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Water Heritage: Classification and Degrees of Intervention

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ABSTRACT

Water heritage usually involves with water environment that often faces inevitable changes due to demands of the later generations. Although the idea of 'degrees of intervention' has long been developed in conservation practice of cultural heritage, the intervention on water heritage nowadays particularly becomes more complicated and controversial; it impacts not only on heritage structure but also on water environment. The study hence presents a new concept of degrees of intervention specifically for water heritage as a common language for bridging people from different fields, and discusses their classifications to provide a further understanding towards water heritage.

KEY WORDS: degrees of intervention; water heritage; water environment; classification; heritage conservation; World Heritage

INTRODUCTION

Among cultural heritages, although water heritages play such an important role, only a minority of them are individually valued and discussed as a special category. Many water heritages exist inseparably within historic sites, which makes them easily be ignored. As we all know water heritages usually involve with water environment, hence they are particularly vulnerable to changes of water environment. While an increasing number of extreme climate phenomena and inappropriate human activities are posing significant problems in managing and preserving cultural heritage around the globe, improving sustainable adaptation and enhancing hazard mitigation towards water environment of heritage have become extremely urgent. More importantly, water heritage and its water environment should be considered together while dealing with conservation and sustainability of heritage site, as they jointly shape the value of a heritage site; it is hence necessary to protect water environment simultaneously.

In the past, not enough attention has been drawn to such adverse effects of water environment towards heritage. During the late decades, news of massive flooding, subsidence and decay caused by change of water level, landslide, seawater intrusion, and heavy rain erosion have caused great concerns to heritage conservation community. Although conservation community has started to raise more emphasis to water heritage in this decade, not many discussions or conservation practices have been made on it globally thus far. Since World Heritage is currently the most recognizable and well-known system in conserving heritage, Section 2 explores whether World Heritage covers most of the important types of water heritage, whether water heritage accounts for a considerable proportion in World Heritage, and how water heritages are protected or managed by different international conservation programs, by further discussing the classification of water heritage.

Although the conception of degrees of intervention for architectural and monumental heritage has long been discussed for decades, it has become merely a concept and a description of the different degrees, which is reviewed in Section 3. It explains that the concept is not easily understandable and accessible for anyone, especially for someone without professional knowledge in heritage. Since water environment has the feature of change at times and often involves issues of utilization for the present or future generations, it is often inevitable to make some interventions on water heritage in order to conserve or sustainably reuse the property. Hence Section 4 discusses why interventions of water heritage are inevitable, and are different from other cultural heritage, by discussing three case studies including the Roman Baths (World Heritage, England), Dujiangyan irrigation system (World Heritage, China), and Yueya Spring (China). On the other hand, this section also indicates the 'landscape' is another key aspect as the same important as 'water environment' and 'heritage structure' in determining the degree of intervention on water heritage. Hence the study proposes a new perspective of the degrees of intervention for water heritage, so that it could be more applicable and communicable for both heritage professionals and the others when dealing with the issue of intervention on water heritage.

THE CLASSIFICATION OF WATER HERITAGE BY FUNCTIONS

In order to explore the present status regarding water heritage in the World Heritage system, our study investigates the Cultural World Heritage list site by site, which includes the cultural sites and the mixed sites (cultural and natural mixed), 834 sites in total to date (Jan 2016), from the search of literature and World Heritage official publication (Willems et al., 2015; ICOMOS, e.g. 2011). Although many of the water heritages coexist within architectural or monumental heritage sites, and are not listed or considered as a separate or individual 'water heritage', the study still identifies these water heritages by the principle of heritage value. Among 834 cultural World Heritage sites, there are 144 sites that belong to or possess water heritage, which accounts for 17 per cent as shown in Figure 1. The water heritages identified also show the fact that water heritage usually coexists with the water environment. The result manifests that the water heritage accounts for a considerable proportion within cultural World Heritage. Since water-

related issues have become one of the biggest challenges towards heritage conservation, our study also explores how water issues affect none-water World Heritage sites. We investigate further in all 834 sites, identifying at least another 62 sites (none-water heritage) with significant water content that accounts for 8 per cent. The site with water content means the heritage or its water environment is under risk of damage, or under risk of loss of value, due to water or the change of water environment. It also means some measures are in need towards water, in order to protect those heritage sites for sustainability. The measures can generally be the intervention on the heritage structure, or on its water environment, or even on both, which actually faces similar situation with water heritage.

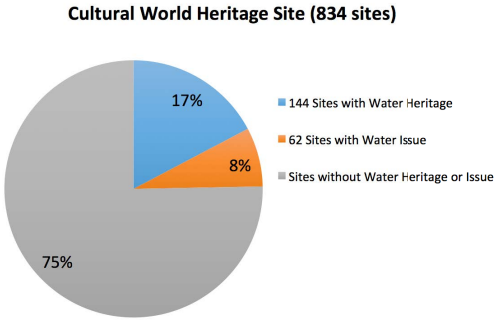

Fig. 1 The proportion of water heritage sites and sites with water content among cultural World Heritage.

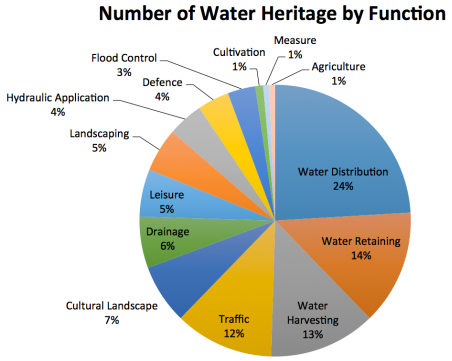

Fig. 2 Water World Heritage classified by functions.

In order to get further understanding of water heritage in World Heritage system, by classifying the 144 water heritages identified, Figure 2 presents a statistical analysis sorted by main functions. As Figure 2 concludes merely from water World Heritage, it means the quantity of certain types of functions would be underestimated because some important water heritages have not been listed in World Heritage yet. Since World Heritage system requests a very high standard in outstanding universal value, as well as in authenticity and integrity that directly involves with the status of conservation. Therefore, some types of water heritages that are particularly not propitious for conservation status are less likely being listed in the system, such as agricultural heritage, aquaculture heritage, and underwater heritage (the last is included in the Cultural Landscape of Figure 2). Furthermore, as World Heritage highlights the value rather than the age of heritage, as time goes on, one can imagine some portions will increase due to newer heritage sites are registered (e.g. Hydraulic Application); and, some new portions will be added in (e.g. Water Purification).

As for how international organizations or programs manage heritage, so as to understand how different systems cover water heritages globally. Figure 3 shows all different kinds of heritage systems managed by United Nations (blue blocks) and other international organizations (green blocks) thus far. In UN's group, the five systems of UN have covered all different parts of the territory, including tangible and intangible, and natural and cultural, which means water heritage can be included in the five systems that seem to have covered the whole territory. However, although GIAHS can cover the 'natural intangible' section, and help manage some heritage sites with significant value but not being qualified to list in World Heritage, yet only in agricultural scope. Some more points can also be seen from the figure, firstly, water heritage is the only category being considered and established as a conservation system among heritage scope, such as UCH, GIAHS, HIS, and WHS, showing heritage community has started to recognize the significance of water-related heritage. Secondly, on the global scale, the figure reveals there are still many more water heritage sites with significant value but not being selected as World Heritage because of unqualified conservation status or belonging to intangible side, such as category of agriculture, aquaculture, and underwater. The last point is that, since there are some overlaps between different conservation systems, such as World Heritage vs. HIS, GIAHS vs. HIS, GIAHS vs. WHS, and ICH vs. WHS, there would be some competitions evolving into levels of the heritage systems. For instance, a heritage site listed as World Heritage or world Intangible Cultural Heritage may not participate in the registration of HIS or WHS. However, those none-UN heritage systems are still substantially contributive to the conservation of heritage or water heritage as a whole, because they can cover some significant sites not being selected as UN's system, or 'World' level. Nevertheless, the paper still poses the weakness of the combined systems. Considering that HIS cannot help other categories of heritage out of World Heritage, even regarding water heritage it can only contribute to irrigation heritage. Similarly, WHS defines its scope as natural or mixed sites. As a complement of ICH, It could be more helpful for intangible water heritage if it extends its scope to the cultural section.

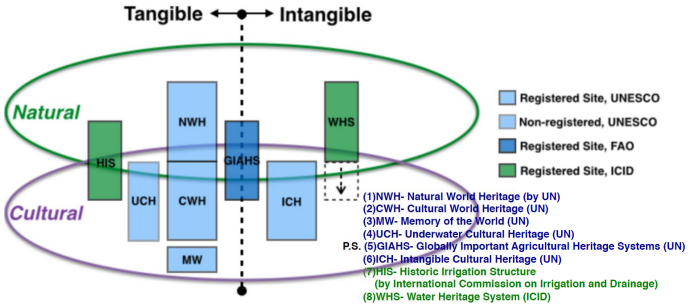

Fig. 3 Integrated international heritage conservative conventions or programs (based on Tyagi & Yamaoka, 2015).

LITERATURE REVIEW – DEGREES OF INTERVENTION

Since 1970s, some scholars and international organizations have presented the concept of degrees of intervention in heritage conservation. However, those concepts can mainly applied on heritage structure (i.e. architecture, monuments, built structures). For instance, the Burra Charter (Australia ICOMOS, 1981), Feilden (1982), MacGilvray (Austin et al., 1988), and Charter for the Conservation of Places of Cultural Heritage Value (ICOMOS NEW ZEALAND, 1992)

all define a variety of degrees of intervention. The last has become the most widely recognized one in international conservation practice, which includes non-intervention, maintenance, stabilisation, repair, restoration, reconstruction or adaptation. However, it is apparent that there are many differences in definition and scope between those degrees of intervention; it is not easy to understand the definition and sorting by non-professionals for applying in practice. Therefore, the degrees of intervention have eventually become a concept and a conclusive principle that promoting a minimum intervention in a protected structure is best summed up by the maxim 'do as much as necessary and as little as possible'.

DEGREES OF INTERVENTION ON WATER HERITAGE

As mentioned earlier, the developed concepts of the degrees of intervention are mainly for conserving heritage built environment. However, when it comes to water heritage, the demand of sustainability regarding its water environment would cause considerable variation and influence on heritage structure. By discussing with the following three cases of water heritage that represent three different kinds of water heritage with different issues from their water environment, this study intends to explore a more integrated perspective of the degrees of intervention for water heritage.

The Roman Baths

The Roman Baths complex is located in the English city of Bath where has been famous for the mineral-rich and healing hot springs that are the only 'hot' springs in the UK. Built by the Romans around 300AD, the bathhouse is a well-preserved Roman site. However, the emergence of pathogenic amoebae in the hot springs in 1977 led to a death of a child and the close of the Roman Baths. In response to this disaster, Bath City Council constructed an inclined borehole on Stall Street outside the Roman Baths, which has successfully supplied biologically clean thermal water to the spa and the fountain (Kellaway, 1991). The measure satisfies the principle and purpose of conservation, on the heritage and the water environment. In this case, the degree of intervention on the heritage structure is nearly none; the only intervention is on its water environment beneath the ground. It is even removable and reversible that would not cause any damage or change to the hot springs resource and its mechanism. As the whole city is a World Heritage site, the measure also prevents from visible variation of the landscape above the soil, except for some tiles and pavement.

Dujiangyan Irrigation System (DIS)

Dujiangyan is a surviving non-dam irrigation system in China, which was built in 256 BC and located in the Minjiang River in Sichuan province. Scientists and engineers around the world admire it for its ingenious mechanism that conforms to natural laws of water flow and utilizes the local natural topography to affect the flow for distributing water, which is a clever use of hydraulics rather than intending to barricade or resist water force by artifact. The system has turned a constant flooding area (Sichuan) into the most productive agricultural area in China, and also dramatically mitigated the frequent thread of flooding in the downstream area. However, considering future demands for utilizing water resource, hydropower and flood control, there were two controversial 'sister dams' built in the heritage buffer zone in the last two decades: the Zipingpu and the Yagliuhu project. The Zipingpu dam (with power plant) was built upstream of DIS, the power plant did not operate because of the risk of damaging the heritage. In order to make the plant operable, the Yangliuhu reservoir is under construction downstream between the Zipingpu dam and DIS, so that it can reduce the fast and powerful flow from the Zipingpu towards the heritage. This is a good example showing how a water heritage easily faces inevitable interventions due to demands of the present or future. Although the two projects did not directly make intervention on the heritage structure, they did change its water environment of which the natural mechanism would be mitigated. Moreover, this case also shows how a surrounding landscape is impacted and conflicted by the modern mega structures, which is the reason why World Heritage system greatly cares about the management of the 'buffer' area.

Yueya Spring

Located along Silk Road in Gobi Desert of China, the natural crescent lake oasis has existed for 2,000 years. Since the Tang (c.618 AD), more than 100 temples and pavilions have been constructed along it. The site is a natural wonder combining with heritages of high cultural value. The spring lake was recharged naturally by the water infiltration in Dang River. After the river was dammed in 1975, which led to a dry downstream and insufficient recharge to the springs causing consequently dry in 1990s. A constructed underground infiltration facility with pumped water for recharging the spring aquifer has reversed the trend of drying in 2008 as a measure of intervention. However, although the intervention has never changed the heritage structure and landscape, the change of the natural recharge mechanism has mitigated the value of the water heritage.

The Matrix of Degrees of Intervention

From the descriptions of the aforementioned cases, the three water heritage sites all exist and evolve with their water environment at all times, which indicates one of the most significant feature of water heritage. Since water environment tends to change over time (it could because of natural cause such as the Roman Baths; or by human cause, such as DIS and Yueya Spring), water heritage sites often face inevitable situation of receiving different degrees of intervention on its water environment. In order to fulfill the conservation principle of minimizing impacts on heritage, more precisely, on heritage structure, it would be quite common that the intervention applied is only on the water environment, rather than on the heritage structure, as the three cases show. However, as the descriptions in DIS and Yueya Spring, although the intervention applied was only on the water environment and consequently has merely changed the original mechanism of it, the value of the water heritage has still been affected or reduced. Besides, the initial purpose for emphasizing on the concept of degree of intervention was to prevent the risk of irreversible damage towards heritage. However, as the example of DIS, the possibility of an extreme flood to cause failure of the dams, or an operational mistake to lead to destructive flood discharge has been formed because of the intervention. It means that even though the intervention is merely applied on the water environment, it can sometimes cause a risk of damage towards heritage structure. From the above two reasons, no matter from the value or the risk perspective, one can understand the 'water environment' and 'heritage structure' are both the crucial aspects when considering or assessing the issue of intervention on water heritage.

Another point can also be revealed from the discussions of the three cases, which is the importance of the surrounding landscape. The

World Heritage system highly emphasizes the concept of the 'buffer zone' of a heritage site, because it is one of the key points for conserving and sustaining a heritage site, as well as maintaining the value of aesthetics and integrity of heritage ensemble (Martin, 2008). Parallel to the concept of the 'buffer zone', the surrounding landscape plays such a crucial role towards water heritage; hence any major intervention measure affecting the landscape of heritage should also be posed and put in the consideration as the same as the 'water environment'. However, the same as the intervention on water environment, the intervention on the surrounding landscape can hardly be described or identified as the way on heritage monument or architecture that is generally a conservation measure or procedure. It is more appropriate to describe as a 'degree' or 'extent' of the influence of intervention, rather than to apply as a conservation measure of architectural heritage as mentioned earlier in the literature review section. Besides, the degrees of intervention on the above two aspects (i.e. water environment and landscape) could be altered depending on different water heritage sites. Therefore, a better way to keep it applicable and flexible for expressing the degrees from low to high is by quantification and indexation. By ranging an integer scale from 0 to 10 to summarize the degree, it can be easier for applying as a communication bridge between heritage professionals and the other users to assess the influence of an intervention towards water heritage.

Since the special features and conditions of water heritage, this study presents three essential aspects to identify and assess the degrees of intervention, which are 'heritage structure', ' water environment', and 'landscape'. A matrix (Figure 4) is developed so that the three aspects can be assessed separately. Then they can be summarized as an overall index so that it can represent the whole degree of intervention on the water heritage site. Therefore, the principles of the matrix on the degrees of intervention are,

- Assessment and discussion separately with all the three aspects is necessary with regard to water heritage, including 'heritage structure', 'water environment', and 'landscape';
- Quantification makes an assessment of the degrees more accessible, objective, and communicable, which replaces the text descriptions developed for built environment;
- The three aspects have different importance and weights on different sites, hence site by site discussion is necessary;
- The three aspects of the degree of intervention should be assessed respectively, then summarized as a final index of the degree of intervention.

The assessment and calculation steps to obtain the Index are:

I. Decide A: B: C ratio of the target site with agreement from all users;
II. Set n, where n is recommended from 5 to10, in order to make the degrees easier to be assessed and to reach a consensus;
III. Assess the degrees of intervention respectively in 'landscape', 'water environment', and 'heritage structure' as D_A, D_B, and D_C;
IV. Calculate the Index of the Degree of Intervention with
Index = $10 \times (A \times D_A + B \times D_B + C \times D_C) / (A \times n + B \times n + C \times n)$, so that $0 \leq \text{Index} \leq 10$.

The Index may also be presented in a color code scale: white, green, yellow, orange, and red, so as to help build a recognizable sense regarding the overall degree of intervention. Each color code may have a general meaning with text explanations if necessary. The proposed matrix is the first attempt to quantify the degree of intervention and there is still room for improvement as more studies are carried out by the community stimulated from this proposal.

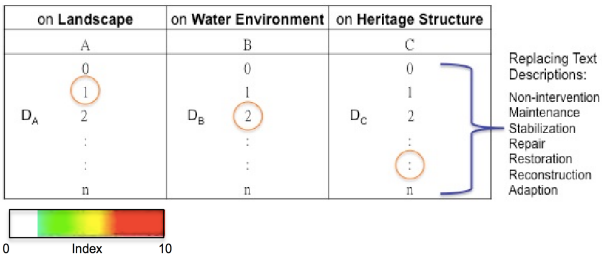

Fig. 4 Matrix of the degrees of intervention and the color code scale of the Index

CONCLUSIONS

Water is the foundation for life, from the past to the future generations. As both natural heritage and cultural heritage are related to human society, they are inherently linked to water. This study has found that at least 25% of the cultural World Heritage sites are identified as a site with water heritage or a site with water issue. Further by discussing with the classification of water heritage, the paper describes the pattern of water heritage in typology of function, and reviews how international conservation conventions and programs manage heritage, especially water heritage. In order to develop the concept of degrees of intervention on water heritage, the study proposes a new perspective that strengthens the importance of the surrounding 'landscape' and 'water environment' towards a water heritage site. Furthermore, the presented method may also extensively be applied on other cultural heritage sites (non-water heritage sites) with issues on the water environment. Although the theory of the matrix proposed still has room to be improved, the authors sincerely hope to raise more attention in encouraging researchers to come forward with more valuable contributions to water heritage, as the spirit and purpose of 'The Statement of Amsterdam'.

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