The Transnational dimensions of Mexican irrigation, 1900-1950

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1. Introduction

This chapter calls attention to a topic that has been little studied: the diverse foreign influences that can be seen in the design and instrumentation of Mexico's irrigation politics during the early years.[2] This irrigation politics was born in 1926, during the government of Plutarco Elias Calles (1924-1928). It was directed at the northern part of the country, with the objective of increasing the region's population and fully occupying the border with the United States. North Americans[3] and other foreigners collaborated in diverse ways with this Mexican strategy, a fact which highlights the complexity of the neighborly relations between the two countries. With knowledge and advice from Americans, the Mexican State was able to increase its irrigated lands, which meant a rise in production and population, as well as a notable increase in the consumption of surface water within national territory. In this way the government's irrigation politics strengthened the Mexican position in the negotiations over the 1944 International Water Treaty. In this article I offer a brief review of some of these transnational aspects of Mexican irrigation. It is a preliminary guide that aims to identify a research strategy and (I claim with not a small degree of optimism) suggests some possible findings.

Two recent studies – Paolo Riguzzi's (2003) book on commerce and Marco Antonio Samaniego's (2006) on the 1906 and 1944 water treaties – suggest that careful, detailed research can reveal aspects of Mexico-US relations that may surprise us. In both books we find a reconsideration of the commonly-held idea that México was a vassal to the expansionist interests of its northern neighbor, and that México was an almost defenseless victim of North American ambition. It may be that this vision is sustained over the long run, but it certainly needs to be reconsidered in the light of these and other studies. Riguzzi and Samaniego show not only that México refused to accept with resignation the demands of its powerful neighbor, but also that it had the capacity to generate initiatives, to resist, to oppose, and to give ground in one area in order to gain ground in others. We see that in the period between 1857 and 1944 Mexico enjoyed an underappreciated capacity for negotiation with the government of the United States. In these negotiations, the ability and knowledge of some Mexican diplomats stands out. These two books, as well as this article, do not attempt to ignore the great differences between the two countries, differences that widened during the twentieth century as the northerly neighbor became a world power. Rather, these works try to illuminate some poorly-understood aspects of this neighborly dynamic, and come out in favor of a more subtle and balanced vision of Mexico's inevitably close relation with its northern neighbor.

In the realm of irrigation, at least two aspects stand out. First, the agricultural development of the arid Southwest United States had a notable influence on agriculture in northern Mexico, and in consequence on its irrigation politics. Second, the engineers and the engineering of the two countries worked closely to carry out the model of large-scale irrigation followed by the Mexican government, especially during the first decade (1926-1935) of existence of the Mexican National Irrigation Commission (the *Comision Nacional de Irrigación*, or CNI). This second dimension had a lot to do with the role played by the White Engineering Company, a U.S. company that played a significant role in jump-starting irrigation in Mexico. Finally, the economic viability of Mexico's new irrigated zones was linked closely to a cotton economy centered in the U.S.

2. New agriculture, new water

In the last decades of the nineteenth century, an economic and social movement of great importance took shape throughout the western United States and northern Mexico. Deploying ever-greater sums of capital, groups of agricultural producers and businessmen opened large expanses of land to cultivation in a

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[2] Elsewhere I have described the wide-ranging effort to build a new rural Mexico as an "irrigation politics" (*política de irrigación*) (Aboites Aguilar 1988). Rather than viewing this effort as simply a set of legal measures or policies, I suggest we look at irrigation in post-Revolutionary Mexico the way its proponents saw it: as a project to build a new economy, society and culture.

[3] The term "North American" is used instead of "American" to refer to the United States and Canada. Mexico, and the rest of the countries in the hemisphere, are also "American" in that they are located in the Americas.

surprisingly short period of time. Because of aridity or irregular rainfall patterns these lands required a regular and systematic supply of irrigation water. The San Joaquin and Imperial Valleys in California, and in Mexico the regions of Mexicali, the Laguna, and later the Yaqui River Valley all underwent agricultural change that was marked by a new way of perceiving land, water, plants, as even the relationship between the two countries (Worster 1985; Samaniego 2006).

A few years later this rural experience was accompanied by the creation of the first hydroelectric dams, which made possible the large-scale production and long-distance transmission of electricity. With the advent of irrigation and electricity, water became big business and began to attract a lot of investment. It wasn't long before urban water systems were installed in cities as large as Los Angeles and as small as Chihuahua (Kahrl 1976; *Datos.*..1905). This was a *new water*, a water free of health-threatening microorganisms, which were a serious worry for city planners by the turn of the century (Goubert 1989; Melosi 2000).

With new sources of electricity available, as well as the internal combustion engine driven by gasoline or diesel, pumps began the assault on subsoil waters. The windmills that brought water to the surface, contributing in that way to the "conquest of the West", were left far behind (Webb 1931). Beginning in some parts of Texas in 1910 and in the Laguna or Yaqui Valley in 1920, wells became a crucial part of agricultural and urban life, proliferating and tapping ever-deeper water sources. For the first time in history humankind had the technology to overcome their dependency on gravity-based water systems. What is important here is the change in scale, and the revolutionary increase in the capacity to control, conduct and consume water. *New water* was part of the expansion of capitalism in the transformation and exploitation of the natural environment, and it took on new meanings.

This water revolution made possible, and was made possible by, a series of innovations in the design and engineering of dams, materials (rebar, cement, tubing, floodgates, valves, cables), forms of labor organization, construction companies, engineering disciplines, institutes, laboratories and educational centers. In this way, the new, expanded capture of water brought with it a wide array of economic and cultural activities, and with diverse government institutions of a new kind. Steam shovels, large trucks, cranes, bulldozers, machinery for mixing and producing concrete, and pneumatic drills were some of the other components of this episode in the history of water use. Fortunately, we have a large number of photographs of the hydraulic works of this period that show the complex diversity of actors and technical elements involved in these constructions.[4]

Another illustration of the relevance of using the term *new water* is the appearance of hydrographic drainages or watersheds. The point is not that these geographic features that concentrate rainfall and snowmelt into surface and subsurface bodies of water and direct them to the sea did not exist before 1880. These watersheds have a geological history measured in millions of years. The story we are interested in here is more modest, even simple: it is the social history of how, in the space of a few years, all the changes described above came together to shape a new way of using water. The construction of big dams required the study or at least the consideration of whole watersheds, in order to estimate the volume of the runoff and stream flows as well as the quantity of silt borne by these waters, so as to determine the appropriate type and size of dam. The emergent science of hydrography looked at the landscape in a new way, serving the interests created alongside *new water*. Government authorities also changed their manner of seeing water because, first, in fiscal terms, if water was becoming big business, it was clear that some sort of government institutional framework and taxation scheme should be adopted. It is no coincidence that in 1902 the United States Congress passed legislation that gave life to the Bureau of Reclamation, the institution charged with the task of building large irrigation works in the Western states. Perhaps more importantly, government increased its purview because the new way of using water generated conflicts due to increased competition. A new form of regulation was required to deal with new conflicts, generated by the appearance of equally new interests that were often built upon social conventions that were very delicate and fragile. In some places the arrival of huge investments of capital smashed these centuries-old legal and social arrangements into smithereens. A fundamental aspect of the *new water* is that it obliged its users and providers to look to the future and to establish a new set of social and legal agreements to control the consequences of increased demand for the resource.

The hydrographic vision, developed to handle the logistical requirements of the new water and its capture, forced the recognition that watersheds do not follow national boundaries. By the beginning of the twentieth century, first in the Bravo/Grande river drainage and then in the Colorado river drainage, businessmen, residents, local and national authorities of the two countries understood that sooner or later they would have to come to some agreement about border waters. The bilateral agenda included a new element: along with commerce, contraband, and indemnizations, water took an important place. It is no coincidence that the first water treaty was signed in 1906. That treaty was a product of none other than the *new water*. In the 1880s farmers in the upper Río Bravo/Grande of New Mexico began to open new irrigation zones. The

[4] The *Archivo Histórico del Agua* (Historical Archive of Water) in Mexico City holds a vast collection of photographs related to the construction of hydraulic works during the twentieth century. The Water Resources Center Archives, at the University of California, Berkeley, has an equivalent collection.

result was a growing shortage of water in the middle stretch of the river, especially in the twin cities of Ciudad Juárez and El Paso. Guided by the common sense principle that water shortages hurt both sides of the river equally, *paseños* and *juarenses* called upon their respective governments for help. Owing to the forcefulness of the demands, the two federal governments were obliged to come to an agreement (Samaniego 2006: 219-227).

3. Irrigation in Mexico

Much has been written about the influence of agrarian development in the Southwestern United States, in particular in California, on the ideas and mentality of those who would triumph in the Mexican Revolution: that is, the group of regional elites from the northwestern state of Sonora (Adolfo de la Huerta, Álvaro Obregón and Plutarco Elias Calles were the most prominent figures) (Carr 1973). It has also been pointed out that this influence was made even more evident when North American investors began to arrive in different parts of northern Mexico, in particular Baja California, Sonora and Sinaloa. The construction of hydraulic works for river water irrigation was undertaken in Mexicali (geographically and hydrographically a continuation of the Imperial Valley), and in the Yaqui River Valley, with the arrival of the Richardson Company in 1910. But in fact the opening of new irrigated lands and the appearance of a new capital-intensive agriculture was also undertaken, with different rhythms and modalities, by Mexican capital in the Culiacan Valley, Los Mochis, and in the Laguna region.[5] The revolutionary Sonorans embraced the attributes of capitalist agriculture, such as the centrality of private rather than communally-held property, as well as the importance of the individual producer - progressive, hungry for technological innovation - with access to modern credit and markets. In sum, the Sonoran politicians fed off the North American experience that poured over the border into northern Mexico, and adopted the "farmer" as the axis of an agrarian development model that implied a drastic change in land tenure in this new context.

But North America was not the only influence. The agrarian project of the Sonorans also felt the weight of older liberal ideas that were important in Mexico throughout the nineteenth century (Hale 1984). The vision of the small proprietor as the basis of a modern, market-oriented, middle-class agriculture that would in turn undergird social stability, defined the posture of these Sonoran politicians. Put another way, the "farmer" that began to appear simultaneously in the American Southwest and Northern Mexico gave concrete, viable form to established Mexican Liberal ideas. All this gained added importance because the Sonorans felt that the path of Mexico's future development could only be agricultural; industry was not an option. An official document from the period expresses this idea succinctly:

> Anyone who looks calmly at national production and the sources of wealth upon which this country depends, must arrive at the conclusion that we are, and should be during the foreseeable future, an essentially agricultural country (Salido 1927: 429).

The countryside needed modernization, which implied technical innovation and the leaving behind of "routine procedures." This phrase, so common in the 1920s, contained a critique of the landowners that based their production on the exploitation of peons and day laborers on large landholdings: the *latifundios* and *haciendas*. "Modernization" meant doing away with large landholdings and with the landlord class so as to open the way for small private property owners idealized as "farmers." The Sonorans were so convinced of this political vision, inspired in the peculiarities of their homeland in northwest Mexico, that they promoted it for the entire country.

In January of 1926 the Mexican Congress approved a proposal for a law, generated by President Calles, that would establish a wide program of irrigation activities and institutions. The "Law of Irrigation with Federal Waters" (*Ley sobre irrigación con aguas federales*) created the National Irrigation Commission (*Comisión Nacional de Irrigación*, or CNI) and declared the construction of irrigation works to be of public interest. The failure of the Agriculture and Irrigation Loan Fund (the famous *Caja de Préstamos para la Agricultura y la Irrigación*), created by the government in 1908, strongly influenced the shape that postrevolutionary irrigation politics took. Starting with many of the same ideas that gave birth to the Bureau of Reclamation in the United States, Mexican authorities during the government of President Porfirio Diaz insisted on giving loans to businessmen so that they would take care of building irrigation works on their properties.[6] This government project failed because a good part of the money stayed in the hands of a very few landowners, who did little to fulfill the goals of the government (Oñate 1991). Various Mexican experts, among them Roberto Gayol, had argued even before 1908 that irrigation had to be a government affair, and

[5] Northern Mexican cities also showed the North American influence. In 1927 the governor of the Northern District of Baja California said that "The most elegant and costly private residences are located in the second section of the city, which was subdivided according to the North American system. . . . Their archictecture does not reflect the style of our country, but rather an American, Californian style knows as the "bungalow" (Rodríguez 1928: 142).

[6] Díaz governed from the end of 1876 until May of 1911, with an interruption from 1880-1884.

pointed to the example of the Bureau of Reclamation in the United States (Gayol [1906] 1994). Needless to say, with the bankruptcy and failure of the *Caja de Prestamos* these ideas gained strength.

The 1926 Irrigation Law broke from the model of the *Caja de Prestamos* and adopted the posture that direct government intervention in the financing and management of irrigation works was unavoidable, a posture advocated by Gayol as well of course as those in the United States who had created the Bureau of Reclamation. However, despite the formal similarities in the government irrigation projects of the two countries, there are no direct references to the Bureau of Reclamation in the Mexican irrigation law of 1926, or in the scarce documentation available concerning the creation of the CNI.[7]

At least two features distinguish the Mexican irrigation program from that of the U.S.: the property regime concerning water, and the monopoly held by the government over irrigation. Article 27 of Mexico's 1917 Constitution declares water to be property of the nation. Access to this water by private individuals thus depends on concessions awarded by the federal government, acting on behalf of the nation. This constitutional principle prohibits (at least formally) the private acquisition of water rights. The second point is that the Mexican government monopolized large-scale irrigation. While it did not legally prohibit private investment in this area, the government did in fact oppose the efforts of private investors to create hydraulic infrastructure. Benjamin Johnston, owner of the sugar mill in Los Mochis, Sinaloa, tried to build a dam on the Fuerte River, but President Alvaro Obregón rejected the proposal (Carton de Grammont 1990: 71).

Analysis of the Mexican government's irrigation policy must take into account its timing. Mexico had just emerged from more than a decade of revolutionary unrest, a long and cruel civil war that involved a variety of popular groups that struggled for, among other things, land reform and the destruction of large properties, or *latifundios*. Mexican authorities did not trust the landowners to take agricultural modernization seriously. If the landowners did indeed make reforms, reasoned figures such as President Calles or his Secretary of Agriculture Luis León, they would ask for privileges that were not acceptable or possible after the Revolution. Rather than support the landowners, government irrigation was seen as a way to destroy the *latifundios* as well as the landlord class. Not only would the government support the modernization of agriculture through a series of technological innovations that would accompany the extension of irrigated lands. They also sought to divide the *latifundios* in order to stimulate the formation of a thick social stratum of small proprietors, and proposed a colonization program that would move small producers into these newly opened irrigation zones. In this way a fundamental component of Mexican irrigation was a change in land tenure, something that was not undertaken in the United States, where the goal was to facilitate the private appropriation of public lands. In both countries, however, irrigation was considered the most efficient way to propel the settlement of extensive areas characterized by aridity and low population density.

Mexican irrigation looked toward the northern neighbor in many ways. In addition to the influence of the modern irrigated agriculture in the Southwest, spread throughout northwestern Mexico by the North American companies of the Mexicali and Yaqui valleys, the Mexican government clearly directed its irrigation program toward the northern half of the country. The explanation for this can be found in the border with the United States, where the Mexican state sought to strengthen its geopolitical and cultural presence. The loss of territory after the War with the United States was vivid in the minds of many in government, and in their opinion the northern border was a scarcely populated, fragile and vulnerable area. It is worth recalling that still in 1930, some eighty years after the war between Mexico and the United States ended with the Treaty of Guadalupe Hidalgo, some politicians and businessmen in the United States advocated the annexation of the Baja California peninsula.[8] The economic growth experienced during the reign of Porfirio Díaz resulted in a notable increase in population in the states that share borders with the country to the north, but in 1930 only 18% of the country's people lived there (Aboites 1995: 99). It was anticipated that hydraulic works would help this situation by attracting large numbers of Mexican settlers to the borderlands, and that they would constitute the best defense of the border. An example of this argument appears in the following paragraph from the archives, penned in 1934:

> The utilization of the international waters is not only a patriotic responsibility of the National Irrigation Commission, but also an affair of great importance for the future of the country, for if these waters are not used soon we run the risk of losing them forever. The irrigation of arid and desert lands of our border states demands particular attention, for not only is it necessary to solve the problem of the lack of basic grains so often present in those states, but also to increase the prosperity of those regions through the creation of new centers of agricultural activity and population.[9]

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[7] Here we discern the fiscal issue - the new rulers of Mexico did not hide the relation they enjoyed with U.S. experts in carrying out a modernization program that included the creation of an income tax in 1924, a decade after a similar tax was created in the United States.

[8] Treaty of Guadalupe Hidalgo, 1848. Full text: http://www.ourdocuments.gov/doc.php?flash=true&doc=26&page=transcript

[9] FAPEC-FT, Archivo Plutarco Elías Calles, expediente 68: *Comisión Nacional de Irrigación*, leg.3/3, ff. 156-157, inventario 924: "Programa de trabajos de la Comisión Nacional de Irrigación para el sexenio 1934-1940".

The orientation of Mexico's irrigation program toward the northern borderlands was even more specific: it was designed to take advantage of the waters of the tributaries to the Río Bravo (known as the Rio Grande in the United States). The strategy was to use the waters of those tributaries, in particular those of the Conchos and Salado rivers, before they emptied into the main course of the Bravo/Grande , because the idea was that once there they were at the disposal of the United States. This view of the rightful division of the waters of the Río Bravo/Grande derived from interpretations of the 1906 Water Treaty. Regardless of the correctness of these legal readings, what is certain is that Mexican irrigation policy was borne of strategic thinking about water and development in the northern borderlands, and it remained that way for decades to come.

Another aspect of this orientation of Mexican irrigation policy had to do with the idea of repatriating Mexicans living in the United States so that they might settle in the new irrigation districts planned for northern Mexico. According to this idea, which was strong even before the crisis of 1929 sent thousands of Mexicans streaming back from the United States into northern Mexico, repatriation would bring modern agricultural knowledge and practices and help jump-start development in the new irrigation districts. These were the perfect colonists for the new Mexican agriculture planned by the government, and the CNI actively recruited them.[10]

4. The role of the White Engineering Company

In the moment it began to plan its first works, the CNI made the decision to contract a prestigious construction firm, the J.G. White Engineering Company, founded in 1890. By 1920 this New York-based company had led a wide array of construction projects in 36 countries, and had opened an office in London to attend to its growing clientele.[11] In an interview given to two engineers shortly before his death in 1945, former president Calles, who was undoubtedly the principal promoter of Mexico's irrigation program, revealed that it was he who decided to contract White Engineering. The reason was simple: at that time Mexican engineers didn't know how to do big irrigation projects (Tamayo 1942).

Beginning in 1927 various U.S. engineers started working in Mexico on different aspects of the irrigation program. Fortunately they conducted studies that the CNI published, and these now serve to reconstruct some of modalities by which hydraulic engineering was brought to Mexico (Bond 1928; Packard 1928; Smith 1932). One notable aspect of these studies is the constant reference to and comparison with data (irrigation applications; crop yields) about irrigation zones in the Southwest that shared characteristics with northern Mexico. The importance of this should not be underestimated, for it shows that the engineers thought of the borderlands river systems as hydrographic and geographic entities that spanned the political boundary. Another interesting point is that these American engineers carried out their surveys using a method learned in the United States:

> …the survey of the region where the system is located was conducted using the American method of establishing quadrants, formed by tracing meridians and parallels a kilometer apart, and placing markers at each point of intersection (Historia general…1934).

The government irrigation program put into effect in the 1920s in Mexico represented a growing closeness between Mexican and American engineering, and a growing distance from the European (French) influence. A famous Mexican engineer and future director of the CNI, Adolfo Orive Alba, wrote that his teachers at the National Engineering School "lived before 1910," because they only read texts in French (La enseñanza… 1985). This same engineer went on to say that upon leaving the School of Engineers he received the support of the CNI and the School to work for a year (1928) in the U.S. Bureau of Reclamation. According to his own testimony, those who gave him the fellowship explained the conditions the following way:

> We just don't want you to go study in a university. What they can teach you in a university is theory. We want you to go study with the American Irrigation Commission – a similar organ to what had just been created in Mexico – because the work carried out by the CNI is supervised and, in a way, executed by American engineers that we have gotten in contact with and who come from that American Commission (Azpiróz 1988: 66).

[10] A pamphlet produced and distributed by the CNI speaks of this effort: "An announcement to Mexican farmers in the United States about the works of the National Irrigation Commission on the Salado River." (Sánchez Mejorada, 1928)

[11] J.G.White Companies, 1930. This commemorative pamphlet can be found in the FAPEC-FT, Plutarco Elías Calles, exp. 44. inv. 758.

The last sentence of this quote is important. The engineers who arrived to Mexico with White Engineering had been employed previously with the Bureau of Reclamation. Orive Alba mentions this elsewhere:

> The Company had the foresight to hire the services of some of the best North American engineers who had been working in the Bureau of Reclamation. That's how they came to Mexico to work, chief engineer F. Weymouth . . . and a constellation of notable engineers such as Max W. King, Ch. Howell, R. Throne, Walter E. Packard, Andrew Weiss… (Orive Alba 1960: 52).[12]

In 1927 the Mexican government decided to build two irrigation projects, one on the Salado River and the other on the Conchos River, both tributaries of the Rio Bravo/Grande . Construction of the first was begun in 1928 and the second in 1930. Two new cities were created, Ciudad Anáhuac in Nuevo León, and Delicias, Chihuahua. The first irrigation system required the construction of a huge storage dam (called the Don Martin dam) as well as primary and secondary canals. The Conchos project was simpler and cheaper, for it used the waters stored by the La Boquilla hydroelectric dam, built by a Canadian firm between 1909 and 1915 (Salmerón Sanguines 2006). The reservoir of La Boquilla was, in its time, one of the largest in the world. In this case all the CNI had to do was build a 105 kilometer main canal, with a capacity of 60 cubic meters a second. With the Salado and Conchos projects, it was hoped that more than 100,000 new hectares of land could be opened to irrigation and cultivation.

Another dimension of the engineering connection between the two countries had to do with machinery. As was to be expected, the White Company engineers asked for North American machinery. In February of 1927 the Bucyrus Company asked President Calles to confirm an order of twelve "50B" graders with diesel motors, at a cost of US$32,685 each. They told Calles in 1927 that "the National Irrigation Commission, by orders of the J.G. White Engineering Corporation, had formulated the request."[13] In 1930, at the start of construction on the Conchos project, the CNI possessed six of those Bucyrus 50B graders with a shovel capacity of one cubic meter, a 50B steam shovel with the same capacity, a Bucyrus 14 grader with a capacity of 1.9 cubic meters, and two Bucyrus 80B steam shovels with a capacity of 1.9 cubic meters (Informe…1931).

The White Company technicians finished the preliminary geological, topographic, hydrological, agronomic and socioeconomic studies in record time (18 months), and continued on to oversee the construction of the works once a contract had been signed.[14] The CNI designated assistants to work side by side with these American engineers, with the idea that this work experience would transmit to the Mexican engineers knowledge and training in the construction of large irrigation works. For example, in the Conchos project the man responsible for construction was Max L. King, who had worked with the military engineer G.W. Goethals in the building of the Panama Canal, and the resident engineer was Andrew Weiss. Assisting these two was the engineer Jose Vicente Orozco.

The Conchos project involved other international complexities. White Company foreigners provided weighty arguments to the Mexican government for why they should go against the interests of the foreign owners of the Boquilla hydroelectric dam. The Canadian owners of the dam refused to submit to a project which would use the water needed by their hydroelectric plant for irrigation. In 1922 and 1923 the company successfully resisted a similar plan proposed by the state government of Chihuahua. The electricity company defended itself with the concessions it had been awarded during the era of Porfirio Díaz (1906 and 1909), and considered the pretensions of the governments to use the water of the Boquilla dam illegal. Furthermore, they produced plans to build various hydroelectric plants along the river to make use of the water released from the dam, and in fact built two more between 1928 and 1930: Colina and Rosetilla. For their part, the CNI looked upon Toronto Lake (the reservoir created by the Boquilla dam) as an unexcelled resource for its general project of irrigating the northern borderlands, especially considering that it held the waters of the Conchos river, the main tributary of the Río Bravo/Grande .

Water used by hydroelectric dams is not "consumed" in a strict sense. Rather, it is used to turn turbines and generators and then returned to the course of the river. In this case, then, the water used by the Canadian electric company to generate power in the Conchos basin continued on its way to the Río Bravo/Grande . For this reason an engineer in the CNI suspected that the strong opposition of the Canadian company to the government irrigation programs was due not only to their particular interests, but also that

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[12] A similar process occurred years later in Mexico, where a number of engineers from the CNI fed the creation of one of the biggest private construction companies, Ingenieros Civiles Asociados, or ICA (Orive Alba 1960: 52).

[13] FAPEC-FT, Archivo Plutarco Elías Calles, expediente 170: *Dragas*, ff 1-2, inv. 1636: letter of February 3, 1927 from engineer C. Brinkman to President Calles. Brinkman was the director of the export department of the Bucyrus company, located in South Milwaukee, Wisconsin.

[14] The studies carried out by the White company in the Conchos project cost 481,000 pesos. As a point of reference, this quantity was 13% of the entire budget of the state of Chihuahua in 1928.

there must have been some sort of agreement between the company and farmers in Texas who were anxious to continue using the water of the Conchos river for their own crops. This theory cannot be confirmed, but neither does it seem too farfetched (Aboites 1988).[15]

Speculation aside, what interests me here is to highlight the support given by North Americans to a project of the Mexican government that would have repercussions on North American interests. Based on studies and designs elaborated by the American engineers of the White Company, the CNI obliged the Canadian hydroelectric company to sign an agreement in 1929 to harmonize agriculture and the generation of electricity in the management and use of water from Toronto Lake.[16] The key point is that, with this legal agreement, the Mexican government achieved its objective of consuming a greater portion of the water of the Conchos river (held in Lake Toronto) *before* this water reached the Rio Bravo/Grande , in order to bring into existence a new irrigation zone which, in addition to increasing agricultural production, would also lead to the breaking up of *latifundios*, the formation of a new agrarian middle class, and the creation of a new city. This was a project that contained all the goals of the government of President Calles, all in Chihuahua, a border state, on the Conchos river, the principal tributary of the Río Bravo/Grande . As Samaniego points out, the Mexican engineers knew that in the upcoming negotiations with the United States over the water of the international rivers, existing water rights would be confirmed and established legally, based on the principles of prior appropriation and beneficial use (Saminiego 2006: 319-321). If Mexico increased those appropriations and uses with the help of the American engineers working for the White Company, surely it would strengthen the country's position in negotiations with the government of the United States.

5. The CNI, at its own risk

In 1932 the government of Mexico cancelled its contract with the J.G. White Company. The reasons for this decision are not known, although it is likely that financial difficulties resulting from the Great Depression were an important factor. The Depression obliged the government to reduce its spending and the CNI was not exempt from these cutbacks. In a meeting with the Secretary of Agriculture at that time, Francisco Elias, Adolfo Orive Alba declared:

> Sir, here we have a group of very valuable, very efficient North American engineers, but they are foreigners and since we pay them in dollars they are very expensive. Why don't we train a group of young Mexican engineers, including me? Why not train us? . . . We could do the work, but under the supervision of the **N**orth American engineers . . . They could convince us of the best way to do things, and teach us how to do it, but we would do the work. If not, we'll never learn. We'll always need this big group of foreigners, with their high salaries. Thirty or forty or fifty North American engineers worked in the CNI (Azpíroz 1988: 68).

According to Orive, he convinced some of the North American engineers to abandon the White Company and stay in Mexico, in the CNI. Some of them accepted this offer and stayed in Mexico for decades, most importantly Andrew Weiss and Max L. King. They were joined by Paul Waitz, a German geologist who arrived on his own before the White Company began working in Mexico. To house these engineers, the CNI created the Department of Technical Consulting (*Consultivo Técnico*). The old engineers from the White Company worked there alongside Mexican engineers and together they took on the work of supervising the construction and safety of Mexico's hydraulic works. By 1947 Andrew Weiss was the Director of the Technical Consulting, with Max L. King the Superintendent of Constructions (*Secretaria de Recursos Hidraulicos*).[17] A generation of Mexican engineers benefited from the presence of these foreigners. With them they learned the field, passing later into leadership roles in the CNI and eventually taking over the work of the Department of Technical Consulting.

Another aspect of the close encounter between Mexican and U.S. irrigation engineering is that found in the pages of the CNI's house magazine, *Irrigación en México* (1930-1946).[18] In this publication one finds countless examples of studies carried out by these North American engineers, as well as translations of articles on different aspects of the field published in U.S. journals. Concrete and steel, and models of dams, were the topics most discussed, and the magazine reported on the North American institutions dedicated to the study of these materials, such as the American Concrete Institute, American Institute of Steel Construction, the American Association of State Highway Officials, and the American Welding Society.

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[15] The engineer who suspected the collusion of the Hydroelectric Company with Texan interests was Pablo Bistráin.

[16] *Diario Oficial*, 23 May 1929.

[17] For more about the archive of the Consultivo Técnico of the Secretaría de Recursos Hidráulicos and water use in Mexico in general, see *Boletín del Archivo Histórico del Agua*, II:4 (mayo-agosto 1995).

[18] The Archivo Histórico del Agua, in Mexico City, has produced a complete digital reproduction of this publication (2004).

Irrigación en México reviewed *The Proceedings of the American Society of Civil Engineers* in order to propose elements for the design of dams in Mexico.[19]

Another example from the pages of *Irrigación en México* shows the extent to which the U.S. model defined the priorities for the CNI and its magazine. When Manuel Gamio, a renowned Mexican anthropologist, criticized the Mexican government's irrigation program by citing an American commentator who criticized the work of the Bureau of Reclamation, the CNI's magazine could think of no better defense than to laud the accomplishments of the Bureau. Thus the magazine pointed out that from its inception the North American irrigation bureaucracy had spent US$200 million in building 16,000 miles (25,750 kilometers) of canals, 100 dams, 106 tunnels, more than a thousand miles of road, and 12 hydroelectric plants. The 37,000 farms irrigated as a result of these federal works produced harvests worth some US$120 million.[20]

This last argument, about the value of the harvests produced by irrigation, was used in Mexico almost before the irrigation districts began to produce their first fruits. In the Conchos irrigation district, for example, the cultivated surface area grew from 2,287 hectares in 1932-1933 to 20,339 in 1934-1935. By this last production cycle cotton occupied more than 75% of the acreage, almost a monocrop economy (Aboites 1988: 202-3). And in the harvests we once again encounter North Americans, particularly those businesses that since the beginning of the 1930s were involved in the production of cotton, a crop that would be decisive for the economic viability of the fledgling irrigation districts in northern Mexico. Firms such as the Anderson & Clayton Company opened shop in those regions and began to finance production, buy the crop, and process the fiber and cottonseed. As the decade of the 1930s advanced, prices improved in both Mexico and the United States, evidence of an even deeper connection between the two countries. As a result of the Great Depression the U.S. government sought to limit cotton production at home. Faced with these restrictions, cotton businesses turned to Mexico where the new irrigation districts of the northern borderlands were just coming on line (Walsh 2008).[21] In the Conchos irrigation district, and in older irrigation zones such as the Laguna region and the Mexicali Valley, cotton became by far the leading crop. In the early years this cotton supplied the national market, but as irrigated cotton land expanded so did exports of the fiber. To put it another way, cotton financed in part by North American capital provided the economic base that Mexico's irrigation program needed in order to make a few wealthy, provide thousands of jobs, gain legitimacy and impose itself as the model for public investment and agrarian development for much of the twentieth century.

The array of institutional, intellectual and economic connections with the northern neighbor helped Mexican irrigation to reach its greatest splendor after 1937, when construction began on three large dams: El Palmito on the Nazas River; Angostura on the Bavispe River in Sonora; and El Azúcar on the San Juan river in Tamaulipas, another tributary of the Río Bravo/Grande . This splendor was particularly visible between 1940 and 1952, when the Mexican government dedicated ever-growing sums to the irrigation budget (14% of the national budget one year). No other country in the world put so much of its resources into irrigation. By 1950, after 25 years of activity, the government had opened up around 700,000 hectares (about 1.7 million acres) of new irrigated lands, mostly in the north of Mexico. This fact brought great satisfaction to the engineers who were at the head of what was by then a powerful cabinet-level institution. In 1946 the CNI was elevated to the political level of the Secretaries of State: the Secretary of Hydraulic Resources (*Secretaria de Recursos Hidraulicos*). The point was clearly made: no longer just irrigation; no longer just the north. And the Minister of this new organism was none other than Adolfo Orive Alba, that young man who called his teachers at the national engineering school antiquated because they only read books in French. It was the same young professional who spent a year working in the U.S. Bureau of Reclamation and later participated in the negotiations over the 1944 International Water Treaty between the U.S. and Mexico.

At the beginning of the 1950s the Mexican authorities changed the regional focus of public spending on irrigation to the Southeastern part of the country. The biggest rivers in the country were to found there, and the Usumacinta, Grijalva, and Papaloapan, among others, were well suited to the construction of huge hydroelectric complexes, the new government priority. The chapter of the early years of irrigation politics in the north and its foreign influences had closed.

6. Conclusions

During the late-nineteenth and early-twentieth centuries a powerful surge of capital transformed the borderlands of northern Mexico and the southwest United States. This surge also transformed the relations between the two countries, and was accompanied by accelerated population growth, the formation of new

[19] *Irrigación en México*, I:2 (junio 1930).

[20] *Irrigación en México*, I:2 (junio 1930), p. 7. The achievements of large scale irrigation in other places, such as India and Egypt, were also mentioned.

[21] Walsh suggests that there was a close understanding between the Anderson & Clayton Company and the government of Lázaro Cárdenas (1934-1940), known for its radicalism and nationalism. Lacking funds, capacity and experience, the Cárdenas government awarded a favored place to North American businesses in the financing and commercialization of cotton in northern Mexico.

urban and rural spaces, and the expansion of livestock, agriculture, mining, and the exploitation of timber. Railroads linked the eastern seaboard with the Pacific Ocean in the United States, and the capital of Mexico with different areas of its northern border. Technological innovation was an important component of this economic and infrastructural growth, constituting a "second Industrial Revolution" defined by the spread of electricity and the internal combustion engine.

The expression *new waters* refers to one aspect of the general transformation of society-nature relations during those years. During the course of one generation, technologies made great volumes of water available to society that simply hadn't existed in this way before. Thanks to cheaper, bigger and stronger dams, longer and larger canals, and more powerful pumps for extracting subsoil water, people in the vast, dry expanses of the borderlands could open extensive new agricultural zones, generate unheard of quantities of electricity, and provide urban populations with growth possibilities. The national governments of the two countries were not slow to think up new administrative apparati to support the production of these new waters. The creation of the Reclamation Service in 1902 and the CNI in 1926 expressed these intentions. In a similar way, the *new waters* forced the two governments to reach accords about how to use and manage them, through the water treaties of 1906 and 1944. This was a huge change: fifty years earlier these waters didn't exist, and the two countries were at war.

This was the stage on which to locate the intense cooperation, exchange and transmission of knowledge between US hydraulic engineering and its Mexican counterpart, an encounter represented by the private construction firm, the White Engineering Corporation. Mexican engineers left their nineteenth-century ties to French engineering behind, and engaged increasingly with the U.S. branch of the discipline. The complexity of the relation between the two countries is revealed in the decision of the Mexican government to contract the services of a U.S. firm to increase the production of *new waters* in its territory and by doing so increase its leverage to negotiate favorable terms in the Water Treaty of 1944. Without a doubt, there is much more research to be done concerning the participation of foreigners (Americans, really) in Mexican irrigation. Any research, however, must take into account the rapid technological and ecological change that constituted the emergence of the new waters in the Mexico-U.S. borderlands.

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Archives

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Abstract

In the growing field of Mexican water history, the influence of foreign people and ideas has scarcely been recognized. The transnational dimensions of this history, however, are strong and manifold, and this article outlines an avenue of research on the topic. Commercial agriculture in the Southwest US was a model for agricultural development in Northern Mexico, and in consequence, influenced its irrigation politics. Also, engineers and engineering institutions in the two countries worked closely to carry out the model of large-scale irrigation followed by the Mexican government, especially during the first decade (1926-1935) of existence of the Mexican National Irrigation Commission (the *Comision Nacional de Irrigación*, or CNI). In particular, the White Engineering Company, a U.S. company, played a significant role in jump-starting irrigation in Mexico. Finally, the economic viability of Mexico's new irrigated zones was linked closely to a cotton economy centered in the U.S, but which incorporated northern Mexico during and after the Revolution. By outlining this transnational water history, this article contributes to an effort to rethink and refine historical narratives about the subordination of Mexico to its northern neighbor.

Key words: irrigation, northern Mexico, politics of irrigation.

Resumé

Dans l'histoire de l'eau du Mexique, l'influence de personnes étrangères et des idées a été à peine reconnu. Les dimensions transnationales de cette histoire, cependant, sont forts et multiples, et cet article présente une voie de recherche sur le sujet. L'agriculture commerciale dans le sud-ouest des États-Unis a été un modèle pour le développement agricole du Mexique Nord. Il a influencé sa politique d'irrigation. En outre, les ingénieurs et les institutions d'ingénierie dans les deux pays ont travaillé en étroite collaboration pour mener à bien le modèle de la grande irrigation suivie par le gouvernement mexicain, en particulier pendant la première décennie (1926-1935) de l'existence de la Commission nationale de l'irrigation du Mexique (Comisión Nacional de Irrigación, ou CNI). En particulier, la White Engineering Company, une société américaine, a joué un rôle important dans le décollage d'irrigation au Mexique. Enfin, la viabilité économique de nouvelles zones irriguées au Mexique a été étroitement liée à une économie de coton qui a été centré sur les USA, mais qui a incorporé le nord du Mexique, pendant et après la Révolution. En décrivant cette histoire d'eau transnationale, cet article contribue à un effort de repenser et d'affiner les récits historiques de la subordination du Mexique à son voisin du Nord.

Mots clés: irrigation, le nord du Mexique, de la politique de l'irrigation.

Resumen

En el creciente campo de estudios sobre la historia del agua en México, la influencia de ideas y personas extranjeras ha sido poco reconocida. Sin embargo, la dimensión transnacional de ésta historia es fuerte y diversa. La agricultura comercial del suroeste de los Estados Unidos sirvió de modelo para el desarrollo agrícola del norte de México y, consecuentemente, influyo a las políticas de irrigación. Asimismo, ingenieros e instituciones de ingeniería de ambos países trabajaron estrechamente para desarrollar modelos de irrigación a gran escala realizados por el gobierno mexicano, especialmente durante la primera década (1926-1935) de operaciones de la Comisión Nacional de Irrigación. White Engineering, una compañía norteamericana, jugó un papel particularmente importante en el inicio de la irrigación en México. Igualmente, la viabilidad económica de las nuevas zonas de riego de México estaba estrechamente vinculada con la economía del algodón de los Estados Unidos que desde antes de la Revolución ya tenía influencia en el norte del país. Este artículo es una propuesta para explorar esta relación a través de la historia transnacional del agua, y un esfuerzo para replantear las narrativas sobre la subordinación de México con su vecino del norte.

Palabras clave: Irrigación, el norte de México, política de irrigación.