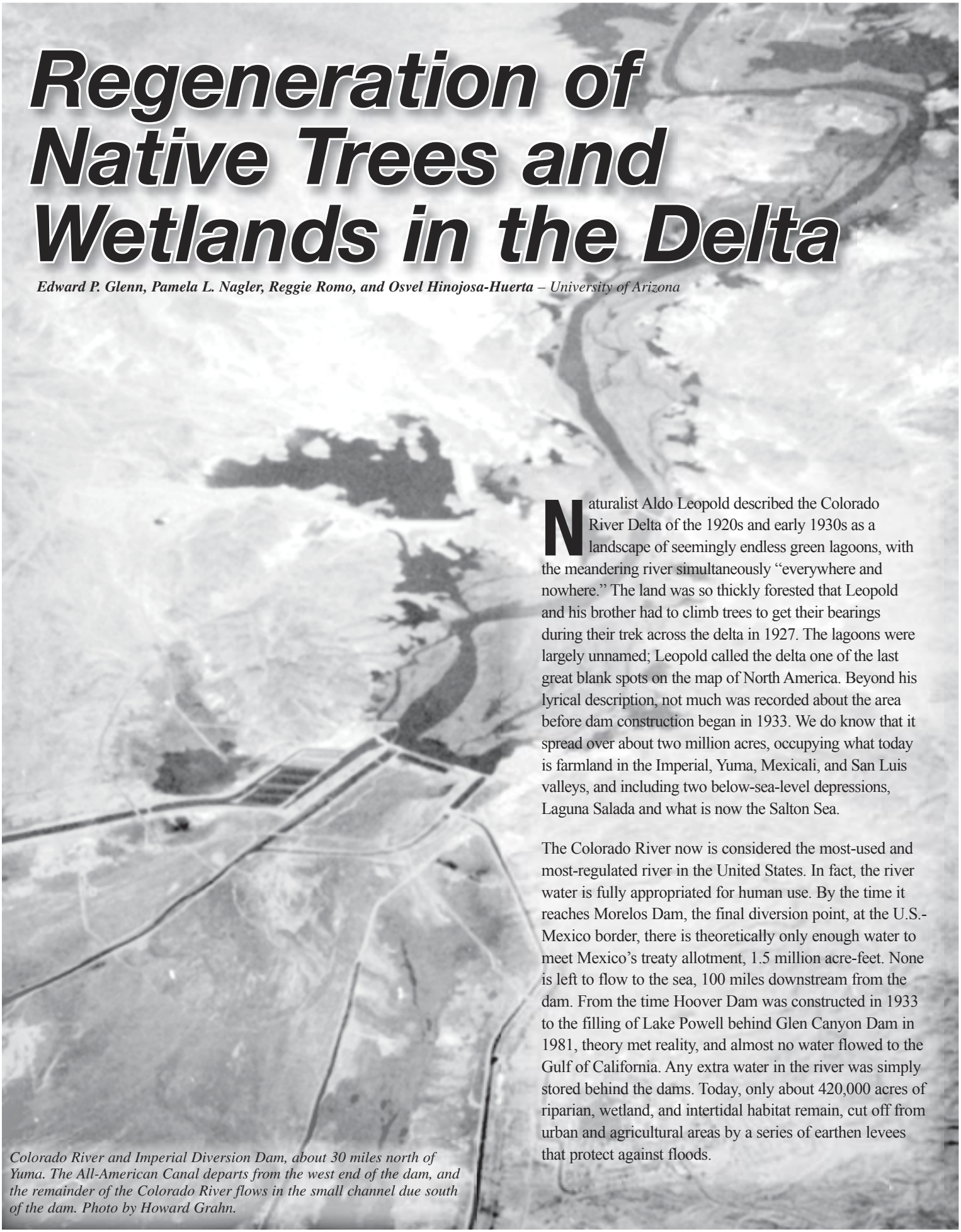
Regeneration of Native Trees and Wetlands in the Delta

Edward P. Glenn, Pamela L. Nagler, Reggie Romo, and Osvel Hinojosa-Huerta *– University of Arizona*



Naturalist Aldo Leopold described the Colorado River Delta of the 1920s and early 1930s as a landscape of seemingly endless green lagoons, with the meandering river simultaneously "everywhere and nowhere." The land was so thickly forested that Leopold and his brother had to climb trees to get their bearings during their trek across the delta in 1927. The lagoons were largely unnamed; Leopold called the delta one of the last great blank spots on the map of North America. Beyond his lyrical description, not much was recorded about the area before dam construction began in 1933. We do know that it spread over about two million acres, occupying what today is farmland in the Imperial, Yuma, Mexicali, and San Luis valleys, and including two below-sea-level depressions, Laguna Salada and what is now the Salton Sea.

The Colorado River now is considered the most-used and most-regulated river in the United States. In fact, the river water is fully appropriated for human use. By the time it reaches Morelos Dam, the final diversion point, at the U.S.-Mexico border, there is theoretically only enough water to meet Mexico's treaty allotment, 1.5 million acre-feet. None is left to flow to the sea, 100 miles downstream from the dam. From the time Hoover Dam was constructed in 1933 to the filling of Lake Powell behind Glen Canyon Dam in 1981, theory met reality, and almost no water flowed to the Gulf of California. Any extra water in the river was simply stored behind the dams. Today, only about 420,000 acres of riparian, wetland, and intertidal habitat remain, cut off from urban and agricultural areas by a series of earthen levees that protect against floods.

Colorado River and Imperial Diversion Dam, about 30 miles north of Yuma. The All-American Canal departs from the west end of the dam, and the remainder of the Colorado River flows in the small channel due south of the dam. Photo by Howard Grahn.

Image courtesy Jacques Descloitres, MODIS Land Rapid Response Team

Floods and Farming Provide Water

Once the reservoirs reached capacity in 1981, the river entered a new hydrological regime. As with all desert rivers, the annual flow of the Colorado River is inherently variable. During El Niño years, the winter snowfall in the Rocky Mountains can be 40 percent higher than in normal years, and in spring this excess water must be rapidly conveyed to the Gulf of California to prevent flooding. From 1981 to 2002, water flowed to the sea in about half of the years (see hydrograph, page 17), with flows ranging from very small – 50 cubic feet per second (cfs) or less – to major floods carrying up to 40,000 cfs. About 20 percent of the river flow reached the sea over those years, with major releases occurring in 1983 to 1988, 1993, and from 1997 to 1999.

These water releases somewhat mimic the natural pulse-flood regime of the pre-dam Colorado River, and benefit the riparian corridor below Morelos Dam. Riverbanks once choked with saltcedar and other salt-tolerant shrubs have sprouted new cottonwood and willow trees following each flood event. The floods wash salts from the riverbanks and wet the soil, allowing tree seeds to germinate and grow. The trees grow in stands, or isochrones, that correspond to the high water mark of each flood.

The data reveal an extremely dynamic floodplain that responds to even small flow events with new cohorts of native trees.

A second source of water into the delta is agricultural drainwater from Mexico and the United States. About 100,000 acre-feet per year enters Mexico from Wellton-Mohawk Irrigation District in Arizona via a 75-mile concrete canal that deposits the mildly saline drain water onto the intertidal mud flats on the eastern side of the delta. This water has flowed to the delta since 1979, and has created Ciénega de Santa Clara, the largest emergent wetland in the Sonoran Desert. The cienega supports a food chain that draws water birds by the tens of thousands, while the riparian zone provides a forested corridor for migratory neotropical songbirds.

Riparian Recovery Documented

The regenerated habitats in the delta are the inadvertent creation of water managers in the United States and Mexico who must dispose of wastewater and excess flows. Researchers at the University of Arizona (UA), funded by agencies and organizations on both sides of the border, have been conducting studies in the delta to develop management practices that preserve and enhance the natural areas, while responding to human water needs.

In February 1997, the researchers flew over the riparian corridor in Mexico and observed a surprising number of stands of cottonwood and willow trees along the river channel and across the wide floodplain that were visible through the saltcedar and arrowweed. On the U.S. side, where the river flow is channelized and rarely exceeds its banks, native trees made up only one percent of the vegetation; the remainder is salt tolerant shrubs. But looking down at the Mexico portion of the river, it was apparent that the river frequently flooded its banks, creating backwaters and oxbows vegetated with native trees.

In 1998, ground surveys documented the percentage of plant cover along 10 transects evenly spaced along the river from Morelos Dam to Río Hardy. On both sides of the border, saltcedar and arrowweed covered most of the floodplain. However, native trees made up nearly 10 percent of the vegetation south of the border. There, willow trees,

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a pioneering species that are replaced by cottonwoods over time, were three times more numerous than cottonwoods. Core measurements showed that the average age of trees was only five years, dating from the 1993 flood release. Seedlings and trees dating to other floods were also present.

In 2002, UA researchers returned to the delta to map the vegetation using remote sensing methods and detailed aerial photography and ground surveys. Using GIS techniques, they transposed the aerial photographs over recent and historic satellite images of the delta, and extracted information on the vegetation. Again, most trees were willows with a mean age of five years, in this case dating from the spring 1997 flood release. Other trees were younger, growing along a smaller channel created in 2000. Although young, the trees showed rapid growth, and ranged from 15 to 40 feet or greater in height.

The data reveal an extremely dynamic floodplain that responds to even small flow events with new cohorts of native trees. With trees forming an overstory, and saltcedar, arrowweed, and seepwillow forming an understory, the floodplain vegetation provides the multistoried habitat favored by birds. Marsh vegetation has also returned to the main channel of the river, supporting water birds. The riparian corridor has become an important linear feature of the Pacific Flyway, providing a passage for birds on their way between southern wintering grounds and northern breeding areas.

Threats and Opportunities

Because the river flows through agricultural fields and populated areas, water managers are inclined to channelize it and clear vegetation to prevent flood damage. Part of the river forms the U.S.-Mexico border, and the International Boundary and Water Commission plans to replace the meandering river with an entrenched channel to permanently define the international border. The agency in charge of the river in Mexico plans to continue the pilot channel to the Río Hardy. These actions would eliminate overbank flooding, and the dynamic tree populations would disappear, replaced by saltcedar and other shrubs. A less immediate threat is presented by diminished flood flows; existing plans will divert and store most of the flood releases in El Niño years rather than passing them to the sea.

Wetlands in the delta also are at the mercy of water managers and policy makers. The Ciénega de Santa Clara was created in an effort to temporarily divert saline subsurface drainwater from Mexican crops until the Yuma Desalting Plant could be constructed and activated. The plant operated only briefly in 1993, but the U.S. Congress recently passed a bill calling for its reactivation, an action that would replace the mildly salty water that presently enters the area with concentrated brine from the desalting plant, effectively eliminating the cienega. The Andrade Mesa wetlands east of Mexicali were formed from water that leaks from the All-American Canal; lining of the canal is in progress and will diminish this marshland.

On the positive side, natural resource managers and environmental groups have become aware of the value of these habitats through scientific studies in the delta. Until the 1990s, the Colorado River Delta was assumed to be a dead ecosystem; it now is recognized as a dynamic ecosystem that supports birds, fish, and mammals that have become rare elsewhere on the river. NGOs, government agencies, and stakeholders have demonstrated a willingness to collaborate in data collection and exchange. The delta ecosystems can be managed deliberately to enhance their value and preserve them for the future. Preliminary studies show that these habitats can be supported by less than one percent of the total flow of the Colorado River, a small price to pay for preserving this critical link in the Pacific Flyway.

Contact Ed Glenn at eglenn@ag.arizona.edu.