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Two Nations, One River: Managing Ecosystem Conservation in the Colorado River Delta

ABSTRACT

The Colorado River delta historically consisted of riparian, freshwater, brackish, and tidal wetlands that covered 1,930,000 acres and supported a legendary richness of plant, bird, and marine life. Dam construction and water diversions in the United States and Mexico in the twentieth century reduced the Delta to small areas of wetlands and brackish mudflats. The Delta is no longer a system that can be understood solely in terms of biology and hydrology; human actions, embedded within a complex institutional framework, have significantly altered and modified the Delta. In the last two decades, flood releases from reservoirs in the United States and agricultural return flows from both the United States and Mexico have begun to restore Delta ecosystems on about 150,000 acres. Deliberate management of existing water resources can significantly improve conditions in this region. This article reviews the numerous institutions that can play a role in conservation of the Colorado River delta and discusses options to protect the Delta's ecosystems, including changing international institutions and agreements to support Delta ecosystems; using U.S. federal law to find legal remedies; asserting Delta ecosystem requirements in ongoing, related management issues; establishing market mechanisms and funding sources for Delta preservation; and increasing public participation in Colorado River decisions that affect the Delta.

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I. INTRODUCTION

Prior to the construction of major dams¹ along its route, the Colorado River fed a great delta in the midst of the Sonoran desert. Spread across the northernmost end of the Gulf of California,² the Colorado River delta's (Delta) vast riparian, freshwater, brackish, and tidal wetlands once covered 1,930,000 acres (475 square miles) and supported a wealth of plant, bird, and marine life. As most of the river's flow reached the Delta, freshwater, silt, and nutrients helped create a complex system of wetlands that provided feeding and nesting grounds for birds, and spawning habitat for fish and crustaceans.³ The legendary richness of the Gulf of California can be attributed to the Delta's productivity as well as its capacity to support marine and bird life. In contrast to the aridity of the surrounding Sonoran Desert, the Colorado River delta's abundance was striking. In *A Sand County Almanac*, Aldo Leopold recalled a visit:

I have never gone back to the Delta of the Colorado since my brother and I explored it, by canoe, in 1922....For all we could tell, the Delta had lain forgotten since Hernando de Alarcón landed here in 1540....On the map the Delta was bisected by the river, but in fact the river was nowhere and everywhere, for we could not decide which of a hundred green lagoons offered the most pleasant and speedy path to the Gulf.⁴

Today, conditions in the Delta have changed. Like other desert river deltas, such as the Nile⁵ and the Indus,⁶ human activity has greatly altered the Colorado River delta. Decades of dam construction and water diversions in the United States and Mexico have reduced the Delta to a remnant system of small wetlands and brackish mudflats. During the years

1. There are more than 20 storage reservoirs with capacities greater than 20,000 acre-feet in the Colorado River basin (an acre-foot is 325,851 gallons of water, roughly the amount two families of four use in one year). Total storage capacity in these reservoirs exceeds 60 million acre-feet, four times the river's average annual flow. The two largest reservoirs in the basin are Lake Mead (25.88 million acre-feet) and Lake Powell (24.32 million acre-feet). See DALE PONTIUS, SWCA, INC., *COLORADO RIVER BASIN STUDY: REPORT TO THE WESTERN WATER POLICY REVIEW ADVISORY COMMISSION* 9 (1997).

2. The Gulf of California is also known as the Sea of Cortez.

3. See Edward P. Glenn et al., *Effects of Water Management on the Wetlands of the Colorado River Delta, Mexico*, 10 *CONSERVATION BIOLOGY* 1175, 1176 (1996).

4. ALDO LEOPOLD, *A SAND COUNTY ALMANAC* 141-42 (1968).

5. See generally Daniel Jean Stanley & Andrew G. Warne, *Nile Delta: Recent Geological Evolution and Human Impact*, 260 *SCIENCE* 628 (1993).

6. See generally Robin M. Leichenko & James L. Wescoat Jr., *Environmental Impacts of Climatic Change and Water Development in the Indus Delta Region*, 9 *WATER RESOURCE DEV.* 247 (1993).

that reservoirs filled behind upstream dams and captured floodwaters, almost no freshwater flows reached the Delta.

Once Lake Mead filled behind Glen Canyon Dam in 1981, flood flows began periodically to reach the Delta, and the Delta's ecosystems began to make a slow comeback.⁷ From 1980 to 1998, total water releases to the Delta have amounted to an estimated 20 percent of the Colorado's total flows over the same period, most of it either floodwater or wastewater from agricultural and municipal sources. Despite the irregularity of flood flows and the high salinity and pollutant content of wastewater, these sources of water have begun to revive some areas of the Delta. Recent hydrologic and institutional conditions have unintentionally and inadvertently caused wetlands and riparian vegetation to flourish on about 150,000 acres, an important restoration of habitat.

As long as these conditions prevail, the Delta's existing ecosystems should continue to thrive. Large, established demand for water by irrigators, cities, and other important constituencies makes it extremely unlikely that substantial pre-development-like flows can be restored to the Delta in the short term. Nevertheless, the habitat gains of recent years should be acknowledged and protected, as a run of dry years or additional water consumption upstream along the river could jeopardize existing Delta ecosystems.

Even in its present state, the Delta is the largest remaining wetland system in the southwest region of North America and supports a very productive estuary. As ongoing field studies document the ecological, social, and economic values of the Delta's ecosystems, it is increasingly likely that these values will be recognized in deliberations over the allocation of surplus waters, and that instream flows may be dedicated to sustain them.⁸ At the same time, increasing population throughout the region and growing pressures on water, land, and other resources will intensify the strain on the Delta. Water users both north and south of the border may be forced to make difficult choices about Colorado River allocations.

7. For the purposes of this article, a flood is any volume of Colorado River water that crosses the U.S.-Mexico international border and is delivered at a rate that exceeds Mexico's diversion capacity and inundates land (either within the levees or beyond) that is normally dry. These floods occur as a result of releases from U.S. reservoirs for flood control purposes (or other reasons), or directly as a result of flooding in the United States (e.g., flooding in the Gila basin).

8. Department of Interior Secretary Bruce Babbitt noted that there should be "no net loss to environmental resources" in the Colorado River delta, in extemporaneous remarks during his 1999 speech to the Colorado River Water Users Association. Department of the Interior Secretary Bruce Babbitt, Remarks at the Meeting of the Colorado River Water Users Association Annual Meeting (Dec. 17, 1999) (tape available at the Colorado River Water Users Association, Coachella, CA).

If the U.S. federal government and the Colorado River basin states⁹ in the United States were to recognize the Delta's ecosystems in the allocation of Colorado River water, the current regime of flows reaching the Delta could be protected.¹⁰ Furthermore, key additional areas of the Delta could be restored through more efficient use of the water that now flows into the Delta, by purposefully managing existing water resources such as agricultural drainage, wastewater, and floodwater, without adverse effects on other Colorado basin water users. Although the Delta's ecosystems deserve greater consideration in the allocation of Colorado River water, the Delta's minimum requirements are surprisingly modest.

This article reviews the Colorado River delta's natural history, the institutions and policies that shape river management, and explores opportunities for conservation of the Delta's ecosystems. Because the Colorado River is so tightly controlled and regulated, the problem of protecting the Delta's ecosystems is ultimately one of institutional and social change. Options to protect the Delta's ecosystems include changing international institutions and agreements to support Delta ecosystems; using U.S. federal law to apply legal remedies; asserting Delta ecosystem requirements in ongoing, related management issues; establishing market mechanisms and funding sources for Delta preservation; and increasing public participation in Colorado River decisions that affect the Delta.

II. THE DELTA

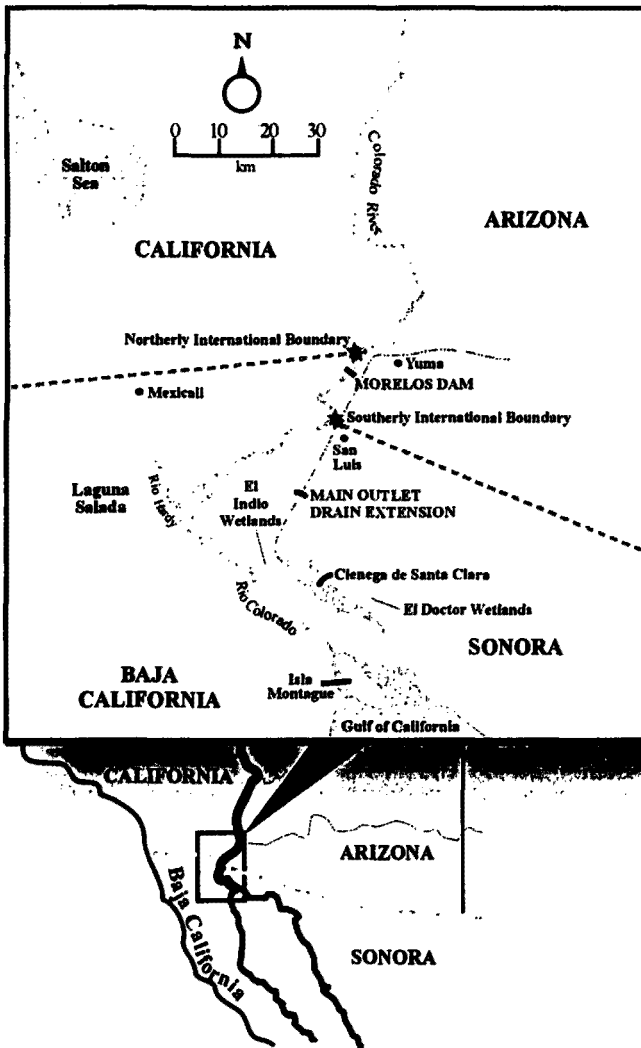
A. Contemporary Geography

The Colorado River flows through nine states in two countries. Its headwaters lie in the Rocky Mountains of the United States in the high peaks of Wyoming and Colorado, more than 1000 miles north of the Delta. The Colorado River watershed encompasses 244,000 square miles, 2000 of which are in Mexico. The current extent of the Delta lies completely within the borders of Mexico (see figure 1).

9. The U.S. Colorado River basin states are Colorado, New Mexico, Utah, and Wyoming in the Upper Basin, and Arizona, California, and Nevada in the Lower Basin.

10. Significantly, the Law of the River effectively ignored ecological considerations in the basin until the passage, in 1992, of the Grand Canyon Protection Act of 1992, Pub. L. 102-575 § 1801-1809, 106 Stat. 4600, 4669-73.

Figure 1: The Colorado River Delta, 2000



The U.S.–Mexico border follows the Colorado River for about 24 miles between southwestern Arizona and northeastern Baja California. The Morelos Dam in Mexico stands as the last major structure on the river’s mainstem. The point at which the international boundary diverges from the river and continues southeast is known as the Southerly International Boundary (SIB).

In Mexico, below the SIB, the river’s alluvial plain forms a broad delta. The Delta is presently confined by levees and encompasses

approximately 150,000 acres, within which the river periodically floods. In the center of the Delta, about 50 river miles south of the SIB, the Río Hardy joins the Colorado River from the northwest. A local tributary, the Río Hardy is about 16 miles long and drains about 135 square miles below the nearby Cucapá Mountains. Most of the Río Hardy's flow is brackish water that drains from surrounding agricultural fields.¹¹ East of the Colorado's mainstem, the Main Outlet Drain Extension canal delivers additional agricultural wastewater to the Delta from southern Arizona in the United States. At the end of its course, the Colorado River empties into the northern end of the Gulf of California.

Outside of the levees, the Delta is surrounded by the agricultural valleys of Mexicali and San Luis Río Colorado and the Sonoran Desert. These farmlands comprise some 500,000 acres irrigated with a portion of Mexico's share of Colorado River water delivered from Morelos Dam via the Central Canal.¹² Beyond the irrigated landscape lies the Sonoran Desert ecosystem, dominated by arid soils and low shrubs.

During the twentieth century, river flows into the Delta have been reduced nearly 75 percent;¹³ in 24 of the past 40 years, less than two percent of the Colorado River's estimated undepleted flow reached the Delta. This reduction in water brought less silt, fewer nutrients, higher salinity, and higher concentrations of pollutants, resulting in major changes to the Delta.¹⁴ Erosion—rather than accretion—is now the dominant physical process in the Delta, a highly unusual condition for a river delta.¹⁵ Like other river deltas at risk, such as the Nile's, the Colorado's delta has actually decreased in size.¹⁶

The loss of freshwater flows to the Delta over the past century, combined with land use changes, has reduced Delta wetlands and riparian areas to about five percent of their original extent.¹⁷ Non-native species, better adapted to high-saline, low-flow conditions, have further compromised the ecological value of the region. Native forests of cottonwood and willow, which supported greater species richness and

11. Total dissolved solids in the water of the Río Hardy have been documented at 4,000-5,000 parts per million. See Edward P. Glenn et al., *Status of Wetlands Supported by Agricultural Drainage Water in the Colorado River Delta, Mexico*, 34 *HORTSCIENCE* 16, 18-19 (1999).

12. See CARLOS VALDÉS-CASILLAS ET AL., *INFORMATION DATABASE AND LOCAL OUTREACH PROGRAM FOR THE RESTORATION OF THE HARDY RIVER WETLANDS, LOWER COLORADO RIVER DELTA, BAJA CALIFORNIA AND SONORA, MEXICO* 10 (1998).

13. See Glenn et al., *supra* note 11, at 16.

14. The natural ecology of most of the world's large river systems has been disrupted by dams, flow diversions, channelization of riverbeds, and alteration of riparian zones by agricultural activities that in turn reduce flows, silt accretion, and nutrient loads to their deltas.

15. See Glenn et al., *supra* note 3, at 1177.

16. See Stanley & Warne, *supra* note 5, at 628.

17. See Glenn et al., *supra* note 3, at 1181.

density than any other desert habitat,¹⁸ have yielded to non-native salt cedar and iodinebush, decreasing the habitat value of the riparian corridor.¹⁹

B. The Undisturbed Delta: Before Upstream Development

The Colorado River delta ecosystem's pre-development conditions provide a context for understanding the current ecosystem, as well as for understanding the goals for ecological restoration. Undisturbed river deltas tend to be highly productive and diverse ecosystems,²⁰ and the Colorado River delta was no exception. Until the 1930s, highly variable flood cycles on the Colorado created a dynamic delta nearly twice the size of Rhode Island, populated by a rich array of adaptable and resilient plant and animal species, as well as human communities that lived off this bounty. Historically, as much as 70 percent of the Colorado River's silt load was carried to the Delta,²¹ importing nutrients and extending the Delta ever wider into the upper Gulf of California. These sediments and nutrients created a fertile delta that once supported an estimated 200 to 400 species of vascular plants.²² The Delta's richness was further increased by the action of tides typically ten feet or more in amplitude, an unusually high ebb and flow that extended the tidal estuary 35 miles upriver.²³ The interaction of these tidal flows with freshwater from the Colorado River created a rich breeding ground for the marine life of the Gulf of California.

The Delta was also home to a local people known as the *Cucapá*, or "the people of the river."²⁴ Descendants of Yuman-speaking Native Americans, the *Cucapá* have inhabited the Delta for nearly a thousand years and used the Delta floodplain extensively, harvesting Palmer's saltgrass (a wild grain), and cultivating corn, beans, and squash. Other foods included

18. See Jake Rice et al., *Comparison of the Importance of Different Habitat Attributes to Avian Community Organization*, 48 J. WILDLIFE MGMT. 895, 905-09 (1984).

19. See MARK K. BRIGGS & STEVE CORNELIUS, DEFENDERS OF WILDLIFE, OPPORTUNITIES FOR ECOLOGICAL IMPROVEMENT ALONG THE LOWER COLORADO RIVER AND DELTA: FINAL REPORT 4 (1997).

20. See EDWARD J. KOMONDY, CONCEPTS OF ECOLOGY 378 (4th ed. 1996).

21. Between 45 million and 455 million metric tons of silt per year were transported through the Grand Canyon between 1922 and 1935. See W. L. Minckley, *Native Fishes of the Grand Canyon Region: An Obituary?*, in COLORADO RIVER ECOLOGY AND DAM MANAGEMENT 124, 126 (National Research Council ed., 1991).

22. See Exequiel Ezcurra et al., *Freshwater Islands in a Desert Sand Sea: The Hydrology, Flora, and Phytogeography of the Gran Desierto Oases of Northwestern Mexico*, 9 DESERT PLANTS 35 (1988).

23. See JACK M. PAYNE ET AL., DUCKS UNLIMITED, INC., FEASIBILITY STUDY FOR THE POSSIBLE ENHANCEMENT OF THE COLORADO DELTA WETLANDS, BAJA CALIFORNIA NORTE, MEXICO 8 (1992).

24. See Sandra Postel et al., *Allocating Fresh Water to Aquatic Ecosystems: The Case of the Colorado River Delta*, 23 WATER INT'L 119, 121 (1998).

mesquite, deer and wild boar, wild geese and ducks, doves, quail, and fish, providing a subsistence lifestyle that required a healthy Delta ecosystem.²⁵

C. The Delta Transformed

The physical transformation of the Colorado River delta is the result of numerous local and basin-wide developments. By the nineteenth century, the Delta was open for navigation, and steamboats consuming riverside cottonwoods for fuel traveled from Yuma, Arizona, through the Delta to the Gulf of California, in an active river trade.²⁶ By the early 1900s, farmers in the Mexicali Valley had begun to clear the land and irrigate their fields. Irrigators in the United States, subjected to the river's annual cycle of spring floods and low summer flows, demanded that the federal government control the Colorado River to provide a consistent and reliable supply of water.²⁷ Water's power to transform the dry desert landscape, and its power to generate electricity, would make Colorado River water an irresistibly valuable resource throughout the twentieth century.

As the West's population and need for water have grown, the Colorado River has been tapped through a system of dams and diversions. Over its 1400-mile course, the Colorado is interrupted by more than 10 major dams. More than 80 major diversions carry water away from the river for agriculture and other uses.

The construction of Hoover Dam in Nevada in the 1930s marks the beginning of the modern era for the Colorado delta. For six years, as Lake Mead filled behind the dam, virtually no freshwater reached the Delta. Even spring flooding was captured, and the riparian zone of the river from Morelos Dam to the junction with the Río Hardy was a dry ecosystem, dominated by widely spaced mesquite trees.²⁸ As Lake Mead filled, the river flow was perennial below the junction of the two rivers due to the discharge of agricultural wastewater from the Mexicali Valley and tidewater entering from the Gulf of California. The marked decrease of water in the mainstem from Morelos Dam to the confluence with the Río Hardy recurred from

25. See Anita Alvarez de Williams, *Cocopá*, in 10 HANDBOOK OF NORTH AMERICAN INDIANS 99 (Alfonso Ortiz ed., 1983).

26. See *id.*; GODFREY SYKES, THE COLORADO DELTA 30-34 (1937). See generally MARK K. BRIGGS, RIPARIAN ECOSYSTEM RECOVERY IN ARID LANDS (1996).

27. See NORRIS HUNDLEY, JR., WATER AND THE WEST: THE COLORADO RIVER COMPACT AND THE POLITICS OF WATER IN THE AMERICAN WEST 5-10 (1975).

28. These observations are based on inspection of 1972 aerial photographs and interviews with residents. See VALDÉS-CASILLAS ET AL., *supra* note 12, at 5.

1963 to 1981 as Lake Powell filled behind the newly-constructed Glen Canyon Dam in Arizona (see figure 2).²⁹

Today, with these reservoirs near capacity, the dams are used to regulate flows so that water can be reliably apportioned among users. Most flood flows can be contained, regulated, and added to the river's capacity to supply agriculture and urban centers. Floodwaters, known as "space-building" or "spill" flows, are released from Lake Mead, the largest reservoir on the river, only when the U.S. Bureau of Reclamation (BOR), the agency managing the dams, predicts flows that exceed the system's capacity for use and storage.

The Colorado River is now one of the most highly regulated and diverted rivers in North America. Virtually every drop is accounted for in the allocation of water among nine states (seven in the United States and two in Mexico) and the 27 native tribes that have rights to use it.³⁰ The river irrigates more than 3.7 million acres of farmland in the southwestern United States and Mexico, and supplies water to nearly 30 million people. While irrigated agriculture tops the list of Colorado River water uses in the United States and Mexico, the second largest consumption of water is evaporation from reservoirs.³¹ Diversions out of the Colorado basin, such as water delivered to Los Angeles, are the third largest use, followed by municipal and industrial uses. In addition to providing water for consumptive use, the dams along the Colorado River in the United States provide hydroelectric power to the states in the U.S. Southwest, with a total generating capacity of about 4425 megawatts.³²

In years without flooding, the only Colorado River water to cross the border is the 1.5 million acre-feet allotted by treaty to Mexico,³³ slightly more than 10 percent of current estimates of the river's average annual

29. See INT'L BOUNDARY & WATER COMM'N, WESTERN WATER BULLETIN: FLOW OF THE COLORADO RIVER AND OTHER WESTERN BOUNDARY STREAMS AND RELATED DATA (1960-1998); U.S. GEOLOGICAL SURVEY, GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1313, COMPILATION OF RECORDS OF SURFACE WATERS OF THE UNITED STATES THROUGH SEPTEMBER 1950, PART 9: COLORADO RIVER BASIN 709-29 (1954).

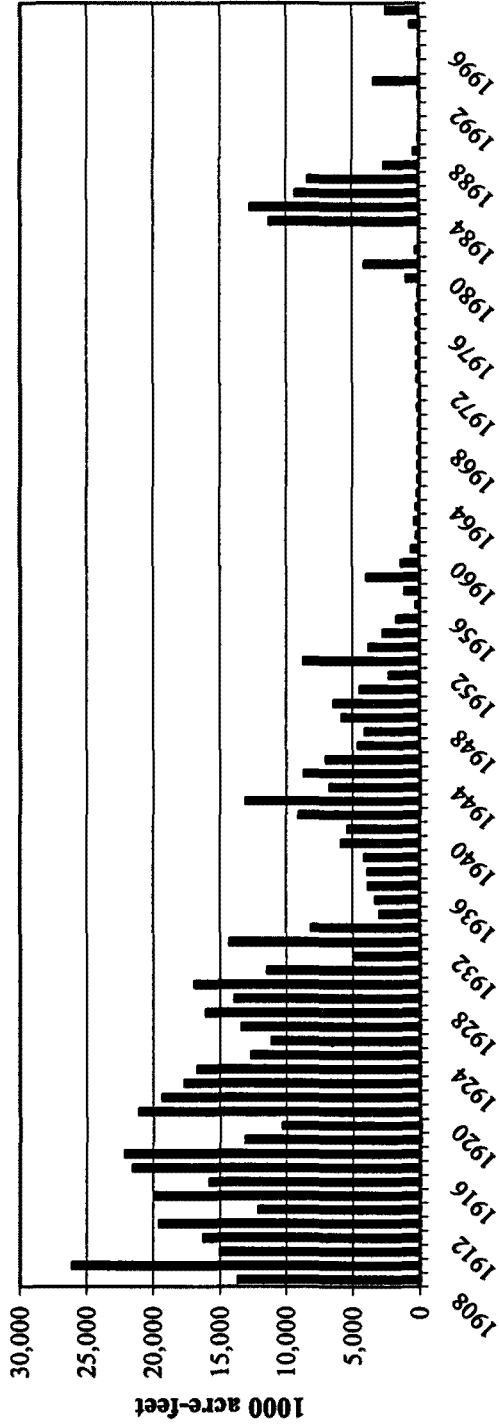
30. There are 34 tribes in the Colorado River basin, of which 27 claim rights to Colorado River water. See PONTIUS, *supra* note 1, at 72.

31. Allocations made under the laws and compacts that make up the Law of the River do not account for 1.5 million acre-feet in annual evaporative losses from mainstem reservoirs. See PONTIUS, *supra* note 1, at 10.

32. See Larry MacDonnell & Bruce Driver, *Rethinking Colorado River Governance*, 1996 PROCEEDINGS REPORT FROM THE COLORADO RIVER WORKSHOP 181, 190.

33. See Treaty on the Utilization of Waters of the Colorado and Tijuana Rivers and of the Río Grande, Feb. 3, 1944, U.S.-Mex., 59 Stat. 1219.

FIGURE 2: COLORADO RIVER FLOW BELOW ALL MAJOR DAMS AND DIVERSIONS 1908-1998



flow.³⁴ The United States delivers 90 percent of Mexico's water allotment to the Northerly International Border (NIB) at Morelos Dam. Mexico diverts this water to the Mexicali and San Luis Río Colorado irrigation districts by way of the Central Canal,³⁵ which has a capacity sufficient to divert Mexico's entire allocation. Water in the Central Canal not used for irrigation is routed to Mexicali and Tijuana for municipal use.³⁶ The ten percent of Mexico's allocation delivered at the SIB in the San Luis Río Colorado valley is diverted for irrigation. In years without flood releases, no Colorado River water reaches the remnant Delta wetlands below the diversion points; the only water reaching the Delta comes from groundwater seeps, agricultural drainage, and tidewater.³⁷

D. Colorado River Delta: Endangered Species, Habitat, and Water Requirements

Despite its diminished state, the Delta plays a significant ecological role extending far beyond the bounds of its 150,000 acres. The Delta supports a variety of wildlife, including several threatened and endangered species listed in both the United States and Mexico.³⁸ The Delta is a key

34. The average flow (over the 90 year historic record) of the Colorado River is 15 million acre-feet. Flows as low as 6 million acre-feet and as high as 24 million acre-feet have been recorded. See PONTIUS, *supra* note 1, at 6. In 1976 researchers estimated the long-term annual flows of the Colorado River, based on extensive tree-ring sampling for the years 1520-1961, at approximately 13.5 million acre-feet. See David Tarboton, *Hydrologic Scenarios for Severe Sustained Drought in the Southwestern United States*, 31 WATER RESOURCES BULL. 803 (1995).

35. Approximately 2 million acre-feet per year are used for irrigation in the Mexicali and San Luis Río Colorado valleys, with Colorado River water making up the majority of this supply. See VALDÉS-CASILLAS ET AL., *supra* note 12, at 22.

36. Telephone interview with Robert Ybarra, Foreign Affairs Officer, International Boundary and Water Commission (Jan. 29, 1999).

37. See Glenn et al., *supra* note 3, at 1178. The Colorado River provides considerable value in terms of recreational and fish and wildlife benefits. However, the ecological needs of the Colorado River have only recently gained legal recognition and protection. See David H. Getches, *Colorado River Governance: Sharing Federal Authority as an Incentive to Create a New Institution*, 56 U. COLO. L. REV. 573, 573-74 (1997).

38. Listed species include the desert pupfish, listed in the United States and Mexico (the largest remaining population anywhere is in the Ciénega de Santa Clara); the Yuma clapper rail, listed as an endangered species in the United States and Mexico; the bobcat, listed only in Mexico; the vaquita porpoise, the world's smallest marine mammal, listed in Mexico, and in the United States as a species of special concern by the Marine Mammal Commission; and the totoaba, listed in both the United States and Mexico, now virtually extinct, a steel-blue fish that grows up to seven feet and 300 pounds, and once supported a commercial fishery that closed in 1975. In addition, Mexico lists five threatened species: the yellow-footed gull, Heermann's gull, elegant tern, reddish egret, and peregrine falcon; three species for special protection: the brant, house finch, and mockingbird; and one rare species: the great blue heron. See 50 C.F.R. § 17.11 (listing endangered or threatened species under the U.S. Endangered Species Act).

stopover along the Pacific Flyway and supports large numbers of wintering waterfowl.³⁹ Although resident and migratory bird densities have not been studied extensively, the Delta is considered a key element of the Flyway, and the only significant freshwater wetland among the Mexican Pacific Coast marshes.⁴⁰ In the United States, the total acreage of habitat in the lower basin of the Colorado River is estimated to support fewer than half as many birds.⁴¹

Agricultural wastewater, tides, a small amount of naturally occurring run-off, and artesian springs provide perennial water to the Delta. Seventeen agricultural drains from the Mexicali Valley flow into the Colorado River delta. The Ciénega de Santa Clara⁴² receives agricultural wastewater from both Mexico and the United States. The U.S. agricultural wastewater flows from southern Arizona's Wellton-Mohawk Irrigation and Drainage District via a canal built by the U.S. BOR in 1977, the Main Outlet Drain Extension (MODE) canal.⁴³ In sum, agricultural drain flows contribute an average annual volume of 200,000 acre-feet of water to the Delta.⁴⁴

Flood flows along the river's mainstem sustain the increasingly rare, and ecologically valuable, native riparian vegetation in the upper reaches of the Delta. Since 1980, Colorado River flood flows have again reached the Delta intermittently due to near capacity storage at Lake Mead and a series of years with above average precipitation. From 1980 to 1993,

Listings are found in Mexico's endangered species act as well, see "Norma Oficial Mexicana que Determina las Especies y Subespecies de Flora y Fauna Silvestres Terrestres y Acuáticas en Peligro de Extinción Amenazadas, Raras y las Sujetas para su Protección," D.O., 16 de mayo de 1994 (NOM-059-ECOL-1994).

39. See PAYNE ET AL., *supra* note 23, at 3.

40. Delta habitat is estimated to support 68,000 resident and 49,000 nonresident summer birds. See DANIEL F. LUECKE ET AL., ENVIRONMENTAL DEFENSE FUND, A DELTA ONCE MORE: RESTORING RIPARIAN AND WETLAND HABITAT IN THE COLORADO RIVER DELTA 24 (1999) (citing the calculations found in B.W. Anderson & Robert D. Ohmart, *Vegetation, in INVENTORY AND MONITORING OF WILDLIFE HABITAT* 639 (Allen Y. Cooperrider et al. eds., 1986)).

41. See *id.* The comparison between river reaches in the United States and Mexico is made to emphasize the importance of the Delta region to the overall lower Colorado River ecosystem.

42. A marsh created and sustained by the irrigation drainage delivered by the Main Outlet Drain Extension canal. See Glenn et al., *supra* note 11.

43. The water in the MODE is too saline to be included in Mexico's allocation of Colorado River water. The U.S. BOR at one time planned to remove the salt from this water, and the MODE was built as a temporary drain for Wellton-Mohawk agricultural wastewater while the Yuma Desalting Plant was under construction. Completed in 1992, the Yuma Desalting Plant has never been operated due to high costs (estimated to be \$25 million annually) and availability of lower-salinity water from other sources. A decision to operate the plant could result in the cessation of flows in the MODE, with devastating consequences for the Ciénega de Santa Clara. See LUECKE ET AL., *supra* note 40, at 31.

44. See Glenn et al., *supra* note 11, at 17.

average annual flood flows across the border (cross-border flows minus Mexico's allotment) were 3.9 million acre-feet, nearly three times Mexico's treaty allotment, and 25 percent of the average flow before dams blocked the river.⁴⁵ In addition to freshwater flood flows, large tides flood some 81,500 acres in the Delta on a daily basis.⁴⁶

In recent years, researchers inventoried the vegetative response to floods, and concluded that the reestablishment of native forest species in the riparian corridor has been a direct consequence of overbank flooding below Morelos Dam since the filling of Lake Powell.⁴⁷ Specifically, modest annual flows (below Morelos Dam) of 32,000 acre-feet have been estimated to be sufficient to maintain, even improve, cottonwood-willow habitat in the upper reaches of the Delta.⁴⁸ Annual flood events are not necessary for survival of these native tree species: they are capable of surviving at least a three-to-four-year interval between major flow events in the Delta floodplain.⁴⁹ Pulse flows of 260,000 acre-feet, released at a rate of 3,500–7,000 cubic-feet per second, are sufficient to inundate the Delta's floodplain within the levees, sustain riparian corridor vegetation, and stimulate seed germination.⁵⁰ This flood volume and release rate is on a par with recent flood releases and is likely to occur on average every four years under the present Colorado River management regime unless there is an extended drought.⁵¹

E. Water Dedicated to the Delta

A coalition of environmental organizations and research scientists are calling for conservation of the Delta's existing habitat and sufficient

45. See *id.* at 19.

46. See *id.* at 16.

47. More field research is needed to quantify with certainty the required volume and frequency of these floods. In addition, freshwater flow needs of Delta fisheries and Gulf near-shore marine species have not been quantified. The flows needed for restoration cited in this article do not include the needs of aquatic species. See generally LUECKE ET AL., *supra* note 40, at 17-32.

48. See *id.* at 42.

49. It is not clear whether the survival of the Delta's riparian vegetation depends on local agricultural return flows or other sources that may recharge the riparian zone during periods in which water does not flow from the United States. See *id.* at 20.

50. Fieldwork conducted after the 1997 floods documented high-intensity riparian vegetation in approximately 30 percent of the floodplain, with evidence of widespread seed germination of native trees as well as salt cedar. Peak flows of 3,500–7,000 cubic feet per second (cfs) inundated nearly the entire floodplain between the levees below Morelos Dam, and diluted significantly the salinity of ocean water in the tidal zone. See *id.*

51. The 260,000 acre-foot pulse flow represents less than two percent of the Colorado's average annual flow.

water to sustain it, by establishing dedicated flows to the region.⁵² These water requirements are currently met through inadvertent and unprotected flood flows and agricultural wastewater. More field research is needed to quantify with certainty the volume and frequency of floods necessary to conserve existing habitat. Significantly, freshwater flow needs of Delta fisheries and the Gulf's near-shore marine species have not been quantified. Because the water that currently sustains the Delta arrives there inadvertently and is unprotected, it is vulnerable to further upstream development as well as to reductions due to drought. Dedication of instream flows in the quantity presently reaching the Delta is necessary to preserve existing habitat. In addition, ecosystem health could be enhanced through changes that do not require additional dedicated flows, such as the timing of water deliveries and improvements in water quality. One short-term improvement would be to provide regular flood releases every few years to inundate riparian and wetland areas, study the vegetative response, and further adapt the timing of these releases to maximize benefits to the Delta ecosystem.

If agricultural wastewater can be deliberately managed, many areas of the Delta can be sustained without any additional dedicated flows. Water quality problems in some wetlands supported by agricultural wastewater require mitigation to protect humans who come into contact with the water or eat the local wildlife and fish. The brackish water pumped from the Wellton-Mohawk Irrigation and Drainage District in Arizona currently bypasses the Yuma Desalting Plant⁵³ and is discharged via the MODE canal into the Ciénega de Santa Clara, where it sustains some 50,000 acres of wetlands.⁵⁴ Agricultural wastewater may not be an ideal source of water,

52. The coalition remains informal, but has in the past included representatives from the American Humane Association, American Rivers, Amigos Bravos, Animal Protection Institute, Asociación Ecológica de Usuarios de los Ríos Hardy y Colorado (AEURHYC), Audubon Council of Utah, Biodiversity Legal Foundation, Border Ecology Project, Bosques de las Californias, A.C., Bradshaw Mountain Wildlife Association, Center for Biological Diversity, Center for Environmental Connections, Centro de Derecho Ambiental e Integración Económica del Sur A.C. (DASSUR), Centro de Estudios de los Océanos y Desiertos (CEDO), Centro Regional de Estudios Ambientales y Socioeconómicas (CREAS), Defenders of Wildlife, Ducks Unlimited, Earth Island Institute, Environmental Defense, Friends of Pronatura, Forest Guardians, Fund for Animals, Glen Canyon Institute, Great Salt Lake Audubon, The Humane Society of the United States, In Defense of Animals, International Rivers Network, International Sonoran Desert Alliance, ITESM-Campus Guaymas, National Audubon Society, Northwest Ecosystem Alliance, Pacific Institute, Pro Esturos, Pronatura Sonora, Sierra Club, Sonoran Institute, Southwest Rivers, Southwest Toxic Watch, and Wetlands Action Network. These organizations represent over eight million United States and Mexican citizens.

53. See *supra* note 43.

54. See Edward P. Glenn et al., *Ciénega de Santa Clara: Endangered Wetland in the Colorado River Delta, Sonora, Mexico* 32 Nat. Resources J. 817, 817 (1992).

yet its benefits may—for the present—outweigh its liabilities, particularly since there are few other potential sources for restoring Delta ecosystems.

II. COLORADO RIVER MANAGEMENT

Defining ecological needs is an important component of preserving the Delta, but good science alone will not suffice. The Delta is no longer a system that can be understood solely in terms of biology and hydrology: human actions, embedded within a complex institutional framework, have significantly altered and modified the Delta. Any program to restore the Colorado River delta will necessarily engage the array of arrangements and institutions that govern the management of the Colorado River.

A. The Law of the River

A complex set of legal and administrative agreements, known as the Law of the River,⁵⁵ governs use of Colorado River water. The Law of the River is not explicitly defined or codified in any single location; it is a dynamic bundle of rules subject to frequent dispute, re-interpretation, revision, and expansion. The Law of the River allocates Colorado River water according to a three-tiered set of priorities. At the top is the United States' international obligation to deliver 1.5 million acre-feet of water within a prescribed salinity range to Mexico each year. The second tier allocates water within the upper and lower basins in the United States, and to the states within each basin. The lowest tier allocates water within each state.

The Law of the River allocates more water than actually flows down the river in most years. Over the historic long term, the average annual flow of the Colorado is 13.5 million acre-feet.⁵⁶ Yet when the river was apportioned, first by the Colorado River Compact of 1922,⁵⁷ and subsequently by the Upper Colorado River Basin Compact of 1948,⁵⁸ court

55. A considerable literature exists on the Law of the River. See generally David Getches, *Competing Demands for the Colorado River*, 56 U. COLO. L. REV. 413 (1985); Charles Meyers, *The Colorado River* 19 STAN. L. REV. 1 (1966); Charles Meyers & Richard Noble, *The Colorado River: The Treaty with Mexico* 19 STAN. L. REV. 367 (1967); NEW COURSES FOR THE COLORADO RIVER: MAJOR ISSUES FOR THE NEXT CENTURY (Gary D. Weatherford & F. Lee Brown eds., 1986); Larry MacDonnell et al., *The Law of the Colorado River: Coping with Severe Sustained Drought*, 31 WATER RESOURCES BULL. 825 (1995).

56. See *supra* note 34.

57. The full text of the Compact can be found in RAY LYMAN WILBUR & NORTHCUTT ELY, *THE HOOVER DAM DOCUMENTS*, H.R. Doc. No. 80-717, at A17 (1948). The Compact can be found on-line at <<http://www.glencanyon.org/CRC.HTM>>. The Compact was ratified by Congress in the Boulder Canyon Project Act 43 U.S.C. § 617(l) (1994).

58. 63 Stat. 31 (1949).

decisions, federal law, and international treaty, the river was overallocated because allocations were based on erroneously high estimates of average annual flow.⁵⁹ Compounding the problems of overallocation are numerous different interpretations of the definition of consumptive use, treatment of evaporation from reservoir surfaces, and water delivery obligations of the Upper Basin states (Colorado, New Mexico, Utah, and Wyoming) under the treaty to Mexico.⁶⁰ To date, none of the Upper Basin states has used its full annual apportionment, enabling reservoirs to maintain storage near capacity, in turn prompting flood flow releases in the recent, above-average flow years.

Implementation of the Law of the River has been subject to considerable litigation and discussion. It is generally accepted that the Law of the River gives priority to

- (1) the delivery of water to Mexico;
- (2) "present perfected rights" (water rights exercised prior to 1922, including the rights of Indian tribes);
- (3) delivery of water to the Lower Basin for consumptive uses;
- (4) consumptive uses in the Upper Basin;
- (5) economic, nonconsumptive uses (e.g., power generation);
and
- (6) non-economic, nonconsumptive uses (e.g., environmental protection).⁶¹

To date, the Law of the River contains no provision for allocating water to support the ecological health of the Colorado's delta. In 1973, the 1944 Treaty with Mexico⁶² was amended with Minute 242, which established salinity standards for water delivered at the NIB.⁶³ The impact of Minute 242 on the Delta is indirect: because some agricultural wastewater from southern Arizona is too saline to meet the standard, it is channeled into Mexico in a canal and drains into the Ciénega de Santa Clara, where it sustains the Delta's largest wetlands.⁶⁴

59. The river's annual average flow for the period 1911-1960 was 13 million acre-feet, yet 16.5 million acre-feet are allocated among Mexico and the U.S. states. See Meyers, *supra* note 55, at 2, 15; Meyers & Noble *supra* note 55, at 388.

60. See generally Getches, *supra* note 55.

61. See generally Meyers, *supra* note 55.

62. Treaty with Mexico Respecting Utilization of the Waters of the Colorado and Tijuana Rivers and of the Río Grande, Feb. 3, 1944, U.S.-Mex., 59 Stat. 1219, 1265.

63. See *Agreement on the Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River* Resolution 1, IBWC Minute 242 (Aug. 30, 1973), reprinted at 12 I.L.M. 1105, 1105 [hereinafter Minute 242].

64. See *supra* note 43.

Despite stiff institutional resistance, resource managers have slowly begun to recognize the need to manage for ecological values in the Delta. The Law of the River developed under the premise that water left instream was "wasted," a norm challenged over the past generation by a society increasingly sensitive to environmental considerations. In the United States, under the mandate of the Endangered Species Act, the federal government and the states are working towards restoration and protection of habitat and endangered species protection in both the Upper and Lower Basins. In 1987, the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin⁶⁵ was developed to protect and improve in-stream flows, restore habitat, and reduce the adverse effects of non-native fish species. In the Lower Basin states (Arizona, California, and Nevada), water users representing irrigation, municipal, and power interests launched the Lower Colorado River Multi-Species Conservation Program (MSCP)⁶⁶ in 1994 to mitigate water development impacts on threatened and endangered species while at the same time optimizing water diversions and hydroelectric power production. The Grand Canyon Protection Act of 1992⁶⁷ established an important precedent for the Colorado River, prioritizing environmental concerns regarding power generation at Glen Canyon Dam.⁶⁸ In 1996, as required by the Act, the BOR released a flood of stored water from behind Glen Canyon Dam in an effort to redistribute sediments in the Grand Canyon and re-create eroded

65. The Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (RIP) is a cooperative effort involving the U.S. FWS; BOR; Western Area Power Administration; the states of Utah, Colorado, and Wyoming; water users; and environmentalists. The recovery program, which is expected to require 15 years, contains five major elements: (1) habitat management, designed to identify and acquire in-stream flows and changes in operation of federal reservoirs in the basin; (2) habitat development based on the development of research methods for creating, protecting, and improving habitat; (3) stocking native fish based on a genetic management plan; (4) non-native species control; and (5) research, monitoring, and data management programs designed to study various means of recovering fish, monitor long-term population trends, recommend flows, evaluate genetic differences between populations, recommend "refugia" (facilities to hold and protect rare fish), evaluate differences between hatchery and wild fish, establish brood stock, and develop and manage a centralized database. See FISH AND WILDLIFE SERVICE, U.S. DEP'T OF THE INTERIOR, RECOVERY IMPLEMENTATION PROGRAM FOR ENDANGERED FISH SPECIES IN THE UPPER COLORADO RIVER BASIN (2000).

66. See Multi-Species Conservation Program (MSCP) for the Lower Colorado River, Arizona, Nevada, and California, 64 Fed. Reg. 27,000, 27,000-27,002 (1999).

67. Pub. L. 102-575 § 1801-1809, 106 Stat. 4600, 4669-73.

68. See JASON I. MORRISON ET AL., PACIFIC INSTITUTE, THE SUSTAINABLE USE OF WATER IN THE LOWER COLORADO RIVER BASIN 4 (1996).

beaches.⁶⁹ These efforts suggest a growing awareness of the importance of the river's ecological health and the flexibility to address new concerns.

Of particular relevance to the magnitude and frequency of flood flows are the "Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs,"⁷⁰ which invest the Secretary of the Interior with the authority to determine surplus and shortage conditions and guide the allocation of surplus water among users. The U.S. Department of the Interior (DOI) must prepare a yearly plan for managing reservoirs in the system and must declare whether a surplus or shortage exists. In early 2000, the DOI began drafting a set of criteria to standardize the process by which these surplus determinations are made (see Section IV *infra*, Surplus and Shortage Criteria).

One unresolved aspect of Colorado River water allocation is the extent of Indian reserved water rights in the United States.⁷¹ These rights are defined in a series of court decisions that set a basis for quantifying them. The quantity of unadjudicated rights is large, particularly those rights associated with Navajo reservation lands.⁷²

B. Governing Institutions

The number of agencies with jurisdictional authority over the Delta, Colorado River water, and border-related environmental issues, is daunting. Successful, long-term preservation of the Delta will require cooperation between Mexico and the United States, among states and resource agencies and tribes, and the active involvement of nongovernmental organizations, communities, and citizens. A review of the likely players and several long-standing, related resource management issues suggests the involvement of many.

1. *International Boundary and Water Commission*

The only institution with binational authority over surface water resources in the border region is the International Boundary and Water

69. The 1996 flood helped increase the sandbar volume of 50 percent of the camping beaches measured between Glen Canyon and Hoover dams. The flood bypassed the dam's turbines, and cost approximately \$2.5 million in lost hydropower revenues. See DAVID A. HARPMAN, AMERICAN GEOPHYSICAL UNION, *THE ECONOMIC COST OF THE 1996 CONTROLLED FLOOD* (Geophysical Monograph No. 110, 1999).

70. See *Arizona v. California*, 373 U.S. 546 (1963) (opinion). See also *Arizona v. California*, 376 U.S. 340 (1964) (decree).

71. See Allen V. Kneese & Gilbert Bonem, *Hypothetical Shocks to Water Allocation Institutions in the Colorado River Basin*, in *NEW COURSES FOR THE COLORADO RIVER: MAJOR ISSUES FOR THE NEXT CENTURY* 94, 94-98 (Gary D. Weatherford & F. Lee Brown eds., 1986).

72. See *id.* at 97.

Commission (IBWC), known as *Comisión Internacional de Límites y Aguas* (CILA) in Mexico. Created in 1889,⁷³ the IBWC/CILA is charged with applying provisions of various boundary and water treaties. The scope of its work includes boundary maintenance, reclamation projects, allocation of transboundary water resources, construction and maintenance of sewage and sanitation works, and the resolution of treaty and water quality disputes.⁷⁴ Today, the IBWC/CILA mission is to "provide environmentally sensitive, timely, and fiscally responsible boundary and water services along the United States and Mexico border...in an atmosphere of binational cooperation and in a manner responsive to public concerns."⁷⁵ For the most part, the IBWC/CILA has limited its focus to problems of water supply and quality along the border, leaving issues of environmental protection to the jurisdiction of other Mexican and U.S. agencies. In late 1997, IBWC/CILA established a binational workgroup to bring together agency managers from both countries to discuss a research agenda.⁷⁶ At present the workgroup is considering several proposals, but has yet to act.⁷⁷

2. NAFTA Institutions

Several international organizations were established with the 1993 signing of the North American Free Trade Agreement (NAFTA). The North American Commission for Environmental Cooperation (CEC) was created with a broad mandate to promote regional cooperation, prevent environmental disputes, and promote effective enforcement of environmental laws. The CEC facilitates cooperation between the three NAFTA nations (Mexico, Canada, and the United States)—through exchange of information, promotion of scientific research, and access to

73. The International Boundary Commission was formed in 1889, and renamed the IBWC following the Treaty with Mexico Respecting Utilization of the Waters of the Colorado and Tijuana Rivers and of the Río Grande, Feb. 3, 1944, U.S.-Mex., 59 Stat. 1219. See STEPHEN P. MUMME, COMMISSION ON ENVIRONMENTAL COOPERATION, THE INSTITUTIONAL FRAMEWORK FOR TRANSBOUNDARY INLAND WATER MANAGEMENT IN NORTH AMERICA: MEXICO, CANADA, THE UNITED STATES, AND THEIR BINATIONAL AGENCIES, at IV.3 (1996).

74. See generally Meyers & Noble, *supra* note 55.

75. See *International Boundary and Water Commission Web Site* (visited Sept. 5, 2000) <<http://www.ibwc.state.gov/>>.

76. See *International Boundary and Water Commission, IBWC-34-97, Meeting of the Commission to Form a Fourth Colorado River Matters Task Force Regarding the Colorado River Data* (Oct. 28, 1997) (unpublished document, on file with author).

77. The workgroup met for a short time in 1997, and then was inactive until late 1999 when it was reconvened. At that time the workgroup members from the United States agreed to propose several collaborative research initiatives. Telephone Interview with Sam Spiller, Lower Colorado River Coordinator, U.S. Fish and Wildlife Service (May 22, 2000); *International Boundary and Water Commission, supra* note 76.

information and public participation at a regional level—on priority projects of their environmental agencies.⁷⁸

The Border Environmental Cooperation Commission (BECC) was established at the same time as NAFTA, although not formally as a component of NAFTA or its related environmental side accord.⁷⁹ BECC is designed to promote and certify "environmental infrastructure" projects in the U.S.-Mexican border region, and while it neither develops nor manages the projects, it aids local communities in their efforts to improve environmental conditions, including developing their water-supply, wastewater-treatment, and solid-waste management infrastructures.⁸⁰

3. National Agencies

Both the United States and Mexico acknowledge the importance of Delta ecosystems in domestic and international policy arenas. In 1993, parts of the Delta and the upper Gulf of California were declared a Biosphere Reserve⁸¹ by the Mexican government. Natural resource agencies from both nations cooperate on projects in the Delta, including revegetation in the Delta riparian area and technical support for local ecotourism efforts.⁸² National agencies with programs in the border region include several U.S. agencies, the Environmental Protection Agency (EPA) and Department of the Interior (DOI); and Mexico's Secretariat of the Environment, Natural Resources, and Fisheries (SEMARNAP).

In Mexico, SEMARNAP has jurisdiction over environmental protection, natural resource management, and the management of marine resources, and it helps develop and implement the nation's Ecology Law.⁸³ SEMARNAP's National Institute of Ecology (INE) carries out environmental research and development, evaluates Mexico's environmental policies, and implements its natural resource programs. INE administers the "National System of Protected Natural Areas" and is

78. The CEC funds projects through the North American Fund for Environmental Cooperation. See Stephen P. Mumme & Pam Duncan, *The Commission on Environmental Cooperation and the U.S.-Mexican Border Environment*, 5 J. ENV'T & DEV. 197, 197-215 (1996).

79. The commission was conceived as a mechanism to win support for the trade pact among U.S. border states, the rationale being that environmental infrastructure improvements could mitigate any potential environmental degradation associated with NAFTA's promised economic development. See *id.* at 5.

80. See MUMME, *supra* note 73, at IV.4.

81. See CENTRO DE INVESTIGACIONES CIENTÍFICAS Y TECNOLÓGICAS DE LA UNIVERSIDAD DE SONORA ET AL., PROGRAMA DE MANEJO DE LA BIOSFERA DEL ALTO GOLFO DE CALIFORNIA Y DELTA DEL RIO COLORADO 4 (1995).

82. See U.S. Dep't of the Interior, U.S.-Mexico Sonoran and Chihuahuan Desert Initiatives, (Feb. 9, 2000) (unpublished activities report, on file with author).

83. Ley General de Equilibrio y la Protección al Ambiente. See MUMME, *supra* note 73, at I.2.

responsible for establishing and managing all natural areas, including the Biosphere Reserve in the upper Gulf of California and the Colorado River delta.⁸⁴ The Biosphere Reserve's management team includes law enforcement, as well as staff for the research station in the Golfo de Santa Clara. Although none have been established in the Delta as yet, INE also oversees the System of Wildlife Management Units, which establishes small wildlife refuges that can be managed for the economic benefit of local communities.⁸⁵

Also within SEMARNAP is the National Water Commission (CNA), which has nearly complete jurisdiction over water resources and planning in Mexico. CNA builds potable water, sanitation, wastewater-treatment, irrigation, drainage, and flood control systems. It administers Mexico's system of water rights and pumping permits, and shares (with INE) responsibility for the nation's water quality. CNA has recently attempted to decentralize its decision making by establishing local watershed councils. State and municipal governments have little local control over water resources.⁸⁶

In the United States, several federal agencies have some jurisdiction over activities in, or impacting, the Delta. The EPA regulates water quality, and has supported research on selenium in Delta waters.⁸⁷ In addition, two DOI agencies play critical roles. The Fish and Wildlife Service (FWS) administers the Endangered Species Act⁸⁸ and is mandated to review federal actions for adverse impacts to endangered species.⁸⁹ The BOR operates the dams on the Colorado River in the United States and has stated it is planning to conduct a needs assessment of the Colorado River delta in cooperation with Mexican agencies under the auspices of the IBWC/CILA, although no action has yet been taken.⁹⁰

84. Other protected areas include national parks, national marine parks, areas for protection of vegetation and wildlife, and natural monuments.

85. Land protected by regulation under the Wildlife Management Units (known as UMAs) includes public, private, and common holding (i.e., *ejido*) lands. See VALDÉS-CASILLAS ET AL., *supra* note 12, at 72.

86. In an attempt to enhance the influence of user groups and allow some local control of water resources, Mexico has established District Water Committees (*Comités Hidráulicos*) composed of water users. In addition, River Basin Councils were created in 1992 to help decentralize water management. CNA sits on both the irrigation district committees and the river basin councils. See MUMME, *supra* note 73, at I.1.3

87. Jaqueline Garcia-Hernandez, *Bioaccumulation of Selenium in the Ciénega de Santa Clara, Colorado River Delta, Sonora, Mexico* (Feb. 26, 1999) (unpublished manuscript, on file with author).

88. 16 U.S.C. §§ 1531-1543 (1994) (amended in 1978 by Pub. L. No. 95-632, 92 Stat. 3751).

89. See MUMME, *supra* note 73, at III.2.8.2.

90. Telephone interview with Robert Johnson, Regional Director, Lower Colorado Region Office, U.S. Bureau of Reclamation (Feb. 1999).

4. Tribes, Basin States, and Local Communities

Beyond the national government agencies, numerous authorities play a role in Colorado River management. In the United States, 34 Indian reservations are located in the Colorado basin. Twenty-seven tribes have undeveloped Colorado River water rights that date to the establishment of their reservations or to more recent court decisions.⁹¹ Together these tribes assert rights to more than two million acre-feet of water,⁹² but little has been developed. Many tribes are looking for ways to secure economic benefits from their entitlements other than traditional water supply development. For example, the ten tribes of the Colorado River Tribal Partnership formed a coalition to secure, develop, and market their water rights.⁹³

State and local governments also play a role in Colorado River management. The seven Colorado River basin states in the United States (Arizona, California, Colorado, New Mexico, Nevada, Utah, and Wyoming) wield considerable decision-making power over water allocations, flows, storage, management of endangered species concerns, and environmental restoration. The two Mexican states (Baja California and Sonora) play a more limited role, with most decision-making authority resting with the CNA.⁹⁴ Local communities in the Delta region as yet have a limited voice.

5. Non-Governmental Organizations

Non-governmental organizations (NGOs) in the United States and Mexico have worked to conserve the Delta's ecosystem by advocating for management improvements within both federal governments, gathering baseline ecological data, and educating the public. A significant number of U.S. and Mexican NGOs have advocated for conservation of the Colorado River delta, including PRONATURA Sonora; the Intercultural Center for the Study of Deserts and Oceans; the *Centro Regional de Estudios Ambientales y Socioeconómicos*; Environmental Defense;⁹⁵ the Sonoran Institute; the Pacific Institute for Studies in Development, Environment, and Security; Defenders of Wildlife; the Center for Biological Biodiversity; the Sierra Club; Southwest Rivers; and others. Also of note, two university-based research centers have been the source of important studies documenting current Delta conditions. Faculty at The University of Arizona and at the

91. See Pontius, *supra* note 1, at 72-74.

92. This figure represents rights asserted by the tribes rather than adjudicated rights. See Kneese & Bonem, *supra* note 71, at 97.

93. See Colorado River Tribal Partnership, Position Paper of the Ten Indian Tribes with Water Rights in the Colorado River Basin, reprinted in PONTIUS, *supra* note 1, at app. D.

94. See MUMME, *supra* note 73, at I.1.

95. Environmental Defense was formerly known as the Environmental Defense Fund (EDF).

Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM) have made appreciable efforts to increase the body of knowledge concerning Delta ecosystems, economies, and communities. Governments and NGOs alike depend on the work of these individuals and institutions to provide credible, scientific data.

6. Institutional Challenges

Despite, or perhaps because of, the long list of institutions with some role to play in determining the fate of the Colorado River delta, the ecosystem remains threatened. The institutions governing the management and use of the Colorado River are often at odds, hindering efforts to develop solutions to pressing problems. The early failure of the Law of the River to address tribal and ecological concerns, as well as its foundation upon erroneous hydrologic assumptions, has generated decades of disputes, negotiations, and litigation that appear likely to continue into the foreseeable future. Agencies with conflicting missions resist cooperation and groundwater and surface water and water quantity and water quality are all independently monitored and regulated. The institutional heterogeneity⁹⁶ that characterizes the agencies listed previously further challenges efforts to address Delta restoration. To date, no one organization or agency has emerged as the forum for a binational effort to protect the Delta, and there is little systematic programming of long-term commitments by either nation.⁹⁷ The establishment of the IBWC/CILA workgroup is an important first step, but it is limited to technical discussions.⁹⁸

To be successful, an international effort will need to be funded, and will need to operate with a transparency that allows stakeholders in both countries to understand and participate in decisions. Furthermore, the efforts of federal agencies in the United States and Mexico should integrate existing Colorado River delta research and restoration plans, the plans formulated by academics and NGOs from the United States and Mexico, and should expand planning to include economic and cultural preservation concerns. Local communities in the Delta region as yet have a limited voice,

96. See generally Gerald D. Bowden et al., *Institutions: Customs, Laws and Organization, in WATER: COMPETITION FOR CALIFORNIA ALTERNATIVE RESOLUTIONS 163* (Ernest A. Engelbert ed., 1982).

97. See MUMME, *supra* note 73, at IV.6.1. See also Stephen Mumme, *NAFTA's Environmental Side Agreement: Almost Green?*, *BORDERLINES*, Oct. 1999, at 1.

98. Possibly, the United States and Mexico will establish a new binational forum under the auspices of the 2000 Joint Declaration to enhance cooperation on the Colorado River delta. See Bruce Babbitt & Julia Carabias, *Joint Declaration between the Department of the Interior of the United States of America and the Secretariat of the Environment, Natural Resources, and Fisheries (SEMARNAP) of the United Mexican States to Enhance Cooperation in the Colorado River Delta* (May 18, 2000) (unpublished document, on file with author).

but the formation of new groups such as the *Asociación Ecológica de Usuarios de los Ríos Hardy y Colorado* (Ecological Association for the Users of the Hardy and Colorado Rivers) demonstrates local commitment to promoting their interest in Delta restoration.

IV. CONSERVATION CONSIDERATIONS AND OPPORTUNITIES

Although the basic objective—keep sufficient water in the river—seems simple, it will require the alignment of numerous institutions, agreements, and organizations. Public attention needs to be focused on Delta ecosystems. The significant institutional commitments required to ensure the Delta's future necessitate that both international stakeholders and local communities develop strong and vigilant voices demanding that attention be paid to the Colorado River delta.

A successful conservation strategy for the Delta's ecosystem is likely to include some or all of the following: an international agreement, legal action, the inclusion of the Delta as a priority in related management decisions, new funding for conservation, and increased public participation in decisions that affect the Delta and related ecosystems. The best conservation strategy will treat the Delta and the river upstream as one ecological whole, overcoming the obstacles presented by the international boundary.

A. International Agreement

Deliveries of Colorado River water from the United States into Mexico have been characterized by a lack of binational cooperation and considerations, necessitating the negotiation of binding international agreements.⁹⁹ After a lengthy series of binational negotiations, the U.S.–Mexico Treaty governing the Colorado River was amended with Minute 242 in 1973 to mitigate the impacts of pronounced increases in the salinity of the Colorado River as it crossed into Mexico.¹⁰⁰ Domestic interests in the United States continue to preclude discussion of transboundary impacts and cooperation. In December 1998, the Colorado River Board of

99. See generally NORRIS HUNDLEY, JR. *DIVIDING THE WATERS: A CENTURY OF CONTROVERSY BETWEEN THE UNITED STATES AND MEXICO* (1966).

100. Mexico complained that water deliveries on the Colorado River were too saline to support agriculture. The river's increased salinity was due in part to the reduction of freshening flows because of storage in new upstream reservoirs and to the release of brackish drainage water from the Wellton-Mohawk Canal. See PONTIUS, *supra* note 1, at 62.

California adopted a resolution¹⁰¹ stating that the MSCP study area should not extend into Mexico, bisecting the river along a political, rather than a hydrologic, boundary.

This history, as well as continuing disregard for the impacts of U.S. actions on habitat downstream of the international boundary, strongly suggests that the restoration of the Colorado River delta will require a binational agreement between the United States and Mexico. Although diplomacy alone cannot restore ecosystems, a binational commitment would serve as a framework under which all other changes take place. Until conservation of the Delta is a priority for both nations, sufficiently important to merit discussion, negotiation, and most importantly commitment, its welfare will remain an afterthought in management decisions. Once the United States and Mexico recognize that the Delta is a natural resource worthy of a conservation commitment, they will be obliged to codify their intentions in a binational treaty that dedicates water, land, and institutional support. Short of such formality, the Delta's future remains uncertain.

1. *Need for Binational Commitment*

Conservation of the Delta's ecosystems will require binational commitment. Mexico lacks sufficient water both to ensure the ecological viability of the Delta and to sustain a burgeoning human population at its border.¹⁰² Additionally, it is not clear that Mexico should unilaterally shoulder responsibility for Delta restoration when the United States diverts some 90 percent of the Colorado's flows. Water that sustains the Delta is a transboundary resource, and it will take commitment from both Mexico and the United States to reserve sufficient waters for environmental purposes. The minimum volume required to sustain the Delta is a significant portion of Mexico's entire Colorado River entitlement. Not only does the United States capture 90 percent of the river's allocated waters, but as a nation of considerably greater wealth it has greater capacity to fund the protection of natural resources.¹⁰³ Finally, all Colorado River water storage capacity, and nearly all control, rests in the United States. Without the cooperation of the U.S. agencies that manage the Colorado's hydraulic systems, Delta ecosystem conservation will not be achieved.

101. Colorado River Board of California, Resolution Regarding the Planning Area for the Lower Colorado River Multi-Species Conservation Program (Mar. 11, 1998) (unpublished document, on file with author).

102. Population in the Delta (entirely in Mexico) grew more than 3% annually from 1990-1995. See Paul Ganster, *Environmental Issues of the California-Baja California Region*, (visited Sept. 6, 2000) <<http://www.scerp.org/scerp/docs/berr1.html>>.

103. See Jessica Mathews, *The Implications for U.S. Policy, in PRESERVING THE GLOBAL ENVIRONMENT: THE CHALLENGE OF SHARED LEADERSHIP* 309, 320 (Jessica Mathews ed., 1991).

At the same time, Delta conservation cannot be implemented by the United States acting alone. The Delta's welfare is subject to local land management as well as the availability of water from the north. In establishing the Biosphere Reserve of the Upper Gulf of California and Colorado River Delta, Mexico demonstrated commitment to Delta ecosystem preservation.¹⁰⁴ Nevertheless, it is unlikely that the United States would be willing to send water across the border without a corollary commitment from Mexico to insure that these waters reach Delta ecosystems and to improve natural resource management and protection in the Delta.

A binational agreement will allow Mexico and the United States to establish a goal for conservation of the Delta, commit resources to this goal, and define a process to achieve it. Each of these three objectives poses a challenge. Straightforward commitments of water, land, and institutional support for environmental purposes should go far to sustain the Delta's ecosystems, but these alone will not suffice. Like all ecosystems, the Delta is dynamic. Indicators of ecological stability such as the presence of keystone species are useful for monitoring the efficacy of restoration efforts, but do not clearly translate into management prescriptions. Optimally, an agreement will recognize this and allow flexibility in management without forgoing measurable commitments such as quantified instream flows, area of protected lands, and management resources.

2. *A Binational Institution*

This need for flexibility suggests that a binational agreement should establish an institution with the responsibility to monitor the health of the Delta and the contributions of Mexico and the United States to sustaining the Delta. Whether a new or newly identified organization, it should have a mandate to monitor and study Delta ecosystems, manage transboundary water movement, promote the sustainable use of water in the Delta, and encourage greater public participation in decisions that affect the Delta. Numerous international environmental agreements have been signed in recent decades, and in virtually every case they are intended to solve well-defined problems by creating institutions to define social practices, assign roles to participants in these institutions, and govern interactions.¹⁰⁵ For example, the Great Lakes ecosystems benefit from a binational agreement that established the International Joint Commission of the United States and

104. The Biosphere Reserve is among the minority of Mexico's protected areas that receive regular funding from the federal government. See Michelle Nijhuis, *HIGH COUNTRY NEWS*, July 3, 1986, at 1.

105. See generally Oran R. Young, *Hitting the Mark*, *ENVIRONMENT*, Oct. 1999, at 20.

Canada.¹⁰⁶ The Commission is charged with assisting and monitoring both nations' progress towards prohibiting the discharge of toxic substances, providing financial assistance for the construction of publicly owned waste treatment works, coordinating planning processes, and developing best management practices.¹⁰⁷

3. National Mandates for Conservation

A binational agreement will also provide a mandate for conservation of Delta ecosystems to myriad institutions within each nation. Commitment at the national level to an international agreement will affect the behavior of sub-national and non-state actors by influencing unfolding political processes.¹⁰⁸ Absent a mandate, sub-national actors that manage water storage and flow, protect species, manage floodplain and watershed lands, and use water for consumptive purposes have little incentive to consider the Delta in the numerous decisions they make that bear on its health. Because the power of water users is presently greater than that of conservation interests, sub-national actors do not consider impacts to Delta ecosystems in their decision processes.

In the United States, managers at the BOR have not recognized the Colorado River delta as a legitimate conservation priority. Specifically, the BOR has consistently excluded Delta species from environmental planning processes such as the 1996 biological assessment for operations on the lower Colorado River¹⁰⁹ and the more recent Lower Colorado River Multi-Species Conservation Program.¹¹⁰ In both cases, the agency denies responsibility for the environmental health of the river beyond the U.S. border by excluding the Delta from its planning areas and excluding the health of the Delta's people, animals, and plants from its objectives. The FWS has concurred with BOR and has not considered the impacts of BOR actions on listed species in Mexico.¹¹¹

106. See Agreement on Great Lakes Water Quality, Nov. 22, 1978, U.S.-Can., art. 7, 30 U.S.T. 1383.

107. See *id.*

108. See Young, *supra* note 105, at 25-27.

109. See U.S. BUREAU OF RECLAMATION, DESCRIPTION AND ASSESSMENT OF OPERATIONS, MAINTENANCE, AND SENSITIVE SPECIES OF THE LOWER COLORADO RIVER, at I(A) (1996), <<http://www.lc.usbr.gov/~g2000/assess/titlepg.htm>>.

110. See Notice of Intent to prepare an Environmental Impact Statement (EIS) /Environmental Impact Report (EIR) and notice of public scoping meetings, 64 Fed. Reg. 27,000, 27,001 (1999).

111. See U.S. FISH AND WILDLIFE SERVICE, FINAL BIOLOGICAL AND CONFERENCE OPINION ON LOWER COLORADO RIVER OPERATIONS AND MAINTENANCE—LAKE MEAD TO SOUTHERLY INTERNATIONAL BOUNDARY 1 (1997). For availability of this document, see Notice of availability of Biological Opinion and notice of public meetings on Bureau of Reclamation's lower Colorado River operations and maintenance, 62 Fed. Reg. 28,894 (1997).

With a binational, environmental agreement in place that included a quantified commitment to deliver water to the Delta for environmental purposes, U.S. agencies could identify water to meet its terms. Precedent exists for the reallocation of water for environmental purposes. The Recovery Implementation Plan in the Upper Colorado River basin has water users, states, federal agencies, and environmentalists negotiating over the establishment of mechanisms, some of which have already been implemented, that will ensure protection of flow releases from federal reservoirs.¹¹² On the Green River, changes in the operation of Flaming Gorge Dam in Utah have enhanced peak flows and reduced and stabilized winter flows to improve habitat for several endangered fishes.¹¹³

Colorado River stakeholders in the United States have not yet engaged in a process to address the ecological health of the Delta, but the need to mitigate the impacts of upstream development on Delta species may force these stakeholders to action.¹¹⁴ Such a process might include quantification of water needed to preserve the Delta's ecosystems, identification of the entity that would hold these allocations and manage the rights, logistics of storing and releasing the water, and the level of priority that ecosystem resources would enjoy.

In Mexico, the lack of a national mandate to protect the Delta presents additional problems. In the summer of 1999, the National Water Commission (CNA) began a program of vegetation clearing in the Delta. The apparent purpose for such activity was to prevent damage to the levee system in the Delta by blocking secondary river channels, and to prevent floodwaters from reaching nearby farmlands.¹¹⁵ A clearly articulated national position could have underscored the importance of this habitat and discouraged CNA from clearing the vegetation, suggesting the need for greater communication and cooperation among resource agencies in Mexico.

112. See *supra* note 65.

113. See Robert T. Muth et al., U.S. Fish and Wildlife Service et al., *Flow Recommendations for Endangered Fish in the Green River Downstream of Flaming Gorge Dam 5-1 to 5-28 (May, 1999)* (unpublished draft final report, on file with author).

114. On June 28, 2000, eight plaintiffs, led by the Defenders of Wildlife and the Center for Biological Diversity, filed a complaint for declaratory and injunctive relief with the U.S. District Court for the District of Columbia contending that the Departments of Interior and Commerce and related agencies responsible for river management and marine protection have violated the Endangered Species Act, its implementing regulations, and the Administrative Procedure Act. See *Defenders of Wildlife v. Babbitt*, No. 1:00CV01544 (D.D.C. filed Jun. 28, 2000). For further discussion, see *infra* Section IV(B).

115. Electronic Memoranda from Carlos Valdés-Casillas, Professor, Instituto Tecnológico y de Estudios Superiores de Monterrey to Colorado River Delta listserv (Aug. 23, 1999) (on file with author).

4. *Coordination and Cooperation*

A binational agreement is needed as well to facilitate coordination of management and research between the United States and Mexico. Improved coordination could maximize the benefit of flood flows to Delta ecosystems. Mexico is presently given little notice of impending flood releases and has no formal vehicle for recommending release schedules to benefit the Delta. With a binational commitment, management authorities on both sides of the border could look for opportunities to divert and store floodwaters for conservation purposes.

With binational cooperation, research could be broadened to a program of adaptive management that might include a determination of the Delta's water needs through experimental variation of the flow rates through Morelos Dam. At present, the lack of a formal program between the United States and Mexico limits the kind of research that can be conducted. To date, the Delta's water requirements have been determined deductively, through snapshot observations of existing conditions. Experimental research would help shed light on the timing and extent of floods in the Delta, evaporative processes, and other dynamics. IBWC/CILA has recently established an international task force on research, but it has yet to act.¹¹⁶ Independent researchers and non-governmental organizations, however, have coordinated research activities, and published baseline ecological information and analyses with contributions of experts from both countries.¹¹⁷ Only a formal mechanism to coordinate the research programs of both countries will harness the research resources of the U.S. and Mexican governments in collaboration.

5. *Precedent for a Binational Agreement*

Fortunately, a considerable and relevant history of agreements between the United States and Mexico sets the precedent for a binational Delta conservation agreement. Migrating birds have long been identified as a transnational resource worthy of dedicated protection efforts, and as early as 1936 Mexico and the United States signed the Convention for the Protection of Migratory Birds and Game Mammals, committing to protection for birds that live in the United States and Mexico.¹¹⁸ This was soon followed by an agreement of western hemisphere nations to protect species and their habitats, which included specific mention of several Delta species, including the jaguar, the Colorado River pikeminnow, and the

116. See International Boundary and Water Commission, *supra* note 76.

117. See LUECKE ET AL., *supra* note 40, at iii.

118. Convention for the Protection of Migratory Birds and Game Mammals, Feb. 7, 1936, U.S.-Mex., art. 1, 50 Stat. 1311.

Yuma clapper rail.¹¹⁹ In 1971, nations of the world protected designated wetlands, including the Colorado River delta, in an agreement commonly known as the Ramsar Convention.¹²⁰ In 1986, both Mexico and the United States established a mandate and process for the protection of wetlands in the North American Waterfowl Management Plan,¹²¹ and listed the Delta as a continentally important habitat. And as recently as 1994, the United States, Mexico, and Canada together formed the Trilateral Committee for Wildlife and Ecosystem Conservation and Management.

In 1983, the United States and Mexico negotiated the U.S.–Mexico Border Environmental Cooperation Agreement,¹²² commonly known as the La Paz Agreement, creating workgroups that bring together environmental authorities from both countries to address environmental issues in the border region.¹²³ These workgroups were reinvented as Border XXI¹²⁴ under the Integrated Border Environmental Plan (IBEP),¹²⁵ created in 1992 and revised in 1996.¹²⁶

In 1997, Secretary Babbitt of the U.S. Department of Interior and Secretary Carabias of Mexico's Department of Environment, Natural Resources, and Fisheries signed a joint Letter of Intent announcing the following plans:

to expand cooperation in the protection of contiguous, natural protected areas,...to harmonize activities directed at the conservation of biological diversity,...beginning with...pilot projects...in Mexico, the Biosphere Reserves of the *Alto Golfo de California y Delta del Río Colorado*...[including] harmonization

119. See Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere, Oct. 12, 1940–Dec. 16, 1965, 56 Stat. 1354, 161 U.N.T.S. 193.

120. Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Feb. 2, 1971, T.I.A.S. No. 11,084, 996 U.N.T.S. 245 [hereinafter Ramsar Convention].

121. U.S. FISH AND WILDLIFE SERV., U.S. DEP'T OF THE INTERIOR & CANADIAN WILDLIFE SERV., ENV'T CAN., NORTH AMERICAN WATERFOWL MANAGEMENT PLAN (1986).

122. Agreement on Cooperation for the Protection and Improvement of the Environment in the Border Area, Aug. 14, 1983, U.S.–Mex., T.I.A.S. No. 10,827.

123. The La Paz Agreement created six binational workgroups to deal with border environmental issues of air, hazardous waste, water, pollution prevention, contingency planning, and emergency response. See MUMME, *supra* note 73, at IV.5.

124. The Border XXI Program builds on the efforts of the Integrated Border Environmental Plan and increases its scope to include environmental health and natural resource issues. See U.S.–Mexico Border Program, *Border XXI Program Framework Document Executive Summary*, (visited Aug. 9, 2000) <<http://www.epa.gov/usmexicoborder/ef.htm>>.

125. U.S. ENVTL PROTECTION AGENCY, EPA NO. 160-R-96-003, U.S.–MEXICO BORDER XXI PROGRAM: FRAMEWORK DOCUMENT (1996).

126. Released in 1992, the IBEP identifies priority environmental issues in the border area and projects aimed at addressing those issues.

and coordination of policies leading to the conservation of natural and cultural resources.¹²⁷

Pursuant to this letter, the agencies have collaborated on several projects in the Delta.¹²⁸ These activities are also reported under the Natural Resources Workgroup of Border XXI.¹²⁹ Most recently, in the spring of 2000, the Secretaries of each country's natural resource agency (DOI and SEMARNAP) signed a Joint Declaration to enhance cooperation in the Colorado River delta,¹³⁰ committing to coordinate research on transboundary species, establish compatible information systems, and develop strategies for environmental sustainability. While promising, the good intentions expressed in the Letter and the Declaration are not sufficient to protect the Delta until formalized in a treaty that, at a minimum, dedicates water to the Delta ecosystem.

One possibility for creating an effective binational agreement to dedicate Colorado River water to the Delta is to construct an environmental minute to the Treaty¹³¹ that allocates Colorado River water between Mexico and the United States. This treaty has already been amended to address Mexico's water quality concerns.¹³²

B. United States Federal Law and Legal Remedies

Independent of any binational effort to restore and protect the Colorado River delta, U.S. law could be used to require U.S. river managers to define and provide minimum instream flows for the purpose of preventing further harm to the endangered species that live in the Delta's habitats. The Endangered Species Act (ESA)¹³³ prevents federal agencies

127. Bruce Babbitt & Julia Carabias, Letter of Intent between the Department of the Interior of the United States and the Secretariat of Environment, Natural Resources, and Fisheries of the United Mexican States for Joint Work in Natural Protected Areas on the U.S.-Mexico Border 1-3 (May 5, 1997) (unpublished document, on file with author).

128. For further information contact agency representatives in the United States or Mexico (Javier De La Masa, Coordinador de Areas Naturales Protegidas, INE-SEMARNAP, Ave. Revolución 1425, Nivel 25, Colonia Tlacopac, San Angel Delegación Alvaro Obregon, Mexico Df, 01040 MEXICO; or Susan Lieberman Goodwin, U.S.-Mexico Coordinator, U.S. Department of the Interior, 1849 C St. N.W. (ms4426), Washington D.C. 20240).

129. See *Report from the Workgroup on Natural Resources to the U.S.-Mexico Border XXI National Coordinators Ensenada, Baja California*, (last modified Aug. 22, 2000) <<http://www.epa.gov/usmexicoborder/ef-nr.htm>>.

130. Babbitt & Carabias, *supra* note 98.

131. Treaty with Mexico Respecting Utilization of the Waters of the Colorado and Tijuana Rivers and of the Río Grande, *supra* note 62.

132. See Minute 242, *supra* note 63, at 1105.

133. 16 U.S.C. §§ 1531-1544 (1994).

from taking actions that harm¹³⁴ threatened or endangered species. Whether the ESA restricts agency actions when impacts are created across an international boundary is unresolved.¹³⁵ The National Environmental Policy Act (NEPA)¹³⁶ requires federal agencies to consider the environmental impacts of their actions, and Executive Order 12114¹³⁷ directs federal agencies to consider the environmental effects abroad of major federal actions. In 1997, the Council on Environmental Quality issued a memorandum directing all U.S. federal agencies to consider the environmental impacts of their actions, regardless of where those impacts might occur.¹³⁸ Even the BOR has implementing regulations that require analysis of the affected foreign environment in environmental reviews.¹³⁹ In the MSCP, the BOR and FWS, along with Arizona, Nevada, and California, are committed to a mandated planning exercise that will result in an application by the states to "take" endangered species in exchange for mitigation measures.¹⁴⁰ The MSCP is also intended to serve as a long-term compliance vehicle under the Endangered Species Act¹⁴¹ for federal agencies that must consult with the FWS concerning the impact of Colorado River dam operations on threatened and endangered species. Significantly, MSCP participants have excluded the Delta from the MSCP planning area,¹⁴²

134. Implementing regulations define harm to include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." 50 C.F.R. § 17.3 (1999).

135. The Supreme Court heard a case on this subject but declined to rule on the matter. See *Lujan v. Defenders of Wildlife*, 504 U.S. 555, 582 (1992).

136. 42 U.S.C. § 4321-4370 (1994).

137. Executive Order No. 12,114, 3 C.F.R. 356 (1980), *reprinted in* 42 U.S.C. 4321 (1994).

138. See Memorandum from Kathleen A. McGinty, Chair, White House Council on Environmental Quality et al., to Rosario Green, Minister of Foreign Affairs, Mexico et al. (July 1, 1997) (on file with author).

139. See Bureau of Reclamation, *Policy ENV-P03, National Environmental Policy Act policy*, (last updated Feb. 10, 1998) <<http://www.usbr.gov/recman/env/env-p03.html>>.

140. See Multi-Species Conservation Program (MSCP) for the Lower Colorado River, Arizona, Nevada, and California, 64 Fed. Reg. 27,000, 27,000-27,002 (1999). "Take" is defined in the Environmental Species Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." 16 U.S.C. § 1532(19) (1994); see *supra* note 134.

141. 16 U.S.C. § 1536 (a)(2)(1994).

142. "It is proposed that the MSCP will serve as a coordinated, comprehensive conservation approach for the lower Colorado River basin within the 100-year floodplain from below Glen Canyon Dam to the Southerly International Boundary with Mexico for a period of 50 years." Multi-Species Conservation Program (MSCP) for the Lower Colorado River, Arizona, Nevada, and California, 64 Fed. Reg. 27,000, 27,000-27,002 (1999).

despite the connection between the river's ecosystem both north and south of the international border.¹⁴³

Several environmental groups contend that the MSCP is not only biologically flawed, but also illegal.¹⁴⁴ The exclusion of the Delta prevents federal agencies from considering within the MSCP process the impacts of their actions on endangered species that depend on Delta habitat. It also prevents agencies from evaluating the possible benefits of mitigation in the Delta. Of the five MSCP priority species, three (the American peregrine falcon, the razorback sucker, and the Southwestern willow flycatcher) are listed by the FWS with reference to critical habitat in Mexico.¹⁴⁵ Another endangered bird on the lower Colorado River, the Yuma clapper rail, has been reported in the Delta at the Ciénega de Santa Clara.¹⁴⁶ United States conservation obligations under the ESA must be applied to endangered species found in the Delta even if these species are not found in the lower Colorado River in the United States, such as the desert pupfish, totoaba, and vaquita.¹⁴⁷ However, conservation goals of the MSCP do not include these species.¹⁴⁸ In the long run, FWS and other federal agencies may be forced to end the MSCP, reclaim the process, and complete a full examination of the effects of federal river operations on the viability of endangered species in the Delta.

Mexican law offers fewer possibilities for enhancing Delta habitat and preserving threatened and endangered species. The Mexican Constitution includes the Colorado River in the definition of national waters, but sets no policy for instream flows.¹⁴⁹ The National Water Law of 1992 clearly gives CNA authority over national waters, and 1994 regulations that implement the law provide for the use of national waters for ecological

143. When first established in 1995, the MSCP included representatives from environmental groups. In 1998, when MSCP participants voted not to include the Colorado River delta in the scope of the planning area, the environmental representatives withdrew.

144. See *Defenders of Wildlife v. Babbitt*, No. 1:00CV01544 (D.D.C. filed Jun. 28, 2000). See also *Defenders of Wildlife, Groups Sue U.S. to Protect Mexican Wetlands and U.S. Endangered Species* (visited Oct. 12, 2000) <<http://www.defenders.org/releases/pr2000/pr062800.html>>.

145. See 50 C.F.R. § 17.11 (1999).

146. See Erik Mellink et al., *Non-Breeding Waterbirds of the Delta of the Río Colorado, Mexico*, 68 J. FIELD ORNITHOLOGY 113, 114 (1997).

147. ESA consultation requirements apply to all agency actions affecting listed species, whether within United States or abroad. See *Defenders of Wildlife v. Lujan*, 911 F.2d 117, 123 (8th Cir.1990), *rev'd on other grounds*, 504 U.S. 555 (1992).

148. See generally Ogden Envtl. and Energy Services Co., Inc., *Lower Colorado River Multi-Species Conservation Program: Preliminary Species Conservation Goals* (August 28, 1998) (unpublished presentation to Lower Colorado River Multi-Species Conservation Program Biology Subcommittee), available in pieces at <<http://www.lcrmscp.org/files.html>>.

149. See Constitución Política de los Estados Unidos Mexicanos [Constitution], Art. 27.

conservation purposes.¹⁵⁰ The General Law of Ecological Equilibrium and Environmental Protection¹⁵¹ authorizes Mexico's biosphere reserves to protect areas of great biological diversity and unique ecological characteristics.¹⁵² To the extent that the ecological value of the Biosphere Reserve in the Delta is found in its wetlands, this law might serve as a tool to secure or protect adequate flows.

C. Related Issues and Opportunities

Given the many competing demands for water in the Colorado River basin, prospects for improving water management to benefit the Delta may be found in conjunction with other, related efforts. Several resource management issues related to management of the Colorado River or other water resources on the border may offer strategic opportunities for improving management of the Delta.

1. Colorado River Entitlements and the California Colorado River Water Use Plan

Collectively, states in the Upper Basin (Colorado, New Mexico, Utah, and Wyoming) do not presently use their full allotment of water, and (with the exception of New Mexico) are unlikely to develop their entire Colorado River water apportionments in the foreseeable future.¹⁵³ California currently uses just over 5.1 million acre-feet a year, including surplus water and a diminishing quantity of unused Lower Basin entitlements.¹⁵⁴ In an ongoing planning process for the California Plan, California has committed to reduce its use of Colorado River water by 2015.¹⁵⁵ One component of the California Plan is an agreement in 1999 between municipal water users in

150. Ley de Aguas Nacionales, su Reglamento y Ley Federal del Mar (1992, amended 1994).

151. The Ley General del Equilibrio Ecológico y Protección al Ambiente can be accessed at <<http://www.ine.gob.mx/uaj/lgeepa/index.html>>.

152. See VALDÉS-CASILLAS ET AL., *supra* note 12, at 56.

153. Development of Upper Basin water will be regulated under the Endangered Species Act. The most optimistic projections for development in the Upper Basin forecast full development for New Mexico by 2030, and Colorado and Wyoming in some year beyond the 60-year projection timeframe. Utah is not projected to develop its entire apportionment under these projections. See Memorandum from Wayne E. Cook, Executive Director, Upper Colorado River Commission, to Interested Agencies/Parties (Dec. 19, 1999) (on file with author).

154. Under the Supreme Court decree in *Arizona v. California*, 376 U.S. 340 (1964), California has the right to use 4.4 million acre-feet in normal years, plus the unused portions of Arizona and Nevada. In years when the Secretary of the Interior declares a surplus condition, California is entitled to use an additional 500,000 acre-feet (50% of a one-million acre-foot surplus), plus the unused surplus entitlement of Arizona and Nevada.

155. The Draft California Colorado River Water Use Plan may be accessed at <<http://crb.water.ca.gov/reports.htm>>. A final plan is expected in early 2001.

San Diego and irrigators in the Imperial Irrigation District to implement water conservation measures.¹⁵⁶

2. Surplus and Shortage Criteria

The Secretary of the U.S. Department of Interior has discretion to declare a surplus on the Colorado River, and has the subsequent responsibility to allocate surplus water among the states.¹⁵⁷ The Colorado River Compact¹⁵⁸ protects the Lower Basin states from shortage by requiring the Upper Basin states not to deplete flows to the Lower Basin based on an aggregate flow over a period of 10 consecutive years.¹⁵⁹ In compliance with the Compact, BOR managers keep Lake Mead, the reservoir behind Hoover Dam, near capacity, and in wet years must spill water to create space for spring floods—the releases that create flood flows to the Delta. Viewing these releases as “wasted” water, the Lower Basin states have proposed various off-stream storage opportunities to capture it.¹⁶⁰ Surplus declarations are presently made on an annual basis, but the Department of Interior, in early 2000, solicited comments on a 15-year plan that would allocate surplus based on a list of criteria.¹⁶¹ The Department of Interior’s initial surplus proposal will allow Lower Basin states to divert additional Colorado River water in years when Lake Mead exceeds prescribed elevations, thereby reducing the frequency and magnitude of flows to the Delta. A coalition of organizations has proposed interim criteria reflecting a tiered strategy that guarantees deliveries to satisfy the baseline needs of the Delta before any surplus flows for municipal and industrial uses, agriculture, or off-stream storage (including groundwater banking) could be allocated in the United States or Mexico.¹⁶² Under these criteria, flood flows for the Delta would be allocated before agricultural users could claim

156. See *Key Terms for Quantification Settlement among the State of California, Imperial Irrigation District, Coachella Valley Water District, and Metropolitan Water District* (last modified Oct. 15, 1999) <http://www.cvwd.org/wateriss/Key_Terms.htm> [hereinafter *Key Terms for Quantification*].

157. The Supreme Court established DOI’s authority to declare surplus in *Arizona v. California*, 376 U.S. 340 (1964).

158. See *supra* note 57.

159. See *id.* at art. III(d).

160. See PONTIUS *supra* note 1, at 32.

161. See Notice of availability of a draft environmental impact statement and public hearings for the proposed adoption of Colorado River Interim Surplus Criteria: INT-DES 00-25, 65 Fed. Reg. 42,028, 42,029 (2000).

162. See Letter from Mindy Schlingens-Wilson, Associate Director, Southwest Regional Office, American Rivers et al., to David Hayes, Acting Deputy Secretary, U.S. Department of Interior, & Robert Johnson, Regional Director, Lower Colorado Region Office, U.S. Bureau of Reclamation (discussing Colorado River Interim Surplus Criteria) (Feb. 15, 2000) available at <<http://www.pacinst.org/coriver.html>>.

any surplus, as well as before any off-stream storage uses. If and when the Department of Interior formalizes shortage criteria, environmental groups will demand that baseline flows for the Delta receive priority as well.

3. *Salton Sea*

Several proposals to improve the ecological conditions of California's Salton Sea, a large inland saline lake fed by agricultural drainage and lying in a former arm of the Colorado delta, would link the Sea to the current limit of the Delta and its estuary. To reduce and stabilize the salinity and elevation of the Salton Sea, resource managers have proposed several alternatives, including pumping Salton Sea water to the Gulf of California.¹⁶³ Any consideration of management options involving discharge of Salton Sea water to the Delta or Gulf of California will require Mexican involvement, and thus may present an opportunity for Mexico and the United States to consider binational measures for enhancing Delta ecosystems.¹⁶⁴ Another Salton Sea restoration proposal would have diverted up to 300,000 acre-feet of Colorado River flood flows from the mainstem at Imperial Dam in Arizona to the Salton Sea, significantly diminishing the quantity of water that would otherwise reach the Delta.¹⁶⁵

Were the effluent and wastewater now flowing into the Salton Sea managed with care in the Delta, they might bring some benefit to wetland ecosystems. For example, flood flows could flush away any buildup of pollutants or salinity. A new wastewater treatment plant in Mexicali—to be completed in 2001—will improve the quality of some of the effluent now sent via the New River to the Salton Sea. The plant is presently designed to discharge treated effluent into the New River and eventually empty into the Salton Sea. If instead this treated effluent is discharged into the Río Hardy basin, the Río Hardy wetlands might serve as part of the wastewater treatment process. Both the Mexican government and the U.S. EPA have indicated an interest in exploring options for using treated water to enhance Delta environments.¹⁶⁶

163. See Tetra Tech, Inc., *Salton Sea Restoration Project Environmental Impact Statement/ Environmental Impact Report* at 2-43, 6-27 to 6-34 (2000) (unpublished draft prepared for Salton Sea Restoration Authority & U.S. Bureau of Reclamation), available at <<http://www.lc.usbr.gov/~saltnsea/deistoc.html>>.

164. The transfer of Salton Sea water to Delta wetlands may increase pollutants and salinity in the Delta and adversely affect Delta wildlife.

165. See Tetra Tech, Inc., *supra* note 163 at 2-27, 4-27 to 4-29.

166. Telephone interview with Doug Eberhardt, Environmental Engineer, Water Management Division, U.S. Environmental Protection Agency Region IX (Jul. 1999); Telephone interview with Carlos Peña, Division Engineer, International Boundary and Water Commission (Apr. 1999).

4. Yuma Desalting Plant

A proposal by the BOR to operate the Yuma Desalting Plant¹⁶⁷ and market the resulting water would divert agricultural wastewater flows from the Ciénega de Santa Clara and replace the wastewater with concentrated brine.¹⁶⁸ The basin states are likely to increase pressure on the BOR to operate the plant in order to treat the MODE canal water to Minute 242 salinity standards. In this way agricultural wastewater could be counted as treaty water, freeing a like amount of upstream water for use by the basin states.¹⁶⁹ Operating the Desalting Plant would markedly reduce the area of the Delta wetlands and negatively impact wildlife and local residents who generate income as wildlife guides. A decision to operate the Desalting Plant will require an environmental assessment. In order to prevent damage to the Delta ecosystem, water supplemental to Mexico's Colorado River entitlements must be dedicated to support the Ciénega de Santa Clara.

5. All-American Canal and Delivery of Water to Mexico

Mexico relies on groundwater pumped from border region aquifers to augment its supplies,¹⁷⁰ but plans by California and Nevada to line the nearby All-American Canal will lower the water table in these aquifers.¹⁷¹ Mexico opposes these plans on the grounds that the seepage from the canal is "grandfathered"¹⁷²—in other words, a known condition that existed at the time the original treaty was negotiated, and, therefore, water to which Mexico is entitled. In addition, Mexico has requested that its entire allocation of water from the Colorado River be delivered at the Northerly

167. See *supra* note 43.

168. Telephone interview with Robert Johnson, Regional Director, Lower Colorado Region Office, U.S. Bureau of Reclamation (Jan. 2000).

169. At present, 110,000 acre-feet of saline agricultural wastewater flows to the Ciénega de Santa Clara annually, sustaining 50,000 acres of wetland habitat. See discussion *infra* Section II. Despite the inadvertent nature of the Ciénega's creation, any proposal that results in its destruction or degradation is certain to be challenged by environmental groups in both Mexico and the United States.

170. Mexico pumps approximately 100,000 acre-feet of groundwater per year that is directly attributable to seepage loss from the All-American Canal. See Douglas L. Hayes, *The All-American Canal Lining Project: A Catalyst for Rational and Comprehensive Groundwater Management on the United States-Mexico Border* 31 NAT. RESOURCES. J. 803, 805 (1991).

171. The Bureau of Reclamation estimates that the 29.9 mile reach of the All-American Canal from Pilot Knob to Drop 4 loses 91,600 acre-feet per year, most of which recharges the shallow aquifer in the northeast section of the Mexicali Valley. When the Canal is lined, groundwater depths are projected to drop from one to 30 feet in a 70 square mile region over 50 years. See U.S. Bureau of Reclamation, U.S. Dep't of the Interior, *All American Canal Lining Project: Imperial County California: Final Environmental Impact Statement/Final Environmental Impact Report*, at III-4, III-5 (1994).

172. See Hayes, *supra* note 170, at 806.

International Boundary,¹⁷³ one of two sites where water is currently delivered.¹⁷⁴ Resolution of these issues will require negotiations between the two countries, creating another opportunity to discuss water for the Delta.

D. Market Opportunities

The Law of the River, established historically and based on a system of equitable apportionment, creates entitlements to Colorado River water. Dedicating water to the environment after these rights have been established presents a challenge: how to secure water for instream flows while respecting existing entitlements? A potential solution is to compensate possessors of water rights.

The direct cost of water required for conservation of the Delta is considerable, although impediments to water transfers imposed by the Law of the River make it difficult to put a price on Colorado River water. Based on recent transactions between consumptive users of Colorado River water, it is possible to estimate the cost of an acre-foot of water between \$144 and \$233.¹⁷⁵ The cost of a permanent water right is greater by at least an order of magnitude, so securing permanent rights to a minimum annual baseflow of 32,000 acre-feet could cost at least \$46 to \$75 million. Securing the larger pulse flows needed on average every four years is a matter of policy and management changes rather than the acquisition of additional water rights, as Army Corps of Engineers Flood Release Guidelines¹⁷⁶ dictate the release of floodwaters. Additional direct costs will include on-site management and operation of a binational institution.

Market transactions offer several possibilities for conservation of the Delta's ecosystems, resulting in either water or funds that could be used to purchase water. Mechanisms have been established in recent years to allow for the market transfer of water rights, including water banking and

173. See PONTIUS, *supra* note 1, at 69.

174. Mexico's interest in receiving its entire allocation at the Northerly International Boundary (NIB) is twofold: (1) water delivered at the NIB can be diverted into the Central Canal, while water delivered at the SIB bypasses this diversion point; and (2) Minute 242 to the 1944 Treaty holds that water delivered at the SIB is not subject to salinity control. See Minute 242, *supra* note 63, at 1105.

175. In 1992, the Metropolitan Water District in southern California paid \$26.7 million to the Palo Verde Irrigation District to fallow 20,000 acres for two years, in order to bank 186,000 acre-feet in Lake Mead. See PONTIUS, *supra* note 1, at 31-32. In 1998, the San Diego Water Authority contracted with the Imperial Irrigation District for water purchased at a rate of \$233 per acre-foot. See *Agreement for Transfer of Conserved Water by and between Imperial Irrigation District and San Diego County Water Authority* (visited Sept. 8, 2000) <<http://www.iid.com/water/agmt/>> [hereinafter *Conserved Water Transfer Agreement*].

176. See generally U.S. ARMY CORPS OF ENGINEERS, *WATER CONTROL MANUAL FOR FLOOD CONTROL: HOOVER DAM AND LAKE MEAD, COLORADO RIVER, NEVADA AND ARIZONA* (1982).

water transfer agreements. Off-stream water banking in the United States has been established in several states as a means to move water between consumptive users.¹⁷⁷ To date, environmental resource agencies and private groups have not used these banks,¹⁷⁸ so changes may be needed in water banking provisions to allow a market-based approach to Delta preservation to succeed. Any such program will need to designate entities eligible to bank water for the environment, implement water transfer and purchasing programs, and support prospective water-banking regulations that allow timed releases to meet environmental needs.

1. Water Transfer Agreements

Two recent water conservation and transfer agreements in California set a precedent for future transfers. In 1989, the Metropolitan Water District of Southern California (MWD) and the Imperial Irrigation District (IID), located in southeastern California, signed a water conservation agreement enabling MWD to divert up to 106,000 acre-feet per year of conserved agricultural water through MWD's Colorado River Aqueduct.¹⁷⁹ A 1998 agreement between IID and the San Diego County Water Authority would allow the transfer of as much as 200,000 acre-feet of conserved water from agricultural users to the Authority.¹⁸⁰ These two agreements are driven by urban users' desire to increase the reliability of their supply of water. Each year since 1986, MWD, which supplies water to 16 million people in Southern California, has diverted more than 1.18 million acre-feet of Colorado River water through the Colorado River

177. For example, the Arizona Water Banking Authority has proposed to contract with California and Nevada to allow these states to store unused Colorado River water. The contracting state would pay to store water in Arizona, helping to replenish Arizona's aquifers, and in the future would be able to draw a similar quantity directly from the Colorado River. The program does not involve the sale of any future rights to water, only a specified quantity of unused water. See ARIZ. REV. STAT. ANN. § 45-2471 (West Supp. 1999).

178. Telephone Interview with Tim Henley, Manager, Arizona Water Bank (Jul. 10, 2000).

179. See NATIONAL RESEARCH COUNCIL, WATER TRANSFERS IN THE WEST: EFFICIENCY, EQUITY, AND THE ENVIRONMENT, 234-48 (1992) for a discussion of the water conservation agreement, and ROBERT STAVINS, ENVIRONMENTAL DEFENSE FUND, TRADING CONSERVATION INVESTMENTS FOR WATER (1983) for an appraisal of the conditions leading to the agreement. In 1984, the California State Water Resources Control Board held that IID was wasting water and ordered IID to implement water conservation programs. See California's State Water Resources Control Board's Decision 1600 of June 21, 1984, *aff'd*, Imperial Irrigation District v. State Water Resources Control Board, No. 58706 (Super. Ct. Cal. 1985), *rev'd in part* 231 Cal.Rptr. 283 (1986), *cited in* Hayes, *supra* note 170, at 813. IID's own Draft Water Conservation Plan (date January 31, 1985) identified potential conservation of 325,000 acre-feet annually. See Hayes, *supra* note 170, at 813. IID has rights to 3.1 million acre-feet, making it the largest single user on the Colorado River and an obvious party to water transfer agreements. See *Key Terms for Quantification*, *supra* note 156.

180. See *Conserved Water Transfer Agreement*, *supra* note 175.

Aqueduct to meet its customers' demand.¹⁸¹ Yet, of California's annual entitlement to 4.4 million acre-feet of Colorado River water, only 0.55 million acre-feet are apportioned to MWD.¹⁸² With the exception of the conserved water transferred from IID, MWD's diversion of Colorado River water in excess of its rights to 0.55 million acre-feet has come from Arizona and Nevada's unused Colorado River entitlements and, since 1996, from additional water released from Hoover Dam as "surplus" at the discretion of the Secretary of Interior.¹⁸³

These new agreements set powerful examples of water transfers, although they do not include environmental goals. Nevertheless, the agreements demonstrate that despite the tangle of rules embodied by the Law of the River, flexibility remains in the system. New provisions for interstate and interbasin water transfers can allow reallocation of developed water supplies to meet environmental demands. States in the Lower Basin already have proposed several approaches for marketing water among themselves. In the Upper Basin, Utah has expressed an interest in marketing its undeveloped Central Utah Project water to downstream users.¹⁸⁴ At least one holder of a senior water right in the Lower Basin has expressed an interest in marketing water to an entity that would deliver water to the Delta.¹⁸⁵ The prospect of claims by U.S. tribes opens the possibility that large, senior priority water rights might be available for purchase for instream flows. New provisions in U.S. and state law would have to address how water could be transferred across the international boundary, and open the market to allow participation by entities representing non-consumptive environmental and recreational uses. New legal provisions

181. Data derived from U.S. BUREAU OF RECLAMATION, COMPILATION OF RECORDS IN ACCORDANCE WITH ARTICLE V OF THE DECREE OF THE SUPREME COURT OF THE UNITED STATES IN ARIZONA V. CALIFORNIA: CALENDAR YEAR 1998, at 16-17 (1999), combining the record of MWD's consumptive use and "IID/MWD Water Conservation Program Phase 1 conserved water made available by IID for diversion in current year by MWD." *Id.*

182. Although California's Seven-Party Agreement of August 18, 1931, apportions 5.362 million acre-feet annually among California's water users, the 1929 California Limitation Act of March 4, 1929, 1929 Cal. Stat. ch. 16, and the 1964 decree, *see* U.S. BUREAU OF RECLAMATION, *supra* note 181, at 16-17, limit California's use of Colorado River water to 4.4 million acre-feet per year, of which the first three priority rights to a combined 3.85 million acre-feet belong to agricultural users in southeastern California and the fourth priority right to 0.55 million acre-feet belongs to MWD.

183. *See* U.S. BUREAU OF RECLAMATION, #DES 00-25, COLORADO RIVER INTERIM SURPLUS CRITERIA DRAFT ENVIRONMENTAL IMPACT STATEMENT 1-3 (July 7, 2000).

184. *See* Rodney T. Smith, *Water Marketing: Building Flexibility into Water Allocations*, 1996 PROCEEDINGS FROM THE COLORADO RIVER WORKSHOP 113, 139.

185. The Cibola Irrigation District in Arizona has offered to sell 22,560 acre-feet of marketable Colorado River water. *See* Letter from Dan Israel, Attorney for the Cibola Irrigation District, to Chelsea Congdon, then Senior Research Analyst, Environmental Defense (June 6, 1997) (on file with author).

would also have to define parameters for the price of water for environmental uses and for the duration of the transferred water right.

2. Environmental Damage Taxes

Charging the costs of ecosystem damages to Colorado River water users is another potential use of the market to secure water for environmental purposes. An accounting system that established mitigation and restoration surcharges on all water and power used in the basin, internalizing ecosystem damage costs, would provide a reliable and broad-based source of funds for Delta restoration. An alternative version of this idea is to levy a surcharge (in water or money) against all U.S. transfers of Colorado River water, with revenues going to restore critical habitat in the United States and Mexico or to purchase water for the Delta. Water purchased or leased for environmental purposes should not be subject to these surcharges. Any fees would be earmarked to protect the "public-good" values of the river, such as habitat, wildlife, and recreation, including protection and restoration of the Delta and upper Gulf of California. Revenues could be collected by an entity authorized to represent environmental uses in the water market, such as buying or leasing water for the environment, and to spend monies for habitat restoration projects. The eligible entity could be established in a binational agreement. This entity could then administer funds to organizations that undertake conservation activities.

3. Mitigation Banking

Finally, the United States could revise environmental regulations to allow mitigation transfers and mitigation banking programs to support Delta habitats. Healthy Delta habitats could offset damage to threatened species and habitat components elsewhere in the lower Colorado basin. In some instances, it may be easy to demonstrate that greater benefits would accrue from conservation measures in the Delta than in other areas of the basin.

B. Public Participation and Environmental Advocacy

The success of any effort to preserve Delta ecosystems, whether administrative, legal, or based on markets, hinges upon its ability to identify and include the interests and concerns of local people—the community of place. Many daily decisions that affect the health of Delta ecosystems, such as the treatment of riparian vegetation, are made at the local level. Communities in the Delta are most directly harmed by degraded ecosystem conditions. If local communities benefit from a conservation strategy, their

stewardship is likely to enhance the Delta's health.¹⁸⁶ Support from the broader conservation community—the community of interest—is also essential, for without pressure from broad constituencies, decision makers in the United States and Mexico are unlikely to put Delta conservation ahead of the demands of consumptive water users. Like many natural resource management institutions, those responsible for the Colorado River operate on a mechanistic, reductionist worldview.¹⁸⁷ The inertia of these institutions will require that NGOs press them to adopt a paradigm shift to a perspective that provides products and services within a broader social and ecological context.

1. Local Communities and Advocacy

People living in the Delta region continue to depend on the ecosystem, from fishermen in the Gulf of California to burgeoning ecotourism operators.¹⁸⁸ To the extent that conservation plans include these economic interests, local communities will advocate for them, and will have the incentive to be good ecosystem stewards.

The Delta generates significant economic activity in addition to irrigated agriculture. Three communities—El Golfo de Santa Clara, San Felipe, and Puerto Peñasco—continue to rely on fishing as the basis for their culture and economy.¹⁸⁹ Sixteen tourist camps located near the confluence of the Río Hardy and the Río Colorado are used by visitors from Mexico and the United States for fishing, hunting, and other water-based recreation, and local residents work as guides for these visitors.¹⁹⁰ Many communities in the Delta rely on riparian forests for fuel wood. One community produces catfish in an aquaculture facility.¹⁹¹

Approximately 600 Native Americans live in the Delta region, some 200 of whom are *Cucapá*.¹⁹² No longer able to engage in their traditional subsistence practice of harvesting Palmer's salt grass, which has limited reproductive capability without regular flooding to disperse seeds, the *Cucapá* have looked to other harvests that the Delta supports. Members of

186. See BOB DOPPELT ET AL., ENTERING THE WATERSHED: A NEW APPROACH TO SAVE AMERICA'S RIVER ECOSYSTEMS 62 (1993).

187. See generally Winifred B. Kessler et al., *New Perspectives for Sustainable Natural Resources Management*, 2 ECOLOGICAL APPLICATIONS 221 (1992).

188. See VALDÉS-CASILLAS ET AL., *supra* note 12, at vi-vii.

189. See *id.* at 50.

190. See *id.* at 51.

191. See *id.*

192. See *id.* at 48.

several *Cucapá* settlements (*ejidos*) hunt and fish in the Delta,¹⁹³ but diminished river flows have forced many to truck their boats miles to reach the nearest waterways, and many travel farther to find work in the agricultural fields of the Mexicali Valley.¹⁹⁴ The *Cucapá* people have the only licensed commercial fishing operation in the Delta, with tribal rights to fish for Gulf corvina and shrimp.¹⁹⁵ However, subsistence fishing, hunting, and gathering are no longer common, and many *Cucapá* work as hunting and fishing guides and sell arts and crafts to tourists.¹⁹⁶

Current debates over the Delta's future assume the support of Delta residents for ecosystem conservation. U.S. environmental groups act as if the benefits of conservation that would accrue to local communities outweigh the costs to the local communities. Yet human-induced threats to Delta ecosystems include local activities, not just damage from the absence of water. Overfishing has depleted Totoaba stocks.¹⁹⁷ Agricultural activities can result in the loss of native vegetation. People living in the Delta rely on local natural resources, and unless their subsistence needs are met, local pressures on the resource will continue. Successful examples of ecosystem protection in inhabited landscapes, such as Chitwan National Park in Nepal and Matobo National Park in Zimbabwe, demonstrate that protected area management can be structured to allow direct harvest of resources.¹⁹⁸ There are also ways to reduce locals' demand on ecosystem resources by developing alternative income sources. Although some ecotourism exists in the Delta, the potential for its expansion has not been well researched. The management plan for the Delta's Biosphere Reserve¹⁹⁹ recognizes that local communities have subsistence needs, but need greater incentives to shift from patterns of resource use to other income-generating activities.

Several agencies and organizations working on Delta restoration have sought input from communities in the Delta concerning strategies to improve Delta ecosystems. Two Mexican organizations, PRONATURA Sonora and the Intercultural Center for the Study of Deserts and Oceans

193. In 1937, Lazaro Cardenas, Mexico's forceful and popular president, ordered the creation of the first 67 *ejidos* in an effort to reform land tenure. The Cardenas reforms triggered the first wave of migration to the upper Delta. See WILLIAM DEBUYS & JOAN MYERS, *SALT DREAMS* 141-44 (1999).

194. See Peggy Boyer, *Colorado River Water*, CENTRO INTERCULTURAL DE ESTUDIOS DE DESIERTOS Y OCEANOS NEWS, Spring/Summer 1998, at 25.

195. See CARLOS VALDÉS-CASILLAS ET AL., *WETLAND MANAGEMENT AND RESTORATION IN THE COLORADO RIVER DELTA: THE FIRST STEPS* 17 (1998).

196. See VALDÉS-CASILLAS ET AL., *supra* note 12, at 50.

197. See Tom Knudson, *Sea of Cortez Teeming with Greed*, SACRAMENTO BEE, Dec. 10, 1995, at A1.

198. See JOHN A. DIXON & PAUL B. SHERMAN, *ECONOMICS OF PROTECTED AREAS* 65 (1990).

199. See generally CENTRO DE INVESTIGACIONES CIENTÍFICAS Y TECNOLÓGICAS DE LA UNIVERSIDAD DE SONORA ET AL., *supra* note 81.

(CEDO), have been effective in soliciting local involvement,²⁰⁰ but no established community or environmental organization has yet emerged as the primary facilitator of local involvement and advocate for local interests. One important development is the recent grassroots organization of local interests in the Delta. During the summer of 1999, Delta residents formed the *Asociación Ecológica de Usuarios de los Ríos Hardy y Colorado* to share information and seek consensus on the issues affecting the area, to promote ideas to improve the management of the Delta's natural resources, and to develop sustainable development projects.²⁰¹ The Association's membership includes broad representation, including individuals who work in the fishing industry, tourism, and agriculture, as well as other stakeholders with an interest in the use and management of the resources of the Río Hardy-Colorado River region. As restoration of the Delta ecosystem progresses, this group and others may take on additional stewardship activities best conducted by local communities, such as monitoring habitats.²⁰²

3. NGOs and International Advocacy

People from all over the world—the community of interest—would like to see Delta ecosystems restored and have a role to play in Delta conservation as well. Absent legal action, public resources are not likely to be dedicated to Delta restoration unless a large and vocal constituency insists that it be made a conservation priority. Institutions presently controlling use of Colorado River water have historically protected the interests of water consumers, a dynamic not likely to change without significant pressure from people who want a healthy Colorado River delta ecosystem. The National Environmental Policy Act of 1969²⁰³ obligates U.S. agencies to consider all interests as they make resource management decisions in the lower Colorado basin, but to date the BOR has not considered the full range of stakeholders. In Mexico, no legal mandate requires CNA to consider environmental interests.

Given that Mexico and the United States have historically been slow to advance Delta conservation, NGOs have an important role to play in assuring that alternatives to consumptive water use are considered. Public interest groups on both sides of the border have worked to coordinate their response to Delta threats. Groups from both countries have worked

200. See generally Elena Chavarria, *Public Involvement in the Management and Restoration of the Colorado River Delta* (unpublished manuscript, on file with author).

201. See Nijhuis, *supra* note 42, at 1. For more information, contact the Ecological Association for the Users of the Hardy-Colorado River via Jose Luis Blanco Argil <jlblanco@campus.gym.itesm.mx>.

202. See DOPPELT ET AL., *supra* note 186, at 66-67.

203. 42 U.S.C. § 4321-4370 (1994).

together to establish the Delta as a conservation priority, conduct research, educate, forge coalitions, encourage dialogue, and address the needs of people who live near the Delta and depend on its resources.²⁰⁴ A small portion of these activities has been supported by U.S. agency dollars, but the majority has been funded by the philanthropy of foundations and individuals.

NGO advocacy efforts are increasing as NGOs accumulate a growing understanding and appreciation of Delta ecosystems as well as the mounting list of evidence that U.S. government agencies are not establishing Delta conservation and restoration as a priority. A number of NGOs and individuals concerned about the Delta have formed an informal caucus²⁰⁵ to

- facilitate recognition of currently unheard voices for conservation;
- halt degradation and restore ecological and sustainable social conditions;
- identify alternative water sources;
- seek specific water allocation for Delta conservation;
- demand that U.S. water managers consider the effects of U.S. actions on Mexican Delta resources;
- monitor species dependent on flows;
- increase scientific understanding of conservation needs including an inventory of Delta resources and collection of information relevant to adaptive conservation management;
- stop toxic threats;
- relate economic health to ecosystem health;
- enhance local cultures; and
- recognize the importance of recreation and fisheries.

The significance of this caucus cannot be overstated; together the member organizations represent Delta residents, more than a dozen scientific organizations, and hundreds of thousands of voters. If this group coordinates its activities, it has the potential to become a formidable voice in the politics of Delta conservation.

204. See *supra* note 52. See also Pacific Institute, *Workshop Proceedings, Water Issues in the Colorado River Basin Border Region* (Nov. 18-19, 1999) (visited Sept. 8, 2000) <<http://www.pacinst.org/coloradopro.pdf>>.

205. See *supra* note 52. For more information on this informal caucus, contact the author at Environmental Defense (jennifer_pitt@environmentaldefense.org).

V. CONCLUSION

Saving the Delta from further decline and shoring up resources to improve the quality of its habitats will require substantial long-term commitments by numerous stakeholders. The challenges are many, including the arbitrary obstacle of a political border that severs the Delta from its watershed; the distrust across an international border; the heterogeneity of institutions implicated in the Delta's conservation; the archaic Law of the River that focuses on offstream water developments and consumptive use instead of a more modern interest in instream flows, environmental restoration, and the ecological values of the Delta; the need for specific, codified water deliveries to the Delta; and the need for a binational agreement between Mexico and the United States that requires the commitment of governments and local communities to manage for the Delta ecosystem's health.

These challenges are considerable, yet surely less imposing than the cumulative cost and complexity of the construction of storage and diversion projects on the Colorado River. The cost of dessication and loss of remaining emergent wetland and riparian habitat in the Colorado River delta, and the loss of myriad terrestrial and aquatic species these habitats support, cannot be calculated. Clearly these costs would be unacceptably high. The value society places on nature today is reflected in environmental laws such as the U.S. Endangered Species Act and the billions of dollars in voluntary contributions given each year to environmental organizations. Mexico has made a significant commitment to the Delta in declaring it a biosphere reserve, and both the United States and Mexico have laid the foundation for substantive conservation management in their Letter of Intent and Joint Declaration. Both nations are ruled by democracies that ostensibly represent their citizenry and govern for their benefit. The Colorado River was developed in the twentieth century by a society determined to tap natural resources for economic gain; surely the river's Delta can be preserved in the twenty-first century by a society determined to conserve natural ecosystems.