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Dissonant Views of Socioecological Problems: Local Perspectives and Conservation Policies in Xochimilco, Mexico

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Abstract

Social participation in the design and implementation of conservation policies has become increasingly relevant. Despite the recognition of the importance of local communities' perspectives in the design and implementation of conservation policies, participation mechanisms are usually deficient. Simplification of socioecological complexity in policy design has been documented as one of the most salient challenges limiting policies' success. We examined conservation policies, objectives and implementation in an urban wetland of high biocultural importance in Mexico City, and contrasted them with local community perspectives about the causes and solutions of socioecological problems in the wetland. We documented policies developed for the wetland conservation since 1989, and interviewed local inhabitants whose livelihoods depend directly on the wetland, governmental officials, and non-governmental organisations representatives. Our results showed that policies' design simplify complex socioecological reality in the Xochimilco wetland. This complex reality, as perceived by local communities, is not represented nor addressed by governmental programmes, which systematically avoid dealing with the most urgent processes linked to wetland degradation and have exacerbated local social asymmetries. This study emphasises the need to develop and evaluate policies through transdisciplinary strategies and participatory processes, which include all social actors involved, particularly those that depend directly on ecosystems.

Keywords: Mexico City, Protected areas, Social participation, Urban sustainability, Urban wetlands

INTRODUCTION

Cities' sustainability has become increasingly relevant for global environmental institutions (Elmqvist et al. 2019). Currently, urban dwellers exceed 50% of total human population and are expected to grow to 68% by 2050; 98% of this growth will take place in developing countries (SDPD 2018). Urban areas are complex and heterogeneous landscapes,

where various human-made and natural elements, including urban infrastructure, forests, lakes, rivers, and farmlands, interact in multifaceted ways (McKinney 2006; Pickett and Cadenasso 2008). Cities' sustainability depends on these interactions. Urban forests play important roles in water and wood supply, noise mitigation and carbon sequestration, while urban lakes are essential for water supply, flood control, climate regulation, and air pollution control (Kang et al. 2015; Zhu and Zheng 2018). Both lakes and forests sustain biodiversity and human wellbeing, and their urbanisation represents habitat and biodiversity loss (Seto et al. 2000; Hahs et al. 2009).

Despite their importance for cities' sustainability, relatively conserved areas tend to attract urbanisation (Wade and Theobald 2010), are considered as isolated green patches, and treated as separated elements in urban planning and management. Urban Protected Areas (PA), in turn, are conceived as their rural counterparts. This approach is problematic as it fails

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to consider local contexts associated to urban dynamics (Elander et al. 2005; Borgström et al. 2012), overlooking the strong dissimilarities with rural contexts. For example, buffer zones, common in rural PAs, are not applicable in their urban counterparts because space is limited (Borgström et al. 2013), and spillover effects such as deforestation, territorial conflicts, water and soil pollution due to urban sprawl are more critical (Carpenter et al. 1998; Nguyen 2010).

Social participation in the context of conservation policies has been largely recognised as central for integrating effective conservation and social justice (Little 1994; Parkins and Mitchell 2005). Particularly, democratic bottom-up participation processes, where all social actors are able to deliberate and influence in decision-making processes, are regarded as necessary to construct environmentally and socially viable conservation initiatives (Durand et al. 2014). However, conservation policies commonly restrict social participation, which in turn exacerbates social conflicts and inequality, on one hand, and ecosystems degradation and biodiversity loss, on the other (Little 1994; Agrawal and Gibson 1999; De Pourcq et al. 2017). Social conflicts may be particularly acute in urban contexts given the high socioeconomic and political heterogeneity, and the differing views and interests over land-use, particularly when conserved areas become commodities, for which social actors compete (Zerah and Landy 2013).

Environmental policies' design has been subject to criticism, as they are often based on an oversimplified, technocratic and linear interpretation of socioecological problems (Scott 1998; Ascher 2009). These interpretations obscure the complex interconnections among ecosystems degradation and socioeconomic and political processes. Oversimplification often leads to general technical solutions that ignore specific human-environmental conditions (Lambin et al. 2001; Bieling et al. 2013; Buda et al. 2017). Also, local communities' perspectives of conservation, and their knowledge and needs, are usually not considered in policy design, in part because of governmental authorities' reluctance to give in power and control of ecosystems to people (Li 2007). Finally, the possibility of adaptive management is limited by governmental inability to recognise policy failures to elude political costs, and by the institutional/personal interest to accomplish short-term results. Instead, the blame of failure is transferred to society by underscoring its inadequate response to regulation, thus promoting more stringent sanctions but unable to stop environmental degradation (Ascher 2001).

In Mexico, PAs are the main conservation policy, covering more than 90 million ha (33% of national territory; CONANP 2017). Even though conservation is generally considered necessary *vis a vis* global environmental change, concerns regarding PAs effectiveness and their social impacts are still part of the conservation debate.

Mexico City is one of the largest and most populated cities globally. It developed in an endorheic basin, over a former lake. This environmental history determines many of its most pressing socioecological problems (Miller 2007). The city

still comprises many forested areas and some wetlands (lake remnants), all of which are important for maintaining cities' ecology and functioning (Jujnovsky et al. 2010; Livesley et al. 2016).

In this study, we aimed at understanding how environmental meanings and perspectives on socioecological problems are integrated in policy design and implementation, *vis a vis* the perspectives of various social groups linked to a protected urban wetland. We examined conservation policies designed and implemented for the protection of Xochimilco's wetland in Mexico City, by analysing the evolution of their objectives and implementation actions, and contrasted them with local people's perspectives about the wetland socioecological problems, its conservation, and the ability of policies to address them. This study contributes with elements for designing more contextualised conservation policies for the wetland of Xochimilco, and offers insights for transforming such design for other urban ecosystems. By incorporating local actors realities into processes of collective design, more successful and just conservation may develop, maintaining ecosystem function and structure, as well as local people's wellbeing.

THE STUDY SITE

The wetland of Xochimilco is located on the southern part of Mexico City (19°15'11" and 19°19'15" North, 99°00'58" and 99°07'08" West; Figure 1). The site represents one of the last vestiges of the Great Lake of Mexico Basin, covering an area of 2,600 ha of water channels and floodplains (Candiani 2004). This wetland was transformed since 900 AD through the establishment of agricultural islands (*chinampas*) on its lacustrine surface (Rojas-Rabiela 1983). However, this socio-ecosystem is endangered by urban sprawl and water scarcity derived from the springs' overexploitation, thus its disappearance is estimated to occur by 2050 (Merlin-Uribe et al. 2013a). Wetland dwellers lived in its periphery and neighbourhoods, dominated by native people still connected to their farmlands, were formed. Today, the most populated of these are *San Gregorio Atlapulco*, *San Luis Tlaxialtemalco*, *Caltongo*, *Santa Cruz Acapulxca* and *La Asunción*.

The wetland is a PA under local jurisdiction where ca. 180 species of plants and more than 200 species of vertebrates live, including seven endemic species, such as the axolotl (*Ambystoma mexicanum*) (SEMARNAT 2010). It is also a wetland included in the Ramsar Convention, decreed as a World Heritage Site by UNESCO and considered a Globally Important Agricultural Heritage System by FAO (Aranda-Sánchez 2004; AZP 2017; GCDMX 2018).

Xochimilcas culture flourished linked to the lake environment, its high species richness and freshwater abundance that poured from natural springs. Xochimilcas learned to use every available lacustrine resource and created a cultivation technique that allowed them to sustain one of the most important urban centres in Mesoamerica (Ezcurra et al. 2006). Traditional productive activities include fishing, agriculture

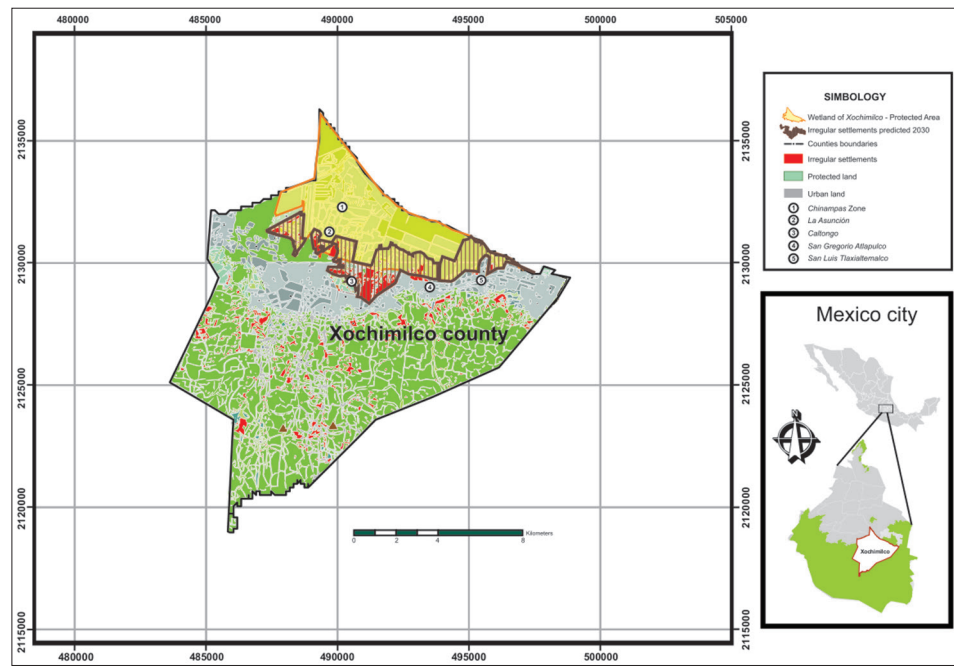


Figure 1

Location of the Protected Area of Xochimilco wetland and irregular settlements within it (modified from PAOT 2008)

and hunting for self-subsistence and commerce (Rojas-Rabiela 1983). These activities remain as a biocultural legacy, although are highly jeopardised by diverse socioeconomic pressures. Thirty years ago, Xochimilco's *chinampas* produced about 15% of all vegetables consumed in the city (Rojas-Rabiela and Pérez-Espinoza 1998); today, nearly 80% of farmlands have been abandoned at a loss rate of 31 ha/year (Merlín-Uribe et al. 2013a). Concurrently, tourism has become a major economic activity (Clauzel 2011). In the late XIX century there were 100 traditional boats (*trajineras*) used by urban people who visited the lake for recreational purposes (Peredo 1991), but currently, there are 1,200 *trajineras* providing services for 1.2 million annual visitors (GODF 2006).

The wetland face diverse degradation processes. In the early 1900s, the springs were routed by underground pipes to supply water for Mexico City's population and by 1950, the wetland was almost dry (Onofre 2005). Therefore, local authorities replaced the extracted freshwater with treated water, causing the extinction of various native species and soil contamination, decreasing the ecosystem's productivity (Rojas-Rabiela 1991; Sedeño-Díaz and López-López 2009). Nevertheless, Xochimilco's lacustrine area is still the main groundwater resource for Mexico City, and is highly relevant for the city's aquifer recharge (Bojórquez-Tapia et al. 2000). Furthermore, land-use changes induced by housing demands, low land prices, and growing irregular settlements have endangered the wetland (Wigle 2010). In six years (2010-2016), irregular settlements grew 79%, in the PA's periphery, and are expected to continue growing (Figure 1). These settlements contribute further to water contamination through direct sewage drainages (PAOT 2016).

In the face of these degradation processes, conservation policies were developed by governmental institutions of

the three hierarchical levels: Mexican Federal Government, state level (Mexico City), and local level (Xochimilco county). Environmental policies for the conservation of the wetland date from 1936, when its *chinampas*, canals, and historical monuments, were decreed as a Picturesque Village (*Zona Pintoresca*), a governmental instrument to protect and enhance places considered of great cultural and environmental importance. That decree is considered a precursor of the World Heritage inscription obtained in 1986 from the UNESCO (Delgadillo-Polanco 2009). In 1989, the Ecological Rescue Plan for Xochimilco (*Plan de Rescate Ecológico de Xochimilco*) was decreed, as a federal response to environment protection demands from citizens. Its main objectives were to reverse ecological degradation caused by the aquifer overexploitation, to delimit an ecological area protected from urbanisation, and providing incentives for agriculture. In 1992, after an expropriation process, the PA "*Ejidos de Xochimilco and San Gregorio Atlapulco*" was decreed, to conserve the site as a priority area to safeguard Mexico City's sustainability.

METHODS

We reviewed conservation policies implemented in Xochimilco since the PA's decree. Documentary research comprised official documents and press reports of conservation projects developed for Xochimilco's conservation. We found 141 documents and carried out content-analysis identifying programmes' objectives, financing and implementing governmental institution.

We also conducted semi-structured interviews with local actors, women and men, whose livelihoods depend on the wetland or whose jobs are related to its conservation

(governmental and non-governmental organisation employees). Interviews were conducted from January 2017 to September 2018 in five localities at the shores of the wetland and in the *chinampas*' zone (Figure 1). Interviews were carried out with informed consent from interviewees, guaranteeing confidentiality regarding their identity.

Interviews explored perspectives about 1) the wetland importance, 2) ecosystemic changes through time, 3) main threats to the site's conservation, 4) responsibility allocation for developing and implementing solutions, and 5) policies implemented and their social and environmental impacts. Interviewees were selected through the snowball method, relying on key informants who had been previously identified as local leaders. The saturation principle (Newing et al. 2011) was used as a criterion to determine sample size. Seventy-five interviews were applied to individuals belonging to different groups: fishermen, peasants, tourist service providers, owners of soccer fields, representatives of non-governmental organisations (NGOs) and of governmental institutions (Table 1). 68% of respondents were born at the site, whereas the remaining 32% were immigrants living in the site for more than 20 years. The sample included 64 men and 11 women, reflecting the predominance of men in productive activities. Average age was 48.1 years (SD = 15.3, range 19-83). For 86.7 % of respondents, the main source of income is the productive activity developed in the lake, while 13.3% of them combine various economic activities or are retired. Although there were individuals with professional degree in all groups, low education levels (elementary to junior high school) were more common among the elderly, whose main economic activities depend directly on the wetland. People without any formal education were only found among fishermen.

Digital audio recordings of interviews were transcribed and imported to Atlas.ti (v.7.5.4) (SSD 2003) to perform qualitative analysis of texts. Each group of actors was analysed separately, and transcripts were coded using a line-by-line review (López-Medellín et al. 2011). Analysis was performed by MR. Codes represent interviewees' perspectives about the main problems for the conservation and sustainable management of the wetland, the causes related to these problems, and their interrelations. Categories created and their links, obtained from the narratives, were depicted in two graphic summaries (Figures 2 and 3). The importance of each problem and cause was inferred from the frequency of mentions.

Table 1
Total sample of interviews

Social actor	No. of interviews
Fishermen	12
Peasants	25
Tourist service providers	20
Owners of soccer fields	5
NGO representatives	5
Government representatives	8
Total	75

Number of people interviewed by social group is shown

RESULTS

Conservation policies for Xochimilco wetland

A year after the PA was established (1992), conservation actions developed by state and local governments were directed to collecting garbage, dredging and reopening canals, reforestation, patrolling, supporting ecotourism projects, environmental education workshops and supporting the commercialisation of local organic products. However, these actions were implemented only for one year. In 2000, the City Government created the Sustainable Development Council for Conservation of Rural and Natural Protected Areas (*Consejo para el Desarrollo Sustentable del Suelo de Conservación, Zonas Rurales y Áreas Naturales Protegidas*). Its main objective was to develop environmental policies, according to Urban Development Programme of Mexico City and its General Law. To improve water quality and reduce the negative effects of sinking, this council carried out the dredge of 50 km of canals (less than 30% of their total longitude) and built five treatment plants and three canal locks.

In 2002, given the continued deterioration of the wetland, UNESCO conditioned the World Heritage denomination of Xochimilco. In response, the Plan UNESCO-Xochimilco (PUX) was launched by Xochimilco's local council with the participation of Mexican universities. The main achievements reported were the updating of biodiversity data and a diagnosis of wetland degradation. As a result, PA polygon was expanded by 11 ha. In 2005, the Inter-Institutional Commission for the Conservation of the Natural and Cultural Heritage of Xochimilco, Tlahuac and Milpa Alta (*Comisión Interdependencial para la Conservación del Patrimonio Natural y Cultural de Xochimilco, Tláhuac y Milpa Alta*) was created. This commission aimed at addressing environmental problems with a comprehensive approach among state agencies, coordinating public budgets for planning and developing projects for research and conservation. Later, in 2011, community-based projects appeared as part of conservation policies in Xochimilco, incorporating Xochimilco County's residents in actions intended to rescue the wetland. These included subventions for productive projects (i.e. to obtain seeds and organic fertilisers), ecotourism projects, and reforestation actions. Intermittently and up to date, only programmes to purchase seeds and fertilisers, and reforestation actions have been implemented. That same year, a public trust of ca. USD\$1.6 million was created to elaborate the Master Plan of Xochimilco's Environmental Complex (*Plan Maestro del Complejo Ambiental Xochimilco*). Additionally, a fund of USD\$33 million, directed for executive projects of the Research Centre and Xochimilco Water Education (*Centro de Investigación y Educación del Agua Xochimilco- CIEAX*), as well as for the *Cienaga Chica* rehabilitation, was created. The results of this financial support are unknown. By the end of 2012, the City Government created the Authority for Xochimilco, Tlahuac and Milpa Alta Heritage Zone (*Autoridad*

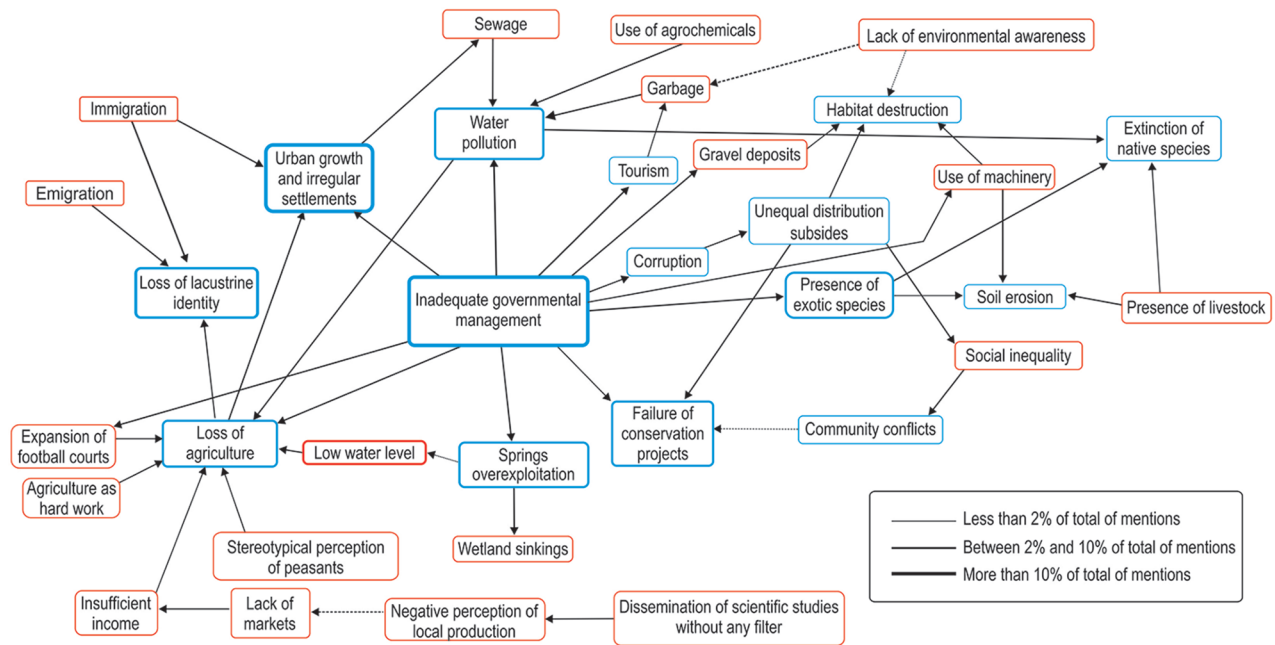


Figure 2

Representation of socioecological problems (blue outline) and their causes (red outline) constructed from local community narratives. Outline size represent the importance interviewees gave to problems-causes, interpreted by the number of times each item was mentioned

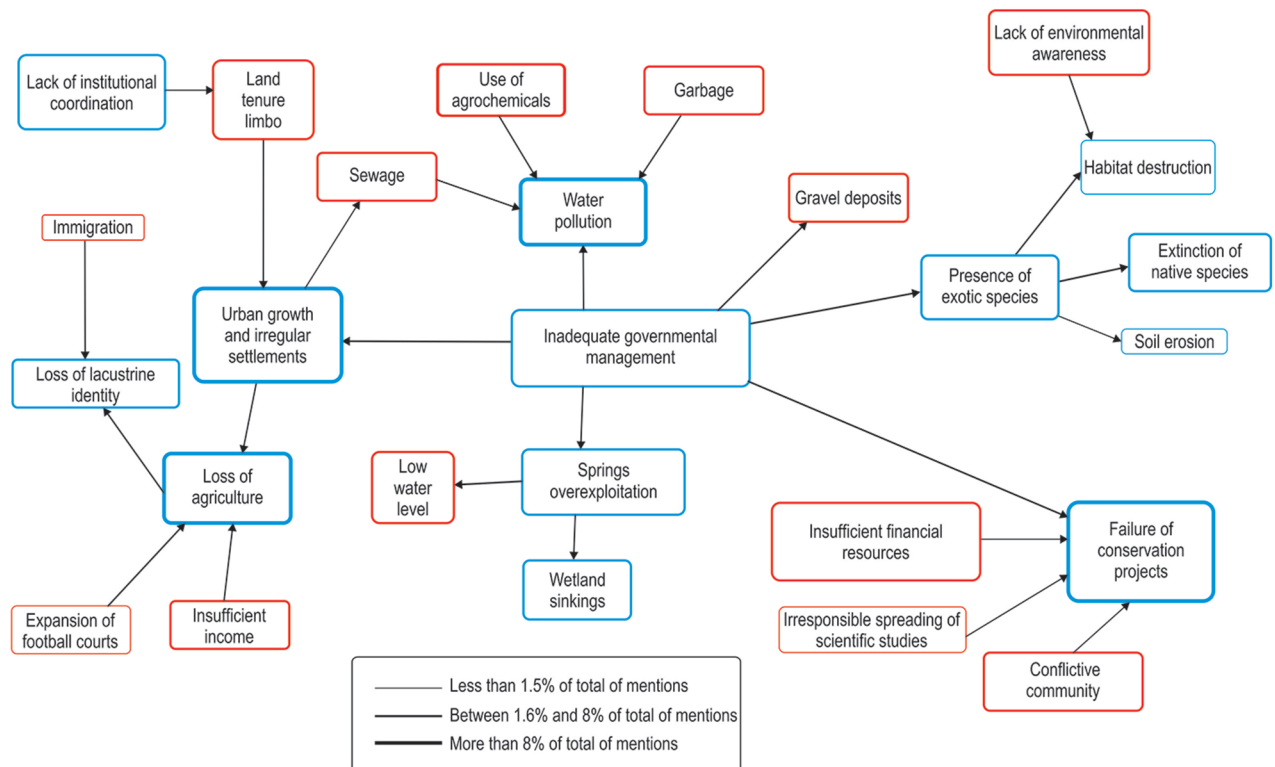


Figure 3

Representation of socioecological problems (blue outline) and their causes (red outline) constructed from government representatives and NGO narratives. Outline size represent the importance interviewees gave to problems-causes, interpreted by the number of times each item was mentioned

de la Zona Patrimonio Xochimilco, Tláhuac y Milpa Alta-AZP), a governmental institution that would replace the

Inter-Institutional Commission. The main objectives of this new institution are to develop conservation actions to

preserve and recover the wetland, the environment and cultural infrastructure, and to promote public interest about the site's archaeological patrimony, achieving sustainability through the participation of community groups and NGOs. Activities developed by the AZP included the rehabilitation of hydraulic infrastructure, sanitation of canals and the recovery of *chinampas*. A year after its creation, the work of 51 community groups was supported by distributing a budget of *ca.* USD\$1 million among them.

Simultaneously and for the first time in Xochimilco's county policies, there were programmes that explicitly intended environmental management in conservation lands (including wetlands) and the control of irregular settlements. Their goal was to enforce the frontier dividing urban and conservation lands, to create a physical barrier against new settlements and to relocate those already established. There is no information about the success or results of these programmes.

Today, the AZP is the governmental institution receiving and channelling most economic resources and implementing most actions for the conservation of the wetland. It has a yearly constant budget of more than USD\$ 680,000 for community projects; it also has an extra budget for its administrative operations and for projects jointly executed with other public institutions, such as universities. To obtain funding for community projects, potential beneficiaries must apply by presenting projects. An internal committee in AZP assigns the funding. Table 2 summarises the total 2007–2017 public financial support granted to programmes of restoration and conservation for the wetland. Official records of budget allocation are available only for these years and only include programmes aimed specifically at the conservation of Xochimilco wetland, thus excluding those implemented indirectly by other agencies or through agreements among governmental institutions, NGOs and universities.

Local perspectives about the conservation of the wetland

The wetland importance

Perspectives about the importance of the wetland differ among social groups most closely linked to it. The most acute

differences were observed between the local community¹ and the government —NGOs employees. For the former, the importance of the wetland is precisely rooted in its role on the sustenance of their households (40.5% of mentions), through the direct provision of food (e.g., agriculture) or by the commercialisation of agricultural commodities. For them, the wetland is also important as a provider of environmental services for the city (38% of mentions). The biocultural heritage of the wetland is also mentioned (21.5% of mentions), as it houses a great lacustrine culture, expressed through people's daily activities and knowledge, inherited from parents to children. Particularly for native residents, the wetland is where they have lived for generations and has an intangible value defined by their relationship with it. As two of our interviewees stated:

“For me [Xochimilco] is important because I have always obtained sustenance from it [...] I've always sustained myself from what Xochimilco is; first, because it gives me food, that is essential. Besides, well, because I grew up here, I was born here, and I am deeply rooted [...] I feel a lot of affection for Xochimilco, because I was raised here, this is the place of my upbringing” (He/Fishermen).

“Since I've got use of reason, since I was a kid [...] my grandparents took me to fields (*chinampas*). In the fields [we were] very poor, very humble, and we ate crayfish recently fished from the canals; they threw them into a griddle with some tortillas that they brought with them, and that's what we ate. Oh! And *nopales*, *quelites*, watercress or carps that we caught with our hands, we fished with our hands...and axolotls [...] As a Xochimilca, this is my paradise.” (He/Peasant).

For government and NGOs representatives, the importance of the site lies mainly on the provision of environmental services (66.3% of mentions), although the cultural value represented by the *chinampas* was also mentioned (33.6% of mentions). Environmental services mentioned include its role as the “main lung” of Mexico City, as a “reserve for fauna and flora species”, that it contributes to water infiltration,

1 Local community in this study was considered as native people, whose livelihoods depend on wetland resources; their economic activities, like farming and fishing, or tourism and recreation that are sustained by wetland landscape. These people usually live at wetland shores and are or were owners of *chinampas*.

Table 2
Total financial resources granted by the government to specific public policies aimed at the site's ecological restoration or conservation (2004 to 2017)

Conservation policy or activity	Estimated budget (USD\$)
Promotion of tourism infrastructure and ecotourism projects	4,031,875.00
Dredge and cleaning, garbage collection and reforestation on channels	4,862,341.00
Exotic species control (2004, 2005 and 2008)	238,674.00
Hydraulic infrastructure	21,943,765.00
Axolotl conservation	1,193,368.00
<i>Chinampas</i> rehabilitation and productive projects	1,594,094.00
Other*	20,737,410.00
Total	54,601,527.00

*Projects that cover more than one activity and for which there are not specified budget

preventing the “sinking of the city” and floodings, and constitutes a water reservoir.

Ecosystem changes through time

A negative view about the state of conservation of the site predominates in all social groups. The loss of cultivated areas is depicted as the most important transformation. For almost all respondents (98.6 %), the remaining conserved areas (*i.e.* those where agricultural production on *chinampas* still exist), represent only from 10 to 30 % of their original surface.

“In the past, here in Xochimilco [...] it was beautiful, because [...] everybody here cultivated the fields. You could not see even a little piece of uncultivated land, covered with grass. All *chinampas* were full of flowers, lettuce, cauliflower [...] If you came here [...] in the afternoon, at sunset, rowing the boat, and smelled [...] it was delicious” (Fishermen)

Another change commonly mentioned was the decrease of water quality in the canals. According to our interviewees, this change resulted from the deviation of Xochimilco’s spring water to provide potable water for the city’s downtown. As one peasant explained, the “extracted water was replaced by sewage” and it was then, when “people began to abandon their *chinampas*” because water became “extremely dirty to produce”. Also, the loss of native species was identified as a major change provoked by water pollution and the introduction of tilapia, a fish that, according to a fisherman, “killed all species: frogs, axolotl and other fishes”. That event triggered a series of transformations in species abundance and composition; hence, species that once were as abundant as to be considered “pests”, became threatened.

Social changes were also addressed. One of the most important (47% of mentions) was that young people are no longer interested in traditional productive activities. Those who could afford giving higher education to their children, do not envision them returning to work the fields, partly because it is considered a heavy and underpaid work and partly because there is a general negative perception of agriculture, regarding it as a socially inferior and “backward” occupation. Fishermen and peasants, most of who acknowledge enjoying their work, often respond negatively to the idea of their children working in their same activity, as they would like them to “have higher aspirations for their lives”. Young Fishermen (<30 y old) expressed that young people no longer care for the *chinampas* and prefer to work where they can own their free time, as agriculture is considered as a full-time activity. Interestingly, that same age group was the only one to mention an “increase in crime and drug addiction” in the vicinity of the wetland, as part of the relevant changes.

Threats to the conservation of the wetland

Respondents identified various causes of wetland degradation and stated the interconnectedness of many of them. Among social groups, the most important differences in the perceived socioecological situation was observed between the local community, on the one hand, and governmental representatives and NGOs, on the other (Figures 2 and 3).

Comparative analysis of narratives showed a more complex socioecological perspective of local people, which is evidenced by diverse social, economic and ecological processes that are interconnected in multiple ways, reinforcing their impacts through synergies. In contrast, for NGOs and governmental representatives, the narrative is more concise, characterised by linear cause-effect relations and less interactions among phenomena. Differences in the frequency of mentions of elements also reflect varying importance of problems and priorities between local community interviewees and governmental / NGO interviewees.

For local people, the most important socioecological problems were 1) inadequate governmental management, perceived as the main cause of all other problems; 2) water pollution, which they associated with trash dumping into the canals and sewage discharges from irregular settlements; 3) loss of agriculture production, provoked by the lack of markets (which is attributed partly to the dissemination of scientific reports that fail to reflect the local socioeconomic context), the negative perception of agriculture, that inhibits the formation of new generations of peasants, and the expansion of football courts; 4) loss of the lacustrine identity provoked by migration and the professionalisation of younger generations, and; 5) failure of conservation projects, attributed to inadequate allocation of subsidies and projects related to corruption, that in turn worsens local inequalities and conflicts within the community, because they “always benefit the same groups of people”. In addition, for people of the local community, tourism was considered a major source of solid wastes in the wetland because of lack of environmental awareness of visitors and local inhabitants that allowed them “to do anything for some pesos [Mexican currency]”. As an exception, owners of soccer fields did not consider the failure of conservation projects as a major problem, but instead, the low level of water associated with the overexploitation of springs was regarded as such, because grass needs daily watering.

Contrastingly, for governmental representatives and NGOs, the most salient socioecological problems were 1) urbanisation as a process associated to lack of institutional coordination to regulate land tenure of the *chinampas*; 2) loss of agriculture caused by peasants’ insufficient earnings and the expansion of soccer fields as a more lucrative activity; 3) water pollution linked to irregular settlements, use of agrochemicals from greenhouses and garbage rubbish dumps, and; 4) failure of conservation projects which they attributed to insufficient financial resources that inhibit tangible results; the failure of projects was also attributed to isolated conservation actions, and challenges stemming from working with what they depict as “a conflictive community”. For an NGO representative, difficulties arise because they “are envious among them”, “do not collaborate if they belong to different political groups or with people outside the community” and “do not work unless a stable income for long periods is guaranteed”. Other problems mentioned were the presence of exotic species (fishes), as one of the main factors of native species extinction, soil erosion and habitat destruction.

One interesting difference between local community people and other actors was how they conceptualise the role of urbanisation of the wetland. For governmental and NGO representatives, urbanisation is the cause agricultural surface loss; contrastingly, for local community people, the relation was inverse: for peasants abandoning agricultural activities, selling the land is more profitable than keeping it; these lands may end up as irregular settlements. Also, the peasant's children may need a place to live and thus, use the abandoned *chinampas* to construct their homes.

Who is responsible for implementing actions?

Local community people recognise the importance of their collective and individual actions to improve wetland conservation. They recognise that they need to be more environmentally aware and organised to maintain their environment and avoid individualist and envious attitudes. However, they all agree about the preeminent role of governmental institutions as the legal authority in charge of surveillance and of implementing direct solutions to the most acute problems. Yet, local actors doubt the government's good intentions, given the latter's reluctance to consider their opinions about environmental problems. Actions highlighted as fundamental for the conservation of the wetland by local community include the eviction of irregular settlements, regardless of its political implications; the cancellation of all direct drainages; the reactivation of traditional agriculture "with people who really want to work the fields, as long as they are Mexicans", subsidising all people cultivating, and supporting the recovery of traditional agriculture earnings; the promotion of family-based tourism -as an alternative to mass tourism-, to control water pollution by solid wastes; the establishment of water purification plants to recover water quality; planting flowers in the canals banks to recover the historical landscape; pumping water into groundwater deposits to counteract the high rates of extraction from springs and to reverse the sinking of the wetland; dredging the canals to recover water levels; and developing actions for recovering native species, so that activities, like fishing, become a livelihood option again.

Environmental policies implemented in the wetland and their impact on conservation

Governmental programmes identified by respondents from all social groups are those promoting traditional productive activities, wetland conservation and rehabilitation, including reforestation and the cleaning of canals. However, all interviewees, except for governmental officials, view these programmes as ineffective. According to most interviewees (63%), conservation programmes always benefit the same groups of people, thus financial resources "do not reach people who are really cultivating" or that know how do traditional *chinampa* agriculture:

"In the community, there are two or three groups of people that receive thousands [of pesos] each year, in plastic materials,

wire mesh, everything, and they end up selling that material because they do not produce" (He/Peasant).

Moreover, bureaucratic procedures to obtain subsidies for production are difficult to carry out for peasants, as they entail "spending several days on governmental facilities" and abandoning the daily agricultural activities. The complexity of the requirements for peasants gives rise to corruption opportunities. As some interviewees pointed out, being involved in subsidy programmes implies the elaboration of a technical report, that many of them are unable to do; in many cases this report is provided by the same authority in return for a percentage of the subsidy, "sometimes leaving the producer with only 40% of what he[she] was supposed to receive".

Contrastingly, for government officials, conservation policies have had achievements, which include "promoting the interest of producers and *chinampa* owners in reopening the canals and rescuing water ditches" and "developing agro-ecological projects". However, they acknowledge the partial failure of the Interdependence Commission and the AZP. According to these interviewees, these agencies should have worked together and lead the policies for conservation, but instead, they are uncoordinated, resulting in the atomisation and inefficient allocation of the funding directed towards the recovery and rehabilitation of the wetland ecosystem.

For NGO representatives, adequately planned policies "with well-established guidelines" are lacking, and "policymakers ignore the current situation of the site", much less local people's needs. For them, working in strengthening social organisation, furthering knowledge exchange and building up social actors' abilities are of most importance. Moreover, they mentioned the risk of using the axolotl to attract public attention to Xochimilco, as it has triggered "lucrative activities based on the species image" that do not crystallise into the recovery of the ecosystem. This perspective is also shared by some peasants and fishermen, who argue that "governmental institutions allocate a lot of resources for the conservation of the axolotl and its habitat", however "its population size has only diminished," and has consequently become almost extinct in the wild.

Programmes for wetland restoration recognised by local people are the control of water hyacinth [*Eichhornia crassipes*] in touristic canals, staking the canals shores to avoid erosion of the *chinampas*, dredging of canals, the support of the axolotl reproduction in captivity, the control of mistletoe [*Phoradendron leucarpum*], and the planting of bonpland willow trees [*Salix bonplandiana*]. However, many interviewees argue that these programmes do not have an articulated implementation, are carried out only on touristic canals, are not constant throughout the year, and "are often carried out by untrained personnel" or "by the council's crews that do not cover the full working day, for which they are paid for." For more than 60 % of respondents, these criticisms justify their views about both the ineffectiveness of the programmes and the deviation of economic resources originally destined for conservation.

DISCUSSION

Local traditional farming in *chinampas* is recognised as the expression of a millenary knowledge of the use of lacustrine resources. The wetland of Xochimilco constitutes a complex socioecological system whose preservation depends on both conservation of the agricultural landscape and of local social interactions with it.

As expected, the perspectives about the wetland socioecological problems, their causes, and the responsibility for solutions, show variations and convergences among different social groups, as has been observed in other studies (Walpole and Goodwin 2001; Bauer 2003; Weladji et al. 2003; Durand and Lazos 2008). All interviewees share views about the importance of the wetland for their livelihoods and for the city's environmental quality, and about the degree of the wetland degradation and its causes. However, there are contrasts on the importance that different groups gave to various socioecological problems, and about the differential responsibility for their solutions. These differences can be related to each group's economic activities, their dependence on certain attributes of the wetland, and their day-to-day difficulties (Webb et al. 2004; McClanahan et al. 2005).

Coincidences within local communities reflect their coevolution with the environment (Marten 2001; Castán-Broto et al. 2010). This interrelation is a result of the biocultural memory constituted by a set of organised beliefs (*kosmos*), knowledge (*corpus*) and productive practices (*praxis*), associated to the availability of natural resources and their use (Boege 2008; Toledo and Barrera-Bassols 2008). In Xochimilco, local people's livelihoods depend upon the presence of water and farmland. Deterioration on quality of those components causes the extinction of useful species and the loss of productive activities that have been historically carried out in the site for centuries (Mazari-Hiriart et al. 2008, Merlín-Urbe et al. 2013a). Those changes deplete the biocultural memory of the community and derive in the erosion of the lacustrine identity, including the transformation of meanings and values associated to the wetland.

Our results show a mismatch between the design and implementation of governmental policies and local people's perspectives about the socioecological problems and their causes. The combined perspectives of community members allowed the construction of a complex web of degradation processes and their causes. Governmental policies do not respond to such a complex social construction, neither NGOs actions. From the local community perspective, the reactivation and spatial expansion of traditional productive activities and the recovery of adequate environmental conditions for their development (such as water quality) are among the highest priorities for the conservation of the wetland. Productive lands are highly valuable for local community as the last preserved areas remaining. For peasants, public awareness about the importance of traditional producers—stigmatised as backward and inefficient by modernity—is also paramount for incorporating young people to *chinampas* production, in

order to preserve traditional cultivated lands. Contrastingly, governmental programs prioritised the incorporation of exogenous technologies for industrialising agricultural production (Narchi and Canabal 2015), relegating *chinampas* traditional production. Even when all stakeholders concurred about insufficient income as a cause of the abandonment of agricultural lands, local narratives showed a more elaborated explanation, identifying lack of markets influenced by negative perception of clients about the quality of product, and the hard work that *chinampas* require.

The increase in irregular human settlements is another common concern as an important cause of ecosystem degradation and water pollution. Yet, no policy has been implemented to prevent or reverse their establishment. This particular omission derives from the considerable political costs of limiting or relocating irregular settlements. In fact, initial urbanisation in the area, was promoted by political institutions that used it as a mechanism to entrench their local power (Canabal 1997). Urban growth derived from irregular settlements is linked to water quality concerns, particularly in narratives of governmental representatives and NGOs employees. During the last 15 years, developing hydraulic infrastructure had the highest budget of all programmes designed for the wetland rehabilitation. However, this investment has ignored the need of upgrading the quality of the wastewater treatment plants that discharge in Xochimilco, much less the development of comprehensive waste and water management actions.

In contrast, one of the main axes of governmental programmes has been the support of tourism, as has occurred throughout the country, regarding it as a “panacea” strategy for economic diversification and attaining conservation and poverty alleviation (Orams 1995; Scheyvens 1999). However, programmes implemented in Xochimilco have not worked towards sustainable tourism. As this activity has gained economic importance, it has also aggravated water pollution and the lack of regulation of visitors' actions. This may result from the prioritisation of revenue for government agencies or private operators, disregarding its negative effects (Duffy 2008; Ziegler et al. 2012).

The design of environmental policies for Xochimilco wetland suggests that these policies are based on an oversimplification of a complex socioecological reality. Therefore, policies are not designed to address the heterogeneity formed by complex wetland-urban landscape relationships. This situation generates a mismatch between reality as local inhabitants experience it and policies. Moreover, policies directed towards the conservation of the wetland, have remained unchanged for decades, and governmental institutions have eluded developing indicators to evaluate their effectiveness.

Policies omissions and the lack of failure recognition may respond to the need of avoiding political costs (Ascher 2001). In a context where political forces enter in conflict when seeking power (Canabal 1997), personal interests of officials and the aim to increase government legitimacy by showing they are “doing something” prevail. Besides, governmental

institutions have established client-based relationships with programmes' beneficiaries (García-Amado et al. 2013). As a result, according to most interviewees, conservation policies tend to benefit an elite, who already possesses infrastructure, power, education and relations with government officials; this situation increases social inequalities within the community and provokes the failure of conservation projects and the prevalence of environmental degradation. Local actors identified problems constructed from a daily coexistence with the wetland, while government and NGO discourses align to dominant narratives about conservation and may influence the perception of citizens about how to interpret and respond to socioecological problems, generalising explanations of what is wrong and legitimising certain avenues of action (Leach and Mearns 1996; Hirsch et al. 2010). The result is the implementation of environmental policies based on technical solutions that have been developed from a linear cause-effect approach (Scott 1998), that in the absence of local people participation, fail to integrate multiple socioecological processes interacting at different scales.

The case of Xochimilco's wetland opens the door to analyse the pressures that urbanisation generates on natural resources conservation from a socioecological approach. Also, it leads to inquire about the risk that entails the transformation of the environmental collective imaginaries, resulting from new values and meanings about the ecosystem, productive activities and pressures that displace traditional uses and knowledge. These values constitute the cultural expression associated with such ecosystem, jeopardising sustainability for the wetland and for the whole city. Urbanisation tendencies show that many PAs will be affected by this process (McDonald et al. 2008), resulting in a growing confrontation among social actors, regarding values and perspectives about nature. In this urban conservation context, it is important to understand how historical socio-natural relations may work as tools to prevent environment degradation associated with urbanisation.

The wetland of Xochimilco supports one of the last remnants of agricultural lands within Mexico City and provides ecosystem services of great importance to the sustainability of the city. The wetland contributes to biodiversity maintenance, food sovereignty, carbon sequestration, water supply and groundwater recharge, but it also supports a long-standing culture that developed from the sustainable use of their lacustrine resources (Ibarra et al. 2013; Merlín-Urbe et al. 2013b). Our study reinforces evidence about Xochimilco's community perspectives regarding environment problems (Narchi and Canabal 2017; Charli-Joseph et al. 2018). But it also shows how urban processes and imposed environment policies may jeopardise conservation, as a result of the loss of traditional relations (knowledge, practices, world views) between the community and the ecosystem.

Within cities, mosaics of different land uses are created as a result of high ecological and social heterogeneity (Cadenasso et al. 2007). Each mosaic may have its own land use perception framed by political and economic forces (Latour

2002). When these perceptions clash, power relations decide which one will prevail. Western modern cultural notions of nature prevail in cities and are reinforced by the technocratic notions derived from the dominant narratives of environmental policies. For urban dwellers, the main functions of nature areas include biodiversity protection, leisure or recreational space, and as a means for mitigating environment problems derived from urban processes (Mawdsley et al. 2009). In contrast, peri-urban dwellers tend to consider natural areas as means to support their livelihoods emanated from raw materials or productive lands for livestock or agriculture (Zérah and Landy 2013). In our case study, local community narratives reflected how environment degradation derived from multiple causes has translated in the loss of lacustrine identity, which in a feedback process, contributes to loss of the ecosystem and simultaneously to the loss of their means of production.

Xochimilcas' culture live from traditional productive activities and agricultural practices interwoven with other cultural elements, such as religious beliefs and gastronomy (González-Carmona and Torres-Valladares 2014). Since the Colonial era, a new relation with the lake was imposed, as the new management of the territory was focused in drying the Basin and establishing European agriculture techniques (Bojórquez-Tapia et al. 2000; Narchi and Canabal 2015). In the 20th century, the wetland became important as a biodiversity sanctuary and as a water supply for the city, but the value of traditional practices were (and are) still ignored by policies. Xochimilco's population used to rely on a variety of species through agricultural production, fishing and hunting; the axolotl and other native species were included in their basic diet (Widmer and Storey 2016). However, programmes have promoted change even in those aspects, as with the introduction of tilapias in the wetland aiming to increase local sources of protein (Valiente et al. 2010).

This study showed an oversimplification of socioecological processes related to environmental degradation in the design of conservation policies; but also, the dominance of the Western perception of nature reflected in environmental policies that consider the wetland mainly as a provider of ecosystem services for Mexico City. Urbanisation processes affect ecological dynamics but also jeopardise sustainable socio-natural relations by the insertion of new uses of preserved lands. Our study suggests that the lack of community participation in policies design and evaluation is largely responsible for environmental policies failure over the last two decades. Local narratives helped to identify the necessity to incorporate cultural identity protection in policies, identity represented not only in *chinampas*, but in all components of biocultural lacustrine memory. Government has a primary responsibility for developing policies and conservation projects, but participatory approaches should be intended to integrate community in more democratic decision-making processes (Méndez-López et al. 2014). Therefore, community participation could be a mean to promote agency for local social actors and change power relations that aggravate inequalities (Durand et al. 2014).

CONCLUSION

This study contributed with evidence about the mismatch between conservation policies construction and local actors' perspectives about socioecological problems, underlying the degradation of Xochimilco's wetland. Moreover, it provided evidence on the oversimplification that characterises the rationale behind environmental policies design, and the limitations associated to short-term perspectives, eluding political costs and the lack of social and environmental indicators to evaluate performance. Even when governmental institutions need to use a reductionist scheme to address socioecological problems, local community participation may allow the identification of complex relations and processes, to achieve better policy results by designing context-specific responses to particular socioecological scenarios. This requires transforming how policies are designed and implemented. It is central to incorporate both social and environmental needs, integrating ideas, values and cultural identity of communities in these processes. Negotiation and co-construction of policies through transdisciplinary approaches are necessary and, as has been shown, local actors can make a central contribution with their first-hand experience and knowledge. Effective social participation in conservation policies design has been acknowledged for decades, but it has still to become a reality in most contexts. The viability, efficiency and adequacy of policies may depend on these processes.

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