SEVENTH ANNUAL MEETING OF THE ARIZONA RIPARIAN COUNCIL

Rio Rico Resort
16-17 April 1993

International Border Rivers: Their Ecology and Management

PROGRAM AND ABSTRACTS
1993

ARIZONA RIPARIAN COUNCIL SEVENTH ANNUAL MEETING
RIO RICO RESORT, RIO RICO, ARIZONA
APRIL 16-17, 1993

Friday, April 16

8:00-9:00 AM Registration - Hotel Lobby

9:00 - 9:15 AM Introductory Remarks

GENERAL SESSION
International Rivers: Their Ecology and Management

9:15-9:45 AM *Upper San Pedro* - Greg Yuncevich, San Pedro National Riparian Conservation Area, Bureau of Land Management

9:45-10:15 AM *Lower Rio Grande* - Larry Ditto, Rio Grande Valley National Wildlife Refuge, U.S. Fish and Wildlife Service

10:15-10:30 AM BREAK

10:30-11:00 AM *Lower Colorado River* - Edward Glenn, Environmental Research Laboratory, University of Arizona

11:00-11:30 AM *Upper Santa Cruz* - Julie Stromberg, Center for Environmental Studies, Arizona State University

11:30-1:00 PM Lunch with luncheon speakers

12:15-12:30 *Update on Governor's Riparian Area Advisory Committee*, Kris Randall, Arizona Department of Environmental Quality

12:30-1:00 *Special Areas — Plants and Animals in Southern Arizona,* Jeffrey Cooper, The Nature Conservancy

TECHNICAL SESSION I:
RIPARIAN AND AQUATIC ECOSYSTEM RESEARCH

1:15 PM KEARSLEY, MICHAEL J. C., L. E. STEVENS, and T. J. AYERS. Geomorphic and hydrologic controls on riparian vegetation development in Grand Canyon.

1:35 PM BUSCH, DAVID E. Functional analyses of water sources and water use by woody riparian vegetation.

1:55 PM STROMBERG, JULIET C. Regional variation in *Populus fremontii* recruitment patterns: preliminary analysis.

2:15 PM SOMMERFELD, MILTON, C. KRAMER, C. CHRISTIAN, and F. AMALFI. Preliminary observations on water and sediment chemistry of the Santa Cruz River (Santa Cruz County).

2:35 PM PATTEN, DUNCAN T. Research on U.S./Mexico border rivers: studies by the Southwest Center for Environmental Research and Policy.

2:55 PM BREAK

TECHNICAL SESSION II: RESOURCE MANAGEMENT ISSUES

3:15 PM HOLUB, HUGH. Arizona groundwater management conflicts with riparian areas.

3:35 PM LOMELI, BEN. International water management considerations in the upper San Pedro River Basin.

3:55 PM HUGHES, LEE E. Riparian management on the Arizona Strip.

4:15 PM KEARSLEY, LISA, and K WARREN. River campsites in Grand Canyon National Park: inventory and effects of discharge on campsite size and availability.

4:35 PM MAYNARD, JOHN. Decision-making regarding housing development in riparian areas in Madera Canyon.

5:00-5:15 PM BUSINESS MEETING

6:30-7:00 PM Cash Bar

7:00 PM Mexican Buffet Dinner

POSTERS AND DISPLAYS

BRIGGS, MARK K. Evaluating degraded riparian ecosystems — a guidebook on developing reclamation strategies for degraded, wild riparian ecosystems in the arid Southwest.

HENRY, SUSANNA G. Vegetation management and inventory efforts on the Lower Colorado River.

KRAUTHAMER, JUDY. Arizona State Parks' streams and wetland program.

THORNBURG, TANNA. Arizona Riparian Council.

VALENCIA, RUTH. Statewide riparian inventory and mapping efforts by the Arizona Game and Fish Department.

Saturday, 17 April

8:30 AM Load bus(es) at Rio Rico Resort

9:00 AM Arrive Guevavi Ranch

Marie Sullivan (U.S. Fish and Wildlife Service) - Partners for Wildlife Program and restoration of Santa Cruz floodplain

John Maynard (Santa Cruz Co.) - Establishment of Calabasas Park

Andy Robinson (Native Seeds Search) - Use of riparian floodplains for native seed farms

10:30 AM Load bus(es)

11:00 AM Arrive Meadow Hills Cienega (wetland)

Judy Davis (University of Arizona) - Cienega ecology

11:30 AM Load bus(es)

12:00 Arrive Rancho Santa Cruz Guest Ranch

Lunch
Sherry Sass (Friends of the Santa Cruz River) - Volunteer efforts by the Friends of the Santa Cruz River

1:30 PM Load bus(es)

1:45 PM Arrive Tumacacori National Monument

Richard Williams (Arizona State Parks) - Will lead De Anza Trail hike from Tumacacori to Clark Crossing (FEET MAY GET WET)

2:45 PM Load bus(es)

3:00 PM Arrive at Rio Rico Resort

ABSTRACTS

BUSCH, D. E. Division of Environment, Lower Colorado Region, Bureau of Reclamation, PO Box 61470, Boulder City, NV 89006-1470. *Functional analysis of water sources and water use by woody riparian vegetation.*

For some time, isotopes of hydrogen and oxygen have been used to trace water movement in hydrological systems. Analysis of the deuterium (D) and oxygen-18 (^{18}O) content of free water found in plant tissues is one way that this technique has been extended to the biosphere. Given the proper conditions, it is possible to distinguish between groundwater and unsaturated zone water absorption locations, or between local precipitation and stream runoff as water sources for plants. Analysis of stem water D and ^{18}O ratios was used to determine the degree to which riparian woody species were dependent upon an alluvial groundwater moisture source. Discrimination among carbon isotopes during photosynthetic CO_2 uptake was used as the basis for evaluations of plant water use efficiency. There were significant differences in leaf tissue carbon-13 (^{13}C) ratios of important Colorado River riparian tree and shrub species. Cottonwood (*Populus fremontii*) and willow (*Salix gooddingii*) appeared to be obligate phreatophytes with low water use efficiencies. There was evidence for higher water use efficiency and facultative phreatophytic water absorption in naturalized saltcedar (*Tamarix ramosissima*). Such adaptations are likely to contribute to saltcedar's success in invading riparian plant communities, especially in perturbed ecosystems.

DITTO, L. R. Project Leader, Lower Rio Grande Valley National Wildlife Refuge Complex, McAllen, TX. *The Lower Rio Grande.*

For this discussion, the lower Rio Grande is defined as that portion of the river between Del Rio, Texas, and the Gulf of Mexico. Until 1953, the river was wide, free-flowing and relatively unpolluted. Few people lived in the floodplain and industrial development was limited. To reduce periodic flooding and help maintain an unshifting river channel (international boundary), Falcon and Amistad dams were constructed. The once meandering channel became a deep. narrow conduit for a "tamed" river. Human populations on both sides of the border exploded as industry arrived in the early 1980s. Water quantity and quality began to decline. By the 1950s agriculture and other development cleared over 90% of the original Tamaulipan thorn brush. An improved EPA border environmental plan is needed to buffer the impacts of the North American Free Trade Agreement by protecting wildlife habitat. The U.S. Fish and Wildlife Service initiated a land acquisition plan for the Lower Rio Grande Valley National Wildlife Refuge in 1979 to protect a highly diverse plant and animal community; half of the project's total acreage of 130,000 acres have been acquired. Mexico may join the struggle to protect the river and riparian habitat. The wildlife refuge and an improved border environmental plan can save a remnant of the once extensive Tamaulipan brushlands and provide water quality and quantity guidelines to secure the river.

HOLUB, H. Attorney at Law, 177 N. Church Ave., Suite 200, Tucson, AZ 85701.
Arizona groundwater management conflicts with riparian areas.

The 1980 Groundwater Management Act makes it virtually impossible to protect riparian areas in Active Management Areas. Proposed new assured water supply rules being considered by the Arizona Department of Water Resources only exacerbate the problem of protecting riparian environments. This paper will address the problems of riparian protection generated by the state groundwater law and assured water supply rules, using the Santa Cruz River in Santa Cruz County as an example.

HUGHES, L. Bureau of Land Management, Arizona Strip District, 390 N 3050 E. St. George, UT 84770. *Riparian Management on the Arizona Strip.*

Less than 1% of the Arizona Strip District's 3,000,000 acres are riparian habitat. Most habitat occurs on the Virgin River, Kanab Creek, Paria River, and scattered springs with wet meadows. The Virgin River and Kanab Creek have been inventoried. In the early 1980s, 13 major springs and some smaller ones, were fenced and a rest rotation system was placed on the Paria River, which allows 6 months of grazing out of a 36-month grazing cycle. The Virgin River receives cattle use from October/November to the end of May. Kanab Creek receives cattle use from October/November to the end of May. The cattle use has been largely eliminated on three of nine segments of the Virgin River. Kanab Creek is about 2,000 feet higher than the Virgin and the removal of cattle in May allows for more spring growth than for the Virgin. A program of planting cuttings of hardwoods is now in place on the Virgin River.

CONCLUSION

The historical removal of cattle in May out of Kanab Creek has allowed more willow resurgence than that occurring on the Virgin.

On three segments of the Virgin where livestock have been removed, the sedges, rushes and willows are doing better than those segments used in the spring.

The rest rotation system on the Paria appears to be allowing the cottonwoods to increase, as opposed to the yearlong grazing.

Fencing of the wet meadows has improved their vegetation conditions.

Success of cottonwood plantings shows most success when planting cuttings. Planting poles or saplings is significantly less successful.

KEARSLEY, M. J. C.[1], L. E. STEVENS[1,2], and T. J. AYERS[1]. [1]Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ 86011-5640 and [2]Resources Management Division, Grand Canyon National Park, PO Box 129, Grand Canyon, AZ 86023-0129. *Geomorphic and hydrologic controls on riparian vegetation development in Grand Canyon.*

Development of the structure and composition of riparian vegetation along the dam-regulated Colorado River and its unregulated tributaries in Grand Canyon National Park is largely controlled by the interactions between hydrology and geomorphology. By using data gathered from 122, 5-x-10-m long-term plots, we are able to show that variation in geologic structure, flooding frequency, sediment type and sediment deposition patterns, together with variation in the water table, create a series of distinct habitats within the riparian corridor. Principal components analysis allows the separation of these plots based on combinations of physical factors including substrate size, variability, and chemical composition, flooding frequency, slope, and aspect. These combinations of physical factors are, in turn, correlated with discrete plant assemblages as defined by total basal area per species. Data on seedling recruitment and establishment, and mature plant growth rates and water potential confirm that the physical attributes of geomorphic zones are the causal force behind plant community structure. Alternative biotic hypotheses of community organization (e.g. competition, herbivory, dispersal) are discussed and dismissed.

KEARSLEY, L, and K. WARREN. Division of Resources Management, National Park Service, PO Box 22459, Flagstaff, AZ 86002-2459. *River campsites in Grand Canyon National Park: inventory and effects of discharge on campsite size and availability.*

A 1991 inventory of river campsites between Lees Ferry and Diamond Creek, Grand Canyon National Park, shows that campsites have dramatically decreased in both number and size in the past 20 years. The inventory documents a total of 219 campsites available above river flows of 25,000 cfs. In comparison with previous inventories, this is a 35% reduction in the number of campsites since 1973, and a 50% reduction in the number of sites since 1983. Of campsites remaining, 40-50% have decreased in size class. Loss of campsites since 1983 is primarily attributed to erosion and vegetation growth. In what were termed "critical reaches" — primarily narrow stretches of the river where the number of available campsites is limited — erosion is the primary cause of campsite loss. In non-critical reaches, vegetation growth is the primary cause of campsite loss. Carrying capacity in the river corridor is most limited in critical reaches. Critical reaches have fewer campsites per mile than non-critical reaches at 0.7 versus 1.1 camps/mile respectively, and have less than half the number of large campsites per mile as non-critical reaches.

In a comparison of the effects of dam discharge on campsite availability due to exposed camping area, low discharges from Glen Canyon Dam increase the number of available campsites. The 1991 inventory identified 42 "low water" sites that become available when dam releases are reduced to discharges of 15,000 cfs and less. To determine the effects of dam discharge on campsite size, 125 campsites were measured at different discharges. For these sites, campsite area increased an average of 35% when dam discharges were decreased from 25,000 cfs to 5,000 cfs. Increases in campable area were documented for 73% of all measured campsites when flows were decreased from 25,000 to 15,000 cfs, 46% of the sites when flows were further decreased to 8,000 cfs, and 31% of the sites when flows were further decreased to 5,000 cfs. In an analysis of campsites according to size class (small, medium, large), 36% of the small and medium sites increased in area enough to also increase in size class when dam releases were reduced from 25,000 cfs to 15,000 cfs.

LOMELI, B. Hydrologist, USDI Bureau of Land Management, Tucson Resource Area, San Pedro Riparian National Conservation Area, RR 1 Box 9853, Huachuca City, AZ. 85616. *International water management considerations in the upper San Pedro River Basin*.

A combination of climatic, hydrologic, geomorphic, and biologic factors, and historic events have shaped the upper San Pedro River watershed in southeastern Arizona. The forces leading to present conditions are examined from a holistic, interactive perspective. Effects on the environment and the economy of the area are addressed.

Past, present and future land and water uses in the United States and Mexico, and issues and concerns at local, regional, national, and international levels are delineated in general terms with examples in the areas of water depletions, water rights, water quality and pollution, global warming, private property rights, biodiversity and others.

The extensive riparian ecosystem and related holistic values are dealt with in more detail. Specific geologic, hydrologic, cultural, and historic features are also identified. Some future considerations are diverse as "Free Trade Agreements", economic development, industrialization, beaver re-introductions, and ecological succession are identified. A proactive holistic ecosystem management approach, and improved international coordination are suggested as means to protect, maintain, and enhance shared natural values, and to help ascertain, understand, and mitigate mutual concerns.

MAYNARD, J. C. Santa Cruz County Planning and Zoning Department, PO Box 818, New County Complex, Nogales, AZ 852628. *Decision-making regarding housing development in riparian areas in Madera Canyon.*

A Tucson developer proposed rezoning an 8.5-acre mining claim in the Coronado National Forest for condominiums. The developers proposed building 12 residential units on approximately 4 acres, leaving over half of the site undisturbed. The parcel's current zoning (GR General Rural) allows the construction of two residences.

Madera Canyon is a riparian habitat known worldwide for a large number of bird species and is considered unique by many ornithologists. The impacts of the proposed development would have altered the canyon's habitat as well as set a precedent for other private land holding in the canyon and in other areas of the National Forest throughout Santa Cruz County.

After an initial site visit and an inventory of both the environmental and man-made characteristics related to the site, staff opposed the request for rezoning. Staff utilized an evaluative method developed by Ian McHarg, a landscape architect, to demonstrate to the public and the Santa Cruz County Board of Supervisors how we came to our conclusion.

The environmental characteristics inventoried were soils, vegetation, slope, hydrology, floodplain, and endangered plants and animals. National planning standards were applied to the man-made characteristics which included water, wastewater, solid waste, roads, utilities (telephone, electric, and gas), emergency services, and schools. Their adequacy, availability and ability to sustain the proposed development were evaluated.

The rezoning request was approved by the Planning and Zoning Commission in November 1992 by a vote of 3 to 2. The Santa Cruz County Board of Supervisors denied the rezoning request in March 1993 with a 3 to 0 vote.

PATTEN, D. T. Center for Environmental Studies, Arizona State University, Tempe, AZ 85287-3211. *Research on U.S./Mexico border rivers: studies by the Southwest Center for Environmental Research and Policy.*

The Southwest Center for Environmental Research and Policy (SCERP), a consortium of five U.S. and two Mexican universities, studies environmental issues dealing with air, water, hazardous materials, health and policy along the U.S./Mexico border. SCERP also develops environmental training programs along the border. The water research program of SCERP is comprehensive. It covers water quantity and quality; source, transport and fate of contaminants; conservation; and mitigation including alternative methods of wastewater treatment. During its first two years, SCERP has supported approximately ten research projects related to water quality and/or use of the border rivers. Five of these projects relate to environmental conditions of the Rio Grande because two of the consortium universities are in that region. These studies cover identification of water requirements and urban/industrial contaminants of the El Paso/Cd. Juarez area, determination of the ecotoxicological impacts of agricultural chemicals, and development of a decision support system using river contaminant information for environmental policy analysis. Two projects in the Santa Cruz River watershed have been supported by SCERP, one deals with the effects of surface/subsurface water decline on Sonoran woodlands, and the other is a broad watershed/land use/ water quality/riparian management project. Other SCERP projects relevant to border rivers include studies of selenium levels in the Colorado River, the role of riparian systems in the movement of contaminants from upland to groundwater, and the development of artificial wetlands for control of effluent contamination near border rivers.

SOMMERFELD, M., C. KRAMER, C. CHRISTIAN, and F. AMALFI. Department of Botany, Arizona State University, Tempe, AZ 85287-1601. *Preliminary observations on water and sediment chemistry of the Santa Cruz River (Santa Cruz County).*

The Santa Cruz River flows from its headwaters in southeastern Arizona into Sonora, Mexico, and back into Arizona near Nogales. In an attempt to fill gaps in existing data and provide a general overview of environmental quality of the watershed, water and sediment samples are being monitored for selected physical, chemical, and biological indicators of water quality. Upstream of the Nogales International Wastewater Treatment Plant (NIWTP), the Santa Cruz River is ephemeral and characterized by moderate conductance and hardness, relatively low nutrient and metal concentrations, but appreciable numbers of coliform bacteria. Effluent discharge from the NIWTP is the main source of downstream surface water in the Santa Cruz for much of the year, and especially during low precipitation periods. The effluent entering the Santa Cruz River has a lower pH, higher dissolved and suspended solids, nutrients and organic content than the Santa Cruz River. Fecal coliform and metal concentrations are typically lower in the effluent than found upstream in the Santa Cruz. The bottom sediments of the Santa Cruz below the NIWTP also reflect the nature of the effluent by exhibiting elevated nutrient, organic and total petroleum hydrocarbon concentrations. The permanent water and high nutrient levels in the Santa Cruz River provided by the NIWTP effluent supports an abundance of aquatic primary producers.

STROMBERG, J. C. Center for Environmental Studies, Arizona State University, Tempe, AZ 85287-3211. *Regional variations in flood magnitude and* Populus fremontii *recruitment patterns: preliminary analysis.*

Flood patterns in Arizona's desert rivers vary regionally and temporally. Large magnitude winter and fall floods have occurred fairly regularly over time for rivers of central Arizona (e.g., the Hassayampa River). For many southern Arizona rivers, periods with large winter or fall floods have alternated with periods of reduced winter/fall flooding, lasting several decades. Recruitment patterns of *Populus fremontii* vary with these flood cycles. As a result, populations of *P. fremontii* have large age gaps along southern Arizona rivers including Sonoita Creek and the Santa Cruz River. *Populus fremontii* established in abundance along these rivers during recent decades (1960s-present) with large floods, but few cohorts are present from the preceding decades of reduced flooding (1930s-1960s). At the Hassayampa River, in contrast, *P. fremontii* trees have established at more regular intervals. *Populus fremontii* populations along these and others rivers also have been effected by late 19th century arroyo cutting, cattle grazing, and water manipulations. Nevertheless, these data highlight the importance of considering the effects of natural climatic variation together with human factors when assessing the status and management of riparian plant populations.

STROMBERG, J. C. Center for Environmental Studies, Arizona State University, Box 873211, Tempe, AZ 85287-3211. *Riparian ecology and management along the upper Santa Cruz River.*

The Santa Cruz River is an international river of great ecologic, economic, and aesthetic importance to the U.S./Mexico border region near Nogales. Much of the lower Santa Cruz River near Tucson, Arizona, is now ephemeral and devegetated because of groundwater pumping. The upper Santa Cruz River, however, flows freely from it's headwaters in Arizona's desert grasslands, through northern Mexico, and back into the U.S. near Nogales. Water and watershed management present a challenge to all concerned with the Santa Cruz River, because of the complexities of land and water ownership and use patterns, and because of projected increases in population in the region. Water for municipal use is pumped and diverted from the upper Santa Cruz River and it's tributaries to the border cities known as Ambos Nogales. Near these pumpage areas there occur localized areas of water table depression and reduced riparian vegetation abundance. Some of this water is returned to the river as effluent from the Nogales International Wastewater Treatment Plant. The effluent has rejuvenated the downstream riparian ecosystem, by raising water tables, enhancing nutrient availability, and allowing for survivorship of dense riparian forests of Fremont cottonwood (*Populus fremontii*) and Goodding willow (*Salix gooddingii*). Less well represented along the Santa Cruz River are riparian vegetation types characteristic of higher floodplain areas, including sacaton (*Sporobolus wrightii*) grasslands and mesquite (*Prosopis* spp.)-elderberry (*Sambucus* spp.)-hackberry (*Celtis* spp.) woodlands. This is due, in part, to floodplain clearing for agriculture and pasturing. Conversion of agricultural water rights to municipal water rights carries with it opportunities for restoration of these latter riparian vegetation types to abandoned agricultural fields.

YUNCEVICH, G. Bureau of Land Management, San Pedro Riparian National Conservation Area, RR 1, Box 9853, Huachuca City, AZ 85616. *Upper San Pedro River.*

The upper San Pedro River originates in northern Mexico and flows northward 80 miles to the Narrows north of Benson, Arizona. Twenty-eight percent of the 2,500 mi^2 watershed is in Mexico, and 40 mi of the river is managed as a National Conservation Area by the Bureau of Land Management. The river is perennial throughout most of the Conservation Area and supports a riparian ecosystem in good condition with abundant species diversity. The rich human history of the area spans 11,200 years and proves that riparian resources have been of value since the first Americans. The river today is considerably different than the first historical accounts of numerous cienegas and marshes. Human occupation and development beginning in the nineteenth century, combined with natural events, shaped the cottonwood/willow riparian forests that now dominate the river. Water resource uses in the United States and Mexico include irrigation, mining, municipal, domestic, livestock, wildlife, riparian, and recreation. How these users are managed will determine the future of the San Pedro River.

POSTERS

BRIGGS, M. K. The Rincon Institute, 6842 E. Tanque Verde, Tucson, AZ 85715.

Evaluating degraded riparian ecosystems - a guidebook on developing reclamation strategies for degraded, wild riparian ecosystems in the arid Southwest.

A guidebook has been developed to assist resource managers in evaluating degraded riparian ecosystems. The guidebook provides methodologies for determining the causes of degradation and then presents various reclamation strategies tailored to specific site conditions. The guidebook is based on an initial study funded by the U.S. Fish and Wildlife Service (completed January 1992) that evaluated the effectiveness of riparian revegetation to improve the ecological condition of degraded riparian ecosystems in Arizona.

The underlying theme of the guidebook is one of identifying and treating the causes of degradation. In this regard, evaluating the riparian area prior to developing a reclamation plan is important because it allows resource managers to identify the causes of degradation, improving the likelihood that reclamation strategies will be effective. This approach not only requires considering the condition of the immediate degraded riparian area, but also the condition of reaches upstream and downstream, and the surrounding uplands.

The guidebook is divided into three sections. The first section describes methodologies for evaluating the condition of degraded riparian ecosystems. This section is divided into four parts: (1) channel stability and health of surrounding uplands; (2) water availability; (3) direct competition from vegetation, animals, and humans; and (4) the soil environment. The second section determines the potential that prolific natural regeneration will occur. This section is divided into two parts: (1) assessing natural flood patterns, and (2) determining if natural seed sources will influence the site. The third section describes methodologies and identifies additional sources of information for developing effective reclamation strategies given specific site conditions.