

# Interaction of Water Management and Riparian Ecosystems: Attitudes, Practices, and Effects<sup>1</sup>

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Under its broad mission of planning, developing, and managing water and related land resource projects which supply water for agriculture, domestic, and industrial use in the 17 western states, the Bureau of Reclamation also fulfills the mission of preserving or mitigating riparian habitat.

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The Bureau of Reclamation has the general mission to plan, design, construct, operate, and maintain works for conservation, storage, diversion, and development of waters for the reclamation of arid and semiarid lands in 17 Western States. The basic objectives of the Federal Reclamation program are to assist the States, local governments, and other Federal agencies in stabilizing and stimulating local and regional economies, enhancing and protecting the environment, and improving the quality of life through development of water and related land resources throughout the 17 contiguous Western States. To fulfill this mission and meet these objectives, the Bureau operates and maintains a variety of projects which deliver municipal and industrial water supplies, generate hydroelectric power, provide irrigation water, improve water quality, conserve and develop fish, wildlife and other environmental values, and provide outdoor recreation, flood control, and river regulation.

This is a broad mission and we accomplish it through a wide range of activities. However, most relevant for our discussion today is the fish and wildlife objective. This objective requires the full recognition

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that fish and wildlife resources are as important as other resources. The significance of riparian vegetation to Bureau programs is related to the objective of conserving and developing fish and wildlife resources. Much of the impetus behind the Bureau's present environmental awareness was provided by the National Environmental Policy Act of 1969. Reclamation has focused on the requirements of this Act and particularly toward those which promote the concept of man and nature existing together in productive harmony.

Riparian vegetation, or that vegetation adjacent to a water supply such as a riverbank, lake, or pond, is encompassed by the Fish and Wildlife Coordination Act of 1958 which states that "wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs." The Act defined wildlife as including the habitat which supports it. Bureau planning is guided by the Principles and Standards as promulgated by the Water Resources Council. Our planning, therefore, should emphasize environmental quality as much as economic development. An essential part of environmental quality is the continued maintenance of wildlife resources including the riparian vegetation which so largely nurtures important species in the Southwest.

Compared to the Southeast, the West is by and large arid. Water supplies are largely dependent upon the meager rainfall and the snow that falls in the mountains. At the lower elevations, the richest vegetation is riparian. However, it is not nearly

as broad or as dense as that found in the East.

When considering riparian vegetation in the West, several important points have to be kept in mind. One is that the West's predominant water law system is based on prior appropriation, which means that the first in time have first right to use of the water. The second is that, due to the limited availability of water, it is often overappropriated; therefore, little water is left to devote to other than traditional and historic uses. What this means in practice is that to allocate water to any use, including the expansion of riparian vegetation, requires a water right, and new water rights are scarce. A third thing to keep in mind is that water rights are administered under State water laws. Hence water rights are a State matter and are not under the control of the Federal government.

There are only a few water rights in the West devoted strictly to the maintenance of riparian vegetation. For instance, on the lower Colorado River, the Havasu, Imperial, and Cibola National Wildlife Refuges have limited water rights, but these are low in priority. Most riparian vegetation along western streams is supported by water lost naturally from the stream as it runs through its course. Although no water right is adjudicated, nature has arranged that the first use of water is by vegetation. To speak candidly, the Bureau, along with other agencies, has been a child of its times. In the days of emphasis on dam building and river taming, there were other priorities which took precedence. Power production and agricultural expansion were seen as vital to fuel our nation's growth, and flood control was essential to protect that growth. So water was not set aside for the maintenance of riparian vegetation. We now recognize that riparian vegetation is a valuable resource, essential to the maintenance of a healthy and pleasing environment for humans as well as fish and wildlife. Yet the West has little water devoted to enhancing riparian vegetation.

Riparian vegetation has declined steadily over the years. Taking the cottonwood as an example, we can see the rate of decline. For instance, in a paper called "A Riparian Case History: The Colorado River," Drs. Ohmart, Deason, and Burke stated that "Cottonwood communities have declined from high abundance (5,000 acres plus) along the lower Colorado River in the 1600's to scattered groves containing a few mature individuals today." They went on to say that, if one considered pure cottonwood communities,

there would be less than 500 acres left today.

The decline of native riparian vegetation in the West has been complicated by the introduction of exotic species of plants, especially other phreatophytes. These phreatophytes have shown an explosive growth rate, moving not only into vacant areas but also those areas occupied by native species. These species seem to compete far more successfully for the little water available than the native species such as cottonwoods, mesquites, and willows. So not only has much of the native riparian vegetation been sacrificed for agriculture, flood control, power production, and recreational and urban development, but much of it is still being lost due to the proliferation of non-native species like saltcedar. Saltcedar, unfortunately, has less wildlife value than native species such as cottonwood, mesquite, and willow, and, what is worse, saltcedar seems to use far more water than these native species.

Preserving riparian vegetation has therefore become a management problem. However, every problem presents a challenge. The maintenance and enhancement of riparian vegetation in the West is just such a challenge. I would like to discuss what the Bureau of Reclamation is doing to respond to that challenge using the Lower Colorado Region as an example.

This Region is headquartered in Boulder City, Nevada and is under the direction of Manuel Lopez, Jr. It extends from below Glen Canyon Dam in northern Arizona to the Mexican border near Yuma, Arizona. It comprises the lower Colorado River drainage basin in which the Colorado River travels a distance of almost 700 miles. The major project along the river is Hoover Dam and Lake Mead located at Boulder City, Nevada. Hoover Dam and the subsidiary dams and reservoirs have the priorities of providing flood control, furnishing irrigation and domestic water, and producing power. The lower Colorado River and its tributaries support a thriving agricultural, industrial, and metropolitan growth supporting the needs of about 15 million people.

The riparian vegetation program of the Lower Colorado Region has evolved by phases. The first step was a research phase which, by the way, is still going on. The Lower Colorado Region, in response to the general environmental awareness sparked by NEPA, recognized the problem of declining riparian vegetation in the early 1970's. They realized that the first step in any successful

management program was to accurately determine the types of riparian vegetation in the basin and the types of wildlife it supported. This knowledge could then be used as the baseline for developing concepts and programs to maintain and promote a healthy riparian habitat.

Initially planned as a 3-year effort, this baseline study has been extended several times and is now in its sixth year. It should be completed in 1980. Under contract with Arizona State University, researchers have collected data on (1) plant species composition and density, (2) the macro-and micro-climatic conditions along with physical and chemical characteristics of the soil, (3) the relative abundance, distribution, and diversity of birds, mammals, reptiles, and amphibians, and (4) types of habitat modifications beneficial or detrimental to wildlife. Biological models have also been developed which will predict the wildlife changes that will occur with controlled modifications of the plant communities. I would like to give you some idea of the size of our studies. We are using 150 transects. Each transect is a 1/2 to 1 mile long, so we are studying nearly 100 miles of the river. Transects are censused for birds two or three times monthly and censused for small mammals every 2 to 3 months. We read about 12,000 acres monthly, and have been doing so for over 4 years, so you get some idea of the amount of data we are collecting.

The second step in the riparian vegetation program in the Lower Colorado Region is the experimental application of some of the management concepts at selected spots along the river. The undeveloped areas of the flood plain of the lower Colorado river are now largely infested with saltcedar, which was introduced before the turn of the century and has since spread throughout the Southwest. Our experiments will attempt to reestablish cottonwoods, willows, and mesquite and other selected native species at specific locations to determine the feasibility of reestablishing native species along the lower Colorado River.

Using the data collected during the baseline study, the researchers have developed riparian management concepts that are concerned with wildlife enhancement, reduced evapotranspirative water loss, and the quicker passage of floodwaters. A 3-year study to test the concepts includes three revegetation test plots. There is one 50-acre plot designed to establish native vegetation on dredge spoil that also provides for passage of floodflows and wildlife enhancement. Another 25-acre plot

is designed to establish vegetation on dredge spoil strictly to enhance wildlife values. This plot will be cleared of mature saltcedar and planted with vegetation better able to sustain wildlife. The third plot, a 38-acre site found on a national wildlife refuge, is being jointly funded by the Bureau of Reclamation and the U.S. Fish and Wildlife Service.

The study is designed to answer a variety of questions. For example, is it possible to reestablish natural communities? Are wildlife values in the new communities equal to predictions based on past research? How long must vegetation be watered before survival is assured? What is the cost per acre to establish native plant communities? What are the evapotranspiration rates for native and exotic vegetation? Do certain types of vegetation increase the capacity of the floodway to carry flood-flows? At the end of 3 years, if the experimental revegetation program proves viable, it will continue and an artificial manipulation of plant communities could be incorporated in management plans for the lower Colorado River.

Because of the objectivity of the Arizona State University personnel conducting the work, the studies have gained an increasing respect and credibility from the biological community. Other agencies and irrigation districts are becoming involved. In 1978, the Fish and Wildlife Service entered into a joint agreement for an experiment with the Bureau to conduct a 3-year study to reestablish native vegetation along the river.

Baseline studies of riparian vegetation along the lower Colorado River have produced another study of a different form of vegetation. We are now studying the relationship between wildlife and irrigated agriculture. This study is examining the contribution of agriculture to wildlife. It should provide concepts for managing wildlife populations in and around agricultural areas. This study has the support of the fish and wildlife agencies, the state water commissions, and the irrigation districts in the Lower Colorado River Basin.

These baseline studies and the resulting experiments in riparian management are organized and systematic management programs. Other management programs have grown out of what can only be called, from an environmental viewpoint, beneficial opportunism. We practice beneficial opportunism when we preserve and enhance conditions which occurred more or less by accident, but which are highly favorable to wildlife. For

instance, along the Rio Grande River in New Mexico, pilot channel work and training jetties have created wetland areas. Channel straightening work cut off oxbows from the main body of the river and these oxbows filled with seepage from the river or from irrigation canals. Although it was mostly saltcedar, vegetation quickly sprang up in these artificially formed wetlands. This vegetation soon attracted various forms of wildlife. This area is particularly useful to waterfowl and wading birds. One of the best known of these artificially created oxbows lies just north of Albuquerque, and the University of New Mexico uses it for nature studies.

Another example is the work being done at Topock Marsh, which is part of the Havasu National Wildlife Refuge. The marsh, a national wildlife refuge, approximately 4 miles southeast of Needles, California, is a 4,000-acre wetted and open water area located adjacent to the Colorado River on the Arizona side. It is located in one of the hottest areas of the Southwest desert.

Topock Marsh, as we know it today, came into existence during a period between 1938 and 1940 as a result of the closing of Parker Dam and the filling of Lake Havasu in 1938. Topock Marsh was not created by the simple and routine filling of the reservoir. Filling this reservoir behind Parker Dam, located 46 miles downstream, slowed the Colorado River and allowed much of its heavy load of sediment to settle out in Topock Gorge, which is located at the head of the reservoir. This in turn backed the water up even more than had originally been anticipated. In fact, the water behind Topock Gorge rose 7 feet above what had been expected and resulted in the creation of Topock Marsh. If the water level were lowered to the pre-Parker Dam elevation, only 7 acres of the marsh would be inundated, a marked contrast to the 4,000 acres of today.

The marsh's value as a wildlife refuge is directly related to water levels. This level is dependent upon the existence of Lake Havasu and related backwater sediment deposits in the vicinity of Topock Gorge. Realizing this fact, the Secretary of the Interior in 1951 directed the Commissioner of Reclamation to protect the existence of the Havasu National Wildlife Refuge, of which Topock Marsh is a unit, from water loss under the authority of the Colorado River Front Work and Levee System Act.

In 1973 the Fish and Wildlife Service requested that the Bureau of Reclamation use its 12-inch dredge "Little Colorado" to

enhance wildlife habitat in Topock Marsh. Specifically, the project provided diking to improve water management and channeling to improve water circulation. An efficient sediment basin was constructed to reduce the silt load entering the marsh, and dikes were provided to separate marsh waters from Fort Mohave Indian land.

Although Topock Marsh accidentally happened as a result of filling Lake Havasu, it has produced excellent riparian vegetation and wildlife habitat, including new habitat for the endangered Yuma clapper rail. Carefully monitored dredging as conducted in Topock Marsh is one of the ways the Bureau of Reclamation is helping the Fish and Wildlife Service manage an important Southwest desert wildlife refuge.<sup>1</sup>

Other aspects of the Colorado Front Work and Levee System are proving beneficial to riparian vegetation. There are other backwater areas similar to Topock Marsh, but on a lesser scale up and down the river. Dr. Tash of the Cooperative Fishery Unit at the University of Arizona at Tucson has done some interesting work in the productivity of these backwaters and has published several papers. These backwater areas were designed to use daily high flows flooding the banks of the river. Other areas were formed when the river changed its course. In the past, though, these naturally occurring marsh areas were ephemeral. They would dry up beneath the desert sun. However, one of the beneficial side effects of our bank stabilization work and comprehensive marsh management scheme is that these marsh areas are lasting longer now. Today, as a result of planned bank stabilization work, these areas can be managed and their lives prolonged indefinitely.

I have summarized the principle riparian programs of the Bureau of Reclamation in its Lower Colorado Region undertaken thus far. We plan to continue our riparian vegetation studies and experiments which we

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<sup>1</sup> Further information about this dredging in Topock Marsh can be found in an article written by Dr. Wayne Deason and Mr. Phillip Sharpe, biologists in the Lower Colorado Region, which appeared in the November 1975, issue of the magazine World Dredging and Marine Construction, and a more advanced presentation "Development of Hydraulic Structures for Improvement in Habitat of the Endangered Yuma Clapper Rail" by Deason and Sharpe made at the International Symposium on the Environmental Effects of Hydraulic Engineering Works in September 1978.

trust will lead to sound multi-use management programs for the future. Regardless of where these studies lead, the Bureau definitely plans to stay in the forefront in riparian vegetation research and management.

At this time, I would like to try and give a succinct statement about Bureau of Reclamation policy toward riparian vegetation in the Southwest. But before I do so, I would like to shift your attention away from the Southwest for a moment. Not too far from where we are meeting today, a great Southern poet, Sidney Lanier, immortalized his observations of the Chattahoochee River. He identified with this river and described the rushes and the waterweeds, the "laving laurel" and the ferns, the dewberry and the "little reeds" which lined its banks. With obvious relish he mentioned the hickory, the "poplar tall," the chestnut, the oak, and walnut, and the pine. Sidney Lanier's poem is significant not only because of the profusion of riparian vegetation which he lists, but also because he so vividly points out the deep underlying communion between the river and the plants which line its bank. Such profusion does not exist in the Southwest, but the communion is there. The river and its vegetation are one, and such a unity is as true of the Colorado River as it is for the Chattahoochee. That unity has to be one of the cornerstones of our riparian policy. Regardless of what has happened in the past, we now realize that riparian vegetation has unique and special qualities and is an integral part of the river ecosystem that needs to be protected and enhanced along with other multiple resources.

With this in mind, I would again like to shift your attention back to the West. The Bureau of Reclamation does not have a

formal, specific policy about riparian vegetation. However, we believe that guide lines encompassing three major points are desirable and need to be addressed by this meeting.

1. The Bureau of Reclamation will strive to minimize impacts on the remaining riparian communities as far as it is possible. Whatever native riparian vegetation exists now will be considered a unique resource in project planning. Recommendations for replacement of riparian vegetation that is unavoidably lost as a result of project construction will be given high priority in project consideration.

2. Research on the multiple use management of riparian vegetation will be continued. As much information as possible will be gathered to facilitate the development of sound management concepts to guide us in our planning and operation of projects that affect riparian vegetation. In addition, should future water supplies become available as a result of advancing technology, research efforts will include the concept of devoting some of this water to expanding riparian habitat.

3. Where authorized, revegetation efforts will be accomplished to meet goals of multiple use management.

We realize that riparian vegetation in the West will never exist in such profusion as it does here in the Southeast. However, we hope someday that a native Western poet will be able to write a poem in praise of the thick riparian vegetation along the Colorado River just as Sidney Lanier did about the Chattahoochee here in Georgia. If so, our effort will have been a success.