Arizona Riparian Council

Volume 13, Number 2 June 2000

# PART 2: RESTORATION OF RIPARIAN VEGETATION IN THE ARID SOUTHWEST: CHALLENGES AND OPPORTUNITIES

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*Editors' Note: This is Part 2 of a paper by Julie Stromberg that was presented at the "Restoring and Maintaining Riparian Vegetation in the US Southwest" a U.S. Fish and Wildlife Service/Bureau of Reclamation workshop on Restoring Natural Function to the Lower Colorado River held in Las Vegas, Nevada, on July 8-9, 1998. Part 3 will be in the next newsletter.*

## HOW DO WE RESTORE DEGRADED ECOSYSTEMS?

### 1) Restoration of Physical Elements and Process

**Water Quantities**. Although stream water is fully allocated and even over-allocated in parts of the arid Southwest, there are many opportunities for restoring perennial flows and raising groundwater levels in dewatered river reaches. Recycling of paper, plastic, and aluminum has become a way of life for many urbanites; if we approach municipal water the same way, we can create restoration opportunities by recycling treated municipal water back into river channels near to the point of initial diversion. Many cities are releasing their effluent directly into stream channels. At sites where the alluvial aquifer has not been depleted, the net result has been restoration or rehabilitation of large expanses of riparian vegetation. Below the 91st Avenue water treatment plant in Phoenix, Arizona, the channel of the Salt River is lined by herbaceous plants and young stands of cottonwoods, willows, and tamarisk trees. Vegetation extends across the wide floodplain, sustained by groundwater that is recharged by effluent and agricultural return flows. Along the Santa Cruz River near Nogales, Arizona, cottonwood and willow forest ecosystems similarly have redeveloped as an unintended consequence of the release of treated municipal waste-water to the dry river channel (Stromberg et al. 1993). There is a short sacrifice zone below the treatment plant where poor water quality has selected for a depauperate and pollution-tolerant aquatic biota; but the presence of a functional riparian and aquatic ecosystem causes nutrient concentrations to return to ambient levels after only a few kilometers. There have been discussions about relocating the effluent release point closer to the main aquifer-pumpage sites, to reduce the length of the river that is dewatered; such approaches should be considered for other rivers, as well.

Effluent also is released into the Tucson reach of the Santa Cruz River. Here, the effect has been to restore a narrow stringer of riparian vegetation along the edge of the stream channel. Due

*Cont. pg. 3...Restoration*

## Inside This Issue

## PRESIDENT'S MESSAGE

The 14th Annual Meeting of the Arizona Riparian Council was a success even though attendance was rather low compared to previous meetings. The morning session focused on present management strategies for the Upper Gila River Riparian National Conservation Area (RNCA) and the San Pedro Riparian National Conservation Area . I don't mean to sound redundant by using the long title description of these areas except that it is important to realize that Arizona has two such areas set aside primarily to maintain their unique riparian values.

Diane Drobka, of the Bureau of Land Management (BLM) gave an overview of the management practices that are being utilized for the Upper Gila RNCA. Jerry Barney, a local community member gave an overview of the accomplishments of the locally led San Carlos-Safford-Duncan watershed group. The group has formed to address water quality issues. The take-home message I got from listening to Jerry is for a watershed group to be effective it must address all the needs within the watershed.

Jesse Juen of BLM discussed the present management of the San Pedro RNCA. One of the most important issues that have been addressed in this area is the 15-year moratorium placed on grazing. Jesse went on to explain that some of the wildlife inventories that have been done have counted 400 species of birds utilizing the area and that 25% of the population of Yellow-Billed Cuckoos are supported in this area. Holly Richter, The Nature Conservancy, then spoke on the Upper San Pedro Partnership. This group is made up of state, federal and county agencies and other stakeholder groups. The Partnership is developing a conservation plan to address reduction of water consumption, find ways to reclaim water and augment water resources.

The speakers did an outstanding job explaining the challenges and opportunities that are occurring in these two large-scale management areas and the need for people to listen to each other, understand each other's needs, and strive to devise cooperative and collaborative solutions.

I want to thank all of our morning and afternoon speakers for presenting relevant and interesting information. Thank you for your time and effort and keep up the good work you are doing!

What's an Annual Meeting without an election? This year we had elections for Secretary and Treasurer. I am pleased to announce that Cindy Zisner will remain our Secretary and Theresa Hoff of the Maricopa County Flood Control District will be our new Treasurer. Both of these positions have a three-year term.

In addition at the Business Meeting, I gave an overview of each of the six committees and introduced the chairs of each committee. People are always needed to help whether its manning our booth at an education event, formatting fact sheets, or writing responses to projects. We need someone to put together an electronic presentation on riparian areas that can be checked out by teachers. We already have the slides – help is needed in making the images flow and writing a script. If that interests you, please call Cindy Zisner (480-965-2490) or myself (602-207-4509) and we can get you started on a project that could potentially change a child's view of the world, or at least Arizona!

If there are projects or events you are aware of and you think the Council should be involved, please call me and let's see how we can make it happen.

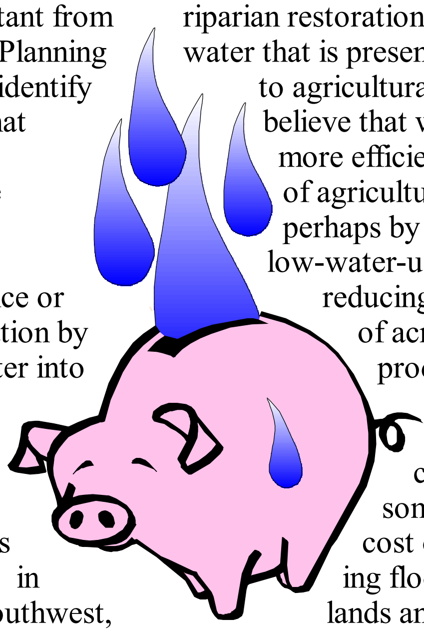
Thanks again to Janet, Cindy, Jeff, Marty, Matt, Barbara, Bill, Susan and Diane; your Board of Directors for making this year's meeting smooth running.

*Kris Randall, President*

*(Restoration...Cont. from pg 1)*

to long-term dewatering in the region, the stream flow is no longer hydraulically connected to the alluvial aquifer, thereby limiting the width of the riparian corridor. Nevertheless, riparian forests have developed. There also are cases where effluent is released into ephemeral rivers, producing small patches of riparian vegetation that are distant from larger river networks. Planning efforts may be able to identify effluent release sites that best fit our needs with respect to region-wide riparian restoration.

There also are opportunities to enhance or restore riparian vegetation by recharging ground water into appropriate sites. Through water-banking, some of the Colorado River allocation of Arizona is recharged or "banked" in aquifers. In the arid Southwest, where open water evaporation rates exceed 2.7 m per year, aquifer recharge is a more viable and desirable method of water storage than storage in surface impoundments. A recent modeling showed that we can accomplish the dual goals of groundwater recharge and riparian restoration. This study predicted that extensive riparian forests could be reestablished in a dewatered reach of the Agua Fria River below the New Waddell Dam in central Arizona dam, if Central Arizona Project water was released from the dam (Springer et al. 1999). The river corridor could be used as a conduit for water delivery to the recharge/recovery zone, while also providing surface and groundwater to sustain riparian vegetation The total amount of water transpired by the vegetation would be less than the amount that presently evaporates from the reservoir. This and other such projects could restore diverse and productive riparian ecosystems to dry river reaches.



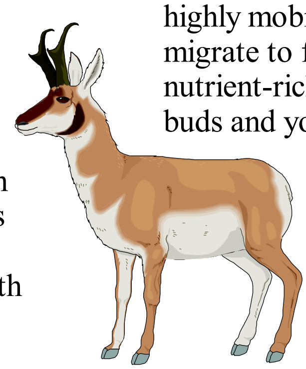
Another source of water for riparian restoration efforts is water that is presently allocated to agricultural activities. I believe that we can be more efficient in our use of agricultural water, perhaps by growing low-water-use plants or reducing the amount of acreage in production of livestock forage crops. In some areas, the cost of purchasing floodplain farm lands and water rights may be economically competitive with the costs of restoring habitat by constructing highly engineered water delivery systems and removing exotic species.

**Watersheds**. Dams and diversions are certainly not the only factors to be addressed when restoring hydrogeomorphic conditions and processes. We also must restore quality to upland plant communities. Long-term overgrazing and extensive urbanization have, in places, reduced plant cover and soil in the uplands. In many cases this has produced "flashier" systems characterized by larger flood peaks and smaller base flows. In other areas, fire suppression has resulted in higher tree densities, higher transpiration rates, and smaller stream flows (Covington and Moore 1994; Covington et al. 1997). These changes have altered riparian ecosystems by reducing water availability in the critical summer dry period, and by selecting for disturbance-tolerant species over the less flood-tolerant species that once characterized our headwater streams. Although floods are an important natural process, too much of most anything can be harmful.

Watershed restoration is an issue that I cannot adequately address here. It will require a mix of passive measures, such as restoring natural fire regimes and grazing regimes, and active measures. Controlled burns may be useful for restoring structure to upland forests. Within the riparian corridor itself, small check dams can allow for more infiltration of water into the aquifers, thereby helping to sustain base flows year round while also reducing the frequency of catastrophic floods.

**Channel-Floodplain Connectivity**. Riparian ecosystems can be restored or improved along some rivers by removing the physical barriers that separate a channel from its floodplain. Along the Colorado River, for example, there are opportunities to remove the dikes and levees and restore some degree of channel-floodplain connectivity. By allowing water to periodically flow onto the flood plain, we provide the input of water, nutrients, sediments, and plant propagules to sustain the productivity and diversity of the riparian forest. Small flood releases along the Rio Grande (New Mexico), although too small to serve as recruitment flows, have reconnected the floodplain vegetation with the river water and served to partially restore riverine functioning in cottonwood forests (Molles et al. 1998).

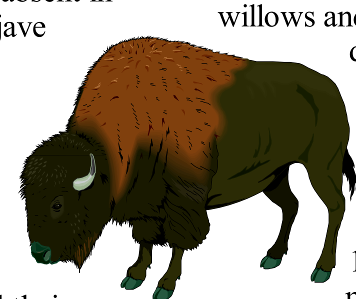
**Integration of Natural and Managed Ecosystems**. Not all of our flood plain lands can be managed as ecological preserves. On our heavily used flood plains–such as those used for agriculture or urban centers–there are many benefits to be had by intermingling direct human uses with restoration of native riparian vegetation. For example, riparian forests could be restored to strips between agricultural fields, similar to the hedgerows used in Europe and elsewhere (Petit and Usher 1998). In the lower Colorado River floodplain, agricultural return flows have been used to increased the survivorship of riparian trees and shrubs planted as part of revegetation efforts (Briggs and Cornelius 1998), and such efforts could be expanded. When using return flows to support or create riparian habitat, it may be necessary to periodically flush the soils to reduce the concentrations of salts below the levels that are toxic to cottonwoods and willows. Revegetation success also will be enhanced if water level fluctuations do not exceed tolerance ranges of the plant species. Such efforts can move us farther towards sustainable agricultural practices, provide us with services such as crop pollination and consumption of crop pests, and help us to meet riparian restoration goals.



## 2) Restoration of Animal Populations and Processes

Just as it is important to restore the hydrogeomorphic regimes to which native riparian species are adapted, it also is important to maintain biotic interactions, such as herbivory, within evolved tolerance ranges. Herbivores exert strong selective pressure on plant species. Alteration of herbivore grazing patterns or grazing intensity selects for a different assemblage of plant species. Heavily grazed plant communities, more often than not, do not provide us with a wide range of desired functions and services.

**Ungulate Grazing**. Large, stationary herds of grazing animals were rare or absent in the Sonoran and Mojave Deserts during the centuries prior to the introduction of domestic livestock by the Spanish in the mid-1500s. Bison were present in desert grasslands and their associated riparian corridors (Parmenter and Van Devender 1995), as were elk at higher elevations. Deer and pronghorn antelope used the riparian corridors of the deserts, but are highly mobile browsers that migrate to follow supplies of nutrient-rich foods such as the buds and young leaves of shrubs and forbs. In the past few centuries, cattle ranching has been a nearly ubiquitous influence, constituting a new and major stressor for riparian plant communities in the hot deserts of the Southwest. High intensities of grazing, from cattle or elk, similarly constitute a major stressor for riparian communities of higher elevations.



Will livestock exclusion restore riparian health? Sometimes, eliminating a stressor is all that is needed to enable natural recovery. Livestock removal (or reductions of higher-than-typical populations of elk and deer) can result in dramatic and rapid recovery of some elements of the riparian ecosystem, particularly where the ecosystem has not been degraded by other factors. Along the free-flowing upper San Pedro River, Arizona, cattle exclusion was followed by rapid channel narrowing and vegetative regrowth. New stands of cottonwood and willows and herbaceous plants developed in the wide, open stream banks, and songbird populations increased (Krueper 1992). Within velvet mesquite (*Prosopis velutina*) bosques in southern Arizona, Rogers (1994) found improved soil conditions (more organic matter and fine sediments) and improved vegetation conditions (greater cover of native perennial grasses and herbaceous cover overall) in ungrazed sites compared to grazed sites. Even after 25 years of cattle exclusion, however, exotic herbs including horehound (*Marrubium vulgare*) and stink-grass (*Eragrostis cilianensis*) were still present, suggesting that full restoration had not been achieved.

There has been a slow recovery of the native understory at the Nature Conservancy's Hassayampa River in central Arizona, which became dominated by stands of exotic herbs presumably during its past tenure as cattle ranch, orchard, and trailer park. Flood pulses have assisted in this recovery. We detected reductions in cover of many exotics (e.g., brome grass, *Bromus rubens*; sweet clover, *Melilotus* spp., Bermuda grass), increases in cover of some native species (e.g., cocklebur, *Xanthium strumarium* and desert dicoria, *Dicoria canescens*), and a general increase in diversity following a 10-year return flood (Wolden and Stromberg 1997). Floods accomplish many of the same goals of active restoration treatments: they deposit a diverse seed mixture on fresh substrate while scouring or burying established exotics. Other studies also show that floods can help to restore species composition to sites floristically altered by grazing (Chaneton et al. 1988). Floods can create opportunities for exotic invasion under management stress, but also can facilitate recovery when the management disturbances are reduced or removed.

In other cases, the legacies of past overgrazing, or the presence of ongoing stressors, present more intractable restoration challenges. Natural recovery after cattle exclusion can be slow and problematic on severely overgrazed sites.

One can approach livestock exclusion as one might approach the issue of dam removal, by assessing the costs and benefits. One could exclude cattle from sites where grazing exclusion would result in the least economic loss and greatest ecological improvement. At the very least, it is essential to maintain a sizeable number of ungrazed reference allotments at different elevation and in different geomorphic settings. This will provide us with a series of benchmark or reference sites against which we can compare the condition or integrity of grazed watersheds (Brinson and Rheinhardt 1996) and help to insure that we maintain a large diversity of high-quality riparian sites across the landscape.

Other important questions remain: can we manage for economically viable livestock grazing and riparian ecosystem health on the same parcel of land? There is some consensus that this compromise is best met by reducing the stocking rate rather than by imposing rest and rotation schemes (Holechek 1995). If we don't reduce the stocking rate to acceptable levels (and therein lies the crux of the matter: when does grazing become overgrazing?), use of such schemes seems to bring about little ecological improvement, although there are few studies that demonstrate the consequences of grazing management schemes on arid-region riparian vegetation. Tolerance of, and recovery from grazing, is a much different ecological story in hot, arid regions than in mesic regions (Belsky et al. 1999). There is only anecdotal evidence that riparian ecosystems can be restored, or that damage can be minimized, by restricting the season of use to the nongrowing season (an idea that conceptually breaks down in the hot desert biomes, where the growing season is year-round). Along Date Creek in central Arizona, for example, the riparian ecosystem appears to be responding well to summer grazing exclusion (Briggs 1996). However, the tale of recovery at Date Creek has not been approached from a scientific framework. It may be that the vegetation changes observed at Date Creek and other sites have resulted from climatic variations rather than changed grazing regimes. Stream flows and flood pulses vary tremendously over time in desert regions. In the past few decades, the Sonoran Desert has been wetter-than-normal (Swetnam and Betancourt 1998), and conditions have been favorable for Fremont cottonwood and Goodding willow regeneration (Stromberg 1998). We must be careful not to take management credit for ecological changes–such as large pulses of cottonwood and willow regeneration–that may simply be due to weather patterns.

Perhaps the most critical question is, what is an acceptable stocking rate? I suggest that we set livestock stocking rates based on the amount of forage available during dry years, rather than during average rainfall years (the typical practice). Ecological damage often occurs when there is a combination of stressors, such as drought and herbivory. Realistically, this may mean that livestock grazing is not economically viable in the hot deserts of the Southwest.

**Keystone Species**. Reintroduction of missing or extirpated keystone species–such as beaver–can be an effective restoration tool. Beaver are considered to be a keystone species in riparian ecosystems because of the extent to which they modify local hydrology, stream geomorphology, and habitat conditions for plants and animals. Dams built by beavers serve to raise ground water levels, minimize seasonal variations in surface and groundwater levels, and expand the areas of the flood plain and channel inundated by shallow water. Because of the flashy, highly variable nature of stream flow in the arid Southwest, these changes increase habitat for hydrophytic, wetland vegetation and promote shifts in vegetative communities from facultative to obligate wetland species. Unlike the large dams constructed by humans, the beaver dams tend to be short-lived and do not impede the flows of flood-borne sediments and propagules.

The combined effect of feeding activities, felling of trees for dam and lodge building, and water impoundment creates a mosaic of vegetation types, sometimes called patch types, within the floodplain (Naiman and Rogers 1997). Beaver thus create a more heterogeneous floodplain. On rivers such as the San Pedro, where beaver were recently reintroduced, beaver activity should help to produce a more divers mosaic of patches including open ponded water, marshland, cottonwood-ash-willow swamp, and willow-buttonbush (*Cephalanthus occidentalis*) forest. They also may serve to create habitat for the many threatened and endangered aquatic and wetland species that depend on slow-moving, nutrient-rich waters. There is a need, however, for additional scientific study of the effects of beaver on arid region riparian ecosystems (Naiman and Rogers 1997).

Prior to reintroducing beaver, one should assess site conditions to insure that the habitat and food supply are suitable. As with other natural forces such as floods, beavers can be problematic and cause further loss of quality at degraded sites. For example, if preferred food sources such as cattails (*Typha domingensis*) are sparse as a result of stream dewatering, beaver may be forced to feed heavily on cottonwoods and willows; if these are in short supply, due to river regulation for example, the net effect can be further reduction in site quality.

*Editors' Note: The next part of the text will be in the next newsletter (Vol. 13, No. 3) and will have the complete references.*

## SPECIES PROFILE

# BONYTAIL (*GILA ELEGANS*)

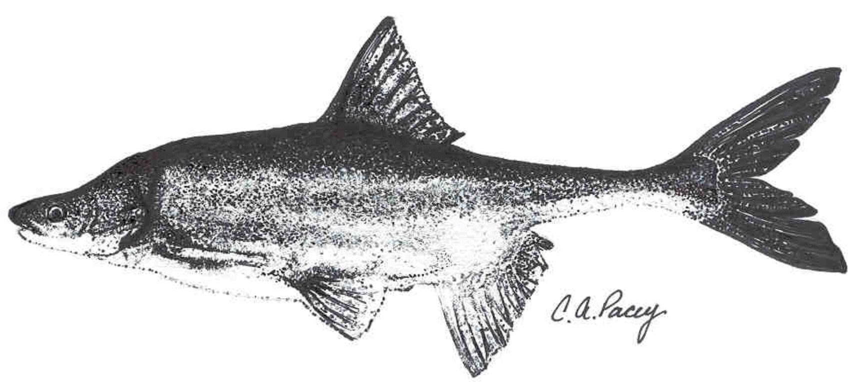
*by Carol A. Pacey and Paul C. Marsh, Department of Biology, Arizona State University, Tempe*

The bonytail (*Gila elegans*) is a fish species with as much history as mystery surrounding its existence as a Colorado River aquatic community member. Bonytail are endemic to the basin, which means they are not found in any other system anywhere in the world. And, they have been there a very long time as evidenced by bonytail bones unearthed from prehistoric Native American fishing campsites (Minckley et al. 1991). Explorations of the western United States from the 1850s through the 1950s generally identified all chubs of the genus *Gila* that were found in the Colorado River basin as “bonytail,” making documented accounts of the species’ distribution and abundance questionable (USFWS 1990, Johnson and Jensen 1991). However, it was clear that the species was widespread and abundant in suitable habitats throughout the basin. Scientists eventually recognized *G. elegans* as a valid species, distinguishable from congeners by its unique adult physical characteristics: fusiform body with gray or olive-green colored back, silvery sides and white underbelly, proportionally small and laterally flattened head anteriorally, gradually giving rise to a dorsal hump that progressively tapers down into a long, thin caudal peduncle (hence the common name), and ending with a comparatively large tail fin (Minckley 1973, Holden 1980). In gaining this, however, scientists also discovered that bonytail had become extremely rare. It is considered by some as functionally extinct, and now is federally listed as endangered (listed in 1980).

The few remaining bonytail mostly inhabit the mainstem lower Colorado River in Lakes Havasu and Mohave, but it is consistently captured only in the latter reservoir during periodic scientific sampling expeditions (USFWS 1990). During the day, bonytail primarily occupy the limnetic zones, which are areas of deep water and swift currents, but at night they may move into shallower water of pools and eddies, favoring gravelly shorelines and points, marshy backwater sloughs and oxbow lakes (Minckley 1979, Marsh and Minckley 1992, Marsh and Mueller 1999). Like many other fishes, bonytail feed on aquatic and semi-aquatic fauna and flora, specifically dining on drifting matter such as terrestrial insects, plant debris and algae entrained or on the water surface (Minckley 1973, Minckley 1979).

Bonytail are considered one of the "big-river" fishes of the Colorado River basin even though they are scientifically classified as minnows (family Cyprinidae). While most people commonly think of minnows as some of the smallest fish, adult bonytail recently captured from Lake Mohave averaged 46 cm (18 in) long, with the largest to date measuring 56 cm (22 in). One exceptional bonytail captured in Lake Havasu measured at more than 81 cm (32 in) (Minckley 1973)! In addition to their great length, bonytail are long-lived, with some individuals captured in Lake Mohave estimated between 30 to 50 years old (Johnson and Jensen 1991).

If bonytail can attain such large size and old age, then why have they become so rare? The key to this mystery lies in a combination of factors. First,



our knowledge of the optimal habitat for all life stages of bonytail as well as their habitat needs for successful reproduction is limited. Other than captive situations, there has been only one recorded observation of bonytail spawning. In May 1954, approximately 500 adults were congregated enmass and presumably depositing gametes over a gravel shelf in water as deep as 8 m (26 ft) in Lake Mohave (Minckley 1979). Second, our water and land requirements have come first and the subsequent alteration of the historically dynamic and unpredictable Colorado River system through depletion, diversion, and damming may have reduced or ruined optimal bonytail habitat. According to Washington Department of Fish and Wildlife (1995):

> *In Arizona and New Mexico, 80 percent of all vertebrates use riparian areas for at least half their life cycles; more than half of these are totally dependent on riparian areas. The Arizona Riparian Council stated that 60-75 percent of Arizona's resident wildlife species depend on riparian areas to sustain their populations. Healthy riparian habitats are directly related to aquatic and fish productivity.*

Damming may also directly kill larvae by drawing them through turbines and/or by limiting access to essential food that would have been delivered downstream from upstream areas. And finally, our desire to mimic the fish fauna available in other North American rivers, and elsewhere, by the addition of competitive and predatory non-native fish and invertebrate species may have dealt a final blow that devastated already stressed bonytail populations. Established exotics inhabit the particular spaces used by bonytail, and preclude larval survival or juvenile recruitment via predation.

By the 1980s, augmenting the depleted bonytail population by stocking hatchery-produced fish was the only viable management choice in the prevention of its extinction. Special handling protocols were developed and adapted for the capture and care of endangered wild adults, and culture methods were developed for propagation and rearing their offspring. Adults have been collected annually from Lake Mohave during their March to June spawning season by trammel netting along gravelly shorelines in several meters of water. Selected fish are placed in live tanks for immediate transport to Willow Beach National Fish Hatchery (Arizona) where they recover from the capture experience; then they are sent by truck or airplane to their permanent home at Dexter National Fish Hatchery and Technology Center (New Mexico). Once at Dexter, fish are quarantined and treated for any bacterial or fungal conditions, tagged with internal tags and then released into holding ponds. Adults are allowed to spawn naturally in captivity, and their fertilized eggs hatch after about four to seven days, with larvae remaining on the bottom until they swim up to the surface, after two to five days to begin feeding. Larvae remain at Dexter until they grow to juveniles, and then are transported back to the lower Colorado River, either to continue growing in lakeside backwaters along the perimeter of Lake Mohave or to be released (repatriated) directly into Lakes Mohave or Havasu. To date, this approach has been successful based on the number released, which totals more than 200,000 bonytail repatriates since 1981.

Bonytail numbers were depleted even as the species came under the scrutiny of concerned fishery biologists. Although their original population size was unknown, by the time it was federally listed there was general acceptance that the species was dangerously close to extinction. This created a sense of urgency that propelled this fish into the "endangered species" spotlight, initiating fact-finding research and a bonytail repatriation program. The past decade of this program may have been the "shot in the fin" that bonytail needed to prevent their extinction, but it is known that only a few repatriates have survived to sexually maturity. It now is believed that successful reproduction is precluded by predation by the non-native fauna, compounded by alteration of the physical habitat of the aquatic and riparian areas along the Colorado River. Perpetuation of this unique natural resource may succeed as a result of new programs that will provide dedicated, exotic-free habitats. If not, the species may be relegated to existence only in zoo-like hatcheries, or worse, to museum bottles.

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## SPRING MEETING BIRDING FIELD TRIP

### THE BOUNTY OF BONITA CREEK

*by Diane Laush, Bureau of Reclamation, Phoenix*

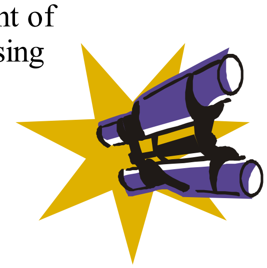
The group was small, but determined, as we set out for Bonita Creek on a warm, late spring morning. Although we didn't arrive early enough to see the sunrise over Bonita Creek, we did manage to see, or hear, 52 species of birds. We leisurely hiked about 2 miles up Bonita Creek enjoying the warm sun and cool waters of Bonita Creek. The road closure near the confluence of Bonita Creek with the Gila River ensured an undisturbed walk.

The riparian habitat has improved since I first saw this creek 20 years ago, when I spent a summer inventorying raptors for BLM. At that time, I saw little sign of regeneration. Today, the area is lush with cottonwood, sycamore, willow, walnut and mesquite.

The weather was pleasantly warm and the breeze slight as we started up the Creek, serenaded by a Canyon Wren. As if reluctant to leave this spot, there were still some late migrants and winter residents present. Some of the most common birds we saw were Brown-crested Flycatchers, Gila Woodpeckers, Western Wood Pewees, Warbling and Plumbeous (Solitary) Vireos. Warblers were in abundance, in addition to summer resident Common Yellowthroat, Yellow and Lucy's Warblers, we also saw Yellow-rumped, Wilson's, MacGillivray's, Black-throated Gray and Townsend's Warblers.

An eclectic group, we did not limit our interest to birds. A few people looked at plants while others explored the small beaver dam and lodge. One of the trip highlights was a great look at a desert bighorn ewe. She was content to watch us from her lofty perch about 150 feet above the Creek.

Nearly half of the group could identify birds by their songs or calls. This ability is extremely helpful in locating birds that are "out of sight." The group spent a fair amount of time discussing the difference between Lucy's and Yellow



Warbler songs. An unexpected Cassin's Kingbird caught a few people off guard. A fitting end to our trek was had as we heard the strident cry of a Black Hawk and looked up just in time to see it circle once and head upstream.

### BIRDS SEEN, MAY 13, 2000

1. Turkey Vulture
2. Red-tailed Hawk
3. Black Hawk
4. Gambel's Quail
5. Great Blue Heron
6. White-winged Dove
7. Mourning Dove
8. White-throated Swift
9. Black-chinned Hummingbird
10. Gila Woodpecker
11. Ladder-backed Woodpecker
12. Vermilion Flycatcher
13. Cassin's Kingbird
14. Western Kingbird
15. Brown Crested Flycatcher
16. Ash-throated Flycatcher
17. Black Phoebe
18. Say's Phoebe
19. Hammond's Flycatcher
20. Cordillean (Western) Flycatcher
21. Western Wood Pewee
22. Cliff Swallow
23. Violet-green Swallow
24. Rough-winged Swallow
25. Common Raven
26. Verdin
27. Cactus Wren
28. Rock Wren
29. Canyon Wren
30. Plumbeous (Solitary) Vireo
31. Bell's Vireo
32. Warbling Vireo
33. Black-throated Gray Warbler
34. Lucy's Warbler
35. Yellow Warbler
36. Townsend's Warbler
37. Yellow-rumped Warbler
38. Common Yellowthroat
39. Yellow-breasted Chat
40. MacGillivray's Warbler
41. Wilson Warbler
42. Brown-headed Cowbird
43. Hooded Oriole
44. Northern Oriole
45. Western Tanager
46. Summer Tanager
47. Northern Cardinal
48. Black-headed Grosbeak
49. Lazuli Bunting
50. House Finch
51. Lark Sparrow
52. Black-throated Sparrow

## EFFLUENT ALLOCATED FOR RIPARIAN RESTORATION

*by Julia Fonseca, Pima County Flood Control District, Tucson*

City of Tucson, Pima County, and the Pima County Flood Control District recently negotiated an agreement reserving effluent and reclaimed water for environmental enhancement and restoration. The agreement also dismisses pending litigation between City and County concerning effluent.

The agreement requires the parties to cooperate in managed and constructed recharge projects, which would create storage credits for wastewater that infiltrates and recharges the aquifer after being discharged to the Santa Cruz River following treatment in the County's facilities. This will augment the City's ability to produce reclaimed water, which barely meets peak summer demands at present.

The County and City agree to create a Conservation Effluent Pool to use in riparian restoration projects, such as those in the Sonoran Desert Conservation Plan. Projects endorsed by the U.S. Fish and Wildlife Service will be eligible for a portion of a 5,000 acre-ft pool for each of the first 5 years of conservation efforts. If, after the first 5 years, the entire 5000 acre-ft has been used, effluent will be added to the pool to meet additional demand.

Approximately 70,000 acre-ft of effluent is discharged to the Santa Cruz River each year. Due to pumping, the water table is generally in excess of 80 ft, too deep for groundwater-dependent vegetation. There are approximately 300 acres of Goodding willow- or willow-tamarisk-dominated vegetation along the river that will continue to be supported by discharges to the river. Water to support the riparian restoration projects will probably go to projects located outside the effluent-dominated low-flow channel of the Santa Cruz.

The agreement marks the first allocation of effluent for environmental enhancement and restoration in the Tucson area. Interior Secretary Bruce Babbitt helped to initiate the agreement process. The effluent will be made available to each qualifying riparian project, at a fee that covers the operating costs of producing and delivering the water.

## LEGAL ISSUES OF CONCERN

*Richard T. Campbell, Law Offices of Storey and Pieroni, Phoenix*

# LONG TIME COMING: THE ARMY CORPS OF ENGINEERS ISSUES ITS REPLACEMENT OF NATIONWIDE PERMIT 26

On March 9, 2000, the Army Corps of Engineers (Corps) published its long-awaited replacement of Nationwide Permit (NWP) 26 with five new NWPs and six modified existing NWPs. In addition, the Corps revised nine NWP General Conditions and added two new NWP General Conditions. The final regulations radically alter the nature of Army Corps of Engineers permitting in Arizona and throughout the nation. The most significant changes, from a riparian-interest perspective, are discussed in this article. Some background is provided below.

### NATIONWIDE PERMIT 26: AN OVERVIEW

Section 404 of the Clean Water Act (CWA) authorizes the Corps to issue general permits on a nationwide basis to discharge dredged and fill materials into water of the United States, which in Arizona include rivers, streams, lakes and even ephemeral (dry) washes as small as three feet across. These nationwide permits (NWPs) are only available for activities that are similar in nature and that have only minimal individual and cumulative environmental impacts. CWA § 404(e)(1). By eliminating the need to obtain an individual permit for all activities affecting waters of the United States, NWPs serve to ease the Corps' administrative workload and streamline the permitting process. The Corps' NWP program has not been without controversy, and none of the Corps' available nationwide permits has been more controversial than NWP 26.

NWP 26 authorizes discharges into "headwaters and isolated water." Headwaters are defined as "nontidal rivers, streams, and/or lakes and impoundments, including adjacent wetlands, that are part of a surface tributary system to an interstate or navigable water of the U.S. upstream of the point on the river or stream at which the average annual flow is less than five cubic feet per second." 33 C.F.R. §330.2.d. Isolated waters are nontidal water of the U.S. that are "not part of a surface tributary system to interstate or navigable waters of the U.S. and not adjacent to such tributary water bodies." *Id.,* §330.e.

Before 1996, NWP 26 required that discharges not cause a loss of more than 10 acres of waters of the U.S. and that the permittee notify the Corps if the discharge would cause a loss of more than 1 acre. Growing concern among environmentalists over the potentially large amounts of wetland losses that were occurring without individual review under NWP 26 convinced the Corps that NWP would have to be scrapped. Environmentalists also objected to NWP 26 on a technical basis – they argued that since any activity could qualify for NWP 26 as long acreage limits and permit conditions were met, NWP 26 was not being used to authorize activities that were "similar in nature." The Corps was also dissatisfied with the ability of NWP 26 to reflect the differences in aquatic ecosystem functions and values that existed across the country. Thus, in 1996 the Corps began work on using a combination of modified existing NWPs and new NWPs to replace NWP 26. In the interim period before NWP 26 would actually be replaced, the Corps modified NWP 26 to require that discharges not cause a loss of more than 3 acres of waters of the U.S. nor cause a loss of more than 500 linear feet of the stream bed. Moreover, permittees were required to notify the Corps if the discharge causes a loss of more than ⅓ of an acre (down from 1 acre previously). 61 Fed. Reg. 65873 (December 13, 1996).

The Corps published its first proposal to replace NWP 26 on July 1, 1998. Due to widespread concerns and over 3,200 comments raised by industry and environmental groups regarding the expiration of NWP 26, the Corps extended the deadline for publication of its replacement several times until this March.

### The Modified and Replacement Permits

The six existing nationwide permits that were modified include: NWP 3 (repair, rehabilitation, or replacement); NWP 7 (outfall structures and associated intake structures); NWP 12 (utility activities); NWP 14 (linear transportation crossings); NWP 27 (stream and wetland restoration activities); and NWP 40 (agricultural activities). The five new NWPs include: NWP 39 (residential, commercial, and institutional developments); NWP 41 (reshaping existing drainage ditches); NWP 42 (recreational facilities); NWP 43 (stormwater management facilities); and NWP 44 (mining activities).

***...six existing permits... modified.... five new NWPs.....***

Perhaps the most stunning development is that the maximum acreage limits for most of the new and modified NWPs is ½ acre and that pre-construction notification (PCN) thresholds are now triggered by activities that result in the loss of as little as $^{1}/_{10}$ of an acre of waters of the U.S. In Arizona, these new acreage limits are most controversial in regard to residential and commercial developments that attempt to fall under NWP 39. NWP 39 has also been criticized within the development community for prohibiting stream channelization or stream relocation downstream of the point on the stream where the average annual flow is 1 cubic foot per second (cfs). This requirement is seen as time-consuming and difficult to implement. *Id.* at 12889.

### The Modified and New NWP General Conditions

The Corps revised nine NWP General Conditions and added two new NWP General Conditions in this rule change. The new General Conditions also substantially alter the NWP program's regulatory landscape. Of particular significance to Arizona Riparian Council members is General Condition 25, which limits activities in designated "critical resource" waters and fills. Critical resource waters include NOAA-designated marine sanctuaries, National Estuarine Research Reserves, National Wild and Scenic Rivers, critical habitat for federally listed threatened and endangered species, coral reefs, state natural heritage sites, and outstanding national resource waters or other waters officially designated by a State as having "particular environmental or ecological significance." *Id.* at 12872, 12897. This definition likely encompasses Arizona's "unique waters" that are periodically designated by Arizona Department of Environmental Quality.

Another General Condition that would have had a significant impact on development in riparian environments was withdrawn due to negative comments. General Condition 26 would have limited the use of NWPs in waterbodies identified as impaired through the Clean Water Act Section 303(d) process. This Condition was particularly controversial because the listing of a water as impaired under 303(d) triggers the EPA's Total Maximum Daily Load (TMDL) program, which raises a host of issues that are in the process of being resolved by EPA in an upcoming TMDL rule. For example, it was unclear in the Corps' proposed rule whether tributaries of impaired waters, or waters subject to a TMDL, would also be subject to General Condition 26. *Id.* at 12875, 12897.

General Condition 27 has also generated a lot of interest in the regulated community. This Condition now restricts the use of NWPs in waters of the U.S. within 100-year floodplains (as designated by FEMA). While the existing NWPs for roads and utilities will remain available in the 100-year floodplain (provided the project meets the FEMA federal standards for floodplain protection), the Corps will generally not authorize above-grade fill under an NWP in the FEMA mapped floodway. *Id.* at 12869, 12876, 12897. Individual permits are still available.

Riparian areas will also be affected by modified General Conditions 13 and 19 (as well as new NWP 39), which require, where "appropriate and practicable," compensatory mitigation of adverse effects on the aquatic environment, including a vegetated buffer–25 to 50 ft wide–on both sides of jurisdictional waters.

The new and modified NWPs and general conditions are effective June 5, 2000. Thus, the expiration date for NWP 26 is June 5 as well. NWP 26 activities that do not require a PCN are authorized by NWP 26 until June 5.

There are numerous other significant changes to the nationwide permit rules contained within the Corps' 81-page rule change. Those involved in Corps permitting should take care to read the new rules very carefully.

# NOTEWORTHY PUBLICATIONS

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

***Editors' Note:*** *With this issue Michelle will be stepping down as Noteworthy Publications editor as she is graduating from Arizona State University and will be pursuing her career goals. We would all like to express our special thanks to her for the efforts she has put into the newsletter. Our new Noteworthy Publications editor for the next issue will be Jere Boudell, a third-year doctoral student in the Department of Plant Biology, Arizona State University. Goodbye and good luck Michelle and welcome aboard Jere!*

Briggs, Mark K. 1996. *Riparian Ecosystem Recovery in Arid Lands: Strategies and References*. The University of Arizona Press. Tucson.

Riparian ecosystems are impacted by human-related activities such as agriculture, groundwater pumping, live-stock grazing, and urbanization. Deterioration of these ecologically valuable areas in the last several decades has led to increased interest in repairing them. Briggs' text functions as a beginner's guide to structuring a recovery plan for riparian areas in the southwestern United States. The text is friendly to the lay person. Jargon is often unavoidable, but the author remedies this situation by defining terminology in the body of the text, inserting numerous figures, and including a glossary at the back of the book. There are several case studies within the text that drawn attention to both successful and unsuccessful recovery plans. For the curious or more advanced reader, Briggs includes numerous references to more detailed literature as well as contact organizations that provide historical information and ecological data.

Briggs begins his text with a primer that defines riparian ecosystems, highlights their value, and describes their current conditions. He then proceeds to discuss the factors that need to be considered when constructing a recovery plan. An entire chapter is devoted to each of the following topics:

1. Considering the Damaged Riparian Area from a Watershed Perspective
2. Impacts within the Riparian Zone
3. Natural Recovery in Riparian Ecosystems
4. Water Availability
5. The Drainageway
6. Soil Salinity and Riparian Ecosystems.

He concludes the text with a chapter on the Recovery Plan itself.

Throughout the text, the author stresses several key concepts that should permeate the construction of any recovery plan. First and foremost, he encourages the determination and evaluation of the causes that led to deterioration of the riparian ecosystem. These factors, which may include such things as overgrazing or groundwater pumping, need to be eliminated before any successful recovery plan is implemented. Another recurring theme in the text is the author's emphasis on "passive restoration." He reminds the reader that riparian areas are resilient and that the potential exists for natural recovery if imposing forces are controlled or removed. Third, the author encourages a broad perspective both spatially and temporally. He recommends a historical examination of changes along the river and consideration of the entire watershed, including uplands, factors upstream which will influence the recovery plan and the impacts of the plan on downstream reaches.

Briggs' writing and recommendations are a blend of optimism and realism. For example, he values complete restoration where possible, but if groundwater levels are too low to support phreatophytes such as cottonwood or willow species, Briggs recommends selection of an alternate native, woody species which may be better suited to current site conditions. Additionally, he stresses the value of spending adequate time evaluating sites to determine those which possess the greatest probability for successful recovery, rather than investing time into those sites which are most degraded or may not respond to a recovery plan. His realism is evident in each chapter as he states all factors that should be considered, yet includes recommendations of those which are most important if time or money is limiting.

As for the recovery plan itself, Briggs states that it is essential to define objectives and goals at the onset of the project. These goals should be quantifiable or measurable if possible and a time line for the plan should be developed. A novel idea is to conduct a small scale or pilot recovery project before implementing the larger plan. This would allow managers to determine the most optimal methods for recovery. The plan should include consideration of all ways in which the riparian ecosystem is used and Briggs encourages the involvement of farmers, cattle owners, biologists and recreational users in the development of the plan. Further, he suggests soliciting community support and participation throughout the duration of the project. Finally, he emphasizes the importance of post-project evaluation and monitoring.

Although Briggs' text does not propose new strategies for riparian restoration, his book is valuable as an introduction to the subject, a summary of all variables influencing recovery plans and a statement of where emphasis in riparian restoration should lie.

## CONFERENCE REPORT

## SOUTHWEST RIVER MANAGEMENT & RESTORATION: NONSTRUCTURAL APPROACHES, APRIL 3-5, 2000

*by Matt Chew, Arizona State Parks, Phoenix*

The Arizona Floodplain Management Association and cooperators, including ARC, put together a fine two-day program of invited speakers on a variety of topics orbiting the conference theme. Appearing on the agenda were federal, state, local, and academic experts, including familiar Arizonans plus notables from California, Colorado, Utah, Oregon and even Washington, DC. Every talk I attended (missing 3 or 4) was well-thought out and well-presented. Each session ended with a lively panel discussion. My particular kudos go to Nancy Grimm, Duncan Patten, Fritz Steiner, John Keane and Jon Fuller, but there wasn't really a weak link.

The final session included audience participation and a mega-panel discussion disguised as a fictional town meeting. Many thanks to everyone who accepted roles that I assigned to them with little or no warning. We started slowly, but had a few laughs and discovered some fine actors in our midst. In the process, it became evident that there are plenty of good intentions out there, but still some old attitudes to overcome and a few laws and regulations that need updating.

Day three consisted of field trips. I went to see the familiar (to me) Phoenix Rio Salado and Tres Rios projects. I didn't come away enlightened much further; the City of Phoenix controls the spin on these pretty tightly. But there are things to be learned by seeing, and the discussions among the attendees were interesting and useful.

Finally, hats off to Cindy Zisner, who worked very hard on the planning committee to help make the meeting a success. We need more like her, and more meetings like this one.

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, 2000. Please call or write with suggestions, publications for review, announcements, articles, and/or illustrations.

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## CALENDAR

**Workshop and Training Session**: Restoring Streams, Riparian Area, and Floodplains in the Southwest, Fall, 2000. Albuquerque, NM. Session Goals: Build state, tribal, local government, federal, and private stream, riparian, and floodplain restoration capabilities in the Southwest. Association of State Wetland Managers, P.O. Box 269, 1434 Helderberg Trail, Berne, NY 12023-9746, 518-872-1804; Fax: 518-872-2171 E-Mail: aswm@aswm.org http://www.aswm.org/upcoming.htm.

**Desert Fishes Council,** November 16-17, 2000. Furnace Creek Ranch (Death Valley National Park, CA). Members may now submit papers electronically at http://www.utexas.edu/depts/tnhc/.www/fish/dfc/meetings/dfc_abstract_form.html. For more information go to the website http://www.utexas.edu/depts/tnhc/.www/fish/dfc/meetings/2000/call.html or contact Dean Hendrickson at deanhend@mail.utexas.edu. Deadline date is 1 September.

**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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