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Defiance from Down River: Deflection and Dispute in the Urban-Industrial Metabolism of Pollution in Guadalajara

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Abstract: Research in urban political ecology has been important in recent decades in understanding the complex socio-natural processes entailed in urbanization, exploring the local and global linkages of the production and consumption processes of urban metabolism. While these studies have explored diverse networks and artefacts in this metabolism, little attention has been paid to the flows of the pollution of water and air, particularly of the industrial emissions that are also key to the socio-natures of urbanization in industrialized regions of the Global South. In this paper, we explore two interconnected nodes in the metabolism of the Guadalajara Metropolitan Area in Western Mexico. These are key sites for the flows of resources and emissions, with different levels of social discontent and conflict related particularly to the health impacts of water pollution. Here, government authorities tend to deflect attention from industrial- and city-level sources of pollution, focusing instead on proximate sources and household emissions. Organized social resistance, on the other hand, calls attention to powerful industrial actors and speculative urban development while taking action to imagine new socio-ecological configurations in the region. We focus on the role of the state in maintaining socio-ecological inequities, and the lessons that can be learned about urban metabolism by expanding the frame to include industrial processes in the shaping of urban socio-natures.

Keywords: industry; water pollution; urban political ecology; Mexico

1. Introduction

In a clear rejection of the current urban metabolism of the Guadalajara Metropolitan Area (GMA) in Western Mexico, one of the first messages of local organization Leap of Life (*Un Salto de Vida*) in 2007 read “Your shit pisses me off: government + industry + indifference = death in El Salto and Juanacatlán” [1]. Where Leap of Life members are based in El Salto, the waterfall that separates the town from neighboring Juanacatlán has been converted to a large extent into a river of “shit,” in a literal and figurative sense, as the relatively low-flow Santiago River carries high loads of treated and untreated municipal wastewater as well as the effluents of an important industrial corridor. The main landfill for the GMA, privately run Los Laureles, is located just one kilometer north of El Salto. The typical fetid emissions from the garbage dump, which receives 2500 tons of waste per day [2], turned into noxious smoke when a fire broke out in April 2019, and since that time, Leap of Life has focused on a campaign to permanently shut down the dump.

At the other node we explore, where the municipality of El Salto meets Tlaquepaque in Las Pintas, poor air quality, polluted waters and periodic flooding contribute to insalubrious conditions for

residents of this urban-industrial fringe. Prevailing winds, intense vehicular traffic, industries and artisanal brick kilns all make this the location of the worst air quality in the GMA, Mexico's second largest city with a population of 4.8 million in 2015 [3]. Las Pintas is also at the confluence of a complex set of canals that bring waters of questionable quality from upstream on the Santiago River into the GMA for "purification" and distribution through the city's water infrastructure. Overflows from the Las Pintas Dam mix with wastewater to form the El Ahogado Canal, the most toxic tributary of the Santiago, as it winds its way through the terrain of factories and industrial warehouses between Las Pintas and El Salto. Residents living near the dam and canals employ diverse strategies to adapt to flooding in the rainy season. Unlike in El Salto, however, in Las Pintas, many residents accept official discourses, laying the blame for water pollution and flooding on local bad habits, such as disposing of garbage in nearby canals.

When viewing this terrain of chaotic "suburbanization" between Las Pintas and El Salto [4], a study of urban metabolism can constitute a powerful tool to comprehend the power relations undergirding these socio-ecological configurations and how "the material conditions that comprise urban environments are controlled, manipulated and serve the interests of the elite at the expense of marginalized populations" [5] (p. 6). In this vein, research in urban political ecology has been important in recent decades in understanding the complex socio-natural processes entailed in urbanization, exploring the local and global linkages of the production and consumption processes of urban metabolism [6,7]. While these studies have explored diverse networks and artefacts in this metabolism, studies based in political ecology and urban political ecology have paid less attention to the flows of the industrial pollution of water that are also key to the socio-natures of urbanization in industrialized regions of the Global South. In this paper, we argue that more attention should be paid to industrialization as an integral part of many processes of urbanization and as key sites of metabolic exchange of energy, water, and a diverse array of resources and commodities, often emitting uncontrolled toxic wastes, within urban contexts in the South. In doing so, we are also attending the call of Swyngedouw and Kaika [8] for an intellectual and political agenda that contemplates the analysis of the role played by the state in fostering "governance," as well as in engendering discourses of urban natures that protect elite interests, and that explores the potential of urban socio-ecological movements to imagine more democratic urban socio-natures and contest hegemonic discourses of modernization and progress. In this paper, we particularly argue for the potential, in this regard, of a movement against industrial pollution.

Our focus is on two interconnected nodes to the south of the GMA where industrialization and urbanization have gone hand-in-hand and where residents are exposed to the risks of living in the proximity of factories with often uncontrolled emissions. Here, we use the idea of a node to describe areas where diverse flows of resources and wastes converge and where the negative impacts of the current urban metabolism have direct effects on people's daily lives and health. These are areas where municipal and state authorities have promoted the installation of industry, particularly since the 1970s, and where in more recent decades there has been a push for the construction of social interest housing, bringing workers and their families into greater proximity of the sites of employment and pollution. Social protest centered on the health impacts of the industrial pollution of the Santiago River has existed for over fifteen years, yet decisive action has yet to be taken by government authorities. To understand the persistence of these risks and polluting activities, we argue that it is necessary to foreground the analysis of industrial activities and the power relations that sustain their polluting practices.

In the following section, we discuss the relative absence of studies focused on industry and manufacturing in political ecology generally, and in urban political ecology. From there, we briefly present our research methods. The results section covers, first, our analysis of the flow of resources and waste in El Salto focusing on the industrial pollution of the Santiago River to highlight how government action, including the recently announced Santiago River Comprehensive Recovery Strategy, minimizes the role of industry in on-going river degradation. Second, we explore the related node at Las Pintas to examine the profoundly asymmetrical power relations between local residents, government actors,

and speculative urban developers, and the dynamics of social resistance and daily life in this polluted context. This article closes with a discussion of the strategies of the state to downplay the role of industry in water pollution and the potential of socio-ecological movements in the affected areas to construct more democratic forms of urban metabolism.

2. Industry, the State and Urbanization

In the diverse and burgeoning field of political ecology, several studies have discussed the relative lack of analytical attention paid to industrial activities, though they are clearly key to modern processes of socio-environmental change [9–12]. In 2014, manufacturing industries accounted for 30.5% of global energy consumption, a similar proportion to the transport (30.6%) and residential sectors (24.9%) [13] (p. 175). Concomitantly, the Intergovernmental Panel on Climate Change (IPCC) reports that, accounting for indirect emissions, industry was the source of 31% of global greenhouse gas emissions in 2010 [14] (p. 46). A significant proportion of water consumption is for industrial purposes, where industry including power generation absorbs 19% of water extraction globally, exceeding household consumption (12%) [15]. At the “end of the pipe”, global estimates indicate that industry annually dumps between 300 and 400 million tons of heavy metals, solvents, toxic sludge and other forms of waste in waterways [16]. In so-called developing countries, the problem is compounded by low levels of treatment, estimated at just 30%, and the inability of conventional treatment systems to remove many chemicals generated in industrial processes [16]. Finally, industry generates almost eighteen times more solid waste than households, according to information from the World Bank [17], although this varies greatly with income level. Industry is also the principal source of hazardous waste [18].

In the shifting geographies of capitalism and the global division of labor, Smith [19] (p. 263) notes in the Afterword to the third edition of his treatise on *Uneven Development*, that while “[t]he financial command and control functions of the global economy may still be concentrated in New York, Tokyo, and London, [. . .] the new global cities of Asia and Latin America and now increasingly Africa are very much the workshops of global capital.” Since 2010, China has been the top global manufacturer in terms of manufacturing value added (MVA), and in 2018, it accounted for 24.9% of global MVA, slightly more than the U.S. (15.0%) and Japan (9.7%) combined. Overall, the share of MVA of “industrialized economies” in Europe, North America and Asia has dropped from 67.4% in 2007 to 55.3% in 2017 as part of a “long-term trend [of] relocation of manufacturing production from industrialized economies to the developing world” [20] (p. 13). Mexico is among the top fifteen global producers (1.45% of global MVA), and in 2018, manufacturing accounted for 17.1% of gross domestic product (GDP) [21] and employed over 3.6 million [22].

The export-oriented structure of manufacturing in Mexico, with its profound and sustained commitment to policies of neoliberalization since the mid-1980s, is worth commenting on briefly. In 2015, Mexico was the source of 54% of Latin America’s manufacturing exports [13]. That same year, 82.9% of said exports were destined for the United States [23]. Mexican manufacturing exports are highly concentrated in the automotive, electronics, and electrical equipment sectors. This reflects the nature of the economic strategy in Mexico, appositely termed by Cypher and Delgado [24] (p. 11) “transnational dependent capitalism,” based on the exploitation and exportation of cheap labor in the maquila and “disguised” maquila sectors. Here, while the maquila sector refers to assembly plants on the northern border, encouraged by the 1965 Border Industrialization Program, Cypher and Delgado [24] (p. 4) define the “disguised” maquila sector more generally to refer to “firms that receive imported inputs in order to process, assemble, and export with the use of cheap Mexican labor.” In general terms, the Mexican economy has been dismantled and restructured to serve the interests of the productive system and corporations in the U.S., while generating rentier benefits for Mexican elites [24,25]. In addition to exploiting some of the world’s cheapest labor [26], this system also exploits the environment and has contributed to the upsurge in social environmental conflicts in the country [27].

In Mexico, where 58% of the national territory is considered semi-arid, arid or hyper-arid [28], industry consumes 4.9% of water, compared to 4.7% for energy generation (excluding hydroelectricity), 14.4% for households and 76.0% for agriculture [29]. The polluting impact is greater than this share, however, where the National Water Commission (CONAGUA, *Comisión Nacional del Agua*) calculates that industry generates a contaminant load (measured in terms of biochemical oxygen demand) equivalent to that generated by a population of 300 million [30], or approximately 2.5 times the Mexican population of 119.5 million [3]. Electricity consumption by medium-sized and large industry constituted 57.7% of national usage in 2017 [31] (p. 113); and in 2010, industry's share of total energy consumption was 28.8%, compared to 44.9% for transportation, and 18.9% for residential, commercial and public use [32]. While data on total waste produced by industry is scant [33], official statistics indicate that 7548 large generators were responsible for 94.7% of over 2.4 million tons of hazardous waste reported between 2004 and 2017 [34].

This "industrial metabolism," and its optimization for greater efficiency and decreasing impacts on the biosphere to "make it compatible with the way natural ecosystems function," is the focus of studies of industrial ecology [35] (p. 1) [36]. Industrial ecology, however, aimed at inducing "webs" of exchange of energy and waste, and contemplating such quantitative methods as materials flow analysis and life cycle analysis, employs a view of this metabolism that has been criticized as "functional, linear, organismic and based on an ontological construction of nature as distinct from society" [37] (p. 713). It is certainly not an apt tool to examine the power dynamics surrounding the impacts of industry "externalities" or to understand the shifting geographies of manufacturing under contemporary capitalist globalization. While traditionally focused on rural areas and sites of resource extraction in the Global South, political ecology, as a field concerned with analyzing the "winners and losers" in processes of socio-environmental change, in "identifying broader systems rather than blaming proximate and local forces," and in comprehending the "power-laden" nature of ecosystems [38] (p. 13), can enable examinations of the contested polluting practices of industry, and the role of the state in facilitating such practices.

Harvey's assertion that "there is [. . .] nothing unnatural about New York City" [39] (p. 28), drawing attention to the impossibility of bounding off "society" from "nature" or the "environment," is fundamentally different from Erkman's argument, based on the idea of an objective external "nature" that can be mimicked, that an "industrial system can be seen as a certain kind of ecosystem" [35] (p. 1). Nonetheless, we can certainly take from Harvey that there is nothing in essence *unnatural* about a landscape scattered with nondescript industrial warehouses or chemical factories and their mazes of intertwining tanks, pipes, and chimneys—features of an urban-industrial second nature [19]. In a call to "industrialize" political ecology, Huber [11] questions what counts as ecology and traces the neglect of sites of manufacturing in political ecology and urban political ecology to trends in the history of geographic thought. Particularly important, he argues, is the legacy of Carl Sauer's inclination for the study of cultures at the margins of industrial capitalism, where one might encounter ecologically sustainable ways of living and possible sites of resistance. This trend set the stage, Huber affirms, for the "peripheralization of nature-society research in geography: away from urban industrial spaces and toward rural resource and conservation areas" [10] (p. 76). Turning to the question of what counts as "political," Huber [11] advocates examining even the uncontested access and control of industry to resources and sites of waste disposal. However, there is an argument to be made for studying industrialization by "following the politics" in the conventional sense of cases where "social movements and institutions make environments political" [11] (p. 156).

Such are the examples of the political ecologies of industrialization to date, where Barca and Bridge [9] (p. 369) note that the limited number of studies undertaken have "focused largely on ecological distribution conflicts and the environmental risks associated with industrialization." Forsyth [40] (p. 389), for example, employs a science-policy perspective to explore cases of lead and lignite poisoning in Thailand, arguing that middle-class environmental activists, through expert-driven discourses of environmental risk that reproduce ideas of "uncaring industry," may not be sensitive to

the perceptions and material interests of marginalized people and workers. Underlying this argument is the goal of attaining “more inclusive access to development” for marginalized people, such that activists are questioned for being “opposed to industrialization in general, rather than seeking a more sensitive inclusion of workers within industrialization” [40] (pp. 393, 395). O’Rourke’s [12] (p. 226) [41] exploration of community-based demands for the control of industrial pollution in Vietnam is not focused on the class interests of activists versus local communities, but rather on the inherent tensions surrounding the role of the state in developing countries in “promoting industrial expansion and trying to protect bases of local livelihood.” The push of community demands is here somewhat successful in overcoming the contradictions within the state and achieving a higher degree of enforcement of environmental regulations. O’Rourke posits that Vietnam “may yet be able to chart a less destructive path towards industrialization,” if there is an opening to community participation and increased state autonomy and responsiveness to local environmental and social concerns [12] (p. 244).

Landscapes blighted by rural industry in China are the site for Tilt’s [42] analysis of the political ecology of pollution enforcement. Despite a strong national regulatory framework, Tilt explores the incentives against enforcement by local governments dependent on tax revenues from industry, and the role of the media and civil society in sparking decisive action against polluting firms. Inherent tensions and conflicts are again highlighted in the state’s elusive pursuit of how “best to balance economic development and environmental protection” (p. 932). That balance may continue to prove elusive, along with inclusive and less-destructive industrialization, in contexts where said industrialization is predicated on low wages and “flexible” environmental regulations. The state here may not function to make continued capitalist exploitation of nature “compatible” with nature’s role as the context for social reproduction and for the existence of diverse cultures [43] (p. 54). This “juggling act” may be abandoned for a clearer role in maintaining the conditions for destructive industrialization and containing social protest, whether through overt repression (as is common in Mexico, see Reference [44]) or through the techno-managerial “consensus” mechanisms of environmental governance [45].

While advocating the need for a political ecological framework of the state, Ioris [46] (p. 167) delves into the “internally fractured and contradictory” role of the state as environmental actor. Taking up Marxist perspectives on the state, Ioris observes that, in addition to curbing social environmental conflicts, the main objective of environmental regulations is to decrease uncertainties and production costs and “to systematize the access and ownership of parts of socionature that have economic or political relevance” (p. 173). While the primary objective of the state is to ensure conditions for the reproduction of capitalism, not all actions of the state may tend to this goal. This was also observed by Miliband [47]. In a capitalist context, Miliband affirms, the principal role of the state is as “guardian and protector” of dominant economic interests. Nonetheless, in any particular time and place, “the manner in which the state fulfils that role and the degree to which it manifests its bias differ greatly” (p. 266).

In his theorizations on the “neoliberalization of nature,” Noel Castree [48] (p. 149) delineates two possible postures that states may adopt given the internal contradictions faced regarding the environment; the first involves the “hollowing-out” of state responsibilities via “off-loading responsibilities to the private sector and/or civil society groups” through the aforementioned governance mechanisms or privatization of state functions. The second possible stance, more prevalent in developing countries without robust environmental legislations and institutions, involves “adopting a ‘minimal state’ stance in the first place,” and thus abdicating from the balancing act. While discursively attempting to maintain the green façade of environmental protection, the cases here explored demonstrate the will of the Mexican state to protect elite interests, even in face of on-going social protest and environmental devastation. Prescient for this analysis is also Castree’s observation that the state may “make formal efforts to encourage citizens to take personal or communal responsibility for the ‘goods’ and ‘bads’ that arise from nature’s neoliberalisation” [48].

Environmental justice research and activism have certainly addressed the distribution of such ‘bads’ as industrial pollution and hazards in urban areas (for example, [49,50]), not just in the United States where the movement was born, but also in the Global South [51,52]. What an urban political

ecology perspective can contribute, according to Heynen et al. [5] (p. 9) is a more structural analysis, exploring the power relations governing urban socio-natures and how “these relationships are integral to the functioning of a capitalist political-economic system.” To date, however, industrial activities have not often been foregrounded in analyses based in urban political ecology. A clear exception is Desfor and Vesalon’s [53] exploration of the production of “industrial nature” in the Port Industrial District of Toronto during the first decades of the twentieth century, conceived by these authors as a spatio-temporal fix where political and economic elites worked together to expand urban land for industrial development. Investigating a more contemporary conflict, and attempting to bridge work in urban political ecology (UPE) and studies of the peri-urban, the work of Karpouzoglou, Marshall and Mehta [54] in Ghaziabad city at the eastern fringe of Delhi, India, underscores the importance of analyzing the politics around industrial operations to grasp the “power and politics” of water quality decline in this peri-urban region (p. 486) (see also [55]). These authors note that little attention has been given to water quality decline (water pollution) in UPE studies, when compared with issues of water access, and argue that UPE has the potential to apprehend the contested nature of this pollution and the politics surrounding who is blamed and who are the victims of water quality decline.

Certainly, industrialization is not a *sine qua non* of urbanization [56], and processes of industrialization and deindustrialization present differently across the globe. Even so, industrialization is a driver of urbanization in many regions, and industrial parks and factory fringes are characteristics of urban growth in a diversity of settings; as Keil [4] notes “industrialization and suburbanization have been linked since the early days of urban expansion in the nineteenth century [and] industrial suburbanization has been one of the chief trends of metropolitanization for one and a half centuries.”

In the exploration of the urban metabolism of socio-natures in UPE thus far, sociotechnical infrastructures, particularly of water supply and sanitation, have been some of the main foci [7,57–63], examining flows of water and power in both the North and South, and probing issues such as the discursive construction of water scarcity and “crisis,” accumulation by dispossession in the water supply sector, and unequal access to quality drinking water across urban waterscapes. While the bulk of UPE studies bring to bear Marxist approaches to understanding urban metabolisms, many authors share an interest in the political and social implications of the “acting of non-human actors” [64] (p. 902), taking up actor network approaches and constituting what Heynen [65] (p. 601) has referred to as a “second wave” in UPE centered on “post-humanist perspectives.” In this line, Robbins’ [66] (p. 135) engaging study of the North American lawn, in addition to exploring the socioeconomic and ecological factors leading agrochemical manufacturers to seek profits in nonagricultural markets such as lawn care, probes the active role of turfgrass itself, with its requirements for water, fertilizers and other agrochemicals as well as for constant cutting and tending, to attain the ideal of the American lawn, in creating “turfgrass subjects” as part of a “capitalized ecosystem.”

Several recent critiques have sought to diversify the theoretical perspectives and/or methodologies employed in UPE studies. For instance, Angelo and Wachsmuth [67] have drawn attention to the “methodological cityism” in UPE, citing a narrow focus on the traditional city versus processes of global urbanization. Calling for a more “situated UPE,” Lawhon et al. [68] posit the need for greater theoretical heterogeneity, given an overarching trend to unselectively apply “Northern theory” to contexts in the Global South. These authors draw insights from African urbanism, in order to observe everyday practices in urban areas not conceived as “failed cities” versus a Northern norm, and to apprehend diffuse forms and ways of contesting power (p. 505). Zimmer [69] also advocates “theorizing from the South,” particularly proposing greater engagement of UPE with postcolonial thought and highlighting how urban studies research in South Asia can contribute to more complex political narratives through examinations of the complex negotiations enacted in interactions between diverse actors and the state. More place-based, nuanced and historically grounded analyses are the target of Rademacher’s [70] invitation for a more ethnographic UPE. Drawing from urban anthropology and ethnographic political ecology, Rademacher maintains that a more ethnographic UPE can broaden current debates and “shed

light on power relations, social processes, and the plurality of ecologies that vie for positions of power and influence in lived social practice” (p. 146).

Related to our concern with urban-industrial pollution are the studies of air pollution—all of which cite the relative lack of attention to urban air in UPE research [71–73]. Verón’s [71] argument centers on a middle-class bias in the air pollution policies promoted by non-governmental organizations (NGOs) and the judiciary in New Delhi, marginalizing the environmental concerns of the urban poor. Based in a case study of Vancouver, Buzzelli [72] (p. 502) advocates for a rescaling of air pollution monitoring, demonstrating how regulated monitoring fails to capture the “microgeographies” of chronic air pollution which determine both the human health effects and the injustices in spatially differentiated exposures. Honing in on the continuing neglect of air quality issues in political ecology, Graham’s [73] wide-ranging review suggests ten possible themes and convincingly illustrates how the global health crises related to toxic urban air can and should be studied in terms of the ways unequal power relations are “inscribed” in the air [74] (p. 13). In Harper’s [75] exploration of air quality and health in Houston, she demonstrates how a political ecology of health can demystify dominant explanations that naturalize and individualize social and health inequalities, and which fail to problematize the power of elites to ensure lax regulations and enforcement for industrial actors.

The two intricately connected nodes of the urban-industrial metabolism of the Guadalajara Metropolitan Area (GMA) addressed in the following sections propose to illuminate industrial activities as part of urbanization and as key sites of conflict over the unequal distribution of environmental “goods” and “bads.” In these disputes, the commitment of the state to protect elite interests also comes into focus. At the community level, these cases demonstrate how local residents may, on the one hand, internalize state discourses which attribute environmental pollution and hazards to local “bad habits.” On the other hand, where there is organized resistance to unchecked urban-industrial development, these discourses are defied and call into question the possibility of benign industrial development.

3. Materials and Method

Our research is based on on-going ethnographic field work commenced in 2013 and continuing to date, including over 120 interviews with community activists and residents, municipal, state and federal government authorities, and representatives of a number of industry associations and companies in the industrial corridor. In the El Salto area, McCulligh has employed a research strategy based in institutional ethnography [76] comprising semi-structured interviews, participation in a series of related events and the analysis of documents from government sources. During the 2013–2015 period, McCulligh undertook 80 interviews, including interviews with 21 representatives from sixteen companies and two industry associations. Obtaining interviews with company representatives posed a particular challenge and, in addition to negative responses from other important companies in the corridor, persistent requests over periods from one to eight months were required to complete the interviews undertaken. In the case of industry, interviews were sought with environmental health and safety personnel to discuss the sustainability and/or environmental management systems employed at their local site and/or at the corporate level. This skewed the sample of companies to larger and often transnational companies (12 of the 16) with formal systems and reports related to sustainability and environmental management. Interviews were conducted with representatives of seven chemical companies, four from the food and beverage sector, two electronics companies, an auto-parts manufacturer, a tire manufacturer, and a company from the metal working industry. It was also possible to visit the installations of ten of these factories.

To test the limits of the information available on industrial activity in this corridor and its environmental impacts, and to garner information on a wider range of installations, approximately 200 access to information requests were made to state and federal agencies, mainly to the Ministry of Environment and Natural Resources (SEMARNAT), the National Water Commission (CONAGUA) and the Federal Bureau of Environmental Protection (PROFEPA). This information permitted the analysis,

among other aspects, of the discharge permits, annual operating certificates and environmental permits of a group of companies.

Research has also involved participant observation in a diversity of settings. Particularly relevant was the participation in three courses and three congresses on environmental topics of the National Chemical Industry Association (ANIQ, *Asociación Nacional de la Industria Química*), as well as two events organized by the government's investment attraction agency ProMéxico, and a business summit. On the governmental side, since 2013 both authors have participated as members of the Academic Council on Water of the Jalisco State Water Commission. McCulligh has also participated consistently in meetings and workshops on the Santiago River and the so-called Region of Environmental Fragility organized by the state Ministry of Environment and Territorial Development (SEMADET) and more recently the state government river restoration strategy, as well as diverse meetings with members of civil society organizations based in El Salto and Juanacatlán

In Las Pintas, we draw from Vega Fregoso's ethnographic environmental health research, including participant observation, interviews, workshops and an environmental sanitation survey. Here, the field work was carried out from 2014 to 2017. An Environmental Sanitation Survey (ESS) was designed, and 179 questionnaires were applied through non-probabilistic sampling (convenience) with residents over 18 years of age who agreed to respond. The survey included 38 closed and multiple-choice questions organized in four areas: I. Sociodemographic data, II. Disease and health, III. Quality of life and IV. Basic sanitation. The descriptive analysis was made based on the identification of frequencies in variables such as age, sex, income and level of education, as well as access to public and social security services. In addition, a central tendency analysis was applied to variables such as the number of doctor's visits, the type of illnesses in the past month and whether the respondents identify the relationship between environmental pollution and their state of health.

Non-parametric analysis was applied to a sample of 37 in-depth interviews or Ethnographic Environmental Clinical Histories (EECHs). Subsequently, the data was reported not as continuous values but in ordinal scale to assign ranges and establish two groups: sick and not sick. The hypothesis was that the most exposed population is not homogeneously distributed in the neighbourhoods that constitute Las Pintas, but rather the distribution is determined by diverse variables or environmental determinants of health; the variables that were recovered were skin diseases, presence of wheezing, cough, dyspnea and distance in meters to industries, canals and dams, brick kilns and high traffic roadways. For the analysis, SSPS version 25 was used, and a chi-square test was applied for variables that are qualitative or categorical and the Mann–Whitney U test for quantitative variables.

To analyze the results of the participant observation, typologies were developed inspired by the ideal types of Max Weber. Typological criteria included grouping families by income level, schooling, number of family members suffering from asthma or allergies, distance from housing to sources of environmental pollution; the types allowed us to show, by contrast, how families understand and explain the relationships between environmental pollution and the health of their members.

For the realization of the 37 EECHs, informed consent was obtained in advance, directly and with the support of the school community. This research was carried out in accordance with laws in force in Mexico, and the project was classified as risk-free research. Participating families were provided with a clear explanation of the objectives of the investigation, stating that they were free to agree to participate or not, and providing them with certainty that they could leave the project at any time without any negative consequences. All research also took other ethical considerations into account, including maintaining confidentiality and preventing the disclosure of identities where it could harm those participating in the research.

4. Results

4.1. Defiance and Deflection in El Salto

Industrial pollution has been at the center of the conflict over the pollution of the Santiago River in El Salto and Juanacatlán since local communities began to organize in 2001 [77]. A 2002 letter to then President Vicente Fox (2000–2006) from local NGO Instituto VIDA, citing the “dramatic” health problems in the community ranging from gastrointestinal and respiratory infections to cancer, kidney failure, and birth defects, called for action on the “industrial pollution of the Lerma Santiago River.” The river is called Lerma from its headwaters near Mexico City till its entry into Lake Chapala, while the outflow from Chapala and to the Pacific Ocean is the Santiago River. The severe pollution of the river predates these demands by several decades. In January 1973, *El Informador*, one of Guadalajara’s major daily newspapers reported on the “high [levels of] pollution registered in the Lerma and Santiago rivers, resulting from the chemical waste emitted by the industries located on its margins,” where inspectors from the Ministry of Fisheries found “many dead fish floating on its waters, mainly on the Santiago River” [78]. Testimonies of local residents who witnessed the major fish kills in the early 1970s associate them with the establishment of Swiss, American and Japanese chemical factories in the region: Ciba, Cyanamid and Quimikao.

El Salto itself was founded as a factory town three years after the country’s first hydroelectric plant was built at the waterfall in 1896, when a textile factory set up at the site [79]. It was not until the decade of the fish kills, however, when the formation of an industrial corridor along the Santiago River, from its origins in Ocotlán and to the south of the GMA in El Salto, received significant government support, as part of policies of industrial decentralization and dubbed the Jalisco Industrial Corridor [80]. While more recent government pretensions to convert Guadalajara into Mexico’s Silicon Valley have not been realized, particularly with the loss of many jobs in the electronics industry to China in the early 2000s [81], the area is one of the most important manufacturing regions in the country. In 2017, the state of Jalisco ranked third in manufacturing GDP, contributing 9% to the national total [82]. This manufacturing is highly concentrated, with 77.5% of manufacturing jobs clustered in five municipalities of the GMA (Guadalajara, Zapopan, Tlajomulco de Zúñiga, Tlaquepaque, and El Salto) [83].

In the area upstream of El Salto, from Ocotlán to the El Ahogado sub-basin covering the southern portion of the GMA, we have identified 675 small, medium and large manufacturing facilities (see Figure 1) [84]. Seventy-one of these are foreign-owned factories—of which, 80% belong to five manufacturing sectors: electronics and electrical industries (24%); chemical and petrochemical (17%); automotive and auto parts (15%); food and beverages (13%); and plastics and rubber (11%). More generally, a diversity of industries is found in the corridor, where, in addition to the aforementioned sectors, there are a significant number of metallic-based industries, tequila producers and small furniture manufacturers. Industry is of course not the only source of degradation, as deficient municipal wastewater treatment leads to the discharge of untreated sewage and the river receives pesticide runoff and leachates from garbage dumps such as Los Laureles near El Salto.

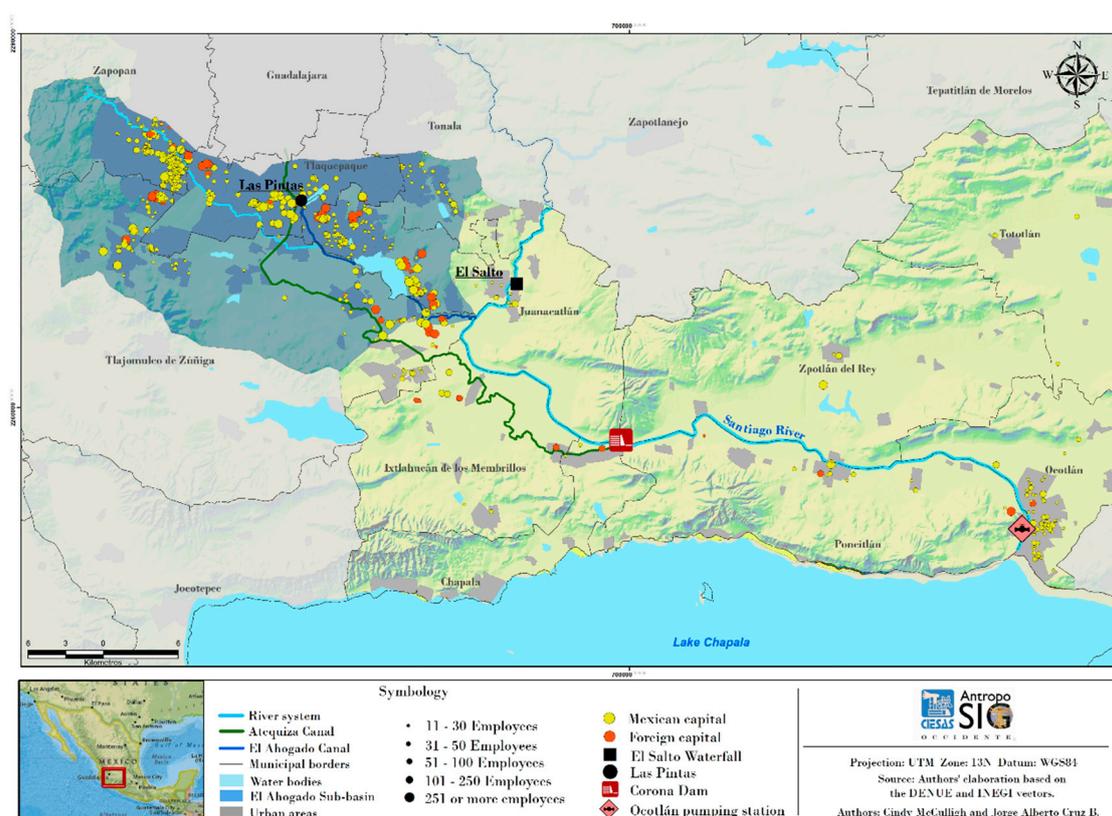


Figure 1. Ocotlán–El Salto Industrial Corridor and surface water infrastructure.

El Salto is at the heart of the industrial corridor and is conceived here as a node in the urban industrial metabolism of the GMA. The El Salto area can be conceived as such in that it is a key point for the flow of wastewater from the south of the GMA into the Santiago River and is, to date, close to the largest receptor of the solid waste of the GMA, together exposing the population to high levels of air and water pollution. Looking at the flows of people and resources around industrial activity, it is also a key site for employment and has been one of the key areas in the recent boom in construction of social housing in the GMA. In fact, El Salto is now one of the major areas of demographic growth in the GMA.

The population of the municipality more than doubled between 2000 and 2015, from just over 83,000 to over 183,000. The neighboring municipality of Tlajomulco de Zúñiga almost quadrupled in the same period, from 123 thousand to almost 550,000 inhabitants (see Figure 2) [3]. These peri-urban municipalities, officially incorporated into the GMA in 2009, have been fertile terrain for the housing boom promoted during the presidency of Vicente Fox (2000–2006), and are characterized by social housing developments disconnected from consolidated urban areas and services, featuring what Cabrales [85] has called “macrodevelopments of minihouses” or “residential underdevelopments.” Speculative real-estate development and government-sponsored social housing developments, a phenomenon seen in other Mexican cities, has in this case brought workers closer to the expanding industrial belt in Tlajomulco, El Salto and Tlaquepaque. The failure of this housing strategy is now evidenced in the astonishing figure of more than 68 thousand abandoned homes in Tlajomulco [86]. The problem of abandoned social housing is repeated, though to a slightly lesser degree, in El Salto and Tlaquepaque, and is a factor in the extremely high levels of violent crime. Based on official statistics, these are the three most violent municipalities in the state and among the worst in the country: El Salto was ranked 17th, Tlaquepaque 43rd and Tlajomulco 52nd in an index of the most violent of the 2457 municipalities in Mexico [87].

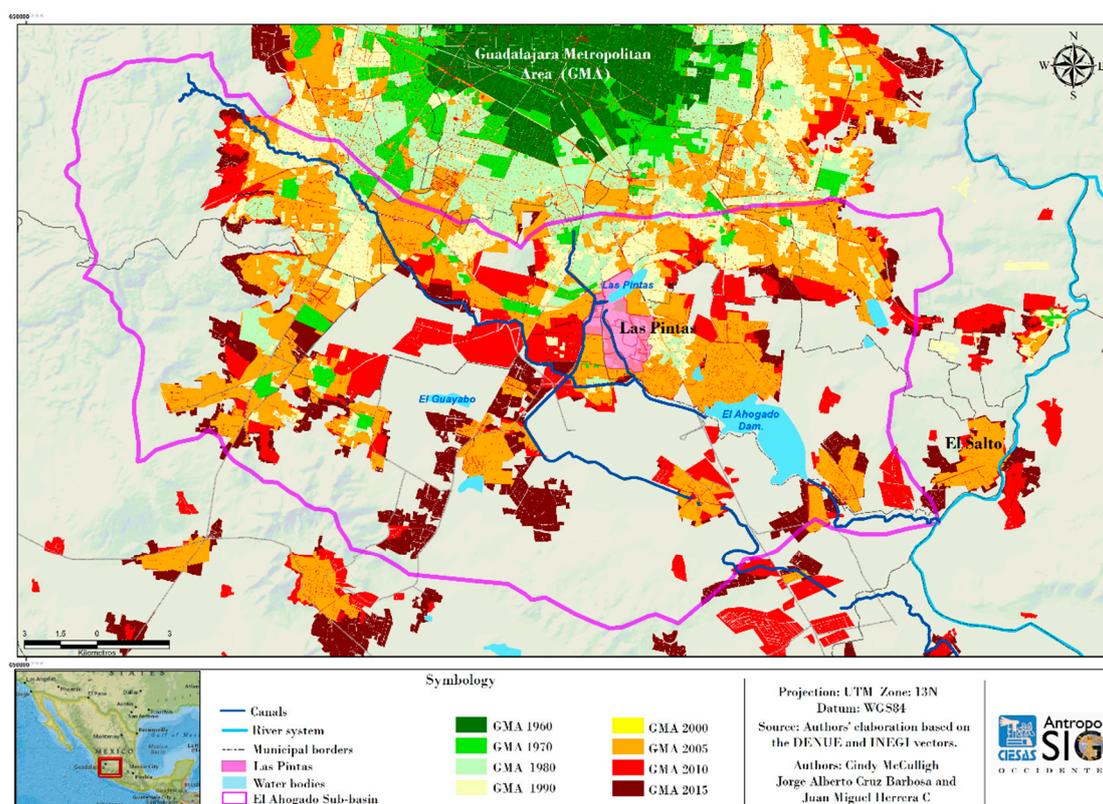


Figure 2. Urban Growth in the El Ahogado Sub-Basin and Guadalajara Metropolitan Area, 1960–2015.

El Ahogado, the ‘drowned one’, the sub-basin where these municipalities converge, is known as such not because of a famous drowning but rather the naturally slow water runoff in the central and lower part of the basin, where the terrain has a gradient of just 0.25% [88]. It was in a flood-prone social housing development in El Salto, La Azucena, where in January 2008, eight-year-old Miguel Ángel López Rocha fell into the El Ahogado Canal, near its confluence with the Santiago River. After accidentally ingesting water, Miguel Ángel was hospitalized, diagnosed with arsenic poisoning, and perished after 19 days in a coma. The immediacy of his death and the clear link to river pollution put the spotlight on government and industry. This was one of the few times when industry representatives made public statements on the issue of the Santiago River. In fact, then vice president of the Industrial Association of El Salto, A.C. (AISAC, Asociación de Industriales de El Salto), Rubén Reséndiz, a director at the Honda plant, did not deny that factories might exceed the official discharge standard, stating that only half of the 150 companies based in El Salto had treatment plants. However, he laid the blame elsewhere. In response to studies demonstrating that AISAC member companies exceeded effluent limits, he affirmed, “they should be investigated, they should be checked [. . .] the authorities have the information, if the companies aren’t complying it’s their responsibility.” On the other hand, the absence of government action was proffered as proof of private sector compliance: “If there was no punitive action by the authorities against the companies, it means things are being done well” (cited in [89]).

Government authorities are thus conceived as both the actors responsible for tolerating polluting activities and, in this circular reasoning, the source of evidence of the legal adherence of industry given government inaction. At this point, one of the said authorities, the head of the Lerma-Santiago-Pacific Basin Council, Raúl Antonio Iglesias, undertook the clear defense of industry, publicly stating that the main source of water pollution was municipal sewage, while industry generally complied with the effluent discharge standard (NOM-001-SEMARNAT-1996), or had minimal violations, exceeding the standard by 10% [90].

The death of Miguel Ángel also brought together the disparate organizations in El Salto and Juanacatlán and in April, 2500 protesters blocked streets in downtown Guadalajara in a large march that brought a list of demands to state and federal authorities. One of the main demands of the organizations was the declaration of a state of environmental emergency in the area. The definitive response came from then Minister of the Environment, Juan Rafael Elvira Quezada, who dismissed the option stating: “The declaration of an environmental emergency entails the paralysis of an extremely important number of investments in this region” [91]. Here was one of the clearest statements to date prioritizing industrial development over the health and quality of life of the communities.

Renewed pressure to clean up the river came in early 2009 when the Jalisco State Human Rights Commission put out the so-called Santiago River “macro-recommendation,” making 148 recommendations to the Governor, state agencies and fourteen municipal governments based on their finding of violations to the rights to a “safe and ecologically balanced environment; to water, health, food, [. . .] work, decent housing” as well as the rights of children [92] (p. 132). The recommendations appertaining to the control and evaluation of industrial emissions were immediately rejected by the state government, contending that only federal and municipal agencies had legal authority. Rather, the state government’s response centered on the creation of a Region of Environmental Fragility (REF), formalized in September 2010, with the goal of “fostering the comprehensive cleanup of the ‘El Ahogado’ basin and its surroundings” [93] (p. 5). Unfortunately, the REF has to date sparked little tangible action; the most notable “achievement” being the construction of a parking lot and lookout point over the waterfall on the Juanacatlán side of the river: to better appreciate all that has not been done towards a comprehensive cleanup.

In 2012, the spotlight on industrial emissions intensified with the actions of Greenpeace Mexico, working with Leap of Life in El Salto and a Guadalajara-based NGO, the Mexican Institute for Community Development (IMDEC). Greenpeace Mexico highlighted the case of the Santiago River in its Toxic Rivers campaign, including sending out volunteers in protective gear on inflatable kayaks to pose among mounds of foam under the waterfall on World Water Day (Figure 3). One of the key actions of Greenpeace was to access government information, including making public the most complete study of the river and industrial effluents in this region to date. The study, undertaken by the Mexican Institute of Water Technology (IMTA) for the Jalisco State Water Commission, analyzed the effluents of twenty-six factories, in addition to monitoring municipal wastewater discharges and numerous sites along the river, and concluded that “industrial effluents were more polluting than municipal wastewaters, since between 87% and 94% of industries infringed at least one of the parameters of the [national discharge standard] NOM-001-SEMARNAT-1996” [94] (p. XI-2). Beyond conventional pollutants, the IMTA study detected 1090 volatile and semi-volatile substances in discharges and sites along the river, frequently detecting phthalates, toluene, chloroform, benzene, phenol and hormonal compounds (p. XI-3). Certain phthalates, used to make plastics flexible, are known to affect human reproduction or cause liver damage; toluene affects the nervous system; chronic exposure to chloroform may cause liver or kidney damage; benzene is a known carcinogen, and chronic exposure to phenol affects the nervous system and can also cause liver and kidney damage [95].

At first, IMTA refused to release the study, arguing that it should be considered an “industrial secret” as it could give a competitive advantage to companies that could denounce the polluters exposed [96]. The study provided clear evidence to counter narratives from government and industry, indicating that the real problem of the river was municipal sewage, clandestine operations or—clearly misinterpreting a profoundly modified hydrology—industry in the Lerma River Basin.



Figure 3. Greenpeace action on World Water Day 2012 at El Salto de Juanacatlán falls (source Greenpeace/Iván Castaneira).

This misinterpretation of the hydrology is related to the dams and diversions which interrupt the continuity of the Lerma, such that the National Water Commission (CONAGUA) considers it a closed basin terminating in Lake Chapala. The Santiago River is the natural continuation of the Lerma River at its outlet from Lake Chapala. However, given low lake levels, it has been common in recent years that the only outflow from the lake to the Santiago River have been as a result of water pumped at a pumping station where the river originates in Ocotlán (see Figure 1).

The narrative that the principal problem of the Santiago is municipal sewage was front and center when the first major wastewater plant of the GMA came online in 2012. At the inaugural event, then head of CONAGUA, José Luis Luege, affirmed that the 2.25 cubic meter per second (m^3/s) wastewater treatment plant (WWTP) for the population of approximately one million in the El Ahogado sub-basin

would “guarantee zero polluting discharges into the Santiago River.” Ramping up the hyperbole, Raúl Antonio Iglesias asserted that with the new WWTP “there will be no foul odors or pests, the panorama will change overnight” [97]. It is no surprise that his words have not stood the test of time. When members of the United Nations Working Group on the issue of human rights and transnational corporations visited the Santiago River in 2016, as one of several “cases of severe environmental pollution caused by industrial activities,” they reported on the “strong impact” left by the “view of the river covered by foam and the smell of the strong gases and odours that dispersed as the water flowed over the El Salto waterfall” [98].

Shortly after this visit in September 2016, the media reported on new evidence of the health impacts of this pollution from researchers at the University of Guadalajara. The researcher group encountered alterations at the cellular and genetic levels affecting residents of communities along the Upper Santiago, including El Salto and Juanacatlán, and concluded this cytogenetic damage was due to chronic exposure to heavy metals and other metals [99,100]. The industrialists of El Salto (AISAC) and the Council of Industrial Chambers of Jalisco (CCIJ) quickly responded. The coordinator of the CCIJ averred, “I think it’s the whole metropolitan area,” while the head of AISAC argued that, “we are directly pointed at, the industries in El Salto, but we are the last ones in a chain, the river really comes polluted from the State of Mexico, Guanajuato, Michoacán, the whole Lerma Santiago Basin” [101]. This statement avails the general lack of awareness on how hydraulic infrastructure has modified the basin. As mentioned, the Lerma River flows into Lake Chapala, but there is no continuous flow into the Santiago River as natural outlet, only entering the Santiago through a pumping station located where the river originates in the municipality of Ocotlán. This water is pumped into the river to supply an irrigation district (DR013) and for water supply to the GMA and is diverted through the Atequiza canal upstream of El Salto and Juanacatlán. Visits to the diversion site at the Corona Dam have found that at times the entire flow of the Santiago River is diverted here (see Figure 1). The affirmations from industrialists continued in this vein, nonetheless, with the main message being “it’s not (just) us”.

The persistence of pollution and social unrest, particularly given the explosion of cases of kidney failure in several communities on the shores of Lake Chapala and the upper reaches of the Santiago [102], were met with a more grandiose response when state governor Enrique Alfaro (2018–2024) took power in December 2018. On his second day in office, and as promised during his campaign, he announced the Santiago River Comprehensive Recovery Strategy, in absence of prior consultations with communities, activists or researchers and with glaring omissions. The only clear projects contemplated and now funded involve the rehabilitation and/or expansion of municipal WWTPs, including completing the sewer network feeding the El Ahogado plant. It is also unclear how the on-going operation and maintenance of these WWTPs, to be built by private contractors, will be guaranteed. Abandoned WWTPs are a major problem in Jalisco and thus, while the investments may ensure short-term private profits, they will not necessarily contribute to the “recovery” of the river.

In the strategy, industry has only been addressed thus far through non-specific references to increased inspections and an inventory of point source polluters. The strategy has also failed to date to secure the participation of federal authorities, particularly CONAGUA, the entity with broad authority over industrial discharges into water bodies. That the lack of attention to industry was not an oversight was evident when a spokesperson for the state government sought to reassure industry representatives in a meeting in the state Congress:

[. . .] the businessman has an address, I know where the businessman is, it’s not in the interests of the businessman to pollute, the businessman wants to get certified, the businessman makes an effort to send his water clean to the river and, what about us? The great majority of the discharges we’ve encountered are sewage from the municipalities! But it’s easy [to say] it’s the industries! [103].

Not surprisingly, the 2018–2024 state development plan refers to the pollution of the Santiago as “diverse and complex” while failing to mention industry [104]. The state congress also undertook an

interesting legal change, lending credence to the concerns of activists that the river strategy may be more cosmetic than substantive. In 2019, legislators approved increases to penalties for polluters of waters of state government jurisdiction, unfortunately, as even state Minister of Environment, Sergio Graf, has acknowledged, “[t]here are no waters of state jurisdiction” [105]. Meanwhile, CONAGUA, with jurisdiction over water bodies, undertakes very little enforcement. This is evidenced in the fact that between 2010 and 2017 CONAGUA completed only 269 inspections per year in Jalisco, where there are over 41,000 users with extraction or discharge permits. At this rate, in the state, CONAGUA would need 153 years to inspect all users [106,107].

The control of industrial emissions has long been among the main demands of local organizations including Leap of Life. Its absence has also been among the main critiques towards the state government’s current program. “We want to emphasize the responsibility of the industrialists of the basin [. . .] in the impacts on the ecosystem and the health of the population, and the fact that they have been absent in the new cleanup efforts,” stated Alan Carmona from Leap of Life when presenting a public statement also supported by researchers from a number of universities [108]. Criticism of the cleanup strategy has been met with a “governance” plan, involving a series of meetings to separately consult local organizations, academics and private sector representatives. While the meetings have bought time for the authorities, they leave little room for hope that the strategy will be truly participatory and transparent or contemplate strong action on industrial emissions, as organizations and academics have demanded.

On the challenge of confronting industrial polluters, Graciela González of Leap of Life reflects that, “They make you believe that [. . .] we must support economic development and acting against that [. . .] they make you feel that you are crazy or that how dare you go up against the empire of money?” Fellow activist Sofía Enciso believes that in some regards industry is “untouchable,” based on a number of factors. On the one hand, obtaining proof of industrial pollution through sampling, etc., is beyond the economic capacity of local organizations, and past denouncements such as Greenpeace Mexico’s report on heavy metals and organic pollutants in the effluent the American chemical manufacturer Huntsman discharged into the Santiago led only to increased security at the outlet pipe into the river [109]. On the other hand, when a Leap of Life member denounced the private concession holder responsible for the running of the Los Laureles garbage dump, Caabsa Eagle, he was accused of defamation—another risk when dealing with private actors. In the experience with Caabsa Eagle, Leap of Life members have found the state Ministry of Environment (SEMADET) takes the side of the company and, in general, Sofía Enciso states that the authorities “put us up against industry instead of defending us against industry.” The lack of regulation and oversight of industry in this region, taken together with a very lax national discharge standard and the instances of overt defense of industrial actors, has been described by McCulligh as a system of “institutionalized corruption,” which serves to normalize and make invisible the degradation caused by industrial activities [77].

4.2. *Smelling of Las Pintas: The Production of a Toxic Urban Environment*

The area known as Las Pintas, on the border between Tlaquepaque and El Salto, was mainly agricultural when it started to be inhabited by brickmakers in the 1950s. Over the following decades, through “invasions” and the irregular sale of communally-held ejido land, the population has grown to more than 35,000 in recent years [110]. While title has been regularized for many plots, the area remains a patchwork of paved and unpaved roads, houses incorporating boards and sheet metal side by side with well-built homes and interspersed with plots used by brick makers or left barren. The area can be conceived as a “node” in the flows of resources and waste, particularly air and water. Las Pintas is crossed by a number of important canals. The Las Pintas–Atequiza Canal, inaugurated in the 1950s, still brings approximately 1.6 cubic meters per second of water to Guadalajara from the Santiago River [111], though it now also receives a significant volume of treated and untreated wastewater. It flows into the Las Pintas Dam, where water is pumped to a purification plant, and the overflow forms the El Ahogado Canal, the most polluted tributary of the Santiago River as it crosses through the

industrial area of El Salto. As the area has been built up, it has been surrounded by industrial parks and new social housing developments. The clean water where residents fished and swam became a memory by the early 1990s, and the frequency of flooding has increased as residential development in the basin has boomed (see Figure 2).

As Valdivia et al. [112] observe, while the tendency is to blame flooding in the GMA on insufficient infrastructure or garbage in sewers, the situation is more complex and is related to modifications of watersheds. The problems are compounded in flood risk areas such as adjacent to the Las Pintas canal and dam, and along the El Ahogado Canal, which are “highly dangerous as they are areas of very high concentration of water” (p. 35). Conditions for local residents are further degraded since prevailing west-southeast winds in the GMA also lead to a concentration of airborne contaminants in several neighborhoods in Tlaquepaque and Tlajomulco, including Las Pintas [113]. Furthermore, Tlaquepaque is also among the areas with the largest number of fixed sources of air pollution, including industry, where official reports indicate the population most affected is found in the neighborhoods of Miravalle, Loma Dorada, Las Pintas and Oblatos [114].

Surface waters in this area are extremely polluted. The State Water Commission (CEA) undertakes nominally monthly monitoring on several points of the Upper Santiago and two sites on the El Ahogado Canal. The first site on the canal is just downstream of Las Pintas, and CEA data confirms its high levels of pollution. Looking at just one parameter, chemical oxygen demand [115], the average concentrations for samples taken from 2014 to June 2019 was 262.4 mg/L, with peaks of up to 744.9 mg/L (average in the dry season of 362.4 mg/L and in rainy season of 158.6 mg/L) [116]. These are levels classified by CONAGUA as heavily polluted and are indicative of the presence of municipal and industrial wastewater [117] (p. 60).

Local activist Enriqueta Hernández recalls the El Ahogado Canal as a river where families picnicked, fished and washed clothes when she arrived in the area in 1982. When thousands of dead fish turned up on the canal several years later, she says, “as time passed we realized that this was when all the factories from the industrial park started to discharge all their chemicals.” Now, the canal is associated with disease, such as the kidney disease that is frequently seen in these neighborhoods, and Enriqueta is particularly troubled by the gases emitted from the canal, especially in the mornings; “What are we breathing?”, she asks, “Pure poisons that are there in the canal.”

The issue of water pollution was front and center in an attempt to co-opt the national water agenda shortly after the election of current president Andrés Manuel López Obrador (2018–2024). The non-profit Water Advisory Board (CCA, Consejo Consultivo del Agua, A.C.), created in a formal act with then president Ernesto Zedillo in early 2000 [118] and which acts as a consulting organization for CONAGUA, spearheaded the development of a “Social Pact for Water” with several meetings in early 2019 and a social media campaign. Members of the CCA, now headed by former minister of environment (2000–2003) Víctor Lichtinger, include representatives of transnationals linked to water privatization and to conflicts over water overexploitation, including Veolia, Suez, Nestlé, Coca-Cola and its bottlers in Mexico (FEMSA and Arca Continental), Constellation Brands, Grupo Modelo (Anheuser-Busch Inbev), and Cervecería Cuauhtémoc-Heineken, as well as representatives of some of Mexico’s largest corporations, among others Grupo Carso, CEMEX, Grupo Alfa, Grupo Bal, and Grupo Lala. The legitimacy of the Social Pact for Water was questioned by national organizations such as Water for all, Water for life (Coordinadora Nacional Agua para tod@s, agua para la vida), a network created in 2012 that brings together academics and grassroots organizations advocating for a new General Water Law to be passed based on proposals brought together in its collectively developed citizens’ initiative [119]. Despite its ultimate abandonment, the campaign supporting this pact is interesting for our analysis because of the message communicated with respect to the issue of water pollution. Below the watercolor image of a blackened river with floating garbage bags, tires and bottles, the ad reads, “6 out of every 10 rivers in our country are polluted, and you continue to throw your garbage in them!” [120] (Figure 4). In this way, untreated sewage or the industrial effluents that

even official statistics concede much exceed municipal wastewater in contaminant load are disregarded and the responsibility is individualized and, strangely, converted into an issue of solid waste disposal.



**6 de cada 10 ríos de nuestro país
están contaminados,
y tú les sigues arrojando tu basura. ¡Actúa!
Súmate al www.pactosocialagua.mx**



Figure 4. Campaign image from Social Pact for Water campaign 2019.

This same discourse plays out and is at times internalized by residents of Las Pintas. In workshops and interviews with children and their parents, many associate the fouled canals with garbage disposal (dead animals, furniture, tires, containers, and cadavers), and this persistent image reduces the concept of environmental pollution to the arena of individual responsibility, thus obscuring structural relations with the conditions of production and consumption [121]. This tendency has previously been remarked on by Romo-Arias [122] (p. 151), who reflects on a popular environmental education project carried out in neighborhoods on the El Salto side of the area between 2010 to 2014, and finds that even in school settings “the idea prevails that [children and their families] are to blame, at least to a large extent, for the polluted conditions of their community”.

This idea is also prevalent in explanations of another danger of the current urban metabolism, frequent flooding, which oftentimes involves sewage backing up from drains into homes. In the environmental sanitation survey ($n = 179$) undertaken in the area in late 2014 and early 2015, 59% of respondents indicated that their street or home experiences flooding during the rainy season. Many local residents also consider improper waste disposal by their neighbors as one of the main causes of this flooding. A nurse in Las Pintas shares a commonly held belief:

It’s our fault, in the middle of the storm [there are] people taking garbage out of the sewers and I tell myself: ‘Why is this necessary when it can be avoided by disposing properly of garbage and not throwing it out of the car onto the street.’ It’s a matter of education and raising awareness among the people.

This was also the message from the state civil protection brigade during flooding in Las Pintas in 2017. While not discounting other factors, the Head of Operations emphasized the buildup of rubbish: “The blockage is a tremendous amount of garbage, different types of solids from furniture that citizens no longer want and well the easiest thing is to put them on the sidewalk or throw them into watercourses” [123].

The irony of the discourse blaming flooding on the bad habits of local residents is compounded by their lack of access to basic services, including adequate garbage collection. The garbage collection services in Las Pintas are intermittent and when this service is suspended residents deploy a series of strategies, such as taking their waste to another neighborhood or arranging with neighbors to collect their waste and pay to have it removed. Water services are also often intermittent here, obliging many residents to pay high prices for water of unknown quality from private tanker trucks.

The type of organized resistance found in El Salto does not exist in Las Pintas. Nonetheless, there are many who also provide counter arguments to the discourse centered on garbage as the main reason for frequent flooding. Thus, rapid urbanization is identified as the leading driver of environmental problems in the testimonies of local residents. One of the first residents of the area recalls how the surroundings were agricultural when he arrived and how, with the explosion of housing developments, particularly in Tlajomulco, water flows increased:

About twenty years ago a fever of construction started in Tlajomulco, and then they also started to build housing and factories in Tlaquepaque. I'll tell you why there is flooding: we are almost in a cradle [and] all the water comes this way . . . [B]efore [. . .] all the water was absorbed in the fields, in the orchards, in the brickmaking yards. Now they aren't fields, pure concrete, they are developments; every new housing development they build will send more water and it's going to end up here.

In Las Pintas people have also adapted to flooding in diverse ways, from low barriers in doorways to more politically adept strategies to obtain some "benefits" from this recurring problem, as one resident explains:

There are such clever people! They go and buy old used stoves, and when the floods come they store their good things and put out the old ones. Then when the government comes to distribute [goods to people affected by floods], they say, 'Oh, I lost my things because of the floods!' Then they hand over the old things for new ones, and later go to the pawn shop and sell them to get money.

This narration is also reflective of clientelistic relations with municipal governments in moments of crisis, where loyalty to the political party in power can provide benefits such as compensation for lost household goods, and many residents of this urban periphery have an intense nonpartisan and partisan political life. At the same time, given the role of municipal and state authorities in approving the changes in land use that have driven the increase in flooding, residents are cognizant of the contradictions between political-economic powers and their power as citizens to defend their right to live in healthy environments.

In Las Pintas, these polluted conditions represent more than the exchange of wastes and energy, affecting how people see themselves as urban residents. As one local interviewee stated:

We recognize that there is a lot of pollution that affects the lungs because of so much burning of tires by the people, [because of emissions from] the canals, the dam, the burning of bricks and so many cars. I have a friend who says to me, 'Now you're coming smelling of Las Pintas, you smell like smoke.' You come from Las Pintas and you smell of burning.

"Smelling of Las Pintas" is a metaphor for the inequalities brought on by the urban metabolism of the GMA. Las Pintas is associated, in the words of another resident, with "dirt, pollution, ticks, fleas," which explains why "there's a society over there that doesn't allow us to enter their cycle of life."

This brief narration of the politics and discourses around water pollution and flooding in Las Pintas allows us to demonstrate how toxic waters and floods are produced by diverse actors and how the state opts to divert attention towards historically disadvantaged groups, constructing a public discourse that revictimizes and bolsters socioecological inequalities [73,75,124]. In this context, many residents blame themselves, identifying polluted canals and floods as the unwanted corollaries of their bad habits. Conversely, there are those who recognize these socioecological phenomena as the consequences of an unequal urban-industrial development model featuring speculative urbanization and the expansion of (in practice) uncontrolled industry.

5. Discussion and Conclusions

The manager of an American chemical factory in the Ocotlán–El Salto industrial corridor shared his perceptions of environmental regulations in Mexico, reflecting on the period when many laws and standards were passed in the lead up to the signing of the North American Free Trade Agreement (NAFTA) in 1994, stating in interview that: “New environmental laws that we’d never had appeared overnight, and the government has never had, not then and not now, the ability to verify that the laws are complied with by industries.” This lack of “ability” to enforce environmental regulations is related to what Acsehrad calls the “locational blackmail” of corporations, which has increased with globalization and trade openness, whereby “companies [. . .] may use a lack of employment and public revenue as leverage to impose polluting practices and retract social rights” [125] (p. 380). This power to exert locational blackmail will clearly be greater or lesser depending on each country or region’s strategy of insertion into the global economy, as well as on the relationship between the state and the private interests involved.

Our analysis of the urban industrial metabolism of the GMA, and particularly the conflict over the industrial pollution of the Santiago River, does not support a presumptive belief that the state is concerned with “balancing” industrial development with environmental protection in this case, as evidenced in the lack of enforcement of CONAGUA at the federal level, and the unwillingness of state authorities to even acknowledge that a problem exists. The refusal to call out industrial polluters and incorporate meaningful enforcement actions as part of the Santiago River Comprehensive Recovery Strategy provides a clear indication of the relationship between industry and the state in this region of Mexico.

This is, of course, not an isolated phenomenon. The industrial pollution of the Atoyac River in Puebla and Tlaxcala, of the Lerma River in the State of Mexico or the Coatzacoalcos in Veracruz are among the “most dramatic” of the social environmental conflicts in Mexico, asserts Paz [126] (p. 19), because the poisoned surface and groundwaters “directly affect the health of the population.” The power of industry also plays out at the national level in the stalling of a new national discharge standard. Although a modification to the current standard NOM-001-SEMARNAT-1996, unchanged for over 20 years, was put forward in early 2018, the opposition from industry inundated the federal Ministry of Environment with more than a thousand questions and the process has remained suspended [127]. If a new standard were to come into effect, an environmental health and safety specialist at a transnational auto parts manufacturer in El Salto states in interview that he has peers who are concerned with losing their jobs, as their corporate offices had indicated “they were going to think about going elsewhere.” While the state government proudly announces in materials to attract foreign investment that Jalisco has “friendly unions,” industry friendly environmental regulations and enforcement are implicitly part of the package.

The dynamics of the urban-industrial metabolism we have explored cannot be understood without contemplating the flows of energy and resources around industrial manufacturing. The housing boom in the El Ahogado sub-basin, ensuring “workers are spatially concentrated in close proximity to the workplace” [19] (p. 116), has failed to seriously consider the topographical, hydrological, and climatological conditions of the territories. The toxic and polluted socio-natures of Las Pintas and El Salto are the foreseeable outcomes of chaotic urban and industrial development, bringing profits to investors in quickly deteriorating social housing developments and for the factories that need not invest in pollution control. In Las Pintas, we have shown how the government discourses of deflection seek to lay the blame for floods and polluted canals on the bad habits of local residents.

The analytical tools of urban political ecology are useful in deciphering these discourses and teasing out the power relations and political economic motives behind these unequal urban-industrial socioecologies. At the same time, greater analytical attention to industry within urban dynamics and metabolisms may broaden the insights of urban political ecology and the visions of more democratic and just urban socio-natures. If industry is “untouchable,” as Sofia Enciso from Leap of Life asserts, this has not impeded this and other organizations from insisting substantive action be taken to protect

the health of the population. Enciso calls for each factory to take responsibility for its effluent and affirms that “it is urgent and necessary for the companies to change their production methods.” Local changes will be insufficient, she states, “the idea isn’t that we stop being the unfortunate ones, but rather that locally and globally we stop forging production methods that kill and poison communities.” As Harvey [128] points out, when the questions become more systemic, by questioning how and why hazardous pollutants and waste are generated, this “requires a discursive shift to the far more politically charged terrain of critique of the general characteristics of the mode of production and consumption in which we live.” Thus, the vision of river recovery from El Salto is not compatible with the pragmatism of the current state government strategy nor with the double standards applied by the transnational corporations who enjoy the flexibility of the lax environmental regulations in Mexico. This vision defies the predominant logic of economic growth and is not assimilable within the current strategies of insertion of this area into the national and global economy.

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