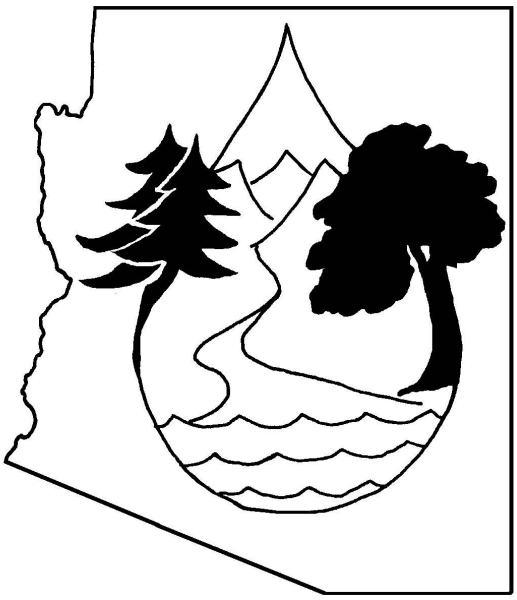
NINTH ANNUAL MEETING OF THE ARIZONA RIPARIAN COUNCIL

Swiss Village Lodge
Payson, Arizona
May 12-13, 1995

BALANCING RIPARIAN ISSUES



PROGRAM AND ABSTRACTS
1995

ARIZONA RIPARIAN COUNCIL
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PAYSON, ARIZONA
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Friday, May 12

8:00-10:00 Registration

9:00-9:30 **Stephen M. Jones**, Desert Foothills Land Trust, **Local Perspective.**

9:30-10:00 **Jim Walsh,** The Nature Conservancy, **State Perspective.**

10:00-10:30 **Ron Hooper,** Bureau of Land Management, **Federal Perspective and Rangeland Health.**

10:30-10:45 BREAK

10:45-11:15 **Buzz Walker,** City of Payson, **Recharge Project in Payson.**

11:15-11:45 **Judy Gignac,** Bella Vista Ranches, **Water Management for Sierra Vista: Lessons Learned and Future Outlook.**

11:45-12:15 **Placido dos Santos,** Santa Cruz Active Management Area Director, **Status of the Santa Cruz Active Management Area.**

12:20-1:30 LUNCH (Lodge Dining Room)

AFTERNOON TECHNICAL SESSION

1:30-1:45 **Norris Dodd**, Arizona Game and Fish Department, ***Recovery of Riparian Ecosystems and Threatened Native Fish in Eastcentral Arizona — Role of the Heritage Fund.***

1:45-2:00 **John N. Rinne,** USDA Forest Service, Rocky Mountain Station, ***The Effects of Fire and Its Management on Southwestern (USA) Fishes and Aquatic Habitats: Monitoring and Research.***

2:00-2:15 **Steven Danzer[1], D. P. Guertin[1], and Roy Jemison[2],** [1]School of Renewable Resources, University of Arizona, and [2]USDA Forest Service, Rocky Mountain Station, ***Riparian Vegetation Types in Mountain Streams in Southeastern Arizona.***

2:15-2:30 **Kimberly A. Buck and Lawrence E. Stevens,** U.S. Bureau of Reclamation, Glen Canyon Environmental Studies, ***Spatial and Temporal Waterbird Distribution in the Colorado River Downstream from Glen Canyon Dam, Arizona.***

2:30-2:45 **Michelle Alexander and John Rinne,** USDA Forest Service, Rocky Mountain Station, ***Monitoring Effects of Wildfire in Riparian Aquatic Ecosystems: Large Organic Woody Debris (LWOD).***

2:45-3:00 **Rick Yarde,** Water Resources Research Center, University of Arizona, ***The Use of Beavers as a Tool for Riparian Habitat Restoration.***

3:00-3:15 BREAK

3:15-3:30 **Wilbert Odem,** Northern Arizona University, ***The Verde Watershed Watch Network.***

3:30-3:45 **Tom Cain[1], L. Mathews[1], J. Stefferud[2], G. Loomis[2], and R. Martin[2],** [1]Coconino National Forest, USDA Forest

Service, and [2]Tonto National Forest, USDA Forest Service, ***Fossil Creek: Restoring a Unique Ecosystem.***

3:45-4:00 **Jim Donovan[1], E. Glomski[1], and B. Parlette[2],** [1]RIPARIA, Flagstaff, Arizona and [2]Prescott, Arizona, ***Towards Watershed Conservation: A Model for Community-Based Riparian Conservation in Prescott, Arizona.***

4:00-4:15 **Paul LeBrun,** U.S. Army Corps of Engineers, South Pacific Division, ***Rio Salado, Salt River, Arizona, Environmental Restoration.***

4:15-4:30 **Gary Ahlborn[1], William Davilla[1], Barbara Moritsch[1], and Brian Mihlbachler[2],** [1]BioSystems Analysis, Inc. and [2]U.S. Bureau of Reclamation, Phoenix Area Office, ***The Tonto Creek Riparian Unit Riparian Habitat Monitoring Study — A Preliminary Assessment.***

4:30-4:45 **John Swett,** U.S. Bureau of Reclamation, Lower Colorado Regional Office, ***Revegetation Efforts Along the Lower Colorado River.***

4:45-5:00 **Don Manthe and N. Ash,** ENTRANCO, ***Constructed Wetlands for Nitrogen Removal in Kingman, Arizona.***

5:00 BUSINESS MEETING

6:00 NO HOST CASH BAR

7:00 DINNER AT SWISS VILLAGE LODGE DINING ROOM

POSTERS (Presenters please be at your posters at break times)

Patti Fenner[1], Janet Eubanks[2], Jeff Griswold[3], Carol Savin[3], Scott Underwood[4], and Adrienne Gibson[4], [1]Tonto National Forest, USDA Forest Service, [2]Fountain Hills High School, [3]North Canyon High School, and [4]Cactus Shadows High School, ***High School Cooperative Stream Monitoring Program Update.***

Alvin L. Medina and Daniel G. Neary, USDA Forest Service,
Geomorphological Response of a Montane Riparian Habitat to Interactions of Ungulates, Vegetation, and Hydrology.

Brooke Parlette[1], E. Glomski[1], and Jim Donovan[2], [1]RIPARIA, PO Box 12624, Prescott, AZ 86304 and [2]PO Box 23372, Flagstaff, AZ 86002,
Riparian Restoration: An Educational Avenue to Engage People in Riparian Conservation.

Saturday, May 13

FIELD TRIPS

FOR BOTH TRIPS YOU NEED TO PROVIDE YOUR OWN LUNCH.

8:00 AM We will be leaving **ON TIME** from the Swiss Village Lodge parking lot for respective sites.

Trips are scheduled to end after lunch.

BUCK SPRINGS, BLUE RIDGE RANGER DISTRICT

This field trip will be hosted by Alvin L. Medina, Research Ecologist, and led by James Steed, Research Technician, Rocky Mountain Forest and Range Experiment Station, Flagstaff.

Rocky Mountain scientists have been actively engaged in riparian research on montane ecosystems of the Colorado Plateau. The focus of this research is to determine the manner in which these systems function and how the influences (e.g., grazing by elk and livestock) affect their structure and function. In this field session, we will witness the effects of restoration on a riparian system with prior intensive use. The study area is an excellent example of what the restoration potential of these systems is and how it can be achieved in a relatively short time frame. The discussion centers on hydrological, geomorphological interactions with vegetation and ungulates. The state--of-the-art in knowledge of the structure and function is presented.

- Leave Swiss Village Lodge 8:00 AM, travel to Blue Ridge via Highway 87
- Arrive at the Blue Ridge Ranger Station at 9:00 AM
- Travel to Buck Springs 9:00-9:40 AM
- Field Session 10:00-11:20 AM
- Travel to Blue Ridge Campgrounds 11:30-12:00 NOON
- Lunch
- Return to Payson

The meadows may be saturated and boggy in spots, so appropriate footwear is recommended along with hats. The hike is about 1 mile round trip of easy walking. Bring cameras. There are no restroom, water or other amenities available at Buck Springs, but they all are at Blue Ridge Campgrounds.

DUDE FIRE REHABILITATION

This field trip will be led by Robert S. Ingram, Payson Ranger District, Tonto National Forest, and John N. Rinne, Rocky Mountain Forest and Range Experiment Station, Flagstaff.

The purpose of the trip is to view the Dude Fire area five years following a major forest fire. An excellent example of fire ecology and rehabilitation efforts. We will view and discuss reforestation, seeding, watershed structures, and riparian plantings. Elk utilization and changes in grazing patterns will also be discussed.

- Leave Swiss Village Lodge, 8 AM, travel to Dude Fire via Highway 260 and Forest Road 64.
- 8:45 AM, Meet at junction of FR 64 and FR 29. Follow the Dude driving tour to Jim Roberts Draw.
- View rehabilitation work in Jim Roberts Draw area, 10:00 AM.
- Lunch and/or return to Payson.

The trip will be mostly along forest roads. Some light hiking through the fire area in the Jim Robert Draw area. There are no restrooms, water, or other amenities.

PLEASE, IN THE SPIRIT OF CONSERVATION AND RECYCLING, WHEN FINISHED WITH YOUR NAME TAG PLEASE RECYCLE IT BY GIVING IT TO CINDY ZISNER, RATHER THAN DISCARDING IT.

AHLBORN, G.[1], W. DAVILLA[1], B. J. MORITSCH[1], AND B. MIHLBACHLER[2]. [1]Biosystems Analysis, Inc., 303 Potrero St., Ste. 29-203, Santa Cruz, CA 95060 and [2]Bureau of Reclamation, Phoenix Area Office, 23636 N 7th St., Phoenix, AZ 85068. ***The Tonto Creek Riparian Unit Riparian Habitat Monitoring Study — A Preliminary Assessment.***

The Tonto Creek Riparian Unit (TCRU) Riparian Habitat Monitoring Study is being conducted to partially fulfill mitigation requirements associated with the loss of riparian habitat resulting from the modification of Theodore Roosevelt Dam. Following issuance of the Final Environmental Assessment on the dam modifications, an interagency team was formed to develop and recommend alternatives for the implementation of the TCRU concept. This team is composed of members from the U.S. Forest Service, U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, and Arizona Game and Fish Department. BioSystems Analysis, Inc. (BioSystems) has been contracted to conduct a five-year biological monitoring study within the TCRU. A key objective of this study is to determine how, in what direction, and to what extent the riparian habitat is responding to a new, managed livestock grazing regime.

The TCRU was established as a special riparian management unit the management unit with the management goal of achieving recovery of the degraded Tonto Creek riparian communities. The unit is composed of approximately 5,900 acres, and is within the Tonto Basin Ranger District of the Tonto National Forest in Gila County, Arizona. It is located along Tonto Creek, northeast of Phoenix and upstream from Theodore Roosevelt Lake, with stream elevations ranging from 2,136 feet at Roosevelt Lake to 2,500 feet near the confluence of Tonto and Gun creeks. Existing riparian plant communities in the TCRU include cottonwood, cottonwood/willow, mesquite bosque, burro brush/seepwillow, and cattail emergent.

In 1993 and 1994, the interagency team and BioSystems refined a study design, and BioSystems conducted first-year, baseline data collection. The study area within the TCRU was divided into three pastures. Two exclosure sites were established in each pasture to provide ungrazed control sites. Permanent vegetation transects were established as each of the exclosure sites and data on trees, shrubs, herbs, substrate, and riparian tree recruitment were collected along these transects. In addition, to closely monitor changes in recruitment of key tree species, numerous transects were established in recruitment beds within and adjacent to the six exclosures. Permanent photo points were established at each exclosure site to facilitate a qualitative evaluation of changes occurring in the study area vegetation over time.

The dynamic nature of the study area, in particular, the frequency and intensity of flooding, has proven to be a significant challenge to this study. The cross-fences dividing the three pastures, and fences around two of the six exclosures were completed in late 1994. Baseline data collected also was completed in late 1994. The first grazing cycle was initiated January 1, 1995, when cattle were released into the upper pasture. On January 3rd, significant rainfall resulted in flood conditions in the pastures. All of the fences sustained considerable damage and the cattle were uncontrolled.

A meeting of the interagency team and BioSystems biologists was conducted in February 1995 to develop recommendations for subsequent phases of the project. As a result, the study design has been modified to accommodate, as well as possible, the vagaries of Tonto Creek.

ALEXANDER, M., and J. RINNE. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Southwest Forest Science Complex, 2500 S. Pine Knoll Dr., Flagstaff, AZ 86001. ***Monitoring Effects of Wildfire in Riparian Aquatic Ecosystems: Large Woody Organic Debris.***

Fire, through removal of vegetation on the watershed, potentially may have a dramatic effect on riparian and aquatic ecosystems. Changes in stream hydrographs following either prescribed or wildfire affect channel morphology and transport and disposition of large woody organic debris (LWOD). Most information on LWOD comes from the northwestern United States. No information on either LWOD, fire effects, or their combination on aquatic-riparian ecosystems is available for the Southwest. Accordingly, land managers have no protocol on which to base postfire management of riparian areas relative to either (1) increased transport LWOD or (2) possible formation of debris jams. The recent (1990) Dude Fire below the Mogollon Rim in Arizona provided an opportunity to monitor the effects of wildfire on LWOD dynamics. The watersheds of three first-order streams were affected by the fire and will permit comparison of LWOD dynamics in these streams relative to that of an unburned stream. Rationale for study, methods of monitoring, and some preliminary data on LWOD transport will be discussed.

BUCK, K. A., and L. E. STEVENS. U.S. Bureau of Reclamation, Glen Canyon Environmental Studies, PO Box 22459, Flagstaff, AZ 86002-2459. ***Spatial and Temporal Waterbird Distribution in the Colorado River Downstream from Glen Canyon Dam, Arizona.***

Waterbird populations (aquatic and semi-aquatic avifauna) are sensitive indicators of ecological change and are of interest because of hunting, conservation biology, nutrient dynamics, and legal issues; however, the impacts of flow regulation on riverine waterbirds is known from only a few systems. Flow regulation modifies the geomorphic condition of rivers by changing hydrology (e.g., flood frequency), water quality, sediment transport, and shoreline and aquatic vegetation. We examined the influences of dam-induced changes in turbidity and channel geometry on the seasonal (summer *versus* winter) distribution of waterbirds in five feeding guilds in the Colorado River downstream from Glen Canyon Dam, in lower Glen Canyon, and all of the Grand Canyon. The waterbird guilds include: dabbling waterfowl, diving waterfowl, wading birds, picivorous raptors, and shorebirds. Fifty-five species of waterbirds were observed during 42 complete and 62 partial censuses of the 470 km river corridor from 1973 to 1994.

Impoundment effects (increased water clarity and riparian vegetation) exert a stronger influence on waterbird distribution than does natural channel geomorphology during both winter and summer seasons. Interviews with pre-dam residents and visitors, and analysis of river explorer journals indicate that winter waterbird concentrations were not observed in this system prior to the completion of Glen Canyon Dam (1963), and that summer breeding activity in the mainstream was extremely limited.

The census data demonstrated the dominance of impoundment effects over channel geomorphology. Maximum post-dam winter waterbird density reached 4,679 waterbirds/km^2 in the clearwater reach at Lees Ferry (km 0). This winter concentration peaked from November through February, declined abruptly after March, and consisted of at least 17 Anseriformes species, with dominance of diving and dabbling waterfowl: Gadwall (mean area - adjusted rates of encounter, AARE = 174 birds/km^2/hr) > Bufflehead (133 birds/km^2/hr) > American Wigeon (102 birds/km^2/hr). Winter waterbird AARE values decreased downstream from Glen Canyon Dam through Grand Canyon, but were higher in wide-shallow reaches. A novel winter Bald Eagle concentration also occurred in the wide-shallow Marble Canyon reach; however, wading and shorebird guilds tend to occur as migrants or vagrants. These reach-based distributional differences correlate with greater habitat and food resource availability in wide reaches.

During the summer months, waterbird occurrence became relatively uniform from Glen Canyon Dam to km 123 (mean AARE = 11/km^2/hr). Mallard pairs were observed in virtually every large eddy in these reaches, and several nests and numerous broods were observed. Mainstream mallard reproduction was first observed in 1982, and annual nest and brood production have increased since 1987. Dam management policies that affect food and habitat resource availability are likely to influence winter concentration and summer breeding in this species.

CAIN, T.[1], L. MATHEWS[1], J. STEFFERUD[2], G. LOOMIS[2], and R. MARTIN[2]. [1]Coconino National Forest, 2323 E. Greenlaw Ln, Flagstaff, AZ 86004, and [2]Tonto National Forest, 2324 E. McDowell Rd, Phoenix, AZ 85010. ***Fossil Creek: Restoring a Unique Ecosystem.***

Fossil Creek, a tributary of the Verde River near Strawberry, Arizona, is fed by a series of carbonate springs with a constant discharge of 43 cfs. Historically, travertine deposited in areas of turbulence in the stream channel, forming a stairstep series of dams and deep pools. Since 1910, the Childs/Irving hydroelectric project has diverted most of the base flow from Fossil Creek. Except in a few isolated places, travertine formation has ceased, and only erosional remnants of the large travertine structures remain. Today, stream reaches which were dominated by travertine formations have largely been scoured to bedrock, reducing the habitat complexity of the aquatic and riparian environments. Expiration of the current license for the hydroelectric project provides an opportunity to increase base flows as a requirement of a new license, or to restore full flows through decommissioning of the project. Discussions during the relicensing process have largely focused on the potential for restoring travertine formations in Fossil Creek and the resulting change in the aquatic and riparian communities.

The Federal Energy Regulatory Commission and U.S. Forest Service are currently reviewing a range of alternatives for the hydroelectric project and are jointly conducting the environmental analysis. Although the scientific and ecological relationship of the system are the focus of the analysis, the final decision will be subjective and value-based, with the human element playing a large part. While the final outcome is still uncertain, the context of the decision to balance riparian issues identified during the relicensing process will be important. Balancing these issues at the project level can have a different outcome than balancing these issues in the broader context of the history and future of riparian management and energy development in Arizona.

DANZER, S. J.[1], D. P. GUERTIN[1], and R. JEMISON[2]. [1]School of Renewable Natural Resources, University of Arizona, 325 Biological Sciences East, Tucson, AZ 85721 and [2]USDA Forest Service Rocky Mountain Forest and Range Experiment Station, 2500 S Pine Knoll Dr, Flagstaff, AZ 86001.
Riparian Vegetation Types in Mountain Streams in Southeastern Arizona.

Much of the research on riparian vegetation in Arizona has been conducted on low-elevation alluvial systems. Less research has been conducted on the higher gradient, bedrock controlled, high-elevation mountain streams. As Arizona's human population continues to grow, these mountainous riparian areas will be increasingly impacted due to more recreation, livestock grazing, and water impoundments. These expanding demands on Arizona's mountain riparian areas will require a management style which necessitates an understanding of how riparian vegetation relates to, and is affected by, the physical landscape in which it is situated.

In order to address these research concerns, a two-year research project was developed through the University of Arizona's School of Renewable Natural Resources and the U.S. Forest Service's Rocky Mountain Experimental Station. The focus of this research program, currently concentrating on the mountains of southeastern Arizona, is to answer two main questions. First, what are the dominant riparian types found in these mountain systems? And second, what are the relationships of these overstory assemblages to macro-scale parameters such as elevation and watershed size, and to the more locally determined hydrologic parameters such as channel gradient and channel width-depth?

To answer these questions, 58 sites within 8 canyons in the Coronado National Forest have been sampled in the last year for use in this study. More canyons are expected to be sampled in the coming year. Canyons sampled ranged from 3,500 ft to 7,700 ft. Their hydrologic regimes were primarily intermittent to ephemeral. Preliminary analyses indicates that there are six woody riparian types present within the study area. Two of these assemblages are conifer-dominated, two of these assemblages are dominated by deciduous riparian obligates, and the remaining two share a high proportion of successful shrubs. Watershed size, elevation, and stream gradient are the primary factors that define the occurrence of these communities. This paper will review the results from the first year of the study.

DODD, N. L. Arizona Game and Fish Department, HC 66 Box 57201, Pinetop, AZ 85935.
Recovery of Riparian Ecosystems and Threatened Native Fish in Eastcentral Arizona — Role of the Heritage Fund.

In 1990, the Arizona Heritage initiative was passed by voters, transferring $10 million of lottery proceeds annually to the Arizona Game and Fish Department, primarily for threatened, endangered, and sensitive (TES) species management and habitat acquisition. This fund has facilitated cooperative ecosystem-level riparian management and recovery efforts for two threatened native fish. Three recent habitat acquisitions represent the cornerstone of ecosystem management activities for the Little Colorado spinedace (*Lepidomeda vittata*). Most significant, these acquisitions include water rights which will allow for enhanced flows to benefit riparian resources along 35 miles of stream. Cooperative management of an 18,000-acre U.S. Forest Service grazing allotment will protect upper watershed, riparian, and critical winter range habitats. A total of 12 TES species will benefit from these activities. Sensitive reaches of four Apache trout (*Oncorhynchus apache*) streams have been protected from livestock grazing through fencing to expedite recovery. Similar measures are planned for another 9 Apache trout streams supporting 40 TES species on U.S. Forest Service lands. Stream and fish survey, riparian research, population renovations, and habitat improvements are ongoing for both fish. The Heritage Fund holds potential to expedite the recovery of riparian ecosystems and ultimately achieve delisting of these fish species, as well as providing "win-win" opportunities for resolution of resource conflicts.

DONOVAN, J.[1], E. GLOMSKI[2], and B. PARLETTE[2]. [1]RIPARIA, PO Box 23372, Flagstaff, AZ 86002 and [2]PO Box 12624, Prescott, AZ 85304. ***Towards Watershed Conservation: A Model for Community-Based Riparian Conservation in Prescott, Arizona.***

Community-based support should be an integral part of riparian conservation. Riparian conservation is being achieved with large community support in Prescott, Arizona. Prescott sits at the top of the Verde watershed and has five riparian creek systems running through it. Through two projects, RIPARIA, a local ecological restoration organization, engaged the community in riparian conservation working with a watershed perspective.

The first project (The Prescott Riparian Conservation Project) involved educating people about the five local creeks and developing neighborhood coalitions around each creek. Phase One of the project involved collecting biological information about each of the five creeks and collecting information on land ownership along each of the creeks. This information was placed on a 5 × 5 ft map which has the vegetation types, National Wetlands Inventory (NWI) codes, and Hydrologic Unit Codes (HUC) of the creeks. The land ownership and biological information was placed in a relational database which is available for public use at the Sharlot Hall Museum in downtown Prescott. The information is being converted into a GIS database so future information can be updated easily.

Phase Two of the project involved giving community workshops on riparian natural history and the need for community-based riparian conservation. The workshops presented the historic degradation of riparian areas and wetlands in the Southwest and then focused on local conservation problems. The workshops involved lectures, a slideshow, and information on organizations and government groups that are involved with riparian conservation. The workshops were designed to give people tools to become involved in local and statewide conservation. The workshops also proposed to create greenway corridors along the creeks of Prescott, giving the participants a locally based and attainable goal.

The second project (Preservation of Watson Woods) involving creating a riparian nature preserve. The preserve will be an example of how to achieve conservation. The preserve is located just south of Watson Lake and is known as Watson Woods. This area represents the total expression of the five creeks in Prescott; it is perhaps the best example of a cottonwood/willow gallery forest in central Arizona. With a strong community support base we proposed to the City, who owns the land, that the citizens would like to see a nature preserve on that land. The nature preserve will be a living learning center for the local community to meet and learn about conserving wetlands and riparian areas.

These projects represent a model towards community-based riparian conservation and ultimately watershed conservation through the creation of a riparian preserve and the development of greenway corridors to connect the watershed. We present a model for achieving riparian conservation by engaging local communities and provide a "how-to" list for people interested in developing a conservation approach in their region.

FENNER, P.[1], J. EUBANKS[2], J. GRISWOLD[3], C. SAVIN[3], S. UNDERWOOD[4], and A. GIBSON[4]. [1]Tonto National Forest, Cave Creek Ranger District, PO Box 5068, Carefree, AZ 85377, [2]Fountain Hills High School, [3]North Canyon High School, and [4]Cactus Shadows High School. ***High School Cooperative Stream Monitoring Program Update.***

Biology and chemistry teachers from three high schools in Cave Creek, Fountain Hills, and north Phoenix have continued to build on a cooperative stream monitoring program with the Cave Creek Ranger District. Last year, students from all three schools wrote a paper on their monitoring work on three separate segments of Cave Creek and Seven Springs; this was presented at the Eighth Annual Riparian Council meeting in Phoenix. These streams are important sycamore/ash/ cottonwood corridors in the juniper woodland and desert upland of the southwestern corner of the Tonto National Forest.

With the new Forest Service emphasis on adaptive management, there is an increasing need to monitor changes in selected environmental variables. Recent large reductions in numbers of livestock permitted to graze the Cave Creek watershed, and implementation of an improved rest-rotation management system are actions the Forest Service and grazing permittees have taken to improve riparian conditions.

Unusually heavy winter rains in January 1993 and February 1995 have resulted in very large streamflows that have affected the entire community, from trees to fish, to macroinvertebrates.

This year, with two year's worth of data collected, students will present an analysis of information on the following three attributes of Cave Creek and Seven Springs, in light of these actions and events:

- Water chemistry tests for nitrates, sulfates, dissolved oxygen, and pH.
- Macroinvertebrate sampling to detect changes in riparian and aquatic habitat adjacent to the stream. Macroinvertebrates communities reflect changes due to both weather and land management practices.
- Streamflow is being measured in Cave Creek and Seven Springs monthly as a requirement of obtaining instream flow rights for wildlife and riparian vegetation. The purpose for this is to prevent any future diversions from damaging the riparian community.

This "Adopt-A-Stream" project has now broadened to include an educational segment to some of the monthly site visits. Guest speakers have come out to increase students' awareness of archaeological resources, riparian tree identification, leave-no-trace camping ethics, Forest Service instream flow program and methodology, hazard tree identification in campgrounds, and native fisheries.

GIGNAC, J. Bella Vista Water Company, PO Box 1150, Sierra Vista, AZ 85636-1150. ***Water Management for Sierra Vista: Lessons Learned and Future Possibilities.***

The process of consensus building, the translation of concept into legislation and what happens when regulation meets the antigovernment revolution head-on is discussed in the context of growth in the Sierra Vista/Fort Huachuca urban area juxtaposed with the riparian needs of the San Pedro Riparian National Conservation Area. The additional issue of the water rights adjudication and Sierra Vista's uneasy fit between the conflicting water users of the Gila River Indian Community and the Department of Defense will provide a different twist to an already complex debate.

JONES, S. M. 31801 N Black Cross Rd, Cave Creek, AZ 85331. ***The Desert Foothills Land Trust***.

The Desert Foothills Land Trust was formed in 1991. A strategic planning process was developed to establish its mission, vision, and organization. Committees include planning, publicity, membership, acquisitions, stewardship, and fundraising. Acqusitions are guided careful evaluation process. The land trust has acquired and manages three properties to date. A study of vegetative communities in the riparian areas of the Cave Creek system, funded by the Arizona Game and Fish Heritage Fund, has been completed, and will aid in planning and evaluation. The vegetative community data has been entered in a geographic information system (PC ARC/INFO), along with other layers such as parcel maps, flood maps, soils, etc.

LEBRUN, P., U.S. Army Corps of Engineers, South Pacific Division, Los Angeles District, 3636 N. Central Ave., Phoenix, AZ 85012. ***Rio Salado, Salt River, Arizona: Environmental Restoration.***

As directed by Congress, and in cooperation with the cities of Tempe and Phoenix, Arizona, the U.S. Army Corps of Engineers has recently completed the Rio Salado, Salt River, Arizona Reconnaissance Study. This study is in the first phase of a two-phase study process; the results of which is a recommendation to proceed into the more detailed feasibility phase. The objective of the reconnaissance study was to investigate a variety of water resource problems including riparian habitat restoration, water quality, recreation, and flood control along a reach of the Salt River in Tempe and Phoenix known as Rio Salado. The Salt River and Indian Bend Wash are two water courses whose environmental settings have been substantially altered by federal water control projects. Environmental quality issues in the study area have been further compounded by water quality contamination problems including both groundwater and surface water.

In cooperation with federal, state, and local agencies, an array of environmental restoration concepts were identified to explore integrated water resource solutions to environmental problems. Because water is the limiting factor for riparian habitat restoration in this arid environment, opportunities for providing a continuous water source for restored riparian habitat were uniquely combined with measures to solve water quality problems. One concept that was brought forward utilizes aesthetically unpleasant abandoned sand and gravel pits along the Salt River channel as water storage basins for riparian vegetation located with the river channel. Storm drain runoff from the immediate urban area would be collected in these abandoned pits as opposed to continuing to discharge these often contaminated flows into the Salt River channel. An additional water quality benefit is realized as storm drain runoff is treated via constructed wetlands in the Salt River channel. During dry periods, water supplies to the wetlands would be supplemented by pumped contaminated groundwater that would be treated for the removal of volatile organic compounds using conventional methods such as airstripping and discharged into the wetlands. The wetlands themselves provide further treatment of groundwater as nitrates, a major water quality problem in the area, are removed.

As a component of environmental quality, outdoor recreation is in high demand in the Phoenix metropolitan area. In an effort to satisfy a portion of the unmet demand for recreation, varying levels of recreation development opportunities were evaluated relative to complementing riparian habitat restoration objectives. Recreation opportunities ranged from developing urban lakes to passive dispersed recreation.

Results of the reconnaissance study indicate a federal interest has been identified for environmental restoration. In total, over 300 acres of wetlands, mesquite, willow, and cottonwood habitats would be restored in conjunction with improved water quality. In contrast to the "without project" conditions, as much as a 132% increase in habitat units in the Salt River from Tempe to Phoenix would occur. At least 1.4 million annual recreation user-days would also be provided by developing recreation sites that are adjacent to and compatible with the riparian habitat projects. While this study identified several environmental restoration concepts a number of technical, environmental, and institutional issues await the more detailed feasibility study, scheduled to commence in July 1995. The synergy among riparian habitat restoration measures, water treatment techniques, and recreation activities, explored during the reconnaissance study, will be more completely evaluated during the feasibility study.

MANTHE, D., and N. ASH. ENTRANCO, 2400 W Dunlap Ave, Ste 100, Phoenix, AZ 85201. ***Constructed Wetlands for Nitrogen Removal in Kingman, Arizona.***

In 1991, the City of Kingman retained consultants to examine methods of providing expanded wastewater treatment and meet new water quality standards at the Hilltop Wastewater Treatment Plan (WWTP). The selected alternative consisted of an expansion and upgrading of the City's existing aerated lagoon secondary treatment process, followed by constructed wetlands for tertiary treatment, with rapid infilitration disposal of the treated effluent. This process train was developed both in response to the requirements of the Arizona Aquifer Protection Permit (AAP) program and the desire of the City for a "low tech," environmentally sensitive facility. The process required a significant land area, which was readily available to the City of Kingman. The fundamental purpose of the constructed wetlands in the process train is for nitrogen removal.

Secondary effluent from the aerated lagoons is pumped to the constructed wetlands cells through a 2 km (1.5 mi) long force main. Wetlands cells are surface flow type, with normal operating depths varying from 0.15 to 0.91 m (0.5 to 3 ft), fully vegetated. The wetlands occupy approximately 20 ha (50 ac) with two separate process trains (3,800 m^3/d/train). Each train consists of three separate sequential cells, 46 m (150 ft) wide and 655 m (2,150 ft) long, arranged for serpentine flow. Between cells, flow passes through structures designed to statically re-aerate the water as well as to isolate individual cells for maintenance. The cells are planted with bulrushes (*Scirpus* spp.) and cattails (*Typha* spp.). The influent area of the wetlands provides a sedimentation zone for algae and suspended solids. Shallow areas, creating more densely vegetated zones to enhance nitrification, alternate with deeper zones, to promote anaerobic conditions leading to denitrification. Outlet areas have deep water surrounding them to discourage heavy plant growth and reduce the possibility of plant materials leaving the wetlands.

Construction of the Kingman Hilltop WWTP began in October 1992. Planting of the first 1 mgd train of wetlands cells took place in April 1994 (inclement weather prevented planting during the first summer of treatment plant operations). The wetlands plant stock was separated into individual plants and associated root mass, and planted on 1 m centers. Growth and expansion of the transplanted wetlands stock was rapid, and by late summer the first train was densely covered with vegetation.

Test results to date indicate essentially complete BOD removal in the aerated lagoons. At this time, much less than half of the installed aeration capacity is being used due to the plant flow being less than the ultimate 2 mgd capacity. Nitrogen is typically partially nitrified when leaving the aerated lagoons. The nitrogen component at this point consists of approximately 20% nitrate, 20% nitrite, and 60% TKN. By the end of the first wetlands cell, the total nitrogen concentration has decreased by 50% to 85% of the influent concentration; its form is primarily TKN. Overall treatment systems nitrogen removal as measured in the effluent is 70% to 90%.

MEDINA, A. L., and D. G. NEARY. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, 2500 S Pine Knoll Dr, Flagstaff, AZ 86001. ***Geomorphological Response of a Montane Riparian Habitat to Interactions of Ungulates, Vegetation, and Hydrology.***

Wildcat Creek, a tributary of the Black River on the Apache-Sitgreaves National Forest, is being studied to determine the impacts of grazing on riparian wet meadows. An intensive survey of a selected stream reach a unique channel development involving a compensated degradation/ aggradation process. This long-term process is affected by the short-term grazing and trampling by elk and cattle. The longitudinal profile was classified as an E-6 (Rosgen 1994) stream channel type (pool-riffle sequence) with a sinuosity of 2.1, 1.5% slope, entrenchment ratio of 2.6, and a depth ratio of 9.6. The cross-sectional profile of the long view is characterized by deep scour pools (50-140 cm) and shallow riffle (<15 cm) sections. Substrates in riffle sections from scour pools and nick points are redeposited in riffle sections at the toe of each scour pool with little transfer of sediment from the system. Fine sediment is re-incorporated back into the channel by action of vegetation which pervades across the small riffle sections immediately below scour pools. Elk and cattle affect the degradation/aggradation process in two ways:

(1) Overgrazing of streambanks results in

(a) exposure of the soil fabric,
(b) loss thereof during high flows,
(c) sloughing of banks,
(d) side cutting of the exposed bank during normal flows, and
(e) reduction in capacity to trap sediments;

(2) Trampling initiates a process of degradation of riffles by breaking down the armored sediments which are partially held in place by aquatic vegetation.

The type of vegetation is most important in determining the direction of channel cutting as well as the extent thereof. Aquatic native species of *Carex, Cyperus, Glyceria, Juncus,* and *Scirpus* are essential in maintaining streambank integrity, capturing sediments, and maintaining the aggradation process. Other graminoids, such as Kentucky blue grass (*Poa pratensis*), wheatgrasses (*Agropyron* spp.), and or orchardgrass (*Dactylis glomerata*), do not reduce the erosive effects of water. One reason is because the roots of the latter are shallow (depth <20 cm) and fragile (diameter <2 mm) as opposed to deep (1-1.5 m), thick (5-10 mm), and fibrous in the aquatic species. Preferred stream crossing of elk and cattle are in the shallow riffle sections, where their hoof action initiates the breakdown of the substrates, banks, etc. The importance of aggradation/degradation process is in the long-term maintenance of these meadows in a quasi-stable condition with fully functional processes.

PARLETTE, B.[1], E. GLOMSKI[1], and J. DONOVAN[2]. [1]RIPARIA, PO Box 12624, Prescott, AZ 86304 and [2]PO Box 23372, Flagstaff, AZ 86002. ***Riparian Restoration: An Educational Avenue to Engage People in Riparian Conservation.***

Riparian restoration projects are opportunities to put conservation into action and for conservation to continue environmental education must be an integral aspect of the project.

Riparian restoration projects often have several phases before the on-site work can begin. We discuss how to involve technical and nontechnical parties in all phases of a restoration project with the goal of creating a learning atmosphere throughout the project. By doing this we feel restoration projects have a better chance for success if they have strong support from an informed public.

By creating an atmosphere of learning and teaching, riparian restoration projects can weave through natural history, environmental ethics, and hands-on labor and ultimately create new conservationists. Restoration projects often involve many people doing lots of physical labor; planting trees, digging wells or building fences. These projects can also involve research and with a little time and some background knowledge volunteers can collect accurate data if properly trained. Ecosystem restoration ultimately means returning a system back to a functioning state and part of that system is human beings. Restoration opens the system back for humans.

By physically immersing people into the landscape we improve our bond with nature, we also combat the feeling of helplessness people fee when faced with environmental problems by providing them direct experience in a solution. To engage people in conservation means they must get intrigued about the natural world; they must have a reason to protect land and ecosystems. This process involves education about the natural history and beauty of riparian areas as well as the past degradation and current political realities these systems face. It involves discovery whether it be a small one like a beetle or a large one like a towering sycamore.

Riparian restoration projects can be designed to include all types of people, ranging from biologists to grandmothers with the goal of creating riparian conservationists of the future.

ODEM, W. Northern Arizona University, Box 15600, Flagstaff, AZ 86001. ***The Verde Watershed Watch Network.***

The Verde Watershed Watch Network is an outgrowth of two, related thrusts. First, it extends Northern Arizona University's current project focusing on water quality in Oak Creek Canyon, a National Monitoring Project. Second, it implements a pilot program begun two years ago by high school science teachers in the Verde Valley. The project addresses the following needs:

- The need for an educated, active, broad-based involvement in the Verde River watershed. As development in the Verde Valley proceeds at a rapid pace, it is necessary to understand the effect of land use activities can have on the water quality of the Verde River. This project will provide training in technical, regulatory, and management issues that relate to riparian water quality.

- The need to provide relevant, meaningful experiences to high school science students. This project will provide training in sampling and analysis techniques and watershed issues to high school teachers, who will in turn integrate this training into their science and social studies curricula.

Funded jointly by the Arizona Board of Regents through the Eisenhower Mathematics and Science Program and the U.S. Environmental Protection Agency, this project will span three years. It will provide seven to nine high schools in the Verde River Watershed with equipment money and teacher training that will allow assessment of nonpoint source pollution effects on the water quality of the Verde River. Workshop training has been provided in macroinvertebrate sampling and analysis. Each workshop will also address integration of the training into the high schools' science and social science curricula. Other workshops will address land use and water quality impacts, regulations, geographical information systems, best management practices, and issues pertinent to the Verde River Watershed.

RINNE, J. N. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Southwest Forest Science Complex, 2500 S Pine Knoll Dr, Flagstaff, AZ 86001. ***The Effects of Fire and Its Management on Southwestern (USA) Fishes and Aquatic Habitats: Monitoring and Research.***

The effects of naturally caused wildfire on aquatic habitats, fishes and their food supply may be marked and long-lasting. Hydrologic events following recent (1989-90) wildfires in Arizona and New Mexico effectively extirpated two populations of brook trout (*Salvelinus fontinalis*), one of rainbow trout (*Oncorhynchus mykiss*), and one of Gila trout (*O. gilae*). Aquatic macroinvertebrate densities declined to zero within 1 month after the Dude Fire, and diversities 25 to 70% a year later. Trout re-introduced after the fire declined 85 to 97% in a 2-year period.

Suppression of fire in forests of the Southwest has resulted in increased fuel loading on watersheds. As a result, large, hot, crowning wildfires are becoming increasingly more common. Removal of greater than 60% or more of forest vegetation, extensive exposure of bare soil, and large accumulations of ask, followed by annual monsoon convectional storms (July-September), result in flow events that both quantitatively and qualitatively have a high probability of totally removing a stream fish population and/or dramatically altering aquatic habitat and food supply. Monitoring the effects of fire on fishes and aquatic habitats is woefully lacking. More intimate, coordinated interaction of Forest Service research and management is suggested as a remedy to better monitor, research and manage natural and man-induced disturbance events.

SWETT, J. Bureau of Reclamation, Lower Colorado Regional Office, Box 61470, Boulder City, NV 89006-1470. ***Revegetation Efforts Along the Lower Colorado River.***

The Bureau of Reclamation, in cooperation with the US Fish and Wildlife Service, has begun a program to enhance wildlife habitat along the lower Colorado River by re-introducing native riparian plant communities. Studies are being conducted to learn the ecological processes involved within the native plant communities so that more efficient methods of reestablishing native plants may be developed.

Past revegetation efforts along the lower Colorado River have met with minimal success. Many past efforts were complete failures and few, if any, have met the ultimate goal of providing quality wildlife habitat. Reasons for these failures are varied and not always understood. A more complete understanding of the biotic and abiotic factors influencing native riparian plant communities needs to be gained before successful and efficient revegetation methods can be established.

Presently, three demonstration plots have been established on national wildlife refuges along the lower Colorado River. Two additional sites are scheduled to be established in 1996. Among the factors being investigated at these demonstration sites are soil salinity, soil texture, nutrient availability, water table fluctuations, rooting patterns, and wildlife usage. Preliminary results indicate that it is possible to plant native Fremont cottonwood and Goodding willow in areas of high salinity if flood irrigation is used and if soil texture allows leaching of salts to occur.

WALKER, B, Town of Payson, 303 N Beeline Highway, Payson, AZ 85541. ***Green Valley Park Project.***

Since 1973, the Town of Payson, totally dependent on in-town groundwater wells, has pursued the development of all local water supply options. A key component of Payson's future water supply was to have been use of East Verde River surface water via a Central Arizona Project allocation exchange program. Environmental concerns frustrated this effort and the Town has focused on other areas such as groundwater recharge, local area groundwater development, and maximizing the use of high-quality effluent produced by the Northern Gila County Sanitary District. The Green Valley Project is the cornerstone of this effort as the centerpiece of this park project is a 150-ft wastewater storage lake and pumping facilities for distributing effluent throughout Payson for nonpotable uses, therefore saving local groundwater supplies for potable needs. The project maximizes public benefit of satisfying local groundwater supplies for local recreation, storm water control, transportation, and economic development needs.

YARDE, R. Water Resources Research Center, University of Arizona, 350 N Campbell Ave, Tucson, AZ 85719. ***The Use of Beavers as a Tool for Riparian Habitat Restoration.***

Many of Arizona's rivers are in a degraded state relative to their characteristics prior to settlement. Restoration of riparian areas has been attempted through various means. The use of beaver (*Castor canadensis*) as a tool for restoration is one method that has been employed in the past. Beavers have long been absent from many rivers due to various impacts (trapping, grazing, loss of water), and studies have shown that reintroduction into suitable habitat provides many benefits. The dam-building behavior of beavers form small ponds that provide habitat for many other species of animals and plants, reduce erosion, raise the water table, and allow silt to settle, thus improving water quality.

In the past, waters in Arizona have been primarily viewed from a utilitarian perspective. Beavers have been, and in many cases still are seen as incompatible with other uses of rivers, and the presence of the animal inevitably leads to conflicts in management goals. However, some riparian areas are now undergoing dynamic changes in management practices, which afford the opportunity to employ exceptional restoration techniques. Recent plans which include the reintroduction of beavers validate this method as one important tool for restoration. The lack of water and appropriate vegetation is some streams, though, would not support a population of beavers. Reintroduction is just one step in a process which promotes overall riparian ecosystem health.