habitat Restoration Project is to restore the riparian habitat along the Salt River with a network of wetland ponds, a low-flow channel, and various habitats aided by drip irrigation systems, in the central Phoenix area.

Background

In the Fall of 2001, the first water supply well (RSSW-2) was installed and screened exclusively in Subunit A of the UAU on the east side of Central Avenue just north of the Salt River. Results of the aquifer test performed at RSSW-2 coupled with the regional water level decline rates of 4 feet per year suggested that Subunit A may not be capable of providing the required water supply for the 20-year life of the project (URS 2002a, 2002b). To ensure that the water supply wells will be able to provide sufficient water for the life of the project, the proposed design for the remaining water supply wells was modified to produce water from both the lower (Subunit C) and upper (Subunit A) subunits of the UAU.

Well Installation Summary

Four production wells were drilled and installed on opposite sides of the Salt River at 7th Avenue and 16th Street. These wells were designed to fully penetrate the UAU to a depth of approximately 360 feet and constructed with screened intervals in Subunits A and C, which were the anticipated producing units of the UAU. To evaluate the vertical distribution of well yield, URS and Welenco Inc. conducted down-hole spinner flowmeter logging at production wells located at opposite ends of the project area during aquifer testing. Spinner log analyses indicated that Subunit A contributed about 75% of the total well production, while Subunit C provided 25% of the water production in each well.

To estimate aquifer properties and evaluate sustainable pumping rates of the UAU, 3-7-day aquifer tests were conducted at each production well at pumping rates of about 2,500 gallons per minute (gpm). During each aquifer test, observation wells at various distances away from the pumped well were monitored with pressure transducers. Estimated aquifer parameters were calculated by using the Copper-Jacob (1946), Theis (1935) and Neuman (1974) methods. The aquifer response data were best approximated by type curve solutions derived from the Neuman method (1974), which incorporates the effects of delayed yield due to gravity drainage that occurs after the water table is initially lowered in an unconfined aquifer.

Conclusions

Estimated average aquifer properties of the UAU indicate a transmissivity of 500,000 gallons per day per foot, hydraulic conductivity of 250 feet per day, vertical anisotropy (Kh/Kz) of 50:1, and specific yield of 0.17. Based on the results of long-term aquifer tests, spinner logging, and estimated aquifer hydraulic properties, it is anticipated that the UAU can provide an adequate water supply (pumping rate of 2,400 to 2,500 gpm) to sustain the 20-year life of the project.

References

Cooper, H. H., and C. E. Jacob. 1946. A generalized graphical method for evaluating formation constants and summarizing well field history. *American Geophysical Union Transactions* 27:526-534.

Neuman, S. P. 1974. Effect of partial penetration on flow in unconfined aquifers considering delayed gravity response. *Water Resources Research* 10(2):303-312.

Theis, C.V. 1935. The relation between the lowering of the pieziometric water surface and the rate and duration of discharge of a well using groundwater storage. *American Geophysical Union Transaction* 16:519-524.

URS. 2002a. *Final Well Installation and Data Analysis Report, Rio Salado Production Well No. 2, Rio Salado Habitat Restoration Project, Phoenix, Arizona*. Prepared for U.S. Army Corps of Engineers, April 15, 2002.

URS. 2002b. *Groundwater Supply Investigation of the Upper Alluvial Unit, Rio Salado Habitat Restoration Project, Phoenix, Arizona.* Presentation to the City of Phoenix, U.S. Army Corps of Engineers, and Arizona Department of Water Resources, May 1, 2002.

U.S. Army Corps of Engineers. 1998. *Rio Salado, Salt River, Arizona, Feasibility Report and Environmental Impact Statement.*

HILDEBRANDT, T. Arizona Game and Fish Department, 7200 E. University Dr, Mesa, AZ 85207.
Riparian habitats and wildlife in the lower Gila River region west of Phoenix.

The Lower Gila River west of the Phoenix metropolitan area is an under-recognized example of rich riparian habitats and their associated wildlife. With significant influence from nutrient-rich effluent discharges, this system is perennial in nature, well-linked to downstream habitats, and highly productive. It is very under-utilized at present, but is the focus of many efforts which could change its character for better or for worse. This talk will illustrate some of its habitats and examples of rich wildlife resources, and discuss their conservation for our future.

LITE, S., AND J. STROMBERG. School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287. ***Riparian vegetation water needs: Stressor-response model for assessing riparian ecosystem condition, case study of the San Pedro River, Arizona.***

As riparian conservation and restoration projects have increased in recent years, there has been a heightened need for techniques that assess riparian ecosystems. We developed the Riparian Condition Index, which is based on nine vegetation traits (indicators) that were sensitive to changes in surface flow presence and ground-water levels on the San Pedro River, Arizona. The indicators include measures of woody and herbaceous species composition, and population and community structure. Focusing on plant functional groups and structural traits emphasizes restoring ecosystem functions rather than particular species. Riparian condition classes are based on surface flow duration and ground-water depth and fluctuation; each condition class is associated with ranges for each indicator variable as well as levels of functional capacity. Site scores range from 1 (dewatered conditions) to 3 (reference conditions). We tested the model on the 17 sites used in model development and achieved a success rate of 88% (i.e., 15 of the 17 sites were scored correctly). The model was internally validated at six burned and four unburned San Pedro River sites not used in model development, for an overall success rate of 80%. This index of riparian condition is presently designed to enable diagnosis of ecosystem condition change from the specific stressors of surface and ground-water depletion along the San Pedro River.

MARLER, R. J.[1], D. T. PATTEN[2], AND J. C. STROMBERG[3]. [1]Department of Science and Math, Cascade College, 9101 E. Burnside, Portland, OR 97216; [2]Big Sky Institute for Science and Natural History, Montana State University, Bozeman, MT 59717; and [3]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287. ***Riparian vegetation community development along the effluent-receiving Salt River near Phoenix, Arizona.***

Diversion of stream water has led to the decline of many riparian communities throughout the state of Arizona. There is the potential to restore some of these communities, or enhance existing ones, by the release of effluent (treated wastewater) back into the stream channel. Southwest of Phoenix the 91st Ave Wastewater Treatment Plant (WWTP) discharges effluent into the Salt

River floodplain, creating a substantial perennial flow that extends for many kilometers downstream. This study was conducted to address the interaction of the effluent with the riparian vegetation community in the lower Salt River and Gila River. Density, basal area, and canopy vegetation volume were analyzed along five transects for Fremont cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), and saltcedar (*Tamarix ramosissima*), the three dominant tree species in the lower Salt and Gila River watersheds. Tree cores were examined to determine growth rates of these species. For the herbaceous flora, data were collected on species richness, cover values, and floristic composition. Herbaceous species were sampled during spring and fall seasons over a two year period. In this talk we contrast the structural and floristic similarities and differences of this riparian community that has developed in the floodplain associated with the effluent channel with that of upstream control sites in the Salt River watershed. In general, the riparian community that has developed along the effluent channel is similar to the structure and floristic composition seen at the control sites, with a mature, structurally complex cottonwood/willow riparian community established near the WWTP.

SCALERO, D., AND J. FONSECA. Water Resources Division, Pima County Department of Transportation and Flood Control District, 201 N. Stone Avenue, 4th Floor, Tucson, Arizona 85701.
Revegetating abandoned farmland in the Cienega Creek Natural Preserve, Pima County, Arizona.

The Project was developed by the Pima County Flood Control District (District) in cooperation with the U.S. Fish and Wildlife Service (USFWS, Partners for Wildlife Program) and the Arizona Game and Fish Department (AGFD). Specific project objectives include: (1) promoting the propagation and long-term reestablishment of mesquite bosque habitat in an area currently dominated by non-native species; and (2) increasing the structure and species diversity of native vegetation for the benefit of neotropical birds.

Native grasses were planted in August 1996 and native woody plants were planted in November 1997. Species included velvet mesquite, catclaw acacia, hackberry, desert willow, little-leaf sumac, graythorn, saltbush, wolfberry, elderberry, cholla, and Wright's sacaton. Many of the plants were propagated using seeds collected from native plants found on the Preserve. Mesquite trees and about half of the sacaton plants were propagated using tall pots. Drip irrigation was provided to most plants over a two-year establishment period.

A ten-year monitoring program for the project was initiated in 1998. Sample plots are monitored in July for survival and recruitment. Photo points are monitored in October to determine relative growth rates.

Studies conducted by Ronald L. Tiller, University of Arizona, indicate a success rate of 74% for the establishment of native sacaton grasses in the planted area. Surveys conducted by District staff and others indicate a success rate of approximately 79% for the establishment of woody plant species. Saltbush has reached significant maturity to produce flowers and seed heads. All other plants, including mesquite trees, have showed some signs of stress that has limited their growth. Three new mesquites have been observed as recruits within the monitoring area.

Virgin's bower and feather fingergrass have established on their own, elsewhere in the field. Photopoint monitoring indicates successful establishment of saltbush and significant growth in the mesquite trees that existed in the field prior to the revegetation effort.

The project has been successful in reintroducing species that were formerly prominent in the area (i.e., saltbush and native grasses) and increasing the overall species diversity within the abandoned agricultural field. However, the project has not produced any significant recruitment of woody species to help accelerate the restoration of the mesquite woodland community at the site. Main factors that are limiting the native plant growth and recruitment include the lack of rainfall and the dominance of invasive, non-native weeds.

SOMMERS, C., L. PAYSON, AND A. POWERS. ERO Resources Corporation, 1842 Clarkson Street, Denver, CO, 80218 (for Salt River Project, Phoenix, AZ). ***Quantitative study of riparian vegetation changes on the Verde River, 1934 to present.***

As part of the Salt River Project's evaluation of the effect of Horseshoe and Bartlett reservoirs on tall woody riparian vegetation along the lower Verde River, ERO Resources investigated the current (2002) and historical (1934 to 1997) riparian plant communities at three sites along the Verde River. Site 1 (above Horseshoe) is located directly upstream of the Horseshoe high water mark. Site 2 (KA Ranch) is located about 2.5 miles downstream of Horseshoe. Site 3 (Box Bar Ranch) is located about 4 miles south of Bartlett. The three study locations were selected during an aerial reconnaissance of the lower Verde River on November 4, 2002. The sites were chosen because they have relatively wide floodplains that would allow recruitment of tall woody vegetation.

The primary purpose of the study was to examine the potential impact that regulation has on riparian vegetation, and therefore habitat for several threatened and endangered species of birds. Tall dense vegetation, especially cottonwood and Goodding willow, provide nesting habitat for various species of birds, including the threatened bald eagle, endangered southwestern willow flycatcher, and candidate yellow-billed cuckoo.

Aerial photography for all three sites for the period from 1934 to 2002 was collected. Riparian vegetation mapping was field verified for 2002. Vegetation was grouped into categories based on species, height, and density. Historical vegetation was delineated for the three study sites, referencing the 2002 delineation and field review to identify vegetative

stand characteristics that could be readily observed on historical aerial photography. A companion study of fluvial geomorphology at the three study sites – focusing on inundation and substrate stability – was completed in support of this vegetation analysis.

Along the lower Verde River, the area covered by tall woody riparian vegetation is dynamic in both the regulated and unregulated reaches. In general, the acreage of tall woody vegetation acreage has increased at all sites since aerial photos first became available in 1934, prior to the construction of Bartlett and Horseshoe dams in the late 1930s and early 1940s. Comparison of vegetation types and long-term trends for the study sites indicates that flow regulation has not had a significant adverse effect overall on establishment and maintenance of tall woody vegetation stands to date. The slightly greater increase in tall woody vegetation at the two unregulated sites over the past 60 years suggests that the dams may have provided a slight long-term benefit to persistence of woody stands by reducing the frequency and magnitude of scouring. More recently, the minimum flow of 100 cfs below Bartlett since 1994 is likely of benefit to tall woody vegetation downstream of the dam.

VANDERMARK, B. Arizona Country Environmental Consultants, 4702 E. Ahwatukee Dr., Phoenix, AZ 85044. ***Water desalinization plant: Is it for Arizona, the western United States, the world -- or is it a mirage dancing in the desert?***

The state of Arizona is working to have the federal government reopen its "moth-balled" Bureau of Reclamation Water Desalinization Plant (WDP). This WDP, located west of Yuma is called the Yuma Water Quality Improvement Center, is one of the five such specialized research stations in the United States, and is the largest reverse-osmosis desalting plant in the world.

Originally it cost $280 million to build, and it was completed in 1992. It operated for only nine months at one-third capacity before being mothballed for technological deficiencies and flooding. It will cost $30 million to reopen, plus an estimated $24 million to $30 million per year to operate. The WDP was built to take high salinity water (i.e., 2,700 to 6,000 parts per million [ppm]) that is generated by the Wellton-Mohawk Irrigation District farming practices along the lower Gila River within Yuma County, Arizona. It is hoped that the WDP will produce about 25 billion gallons of 300 ppm desalted water, which is roughly 76,700 acre-feet per year or about *0.6% of the Colorado Rivers's total flow.*

In the western United States, and Arizona specifically, water is not just "cheaper than dirt," water is 100 times cheaper than dirt. Most agricultural water in Arizona costs from less than $10 per acre-foot (Yuma area) to $50 per acre-foot (Central Arizona Project) water. Just using the WDP annual operating costs, the estimated costs for the Yuma WDP water ranges from $311 to $392 acre foot. The farmers will not use nor can they afford this desalted water.

The western United States is famous for its gross misuse of its water resources because water is so cheap, subsidized by the federal government, and not being reallocated to more appropriate use because of the "Law of the River" (or "prior appropriation") doctrine. The *Law of the River needs to be eliminated and replaced with a more representative and market allocated (within limits) water usage system.*

The Yuma Water Desalinization Plant is a waste of federal, state, and local monies. Although I believe in basic research for the sake of basic research, this Yuma WDP is an *applied research project*. These limited tax dollars could be spent on more promising basic and applied research areas or cheaper alternative water usage options – with far higher water savings potential for the West, the nation, and the world.

WERNER, W. Arizona Game and Fish Department, 2221 W. Greenway Rd, Phoenix, AZ 85023.
Impacts of growth on sustainability of riparian areas.

Impacts of growth on sustainability of riparian areas will be discussed. Urbanization and growth affect typical and flood hydrology, water quality, and sediment regimes in our watercourses, which in turn affects riparian vegetation and habitats in those systems. As urbanization moves into undeveloped areas or converts use from agriculture there are opportunities to anticipate changes and manage the issues through careful planning. Absent that planning, the systems will likely change, perhaps requiring expensive remedies. In an era where society is trying to "retrofit" riparian vegetation and habitat back into altered systems equal attention should be focused on avoidance and minimization of changes in developing areas. Trends and examples will be discussed.

WILLIAMS, D. A., Flood Control District of Maricopa County, 2801 W Durango, Phoenix, AZ.
Watercourse Master Plans in Maricopa County.

The State of Arizona recently established statutes (ARS 48-3609.01) that enable local flood control districts to identify sensitive watercourses for floodplain management. The Flood Control District of Maricopa County, Arizona, has sponsored the development of over five watercourse master plans: A watercourse master plan is a new approach to comprehensive flood control planning that blends hydrologic and hydraulic analyses and future land use conditions with environmental considerations. The watercourse master plan process involves bringing together public and private stakeholders to identify unique characteristics along a watercourse that should be preserved while accommodating existing and future uses. Each watercourse master plan has common challenges and unique solutions.

The main components of the watercourse master plan process are: Pre-Design Partnering with Potentially Affected Interests, Public Involvement, Technical and Environmental Considerations, Recreation and Public Infrastructure Considerations, Alternative Analyses, Development and Implementation of the Master Plan. Flood control approaches include both nonstructural and enhanced structural methods.

NOTES