

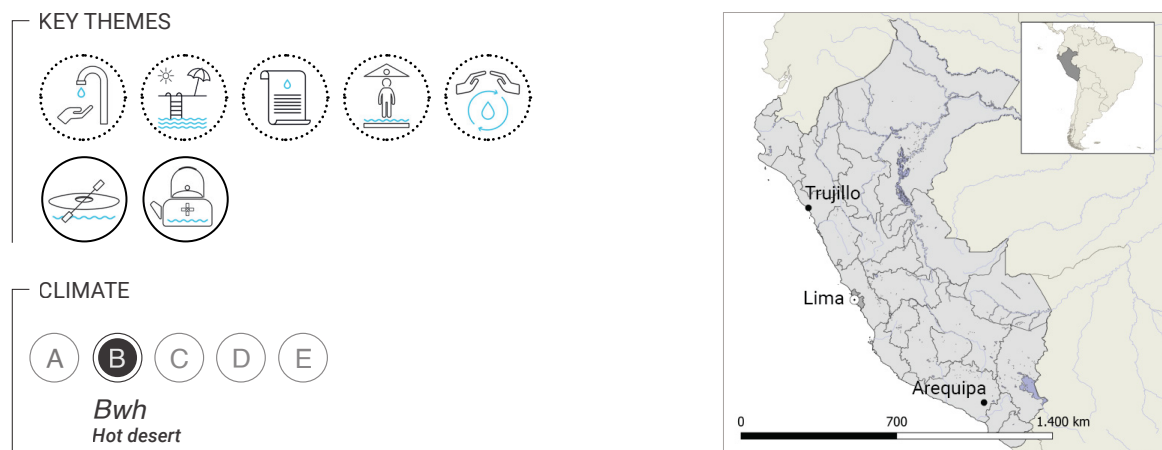


The Canals of Lima: Landscape and Memory

Javier Lizarzaburu

Vrije Universiteit Amsterdam, Heritage and Urban Studies

This article examines the ancient irrigation canals in Lima, the capital of Peru, and it reveals the role of indigenous groups who transformed the desert into agricultural valleys over millennia. The current role of the surviving canals is explained, as is their relevance to the city's environmental sustainability. It discusses aspects related to their management from precolonial times to the present and outlines the key elements of the campaign for their declaration as cultural heritage of Peru, sharing the main results, including the 2019 declaration. It also discusses the work done to decolonize traditional narratives that had obscured the indigenous role in the creation of the canal system.



< Fig.1 Beginning of the route of the Surco canal (Source: Gonzalo Cáceres, published in "Canales de Lima, 2000 años regando vida").



^ Fig. 2 Surco canal running through a park in Lima (Source: Roger Haro, 2018).

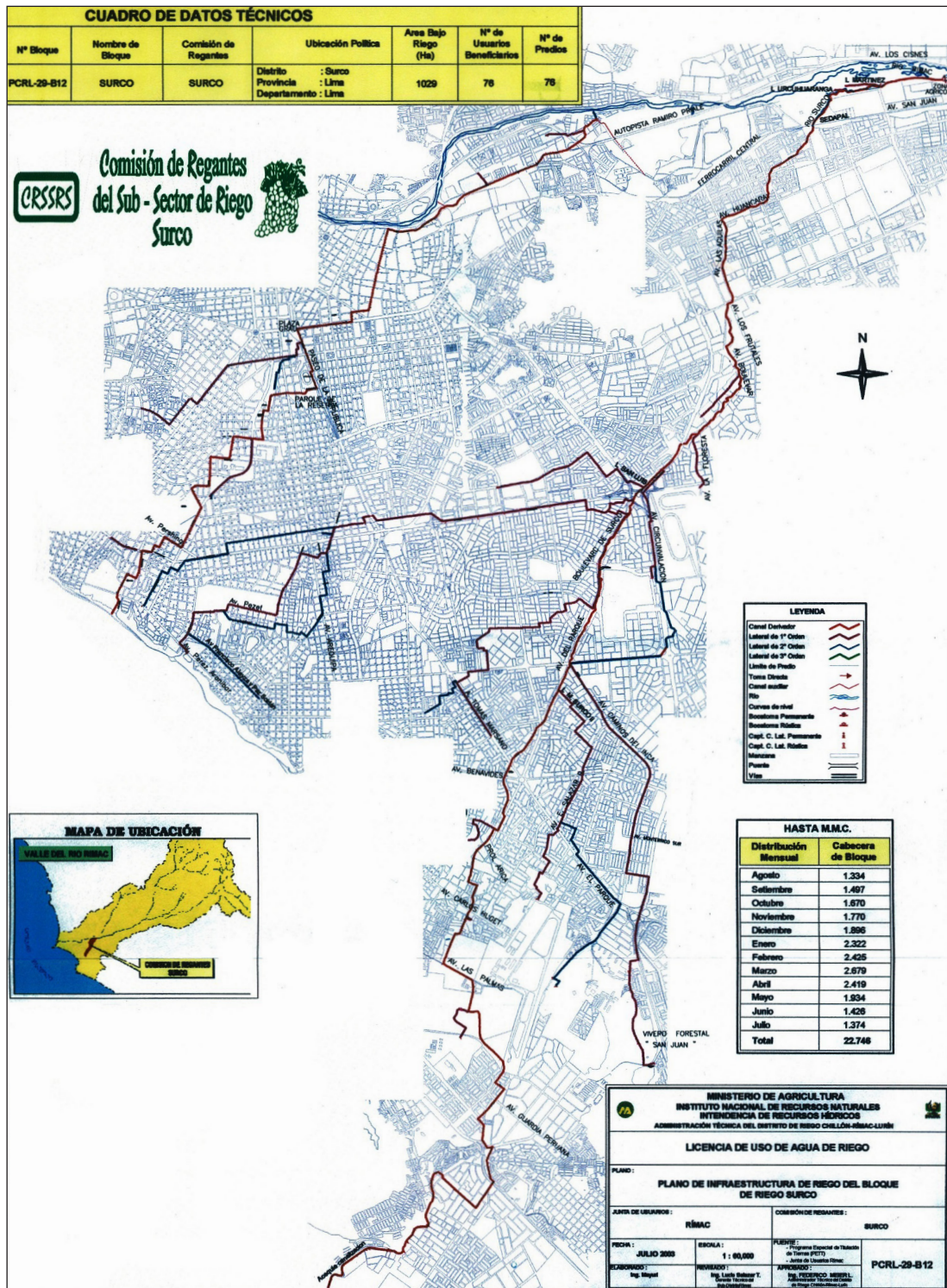
Introduction

The city of Lima sits on cliffs overlooking the Pacific Ocean and is part of the Rimac River basin, a vital source of water supply for human consumption, agriculture and energy, including five hydroelectric power plants. The Rimac River originates on the western slopes of the Andes at an altitude of 5,500 meters, some 130 km from Lima, and flows into the ocean. Even though water availability is limited, the Rimac River meets 90 per cent of the water needs of a population of 11 million people. By way of comparison, the Amazon River, which begins in the mountainous region of southern Peru and makes its way down to the Atlantic basin, has an average annual discharge of 215,000 m³/s. The Rimac's average discharge is 25.8 m³/s (Surco-Huatica Comisión 2016). Archaeological evidence shows that early indigenous cultures began an extensive system of irrigation canals in what is now the Peruvian capital some 2000 years ago. Their main purpose was to irrigate the desert and use the land for agriculture. These waterways were originally built by redirecting sections of the Rimac River and they traditionally provided water for irrigation by flooding, taking advantage of the city's natural slope. Metropolitan Lima reaches an altitude of 850 m, and the two canals under consideration here begin to descend to the ocean at an altitude of 174 m, which roughly corresponds to where the historic center of the city is today (IRA 2015) (fig. 1).

Originally, there were four "mother" or main canals from which multiple other waterways branched off, in varying degrees of importance and size, crisscrossing the territory. The present article focuses on the two main ones: Surco and Huatica, whose area of influence extends over central areas of the capital, home to about one-third of the city's population. All green areas in

the city depend on the canals for their survival, and the canals depend on the flow of the river for their existence. The Peruvian coast is a desert 2,250 km long and Lima, located roughly in the middle, receives an average annual rainfall of 7 mm, which places it in the category of hyper-arid territory. However, a combination of other factors, such as temperate climate, high humidity, an abundant phreatic layer and seasonal green belts contribute to a unique landscape. Two elements that enabled the efficiency and survival of the system over millennia are the progressive slope towards the sea – the route has a descent that varies by one grade per 100 m – and the force of gravity. Today, the Surco and the Huatica canals are managed by an official Water Board and are largely used to irrigate parks and green areas in Lima. The Surco runs for 29.5 km from its source in the Rimac River to the ocean; the Huatica, 15 km. When their main function was agricultural, these mother canals were on average six metres wide and 1.5 m deep, having an additional margin of another six meters on each side (Comisión 2007). Over time, the various indigenous cultures that inhabited Lima continued to expand the system by making new canal branches into existing ones. At the time of their greatest expansion (sixteenth century), they came to cover some 30,000 hectares, which largely corresponds to the total area of present-day metropolitan Lima.

According to Peruvian experts, a distinction must be made between excavating the first canals, which had a limited territorial reach and were not connected to each other (archaeologists have determined that they became connected in Lima around 4000 years ago), and the creation of a hydraulic system or irrigation system, which is the hierarchical organization of these waterways over a large territory (Chalcaltana 2016). Available information points to the fact that this system began in Lima around



^ Fig. 3 Current route map of the two canals (Source: Surco-Huatica Water Board, 2003).

2000 years ago. For his part, architect Juan Günther (2012, 50), elaborated on the type of canals that were created, explaining that:

Building them parallel to the contours of the water level risked causing the water to flow too slowly and silt up the soil it carries on the bottom, forcing the level of the canal to rise gradually until it becomes inoperable (...) On the other hand, building it perpendicular to the contours would have forced the torrent to increase its speed, with the consequence of eroding the bottom of the canal and thus increasing its depth to the point of ruining it as an irrigation feature.

That is a reason why, in Günther's view, the canals were built in a meandering shape and not in straight lines (fig. 2). Arguably one of the greatest achievements of the indigenous cultures here was the transformation of the desert into agricultural land over millennia, a feature that later sustained the local colonial economy. Lima's agricultural landscape remained virtually untouched until the first half of the twentieth century. From the 1950s onwards, the rapid and disorderly growth of the city on former agricultural land led to the destruction of part of the system. As a consequence, the available land watered by the canals was reduced to about 3,000 hectares (Observatorio del Agua 2017). The two canals referred to in this article irrigate 85 per cent of all green areas in central Lima or 1.150 hectares. This is the equivalent of 711 parks in 17 (out of 43) districts where more than three million people live (Comisión 2016) (fig. 3).

History and Evolution

Metropolitan Lima covers an area of about

3,000 km² and is home to 11 million people. Throughout pre-Hispanic or precolonial times, and for some 4,000 years, the territory was home to five cultural groups – the Incas were the last of these. Spanish Lima was founded in 1535 on an already existing indigenous system that included valleys with high agricultural production, roads and canals. Due to the very nature of these waterways, which are still in constant use, precise dating is impossible. In archaeology, therefore, inference is used. A key factor is that most of the abundant adobe architecture that has survived would not have been possible without access to abundant water sources – brought by the canals.

A study by the National Water Authority (ANA) found that the first canal in Lima could date back to 2000 BC, being associated with the ancient temple of "Las Salinas," in the district of El Agustino, next to the Rimac River (Casareto and Perez 2016). But this would have been only a canal and not part of any system of canals. It is only around 200 BC that the civilizations in this part of Peru embarked on a pattern of urban development different from that of earlier times, free from rivers (Canziani 2009). Santiago Agurto, another Peruvian architect, believed that the construction of the early canal system allowed the people of Lima to become independent from the riverbank and to be able to build ceremonial and administrative settlements in the heart of the valley, in wide and flat areas suitable for large urban development (Agurto 1984).

In the absence of written records from precolonial times, little is known in detail about how canals were managed. What is better known is that ancient cultures developed and there is knowledge of the relationships between the communities and their canals. There was a very close relationship between the population dedicated to their crops and the water system.



^ Fig. 4 Ancestral ceremony of the blessing of the canal, carried out by an Andean priestess (Source: Joaquin Narvaez).

This relationship was expressed in the form of dances, songs, rituals and cleansing festivals (fig. 4), some of which have survived in the rural areas outside Lima. In precolonial times, the most common crops were cotton, potatoes, avocados, chilli peppers, beans, sweet potatoes, guavas, pineapples and plums. With the arrival of the Europeans, new crops were introduced, like olives, apples, oranges and sugarcane.

Very early on, the Spanish realized the importance of the canals for their subsistence and one of the first pieces of legislation they passed was aimed at protecting them. During the colonial period, the institution of the Water Judge was introduced to deal with the many legal disputes that would arise (Cerdán y Pontero 1793). Many of the cases had to do with complaints from lowland users who had less access to water because their neighbors, in higher areas,

were using more than they had been allocated. Despite the constant legal conflicts, agriculture remained the primary activity in Lima until the mid-twentieth century. By then, there were some 800 estates and farms (Orrego 2008), all of which continued to benefit from the existing pre-Hispanic irrigation system.

After the 1950s, as the city grew through successive waves of informal settlements – the result of migration from poorer parts of the country – the irrigation system was severely affected. As agriculture gradually disappeared, many of the primary, secondary and tertiary canals were destroyed or incorporated into the sanitation system. As a result, there are only a few green areas in these new urban sectors. With fewer fields to irrigate, the Water Board reduced the width of the canals from six meters to one and a half. This process of unregulated

urban growth revealed a system that was naturally fragile and became a scenario that represents a pattern of inequality in the city. Today, the greener parts of Lima, where the Surco and the Huatica canals survived, correspond to the richer areas. Here, they irrigate most parks, avenues, universities, golf courses and cemeteries (Comisión 2016).

Water Management

The early inhabitants of the territory managed to use this natural resource efficiently and in a sustainable manner. A few reasons help to explain this. One of them is that before the arrival of the Spaniards, the territory of Lima was politically divided into different groups and archaeological work so far has not found evidence of any continuous warfare (Eeckhout 2019; Gaither et al. 2012), a fact that would have affected the distribution of water. Another reason has been revealed by scientific studies that analyzed bones and stable isotopes of people who died in the area before the sixteenth century: they found consistency in the consumption of healthy diets (Marsteller et al. 2017; Williams and Murphy 2013; Béarez et al. 2003). This suggests a period of peaceful coexistence (albeit of indeterminate duration), possibly in the knowledge that their survival depended on the good use of the canals. It is possible there were rules that had to be respected. That is, each group of people knew who received how much water, where, at what time, and for how long. The same principles still apply today. In other words, this situation reflects the political balance of complex societies, whose planning is the result of a process of continual negotiation (Gavazzi 2014).

At the beginning of the twentieth century, the water boards were reorganized and incorpo-

rated into the role of the state. Irrigation Commissions and Water Boards were set up under the Local Water Authority (ALA), the Water Administration Authority (AAA), and the National Water Authority (ANA). The local water board is responsible for the main or mother canal. The Surco-Huatica Water Board is one of 17 such organizations in metropolitan Lima and is the only one serving millions of people. It is made up of 69 users who each pay a rate of 0.10 Peruvian cents per cubic meter of water (US\$ 0.028 approx.). Among its members are local authorities (17 municipal districts for both canals), 10 public institutions (including the city's two main cemeteries), 7 private institutions (including 3 universities and 4 private clubs), as well as a small number of urban farmers.

The most common risk factors for the proper function of the canals along the main Surco canal (the Huatica now runs under the city streets) include those stemming from urban sprawl, encroachment on private and/or public land, waste dumping, illegal use of the waterway and unauthorized diversion of the route (Lizarzaburu 2018) (fig. 5).

The irrigation board organizes an annual cleaning operation twice a year, in February and August, excluding emergencies (overflows, floods, accidents), to allow for the correct flow of water (fig. 6). Although traditionally irrigation was accomplished by flooding, in recent years, more technical irrigation systems are being installed. In other cases, irrigation is carried out with water carts, in which trucks draw water from the canals. When the research on the canals I did for the campaign was initiated, in addition to the risk factors affecting them, some striking data related to the availability and consumption of water in Lima soon came to light:

- Peru ranks number 8 in potential water



^ Fig. 5 Illegal dumping of waste is one of the major problems in functioning of the canals (Source: Javier Lizarzaburu).

availability in the world, with 1.89 per cent of the total (FAO 2013). However, 98 per cent of those resources go directly into the Atlantic basin.

- Most of the population, 66 per cent, lives close to the Pacific basin, where water availability is calculated at 2.2 per cent (ANA).
- The WHO recommends an average water usage of 100 liters per person per day. The average in Lima is 250 lt pp pd (Ministry of Housing 2018).
- The richest districts consume the most in Lima: San Isidro, 477 lt pp pd, and Miraflores, 436 lt pp pd.
- In comparison, in the city of Amsterdam, the average is 133 lt pp pd (Waternet), Paris 143 lt pp pd, down from 151 in 2008 (Statista).

If people were using so much water in a place where there is so little, it seems clear that there was a lack of awareness. Even though the use



^ Fig. 6 Cleaning of the canal (Source: Surco-Huatica Water Board).

and distribution of water is not the responsibility of the water boards, this data together with other developments happening at that time prompted the Surco-Huatica Water Board to rethink their way of working (Lizarzaburu 2021). Additionally, the process of global warming has had its greatest impact here, causing the loss of more than 50 per cent of tropical glaciers, the source of water for the capital, in the last 50 years. And the process continues. In this context, Lima's environmental sustainability depends to a large extent on the proper management of this water infrastructure. Without the canals, green areas are impossible and Lima, with an average of 3 m² pp, already has a serious deficit of those.

In 2015, the Sustainable Development Goals and the New Urban Agenda were launched, and the Surco-Huatica Water Board understood that

this new vision for city, landscape and natural resource management offered new opportunities. Consequently, they decided to incorporate some of the elements suggested by the international agreements. Thus, together with the campaign a vision of a sustainable city was developed, defined by:

- Sustainable management of water resources;
- Protection and enhancement of biodiversity;
- Creation of new, safe, accessible public spaces;
- Promotion of sustainable mobility;
- Recuperation of cultural heritage;
- Support for urban resilience through green areas (Comisión 2017).

Campaign/Decolonizing Heritage

While canals in a country like the Netherlands are part of the national identity, this is not the case in Lima. Here, the dominant narrative had historically obscured their existence as an indigenous creation, popularizing the myth that they were natural rivers. In this way, that narrative became a symbol of an erased memory that began during the colonial period and continued until recently. Originally the canals were a visible part of the urban landscape (fig. 7).

However, in recent decades, and in order to protect them, they were covered (fig. 8). This is the case for the entire length of the Huatica canal and for 21 km of the 29.5 km of the Surco canal. Thus, both continued to disappear from the urban fabric, losing their potential as generators of identity and as a structuring element of an urban space that fosters encounters and the shaping of citizenship.

In 2014, I started researching and writing about

the Lima canals. My proposal for a full-fledged campaign to raise awareness about them was officially approved during an Extraordinary General Assembly of the Irrigation Commission on 29 February 2016. The main and most immediate objective was to secure recognition of the Surco Canal as Peru's Cultural Heritage, to be granted by the Ministry of Culture. Additional objectives included raising awareness about the canals' environmental importance and vulnerability, fostering links between citizens and their canals and green areas, and rehabilitating their indigenous, precolonial origin.

In the eight months that the campaign officially lasted, over 100 stories were published in the press, TV and radio, both in the national and international media. The social media campaign reached over two million people and 25 public meetings were held in citizens' associations, municipal auditoriums and cultural centers. As the campaign expanded, artists, urban and heritage activists and citizens came together in different ways to offer their support, all of which gave further momentum to the petition to have one of the canals declared national heritage.

Process for the Declaration of National Heritage and UNESCO Historic Urban Landscape Approach (HUL)

As part of the process, the Ministry of Culture required a document produced by the petitioners justifying the reasons for requesting such a declaration, which was produced. An advisory board was appointed to ensure academic and professional support, and the members provided advice along the way. Equally, some concepts had to be clarified, one of them the reasons why the canals should be considered heritage. The answer to this was based on the fact that there existed precolonial and colonial



^ Fig. 7 Huatica canal in the 1940s as it went through the city of Lima (Source: Colección Juan Mulder).



^ Fig. 8 Covered canal: the curved paving follows the route of the canal, underneath (Source: Javier Lizarzaburu).

evidence, material and written, showing that it was a pre-Hispanic creation, that over time the system of canals had transformed the desert into valleys, and that despite having survived in a very complex urban environment, they had a definite impact on the environmental sustainability of the city. Along with this, the document incorporated a section on the values that, in the opinion of the petitioning group, were associated with the canals. They included cultural, historical, environmental and territorial values.

In October 2016, the final report was submitted to the ministry. What made the experience unique was the willingness of the authorities to engage in regular contact with the petitioning group in order to advance the request. Despite that initial openness, during the first meetings some officials expressed their reluctance to grant national heritage recognition to the canal. The ministry contended that they only considered the “monumental and extraordinary” to be National Heritage – a view that eventually changed but made the process longer. The first legal argument supporting the request did not manage to convince the authorities.

It was later that the group learned of UNESCO’s 2011 Recommendation on Historic Urban Landscapes (HUL), and how heritage considerations had been adapted precisely in the light of changing urban environments. The group then decided that this approach fitted the case well. Together with the HUL argument, a UNESCO report on Heritage Canals, from 1994,¹ was included in the new document to the ministry. Two and a half years later, in March 2019, Vice-Ministerial Resolution N° 041-2019-VMP-CIC-MC was officially published in which (one of the four segments suggested by the group) was declared to be part of Peru’s National Cultural Heritage (El Peruano 2019).²

Conclusions and Challenges

Although the main objectives of achieving heritage status and raising awareness about the canals were attained, the final result shows progress and setbacks. One of the shortcomings of the campaign is that it did not reach the most problematic areas. This was partly due to the fact the activities that were organized and the information that were produced were mainly disseminated through the media and social media, to which many of the people living in these areas do not have access. Organizing public presentations there to explain the process, as happened in other parts of the city, proved to be a difficult task. Consequently, many of the original problems there continue to exist. At the water management level, some fundamental changes are underway. The main one has to do with Lima’s vulnerability to climate change and its increasing levels of water stress. In the last five decades, over 50 per cent of the glaciers that feed the city have melted, and the process is now unstoppable. At the same time, every year Lima produces 500 million m³ of wastewater. Of this total, 80 million m³ are treated and discharged into the sea (OEFA 2014). On the other hand, the water provided to the city by the Surco and Huatica canals is on average less than 20 million m³ per year (Inventario 2007). So, the organization is now working to achieve a far-reaching transformation. That is, the plan in the medium-to-long term is to stop using water from the river and start using treated wastewater instead, which would be exclusively for parks and green areas. It is an ambitious plan, but it seems there is a new understanding of the future threats and the focus is changing.

At the level of narratives, it was important to make the effort in reclaiming the indigenous memory and identity of the canals, especially in a city where this contribution historically tended

to be minimized or erased. Beyond academia, this narrative of continuity did not exist, so this was the first time an integrated vision was put into the public domain. As part of the production of the book that was later published, more than 120 places watered by the canals, or which were irrigated by them at some point in the past, including parks, archaeological sites and public spaces, were visited. This made it possible to immerse oneself in the different layers created by this system. It's not just the green spaces. It is the variety of species of trees, birds and flowers that have made their habitat in a city where it never rains. They are the places that citizens use for sports, walks, games or wheelchairs. They are the spaces for community, commercial and artistic activities. Without these spaces that exist thanks to the canals, Lima would be less Lima. There are important challenges ahead, but there are also important lessons from the past, which have not lost their relevance.

Acknowledgment

This text is the result of work carried out by the author between 2014 and 2019 on the canals of Lima and the city-wide campaign he led to obtaining official recognition of them as part of Peru's cultural heritage, achieved in 2019. The two pillars of this work were memory and sustainability, and the underlying aim was to restore the canals' indigenous identity. The campaign and the publication of the book were funded by the Surco-Huatica Water Board. This contribution was peer-reviewed. It was edited by members of the editorial team of the UNESCO Chair Water, Ports and Historic Cities: Carola Hein and Matteo D'Agostino.

1. <https://whc.unesco.org/archive/canals94.html>

2. <https://busquedas.elperuano.pe/normaslegales/declaran-patrimonio-cultural-de-la-nacion-al-paisaje-arqueol-resolucion-vice-ministerial-no-041-2019-vmptic-mc-1752226-1/>

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Javier Lizarzaburu is a specialist in communication and heritage and an urban activist and lecturer. In 2022, he obtained a master's degree in heritage and spatial Planning at the Vrije Universiteit, Amsterdam. He started his professional life as a journalist with the BBC in London, where he won more than ten international awards. In his hometown of Lima, he has been an advocate for the protection of the pre-colonial legacy as a way of confronting racism. His interests are decolonization, memory and inclusive cities. He lives in the Netherlands.

Contact: jlizarzaburu.montani@gmail.com