

Possible Strategies for Preservation of the San Pedro River Riparian Community¹

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Abstract--Because of the scarcity of riparian habitat in Arizona and its obvious importance to fish and wildlife, the U.S. Fish and Wildlife Service is investigating methods to preserve remaining riparian areas along the San Pedro River, south-east Arizona. Possible strategies include acquisition under the Unique Ecosystems Program, enactment of local ordinances, and state-wide legislation.

Riparian areas in the arid Southwest have undergone significant physical and biological changes since the early 1800's. Nowhere is this resource deterioration more obvious than in the Colorado River and tributaries such as the Gila, where many former riparian communities are now absent or severely reduced in size.

The San Pedro River, a major tributary to the Gila, enters the United States from Sonora, Mexico, approximately 100 km east of Nogales, Arizona (fig. 1). The river channel then runs NNW for approximately 200 km to its confluence with the Gila River near Winkelman, Arizona. Headwaters of the river are located 40 km south of the International Boundary, near Cananea, Mexico. Total area of the San Pedro basin is 11,621 km², of which 1802 km² occur in Sonora. Elevation of the river channel is 1303 m above mean sea level at the International Boundary, and drops to an elevation of 585 m at its confluence with the Gila River, an average gradient of 4 m/km (Roeske and Werrell, 1973). The largest tributary to the San Pedro is Aravaipa Creek, which drains an area of 1530 km and enters the San Pedro mainstream 19 km upstream from Winkelman (fig. 1).

San Pedro valley sediments, bounded by several desert mountain ranges composed of low-permeability, crystalline and consolidated

sedimentary rocks, consist of well-bedded semi-consolidated to nonconsolidated valley-fill material overlain by floodplain alluvium. The valley-fill upstream from Benson ranges from 90 m - 644 m thick, but has generally been eroded away further downstream (Reichhardt et al., 1978).

Floodplain alluvium, consisting of gravel, sand, and silt, along the channels and floodplains of the San Pedro mainstream and its tributaries ranges in thickness from 12 to 43 m. This alluvium is very porous and is capable of producing water flows in excess of 2000 gallons per minute (7.57 cubic meters per minute). Ground water in the alluvium is under strong artesian pressure in the vicinity of Palominas - Hereford, St. David-Benson, and Mammoth. Further downstream, ground water occurs at increasing depths beneath the surface (Roeske & Werrell, 1973).

Because of high sediment porosity, ground water withdrawn from the alluvium is rapidly replaced by infiltration from periods of high surface runoff. During the past 25 years, net change in ground water level has been negligible except in the Sierra Vista-Fort Huachuca area due to domestic-industrial uses. The relatively constant ground water level may be due in part to replacement of riparian vegetation by irrigated agricultural land (Roeske and Werrell, 1973).

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Lack of substantial lowering of ground water since the early 1950's, however, does not mean that the flow regime of the San Pedro has not been radically altered. Diversions, headwater impoundments, depletion of underground aquifers, and a possible regional tendency toward increasing aridity have reduced surface flow in the mainstream to that of an intermittent stream,

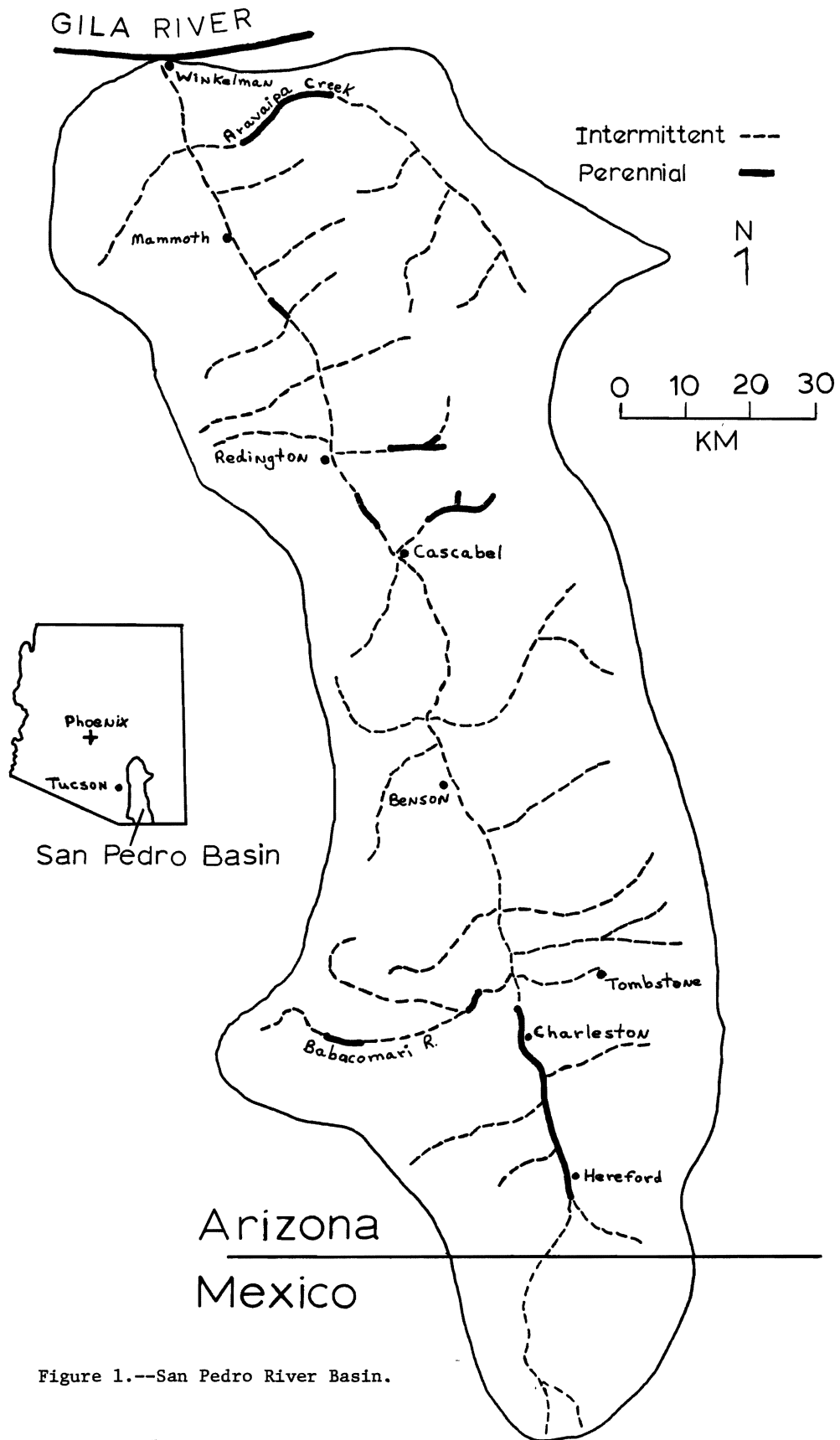


Figure 1.--San Pedro River Basin.

with permanent water present in three main sections which comprise only 50 km of the total river length of ca 250 km (fig. 1). That the San Pedro historically contained consistently high surface flows is documented by occurrence of Colorado River squawfish, *Ptychocheilus lucius*, (Miller, 1955), a species confined to swift, big-river habitats in excess of one meter deep (Minckley, 1973). The San Pedro drainage historically supported at least 12 native fish species. Aravaipa Creek, the largest tributary, presently contains 7 of 12 fishes reported, and is the only portion of the entire drainage that supports a relatively secure native fish fauna. Of these 7 species, 5 have not been reported elsewhere in the basin since at least 1963; the remaining 5 species likewise were eliminated prior to 1963. Further reduction of the already-depleted native ichthyofauna occurred in February 1978, when pollutants from copper mining operations on the San Pedro headwaters in Sonora, Mexico, apparently destroyed all fishes in the upper portion of the mainstream. Reestablishment of fishes in this section must occur from tributaries such as the Babacomari River where small populations of native species occur.

According to Brown et al. (1977), only a few southwestern drainages such as the Rio Magdalena in Sonora, Mexico, and the San Pedro in Arizona, presently contain any extensive linear riparian forest development. Such forests were once extensive, but have decreased dramatically in area during the past century due to diversions and/or elimination of streamflows. Davis (1973) mentions prior accounts of the extent of riparian forests along the Santa Cruz, Gila, and Colorado Rivers before 1900. Such forests are difficult to imagine when one views the present remnants. Remaining riparian plant communities are continually subjected to upstream impoundments, channel cutting (fig. 2), channelization, irrigation diversions, groundwater pumping, and, in many areas, increased water salinity. In addition, overgrazing by cattle has negatively affected remaining forests, especially cottonwoods, which reproduce primarily from seed rather than sprouts (Horton et al., 1960).

A recent study by Reichhardt et al. (1978) compared various land-use practices along the San Pedro River from 1935-1978. Somewhat surprisingly, conclusions were that riparian areas composed of cottonwood, mesquite, salt cedar, and willow had increased since 1935, as had agricultural and cultural-industrial areas (Table 1). These increases occurred simultaneously with a decrease in areas such as marsh lands, mesquite-scrub, river channel, and streambed thickets of annual and/or immature riparian species. However, these authors also concluded that, although mesquite and salt cedar areas appear to have increased significantly since the



Figure 2.--Bank erosion on San Pedro River south of Winkelman, Arizona.

early 1900's, cottonwood and willow associations require essentially perennial streamflow and consequently are declining. Events which are implicated in the increase of mesquite along the San Pedro and other southeastern Arizona drainages (Hastings and Turner, 1965) are: overgrazing by cattle in the late 19th century; subsequent runoff and flooding; and climatic drought and lowering of the water table.

Table 1.--Acreages of land use and vegetation types of the San Pedro River, 1935-1978 (from Reichhardt et al., 1978). Numbers in parenthesis indicate percentage of total acres.

Type	1935	1966	1978
Dense Riparian ¹	17,300 (22)	30,400 (39)	35,200 (45)
Agricultural	8,900 (11)	14,600 (19)	22,300 (28)
Cultural-Industrial	950 (1)	1,600 (2)	7,000 (9)
Other ²	51,650 (66)	32,300 (40)	14,300 (18)
Total Area	78,800	78,800	78,800

¹Cottonwood, mesquite, salt cedar, and willow.

²Marsh, mesquite-scrub, river channel, and streambed thickets of annual and/or immature riparian species.

Riparian areas along the river and its tributaries are continually threatened with destruction from numerous types of development. Loss or alteration of this habitat type from floodplain clearing and conversion to other land uses is taking place at an alarming rate. Agriculture, industry, recreation, and urbanization are all contributing factors to the alteration or destruction of riparian habitat.

Although significant riparian areas presently occur along the San Pedro, clearing of mesquite and cottonwood lands, primarily for agricultural use, is continuous, especially in the Mammoth-San Manuel and Winkelman-Dudleyville areas. Studies have indicated the high wildlife

potential of similar communities along the Verde and Lower Colorado Rivers in Arizona (Carothers and Johnson, 1970; Anderson and Ohmart, 1976, 1977). Wauer (1977) found that many bird species regularly used the Rio Grande riparian corridor as a migration and emigration route. Similar utilization of the San Pedro riparian zone would be expected. Important raptors such as Mississippi kites, black hawks, gray hawks, and zone-tailed hawks are presently using mature cottonwood stands in the San Pedro basin as nesting sites.

A recent occurrence south of Mammoth, Arizona, illustrated what is generally happening to fish and wildlife habitat along much of the San Pedro. A new locality for the Gila topminnow, *Poeciliopsis occidentalis occidentalis*, was identified in July 1978, in the outflow of an artesian well. At that time, clearing of mesquite immediately adjacent to the site was underway. By September, the well piping had been partially capped and dense mesquite around the well was removed by bulldozer (fig. 3). Much of the outflow area had become silted in and few fish could be observed. By early October, the well had been completely capped and connected to an irrigation system in the adjacent cleared area, resulting in complete drying of the former habitat and extirpation of the topminnow population. This incident is particularly significant because the well outflow was the only known locality in the entire San Pedro basin where *Poeciliopsis* was still present, and was one of only seven naturally-occurring populations presently known in the U. S. Thus, in a matter of three months, an important endangered species population was both discovered and extirpated.



Figure 3.--Artesian well locality of Gila topminnow, *Poeciliopsis o. occidentalis*, south of Mammoth, Arizona, September 1978.

Because of the scarcity of riparian habitat in Arizona (only 0.003%) of total vegetative cover and its obvious importance to fish and wildlife, preservation studies of the remaining riparian areas along the San Pedro River are actively being pursued by the U. S. Fish and Wildlife Service. These investigations fall primarily into two categories. First, portions of the San Pedro mainstream are being considered by the Division of Refuges and Wildlife for possible acquisition under the Unique and Nationally Significant Ecosystems Program, including easements as well as land purchases. This program is operated under authority of the Land and Water Conservation Fund Act of 1965 to purchase land and water defined as either "nationally significant wildlife ecosystems" or "unique wildlife ecosystems." These two types of ecosystems are defined as:

- 1) Nationally significant wildlife ecosystems: areas which have wildlife habitat values which go beyond local values in that they provide substantial benefits to many people over a wide geographical area.
- 2) Unique wildlife ecosystems: wildlife habitats that are significantly different from other habitats in the region and support natural wildlife communities.

Wildlife diversity and value to endangered, threatened, or other special recognition wildlife are primary considerations in identifying areas under this program. Such areas are managed as units of the National Wildlife Refuge System. Recreational, educational, and scientific uses will be encouraged and managed where appropriate.

Portions of the San Pedro River are being considered under the Unique Ecosystem Program because riparian woodlands are undoubtedly the habitat type of greatest concern in Arizona from both the standpoint of animal diversity and threat of destruction. Riparian habitat along the San Pedro provides nesting, migratory or wintering habitat for at least 20 raptor species and a total of approximately 210 species of birds. A study by Hoffmeister and Goodpaster (1954) recorded 78 species of mammals in the grassland corridor between the riparian woodlands and adjacent mountains. This represents the second-highest mammalian diversity recorded in the world, making the area one of national significance. Also, the San Pedro provides vital habitat to many species which interchange between Mexico and the United States.

The second thrust of preservation efforts on the San Pedro River has been initiated by the Riparian Habitat Analysis Group, U. S. Fish and

Wildlife Service. This group, based in Albuquerque, was organized to facilitate resource analysis, information development, and preservation efforts relative to riparian habitats. Investigations to date have centered on the feasibility of local ordinances, perhaps similar to those recently initiated in Shasta, Napa, and Santa Cruz counties, California.

The Napa County ordinance, enacted February 1974, seeks to prevent and/or minimize losses from flooding by regulating activities within "certain watercourses" and "protecting the riparian cover within specified distances thereof." The County Board of Supervisors recognized riparian vegetation as a "valuable natural resource" and, in the legislation, mentioned such benefits as increased wildlife diversity, enhanced fish habitat, maintenance of lower water temperatures and consequent retardation of algal blooms, bank stabilization, reduced siltation, and enhancement of aesthetic values. Non-permitted activities include planting or removing any vegetation within a watercourse. Violations of the ordinance are punishable by a fine not to exceed \$500.00, or by imprisonment not to exceed 6 months in the county jail, or by both. However, the Conservation, Development, and Planning Commission of Napa County has the authority to issue permits for activities which would be in violation of the ordinance. No permit may be issued if the Commission determines that the proposed work will "substantially impair the water conveyance capacity of the watercourse, or destroy a significant amount of riparian cover." Interestingly, the permit procedure does not apply to public agencies and their contractors.

The Santa Cruz legislation, enacted June 1977, is entitled "Riparian Corridor Protection." Purpose of the ordinance is:

"To preserve, protect, and restore riparian corridors for: protection of wildlife habitat; protection of water quality; protection of aquatic habitat; protection of open-space, cultural, historical, archaeological and paleontological, and aesthetic values; transportation and storage of floodwaters; prevention of erosion; and general promotion of the public health, safety, and welfare in Santa Cruz County."

Some pre-existing agricultural and non-agricultural land uses within Santa Cruz County are exempted from the ordinance, as are activities permitted under a valid timber harvest permit. In addition, the County Zoning Administrator has the authority to issue exception permits under certain conditions.

In Shasta County, riparian protection is contained in a section of the county flood plain zoning ordinance which reads: "No natural riparian vegetation shall be removed from any portion of this District adjacent to the Sacramento River or any stream named as a designated floodway by the State Reclamation Board except by a federal or state agency, Shasta County, or Shasta County Water Agency." As in Napa and Santa Cruz counties some exceptions to the ordinance are provided for.

Current efforts of the Riparian Habitat Analysis Group have centered on the San Pedro riparian areas in Pinal County, Arizona, and include: delineation of land ownership in riparian areas; documentation of vegetational changes and of fish and wildlife populations; investigation of local support for preserving riparian areas; and, investigation of local and regional political institutions, especially water conservation and/or irrigation districts.

Recently, environmental considerations have received emphasis in Arizona from Governor Bruce Babbitt with the formation of the Governor's Commission on Arizona Environment. Preservation of riparian habitats is one of the areas of prime concern to Governor Babbitt and the Commission. As a result, Robert D. Curtis, Chief of the Wildlife Planning and Development Division, Arizona Game and Fish Department, has lead efforts to introduce legislation to provide for "protection of water courses and riparian environment" in Arizona. The proposed legislation is currently being refined and amended and will be introduced for consideration by the State legislature in early 1979. Wording of the proposed act is as follows (in part):

"No person shall engage in any project or activity which will alter a watercourse or riparian environment without first applying to and receiving a permit therefore from the department."

At present, "watercourse" is defined as "any lake, river, creek, stream, wash, arroyo, channel, or other body of water having banks and bed through which waters flow or have flowed at least periodically;" "department" is defined as the State Land Department.

Since the Riparian Team has directed its efforts on the San Pedro River to include support of the statewide preservation efforts, contacts have continued with county officials in Pinal County, including the Director of County Zoning and Planning, and County Commissioners, to inform them of the proposed legislation and to encourage their support of the act.

One group which supported the California riparian legislation was the beekeepers within

the State, since many apiaries are dependent, especially at certain times of the year, on riparian vegetation as a nectar source. The Arizona Beekeepers Association was contacted to inform them of the proposed legislation, and a member of the Riparian Team addressed the annual statewide meeting in Phoenix. The presentation emphasized benefits of preserving riparian habitats, with emphasis on the apiary industry, and encouraged the support of members of the Beekeepers Association, both as a group and individually.

SUMMARY

In summary, because of its uniqueness and its importance to fish and wildlife, the San Pedro River riparian community has been recognized as an area to be preserved. Efforts toward this end are continuing and are apparently gaining momentum, as evidenced by recent progress in establishing state-wide protection for riparian habitats in Arizona.

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