



Silva

Silva Reservoir

An example of regional environmental cooperation in North America

In the winter of 1994–1995 some twenty to forty thousand waterbirds on their migratory route from the northernmost reaches of North America died at Silva Reservoir, a small impoundment in the high plains of central Mexico.

The mass mortality of birds at this site on the outskirts of the municipality of San Francisco del Rincón, Guanajuato, was neither unique nor new. The event was novel, however, because it set in motion an extensive process of research, public participation and the col-

laboration of different governmental agencies and international organizations to ascertain the causes of the die-off and to search for solutions to the problems that affect migratory waterbirds of the three North American countries: Canada, Mexico and the United States.

Four years after initiating this process, the restoration of Silva Reservoir is a success: water quality in the reservoir has improved dramatically and the reservoir once again provides a healthy habitat for

migratory birds of North America as well as supplying agricultural users with a cleaner source of water. Moreover, state and federal officials, together with local industry, NGOs, and academic institutions, have taken steps to address the root causes of the problem—approaching the restoration of bird habitat at Silva as a practical application of sustainable development at the community level. Once current plans are fully implemented, more than just birds will be the beneficiaries of the plan of action.



Mass mortality at Silva Reservoir



Between 20,000 and 40,000 northern pintails, northern shovelers, ruddy ducks, American coots, and green-winged teals, among others, died at the Silva Reservoir.

The Silva Reservoir has traditionally been used as a complementary water reserve for nearby populations whose livelihood is based primarily on agriculture. The condition of the reservoir has depended in large part on the condition of the Río Turbio, since its waters provide about 70 percent of all inflows during the rainy season and 100 percent during the dry season (December through June).

The Río Turbio transports residual waters for the irrigation of crops. The waterway passes through the city of León, an economic hub of the region with intensive industrial activity and the processing of a wide variety of toxic chemical substances, whose waste products and residues are discharged into

the sewer system without any previous treatment, making for an extremely poor water quality. This is further exacerbated by the sewage discharges of San Francisco del Rincón and local industries, in particular, those of tanneries, shoe manufacturers and agriculture.

This zone is likewise an over-wintering area for a great variety of waterfowl migrating from the central sections of Canada and the United States. Between November and December 1994, local inhabitants began reporting massive numbers of bird carcasses. In December of the same year, the phenomenon attracted the attention not only of the local inhabitants but also of the press, national

and international environmental organizations, as well as local and federal authorities. So began an extensive process of rescuing birds, inquiry into the causes of the die-off and demands regarding the need for effective measures for the cleanup of the zone.

In June 1995, three nongovernmental organizations (the National Audubon Society, the Grupo de los Cien and the Centro Mexicano de Derecho Ambiental) sent a letter to the Commission for Environmental Cooperation requesting it to prepare a report under NAAEC Article 13 examining the causes and circumstances for the mortality of the migratory waterfowl at the Silva Reservoir.

Cooperation at work

Following the public inquiry, the CEC organized a group of specialists from various disciplines: biology of aquatic birds, wildlife disease and toxicology, ecology, hydrology and chemical engineering. The group of nine experts, three per country, had two main functions: to identify the probable causes of the incident and to propose alternatives, including the cooperative actions necessary to prevent the situation from being repeated.

The group presented the report to the Council of the CEC (composed of the environmental heads of the three countries) in October 1995. Later published under the title, the CEC Secretariat Report on the

Death of Migratory Birds at the Silva Reservoir (1994–95), it includes a diagnostic study of the problem and a series of concrete recommendations for action.

The report put the problem into context by pointing out that, although many birds died, the numbers were comparable to other incidents of a similar nature in North America. Documented cases of greater die-offs—hundreds of thousands to as many as a million migratory waterbirds—occurred at the beginning of this century and cases of twenty thousand to a hundred thousand bird deaths occur with relative frequency in North America.

The group of experts also determined that the die-off, which included 21 species of birds, was due primarily to an outbreak of avian botulism, a bacterial disease relatively common among birds. However, the research revealed the presence of certain pollutants (chromium, lead, mercury and other substances) and the contamination of the municipal wastewaters draining into the reservoir through the Turbio River that could exacerbate the effects of the outbreak. It is known, for example, that high concentrations of organic material reduce the quantity of oxygen in the water, favoring the accelerated growth of microalgae associated with the outbreaks of botulism.

Toward an integrated solution

The results of the exploratory studies revealed a complex situation in which a great variety of factors contributed to the problem in different ways. The solution to the environmental problems of the dam required a coordinated solution, involving social, industrial, legal, and infrastructural contributions. It could not be arrived at by purely ecological considerations. The phenomenon of the Silva Reservoir clearly shows the importance of public participation in the solution of environmental problems.

In order to strengthen governmental capacity for responding to

environmental problems such as those that arose in the Silva Reservoir, the CEC worked with State authorities to:

- ▶ carry out a detailed study on the environmental conditions in the area and the functioning of the government structures responsible for dealing with it;
- ▶ create a Council for Public Participation to become involved in state environmental procedures;
- ▶ give environmental training courses to the public as well as to governmental, industrial and business personnel;

- ▶ develop the State Environmental Program 1995–2000;
- ▶ create the System of Protected Natural Areas for the State of Guanajuato (with its guidelines); and
- ▶ establish a protected natural area in the Silva Reservoir.

Restoration of the reservoir



The experts' study advised confining the contaminated bottom sediments.

It also became clear that in order to resolve the problems in the reservoir, no action would be sufficient without improving the water quality of the Río Turbio. For this reason, the National Water Commission (Comisión Nacional del Agua) undertook an integrated program for the cleanup of the reservoir. Furthermore, the Guanajuato Ecological Foundation (Fundación Ecológica de Guanajuato, A.C.) was engaged to assemble a Management Plan for the Río Turbio Watershed, promoted by the CEC and the Institute of Ecology for the State of Guanajuato (Instituto de Ecología del Estado de Guanajuato — IEEG).

The plan contemplates a new framework of coordination and co-responsibility between watershed beneficiaries and authorities, the protection and sustainable use of natural resources, as well as the economic and social development of the zone. To this end, future actions will call for:

- management of natural resources, a cleanup program for the

- dam and its inclusion in the System of Protected Natural Areas of the State of Guanajuato;
- a management plan for the upper Río Turbio Watershed;
- the establishment of a protected natural area in the Lobos and Cuatralba mountains;
- construction of industrial collectors and a wastewater treatment plant for the municipalities of León, San Francisco and Purísima del Rincón;
- establishment of the León Industrial Ecological Park (Parque Industrial Ecológico de León—PIEL), together with an onsite wastewater treatment plant that will allow the majority of industrial process water to be reused and nearly all elemental chromium to be recovered. This plan will also involve the relocation to the industrial park of approximately 120 tanneries which are economically important for the region, but which have also been such significant contributors to the volume and toxicity of area wastewaters.

The CEC sought to facilitate the promotion of pollution prevention initiatives through projects that generate a multiplying effect in this industry. To achieve this objective, case studies were carried out to analyze the tanning process, classify the wastes of the process, and propose alternatives that improve environmental performance while providing economic benefits. The results of these studies proved that investment in pollution prevention technologies is low in most cases and the time for recovering the investment is generally short. Even more important, the studies demonstrated that the content of chromium in wastewater discharges can be reduced by more than one-half, an alternative that generates benefits for both industry and society because it significantly reduces pollution without necessarily resorting to discharge treatment systems.

The Silva Reservoir Management Program

The Silva Reservoir Management Program is based on previous studies carried out with the help of the IEEG and the CEC, in order to include the site as an Area of Ecological Restoration in the System of Protected Natural Areas of the State of Guanajuato. It pays special attention to the involvement of the communities of San Francisco del Rincón and the town of Silva in the process of planning, management, conservation and promotion of the area through environmental education, follow up on the restoration process, crop improvement and recreational activities. It also establishes guidelines for the maintenance of wild flora and native and migratory wildlife as well as for the management and reutilization of water in agricultural development and the recharging of the aquifer.

One of the first actions resulting from the program was to carry out

a specific study on the levels of sediment contamination in the reservoir. The study was undertaken by the IEEG with technical assistance from experts of the Quebec provincial Ministry of the Environment and Wildlife (Ministère de l'Environnement et de la Faune du Québec), who evaluated the extension of the contaminated area and proposed rehabilitation measures.

Based on the Silva Reservoir's different functions, the guiding principles for the study were to:

- 1) utilize the reservoir to ensure agricultural irrigation for the ejido towns of Silva, San Bernardo, El Liebrero, El Maguey and San Roque de Torres,
- 2) rehabilitate the area in order to maintain its capacity to shelter migratory waterbirds, and
- 3) open up the possibility of recreational and tourist functions for the reservoir.

The Canadian experts deemed it necessary to carry out an exhaustive evaluation to determine the exact distribution of the contamination, the volume of bottom sediments to be treated or confined and the costs of the undertaking. The results suggested confining the sediments from the layers where the concentrations of chromium were highest; dredging a layer from the bottom of the reservoir (and thus increasing the storage capacity of the reservoir, which would yield several advantages); and improving the overall environmental conditions of the area. In addition to the confinement of heavy metals such as chromium, the study recommended better management of chemical fertilizers and insecticides used in agriculture in the surrounding areas.



Specific remediation activities



More than 182,000 cubic meters of contaminated material were dredged.

The surface area of the reservoir basin is about 2x27 hectares, of which approximately 73 (the zone closest to the dam) were contaminated. The report had recommended that the dredged sediments be confined around the periphery of the reservoir, but the environmental authorities of Guanajuato decided to place them all on the inside of the existing retaining wall in huge stone-and-concrete containers. This allowed the most contaminated sediments to be placed on the bottom and effectively capped with uncontaminated soil and, on the top, with vegetation. This procedure allowed the remediation work to be done at less cost, while still achieving the desired environmental objective. It also favored the development of ecotourism, which, it is hoped, will add value to the environmental objective and help defray the cost of the project.

The two containers were constructed within the basin of the reservoir and measured 900 and 450 meters long, with capacities of about 120,000 and 65,000 cubic meters, respectively. In addition to concentrating and confining the contaminated sediments, the containers function to reinforce the original retaining wall of the reservoir, which was seriously deteriorated. The volume of material thus confined is calculated to be 182,500 cubic meters, which

corresponds to the removal of a layer of sediment 25 centimeters deep over the 73 contaminated hectares.

Once confined, the contaminated material was spread and compacted 80 percent within the containers; on top of this surface two more layers of clean material were later deposited, the first to ensure definitive confinement and the second to encourage the development of wetland vegetation. The new vegetation will permit the extraction of heavy metals from the contaminated soil.

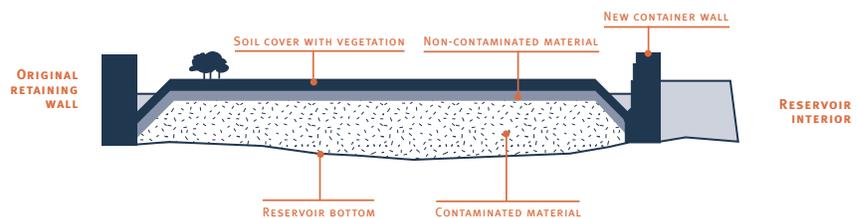
With these actions, not only have the original environmental conditions of the reservoir been restored, but also the impoundment capacity has been increased, benefiting area agriculture. Likewise, additional construction work is in process to provide protection for the town of Silva, create a peripheral road giving access to the reservoir, and reforest the area. Another medium-range action under consideration is the construction of a waterfowl observatory in the southwestern part of the basin.

The five ejido towns involved formed a nongovernmental organization (NGO) in charge of the administration of the protected natural area, now officially decreed as such under the category of

environmental restoration in the System of Protected Natural Areas of the State of Guanajuato. This NGO is making use of over US\$160,000 in economic support from the North American Wetlands Conservation Council to strengthen the restoration and development of the area.

The IEEG has channeled nearly US\$1 million into the restoration of the site, which includes not only the work needed for remediation, but also the training of young people from neighboring communities to serve as guides for birdwatching tours.

The actions described above represent a local chapter in protecting the shared natural resources of North America—in this case the migratory birds that require sustained support in order to guarantee their survival. The project also demonstrates what can be achieved by strengthening local management capacity and making use of local resources and organizations. The work undertaken in the wake of this waterfowl die-off shows that, through international cooperation, public participation, the commitment of business, and the vision of local government and the CEC joining forces, it is possible to transform an environmental problem into an opportunity for local community development.



The illustration represents a transverse view of the containers



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The North American Agreement on Environmental Cooperation (NAAEC), the environmental side agreement to the North American Free Trade Agreement (NAFTA), was negotiated by the United States, Canada and Mexico. It provides a framework, and establishes the Commission for Environmental Cooperation, to facilitate effective cooperation in the conservation, protection and enhancement of the environment in the three countries. An objective of the Agreement is to “increase cooperation between the Parties to better conserve, protect and enhance the environment, including wild flora and fauna” and the Council of the Commission “may consider and develop recommendations regarding the conservation and protection of wild flora and fauna and their habitat, and specially protected natural areas and the protection of endangered and threatened species.” Article 13 of the NAAEC enables the Secretariat of the Commission to prepare reports for Council on any matter within the scope of the Commission’s annual work program. In this instance, CEC activities included responding to public inquiries about the Silva Reservoir, issuing a report under Article 13 of NAAEC (*CEC Secretariat Report on the Death Migratory Birds at the Silva Reservoir, 1994–95*), and collaborating with the governments of Guanajuato and Mexico in various projects related to environmental management in the area. This document is a short report summarizing the Silva Reservoir inquiry and describing the conclusions and action plans that resulted from it.