Twenty-First Meeting
of the
Arizona Riparian Council

Hotel Casa Grande
Casa Grande, Arizona
April 11-13, 2007

Climate and Riparian Areas:
Connecting the Dots –
Climate Change/Variability and Ecosystem Impacts in Southwestern Riparian Areas

Program and Abstracts
2007

Twenty-First Annual Meeting
Arizona Riparian Council
in conjunction with
University of Arizona's
Cooperative Extension Service and CLIMAS

Climate and Riparian Areas Workshop:
Hotel Casa Grande, 777 N Pinal Ave, Casa Grande, Arizona
April 11-13, 2007

What does everyone need to know about climate change & variability and the impact on Southwestern riparian areas?

Wednesday April 11th: Plenary Session

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

9:00 - 9:10 ***Introduction*** – Tom Hildebrandt, George Zaimes

9:10 - 9:40 ***Climate Change and Variability: New Insights Suggest New Urgency*** – Lisa Graumlich, Director, School of Natural Resources, University of Arizona

9:40 - 10:10 ***Climate Change and Southwest Riparian Areas*** – Katherine Hirschboeck, Associate Professor of Climatology, Laboratory of Tree-Ring Research, University of Arizona

10:10 - 10:30 ***Break and Poster Viewing***

10:30 - 11:00 ***Climate Impacts and Water in the Riparian Zone*** – James Hogan, Assistant Director of Science, Center for Sustainability of Semi-Arid Hydrology and Riparian Areas, University of Arizona

11:00 - 11:30 ***Projecting the Effects of Climate Change on Riparian Ecosystems in the Southwest: The Upper San Pedro as a Case Study*** – Mark Dixon, Assistant Professor, Department of Biology, University of South Dakota

11:30 - 12:00 ***Watershed and Upland Disturbance Factors*** – Peter Ffolliott, Professor, Watershed Resources, School of Natural Resources, University of Arizona

12:00 - 12:20 ***Q & A Session with Morning Presenters*** – Tom Hildebrandt, moderator

12:20 - 1:30 ***Lunch***

1:30 - 2:15 ***Synthesis Discussion - Implications of Morning's Topical Presentations for Management of Riparian Areas*** – Duncan Patten, Research Professor, Land Resources and Environmental Sciences, Montana State University

2:15 - 4:15 ***WorldCafé -A Creative Process for a Conversation Leading to Collaborative Dialogue, Sharing Knowledge and Creating Possibilities for Action*** – Gregg Garfin (Lead Moderator), Program Manager/Investigator, Institute for the Study of Planet Earth, University of Arizona

4:15 - 5:00 ***Arizona Riparian Council Business Meeting*** – All are encouraged to participate.

- Elections
- Bylaws
- Agua Fria National Monument Project
- Fall meeting suggestions

6:00 - 6:30 ***Poster Session***

Web-Based Drought Impact Reporting System for Arizona – Evelyn Erlandsen, Melanie Ford, Arizona Department of Water Resources, and Michael. A. Crimmins, Department of Soil, Water, and Environmental Science & Arizona Cooperative Extension, The University of Arizona

Proposed Riparian Assessment and Monitoring within the Agua Fria National Monument – Tim Flood, Scott Jones, and Wanda Kolomyjec, Friends of the Agua Fria National Monument

Changes in Floodplain Vegetation in Response to a Late Summer Flood on the Hassayampa River – Andrea Hazelton and Juliet Stromberg, School of Life Sciences, Arizona State University

Teleconnection of Verde River Geomorphology and Cottonwood-Willow Community with North Pacific Climate Patterns - The Pacific Decadal Oscillation – Sharon Masek Lopez, Diana Elder Anderson, The Hope Tribe Water Resources Program, and Abraham Springer, Department of Geology, Northern Arizona University

Return of Fire to a Free-Flowing Desert River: Effects on Vegetation – Tyler J. Rychener and Juliet C Stromberg, School of Life Sciences, Arizona State University, and Mark D. Dixon, University of South Dakota

Restoration of a Portion of Billy Creek and Implementation of Natural Area and Recreational Trail for Public Use – K. Barbara Teague, Pinetop/Lakeside

Southwestern Willow Flycatcher Mitigation Land Management and Endangered Species Act Requirements: Implications of Salt Cedar Control Ruth A. Valencia and Charles E. Paradzick, Salt River Project

6:30 ***Arizona Riparian Council Banquet*** - Stan Leake, U.S. Geological Survey is the featured speaker and coauthor of *Ribbon of Green: Change in Riparian Vegetation in the Southwestern United States*

Climate and Riparian Areas Workshop: Thursday, April 12th, Technical Session

8:00 - 8:15 ***Welcome/Housekeeping*** – Tom Hildebrandt/Mike Crimmins

8:15 - 8:45 ***Climate Change and Riparian Areas Research Finding and Implications*** – Juliet Stromberg, School of Life Sciences, Arizona State University

Technical Papers Session (Tom Hildebrandt, Moderator)

8:45 - 9:05 ***Picture Canyon: Planning Riparian-Wetland Refugia in an Urban Setting*** – Tom Moody and Stephanie Yard, Natural Channel Design, Inc.

9:05 - 9:25 ***Bringing Back Native Riparian Plant Communities Along Hydrologically Altered Rivers: Lessons Gained From Bi-National Collaborative Efforts Along the Big Bend Reach of the Rio Grande/Rio Bravo*** – Mark Briggs, Chihuahuan Desert Program, World Wildlife Fund

9:25 - 9:45 ***Differential Effects of Climate Perturbations on Pure and Hybrid Cottonwood Species: Implications for Management*** – Alicyn Gitlin and Thomas Whitham, Department of Biological Sciences, Northern Arizona University

9:45 - 10:05 **Native Fish Conservation and Climate Variability in the Southwestern United States** – Doug Duncan, US Fish and Wildlife Service and Gregg Garfin, CLIMAS, University of Arizona

10:05 - 10:25 ***Break and Poster Viewing***

10:25-10:45 ***Effects of Surface Water Depletion and Groundwater Withdrawal on Arizona's Riparian Bird Communities*** – Chris Kirkpatrick and Courtney J. Conway, University of Arizona

10:45-11:05 ***Influence of Beaver Activity, Vegetation Structure, and Surface Water on Riparian Bird Communities along the Upper San Pedro River, Arizona*** – Glenn Johnson and Charles van Riper, School of Natural Resources, University of Arizona and USGS Sonoran Desert Research Station

11:05 - 11:30 ***Technical Paper Session Wrap-up - Synthesis of Discussion Points of Technical Papers and Workshop Theme*** – Duncan Patten, Research Professor, Land Resources and Environmental Sciences, Montana State University

11:30 - 12:45 ***Lunch***

Management & Policy Implications

12:45 -1:00 ***Using Recent Observations to Consider Global Warming Impacts on Riparian Areas*** – Melanie Lenart, Research Associate, Institute for the Study of Planet Earth, University of Arizona

1:00 - 1:15 ***Riparian Areas and Human Water Demand*** – Jeanmarie Haney, Hydrologist, The Nature Conservancy

1:15 - 1:30 ***Wildlife and Habitat Issues*** – Charles Paradzick, Senior Ecologist, Salt River Project

1:30 -1:45 ***Regional Groundwater Management for Sustaining Riparian Ecosystems: Linking Science with Policy and Dealing with Uncertainty***. – Holly Richter, Upper San Pedro Program Manager, The Nature Conservancy

1:45 - 2:30 ***All Speakers Panel Discussion*** - Q & A Session, Gregg Garfin (Moderator)

2:30 - 2:45 ***Break***

2:45 - 4:30 ***Riparian Areas Photo Series Exercise - Breakout Activity***. – George Zaimes, Watershed, Riparian & Rangelands Specialist, School of Natural Resources, University of Arizona and Michael Crimmins, Climate Science Specialist, Department of Soil, Water & Environmental Sciences, University of Arizona

4:30 - 5:00 ***Wrap-up***

Climate and Riparian Areas Workshop:
Friday Apr. 13th, Field Trip

8:00 Assemble for field trip - Tom Hildebrandt (lead), Tucson Audubon Simpson Restoration Site on the Santa Cruz River in Avra Valley

Facts about the Tucson Audubon Simpson Restoration Site:

The land owned by City of Tucson and managed by Tucson Water and the parcel being restored by Tucson Audubon is 1,700 acres. The site elevation is 1,900 ft. About 1.2 miles of the river runs through the site. Water source is treated municipal effluent, except when storm waters enhance the flow. Restoration focuses on planting and seeding native plants appropriate for floodplain and riparian plant communities in this region; heavy use is made of rainwater harvesting earthworks (microbasins, swales) to increase soil moisture around plantings.

A water use agreement with Tucson Water allows the use of 10 acre-feet/year for irrigation of plantings (either groundwater or river water). Restoration plants and infrastructure are challenged by harsh conditions at the site, including annual high and low temperatures that have differed by as much as 97 degrees; very dry foresummers; immense floods, invasive species, etc. Restoration work has been funded by in-lieu mitigation funds, the Arizona Water Protection Fund Commission, and a U.S. Fish and Wildlife Partners grant.

12:00 pm Box Lunch provided

2:00 pm Return to hotel

Invited Speaker Biographies

Michael A. Crimmins
Michael A. Crimmins is on the faculty of the Department of Soil, Water, and Environmental Science at the University of Arizona and is an Extension Specialist in climate science for Arizona Cooperative Extension. Dr. Crimmins is trained as an applied climatologist and meteorologist and has ten years experience in the application of climatological and meteorological methods, tools, and data for natural resource management. Watershed management was his focus for four years while working as a private sector environmental scientist. In that position, he provided expertise on hydroclimatology, urban and agricultural non-point source runoff modeling, remote sensing and GIS applications for watershed management. He is currently working with land managers across Arizona to incorporate climate information into their operations and decision making.

Mark Dixon
Dr. Dixon's research centers on the drivers of change in riparian landscapes, with a particular focus on how hydrologic and geomorphic processes - and alterations to these by climate or flow regulation - influence the dynamics and structure of floodplain forests and their biota. Dr. Dixon received his B.S. in Animal Ecology from Iowa State University in 1987, his M.S. in Wildlife Ecology from South Dakota State University in 1994, his Ph.D. in Zoology (Landscape Ecology focus) at the University of Wisconsin in 2001, and worked as a postdoctoral researcher at Arizona State University with Dr. Julie Stromberg until 2006. Since August 2006, Dr. Dixon has been an assistant professor in the Department of Biology at the University of South Dakota. In addition to work on the San Pedro River in Arizona, Dr. Dixon has conducted research on riparian vegetation dynamics on the Wisconsin, Snake, and Platte Rivers and is now initiating work on floodplain forest ecology and historic land cover change along the Missouri River in South Dakota.

Peter F. Ffolliott
Peter F. Ffolliott holds appointments as a Professor in the School of Natural Resources, Professor in Arid Lands Resource Studies, and the Laboratory of Tree Ring Research, University of Arizona, Tucson, Arizona. He holds a B.S. in Forest Management and a M.S. in Forest-Wildlife Management from the University of Minnesota and a PhD in Watershed Management and Water Resources Administration from the University of Arizona. Prior to coming to the University of Arizona in 1970, he was a Research Forester with the Rocky Mountain Research Station, USDA Forest Service, Flagstaff, Arizona. Ffolliott currently teaches courses and conducts research programs in water resources; watershed, range, and other natural resources management; and ecological assessments and evaluations. He is a Fellow of the Society of American Foresters, the Indian Association of Hydrologists, and the Arizona-Nevada Academy of Science and a member of many other professional and honorary societies. Ffolliott has authored, co-authored, or jointly authored over 530 publications on the ecology, management, and appraisal of watershed and other natural resources programs and related topics.

Gregg Garfin
Dr. Garfin is project manager for the Climate Assessment for the Southwest (CLIMAS) project, a NOAA-funded integrated assessment designed to identify and evaluate climate impacts on human and natural systems in the Southwest, and to identify climate services useful in assisting decision makers to cope with climate-related risks. As manager of the project, Dr. Garfin works to bridge the science-society interface and to facilitate knowledge exchange across that interface. Dr. Garfin is

trained as a climatologist, dendroclimatologist, and geographer. His research interests include climate variability, drought, and the effective delivery of climate science to decision makers. Dr. Garfin is co-chair of Arizona's drought monitoring technical committee. He is a contributor to the U.S. Drought Monitor. In 2004, he served as a member of the integrated team for the development of a National Integrated Drought Information System.

Lisa Graumlich
Dr. Lisa J. Graumlich's position as Director of the School of Natural Resources at the University of Arizona allows her to combine her career-long interest in global climate change with the emerging issue of how to best manage natural resources in an uncertain future. As a researcher, she investigates the nature of human-environment interactions by melding records of severe and persistent climate episodes, such as mega-droughts, with historical accounts of social adaptation vs. collapse. Graumlich received her Ph.D. from the University of Washington (1985). She was named an Aldo Leopold Leadership Fellow in 1999 and was elected as Fellow of the American Association for the Advancement of Science in 2004.

Jeanmarie Haney
Jeanmarie Haney, Hydrologist, The Nature Conservancy in Arizona, is a Sonoran Desert native who has been passionately devoted to the American Southwest all of her life. Jeanmarie has a BS and MS in geology (University of Arizona and Colorado State University, respectively) and has been active in Arizona water issues for over 20 years, the past 6 years with The Nature Conservancy. Jeanmarie works on a variety of projects aimed at keeping water in our remaining streams for the maintenance of biodiversity. Jeanmarie spends her free time exploring wild places and her own backyard.

Katherine Hirschboeck
Katherine (Katie) Hirschboeck's research involves the climatology and hydroclimatology of extreme events - especially floods, paleofloods, and droughts – which she analyzes from the perspective of their meteorological and climatological causes and their long-term variability. She also uses synoptic climatology and dendroclimatology to link tree-ring responses to anomalous atmospheric circulation patterns. She is a Associate Professor of Climatology in the Laboratory of Tree-Ring Research and holds joint appointments in the departments of Hydrology & Water Resources, Atmospheric Sciences, and Geography & Regional Development, University of Arizona. She also serves as the Chair of the Global Change Ph.D. Minor Graduate Interdisciplinary Program and participates in the Arid Lands Resource Sciences Interdisciplinary Program. She earned her B.S. and M.S. degrees in Geography, with a minor in Geology, from the University of Wisconsin-Madison and her Ph.D. degree in Geosciences from the University of Arizona in 1985. Her dissertation examined the hydroclimatic causes of mixed distributions in Arizona flood records, linking them to climatic variability. Prior to joining the University of Arizona faculty in 1991 she held positions at the University of Oklahoma and Louisiana State University.

Stanley Leake
Stan Leake, of Tucson, Arizona, is a research hydrologist with the U.S. Geological Survey, where he has worked for more than 30 years. His main areas of work include water availability, interaction of ground water and surface water, land subsidence, and development of new capabilities for simulating processes related to ground-water flow. For the popular ground-water model program, MODFLOW, Leake has developed capabilities to simulate land subsidence, reservoirs, time-varying boundary conditions, and detailed local models within larger regional models. His current activities include

regional perspectives on ground-water/surface-water interaction, effects of ground-water withdrawals on surface water features, geohydrology and water management in an agricultural area, and further development of ground-water simulation capabilities applicable in the arid and semi-arid Southwest. He is a coauthor of *Ribbon of Green: Change in Riparian Vegetation in the Southwestern United States* with Robert Webb and Raymond Turner.

Melanie Lenart
Melanie Lenart is a research associate with the University of Arizona's Institute for the Study of Planet Earth, hired in October 2003 to join the Climate Assessment for the Southwest (CLIMAS) project. Dr. Lenart has a Ph.D. in Natural Resources and Global Change from the University of Arizona (2003), an M.S. in forestry from the University of Illinois (1992) and a B.A. in journalism from Northern Illinois University (1984). Between academic stints, she worked as a reporter and environmental writer in Chicago and Puerto Rico. Her dissertation through the UA Laboratory of Tree-Ring Research involved research on uprooted trees in tropical and temperate forests. Current outreach efforts include writing feature articles on climate variability and change for publications including Environment, the Tucson Desert Museum's sonorensis, and CLIMAS' monthly Southwest Climate Outlook. A series of her Outlook articles are being compiled into an upcoming book, Global Warming in the Southwest.

Charles E. Paradzick
Chuck began work as Senior Ecologist, Siting and Studies, Environmental Services, Salt River Project in 2005 and focused primarily on the development and implementation of a Habitat Conservation Plan for operations of Horseshoe and Bartlett dams on the Verde River. He also assists other water and power work units with evaluation of projects on wildlife, fisheries, and habitats, and compliance with various federal and state natural resource laws. Prior to SRP, he worked 10 years for Arizona Game and Fish Department in their Habitat, Nongame, and Fisheries Branches. He has a B.S. in Wildlife Conservation Biology (1994), and a Masters of Natural Science (2005) both from Arizona State University.

Duncan T. Patten
Duncan Patten is Research Professor with the Department of Land Resources and Environmental Sciences and affiliated faculty with the Big Sky Institute. He is also Professor Emeritus of Plant Biology at Arizona State University with a Ph.D. in plant ecology from Duke University. Duncan taught at Virginia Polytechnic Institute and State University before going to Arizona State University in 1965 and then moved to Montana State University in 1999. He has served on National Science Foundation panels, is a member of various committees, boards, and commissions of the National Research Council and has been an officer in the Ecological Society of America. At Arizona State University, he served as Assistant Vice President for Academic Affairs, Chairperson of the Department of Plant Biology and Microbiology, and Director of the University's Center for Environmental Studies, an interdisciplinary research center. He is a certified senior ecologist and a Fellow of the American Association for Advancement of Science. Dr. Patten is also founding President of the Arizona Riparian Council and was President of the Society of Wetland Scientists. Research of Dr. Patten and his students and colleagues is centered on the dynamics of plant communities and ecosystems. Systems that are being studied range from the desert to subalpine spruce-fir communities including riparian ecosystems that link the altitudinal zones together. Much of the research is oriented toward assessing the effects of human activities on these systems. Because ecosystems vary in their resistance and resiliency to disturbance, resource management decisions

should be based on information about the response of the systems to types of perturbation. The goal of Patten's research program is to integrate basic and applied ecological research to permit better resource management decisions while expanding our knowledge of the basic functions of riparian, wetland, mountain and other western ecosystems.

Holly Richter
Since 1998 Dr. Richter has worked closely with many academic partners, agencies, organizations, and stakeholders within the Upper San Pedro Basin to conserve the San Pedro River through informed decision-making regarding groundwater management. She currently chairs the Technical Committee of the Upper San Pedro Partnership, and serves as Vice-Chair for their Executive Committee. She was appointed by the National Research Council to their Committee on USGS Water Resources Research, and also collaborates with conservation partners in Sonora, Mexico to address conservation issues within the larger bi-national San Pedro watershed. Dr. Richter completed her Ph.D. research focused on riparian ecosystem modeling studies at Colorado State University in 1999.

Julie Stromberg
Julie Stromberg is Associate Professor in the School of Life Sciences at Arizona State University. She and her graduate students have been studying the plant ecology of desert rivers for over two decades. Her research goal is to understand the processes that shape riparian plant populations, communities, and landscapes, and in particular to understand the linkages that exist between stream hydrology and riparian vegetation.She serves on the editorial board of the journal *Wetlands* and has also been an editor for the journal *Restoration Ecology*.

George Zaimes
Dr. Zaimes goal is to develop a statewide extension program on watershed and riparian management for public and private lands. Dr. Zaimes joined the School of Natural Resources at the University of Arizona in 2005 as an Assistant Extension Specialist, Watershed Resources and Riparian Areas, School of Natural Resources, University of Arizona. His past research has focused on conservation practices of riparian areas in heavily agricultural landscape to mitigate non-point source pollutants reaching streams. In his current position he develops programs to inform the public on proper management practices on watersheds with an emphasis on the riparian areas and rangelands. He received a Ph.D. in 2004 in Water Resources, M.S. in Forest Biology in 1999 and B.S. in 1997 in Forestry, all from Iowa State University. Dr. Zaimes also received a Ptyhio in Forestry from the Technological Education Institute of Drama in Greece in 1995.

ABSTRACTS

Abstracts are listed alphabetically by first author.

Briggs, M. Restoration Ecologist, Chihuahuan Desert Program, World Wildlife Fund; mkbriggs@msn.com. ***Bringing Back Native Riparian Plant Communities Along Hydrologically Altered Rivers: Lessons Gained From Bi-National Collaborative Efforts Along the Big Bend Reach of the Rio Grande/Rio Bravo***

The Rio Grande/Rio Bravo defines the entire US-Mexico border in the Texas-Chihuahua/Coahuila region. Along the Big Bend reach, the river passes through the Chihuahuan Desert biome – a largely arid, yet extraordinary diverse landscape that is recognized as being of critical global biologic importance. Although the Rio Grande as a border receives attention, the Rio Grande as a river has not. The combined influences of over-allocation of river water, river impoundment, increased contamination, invasion of non-native species, and the potential overarching affects of climate change have significantly reduced the diversity, extent, and distribution of native species throughout much of the lower Rio Grande. To address this ecological decline, a broad-based, bi-national coalition has formed that includes five protected areas (three in the U.S., two in Mexico), federal and state natural resource agencies, the World Wildlife Fund, and local NGOs. This collaborative approach has produced bi-national agreements and working groups that are purchasing water rights for the environment, removing non-native plants, restoring native bottomland plant communities, amongst other activities. Although the Big Bend effort began only five years ago, several critical lessons have been gained that can be applied to bottomland restoration efforts throughout the arid southwestern US and northern Mexico. Some of these lessons include the formulation of realistic restoration objectives (e.g., is true restoration feasible?) in the context of climate change and increasing water demand, the importance of conducting ecological research and hydrologic modeling to better understand current conditions, the benefits and limitations of efforts focused solely on removing non-native vegetation and revegetating with native plants, the challenges and potential long-term benefit of purchasing water rights for the benefit of the environment, and the inherent opportunities and challenges in 'restoration' efforts along a significant reach of a heavily impacted bi-national river.

Dixon, M. D.[1], and J. C. Stromberg[2]. [1]Department of Biology, University of South Dakota, Vermillion, SD 57069; Mark.Dixon@usd.edu; and [2]School of Life Sciences, Arizona State University, Tempe, AZ 85287-4501; jstrom@asu.edu. ***Projecting the Effects of Climate Change on Riparian Ecosystems in the Southwest: The Upper San Pedro as a Case Study***

Climate is an important direct and indirect driver of change in aquatic, riparian, and terrestrial ecosystems in the Southwest. Indirect climatic effects on the structure and function of riparian ecosystems occur largely through the influence of climate on stream flow (floods, low flows) and groundwater hydrology. Hence, long-term changes in climatic regimes would be expected to have significant effects on riparian ecosystems. We projected the potential effects of a range of different climate change scenarios on the Upper San Pedro riparian ecosystem, with a particular focus on riparian vegetation. We modeled the potential effects of transient changes in temperature (no change

or 5°C increase) and winter precipitation (50% decline, 50% increase, 100% increase) on riparian vegetation dynamics by linking models of watershed runoff, channel migration, and vegetation succession. Overall, we project a significant decline in cottonwood forest area and an expansion of mesquite shrubland and/or grassland in the Upper San Pedro floodplain over the next 100 years, with the most severe declines occurring under climate change scenarios with warmer, drier winters. However, declines in cottonwood area are also projected both under scenarios of no climate change and under a significantly wetter future climate, as the current distribution of forest along the river is largely a legacy of long-term channel recovery from the arroyo phenomenon of the late 19th and early 20th centuries and is not in equilibrium with present-day geomorphic processes. Declines in the area of cottonwood forest under all scenarios would likely negatively affect regional abundance of bird species that are obligate users of cottonwood-willow forests. Our results suggest that the responses of dynamic riparian ecosystems to climate change may be complex and idiosyncratic, and that the influence of existing historical legacies and vegetation successional processes should be considered when projecting the response of riparian ecosystems to potential future climate change.

Duncan, D.[1], and G. Garfin[2]. [1]U.S. Fish and Wildlife Service, 201 N. Bonita, Suite 141, Tucson, AZ 85745; and [2]CLIMAS, University of Arizona, 715 N. Park Ave, The University of Arizona, Tucson, AZ 85721. ***Native Fish Conservation and Climate Variability in the Southwestern United States***

The conservation of native fish in the southwestern United States has always been reliant on finding water that isn't "used," or that does not have conflicts that make the site unavailable. Examples of issues that can render a site unsuitable or unusable for native fish are sport fisheries, low-quality effluent, non-indigenous fish, and livestock use. Climate change and drought also have the potential to drastically and negatively alter the status of and conservation activities for native fishes.

In addition to the issues listed above, the multiple effects of human activities in a watershed also impact waters. Native fish conservation is also complicated because of potential conflicts with other rare aquatic species.

The potential effects of climate change and drought need to be addressed by the time factor and uncertainty of effects. The precautionary principle should be adhered to when planning for native fish conservation. While there may not necessarily be solutions to the problems presented by drought and climate change, there are things that can be done to minimize their effects to native fishes in the southwestern United States.

Erlandsen, E.,[1] M. Ford[1], and M. A. Crimmins[2]. [1]Arizona Department of Water Resources, Statewide Drought Program, 3550 N. Central Ave, Phoenix, AZ 85012; and [2] Department of Soil, Water, and Environmental Science & Arizona Cooperative Extension, The University of Arizona, Room 429 Shantz Building #38, P.O. Box 210038, Tucson, AZ 85721-0038. ***Web-Based Drought Impact Reporting System for Arizona*** **(POSTER)**

A web-based drought impact reporting system is being developed to assist in the collection of county level drought impact data. The monitoring and collection of drought impact data will serve several purposes. The data will provide groundtruthing in relation to the drought status maps produced by the State Monitoring Technical Committee (MTC). These status maps are based on standardized precipitation index (SPI) and streamflow data. The local-level monitoring helps create a map product that more accurately reflects local conditions. In addition to assisting the MTC in their efforts, gathering local data will also help local communities identify drought vulnerability areas which will assist in the development of mitigation and response planning for those local areas.

This poster presentation will include background information on the Arizona Drought Preparedness Plan including the Monitoring Technical Committee (MTC), the Interagency Coordinating Group (ICG), and the Local Drought Impact Groups (LDIG). This information will help lay the foundation for why we need "drought reporters." The display will have the drought impact reporting system as the focal point. The reporting system will highlight who should report (local land/water users), how they will report (drought reporting system) and what they will report (drought impact data related to watersheds, wildlife, rangelands, agriculture, etc.).

Flood, T. S. Jones, and W. Kolomyjec. Friends of the Agua Fria National Monument. Http://www.aguafriafriends.org ***Proposed Riparian Assessment and Monitoring within the Agua Fria National Monument*** **(POSTER)**

The Friends of the Agua Fria National Monument (FAFNM) was founded in 2004 to support the management of this Presidentially declared monument. The FAFNM is a non-for-profit organization of individuals that assists the Bureau of Land Management (BLM) – the agency directed to manage the Monument. The 120 members of the group reside mostly in the Phoenix metro area, but there also is significant representation from areas north of the Valley.

The assets of the Monument are identified in the Presidential declaration: numerous but fragile archeological ruins, pronghorn and other wildlife species, and a desert stream with associated riparian habitat. The 71,000-acre expanse of the Monument and limited federal resources pose management challenges. The Friends encourage responsible visitation to the Monument. Like the BLM, the Friends seek to preserve the Monument's assets while allowing human appreciation of this desert ecosystem.

In 2006 in five workday outings, the FAFNM removed over 100 tamarisk trees from the one-half mile Badger Springs Wash that adjoins the Agua Fria River. In 2007 the Friends have initiated a collaboration with the Arizona Riparian Council and Audubon Arizona to document the status of the several riparian zones within the Monument. This poster will describe the organization of the FAFNM, general activities to date, and our initial project plans for addressing the water-related values of the monument.

Ffolliott, P. F. School of Natural Resources, University of Arizona, Tucson. ***Watershed and Upland Disturbance Factors***

Soil erosion and the resulting sediment movement and surface runoff (overland flow) are crucial to the stability of riparian ecosystems. Soil erosion rates on the watersheds surrounding riparian corridors and sediment transport and water flow to downstream riparian areas are controlled by the vegetation, topography, hydrology, and soil and geologic formations within this linked system. A response to disturbances on the upland watersheds such as wildfire, livestock grazing, or tree cutting on the quantity and quality of streamflow, bank storage, and channel stability of the riparian corridors must be determined within this context. This presentation stresses key relationships between watershed condition and riparian health and how these relationships can change as a consequence of watershed disturbances in terms of a dynamic equilibrium between channel erosion (degradation) and sediment deposition (aggradation). Current research efforts and management implications relative to these relationships are also discussed.

Garfin, G. Deputy Director for Outreach, Institute for the Study of Planet Earth, University of Arizona, 715 N. Park Ave., 2nd Fl., Tucson, AZ 85721-0156. ***World Café***

The World Café is an interactive discussion session during which workshop participants will engage in conversations to explore solutions to issues related to climate and riparian areas in the Southwest. We will collectively examine issues related to the effects of multiyear and decadal climate variability on riparian environments. We will also discuss the potential impacts of climate change on riparian environments. We will develop a strategy for research needed to make climate information and climate change projections useful to riparian managers and others. We will evaluate the intersection of human and climatic impacts and explore ways to enhance management practices to meet these challenges. The World Café discussions will connect ideas presented by the plenary speakers (April 11) with the experience and practical knowledge of riparian managers and field scientists. This will enrich the perspectives put forth in technical session papers (April 12), as well as preparing the ground for lively panel discussions during the afternoon session (April 12).

Graumlich, L. J. School of Natural Resources, The University of Arizona, Tucson, AZ 85721; lisag@cals.arizona.edu. ***Climate Change and Variability: New Insights Suggest New Urgency***

Earlier this year, the Intergovernmental Panel on Climate Change (IPCC) released its latest comprehensive assessment of the current state of knowledge of global climate change and its impacts (http://www.ipcc.ch/). The report concludes that warming of the climate system is unequivocal and that most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations. In addition, the report provides sobering projections as to climate trajectories for the southwestern USA,

including decreased precipitation and water availability in the coming decades. In my talk, I will summarize the background to this latest assessment and discuss its implications for the Southwest. In particular, I will point to how non-linear responses in ecosystems create challenges for managing natural resources in a warming world.

Gitlin, A., and T. Whitham. Department of Biological Sciences, Northern Arizona University, PO Box 5640, Flagstaff, AZ 86011-5640. ***Differential Effects of Climate Perturbations on Pure and Hybrid Cottonwood Species: Implications for Management***

Studies published in the last decade argue that anthropogenic influences on Western riparian systems are threatening cottonwoods (*Populus* spp.), which, as dominant species, structure the riparian community by creating locally stable conditions for other species and modulating fundamental ecosystem processes. Compounding the impacts that the increasing water demands of a growing population will have on riparian forests, several models predict rising global temperatures will cause greater climatic variation in the Southwest and increase drought severity. This study combined field studies with spatial analyses of native cottonwood trees (low elevation broadleaf cottonwoods, *Populus fremontii* and *P. deltoides*, upper elevation narrowleaf cottonwoods, *P. angustifolia*, and their naturally occurring hybrids) during an ongoing extreme drought to identify riparian areas in the southwest U.S. that are most drought sensitive and most resilient, providing a basis for prioritizing management. Our method revealed the following four patterns: 1) Projected temperature and precipitation change will have opposing effects on the two cottonwood species we studied. Broadleaf cottonwoods will be highly vulnerable to drier conditions, and narrowleaf cottonwoods will be vulnerable to temperature increases. 2) Broadleaf cottonwoods, which are common, currently have a greater potential niche than other cottonwoods (narrowleaf and hybrids) and tolerate the greatest environmental variation, but can become rare under extended extreme drought conditions. 3) Trees capable of asexual reproduction will have an advantage in maintaining aboveground biomass during dry periods. 4) Hybrid zones, areas of high genetic and associated community diversity, show greater drought tolerance than zones with parental species only. During drought, the mortality of the parental species was 3-4 times greater than their naturally occurring hybrids. Our GARP model accurately predicted the distribution of upper- and lower-elevation cottonwood species and their overlap was a significant predictor of hybrid tree locations, as verified by three independent validations. This enabled the identification of likely drought refugia deserving special protection, and vulnerable areas needing proactive attention. We argue that effective conservation practices may require attention to finer scales than species-level protections, i.e., conserving genetic diversity and more drought tolerant naturally occurring hybrids.

Haney, J. The Nature Conservancy; jhaney@tnc.org; ***Defining the Water Needs of Freshwater Ecosystems***

Freshwater ecosystems - rivers, creeks, springs, cienegas, and wetlands - support a disproportionately large number of plants and animals relative to the area they occupy. The web of water law, policy, and management in Arizona is exceedingly complex, reflecting the attempt to achieve equity among the

various water use sectors. However, the environment – the plants and animals that inhabit or rely on freshwater ecosystems – has been absent from the water-negotiating table. Hydrologic alterations from human activities such as dams, diversions, groundwater pumping, and land development, have caused loss of diversity and ecologic function in freshwater ecosystems. Rivers and other freshwater ecosystems have varying degrees of reliance on surface water and groundwater, and organisms inhabiting these systems have evolved life cycles keyed to the natural seasonal and annual fluctuations in flow and water availability. Advances in the interdisciplinary field of hydroecology, which combines hydrology, geomorphology, and ecology, have provided critical insights into the water needs of these systems. Opportunities exist to re-operate dams and diversions and to conduct spatial groundwater management such that environmental water requirements are considered along with human water needs. Science can provide the tools and methods for defining the water needs of particular freshwater ecosystems and projecting the consequences of alternative development scenarios. Scientific studies are best developed through a collaborative, interdisciplinary process, involving a broad range of state, federal, and academic scientists working with water managers. Understanding the water needs of freshwater ecosystems and the spatial connections of the natural and human-built environment is crucial to managing water effectively to meet both human and ecosystem water needs. The goal is for results from scientific studies to be translated to informed decision making and holistic river-aquifer management.

Hazelton, A. F., and J. C. Stromberg, School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. ***Changes in Floodplain Vegetation in Response to a Late Summer Flood on the Hassayampa River*** **(POSTER)**

Floods are the primary disturbance in riparian ecosystems, and play a dominant role in maintaining as well as altering floodplain vegetation. In the desert Southwest, floods occur in response to summer monsoon storms, winter synoptic storms, and, less frequently, in response to late summer and early autumn tropical storms. Some researchers predict that global climate change will lead to an increase in size of tropical storms; winter storms also may increase while changes in monsoonal storms less well understood. If the former occurs, then the floo regime of Southwestern rivers will shift toward larger and later warm-season floods. To better understand the potential effect of this shift to later-season flooding, we tracked changes in riparian vegetation following a mid-September 2006, five-year recurrence interval flood on the Hassayampa River. Preliminary results are consistent with other studies of flood effects: In the three months following the flood, species richness increased in inundated plots, while it decreased in plots that were not inundated by the flood. Inundated plots in ephemeral and intermittent reaches of the river experienced the greatest increase in diversity, due to the increased water availability. To examine the effect of flood timing, we compare our data from this flood with that from past floods of relatively similar magnitude (on Hassayampa and San Pedro Rivers). We hypothesize that different suites of species will emerge in response to floods occurring in different seasons. If this were to occur, it could point to a long-term shift in floodplain species composition.

Hirschboeck, K. K. University of Arizona, 208 W Stadium, Tucson, AZ 85721; katie@ltrr.arizona.edu. ***Climate Change and Southwest Riparian Areas***

How do we transfer the growing body of knowledge and assertions about global climate change and variability to individual Southwestern watersheds and their riparian areas? Issues of spatial and temporal scale are of key importance in understanding the processes involved in the delivery of precipitation to individual watersheds. This presentation argues that attention to some very basic geographic elements at the local and regional scale – such as basin size, watershed boundaries, storm type seasonality, atmospheric circulation patterns, and geographic setting – can provide a basis for a cross-scale approach to linking global climate variability with local hydrologic variations that affect riparian areas, including extreme events in the "tails" of the streamflow distribution such as floods and droughts. By definition extreme events are rare, hence gauged streamflow records capture only a recent sample of the full range of extremes that have been experienced by a given watershed. Information extracted from tree-rings and stratigraphic paleo-stage indicators (PSI) can augment the gauged record of extreme events in some Arizona watersheds. A systematic compilation of this watershed-specific information about spatially and temporally varying hydroclimatic extremes is proposed as a starting place for making operationally useful decisions about prospective climatic changes. By associating seasonal and long-term variations in a stream's hydrograph with storm types and the synoptic atmospheric circulation patterns that deliver them, a process-based "upscaling" approach provides an alternative way to bridge the gaps between local, regional, and global scales of hydroclimate information and projections. Some challenges involved in using this approach to sort out the linkages between global climate change and regional streamflow variability will be illustrated using the Verde and San Pedro watersheds.

Hogan, J. Assistant Director for Science, SAHRA - Sustainability of semiArid Hydrology and Riparian Areas and Adjunct Assistant Professor of Hydrology and Water Resources, University of Arizona, Marshall Building Room 534, 845 N Park Ave, PO Box 210158-B, Tucson AZ 85721-0158; jhogan@hwr.arizona.edu ***Climate Impacts and Water Sources in the Riparian Zone***

Regional groundwater discharge to riparian zones, along the potential impacts of pumping induced water table lowering, has long been recognized. Recent research results in the southwest United States and elsewhere have demonstrated that flood waters stored in alluvial aquifer systems are critical for maintaining riparian groundwater levels and stream baseflow during the dry periods between rains in semiarid systems. This storage of floodwaters has specific implications for the water available to desert streams. First, seasonal flooding, in contrast to regional groundwater which is hundreds to thousands of years old, represents a riparian water sources that is sensitive to climate variability and change. Second, since flood waters are found in alluvial aquifers, management of the upland regions where runoff is generated is critical to sustainable management of these systems. Third, if floodwaters represent a replacement in the water budget for mountain front or basin floor recharge the implication is that there is less water available for pumping before a river s water budget would be impacted. Critically the actual mechanism and controlling factors by which transient floodwaters are stored and converted into baseflows is not well understood. Important considerations include the seasonality of flooding (winter vs. summer), the hydrologic status of a given reach (gaining vs. losing) and scale of river-aquifer interaction as driven by geologic structure (basin sediments vs. bedrock).

Examples drawn from the San Pedro, Verde and Rio Grande riparian systems will be used to illustrate the critical role of floodwaters on the riparian water budget, controls on flood driven recharge, and the implications for sustainable management of riparian systems.

Johnson, G., and C. van Riper. School of Natural Resources and USGS Sonoran Desert Research Station, 125 Biological Sciences East, University of Arizona, Tucson, AZ. 85719. ***Influence of Beaver Activity, Vegetation Structure, and Surface Water on Riparian Bird Communities along the Upper San Pedro River, Arizona***

Conserving and restoring riparian areas are fundamental for the persistence of bird and other wildlife populations, especially in arid environments. Many land managers and restoration ecologists consider the re-establishment of beaver (*Castor canadensis*) as a valuable and low-cost means of restoring riparian attributes and functionality. To assess this expectation, we studied avian abundance and community structure in relation to a recently re-introduced population of beaver across a gradient of riparian conditions along the upper San Pedro River in southeast Arizona in 2005 and 2006. We used distance sampling to estimate bird abundance and species richness and measured vegetation and hydrologic factors at 300 survey stations, a sub-set of which were surveyed prior to the re-establishment of beaver in 2001. We found that a greater intensity of beaver activity was associated with higher bird species richness and greater abundance of several species of regional conservation concern (e.g., song sparrow, *Melospiza melodia*) after controlling for variation in presence of surface water, vegetation structure, and other factors. In contrast, the presence of surface water, but not beaver activity, was highly correlated with greater abundance of other such species (e.g., yellow warbler, *Dendroica petechia*). Our study helps elucidate the relative importance of beaver activity and various riparian attributes that influence this regionally important bird community, and can aid managers that are considering using beaver to restore riparian areas.

Kirkpatrick, C., and C. J. Conway. School of Natural Resources, 104 Biological Sciences East, The University of Arizona, Tucson, AZ 85721. ***Effects of Surface Water Depletion and Groundwater Withdrawal on Arizona's Riparian Bird Communities***

Riparian woodlands in the desert Southwest are an extremely important resource because they constitute <1% of the desert landscape, yet typically support >50% of the breeding birds. Riparian woodlands also provide shelter and critical food resources for dozens of species of Neotropical migratory birds that alight in these woodlands during their spring and fall migrations across the desert Southwest. Groundwater withdrawal (and subsequent loss of surface water) to support growing human populations in the desert Southwest has the potential to degrade or eliminate riparian woodlands throughout the region. The goal of this long-term research project is to assess the value of riparian woodlands to the health and persistence of avian communities in the desert Southwest. Specifically, we seek to quantify the extent to which both surface water and the health of riparian vegetation affect the abundance and diversity of riparian birds. During the first year of our study (2006), we surveyed birds, sampled vegetation, and measured surface water at 17 study sights located

in riparian woodlands throughout southeastern Arizona. We also sampled avian food resources (i.e., aerial arthropods) and monitored nests of riparian bird species at a subset of these study sites. We used multiple linear regression to examine the role of both surface water and the health of riparian vegetation on bird parameters while controlling for potentially confounding variables such as vegetation structure and composition. Results from the first year of our study indicate that relative abundances of four species of birds (black phoebe, Wilson's warbler, common yellowthroat, and song sparrow) were positively associated with the presence and extent of surface water in riparian woodlands of the desert Southwest. In addition, we found evidence of substantial declines in breeding populations of several riparian-obligate bird species (e.g., Bell's vireo and yellow warbler) following a recent die-off of riparian trees at 1 of our 17 study sites (Rincon Creek, Saguaro National Park). Ultimately, results from this research project will provide data that will allow managers to better predict how abundance and diversity of riparian birds will be affected by future reductions in ground and surface water levels in the desert Southwest. These data are important given that climate change is likely to compound problems associated with groundwater withdrawal and surface water depletion in the region.

Lenart, M. University of Arizona, Tucson, AZ 85721; mlenart@email.arizona.edu. ***Using Recent Observations to Consider Global Warming Impacts on Riparian Areas***

How can riparian specialists apply the growing body of knowledge about climate change and variability to their management efforts? This session briefly reviews some of the research about how warming temperatures can affect various seasonal precipitation regimes, with a focus on the observational record. Earlier snowmelt is changing the timing of peak streamflow. The summer monsoon, summer and fall rainfall from hurricane remnants, and winter/spring El Niño events may be influenced by rising temperatures on land and at sea. However, the climate patterns influencing seasonal precipitation do not move in synch; in some cases, they interact in ways that increase the expectation for greater variability in precipitation at the intraannual scale. Because riparian areas integrate precipitation events in time and space, the streamflow record may magnify precipitation trends, as illustrated by the San Pedro River at Charleston. As at Charleston, streamflow trends for the same gage may differ when considered at the seasonal rather than annual scale (with the caveat that seasonal differences in nearby groundwater withdrawals also influence trends). The Climate Forecast Evaluation Tool is briefly introduced as a management tool for considering the value of short-term seasonal projections within the context of climate variability.

Masek Lopez, S.[1], D. Elder Anderson[1], and A. Springer[2]. [2]The Hopi Tribe, Water Resources Program, 5200 E. Cortland Blvd., Ste. E-100, Flagstaff, AZ 86004; and Department of Geology, Northern Arizona University, PO Box 4099, Flagstaff, AZ 86011-4099. ***Teleconnection of Verde River Geomorphology and Cottonwood-Willow Community with North Pacific Climate Patterns - The Pacific Decadal Oscillation*** **(POSTER)**

The Pacific Decadal Oscillation (PDO) has been shown to influence precipitation, streamflow, and flood magnitudes throughout the West. However, few studies have made a correlation between PDO and fluvial geomorphologic changes that can result from changes in flood magnitudes. The positive phase of the PDO from 1977 though 1997 brought increased flood magnitudes to the Southwest. To demonstrate the effects of the PDO and increasing flood magnitudes, we mapped features in the Verde Valley, Arizona from historic aerial photographs in GIS and then ran simple linear regressions on data using the following factors: PDO index, peak annual discharges greater than 10,000 cfs, changes in channel area, and changes in cottonwood-willow area. Our results demonstrated significant linear realtionships between (1) PDO and flood magnitude, (2) flood magnitude and channel area, and (3) flood magnitude and medium-density cottonwood-willow coverage.

Based on the apparent PDO cycle, land managers can anticipate warm-dry conditions for the next one to two decades and expect lower flood frequencies and magnitudes and gradual recovery of Southwestern riparian areas from the flood damage of the 1980s and 1990s. However, water stress on riparian trees may complicate restoration efforts, particularly in areas where humans compete with riparian vegetation for available water resources.

Moody, T., and S. Yard. Natural Channel Design, Inc., 3410 S Cocopah Dr, Flagstaff, AZ 86001. ***Picture Canyon: Planning Riparian-Wetland Refugia in an Urban Setting***

If the climate scientists are correct, the climate in the Southwest will get drier and hotter. And the already limited riparian areas will shrink to smaller ecological niches and refugia will become increasingly important. Urban stream segments supported by reclaimed effluent can not only provide valuable aesthetic and recreational benefits but maintain valuable refugia for the remaining native riparian plant communities. But these projects can require complex planning and coordination due to the large number of stakeholders. One such example is the Picture Canyon project along the Rio de Flag within Flagstaff's city boundaries. This project area includes lands belonging to the City of Flagstaff and Arizona State Land Department and lies partly within the jurisdiction of City and part in Coconino County. The unique ecology and cultural resources have attracted interest of Arizona Department of Game and Fish, Museum of Northern Arizona, Northern Arizona University, the Audubon Society, local hiking and biking clubs, and a number of Native American tribes including the Hopi and Apache. These stakeholders, along with interested citizens, have assembled into a working group that is enthusiastically creating plans to manage weeds, restore channel function, repopulate native and ethnobotanically important plants, monitor habitat value, and develop educational opportunities. With the assistance of a grant from the Arizona Water Protection Fund, this project has the potential to become a win-win situation for humans and wildlife alike. Implementation is planned for Spring, 2007 with plant inventories and weed control. Channel restoration and revegetation will occur over the next 5 years with monitoring, adaptive management, and educational projects extending at least 15 years into the future.

Paradzick, C. E. Salt River Project, PAB 352, PO Box 52025, Phoenix, AZ 85072-2025; Charles.Paradzick@srpnet.com ***Implications of Climate Change on Conservation of Riparian Wildlife and their Habitats in the Southwest***

Southwestern aquatic and riparian habitats are recognized as having a disproportionate importance to wildlife compared to their area on the landscape. Their functional role in the environment includes supporting regional biodiversity hotspots, providing essential habitat for rare endemic fish, wildlife, and plant species, sustaining connectivity between uplands and aquatic systems, and providing important migratory stopover habitat and movement corridors for many species. Abundance and distribution of riparian and aquatic species are largely driven by 1) temperature (e.g., thermal tolerances of coldwater native trout), and 2) water availability that influences flow regime and related hydrogeomorphic processes, which in turn create and sustain species habitats. Thus, the ecological consequences of climate change on species and their habitats may be direct (i.e., changes to air or water temperatures) or indirect through alteration to broader environmental conditions (e.g., vegetation community, food web effects) caused by flow regime changes. Climate change projections for the southwest suggest warming over the next century, but the predictions for precipitation (i.e., wetter or drier than today) is unclear. This uncertainty, coupled with confounding influence of past, current, and future anthropogenic impacts on aquatic and riparian systems (e.g., groundwater pumping, introduced species, fragmentation) and lack of quantitative habitat data for many species, makes predicting responses to climate change difficult. The impact of climate change adds a new threat onto an already substantial list of concerns, but also presents many novel and unique questions and challenges for wildlife managers and policy makers who are working to conserve species and their habitats.

Richter, H. The Nature Conservancy, Bisbee, AZ USA, hrichter@tnc.org ***Regional Groundwater Management for Sustaining Riparian Ecosystems: Linking Science with Policy and Dealing with Uncertainty***

Regional groundwater management that addresses the needs of both sustainable ecosystems and growing human communities involves complex decision-making processes that have significant political, socio-economic, and ecological implications. These decisions are even more difficult, and involve more uncertainty, within the context of high inter-annual climatic variability, fluctuating population growth rates, and global climate change. The efforts of the Upper San Pedro Partnership provide a case study example of how decision-makers and scientists can incrementally move decision-making processes forward through an adaptive management approach. Integration of ecological and hydrologic research and monitoring programs, simulation models, iterative project planning and policy formation, along with consensus building processes within the Sierra Vista Subwatershed of the San Pedro River will be discussed.

Rychener[1], T. J., J. C. Stromberg[1], and M. D Dixon[2]. [1]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501; and [2]Department of Biology, University of South Dakota, Vermillion, SD 57069. ***Return of Fire to a Free-Flowing Desert River: Effects on Vegetation*** **(POSTER)**

Changes in disturbance regime often lead to changes in plant community structure. After a long period in which fuel loads were sparse, fire recently has occurred with high frequency in the ungrazed riparian zone of the Upper San Pedro River. We studied four accidental fires that occurred during 1994-2003. Woody vegetation and landscape structure were contrasted between burned sites and matched spatial controls, and before and after one fire. Herbaceous vegetation was sampled in multiple years producing a chronosequence of time since fire. Riparian fire was associated with reductions in woody plant species diversity and canopy cover. For herbaceous vegetation, fire caused a short-term (2 year) pulse of diversity, driven by annual species, similar to patterns observed after fire in Chihuahuan Desert uplands and after floods in riparian zones. Fire also caused persistent increase in herbaceous cover, mediated in part by the reduction in tree canopy cover. By converting riparian woodlands to grasslands and savannahs, fire appears to be shifting vegetation structure of the Upper San Pedro floodplain closer towards conditions present during past centuries, when fire was frequent in the upland desert grasslands and embedded riparian corridor. These patterns constitute a reversal of trends, observed in many ecoregions, for grasslands to shift to wooded vegetation types following grazing-linked fire suppression.

Teague, K. B. Pinetop/Lakeside, 1360 N. Niels Hansen Ln, Lakeside, AZ 85929, ***Restoration of a Portion of Billy Creek and Implementation of Natural Area and Recreational Trail for Public. Use*** **(POSTER)**

The Town of Pinetop-Lakeside leases land from Navajo County along a portion of Billy Creek. Billy Creek and Walnut Creek provide the geographical structure for town activities in which residents and visitors are regularly engaged. The creeks help to bridge the gap caused by a state highway which bisects the community along the lengthy vertical axis. Much of the water corridor is privately owned making public access limited. The Town and the County have formed a partnership to restore the neglected public natural area of the Billy Creek. The paper discusses the following: renewal of the Partnership; assessment of the natural water channel and its riparian corridor, and necessary restoration; public enjoyment of the natural area; and protection of required flood way corridors.

Valencia, R. A, Sr. Biologist (ravalenc@srpnet.com) and C. E. Paradzick (ceparadz@srpnet.com), Sr. Ecologist, Salt River Project, PAB352, PO Box 52025, Phoenix, AZ, 85072-2025. ***Southwestern Willow Flycatcher Mitigation Land Management and Endangered Species Act Requirements: Implications of Salt Cedar Control*** **(POSTER)**

Salt River Project (SRP) presents a case study of potentially conflicting federal objectives related to tamarisk eradication and protection of an endangered species, the Southwestern willow flycatcher. New funding sources for eradication of tamarisk in the Southwest have captured the attention of communities along Arizona's riparian corridors. Communities are evaluating costs of eradication against perceived benefits of increased water yield, reduced risk of wildfire, and increased channel capacity for flood waters. SRP is responsible for the perpetual protection of Southwestern willow flycatcher habitat on mitigation lands along rivers where large-scale tamarisk eradication is being considered, specifically the upper Gila River in Arizona. Concern arises over the lack of knowledge about the type of vegetation that would replace tamarisk stands. SRP lists a number of research needs and issues that should be addressed prior to the development and implementation of a large-scale attempt to eradicate tamarisk from the upper Gila River in Arizona.

Zaimes, G.[1] and M. Crimmins[2]. [1]Watershed, Riparian and Rangeland Management Extension Specialist, University of Arizona, School of Natural Resources, 310 Biological Sciences East, Tucson, Arizona 85721, zaimes@cals.aruzona.edu; and [2]Climate Science Extension Specialist, University of Arizona, Department of Soil, Water & Environmental Science, P.O. Box 210038, Tucson, Arizona 85721, crimmins@cals.aruzona.edu. ***Riparian Area Photo Series Exercise***

Riparian areas are estimated to be less than 2% of the total land area in western United States. Their value is disproportionate to their area because of their many functions and uses. The high number of users and diverse perception regarding the importance and proper use of riparian areas makes managing these areas complex. A key to properly managing these areas is to understand how these areas function and change through time. Riparian areas are disturbance driven and very dynamic and as result can change frequently and suddenly. Through this thought exercise we will look at photographs of riparian areas taken from the same location over a number of years and try to understand if changes are correlated to hydroclimatological data.

NOTES