



Reach Alliance

Global Heritage, Local Voices: Community-Led Pathways for Preserving Xochimilco

Ana Saraí Espadas Martínez, Sandra Abigail Franco Ramirez, Carlos Patricio Heredia Ledezma,
Jennyfer-Lizet Monroy-Saavedra, Jorge Membrillo-Hernández

The Reach Alliance

The Reach Alliance is a consortium of global universities — with partners in Australia, Canada, Ghana, Kenya, Mexico, Singapore, South Africa, United Kingdom, and the United States — developing the leaders we need to solve urgent local challenges of the hard to reach — those underserved for geographic, administrative, or social reasons. Working in interdisciplinary teams, Reach’s globally minded students use rigorous research methods to identify innovative solutions to climate, public health, and economic challenges. Research is conducted in collaboration with local communities and with guidance from university faculty members, building capacity and skills among Reach’s student researchers. The power of the Reach Alliance stems from engaging leading universities to unleash actionable research insights for impact. These insights have been published in leading journals and taken up by policymakers and sector leaders around the world.

The Reach Alliance was created in 2015 by the University of Toronto’s Munk School of Global Affairs & Public Policy, in partnership with the Mastercard Center for Inclusive Growth. It is guided by an advisory council of leaders in academia, and in the private, public, and nonprofit sectors who help to drive impact, influence and scale, and support fundraising efforts.

Note: Authors are listed alphabetically with the faculty mentor listed last.

Cover photo: Dawn in Xochimilco’s canals (photo by Martín Maya Ledesma)



Acknowledgements

This research is the result of the collective effort, wisdom, and generosity of many people. The project would not have been possible without the unwavering guidance of our faculty mentor, Dr. Jorge Membrillo-Hernández. We owe him our deepest gratitude for his mentorship, his vision, and for being the pillar of our team throughout this journey.

Our greatest and deepest thanks go to the people of Xochimilco, the true guardians of this World Heritage City. We are deeply grateful to the community members who participated in our surveys and generously shared their realities, concerns, and knowledge with us. In particular, we thank the *chinamperos* and *chinamperas*, including Esteban Dehesa Leyva, Ramiro Dehesa Sánchez, María del Lourdes Dehesa Sánchez, María del Rosario Dehesa Sánchez, Silvia Pérez Flores, and Pedro Rojas, who shared their ancestral knowledge and introduced us to the majestic ecological architecture of the *chinampas*. Likewise, we thank Manuel Rodríguez for his inspiring, dedicated independent work to preserve the axolotl. His observations in the field provided us with a deep understanding of conservation efforts and the challenges that arise outside of government agencies.

We extend our sincere gratitude to the academic and institutional leaders who broadened our perspective: Dr. Edgar López-Caudana, research professor in the Complexity Reasoning Group at the Institute for the Future of Education, whose work with NAO humanoid robots designed for children demonstrated how complex systems, educational innovation, and technology can be used to strengthen heritage preservation; and Jorge Ortega González, general director of the National Association of Mexican World Heritage Cities, who provided us with a crucial institutional perspective on the financial and structural challenges of implementing preservation programs in our country. Staff of the Secretariat of Education, Science, Technology, and Innovation (SECTEI) of the Government of Mexico City shared information on applied science policies, social innovation, and cross-cutting approaches to the management of natural and cultural areas. Thanks also to the historian of Xochimilco, Professor Joaquín Praxedis Quesada. We are also very grateful to Sylvia Thompson and the CBC News team. Navigating the waters of the Xochimilco canals with them allowed us to view the social, environmental, and cultural dynamics of the area from a different perspective, which helped us document the settings where the story for this report originated.

Our report aims to amplify the voices that are, unfortunately and all too often, silenced. The findings contained in these pages do not belong to us — they belong to the resilient hands that keep the *chinampa* culture alive and to the children who will inherit it. We share a commitment as a team to ensure that Xochimilco's World Heritage City is never discussed without first listening to its local voices.

This project received all research ethics approvals. The Project Approval Letter, evaluated and issued by the Institutional Committee for Research Ethics at Tecnológico de Monterrey (Comité Institucional de Ética en la Investigación del Tecnológico de Monterrey), was officially obtained on 21 November 2025. In addition, we obtained informed consent from all individuals whose photographs appear in this report. Participants were informed about the purpose of the documentation, the intended use of the images, and their voluntary participation, and they agreed to the inclusion of their photographs in this publication.

During the research process for this report, the research team used Google Gemini and Microsoft Copilot in a supporting role. AI assistance was used primarily to check grammar, improve concision, format text, and reformulate specific phrasing for clarity and alignment with reviewer guidelines. AI was not used to conduct secondary research, generate empirical data, transcribe interviews, or perform the core analysis. The research analysis, arguments, and conclusions presented in this case study are entirely the authors' own, and we take full responsibility for the final content.



Contribution	Contributor (Initials)
Conception or design of the work	JMH, SAFR, ASEM, CPHL, JLMS
Data collection	JMH, SAFR, ASEM, CPHL, JLMS
Data transcription	JMH, SAFR, ASEM, CPHL, JLMS
Data analysis and interpretation	JMH, SAFR, ASEM, CPHL, JLMS
Drafting of the case study report	JMH, SAFR, ASEM, CPHL, JLMS
Critical revision of the case study report	JMH, SAFR, ASEM, CPHL, JLMS
Final approval of the version to be submitted	JMH, SAFR, ASEM, CPHL, JLMS

Contents

Executive Summary..... 1

Context: Ancestral *Chinampa* Agriculture, Climate Adaptation,
and Heritage Preservation.....2

Institutional Risk and the Imperative for Policy Intervention..... 4

Hardest to Reach..... 5

The Gender Lens.....8

A Multi-layered Socio-ecological Paradigm.....8

Assessing Project Impact: Structural Barriers and Empirical Signals..... 12

Empirical Validation and Preliminary Outcomes..... 15

Critical Research Dilemmas and Remaining Questions 17

Conclusion and Recommendation: Proposing the *Libellus* Manual as a Model
for Global Heritage Preservation..... 19



Executive Summary

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Heritage City of Xochimilco represents a critical socio-ecological system and a monumental achievement in human ecological engineering. As the last major remnant of the ancient Lake Texcoco, where the Aztec capital of Tenochtitlán was established, Xochimilco's *chinampa* system (human-made agricultural islands) and intricate canal network have sustained urban populations for centuries. Beyond agricultural productivity, this unique biocultural landscape plays a vital regulatory role in Mexico City's microclimate and serves as the primary habitat for endemic, critically endangered species, notably the axolotl (*Ambystoma mexicanum*).

Despite its profound ecological and cultural significance, this fragile ecosystem faces imminent collapse. Decades of unmanaged peri-urban encroachment, severe hydrological degradation from illicit discharges of municipal and industrial wastewater, and the ecological disruption caused by invasive fauna have precipitated an unprecedented systemic crisis. Currently, approximately 95 per cent of the active *chinampa* territory lies abandoned or severely degraded. While administrative concern often centres on the potential revocation of Xochimilco's UNESCO World Heritage status, the primary threat is the irreversible collapse of a living social-ecological system and the permanent erasure of an irreplaceable biocultural heritage.

Our research demonstrates that Xochimilco's degradation is driven by deeply intertwined socioeconomic and environmental stressors. The ancestral agricultural knowledge essential to operating these complex wetland agroecosystems is held by a rapidly shrinking, marginalized, and aging demographic: the *chinamperos* (traditional agricultural producers who construct, maintain, and cultivate the human-made wetland islands). Structural vulnerabilities, including land-tenure insecurity, economic marginalization relative to

subsidized industrial agriculture, and systemic social stigma, compel *chinamperos* to abandon their lands. Simultaneously, younger generations are increasingly alienated from agrarian livelihoods, causing a profound rupture in the intergenerational transmission of ecological knowledge that threatens the permanent loss of this historical heritage.

Based on our evaluation of the territory's socio-educational dynamics, our study recommends socio-educational interventions, namely, the collaborative compilation of the *Libellus de Conservanda Hereditate Globali Manual* (Manual for the Conservation of Global Heritage), and the design of hands-on intergenerational agricultural workshops, targeting children, youth, elderly residents, and local institutional actors. Central to this inquiry is the phenomenon of what we call "social axolotization," the process by which the endangered axolotl is leveraged as a socio-cultural boundary object to foster local identity and mobilize grassroots conservation. Does this symbolic appropriation translate into substantive ecological and socioeconomic conservation outcomes, or does it mask a disconnect between fragmented institutional governance structures and the lived realities of Xochimilco's marginalized communities?

Conventional preservation models frequently fail because they favour technocratic, purely environmental interventions while ignoring the human dimension, thereby perpetuating an extractive model of knowledge production. By contrast, we argue that the physical rehabilitation of Xochimilco and its *chinampas* is contingent upon the structural empowerment and knowledge preservation of the *chinamperos* themselves.

We propose the *Libellus de Conservanda Hereditate Globali Manual* as a recommended framework offering a scalable, replicable methodology for safeguarding Xochimilco and comparable World Heritage cities globally. Our work serves as a policy directive to global stakeholders, arguing that the preservation of exceptional cultural landscapes must prioritize the agency, voices, and livelihoods of the local communities who sustain them.



Figure 1. Welcome marking the entrance to a chinampa community in Xochimilco

Context: Ancestral *Chinampa* Agriculture, Climate Adaptation, and Heritage Preservation

A floating city does not sink from the weight of time, but from the silence of its people. To preserve the exceptional, we must look beyond the landscape: we must listen to the voices that keep the water alive and learn to read the hands of those who still cultivate it.

—Sandra Abigail Franco Ramirez

Under the regulatory framework of the United Nations Educational, Scientific and Cultural Organization

(UNESCO), a World Heritage designation is predicated not merely on aesthetic appeal or localized historical relevance, but on the determination of “outstanding universal value.” UNESCO defines this value as cultural or natural significance so exceptional that it transcends national boundaries and remains of vital, collective importance for present and future generations of humanity.

The accelerating degradation of these exceptional spaces presents a profound challenge to global heritage governance. When a living cultural landscape approaches systemic collapse, the loss extends far beyond physical geography — it represents the irreversible erasure of collective memory, climate resilience, and localized socio-ecological identity. Within the southern periphery of Mexico City, this existential threat is no longer a theoretical projection but an active crisis unfolding across the lacustrine (lake-based) ecosystem of Xochimilco’s canals.

“

As the final hydrological remnant of the extensive valley lake system that supported the Aztec capital of Tenochtitlán, Xochimilco preserves an unprecedented model of historical ecological engineering.

Xochimilco represents a unique, living biocultural landscape rather than a static archaeological site or an open-air museum optimized for tourist consumption. As the final hydrological remnant of the extensive valley lake system that supported the Aztec capital of Tenochtitlán, Xochimilco preserves an unprecedented model of historical ecological engineering.

The core of this system is the *chinampa* infrastructure: human-made agricultural islands constructed via layers of lacustrine sediment, organic matter, and the root networks of local *ahuejote* trees (*Salix bonplandiana* — a kind of willow). Rather than deploying an extractive approach to land reclamation, this Indigenous engineering framework established a symbiotic relationship with the wetland environment.

Historically, this agroecosystem sustained high-density Mesoamerican urban populations while simultaneously developing a highly specialized microclimate that regulates the broader basin's hydrological cycle and fosters endemic biodiversity. Preserving Xochimilco is therefore an imperative of contemporary ecological and agricultural science, maintaining a functional ancestral methodology as a viable tool for climate adaptation.

To visualize this, imagine a vast, dynamic maze of tranquil water canals weaving through lush, rectangular islands. These islands, built entirely by hand from nutrient-rich mud and aquatic plants, are securely held together by the roots of native willow trees. It is a highly productive, floating agricultural landscape where traditional farmers navigate small, flat-bottomed wooden boats to cultivate and transport fresh produce, demonstrating a perfect, living balance between human needs and wetland ecology.

Drivers of Systemic Ecological Collapse

The contemporary socio-ecological status of Xochimilco is characterized by severe, compounding human-caused pressures. These disruptive “anthropogenic” forces are not isolated, localized anomalies — they represent deeply entrenched systemic failures across three distinct vectors:

Unregulated peri-urbanization. Rapid, poorly planned metropolitan expansion has led to direct territorial encroachment upon the historical canal network. The conversion of wetland zones into informal settlements and impermeable concrete

surfaces disrupts the natural infiltration of the local aquifer, permanently altering the basin's water table and regional microclimate.

Hydrological degradation and toxicological load.

The structural integrity of the canal network is severely compromised by water quality degradation. The daily influx of unauthorized domestic wastewater discharge, microplastics, untreated sewage, urban pesticide runoff, and greywater has toxified the water, rendering it increasingly hostile to biological communities — of plants, animals, and people.¹



Figure 2. Traditional *chinamperos* managing fishing nets in the canals, a practice increasingly impacted by invasive species like carp and tilapia

Trophic cascades and biodiversity loss. The biological indicators of this ecological decline are starkly visible in the population collapse of critical local species. The apex bioindicator of the system, the critically endangered axolotl (*Ambystoma mexicanum*), has suffered an unprecedented demographic crash.² This decline is heavily driven by the introduction of non-native fish, specifically carp (*Cyprinus carpio*) and tilapia (*Oreochromis niloticus*), which were originally brought into the canals decades ago to promote local fisheries. Because these fish do not belong in this ecosystem, they have devastated the natural food chain by eating

1 Fernando Arana Magallón, Luis Bojórquez Castro, Alfonso Esquivel Herrera et al., “Contaminación química y biológica en la zona lacustre de Xochimilco,” Universidad Autónoma Metropolitana, 2017.

2 Karla Angélica Castro Yáñez, “Ajolotes y chinampas en el rescate de Xochimilco,” Ciencia UNAM, 2022. c

the eggs of native species, including those of the axolotl, and have structurally altered the ecological balance. As local *chinamperos* note, these invasive fish also physically destroy the agricultural islands; they constantly bump into the muddy banks, causing the edges of the chinampas to weaken, crumble, and erode into the water, resulting in severe land loss.

Structural vulnerabilities of the *chinamperos*.

The environmental degradation of Xochimilco is related to an acute socioeconomic crisis confronting its traditional stewards: the *chinamperos*. The preservation of this wetland matrix depends entirely on people retaining and using ancestral agricultural knowledge. However, contemporary macroeconomic structures render this traditional livelihood increasingly untenable.

“

The preservation of this wetland matrix depends entirely on people retaining and using ancestral agricultural knowledge.

Logistical constraints of low-impact infrastructure.

The distinct geography of the *chinampa* matrix, composed of fragmented, water-locked islands, prevents the use of conventional, high-emission industrial agricultural machinery. Transporting inputs and harvesting produce remain dependent on manual labour and traditional shallow-draft vessels (*trajineras*). This structural reliance on low-impact, traditional logistics increases operational costs and reduces short-term output volumes relative to industrialized operations.

Market asymmetries and economic

marginalization. When bringing high-quality, agroecological produce (such as spinach, lettuce, radishes, and seasonal flora like *cempasúchil* and poinsettias) to regional markets, *chinamperos* must compete directly with large-scale commercial agro-industries.³ Industrial operations externalize environmental costs to achieve economies of scale, artificially depressing prices to levels that are economically unsustainable for small-scale, regenerative producers. Consequently, producers face severe legal, financial, and social vulnerabilities that drive systemic land abandonment.⁴

Institutional Risk and the Imperative for Policy Intervention

Xochimilco's ongoing decline represents an immediate challenge to international heritage policy. The loss of geographical, environmental, and cultural authenticity places the zone at imminent risk of losing its UNESCO World Heritage status.⁵ While the revocation of this designation would represent a major diplomatic and reputational failure for regional and national environmental governance, the physical consequences are far more severe.

Shifting from Extractive to Regenerative Governance

Prior institutional conservation frameworks have consistently underperformed because they treated Xochimilco's crisis as a purely technical or environmental issue. By focusing narrowly on water

3 "Xochimilco, de la chinampa a tu mesa. Gobierno de México," Secretaría de Agricultura y Desarrollo Rural, 2017.

4 "En más de 15 años se redujo en dos tercios la zona chinampera de Xochimilco," Secretaría de Educación, Ciencia, Tecnología e Innovación, Gobierno de la Ciudad de México, 2015.

5 Guadalupe Ponce, "La razón por la que Xochimilco puede dejar de ser Patrimonio Cultural de la Unesco," *La Silla Rota*, 29 September 2024.

filtration metrics or targeted wildlife conservation while ignoring the human element, these interventions perpetuated an “extractive knowledge” approach that alienated the local community from formal governance mechanisms. For example, local *chinamperos* frequently recount how external university researchers or NGOs arrive to study the axolotl or test water quality, secure millions of pesos in institutional funding based on that local data, and depart without sharing the results or investing a single peso back into the agricultural plots. As one local farmer said regarding these academic partnerships, “hacen la estafa maestra ... sacan sus proyectos de 30 millones ... y nunca hacían nada” [they pull off the master scam ... they get their 30 million projects ... and never did anything].

“

Local *chinamperos* frequently recount how external university researchers or NGOs arrive to study the axolotl or test water quality, secure millions of pesos in institutional funding based on that local data, and depart without sharing the results or investing a single peso back into the agricultural plots.

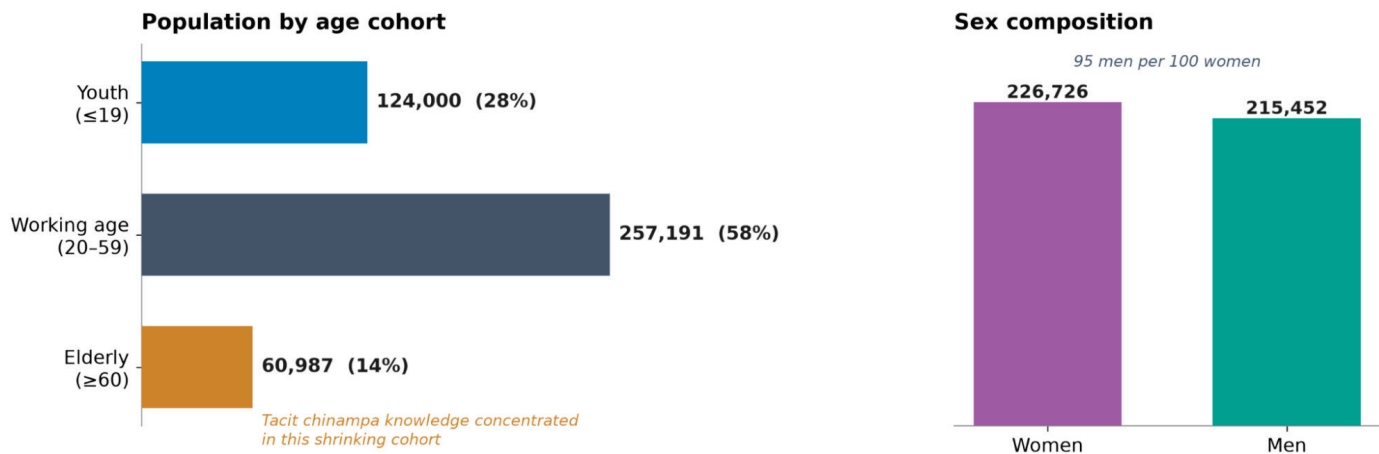
Wetland infrastructure cannot be decoupled from its human inhabitants. The root cause of the crisis is the fracturing of the historical connection among the local population, ancestral agricultural practices, and the physical landscape. Decades ago, the wetland and the farmer operated as a single, living organism. A veteran *chinampero* shared a vivid memory of this lost connection where farmers used to weave long floating mats of aquatic plants, known as *cintas*, and drag them across the canals to collect nutrient-

rich lake mud. “En eso se podía uno hasta caminar, bailar en eso y no se sumía... Nomás imagínense la cantidad de vitamina que llevaba esa cinta” [You could even walk, dance on that and it wouldn’t sink ... Just imagine the amount of vitamins that mat carried]. Today, this highly specialized, closed-loop fertilization system has been replaced by synthetic fertilizers, turning the living soil into sterile, hardened rock and erasing the youth’s physical and spiritual connection to the fertile soil.

As traditional knowledge systems fail to transmit to younger demographics due to systemic economic barriers, the window for meaningful intervention narrows. These barriers are not abstract; they dictate the daily survival of the *chinamperos*. Market asymmetries force traditional farmers to compete against cheap, subsidized industrial agriculture. When *chinamperos* bring organic, chemical-free vegetables to the market, urban buyers often reject them for not looking artificially perfect, complaining “¿por qué tu verdura viene muy feíta?” [why do your vegetables look so ugly?]. This insistence on the aesthetics of produce severely depresses their income. Socioeconomically, agricultural day labourers face intense exploitation, sometimes earning a mere fraction of a living wage for gruelling physical labour. Legally, the majority of *chinamperos* lack formal property deeds, operating under ancestral verbal agreements that offer no protection against urban land invasions or arbitrary government zoning. Reversing this trajectory requires a comprehensive policy shift that moves away from superficial conservation toward a model that directly addresses these structural socioeconomic vulnerabilities, legal insecurities, and market asymmetries, thereby centring local agency at the core of global heritage preservation.

Hardest to Reach

The population of Xochimilco faces intersecting vectors of geographic isolation, socioeconomic marginalization, and structural vulnerability. This socio-ecological cohort consists of an interdependent network of traditional agricultural



Note: This figure summarizes the current status and productive capacity of the *chinampa* system in Xochimilco. Active *chinampas* represent only 17.14%, and abandoned or inactive *chinampas* account for 82.86%. It also presents key indicators of the system's scale and value, including the total number of identified *chinampas*, total area, annual food production, and estimated agroeconomic value.

Figure 3. Xochimilco's demographics: a youthful population, an aging knowledge base⁶

producers, the *chinamperos*, elderly knowledge holders, school-aged youth, local educational stakeholders including the nonprofit organizations REEDUCA, Humedalia AC, and the UNESCO-recognized Abejas de Barrio as well as universities such as UAM Xochimilco and Tecnológico de Monterrey. Together, they inhabit the fragmented lacustrine, peri-urban fringe of southern Mexico City. The community does not interact within a homogeneous urban environment. Instead, they navigate a high-friction landscape vulnerable to compounding environmental shocks, including localized hydrological subsidence (literally the ground sinking), acute water scarcity, surface-water contamination, and the systemic dismantling of historical agricultural safety nets.

Demographic Paradox and Intergenerational Knowledge Rupture

There is a profound demographic and operational paradox within Xochimilco. According to 2020 census data, the municipality has a population of 442,178, exhibiting a pronounced youth bulge alongside an aging traditional agrarian core. The

youth cohort (≤19 years = 124,000) accounts for around 28 per cent of the population, and the elderly cohort (≥60 years = 60,987) make up almost 14 per cent (Figure 3).⁷

This demographic configuration represents a critical socio-ecological disconnect. While a substantial youth demographic (28%) might once have driven long-term territorial preservation, young people today aren't learning what they need to manage this complex wetland ecosystem. The tacit cultural knowledge is concentrated within an increasingly elderly, marginalized population. This creates an imminent risk of an irreversible intergenerational knowledge rupture.

The fact that almost 83 per cent of historical *chinampa* infrastructure is abandoned does not, by itself, prove that young people are leaving the sector. Rather, it reveals the material consequences of a weakening system of agricultural succession. When read alongside the aging profile of traditional knowledge holders and the limited incorporation of younger generations into *chinampa*-based livelihoods, abandonment becomes evidence of an intergenerational rupture in both labour and ecological knowledge.

⁶ INEGI Census 2020.

⁷ "Panorama geográfico y estadístico: Xochimilco," Instituto de Planeación Democrática y Prospectiva de la Ciudad de México, 2024, 15.

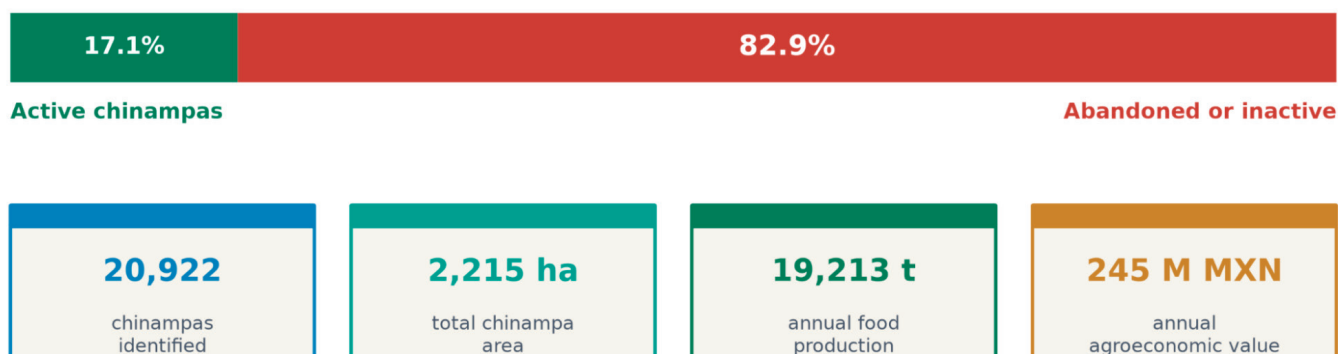


Figure 4. Current status and productive capacity of *chinampas* in Xochimilco

Vulnerability Dimensions: Hard-to-Reach Typologies

The area's population encounters three distinct, compounding barriers that complicate external intervention and standard public policy implementation

Geographic and logistical friction. The *chinampa* zone spans approximately 47 per cent of the municipality's territory, forming a complex, nonlinear maze of canals, semi-rural islands, and conservation areas. Accessing these points requires taking a flat-bottomed row boat (*trajineras*), which is highly dependent on variable water levels and seasonal weather conditions.

Institutional distrust. Local communities maintain a well-founded historical skepticism toward external academic institutions, nongovernmental organizations (NGOs), and short-term municipal conservation schemes. Historically, these groups have deployed extractive research methodologies, collecting local data to secure institutional funding or academic publications without establishing long-term local infrastructure, accountability mechanisms, or tangible economic returns for the community.

Ethical and normative frameworks for youth engagement. Since more than a quarter of Xochimilco's population is under the age of 19, we treated youth engagement as an ethical and methodological priority. Involving school-aged participants, we sought youth perspectives through age-appropriate formats, clear explanations of the

project's purpose, and safeguards designed to protect participants' privacy and dignity. This matters because young people are not only future inheritors of *chinampa* knowledge; they are also current inhabitants of the territory whose relationship to the landscape helps explain whether intergenerational transmission is being sustained or interrupted. For this reason, youth participation cannot be treated as informal consultation. It requires parental or institutional consent where applicable, careful facilitation, and data protection standards that allow young people to contribute without being exposed to secondary risks.



Figure 5. Research team navigating the canals while conducting field observations and interviews

The Gender Lens

In Xochimilco there are slightly more women than men (226,726 women and 215,452 men) — a sex ratio of 95 men per 100 women. Historically, formal land tenure systems and high-visibility representation within Xochimilco's agricultural sector have favoured men. However, women serve as the primary curators of agroecological biodiversity, managing domestic seed conservation, localized trading networks, and informal environmental education.

For example, in ancestral Xochimilco, women played a crucial role in sustaining the *chinampa* system beyond agricultural production itself. Research has found that textile production during the postclassic period was an important activity in Xochimilco, and that women were responsible for manufacturing textiles using different fibres. This work was not limited to domestic life or family care; in many cases, textiles were exchanged or paid as tribute to the Triple Alliance, which means women contributed directly to the regional economy and political system.⁸ Their labour required technical knowledge, specialized tools, and the ability to manage raw materials such as cotton, xtle, bone, stone, and wood. Women were producers, knowledge holders, and key actors in the reproduction of everyday life.⁹ Their textile work reveals that the continuity of Xochimilco depended not only on farming and land management, but also on the often-invisible labour of women who sustained households, economies, and cultural knowledge across generations.

By recognizing women not merely as passive beneficiaries or domestic caregivers, but as formal researchers, agricultural producers, and institutional organizers, we address a critical gap in traditional conservation policy. This approach ensures that the transmission of ancestral agricultural practices is structurally equitable and resilient against future socioeconomic shocks.

“

Unlike conventional World Heritage configurations that safeguard static architectural monuments, Xochimilco's UNESCO designation honours a dynamic, living socio-ecological system.

A Multi-layered Socio-ecological Paradigm

The people of Xochimilco are inextricably linked to the highly specialized lake-based landscape historically designated as the “Floating Gardens.” The landscape is anchored by the *chinampa* agroecosystem, an ancestral framework of human-made agricultural islands constructed over shallow lake beds during the pre-Hispanic era, and an intricate network of interconnecting canals.¹⁰

Unlike conventional World Heritage configurations that safeguard static architectural monuments, Xochimilco's UNESCO designation honours a dynamic, living socio-ecological system. The functional value of this matrix relies on the continuous maintenance of traditional agricultural practices, which coexist alongside fluctuating tourist corridors navigated by traditional row boats (*trajineras*) and highly degraded micro-

8 Alcántara Muñoz and Karen Valeria, “La Triple Alianza: Serie “Tenochtitlan 1521–2021,” Instituto Nacional de los Pueblos Indígenas, 2021. The Triple Alliance was a political and military pact formed in the fifteenth century between the rulers of Tlacopan, Texcoco, and Tenochtitlan. It was created to confront the power of the lordship of Azcapotzalco. After Azcapotzalco's defeat in 1428, the alliance expanded its control over other territories in the Basin of Mexico. Xochimilco was later conquered by the Triple Alliance and became incorporated into the Mexica imperial system.

9 Berenice Jiménez González and Patricia Pérez Martínez, “Las tejedoras de las chinampas,” *Arqueología Mexicana* no. 102 (April 2022): 88–93.

10 Victor Rivera-Díaz, “Floating Gardens in the Urban Landscape,” *Contemporary Aesthetics* 18 (2020). [↗](#)

From systemic pressures to community-based response

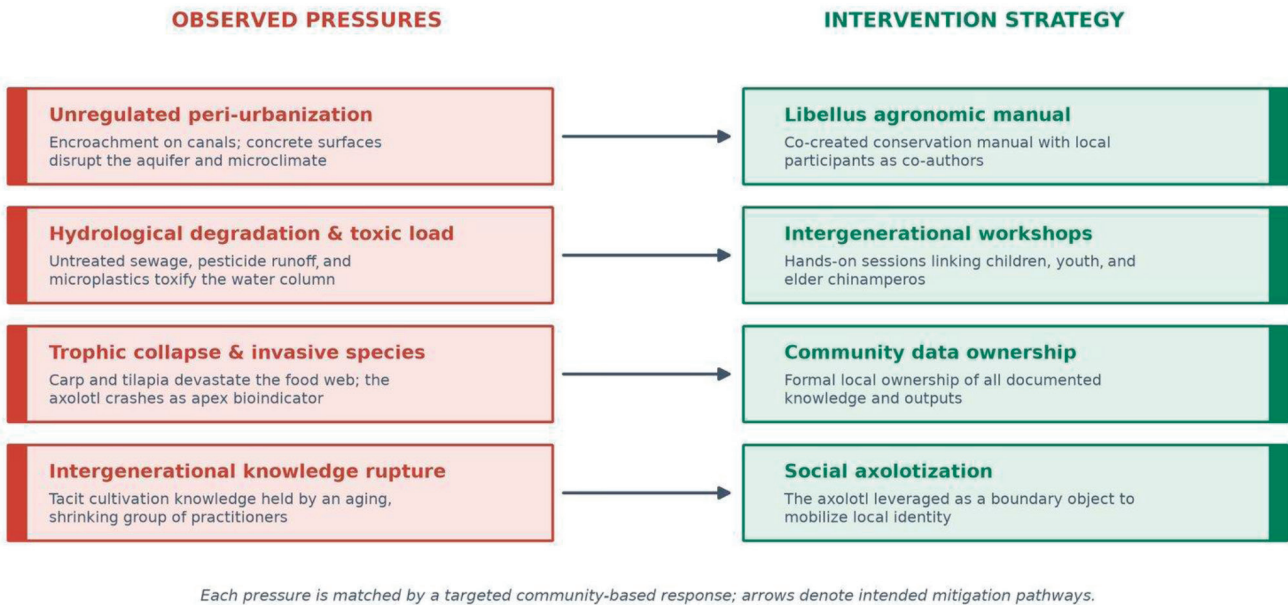


Figure 6. Observed pressures on the socio-ecosystem in Xochimilco and its intervention strategies to address them

habitats sheltering the critically endangered axolotl (*Ambystoma mexicanum*).¹¹

For its inhabitants, this complex ecosystem is their ancestral home, and a primary source of livelihood. We therefore think of the approaches to conservation we analyze as a multilayered conservation framework designed to safeguard the cultural, ecological, and structural integrity of the landscape. Our central focus of this research is to critically evaluate the systemic efficacy, structural barriers, and institutional durability of these conservation mechanisms to preserve what Xochimilco represents culturally, ecologically, and socially. The real question remains whether that effort is actually working. Figure 3 maps the four principal pressures identified in Xochimilco against the intervention strategies designed to address them, illustrating the logic underlying the conservation framework analyzed in this study.

The Biocultural Conservation Framework

Xochimilco is considered an urban socio-ecological system whose resilience has depended on continuous interaction between human management and ecological processes. This adaptive, co-evolutionary relationship between people and landscape that distinguishes Xochimilco from more conventional heritage sites makes a single-lens approach to its conservation insufficient. Accordingly, the heritage of Xochimilco operates on three deeply interconnected domains.¹²

As Table 1 illustrates, the axolotl occupies a singular position. It serves as a biological indicator of ecological domain health and a cultural referent that anchors the intangible heritage of the culture and scientific domain, transforming a specimen into a highly visible global and national symbol of ecological identity. We call this sociopolitical

¹¹ "Historic Centre of Mexico City and Xochimilco," World Heritage List, UNESCO, 1987.

¹² Marcela Jiménez et al., "Assessing the Historical Adaptive Cycles of an Urban Social-Ecological System and Its Potential Future Resilience: The Case of Xochimilco, Mexico City," *Regional Environmental Change* 20 (2020): 1–14.

Table 1. The biocultural heritage domains of Xochimilco

Domain	Description	Illustrative Example
Cultural	Intangible heritage, ancestral agronomic techniques, and the intergenerational networks that sustain community cohesion	Oral <i>chinampero</i> knowledge; the axolotl as a symbol of local identity (“social axolotization”)
Natural	The hydrological network, wetland ecosystems, and specialized local flora and fauna	Canal system and the endangered axolotl (bioindicator of water quality and trophic health)
Biocultural	The intersection where human agricultural labour and ecosystem functions become functionally inseparable	The <i>chinampa</i> system itself

Note: This table summarizes the three interconnected domains (cultural, natural, and biocultural) that together define Xochimilco’s living heritage system

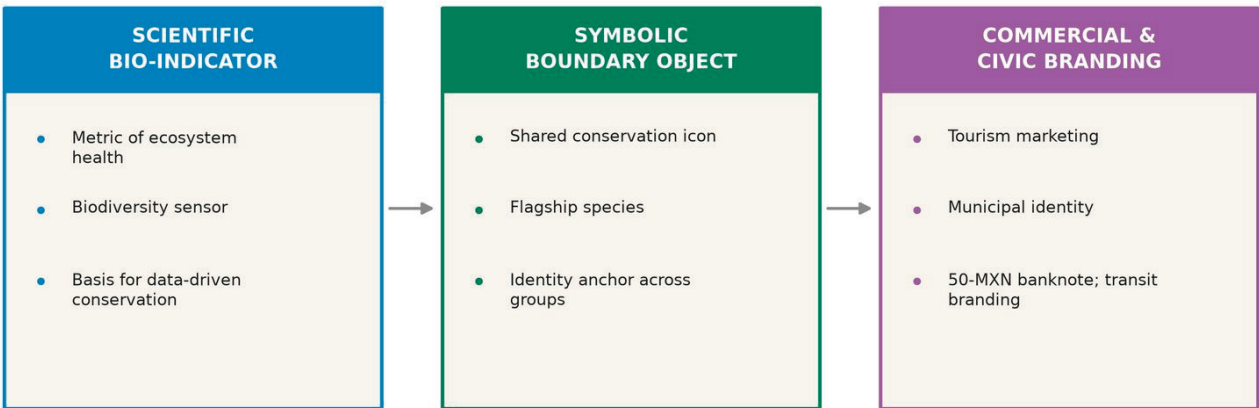
process “social axolotization,” by which we mean the mechanism by which an endangered species is transformed into a primary vehicle for cultural identity, collective memory, and civic mobilization (Figure 7).¹³

It remains unclear whether this can be translated into actual conservation outcomes or whether it operates

largely as a symbolic appropriation that leaves the structural pressures of problems unaddressed. By symbolic appropriation, we refer to the process by which government agencies, NGOs, media, and tourism operators mobilize the axolotl’s identity as a branding device or fundraising narrative.

Social axolotization: three roles of the axolotl

How one endangered species is enrolled as bio-indicator, cultural symbol, and commercial brand



Central question: does symbolic appropriation translate into measurable conservation, or a symbolic distraction?

Figure 7. Social axolotization: three roles of the axolotl

13 Santiago Echarri-Cotler, “Una ciudad para ser vista: la “ajolotización” de la CDMX a menos de treinta días del Mundial,” *Este País*, 19 May 2026.



Note: Beyond their iconic cultural significance, axolotls serve as a critical bioindicator of wetland health and illustrate the intersection of scientific conservation and local identity, remaining the quintessential mascot of Mexico City.

Figure 8. Axolotls (*Ambystoma mexicanum*) housed within a conservation facility in Xochimilco

Institutional Governance Configurations and Regulatory Friction

Formal governance over Xochimilco is distributed across a highly complex, multi-tiered institutional framework characterized by severe regulatory friction and horizontal communication gaps. At the international level, UNESCO provides the recognition framework and periodic conservation reporting requirements, but its practical influence on day-to-day management is limited. Federally, SEMARNAT (Ministry of Environmental and Natural Resources), INAH (National Institute of Anthropology and History), and CONABIO (National Commission for the Knowledge and Use of Biodiversity), each operate under distinct institutional mandates and independent timelines. For example, INAH's heritage framework was designed around discrete monuments, SEMARNAT has documented failures in enforcement (such as infrastructure built over the protected chinampa zone), and CONABIO can formally register a species as endangered without holding enforcement

authority.¹⁴ At the local level, the Alcaldía Xochimilco holds administrative jurisdiction over land use, canal maintenance, and tourism permits, in which most of the day-to-day decision making happens, and also where the gap between policy and practice tends to be most visible (Figure 9).

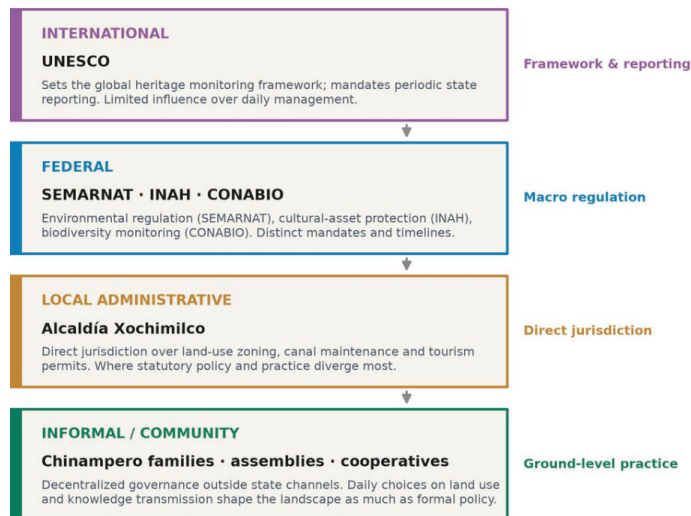


Figure 9. Multi-tiered governance of Xochimilco

The administration of each institution is limited by resources, political dynamics, and the sheer complexity of managing a heritage site that is also a densely populated urban borough. To add to the complexity, an informal tier of decentralized community governance operates outside formal state channels. This network includes traditional *chinampero* families, neighbourhood assemblies, and agrarian cooperatives. Their daily, localized choices regarding land use, the transmission of oral histories, and interactions with external tourist and research cohorts shape the heritage landscape just as profoundly as formal state policies do.

Analytical Mapping of Interacting Partners

On paper, the Xochimilco site features extensive regulatory protections but, in reality, it faces compounding pressures from urban expansion, environmental contamination, and the degradation

14 "Ley General del Equilibrio Ecológico y la Protección al Ambiente," Diario Oficial de la Federación, 2018.

of its underlying knowledge systems.¹⁵ As Figure 9 shows, these protections are administered by a fragmented set of partners operating at different scales and with different logics. In this context, conservation is a deeply embedded social process rather than a detached technical exercise, demonstrating that sustainable policy design requires a thorough understanding of how diverse stakeholders perceive, experience, and engage with their shared landscape.



Figure 10. Researchers engaging with a community representative outside a local facility dedicated to the research and preservation of the axolotl, demonstrating the vital intersection of ecological science and grassroots conservation

Assessing Project Impact: Structural Barriers and Empirical Signals

To accurately evaluate the impact of contemporary conservation initiatives in Xochimilco, we have to situate them within the historical context of prior public policy interventions. Historically, state-led efforts to safeguard the site have deployed an elite-driven, top-down approach focused almost exclusively on large-scale engineering projects, such as installing centralized water treatment facilities, constructing retaining walls, and enforcing restrictive zoning laws.

While technically sound on paper, these strategies have consistently failed because they treat a living biocultural landscape as a static engineering problem, effectively marginalizing the traditional agricultural communities who maintain the physical infrastructure of the *chinampas*.

In response to this systemic failure, our research indicates a strong need for the collaborative development of a resource such as the *Libellus de Conservanda Hereditate Globali Manual*. Rather than being a static academic document, we recommend that this manual be structured as a living repository that constantly adapts to the shifting needs of the community, designed specifically to address the breakdown of oral tradition within the *chinampero* sector. Specifically, the *Libellus* should function as a practical biocultural toolkit. It would systematically document unwritten agronomic practices, such as the creation of *chapines* (traditional mud seedbeds), native seed preservation, and nonchemical pest management, while remaining open to continuous updates by the *chinamperos* themselves. By acting as an accessible pedagogical guide, it would

15 Luis Zambrano, Elsa Valiente, and Jake Vander Zanden, "Stable Isotope Variation in an Endemic Aquatic Organism (*Ambystoma mexicanum*) in the Freshwater System of Xochimilco," *Freshwater Biology* 55, no. 5 (2010): 1030–1040.

bridge the gap between ancestral ecology and contemporary conservation.

To translate this knowledge into practice, we recommend developing intergenerational initiatives that bridge elderly *chinamperos* into direct dialogue with local youth, operating at the intersection of ecological restoration and cultural identity. A core component of such knowledge translation efforts should involve using the endangered axolotl as a narrative bridge. By showing youth that the axolotl's survival depends on the specific mud filtration techniques maintained by the *chinamperos*, these educational approaches can reframe agricultural labour as a heroic, climate-adaptive conservation effort. This approach is rooted in the empirical understanding that long-term ecological preservation is impossible without active community ownership and identity formation.



Figure 11. Research team member exchanging perspectives with CBC News reporters while documenting Xochimilco, to understand how local heritage is interpreted and communicate it to international audiences

Methodological Insights and Preliminary Empirical Signals

Our research provided insights regarding knowledge distribution, institutional access, and the gap between official heritage recognition and lived experience.

The realities of agrarian isolation. While Xochimilco holds international designations, the families who farm the *chinampas* live in a daily reality marked by economic precarity, severe water toxicity, and

expanding informal housing. For these primary producers, macro-level international heritage frameworks remain abstract and disconnected from daily survival.

“

While Xochimilco holds international designations, the families who farm the *chinampas* live in a daily reality marked by economic precarity, severe water toxicity, and expanding informal housing.

Deconstructing proximity versus connection. To ground our analysis, we designed and executed field surveys with the general public alongside in-depth interviews with traditional *chinamperos*. This mixed-methods approach highlighted critical nuances in stakeholder categorization. For instance, our surveys revealed a complex local perception of tourism. Older residents acknowledge it as an economic lifeline, noting that “el turismo es una ayuda porque poca gente participa para conservarlo por la cuestión económica” [tourism helps because few people participate in conservation due to economic issues], yet simultaneously recognize that this does not translate to genuine care: people “esperan que el gobierno se haga cargo de ellos” [wait for the government to take care of them]. Conversely, *chinamperos* experience the physical toll of this disconnect, expressing deep frustration with external actors who “llegan a invadir, contaminar y, encima de todo, a imponer” [arrive to invade, to pollute, and on top of that, to impose]. Proximity to the landscape does not automatically make for systemic connection or a commitment to conservation.

Approximately two million tourists engage with the canal network annually. The vast majority of these visitors experience the canals strictly

through commercial tourism on *trajineras* without ever interacting with a *chinampero* or stepping onto an agricultural plot. Crucially, local municipal authorities and commercial tour operators frequently conflate this tourism revenue with environmental conservation, promoting a narrative that simply bringing visitors to the canals financially sustains the heritage site. Our research challenges the assumption of superficial proximity to the water, which often generates pollution from street vendors. It must not be mistaken for active community conservation.

Quantifying the intergenerational knowledge deficit.

Fieldwork confirmed that the tacit knowledge required to sustain *chinampa* farming is concentrated within an aging, shrinking group of practitioners. Our interviews underscored the urgency of this generational deficit. Traditional soil management is being rapidly lost to agrochemicals. As one veteran *chinampero* poignantly explained, “es muy triste ver cómo nuestro suelo se está acabando por medio de fertilizante químico ... las tierras ahora son piedras” [It is very sad to see how our soil is being depleted through chemical fertilizers ... the land has turned to stone].

The spiritual and reciprocal connection to the land is also fracturing among the youth, contrasting sharply with elders who remember that “de la tierra, cuando comenzamos a cosechar, le damos las gracias por darnos de comer” [when we begin to harvest, we give thanks to the earth for giving us food]. Because the current rate of knowledge transmission cannot ensure structural continuity, our research suggests evaluating how symbolic icons like the axolotl can be leveraged. The axolotl is biologically dependent on the natural water filtration provided by active, chemical-free *chinampas*. By explicitly teaching younger generations that saving the beloved axolotl is impossible without preserving the ancestral soil practices of the *chinampero*, future initiatives could build functional, appealing agricultural pathways for the youth.

Diagnostic mapping and mitigation strategies for chinampa regeneration. Rather than relying on simplified visual abstractions, our analysis critically centres on the lived realities of the territory. The long-term success of community-led interventions

faces three deeply entrenched structural barriers, which require specific mitigation strategies:

- *Generational and perceptual rupture:* Our surveys reveal that youth increasingly view the canals as polluted spaces or mere tourist attractions rather than productive agricultural systems. To mitigate this, we recommend implementing targeted, on-site workshops designed to reframe *chinampa* farming not as an obsolete chore, but as a vital tool for sustainable food production and urban climate adaptation.
- *Historical institutional mistrust:* There is profound skepticism among *chinamperos* regarding academic and governmental research, which is widely perceived as an extractive process yielding no local benefits. One *chinampero* passionately criticized past academic interventions, saying that researchers engage in “extractivismo del conocimiento ... llegan, aprenden y llevan a cabo sus proyectos, mientras que la comunidad local no recibe nada” [knowledge extractivism ... they come, learn, and carry out their projects while the local community receives nothing]. To counteract this, we recommend future methodologies to be built on collaborative co-creation, ensuring locals act as co-authors of initiatives like the *Libellus* and retain ownership of their community data.
- *Logistical and geographic friction:* The physical reality of the *chinampa* matrix makes water transport complex. Remote canals are highly vulnerable to shifting weather conditions and the safety risks of navigating traditional wooden boats. Effective mitigation requires structured logistical protocols and the formation of local cooperative partnerships to ensure safe, reliable transport for both agricultural workers and educational outreach programs.



Note: The interview was conducted by the CBC (Canadian Broadcasting Corporation) News team. His guidance and deep commitment to the preservation of this unique heritage continue to inspire this project.

Figure 12. Interview with Jorge Membrillo-Hernandez, notable scientist and passionate advocate for Xochimilco, during fieldwork in the canals

Empirical Validation and Preliminary Outcomes

Despite these structural barriers, initial field tracking validates a viable pathway for respectful, community-centred academic research. The early phases of our research demonstrate that alternative, non-extractive relationships can be established between formal academic institutions and marginalized heritage communities.

This viability is reflected in several key indicators:

- The active engagement of international media platforms such as CBC News demonstrates the broader communicative viability of the project. By documenting the field methodology through the lens of local knowledge, environmental sustainability, and community practice, the coverage helped frame Xochimilco not as an exoticized landscape, but as a living socio-ecological system with global relevance. This framing is reinforced by local voices that emphasize both pride and responsibility toward the territory: “we are living in a World Heritage City ... we need to be proud and look after it.”¹⁶ In this sense, the media coverage does more than provide visibility; it shows that the project can translate the significance of *chinampa* knowledge to international audiences while still centring the people, practices, and territorial relationships that sustain Xochimilco.
- The willingness of traditional *chinamperos* to share sensitive, unwritten agronomic practices despite negative past experiences with external researchers.
- Highly detailed, emotionally invested responses to field surveys from local residents, signalling a deep interest in rigorous, community-led documentation.
- The cooperation of local school administrators and community leaders who provided direct access to youth cohorts, bypassing standard bureaucratic delays.

While the challenging work of building deep trust and demonstrating reciprocity is currently underway, these initial outcomes confirm that a community-centred foundation can support the demanding tasks of knowledge preservation, intergenerational transmission, and systemic policy influence.

16 Jorge Membrillo in “Video on Xochimilco and World Heritage City,” *The Current*, CBC, 18 February 2026. [↗](#)

Empirical Findings, Policy Imperatives, and Strategic Horizons

The UNESCO World Heritage landscape of Xochimilco cannot be treated as a static historical monument. Instead, it functions as a highly dynamic, living social-ecological system. The structural durability of this wetland depends entirely on localized tacit ecological knowledge and traditional engineering techniques transmitted orally across generations.

From a policy design perspective, this fact fundamentally redefines the preservation paradigm: the physical stabilization of the *chinampa* infrastructure is systematically impossible without first addressing the structural and economic vulnerabilities of its human custodians, the *chinamperos*. The empirical field data confirms a state of critical systemic degradation, characterized by four primary structural disruptions.

Spatial Abandonment and Sociological Stigma

Approximately 90 per cent of the *chinampa* area is currently abandoned, a figure that encapsulates decades of systemic neglect, social stigma, and institutional indifference. Historically, a deep social stigma was attached to the work of the *chinampero*, perceived as a humble occupation of low social status. Parents actively encouraged their children to pursue university degrees as a pathway away from the fields. As a result, the ancestral knowledge of water and land management that sustained one of the most sophisticated wetland agricultural systems ever devised by humankind now rests with a small and aging population. Nevertheless, some young people are returning to the land with academic perspectives, seeking to reconcile science with tradition and breathing new hope into the preservation effort.

Biophysical and Toxicological Degradation

Xochimilco's soil and water have undergone drastic and accelerating deterioration. The traditional

chinampa technique of using nutrient-rich mud from the canal bed, known as *chinampeo*, to create seedbeds has been displaced by the widespread use of agrochemicals introduced by external producers. This shift has caused severe soil alkalization and compaction. *Chinamperos* describe the earth as having turned "hard as stone," rendered sterile with constant industrial fertilizers.

Water pollution is equally severe because domestic wastewater discharge and microplastics from tourism activities, including fiberglass kayaks, contaminate the canals and disrupt the biological cycles of native species. The invasive tilapia poses a particularly acute threat, feeding on axolotl eggs and eroding the walls of the *chinampas* by digging nests along their banks.



Figure 13. The delicate aquatic vegetation required to support the axolotl, currently threatened by severe toxicological degradation in the canal network

Tenure Insecurity and Legal Precarity

A vast majority of active *chinamperos* lack formal, notarized property deeds. Instead, they operate under ancestral land allocations, colonial-era royal decrees, or informal verbal agreements passed down within families. This makes them legally vulnerable to unauthorized land occupation (*paracaidismo*) by informal urban settlers and permits external agricultural

actors to use highly polluting, short-term commercial farming techniques.¹⁷ Without secure land tenure, traditional producers lack both the legal protections and the financial incentives required to invest in long-term, low-impact infrastructure restoration.

Extraction Friction

We heard widespread community resentment toward past academic and institutional interventions, a phenomenon the community defines as “knowledge extractivism.” In the past, and still today, external research entities enter the landscape, extract local data to build academic capital or secure institutional funding, and depart without returning tangible benefits, infrastructural investment, or collaborative governance frameworks to the community.

Critical Research Dilemmas and Remaining Questions

To establish a scalable and enduring framework for heritage preservation, public policy must address three primary structural dilemmas.

Dilemma 1: Economic Viability and Market Asymmetries

How can low-impact, traditional *chinampa* agriculture achieve long-term economic sustainability when competing within asymmetric markets dominated by subsidized, high-emission industrial agriculture? Urban consumers frequently misperceive *chinampa* produce as being cultivated in contaminated waters, artificially depressing its market value. Research

must investigate alternative economic models, including short-chain premium logistics, biocultural certifications, and localized circular economy frameworks, to internalize the positive environmental externalities of *chinampa* production.

Dilemma 2: Institutional Integrity and Political Will

Does the political will exist across federal and municipal tiers to regularize land tenure, execute a comprehensive plot-by-plot agricultural census, and fund long-term ecological restoration? Xochimilco is frequently vulnerable to political instrumentalization, serving as a source of local political capital or a destination for short-term public funding diversions that fail to implement structural regulatory reforms or improve local enforcement.



Figure 14. Captive axolotls maintained for conservation, representing the delicate balance between modern scientific intervention and natural habitat preservation

¹⁷ Ivanna Alvarez Sandoval, “Paracaidistas en México: el problema de ocupar una casa abandonada,” *El Imparcial*, 27 de marzo 2026; “La ocupación de viviendas abandonadas, conocida como ‘paracaidismo’, es una práctica extendida en México, especialmente en zonas donde existen miles de casas deshabitadas.”



Figure 15. The critically endangered axolotl, a unique endemic bioindicator whose preservation is of global biomedical and ecological importance

Dilemma 3: Technological Integration Versus Cultural Preservation

To what baseline can modern eco-technologies, such as solar-powered pumping systems, biological micro-wetlands, localized biofilters, and GPS-assisted spatial mapping be integrated into the landscape without degrading its traditional value and cultural substance? The line between technological empowerment and the erosion of intangible cultural heritage is delicate. Policy frameworks must ensure that communities remain at the centre of the co-design process, preventing technological paternalism from displacing functional ancestral systems.

Global Relevance and Broad Policy Implications

The systemic preservation of Xochimilco extends far beyond localized environmental management; it represents a critical case study for international heritage policy and climate adaptation strategies across three distinct dimensions.

Metropolitan climate regulation and carbon sequestration. As a critical urban lung for the densely populated Valley of Mexico, Xochimilco

serves as a primary regional temperature regulator and carbon sink. The total collapse of this lacustrine wetland would trigger a severe cascade across the metropolitan basin, accelerating urban heat island effects, degrading regional air quality, and permanently severing critical biological corridors that sustain regional biodiversity.

Scalable models for sustainable wetland

agriculture. In an era of accelerating global food insecurity and disrupted hydrological regimes, the *chinampa* architecture provides a globally scalable model for high-yield, regenerative food production within sensitive wetland environments. Designated by the FAO as a globally important agricultural heritage system (GIAHS), this infrastructure represents centuries of empirical data on water efficiency and climate resilience that contemporary agricultural sciences require to design adaptive food systems.

Biomedical value of endemic bioindicators. The axolotl serves as both the primary bioindicator of the ecosystem's hydrological health and a critical model organism within global biomedical research. Its unparalleled capacity to regenerate complex tissues, limbs, and vital organs positions the preservation of its natural habitat as a priority for international regenerative medicine, oncology, and neuroscience.

Conclusion and Recommendation: Proposing the *Libellus* Manual as a Model for Global Heritage Preservation

Our findings point to a central conclusion: the disappearance of Xochimilco's culture cannot be prevented through isolated environmental projects, symbolic conservation campaigns, or the documentation of heritage after it has already been lost. What is required is a living mechanism capable of gathering, organizing, transmitting, and continually updating the knowledge that still sustains the territory. Based on these findings, we recommend the development of a resource such as the *Libellus de Conservanda Hereditate Globali Manual* as that mechanism.¹⁸

The name pays homage to the *Libellus de Medicinalibus Indorum Herbis*, also known as the Codex de la Cruz-Badiano. Compiled in Mexico, formerly known as New Spain, more than 500 years ago, the codex documented 224 medicinal plants and is widely regarded as the first Indigenous pharmacopoeia produced in Mexico. By invoking this historical work, the proposed *Libellus* manual seeks to continue its legacy of preserving Indigenous knowledge in written form, while adapting that principle to the contemporary protection of Xochimilco's biocultural heritage.

The *Libellus* would bring together the ecological, agricultural, historical, cultural, legal, and

community-based knowledge documented throughout this study. It would compile ancestral practices that have traditionally been transmitted orally, including the construction and maintenance of *chinampas*, the preparation of *chapines*, native seed preservation, natural pest management, canal care, soil regeneration, and the cultural meanings attached to water, land, food, and the axolotl. It would also incorporate the voices of *chinamperos* and *chinamperas*, elderly knowledge holders, youth, educators, researchers, community organizations, and local institutions. In this way, the manual would not preserve knowledge as a static record of the past, but as a practical resource for its continued use.

Its purpose is to counter the disappearance of Xochimilco's biocultural heritage by addressing one of the most urgent threats we discussed: the interruption of knowledge transmission between generations. By transforming dispersed and vulnerable oral knowledge into an accessible, community-owned pedagogical tool, the *Libellus* can support workshops, school activities, agricultural training, public policy design, and future conservation initiatives. Elderly practitioners would not be treated merely as research subjects, but as authors and guardians of the knowledge contained in the manual, while younger generations would be invited to interpret, practise, and adapt that knowledge to present environmental and social conditions.

We envision this recommended *Libellus* not just as a record, but as a future instrument to build relationships among people who rarely work within the same conservation framework. It would connect local experience with academic research, ancestral agriculture with contemporary ecological science, and cultural identity with practical restoration.

The proposed *Libellus* is not intended to replace the living practice of chinampa agriculture. A written manual cannot substitute for direct learning in the territory, nor can it solve by itself the economic, legal, and environmental pressures confronting Xochimilco. Rather, it is designed to strengthen the conditions under which this living knowledge can survive. Its future implementation must therefore be

18 Martha Eugenia Rodríguez Pérez, "Códice de la Cruz Badiano, el libro sobre plantas medicinales," *Su Médico*, 8 April 2024.

accompanied by intergenerational workshops, secure community ownership of the information, economic support for traditional producers, protection of land tenure, and institutional commitments to restore the chinampa system.

By positioning local practitioners as co-authors and primary decision makers, the *Libellus* would offer an alternative to extractive research and top-down heritage management. It would transform documentation into reciprocity and conservation into a process of shared responsibility. Under this framework, the information collected does not leave the territory as academic capital — it returns to the community in a form that can be taught, revised, expanded, and used.

“

Preserving Xochimilco means preserving the relationships that make the landscape possible: between water and soil, farming and biodiversity, elders and youth, memory and practice, culture and traditions, legal certainty, and feeling of belonging.

For this reason, the envisioned *Libellus de Conservanda Hereditate Globali* Manual may also serve as a model for other living heritage sites confronting similar processes of cultural erosion, ecological degradation, and intergenerational rupture. Its methodology could be adapted to the other World Heritage Cities of Mexico and, more broadly, to UNESCO sites and cities around the world, where heritage depends on the continued practice of local knowledge rather than solely on the preservation of monuments.

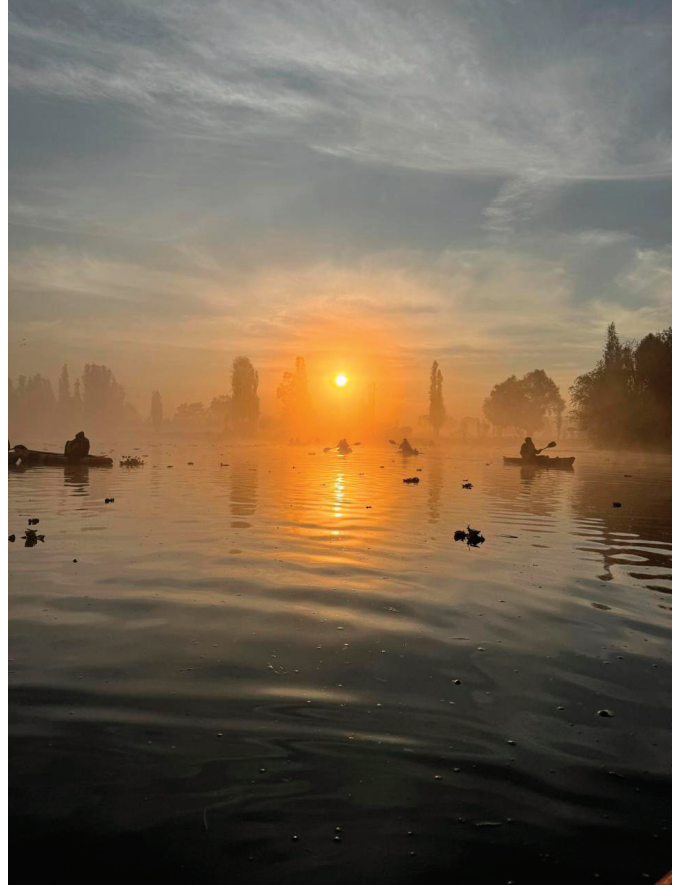


Figure 16. Sunrise over the canals. The landscape remains alive as long as the knowledge and voices of its people continue to flow.

Preserving Xochimilco means preserving the relationships that make the landscape possible: between water and soil, farming and biodiversity, elders and youth, memory and practice, culture and traditions, legal certainty, and feeling of belonging. The *Libellus* would gather these relationships into a shared framework for action. It does not seek to turn Xochimilco into a memory of what once existed, but to help ensure that its culture remains lived, transmitted, and transformed by the communities that continue to sustain it. Ultimately, as the epigraph by Sandra Abigail Franco Ramirez at the beginning of this case reminded us, a floating city does not sink from the weight of time, but from the silence of its people. By anchoring preservation in the agency of the community, this framework ensures that we not only look beyond the landscape but actively amplify the voices that keep the water alive and empower the hands that still cultivate it.

Research Team



Sandra Abigail Franco Ramirez is a dual-degree candidate in law and international relations interested in human rights, geopolitical analysis, and regulatory compliance, systematically translating macro-level legal frameworks into localized community advocacy. As a researcher for the World Resources Institute (WRI) Mexico, she conducted prospective diagnostic studies on metropolitan air quality in Mexico City and water governance mechanisms in Monterrey. She designed a triangular cooperation framework for mangrove conservation in Colombia in collaboration with the Spanish Agency for International Development Cooperation (AECID). She provided pro bono counsel to vulnerable demographics, including migrants and the families of missing persons. She has also served as vice president of the Legal and Political Affairs Commission at the XXXVIII Model OAS General Assembly.



Ana Saraí Espadas Martínez is an undergraduate researcher pursuing a BSc in sustainable development engineering at Tecnológico de Monterrey. Her academic focus centres on sustainable finance, energy markets, and structural environmental strategy. She has engineered decision-support models for electricity market analysis and conducted financial viability evaluations for renewable energy infrastructure projects. She serves as vice president of the Nexus Student Innovation Group, where she directs cross-functional teams to plan and execute sustainability-driven initiatives. Her work consistently targets the intersection of environmental policy and economic analysis to design scalable interventions for resilient urban and energy systems.



Carlos Patricio Heredia Ledezma is an undergraduate researcher and dual-degree candidate in international affairs and law. His academic interests include geopolitical analysis, human rights frameworks, and the structural application of justice. Trilingual in Spanish, English, and Japanese, he brings a robust cross-cultural and comparative perspective to international legal studies. His research specifically investigates the intersection of cultural continuity and environmental conservation, documenting localized narratives and community-driven mechanisms needed to safeguard heritage sites worldwide.



Jennyfer-Lizet Monroy-Saavedra is a medical researcher currently conducting her academic social service at the National Rehabilitation Institute, having completed her undergraduate medical training at the Tecnológico de Monterrey School of Medicine. She is interested in clinical medicine and the social determinants of health. She has contributed to multidisciplinary public health initiatives, supported by organizations such as Disney and Youth Changing the World, that address community well-being through innovative socio-medical

frameworks. A dedicated advocate for systemic equity in healthcare, she previously served as vice president of Women in Surgery and Health (WISH) and actively advances the HeForShe movement. Her research bridges clinical realities with social contexts to develop holistic, community-centric health interventions.



Jorge Membrillo-Hernández is a professor in the School of Engineering and Sciences and a researcher at the Institute for the Future of Education at Tecnológico de Monterrey, Campus Ciudad de México. He earned his PhD in biotechnology from King's College London, followed by postdoctoral fellowships at the University of Sheffield and Harvard Medical School. An internationally recognized authority on Challenge-Based Learning (CBL) and educational innovation in engineering curricula, he investigates the integration of generative artificial intelligence, biomimicry, and competency-based assessment in higher education. Membrillo-Hernández specializes in socially oriented STEM pedagogy, developing frameworks that bridge scientific rigour with sustainable, real-world applications.



Founded in 1943, **Tecnológico de Monterrey** is a private university, made up of 36 campuses in 25 cities across Mexico. It offers 57 undergraduate degree programs — 37 of which are available in English — and 33 master's programs. It is one of only two Mexican universities ranked in the QS World University rankings. Tecnológico de Monterrey hosts a new generation of students: talented, enthusiastic, committed to the development of their environment and the welfare of society; people who have the potential to become leaders with an entrepreneurial spirit, and human sense who are also internationally competitive. <https://tec.mx/es>



Founded in 1827, the **University of Toronto (U of T)** is Canada's leading institution of learning, discovery, and knowledge creation. One of the world's top research-intensive universities, its students learn from and work with pre-eminent thought leaders through a multidisciplinary network of teaching and research faculty, alumni, and partners. Consistently ranked among the top 10 public universities worldwide, U of T has remarkable strengths in disciplines that span the humanities, social sciences, sciences, and the professions. U of T's three campuses host 93,000 undergraduate and graduate students from 159 countries, who are taught by 15,000 faculty. www.utoronto.ca



The Center for Inclusive Growth advances equitable and sustainable economic growth and financial inclusion around the world. The Center leverages the company's core assets and competencies, including data insights, expertise, and technology, while administering the philanthropic Mastercard Impact Fund, to produce independent research, scale global programs, and empower a community of thinkers, leaders, and doers on the front lines of inclusive growth. mastercardcenter.org



Reach Alliance

Published by the Reach Alliance, September 2026
reachalliance.org |  The Reach Alliance |  @reachallianceto