

THE GOVERNMENTAL RESPONSE TO ENVIRONMENTAL DEGRADATION
IN THE XOCHIMILCO ECOLOGICAL ZONE OF MEXICO CITY

by

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“Xochimilco is a cultural symbol of the city, a place described by travelers of all times. It is a center of profound community life and a living vestige of the Prehispanic world in the Valley of Mexico.” From *El Rescate Ecologico de Xochimilco*, 1993.

Introduction

In the 1970s scholars and governments initiated research on ecological degradation in the mega-cities of the less developed countries (LDCs). Invariably these studies found serious environmental degradation in water resources, air quality, and in the surrounding forests and agricultural lands. For example, in 1978 the U.S. Department of State and the U.S. Council on Environmental Quality directed a comprehensive study of environmental resources and ecological degradation on a world-wide basis. This study, designated The Global 2000 Report, (U.S. Council on Environmental Quality) found serious environmental degradation in the mega-cities of the LDCs which increasingly threatened the quality of life for millions of urban dwellers. Issues concerning the causes and consequences of environmental degradation in the mega-cities of the LDCs have received increasing attention in recent years. Indeed, most recent publications on the mega-cities of the LDCs include some discussion of the causes and consequences of environmental degradation (Dogan and Kasarda, 1988a/1988b; Gilbert, 1994; Gugler, 1988; Kasarda and Parnell, 1993; Knight and Gappert, 1989). And many of these publications provide scientific and technical solutions to causes of environmental degradation. However, the politics concerning governmental policies regarding environmental degradation has received less study. The main objective of this article is to examine the governmental response to environmental degradation in the Xochimilco zone of Mexico City.

Xochimilco represents a useful case study for learning about how governments of the LDCs respond to ecological degradation. The need for environmental protection is objectively demonstrated in the case of Xochimilco. And the Federal District (D.F.) of Mexico City, in comparison to other mega-cities of the LDCs, has a greater capacity to marshal the financial and technical resources necessary to undertake a complex project designed to alleviate the environmental problems. The situation of Xochimilco is therefore not typical of the governmental response to environmental degradation. Also, if the governmental response is weak where there is a clear need of environmental protection by the government in this comparatively modern city (in terms of resources and government bureaucracy), we can assume that it is even weaker in other mega-cities of the LDCs which have less governmental resources. This research is based on government reports, studies of ecological organizations, journal articles, monographs, and interviews with government officials, academicians, and owners of agricultural lands.

The case of Xochimilco demonstrates that several factors constrain the governments of LDCs from providing significant protection of the environment. Financial resources circumscribe major investments. Political corruption constrains governments from enforcing regulations that are designed to improve environmental protection policies. Finally, elite policy making is focused more on short term public relations than on long term public policy that will benefit the national interest.

Mexico City is located in the southwestern region of the Valley of Mexico, some 2,240 meters above sea level on the meridional *Altiplanicie Mexicana*, or high plateau of southern Mexico. The Valley is a closed basin formed by a ring of mostly extinct volcanoes which are most prominent near the southern area of Mexico City. In Prehispanic times the floor of the basin was covered by an interconnected system of shallow lakes (up to three meters deep) covering some 800 to 1000 square

kilometers. The Aztecs built dams and aqueducts to manage the lacustrine resources, but the ecological degradation to the lakes was minimal because the water table and dimensions of the lakes were not significantly altered. Because the Aztecs relied completely on human portage or manually powered boats for transporting food, proximity of the Xochimilco agricultural area to the population centers in and around the lakes was important. Similarly, the social historian Tilley (1975) found that urban populations of preindustrial European cities lived generally within two kilometers of food sources because transportation costs for food were so high prior to modern transportation methods. Tilley's analysis is especially relevant to the Prehispanic inhabitants of the Valley of Mexico who lacked the wheel as well as domestic animals for haulage. For the Aztecs the lakes were a vital resource for military defense and food production that was located close to the center of their empire in Tenochtitlán.

Rojas Rabiela (1991, 276) concludes that *chinampa* agriculture originated around 1000 B.C. in Lake Chalco. The *chinampas* are raised horticulture plots that are constructed in swamps or shallow lakes. Typically these islets are constructed of long narrow mounds of earth over sticks and branches that are rectangles of two to four meters wide and 20 to 40 meters long, or of larger dimensions. They are surrounded by water on three or four sides, thus providing for crop "irrigation" by raising the level of water in the surrounding canals (Rojas Rabiela, 1991; Parsons 1991: 21). In about 900 A.D. the Xochimilcas, who inhabited the lake zone named after them, extended and developed the *chinampas* into a highly productive process for farming, which maximized food production near to the population (Parsons, 1991). *Chinampa* building was accomplished by partial drainage of lake Xochimilco and the surrounding swamps and wetlands. The primary function of the *chinampas* has been to provide seedbeds for growing seedlings that were

subsequently transplanted on firm lands. The Prehispanic *chinampas* occupied some 120 square kilometers of Lake Xochimilco devoted to intensive horticulture. The lake beds supplied rich soils and the dikes provided for control of water levels and enabled careful regulation of soil moisture on a year round basis (Rojas Rabiela, 1991). Parson's analysis of the archaeological evidence supports the view that *chinampas* agriculture was the key to the growth of population and political power in the southern region of the Valley of Mexico. The expansion of the Aztec empire coincides with the expansion of *chinampas* agriculture in the Late Aztec phase from 1350 to 1520. In addition, the Aztecs built an extensive system of dikes and dams to control water levels for *chinampa* agriculture and to prevent seasonal flooding.

In the sixteenth century the Spanish initiated the drainage of the lakes and wetlands in the Valley of Mexico. The Spanish conquerors and colonists were less dependent on centralized agricultural production because draft animals and wagons reduced transportation costs for the new rulers of the Valley. Therefore when the Spanish destroyed the Aztec political system, they neglected the maintenance of the hydraulic systems which the Aztecs utilized for flood control and *chinampa* agriculture in Xochimilco. The lakes initially began to evolve toward their original condition (Rojas Rabiela 1991: 288). The Spanish, however, soon used their relatively advanced knowledge of hydraulic construction technology to drain the lakes. Periodic floods produced by rain storms generated public demands for drainage of the lakes. The Spanish initially built dikes to hold back flood waters, but then constructed a series of expensive drainage projects beginning in 1607 (Cervantes Sanchez 1988: 17). Cattle ranchers, hacienda owners, and developers demanded expanded lake drainage in the mid 19th century (Rojas Rabiela, 1991). In the early 1990s Mexico City undertook the program of "Sistema de Drenaje Profundo" to construct an integrated system of

deep drainage of the basin toward the Tula River. By mid century the drainage of the Valley lake system left only a few square kilometers of Lake Texcoco and a network of canals and lagoons in Xochimilco. The drainage of the lakes in the Valley of Mexico accelerated the destruction of lacustrine vegetation, plant life in marshes and wetlands, aquatic birds and animals, and the lake beds which supplied fertile soils which had been extracted for agricultural uses for centuries.

MODERN XOCHIMILCO

Delegación Xochimilco is located in south central region of the D.F. of the DF and skirts the mountainous region of the Ajusco volcano. Xochimilco is important to Mexico City for a variety of reasons. The aquifers of Xochimilco currently provide some eight percent of the water resources for the D.F. (Mansilla Menéndez, 1995: 202-03). The zone is historically important for the advances that the Xochimilcas made in developing advanced forms of agriculture, hybridizing a large variety of fruits, vegetables, and flowers, and identifying medicinal herbs. Today Xochimilco produces some 15 percent of the agricultural products for the D.F., as well as a substantial quantity of the city's flowers. In 1987 the United Nations Educational, Scientific, and Cultural Organization (UNESCO) recognized Xochimilco as a place of "universal historic and cultural human patrimony." Xochimilco has remained a traditional national and international tourist attraction (D.D.F.; 1985:310-316; D.D.F. 1993:5; and Rodríguez, 1987).

Presently Xochimilco includes an ancient lake basin which has been largely drained except for a network of Prehispanic canals and waterways, as well as rich agriculture land in the *chinampas* and an urbanized zone which is close to the canals. The area also includes forests, hills, and a

mountainous zone. Xochimilco is some 127 square kilometers; 79 square kilometers are agricultural and forest land; 12 square kilometers are occupied by canals and lagoons; and 36 square kilometers are urbanized. The agricultural land is alluvial, well supplied with water and, has high humidity which enhances vegetable production. The most serious ecological problem for Xochimilco has been the exploitation of aquiferous water resources. The abundant springs Xochimilco were capped in 1913 to provide the D.F. with inexpensively obtained potable water which was piped to the city center some 18 kilometers from Xochimilco (Moreno Mejía, 1987). Then in the 1950s the D.F. drilled a series of deep wells to accelerate the extraction of water to the city center. This exploitation of water resources resulted in a cessation of water to springs which feed the canals with fresh water, lowering the freatic water level, sinking of the old lake bed area and land in the hills (at a rate of 40 centimeters a year), desiccation of the canals in the 1980s, and the creation of lagoons and stagnate water in the ancient canals (López Escalente, 1995: 249). To maintain water for irrigation and *chinampa* farming treated sewage water was pumped into the canals. However, by the late 1980s the many of the canals were desiccated. Similarly, the destruction of vegetation (due to urbanization) has created conditions of rapid run off of rains which reduces the quantity of rain water which is absorbed and channeled to underground aquifers. The canals were polluted by the channeling of raw sewage (*aguas negras*) into the Xochimilco canals beginning in the 1950s to replace the water lost from the springs, and 20,000 residences from irregular settlements utilized the canals for drainage of all household discharges.¹ In sum the canals became, desiccated, stagnant, and polluted from a lack of fresh water and from sewage which was pumped and drained into the canals by the government and residents. The Xochimilco region now receives 30 percent less precipitation and slightly higher temperatures. The reduction in vegetation and increased urbanization caused rapid runoff off of rains which caused

occasional flooding in some canals. Agricultural production decreased substantially after the 1950s due to the abandonment of 53 percent of the 2,291 hectares of the *chinampas* (Jiménez, 1995:19). Decades of watering crops with polluted water resulted in degraded soils due to salinization. Reduced agricultural production accelerated unemployment and threatened tourism due to poor water quality in the canals. (D.D.F., 1993; and Rojas Rabiela, 1995).

Urbanization of the Xochimilco is major factor which threatens the ecology of Xochimilco. The population of Xochimilco increased rapidly: 47, 000 in 1950; 116,000 in 1970; 271,000 in 1990; and 318,000 in 1996 (INEGI, 1991: 4; Reforma, 6/24/96: 70). This rapid population increase was spurred by the construction of the outer ring highway (*Anillo Periférico*), Viaducto de Tlalpan highway, the extension of División del Norte highway, and the México-Xochimilco-Tulyehualco highway in the late 1960s and 1970s. And the tram (*Tren Ligero*) from the Metro Taxqueña station to Xochimilco which was completed in 1988 (González, 1990: 111; Ziccardi, 1989). Although much of the population growth in the 1950s and 1960s was due to natural increase from a high birth rate, the rapid population growth after 1970 is mostly due to migration (Jesús Rodríguez, 1987). These transportation improvements made commuting from Xochimilco to the rest of the metropolitan Mexico City less expensive and more rapid. The urbanized zone of Xochimilco includes 53,000 households, many of which are located on the ancient canals and on former *Chinampa* lands. The location of residences near the ecologically sensitive areas along México-Xochimilco-Tulyehualco highway was accelerated by the illegal sales of land which has persisted at the time this article was written. In the early 1990s about 9,000 houses were built annually in the “*zona de reserva ecológica de Xochimilco*”(Rodríguez, 1987). And according to the studies of the federal Comisión de Recursos Naturales (CORENA) irregular settlement growth is highly prevalent in Xochimilco currently (Reforma, 7/26/96: B1).

THE PLAN TO RESCUE XOCHIMILCO

In the aftermath of the 1985 earthquake in Mexico City *ejiditarios* and *chinamperos* in Xochimilco modeled the organization and political actions of neighborhood and housing organizations that had been successful in demanding earthquake relief and housing from the government. The groups in Xochimilco demand that first, that treated water (not sewage water) be pumped into the canals, and second, that flood control measures be implemented into the *chinampas* from the government. Pressure from the international community spurred government action concerning the environmental degradation of Xochimilco. In 1987 UNESCO declared Xochimilco a place of “Universal Human Patronage” and indicated the need for protection of this living cradle of civilization. In addition, the policies of the federal government resulted in a tangible inequity because water resources were pumped to the urban center at the expense of the agricultural economy of Xochimilco. Government officials were concerned that if these inequities persisted, social conflict might erupt between agricultural interests in Xochimilco and the federal government (Stephen-Otto, 1996).

In 1990 the *Movimiento Ecologista Mexicano* (MEM) held a press conference with other environmental organizations, groups of ecologists based in Xochimilco, owners of the *chinampas* (*los chinamperos*), and faculty from the School of Plastic Arts of the Universidad Nacional Autonoma de Mexico (UNAM) which is located in Xochimilco. MEM announced a campaign to save hydro-agriculture and ecology of Xochimilco from the “greed of the developers and those selling land illegally (*fraccionadores*)” and they called on the public to support their effort (UnoMasUno, 2/22/90:11). This coalition of environmental groups had been spurred in to action by a series of

announcements by the D.F. government in 1989 which called for the “ecological rescue of Xochimilco.” Invariably environmental groups in Mexico view the DF government as an adversary in the fight for environmental protection and their press conference signaled a concerted effort to pressure the D.F. toward actions which would protect the ecology of Xochimilco.

The plans of the D.F., designated *Plan to Rescue the Ecology of Xochimilco*, were formally announced by President Carlos Salinas de Gortari on November 21, 1989 and called for major hydraulic works for water treatment, expansion in the agricultural sector, historical and archeological studies of the *chinampa* system, improvement in the sanitary conditions of residences, and the introduction of drainage to conserve rain water for diversion to aquifers. The D.D.F. invited discussions and proposals for rescuing Xochimilco from *ejidatarios*, *chinamperos*, farmers, and flower growers in the areas of San Gregorio Atlapulco, San Luis Tlaxialtemalco, and the 17 towns of Xochimilco. The DDF also conferred with university researchers from the fields of biology, ecology, archeology, agronomy, chemistry, sociology, architecture, hydraulic engineering, and history. A year later on December 4, 1990 the government signed the “Accord of Democratic Cooperation for the Ecological Rescue of Xochimilco” which included specific plans for protection of the agricultural land by expropriating three *ejidos* (communal farms) to restrict urban development in a *chinampa* zone, the construction of two lagoons to reduce flooding and limit the sinking of land, reduction of river flooding, advanced treatment of the sewage water which is pumped into the canals. But at the same time the D.D.F. planned to utilize the expropriated *ejidos* and ecologically protected zones for tourism.

With the World Environment Day as a backdrop, the 1993 *Premio al Mérit Ecológico* was delivered to the President Salinas de Gortari, notable ecologists, and the scientists who designed the

Plan Lago de Xochimilco. The award was presented at the inauguration of Parque Ecological de Xochimilco and received extensive news coverage (Excelsior, 6/6/93: 1, 28, 37). The administration of Salinas de Gortari claimed that the government had accomplished the following: 3,000 hectares of canal and *chinampas* had been protected; 1100 hectares had been expropriated; 200 kilometers of canals were now navigable, 1000 hectares of land were desalinized and now productive; 1200 hectares of *chinampas* were newly planted; 500,000 more residents had drainage; and 20,000 fewer residents discharged domestic wastes into the canals; two water plants to provide good quality water for the canals; construction of four lagoons to regulate flooding; creation of an ecological park to preserve flora, fauna, and aquaculture; the construction of 2,000 earthen water reservoirs, 20 dams, and 5,000 square meters de soil and rock fill were placed in the canyons of the Sierra de Xochimilco; and 13 kilometers of sewage line were constructed for the towns in the mountains above Xochimilco. These assessments of President Salinas de Gortari were based on a 1993 report of the DDF entitled El Rescate Ecologica de Xochimilco (DDF 1993) which reviewed the progress of government's programs to improve and protect Xochimilco. However, many of the claims of the President and the report are inaccurate.

First, irregular settlement growth has not been controlled, as indicated in the this report (DDF 1993, 18). Indeed, in 1996 the national *Comisión de Recursos Naturales* cited Xochimilco as the ecological zone with the highest level of irregular settlement.² In essence, government programs protect only the 160 hectares of Parque Ecological. Second, there is common agreement that the treated water is poor in quality.³ From time to time raw sewage water is pumped into the canals because of equipment problems at the two treatment plants. The water quality is consistently of low quality, with pH levels of 7.4 and sodium levels of 3.91. In addition the water contains phosphates

and is eutrophied. The level of water in the canals is very low and necessitates the use gasoline, diesel fuel, or electricity to pump the water the fields. Moreover, the pumping of the aquifers of the Xochimilco zone have caused land subsidence of about 40 centimeters per year. Uneven land subsidence has resulted in different land heights for the *chinampas*. This means that the *chinampas* can never be supplied with water by raising the water levels in the canals, because some *chinampas* would be under water in order to adequately supply others with water. In addition, the annual rainfall has declined 30 percent in this century due to deforestation of the Valley of Mexico. Moreover, there is substantial agreement that the government's agricultural programs have not benefitted the *chinamperos*.⁴ Despite efforts of the government to involve the *chinamperos* in planning agricultural programs, the government has not addressed the concerns of these small farmers. The government offers the usual assistance in loans for tractors and fertilizers, even though these are not appropriate technologies for the canal zone of Xochimilco. Tractors are not useful for small parcels of land, and chemical fertilizers are a source of water pollution and eutrophication.

DISCUSSION

The title of this article focuses on "the governmental response to environmental degradation." This paper, however, reveals that government policies are largely responsible for the degradation of the Xochimilco zone. First, the government is directly responsible for the aquifer depletion and concomitant land subsidence in the *chinampa* zone of Xochimilco. Second, the government failed to provide a program of ecological protection of this historic area, until it was seriously degraded. Third, the government encouraged population growth in the zone by providing basic services to new

developments in ecologically protected zones. These findings agree with the notion that government policies and activities are responsible for a significant level of environmental degradation in mega-cities of the LDCs (Harris and Puente, 1990).

The incapacity of the government to control urbanization is a major problem now facing historic Xochimilco. The continued proliferation of irregular settlements in the canal zone is a direct source of the degradation for the canals, *chinampa* farming, and ultimately the tourism industry. Typically builders bribe local officials to allow construction. Political and bureaucratic corruption is a main obstacle to government regulation in the cities of the LDCs (Teune 1988, 372). The case of Xochimilco suggests, however, that government elites and the elites of Mexican society neglected the protection of Xochimilco. Xochimilco has never been designated a national park preserve, similar to other areas, such as *Desierto de los Leones* or *Cerro de Estrella*.

A positive interpretation of the Plan to Rescue Xochimilco is that the government provided the best possible solution, given the economic needs and severe housing and land shortages in Mexico City. A more cynical interpretation is that the Plan to Rescue Xochimilco is a public relations initiative designed to rescue the declining political fortunes of the ruling PRI party in Mexico City. The Plan is a lost cost effort, because the Ecological Park is largely self-supporting. This park is a show piece that demonstrates to national and international visitors alike that the government has acted to protect Xochimilco, although in reality, the park protects only a small area of the historic *chinampas*.

The governmental response to environmental degradation in Xochimilco is not promising. Environmental policy in the mega-cities of the LDCs is generally designed to provide future protection for urban society which may not appear necessary to the public or policy makers, and at

the same time it requires government expenditures and investments that could be utilized for economic growth or projects which are in high demand (Nigel and Puente, 1990:518). Thus in competing with other issues, environmental issues are uniquely positioned toward rejection by policy makers. In the case of Xochimilco, the need for environmental protection is directly linked to the current economic well-being of Mexico City, including jobs and food for the city. If Mexico City, which is among the more affluent cities of the LDCs cannot protect the environment which closely supports the city, then we can expect that other cities will be less protective about the environment which indirectly supports the city.

NOTES

1. In 1990 10 ten percent of the homes in *Delegación Xochimilco* lacked toilet facilities and 19 percent lacked general household drainage (INEGI, 1992: 76).
2. I observed significant housing construction within 100 meters of the canals in field visits to Xochimilco in 1996 and 1997. In interviews with the author the following persons indicated that irregular settlement was a serious problem in the continued degradation of the canals: (1) Dr. Edwin Stephen Otto, Director del Parque Ecologico de Xochimilco, in Xochimilco, April 25, 1996; (2) Dr. Cuitlahuac Ceron D., Presidente del Patronato para el Rescate del Centro Historico de Xochimilco, in Xochimilco, July 17, 1996; and (3) Ing. Ruben Trejo Elias, Chinampero, in Xochimilco, July 24, 1996.
3. Based on the author's interviews with Ing. Ruben Trejo Elias, *Chinampero*, in Xochimilco, July 17, 1996; Dr. Edwin Stephen Otto, Director del Parque Ecologico de Xochimilco, April 25, 1996; Ing. Octavio Escobar Lopez, Branch Office Director of COCODER/CORENA, KM 5 Carretera Panoramica Ajusco, July 11, 1996; and five *campesinos* and two *chinamperos* in San Gregorio, Xochimilco, January 9, 1997.
4. Based on the author's interviews with Lic. Hector Negrete Espinoza, Sudelegado del Programa Plan Lago, Delegacion Xochimilco in Xochimilco, July 24, 1996 and Ing. Ruben Trejo Elias, *chinampero*, in Xochimilco, July 24, 1996.

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