

From water abundance to water scarcity: the case of the Chontalpa, Mexico

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Abstract

This article uses original ethnographic data to show how a development program known as Plan Chontalpa failed to extend potable water provision to rural people in Chontalpa, in Tabasco, Mexico. Despite arguably short-term benefits, this large state-led, large-scale hydrodevelopment program created overly large infrastructures and imposed a hierarchical water management regime on previously open-access water resources, negatively impacting the communities it purported to serve. This article demonstrates how, in lieu of the vulnerabilities created by the Plan, residents have resiliently devised their own water management system that combines customary techniques, such as harvesting rainwater, with formal and informal ones. In conclusion, this article insists that water management resilient practices at the household level can teach us alternative ways of decision-making that can transform local development efforts.

Keywords: resilience, political ecology, water harvesting technique, household management, hydrodevelopment

Résumé

Cet article utilise des données ethnographiques originales pour montrer comment un programme de développement connu sous le nom de Plan Chontalpa n'a pas réussi à étendre l'approvisionnement de l'eau potable aux populations rurales de Chontalpa, à Tabasco, au Mexique. Malgré des avantages à court terme, ce vaste programme d'hydrodéveloppement à grande échelle dirigé par l'État a créé des infrastructures trop grandes et a imposé un régime hiérarchique de gestion de l'eau sur les ressources en eau auparavant en libre accès, ce qui a eu un impact négatif sur les communautés qu'il prétendait servir. Cet article démontre comment au lieu des vulnérabilités créées par le Plan, les résidents ont conçu avec résilience leur propre système de gestion de l'eau qui combinent des techniques coutumières, telles que la récolte de l'eau de pluie, avec des techniques formelles et informelles. En conclusion, cet article insiste sur le fait que les pratiques résilientes de la gestion de l'eau au niveau des ménages peuvent nous enseigner d'autres moyens de prendre des décisions qui peuvent transformer les efforts de développement local.

Mots-clés: résilience, écologie politique, technique de récupération de l'eau, gestion des ménages, hydrodéveloppement

Resumen

Este artículo utiliza datos etnográficos originales para mostrar cómo un programa de desarrollo conocido como Plan Chontalpa no logró extender el suministro de agua potable a la población rural de Chontalpa, en Tabasco, México. A pesar de los posibles beneficios a corto plazo, este programa de desarrollo hidroeléctrico a gran escala, liderado por el estado, creó infraestructuras demasiado grandes e impuso un régimen jerárquico de gestión del agua en los recursos hídricos previamente de acceso abierto, impactando negativamente a las comunidades que pretendía servir. Este artículo demuestra cómo, a consecuencia de

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las vulnerabilidades creadas por el Plan, los residentes han ideado resilientemente su propio sistema de gestión del agua que combina practicas cotidianas, como la recolección de agua de lluvia, con otras formales e informales. En conclusión, este artículo insiste en que las prácticas resilientes de gestión del agua a nivel del hogar pueden enseñarnos formas alternativas de toma de decisiones que pueden transformar los esfuerzos de desarrollo local.

Palabras clave: resiliencia, ecología política, técnica de recolección de agua, manejo del hogar, desarrollo hídrico

Una de las cosas que los ingenieros del Plan prometían era agua potable a la población, pero ¿dónde está esa agua? Veo esa planta... esa la construyo el Plan, y la dejo a cargo de las autoridades del pueblo para que la manejen. Ya no funciona bien desde hace tiempo. Funciona más o menos. Llega poquita agua y sin presión. Y la que llega tiene mal olor. Aquí en este poblado si quieres agua para beber y cocinar, la tienes que comprar en la tienda o en casa de Don Alberto. Para lo demás, agua del pozo, de lluvia y si llega a tu casa, de la planta.

One of the things that the plan's engineers promised was drinking water to the population, but where is that water? You see that plant ... that was built by the Plan, and they left it in charge of the town authorities to manage it. It has not worked well since a long time. It works more or less. Some water gets home but without pressure. And the one that arrives has a bad smell. Here in this town if you want water to drink and cook, you have to buy it in the store or at Don Alberto's house. For the rest, water from the well, from rain and if it reaches your house, from the plant.

-Jessica², a resident in one of the towns build by Plan Chontalpa

1. Introduction

State-led, large-scale hydrodevelopment programs continue to be hailed as vehicles of social, economic, and technological progress in impoverished areas of the world. Some projects have indeed empowered groups and spurred the development of certain economic sectors. Nonetheless, despite arguable short-term benefits, most programs create overly large infrastructures for the communities they purport to serve, and they impose hierarchical water management regimes on previously open-access water resources. Furthermore, they do not always address the needs of the populations in whose name they were proposed.

This article studies a development program known as Plan Chontalpa, showing how it failed to extend potable water provision to rural people in Tabasco, Mexico. Arguably, the Plan left community residents in a more precarious condition than before. Nevertheless, I also show how local people's resilient practices addressed the Plan's shortcomings. **First**, I present original data collected during fifteen months of anthropological ethnographic research in the Chontalpa region. I observed four families chosen from a larger pool, eventually focusing on specific women. In Latin American households, women are traditionally important household water managers in both urban and rural areas, which is why I chose women's experiences. As a participant, my rapport with these families was enhanced by having grown up in a similar semi-urban environment impacted by development policies, as well as by sharing language and socioeconomic background. **Second**, I demonstrate how, in lieu of the vulnerabilities created by Plan Chontalpa, *Poblado's* residents, like Jessica and her family mentioned in the epigraph above, resiliently devised their own water management systems. They combine customary practices, such as harvesting rainwater, with formal and informal ones. This family's responses to state failure are not new to those of us familiar with how communities of marginalized and indigenous groups throughout Latin America are impacted by "high-modernist" development policies. Notwithstanding, their idiosyncratic responses that succeed when others fail need to be formally studied in articles such as this one, for they can teach us

² All individual names are pseudonyms that our informants chose for themselves.

alternative ways of decision-making that can transform local development efforts, potentially benefitting millions of people and equally saving millions of dollars.

2. Theoretical discussion

This article examines how a state-led, large-scale hydrodevelopment program in the Grijalva river watershed brought about the imposition of a hierarchical water regime on previously open-access water resources, and failed to extend potable water provision to rural population in the Chontalpa, in Tabasco, Mexico. My analytical approach is informed by the anthropological literature, and cognate disciplines, that stress the significance of a political ecology approach to studying socio-environmental outcomes in the context of large-scale, state-led hydrodevelopment programs (Donahue and Johnston 1998; Johnston 2003, 2013; Scudder 2005). The political ecology scholarship in this area focuses on the ways in which power-laden economic, political, and socio-cultural processes shape the dynamics of water meanings, knowledge, use and management (Donahue and Johnston 1998; Johnston 2003, 2013; Scudder 2005; Swyngedouw, Kaika, and Castro 2002; Strang 2004; Worster 1985). Scholarship insists that the economic development and progress achieved through centralized, large-scale hydrodevelopment programs comes at a heavy price, usually paid by marginalized and indigenous populations (Donahue and Johnston 1998; Johnston 2003, 2013; Scudder 2005). These programs and their associated large-scale institutional water management regimes are based on notions that favor what Scott calls "high-modernist" and technocratic ideals of progress (Scott 1999), and do not always represent the local biocultural knowledge and practices (Johnston 2013). These knowledge and practices, although small-scale, are instructive because they are the results of historical understanding of the natural dynamics of the ecosystems, as well as formal and informal sociocultural practices and relationships.

Referring to centralized, large-scale water management schemes of the twentieth century in particular, Scott observes that these kind of schemes—and their accompanying massive legal and infrastructural work—often undermine practices particularly suited to local histories and environments, and instead, privilege "a strong...version of the self-confidence about scientific and technical progress, the expansion of production, the growing satisfaction of human needs, the mastery of nature (including human nature), and, above all, the rational design of social order commensurate with the scientific understanding of natural laws." (1999: 4) Indeed, political ecology scholarship observes that this approach results in rigid, hierarchical and technical understanding of water (Johnston 2013), that removes it from the diverse natural and socio-cultural environments with which water has been in an ever-ending co-constitution (Linton and Budds 2014). In doing so, water is tamed, contained, diverted, estimated, and allocated. Its allocation often privileges quantifiable and distant political and economic needs (agriculture, industry, energy) over qualitative and more local needs such as the health of the immediate environment and the local population, disregarding important local cultural knowledge about the management and use of riparian systems (Johnston 2012; Johnston 2013; Strang 2004). Alarming is the undeniable impact that large-scale hydrodevelopment schemes have had on the quality and quantity of freshwater around the world; making freshwater scarcity a manufactured scarcity rather than a natural one (Donahue and Johnston 1998; Johnston *et al.* 2012; Johnston 2003, 2005, 2013; McCully 2001; Scudder 2005; WCD 2000). Large-scale water management projects that promote big dams, canals, and complicated delivery systems for economic development provide water to some at the cost of others, usually with short-term economic gains. In the process, small-scale community-based knowledge and management are disregarded as the water management decisions move from the floodplain to distant centers of power (Peña 2003; Rodríguez 2006).

Scholars studying the experiences in the Global South have considered these large-scale development enterprises problematic, as total failures, and have demanded their immediate dissolution. They argue that not only have the ideals of development not been achieved in many instances but also that they have been proven to be detrimental to local communities and natural environments. Case studies from Africa, Asia, and Latin America have highlighted the exclusion of a large sector of the population from the promised benefits of development (Escobar 2011; Esteva 1987; Farmer 2006; Ferguson 1990; Fernandes 2007; Moore *et al.* 2010; Oliver-Smith 2009; Richter *et al.* 2010; Sachs 1999). As a call for action, scholars have

suggested resisting our desire to formulate alternatives at the abstract macro-level, and instead dedicating effort to the study of daily resilience of local communities. This approach, in turn, can offer insights into the local ways of self-sufficiency and complex adaptive practices that can potentially generate long-term social and environmental sustainability (Barkin 2006; Escobar 2011; Johnston *et al.* 2012; Johnston 2013; Lansing 1987; Scott 1999).

In responding to a call for a bottom-up approach, and to move beyond "declensionist narratives of tragedy" (Carey 2009) about the impacts of centralized large-scale development programs on local communities of the Global South, this article proposes to interpret the local population's diverse and quotidian responses to the potable water scarcity caused by Plan Chontalpa as 'resilience.' Resilience, as a heuristic concept, was developed in ecology and physics and has gained popularity in disaster scholarship and management (Barrios 2016). However, in the social sciences, this concept is also associated with other academic conversations that have been taking place in peasant resistance studies (Colburn 1989; Scott and Kerkvliet 1986) and subaltern studies (Chakrabarty 1985; Guha 1982; Spivak 1995) about the ways in which marginalized populations cope and resist, stressing environmental or social circumstances in diverse and creative ways (Bollig 2014). Intending to advance the conversation and understanding of resilience from an anthropological perspective, I take on MacKinnon and Derickson's (2013) and Barrios's (2016) thoughtful critiques of the concept. Generally understood as the adaptive capacities of systems or communities to evolve alongside social and environmental challenges, these scholars argue that resilience studies' narrow focus on communities' ability to cope, adapt and bounce back from disasters 'depoliticizes' their experiences and, crucially, places responsibility for the outcome on the affected communities themselves (see also Hsu *et al.* 2015; Oliver-Smith 1999; Schuller 2016). In doing so, resilience approaches often ignore the "root causes and global interconnections" that create vulnerabilities to disasters (i.e. political marginalization, inequity, environmental injustice often caused by development schemes) in the first place and that undermine the capacity of communities to cope and carry-on (Barrios 2016). Barrios emphasizes the role of anthropology in general, and political ecology in particular, in demonstrating that 'disasters' are shaped by long-term anthropogenic causes that create vulnerabilities that enhance the socially destructive capacities of geophysical phenomena (Barrios 2016). Hence the importance of identifying not just communities' adaptive practices, but even more importantly the root causes of the drastic transformations that create vulnerabilities and leave communities exposed to social and environmental challenges in the first place. Consequently, in this article I use the case of Plan Chontalpa to show how it failed to extend potable water provision to rural people in Tabasco, Mexico; and more importantly, to demonstrate how people's resilient practices are addressing the vulnerabilities created by the Plan's shortcomings.

3. Methodology

I conducted research in the Chontalpa, in Tabasco, Mexico, in an area that has been the focus of a large-scale development program known as Plan Chontalpa (hereafter the Plan). The overall goal of my research was to understand if and how the population became socioeconomically better off after the Plan. The ethnographic data I address in this article was gathered in one of the towns built by the Plan, which I call here *Poblado*³, during fifteen months of fieldwork: one month in 2006, followed by 13 consecutive months from December 2007 to December 2008, and one month between June and July of 2009. Since then, I have also conducted follow up interviews, by phone and Skype, in preparation of this manuscript.

Throughout my fieldwork, I collaborated in recording the personal and economic experiences and thoughts of four families. I also recorded the life history of one of them, Jesús, Jessica's father. His thoughts and ideas about the Plan, the decisions he made regarding his family's *ejido*⁴ land, and his family's

³ The individuals who collaborated with me in this research requested the name of their community not to be disclosed due to the fact that they live in an area where organized crime (drug cartels) is a prevalent threat to people's life and possessions.

⁴ *Ejido* land is "land owned by the Mexican government to which communities have usufruct rights" (Liverman *et al.* 1999: 618). This type of landholding derived from the Mexican Revolution of 1910 (McMichael 2004: 141). The idea

experiences with water access for his agricultural production and household consumption became illustrative of how locals experience life after the Plan. I collected the data through a series of lengthy sessions of structured and unstructured interviews and participant observation. Additionally, information was gathered from a variety of sources such as radio news, local newspapers, local scientific reports, interviews with local and state government officials, local university professors, health care providers, teachers, and sugarcane associations' leaders. I also carried out short visits to the upper watershed region, in the neighboring state of Chiapas, to interview water management officials on their policies in the area.

My interests in recording Jesús's life history resided in the fact that he was the only healthy resident who was originally from that same region, and he and his family have lived through all the social and environmental changes brought about by Plan Chontalpa. Furthermore, Jesús's life history and his family experiences are significant because most of the research done about Plan Chontalpa addresses the more salient political and economic processes that impacted this region from a top-down approach. In contrast, my research sought to present a bottom-up account of the ways in which Plan Chontalpa's policies have impacted the lives of people who stayed in that area with the promise of a better life. Jesús, Jessica and their household's experiences constitute a much-needed effort to give a platform to voices that are not usually accounted for (Thompson 1978).

Life history as a research method has been part of anthropology from the beginning of the discipline. Anthropologists collected personal histories from the individuals in the cultures they studied. Eliciting accounts of individual experiences to obtain information about general practices was in the very nature of ethnographic fieldwork (Watson and Watson-Franke 1985). To Watson and Watson-Franke, life histories are inevitably subjective, and to fully exploit the potential contribution of life history, the essentially subjective nature of it must be not only acknowledged but also adopted as a major element in the interpretive process. It is its subjectivity that gives meaning to life experiences. As a result, the role of qualitative research such as a life history should be to grasp the insider's perspective—that is, the meanings narrators attribute to their life experiences as well as facts. I conceive their subjective experiences as valuable phenomena of analysis in themselves. They constitute a window through which understanding of the implications of Plan Chontalpa can occur, and of the livelihoods of rural families. Consequently, I focus more on experiences and decisions that individuals have or make to be able to engage, respond, and adapt to the society to which they belong. In this sense, I explore some socio-environmental changes the region experienced, and the decisions individuals make to cope with them; highlighting the importance of the individuals' experiences in their society, and the impact of these personal decisions in the context of environmental challenges and social change (Barrios 2016; Glantz 1979; Mintz 1974).

My respondents were ideal informants. Jesús is rather shy and reflexive but has an exceptional memory and narrative skill, and his family is representative of the average families living in the *Poblado*. They have an average economic position for the town, and none of them is a public figure. The challenges and vulnerabilities that the household wrestle with and the strategies they have developed to handle them are common to families attempting to carry on, improvise, and survive despite the challenges. In their current situation, they are average, but their history in the area is considerably longer than most. Jesús is one of the few residents who have lived continuously in the region since before Plan Chontalpa was implemented. Before Plan Chontalpa, he was a self-sufficient subsistence farmer and a rancher (*vaquero*), and today he is one of the small-scale and marginal sugarcane producers. His household have witnessed profound changes to both Plan Chontalpa and the region through the decades. These changes have completely transformed their communities and the environment.

Finally, to analyze the qualitative data gathered, I created a sequence of historical political and economic events at the regional, national, and international level that served as a backdrop to the residents' experiences. I also included in this sequence, environmental reports that described the hydrology and forest cover of the region before, during and after Pan Chontalpa's operation. All the information gathered was organized chronologically using N-Vivo, which allow me not just to organize it but to identify patterns and

was to provide land to the landless majority in the major centers of development in the Mexican central plateau and the rest of the country (Barkin and King 1970).

correlations in the data collected. Those patterns and correlations were later analyzed and discussed in the context of the literature on the impact of Plan Chontalpa on the community and the environment. The quantitative economic data gathered about households' economics, including all their livelihood and water collections strategies, were analyzed using basic economic cost/revenue operations.

4. The study area

Tabasco is the wettest state in the entire country. It is a hot, humid tropical lowland area located on the Gulf Coast in southeastern Mexico, and occupies the northern half of the Isthmus of Tehuantepec. It is bordered by the Mexican states of Veracruz to the west, Chiapas to the south, and Campeche to the northeast. To the east, Tabasco borders with the Republic of Guatemala, and to the north, with the Gulf of Mexico (Figure 1). The state's landscape is part of the narrow strip of rich soil that fronts the Gulf and extends "from Louisiana and Texas down through the Mexican states of Tamaulipas, Veracruz...and the Yucatan peninsula" including Tabasco (Coe and Koontz 2013: 12).



Figure 1: Tabasco is located in a fertile floodplain irrigated by the Grijalva River, which meanders from the Chiapas mountains on its way to the Gulf of Mexico. (Instituto de Ingeniería, Universidad Autónoma de México)

Tabasco's landscape is particularly marked by the presence of water. The state is drained by two of Mexico's largest rivers, the Grijalva and the Usumacinta, which originate in Chiapas (Gama *et al.* 2011). The system is one of the largest in North America and by far the biggest in Mexico. Together, the two rivers account for 30 percent of all the freshwater flows of the country (Gama *et al.* 2011). The confluence of these

rivers creates extensive coastal floodplains with numerous marshes, mangrove swamps, and tidal lagoons with poor drainage. This explains why Tabasco is prone to severe river flooding events. Any rain of over 50 mm in less than 24 hours produces a flood in the state, and the normal yearly rainfall is between a staggering 2,000-4,000 mm per year (Dewey 1981; Gama *et al.* 2011; Rubio and Triana 2006; Tudela 1989). This rainfall pattern often leads to major flood events every five to six years when the lowland rainfall pattern coincides with flows of low pressure from the highlands in the neighboring state of Chiapas.

According to archaeological records, Tabasco's abundance of water and rich soil played a crucial role in the development of settled life and the birth of civilizations in Mexico (Coe and Koontz 2013). The Chontalpa region— where Plan Chontalpa took place—is in the northwestern part of Tabasco. It is a rich agricultural region that shares the same weather and landform characteristics of the state. Notably, it has always been the agricultural heartland and preferred place for human settlement because of its fertile soils, formed by sediments and alluvia deposited by the numerous flowing streams, old breaks from the Grijalva river and massive flood episodes during rainy season (Robinson 2007). Indeed, archaeological records demonstrate that human occupation in this lowland region started in the Initial Formative (2,000-1,200 BC) and became heavy in the Early Formative (1,200-900/800 BC) (Toby 2004: 179). Over millennia, the Grijalva river provided a bounty of resources for cultures and the environment. Particularly for humans, the river was a source of sustenance, while also providing strategic arteries of communication and trade along the Gulf coast to diverse ethnic groups.

Ethnographically, the population living in the impacted Chontalpa area, before Pan Chontalpa, were mainly self-sufficient peasants with a diversified agrarian production. Locals, like Jesús and his family of origin, worked their farmland through a common system practiced in tropical regions, swidden (slash-and-burn) cultivation, without any degree of mechanization. With this system, a fraction of the jungle is cut down, the land is cultivated for a period of time (two or three years), and then they move to exploit another parcel of land, leaving the previous parcel to recover its fertility naturally. They planted annual crops such as corn, beans, squash, sweet potato, and rice with *macana*.⁵ They also planted perennial crops such as fruit trees, cacao, *corozo* palms, and plantain known locally as *macho* (Lanzas 2014). Corn was and still is, the most important staple crop, and it is typically consumed in the form of *tortillas* and *pozol*⁶ (Dewey 1981).

Before the Plan, people were settled in *rancherías* or small cluster of a few houses aligned along a dirt road and scattered in the rural areas, with quite a distance between them, and in houses built with perishable materials found locally (Arrieta 1994). Arrieta's ethnography highlights that the common medium of transportation was the *canoas* (canoe) traversing the abundance of rivers and streams. He describes a social life characterized by mutual support among the families and neighbors, despite the lack of modern systems of transportation and communication; with strong kinship ties, a commitment to cooperation and assistance with productive activities. According to Jesús, there were no public services except a rural elementary school. Almost everything that a household needed for its production and reproduction was done by the family unit, with the assistance of the extended family and close neighbors (Arrieta 1994). The social networks and ties of cooperation and exchange between family groups were very useful during times of flooding events and food scarcity, particularly during the wettest season (from June to early October). Access to freshwater for productive and reproductive activities was not an issue; at times the abundance of water abundance posed problems.

5. From water abundance to water scarcity

Plan Chontalpa

Plan Chontalpa has been studied by scholars such as Arrieta (1994), Barkin (1978) and Tudela (1989). They have published extensive work about the Plan and its initial impact on the area. However, it

⁵ *Macana* is a stick with a pointed end used for planting.

⁶ According to Dewey (1981), this native Tabascan drink is highly nutritious and contains substantial amounts of protein and other nutrients. Unfortunately, under Plan Chontalpa *pozol* was increasingly replaced by sugary soft drinks.

had not been studied by social scientists for over a decade leading up to my fieldwork. I considered it significant to follow up on the studies and learn what life was like after the Plan. Before proceeding, I must clarify that it is not my intention in this article to present a thorough evaluation of the successes and failures of the Plan. For a rich discussion on the subject, I invite readers to review the works of the authors mentioned above. My research builds on the previous studies and contributes with a contemporary look at life in one of the towns built by the Plan.

Plan Chontalpa was a development program part of an overarching regional integrated management program to develop the Grijalva river watershed, the second largest in the country, and its fertile floodplain. The regional integrated program was led by a powerful federal agency known as *Secretaría de Recursos Hídricos*⁷ (SRH) (Ministry of Water Resources) through a centralized state organism known as the Grijalva Commission. The Commission sought economic modernization and industrial development of an impoverished region through investment in large-scale hydraulic infrastructures for flood control, hydroelectric energy production, construction of roads and highways, and the draining of important biodiverse wetlands for large-scale modern agricultural development. This overarching program followed the comprehensive development schemes modeled on the Tennessee Valley Authority (TVA) in the U.S., a very influential, but controversial scheme initiated in President Roosevelt's New Deal era (Arrieta 1994; Melville 1990; Olsson 2017). Geographically, the integrated management program impacted the upper watershed area, located in the state of Chiapas, through the construction of dams⁸ to produce hydroelectricity. Downstream, in the state of Tabasco, Plan Chontalpa, an agricultural and social development program, went into action in 1966. Plan Chontalpa was initially designed to achieve three goals which were conceived as interconnected and mutually reinforcing.

- 1) increase staple food production using input-intensive crops, modern technology, and irrigated agriculture.
- 2) promote the "modernization" of the rural sector.
- 3) transform self-sufficient *campesinos* into commercial farmers.

The Plan was financed by the Mexican federal government (53 percent) and the Inter-American Development Bank (IADB) (47 percent) (Tudela 1989).

To implement Plan Chontalpa, 80,000 hectares of the wetland was drained with a massive system of open canals to reclaim the land for irrigated agricultural purposes. The dirt removed during the construction of the open canals was used for the construction of roads and highways. The drainage system consists of two types of open ditches or canals: the main canals are 2.5-5 m deep and at intervals of 500-1,000 m. The secondary canals are 1.5-2 m deep at intervals of 200-300 m.⁹ The secondary canals run throughout the towns and agricultural fields, while the main canals collect the water from the secondary canals and discharge it into the Gulf of Mexico to the north of the region. Planners hoped that this drainage system would reduce the waterlogging caused by Grijalva River's seasonal flooding events, high water table levels, and excessive soil moisture. Once drained, the tropical forest was clear-cut¹⁰, and the land was leveled to allow the large-scale modern irrigated agriculture project to make Tabasco the granary of Mexico (Barkin 1978). The Plan then built twenty-two identical semi-urbanized towns in the Chontalpa region to, in many

⁷ SRH was a "gargantuan bureau with cabinet-level status, created in the 1940s" (Scott and Banister 2008: 62). The agency responded directly to the President and was responsible for water science, planning, and development. It was the most powerful state agency of its kind in all Latin America (Dávila-Poblete *et al.* 2006). It eventually became the Ministry of Agriculture and Water Resources (*Secretaría de Agricultura y Recursos Hídricos*, SARH) and today's National Water Commission (*Comisión Nacional de Agua*, CONAGUA) (Banister 2010; Scott and Banister 2008).

⁸ There are currently four major hydroelectric dams in the upper watershed area. They are located just over the Tabasco state border with Chiapas.

⁹ This information was gathered through personal communication with German Velazquez Villegas, one of the engineers who worked for the Plan Chontalpa.

¹⁰ The tropical forest in Tabasco went from 50 percent in 1940 to less than 8 percent by the late 1980s (Tudela 1989).

instances, forcibly house both the 4,700 inhabitants that lived in the area before the Plan implementation, and new settlers to the region (Arrieta 1994; Tudela 1989).

Plan Chontalpa was meant to be a model for industrial, agricultural, and social development in the humid tropical regions of the world. However, it fell short of its original goals and went through a series of changes. For example, in the late 1970s, along with Mexico as a whole, it faced economic and political problems. As it was originally conceived, the Plan fit well with the philosophy of import substitution industrialization that Mexico was following. However, under pressure from international lenders following the Mexican debt crisis in the early 1980s, the national development philosophy shifted toward export-oriented growth. The rise of neoliberal policies led to significant changes in Mexico. For example, markets and trade were liberalized, important government companies serving the agricultural sector were privatized, and many agricultural subsidies from the federal government were eliminated (Lanzas and Whittle 2017). In particular, during the 1980s and 1990s the country exercised a series of constitutional changes that brought about a decentralization of water management systems from federal to state and municipal levels. This change was also accompanied by neoliberal economic restructuring that gave new opportunities for private and nominal public sector involvements. Yet, this transfer of responsibility happened without providing the legal authority or funding mechanism necessary for local governments to build and maintain their existing water infrastructures (Barkin 2006; Brown *et al.* 2003).

The shift to a neoliberal development philosophy accompanied the realization that the Plan had not lived up to its expectations. Upstream, the dams did not generate the expected electrical power production (Lanzas 2011; Robinson 2007). Downstream, the production of staple food was not economically sustainable under new market constraints. Rather than abandoning the Plan altogether, the government reconceived the Plan's priorities and reoriented local production. To strengthen its economic viability and align the Plan with the export-oriented development philosophy, the federal government stopped supporting the initial programs and services promised to the local population. For example, the government halted support to the growth of staple foods and the maintenance of the water infrastructure. Currently the cultivation of rainfed sugarcane in *ejido* land is the primary economic activity in all the towns built by the Plan.

The *Poblado*

Poblado is one of the twenty-two identical semi-urbanized towns built by Plan Chontalpa. Its entrance, in the fourth street, is flanked by a beautiful row of tall coconut palm trees, and the view of the town progressively changes from lush palm trees to evergreen ornamental and tropical fruit trees along the street. At the time of my research the town had approximately 400 families of self-identified *mestizos*¹¹ who speak Spanish. The entire population of *Poblado* occupies a little more of 100 ha. *Poblado* was built with what the Plan called "basic or essential services"¹²; that is, sewage system, potable water, electricity, a health center, schooling through high-school, and paved roads. The concrete houses are built one after the other, along the now patchily-paved streets in a nuclear and concentrated fashion. Each house is located within a *solar*¹³, in which families also raise farm animals and plants for household consumption and local sale. Among the benefits brought about by the Plan, there was indeed an overall improvement of the services available to residents. However, while doing fieldwork in the *Poblado*, I learned that the drainage system and irrigation infrastructure built for agricultural purposes has been abandoned. Similarly, the infrastructure built for potable water supply was no longer functioning.

When I arrived at the *Poblado* in December 2007, some families in the town were getting ready for the *zafra* of the *tempraneras*, the harvest of one of the sugarcane varieties cultivated in the region. It was

¹¹*Mestizo* is a quasi-racial category intermediate between Indigenous and White (Sanabria 2007). Mexico's 1917 Constitution declared the country a *mestizo* nation—even when a large portion of the population are indigenous (Martínez 2006; Robinson 2007).

¹² Information provided through personal conversation with the engineer Germán Velásquez, who worked during the initial stages of Plan Chontalpa.

¹³ *Solar*: land where a house is built.

during my conversations with a resident, María, Jessica's mother, that I learned of the difficulties that sugarcane farmers in the area were facing. To my surprise, seven of the local small-scale sugarcane farmers had already illegally sold their *ejido* land in *presta nombre*¹⁴ so far that year. Understanding why this was happening became my entry point to learn what life was like in the area after Plan Chontalpa. Through María, I started my interviews with the other three families with different socioeconomic status. After months of collaborating in recordings these families' socioeconomic experiences, I learned that Jesús, María's husband, was contemplating selling some of his sugarcane *ejido* lands. It was then that I decided to collaborate with Jesús and collect his life history, while also continue working with the other families.

Jesús and María are both long time Chontalpa's residents. Jessica is the fifth of their six living children. Jessica lives with her husband and daughter in her parent's house together with her younger brother, Ivan. Her other brothers and sister left the *Poblado* in search of better opportunities in the nearby cities and currently do non-agricultural jobs. From my work with Jessica's family, I learned that the cultivation of sugarcane is the primary economic activity in the area impacted by Plan Chontalpa. Jesús is the only one in his household who is devoted primarily to agricultural activities. He is today a marginal sugarcane farmer with one hectare under production, after selling four hectares in *presta nombre*. He also has another hectare of *ejido* land in which he cultivates *cacao* to sell commercially to a local factory, and corn for household consumption. The rest of the household members: María, Ivan, Jessica, and Jessica's husband, engage in a variety of formal and informal non-agricultural activities, which supplement the household agricultural income and allows them to meet their household's basic economic needs. In the *Poblado*, most producers are marginal and small-scale and have rights to between one to six hectares of *ejido* land. To guarantee a good payment for their sugarcane harvest, farmers have to request loans from the sugar mill for agricultural inputs and for the irrigation of their plantation, especially during the dry season (late February to May) when the clay soil, characteristic of the area, becomes arid and brittle, affecting the roots of their plants. Nonetheless, even when farmers request a loan from the sugarcane mill to invest in their plantation, this does not always translate into an increased harvest. Under these circumstances, many impoverished borrowers were indebted to the mill, to the point of having to illegally sell their *ejido* land to repay the loans. Cultivating sugarcane on small parcels and, usually in exhausted soil did not allow farmers to fully support their households (Lanzas and Whittle 2017).

One of the most obvious environmental impacts of Plan Chontalpa was the draining of Chontalpa's wetlands, which were characterized by rich alluvium soils and high humidity. Previous studies have observed the 'dramatic ecological' impact of the Plan on the region, and Tudela called it "*desarrollo deteriorante*" (destructive development) (Tudela 1989: 439) (see also Arrieta 1994; Dewey 1981; Toledo 1983). The large drainage infrastructure built, and the region's forest destruction¹⁵ have dried the clay soil and exposed it to the intense heat of the sun and the erosive impact of the tropical monsoon-like rain. The impact of the Plan on the hydrology of the area is equally evident. There are no more naturally flowing creeks that used to meander the region, making it now costly to irrigate during the dry season. It is imperative to make a comprehensive study of the effects of this integrated management program on the health of the Grijalva river, its riparian systems, and the diverse human-environmental systems that it supported to bring accountability and address the needs of the impacted communities and the environment.

In the face of the new challenges, most households like Jesús's engage in a variety of other nonagricultural activities such as the preparation of food for local sale and migration to nearby cities to work as construction workers, factory workers, clerks in stores, nurse assistants in nearby health clinics, and in the tourism industry in Campeche and Yucatan. A handful of residents were working in the most coveted job with the national petroleum company, known in Spanish as *Petroleos Mexicanos*, PEMEX. It was during

¹⁴ *Presta Nombre* a local practice in which the *ejido* land is illegally sold by the *ejidatario* (title holder of *ejido* land) to larger, private farmers who manage it—at times by hiring the labor of its previous title holder—and reap the benefits of the harvest. It is called *presta nombre* because the name of the *ejidatario* still appears in the sugarcane mill record as the title holder of the *ejido* land.

¹⁵ Today, Tabasco's remaining wetlands and mangrove areas are UNESCO-classified as an internationally protected biosphere reserve due to their unique social and environmental diversity.

these extensive interviews about their economic challenges and strategies that I was able also to observe and learn their elaborate system for accessing, managing and using water for household consumption that Jessica and her mother, María, as well as every single *Poblado* household, does daily. In response to my question about the condition of the potable water infrastructure built by the Plan, Jessica instructed me on the condition of the water treatment plant—which I referred to in the epigraph—and described to me what they do every day to guarantee the household has the freshwater it needs.

Water provision strategies

Potable water provision to improve the life and health of the locals was a stated goal of Plan Chontalpa, and a purification plan with networked water pipes was built in each town. I learned that in the *Poblado*, it was built in 1970s.¹⁶ The purification plant consists of an elevated water collection tank and a diesel water pump that extracts water from the water table to the tank. Once in the tank, the water is purified by the use of chlorine tablets. The local health center has been in charge of the periodic chlorination of the water and the provision of diesel for the pump with funds extended by the Mexican federal government. Today, the water purification plant functions sporadically, and there are several reasons why this is the case. For example, the health center no longer receives the federal support to supply the diesel that the pump needs and to buy chlorine tablets for water purification.

Since the system is under-subsidized, fee collection has been low, given the low expectations for service quality, making it even more difficult to maintain it. To make matters worse, the community has grown by approximately ten times since the plant was first built (INEGI 2010), which has increased the number of connections to the system. In lieu of the lack of government response to their requests for network connections, new residents have taken upon themselves to create their own water pipe connections to the system. The increasing number of haphazard connections into the network has further undermined the functioning of the system by reducing the volume capacity of the water purification plant and its coverage. Furthermore, because the mains are located at some distance from their homes, the polyvinyl chloride (PVC) pipes travel, above ground, great distances to their homes. They are exposed to breakage and leaks, or being destroyed periodically. The practice of creating their own pipe connections, although rational in respect to a dysfunctional system, also seems to inhibit their capacity to improve it. It is reducing the capacity of the system to provide pressurized water, and the breaks and leakages that compromise the quality of water. It is not surprising that, even where the network water is available, residents do not trust it because it is murky and has an odor. Overall, the water provision system can no longer provide enough pressurized and good quality water to all the connected households.

Under these circumstances, and to satisfy their water needs, residents of the *Poblado* depend on customary, formal and informal sources of water supply. In terms of customary practices, Jessica and her mother harvest rainwater. The low coverage and poor quality of the utility service combined with the lack of easy access to natural water flows mean that residents like them depend heavily on rainwater collection to meet their water needs. This is the case even in households with networked connections. I witnessed this while visiting Jesús and María's household on a stormy day. Jessica, their daughter, dragged a well-used blue plastic barrel, *tambo*, and placed it under the eaves of the roof of her parents' house. The barrel was semi-empty with some collected water from previous rains, as I later learned. She repeated the same action with several other *tambos* placing them at different points around the house and under the roof. She explained that during the rainy season, they harvest rainwater. "Why not, it is free and abundant!", she exclaimed. Certainly, Jessica's observation is instructive. In a town where so many people have very low incomes, it is vital to have the option to access water at the lowest possible cost. Jessica explained that since the network water stopped being reliable, people in the *Poblado* have resorted to harvesting rainwater for many consumptive water needs such as bathing, cleaning the house, flushing the toilet into their septic system and for domesticated animals. Jessica's parents, Jesús and María lived in the Chontalpa before the Plan and recounted how capturing rainwater was a common practice for a number of household and

¹⁶ Residents do not remember exactly the date of its construction and the *Coordinadora del Plan Chontalpa* (Plan Chontalpa's Office) did not have the records.

productive tasks. It was easier than carrying water from the creeks and rivers. Like many *Poblado* residents, Jessica and her parents believe that rainwater is of better quality than the water that comes from the plant.¹⁷

During the dry season, when rains are uncommon, their household relies on their deep well of twenty-three meters, which has an electric and a manual pump. Most households, except the very poor ones, have the same arrangement. Jessica said:

Mira, mis papas me contaban que antes se podía beber el agua de pozo cruda...[risas]... del pozo que hizo mi papa a diez metros...porque facilito se conseguía agua entonces, había más arroyos y el agua estaba ahí cerquita...No era ni necesario escavar pozos. El agua era más clara y no tenía mal olor. Pero mi mama siempre la hervía...Ese pozo que vez ahí tiene veintitrés metros de profundidad y ya vez como sale el agua...cuando antes se conseguía a menos de diez y mejor agua.

Look, my parents told me that before you could drink the raw well water ... [laughs] ... from the well that my father made ten meters [deep] ... because it was easier to get water then, there were [also] more streams and the water was nearby ... There was no need to dig [deeper] wells. The water was clearer and had no bad smell. But my mom always boiled it ... That well right there is twenty-three meters deep and you see how water comes out ... before it was less than ten [meters deep] and better water.

"Ya no se puede tomar agua de los arroyos...no ves cómo están esos drenes de sucios?...si bebes esa agua o comes lo que hay en esa agua, te enfermas...

You cannot drink water from the creeks anymore ... don't you see how dirty those drains are? ... if you drink that water or eat what's in that water, you get sick ...

This explanation was common in conversations with other residents. They often underscore the fact that they used to have more access to diverse sources of freshwater than it is the case now, after Plan Chontalpa. They feel the Plan has considerably transformed the hydrological characteristics of the area. They explain it by highlighting the lack of natural creeks meandering through the region and the need to build deeper and more costly wells. Usually, residents have to contract the services of the federal institution in charge of water management, the National Water Commission (in Spanish, *Comisión Nacional de Agua*, CONAGUA) which offers their machinery to do the drilling at a lower price than commercial ones. One of the reasons for having to drill deeper wells, and for the lack of more surface water is because the extensive drainage network—built to drain the region for the agricultural project, —has effectively drained many natural creeks and reduced the levels of the water table, making it more difficult to access well water during dry season. Jessica's observation about the color of the water in the well refers to the fact that the water from deeper water table presents higher levels of iron and manganese (Jhabvala 2006), which is what causes the presence of orange or brown color and a strange taste in the water. Jessica explains that they depend heavily on the well water during the dry season for the domestic shores and to provide water to the domesticated animals. The other household activity that requires significant consumption of water is laundry. Two times a week Jessica does laundry using exclusively well water to fill the washer machine, a Frigidaire (15 kg) her oldest living brother—who lives in the city's capital—gave their mother for Mother's Day. Jessica uses the greywater from the wash cycles for domestic chores or to flush the toilet of their septic system. The greywater from the rinse cycles is used for future wash cycles until is too dirty to use. The use of greywater guarantees the use of less colored well-water; which based on Jessica's observation, it tends to stain the white clothes.

¹⁷ A recent survey by the Inter-American Development Bank found out that 81 percent of Mexicans reported that "they do not drink tap water, both for a lack of access and a lack of trust in its quality" (Adler 2015). The lack of trust in the networked water is actually a sentiment shared by many Mexicans, and with reason. In 2010 Mexico ranked 106th out of 122 countries in the UN Development Program drinking water quality list (Castano 2012).

In terms of formal and informal practices, five times a week, Jessica purchases a five-gallon (18 litre) jug, *garrafón*, of commercially purified water (Cristal¹⁸)—usually delivered to their homes by commercial sellers—to use for drinking and cooking. When they don't have enough money in the household to buy water from the private companies, Jessica reluctantly purchases a much cheaper five-gallon jug of *agua clorada* (chlorinated water) from one of the two household-run-services that exists in the *Poblado*. She does not appreciate the 'bleach-like' taste in the water. These household-run purified water services have been proliferating throughout the twenty-two towns built by Plan Chontalpa because, by the time this article was written, none of the potable water plants built by Plan Chontalpa are in operation. These household-run purified water services are a reliable and affordable solution for many low-income families. Still, from one-third to two-thirds of Jessica's household's monthly budget, between MX\$180.00 to 330.00 per month [US\$16.4 to 30]¹⁹, is spent in the provision of potable water for drinking and cooking, a heavy burden for low-income families.

6. Conclusion

The original data I presented in this study showed that due to a shift of Mexico's policies towards a neoliberal development philosophy, Plan Chontalpa, a state-led large-scale development program, had not lived up to its promises, and among other things, has failed to extend potable water provision to the rural population in the Chontalpa, in Tabasco. Today, families living in the area impacted by the Plan are facing similar water challenges and vulnerabilities as a result of the program's failure. In this context, the resilience we saw in Jessica's family is commendable, but it cannot make up for the fact that, in its execution, Plan Chontalpa disregarded local socio-environmental realities; and in doing so, it has undermined the capacity of the ecosystem (the people and the environment) to adapt and thrive.

Like many other residents in the *Poblado*, Jessica and her family have few options to effectively improve the town's under subsidized water infrastructure. As an alternative solution, they have crafted a household water management system that incorporates customary, formal, and informal practices and identifies different types of waters for different uses. These household practices are utilizing significant sustainable methods that deserve our attention such as water access flexibility, the exercise of local expertise, and technological accessibility and malleability. Today, their household water management system is addressing their present water needs. However, this is not to say that households like Jessica's are innately self-sufficient, but rather that their idiosyncratic responses teach us alternative ways of decision-making that can transform local development efforts, potentially benefiting millions of people and equally saving millions of dollars. Their experiences also teach us that local socio-environmental knowledge and water management practices at the household level are instructive and must be taken into consideration when crafting water management development agendas; even if they look like a rain *tambo* in the back patio.

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¹⁸ Mexico is one of the world largest markets for bottled water, with market leader companies such as Danone, Coca-Cola and Pepsi (Castano 2012).

¹⁹ The exchange rate in 2009 was 11 Mexican pesos to 1 U.S. dollar.

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