TWENTY-Sixth MEETING OF THE ARIZONA RIPARIAN COUNCIL

Skysong
Scottsdale, ARIZONA
April 4-6, 2013

Sustaining Urban Rivers – Visions and actions across the southwest: Application for the salt river through the phoenix metro area

PROGRAM AND ABSTRACTS
2013

Cosponsored by:

Central Arizona-Phoenix Long-Term Ecological Research
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TWENTY-SIXTH ANNUAL MEETING
ARIZONA RIPARIAN COUNCIL

Co-sponsored by:
Central Arizona–Phoenix Long-term Ecological Research Project
Center for Biology and Society, Arizona State University

SUSTAINING URBAN RIVERS – VISIONS AND ACTIONS ACROSS THE SOUTHWEST: APPLICATION FOR THE SALT RIVER THROUGH THE PHOENIX METRO AREA

Skysong
Scottsdale, Arizona
April 4-6, 2013

Thursday, April 4, 2013

11:00 a.m.-12:00 p.m.	*Registration*
12:00-12:15 p.m.	*Welcome* – Kris Randall, President, Arizona Riparian Council
12:15-1:00 p.m.	*Lunch and Poster Session*
1:00-1:15 p.m.	*Global Perspective of Urban Rivers* – Nancy Grimm, Director, Central Arizona–Phoenix Long-term Ecological Project and School of Life Sciences, Arizona State University
1:15-1:30 p.m.	*Local River: Overview of the Salt River* – Kris Randall, President Arizona Riparian Council and U.S. Fish and Wildlife Service

Regional Perspectives

1:30-2:10 p.m.	*San Pedro River and Sierra Vista* – Holly Richter, The Nature Conservancy
2:10-2:50 p.m.	*Santa Cruz River and Tucson* – Julia Fonseca, Pima County Office of Sustainability and Conservation
2:50-3:20 p.m.	*Break and Posters*

3:20-4:00 p.m.	*Poudre River and Fort Collins* – David Merritt, U.S. Forest Service
4:00-4:40 p.m.	*Middle Rio Grande and Albuquerque* – Dan Shaw, Bosque Ecosystem Monitoring Program
4:40-4:50 p.m.	*Wrapup and Plans for Friday* – Kris Randall
4:50-5:00 p.m.	*Break*
5:00-6:00 p.m.	*Movie: Rock the Boat – Saving America's Wildest River* (to be shown again at dinner at Monti's La Casa Vieja)
5:30-7:00 p.m.	*Dinner and movie at Monti's La Case Vieja, Tempe*

Driving directions to Monti's La Casa Vieja (3.4 mi)
SkySong, 1475 N Scottsdale Rd, Scottsdale, AZ 85257
1. Take Skysong Blvd west to Scottsdale Rd
2. Turn left (south) onto Scottsdale Rd
3. Turn right onto E Rio Salado Pkwy
4. Turn left onto S Mill Ave
5. Destination will be on the right:

Montis La Casa Vieja
100 S Mill Ave
Tempe, AZ 85281

Friday, April 6, 2013

7:15-8:30 a.m.	*Registration*
8:30 - 8:45 a.m.	*Welcome, Overview of Day, and Business Meeting* – Kris Randall, President, Arizona Riparian Council
8:45 - 8:50 a.m.	*Introduction to Sessions 1: Vegetation, Wildlife, Green Space: What is our Vision?* – Kris Randall, Moderator
8:50 - 9:40 a.m.	*Panelists:* Heather Bateman, Department of Applied Sciences and Mathematics, Arizona State University at the Polytechnic campus Tom Hildebrandt, Arizona Game and Fish Department (retired) Mike Martinez, U.S. Fish and Wildlife Service Julie Stromberg, School of Life Sciences, Arizona State University Wendy Wonderly, Environmental Programs, City of Phoenix

9:40 - 9:55 a.m. *Break*

9:55-10:00 a.m. *Introduction to Session 2: Environmental Flows: How Do We Restore the Physical Environment?* – John Hathaway, Moderator

10:00-10:50 a.m. *Panelists:*
Basil Boyd, Hydrologist, City of Tempe
Debra Daniel, Arizona Department of Environmental Quality
Theresa Pinto, Flood Control District of Maricopa County
Robert Upham, Water Services Department, City of Phoenix
Steve Westwood, Salt River Project

10:50 - 11:50 a.m. *Breakouts*
Breakout A – Convergence Room (1st floor)
Breakout B – Enterprise Room (1st floor)
Breakout C – Ingenuity Room (3rd floor, 301)
Breakout D – Discovery Room (3rd floor, 349)

11:50-12:40 p.m. *Working Lunch*

12:40-1:20 p.m. *Reconvene in Convergence Room: Reports from breakout groups*

1:20-1:30 p.m. *Introduction to Session 3: Taking Action, Engaging the Public* – Monica Elser, Moderator

1:30-2:20 p.m. *Panelists:*
Joe Dixon, U.S. Army Corps of Engineers (retired)
Thomas Krebs, Salt River Pima-Maricopa Indian Community
Roland Wass, WGA, Inc.
Summer Waters, Water Resources Extension Agent, University of Arizona, Maricopa County
Cathy Wise, Education Director, Audubon Arizona

2:20-2:35 p.m. *Break*

2:35 - 3:45 a.m. *Breakouts*
Breakout A – Convergence Room (1st floor)
Breakout B – Enterprise Room (1st floor)
Breakout C – Ingenuity Room (3rd floor, 301)
Breakout D – Discovery Room (3rd floor, 349)

3:45-4:30 p.m. *Reconvene in Convergence Room: Reports from breakout groups*

4:30-4:45 p.m. *Products of the Meeting* – Julie Stromberg

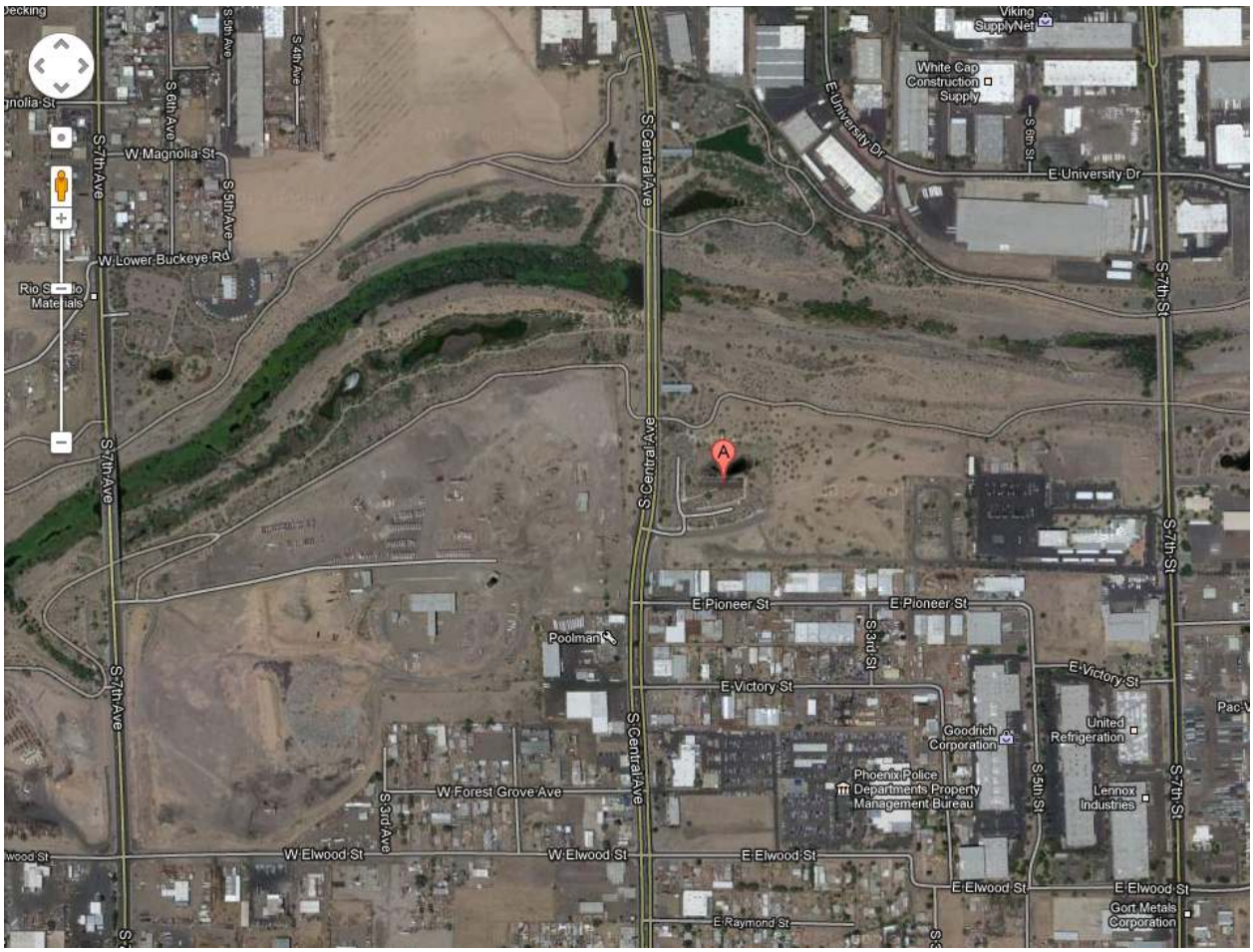
4:45-5:00 p.m. *Workshop Evaluation and Wrapup* – Kris Randall

Saturday, April 6, 2013

Bring water, and wear a hat and hiking shoes. Don't forget your binoculars!

9:00 am -9:45 am. Meet at Rio Salado Audubon Center, 3131 S. Central Avenue, Phoenix, at 9:00 a.m. Executive Director Sarah Porter will give a brief discussion of the history, activities and goals of the Audubon Center.

10:00 am- 11:00 am. Walk north across the bridge to the City of Phoenix Rio Salado parking lot. At 10:00 a.m. Park Ranger and Supervisor Winston Lyons will lead a field trip of the Restoration Area.



Thursday, April 4, Speaker Bios and Abstracts

(Listed alphabetically)

Julia Fonseca

Environmental Planning Manager, Office of Sustainability and Conservation, Pima County

Ms. Fonseca has worked on land and water issues in southern Arizona since 1986. She is environmental planning manager for the Office of Sustainability and Conservation at Pima County. She works with other individuals, agencies and groups toward protecting an inter-jurisdictional landscape spanning three million acres. In a prior 22-year career with Pima County Regional Flood Control District, Julia worked on surface water rights, land development policy, groundwater recharge, and riparian habitat protection and restoration. She also helped develop the biological reserve design, and natural resource inventories for the Sonoran Desert Conservation Plan. Julia received a M.S. in geology at University of Arizona and a long time member of the Arizona Riparian Council.

The Santa Cruz River: Pima County's Green Infrastructure.

Pima County government has long recognized the Santa Cruz River as part of Tucson's green infrastructure, and for that reason has purchased much of the historically private land along the river over the past several decades. A multi-use trail system is nearing completion, providing public access to many miles of river that were once inaccessible. Feasibility studies for environmental restoration have been completed for much of the river's length and many small projects to protect or improve wildlife habitat have been made, and more are planned. Various funding sources, including general obligation bonds and the Flood Control District tax levy, continue to support the efforts. An allocation of 10,000 acre-feet has been agreed upon by Pima County and City of Tucson, to support future efforts. The river channel is used for two managed recharge projects, which involve discharge of treated effluent to the stream. Upgrades to regional wastewater treatment facilities will abate odor and poor water quality in the effluent-dominated stream, which supports the largest and most drought-proof wetlands in this semi-arid desert county. Pima County has recently joined with U. S. Environmental Protection Agency and several local community groups to study the response of the wetlands to the treatment upgrades. Pima County Flood Control District is joining with Tucson Audubon Society to use U. S. Army Corps of Engineers mitigation funds as a source of funding for additional restoration efforts.

This presentation will examine what motivated county government to acted long before an organized river constituency emerged, and what challenges lie ahead for ecologically oriented floodplain rehabilitation.

Nancy Grimm
Director, Central Arizona–Phoenix Long-Term Ecological Research
Professor, School of Life Sciences Arizona State University

Dr. Grimm studies how human-environment interactions and climate variability and change influence biogeochemical processes in both riverine and urban ecosystems, collaborating with hydrologists, engineers, geologists, chemists, sociologists, geographers, and anthropologists. Grimm investigates diverse topics, mostly focused on nitrogen cycling and retention in the context of landscape heterogeneity, including: 1) nitrate transport and retention in urban, agricultural, and natural streams; 2) biogeochemistry and hot spots of N transformation in urban landscapes; 3) effects of urban atmospheric deposition on ecosystem processes in deserts; 4) impacts of long-term climate variability and change on desert stream structure and function (nutrient retention, metabolism, and plant and invertebrate communities). She is a past president of the Ecological Society of America and the North American Benthological Society and is a Fellow of the American Association for the Advancement of Science. Grimm was a contributing author of the recently released synthesis report, *Global Climate Change Impacts in the United States*.

David Merritt
Riparian Ecologist, National Watershed, Fish and Wildlife Program, U.S. Forest Service

David Merritt is a riparian ecologist with the National Watershed, Fish and Wildlife Program of the US Forest Service. David is also an academic advisor in the Graduate Degree Program in Ecology at Colorado State University, Fort Collins, CO. David conducts experimental research on rivers in western North America and in Europe. The main focus of his current work is to understand the role of river flow regime in structuring riparian plant communities in riparian areas. David investigates the influences of dams, water diversion, and groundwater pumping on flow and hydrologic connectivity along river corridors. In his current position, David serves as a liaison between the research community and National Forest service managers on water-resource related issues.

Modeling Alternative Future States of an Urban River: an Ecological Response Model for the Cache La Poudre River, Colorado.

The human population of the Front Range of Colorado is projected to double by 2050. As with many western cities, many rivers are already over-appropriated – human demand for water exceeds supply. With intensifying demands on the freshwater supply, tools that enable us to assess potential changes in freshwater dependent ecosystems in response to various development proposals and management decisions are needed. I will present a multitaxa "Ecological Response Model" which has been developed for the Cache La Poudre River to inform decision-makers and the public about the costs and benefits of various possible futures (incorporating climate change scenarios and

continued population growth and water development) for this urban river. The model was formulated as a Bayesian network that incorporates available empirical data and results from other data-based models, while also utilizing expert judgment when data are limited. This approach allows for the integration of several interacting ecosystem properties in a single model. Application of the model and its social and political implications will be discussed.

Kris Randall
President, Arizona Riparian Council
Coordinator, Partners of Wildlife Program, U.S. Fish and Wildlife Service

Kris Randall is a riparian ecologist and currently the acting Regional and State Coordinator for the Partners of Wildlife Program, U.S. Fish and Wildlife Service. Kris received a Bachelor of Science in Zoology and a Master of Natural Science in Ecology from Arizona State University. She has been a member of the Arizona Riparian Council since 1987, co-chairs the Policy Committee, and is the current President of the Council.

Abstract

For centuries, humans have significantly influenced the riparian habitat and stream flow of the Salt River through Phoenix, Arizona. Starting back with the Hohokam civilization around 300 B.C and development of irrigation diversions; further development of irrigation by the Mormon settlers in the late 1800s; the formation of the Salt River Project and construction of dams in the early 1900s; and to the present-day river uses. In some areas the Salt River is functioning as a "living" river. Can these areas be connected so the river functions more contiguously and provides more habitat benefits and recreational opportunities? The workshop will discuss these ideas and others to explore what the future may hold for the Salt River.

Holly Richter
Director of Conservation, The Nature Conservancy in Arizona

Holly Richter is the Director of Conservation for The Nature Conservancy in Arizona. She is charged with overseeing land and water protection and management, community-based conservation efforts with a diversity of partners, and the operation of all Conservancy nature preserves in the state. During her career with the Conservancy Holly has worked along several rivers in the Colorado River Basin, including the Hassayampa, Yampa, San Miguel, and San Pedro Rivers. She served as a chairperson for the Upper

San Pedro Partnership for over ten years, and as an officer for the Organizing Board of the Upper San Pedro Water District.

The Upper San Pedro Partnership: An Adaptive Management Approach Toward Sustainable Groundwater Resources

Human water needs have increased throughout the Western states in recent years, and millions of relatively new residents now rely upon limited regional groundwater resources to meet their water needs. The Bureau of Reclamation Colorado River Basin Study completed this year reports that the average imbalance in future supply and demand is projected to be greater than 3.2 million acre-feet in the Colorado River Basin by 2060. The Colorado River Basin currently provides water to some 40 million people, and that could double by 2060. In many localized areas however, municipal water demands already compete with the water needs of riparian habitats along the region's rivers and streams.

The Upper San Pedro Partnership (Partnership) is a consortium of 21 local, state and federal agencies, organizations, and business interests that formed in 1998 to "ensure that an adequate long-term groundwater supply is available to meet the reasonable needs of both the area's residents and property owners (current and future) and the San Pedro Riparian National Conservation Area (SPRNCA)." This presentation will summarize a case study describing the adaptive management approach used by the Partnership toward the management of regional groundwater resources (and associated riparian habitats), through the integration of strategic monitoring programs, the application of decision-support tools, and collaborative, consensus-based planning and management.

Dan Shaw
Co-Director, Bosque Ecosystem Monitoring Program
Adjunct Faculty, Biology Department, University of New Mexico
Teacher, Bosque School, Albuquerque, New Mexico

Dan Shaw is faculty at the Bosque School in Albuquerque where he teaches wildlife and conservation biology. He is a nationally recognized science teacher. For over 30 years he has pioneered and led citizen science programs across New Mexico. In partnership with the University of New Mexico's Biology Department, where he is adjunct faculty, he also co-directs the Bosque Ecosystem Monitoring Program (BEMP). Within BEMP over 7,000 people a year are involved in river and riparian citizen science. He is the author or co-author of over 50 publications including several environmental books for middle and high school students.

Pouring Citizen Science and Community into the Rio Grande

The Rio Grande is over appropriated. Its water is the source of tremendous legal wrangling between states, nations, and tribes. Water diversions provide opportunities for agriculture yet also can cause complete dewatering of some river sections. City effluent comprises a significant portion of its flow. Along its banks and under its surface live two endangered species. Drought, climate change, invasive species, and the recent emergence of fire as an ecological driver all complicate

existing issues. Yet the confluence of all these factors creates what one observer calls, “contentious cooperation.” Although there is conflict surrounding river issues there are also areas that build community. One area of cooperation is a citizen science effort conducted to better understand the Rio Grande and its riverside forest, known locally as the bosque. Since 1996 the Bosque Ecosystem Monitoring Program (BEMP) has gathered data on key abiotic and biotic variables and ecosystem response to flood, fire, climate, and human management and alteration. Now working with over 7,000 people a year, mostly K-12 and college students, at 27 monitoring sites along a 300-mile stretch of the Rio Grande, BEMP provides natural resource managers with technical reports and analysis. Literally, multi-million dollar management decisions are informed by the work of school kids contributing to science and becoming stewards of their home watershed and its primary river, the Rio Grande. With over 15 years of experience, BEMP creates a model for providing base line data of a river through tribal, rural, and urban communities.

Friday, April 5, Moderators and Panelists

Session 1: Vegetation, Wildlife, Green Space: What is Our Vision?

Kris Randall, Moderator
President, Arizona Riparian Council
Coordinator, Partners of Wildlife Program, U.S. Fish and Wildlife Service

Kris Randall is a riparian ecologist and currently the acting Regional and State Coordinator for the Partners of Wildlife Program, U.S. Fish and Wildlife Service. Kris received a Bachelor of Science in Zoology and a Master of Natural Science in Ecology from Arizona State University. She has been a member of the Arizona Riparian Council since 1987, co-chairs the Policy Committee, and is the current President of the Council.

Heather Bateman, Panelist
Assistant, Professor, Morrision School of Agribusiness and Resource Management, Arizona State University-Polytechnic

Dr. Bateman is a field ecologist and conservation biologist interested in how human land-use affects vertebrate populations and habitats. Human activities tend to perturb ecosystems by suppressing natural disturbances such as flooding or fire. This can lead to a decline in native species and proliferation of non-native species. Dr. Bateman's research interests lie in exploring population responses to habitat alteration, with a particular interest in amphibians, reptiles, and birds in Southwestern riparian systems. Dr. Bateman is an assistant professor at Arizona State University on the Polytechnic campus in Mesa, AZ.

Bird and Herpetofauna Communities along the Salt River in Central Arizona

The Salt River in the Phoenix metropolitan area (CAP LTER study site) has been altered by upstream damming, flow diversion, channelization, and conversion to urban lands. Portions of the river and riparian area have undergone active restoration, some areas have revegetated on their own from storm drain discharge, and other areas remain degraded with intermittent flows. Our project focuses on seven, 1-km reaches along the Salt River categorized into four types depending upon urbanization and restoration (e.g. wildland, type 1; wet drain, type 2; dry drain, type 3, and restored, type 4). We sampled bird and herpetofauna (amphibians and reptiles) communities during two seasons (fall/winter and spring/summer). At each site, we quantified herpetofauna using visual-encounter-surveys in nine 10x20 m plots and surveyed for birds in six 40-m fixed radius, 10-minute point-count-surveys. During 2012 and 2013 surveys, we detected 11 species of herpetofauna and 44 species of birds. Preliminary results show that compared to the wildland reference site, generally herpetofauna and bird species richness were lowest in urban dry drain sites and similar in wet drain and restored sites. Bird abundance was slightly greater with fewer species

during winter counts compared to summer counts. Bird communities differed by season and by type. Summer counts had more migrant species and winter counts had more winter migrants of water and shorebirds. Generally, the wildland and wet drain sites had more birds associated with permanent water, whereas the dry drain sites had more Sonoran Desert and upland species. Our results will provide recommendation to natural resource managers of urban areas relating habitat and wildlife to restoration activities.

Tom Hildebrandt, Panelist

Wildlife Program Manager, Arizona Game and Fish Department (retired)

Tom Hildebrandt worked for the Arizona Game and Fish Department for 24+ years and is recently retired from the wildlife program manager position for the Region VI office in Mesa. Tom is a long-time member of the Arizona Chapter of The Wildlife Society and has served as Chapter President and other board positions. Tom has similarly served as an officer and board member of the Arizona Riparian Council, and is a Past President of that organization as well. He has represented the Riparian Council on the Fossil Creek stakeholder's group for several years. Tom received a bachelor's degree in the Biological Sciences from the University of Colorado and a Master's in Zoology from Arizona State University, studying Arizona's Bald Eagles for his thesis.

Abstract

The Salt River through the Phoenix metropolitan area and the continuing Gila River corridor offer a rich and vibrant wildlife habitat, suitable for outdoor recreational appreciation. This riverine corridor perpetuates connectivity between points within the Gila River watershed. Restoration projects planned or implemented recently will add to this connectivity.

Effluent from human uses and agriculture return flows are a major factor in the perpetuation of these ecosystems, providing a considerable portion of the water itself, and a source of nutrients and contaminants that alter the otherwise ambient condition. Permanent live water (with a few gaps) in this corridor extends for approximately 30 linear miles from about 91st Avenue in west Phoenix to just beyond Gillespie Bridge near Arlington. Additional areas of enhanced connectivity have recently resulted from restoration or recharge projects beginning in east Mesa and continuing downstream more or less continuously, either as planned or implemented.

These areas are home to a riparian avian community; a rich riparian reptile community; a rich, but exotic fish community; and a near-normal mammal community. A great deal of the richness of this wildlife community derives from nutrient enhancement. Wildlife that show locally significant abundance include fish-eating birds such as cormorants, herons and egrets, bald eagle, osprey, kingfishers, rails and coots, predators such as bobcats and coyotes, and beavers. Wildlife species that seem depauperate for unexplained reasons include various neotropical migrant birds and bats.

Mike Martinez, Panelist
Fish and Wildlife Biologist, Arizona Ecological Services, U.S. Fish and Wildlife Service

Mike Martinez has 15 years experience as a fish and wildlife biologist with Arizona Ecological Services. His current responsibilities include Listing Coordinator, project lead for Maricopa County, species lead for endemic aquatic mollusks, and Federal Activities Program Coordinator.

The Role of Safe Harbor Agreements in Endangered Species Conservation along the Salt River, Phoenix, Arizona

Safe Harbor Agreements (SHAs) encourage proactive conservation efforts by non-federal landowners while providing certainty that future property-use restrictions will not be imposed if those efforts attract listed species to enrolled lands, or result in increased numbers or distribution of species already present. In return for voluntary conservation commitments, permittees receive assurances allowing future alteration or modification of enrolled properties to original baseline conditions. The Phoenix urban corridor of the Salt River provides migratory or nesting habitat for Yuma clapper rail (*Rallus longirostris yumanensis*) and southwestern willow flycatcher (*Empidonax traillii extimus*), both listed as endangered under the Endangered Species Act. As local sponsors for habitat restoration along the Salt River, the cities of Tempe and Phoenix are important partners in endangered species conservation. Tempe and Phoenix completed SHAs for the Rio Salado Project in 2008 and 2011, respectively. Furthermore, the Fish and Wildlife Service (FWS) and the City of Phoenix expect to complete a SHA for the Tres Rios Project this year. FWS expects these efforts to provide a net conservation benefit to the covered species through: the maintenance, restoration, and enhancement of habitats; maintenance or increase in population or distribution; provision of habitat connectivity; reduction of habitat fragmentation; insurance against catastrophic events; establishment of buffers; creation of areas for implementing conservation strategies; and public education. Although these efforts alone may not permanently recover these species, FWS anticipates the net conservation benefit will contribute to recovery by providing conservation opportunities that may not otherwise be realized.

Julie Stromberg, Panelist
Associate Professor, School of Life Sciences, Arizona State University

Julie Stromberg is a plant ecologist in the School of Life Sciences at Arizona State University. She and her students have been studying desert rivers for over two decades, to understand how changes in stream flow regime influence riparian plant communities, and to provide managers with information that can inform conservation and restoration efforts. She is co-editor of *Ecology and Conservation of the San Pedro River* (University of Arizona Press), and teaches courses on restoration ecology and freshwater ecosystems.

Past and Present Vegetation along the Urban Salt River

The vegetation of the Salt River in the Phoenix metro area has undergone substantial change in area and composition over time. Historical vegetation maps show coverage by cottonwood/willow

forests, mesquite forests, and desert saltbush. The few historic field collections indicate presence of riparian plants including western buttonbush, coyote willow, Mexican elderberry, screwbean mesquite, and greasewood. Today, extensive stretches of the river are dry and support xeroriparian shrubs such as sweetbush, albeit with a soil seed bank of wetland plants capable of responding to the occasional winter flood releases from upstream dams. Small portions of the river have been restored via release of pumped groundwater and planting of seeds and trees, providing dense and diverse habitat. Additionally, plant communities have "self-assembled" at perennial storm drain and effluent outfalls, and such areas sustain many wetland plants not found at restoration sites. Presently, the vegetation is shaped by dry season water availability, flood pulses, salinity (with halophytes such as saltbush and saltcedar abundant in the western area), nutrient availability, direct planting and weeding by restorationists, and dispersal of seeds from throughout the urban watershed. Owing to its role as a bird migration corridor and to run-off from diverse irrigated landscapes, the vegetation is a diverse mixture of "native Sonoran" species and riparian plants from Europe, Africa, Australia, and Central and South America. The vegetation provides important ecosystem services including providing recreational opportunities, wildlife habitat, transpirational cooling, and water quality improvement.

Wendy Wonderley, Panelist
Environmental Programs Coordinator, City of Phoenix

Wendy Wonderley is an environmental programs coordinator for the City of Phoenix focusing on environmental compliance issues for City projects. She has had the pleasure of working on all of the City's major riverbed projects including Rio Salado, Tres Rios, and Rio Salado Oeste and has the perspective of assisting with planning, construction, and maintenance issues. Today Wendy is going to discuss some of the unique challenges and opportunities of riparian restoration smack dab in the middle of the city.

Riparian Restoration in the Urban Environment: Unique Challenges and Opportunities

The City of Phoenix, along with its partners the U.S. Army Corps of Engineers, Flood Control District of Maricopa County, and the Arizona Game and Fish Department; created over 1,500 acres of riparian and wetland habitat in the Salt and Gila Rivers through the Rio Salado Environmental Restoration Project (Rio Salado) and the Tres Rios Ecosystem Restoration Project (Tres Rios). In 2005 Rio Salado officially opened, providing the public an amazing experience of nature right in the middle of one of the nation's largest cities. In the subsequent years of operation, many insights have been gathered into some of the unique challenges of riparian restoration in an urban setting such as: getting water in a dry riverbed; integrating the safety concerns of neighboring Phoenix Sky Harbor International Airport; managing the area for native plants and wildlife (including endangered species) as well as public enjoyment and safety; and handling those quintessential urban issues like trash, graffiti, theft, dogs, and cats. Rio Salado offers an outstanding opportunity for public education. The Nina Mason Pulliam Rio Salado Audubon Center, located at Central Avenue, provides interactive exhibits, and interpretive loop, and an array of free programing, much of it geared towards kids who might not otherwise have such direct contact with nature.

Session 2: Environmental Flows: How Do We Restore the Physical Environment?

John Hathaway, Moderator
Treasurer, Arizona Riparian Council
Watercourse Planning Manager, Flood Control District of Maricopa County

As Watercourse Planning Manager, John serves river planning and implementation efforts for the Flood Control District of Maricopa County. Previously, he worked for the Arizona Department of Environmental Quality, where he led development of its watershed framework, and the private sector specializing in water resources in the arid southwest. A licensed civil engineer in California, Nevada, and Arizona, he has a B.S. in Civil Engineering from Union College and pursued a graduate degree in hydrology and river mechanics at San Diego State University.

Basil Boyd, Panelist
Water Resources Hydrologist, City of Tempe

Basil is the Water Resources Hydrologist for the City of Tempe. As a hydrogeologist he has worked in water resources, environmental and geotechnical consulting and mining. He has a B.S. in Geology from the University of South Florida, an M.S. in Geology from Georgia State University, and is a Registered Professional Geologist in Arizona and Georgia.

Abstract

While Tempe Town Lake is one of Tempe's most remarkable attractions, a peek behind the scenes reveals a number of moving parts that allows it to exist. The presentation explains where the water in the lake comes from, how the unanticipated "volunteer" wetland formed upstream of the upper dam, where all this water ultimately goes, water quality issues facing both in the lake and in the wetlands – particularly in light of full-body contact events like the Ironman Arizona Triathlon – and what changes in Salt River flows have occurred since 2005.

Debra Daniel, Panelist
Surface Water Section Manager, Arizona Department of Environmental Quality

Debra's section within the Arizona Department of Environmental Quality's (ADEQ) Water Quality Division is responsible for issuing individual, general, and stormwater permits under the Arizona

Pollutant Discharge Elimination System (AZPDES) program, conducting ambient surface water monitoring, preparing surface water quality assessments and maintaining the state's impaired waters list, and overseeing non-point source improvement grants and outreach. Most of her 12 years at ADEQ has been spent with the individual AZPDES program, with the past four years as Section Manager. She has a B.S. in geology from Lafayette College, PA, and a M.S. in geochemistry from Arizona State University.

Abstract

Storm drain dry weather "nuisance" flows and treated municipal waste water effluent are often looked to as water sources to establish and sustain riparian vegetation in urban river corridors. Before basing a river restoration effort on these sources, the MS4 (Municipal Separate Storm Sewer System) and NPDES (National Pollutant Discharge Elimination System) permit implications must be addressed. In general, if the source of flows can be identified and water quality standards are met, the appropriate regulatory permits can be issued. The presentation touches on key factors to consider to rely on these water sources and whether potential conflicts exist between dry weather storm drain flows and the Clean Water Act.

Theresa Pinto, Panelist
Project Manager, Flood Control District of Maricopa County

Theresa currently manages watershed planning studies within the Flood Control District of Maricopa County's Planning Branch. Previously she oversaw environmental permitting for the District while starting the Tall Pot Nursery program, growing native seedlings with extended tap roots – requiring little or no supplemental irrigation to establish – for mitigation projects. She has a B.S. in Natural Resources from the University of Michigan and a M.S. in Wildlife Ecology from Northern Arizona University.

Abstract

By definition, all of the Valley's Salt River habitat restoration efforts involve the Flood Control District to ensure safe passage of episodic floods along with the well-being of the river's flora and fauna. The presentation outlines where valuable habitat may conflict with the flood conveyance function of the Salt River and its tributaries, what measures are taken to maintain flood conveyance, how, where, and by whom, along with the District's roles and responsibilities to comply with permit requirements relating to vegetation management and public safety.

Robert Upham, Panelist
Civil Engineer and Phoenix Trés Rios Environmental Restoration Project Manager, City of Phoenix

Bob manages the multi-purpose Tres Rios Environmental Restoration Project , which regulates and polishes effluent from the regional 91st Avenue Wastewater Treatment Plant, greatly reducing

nutrient loading while supplying a rich riparian environment downstream of the plant. Previous work includes civil engineering positions with the Arizona Department of Transportation and the City of Chandler, AZ, managing large infrastructure projects. He is a licensed engineer and holds a B.S. in Civil Engineering and Master of Public Administration from Arizona State University.

Abstract

A hallmark of creative environmental restoration along the Salt River corridor, the Phoenix Trés Rios Wetland has a convoluted story of how it came to be and the multiple purposes it serves. Along with Trés Rios, the Phoenix Rio Salado and companion Rio Salado Oeste projects require water in the river to restore and maintain habitat essential for a host of other creatures living along the river. As liaison to those projects, Mr. Upham shares a unique insight into Phoenix and the other SROG (Sub-Regional Operating Group) commitments to those projects, changes to effluent flows into the 91st Avenue and 23rd Avenue wastewater treatment plants and the impact of budget disputes in Washington on the future of the urban Salt River corridor.

Steve Westwood, Panelist
Senior Analyst Water Rights and Contracts, Salt River Project

Steve works to protect shareholder water rights, supplement supplies, and achieve water settlements; establish agreements for 100 year water obligations with local cities; and resolve issues of hydrology, geology, and subflow. Previously, his duties involved quantifying precipitation, river flow, reservoir storage, canal flow, groundwater withdrawals, and other water diversions in SRP's Water Measurement Department. He holds a B.S. in Geology from Arizona State University where this spring he will receive an M.S. in Information Management.

Abstract

The Salt River Project, as steward to the Valley of the Sun's "liquid gold," plays a key role in all of the existing and proposed environmental restoration efforts along the urban Salt River. This presentation provides an overview of water rights with regard to river restoration, implications of appropriating surface water from storm drains for in-stream uses, and how water for in-stream flows can be obtained.

Session 3: Taking Action, Engaging the Public

Monica Elser, Moderator
Education Manager, Global Institute of Sustainability

Monica Elser spent many years engaged in limnological research and published her work in a wide range of scientific journals. She moved out of research and into teaching and working with students at a variety of institutions including the University of California-Davis, Arizona State University, Scottsdale Community College and the Roosevelt Elementary School District. Her current interests are to engage K-12 students and teachers in inquiry-based science curriculum that link communities with their local research university. She leads the education team at Arizona State University's Global Institute of Sustainability which developed the award-winning Ecology Explorers, Service at Salado, and the Sustainability Science for Sustainable Schools programs.

Joe Dixon, Panelist
U.S. Army Corps of Engineers (retired)
Senior Scientist and Engineer, HDR

Joe Dixon has 36 years of federal service with the U.S. Army Corps of Engineers (Corps) and 3 years of working for HDR directing their Southwest federal water resources efforts. Over the years, Joe was involved with the Corps civil works program focusing on the planning, designing and construction of multipurpose water resources projects including Indian Bend Wash, Arizona Canal Diversion Channel, habitat restoration projects in Phoenix on the Salt River and in Tucson on the Santa Cruz and Rillito Rivers. He also had the opportunity of working closely with the Corps Hydrologic Engineering Center, HEC, in teaching several different Corps water resources classes including watershed management, ground water hydrology and hydraulics for planners. Joe was heavily involved with the Corps' efforts with the Western States Water Council and the Western Governors Association, working at the regional level with the 17 western states and other federal water resource agencies in developing compatible Corps policies and programs involving watershed planning and habitat restoration.

Abstract

The intriguing success “story” behind the planning, design, and construction of the Rio Salado and Tres Rios projects. One does not often get to hear the inside story and behind-the-scene activities that take place in the implementation of a multimillion dollar water resources project. That opportunity presents itself as Joe Dixon will share some antidotes and stories that chronicle the Corps of Engineers activities in helping to build two large habitat restoration projects on the Salt River, the Rio Salado and Tres Rios.

Thomas Krebs, Panelist
Senior Environmental Specialist for Wetlands, Salt River Pima-Maricopa Indian Community

Mr. Krebs has been the Senior Environmental Specialist for Wetlands at the Salt River Pima-Maricopa Indian Community for two years. He has developed the monitoring program of the Community's wetlands and bio-monitoring of the Verde and Salt Rivers. The Community now has identified and begun monitoring more than a dozen wetlands that occur in river corridors as well as along irrigation pathways. Mr. Krebs received his undergraduate in Wildlife and Range Resource Management at Brigham Young University (Provo, UT) and his master's in ecology at Northern Illinois University (Dekalb, IL). Before his position at the SRPMIC, he worked for five years in Georgia restoring over 15 miles of streams and many wetlands and performing annual ecological assessments.

Abstract

The Salt River, its riparian area and its valley are the foundation from which the Akimel O'odham people lived. This natural environment is both the past and future of the Salt River Pima-Maricopa Indian Community (SRPMIC). As the Community Development Department (CDD) Environmental Protection & Natural Resources (EPNR) Water Quality Program (WQP) is tasked with not only the technical duty of monitoring ambient surface and groundwater quality, but also the outreach of educating and engaging the Community on environmental issues. Some of the issues addressed are the role of water and wetlands, invasive species, recreational use and watershed cumulative effects. As the SRPMIC seeks to study, restore, or otherwise manage we also seek to involve Community members participation leading to education and engagement. For instance to do saltcedar removal, revegetation, and solid waste pick-up the SRPMIC has used a temporary worker crew made up of Community members. These men have developed a better understanding of the scourge of saltcedar and solid waste. The SRPMIC has created wetlands, removed saltcedar, monitored river water quality, cleaned up river solid waste, replanted native species, and limited the exposure of the West Nile Virus. These projects are affected by the urban sprawl around the Community and by involving its members the Community forever maintain the People's environmental heritage.

Roland Wass, Panelist
Consultant, WASS Gerke + Associates, Inc.

Dr. Wass has worked in both the public and private sector gaining more than 26 years of experience in the characterization, treatment and reuse of municipal effluent, industrial wastewater and storm water. In addition, he has experience in planning, permitting, designing and operation of constructed treatment wetlands, as well as, watershed and river restoration projects worldwide. The final products of Dr. Wass' work have included expert testimony, detailed scientific studies, environmental documents, designs, and design/technical notes submitted to private sector companies and municipal, county, state, and federal environmental and landuse/regulatory agencies.

Wetland and Riparian Restoration in Arid Lands

Wetland and riparian restoration in arid lands can be challenging. Challenges can come in various forms and have changed over the past 15 years. In 1995, restoration of wetland and riparian systems in Arizona was adequately funded and had support at the local, state, and federal levels. At that time the technical challenges, i.e., sustainability, water source(s), physical layout, plant selection, and operations and maintenance concerns were the focus. In 2013, public financial support has waned and there is a lack of desire to move restoration projects forward. With government coffers stressed to the limit it would seem that a new approach is warranted based upon the total economic value these resources provide on the landscape. This approach relies upon being able to communicate to the public and private sector that both use and non-use values in a manner where restoration of these resources can be shown that they provide a myriad of real benefits and potentially serve as true economic drivers. If successful, this will allow restoration projects to compete for funding with more traditional infrastructure/development projects and to engage private funding sources under the concept of natural resource banking. It was important in 1995 and more important now.

Summer Waters, Panelist

Water Resources Extension Agent, Maricopa County, University of Arizona

Summer Waters has a multi-disciplinary educational background that includes a Bachelor's degree in Biology from the University of South Florida and a Master's degree in Civil Engineering from the the Water Resources and Environmental Engineering program at University of Colorado at Boulder. She has over 10 years of experience working in natural resource planning and watershed protection, primarily in the public sector. She has focused on habitat protection and restoration through collaboration and policy. Summer currently works as the Water Resources Extension Agent at the Maricopa County Cooperative Extension office in Phoenix. She implements comprehensive programs that utilize applied research and non-formal adult education to address urban water issues in central Arizona She is a certified floodplain manager and a certified interpretive guide.

Engaging Urban Communities with Local Riparian Areas through the Maricopa County Master Watershed Steward Program

The Arizona Master Watershed Steward (MWS) program is designed to educate adults across the state of Arizona and train them to serve as volunteers who protect and restore local waterways. The Maricopa County program faces major challenges compared to the other MWS programs in Arizona because it has to first overcome the inherent disconnect between people (immersed in a highly urbanized area) and water-dependent natural resources. Then, the MWS program in Maricopa County must continually address funding needs, since it is not considered a high priority area when compared to programs aimed at protecting more pristine waterways. The MWS program in Maricopa County began in 2005. However, while other programs in the state grew to form non-profit organizations and watershed groups, the Maricopa County program dwindled. In 2009 the program was re-invigorated when it began focusing on local riparian restoration areas. Since that time a partnership between the City of Phoenix Parks and Recreation Department Natural

Resources Division and the Maricopa County MWS program has developed to better leverage resources and strengthen the program. In 2006, Master Watershed Stewards assisted with the grand opening of the Rio Salado Habitat Restoration Area. On February 2013, stewards again held a public outreach event at Rio Salado Habitat Restoration Area, this time drawing on the growing artistic and local movements of nearby downtown Phoenix. Both events were a tremendous success and other states have sought to replicate the Arizona MWS program, yet the award-winning Maricopa County MWS program still faces an uncertain future.

Cathy Wise, Panelist
Education Director, Audubon Arizona

Cathy is Audubon Arizona's Education Director and works out of the Nina Mason Pulliam Rio Salado Audubon Center in south Phoenix. She graduated from the University of California, Davis with a B.S. in Avian Sciences and has studied birds throughout the Southwest. Cathy has been involved with raptor rehabilitation and education in California at the Davis Raptor Center and in Arizona at both Liberty Wildlife and Adobe Mountain. She worked as a wildlife biologist for the Arizona Game and Fish Department, during which time she co-authored the *Arizona Breeding Bird Atlas* and changed more than a lifetimes' worth of flat tires doing field work. Cathy has also worked for the US Forest Service and the Utah Division of Wildlife Resources. Cathy strongly believes that conservation begins with education and works daily to reconnect people with nature through birds.

River Conservation for Consumers: Why it Matters More than You Think

Audubon Arizona is the state office of the National Audubon Society and our mission is to conserve birds and their habitats. We achieve our objectives using a three-pronged through science; advocacy and…you guessed it...education! Cathy will speak about the necessity of public involvement in riparian conservation and share some experiences from her work at the Nina Mason Pulliam Rio Salado Audubon Center in South Phoenix.

Posters (view during session and breaks)

Allan, Elijah, and Juliet Stromberg, School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. *Riparian Ecosystem Services: Akimel O'otham Ethnomedicinal Use of Plants in the Salt River.*

Riparian zones in southwestern USA provide habitat for many native and introduced plants. Plants are a primary source of medicinal compounds, and National Institute of Health sponsored surveys indicate that use of Complementary and Alternative Medicine (CAM) has increased in recent years. The Phoenix metro area's minority population, major users of CAM, also has increased. We asked: Does the number of potential medicinal and food sources differ between native and introduced plants in the Salt River riparian zones? We directly inventoried study sites for plant composition and also queried SEINet (a regional database) to determine the names of trees and shrubs growing along the river. To determine medicinal uses, particularly ethnomedicine of Akimel O'otham (AO) people, we queried several ethnobotany/medicine databases, and accessed prior information from AO elders. Of 52 woody plants, 40 native and 12 introduced, 29 had CAM uses. One introduced plant had actual AO CAM use, while the greatest CAM potential (20 medicinal applications) was found in an introduced tree species. We conclude that native and introduced woody plants in the Salt River do provide potential for plant-centered CAM use. Consideration of the plants' ethno-functional roles could be used as a basis to determine whether or not to weed plants from restoration sites.

Banville[1], Melanie, and Heather Bateman[2]. [1]Central Arizona–Phoenix Long-term Ecological Research, Global Institute of Sustainability, Arizona State University, PO Box 875402, Tempe, AZ 85287-5402; and [2]MOrrison School of Agribusiness and Resource Management, College of Technology and Innovation, Arizona State University-Polytechnic, 7231 E. Sonoran Arroyo Mall, 330 San Tan Hall, Mesa, AZ 85212. *Urban and Wildland Herpetofauna Communities and Riparian Microhabitats Along the Salt River, Arizona.*

Metropolitan areas are continually expanding, resulting in increasing impacts on ecosystems. Worldwide, riverine floodplains are among the most endangered landscapes and are often the focus of restoration activities. Amphibians and reptiles have valuable ecological roles in ecosystems, and promoting their abundance and diversity when rehabilitating riparian systems can contribute to reestablishing degraded ecosystem functions. In 2010, we evaluated the herpetofauna community by measuring abundance, richness, diversity, and species-habitat relations along three reaches (wildland, urban rehabilitated, and urban disturbed reaches) varying in degree of urbanization and rehabilitation along the Salt River in central Arizona. We performed visual surveys for herpetofauna and quantified riparian microhabitat along eight transects per reach. The wildland reach had the greatest herpetofauna species richness and diversity, and had similar abundance compared to the urban rehabilitated reach. The urban disturbed reach had the lowest herpetofauna abundance and species richness, and had a similar diversity compared to the urban rehabilitated reach. Principal Component Analysis reduced 21 microhabitat variables to five factors which described habitat differences among reaches. Vegetation structural complexity, vegetation species richness, densities of *Prosopis* (mesquite), *Salix* (willow), *Populus* (cottonwood), and animal burrow density had a positive

correlation with at least one herpetofauna community parameter. Rehabilitation activities positively influenced herpetofauna abundance and species richness; whereas, urbanization negatively influenced herpetofauna diversity. Based on herpetofauna-microhabitat associations, in order to improve herpetofauna habitat when rehabilitating degraded riparian systems, we recommend that urban natural resource managers avoid planting monotypic sized forest, increase vegetation structural complexity, woody debris as well as plant diversity, and promote small mammal abundance to increase burrow density.

Beer, Tom. Bosque School, 4000 Learning Rd NW, Albuquerque, NM 87120. The Bosque *Ecosystem Monitoring Program: A Model for Citizen Science*. (High school student)

The Bosque Ecosystem Monitoring Program (BEMP) involves over 3,500 K-12 and college students a year in direct riparian monitoring along 500km of the Rio Grande through New Mexico. BEMP is a joint project of the University of New Mexico's Biology Department and the Black Institute for Environmental Studies at Bosque School. Since 1996 BEMP has collaborated with K-12 students from across New Mexico and their teachers in a citizen science effort to track long-term change in the middle Rio Grande riparian forest, or bosque. BEMP data and analysis gathered at 27 sites and involving over a million data points a year consider the impacts of the ecological drivers of flood, fire, climate, and human alteration on the riverside forest. Findings are used by federal, state, tribal, and local government agencies to inform multimillion dollar management decisions. Participating students are supported with science education that is consistent with national science education reform efforts.

Birrell, Maria, and Lexi Churan. Bosque School, 4000 Learning Rd NW, Albuquerque, NM 87120. *Effectiveness of a Citizen Science Monitoring Program in Connecting Students to an Urban River*. (High school students)

We looked at how effective the citizen science Bosque Ecosystem Monitoring Program (BEMP) is in connecting students to an urban river. In this qualitative study, we created three different survey instruments to assess the impacts of BEMP participation on time in and care for the primary riparian area in the students' home watershed and to gather anecdotal information about student experiences in BEMP. The first survey was for middle school students, some of whom had participated in BEMP and some who had not. We gave a second survey to high school students currently active in BEMP, and a third survey to college students and recent high school graduates who had also participated in BEMP during their school careers.

Gerhart, Lucilla, and Jonathon Brearly. Bosque School, 4000 Learning Rd NW, Albuquerque, NM 87120. *Non-invasive Techniques for Collecting Beaver Hair Samples*. (High school students)

We ask - Is it possible to obtain hair samples from beaver (*Castor canadensis*) by using the same hair snare techniques used on other riverine mammals? Can we obtain viable hair samples for DNA analysis through hair snare devices adapted from Ruhn's technique which was previously used with river otter (*Lontra canadensis*)? Our preliminary results are promising. We have caught beaver hair, in enough volume to consider DNA analysis a probability. Using posts, suspended wire, and duct tape arranged in a slalom pattern along beaver slides has yielded results. Our work builds on a survey of beaver activity conducted by Giblin and Loftin where they identified areas of high beaver activity along the Rio Grande through Albuquerque. In addition to presenting this technique we also describe how high school students can participate in other various wildlife research along an urban river.

Foltz-Sweat, Jennifer. New College of Interdisciplinary Arts and Sciences, Arizona State University-West, 4701 W. Thunderbird Rd, Glendale, AZ 85306-4908. *A Survey of Bee Biodiversity across Urban and Semi-natural Riparian Habitats of the Salt River.*

The purpose of this research is to begin to assess, describe and quantify the interaction that human disturbance has on bee communities in riparian areas of Maricopa County, AZ. During the summer of 2012 bee biodiversity was surveyed at six locations within riparian communities along the Salt River from Tonto National Forest to the city of Avondale; four sample locations were inside of Phoenix or Tempe city limits. Bees were captured by net and pan trap using established sampling protocols; plants in flower were recorded and collected as needed. Field locations were sampled on one or more occasions each totaling 17 sampling days between March and June 2012. Preliminary identifications indicate that approximately 94 bee morphospecies were collected. Bees were found in flowers on 25 plant species, 80% of which are native to Arizona. Fifteen of the plant species had more than one bee species collected from their flowers. *Bebbia juncea* var. *aspera* attracted the greatest number of bee species (26 species) and was in flower throughout the season. Other woody plants with multiple bee species pollinators included *Encelia farinosa* (6 species), *Parkinsonia aculeata* (7 bee species) and *Vitex agnus-castus* (10 species). *Eriogonum deflexum* v. *deflexum*, a nondescript small annual, attracted 6 morphospecies of the genus *Perdita*, a group whose small size can allow the bees to escape sampling nets with wider mesh. The diversity of species so far collected suggests that the riparian communities of the study areas have a robust and diverse bee assemblage. However, bee populations frequently demonstrate orders of magnitude in sampling detections within sites and seasons; therefore, more sampling must be completed.

Gladding, Eleanor, and DeAnne Rietz. SWCA Environmental Consultants, 343 W Franklin St, Tucson, AZ 85701. *Fire Restoration Near Laguana Dam on the Lower Colorado River.*

On May 18, 2011, a campfire ignited a wildfire on the west side of the Lower Colorado River 15 miles north of Yuma, Arizona; the wildfire jumped the river and eventually burned a total of 751 acres of riparian vegetation. This event was located on federal and state lands near Laguna Dam and

became known as the Laguna Fire. It burned through the Betty's Kitchen Wildlife and Interpretive Area (Betty's Kitchen), Pratt Nursery, and Mittry South Restoration Area (Mittry South), as well as into the Mittry Lake Wildlife Area. Prior to the fire, these burned areas contained wetlands, which were habitat for wildlife, such as mammals and migratory birds, along with selected areas that were used for recreational purposes.

A majority of the area that was burned by the Laguna Fire is managed by the Bureau of Land Management (BLM). The BLM Yuma Field Office has plans underway for restoring 86 acres surrounding the Laguna Dam and Betty's Kitchen Wildlife and Interpretive Area that were destroyed by the fire. There are five planned restoration sites: Betty's Kitchen (15 acres); Pratt Nursery (4 acres); Mittry South (9 acres); Teal Alley (2 acres); and Laguna South (56 acres), which consists of three distinct sites south of Laguna Dam. The purpose of the restoration project is to restore and enhance the severely fire-damaged landscape in these five areas. Project activities include removing hazard trees and invasive/non-native species, seeding and planting native species, replacing lost structures and infrastructure, improving damaged trails, and monitoring the effects of the treatments.

Hamden, Abeer, and Soe Myint. School of Geographical Sciences and Urban Planning, Arizona State University, PO Box 875302, Tempe, AZ 85287-5302. *Quantifying Vegetation Cover Changes Along the Central Arizona Project (CAP) Canal Using Landsat TM Imagery.*

The Central Arizona Project (CAP) canal begins at Lake Havasu City and stretches over 336 miles to its terminus in southeastern Arizona near Tucson. In its path the CAP canal transects hundreds of ephemeral washes. The canal has built-in culverts or overchutes for larger washes to flow downstream, whereas smaller washes are in most cases dammed causing stormwater runoff to pool upslope behind the canal wall/berm. The shuffling of water across a vast desert landscape has caused changes in vegetation biomass.

We use Landsat TM images that date back pre-canal construction to analyze vegetation changes over time. An object-oriented approach using Definiens Developer was implemented in the methodology of image classification. The goal of this paper examines the following research question: How has vegetation cover across the Arizona desert changed due to the longitudinal disconnectivity created by the CAP canal?

Kuchar, Abby, and Claire Reardon. Bosque School, 4000 Learning Rd NW, Albuquerque, NM 87120. *Bat Speciation by Echolocation Survey in a Southwest Urban Riparian Area.* (High school students)

From August and September 2011 and for six months between May and November 2012 we recorded bat echolocation calls using Analook software and a microphone setup on the edge of the Rio Grande's riverside forest (bosque) within Albuquerque, NM. The recording location micro habitat was adjacent to a pond and a flowing irrigation ditch. We analyzed all bat echolocation recordings made each Saturday from 00:01 to 07:00 and 19:00 24:00. We recorded ≥700 bat calls. After collecting the calls, we sorted the calls by frequency pattern to identify the bat genera and

species present in that part of the bosque. We sought to see if our results – collected in a time of drought and after the outbreak of white nose syndrome – were similar to the results of an earlier study conducted from 2004 to 2006 by Gannon et al. at a similar site 1.6 kilometers distant. Our preliminary results show 14 bat species and a preponderance of silver-haired bat (*Lasiurus noctivagans*), California bat (*Myotis californicus*), pallid bat (*Antrozous pallidus*), and Allen's big-eared bat (*Idionycteris phyllotis*) calls. Our preliminary results indicate that our data track with Gannon's related to *M. californicus, A. pallidus, L. noctivagans,* and *I. phyllotis* and differ in relation to Mexican free-tailed bat, (*Tadarida brasiliensis*), and the species in the genus *Pipistrellus*, of which we have seen significantly fewer than observed by Gannon et al.

Makings, Elizabeth. School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. *The Salt River Flora, Then and Now.*

Recent botanical inventories along the Urban Salt River in central Arizona have revealed a variety of noteworthy discoveries and prompted questions about the past and present flora. Fortunately, the growing access to biological collection data has greatly enhanced our ability to reconstruct historical species assemblages. Herbarium records from 44 regional institutions were queried for their holdings of collections from the Salt River Valley in central Arizona. The earliest vouchers from the late 1800 and early 1900's present us with comparisons between the historical and present day flora as well as ecology of the region- with many taxa (and habitats) that are now locally extinct and/or rare, as well as recent introductions and novelties.

Madera, Robert, and Juliet C. Stromberg. School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. *Stormwater Tributaries, an Overlooked Environmental Flow.*

Urban tributaries in the form of underground pipes transport stormwater, irrigation overflow, and other sources of water to outfalls along the Salt River within the greater Phoenix metropolitan area. Over 800 outfalls route stormwater to the Salt River within the City of Phoenix alone. There is a need to understand how these outfalls influence wetland development in the Salt River bed. This project will create a baseline understanding of stormwater tributaries and provide a source of information to answer questions such as: What are the pathways of flow through stormwater systems? Which catchments route the greatest amount of water? Is riparian vegetation abundance at the outfalls correlated with urban catchment area and land cover? Do stormwater tributaries play important roles in hydrochoric seed dispersal? Stormwater data was obtained from the City of Phoenix on flow direction within pipes and location of inlets, outlets, and reservoirs. These data along with a digital terrain model (DTM) will be used to delineate catchment boundaries in ArcGIS. Four vegetation land cover classes were obtained from a 2011 Landsat thematic mapper (ETM) image using Erdas Imagine: xeric, mesic, impervious, and agriculture. Abundance of each type per catchment will be calculated with ArcGIS. Ground truth data will be gathered from 6 locations within each class to validate the classification. Area of riparian plant cover at the stormdrain outfalls will be measured using a combination of photo analysis and field sampling. This study will be of

value in contributing to our understanding of how urban water infrastructure influences the distribution of riparian vegetation along the mostly dewatered Salt River.

Monteith, Nancy. Environmental Planning Group, 209 East 800 South, Salt Lake City, UT 84101. *Best Practices for Riverfront Communities*.

The Jordan River corridor runs through 3 counties and 15 cities in the State of Utah, from Utah Lake, through the Salt Lake Valley, and finally into the Great Salt Lake. The Jordan River corridor has tremendous value as a recreational, economic and cultural resource to Wasatch Front communities and as an important habitat for native wildlife. Conditions along the river corridor vary greatly; from developed, and highly constrained sections, to mostly undeveloped and natural sections. Because of this variety, the communities along the river corridor have very different needs and priorities.

The project team is developing a set of best practices and implementation tools, based on the best available environmental, scientific, and engineering knowledge, to assist counties cities in protecting, enhancing, and capitalizing on an improved River corridor environment. The project area includes all land within ½ -mile of the river corridor. The consultant team includes landscape architects, planners, code developers, civil engineers, and public relations specialists.

The team interviewed planners and public works personnel from each city and county along the corridor, to gain understanding of how the community currently manages the river resources, and their perspective on the river. Two stakeholder workshops that included elected officials, city staff, agencies, and interested citizens, were held to solicit input on opportunities and challenges facing the communities in regards to improving the river corridor.

Project deliverables include a set of best practices that address: land use, environment, recreation, stormwater, and utilities for the ½-mile corridor. Included in the best practice document are implementation tools such as: an outline of an annotated riparian corridor ordinance (that communities can easily adapt); guidelines on how to include the best practices in short- and long-term planning mechanisms; and checklists for community self-evaluation, and development review.

Palta, Monica. School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. *"Accidental" Urban Wetland Networks along the Salt River in Phoenix, Arizona.*

Increases in available nutrients and bacteria in urban streams are at the forefront of research concerns within the ecological and medical communities, and both pollutants are expected to become increasingly problematic under projected changes in drought frequency and storm severity. The aim of this research was to examine the effect of storm events on nutrient (total organic and inorganic nitrogen, total organic carbon, sulfate) and *Escherichia coli (E. coli*) loading and attenuation along flowpaths in urban wetland networks along the Salt River in Phoenix, AZ. The study wetlands are fed by storm water outfalls exiting industrial and residential areas. Samples were collected along flowpaths downstream of six large, perennially-flowing outfalls during baseflow and immediately after storm events. Total discharge into the wetlands increased during storm events as compared to

discharge prior to storm events. Concentrations of nutrients and *E. coli* were significantly lower during baseflow conditions than immediately following storm events. Spikes of dissolved pollutants returned to pre-storm levels rapidly (within a week) following each storm event. *E. coli* counts and nutrient concentrations dropped over the length of flowpaths through the wetlands, indicating high attenuation capability. Wetlands are typically constructed or restored to mitigate microbial and nutrient contamination of wastewater. Our research indicates that even "accidental" urban wetlands can serve to help reduce the amount of nutrients, *E. coli*, and Coliforms in storm and wastewater. However, wetland restoration or design targeting increased water retention time may increase the capability of the Salt River to remove nutrient and pathogens from stormwater.

Rupprecht, Candice. Water Resources Research Center, Univerity of Arizona, 350 N. Campbell Ave, Tucson, AZ 85719. *Conserve to Enhance: A Tool for Linking Consumer Water Efficiency and Riparian and Urban Waterway Enhancements.*

The University of Arizona Water Resources Research Center (WRRC) is exploring ways to meet the challenge of water for the environment in Arizona. The Sonoran Institute, Tucson Water, Watershed Management Group, and WRRC have partnered to engage Tucson Water customers as pilot program participants to voluntarily conserve water and contribute the value of their savings to the Conserve to Enhance (C2E) fund. From January 2011 through December 2012, 58 pilot participants engaged in a variety of water conservation actions, including water harvesting workshops and pledged donations based on monthly water savings to a C2E fund. C2E pilot participants saved 2.2 million gallons of water and donated over $2,000 in donations during the pilot. Simultaneously, C2E has gained political support through a voluntary check box on the Tucson Water utility bill that was approved by City of Tucson Mayor and Council and provides thousands of dollars in additional funding for local C2E projects annually. Check box funds and participant donations were invested in a riparian enhancement project adjacent to Atturbury Wash in Lincoln Park, on the south side of Tucson in October 2012. In 2013 C2E will be funding new urban wash and neighborhood enhancement projects throughout Tucson that include small-scale rainwater harvesting and green infrastructure to improve neighborhoods and local washes.

Schelz, Charles, National Park Service, Flagstaff, AZ 86004. *Arizona Walnut Population Study in Walnut Canyon National Monument, 2011-2012.*

This projects primary goal was to record the condition of the Arizona walnut (*Juglans major*) population by locating and measuring every tree, seedling, and sapling within the canyon corridor of Walnut Canyon National Monument. The riparian area is the primary habitat for the Arizona walnut within Walnut Canyon National Monument and was the area most intensively surveyed Upstream dams have disrupted the natural flow regime for over 100 years since 1904, when the first of two dams was constructed and formed Lower Lake Mary.

A total of 2,065 Arizona walnut trees were counted within the monument. Trees are distributed throughout the canyon bottom, but there are a few gaps and clusters. Gaps appeared in the driest sections where the canyon was wide and there was minimal shade. Other gaps are in the steepest

sections where the walls tower over the canyon, and there is seasonal erosional scouring on the narrow canyon bottom with little sun and actual space for tree development. The thickest clusters of trees appear to be associated with archeological sites and human habitation. Possibly from the intensive historic use of the walnut, a protein rich food, and probably from the fact that water is closer and more available in these areas.

The lack of an evenly distributed age class distribution was a major concern before this project was completed. In fact, the loss of recruitment or lack of young seedlings and saplings was thought to be the most serious future problem for the Arizona walnut population in the monument due to upstream dams and development. However, this survey has shown that a healthy diversity of the whole range of age classes, as measured by Diameter at Breast Height and height of trees, is present throughout the monument. There is high age-class diversity and this diversity is widespread throughout the canyon. This bodes very well for the future of the Arizona walnut population health and vitality within the monument.

The vigor of the trees in the monument also appears to be very diverse and healthy. All stages of vigor are present in representative numbers throughout the monument, with no areas displaying high numbers of low vigor.

A separate final report was developed for the genetic analysis of Arizona walnut samples taken throughout Walnut Canyon National Monument. This report was authored by Dr. Gery Allan of Northern Arizona University (Allan 2012), and is based on 148 leaf samples collected from different trees throughout the monument in 2011. Results indicate high genetic diversity throughout the canyon. Data were compared between trees found below and above Santa Fe Dam within the monument, and no significant genetic differences could be determined.

Schelz, C. D., D. Scher, T.Vegh, and P. Whitefield. 2013. Arizona Walnut Population Study at Walnut Canyon National Monument. Prepared for the National Park Service, Flagstaff Area National Monuments, Resource Management Division. Natural Resource Technical Report NPS/XXXX/NRXX-20XX/XXX. National Park Service, Fort Collins, CO.

Stromberg, Julie, Dustin Wolkis, Brenton Scott, and Elizabeth Makings. School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. *Beyond Cottonwoods: Floristic Restoration in an Urban Floodplain*.

Efforts to restore urban rivers are on the rise. However, river restoration can be expensive and does not always accomplish its goals. An alternative to actively restoring degraded river bottomlands is to allow plants to self-assemble at sites receiving municipal water runoff. For the Salt River in the Phoenix metro area we asked: 1. Is plant species diversity at actively restored urban sites similar to that at nonurban sites? 2. Are self-assembled (serendipitously restored) sites as floristically diverse as those that were actively restored? Three times during 2012 we surveyed riparian vegetation at a nonurban reference, two actively restored sites (one recent and one >10 years old), outfalls of two perennial storm drains, and outfalls of one ephemeral drain. Across sites and times we sampled 125 taxa. The restoration site was as diverse as the non-urban reference site, but was depauperate in "uncommon" flora and in species classified as facultative riparian. Restoring such species to urban settings would require widening floodplains and providing connectivity to adjoining tributaries and desert uplands, or seeding with a local seed mix. The serendipitous wetlands sustained high diversity

of wetland taxa, including some rare species not found at restoration sites. Storm drains and effluent can provide inexpensive high quality restoration, provided a permanent water source is secured. Ephemeral-flow drains support xeroriparian shrubs and, seasonally, wetland plants, thereby contributing to river-wide diversity.

Stromberg, Juliet C., and Karl A. Wyant. School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. *Mesquite Bosques: A Regionally Important Groundwater-Dependent Ecosystem.*

In dryland regions, groundwater-dependent ecosystems (GDE) are valued for their high productivity and role in sustaining regional diversity. Velvet mesquite (*Prosopis velutina*) bosques are an unusual type of GDE, given the ability of mesquite to extract water from 15 m or more below ground surface and to fix atmospheric nitrogen through a mutualism with bacteria. Arid riparian conservation plans have generally downplayed the role of mesquite bosques in favor of cottonwood/willow (*Populus/Salix*) forests, another type of GDE. Here we present a literature review that indicates that breeding and migratory birds often are as abundant in xeroriparian mesquite bosques as they are in cottonwood/willow forests. Furthermore, the bosques provide a key resource for native bees, with various authors reporting from 64 to 160 species locally associated with *P. velutina* or *P. juliflora*. For belowground fauna, a recent analysis of soil cores shows that mesquite bosque has 2.0x and 1.5x more nematodes per unit of soil than nearby creosote (*Larrea tridentata*) and cottonwood stands, respectively. Similarly, mesquite bosque soils have 3.0x and 4.7x more total microarthropods than creosote and cottonwood soils. Although mesquite forests increased at the expense of riparian grasslands during a late 19th century period of regional channel incision, in the mid 20th century many of the the forests declined in area and stature owing to forest cutting and land clearing for agriculture. Efforts to restore mesquite bosques to old-growth status (with diameters of >1 m and heights >20 m) will require patience on the part of restorationists and formal recognition in land conservation plans of the ecosystem services provided by bosques.

Waters, Summer. University of Arizona Cooperative Extension, Maricopa County, 4341 E. Broadway Rd, Phoenix, AZ 85040. *Training Volunteer Scientists through the Maricopa County Master Watershed Steward Program.*

The Arizona Master Watershed Steward (MWS) program is designed to educate adults across the state of Arizona and train them to serve as volunteers who protect, restore, monitor, and conserve local waterways. The 10-week course combines classroom education and field training activities. The core topics include hydrology, climate, water quality, water management, geology and soils, ecology, and streams. Each graduate must also contribute 40 hours of volunteer time in their community to become a full-fledged Master Watershed Steward. The MWS program in Maricopa County began in 2005 and was re-invigorated in 2009 when it began focusing on local riparian restoration areas and incorporated "Hot Topics" into the course that cover timely and locally relevant issues. These topics complement the core curriculum: The Arizona Watershed Stewardship Guide, which was developed at the University of Arizona to ensure the dissemination of non-biased, research-based information.

The Maricopa County program focuses on issues facing the Phoenix metropolitan area such as urbanization, non-point source pollution, water conservation, urban riparian restoration, and connecting people with riparian ecosystems. MWS graduates have contributed over 2000 volunteer hours in Maricopa County and gained recognition when the program won the 2012 Valley Forward Environmental Stewardship Award and President's Award. Project highlights include seasonal photopoint monitoring in the Rio Salado Habitat Restoration Area, construction of a Low-Impact Development (LID) demonstration area at the Maricopa County Cooperative Extension office, GIS mapping of restoration and monitoring activities at the Rio Salado Habitat Restoration Area, wetland and river clean-up activities, and public outreach events.

Wilson, Lea Ione. School of Sustainability, Arizona State University, PO Box 875502, Tempe, AZ 85287-5502. *Attitudes Towards Ecosystem Services in Urban Riparian Parks.*

Urban riparian parks provide an important access to point to nature for urban dwellers, but they are also an important "green infrastructure" providing ecosystem services through their design and management. Design and management, however, are determined by the attitudes of people towards ecosystems. What are the attitudes of urban riparian park users towards ecosystem services? Are these attitudes different between two types of urban riparian park space? What is the relationship between design and management goals and the attitudes of park users towards ecosystem services? In this study, design and management goals were determined through interviews with park officials. The attitudes of urban park users towards refugia, aesthetics, microclimate regulation, stormwater regulation, recreational opportunities, and educational opportunities were evaluated using the tripartite model of attitudes (affect, cognition, and behavior). A questionnaire was administered to 104 urban riparian park users between two different parks in Tempe and Phoenix, AZ: a classically developed park; and a habitat rehabilitation area. All components of attitude were found to be positive, however attitudes towards refugia, stormwater, recreation, and education, were statistically different ($p<0.05$) and more positive in the habitat rehabilitation area. Park users supported management goals, though they valued stormwater regulation less than did managers. In addition, qualitative responses suggest that the nature of park use and human interaction differ between the two parks. These differences between parks suggest support for green infrastructure but also a variety of integrated designs to expand and diversify both ecosystem services and the opportunities for social-ecological interactions.

Xiu, Brittany Choate, Kelly Mott Lacroix, and Sharon B. Megdal. Water Resources Research Center, University of Arizona, 350 N. Campbell Ave, Tucson, AZ 85719. *Calculating and Considering Environmental Water Demands in Arizona.*

In the southwestern United States we take great pride in the natural beauty of our landscapes and rely on those landscapes to power cities, support crops, and quench our thirst. While economic engines drive quantification and planning of water for cities, farming and the like, few have pursued the question of what it would take to maintain water in Arizona's environment. An increasing interest in keeping water in the environment for outdoor recreation and riparian biota presents an

opportunity for establishing water management that is mutually beneficial for the environment and human populations. Determining options for water management that benefit all users requires at least two things: 1) a better understanding of the water demands of the environment and 2) dialogue between users on the role of the environment in water planning and management. To understand the water demands of the environment the Water Resources Research Center (WRRC) reviewed 92 studies on environmental water demands in Arizona and found that only 20% of all Arizona stream reaches have been studied (35% of perennial, 8% of intermittent). Of the studies reviewed, 58% quantified information on some aspect of water needed by the environment. Most studies were of multiple species; however, very few studies quantified the environmental water needs of the entire ecosystem. This poster explores what we know about environmental water demands, the need for water planning that integrates human and environmental demands, and how the WRRC is working to apply available information on water demands for humans and the environment to start a dialogue on how water planning efforts in Arizona could consider the environment.