

Contributing Paper

The Experience with Dams and Resettlement in Mexico

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Introduction

Until the 1980's, Mexico was the country with the largest population displaced by irrigation and hydropower dams.¹ Under the guise of a “revolutionary” State committed to infrastructure development, the Mexican federal government diligently applied its right to eminent domain (“proyecto de utilidad pública”) and built a patchwork of dams and irrigation projects throughout this geographically diverse land. From the arid north to the subtropical southern states, a series of hydropower dams now supply almost 29% of the energy flowing on the nation's electric power grid. A total of 80 “irrigation districts” now form the lucrative homelands for exported horticultural products, and officially, water is no longer judged to be a renewable resource.² On balance, there was no participatory resettlement planning, nor were impacted groups fairly compensated for their losses, and many claims remain outstanding; neither was there a systematic pattern of land restitution for those who sacrificed their cultivated parcels for the national good. In sum, development for the resettled was not a priority.³ Within the confines of a single party State (1929-1988), there were few countervailing forces to mitigate and negotiate better terms for the consistent pattern of selective impunity with regard to resettled communities, a situation which induced radical, often armed opposition and consequent police action or military intervention. Appeasement of resettled rural folk was achieved through coercion, money, discretionary legal interpretations and skillful, improvised negotiations. In effect, resettled populations often joined the ranks of the urban poor, turned to illicit crop production or migrated to the United States. And the design of a coherent legal and institutional framework for infrastructure-induced resettlement remains an item on the priority agenda in Mexico today.

1. Historical Overview

Once the revolutionary period's regionally specific chaos subsided, in the early 1920's, Mexico embarked on a novel program of State creation, social modernization and industrialization. At the time, this process was second to a similar process underway in the newly galvanized Soviet Union. Following the pattern of “first things first” in any post-revolutionary nationalist regime, agrarian reform and the creation of a primary school system on a national scale took priority. The arid environment in the country's northern half, plus the raging rivers to be found during the rainy or monsoon season (May-October) in the southern half eventually led to the creation of a centralized State policy of hydraulic resource management as well as electric power generation. However, this program did not get underway until President Lázaro Cárdenas' administration (1934-1940); his presidency created a Water Resources Department (later the Ministry of Hydraulic Resources, SRH) and expropriated a portion of the foreign electric utilities while forming the Federal Electricity Commission to operate and expand the nascent national power grid. Technicians for both public agencies were recruited from the first generation of engineering graduates from the National Polytechnic Institute, another Cárdenas legacy. And the first irrigation control dam was built in the northern state of Durango during this time (1937). Given the fierce nationalism evinced by the new generation of leadership, capital scarcity and the turbulent international scenario, Mexico embarked on a go it alone strategy of infrastructure development. This meant, in effect, that projects were begun when capital and engineering skills were available. Whereas one foreign-built hydropower scheme (Necaxa, 1906) supplied the bulk of Mexico City's electricity, the decade of the 1940's marks the first phase of Mexico's investment of material and human resources in a system of irrigation and hydropower dams.⁴

This first phase, constructed in the early 1940s, included a linked set of small hydropower dams west of Mexico City (See Table I) as well as the planning and feasibility studies for a series of large

multipurpose dams at the base of the western Sierra Madre range in parallel with the Pacific and Gulf of California northern coastline. These dams were begun in the 1950's and construction proceeded at a pace of 2-3 large dams per each six year presidential budget period until 1982. On balance, the Hydraulic Department (SRH) engineers were busy along the northern border and in the northwest (10 large dams), while the CFE Mechanical & Electrical engineers were building large hydropower dams in the convoluted geology of southern Guerrero and Chiapas states (4 dams). A competitive environment prevailed among the two dam building engineering elites, and the north - south division was not symmetrical: CFE built a hydropower dam in northern Chihuahua (Boquillas), while the SRH built a multipurpose dam in Chiapas (Malpaso). From the mid 1940s through the '70s, Mexico built dams aplenty and succeeded in the mammoth task creating a national network of irrigation districts as well as an interconnected power grid over its vast territory.

The Papaloapan Commission was created in 1948, and its strategic *modus operandi* borrowed heavily from the United States' Tennessee Valley Authority regional development model. This Commission designed a series of five hydropower dams (only two have been built to date) in the upper reaches of the Papaloapan River watershed emptying from the Oaxaca highlands into the Gulf of Mexico in south central Veracruz state (just north of the narrow Isthmus of Tehauntepec separating Atlantic and Pacific waters). The first Papaloapan Commission dam was commissioned in 1957 (Presidente Miguel Alemán - or Temascal, the name of the power house location). On the northwest coast, multipurpose dams created extensive irrigation districts on the coastal floodplain and the dams, built at the mouth of narrow, arid canyons, displaced few rural populations. Rather, creating the irrigation districts' layout moved people, ranches and villages about. The Papaloapan basin projects, however, were another story: the Temascal dam displaced circa 25,000 Mazatec people, one of the major traditional ethnic groups comprising this plural nation of 56 languages. A second Papaloapan Commission project, the Cerro de Oro dam, was initiated in 1972, but built in fits and starts over a 16 year period; the budget crisis of 1982 dramatically halted construction and, of course, interrupted the continuity of resettlement and rehabilitation programs for the impacted Chinantecs. The dam was not inaugurated until 1988, blessed with the outgoing President's name, Miguel de la Madrid.

The second phase of dam construction in Mexico begins at an arbitrary benchmark: the financial crisis of 1982, the technical bankruptcy at the end of the Lopez Portillo administration. From this point forward, Mexican public infrastructure budgets contracted and politics began to diversify: vociferous, dissident and locally legitimate rural (and urban) organizations began to erode the power and patronage networks of the official governing party, the PRI. This process is still underway, and in the arena of hydropower and irrigation dam resettlement, it translates into an increased politicization of displaced communities' response to State infrastructure projects and a reduced capacity for government agencies to appease discontent with traditional mechanisms of social control. As a consequence, the Federal Electricity Commission (CFE) dam project at Itzantun, Chiapas was cancelled (1983), and after a significant investment and a previously unknown scale of social mobilization. The San Juan Tetelcingo, Guerrero dam project, after years of turbulence, was cancelled as well (1992). Nearby and downstream, for the first time, a community of dissidents refused to follow the official resettlement plan at the Caracol dam project (1986), and, for the first time, a clever, unknown lawyer filed suit against the CFE which was obliged to negotiate in 1991 a just settlement for the dissidents unwilling to accept compensation checks for their by then inundated property with assessed values pegged at 1981 prices (long before the mid-1980s inflationary spiral). The political fallout from the CFE leaderships' failure to comply and succeed with the standard strong arm operating procedure not only shook the engineering establishment, accustomed to getting its way on "social matters", but reached the World Bank as well. At the same time, this precedent circulated among the labyrinthine personal networks of rural organizations throughout Mexico. This leak in the dike-like structure of the impugned, modernizing and hegemonic State

modified, in effect, the “rules of engagement” between federal agencies and rural communities scheduled to be resettled as a result of large scale projects such as dams. This rule rewrite took place at the beginning of the recently elected Salinas six year presidential period (1989).

On the national scenario, the long delayed and well documented Cerro de Oro dam project (1972-1988) provided an opportunity for rural-based producers’ organizations to mobilize sympathy, road blocks, noisy demonstrations and a continuous barrage of press releases and media events. By this time the former Papaloapan Commission had been folded administratively into the Ministry of Hydraulic Resources which eventually (1989) became the National Water Commission (CNA). The CNA together with the CFE and Pemex (Petroleos Mexicanos) form the tripod of quasi-autonomous agencies sustaining Mexico’s national energy and infrastructure development. While there were no specific MDB loans for the Cerro de Oro dam, it is widely suspected that sexenio (each presidential and budgetary six year period) specific sector loans were used to finance the massive packed earth and gravel dam curtain. More than 25,000 traditional Chinantec people were moved twice: beginning in 1975 to a resettlement site 200 kilometers in virgin forests to the south, and their kin who remained behind were moved (1986-1988) to over 30 “new villages” with second rate lands spread over a wide area in south central Veracruz. The Chinantec were true victims of progress, and their plight, a case of dam-induced ethnocide, was well documented and, perhaps for the first time, the relevant issues ventilated in the free press and discussed among Mexican professional elites.

This second phase concluded with two highly touted “participatory resettlement” projects (Zimapan and Aguamilpa dams) associated with a usd \$470m World Bank 1990 loan. Both dam projects coincided with new World Bank operational directives that required some validating in the field with a few “successful” resettlement schemes. In the first case, Zimapan, a delegation representing some of the 3500 resettlers-to-be innovatively visited on their own accord the dissident community at the edge of the Caracol dam reservoir to obtain a first hand report on recent CFE resettlement tactics; their tape recorded interviews were listened to attentively upon their return. In the case of Aguamilpa, the total population to be flooded was under 1000 individuals, fragmented in small, “leave us alone after you move us” traditional, Huichol and mestizo communities; hence, the participatory approach was put into effect at this limited scale, in part because there was no other tactical option, and in part due to the unusual and praiseworthy professional ethics of those responsible for administering the CFE Aguamilpa dam resettlement process in the field. Zimapan’s resettlement program began auspiciously with CFE adhering to the new World Bank Operational Directives. Four alfalfa growing “ranches” were purchased with loan money, administered and upgraded (deeper wells, leveled parcels with irrigation ditches). Two smaller, comfortable resettlement towns offered genuine economic “rehabilitation” with fertile lands in restitution. The larger community, three villages from a single ejido⁵, were destined to take possession of the four ranches. A CFE agronomist administered these properties for four years, time enough for the initially enthusiastic campesinos to think about the new costs of maintaining and paying the energy costs of electric pumps, subsequently change their minds, and then refuse to accept their assigned parcels proportionate (2 new hectares x 1 old) to their traditional gravity irrigated farms. The leadership, accustomed to negotiating most details of the design and construction of their “new town” in a very participatory fashion (to the chagrin of CFE and the delight of World Bank staffers), estimated future operating costs for the pumps and wells; they decided it would be too expensive to farm (and commute from their new town, 50 kms away), and asked for another land restitution option. By then the scheduled reservoir flooding was less than a year away, and CFE leadership refused to acquire new lands, offering instead to compensate each male head of family with restitution rights to the tune of the market value of their parcel. In effect, there was no land restitution, although the entire process was redemptively participatory from an institutional perspective. During the resettlement process for both loan-financed dams, the World Bank imposed an innovative scheme: the National Indian Institute (Instituto Nacional

Indigenista) would “monitor” events with a special field team. This may have been the first time one federal agency monitored and evaluated in situ the actions and procedures of another. While the INI reports were not public nor discreetly available to the research community, a highly respected Mexican anthropologist, serving as a short term consultant to the Bank, periodically negotiated with senior CFE officials improvements or modifications in the resettlement procedures underway at Zimapan and Aguamilpa damsites. His role as broker was key to the real time monitoring process and its feedback on CFE field procedures. This process managed to keep the participatory objectives in focus and a priority among field personnel in charge of the resettlement program.

Two other dams illustrate issues yet to be resolved in future infrastructure policy planning. The Huites multipurpose irrigation control and hydropower dam on the Sinaloa, Sonora and Chihuahua state boundaries in northwest Mexico was the first privately financed megadam in Mexican history. A national consortium with a Brazilian master contractor built the dam while operating at a full bore pace (1992-1994). This project was begun in tandem with the 1992 reforms to the Electrical Sector and Water Resources Laws permitting private capital joint ventures for the first time since the Revolution of 1910. The Huites project, under the supervision of the National Water Commission (CNA), called for selling water to farmers on 70,000 hectares of the former arid coastal plain, split evenly between Sinaloa and Sonora states. Two items of moment are noteworthy: the CNA, responsible for the “social aspect” (using engineer’s semantics), or the dislocation and resettlement component of this project, agreed to offer agricultural parcel and homesite restitution to the native Mayo people to be flooded by the reservoir; however, this group only received 65 modest homes next to the town, Choix, Sinaloa, adjacent to the dam’s construction camp. The Mayo complained to the National Indian Institute, already deeply involved (after the World Bank invitation) with resettlement for the Nāhñu and Huichol cultural communities, respectively, at Zimapan and Aguamilpa dams. The INI sent a tenacious field anthropologist to investigate, never having received any prior notification from CNA re the Mayo communities. After outwitting, on different occasions, CNA goons ordered to prevent or limit his freedom of movement in the reservoir basin, he was able to prepare a detailed report which led to the INI filing a complaint against CNA procedures with the Office of the Presidency. There being no effective legal framework guaranteeing the rights of the Mayo, nor the accountability of project officials, under the new rules of private sector investments, only high level negotiations eventually forced CNA to honor their original commitment to land restitution. Suffice it to note the Huites dam has a structural flaw on its right geotechnic anchor, and has never operated with a full reservoir, thereby severely limiting the opening of new lands for irrigation and crippling the export horticulture business plan.

The second case (1997) is also unique, and involves two state governments, Nuevo Leon and Tamaulipas, haggling over water rights to the Cuchillo dam in northeastern Mexico, not far from the United States’ border.⁶ Downstream Tamaulipas, whose large irrigation districts are fed by Cuchillo dam water, complained that Nuevo Leon was not only pinching the inflow, pumping more than their fair share of water for domestic use, and limiting the agreed upon downriver outflow. A lengthy drought, fueled perhaps by global warming, reduced the projected water volume in the reservoir, and almost led to guns being drawn at the pumping station. It was a Mexican standoff, and a prelude to future water wars in irrigated arid regions.⁷ The top level CNA troubleshooter was sent to negotiate a mutually acceptable solution among both state governments and the CNA. Both cases, Huites and Cuchillo dams, imply the absence of an institutional and policy framework where issues can be anticipated, project contingencies planned for, dissidence and negligence accounted for, and conflicts resolved with a minimum of strife and costly efforts on the part of the aggrieved. Insensitive press coverage of these dam-related policy problems also may contribute to popular disenchantment with public entities, while vaccinating against a sensibility to social issues, and, in this fashion, erode the legitimacy of the State and complicate future policy innovations.

The third phase of resettlement in Mexico will begin when the State commits to a policy of equitable reparation for homes and lands sacrificed for “the public interest”. And this process has become more complicated in the context of the quasi-privatization of the electrical sector now underway. This may well be the emerging context in Mexico and elsewhere in Latin America: a legacy of State impunity converging with a rampant privatization process ignoring the rights, human and environmental, of those impacted by energy infrastructure projects. An example is at hand. The current dispute at the first large hydropower dam project at Temascal involves a French consortium who, as a joint venture with CFE, have invested in two 200MW turbines and a corresponding enlargement of the subterranean power station. These additional turbines require, of course, a larger head of water to move them, and hence, the CFE is currently planning to raise the operating level of the dam nine meters. This means the approximately 3500 Mazatec families, who were literally flooded out in 1957, are being asked/ordered to move again, for “the public good” and without compensation from the private corporation to benefit from their sacrifice.⁸ This pending third phase of resettlement must integrate the rights of the displaced with the rights, duties and obligations of the State and its new business partners. In fact, Mexico’s third phase of infrastructure-induced resettlement coincides with the World Commission on Dams’ discussion of future policy guidelines.

In sum, any historical review of the 20th century mosaic of State-induced infrastructure resettlement in Mexico must examine the scenario wherein political and police power is used to endorse, negotiate and coerce compliance on the part of reluctant citizens forced to leave their homes and abandon their productive assets for the public interest. The analytical framework is necessarily a question of political will, rules and countervailing systems (or the lack thereof) to assure acceptance. On balance, in Mexico this process has not been consensual nor participatory, even within the confines of high profile World Bank hydropower dam loan projects (Aguamilpa and Zimapan). There is no legacy of “**best practices**”, unless we accept the logic of minimal deaths, land invasions, demonstrations and appeals to international human rights organs and NGO activism as a suitable benchmark. Rather, what is observed is a persistent pattern of top down, “we know best” kinds of engineer-directed resettlement projects conducted with a selective impunity (often a function of the personal values of project executive engineers), and whose inevitable conflicts are appeased and resolved through extraordinary political, military and judicial procedures. However, the precedent of one state agency monitoring and evaluating the resettlement project of another, under the guidelines of a powerful financial agency such as the World Bank, is illustrative of how policy flexibility can be induced. Mexico may well be another case where the arrogance of those State agencies responsible for resettlement renders them immune to criticism and reluctant to learn from their socially and environmentally costly mistakes. Nevertheless, the Multilateral Development Banks share some responsibility for the bleak panorama sketched here: their demonstrated unwillingness to respect their own guidelines and operational directives. It has been demonstrated that when push comes to shove as it did at the Zimapan dam, the World Bank’s reluctance to respect their own rules is also an undeniable incentive to negligence among their clients. From the perspective of efficacy in public administration, it may be much more costly to muddle through, than plan just solutions with fair compensation and equity participation. Changes in the Mexican political landscape augur for more countervailing power in federal and state legislatures, a process that may favorably modify the extant modus operandi in future projects, if the international ambience also shifts accordingly.

2. The Major Issues

As in other countries, the major issues surrounding the construction of big dams relate to: 1) the strategic model for rural and urban development and the accompanying cost-benefit formulas shared by planners

and financial authorities; 2) a clearly defined role for the State's executive, legislative and judicial bodies in the negotiated definition of "public purpose" justifications for exercising the power of eminent domain; 3) the regulatory framework for private energy ventures and due process for those afflicted by private investments (often piggy backing on extant public assets); 4) the consultation, monitoring and evaluation feedback process linked to the planning and construction of large scale infrastructure investments; 5) the accountability of public entities and their personnel; 6) entitlements of impacted groups under State, private and joint venture projects; 7) an adequate and enforceable legal framework allowing NGO participation as well as respect for human rights, including the right to information; and 8) modifications of university curricula in engineering, ecology, planning and social science fields. As the foregoing general argument suggests, Mexico needs to make dramatic improvements on all these issues which nowadays appear at the core of any future international consensus regarding dams and their impacts. What may be needed is a dramatic shift in the analytical perspectives shared by politicians, planners, economists, engineers, ecologists and anthropologists.

3. A sustainability model in future planning for dam projects

The growing privatization of formerly public sector activities, in energy, water and large infrastructure projects (airports, ports and tourist resorts) begs for a new planning model for resettlement, rehabilitation and reparation. This is true in Mexico and elsewhere. Those individuals and communities affected by these projects, large and small, require a regulatory and accountability framework that is presently non-existent. This is a tall order in a land accustomed to the impugn actions of government agencies. It is imperative to establish the legitimacy of the premise that traditional inhabitants of impacted areas have a right to an equity share in the project that will dramatically alter their lives. This is the paradigm shift presently in order. The premise is remarkably coherent with the Scudder-Colson generic four stage chronology of post-resettlement adaptation referred to in the WCD scoping document, and with the Cernea risk reduction strategy as well. It may be easier to develop a coherent set of norms under privatized or joint venture conditions than with projects employing only public funds. Suits can be filed against private firms under national laws much easier than against State agencies, and risks can be estimated with some precision as a means of determining the "bottom line" cost factor. The argument for equity shares in any energy producing project includes the financial incentive factor together with a participatory dimension. Impacted communities may be galvanized by the incentive of receiving an income from their sacrifices in cultivated lands and home sites, and motivated to participate in planning for their physical relocation or other acceptable options (outmigration). Their collective sacrifices in effect add value to the energy produced. With a guaranteed income, planning and relocation truly can be translated into "rehabilitation", and community services can be restored or improved. In my view, development can only occur when an equity share framework is in place; any other resettlement cum development model is stillborn.

There is a relevant precedent for equity shares in hydropower dam projects: the Pehuen Foundation created in conjunction with the IFC/WB loan and 2.5 % equity share in the southern Chile Pangue dam (begun in 1992, completed in 1997) received a 0.37% equity share in the Pangue subsidiary; this amount guaranteed an annual income for the Foundation in the amount of usd \$140k to be dispersed and invested in projects allegedly benefitting 242 Pehuenche families in three communities near the Pangue construction camp and future reservoir. Whereas this particular dam became a international cause celebre due to unattended environmental issues, and the 1997 Hair and Downing IFC-commissioned evaluation reports indicate negligence in Pehuen Foundation strategies among many other project dimensions, the legal precedent stands, among international loan projects and for joint public-private sector endeavors.⁹ This equity share proposal requires, of course, a generic and transparent formula for estimating the value of land, house plots and communal property to be inundated by any dam project, the

“stress cost” of preparing to move and the almost always problematic physical relocation process, the construction of a “new town” (with individual home-building options), etc. Any “trust fund” or “community foundation” created under the terms of an equity share agreement requires professional consultants in the design and execution of the trust fund itself, plus the technical procedures for census taking, GIS-based data and calculations of impacted property and natural resources, physical relocation procedures, and what not. This is where the WCD can develop a generic data collection and database system to be employed university-based research teams; qualified NGOs may offer their professional services as well. And it is not inconceivable that functions formerly carried out by State agencies will now be performed by consultants and consulting firms using the generic methodology. Only a decade ago, expertise was limited to a few and access to information was a prime criteria for administrative power; the information society, however, is changing the rules. Today, vanguard NGOs employ the new information technologies and can produce public policy initiatives with more agility than staffs in public entities. The emerging non profit sector is a natural ally of impacted communities under any equity share plan tailored to national laws, regulatory frameworks and circumstances.

4. The changing role of the State

...and the new obligations for private initiatives in infrastructure development. The nub of the matter requires a complementary paradigm shift: to wit, private capital must assume the direct and indirect social and environmental costs entailed in their investment projects. These costs cannot nor should be absorbed by the public sector. This means, in short, that Environmental and Social Impact Assessments must be thorough, performed by certified third parties (a legacy of the WCD project..) who consult the agencies, people and communities to be affected, and make reports available to public scrutiny. Of course, the costs of resettlement, rehabilitation and reparations must be included in the formula, not sloughed off as a “government responsibility”. The WCD must create a “certification” process that is a prerequisite for all dam projects that require loans from the international capital markets.

5. A new legal and regulatory framework

In the case of Mexico, there need be a single piece of federal legislation that integrates the distinct components of the multiple aspects of any resettlement project. This includes, of course, legislative input in the definition of “public interest” investments, an enforceable regulatory framework, due process, public consultation of affected parties, planning guidelines, budget accountability and transparency, equity shares in joint public-private projects (where private capital builds on extant publicly financed infrastructure), coordination among the three levels of government—federal, state and municipal, land restitution where applicable, market pegged assessed valuations, etc., as well as clear guidelines under joint ventures and private energy and irrigation initiatives. Not an easy task.

Endnotes

¹ Herewith 3 tables in the Appendix: Table I, Hydropower dams; Table II, Irrigation dams; Table III, Irrigation Districts all involving human resettlement on some scale. The official data regarding resettlement are scanty at best. In the original technical reports of the different federal agencies responsible for irrigation projects, the resettlement item is merely unlisted. Similarly, in the library of the Federal Electricity Commission (CFE) there is no table synthesizing hydropower dam resettlement data—the numbers listed here are the product of personal interviews with CFE personnel who worked on different dam projects.

² The National Water Commission (Comisión Nacional de Agua) reports (**La Jornada**, Mexico City, 1 June 1999) that 83% of Mexico's water resources are destined to agricultural irrigation, although only 45% of this amount is used. The current irrigation infrastructure covers 6.3 million hectares, and 57% of domestic and 70% of exported produce are cultivated with these irrigated lands.

Note the discrepancy between the 99 Irrigation Districts listed in Table II, the 80 "official" Distritos de Riego in the latest available publication on the topic (Gorritz, Subramanian y Simas, "Irrigation Management Transfer in Mexico. Process and Progress" World Bank Technical Paper No. 292, 1995, Map), and the following table of 79 Districts "transferred" to users during the first half of this decade according to E. Palacios, **Benefits and Second Generation Problems of Irrigation Management Transfer in Mexico**, Economic Development Institute, PARTICIPATORY IRRIGATION MANAGEMENT CASE STUDIES SERIES, August 1997:

Sizes of Irrigation Districts - Mexico

Irrigated Area [hectares]	Number of Districts	Total Area
Less than 10,000	23	131,900
10,001 to 50,000	39	980,821
50,001 to 100,000	9	690,256
100,001 to 200,000	3	374,817
More than 200,000	5	1,158,377
Total	79	3,336,171

³ In fact, the data are not available from the enormous compendia of data in the irrigation sector; to deduce what will always be a tentative figure would require an enormous archive and oral history project.

⁴ The nationalization of foreign power companies in Mexico was not completed until 1960, under President Lopez Mateos' administration. The Canadian based Mexican Light and Power held a 7% share in the Compañía de Luz y Fuerza del Centro, the government owned generation distribution company operating in and around Mexico City, until 1994, paradoxically, the end of the rapidly neoliberal President Salinas' six year term.

⁵ Ejidos and Comunidades Agrarias comprise more than half (52%) of Mexico's national territory, distributed among 3.5 million families in 29,951 communities who cultivate on 4.6 million parcels. The ejido is a unit of land tenure, a form of "social property", recognized in the Constitution, and granted in perpetuity by the State to an explicit group or members of traditional communities or homesteaders. Only 35% of cultivated lands are private property. The 1992 Reforms to the Agrarian Law allow and encourage a surveying and title granting process for all ejidos (total 27,400) who must approve this procedure in a series of 14 open meetings of ejido membership. As of June 1999, 62% of the total ejidos have been granted titles to their cultivated parcels and urban house plots. Joint ventures and contract farming is permitted only if approved by the ejido general assembly. Although the 1992 legal reform permits it, only 0.28% (290k Hectares) have been sold to third parties. On the national scale, 60% of grazing lands belong to ejidos, 45% of arable land and 70% of the forests, but the average age of ejidatarios is now over 50 years. The following table is offered as a heuristic device to conceptualize future demand for water and energy in Mexico's major regions. This demand will probably be met by a mix of public and private energy producing configurations.

MEXICAN ECOLOGICAL ZONES AND POPULATION DISTRIBUTION

ECO ZONES	AREA KM ²	COMMUNITIES	POPULATION DENSITY / KM ²	POPULATION (millions)
Arid	1,000,000	63,383	24.6	24.75

Temperate	368,000	53,964	112.8	41.50
Dry Tropics	242.500	30,547	39.5	9.50
Wet Tropics	326.300	50,536	43.6	14.25
TOTAL	1,936,800	198,430	-	90.00

Source: National Population Council, Consejo Nacional de Población, CONAPO, **Población y Medio Ambiente en el Ambito Rural**, as reported in **La Jornada**, México, D.F., 3 May 1999, p. 49.

⁶ The Mexican government built the El Cuchillo Dam to increase water availability for residential and industrial uses in Monterrey, Nuevo León, Mexico's second most important industrial center. The Project consists of: a 43-meter dam on the San Juan River which has a maximum storage capacity of 784 million cubic meters, and is located 48 miles south of the Rio Grande River near the town of China, Nuevo León; five pumping stations to convey water over 60 miles via covered aqueduct to Monterrey; water meters and other improvements to facilitate water delivery to end-users; a sewage and wastewater collection and treatment system for pumping treated effluent from an area northeast of Monterrey into the Pesquería River, out of Nuevo León and into the state of Tamaulipas and, ultimately, into the San Juan River; and a canal to enable to the city of Reynosa, Tamaulipas, to draw its drinking water from the Rio Grande River. With a \$325 million loan from the Inter-American Development Bank, the Project was rushed to completion during the presidency of Carlos Salinas de Gortari, who was indebted to the industrial elites of Monterrey. In October 1994, Salinas inaugurated the El Cuchillo Dam even though the sewage treatment plants were unfinished. The floodgates were closed, the dam's reservoir began to fill, and a slow-motion disaster started to unfold downstream. The San Juan River, the second largest tributary of the Rio Grande River in Mexico, had flowed unimpeded until 1936, when the Marte R. Gómez Dam was built approximately five miles from the U.S.-Mexico border and 40 miles west of the city of Reynosa. Until the construction of the Project, the reservoir created by the Marte R. Gómez Dam, known to Americans as "Sugar Lake", had provided a relatively clean source of drinking water to Reynosa and irrigation water to the Twenty-Sixth Irrigation District, which surrounds Sugar Lake. Source: Ismael Aguilar Barajas, "Interregional Transfer of Water in Northeastern Mexico: The Dispute over El Cuchillo Dam", *Natural Resources Journal*, Spring 1999, Vol. 39, No. 1 (Univ. of New Mexico Law School).

⁷ Due to drought conditions in northwest Mexico, the CFE shut down 8 hydropower dams in the state of Sinaloa alone on 31 May 1999. Power generation responsibilities were shifted to nearby thermoelectric power stations and dams further south (Aguamilpa, Nayarit). Similarly, drought conditions affected irrigation dams elsewhere in northern Mexico; many were reported by the CNA to be completely dry at the beginning of the 1999 monsoon. There is conjecture, however, that inadequate reservoir management, rather than the drought per se, may be the major causal factor responsible for lack of water in downstream irrigation systems.

⁸ The original 1957 expropriation procedure anticipated the creation of the present day linked twin reservoirs of Temascal and Cerro de Oro dams, the largest body of fresh water in Mexico (surpassing Lake Chapala). Because Cerro de Oro was designed to operate nine meters above the traditional altitude of Temascal, opening the 50 meter channel between the two reservoirs will raise, of course, the operating level of Temascal. It is unclear if Temascal was designed originally to have its dam curtain raised at a future date, or if the subsequent design and construction of adjacent Cerro de Oro justified this modification. But what is key from a legal standpoint is the fact that the original Temascal expropriation anticipated the projected maximum operating altitude of today's CFE-CEGELEC joint venture. As a consequence, the CFE is now telling the Mazatec people they have been squatting on federal land since 1957 and must move. Legal advisors to the Mazatecs respond that over 40 years of occupancy creates a right of possession.

⁹ The Hair and Downing reports are discussed at the following websites:

<http://www.ifc.org/PUBLICAT/PRESS/DATE/1997/HAIR-E.HTM>

<http://www.irn.org/programs/biobio/pr980402.html>

<http://www.ameranthassn.org/pehuenc.htm>

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