



Arizona Riparian Council

Volume 12, Number 2

June 1999

RECLAMATION'S ROLE IN NATIVE FISH RECOVERY IN THE GILA RIVER BASIN

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The Phoenix Area Office (PXA) of Reclamation was established for the purpose of planning and constructing the Central Arizona Project (CAP). As a result of mitigation commitments related to the CAP and Reclamation's recent mission change from a construction-oriented agency to one promoting water conservation and environmental protection/enhancement, PXA is now proactively involved in funding and advancing actions for recovery of native fishes in the Gila River Basin. This article details these actions and describes PXA's role in the recovery process.

The CAP transports Colorado River water from Lake Havasu, Arizona-California, to central and southern Arizona in a series of aqueducts and pipelines for agricultural, municipal, and industrial uses. In 1994, one of the 41 separate consultations between Reclamation and U.S. Fish and Wildlife Service (FWS) under Section 7 of the Endangered Species Act (ESA) on environmental impacts of the CAP concluded that delivery of CAP water to the

Gila River Basin would jeopardize the continued existence of four threatened or endangered fishes, the Gila topminnow (*Poeciliopsis occidentalis*), spikedace (*Meda fulgida*), loach minnow (*Tiaroga cobitis*), and razorback sucker (*Xyrauchen texanus*). This Biological Opinion (BO) also determined that operation of the CAP would adversely modify the critical habitat of the three latter species.

The primary justification for the jeopardy BO was the potential for establishment of non-native fishes within the CAP system, and their subsequent escape and invasion into habitats occupied by threatened or endangered fishes. Invasion of non-native aquatic organisms is viewed as one of the most serious long-term threats to the status and recovery of native aquatic species. Threats include predation, competition, hybridization, and parasite and pathogen transmission. Introduction of non-native fishes into

southwestern aquatic habitats usually results in population reductions or elimination of native fishes.

A set of five Reasonable and Prudent Alternatives (RPAs) was identified in the BO to remove jeopardy to the four species. The first RPA directed Reclamation to construct paired drop-structure barriers on lower Aravaipa Creek and the middle San Pedro River to hinder non-native fishes and other nonindigenous aquatic organisms from moving upstream into important conservation and recovery habitats for native fishes. Although barriers are not a perfect tool to solve the problem of non-native fish invasions (e.g., they further

(Cont. pg. 3....Recovery)

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PRESIDENT'S MESSAGE

On April 8 and 9, 1999, I represented the Arizona Riparian Council at the Gila Basin Restoration Workshop. The workshop, presented by the Phoenix Area Office of the U.S. Bureau of Reclamation in conjunction with the U.S. Geological Survey, Water Resources Research Center of the University of Arizona and the Sonoran Institute, was well attended. Several notable speakers gave presentations, including members of the Council such as Dr. Duncan Patten, Dr. Janet Johnson, and Mark Briggs. The need to develop realistic restoration objectives and to design monitoring plans which evaluate success was emphasized throughout the workshop. Many presenters emphasized passive restoration (e.g., removal of stressors or changing how the area is managed) over active restoration (planting vegetation). The Friday morning session dealt with actual case studies. The discussions brought to light that with any restoration project, many factors and viewpoints are involved.

On April 30 and May 1 the Arizona Riparian Council had its 13th Annual Meeting in Flagstaff. The theme of this year's meeting was *Ungulate Grazing in*

Riparian Areas. We had a great turnout with 100 attendees. The plenary speakers presented information ranging from the federal Endangered Species Act to changing management strategies to improve riparian areas and the watershed. We had an excellent afternoon session where technical papers presented. Several people told me the presentations were very informative and they enjoyed the lively discussions. I want to extend my sincere appreciation to all the speakers and attendees for making this year's meeting a tremendous success.

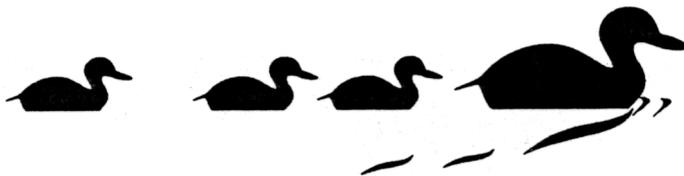
We are already planning for next year. Two organizations have approached the Council to be a part of their meeting. The Arizona Flood Plain Managers Association has asked if we would participate in the preparation of their meeting. Their meeting will take place in February 2000 in the Phoenix metropolitan area, and will focus on river restoration, a very timely topic. At this time we are assisting in defining relevant topics and suggesting speakers.

Staff from the Arizona Department of Water Resources, who assist with the Arizona Water Protection Fund (AWPF), have also asked us to have a joint meeting with them. We are

looking to still have our meeting in its traditional format; Friday meeting with Saturday as a field trip. What we would have in addition to that would be the option of attending all or part of the AWPF meeting which would occur the Wednesday and Thursday prior. Everything is very much in the planning stages and this format may change depending on meeting location and conference room availability. Anyone who is interested is welcome to participate in helping plan these meetings. Please call Cindy Zisner (480-965-2490) for information.

Lastly, the results of the election of officers for the Council are Janet Johnson will serve as Vice President and I will serve as President. The proposal to change the term of office from one year to three years was approved. Also the delegate to the Western States Riparian Council has been removed from our Board of Directors, especially since Western States doesn't really exist any longer. I thank you for your vote of confidence. Janet and I will do our very best to represent the Council in the coming years.

Kris Randall, President



(Recovery.....cont from pg. 1)

fragment already well-fragmented stream systems), they are among the best technologies on hand to effectively deal with the problem. Implementation of this RPA has been slow, primarily because of landowner concerns (we did not get condemnation authority in the BO), but an Environmental Assessment on the Aravaipa Creek barriers was finalized in November 1998, and we have an agreement to allow emplacement of the structures on Indian Trust land in the lower portion of the stream. We intend to have the barriers for Aravaipa Creek completed in the first half of 2000. We are narrowing down sites on the San Pedro, and hope to have those barriers in place by the end of 2000.

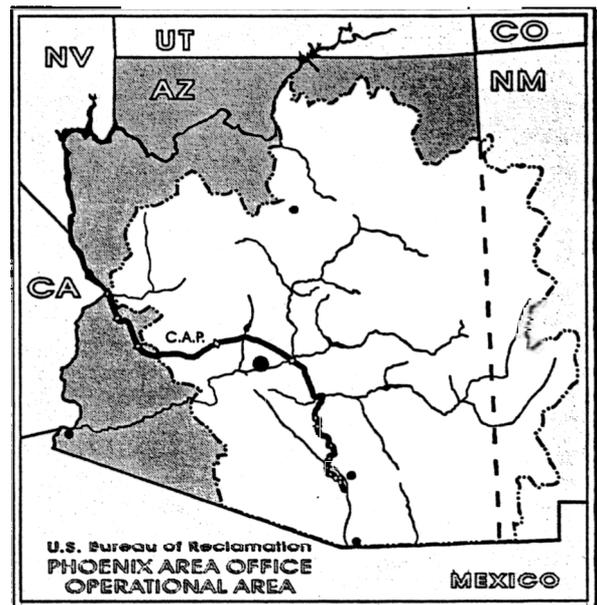
RPA No. 1 also directed Reclamation to continue to operate and maintain several electric fish barriers on Salt River Project and San Carlos Irrigation Project canals. These were constructed when the fish transport issue first surfaced during informal consultation with FWS in the late 1980s and early 1990s, and they are intended to prevent fishes from leaving the canal systems that receive CAP water. Electrical barriers were used because sufficient elevational gradient was not available to allow installation of drop-structure barriers. What could go wrong generally has gone wrong with these barriers, but actions to make them more reliable have been undertaken. For example, when backup generators failed

to start because batteries had discharged, a weekly startup procedure for the purpose of charging the batteries was initiated. When backup generators failed to start because fuel supply ran out as a result of the battery charging routine, a low-fuel alarm system was installed. There have also been instances where fish have been found above these barriers when they shouldn't have (i.e., when electrical monitoring indicated the barriers remained fish-tight). It is clear that electrical barriers, because of their inherent complexity, cannot be considered alone as a comprehensive solution to the problem of movements of non-native fishes.

RPA No. 2 of the BO directed Reclamation to develop and implement a program to monitor fish populations in the CAP aqueduct and selected waters in the Gila River Basin with the goal of detecting presence of new species, determining their distributions, and documenting changes in fish assemblage structure. Fishes have been monitored in the CAP since 1986 (when water deliveries were first initiated), and various Gila Basin waters have been monitored since the early 1990s. Under RPA 2, monitoring procedures have been formalized under a peer-reviewed monitoring plan, where a total of 35 stream and canal

stations are monitored annually under strict protocol. The most serious deficiency of this plan is failure by management agencies to decide on management actions should new non-native species be detected. The early warning system that is monitoring will be wasted if there is never any intention of management action should monitored parameters deteriorate. However, the program is at least documenting faunal changes, and has advanced awareness of native fish conservation needs and the management problems created by non-native species.

The fund transfer programs established under RPAs 3 and 4 direct Reclamation to transfer \$500,000 annually for 25 years to fund projects to recovery native fishes and control non-native fishes, respectively. Money is now finally available for significant on-the-ground actions and applied research to assist the recovery of the beleaguered Gila River Basin native fish fauna. These funds are planned to be used for



activities such as construction of additional fish barriers and stream renovation/repatriation projects, research and development of taxon-specific ichthyocides, acquisition of instream flow rights, development of facilities to provide holding, propagation, growout, or refuge for native fishes, and other innovative management and directed research activities. Identification of projects are made in partnership with FWS, Reclamation, and the Arizona (AZGFD) and New Mexico Departments of Game and Fish, with guidance from the Desert Fishes Recovery Team and faculty at Arizona State University (ASU). Thus far, we have transferred \$1 million to FWS under this program, and the third annual payment is scheduled to be made in October.

Under RPA 5, Reclamation is to develop and implement an information and education program that addresses impacts of non-native fish and other aquatic species introductions to native fishes and aquatic communities. This program will specifically emphasize the role of anglers and "bait-bucket" transfers as agents of faunal translocation. A cooperative endeavor with AZGFD, the program will produce educational videos, fishing regulation inserts,

teacher educational materials, posters, pamphlets, trinkets, and other media to increase public awareness of the value of native fishes and their habitats and the problems that non-native organisms create for indigenous species. The goal of the program is to modify human attitudes and behaviors related to introductions of non-native aquatic species. Tentatively proceeding under the slogan "Think Native," this program should be initiated this summer and hopefully you will be hearing more about it in the future.

Since I joined PXAO in 1995, PXAO has funded several other projects that are not associated with CAP mitigation. These include projects with ASU, AZGFD, and FWS for services such as: update of the book *Fishes of Arizona*; surveys to determine identity, distribution, and relative abundance of non-native crayfishes in the Gila River Basin; monitoring of fish populations in Eagle Creek; characterization of genetic markers in populations of Sonoran topminnow; study of susceptibility of topminnow to exotic parasites; surveys in the Black River drainage to document distribution and status of loach minnow; genetic characterization of populations of desert sucker (*Pantosteus clarki*) and congeners;

construction of desert pupfish (*Cyprinodon macularius*) ponds at ASU and The Phoenix Zoo; development of propagation techniques for speckled dace (*Rhinichthys osculus*) and loach minnow; comparison of Gila topminnow and mosquitofish (*Gambusia affinis*) in controlling mosquito larvae, and; survey of non-native Rio Grande leopard frog (*Rana berlandieri*) in Arizona. Requests for reports of most of these projects can be made through PXAO.

In conclusion, although Reclamation has no authority for species management, we are funneling what resources we can muster to proactively assist in the recovery of native fishes in the Gila River Basin and elsewhere. We hope we can provide an important support role in the native fish recovery process, through both funding of projects and provision of expertise. As our major dam-building days are behind us (thankfully, from my perspective), our agency mission has been retooled toward emphasis of "green" projects, and yes, undoing some of our past misdeeds. With persistence, hopefully PXAO can overcome this environmentally dark past and become a positive agent in the recovery of the native fish fauna of the Gila River Basin. 

TAMARISK.....MAYBE NOT INVINCIBLE

By Lee E Hughes, Arizona Strip Field Office, U.S. Bureau of Land Management

Tamarisk (*Tamarix ramosissima* Ledeb.) is one cussed bush. Cussed because it's a heavy water user, not great wildlife habitat, hard to hike through, and an exotic to North America. Therefore, much effort is taking place to find final solutions to its dominance in the Virgin and Colorado River Basins. There are planning efforts to develop basin-wide thinning or eradication of tamarisk (Virgin River Basin Tamarisk Work Group Draft Mission Statement 1997). Biological controls are being developed to thin out the tamarisk population (DeLoach 1997). Department of the Interior agencies have had some success in eradicating it in small areas, i.e., springs, by using mechanical and chemical methods. The National Park Service (NPS) has put forth a year-to-year effort in some springs and other small water sources to eradicate tamarisk in the Glen Canyon and Lake Mead National Recreation Areas (Nancy Brian, Park Botanist, Grand Canyon National Park, 1998, pers. comm.).

Like many efforts, different strategies emerge depending on individuals and areas involved. There are the head-on-frontal-attack to the minimalist strategies. Both have their places depending on the money available and timetables of those involved.

In the early 1990s, the Arizona Strip Field Office of the Bureau of Land

Management began inventorying its riparian resources. Another and more extensive inventory on the Virgin River took place in Utah, Arizona, and Nevada, in the mid-1990s. During these efforts, locations of monitoring sites were established on the Virgin and Paria Rivers and Kanab Creek. The monitoring plots were established to determine the trends of the various woody species growing on the regeneration zone along these rivers. As reported by Hughes (1993), the exotic, tamarisk, was a major species on two of these drainages. The mid-1990s inventory showed the same results.

VEGETATION MONITORING METHODS AND RESULTS

The segments (or reaches) that were surveyed for this study are the same as those from the original survey. There are a total of nine segments on the Virgin River and five on Kanab Creek. Three of the Virgin River segments and two of Kanab Creek segments were selected because they had access, were public land, and could be monitored for the effects of different levels of livestock grazing utilization levels on on riparian vegetation. A utilization level is determined on grazed forage by how much forage is left in comparison to ungrazed forage. Segment 1 of the Virgin is located in the Gorge and has a winter-spring rotation grazing system and has had light (20-40%) to moderate

(40-60%) utilization. Segment 7 on the Virgin has an old grazing system (30 years of implementation) with livestock grazing use every other spring and light utilization (20-40%). Segment 9 of the Virgin had fall-winter-spring grazing and trespass summer grazing with heavy utilization. Segments 3 and 5 on Kanab Creek had winter and spring grazing with moderate utilization. The Paria River site was chosen as it is the only segment on the river that has grazing. The grazing system is a rotation system with six months grazing in the winter and spring, over a 36-month grazing period. Grazing occurs one year in the winter, one year in the spring, and one year has none.

The regeneration zone, as defined for this article, was that belt of young woody vegetation parallel to the two riverbanks. The method used to inventory, and then used to monitor, was a measure of the quantity and height class of each woody species. The measuring was in a 3 × 6 ft plot. A 300-ft tape was laid parallel to the regeneration zone. At each 10-ft interval mark the plot was placed in the regeneration zone and each woody species was counted and placed in a height class. The height classes were 0-3 ft, 3-6 ft, 6-10 ft, and >10 ft. A total of 30 plots per transect was read. There was one transect, usually placed on each side of the creek or river, per monitoring site. This was the Greenline Method as described in (Cagney 1993).

These data are displayed in Table 1.

Data from Segment 5 of Kanab Creek are weight-based. The 9.6-ft² circular plot was placed along a line 10 times.

Each time the plot was placed, vegetation was clipped and weighed. Once a good estimate could be made the vegetation had its weight estimated in the transect. There were three

readings/transect done on three different years (Interagency Technical Reference 1996). These data are in Table 2.

| Table 1. Number of species per size structure transects by river segment and years. | | | | | | | | |
|---|--------|--------|---------|--------|--------|--------|---------|--------|
| Virgin River/Segment 1 | | | | | | | | |
| 1995 | | | | | 1998 | | | |
| Species | 0-3 ft | 3-6 ft | 6-10 ft | >10 ft | 0-3 ft | 3-6 ft | 6-10 ft | >10 ft |
| Willow | 3 | 18 | 7 | 0 | 40 | 47 | 96 | 0 |
| Tamarisk | 5 | 10 | 5 | 0 | 5 | 20 | 50 | 1 |
| Seepwillow | 0 | 2 | 0 | 0 | 4 | 0 | 0 | 0 |
| Virgin River/Segment 7 | | | | | | | | |
| Willow | 15 | 48 | 39 | 0 | 139 | 196 | 279 | 0 |
| Tamarisk | 7 | 6 | 9 | 0 | 19 | 45 | 51 | 0 |
| Seepwillow | 0 | 7 | 1 | 0 | 10 | 4 | 11 | 0 |
| Virgin River Segment 9 | | | | | | | | |
| Willow | 7 | 36 | 15 | 0 | 10 | 9 | 14 | 0 |
| Tamarisk | 23 | 24 | 18 | 0 | 3 | 2 | 15 | 0 |
| Arrowweed | 3 | 9 | 0 | 0 | 19 | 103 | 0 | 0 |
| Kanab Creek/Segment 3 | | | | | | | | |
| 1995 | | | | | 1997 | | | |
| Willow | 7 | 9 | 16 | 14 | 13 | 60 | 202 | 9 |
| Goodding willow (<i>Salix gooddingii</i>) | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Tamarisk | 2 | 2 | 1 | 9 | 0 | 1 | 0 | 0 |
| Seepwillow | 1 | 6 | 2 | 0 | 2 | 4 | 0 | 0 |
| Paria River | | | | | | | | |
| 1994 | | | | | 1998 | | | |
| Arrowweed | 89 | 0 | 0 | 0 | 51 | 1 | 0 | 0 |
| Rabbitbrush | 7 | 0 | 0 | 0 | 28 | 3 | 0 | 0 |
| Cottonwood | 2 | 0 | 1 | 1 | 5 | 2 | 0 | 4 |
| Russian olive | 4 | 3 | 4 | 3 | 5 | 3 | 13 | 5 |
| Seepwillow | 62 | 0 | 0 | 0 | 0 | 1 | 10 | 0 |
| Tamarisk | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 |
| Willow | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 |

Table 2. Plant percent composition from Kanab Creek/Segment 5. The structure trend data is not shown as there was only one reading in 1997.

| Species | 1991 | 1993 | 1997 |
|--|------|-------|------|
| Tamarisk | 9 | 13 | 10 |
| Rabbitbrush | 0 | 5 | 1 |
| Willow | 11 | 28 | 40 |
| Seepwillow | 31 | 6 | 10 |
| Russian olive | 0 | 11 | 1 |
| Saltgrass (<i>Distichlis stricta</i> (Torr.) Rydb.) | 38 | 34 | 12 |
| Sedge (<i>Carex</i> spp.) | 8 | Trace | 6 |
| Other | 3 | 3 | 20 |

Monitoring was done on the Arizona segments on the Virgin and Paria Rivers and Kanab Creek sites. Vegetation monitoring, as described above, began in 1991. Some monitoring sites have been read twice and others three times.

TREND OF THE REGENERATION ZONES

Virgin River

Segment 1, located in the Gorge of the Virgin River in Arizona, showed an increase in willow (*Salix exigua* Nutt.) from 1995 to 1998. Tamarisk also showed an increase of equal robustness. Cattle management of this segment allowed grazing from January to May. Each pasture receives winter rest and spring rest every other year. Grazing occurs every other year in the spring when the willows are greening up. However, spring rest and light (20-40%) to moderate (40-60%) utilization levels on forage species during spring-use years allows willows to be as aggressive as tamarisk and other woody shrubs.

Segment 7 of the Virgin River had a significant increase in the willow population that occurred from 1996 to 1998. This segment is affected by a Category 1 habitat designation for desert tortoise (*Gopherus agassizi*), a threatened species. Category 1 designates that the desert tortoise population is to be increased and the habitat well maintained. Cattle may only graze the allotment in the winter. No livestock use occurred in this segment from 1995 to 1998.

Segment 9 is designated as Category 2 desert tortoise habitat, which up to now has allowed for use by livestock. Category 2 designates that tortoise habitat and population are to be maintained in stability. Cattle grazing has occurred every winter and spring, but beginning in 1999 spring grazing ends. The trend of the willows and the tamarisk was down significantly and the arrowweed (*Pluchea sericea* Nutt. Cov.) increased almost tenfold from 1995 to 1998 in the trend area. The location of the regeneration zone transect is

currently an upland site more than a regeneration zone. The river moved more than 100 ft southward from the transected zone, which is at a higher elevation than the river. The transect was relocated in 1998 after the final trend reading.

Kanab Creek

Segment 3 of Kanab Creek showed a notable increase in the willow population in the regeneration zone. Little else existed in the zone. Willows in Segment 5 of Kanab Creek showed a steady increase, the tamarisk had a static level, Russian olive (*Elaeagnus augustifolia* L.) and seepwillow (*Baccharis* spp.) went down in numbers, and rabbitbrush (*Chrysothamnus nauseosus* (Pallus) Britton) maintained a presence. The data from Segment 5 was weight-based gathered prior to establishing the structure transect in 1997. Thirty-six head of cattle graze in the canyon from October through May each year.

Paria River

The trend transect in the lower segment of the Paria River showed small changes. Arrowweed and seepwillow showed decreases, cottonwood (*Populus fremontii* Wats.), Russian olive, and willow showed increases. Russian olive showed the largest increase. Tamarisk did little. A week prior to monitoring the Paria site, a severe, high flood occurred, so the regeneration zones was mud caked at the monitoring time. Cattle grazing in the lower Paria occurs in the winter and spring. One year of three is a rest-from-grazing

year. However, no livestock grazing occurred in 1997 and 1998.

CONCLUSION

Tamarisk is an aggressive, non-native species, but near the water zone in a riparian area several native species like willow, seepwillow, and cottonwood can compete and increase in its presence. Granted, observations show that on the uplands above riparian zones, tamarisk can out compete the plants such as willow when water is more distant. In the case of Segment 9 of the Virgin River, the arrowweed, a native, increased in the drier floodplain rather

than the tamarisk and willow, which were left high and dry by the river's relocation.

On the Arizona Strip when livestock are restricted to winter use and kept out of riparian areas during the growing seasons on a systematic basis, willows and other palatable woody species can grow and increase to their potential.

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BUENOS AIRES NWR PLANNING UPDATE

The U.S. Fish and Wildlife Service (Service) would like to update the public and interested parties in the ongoing planning effort for the Comprehensive Conservation Plan (CCP) for the Buenos Aires National Wildlife Refuge (Refuge). The Service initiated the process of preparing a CCP for the Refuge by distributing a fact sheet in the summer of 1997. The fact sheet included Refuge history, the goals and objectives, long-range plans, recreational activities, habitat management, and ongoing public use activities. It also described the CCP process and defined the comment period. The Service uses CCPs to help guide the planning and management of refuges with input from the public and other interested parties. In September

1997, the Service conducted three open house/scoping meetings in the city of Tucson and the town of Arivaca; and in the city of Phoenix. In March 1998, the Service hosted public planning workshops in Tucson and Arivaca to solicit information and hear concerns regarding the preparation of the CCP.

In August of 1998, the Service hired a full-time biologist in its Regional Office in Albuquerque, NM, to assist in coordinating the CCP preparation effort. The biologist has worked closely with state and federal agencies during the planning process. In October and November 1998, meetings were held with the Arizona Game and Fish Department as part of this coordination.

The Service proposed to complete an internal agency draft of the CCP by the end of

May 1999. In July 1999, a draft of the CCP should be available for review and comment by the public.

An environmental assessment (EA), required by the National Environmental Policy Act (NEPA), will be prepared for the CCP. A Notice of Availability for the draft CCP and accompanying draft EA will be published in the Federal Register allowing the public a 45-day comment period. The Service will then finalize the CCP in consideration of comments received by the public and interested parties.

The Service appreciates the interest you have expressed in the development of the CCP. If you have any questions or comments, please contact Yvette Truitt, Biologist, at (505) 248-6452.





SPECIES PROFILE



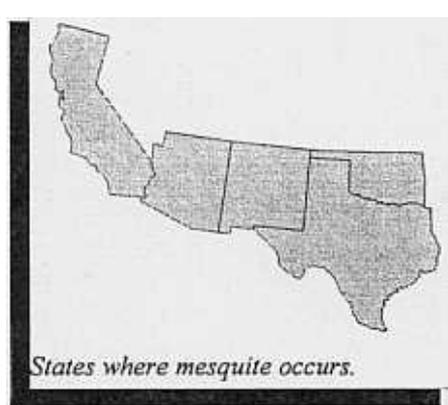
MESQUITE

by Donald J. Pinkava, Department of Plant Biology, Arizona State University

Mesquites are the most widespread desert tree legumes in North America, particularly velvet mesquite (*Prosopis velutina* Wooton) and honey mesquite (*P. glandulosa* Torrey var. *glandulosa* in the Chihuahuan Desert and var. *torreyana* (L. D. Benson) M. C. Johnston in the Sonoran Desert). These mesquites occur on approximately 75 million acres in the states of Oklahoma, Texas, New Mexico, Arizona, and California; they also occur in northern Mexico.

In southern Arizona, early settlers described mesquites as rather restricted to well-defined riparian gallery forests (bosques) in the lower desert areas, but also occasionally in nearby desert grasslands. These bosques were restricted in habitat by competition of well-established grasses and by range fires (deadly to seedlings and young trees to five years old), according to Hastings and Turner (1965). In the late 1800s, settlers changed the status quo with their agriculture, cattle grazing, and rangeland developments. Severe drought in the early 1890s coupled with overstocking for the conditions led to degradation of the grassland and high losses of cattle (Cornejo et al. 1982, Ohmart 1996). When heavy rains came, the rangeland had

lost the good groundcover; water no longer percolated through the soil and severe arroyo downcutting occurred; in turn, the water tables were lowered. Desertscrub and mesquite invaded these disturbed sites at the expense of grasses. Mesquite invasions now followed the arroyos away from the main streams. A similar series of events followed the severe drought in the 1930s. These mesquite invasions led to changes in outlook and the need to restore grassland for ranching by



removing mesquite (see, e.g., Reynolds and Tschirley 1957, 1963; Glendening and Paulsen 1955). Since cattle forage on mesquite beans, they also become a major dispersal agent, another argument to remove mesquite from rangeland or to restrict cattle from mesquite. Solving the mesquite problem is difficult because of the

complexity of factors involved and because more research is needed.

Mesquite has been utilized by indigenous peoples from prehistoric times until recent times – for food, fuel, shelter, weapons, tools, fiber, medicine, etc. (Felger 1977). Mesquite is the most widespread unfailing crop (perennial plants that can be counted on to produce large crops almost yearly) in the hot lowlands of the Southwest. Phenology of mesquite is used as a calendar for the Seri, much like the phenology of the saguaro is used for the Tohono O'odam. Gathering and processing of mesquite beans for food is complex and varied. The beans are collected at various stages of their development and the parts of the fruit (mesocarp and seeds) are usually separated and processed differently. The bean is used raw, mashed, toasted and made into flour, the processed materials are often treated with water and drunk, even fermented, or stored in ollas. Various parts of mesquite (gum, pitch, herbage, roots, but not flowers or fruits) were used medicinally for eye ailments, as emetics and purgatives, etc. (Felger 1977).

Mesquites (Fabaceae: Mimosoideae) are characterized as trees or shrubs with blackish trunks when mature, zig-zag branches bearing twice-

compound leaves, "catkins" of numerous flowers with showy stamens rather than petals and sepals, and indehiscent, elongate pods or the pods coiled (screwbean species). There are about 40 species: 4 in Asia, 1 in Africa, and the remainder in the New World, mostly in South America (Simpson et al. 1975). The origin of the genus appears to be in South America.

Prosopis reptans Benth., a screwbean, is disjunct as two varieties, one in Texas and adjacent Mexico, the other in Argentina (Carmen and Mabry 1975), a pattern similar to that of creosote bush (*Larrea divaricata* Zygophyllaceae family) when treated as having North and South American varieties.

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ARIZONA RIPARIAN COUNCIL THIRTEENTH ANNUAL MEETING IN FLAGSTAFF, ARIZONA – APRIL 30-MAY 1, 1999

This year's annual meeting theme was *Ungulate Grazing in Riparian Areas*. It was held Friday, April 30-May 1, 1999 in Flagstaff, Arizona at the Radisson Woodlands Hotel. Welcome and introductions by Kris Randall, President, started the meeting. Invited speakers included Rick Miller, Arizona Game and Fish Department, who provided an overview of elk and livestock grazing in riparian areas along the Mogollon Rim; Bruce Palmer, U.S. Fish and Wildlife Service, gave us background information on how consultation and compliance with the Endangered Species Act affects development of management plans on U.S. Forest Service allotments; Dave Stewart, U.S. Forest Service, told us about changes in the U.S. Forest Service management plans and future plans in the Rim country; and Kate Klein, U.S. Forest Service, and Rick Remington, Arizona Game and Fish Department, discussed Forest Service and Game and Fish management activities to address elk grazing impacts. Afternoon talks were the following technical papers.

Managing Watersheds to Improve Streams from the Mountains to Near Sea Level in Arizona – William E. Werner, Arizona Game and Fish Department
Burro Creek: A Study in Riparian Restoration Through Livestock

Management – Michael Blanton, Bureau of Land Management
Evaluation of a Pipe-Rail Fence Exclosure to Preserve the Integrity of Springs in the Sonoran Desert and Their Significance to Mule Deer Populations – Jon D. Hanna, Arizona Game and Fish Department
Plant Community Changes Following Cattle and Elk Exclusion at Hoxworth Springs – Rebecca C. Sayers¹, Laura E. DeWald¹, and Abe E. Springer², ¹School of Forestry and ²Department of Geology, Northern Arizona University
Riparian Improvement with Livestock Grazing on the Orme Ranch – Alan Kessler, Orme Ranch
Observations on Riparian Management on the Arizona Strip – Lee E. Hughes, Bureau of Land Management
Ungulate-Fishery Interactions in Southwestern Riparian Ecosystems: Pretensions and Realities – Alvin L. Medina and John N. Rinne, U.S. Forest Service
Recent Legal Developments Surrounding Livestock Grazing in Arizona's Riparian Areas – Rolf von Oppenfeld and Richard Campbell, Team for Environmental, Science, and Technology Law Practice Group

Patterns of Riparian Tree Physiology and Growth During Dry and Wet Years – Jonathan Horton, Thomas E. Kolb, and Stephen C. Hart, School of Forestry, Northern Arizona University
Quantifying the Difference between Restoration Method and Climate in Riparian Restoration – Abe Springer¹, T. Godwin¹, and Laura DeWald², ¹Department of Geology and ²School of Forestry, Northern Arizona University
Riparian Vegetation Inventories on Moenkopi Wash, Hopi Indian Reservation, Using Multispectral Airborne Scanner Data, Orthophotos, and a GIS Database – Kyle Bohnenstiehl, Land Information System Office, The Hopi Tribe
Population Biology of Arizona Sycamore: Results and Management Applications – Julie Stromberg, Department of Plant Biology, Arizona State University
Regional Relationships of Bankfull Stage in Central and Southern Arizona – Tom Moody and W. Odem, College of Engineering and Technology, Northern Arizona University

We also had some very interesting posters presented.

Riparian Improvement with Livestock Grazing on the Orme Ranch – Alan Kessler, Orme Ranch



RECENT LEGAL DEVELOPMENTS SURROUNDING LIVESTOCK GRAZING IN ARIZONA'S RIPARIAN AREAS

Livestock grazing along riparian areas is an increasingly controversial activity in Arizona and throughout the western United States. As a result, the laws that affect livestock grazing in riparian areas are rapidly changing. Some recent developments affecting Arizona are discussed below.

NEW ARIZONA LEGISLATION: HOUSE BILL 2471

HB 2471, signed into law in April, deletes from existing law the requirement that the Arizona Department of Environmental Quality (ADEQ) certify under Section 401 of the Clean Water Act (CWA) that any applicant applying for a federal or state license or permit for livestock grazing will not violate water quality standards. To understand how this legislation came about requires a brief description of recent case law developments out of Oregon and Arizona's legislative response to that case law.

CWA §401 requires state certification for any applicant applying for a federal license or permit for any activity that may result in a discharge of pollutant into waters of the United States. In late 1996, an Oregon federal district court held that the

pollution of a creek located in a National Forest in Oregon caused by a cattle grazing outfit operating under a federal permit issued by the U.S. Forest Service constituted a "discharge" of a pollutant under the CWA. Thus, as environmentalists in the case argued, the grazing activity required state CWA §401 certification. Since this had not occurred, the district court disallowed the federal grazing permit (*Oregon Natural Desert Ass'n v. Thomas*, 940 F. Supp. 1534 (D. Or. 1996)).

In response to *Oregon Natural Desert Ass'n*, the Arizona Legislature passed a law in 1997 that required ADEQ to provide §401 certification for all applicable grazing activities that comply with either voluntary state best management practices (BMPs) or BMPs established by the federal land management agency having jurisdiction over the land upon which the grazing activity occurs. (See A.R.S. § 49-201.01 and .02.) The 1977 law also established the Grazing Best Management Practices Advisory Committee (consisting of three persons actively engaged in cattle grazing and one person actively engaged in sheep grazing) to develop and recommend to ADEQ voluntary BMPs for discharges from grazing activities to navigable waters.

ADEQ was also charged with adopting by rule a surface water quality general grazing permit, taking into consideration the voluntary BMPs recommended by the Advisory Committee.

Subsequently, the Oregon district court decision requiring the certification of grazing permits was reversed by the 9th Circuit Court of Appeals (*Oregon Natural Desert Association v. Dombeck* 1998 WL *407711 (9th Cir. (Or. 1998))). Although the factual basis for the case did not leave any room for doubt that the cattle grazing polluted riparian areas in the National Forest, the Ninth Circuit concluded from the language and structure of the CWA that the §401 certification requirement was meant to apply only to point source releases, not nonpoint sources such as cattle grazing. The court found it decisive that cattle grazing did not result in the "discharge" of a pollutant from a point source. (The court also rejected the argument that the cow itself could be considered a point source!)

To keep in step with federal case law the Arizona Legislature introduced legislation in January 1999 that eliminated the §401 certification of grazing activities by ADEQ. As signed into law, HB 2471 also requires the Grazing BMP Advisory Committee to come up with its voluntary

BMPs by July 1, 2000. The new law still requires ADEQ to implement a surface water quality general grazing permit consisting of the Committee's voluntary BMPs.

NEW LIVESTOCK GRAZING CASE LAW

A recent decision by the federal district court in Phoenix clarifies the burden of proof that a federal agency must satisfy before it can prohibit livestock grazing in riparian areas under the Endangered Species Act (ESA). In *Arizona Cattle Growers' Association (ACGA) et. al. v. Fish and Wildlife Service (FWS) et. al.*, CV No. 97-02416-PHX-SMM (DAE) (Dec. 1998), the federal district court held that FWS and the Bureau of Land Management (BLM) could not exclude cattle from grazing allotments located on BLM land in order to protect endangered species habitat where there was no evidence that members of the endangered species to be protected were actually present on any of the grazing allotments. The facts in *ACGA v. FWS* involved FWS's incidental take statements that were issued in conjunction with its "Programmatic Biological Opinion" (BO) for its Safford and Tucson Field Offices' Livestock Grazing Program. The Program covers 1.6 million acres of BLM land in southern Arizona, most of which is allocated for grazing operations. A BO is part of the formal consultation process that must occur between federal agencies under the ESA when a proposed federal action is likely to jeopardize the continued

existence of listed species or adversely affect a critical habitat. See 50 C.F.R. §402.14(g)(4). If, in the course of developing a BO, the FWS finds that a "take" will occur, then it must impose "reasonable and prudent measures" that are "necessary or appropriate" to minimize the impact on the species (*Id.*, § 402.14(i)(1)). These measures are referred to as the "incidental take statement" and function as a limited permit, allowing the applicant to legally undertake activities which may harm a protected species. Generally, it is unlawful for any person to "take" a species which has been listed as endangered or threatened unless that person has complied with certain provisions in the ESA. (See ESA, § 9(a)(1)(B).) The following acts comprise a "take" under the ESA: "to harass, harm, pursue, shoot, wound, kill, trap, capture, or collect" ESA §3(19). In *Babbitt v. Sweet Home Chapter of Communities for a Great Or.*, 515 U.S. 687, 115 S.Ct. 2407, 2418, 132 L.Ed.2d 597 (1995), the Supreme Court held that FWS "reasonably construed the intent of Congress when [it] defined "harm" to include "significant habitat modification or degradation that actually kills or injures wildlife." However, as mentioned above, if a take occurs within the terms and conditions of an incidental take statement, then generally that take does not violate the ESA.

In *ACGA v. FWS*, the incidental take statement prepared by FWS as part of the BO included protections for a

number of endangered species, including the razorback sucker (*Xyrauchen texanus*), southwestern willow flycatcher (*Empidonax traillii traillii*), and ferruginous pygmy-owl (*Glaucidium brasilianum*). In FWS's estimation, these species were likely in the next 10 years (the period of time covered by the BO) to use as habitat those areas within the grazing allotments. One basis for this conclusion was that the razorback sucker had been reintroduced by the thousands in the allotment areas in the 1980s. The reintroduction failed but FWS believed a remnant population of fish had survived. However, no survey was performed to verify this belief. Likewise, FWS's belief that some pygmy owls could still be in the area, or were likely to move into the area once livestock were removed, was open to question since no surveys had recently been performed and no recovery efforts for the owls had been made recently in the area. Nevertheless, in an effort to protect the potential habitat of these endangered species in the event these species were to move back into the area, FWS issued an incidental take statement with the following terms and conditions:

No grazing of cattle shall occur on Bureau-administered lands in the 100-floodplain of the Gila River, and the riparian corridors of Bonita Creek and the San Francisco River through the project area for the life of the project

(through December 31, 2006). Actions shall be taken, including fencing, monitoring for and removal of trespass cattle, and other measure to ensure grazing does not occur on these lands (Administrative Record VI-42, at 175).

ACGA sued to prevent the implementation of these terms and conditions claiming that they would effectively end ranching operations in south-eastern Arizona. ACGA also argued that since FWS did not present adequate evidence that the species FWS wanted to protect were actually present on the grazing allotments, FWS's finding of take violated the ESA's requirement, as articulated in *Sweet Home*, that FWS provide proof of "harm" with evidence of attendant injury or death to individual members of the species before

issuing an incidental take statement. The court agreed with ACGA and rejected FWS's argument that a "take" in violation of the ESA occurs due to "harm" that need only take the form of habitat modification and degradation. As for FWS's argument that the terms and conditions of the incidental take statement should be implemented as a "safety" measure in the event endangered species were to move into the areas at issue, the court dismissed it as "speculative regulation." Thus, the court held that the incidental take statement and its terms and conditions were invalid.

ACGA v. FWS presents an interesting Catch-22 for federal agencies, and, ironically, their applicants. Without an incidental take statement in place, any taking of an endangered species that moves into the areas covered by a BO, whether by a federal agency or its applicants, is considered an

unauthorized taking under the ESA. This opens up the federal agency (and its applicants) to a citizen suit by environmental organizations. On the other hand, under the reasoning in *ACGA v. FWS*, federal agencies cannot engage in "speculative regulation" and place terms and conditions in an incidental take statement that protect against the possible harm that may occur to endangered species if their potential habitat is not adequately protected. Any attempt to do so risks a lawsuit by organizations such as the ACGA. How federal agencies and the courts will deal with this dilemma remains uncertain.



RIVER NETWORK AWARDS \$557,000 IN WATERSHED ASSISTANCE GRANTS

River Network, a Portland, Oregon-based national river and watershed conservation organization, has announced the list of 22 recipients for \$557,000 available through the Watershed Assistance Grant (WAG) program. The WAG program, a pilot project supported by the Environmental Protection Agency (EPA), supports communities as they work to protect and restore their watersheds. Award amounts range from \$6,500 to \$30,000.

With guidance from a national advisory panel, River Network reviewed over 480 proposals, seeking projects which can demonstrate nationally important lessons associated with group process, formation, organizational structure, and action to protect and restore watersheds.

"The number and quality of the proposals we received was nearly overwhelming," said River Network President, Ken Margolis. "Even before accomplishing anything else,

this program has provided a service by making visible a broad cross-section of the exciting, effective partnerships that people are building in the course of working for healthy rivers and watersheds."

Added Kathy Luscher, coordinator of the grants program for



River Network, "Nationally, there is very little money available to fund organizational-building processes. Yet, without effective organizations in place, implementation of on-the-ground work becomes exponentially more difficult. EPA should be praised for its commitment to support the development of watershed partnerships."

Collectively, the 22 funded projects represent a geographically balanced mix of diverse, sustainable watershed partnerships utilizing conventional and innovative organizing methods.

Funded projects include:

- The Mississippi River Basin Alliance (MN), which will help communities implement effective nutrient management and watershed planning systems to address the "Dead Zone" at the mouth of the Mississippi through a facilitated consensus-building process of public meetings, workshops and conferences.
- The Rogue Basin Coordinating Council (OR), which will prepare a collaborative assessment of all human-made barriers to anadromous fish passage within the Basin and develop an action plan for barrier removal.
- The Navajo Nation (AZ), which will implement a community program to address the concerns of resource degradation and develop best management practices.

The remaining 19 awardees are:

Alabama Rivers Alliance, AL
 Cabinet Resource Group, MT
 Charles River Watershed Association, MA
 City of Alpine, TX
 City Parks Foundation/
 Partnership for Parks, NY
 ClearWater Conservancy, PA
 Colorado Acequia Association, CO
 Cook Inlet Keeper, AK
 Friends of the Poudre, CO
 Huron River Watershed Council, MI
 Native Village of Kwinhagak, AK
 Natural Resources Council of Maine, ME
 Plumas Corporation, CA
 Pure Water for Kansas, KS
 Resource Conservation and Development for Northeast Iowa, IA
 Ruidoso River Association, Inc., NM
 Shenandoah Valley Pure Water 2000 Forum, VA
 St. Louis River Citizens Action Committee, MN
 Tennessee Clean Water Network, TN

River Network is dedicated to helping people protect and restore rivers and watersheds. River Network supports river and watershed advocates at the local, state, and regional levels, helps them build effective organizations and promotes and national movement for rivers and watersheds. River Network also acquires and conserves riverlands that are critical to the services that rivers perform for human communities: drinking water supply, floodplain management, fish and wildlife

habitat, recreation and open space.

Announced by President Clinton and Vice President Gore in February, 1998, The Clean Water Action Plan (<http://www.cleanwater.gov/>) will protect public health and restore our nation's waterways by setting strong goals and providing states, communities, farmers, and landowners the tools and resources to meet them. It emphasizes collaborative strategies built around watersheds and the communities they sustain. The Watershed Assistance Grants, a key action under the Clean Water Action Plan, promote and support joint efforts among states, tribes, local communities, and stakeholders in local watersheds. EPA believes that watershed management works best when the programs and authorities of the public sector are enhanced and guided by the active involvement of local citizens and organizations interested in protecting the quality of waters where they live. These efforts can be dramatically enhanced by a small amount of grant assistance.

For more information contact: Kathy Luscher: (503) 241-3506 ext. 16 or Thalia Zepatos: (503) 241-3506 ext. 40. 

Editor's Note: This information was provided by River Network through their listserve and their web page at <http://www.teleport.com/~rivernet/>



Noteworthy Publications

Michelle M. Oleksyszyn, Department of Plant Biology, Arizona State University

In this issue, I have chosen three articles about the exotic saltcedar (*Tamarix* spp.). There are some commonly held opinions about saltcedar's invasiveness, competitive abilities, and negative impacts. Each of these recent publications takes a slightly different viewpoint about the effects of saltcedar in riparian areas and in competition with native tree species. I present these three articles merely to keep us open to all viewpoints on exotic species.

Everitt, B. L. 1998.

Chronology of the spread of tamarisk in the central Rio Grande. *Wetlands* 18(4):658-668.

Tamarisk (a term used to collectively refer to *Tamarix gallica*, *T. ramosissima*, and *T. chinensis*) is often called an "invasive plant" and has been blamed for changing riparian areas by constricting river channels, increasing flood height, and displacing native species. In contrast to the negative connotation that the term invasive carries, Everitt calls tamarisk an "opportunistic colonizer." He claims that the success of this woody species is due to its reproductive traits, e.g., short time to seed set, many small seeds, and water and wind dispersal. In keeping with this more moderate label, the author hypothesizes that tamarisk's dominance on the

Rio Grande River was a chance event which corresponded with human agricultural activity and flow regulation. He examined data from several sources for the stretch of the river from Elephant Butte Dam (near San Marcial, NM) to its confluence with Rio Conchas (in Presidio, TX). He found that in 1915, a dam was constructed on the Rio Grande River and for 25 years, this dam completely stored spring snowmelt floods. In response to damming, the channel width decreased and the river silted in. Because of these changes, the dammed river was no longer able to handle large flood flow. In 1942, a huge flood exceeded the dam and so severely destroyed agricultural land that most of it was abandoned. Everitt found that the introduction of tamarisk and its subsequent boom followed the history of the dam and the flood event. He explains that in 1926, tamarisk was planted for flood control on the river. Although large floods on the river were prevented by the construction of the dam, flood frequency remained the same and the exotic tree species was introduced with the hope of decreasing these impacts. The 1942 flood enabled tamarisk to replace cottonwood stands. Everitt concludes that flow regulation and flooding were responsible for the success of tamarisk and that the dominance of this species was

not due to its supposed invasiveness.

Glenn, E., Tanner, R., Mendez, S., Kehret, T., Moore, D., Garcia, J., Valdes, C. 1998. Growth rates, salt tolerance and water use characteristics of natives and invasive riparian plants from the delta of the Colorado River, Mexico. *Journal of Arid Environments* 40:281-294.

Not only is there a relationship between human disturbance along river corridors and invasion by exotics, but there is also a relationship between the increasing success and establishment of tamarisk while cottonwood and willow communities struggle with seedling establishment. Glenn et al. reviewed existing the literature from field studies and found that there were conflicting results on the relationships between saline soils and the success of exotic species. They also found evidence suggesting that invasive species tend to consume more water than their native counterparts. They designed a greenhouse study that would examine the salt tolerance and water use characteristics of six riparian plant species – both natives and exotic, trees and herbs. They hypothesized that there would be a difference in salt tolerance

between native and exotic species, but no difference in water use. Seed was collected from the Colorado River Delta near Ejido Oviedo Mota, Mexico and the experiment was conducted in Tucson, Arizona. They found that as the salinity of the water increased, the relative growth rate (a value calculated by the final weight of an individual minus the initial weight of the individual divided by the total amount of days grown) of tamarisk, cottonwood, willow, and baccharis all decreased, but, as predicted, tamarisk was less affected by salinity than the other 3 species. Above a value of 4 grams of salt per liter, cottonwood, willow and baccharis could not compete with tamarisk and *Pluchea* (arrowweed). The water use data also supported their hypotheses as all three trees (tamarisk, cottonwood and willow) lost water in the same amounts. This result comes in contrast to the commonly held belief that tamarisk will "waste" more water than native trees.

They concluded that the salt tolerance of these riparian species will be a major factor influencing woody success and structuring plant communities.

Gladwin, D. N. and Roelle, J. E. 1998. Survival of Plains Cottonwood (*Populus deltoides* subsp. *monilifera*) and Saltcedar (*Tamarix ramosissima*) Seedlings in Response to Flooding. *Wetlands* 18(4):669-674.

Both saltcedar and cottonwood species require

bare, moist ground for successful germination. The authors argue that the dominance of saltcedar over cottonwood may be explained by their reproductive biology. They state that saltcedar sets seed within its first year and produces seed continually throughout the season while cottonwood may take up to 10 years to produce seed and will have a more narrow window of seed production. They further state that once saltcedar is successfully established, it is extremely difficult to eradicate. Cottonwood does apparently have the advantage of establishing earlier in the season and this allows cottonwood to attain a larger size before fall flooding. Knowing about this difference between the two tree species, the authors hypothesized that flooding may be a means for eradicating young saltcedar individuals and that this method would have little effect on cottonwoods. They conducted an experiment in Fort Collins, Colorado, which investigated the effects of fall and spring flooding on seedlings of cottonwood and saltcedar. Additionally, they considered the effect of turbidity (the extent of cloudiness in water) and available light (or photosynthetically available radiation) on the success of the seedlings. They found that in both species, survivorship was lower when the seedlings were exposed to fall flooding than spring flooding and that, in fact, saltcedar species were more impacted by fall floods than cottonwood. They also found that in both species and both

flood seasons, seedling success was positively correlated with light availability and turbidity. That is, as the turbidity of water increased, less light was available and less seedlings survived the flood event. Fall water was more turbid and therefore fall flooded seedlings were less likely to survive. Spring flooded water was less turbid, had more available light and more seedlings of both species survived. Cottonwoods survived fall flooding better than saltcedar and this may be due to the latter seed release of saltcedar. They concluded that this information could be useful in dam management and that fall flooding may favor the slightly larger cottonwood seedlings over saltcedar seedlings. 

The Arizona Riparian Council (ARC) was formed in 1986 as a result of the increasing concern over the alarming rate of loss of Arizona's riparian areas. It is estimated that <10% of Arizona's original riparian acreage remains in its natural form. These habitats are considered Arizona's most rare natural communities.

The purpose of the Council is to provide for the exchange of information on the status protection, and management of riparian systems in Arizona. The term "riparian" is intended to include vegetation, habitats, or ecosystems that are associated with bodies of water (streams or lakes) or are dependent on the existence of perennial or ephemeral surface or subsurface water drainage. Any person or organization interested in the management, protection, or scientific study of riparian systems, or some related phase of riparian conservation is eligible for membership. Annual dues (January-December) are \$15. Additional contributions are gratefully accepted.

This newsletter is published three times a year to communicate current events, issues, problems, and progress involving riparian systems, to inform members about Council business, and to provide a forum for you to express your views or news about riparian topics. The next issue will be mailed in September, the deadline for submittal of articles August 15, 1999. Please call or write with suggestions, publications for review, announcements, articles, and/ or illustrations.

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CALENDAR

7th Annual Conference on Arizona Water Law: Water Quality, Quantity and Rights, August 26-27, 1999, Scottsdale Princess Resort, Scottsdale, AZ. For anyone involved in the regulation, use, acquisition, and development of water rights in Arizona. For more information and registration, call (800) 873-7130.

Water Issues and Partnerships for Rural Arizona, September 8-11, 1999, Hon Dah Resort Conference Center, Arizona Hydrological Society. Contact Lynda Person at (602) 789-1112 for more information.

Wetlands & Remediation, An International Conference, November 16-17, Hilton Hotel, Salt Lake City, UT. Conference encompasses both the treatment and remediation of contaminated wetlands and the use of wetlands to treat and remediate contaminated water and wastewater. For registration information, (800) 783-6338 or conferencegroup@compuserve.com.

WATERSHED 2000, July 9-12, 2000. Hotel Vancouver, Vancouver, British Columbia, Canada, WATERSHED 2000, to be held in the Pacific Northwest, will explore national and international challenges of managing watersheds. For registration information, call (800) 666-0206 or (703) 684-2452, E-mail: msc@wef.org.



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