Binational Workshop for Wildlife Management and Wetland Restoration in the Colorado River Delta

• CECARENA - ITESM Campus Guaymas
• Environmental Research Laboratory
  University of Arizona
• Sonoran Institute
• Pronatura Sonora
• Reserva de la Biosfera del Alto Golfo de California y Delta del Rio Colorado

Program and Abstracts

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Sponsors

North American Wetlands Conservation Council (NAWCC)
ITESM Campus Guaymas
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Sonoran Institute
Pronatura Sonora
Reserva de la Biósfera del Alto Golfo de California y Delta del Río Colorado
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This workshop has been completed with the support from the North American Wetland Conservation Council (NAWCC), through the projects: "Information System and Local Outreach Program for the Restoration and Management of the Hardy River, Lower Colorado River Delta, Baja California and Sonora, México" (14-48-98210-97-G027) and "Wetland Management in the Hardy River. Phase 2: Demonstrative Sites for Management and Outreach" (14-48-98210-G011).
Wetlands of the Colorado River delta have had a restoration and enhancement process since the first months of 1997, not only in environmental terms by receiving excess water flows, revegetation, and recovery of wetland functions and values, but also in scientific and social terms, in which the importance of this ecosystem has been documented and presented at international and national forums, and with delta communities assuming responsibility for their environment.

These results are part of a binational, multi-institutional effort started in 1997, with the participation of universities, NGO’s, government agencies and local communities of both Mexico and the United States. The institutions that are participating in this effort to restore and conserve the wetlands in the Colorado River delta include: Centro de Conservación y Aprovechamiento de los Recursos Naturales (Center for Conservation and Use of Natural Resources) CECARENA/ITESM Campus Guaymas, Pronatura Sonora, Biosphere Reserve of the Upper Gulf of California and Colorado River Delta, Environmental Research Laboratory of the University of Arizona, Sonoran Institute, Department of Earth Sciences of California State University/Dominguez Hills, Environmental Defense Fund, Pacific Institute, Oregon State University, Southwest Center for Biological Diversity, and the North American Wetland Conservation Council, among others.

During the first year, work was focused toward the integration of a geographic information system (GIS) as a support tool for restoration activities, the design and set-up of a local outreach program for the involvement of the delta communities in the restoration process, the analysis of water flows and water quality from different sources, and the classification and analysis of the wetland vegetation of the Colorado River delta. Potential sites for management and restoration were also identified, as well as management recommendations.

With the completion of these activities, several important results have been obtained, which have let us notice the great importance of these wetlands, their threats and their main environmental problems, the conservation and restoration opportunities, and the social and cultural values that surround this riparian system, which represent one of the most important solid bases in this process. The development of this project has considered a multi-disciplinary and multi-institutional approach in order to incorporate diverse perspectives for the identification of critical issues of these wetlands and for their comprehensive management in Mexico.

During 1998, wetlands of the Colorado River delta are still enjoying excess flows through the Colorado River coming from the U.S. in large volumes. These freshwater inputs have created a very different perspective of society toward the delta, and it has become a major issue all over the Southwest U.S. region and Northwest Mexico, with conferences, meetings, papers, newsletters, TV documentaries, museum exhibitions and newspaper sections being devoted to it. Now the perspective of the delta communities is being shared and understood by an increasing number of people, and this inertia is moving the institutional barriers that have been deteriorating the Colorado River delta ecosystem since several decades ago.

For this year, the main purpose has been to establish three management Demonstration Sites for the wetland complexes of the Hardy and Colorado rivers, that would describe management techniques for riverine and palustrine habitat restoration, to improve water quality, to maintain and increase wetland functions and values, and to establish a coordinated structure for a multi-institutional participation in the ecosystem management approach for the Lower Colorado River.

To facilitate the implementation of management actions, the work has focused on five main components: GIS enhancement and update, public involvement and participatory management workshops, ecosystem assessment, demonstration sites workshops, field work, and the establishment of a multi-institutional participation structure for the conservation of the Colorado River delta wetlands.
These activities allowed us to establish a closer relationship between the needs of local communities, the restoration process, and the practices of governmental agencies, and also start a process for identifying specific management guidelines for different zones in the delta that would support habitat restoration and community development, through scientific evaluation and community participation. Also, a consolidated group of several institutions in Mexico and the United States for the conservation of the Colorado River delta has been conformed, and several strategies have been implemented for their communication as a key element in the discussion of water and wildlife issues with managers and policy makers.

The results shown are just the first achievements of a long term process. There are still several goals to reach, and the most important is that the value of the Colorado River delta ecosystem is being recognized more and more everyday by communities, governments, and scientists of both nations.

II-The Binational Workshop for Wildlife Management and Wetland Restoration in the Colorado River Delta

The Binational Workshop for Wildlife Management and Wetland Restoration in the Colorado River Delta is one of the components of this binational effort to conserve the delta ecosystem. It is part of the activities to achieve an ecosystem assessment of the delta region, to establish a multi-institutional participation structure for the conservation of the Colorado River delta wetlands, and for setting specific management guidelines for different zones in the delta that would support habitat restoration and community development.

The purpose of the workshop is to bring together the scientific, academic, and environmental NGO’s community in order to determine the ecological-environmental status of the Colorado River delta, with emphasis on specific wildlife groups (birds, mammals, fish, amphibians/reptiles and vegetation/habitat); as well as to identify environmental threats and conservation/restoration opportunities, and to know their perceptions and ideas about the proposed management strategies for the restoration of this ecosystem.

The three-day workshop will include presentations of current issues of the Colorado River delta, results obtained on vegetation/habitat value and water requirements to maintain the delta ecosystem, needs and proposals of the delta communities, and the proposed management strategies for the restoration of these wetlands.

The main component of the workshop will be the working sessions and a field trip, which will be held with groups conformed by experts in different wildlife topics. Seven groups will be conformed (this may vary according to the number of participants), and each group will focus on a specific geographic area of the delta. During the first day, the groups will do the planning for the field work on the wetlands of the Colorado River delta. This plan will include the definition of field trip objectives, expected results, and the geographic area that each group will cover, with the purpose to study the diverse habitats existing in the delta.

The field trip to the wetlands will include a rapid assessment of the status of each one of the mentioned wildlife groups, with emphasis on the identification of habitat threats and conservation/restoration opportunities. The field visit will also be a good opportunity for participants to evaluate proposed management strategies and community proposals.

On the last day, participants will present their findings in group sessions, along with their ideas and perceptions on the proposed management strategies and community needs and proposals. Finally, a working session will be devoted to identify future steps for this effort, and to conform a network for information exchange among the diverse institutions working in the delta area.
Binational Workshop for Wildlife Management and Wetland Restoration in the Colorado River Delta

CECARENA ITESM Campus Guaymas - ERL / University of Arizona - Sonoran Institute

Tuesday December 1st

3:30 PM  Registration of Participants.

4:00 PM  Inauguration - Welcome.
   José Campoy - Biosphere Reserve of the Upper Gulf of California and Colorado River Delta

4:05 PM  Presentation of Workshop - Presentation of Participants.
   Francisco Zamora - CECARENA - ITESM Campus Guaymas

4:20 PM  Introduction to the Colorado River Delta.
   Carlos Valdés - CECARENA - ITESM Campus Guaymas

4:35 PM  Hidrological History, Current Status, and Threats of the Colorado River Delta
   Edward P. Glenn - ERL/University of Arizona
   Mark Briggs - Sonoran Institute

4:55 PM  Presentation of Management and Restoration Requirements.
   Francisco Zamora - CECARENA - ITESM Campus Guaymas

5:15 PM  Presentation of Community Needs and Proposals
   Yamilett Carrillo - CECARENA - ITESM Campus Guaymas

5:30 PM  Wildlife Protection in the Colorado River Delta
   José Campoy - Biosphere Reserve of the Upper Gulf of California and Colorado River Delta

5:50 pm  Break.

6:00 pm  Organization of Multispecific Groups.
   Facilitated by Carlos Valdés - CECARENA - ITESM Campus Guaymas

6:10 pm  Presentation of Field Work Purposes, Operation and Areas with Special Interest.
   Carlos Valdés - CECARENA - ITESM Campus Guaymas
   Edward Glenn - ERL - University of Arizona

6:30 pm  Definition of Objectives, Methodology, Expected Results, and Field Trip Plan.
   Facilitated by Francisco Zamora - CECARENA - ITESM Campus Guaymas

7:20 pm  Presentation of the Plan by each Group.

7:45 pm  Final Comments, Questions, and General Plan for Next Day.
   Facilitated by Carlos Valdés - CECARENA - ITESM Campus Guaymas

8:00 pm  Dinner.
Wednesday December 2nd - Field Work

6:00 AM Breakfast
6:30 AM Departure from Mexicali to the wetlands of the Colorado River delta.*
12:00 PM Lunch at Field Site.
6:30 PM Campo Mosqueda Meeting - Dinner.

Functional Restoration of Large River Systems with Focus on the Connectivity and Function of Off-Channel Habitats - Dr. Dixon Landers - Oregon State University

* Each group will go on a vehicle with a group coordinator. As suggested on the 1st day.

Thursday December 3rd

7:00 AM Breakfast.
8:00 AM Begining - Logistics.

Carlos Valdés - CECARENA - ITESM Campus Guaymas

8:15 AM Group work: Organization of Results, Determination of Status by Areas, and Identification of Environmental Threats and Opportunities for Restoration.

Facilitated by Edward Glenn - ERL - University of Arizona

8:55 AM Presentation of Results by Group.
9:25 AM Round Table by Group of Proposed Management Strategies.

Facilitated by Mark Briggs - Sonoran Institute

9:55 AM Round Table by Group of Community Needs and Proposals.

Facilitated by Yamilett Carrillo - CECARENA - ITESM Campus Guaymas


Facilitated by Francisco Zamora - CECARENA - ITESM Campus Guaymas

10:55 AM Break
11:20 AM Presentation of Results by Group.
12:00 PM Conclusions for the Management and Restoration of the Wetlands of the Colorado River Delta.

Moderated by Carlos Valdés - CECARENA - ITESM Campus Guaymas

1:00 PM Integration of a Network - Planning Round Table for Future Activities.

Facilitated by Francisco Zamora - CECARENA - ITESM Campus Guaymas

1:30 PM Final Remarks.

Carlos Valdés - CECARENA - ITESM Campus Guaymas

2:00 PM End of the Workshop.
2:10 PM Lunch.
Introduction to the Colorado River Delta
Carlos Valdés-Casillas, Osvel Hinojosa-Huerta, Francisco Zamora-Arroyo, and Yamilett Carrillo-Guerrero
CECARENA/ITESM Campus Guaymas • Edward Glenn - Environmental Research Laboratory - University of Arizona • Mark Briggs and Steve Cornellius - Sonoran Institute

The Colorado River delta, the last portion of one of the most human-developed rivers, is still the largest desert estuary in North America, which provides a critical interface with the marine ecosystem of the Upper Gulf of California. Historically, it has supported vast riparian, freshwater and brackish wetlands, which are uniquely valuable due to their high productivity compared to the surrounding desert ecosystems (Glenn et al, 1996). It is located between the states of Baja California and Sonora, México, in the Mexicali and San Luis Rio Colorado agricultural valleys (INEGI, 1995; CNA, 1997). Significant remaining delta wetlands include: the Colorado delta riparian corridor, the Hardy/Colorado wetlands, the Ciénega de Santa Clara, the El Doctor wetlands, the Laguna del Indio, and large intertidal wetlands supported by the extreme tidal ranges in the Upper Gulf of California.

This region presents important ecosystems and with high ecological importance within the Lower Colorado River, the Sonoran Desert, and the Upper Gulf of California, since it provides critical habitat for migratory and resident waterbirds, and several fisheries with high economic value. Because of the construction of the dam system that controls and distribute Colorado water in the U.S.A. and México, fresh water flows to the delta are scarce and to the Gulf of California are almost inexistent. This situation has caused severe ecological damages, including the reduction of the wetland area, the invasion of non-native species, and the reduction of critical areas for endangered species. For these reasons, the Colorado River delta was considered a lost ecosystem for several decades. However, the results obtained up to now show that the Colorado River delta in México currently present a richer and more diverse set of ecosystems than the stretch of river below Grand Canyon in the United States, even though that stretch is 5 times longer and has a perennial flow of water. These results also show that important ecosystem functions in the Colorado River delta can be protected and maintained with only a small amount of the native river flow, supplemented with “poor” quality water unsuited for human use, such as agricultural return flows.

Conservation of the delta ecosystem is threatened by several actions proposed in the United States, which would impact the flow of water across the border. Also, the treaties governing water allocation between the United States and Mexico did not incorporate environmental considerations. Since the functions and values of these wetlands provide benefits to both sides of the border ignoring political boundaries, their management and restoration should be considered as a shared responsibility among the two countries. Therefore, support from international, national, state, and local environmental laws, programs, and agreements need to be adapted under a comprehensive regional approach.

Hidrological History, Current Status, and Threats of the Colorado River Delta
Edward P. Glenn - ERL/University of Arizona • Mark Briggs - Sonoran Institute

Generally, the Colorado River mainstem south of the international border and its delta contain three wetland ecosystem types: riparian deciduous forest and woodland, interior marshland, and maritime submergent mud flats. Forest and woodland riparian plant communities, including cottonwood-willows (Populus - Salix) associations, are found along reaches of the Colorado River mainstem, as well as secondary channels and backwater sloughs, that are subject to the lotic energies of periodic river flooding. Towards the southern portion of the study area, the El Doctor and Ciénaga de Santa Clara wetlands contain significant marshland communities that are dominated by cattails (Typha sp.).
The edges of these marshland areas are characterized by an intermingling of aquatic vegetation with such woody species as saltcedar (*Tamarix pentandra*) and salt bush (*Atriplex lentiformis*) that tend to dominate surrounding, slightly elevated lands. The presentation will describe these wetland ecosystems and the methods that were used to delineate them. In addition, there will be a description of the Colorado River flow characteristics that were responsible for establishing and maintaining these wetland ecosystems. The principal threats to these critical wetland ecosystems will also be discussed.

Management and Restoration Opportunities in the Colorado River Delta

Carlos Valdés-Casillas, Osvel Hinojosa-Huerta, Francisco Zamora-Arroyo, and Yamilett Carrillo-Guerrero

*CECARENA/ITESM Campus Guaymas • Edward Glenn - Environmental Research Laboratory • University of Arizona • Mark Briggs and Steve Cornellius – Sonoran Institute*

During this decade, the Colorado River delta wetlands are for the first time perceived in terms of environmental management, and the government agencies and society are finally appraising the importance and values of these areas (Payne et al, 1992, Morrison et al, 1996; Briggs and Cornelius, 1997).

The opportunity to restore wetlands in the delta is now feasible since upstream water impoundments are filled and flood flows are once again being directed to the delta; however, effluent waters must be relocated to the wetlands rather than to evaporative basins. These wetlands can be maintained and restored through effective management of such residual flows and other non conventional water sources within the delta.

Based on environmental, cultural, social and economical criteria, wetlands of the Colorado River delta located outside the Biosphere Reserve of the Upper Gulf of California and Colorado River Delta were divided into three management areas: the Colorado Delta Riparian Corridor, Hardy/Colorado Wetlands, and El Indio Wetlands System. General management and restoration strategies were defined for each of this areas, in order to protect and enhance wetland functions and values, promote sustainable development of the delta communities and provide a transition zone among intense resource uses in the Mexicali agricultural valley and the Biosphere Reserve. These management and restoration strategies, which were conceived through evaluation of habitat, water sources, environmental problems, restoration opportunities, and community perceptions, are the first steps toward a detailed management and restoration program for these wetlands.

**Riparian Corridor of the Colorado River delta**

This zone is the northern area of the delta wetlands. It is conformed by the Colorado River Stream, which is bordered by levees, creating a narrow and delimited wetland. The corridor includes the vegetation zones 1, 2, 3 and part of 4, according to the vegetation classification index (Appendix).

General management and restoration strategies for this zone include maintaining fresh water inputs through the Colorado River at 4.0x10^7 m³ every year, with excess flows of 4.0x10^8 m³ every four years. Other strategy is the implementation of a protection category for the area, in order to change the current view by U.S and Mexican authorities that this is an area for waste water, as well as to establish a coordination process with CNA (National Water Commission) for management of the area, since it is the responsible agency for water issues.

Human activities in the wetland area are limited, except for certain identified spots, which are used by local communities for low impact-traditional activities as subsistence and recreational fishing and swimming. Sustainable use of wetland resource at traditional sites will be promoted while maintaining wetland functions.

**Hardy/Colorado Wetlands**

This wetland area is located in the middle zone of the delta, with influence of excess flows, agricultural drain water and tides. This is a wider area with diverse habitat types including willow-cottonwood, transitioning to saltcedar-cattail. This wetland complex includes the vegetation zones 4 and 5.

General management and restoration strategies include the establishment of infrastructure for habitat enhancement in coordination with local communities and CNA, which may include dredging of sedimented streams, opening of old river streams that have been closed by CNA operations, and the construction of small water reservoirs or lagoons. Human activities in this area are more related to wetland resources. Main activities include tourism, commercial and subsistence fishing and hunting. The maintenance of this type of resource uses is
recommended, with a management and development program for each activity. Another strategy is the implementation of alternative sustainable activities by local communities, diversifying resource uses and eliminating inadequate practices.

**El Indio Wetland System**

This wetland system reaches the limits of the Biosphere Reserve, in the vegetation zones 5, 6, and 7. Water inputs are mainly agricultural drains and tides, with influence of excess flows only when their volume is high. Dominant vegetation is saltcedar-cattail-common reed, with extense salt grass flats.

General management and restoration strategies include promoting the importance of this wetland area among governmental agencies and obtaining their recognition and approval to protect them, specially from CNA; and to establish coordinated efforts with CNA to use agricultural drainage water to maintain wetlands’ functions and values, and avoid their destruction caused by modifications on hydraulic infrastructure. Other strategies include directing and maintaining water in strategic sites in order to enhance habitat value. Human activities are very limited because access and travelling is difficult in the wetland area. Only certain areas are used for hunting and fishing, both touristic and subsistence, by few people. The mainteinance of this type of resource use is recommended, with a management and development program for each activity.

**Community Needs and Proposals in the Colorado River Delta**

Elena Chavarria Correa and Arturo Escamilla Medina - Pronatura Sonora • Carlos Valdés, Osvel Hinojosa, Yamilet Carrillo, Francisco Zamora - CECARENA/ITESM Campus Guaymas

Wetlands of the Colorado River delta have had mystic attributes for the indigenous and rural people of the river. They symbolize the old traditions and innovative uses of natural resources: body, soul and sustain means of the inhabitants. The community outreach tangible steps arised from the management and restoration initiative of this project, are a genuine expression of the vitality of the Colorado River delta wetlands today. The challenges for a community driven commitment to consider the natural environment as another "user" of the Colorado waters are immense: listening to these communities, building team work among them, and promoting support from local government and conservation NGO's. This is a process we have build through community workshops among the river delta communities, which goal is to make a clear connection between people, present threats to the environment and a common future vision of their restoration: community stewardship being the base line.

As deliverables from these workshops to the same community members, they have produced the following key information: extensive lists of common resources and their users; a visual distribution of these resources in local charts and maps; environmental priority problems resulting from human impacts, through the use and abuse of such resources; alternative productive activities to sustain the current use of these resources; a detailed written description of a future vision of the environment and their quality of life, addressing specific attributes which imply a present change of attitude; and the message they want to state to water managers in the United States and Mexico.

People are expressing now their true expectations, concerns, and daily life needs: Water is their main concern, resource and conflict:

- Water sustains agriculture, fisheries aquaculture, game, tourism and cattle raising.
- Water is needed in greater volumes in the Colorado flow.
- Water is not treated in urban settlements, agricultural fields and industry.
- Lack of water produces sedimentation of the river bed.
- Polluted water affects fisheries.
- Poor water quality (high salts content) received in the lower areas of the delta, affect wildlife and human activities related to wetland resources.

Water management quotas established in the past between Mexico and the United States, create complicated political and social scenarios derived in apathy among rural and indigenous communities.
Regardless of the overwhelming list of obstacles, participants to the workshops have expressed their will to become involved in decision making processes affecting a vision they have stated regarding the natural environment:

"To be able to have a reforested landscape, with native plants and allow the river to flow constantly, avoiding sedimentation. To become skilled to use more efficient tools for commercial fishing and to be able to develop an aquaculture site at Laguna Salada and Campo Flores. To attract national and foreign tourism and conduct with them activities focused on environmental enhancement like cinegetic ranches. To plant dates, figs and mesquite fields associated to apiculture. To promote goats and guad nursery."

-Agricultors, fishermen, Cucapa people, and tourism promoters at Campo Mosqueda

"People from Ciénega de Santa Clara would be national and international recognized by their resource management practices and the Cié nega would have the natural conditions to support fish and bird life. The current productive projects (aquaculture and ecotourism) are growing and better, and they generate jobs and resources to provide the community with water supply, phone and roads, a sports center, a health center and a secondary school; everything constantly guarded."

-Teachers, agricultors, fishermen, and ecotourism promoters at Ciénega de Santa Clara

Institutional agendas have found points of concurrence on wetland restoration in this program. Community action has began with the establishment of committees; Thus a sense of belonging by an increasing number of sectors in the communities and their willingness to coordinate and cooperate in this binational effort are their most valuable milestones.

Functional Restoration of Large River Systems with Focus on the Connectivity and Function of Off-Channel Habitats

Dr. Dixon H. Landers - Oregon State University

Background

River “restoration” is rapidly becoming a concept without meaning as it is used in many different ways by scientists, land managers, policy makers and consultants. I use restoration to mean a strategic systems approach to reestablish degrees of ecological function to lotic aquatic systems. Aquatic systems include not only the wetted portion of the channel but also the riparian wetland ecotone communities that border them and that are hydrologically connected on an annual basis. A strategic approach to restoration is one in which the initial focus is on planning and prioritizing efforts rather than designing and implementing projects (Landers, 1997).

Unfortunately, there is often pressure to move quickly past the strategic aspect of restoration into the tactical or project oriented activities. There are hundreds of examples of restoration being attempted by merely assembling a group of projects that have been selected more for convenience than because they fit a restoration strategic plan. This presentation will use examples from research into the functional aspects of the off-channel habitats of the Willamette River, Oregon, to illustrate important considerations with regard to large river habitat function and restoration.

Temporal and Spatial Issues

Many lotic and riparian habitats are temporary, showing varying degrees of fluctuation in key parameters over daily, seasonal, annual or decennial timescales. In many instances these fluctuations alter habitats entirely from terrestrial to aquatic or from lentic to lotic. Where possible, it is invaluable to reconstruct historic condition of the system in question so that cycles of natural variability can be established. Moreover, it is important to overlay in time and space locations of anthropogenic influences to attempt to infer causality. This is not an easy task since one is often faced with a complex array of cumulative point and non-point effects overlain on large scale natural variability. For example, in the Willamette River watershed 13 major dams were built since World War II. During the same time period the population increased dramatically and landuse changes were taking place on a very large scale.
Ecological Research

We have been conducting research to evaluate the ecological functions of off-channel habitat of the Willamette River. These functions are closely linked with the cycles of flooding disturbance that have determined the geomorphological features and vegetative status of the river and riparian areas. Channel complexity and the lateral dimensions of aquatic habitat have been extremely reduced in certain sections of the mainstem Willamette River over the last 150 years. These changes have been due to a variety of human activities including channelization, removal of large woody debris, installation of revetments, dam installation and operation, and landuse changes. We have found that the non-flowing parapotamons (i.e. alcoves) are used very differently than the main channel by adult and juvenile fish in during summer low flow periods. In addition, exotic species prefer the non-flowing off-channel habitats to the main channel.

While flow may be a key factor affecting fish use of these systems, other functional attributes such as cover (habitat), carbon sources, and predation may be important. Hydrological attributes of the main channel “complex,” which includes the hyporheic zone, are also important in affecting the physical and chemical nature of the off-channel habitats. Those features with the greatest hyporheic connectivity are cooler, have higher specific conductance and less dissolved oxygen.

Restoration Strategy

The first set of tasks with regard to restoration of the Willamette River system has been to accumulate, in digital format, available information regarding the history and current status of the river. This information, including maps of land form, water, biotic systems, human populations, land use and land cover, has been compiled into an atlas (Hulse, 1998). Using these data we have quantified geomorphic attributes of the river including slope, number of islands, area of alcoves, etc. In a specific instance we have evaluated the effect of a specific hydrologic event (1996 February flood) on these features.

This work has resulted in a trajectory of historic change and provided quantifiable endpoints that can be used to document the effects of future restoration actions. Alcove age is indicated as an important consideration with regard to ecological function. We hypothesize that the reduction in hydrogeomorphic disturbance due to changes in flow regimes and the addition of revetments throughout the main channel of the Willamette River, have altered the age distribution toward older features. Restoration of disturbance regimes by removing revetments and more careful management of the magnitude, timing and duration of water releases from the reservoirs are currently being explored as the primary components of a restoration strategy for the mainstem of the Willamette River.


José Campoy Favela - Biosphere Reserve of the Upper Gulf of California and Colorado River Delta

The Biosphere Reserve of the Upper Gulf of California and Colorado River Delta was established in 1994, and it is part of the System of Protected Natural Areas, within the Northern Border Environmental Project, coordinated by the Instituto Nacional de Ecología (National Institute of Ecology) of the Secretaría del Medio Ambiente, Recursos Naturales y Pesca - SEMARNAP (Ministry of the Environment, Natural Resources, and Fisheries). The main purpose of the reserve is to conserve for the sustainable use present and future the diversity and integrity of wildlife in its natural ecosystems. The reserve’s specific objectives include: to conserve biological diversity and the ecosystems of this region; identify and protect critical areas for endemic, endangered, and threatened species; and to conserve genetic diversity to allow the continuity of evolutive processes; among others. The reserve include in its programs projects for wildlife monitoring in wetlands of the Colorado River delta, with emphasis in the Ciénega de Santa Clara, El Doctor wetlands, the intertidal zone, and the Montague Island. The Management Plan includes efforts for habitat enhancement and restoration, monitoring and inventories of fish and birds, and in particular special of concern, including desert pupfish and Yuma clapper rail.
Organization of Multispecific Groups

To start the working sessions, mixed work groups of wildlife experts will be conformed, in order to cover different wildlife topics (birds, mammals, reptiles/amphibians, fish, invertebrates, vegetation/habitat), as well as social, economic, and cultural aspects related with the wetlands in the Colorado River delta. The groups will include not only a diversity of expertise in wildlife areas, but also representatives from both countries, as well as a diversity of institutions and backgrounds, in order to start a direct dialogue and information flow among the different players in the wildlife issues of the Colorado delta. All the working sessions will be held following this group organization, including the field trip, result analysis and discussions. Each group will cover a different geographic area of the delta wetlands.

Field Work Purposes, Operation and Target Areas

The field trip to the wetlands of the Colorado River delta will be carried out by the conformed groups. The purpose of the field trip is to provide to the participants the opportunity to collect information to determine the ecological-environmental status of the Colorado River delta, and identify environmental threats and conservation/restoration opportunities in these wetlands. The field visit to the Colorado delta wetlands will allow the participants to get acquainted with local issues and field sites, which will be analyzed and discussed in order to define management strategies for the restoration of this ecosystem. The field trip to the delta wetlands will include a rapid assessment of the status of each one of the mentioned wildlife groups, and it will also be a good opportunity for participants to evaluate proposed management strategies and community proposals.

The trip will start at 6:30 AM, will have a lunch at the field site, and will continue until 6:00 PM, when the groups will meet at Campo Mosqueda. Each one of the groups will travel in one vehicle, with one group coordinator. The group will focus on a specific area, and will try to complete an evaluation for it, filling out the Wetland Evaluation Form. The zones (geographic areas) which will be visited by each different group may include the Colorado River Delta Riparian Corridor (Northern and Southern Portion), Pescaderos River, Hardy River, Cerro Prieto Lagoons, the Cucapá Wetland Complex, Ayala Drain Wetlands, Intertidal Wetlands, and El Indio Wetlands. The Cienega de Santa Clara and El Doctor wetlands are not being included, since they are located at a larger distance from the other zones, they would require another evaluation for themselves due the diversity of important sites they present, and because these areas have received more attention by wildlife researchers.

Definition of Objectives, Methodology, Expected Results, and Field Trip Plan

Each group will define their field trip objective, the specific methodology they will follow to evaluate the status of different wildlife groups, to identify environmental threats and conservation/restoration opportunities, and to collect information to evaluate proposed management strategies and community proposals. The group will also define the expected results of their field trip, as well as the field trip plan, which may include the routes the group will follow, timings, and the areas to be visited.
Determination of Status by Area, and Identification of Environmental Threats and Opportunities for Restoration

After the field trip, the working sessions will continue with the organization, analysis, and discussion of results. This will allow the groups to determine the ecological-environmental status, the environmental threats, and the restoration opportunities for each of the visited areas. The group will present their findings to the rest of participants.

The status of each zone will be based on the findings of each wildlife group analyzed, the ecological functions and values of the wetlands, the presence of critical habitat, and the presence of key species, including endemic and endangered species, and those with high importance in environmental processes. The environmental threats may be human impacts caused by local communities or activities performed in the area, management practices currently applied in the area, and/or management practices applied in other areas, that are affecting the delta wetlands. Opportunities for restoration and conservation may be concrete actions that might be carried out in the delta, as well as concrete changes in policy/management practices currently applied, that could enhance wetland functions and values.

Analysis of Proposed Management Strategies, and Community Needs and Proposals

Based on the results, the groups will discuss the proposed management strategies that were presented for each zone, stating if they agree or not, why, and other consideration that should be included. The participants will also discuss the community needs and proposals, stating if they are feasible and environmentally sound, and the possible implications over the delta ecosystem, specially related to the restoration processes.

Management and Restoration Recommendations

One last approach to the results, will be participants discussion and formulation of management and restoration recommendations for the wetlands of the Colorado River delta. This will be achieved based on all the information obtained through the presentations, the field trips, and the previous discussions. This may include changes that should be done to water and land management practices, activities that government agencies should practice, behavior changes on resource uses by local communities, changes of hydraulic infrastructure, and wildlife/habitat monitoring programs.

All the information produced in the workshop will be presented to local communities, local governments, and federal government agencies on both sides of the border. It also will be used as reference for decision making during workshops to be held with government agencies in Mexico, and guides for community actions, specially by the Local Committee for Wetland Restoration in the Colorado River Delta.

Integration of the Binational Network for the Conservation of the Colorado River Delta

One of the important results of the workshop will be the integration of a binational, multi-institutional network for the conservation of the Colorado River Delta, which might enable the flow of information among the diverse institutions, facilitating dialogue and the exchange of different points of view, as well as providing the means to join efforts of institutions which may be working toward the same direction, and a forum for the presentation of concerning issues of the environmental health of the Colorado delta. Several strategies to achieve this purpose will be proposed and discussed with the participants, including the support with internet media, periodic meetings, the publication of a newsletter, among others.

Conclusions and recommendations resulting from this workshop will be of great importance for the conservation of wetlands in the Colorado River delta, and will be one of the main tools in the process of involvement and assimilation of restoration programs by stakeholders, decision makers, and resource managers in both Mexico and the United States.
Wetlands in the Colorado River delta could be defined as the flood plain covering a broad area along the river which was inundated during the 1997 flows, plus the wetlands in the southeastern delta which receive agricultural drainage water. The east and west boundaries of the flood plain are defined by the system of earthen levees; at the southern end the flood plain empties into the Upper Gulf of California.

The riparian zone is a narrow strip as it passes through the agricultural area in the northern part of the delta, then it widens at the confluence with the Hardy River. The river divides into numerous subsidiary channels in the wide zone, but these recombine into a single channel before the river reaches the sea. Plant cover in the flood plain varied in intensity, species composition and habitat value according to its position in the flood plain.

According to the variations on wetland ecosystem types and geographic settings, seven zones were defined to be visited by the multi-specific wildlife teams, which include the Colorado River Delta Riparian Corridor (Northern and Southern Portion), Pescaderos River, Hardy River, Cucapá Wetland Complex, Ayala Drain Wetlands, and Intertidal and El Indio Wetlands. The Cienega de Santa Clara and El Doctor wetlands are not being included, since they are located at a larger distance from the other zones, they would require another evaluation for themselves due the diversity of important sites they present, and because these areas have received more attention by wildlife researchers.

**Colorado River Delta Riparian Corridor**

This zone start at Morelos Dam and extends to the point before the flood plain widens. It includes zone 1, 2 and 3 of the classification of vegetation communities of the Colorado River Delta (Valdés et al. 1998) (Appendix). The main type of wetland ecosystem is riparian deciduous forest and woodland in areas subject to periodic river flooding, dominated by the mesophytic trees, *Populus* (cottonwood) and *Salix* (willow). The riparian corridor includes dense thickets of *Salix* (willow), most of which were less than 4 m height, but with older plants reaching 8-15 m; channel-side and channel island riparian habitat occupied by *Populus* and *Salix*; scrub vegetation dominated by *Tamarisk* (saltcedar) and *Pluchea* (arroweed), open water (or bare soil when the river was not running); and *Prosopis* (mesquite) shrublands on slightly elevated terraces further away from the channel.

Natural regeneration of *Populus* and *Salix* along parts of the Zone 3 reach was substantial. In some sections, carpets of seedlings of these species dominated near-channel areas, giving way to progressively older stands of trees on slightly more elevated areas. Seed germination, observed in July, 1997, was presumed to be in response to the 1997 flood releases. The presence of multiple age classes of trees shows that sporadic flow releases have produced conditions amendable to the regeneration and long-term survival of the native riparian species. The largest trees were up to 15 m in height.

Water that supports this vegetation comes mainly from pulse floods of water excedents in the Colorado River, and small amounts came from agricultural drains and urban drains. Since this zone is confined between the levees, and access is restricted by the dense vegetation, human activities are very limited inside this area. Activities include fishing and swimming in certain river spots, hunting and wood utilization are also carried out. Land ownership is federal. The main environmental concern for this area is the lack of a perennial source of water that could support this highly valuable riparian corridor.
Pescaderos River

This site is located in the vegetation zone 4, between the riparian corridor and the Hardy. Pescaderos is an old Colorado course, which main sources of water now are agricultural drains. This river crosses several ejidos, and there are a few communities settled on its sides, located before it enters the levees. This tributary in its northern part is considered mainly for agricultural drainage purposes, but at its southern portion, it is used for fishing and hunting by local communities.

The main type of wetland ecosystem is brackish marshland dominated by *Typha domingensis* (cattails) and other emergent hydrophytes, supported by agricultural drainage water. It also includes riparian deciduous forest and woodland inside the levee, dominated mainly by *Tamarisk* (saltcedar) and other salt-tolerant shrubs.

Hardy River

In this zone, the flood plain widens and the river divides into numerous channels, oxbows, backwaters, and pond areas downstream of the confluence of the Colorado River with the Hardy River. It is located on zone 4 of the vegetation classification, but the northern portion of the Hardy River is not included on this classification. The main type of wetland ecosystem is brackish marshland dominated by *Typha domingensis* (cattails) and *Phragmytes* (common reed), supported by agricultural drainage water.

There are several private touristic camps located aside the Hardy River, one of them is Campo Mosqueda, on which the owners have used the levee as a reservoir wall, creating a small lake of the river that is used for recreational activities including swimming, water skiing and fishing. One of the main concerns of this area is the bioaccumulation of selenium, which is magnified by the lack of water flows and the agricultural practices.

Cerro Prieto Lagoons

The Cerro Prieto Lagoons are located nearby the Cerro Prieto Geothermic Plant, and are used as discharge ponds of the effluents of the plant. This zone is located on the western side of the delta, north of the Hardy River, separated from the flood plain of the Colorado River. The geothermic plant effluents used to be connected with the Hardy River, but high arsenic and mercury concentrations were found on these waters, so they were diverted to the lagoons.

Salt concentration on these lagoons is high, reaching 29 ppt. The highest ecological value of this area is that it provides critical habitat for the endemic and endangered desert pupfish, with active reproduction of this specie been reported in this area (Hendrickson and Varela-Romero, 1989).

Cucapá Wetland Complex

The Cucapá Wetland Complex is located on vegetation zone 5, below the confluence of the Hardy River with the Colorado. This stretch of the river is perennial due to tidal intrusion and the discharge of agricultural drain water into the river (Payne et al. 1992). *Typha* (cat-tail), *Phragmites australis* (common reed) and other emergent hydrophytes grow along the river banks.

The high-biomass riparian vegetation is a mixture of plant associations. Although numerous pockets of *Populus* and *Salix* were still found along the main river channels in this reach, they constituted a lower proportion of the vegetation found in the northern portions. Over 70% of this zone is dominated by a mixture of *Tamarisk*, *Prosopis*, and significant numbers of large *Atriplex lentiformis* (quailbush) plants, either intermixed with *Tamarisk* or growing in nearly homogeneous stands on terraces removed from the main channels of the river. In the southern portion, the dominant plant association over most of the zone is a near monoculture of dense thickets of *Tamarisk*. Mesophytic vegetation was no longer common and the lower-intensity vegetation in consists of widely-spaced, stunted (1 m) *Tamarisk* plants mixed with the succulent halophyte, *Allenrolfia occidentalis* (iodine bush), that grow in segregated stands separated by patches of bare soil that are often covered by a salt crust.
Ayala Drain Wetlands

This wetland zone is located on the western side of the levees on vegetation zone 5. The main water source is agricultural run off water from the Mexicali Valley, that flows through the Ayala Drain. This drain used to be an old course of the Colorado, which is now used with agricultural purposes. The type of wetland ecosystem is brackish marshland, with a mixture of marsh vegetation dominated by *Typha* and *Phragmites*, and riparian vegetation dominated by *Tamarisk*. This wetland area continues to the mid portion of the flood plain, and joins the Cucapá Wetland Complex, where several open water marsh areas are formed. The Ayala Drain wetlands has been traditionally used as a hunting zone since decades ago, mainly by U.S. hunting groups who visit these wetlands for waterfowl hunting.

El Indio Wetland

El Indio wetland (approximately 1900 ha), is located on vegetation zone 7, southwest of the Cienega de Santa Clara. It is supported by agricultural return flows from local (México) agricultural fields. Its vegetation is dominated by *Tamarisk* with pockets of *Typha* and other hydrophytes in flooded areas. This wetland was formed about five years ago when the Zacatecas Drain, which flowed into the flood plain, was damaged, discharging its waters outside the levees system, conforming a small lagoon.

The flooding of this 1900 ha outside the flood plain and nearby agricultural land, caused the water table to rise in this area, increasing soil salinity and difficulting drainage flow. Because of this, water from the damaged drain was redirected inside the levees system, leaving this wetlands without a water source. It is highly probable that this small wetland will dissapear, unless management action takes place.

Intertidal Wetlands

The final 20 km of river constitute the intertidal zone, located in the vegetation zone 6. These wetlands support 442 ha of *Distichlis palmeri* (Palmer’s saltgrass). This important species is the only indigenous grass of the Sonoran Desert and its grain has been traditionally used by the Cucapá people (Kniffen, 1931; Álvarez de Williams, 1979). The type of wetland ecosystem is maritime submergent mud flats dominated by this salt grass. This intertidal zone has important ecological values, since it provides habitat for the reproduction, spawning, and nursing of diverse species, including corvina, shrimp, and the endangered totoaba fish.

The lack of water flows has reduced this critical environmental function of the intertidal zone, as it has been transformed from a positive estuary into a negative estuary. This is suggested by water salinity results obtained during the flooding events of January, 1998 (202 m³/s), when fresh water (0 ppt) were found 10 km from the river mouth, and with marine salinities (36 ppt) were diluted to 20 ppt in front of Montague Island. These data contrasts with descriptions of salinity levels in the same area carried out during 1989, when excess flows from the Colorado River to the delta were quite reduced, with mean annual discharges of 1.08 m³/s. The area was described to have high salinity levels all year around, ranging from 35.3 to 39.2 ppt, and salinity levels at 10 km within the river mouth ranged from 35.3 to 37 ppt (Martínez Rojas-Reynoso, 1990).
VII. Map of Wetlands of the Colorado River Delta
Binational Workshop for Wildlife Management and Wetland Restoration in the Colorado River Delta

VIII-Wetlands Evaluation Form

During the field trip participants will make an assessment of wetland’s functions and conditions. Each working group is asked to answer these questions for each wetland site within their study zone. Answers to these questions will be used to develop a standard characterization of functions and conditions of each wetland site. More detailed assessment will be based on the protocol developed by each working group.

Question 1: What is the estimated wetland’s area?

Question 2: How many types of wetlands according to vegetation are present? (open water, emergent, scrub-shrub, forested). Indicate cover in percentage for each type.

Question 3: Is there a buffer (upland wildlife habitat zone) at the wetlands edges? How wide is it? Where? What kind?

Question 4: What is the vegetation species composition?

Question 5: Is there water at the wetland site?

Question 6: What is the apparent water quality of the wetland?

Question 7: Is there a stream flowing into the wetland?

Question 8: What is the wetland’s primary source of water?

Question 9: Is the wetland hydrologically connected to other wetlands? yes/no, how, and distance

Question 10: Is water flow out of the wetland restricted?

Question 11: Is there evidence of water storage in the wetland?

Question 12: What is the dominant existing land use surrounding the wetland?

Question 13: What is the vegetation vertical structure? (based on foliage density: understory <0.6m; midstory 0.6-4.5 m; and overstory > 4.5m)

Question 14: How can an hydrologic connection between the wetland and a source of water be restored or created?

Question 15: Which are the opportunities for nonconsumptive uses of wetland resources such as wildlife conservation, education, research, and photography?
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Binational Workshop for Wildlife Management and Wetland Restoration in the Colorado River Delta


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Appendix
Vegetation Zones in the Colorado River Delta

Classification of vegetation communities, using spectral analysis of a satellite image (July 15, 1997). R1-R4 include riparian vegetation, with R1 having the higher biomass level. W1 and W2 include marsh vegetation, with W1 having the higher biomass level. DIST refers to the areas covered with *Distichlis palmeri* (salt grass), and WATER refers to open water areas.
Characteristics of the Colorado River delta floodplain in México. Vegetation zones were defined by floristic components based on ground surveys, while Land Cover Classes were determined by spectral analyses of satellite images; number after cover class refer to biomass intensity where 1 is highest and 4 is lowest.

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<td>Tr/Bs</td>
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<td></td>
</tr>
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</table>

*Sg = Salix goodingii; *Pf = Populus fremontii; *Tr = Tamarix ramosissima; *Bg = Baccharis salicifolia; *Spp = Prosopis spp;
*Al = Atriplex lentiformis; *Td = Typha domingensis; *Ao = Allistoloma occidentalis; *Dp = Distichlis palmeri.
Since the functions and values of these wetlands provide benefits to both sides of the border ignoring political boundaries, their management and restoration should be considered as a shared responsibility among the two countries. Therefore, support from international, national, state, and local environmental laws, programs, and agreements need to be adapted under a comprehensive regional approach.