



Figure 5. Reconstruction of native plant community placement and species composition from original surveyor notes and plats along the lower Colorado River in 1879 (Ohmart et. al., 1977).

the North Gila Canal (USBR, 1996). The large sediment loads historically found in the Colorado River caused Laguna Dam to silt in almost immediately. From 1913 to 1927, irrigated acreage increased along the lower Colorado River to 95,000 acres (Wilber and Ely, 1948).

In 1918, Arthur P. Davis, Reclamation's Director and chief engineer, proposed a dam of unprecedented height to be built in Black Canyon, between Nevada and Arizona, to control the Colorado River. In 1928, Congress passed the Boulder Canyon Project Act, authorizing the construction of Hoover Dam. Construction began with the diversion of the Colorado River around the dam site in 1932. Construction of Hoover Dam was completed on May 29, 1935. In subsequent years, Parker Dam (1938), Imperial Dam (1938), Headgate Rock Dam (1941), Morelos Dam (1950), Davis Dam (1953), Palo Verde Diversion Dam (1957), and Glen Canyon Dam (1963) have all been constructed along the Colorado River. Detailed accounts of the operations of each of these facilities can be found in the *Description and Assessment of Operations, Maintenance, and Sensitive Species of the Lower Colorado River, Biological Assessment* (USBR, 1996).

The overall ecosystem of the lower Colorado River today is quite different from that which existed prior to modern day use and development. The *Description and Assessment of Operations, Maintenance, and Sensitive Species of the Lower Colorado River, Biological Assessment* (USBR, 1996) includes a more complete description of the Colorado River. Table 6 summarizes the chronology of the lower Colorado River development which has, in part, resulted in the current ecosystem.

**Table 6. Chronology of Lower Colorado River Development.**

1700-1800	Exploration of lower Colorado River by Spanish priests and military, culminating with the establishment of a mission at Yuma in 1774 and its subsequent destruction by Yuma Indians in 1781 (Ohmart et al., 1988).
1848	Acquisition of lower Colorado River area north of the Gila River by the United States.
1840-1870	Exploration of lower Colorado River by U.S. military. Most of the early expeditions were exploring possible transportation routes through the area. Notes on the geology, flora, and fauna of the lower Colorado River were made. <u>Tamarisk</u> introduced into the United States as an ornamental tree and escaped cultivation by the late 1800s. Expansion of range rapid by the early 1900s, especially between 1935 and 1955 along the Colorado River (DeLoach, 1989).
1850	Fort Yuma established by U.S. Army.
1852	First steamboat, the "Uncle Sam" captained by James Turnbull, travels up the Colorado River to re-supply Fort Yuma. Marks beginning of the steamboat trade which would eventually have profound effects on the mature riparian areas along the river (Lingenfelter, 1978).
1854	Gadsden Purchase consummated, extending U.S. territory south of the Gila River to the present international boundary with Mexico.
1857	Lower Colorado River from Yuma, Arizona, north to present site of Hoover Dam explored by J.C. Ives; region reported to be valueless.
1862	Colorado River Gold Rush begins. 1861 silver strike at Eldorado Canyon and the 1861 gold strike at Laguna de la Paz created what is known as the Colorado River Gold Rush of 1862 (Lingenfelter, 1978). Gold rush fueled steamboat trade along lower Colorado River. Initially, downed, dried cottonwood, willow, and mesquite were utilized as fuel for the steamboats (Ives, 1861). Increased river traffic soon utilized all of the available wood debris, and crews began cutting down large quantities of cottonwoods, willows, and mesquites. By 1890, most of the large cottonwood-willow stands and mesquite bosques had been cut over (Ohmart et al., 1988; Grinnell, 1914). Natural regeneration continued to establish new stands with each annual flood event.

1869	Colorado River from Green River in Utah to the Virgin River confluence explored by John Wesley Powell.
1877	Southern Pacific Railroad completes line over the Colorado River at Yuma. First diversion of water from lower Colorado River by European settlers for irrigating the Palo Verde Valley near Blythe, California.
1883	Second rail line crosses river. Together with the crossing at Yuma, the crossing at Needles by the Atlantic and Pacific Railroad in 1883 sounded the death knell of steamboat trade along the lower Colorado River (LaRue, 1916). Declines in mining further reduced steamboat commerce, and by 1887, steamboats no longer went above Eldorado Canyon (Lingenfelter, 1978).
1885	First documented improvements on the lower Colorado River. Lieutenant S.W. Roessler hired a barge and crew to make improvements at Six Mile Rapids and Mojave Crossing for navigation; first recorded instance of alteration of river (Smith, 1972). Carp known established in the lower Colorado River ecosystem; first alteration of the native fish fauna (Minckley, 1973).
1892	Channel catfish stocked into Colorado River by Arizona Game and Fish (LaRivers, 1962)
1895	Construction begins on Alamo Canal at Yuma to irrigate Imperial Valley.
1901	Alamo (Imperial) Canal completed; water diverted near Yuma and conveyed through Mexico to irrigate the Imperial Valley in California; canal supplied 700 miles of lateral canals, enabling irrigation of 75,000 acres.
1902	Reclamation Act passed establishing U.S. Reclamation Service. U.S. government began planning large scale irrigation projects. (LaRue, 1916).
1905	Flood on Gila River breaks through temporary diversion structure at Alamo Canal heading and Colorado River flows into Salton Sink.
1907	Southern Pacific Railroad repairs dike and redirects river back to correct channel. Salton Sea accidentally created from Colorado River floodwaters; 330,000 acres inundated; flooding increased the political pressure to dam the Colorado River.
1909	Laguna Diversion Dam completed; water diverted through the Yuma Main Canal to irrigate 53,000 acres in the Yuma Valley, Arizona, and 14,700 acres in the Reservation Division in California, and through the North Gila Canal to irrigate 3,500 acres in the Gila Valley, Arizona.
1910	Joseph Grinnell leads 3-month expedition from Needles to Yuma to collect data on mammals, birds, and associated habitats. Expedition provides one of first detailed accounts of the flora and fauna of the lower Colorado River. Grinnell observed carp and catfish, documented effects of Laguna Dam on the ecosystem, and documented loss of riparian habitat to agriculture (Grinnell, 1914).
1913	Estimated acreage irrigated along the mainstem Colorado River between the Virgin River and the International Boundary was 367,000 acres, most of this being in the Imperial Valley (LaRue, 1916). The 53,000 acres along the mainstem Colorado between Cottonwood Basin and the U.S./Mexico boundary resulted in a substantial loss of riparian habitat.

1920	<u>Tamarisk</u> appears along the mainstem of the Colorado River (Ohmart et al., 1988). This species is adapted to the changed riverine ecosystem and displaces native riparian species throughout the lower Colorado River. (Important wildlife habitats, including the cottonwood-willow gallery forests, have all but disappeared from the Colorado River and have been replaced by the less desirable <u>Tamarisk</u> [Anderson and Ohmart, 1984b]).
1922	Colorado River Compact signed; water allocated between the upper (Colorado, Wyoming, New Mexico, Utah) and lower (California, Nevada, Arizona) basins.
1927	Irrigated acreage along the mainstem of the lower Colorado River increased from 53,000 in 1913 to 95,000 in 1927 (Wilbur and Ely, 1948). Results in further decreases in riparian habitat.
1935	Boulder Dam (now Hoover Dam) completed; Lake Mead covers 300 square miles and stores 31 maf of water, enough to irrigate 650,000 acres in California and Arizona and 400,000 acres in Mexico. Hydrography of river changed; devastating floods eliminated.  FWS stocks largemouth bass, bluegill sunfish, green sunfish and black crappie into Lake Mead; stock rainbow trout into river below Lake Mead (Jones and Sumner 1954).
1938	Parker Dam completed; Lake Havasu behind dam covers 39 square miles and stores 600,000 acre-feet of water. MWD diversions into the Colorado River Aqueduct initiated. Imperial Dam completed; additional water diverted for irrigating southeast California and southwest Arizona. Pilot Knob Wasteway completed, allowing water diverted from behind Imperial Dam on the California side to be returned to the river.
1938-1939	Although largemouth bass and bluegills already present in the system, the State of California plants additional stocks to increase the spread of the species (Dill, 1944).
1939	Gila Gravity Main Canal completed, replacing the North Gila Canal (from behind Laguna Dam) and delivering irrigation water from behind Imperial Dam to irrigate 105,000 acres in Arizona's Gila Valley.
1940	All-American Canal completed, replacing Alamo Canal and delivering irrigation water from behind Imperial Dam to Imperial Valley in California; 461,642 acres currently irrigated.
1941	Havasu National Wildlife Refuge established near Needles, California. Imperial National Wildlife Refuge established near Martinez Lake, Arizona. Siphon Drop completed, delivering irrigation water from All-American Canal to the Yuma Valley in Arizona; replaces Yuma Main Canal (sealed in 1948) originating behind Laguna Dam.
1944	Headgate Rock Dam completed; irrigation water diverted to the CRIT Reservation near Parker, Arizona; water diverted to enable irrigation of 107,588 acres.
1948	Coachella Canal completed; water from All-American Canal conveyed to Coachella Valley in California; 58,579 acres currently irrigated. Red shiners introduced to Colorado River as baitfish.
1950	Morelos Dam completed; irrigation water delivered by Mexico to the Mexicali Valley. Davis Dam closes and first water storage for Lake Mohave begins in January 1950. Powerplant still under construction.

1952	Yuma division stabilized from Laguna Dam to SIB; 17.6 miles of levees constructed, 17.4 miles dredged, 264,000 cubic yards of riprap placed, 41 miles of access roads constructed.
1953	Davis Dam and powerplant completed, providing regulation of water to be delivered to Mexico and regulating flows from Hoover Dam; Lake Mohave behind dam capable of storing 1.8 maf of water. Threadfin shad introduced into Lake Mead. By 1956, threadfin shad had spread throughout the lower Colorado River (Minckley 1973). Mohave Division from Davis Dam to Topock, Arizona, channelized and stabilized; 31 miles of channel dredged, 288,082 cubic yards of riprap placed, and 47 miles of levees built.
1954	Laguna Dam no longer used for diversion (Imperial Dam used instead).
1956	Topock Settling Basin completed, providing control of river sediment near Needles, California; 4,400,000 cubic yards of material excavated.
1957	Palo Verde Diversion Dam completed; irrigation water diverted to the Palo Verde Valley near Blythe, California; 112,000 acres currently irrigated.
1959	Striped bass introduced by the State of California into Colorado River near Blythe. (Introduced into Lake Havasu in 1960 and into Lake Mead in 1969). Became top fish predator in the Colorado River system.
1962	Flathead catfish introduced into river by State of Arizona.
1963-1967	Tilapia introduced into Colorado River by California and Arizona.
1964	Cibola National Wildlife Refuge established near Blythe, California.
1965	Laguna Settling Basin completed, providing control of river sediment north of Yuma, Arizona; 3,120,000 cubic yards of material excavated. Irrigated acreage estimated at 293,000 acres along the mainstem of the lower Colorado River (Lower Colorado Region State-Federal Interagency Group for the Pacific Southwest Interagency Committee 1971).
1966	Senator Wash Dam and Reservoir completed north of Yuma, reservoir covers 470 acres and holds 13,836 acre-feet of water. Topock Marsh inlet and outlet structures completed providing 4,000 acres of marsh habitat at Havasu National Wildlife Refuge.
1967	Palo Verde Oxbow inlet and outlet structures completed near Blythe, California, to provide wildlife habitat.
1968	River channel stabilized from Palo Verde Dam to Taylor Ferry; 19.5 miles. Banklines armored in Parker Division, Section I; 11 miles stabilized.
1969	Training structures south of Laughlin, Nevada, completed, reducing bankline erosion.
1970	Mittry Lake inlet structure completed south of Imperial Dam, to provide wildlife habitat. Cibola Division stabilized from Taylor Ferry to Adobe Ruin; 16 miles dredged.
1974	Cibola Lake inlet and outlet structures completed at Cibola National Wildlife Refuge, to improve wildlife habitat.
1983	Reservoirs on the entire lower river spilled for the first time due to extremely high precipitation from an El Niño weather event.

1985	Inlet structure to CAP aqueduct behind Parker Dam completed; water diverted to supply Phoenix and Tucson, Arizona; 0.5 maf currently diverted.
1992	Powerplant added to Headgate Rock Dam; maximum generating capacity is 19.5 megawatts (MW).
1993	Hoover Dam powerplant upgraded from 1340 MW to 2074 MW output.
1995	Parker Division, Section II stabilized.

## 2. Present

### a. Riparian Communities

Although the historic riparian communities along the lower Colorado River were dynamic, human-induced change since the beginning of the century has resulted in an ecosystem having significantly different physical and biological characteristics. Such changes have taken place as a result of the introduction of exotic plants (such as saltcedar), the construction of dams, river channel modification, the clearing of native vegetation for agriculture and fuel, fires, increasing soil salinity, the cessation of seasonal flooding, and lowered water tables. Figure 6 illustrates an example of the change in vegetation communities from 1879 to 1977.

The system currently used to classify vegetation along the lower Colorado River is based on plant community and structural type (Anderson and Ohmart, 1984). Six structural types have been described (I to VI) and refer to the proportion of foliage present in each of three vertical layers. For example, a plant community with structural type VI has most of its foliage in the lowermost layer, less foliage in the mid-height layer, and little or no foliage in the upper canopy. A structural type I community has well-developed foliage in all three layers, with the upper canopy dominating. Figure 7 and Table 7 illustrate the relationship between the six structural types and the foliage density at various heights. Community and structural types correlate with wildlife habitat quality, especially for birds; generally type VI provides the poorest habitat and type I the best.

Reclamation has mapped the distribution and acreage of the different riparian plant communities along the lower Colorado River since 1976 (Anderson and Ohmart, 1976; Anderson and Ohmart, 1984, Younker and Anderson, 1986; USBR, 1996; CH2MHill, 1999). The most recent compilation was conducted by CH2MHill using 1997 aerial photography (CH2MHill, 1999).

Direct comparison of acreage delineated during each study may not always be applicable. For instance, although the 1994 aerial photography covered the entire river from Davis Dam to the United States-Mexico border, the entire width of the floodplain was not flown in all places so that coverage is

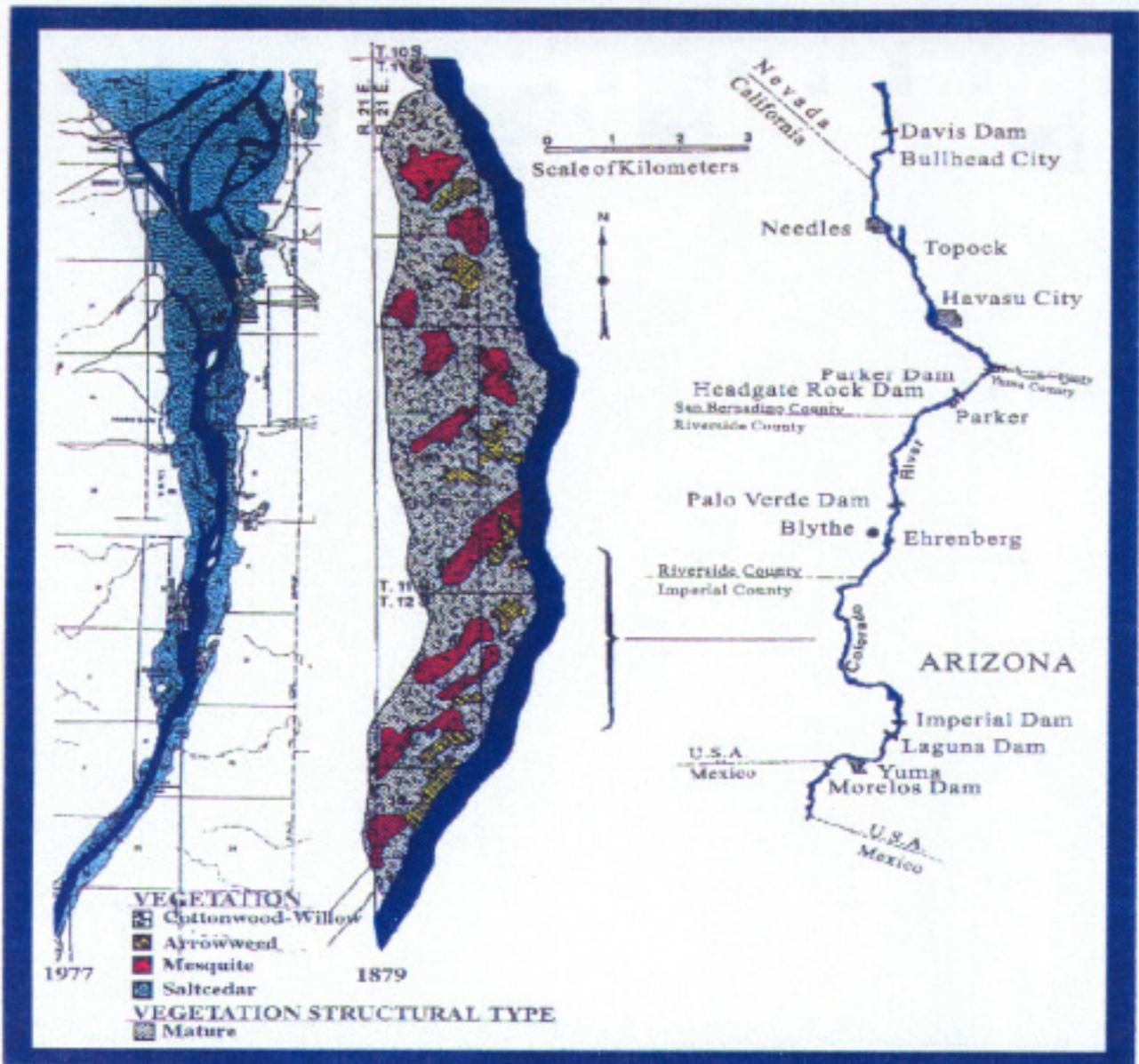


Figure 6. 1879 - 1977 comparison of vegetation communities along same stretch of lower Colorado River near Blythe, California (1879 Reconstruction; Ohmart et. al., 1977)

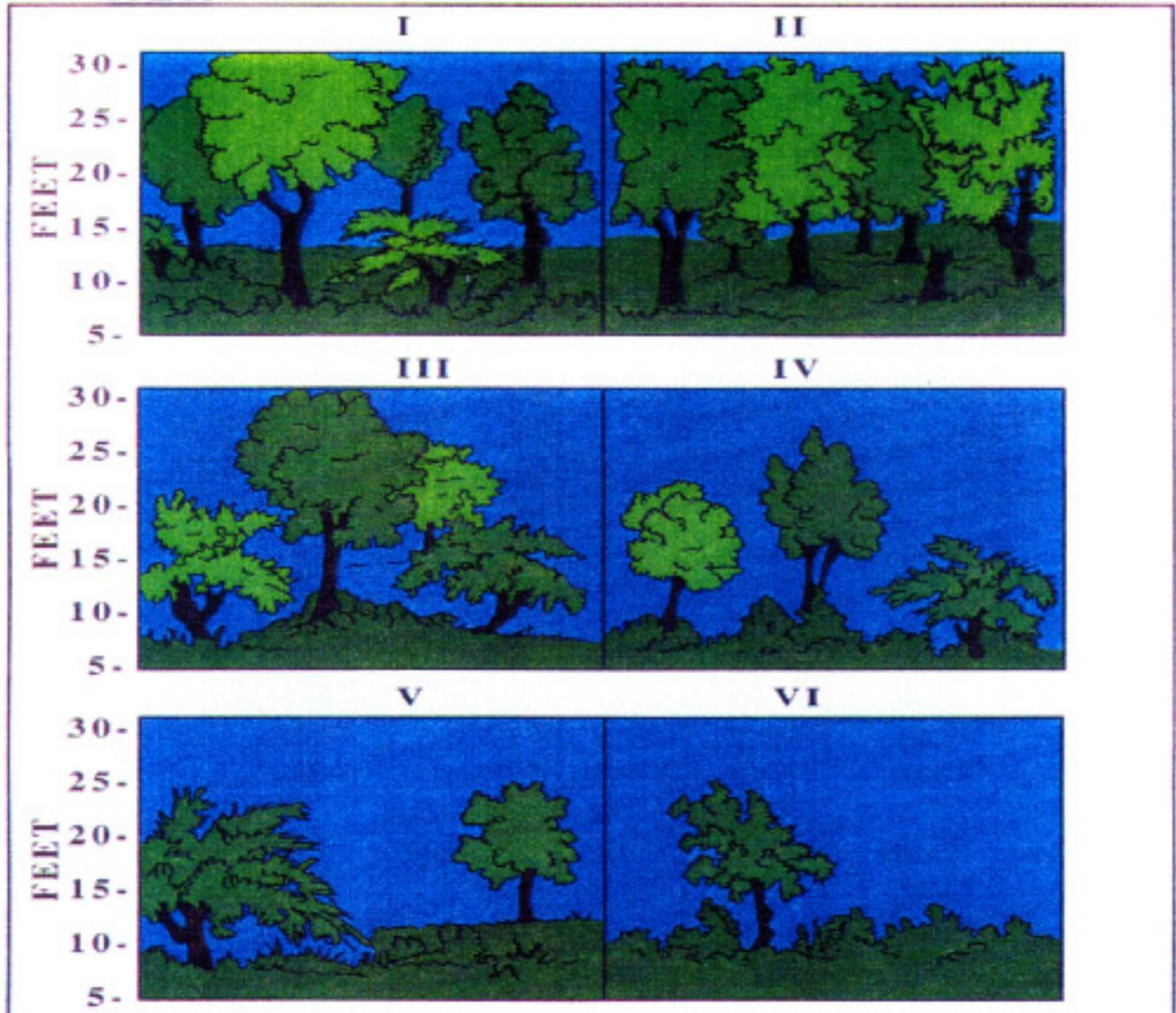


Figure 7. Examples of vertical configurations for the vegetation structural types (from the 1984 Anderson/Ohmart report).