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Exploring the descriptions of World Heritage properties through the perspective of water using a narrative approach

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ABSTRACT

A comprehensive understanding of water systems across space and time is key, both for sustainable urban development and heritage preservation. However, so far, a clear methodology that links the exploration of the past and the protection of heritage properties to the design of the future is still missing. We argue that an exploration of heritage through the lens of water systems using a narrative approach can facilitate the understanding and protection of heritage properties and connect heritage protection to water system thinking. In this research, we established a methodology to collect, code, categorise, and interpret the descriptions of United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage properties created by state members and approved by UNESCO to better understand the role that water systems currently play in the identification and protection of heritage properties. Based on our findings, we argue that adding water to the analysis of heritage can help overcome the ‘culture-nature’ divide. It can also facilitate the systematic thinking necessary for understanding the historic role of heritage properties and facilitating their protection. A water narrative approach can give due recognition to indigenous water narratives in heritage identification and value assessment. We stress the need for a new water awareness and water narrative, considering the input of a wide range of stakeholders to help develop shared strategies for how to identify, treat, utilise, and manage water resources and make them an inherent part of the balanced and sustainable development of historical waterfront cities. The UNESCO Historic Urban Landscape approach and the World Heritage Canopy offer potent tools to tackle current challenges and to emphasise the importance of the new narrative and contribute to its composition.

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Introduction

Cultural heritage is often conceived as isolated objects or structures; yet, the protection of cultural heritage is most successful when properties are embedded in a broader spatial and societal context. The need for systemic embedding of heritage is particularly evident in the context of water systems. Water connects diverse types of buildings and weaves through landscapes. It crosses institutional frameworks and connects cultural practices and people’s spiritual lives. Embracing a systemic approach by exploring heritage in the context of water is especially critical during a time of climate and water-system change. Learning from past wisdom in water management is essential to

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developing new ways of living sustainably with water while protecting our heritage. Connecting heritage to historical and contemporary water systems aligns with the UNESCO Historic Urban Landscape (HUL) approach (UNESCO 2011). Climate change and environmental factors are evident in water-related heritage properties. Such an approach can enrich the World Heritage Canopy (<https://whc.unesco.org/en/canopy/>). We argue that a narrative approach can help achieve a more comprehensive approach to heritage through the lens of water systems. Such an approach can include economic, political, communal, societal and cultural concerns and present a powerful pathway to a sustainable future.

Water systems are key to human well-being and they have been a driver for cultural development. Water systems are also crucial to achieving the UN Sustainable Development Goals (SDGs). SDG 6, the water SDG, aims to promote prosperity while safeguarding the planet by ensuring universal access to water and sanitation (<https://www.un.org/sustainabledevelopment/water-and-sanitation/>). SDG 6 also relates to a more profound theme of humanity coexisting harmoniously with water. The importance of water for human life is reflected in numerous water-related structures for drinking, irrigation, energy production, defence, shipping and leisure as well as in social and cultural practices. People have erected structures in line with the local climate challenges of their time, considering such factors as the distribution of rainfall, snowmelt, river flows and groundwater. Some structures that witness human interaction with water over time are today celebrated as heritage, including being recognized as World Heritage sites.

A comprehensive understanding of water systems in space, society and culture, as well as ways to measure them and prioritise them for protection is still missing. One of the reasons is the absence of shared terminologies, concepts and priorities (Hein 2023). Such an understanding is important today, as knowledge of historical water systems can inform current and future practices, and help protect heritage properties even as they are threatened by water system changes.

To learn from historical water practices systematically, we need to consider water systems and cultural practices in an integrated manner across space and time. We also need such an approach to protect cultural heritage from changing water systems, flooding, drought, and changing amounts of rainfall and ground water levels. We propose that a re-thinking of water as a system by using a narrative approach can facilitate sustainable development and enrich the heritage debate. To better protect cultural heritage, we argue that we need a better awareness of the role of water in relation to heritage as well as a clearer and structured understanding of the multiple intersections between water and heritage. We ask if and how heritage narratives relate to water, and how a water- and system-based approach can help protect heritage at a time of climate change.

To test our hypothesis, we opted to explore the brief descriptions of UNESCO World Heritage properties on the UNESCO World Heritage Centre website to see whether and how they relate to water systems. First, we examined all 513 heritage properties published on the World Heritage Centre website (<https://whc.unesco.org/en/list/>) to identify the descriptions that contain the word 'water'. These short descriptions consist of a brief synthesis, a statement of cultural/natural significance corresponding to the criteria assessing the OUV, authenticity, integrity and protection and management requirements of World Heritage properties in line with the World Heritage Convention adopted by UNESCO in 1972 (UNESCO 1972). For a few short descriptions, the part explaining the OUV, authenticity, integrity, and protection and management requirements is not published. We then identified 195 texts related to water and classified them in terms of 12 types of water connections. Third, we focused on English terminology to understand how the statements of the World Heritage properties recognise different water bodies as integral parts of larger water systems, contributing to the development of water culture in the regions. Additionally, we examined the inclusivity of these properties concerning the types of architecture, structures, and activities related to water, as well as how tangible and intangible heritage are intertwined in the descriptions of water-related heritage.

We argue that a comprehensive understanding of water can contribute to the focus on ‘environment and resilience’ that the World Heritage Centre has identified in the World Heritage Canopy. We stress the imperative of raising a new awareness of water and creating a new narrative to help stakeholders develop shared strategies for how to identify, treat, utilise and manage water resources and make them an inherent part of the balanced and sustainable development of historical cities and landscapes.

Theoretical background: connecting water and heritage

Treaties on water and water management have a long history; heritage protection also has been amply studied. Academics, policy-makers, designers, and the public have perceived the study of ‘water’ and ‘heritage’ as separate, because studies have been conducted by different sectors, informed by different philosophies, scientific disciplines, policy frameworks, and design concepts (Hein et al. 2020). Connecting water and heritage can help to connect cultural heritage, natural heritage and intangible cultural heritage. However, only recently some researchers started to focus on water and heritage (Hein 2019; Pla and Iranzo García 2014; Willems and Van Schaik 2015). The UNESCO World Heritage Centre has begun to take a closer look at humanity’s interaction with water over time regarding water management, so as to uncover the brilliance of the common heritage shared by the world and the potential for future technological advances. The special issue ‘Living with water’ published by the World Heritage Centre in 2011 testifies to this intention of preserving and learning from the past (World Heritage Centre 2011). Other initiatives such as ICOMOS NL (ICOMOS Netherlands 2022) and the UNESCO Chair ‘Water, Ports, and Historic Cities’ (PortCityFutures 2022) have brought the theme to the fore. Such a focus on water and heritage needs to acknowledge diversity, including natural, cultural, and intangible heritage; water-related learning; water landscape history and heritage and water and heritage in terms of climate change (Hein 2023).

To effectively identify and recognise water-related heritage, we should acknowledge structures and activities as an integrated system. The Cultural Landscape of Honghe Hani Rice Terraces is an example. It was listed as a World Heritage Site in 2013 (UNESCO World Heritage Centre 2013) due to its uniqueness as a water system in terms of traditional farming, irrigation, water management and spirituality. The Hani people made use of the water available in the high mountains and built a criss-crossing network of irrigation channels to distribute water from one terrace to another through sills created in the terrace bank walls; they also pursued a fair and rational ‘water distribution system’. Hani people manage water, forests and soils following the principles of ecological sustainability, since they believe that these resources all belong to gods and they are merely guardians of these resources. They perform ceremonies for the gods during the activities associated with the year-round rice cultivation. In this case, the way local people use water connects natural resources and cultural practices, living and production, physical environment and world views. Water practices relate to every aspect of villagers’ daily life and have become a living system as well as heritage defining the Hani culture. Cases of similar complexity in shaping water systems can be found in the Venice lagoon, Amsterdam’s canal belts, and the Iranian Plateau (Bensi 2020). Historically, different types of water relations have complemented each other. People considered natural, cultural and intangible heritage as intertwined. This is why words and narratives matter when studying water heritage.

This holistic approach to water and heritage recognises the inseparable relationship between human societies and water systems, highlighting the significance of water in shaping cultural practices, beliefs, and history. The way people have used water shapes the way we think and is reflected in our language such as in metaphors or proverbs. For example, the word ‘eavesdrop’ today means listening to other people’s conversation.

The language people use to describe water spaces and practices varies depending on what they are thinking about, for example, livelihood, energy or science. Their descriptions of water systems are inseparable from the paradigms that underlie societal choices and approaches to water culture.

For instance, the Ganges River holds immense cultural, religious, and ecological significance in India. When people from India describe the Ganges River, they often use poetic and reverent language to emphasise its spiritual and divine attributes, highlighting its sacred nature and its role in sustaining life and culture. The systematic analysis of water heritage words can help develop ways to conceptualise water heritage and to direct changes and generate strategies to envision and create the future of waterfront cities.

Methodology

We employed a narrative approach to systematically explore the descriptions and words of water and heritage. The narrative approach is a qualitative research method used to explore culture, historical experiences, identity and world views of a narrator or a group of people (Lieblich, Tuval-Mashiach, and Zilber 1998). This approach originated in the social sciences and now is used in many other disciplines including education, healthcare, and the humanities (Creswell and Poth 2016). Narratives can be collected from interviews, observations or documents. The merits of employing a narrative approach in the study of water-related heritage include three that are noteworthy. First, narratives usually provide rich descriptions of themes, and therefore we can easily elicit in-depth data. Second, it is also possible for us to obtain thick meanings from narratives since people who tell the stories usually involuntarily or intentionally reveal their perspectives or standpoints regarding the topics (Savin-Baden and Van Niekerk 2007). Third, narrative studies can help us include heritage properties in a larger story and overcome fragmentation.

To answer the research questions, we established a methodology to collect, code, categorise, and interpret the descriptions created by UNESCO. Our goal was to identify the main ideas and topics in the descriptions, and the need to change them. We started with the interactive map on the World Heritage website, and found that 513 descriptions of World Heritage properties contain the word ‘water’. 325 of them are cultural properties, 161 are natural ones, and 27 are mixed. After meticulously reviewing the descriptions, we identified properties with OUV associated with water. For example, the Budj Bim Cultural Landscape, which boasts an elaborate hydrological engineering system designed to regulate water flow, enabling the trapping, storage, and seasonal harvest of kooyang (*Anguilla australis*, or short-finned eel). This intricate system stands as a remarkable representation of human-environment interaction and serves as a testament to the Gunditjmara way of life. Some descriptions of World Heritage properties mention ‘water’ in the context of integrity, authenticity, or management and protection requirements. For instance, the description of ‘State Historical and Cultural Park “Ancient Merv”’ mentions ‘water’ in relation to ‘underground water levels rising’ and posing a potential threat to the property’s current condition. However, the description does not explicitly elaborate on the connection between water and the heritage values of the site.

Some of these properties, whose descriptions contain the word ‘water’, possess water-related OUV that can be substantiated by at least one if not multiple criteria (UNESCO 2021). For instance, Criterion 1, which pertains to properties representing a masterpiece of human creative genius, is exemplified by ‘Mines of Rammelsberg, Historic Town of Goslar and Upper Harz Water Management System’. This property stands as an exceptional example of human ingenuity in mining techniques and industrial water-management. Criterion 2, concerning the interchange of human values over time or within a cultural area, is demonstrated by ‘The 20th-Century Architecture of Frank Lloyd Wright’, specifically through the house ‘Fallingwater’. This architectural masterpiece significantly influenced global discourse on architecture during the first half of the twentieth century. The relation to water is embedded in the name of the building, which is located above a waterfall. Moreover, Criterion 3, emphasising the importance of exceptional testimony to a cultural tradition or civilisation, finds support in the ‘Cultural Landscape of Bali Province’. The water temples within this landscape are vital to the subak system’s water management. They play

a central role in maintaining a harmonious connection between the natural and spiritual realms through a rich array of rituals, offerings, and artistic performances.

After exploring the interactive map and reading the descriptions that include the word ‘water’ explicitly, we understand that water can be related to several criteria that testify to its OUV. We read all the 513 descriptions containing the word ‘water’ to develop a list of water-related properties from different periods and regions. Simultaneously, we also sorted the properties into categories that collectively form historical water systems. Through this comprehensive approach, we sought to understand and showcase the multifaceted role of water in shaping heritage and its diverse implications across various contexts. Since there is no existing model or theory on which to base our inquiry into water-related heritage to generate a list of coding categories, we employed the constant comparative method (Glaser and Strauss 1967) to generate our own coding tree (Figure 1). This coding tree was developed basically following the two conventions, i.e. the World Heritage Convention of 1972 (UNESCO 1972) and the 2003 Convention, which defines intangible cultural heritage (UNESCO 2003). The first layer of the branch includes three main categories, tangible cultural heritage, intangible cultural heritage, and water at landscape scale. By reading and re-reading the descriptions, and giving descriptive codes to different segments of data, we identified important concepts, incidents, or themes, and finally determined 12 categories at the second layer of the branch.

Following the initial scan of the 513 descriptions and the development of 12 categories based on the constant comparative method, we have identified 195 World Heritage properties as particularly

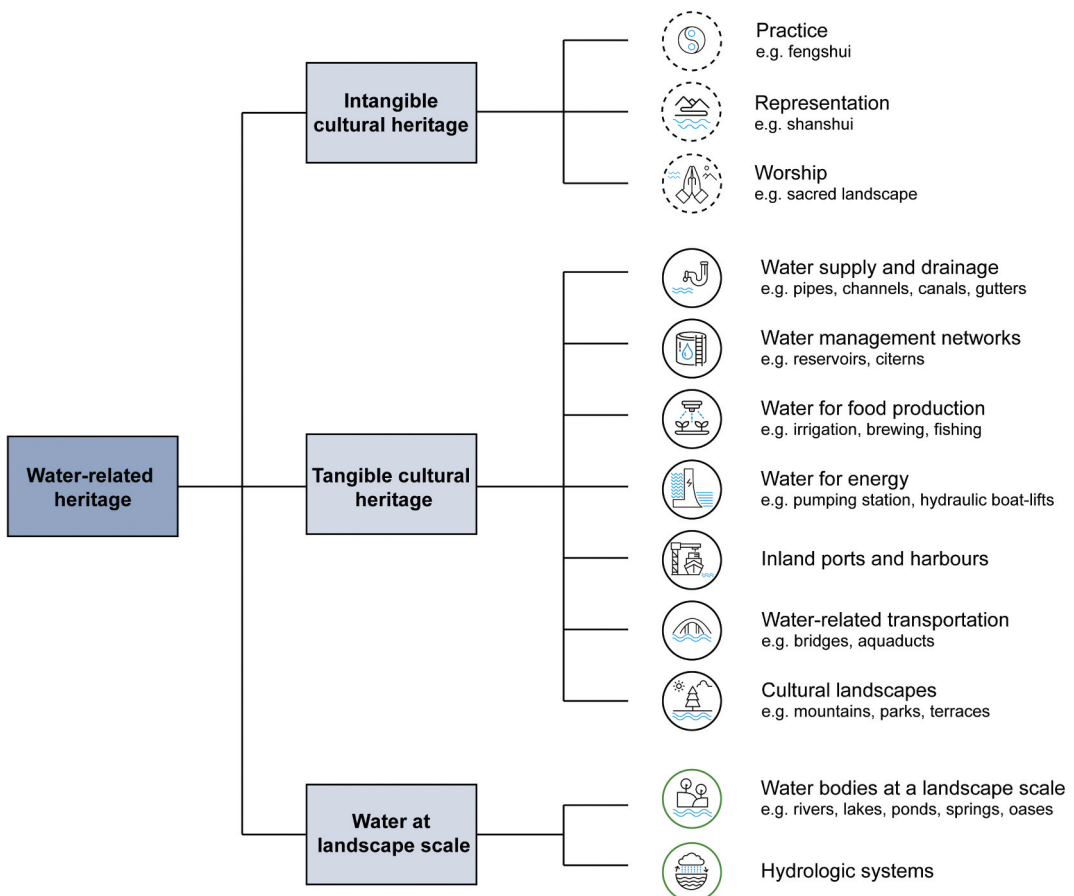


Figure 1. The coding tree for categorising water and heritage.

relevant to exploring the relationship between water and heritage; these include ones with natural features, structures, properties, or practices related to water through a lens of culture. Apart from the 195 properties, there are 280 properties that are spatially connected to water, whether located next to a river, coastline, or located in a sea/ocean as an island or archipelago. However, water is not utilised in the descriptions of these properties as evidence of their OUV. Hence, we decided not to include them in the list of water heritage in the current study. We emphasise that this is merely an endeavour to compile a list of properties that demonstrate the significance of water in World Heritage identification and value assessment. It is important to note that this list may not be exhaustive: there may be additional properties worthy of consideration. However, we view this compilation as a starting point to initiate and encourage further scholarly discussion and debate on the subject. Such categorisation can be particularly helpful in contextualising water-related properties within larger water systems, enabling a deeper understanding of the intricate connections between water systems and cultural heritage, and ultimately leading to better ways to protect them.

Table 1 provides examples from the World Heritage list for the 12 categories we developed. Among these 12 categories, the largest group of World Heritage properties that include water-related features is 'water bodies at a landscape scale' (Figure 2). These water bodies include both natural features and cultural elements, such as wetlands, oases, river valleys, waterfalls, spring water, and canals. One of the representative properties is 'Willandra Lakes Region', the drying of which around 18,500 years BP preserved remarkable evidence of early human-environment interactions, including freshwater resource exploitation, offering exceptional testimony to Pleistocene human development. The second-largest group referred to 'water management'. The representative property is 'Water Management System of Augsburg', consisting of a network of canals, water towers that housed pumping machinery, a water-cooled butchers' hall and a system of three monumental fountains and hydroelectric power stations, which continue to provide sustainable energy today. The group of 'cultural landscapes' came in as the third largest; the English Lake District is an example.

Due to the complexity of water and heritage systems, some properties can be classified in multiple categories simultaneously. To address this, we assigned such cases to their two most prominent characteristics related to water spaces and culture, counting them as half cases in both groups to avoid double-counting. For example, the Honghe Hani rice terraces were categorised as half a case in the group of water management and half a case in the group of cultural landscapes shaped by water, highlighting their two most representative features.

We established a few preliminary findings based on the analysis of all 195 descriptions of the heritage properties containing water-related features. (Figure 3) illustrates the number of these heritage properties compared to that of World Heritage properties in each region. Asia takes the lead regarding the proportion of water-related heritage, followed by North America, Europe, South America, Africa, and Oceania. Despite Europe having the largest number of World Heritage properties ($N = 486$), water heritage in this region is currently under-represented.

Within these regions, there were a few countries holding a large number of water heritage properties (Figure 4). In Asia, China hosts twenty-two water-related heritage properties, surpassing all other countries in the region and the world. The Islamic Republic of Iran came second, with eleven properties. India stood third in this region, holding eight properties. In Europe, France held twelve properties, Spain held nine, Germany held seven, and Italy held six. In North America, Mexico, outdistancing all other countries, boasted ten properties. These numbers raise interesting questions about the factors that contribute to certain countries holding a prominent number of such properties. It also invites future exploration into the role of local policies, community engagement, and international collaboration in the recognition and conservation of water-related heritage properties in diverse regions and nations.

Based on a preliminary analysis of the criteria that the OUV of water heritage properties met (Figure 5), Criterion 1,2 and 3, the three criteria for cultural heritage, were used most frequently to testify the OUV of water heritage properties. These three criteria are frequently employed in combination or are considered in various combinations to substantiate the OUV of water heritage,

Table 1. Proposal for twelve categories of water heritage with examples from World Heritage (source: Authors).

Number	Category	Example	Reason
1.	Practice	Site of Xanadu (https://whc.unesco.org/en/list/1389/)	The site was planned according to traditional Chinese <i>feng shui</i> ¹ in relation to the nearby mountains and river.
2.	Representation	Takht-e Soleyman (https://whc.unesco.org/en/list/1077/)	The site has strong symbolic and spiritual significance related to fire and water – the principal reason for its occupation from ancient times – and stands as an exceptional testimony of the continuation of a cult related to fire and water over a period of some 2,500 years.
3.	Worship	Great Burkhan Khaldun Mountain and its surrounding sacred landscape (https://whc.unesco.org/en/list/1440/)	Burkhan Khaldun is associated with the worship of sacred mountains, rivers and ovoids (shamanic rock cairns), in which ceremonies have been shaped by a fusion of ancient shamanic and Buddhist practices.
4.	Water supply and drainage	Old Town of Lijiang (https://whc.unesco.org/en/list/811/)	Lijiang possesses an ancient water-supply system of great complexity and ingenuity that still functions effectively today
5.	Water management	Water Management System of Augsburg (https://whc.unesco.org/en/list/1580/)	The Water Management System of Augsburg includes a network of canals, water towers, which housed pumping machinery, a water-cooled butchers' hall, a system of three monumental fountains and hydroelectric power stations, which continue to provide sustainable energy today.
6.	Water for food production	Champagne Hillsides, Houses and Cellars (https://whc.unesco.org/en/list/1465/)	The property encompasses properties where the method of producing sparkling wines was developed on the principle of secondary fermentation in the bottle since the early seventeenth century to its early industrialisation in the nineteenth century
7.	Water for energy	The Four Lifts on the Canal du Centre and their Environs, La Louvière and Le Roeulx (Hainaut) (https://whc.unesco.org/en/list/856/)	The four hydraulic boat-lifts on this short stretch of the historic Canal du Centre are industrial monuments of the highest quality.
8.	Inland ports and harbours	Historic Monuments Zone of Tlacotalpan (https://whc.unesco.org/en/list/862/)	Tlacotalpan was a Spanish colonial river port on the Gulf coast of Mexico, founded in the mid-sixteenth century.
9.	Water-related transportation	Ironbridge Gorge (https://whc.unesco.org/en/list/371/)	Ironbridge is the world's first bridge constructed of iron, had a considerable influence on developments in the fields of technology and architecture
10.	Cultural landscapes	The English Lake District (https://whc.unesco.org/en/list/422/)	The combined work of nature and human activity has produced a harmonious landscape in which the mountains are mirrored in the lakes
11.	Water bodies at a landscape scale	Rideau Canal (https://whc.unesco.org/en/list/1221/)	Rideau Canal is the best-preserved example of a slackwater canal in North America, demonstrating the use of this European technology on a large scale.
12.	Hydrologic systems	Laponian Area (https://whc.unesco.org/en/list/774/)	Historical and ongoing geological processes in this area can be seen in the glacial moraines and changing water courses.

encompassing aspects related to water bodies at a landscape scale and to cultural landscapes. For instance, the Classical Gardens of Suzhou, categorised as 'water bodies at a landscape scale', exemplify OUV meeting Criteria 2,3 and 4. Water, as a fundamental element in these gardens, played a pivotal role in their planning, design, and construction, leaving a lasting artistic impact on landscaping in China and worldwide, supporting Criterion 2. The water elements within the

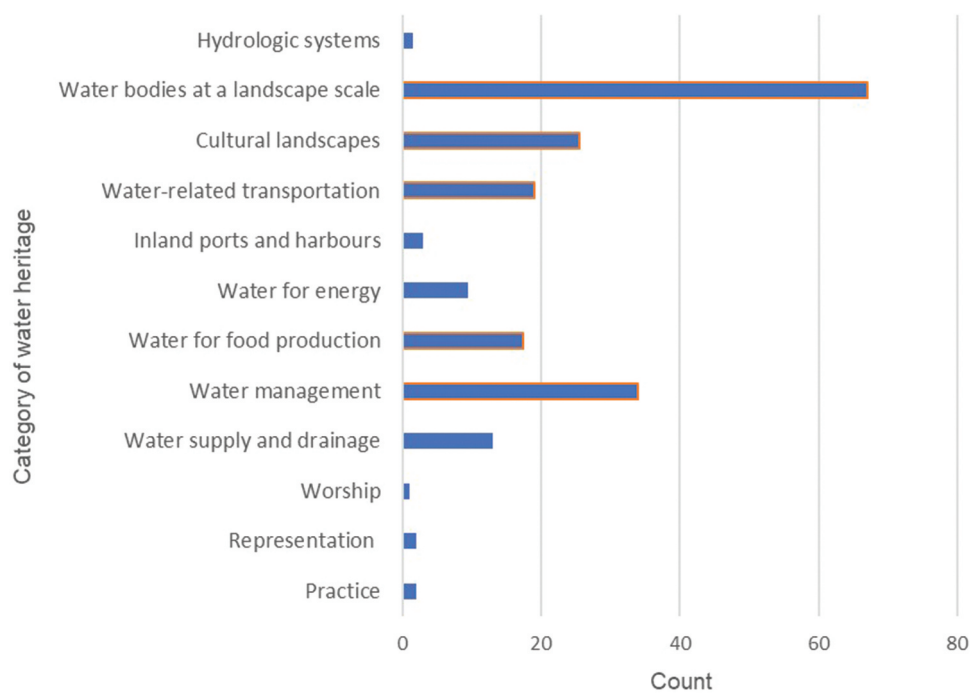


Figure 2. Twelve categories of water heritage, with the count of properties in each category (bars with orange outlines are the five largest categories).

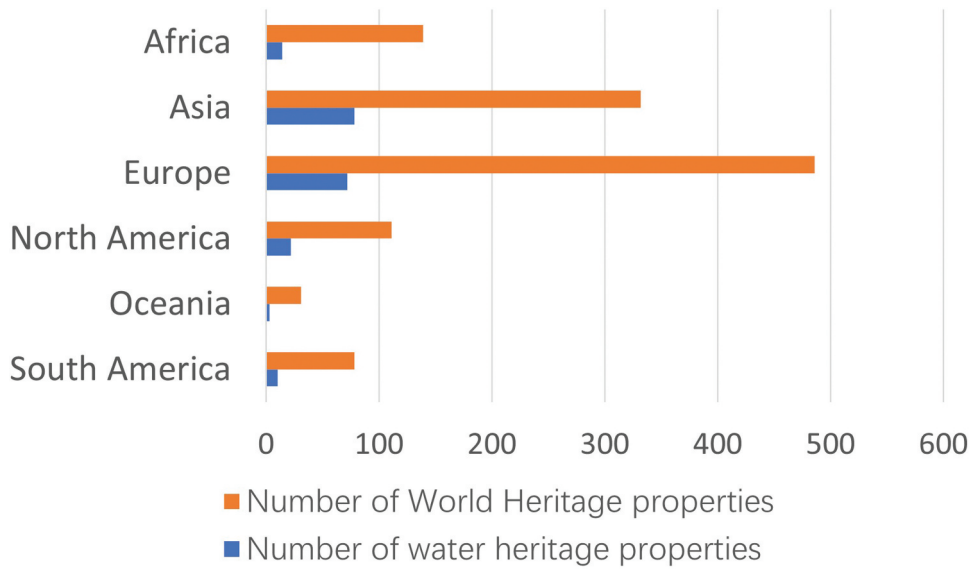


Figure 3. The number of water heritage properties compared to the number of World Heritage properties in each region.

gardens also embody the wisdom and traditions of ancient Chinese intellectuals' harmonisation with nature and self-cultivation, attesting to Criterion 3. Furthermore, the integration of water symbolism in architecture, gardening, and handcrafts reflects significant achievements in social, cultural, scientific, and technological advancements from the eleventh to nineteenth centuries, confirming Criterion 4.

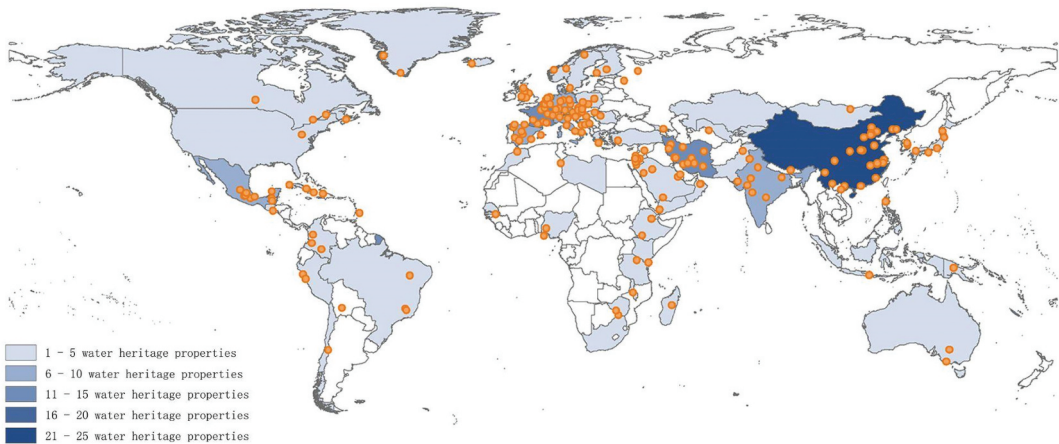


Figure 4. The location of water heritage properties around the world (different shades of blue represent the number of water heritage properties located in each country; the exact locations of water heritage properties are represented by orange dots on the map).

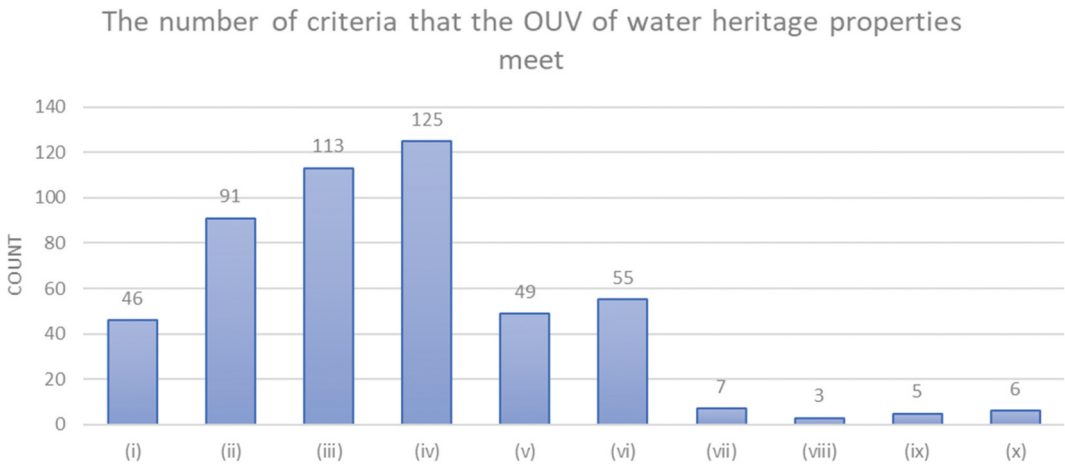


Figure 5. The number of criteria met by the OUV of water heritage properties.

For a property to be listed as a World Heritage Site, it must possess OUV and meet one or more of the criteria assessing this value. The statements testifying the OUV of every World Heritage Site are the key contents explaining why a site is qualified to be listed. Therefore, following the preliminary analysis of the entire list of water and heritage, we continued the narrative analysis by doing a close reading of the OUV statements in the descriptions in each group to check how the connections between the properties and the water systems were reflected in testified OUVs of the properties. The entire process of data analysis is illustrated in (Figure 6).

To get a better understanding of narrative attached to the selected World Heritage properties as shown in the description, and the role of water therein, and in order to make recommendations for an overarching narrative that can support the World Heritage Canopy, we chose to conduct a word/phrase frequency analysis and a text network analysis on the five largest categories that are highlighted by orange frames in (Figure 2). The objective was to understand the role of water in testifying the

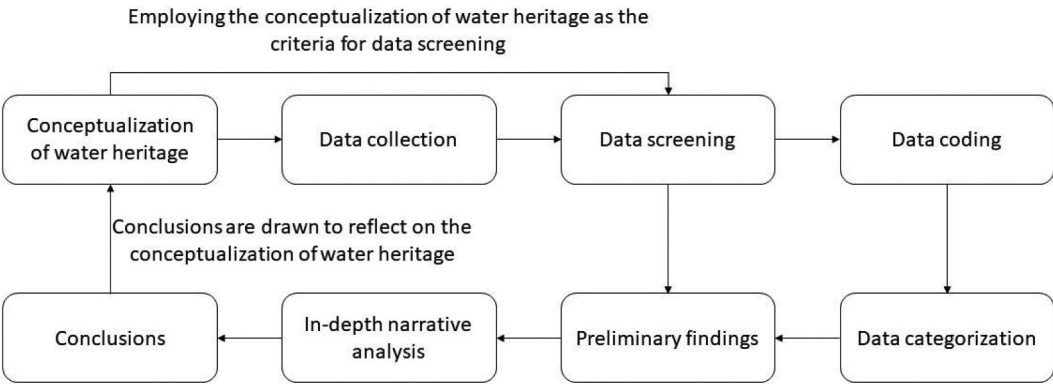


Figure 6. Process of data analysis.

heritage values of these properties. The word/phrase frequency analysis was to find the most frequently used words/phrases in a corpus. The top 50 frequently used words/phrases within the OUV statements of each group were listed in Table 2. By comparatively checking the words in the five columns in Table 2 together, we saw some words recur in multiple columns or even in every column, for instance: ‘archaeological site/landscape/ensemble/park’ and ‘cultural landscape’. This was not very surprising since these two kinds of heritage properties were always large in scale and could easily encompass multiple heritage types within the protection areas. The recurring words also imply that heritage within different categories overlaps in tangible form.

The text network analysis with the aid of a web-based open-source tool (Paranyushkin 2019) was conducted to encode the relationships between words in a text and construct a network of the linked words (Popping 1999). Each group of descriptions were represented as a network graph, with the words being the nodes and their co-occurrences being the edges. The analysis process was divided into five steps: 1) The auxiliary words were removed using tf-idf models. 2) The remaining words were transformed into lemmas to avoid redundancy. 3) Two consecutive scans were performed to realise the conversion from text to network. The first scan created the connections between the lemmas that appear next to each other. The second scan employed a window of four lemmas (e.g. [multiple fundamental research laboratory] and [fundamental research laboratory base] and [research laboratory base USA]) to add a second layer of connections. All the connections were encoded as edges on a directed text graph and were assigned the proper weight. 4) A ranking algorithm was applied to identify the words that appear most often on the shortest paths between any two randomly chosen nodes in the network (Brandes 2001; Freeman 1977). These words play central roles in meaning circulation and are shown bigger on the network graphs. 5) The community detection algorithm was then applied (Blondel et al. 2008; Fortunato 2010) to detect the groups of nodes that are more densely connected with one another than with the rest of the network. Then the topical clusters were obtained and represented in the graphs in distinct colours. The network graphs representing the topical structures and main topics extracted from the descriptions of the five largest groups are respectively shown in (Figures 7–11).

Findings

Based on the results of narrative analysis as shown in each column in Table 2 and in each graph in (Figures 7–11), we identified which kinds of heritage properties or traditions are most commonly recognised within each water heritage group, the narratives that are delivered or not in each group and the role played by water.

Table 2. The top 50 words frequently used in the OUV statements of the five largest groups of properties water heritage properties (source: Authors).

Group 11. Water bodies at a landscape scale (Number of properties = 67)	Group 5. Water management (Number of properties = 34)	Group 10. Cultural landscapes (Number of properties = 25.5)	Group 9. Water-related transportation (Number of properties = 19)	Group 6. Water for food production (Number of properties = 17.5)
Criteria	Criteria	Landscape	Criteria	Criteria
Criteria iii	Criteria iii	Criteria	Outstanding example	Persian garden
Criteria ii	Architecture	Cultural landscape	Exceptional example	Criteria iii
Outstanding example	Outstanding example	Criteria iii	Great wall	Outstanding example
Property	Water management	Outstanding example	Qanat system	Beaune
Exceptional testimony	Property	Cultural tradition	Route of santiago	Lavaux vineyard landscape
Cultural tradition	Management system	English lake district	Centre of avignon	Town of dijon
Exceptional example	Exceptional testimony	Exceptional testimony	Santiago de compostela	Rice terrace
Mount Taishan	Water management system	eighteenth century	Historic centre	Cuicatlán valley
Pimachiowin aki	Cultural landscape	Natural landscape	Exceptional testimony	Archaeological site
Cultural landscape	Mining region	West lake	nineteenth century	Nalanda mahavihara
nineteenth century	Imperial palace	Mount Wutai	Dujiangyan irrigation system	Jurisdiction of saint
Grand canal	Archaeological site	nineteenth century	Coalbrookdale blast furnace	Human creative genius
Sacred mountain	Town of Goslar	Human interaction	City of medina	Important protected area
twentieth century	Historic town	Human settlement	San Miguel de	eighteenth century
Natural landscape	Far region	Water temple	Miguel de Allende	Garden design
Royal tomb	Eurasian continent	Budj bim cultural (landscape)	Persian qanat system	Valued wine
Khangchendzonga national park	Middle age	(budj) bim cultural landscape	Creative genius	Bronze age
Many century	Cultural tradition	Religious system	Ancient China	Management system
Kii mountain	Sassanid archaeological landscape	Landscape design	Medina azahara	Daily life
Centennial hall	Stone terrace	twelfth century	Ottoman empire	Eloquent testimony
Characteristics example	Historic mining network	Beemster polder	Modern period	Viticultural territory
Ganawendamang gidakiiminaan	Region of Erzgebirge	Harmonious beauty	Cultural tradition	Indian subcontinent
Important interchange	Pavagadh archaeological park	twentieth century	Zhoukoudian site	Exceptional way
Tikal national park	Upper Harz water	Conservation initiative	sixteenth century	Cultural region
Garden of Suzhou	Water resources	Water management	Archaeological ensemble	Burgundy climates
Garden of Padua	Mill network	West lake landscape	Royal mint	Natural resources
Hill of Ambohimganga	Traditional human settlement	Work of art	Iberian peninsula	Chahar bagh
Citadel of thang	Rock art	White deer cave	North america	Mediaeval norse
Ngorongoro conservation area	Mining town	Tri hita karana	Urban layout	Eastern Cuba
Late mediaeval period	Hostile environment	Distinctive cultural landscape	Iron bridge	Assembly ground
Human creative genius	Beemster polder	Value of landscape	Forth bridge	Urban settlement
Royal hill	Cuicatlán valley	Form of fujisan	Ironbridge gorge	Saint milion
Profound influence	Human history	Kingdom of Dessau	Ouro preto	South Asia

(Continued)

Table 2. (Continued).

Group 11. Water bodies at a landscape scale (Number of properties = 67)	Group 5. Water management (Number of properties = 34)	Group 10. Cultural landscapes (Number of properties = 25.5)	Group 9. Water-related transportation (Number of properties = 19)	Group 6. Water for food production (Number of properties = 17.5)
Mapungubwe cultural landscape	Field of mining	Breed of sheep	Modern time	Archaeological evidence
Landscape design	Number of monument	Valtice cultural landscape	Doctrine of saint	Choice of flora
Great temple	Umm al amad	Important role	City of Ouro	Floor of st
Irreversible change	Centre of camaguey	Ancient time	Exchange of influence	Edifice of power
Botanical garden	Landscape of far	Social rules	Antônio francisco lisboa	Type of garden
Present day	Exchange of ideas	Solitary strato	Whole production chain	Early mediaeval India
Large scale	16th century ad	Majestic form	Contemporary european art	Ancient holy books
Joseon dynasty	Mine of Rammelsberg	Rock art	Century industrial revolution	Preserved earthen architecture
Imperial citadel	Important protected area	Natural environment	Pattern of Ouro	Major historical period
Willandra lake	City of medina	Romantic engagement	Section of fortification	Period of time
Year bp	Early Islamic time	Zhu xi	Development of techniques	Historic vineyard landscape
Ruins of palmyra	Public water supplies	Perfect form	Array of monument	Important cultural tradition
Yangtze delta region	Dry stone terrace	Outstanding significance	Foundation of Taoism	Modern university establishment
City of Graz	(water management) system of Augsburg	Great beauty	Coexistence of community	Infertile chalky soil
Ancient Chinese intellectual	Konso cultural landscape	Tramuntana area	Distance land travel	Rich vernacular tradition
Short grass plain	Unique artistic achievement	Religious believes	Area of Europe	Middle eastern population

Reflection on water bodies at landscape scale

In Group 5 ‘water bodies at a landscape scale’, as shown in Table 2 Column 1, the most common properties are mountains, canals, tombs, cultural landscapes, national parks, halls, gardens, hills, citadels, temples, lakes, and delta regions. Among these property types, mountains, canals, cultural landscapes, national parks, hills, lakes, and delta regions are contained by or directly connected to water bodies. The tombs, halls, gardens, citadels, and temples are built structures that include water either as a part of the landscape design, or as drinking and bathing water.

(Figures 7(a–d)) show the main clusters of keywords that can be identified in the texts within this category. The connected keywords shown in (Figure 7(a)) illustrate that, at the landscape scale, water heritage reflects important cultural, artistic, and religious elements, forming an intricate tapestry of tradition and natural significance. (Figure 7(c)) presents the three criteria most commonly and simultaneously used in testifying this kind of heritage property. It implies that heritage within this category often exhibits significant human values and developments in architecture, technology, arts, and town planning, while also bearing exceptional testimony to cultural traditions and civilisations of the past or present, representing important stages in human history. (Figure 7(d)) shows this exceptional and unique kind of water heritage property can include a diverse array of species, which can often be found in some large parks connecting natural and cultural aspects. Despite our findings, the text

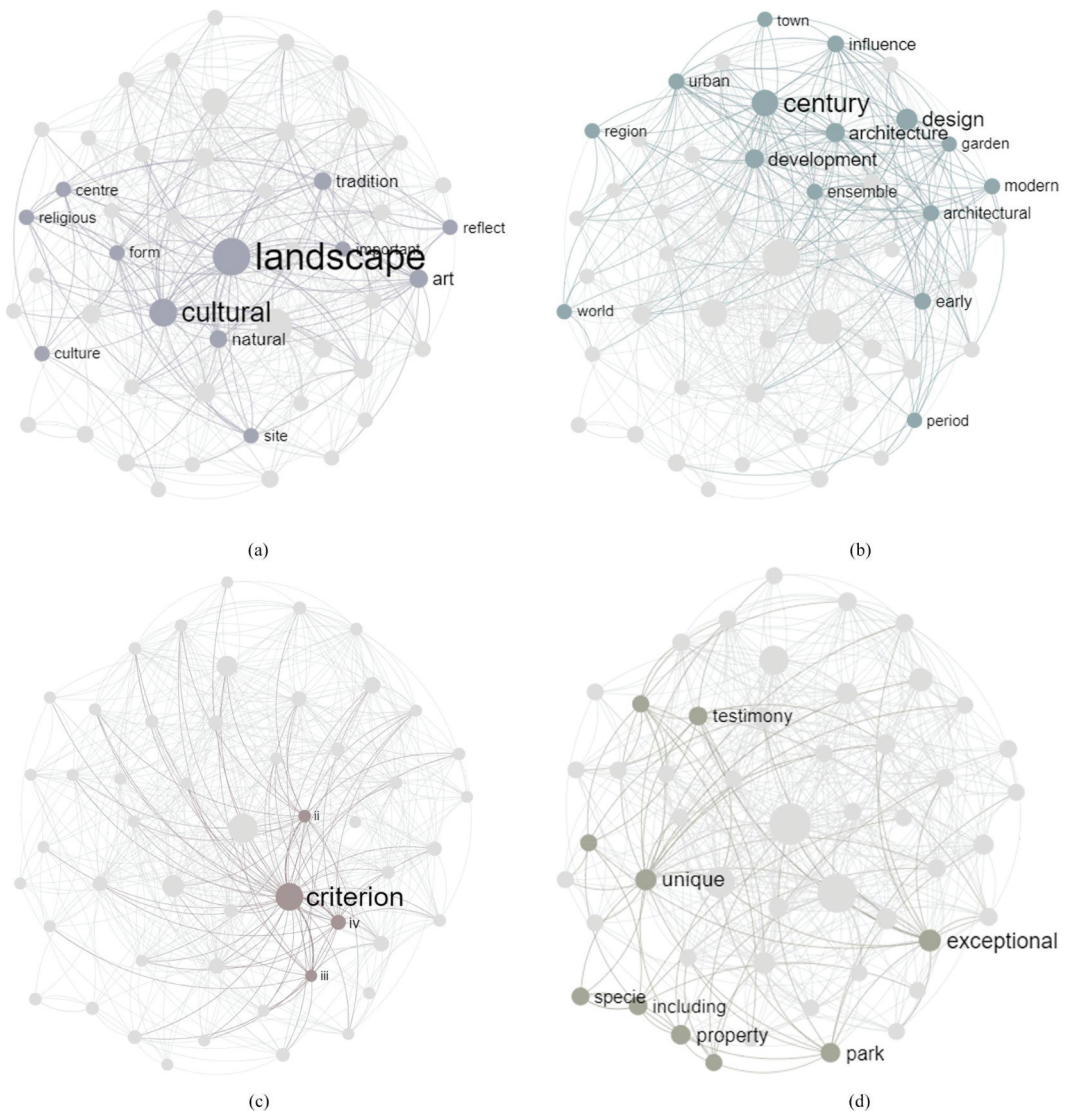


Figure 7. Text network analysis reveals four keyword clusters in heritage descriptions related to ‘water bodies at a landscape scale’, highlighting the significance of water heritage in terms of cultural, artistic, and religious elements; common criteria for testifying water heritage and exceptional properties exemplifying large parks with diverse species.

analysis graphs lack the presence of the word ‘water’ or any related terms concerning water bodies and systems, indicating a lack of systematic consideration of water at the landscape scale in these descriptions of water heritage.

Recognition of water management systems for sustainable development

In Group 9 ‘Water management’, as shown in the second column in Table 2, the most frequently mentioned property types include mills, polders, terraces, and urban public water management systems. Examples include the urban water landscape in Augsburg, Germany (<https://whc.unesco.org/en/list/1580/>), and historical water management systems in palaces, for instance, the one preserved in the Summer Palace in Beijing (<https://whc.unesco.org/en/list/880/>). Water

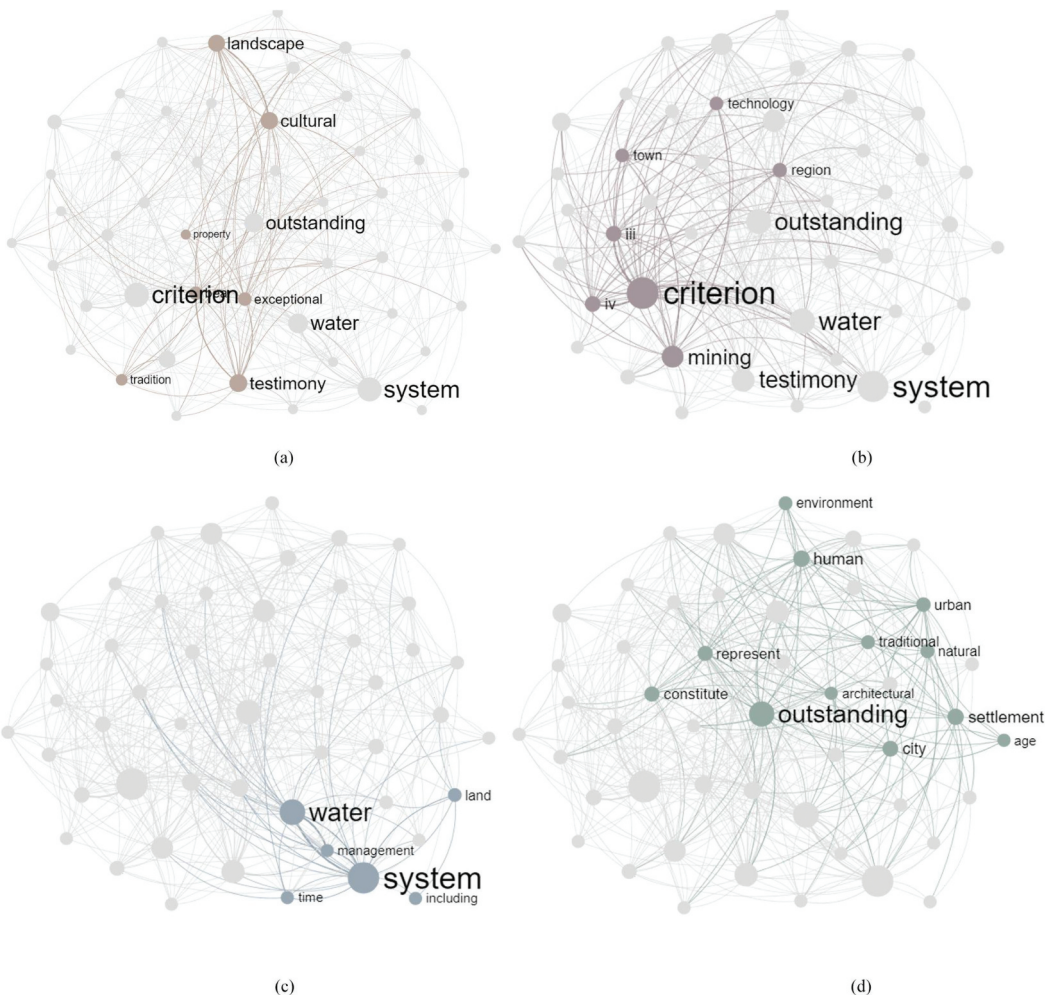


Figure 8. Text network analysis of heritage descriptions referring to ‘water management’ highlights specific heritage types (archaeological properties, cultural landscapes, and architecture) with exceptional cultural landscapes as testimonies to water management traditions.

management systems designed for sustainable urban or vernacular development are scarcely acknowledged. For instance, the impluvia that can be found in traditional patio houses in Italy, Greece, Jordan and China (Zhou, Matsumoto, and Sawaki 2022), drain rainwater and provide temperature adjustment and landscaping in living spaces. Architectural elements like this, designed for sustainable water management and urban development, are seldom found in the selected properties.

As shown in (Figures 8(a–d)), the topics extracted from the descriptions in this group focus mainly on specific types of heritage, including archaeological properties, cultural landscapes and architecture. (Figure 8(a)) illustrates that some cultural landscapes stand as testimonies to traditions of water management, bearing witness to the exceptional significance of this kind of water heritage property. (Figure 8(b)) shows that heritage, incorporating advanced mining technology and meeting the criterion (iii) and (iv), plays a pivotal role in the development and water management of some towns. (Figure 8(d)) demonstrates that some settlements represent a harmonious integration of human and natural elements, showcasing effective water management practices in a traditional urban environment. Yet, words referring to structures or practices of water management are absent.

Examples of water cultural formation – cultural landscapes featured by water spaces and practices

The analysis of Group 7, ‘cultural landscapes’, is helpful for understanding the intricate relationship between human activities and natural water landscapes. The most frequently used words/phrases shown in Column 3 in Table 2 indicate that cultural landscapes containing lakes, mountains, and caves are the most representative ones testifying to the interaction between human activities and natural water landscapes. Apart from the tangible features of cultural landscapes, intangible features such as religious beliefs and belief systems are also related to natural water features. For instance, Matobo Hills in Zimbabwe, with its distinctive granite landforms, has influenced and inspired local people for many millennia. The rock paintings that have survived in situ confirm pastoral and agricultural traditions using water. The Matobo rocks are not only used for painting but are also seen as the seat of God and of ancestral spirits. The living religion ‘Mwari’, centred on Matobo, represents one of the most powerful intangible traditions in southern Africa and one of universal significance (<https://whc.unesco.org/en/list/306/>).

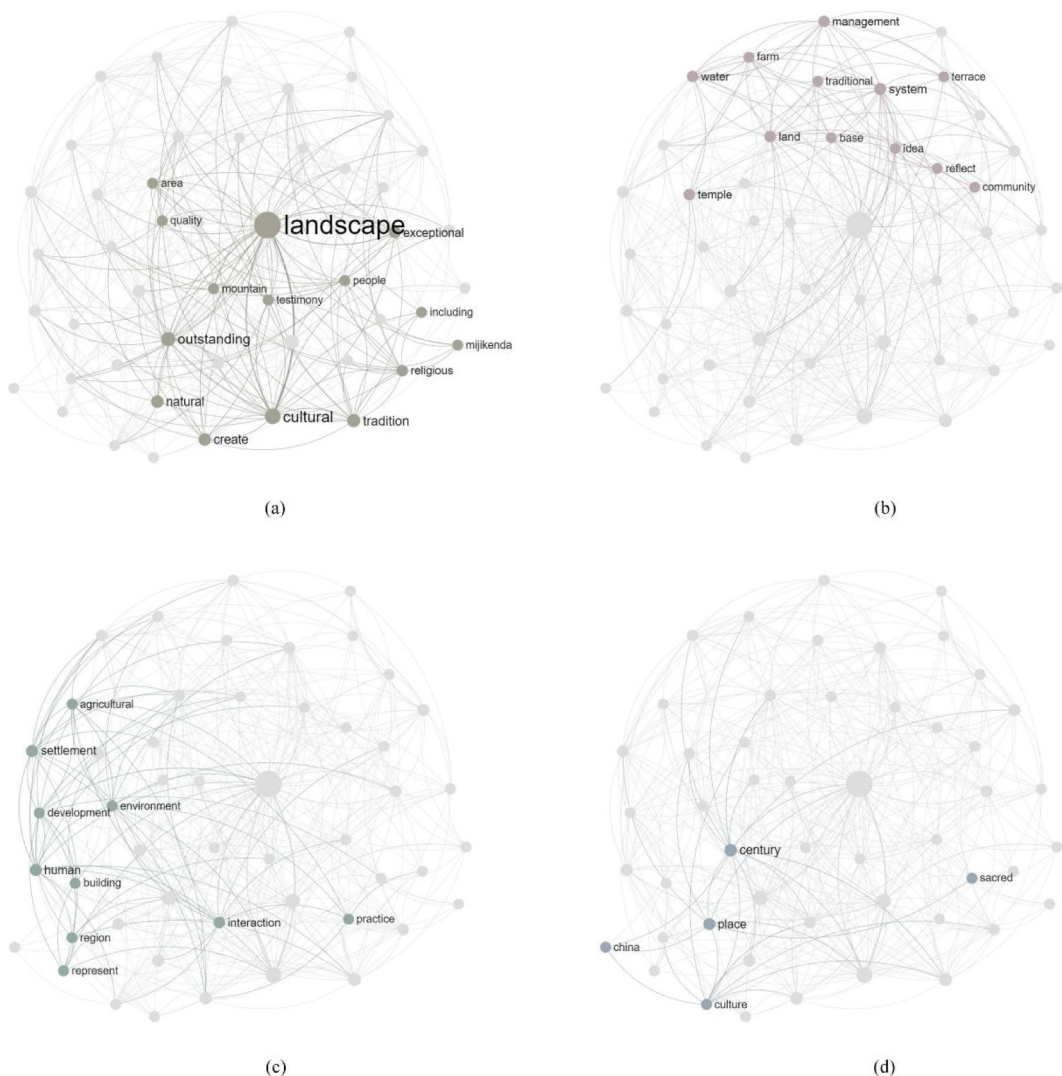


Figure 9. Text network analysis results of heritage descriptions referring to ‘cultural landscapes’ present mountainous cultural landscapes as testimonies to outstanding water heritage (9a), and showcase sacred places, such as water temples and traditional farmland management in the terraced landscape, reflecting a vibrant cultural community rooted in water heritage (9b, 9c and 9d).

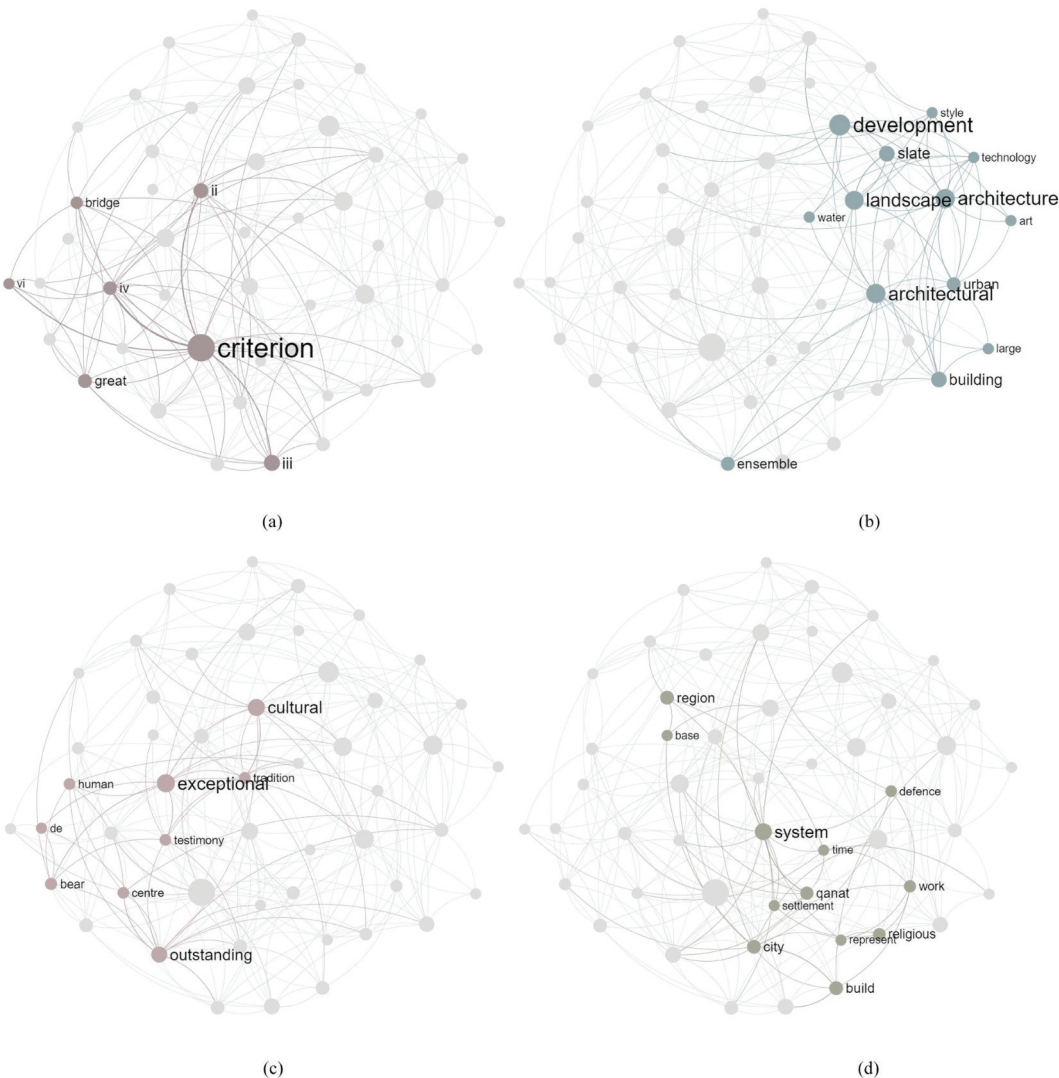


Figure 10. Text network analysis of heritage descriptions of ‘water-related transportation’ shows the influence of this type of heritage on urban architectural styles, including significant impacts of great bridges meeting criteria 2,3,4 and 6 on transportation networks. It highlights exceptional cultural heritage properties as centres of tradition and human interaction in water-related transportation. Additionally, the qanat system in the region played a pivotal role in city building, representing efficient water transportation heritage supporting settlement works and development over time.

The text network graphs in (Figure 9), depicting the extracted keywords and topics, align with and reinforce the findings from the analysis of high-frequency words. The topics shown in (Figure 9(a)) stress that some cultural landscapes in mountainous areas serve as testimonies to the outstanding quality of water heritage, where religious, natural, and cultural traditions harmoniously create a unique and influential environment cherished by its people. (Figures 9(b, c)) illustrates that water temples and traditional farmland management form the basis of an intricate water system that reflects the idea of harmonious coexistence, showcased in the terraced landscape, which represents a vibrant cultural community deeply rooted in water heritage. (Figure 9(d)) highlights the vitality of sacred places in China in shaping the cultural significance of cultural landscapes.

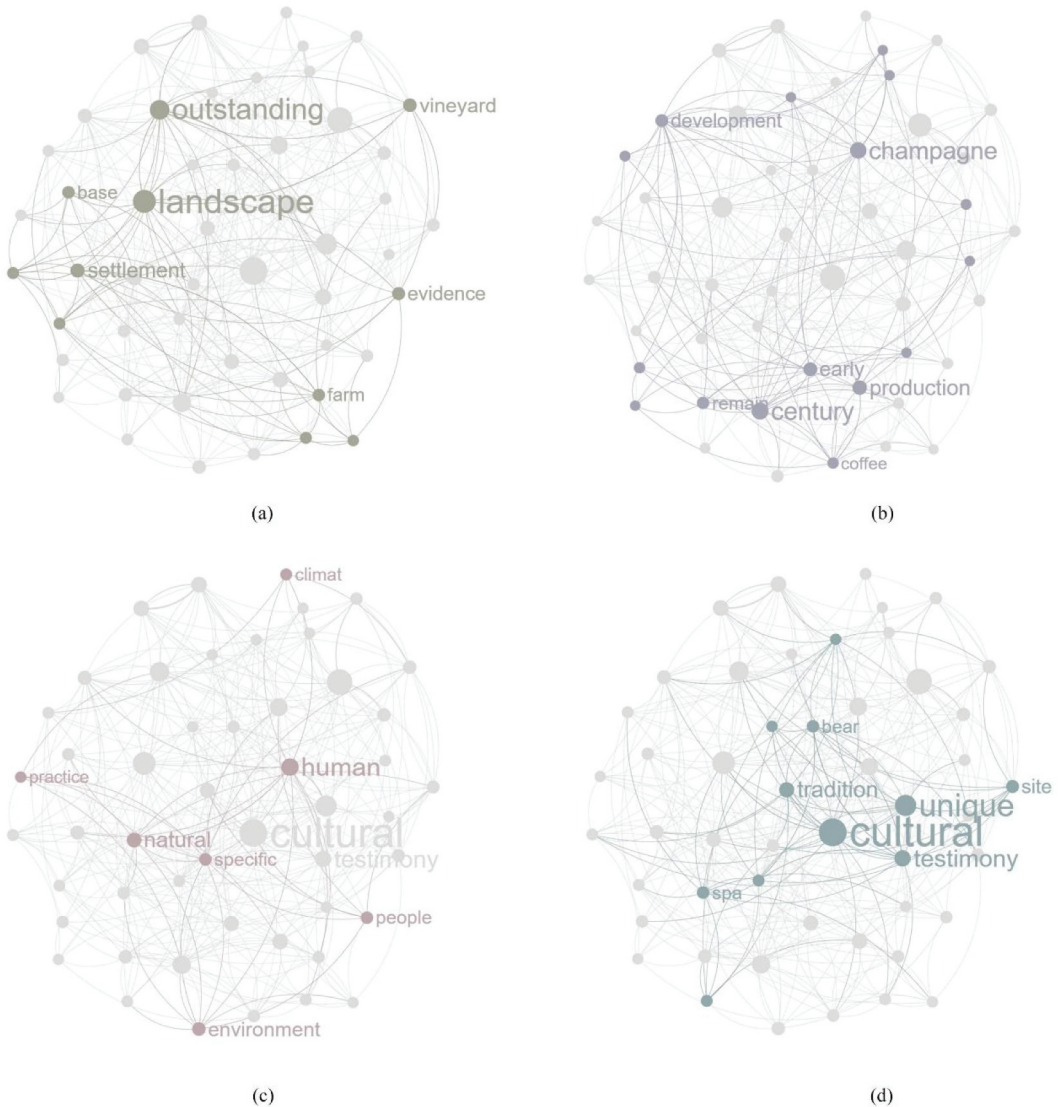


Figure 11. The OUV statements for properties in group 'water for food' focus on vernacular farming and production traditions, including wine making and rice cultivation, as seen in keywords 'vineyard' (Figure(11a)) and 'champagne' (Figure(11b)). Figure 11 (c) highlights the importance of local climate and natural environments in water use for production, showcasing historical reliance on on-site advantages.

Functions and activities of water-related transportation

Properties in the group 'water-related transportation', as shown in column 4 in Table 2, are mainly bridges in historical towns and cities, fortifications, and infrastructures composing qanat systems and irrigation systems. Although the technological and cultural values of these structures are praised in the statements of the OUVs, the main water-related functions of these structures and the activities relying on them — transportation, defence, irrigation, trading, military actions, and so on are not sufficiently discussed in the statements, as shown in Table 2 and Figure 10.

Main practices of water use for food – farming and wine-making

High-frequency words/phrases used in the statements of the OUVs of the properties in group ‘water for food’ are mainly related to vernacular farming and production traditions, such as wine making and rice cultivation, which we can also see presented as keywords ‘vineyard’ in (Figure 11(a)) and ‘champagne’ in (Figure 11(b)). Among the four graphs in (Figure 11(c)) stresses the vitality of the local climate and specific natural environment in practices of water use for production. It indicates that food and drink production in history depend heavily on the advantages of natural conditions on site.

Missing types of structures and activities

Since the number of water and heritage properties in the rest of the groups was not large, instead of analysing high frequency words, we chose to carefully read the descriptions of the properties in each group to establish more findings. Half of the heritage properties in group ‘water supply and drainage’ are celebrated as a system, while the other half are recognised as individual structures in historical dwellings, towns, or archaeological properties, such as aqueducts, qanats, water tunnels, pipes, wells, channels, drains, and canals. Properties associated with ‘water for energy’ ($N = 9.5$) include hydrologic systems and works for water storage, water-conveying, pumping out excess water, and hydropower generation.

After examining the descriptions of a total of 195 water heritage properties, we have identified structures, systems, and activities recognised in each water heritage group and their OUVs. We have also detected some types of structures and activities missing in the list, such as built structures exemplifying the cultural values of water treatment, water resources management, floods and drought prevention. In the descriptions, historical activities primarily centred around water use are agriculture and brewing. Very few leisure activities or ritual practices relying on water spaces are found in the discussions of the OUVs of water heritage. In other words, the structures and infrastructures preserved at the international level do not fully reflect the scenarios of people’s daily interaction with water.

Discussion

Based on the narrative analysis of World Heritage properties through the lens of water, we have identified a series of specific issues related to the narrative depicting water cultures in history. We find: 1) Natural and cultural heritage are linked through water, but these relations are not apparent in the OUV. A narrative approach can help to better connect the heritage properties to their environment and to each other. 2) Tangible structures and intangible factors such as historical events, associated practices, legal systems, and traditions are largely separated, not presented as a system. A system-based water narrative can serve as an instrument to link the two aspects. 3) The relevance of these sites for people’s daily interaction with water is not evident. Narratives about indigenous water practices can help build a more inclusive repository for new narratives that communicate better about the heritage properties. Creating a better intersection between these different areas of heritage would serve protection and sustainable development. A new water narrative to remedy these absences should be created with the aim of balancing development and conservation. The 2030 Agenda for Sustainable Development, the HUL approach, and the World Heritage Canopy can serve as powerful instruments to address the existing issues, underline the significance of the new narrative and help in composing it.

The ‘culture-nature’ nexus: the water and heritage narrative as a tool to bridge nature and culture

Water is a system where nature and culture meet to interact. Many cultural World Heritage properties are linked to various water bodies, including rivers, streams, fjords, rocky coasts, towering cliffs, lakes, waterfalls, wetlands, etc, and possess outstanding natural values, such as rare natural habitats, exceptional natural beauty, or major stages of the earth’s history. The descriptions of these heritage properties usually mention evidence of cultural significance that can only thrive because of the natural conditions of the properties, thus linking culture and nature. For instance, ‘the Old Town of Lijiang’, a cultural World Heritage Site enlisted in 1997, retained a historic townscape composed of architecture that blends elements from several cultures and an ancient water-supply system of great complexity and ingenuity. The OUV of the Old Town of Lijiang is generated through the process of thousands of years of human habitation that has been restricted by and adapted to the unique natural condition in the region of the Three Parallel Rivers of Yunnan, with representativeness in geological history, landscape diversity and biodiversity. ‘The Three Parallel Rivers of Yunnan, China’ was inscribed as a natural World Heritage Site in 2003 on its own right. Yet, the natural values of this region are rarely introduced in the description of ‘the Old Town of Lijiang’. The lack of nature-related cultural values in the descriptions of water heritage highlights the challenges that UNESCO and advisory bodies are facing today, in terms of linking nature and culture, and indeed, the very core intention to facilitate the understanding of the ‘culture-nature’ nexus (Larsen and Wijesuriya 2017).

At the international level, the interrelation between people and nature, as well as the interlinkages between natural and cultural values has been recognised and clearly expressed in the 2030 Agenda for Sustainable Development (see Target 12.8 in Goal 12 and Target 11.4 in Goal 11). The Paris Agreement (United Nations Framework Convention on Climate Change 2015) and the Habitat III New Urban Agenda also embody sustainability from both humanistic and ecological perspectives, and therefore recognise the intricate interdependencies within the world’s systems. These commitments also acknowledge that cultural heritage can provide valuable guidance for making choices that foster development in a manner that aligns with and strengthens our planet’s natural systems (Potts 2017).

UNESCO’s HUL approach also adopts a holistic and integrative approach, promoting interdisciplinary collaboration. As a landscape approach to urban management, it serves as a platform for integrating diverse perspectives from multiple disciplines, including scientific and humanities approaches, along with cultural and natural heritage perspectives (Ginzarly, Houbart, and Teller 2019; Veldpaus and Pereira 2017). Our proposal for water-related heritage narratives is in line with the system-based approach of HUL. It can be used to enrich the World Heritage Canopy, by showcasing case studies and practical examples from perspectives including those centred on the environment, resilience and climate change. The UNESCO’s HUL approach can serve as a dynamic platform that combines innovative strategies and practices to inspire and provide guidance for local initiatives that align with the above-mentioned commitments. One example of how the Canopy links nature and culture through water is the Town of Bamberg, where a new water turbine for hydroelectric power generation has been installed at the site where mills of mediaeval origin once stood, thereby adhering to traditional water practices and upholding the OUV while promoting sustainable development.

Other related promising actions include the launch of the ‘Connecting Practice Project’ (ICOMOS and IUCN 2015) and ‘Nature – Culture Journey’ (Pencek 2017), jointly initiated between IUCN and ICOMOS, and the development of the ‘Enhancing our Heritage’ toolkit (Hockings et al. 2008). These efforts can benefit both natural and cultural sectors. They also can help defy the ‘nature – culture’ dichotomy at the global level.

System-based water narrative: an approach to connect the tangible and intangible

According to the descriptions extracted from the statements of OUVs of water heritage properties (Figures 7–11), tangible structures and intangible factors, such as historical events, associated practices, legal systems, and traditions, are predominantly disconnected and not presented as an integrated system. In addition, structures are more often recognised as independent properties than parts of a large system connected or created by water. For instance, the property entitled ‘Champagne Hillsides, Houses and Cellars’ (<https://whc.unesco.org/en/list/1465/>) represents an agro-industrial system, which has structured not only the landscape but also intangible practices regarding the local economy and daily life. And water played a fundamental role in supporting the complex grape-growing and wine-making systems that developed there. However, the importance of water systems is not mentioned anywhere in the description of this property; in addition, the connections between hillsides, houses and cellars and the water systems are not stressed in the text. A narrative about water systems could be added to provide a system-based approach, facilitate understanding and activate heritage in the context of climate change, which can pose various challenges to agricultural productivity, food security, and livelihoods.

The HUL approach also drives the shift from an object-based to a systemic understanding of heritage, which is revealed in the (re-)assessment of the values of the natural, cultural and human resources of some waterfront historic cities, such as Cuenca, Suzhou, and Naples (UNESCO 2016), for the dual aims of heritage conservation and sustainable urban development. Following the HUL approach, Lisbon has even redefined its heritage boundary to include the riverfront area and the city’s intangible features like song and culture, which contribute to its maritime identity as stated in the 2017 World Heritage application (<https://whc.unesco.org/en/tentativelists/6208/>). This redefinition successfully aligns economic and environmental objectives with the goals of heritage preservation (Pagés, José, and Tom 2020).

Local water practices: building a more inclusive repository for new narratives

The descriptions explored in this study do not fully reflect the role of water in human history and its relevance for today and the future, including the role that indigenous water practices can play. For instance, the qanat of Burhanpur still provides water to around 5000 people and the revived Sarangarh tanks are providing water for some residents of the town (Pangare and Pangare 2015). More importantly, the wisdom gleaned from these ancient systems can be applied in water policy intervention and water management practice. As demonstrated in previous findings, the examined descriptions have not fully depicted how people harness, manage and enjoy water in their daily lives. For instance, tangible heritage instantiating historical practices regarding water treatment, household water management, flood and draught prevention (Hofman and Hoogland 2015), leisure, ecological aesthetics, and sanitation have rarely been mentioned in the current descriptions regarding water heritage. An underlying factor contributing to this shortfall pertains to the lack of due recognition accorded to local water narratives during heritage identification and the value assessment processes.

Locally based water narratives contain recollections, memories and shared experiences regarding water that are significant to local communities. These stories in different themes that have been shared within and between indigenous communities can unveil a network of times and water spaces that may even be invisible to authorities. Hence, water narratives are vital in identifying significant properties and practices that can make a more representative and comprehensive list of tangible and intangible water heritage (Pocock, Collett, and Baulch 2015).

A contemporary understanding of cultural heritage gives a more prominent role to local communities. It automatically involves different actors, mindsets, skills and attitudes with the aim of activating cultural heritage for the benefit of all (Ripp 2018). To respect local communities’ intelligence and allow their participation in heritage identification and

evaluation, their narratives should be explored and studied to understand links between water spaces, structures and activities. Walter (2014) has argued that narratives are a crucial element in the formation of community, therefore it is fundamentally communal. It can help distinguish the values truly inherited by the community from those imposed by introduced systems, then help showcase the intrinsic connections between communities and heritage properties to facilitate a genuinely 'informed conservation'. Meanwhile, for living heritage such as traditional water systems, the narratives can address the continuity of these systems through past, present and future (Walter 2020).

Incorporating local water narratives can also help ensure the inclusion of a wider range of stakeholders. Based on the text analysis of descriptions of water heritage, we could not find these stakeholders, either in the high-frequency words or in keywords composing topics in the narratives. Planners, engineers and citizens who played key roles in building, protecting and using water heritage are almost absent in the descriptions. To remedy this lack, new water narratives should intentionally and sufficiently incorporate personal narratives and subjective attitudes related to water heritage. Multiple stakeholders (Tyagi and Yamaoka 2015) along with their experiences and opinions related to the creation and development of water heritage can better help us understand the dynamics and formation of links between water spaces, structures, and activities.

Conclusion

This study represents an initial to extract and scrutinise the role water plays in listed World Heritage properties. Using the narrative-descriptive approach, we analysed the descriptions of World Heritage properties with the aid of the constant comparative method, and generated a coding tree to identify and categorise the 195 descriptions that testify the intersection of water spaces and culture through time. Our aim is to examine the existing narrative of water heritage and to lay a foundation for a new narrative that can be more inclusive and that will respond to contemporary challenges, bolster the World Heritage Canopy, and facilitate the recognition of heritage as a crucial part of water systems in the past, present and future.

There are three general issues drawing our attention regarding the descriptions of heritage containing water-related features. First, although natural and cultural heritage are interconnected through water, this relationship is not explicit in the statement of OUV. Implementing a narrative approach can foster better connections between heritage properties and their environment, as well as among the properties themselves. Second, tangible structures and intangible factors are largely disjointed and not presented as a cohesive system. Developing a system-based water narrative can serve as a tool to bridge these two aspects. Third, the significance of these heritage properties in people's daily interactions with water is not readily apparent. Incorporating narratives about local water practices can create a more inclusive repository of new narratives that effectively communicate the value of the heritage properties.

We argue that a new water awareness and narrative must be created to facilitate stakeholders in developing shared strategies for identifying, utilising, and managing water resources at all levels. This approach will foster the recognition of heritage values tied to stakeholders' daily lives and attachments over time, drawing from indigenous water narratives. It will also help identify common challenges and opportunities, enabling the development of visions for preserving, protecting, and sustainably developing water heritage in alignment with the dual goals of heritage management and sustainable urban development.

Note

1. *Feng shui* is a traditional practice in China that revolves around the belief in the harmonious flow of energy, known as 'qi' or 'chi', in the environment. It is deeply rooted in Chinese culture and has been practised for thousands of years. One of the key elements in *feng shui* is the concept of water.

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