

TWENTIETH MEETING
OF THE
ARIZONA RIPARIAN COUNCIL

Museum of Northern Arizona
Flagstaff, Arizona
April 27-29, 2006

Riparian Issues:
Reflections on our Past and
Challenges for our Future



PROGRAM AND ABSTRACTS
2006

**Twentieth Annual Meeting
Arizona Riparian Council
Museum of Northern Arizona
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**RIPARIAN ISSUES: REFLECTIONS ON
OUR PAST AND CHALLENGES FOR OUR FUTURE**

**THURSDAY, April 27
Geomorphology Workshop Lecture Session**

Instructor: Tom Moody, Natural Channel Design, Flagstaff, AZ

7:30-10:00 **Registration**

8:30 Fundamentals of natural channels

- Bankfull discharge, stream stability, importance of dimension, pattern and profile, regional relationships of natural channels in the Southwest.
- Geomorphic processes in natural channels.
- Channel form and function. Channel stability, channel evolution, bankfull channel and floodplain processes, energy dissipation, sediment transport.

12:00-1:00 **LUNCH**

1:00 Bankfull channels, field surveys

- Bankfull channel and floodplain features, bankfull indicators, bankfull survey protocols, use of regional curves.
- Field techniques for channel characterization.
- Summary of inventory, assessment, monitoring, and design applications.

FRIDAY, April 28

**Arizona Riparian Council
20th Annual Meeting**

**RIPARIAN ISSUES: REFLECTIONS ON
OUR PAST AND CHALLENGES FOR OUR FUTURE**

- 7:30-10:00 **Registration**
- 8:30-8:45 **Welcome – Tom Hildebrandt, President**
- 8:45-11:30 **Plenary Session – Riparian Issues: Reflections on Our Past and
Challenges for the Future**
- 8:45-9:15 **How We Got Here and Where We May Be Going**
Duncan Patten, Founding ARC President; Emeritus Professor, Arizona State
University; Research Professor, Land Resources & Environmental Sciences,
Montana State University and **Chuck Hunter**, Founding ARC
Secretary/Treasurer; U.S. Fish and Wildlife Service, Southeast Regional Refuge
Biologist, Atlanta, Georgia
- 9:15-9:45 **Agency Perspectives**
Tim Phillips, Flood Control District of Maricopa County
- 9:45-10:00 **BREAK (Poster Session)**
- 10:00-10:30 **Nongovernmental Organization Perspectives**
Andy Laurenzi, Sonoran Institute
- 10:30-11:00 **Legal Perspectives**
Joe Feller, College of Law, Arizona State University
- 11:00-11:30 **Panel and Audience Discussion – Duncan Patten, Chuck Hunter, Tim
Phillips, Andy Laurenzi, and Joe Feller**
- 11:30-12:45 **LUNCH**
- 12:45-1:15 **ARC News and Announcements**

Regulatory Protection

***Indicates presenting author if more than one listed.**

- 1:15-1:30 ***Approaches to Address Riparian Issues in Arizona: The 1980s, 1990s, and the New Century*** – William Werner, Arizona Department of Water Resources
- 1:30-1:45 ***History of Riparian Area Protection in Arizona*** – Kris Randall, U.S. Fish and Wildlife Service, Partners for Fish and Wildlife
- 1:45-2:00 ***The Southwestern Willow Flycatcher in Arizona: What We have Learned since the Early 1990s and the Outlook for the Future*** – Susan Sferra*, Bureau of Reclamation; Greg Beatty, U.S. Fish and Wildlife Service; Lisa Ellis, Arizona Game and Fish Department; Henry Messing, Bureau of Reclamation; and Eben Paxton, U.S. Geological Survey
- 2:00-2:15 ***Wild and Scenic Fossil Creek*** – Jason Williams, The Arizona Wilderness Coalition
- 2:15-2:30 ***Using Wild and Scenic Rivers to Better Understand and Protect Riparian Areas in the American Southwest, a Case Study with Grand Canyon National Park*** – Joel C. Barnes, Environmental Studies and Adventure Education Program, Prescott College

Restoration Parameters

- 2:30-2:45 ***Bankfull Channel Dimensions and Watershed Size Influences on Potential Riparian Community Types in Arizona*** – Dave Smith, U.S. Fish and Wildlife Service
- 2:45-3:15 **BREAK (Poster Session)**
- 3:15-3:30 ***Projects to Enhance Arizona's Environment: An Examination of their Functions, Benefits and Water Requirements*** – Sharon B. Megdal, Kelly Mott Lacroix*, and Andrew Schwarz, Water Resources Research Center, University of Arizona

Case Studies of Riparian Restoration

- 3:30-3:45 ***Genetic Diversity and Restoration Success*** – Laura Hagenauer, Department of Biological Sciences, Northern Arizona University

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- 3:45-4:00 ***A New Design Mimicking Nature's Old Techniques* – Fred Phillips*, Heidi Kloeppe*, and Ann Hadley, Fred Phillips Consulting, Inc.**
- 4:00-4:15 ***Riparian Restoration on Hopi Lands* – Sharon Masek Lopez, The Hopi Tribe, Water Resources Program**
- 4:15-4:30 ***A Point-Source Method of Estimating Evapotranspiration along the San Timoteo Riparian Corridor* – Chris Garrett, SWCA, Inc. Environmental Consultants**
- 4:30-4:45 ***Where the Native Things are... Dead: Population Dynamics of Dominant Riparian Trees on the Colorado Plateau, Potential for Rapid Dominance Shifts during Drought, and the Effects of Exotic Species Removal on Native Cottonwoods* – Alicyn Gitlin* and Thomas G. Whitham, Department of Biological Sciences, Northern Arizona University**
- 4:45-5:00 **Wrap up**
- 5:30-7:30 **Colton House Reception**

We encourage carpooling from the Museum to the Colton House as there is limited parking. From the Museum entrance, turn right toward Flagstaff. Proceed ½ mi and turn left on to Creekside Drive (at the Coyote Springs sign). Follow Creekside Drive past a large newly built home on the right and turn right immediately thereafter onto an unpaved road that crosses a small rock bridge (there is a small sign with an arrow that points toward Colton House). Bear left at the fork in the road and it will take you to the front of the Colton House. Parking spaces are provided in the front of the house and immediately to the east.

POSTERS

(Presenters please be at your posters at breaks)

***Linking Genetic Diversity to Biodiversity: Studies of Fremont Cottonwood at Cibola NWR* – Barb Honchak*, Gery Allan, Randy Bangert, Matt Zinkgraf, Tom Whitham and Paul Keim, Department of Biological Sciences, Northern Arizona University.**

***Abundance of Introduced Tamarix in Arid Basins of Arizona Reflects Prevailing Hydrology* – Juliet Stromberg, Sharon Lite, School of Life Sciences, Arizona State University; Roy Marler, Cascade College; Charles Paradzick, Salt River Project; Patrick Shafroth, U.S. Geological Survey; Donna Shorrocks, Jacqueline White, and Margaret White, School of Life Sciences, Arizona State University.**

Educational Tools for Understanding Arizona's Riparian Areas – George Zaines*, School of Renewable Natural Resources, University of Arizona; Kim McReynolds, University of Arizona Cooperative Extension Service, Willcox; Jim Sprinkle, University of Arizona Cooperative Extension Service, Payson; Jeff Schalau, University of Arizona Cooperative Extension Service, Prescott; Barb Hutchinson, School of Renewable Natural Resources, University of Arizona; Mary Nichols, USDA Agricultural Research Service; Rob Grumbles, University of Arizona Cooperative Extension Service, Kingman; Chris Jones, University of Arizona Cooperative Extension Service, Globe; Doug Green, Department of Applied Biological Sciences, Arizona State University - Polytechnic; and Mike Crimmins, University of Arizona Cooperative Extension Service, Kingman.

SATURDAY, April 29

Geomorphology Workshop Hands-On Training (registered workshop participants only)

8:00 Meet in the Museum parking lot.

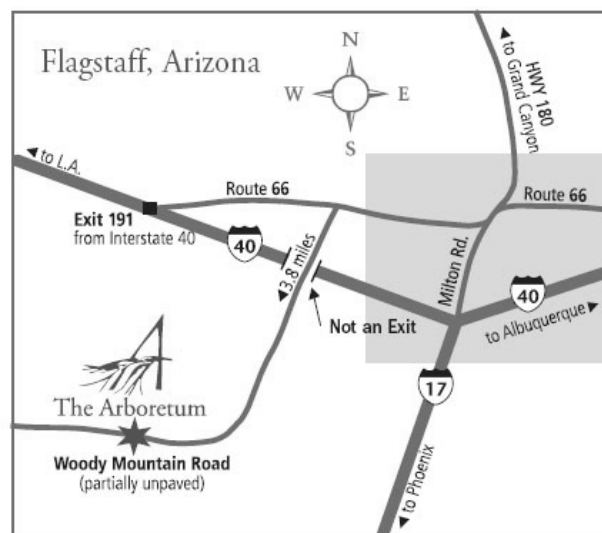
Identification of bankfull stage at various field sites. Site visits to a variety of channel types and erosion/stabilization practices including culverts, road crossings, bank stabilization, channelization, etc. BRING WARM CLOTHES, RUBBER BOOTS, OR WADERS. Lunch provided.

Flagstaff Arboretum Field Trip

8:30 Meet at the Museum parking lot.

We will have a tour of the Flagstaff Arboretum. They have a constructed wetland and a pond housing native fish. The Arboretum has also received a grant from the Arizona Water Protection Fund to restore a section of a riparian area that goes through the Arboretum.

Take Route 66 west through town. When you reach the last stoplight in town (Woodlands Village Blvd), continue on Route 66 about a mile to Woody Mountain Road. Turn left and continue 3.8 miles to Arboretum.



ABSTRACTS

(Abstracts are ordered alphabetically by first author.)

BARNES, J. C. Environmental Studies & Adventure Education Programs, Prescott College, 220 Grove Ave, Prescott, AZ 86301. *Using Wild and Scenic Rivers to Better Understand and Protect Riparian Areas in the American Southwest, a Case Study with Grand Canyon National Park.*

For an aridland region like the American Southwest, a resource management strategy that emphasizes protection of water resources and riparian landscapes represents a sound investment with high returns. These riparian corridors and patches serve to connect the region's physical and biological landscapes, as well as play a central role in cultural, recreational, and scenic resources. While the vast majority of riparian areas in the American Southwest are in poor and/or degrading conditions, the riparian areas of Grand Canyon Ecoregion boast relatively strong ecological integrity and represent one of the largest, intact hydrosapes in the contiguous U.S. Protection of Grand Canyon's streams through Wild and Scenic River designation is arguably the Park's most prudent response to the daunting external threat of regional groundwater pumping. In this presentation we will explore the role of Wild and Scenic Rivers in the conservation of Grand Canyon's aridland river systems and watersheds, and review the preliminary results from a Grand Canyon National Park Wild and Scenic River Study that was supported through a Research Partnership between Prescott College and the Park. This study identified over 577 miles of rivers and streams in and adjacent to the park as eligible for Wild and Scenic River designation. Lessons learned from the GCNP WSR Study will be applied to the broader context of the American Southwest.



GARRETT, C., P.HGW., SWCA, Inc. Environmental Consultants, 2120 N. Central Ave, Suite 130, Phoenix, AZ 85004. *A Point-Source Method of Estimating Evapotranspiration along the San Timoteo Riparian Corridor.*

San Timoteo Creek, located within Riverside and San Bernadino Counties, in California, has developed into a lush riparian corridor due to discharge of effluent from the Yucaipa Valley Water District over the last several decades. The corridor has become habitat to several threatened or endangered species, including the Least Bell's Vireo and Southwestern Willow Flycatcher. New basin water quality requirements and a growing call for commercial use of effluent will soon result in a halt of effluent discharge to the Creek. To avoid a taking under the Endangered Species Act, the habitat must be sustained by a lesser discharge of imported groundwater.

While adaptive management is planned to ensure that habitat is not significantly degraded by the discharge reduction, there was a need to establish a baseline amount of water to replace the historically-discharged effluent. The method of estimating evapotranspiration from the study of diurnal water level fluctuations in individual piezometers has a long history, but is seldom used. Nine piezometers were installed along the riparian corridor, and water levels were collected for an entire growing season (until the winter floods of 2004 buried the piezometers). A seasonal curve of estimated water use by evapotranspiration was then calculated. This estimate provided a reasonable baseline of water quantity needed to maintain the alluvial aquifer and support riparian habitat. A comparison of the point-source field estimate to other methods and studies suggests the usefulness of this technique in other riparian settings.



GITLIN, A. R.¹, and T. G. WHITHAM^{1,2} ¹Department of Biological Sciences, Northern Arizona University, PO Box 5640, Flagstaff, AZ 86011-5640 and ²The Merriam-Powell Center for Environmental Research, PO Box 5765, Flagstaff, AZ 86011-5765. ***Where the Native Things Are... Dead: Population Dynamics of Dominant Riparian Trees on the Colorado Plateau, Potential for Rapid Dominance Shifts During Drought, and the Effects of Exotic Species Removal on Native Cottonwoods.***

There is a great deal of debate concerning the effects of exotic invasive species on native riparian trees, and whether removing exotic species benefits native tree populations. In this study, we surveyed >60 populations of native cottonwood trees (*Populus* spp.) with and without the invasive species tamarisk (*Tamarix* spp.), Russian Olive (*Elaeagnus angustifolia* L.), and Siberian Elm (*Ulmus pumila* L.) in an effort to record population dynamics during a major drought. During the summers of 2003 and 2004, we quantified cottonwood mortality and recruitment, and recorded regional patterns of exotic invasive tree presence on floodplains across the Colorado Plateau and in four parallel watersheds in central Arizona. Ninety-six percent of Fremont cottonwood (*P. fremontii*) stands on the Colorado Plateau with >30 trees had at least one exotic tree present in the stand. Fremont cottonwoods were more likely than narrowleaf cottonwoods (*P. angustifolia*) or hybrid crosses (*P. fremontii* × *P. angustifolia*) to have an association with exotic trees, and less likely to have young trees present in mature stands. Amount of tamarisk cover explained 73% of the variation in Fremont cottonwood mortality on the Plateau and 62% of the mortality in central Arizona during the drought. In an effort to determine whether removing invasive taxa improved conditions for native cottonwoods, we followed up these surveys with an examination of seven floodplain sites where invasive riparian trees had been removed. Each restored site was matched with a nearby, geographically similar unrestored site for comparison. We measured soil chemistry and cottonwood branch growth at each site. Growth measurements indicated decreased water availability for all cottonwoods during drought, regardless of treatment; cottonwoods respond to dry conditions by decreasing growth. Soil chemistry varied by river, suggesting that edaphic studies performed along individual rivers may not extrapolate to all systems. More research is needed to determine whether removal technique, degree of infestation, or other abiotic conditions might affect restoration results. Regional studies such as this one reveal large-scale patterns that may not become apparent when working along a single river or in greenhouse-based experiments. Since exotic trees tend to be more drought tolerant than cottonwoods, and cottonwood seedlings depend on unshaded mineral soils for establishment, prolonged drought could rapidly increase fragmentation of Fremont cottonwood forests and favor dominance shifts toward forests of exotic species along lowland rivers throughout the Southwest.



HAGENAUER, L. Cottonwood Ecology Group, Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ 86011. ***Genetic Diversity and Restoration Success.***

Riparian ecosystems are among the most sensitive and threatened ecosystems across the West. In recent years efforts have been made to replant these areas with cottonwood trees, with the assumption that replanting trees will lead to ecosystem restoration. When replanting riparian areas there is often little knowledge as to the genetic pedigree and geographic origin of the selected plants. Little is known about how the genetic diversity of the plants being restored affects the ecosystem restoration success and the dependent communities, such as arthropods and mycorrhizal fungi. The Cottonwood Ecology Group at Northern Arizona University has recently completed the planting of a 10,000 tree garden at the Cibola National Wildlife Refuge along the lower Colorado River to address such questions. We have planted 16 genotypes of Fremont cottonwood (*Populus fremontii*) in a randomized-block design to address the effects of genotypic diversity on the biodiversity of dependent communities. The trees were collected from across the range of Fremont cottonwood, allowing us to ask how the geographic origin of the tree affects tree success, survival, and ecological function. These issues may prove critical to the future of restoration efforts.



HONCHAK, B., G. ALLAN, R. BANGERT, M. ZINKGRAF, T. WHITHAM, and P. KEIM. Department of Biological Sciences, Northern Arizona University, PO Box 5640, Flagstaff, AZ 86011-5460. ***Population Genetic Variation of Cottonwoods.*** (POSTER)

To investigate the link between genetic diversity and biodiversity we initiated studies of population genetic variation in cottonwoods (*Populus* spp.). Cottonwoods frequently hybridize along river corridors and the hybrid zones typically harbor considerable genetic variation, which is strongly correlated with riparian community diversity. To examine how genetic diversity within a single species of cottonwoods affects biodiversity, we are undertaking an analysis of population genetic structure in Fremont cottonwood in natural populations and in a common garden. Our initial analyses of natural populations indicate differences in genetic diversity and structure across several localities. Based on these results we chose representative populations from which clones were propagated and then planted in a randomized block design along the Lower Colorado River. Our common gardens, consisting of nearly 10,000 trees, will be used to examine how genetic variation in a single species affects the community of organisms that form close associations with this dominant riparian tree species.



MASEK LOPEZ, S. The Hopi Tribe, Water Resources Program, PO Box 123, Kykotsmovi, AZ 86039. ***Riparian Restoration on Hopi Lands.***

Hopi lands have over 12,000 acres of riparian/wetland areas. These areas have been heavily impacted as the consequences of arroyo cutting in the early 20th century and the spread of invasive species from mid-century through present, particularly tamarisk and Russian olive. The Hopi Tribe's Department of Natural Resources has engaged in several riparian and wetland

restoration projects over the past decade. Lessons learned from these efforts include the importance of good water supply, sound fencing, and proper handling and planting of tree stock. A greenhouse was recently completed at Moencopi Day School, which will be used to produce cottonwoods, willows and other plant materials for restoration work. To fully pursue a reservation-wide restoration effort, decisions must be made and implemented regarding tribal policies for herbicide use and fire management. Increasing tribal capacity through the acquisition of equipment and training is also essential for future efforts. Prioritization of restoration sites will be based on water availability, cultural values, and an understanding of the effects of climate variability on the natural establishment of riparian vegetation. A proposed long-term strategy is to create robust refugia of riparian plants that will be mature and producing seed in 20 years, when climate conditions are expected to become more favorable for natural regeneration of cottonwoods and willows.



MEGDAL, S. B., K. MOTT LACROIX, and A. SCHWARZ. Water Resources Research Center, University of Arizona, 350 N. Campbell Avenue, Tucson, AZ 85719. ***Projects to Enhance Arizona's Environment: An Examination of their Functions, Benefits and Water Requirements.***

In Arizona many once lush riparian areas have been lost. This report provides a descriptive and analytical look at 30 environmental enhancement projects throughout the State of Arizona. The report examines the more community-based rather than scientific aspects of environmental projects, such as: Who are the principal sponsors of environmental enhancement projects? What factors drove the projects to be undertaken? What are the benefits and lessons learned of these projects? How do these projects use scarce water resources?

Projects in the study were sponsored by federal, state and local agencies, non-governmental organizations, tribes, and private individuals. Project sponsorship was an important factor in the drivers and benefits of the projects. All projects had multiple drivers. Habitat value was the most common driver, followed by participation in a general or regional restoration plan and public use and enjoyment. Although the drivers were the key elements behind the project's undertaking, each restoration effort incorporated other elements that provided additional benefits. All 30 projects cited more than one benefit, with most having between four and six. Common project benefits include habitat values, public use, environmental education and flood control.

Given the water scarcity in Arizona, an important focus of this study was the water requirements of these enhancement efforts because riparian areas depend on water to maintain their habitat characteristics. Projects were broken down into three groups: requires no supplemental irrigation, requires temporary irrigation, and requires long-term irrigation. Six projects did not require any supplemental irrigation while fifteen require long-term irrigation. Water for the projects in this study came from effluent, groundwater, storm water, rainwater and surface water. Most of the projects have a contract or agreement that ensures the delivery of at least one water source. Many projects also take advantage of variable water sources such as precipitation or effluent discharge.

In the end what have we learned? There are six P's in the pond: preparation, persistence, partnerships, progress, pests and post-construction. Preparation: environmental enhancement projects are complex and dynamic; sponsors need to understand what they are getting into. Per-

sistence: challenges (of many types) are common and flexibility is a key to success. Partnerships: different groups bring different strengths. Projects that had multi-disciplinary teams were more successful. Partnerships also included joining together multiple enhancement efforts to pursue common goals. Progress: quantitative measurement techniques are not widely used. Pests: many projects faced problems from invasives species, mosquito and unwanted wildlife control. Post-construction, monitoring and maintenance are important but difficult to fund.

The presentation will provide an overview of the interactive methodology used to gather information on the projects and summarize the findings and conclusions of the report through an attractive presentation. It will also provide insight into lessons learned.



PHILLIPS, F. O., H. M. KLOEPEL, and A. HADLEY. Fred Phillips Consulting, Inc., 9730 N. Rosewood Dr, Flagstaff, AZ 86004. *A New Design Mimicking Nature's Old Techniques.*

Dam impoundments on the Colorado River have greatly altered the hydrologic regime causing the elimination of natural high flood events that frequently saturated surface soils helping maintain the nutrient dynamics beneficial to native vegetation. As a result, soil salinity levels have increased, especially on the Lower Colorado River (LCR), which have promoted the invasion and domination of non-native, salt-tolerant vegetation causing a subsequent decline in native species diversity. The Yuma East Wetlands Restoration Project (YEWRP) was initiated to mitigate the effects of dam impoundments by restoring the ecological function to native riparian, wetland and aquatic habitats within a 1,400-acre area along the LCR. As a part of the YEWRP, a one-mile long back channel connected to the Colorado River was excavated and fitted with stop logs to provide a mechanism to mimic natural flood events to restore the beneficial nutrient dynamics for native vegetation.

One challenge with restoration design is creating the appropriate planting regime that maximizes native vegetation growth and minimizes non-native vegetation re-colonization while trying to mimic the natural ecosystem. As native vegetation planting of the back channel commences, we addressed this challenge by designing eight experimental planting regimes based on different planting techniques and densities of *Salix gooddingii*, *Salix exigua*, *Carex* sp., *Scirpus americana*, and various native seed mixes. Each planting regime was planted along a randomly selected 15-m stretch within the wetland and riparian zone and replicated in high and low depth-to-water table and salinity conditions along the back channel in February 2006. A systematic sampling design will be implemented to measure the re-vegetation parameters over the growing season for a minimum of three years. Belt transects (4 m x 15 m) will be established in each planting regime to measure tree/shrub growth (cm), survivorship, and growth effects. Vegetation and bare ground percent cover will be estimated using the Braun-Blanquet relevé techniques within five, 1-m² subplots placed every 3 m for 15 m. Monitoring of these vegetation variables started in April 2006 at the beginning of the growing season.



RANDALL, K. U.S. Fish and Wildlife Service, Partners for Fish and Wildlife, 2321 W. Royal Palm Rd, Ste. 103, Phoenix, AZ 85021-4951. *History of Riparian Area Protection in Arizona.*

The momentum for developing regulations to protect riparian areas in Arizona was at its peak in 1992. Actions up to that point include the 1985 Governor's Task Force on Recreation on Federal Lands, the 1988 Arizona Wetlands Priority Plan (addendum to the 1983 Statewide Comprehensive Outdoor Recreation Plans - SCORP), the 1988 Commission on the Arizona Environment, 1989 Statewide Comprehensive Outdoor Recreation Plans which included an Arizona Rivers, Streams, and Wetlands Study, and two Executive Orders signed by Governor Rose Mofford.

In 1992, the Arizona Legislature passed legislation which called for the collection of scientific and economic data and the development of reports on riparian areas in the state of Arizona. A committee called the Riparian Area Advisory Committee, comprised of 34 members from state and federal agencies, various land and water users, and non-governmental organizations including the Arizona Riparian Council. The Arizona Game and Fish Department identified and classified riparian areas along perennial reaches. The Arizona Department of Water Resources assessed the impacts of withdrawals of surface water and groundwater on riparian areas. The Arizona Department of Environmental Quality assessed the impact of land use activities on riparian areas.

The RAAC, using information from the state agencies reports, developed non-regulatory and regulatory approaches for protecting riparian areas that could be adopted for Arizona. An overview of those approaches and the status of present-day protection programs will be discussed.



SFERRA, S.¹, G. BEATTY², L. ELLIS³, H. MESSING⁴, and E. PAXTON⁵. ¹Bureau of Reclamation, 6150 W. Thunderbird Rd, Glendale, AZ 85306-4001; ²Arizona Ecological Services Field Office, U.S. Fish and Wildlife Service, 2321 W. Royal Palm Rd, Suite 103, Phoenix, AZ 85021; ³Research Branch, Arizona Game and Fish Department, 2221 W. Greenway Rd, Phoenix, AZ 85023; ⁴Bureau of Reclamation, 6150 W. Thunderbird Rd, Glendale, AZ 85306-4001; and ⁵USGS Southwest Biological Science Center, Colorado Plateau Field Station, PO Box 5614, Northern Arizona University, Flagstaff, AZ 86011. *The Southwestern Willow Flycatcher in Arizona: What We Have Learned since the Early 1990s and the Outlook for the Future.*

Our understanding of the federally endangered Southwestern Willow Flycatcher (Willow Flycatcher) has changed since various studies and standardized statewide surveys were initiated 13 years ago. One of the Willow Flycatcher's most promising attributes is its ability to adapt to changing conditions. The major Arizona floods of 1992, 1993, and 1995 allowed us to study Willow Flycatcher occupancy patterns as habitat regenerated and developed over time. Willow Flycatchers evolved within dynamic riparian systems and when their habitat becomes unsuitable as a result of flooding, fire, succession, or drought, they can respond by moving to more suitable habitat. Once believed to use primarily native willow habitat for nesting, we now know they can nest successfully using a variety of riparian plant species, including exotic saltcedar. They breed at high and low elevations, and along streams, rivers, wet meadows, and reservoirs. Under optimum conditions, vegetation can regenerate, grow, and be successfully used for nesting within 5 years. In many areas where reservoirs have replaced riparian corridors, Willow Flycatchers have

been able to nest successfully in the habitat associated with fluctuating water levels. Supplemental water supplied by municipal or agricultural return flows has even enhanced some desiccated or decadent riparian habitat, making it suitable for Willow Flycatchers. Brown-headed Cowbird parasitism, once thought to be a major stressor of Willow Flycatcher populations in the Southwest, does not appear to currently be detrimental to the population and is of concern only at a small number of sites. Between 1995 and 2004, the known Arizona population increased from 83 to 522 territories, and rangewide from 352 to 1256 territories. This increase is believed to be largely an artifact of increased survey effort, but several well-studied breeding sites in Arizona and New Mexico have experienced large increases in the number of Willow Flycatchers. Although these findings are encouraging for the recovery of the subspecies, impacts to Willow Flycatchers are likely to accelerate as human population growth and water demands encroach on the remaining riparian habitat in the Southwest. The largest Willow Flycatcher populations on the San Pedro, Gila, and Verde rivers and at Roosevelt Lake face an uncertain future. The Southwestern Willow Flycatcher Recovery Plan requires achievement of territory and habitat goals in specific Management Units and implementation of long-term management agreements prior to delisting. Recovery success will largely be dependent on regional and local planning that ensures future riparian health.



SMITH, D. U.S. Fish and Wildlife Service, 323 N. Leroux St, Ste. 101, Flagstaff, Arizona 86001.
Bankfull Channel Dimensions and Watershed Size Influences on Potential Riparian Community Type in Arizona.

Stable bankfull channel dimensions, particularly mean and maximum depths, would be expected to influence the potential riparian/wetland vegetation community located outside of the active channel. This would be very important in the case of large river systems in the arid Southwest. Large watersheds produce bankfull channels with high bankfull discharges, large cross-sectional areas, and deeper mean and maximum depths. There are often 100 to 1,000 fold differences between summer low discharges and bankfull discharges in large river systems in Arizona. For example, the Santa Maria River (1,129 mi² watershed) produces a bankfull discharge of 3,300 cfs (return interval 1.5 years). The large bankfull discharge forms a channel with deeper mean and maximum depths. The mean summer discharge for May, June, and July on the Santa Maria River is 3.6 cfs. These lower discharges in the dry summer months will influence water table depths outside of the active river channel. Water table depth is a primary control of riparian/wetland plant distributions. Woody riparian species that can survive deeper water table levels are the potential vegetation communities outside of the active river channel in these large river systems.

Herbaceous wetland communities, which require shallow water table depths, would not have the potential to establish or maintain themselves on a large arid river floodplain. Wetland communities would be limited to the wetter portions of the active channel. True riverine wetland communities that are found outside of the active channel would be located in sites with a smaller watershed which produce smaller bankfull discharges and channels. Wetland meadows are known to require a shallow water table within 30 cm of the ground surface. These sites would also be more likely to be found in low gradient, lacustrine valleys with accumulated fine

sediments that store runoff and provide for more consistent base flows with less fluctuating water table levels.

Numerous papers have recently compared channel widths between woody riparian and herbaceous communities. The overall consensus is that woody species form a wider channel. They might not produce the narrower deeper channels we generally look at as improved aquatic habitat condition; they provide a more variable channel with different velocities, depths, substrate sizes which results in a more heterogeneous availability of habitats. It is also important to recognize the ability of woody riparian species to narrow and deepen an unstable, very shallow, and wide channel. After large flood events or changes in watershed management it has been observed that woody riparian vegetation help river channels narrow and deepen as they regain stability. In Arizona, this does not come at the cost of herbaceous wetland vegetation communities since these large rivers are not expected to support them.



STROMBERG J.¹, S. LITE¹, R. MARLER², C. PARADZICK³, P. SHAFROTH⁴, D. SHORROCK¹, J. WHITE¹, and M. WHITE¹. ¹School of Life Sciences, Arizona State University, Tempe AZ 85287-4501; ²Cascade College, Portland OR 97216; ³ Salt River Project, Phoenix AZ 85072-2025; ⁴ U.S. Geological Survey, Ft Collins, CO 80526. ***Abundance of Introduced Tamarix in Arid Basins of Arizona Reflects Prevailing Hydrology.*** (POSTER)

Stream flow regimes are strong determinants of riparian vegetation structure, and altered hydrologic conditions can drive changes in species composition. For many rivers of the southwestern USA, groundwater levels have declined, flood regimes have been altered, and timing of flow patterns has changed. These hydrologic changes have been implicated as the drivers of compositional shifts from *Populus fremontii* and *Salix gooddingii*, the historically common pioneer riparian trees in the region, to *Tamarix*, an introduced shrub/tree. To test this idea, we examined woody riparian vegetation patterns along 24 river reaches in the Gila and Bill Williams drainage basins of Arizona. Reaches varied in stream flow permanence (perennial vs. intermittent), presence or absence of an upstream flow-regulating dam, and presence or absence of effluent as a water source. *Populus fremontii* and *Salix gooddingii* were the dominant pioneer trees along the reaches with perennial flow and a natural flood regime. In contrast, *Tamarix ramosissima* had high abundance (patch width and basal area) along reaches with intermittent stream flows (caused by natural and cultural factors), as well as those with dam-regulated flows. Forest patterns on reaches with effluent-dominated flow were similar to those on non-effluent reaches. Deep alluvial groundwater on intermittent rivers favors deep-rooted, stress-adapted species such as *Tamarix* over shallower-rooted, more competitive species such as *Populus* and *Salix*. On flow-regulated rivers, increased variability in flood timing favors reproductive opportunists such as *Tamarix* over reproductive specialists with narrow germination windows such as *Populus* and *Salix*. Thus, the prevailing hydrologic conditions do appear to favor a new dominant pioneer species in the riparian corridors of southwestern USA. These results reaffirm the importance of flow regime restoration for re-establishing *Populus-Salix* as the dominant pioneer forest type.



WERNER, W. Arizona Department of Water Resources, 3550 N. Central Ave, Phoenix, AZ 85012. *Approaches to Address Riparian Issues in Arizona: The 1980s, 1990s, and the New Century.*

Approaches to address riparian issues in Arizona have varied with a trend from looking at the site level to a broader scale at stressors affecting the site. Non-federal regulation of stressors impacting riparian areas has been proposed but not adopted, except in local areas. The importance of riparian areas has been incorporated into numerous planning efforts statewide.

In the 1980s there was concern about sand and gravel mining directly in the Verde River. Several approaches were utilized to address the issue including a legal assertion of ownership of the streambed by the State, acquisition of property and creation of the Verde River Greenway by State Parks, and an advanced identification of issues that would be encountered in a Clean Water Act permit process by the Environmental Protection Agency. As a result, the Arizona navigable stream adjudication, Navigable Stream Adjudication Commission, and technical studies were initiated. Mining of sand and gravel from the Verde River was determined to be unsuitable. Governor Mofford signed an Executive Order on Riparian Protection. The Bureau of Land Management (BLM) secured the riparian corridor along the upper San Pedro River through a large land exchange. Legislation created the Riparian Area Advisory Committee (RAAC) to develop recommendations back to the Legislature, directed that information be compiled by the Department of Water Resources (ADWR) and that Arizona Game and Fish (AGFD) map riparian areas. The Corps of Engineers and ADWR completed a study on Alamo Dam and determined that there was a basis for more detailed studies. In the 1990s the RAAC submitted recommendations. The Legislature created the Arizona Water Protection Fund, which provides grants to protect rivers and streams. The Corps of Engineers and AGFD initiated studies on reoperation of Alamo Dam in concert with a Steering Committee of agency stakeholders. The BLM acquired Las Cienegas National Conservation Area.

During the 1990s, voters passed an initiative that provides funding from the Arizona Lottery for the Arizona Game and Fish and Arizona State Parks Heritage programs, and additional land was purchased to protect riparian areas. Corps studies were initiated on the Rio Salado Environmental Restoration Project and Tres Rios Environmental Restoration Project with the City of Phoenix as local sponsor as Phoenix looked for approaches to manage issues along the Salt and Gila Rivers. Watershed groups were formed across Arizona with the condition of streams of interest to many. Large-scale conservation programs to address regulatory requirements of the Endangered Species Act were initiated at Roosevelt Lake and on the lower Colorado River, focusing on riparian-obligate species. As part of Rangeland Reform, the Bureau of Land Management developed Standards and Guidelines for Rangeland Health, which incorporate goals of Proper Functioning Condition for riparian areas.

In the New Century, additional Corps studies have been initiated in the Phoenix, Mesa, and Tucson areas. The Horseshoe/Bartlett Habitat Conservation Plan is under development to address impacts of water operations at those reservoirs. The Sonoran Desert Conservation Plan and associated Habitat Conservation Plan are under development to address impacts of growth on riparian wildlife.



WILLIAMS, J. Arizona Wilderness Coalition, PO Box 2741, Prescott, AZ 86302. *Wild and Scenic Fossil Creek*

The Arizona Wilderness Coalition works to protect Arizona's wildlands and waters by identifying lands which qualify for wilderness and wild and scenic river designation and advocating for their protection to Congress. Based in Prescott, Jason Williams serves as the Coalition's Regional Director for the Central Mountains/Sonoran region of Arizona. The Coalition has a collaborative relationship with Prescott College. This relationship has facilitated the completion of the Fossil Creek Wild and Scenic River study as part of a student's senior project. Jason's presentation will highlight how the 14 miles of Fossil Creek are eligible for Wild and Scenic River protection, which is made possible by the historic agreement between Arizona Public Service, various environmental partners, and others to decommission the Childs and Irving hydro-electric plants. The agreement returned full flows to Fossil Creek last summer after nearly 100 years of diversion, allowing myriad plant, animal, and fish species to thrive in their native riparian habitat.

Now is the time to act! Senator John McCain has indicated that Fossil Creek should be designated as Wild and Scenic. The presentation will explain why Wild and Scenic River designation provides the best protection for special places such as Fossil Creek. The nuts and bolts of Wild and Scenic River management and its implications for Fossil Creek will also be explained. Fossil Creek is a crown jewel of beauty, biological diversity, and wildness that should be celebrated and protected for future generations.



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Riparian areas occupy less than 2% of the western United States. Their importance is disproportionate to the small area they occupy because of their multiple use applications. Riparian areas provide recreational amenities, habitat and travel corridors for wildlife, support livestock grazing, and influence water quality and quantity. However, most riparian areas in the United States have been converted to other uses or are degraded from their original condition. In Arizona, as in many other states, there is a need for science-based educational workshops and

web-based information to help the public improve their knowledge of the importance, function and management of riparian areas. Educational workshops were conducted in several counties of Arizona and focused on these topics: 1) the definition, and importance of riparian areas 2) characterization of riparian areas 3) hydrologic, processes in riparian areas, 4) stream processes in riparian areas, 5) climatic processes in riparian areas, and 6) biological processes in riparian areas and 7) human alterations to riparian areas. A handout, based on the above topics, was also provided to the workshop participants. Finally a web-based educational module was developed drawing on the materials and resources used in the educational workshops. Using multi-media web applications, learners were presented with successive steps introducing both theoretical and practical information about riparian areas and methods for affective management.



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