Visual Water Biography

Translating Stories in Space and Time

Bobbink, I.; Loen, S.S.

DOI
10.7480/spool.2020.2.4859

Publication date
2020

Document Version
Final published version

Published in
Spool. Journal of Architecture and the Built Environment

Visual Water Biography

Translating Stories in Space and Time

Inge Bobbink [1], **Suzanne Loen** [2]

[1] *Faculty of Architecture and the Built Environment*
Delft University of Technology
Delft, the Netherlands
[2] *LILA Living Landscapes*
Schiedam, the Netherlands

Abstract

The supervision of water systems in many countries is centralised and taken over from local water management collectives of 'water workers' by governmental or other water management institutions. Communities are literally and figuratively cut-off from 'their' water systems, due to the increase of urbanisation and industrialisation. On account of water management, humankind changed from communities of actively engaged water workers into passive users. In so doing, crucial knowledge about how communities created, maintained, and expanded 'living water systems', such as rice terraces, low-pasture systems, polders, floating-gardens, brooks-mill, and tidal systems, is rapidly diminishing. Revealing stories (oral accounts) of water workers generate insights and understanding of forgotten aspects of the landscape. They hold information on how to engage with water in a more holistic way, strategies that might help in facing today's challenges. The world in general, but planners, spatial designers, and water managers working with water, in particular, have so far taken little account of these stories. Without documenting stories that are about the dynamic interaction between people and landscape, valuable knowledge has disappeared and continues to do so. To help to overcome this knowledge gap, to learn from the past, the Visual Water Biography (VWB) is developed. The novel method is based on the Delft layer approach in which the spatial relationship of a design and its topography is studied, and developed by many authors from the faculty of landscape architecture at TU Delft in combination with the landscape biography approach. The Visual Water Biography visualises and maps: 1) knowledge and 2) engagement of water workers by focusing on 3) circular and 4) cyclical processes that are descended in the landscape. The method developed for spatial planners, researchers, and designers explicitly allows for multi-disciplinary engagement with water workers, water professionals, people from other disciplines such as historians and ecologists, and the general public. The added value of the VWB method is shown by the case of the Dutch *Sprengen* and Brooks system, a water system that is well documented in terms of landscape biography but less understood as a living water system.

Keywords landscape architecture, living water systems, landscape biography, Delft layer approach, Visual Water Biography (VWB), communities of water workers, transformation, spatial analysis, cyclical and circular processes, *Sprengen* and Brooks system

DOI https://doi.org/10.7480/spool.2020.2.4859

Living Water Systems

'[...] no one knows the landscape better than its local communities [...] even if they lack the scientific knowledge for understanding physical and social phenomena [...]'. (Pedroli, 2007)

The Visual Water Biography uses 'research by drawings' to illustrate the stories of water workers, who built, transformed, and maintained landscapes (in the past, some of which are still active today) by using cyclical and circular processes to create living water systems. The drawings show how people adapted their practice and way of life according to the cyclical processes, different series of recurring events and how they integrated and kept natural resources, as long as possible in the system, extracting its maximum value and recovering and regenerating it in the best way.

All over the world, humans lived and worked with the natural water and different grades of wetness between land and water, resulting in the creation of cultural landscapes. Along with the development of civilisation, people have manipulated its [water] function and form, to fulfil their essential needs (Hein et al., 2020). The current worldwide water crisis urges researchers and practitioners to rethink the design and management of our water systems. From a spatial, cultural heritage, and ecological point of view, directed to preservation and/ or reconstruction of landscapes and habitats, the research is moving towards a consensus to learn from traditional water systems to meet today's challenges. The holistic approach towards living systems has gained momentum within 'the interdisciplinary system theory and school of circular economy or circularity'[1]. Within these theories, a 'living system' consists of a cohesive conglomeration of interrelated and interdependent parts which can be natural or manmade, bounded by space and time, influenced by its environment, defined by its structure and purpose, and expressed through its functioning. There is a continual use and reuse of resources to create a 'closed loop', while human and natural interventions boost the regenerative and adaptive capacity of the system (Ellen Macarthur Foundation, n.d.). Acknowledging this need for change in the management of landscapes, the Dutch government urges farmers to implement the principles of *kringlooplandbouw* (circular agriculture) by 2050 to close loops and fertilise the ground naturally by way of a varied planting scheme (Ministerie van LNV, 2019).

After defining the concept of a 'living system' (topic), the next paragraph 'Investigating Existing Research' (literature study) discusses the perspective of the water workers and the need for spatial drawings. The third paragraph 'Towards the Visual Water Biography' (method) explores the theoretical framework of the VWB that builds upon the Dutch layer approach and the landscape biography, adding to them the notion of the cyclical and circular processes. The fourth paragraph introduces 'The *Sprengen* and Brooks system' (study case) to demonstrate the method. Why 'Research Through Drawing' (technique) is so crucial to the development of the novel method is explained in the fifth paragraph. The technique is applied in paragraph six 'Visualising the *Sprengen* and Brooks system' (outcome), supported by drawings that are the main products of the research. Paragraph seven discusses the 'Findings' and is followed by the last paragraph the 'Discussion and Conclusion'.

1 The circular Economy model synthesises several major schools of thought. (Ellen Macarthur Foundation, n.d.) In this research, the two following schools and/or concepts are most relevant: 1) Respect human & natural systems. "Celebrate diversity." This concept is one of the foundations of the 'Cradle to Cradle' school and focuses on the careful management of water use to maximise quality, promote healthy ecosystems, and respect local impacts while guiding operations and stakeholder relationships using social responsibility (McDonough & Braungart, 2002); 2) Ecosystem services theory; In these school ecosystem services are the many and varied benefits to humans gifted by the natural environment and healthy ecosystems. Such ecosystems include, for example, agroecosystems, forest ecosystems, grassland ecosystems, and aquatic ecosystems (Daily, 1997; Brown, Bergstrom, & Loomis, 2007).

Investigation Existing Research

Different publications recognise the necessity to learn from the past and help to find spatial angles to look at living water systems. However, analytical drawings that show the complexity and specificity of human and environmental interaction in living landscapes are mostly absent. In *Europe's Living Landscapes* (Pedroli, 2007) the authors argue that 'no one knows the landscape better than its local communities… even if they lack the scientific knowledge for understanding physical and social phenomena…'. Communities of water workers, who are part of a living water system, are the central figures in *Springs of Life: India's Water Resources.* (Pangare, Pangare, & Das, 2006) The authors document the tangible and intangible aspects of traditional water systems in India to show 'the ways in which communities live and interact with water… and their common-sense solutions to local water problems'. The book also reflects on the importance and crucial role of women as authors (inventors, makers, and managers) of these landscapes and its integrated character. The research of Pangare, Pangare, and Das (2006) and Pangare and Pangare (2016) put great emphasis on the diversity of irrigation and water supply systems and their working principles in relation to the local climate and ecosystems and the interaction with the communities that built and handle them. However richly illustrated with photos they are, their analyses lack the three-dimensional spatial translation and its visualisation. In the recently published book Lo-Tek (Watson, 2019) many beautiful drawings demonstrate people at work creating their landscape by vernacular practices. Drawings, for example, explain the process of the wastewater treatment and its cleaning capacity, but are not related to the specificity of the site, nor to the development over time. In *Stromend Landschap*, a research on the Dutch *vloeiweidenstelsel* (water meadow system), human activities, circular processes of the multifunctional water system, and underlying cyclical processes are revealed as driven forces that continuously shape and change the water system. (Baaijens, Brinkman, Dauvellier, & Van der Molen, 2011) For example, the inundation of fields in wintertime demonstrates how *water farmers* profit from the early growth of the grass, that made it possible to sell primarily healthy, fat lambs to others. In *Landwerk Walcheren* (Loen, De Graaf & Willemsen, 2014), the researchers argue that the 'hands of the *landwerker*' (land worker) have disappeared from the landscape in favour of rationalisation and upscaling, causing a loss of spatial and ecological diversity.
By drawing these practices, they illustrate that in order to (re-)develop a diverse cultural landscape, cyclical and circular processes such as daily tidal ranges, yearly seasonal and multi-year cycles of silviculture[2], floating field-, raised bed-, and agroforestry systems must be part of these landscapes. In the Circular Water Stories lab[3] (2018 - ongoing), at the faculty of landscape architecture at TU Delft[4], diverse traditional water systems are mapped and analysed through the lens of circular and cyclical processes to inform and offer insights to the graduation project of the students, in which they design a 'new' water landscape. Students are familiar with the landscape biography approach, which offers a method to question human interaction with the landscape by collecting stories, and integrate this knowledge in the analyses and design part of their thesis. For the analyses of worldwide living water systems, a fixed set of analytical drawings is developed that makes it possible to compare and learn from them[5].

2 Silviculture is the growing and cultivation of trees.

3 The Circular Water Stories lab coordinator Dr. ir. I. Bobbink is part of the Flowscapes studio, the graduation year of the Landscape Architecture master track at TU Delft in the Netherlands.

4 Faculty of Architecture and the Built Environment in the Netherlands.

5 Some work made in the Circular Water Stories lab forms the base of other articles in SPOOL Urban Landscapes #7 and 8 (2020/21).

Towards a Visual Water Biography

"Drawings are to be seen as a means to exteriorize abstract ideas [...] They widen the perceptual span [...] enabling a switch from macro to micro levels, keeping the totality of the concept in mind while dealing with detailed solutions. [...] (Foque, 2010, p. 78)

The VWB focuses on the 'visual' because the analysis of the living water system is communicated through the universal language of drawings. Foque (2010) underpins the importance of the use of drawings in the design process. Moreover, we extend its importance to the analyses of living (water) systems, as one good illustration (map, section, etc.) has the ability to describe complex spatial relationships much more easily and is more accessible than descriptive text. The method is a tool to visualise stories, describing people's actions in relation to the landscape in space and time. The drawings reveal the multifunctional use of water at a specific site concerning the watershed and the ongoing cyclical and circular processes by emphasising the holistic performance of the living water system.

The VWB builds upon the Delft layer approach of analysing landscape compositions and combines it with the method of the landscape biography. A landscape biography emphasises the idea of people being the co-authors of landscapes and puts the focus on an integrative, long-term perspective of landscape changes; it relies on a large and varied set of historical, environmental, and other sources of data to inform studies about the diverse ways in which communities have interacted with their natural and cultural environments through time. (Van den Brink et al., 2017) From a societal perspective, landscape biography[6] aims at a better integration of historical landscape research with urban planning, landscape design, and public participation in local and regional developments. This is something that, according to Kolen, Ronnes, and Hermans (2015), designers and scholars in the field of spatial planning have often failed to recognise, or integrate into their work, a criticism that researchers, educators, and spatial designers acknowledge and which can hopefully be overcome by introducing the approach of the Visual Water Biography.

In the Delft layer method, analytical drawings, rather than descriptions, are used to reveal how the landscape composition is moulded according to the natural layer, the cultural layer, and the urban layer. This layer approach is about research by drawing, as demonstrated by a whole series of publications[7]. Related to the water topic of this article, two titles should be mentioned: the *Polderatlas of the Netherlands*; Pantheon of the Low Lands (Steenbergen et al., 2009) and *Water inSight; an exploration into landscape architectonic transformations of polder water* (Bobbink & Loen, 2013). Particularly in the book *Water inSight* the authors used drawing techniques in which the technical scheme of the water system and the position of the different water elements are drawn in relation to the layers (natural, cultural and urban) in a single drawing. By doing so, one understands its relationship and can point out the specificity of the site and the water system. Moreover, the Delft layer approach understands landscapes as three-dimensional compositions. The analytical drawings do not capture the dynamic interaction between people and the cyclical and circular processes of the environment over time. This gap is bridged by the Visual Water Stories.

6 The word 'biography' relating to the landscape was introduced by the American geographer M. S. Samuels in 1979 in his article 'The Biography of Landscape'. The archaeologists Kopytoff and Appadurai (1990) reintroduced the term in two well-conceived articles 'The social life of things' and 'Cultural biography'. Dutch scientists, T. Spek (2004) and J. Kolen (2005), contributed by PhD research. The biography approach deals with documenting stories of people who are seen as co-authors of the landscape.

7 Published over the last 25 years: Steenbergen C. en Reh, W. (2004). Architecture and Landscape. *The Design Experiment of the Great European Gardens and Landscapes.* Uitgever: Birkhäuser, Basel/Boston/Berlin. Steenbergen, C.M., Meeks, S. and Nijhuis, S. (2008). *Composing Landscapes; Analysis, Typology and Experiments for Design*. Basel, Boston, Berlin, Birkhäuser. Steenbergen C., Zwart van der J. en Grootens J. (2009). *Atlas van de Hollandse Waterlinie*. Uitgeverij 010, Rotterdam. Bobbink, I. (2009). Land inSight, a landscape architectonic investigation of Locus Uitgever: SUN, Amsterdam/Meppel.

The VBM method comprises (at the least) the following analysis drawings:

- Water workers and authorship through linear time (Fig. 8a).
- The multi-dimensional influence of water workers through space and linear time (Fig. 8b).
- Cyclical and circular processes through time space and territorial scales (Fig. 9 & 10).

The order of the drawings is not fixed and goes back and forth, as each thematic drawing reveals more on the workings of the living water systems, and hence feeds the development of the other drawings.

Each drawing is multi-dimensional and should offer the ability to move through scales and time. This can be achieved by making drawings layered, allowing the reader to zoom in and out of different scales and to read the simultaneous interaction between different types of water workers and the living water system. Making drawings available to be viewed on an online platform is helpful. Because an article lacks the dynamic nature of a dynamic platform, 'stills' of multi-dimensional and multi-scale drawings are used.

The Sprengen and Brooks system

As a test-case to demonstrate the Visual Water Biography, the Dutch *Sprengen* and Brooks system, a former living water system, situated at the *Veluwe* is selected. On the flanks of the forest-rich ridges of the *Veluwe*, the largest push moraine complex (1100 square kilometres) in the Netherlands, many *Sprengen* and Brooks systems have been built up and transformed by water workers over the course of several decades, starting in the 15th century (Fig. 1 & 2). The eastern and southern flanks hold 53 of these systems (IJzerman,1981).

In principle, a *Sprengen* and Brooks system is a water-tapping system that diverts groundwater via a network of natural and dug watercourses to power watermills. In short, groundwater is tapped from a hill by digging a hole (*spreng*) in the slope to reach the groundwater table. Because of vertical clay-layers in the soil, this tapping is possible on many sites at the *Veluwe*. The water is then guided via narrow watercourses (natural brooks, transformed or dug canals) in such a way that, for as long as possible, the water is kept on the highest possible altitude, following the contour lines, and then allowed to drop at a place where there is a significant height difference. Here, a watermill that generates energy by the rapid fall of the water stream is situated. Depending on the height of the hill and its geological condition, this mechanism can be repeated along the stream and its branches at different elevations. By managing the water in this way, the development of a new 'light' industry became possible. Similar hydropower water system concepts are established all over the world, for example, in the *Oberharzer Wasserwirtschaft*[8], Germany, the water mills grind the earth into powder for the production of ceramics in Onta, Japan[9] (Wilson, 1995) and the watermills of Sierra de Cadiz in Spain[10] which transformed a whole region into a granary landscape (Rivero, Ramos-Carranza 2020).

8 A UNESCO World Heritage Site since 2010, Oberharzer Wasserwirtschaft is the largest pond and canal system in the world. Since the Middle Ages, it has been the main source of energy for mining in the Upper Harz for more than 800 years.

9 The pottery of Onta made possible by hydropower is labeled as intangible cultural property of Japan. The term refers exclusively to human skills possessed by individuals or groups which are indispensable to produce Cultural Properties.

10 For more information please check the article in this issue of SPOOL #7: The watermills of the Sierra de Cádiz (Spain), a traditional open water re-circulation system.

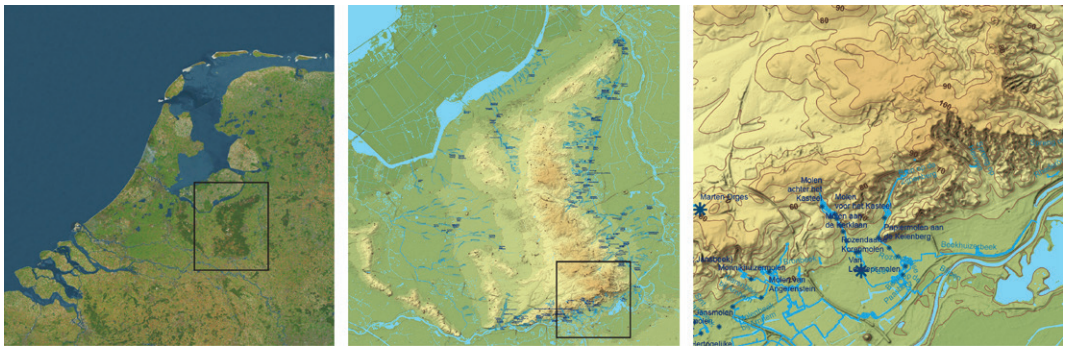


FIGURE 1 The Sprengen and Brooks water system The study area of the Rozendaalse Beek is situated on the south-eastern flank of the Veluwe from where the Sprengen and brooks eventually flow into the river IJssel. Map (a) of the Netherlands, map (b) the Veluwe (brown - height lines and blue - water), map (c) zoom on Rozendaalse Beek by M. Pouderoijen (2019).

FIGURE 2 Historical map of the Sprengen and Brook water system The map depicts the Veluwe area, a push moraine, in a three-dimensional way. The 16th century map, with artistic quality, is engaging and shows the different types of landscapes like forests and heath and the relation between the Sprengen, brooks and the settlements. Source: Wildernis.eu by C. Sgrooten (1570).

The community of water workers who designed and built the *Sprengen* and Brooks system consists of *beekgravers* (brook diggers), *beekruimers* (brook cleaners), millers, craftsmen and -women, farmers, and landowners, sometimes in collaboration, sometimes in competition with each other. A wealth of elements and aspects, like retention basins, dikes, dams, irrigation canals, and controlled floodings were developed to make use of the water in the best way. The water workers developed a silviculture management system with coppicing cycles, to ensure the provision of woody material for the construction and maintenance of the *Sprengen*, brooks, and mill sites. Watermills provided power for the grinding of flour, oil, and copper, and later for the production of paper in the 17th and 18th centuries. After the decline of the local paper industry the mills were transformed into laundry and bleaching mills. Over time the system changed, and due to the availability of other energy sources the mills especially lost their function. A new generation of water workers, drinking water companies, and centralised water boards were unfamiliar with the practices and skills of the traditional water workers. The interference of these companies inflicted damage on the system and the wildlife depending on it.

Research through drawing

When drawing is re-examined in the research context, where it is now being performed as a definitive activity within art and design research, it can be understood in its functionality as a driving force that moves the research inquiry forward. (Mäkelä et al., 2014).

A lot of material relating to the *Sprengen* and Brooks system is collected by the *Bekenstichting*, *Stichting tot Behoud van de Veluwse Sprengen en Beken*[11] (Brooks foundation, foundation to rescue the Veluwse Sprengen and Brooks system) and available in books and on their website. The members of the foundation consist mainly of local people with considerable interest in history, cultivation, geology, ecology, water management, technique, and archology living in the area. The foundation is interested in the preservation of the *Veluwse Sprengen* and Brooks system; it acts as the patron and guard of this unique water system. The foundation manages the online *Bekenatlas* and contributed to the publication *Veluwse beken en sprengen* (Menke, Renes, Smid, & Stork, 2007). Most recently they published the oral history[12] book *Veluwse Waterverhalen* (Water Stories of the Veluwe) with first-person accounts from people who lived and worked, and sometimes still do, within the *Sprengen* and Brooks system (Slijkhuis & Poorthuis, 2019). Paintings and photos are part of their collection. Most stories are not scientific documents but help to understand the relationship between people and water at the *Veluwe*, and bear witness of the integration of different uses of water in a collective, almost public space. Moreover, people in the region were interviewed, and a few field trips delivered site-specific input for the VWB.

Based on this material, analytical drawings of the Visual Water Biography tell the story of the *Sprengen* and Brooks system. The different water workers distilled through research are defined during the time the system arises and develops. Transformations in the landscape can start with the influence of one person or an element making adjustments, which forms the starting point of a chain of developments. Next, the most relevant cyclical and circular processes linked to the condition of certain places on different scales, in which the water workers engage, are identified. The maker of the visual biography needs to decide which cycles, like the day and night rhythm, seasonal cycles, tidal movements and ecological succession[13] are relevant for

11 https://www.sprengenbeken.nl

12 Oral history is a method of historical research. However tainted and/or coloured by personal experiences, the method is especially valuable to give a voice to the marginalised and the 'invisible' such as the poor, women, and/or (ethnic/religious) minorities.

13 Definition of ecological succession: a series of progressive changes in the composition of an ecological community over time.

the specific case. Circularities can be found in different scales as explained in the captions of the drawings. These processes need to be mapped in such a way that it becomes clear how people adapt and make use of them and how these processes shape the landscape. Of course, by making these drawings, one has to bear the amount of information the drawing can carry in mind, in order to stay readable. Analysing is always about being selective.

Three relevant scales - the domain of intervention, the domain of influence, and the domain of effect - according to the territorial approach are defined. (Burns & Kahn, 2005) These domains relate to the intensity of conscious and controlled interference of people in the landscape and are not fixed in a numeric scale but ask for the judgment of the spatial designer. The work to identify these domains is almost inevitable for all spatial analysis. When deciding on the three scales, the units used in hydrology or human geography, such as drainage or catchment area, tributary and sub-stream should be taken into account. Again, there is no fixed step-by-step sequence in this method, the analysis moves back and forth. In that sense, it reflects a design process as described by Elise van Doorn (2013).

Visualising the Sprengen and Brooks System

TIn the case of the *Sprengen* and Brooks system, the domain of effect of actions by water workers concerns the scale of the *Veluwe*. The series of sections, on this scale, show that the water system transformed from a cultivated one to a more utilized one, which today is an urbanised - water system that is kept for its heritage. Timewise, the series overlaps as shown in the diagram (Fig. 10b). The domain of influence is about the scale of 'one' *Sprengen* and Brooks system. As an example, the *Rozendaalse* brook is selected. Of course, each of the 53 systems situated on the east and south flanks of the *Veluwe* can be analysed and documented with the same method, enriching the understanding of the whole *Veluwe* landscape. Other systems might have a smaller pallet of water workers or the same, but due to the different context conditions respond differently and evoke spatial differences in the landscape. The domain of intervention corresponds to the formal (ownership) boundaries of a design site: as put by Burns and Kahn (2005), the location that a designer receives from a client with an associated design question. As we analyse existing situations and do not get involved in the ownership discussion, we define this domain on the scale of spatial ensembles, with different sizes according to the intensity of the cohesion of the elements. For example, a *molenplaats* (mill site) consists of a mill, a pond, dam, tail race, overflow channel, a yard, and trees surrounding the place, and a barn.

Six types of water workers are distinguished (Fig. 8a & 8b), and in different drawings (sections), their specific influence on the landscape is revealed: the role of the water worker as an individual (landscaper, regulator), a collective (utilisers, cultivators, or conservators), a more conscious or unconscious author. The work of the landscaper as we describe them, a person who creates and makes pleasure grounds and parks, is more locally defined with a clear architectonic expression. The work of the utilisers and cultivators is more stretched in terms of scale and might be less visible for visitors in the area since they are familiar with cultivation of land in general and do not recognise the specific characteristics of the *Veluwe* so easily. Each type of water worker has his/her special relationship with the water system in terms of (multi-)functional usage, cyclical and circular processes. Stories reveal how in the *Sprengen* and Brooks system, and most living water systems, water workers perform multiple roles, changing through the seasons and years as explained below and expressed in the drawings. Specific water workers can be dominant in a particular area at a specific time in history. At other times, the same water workers can be marginal. In the *Sprengen* and Brooks system case we distinguish:

1 Cultivators are water workers related to agriculture or aquaculture: land workers, fishermen, shepherds, woodchoppers. Millers are utilisers but also play their part as woodsmen through the extensive management of woodland groves for the maintenance of the mill and the *Sprengen* and Brook system, while also using their mill pond for fish-farming. Cultivators planted trees around a tap point (*spreng*) to mark it, provide shade, and to stabilise the opening and banks of the brooks. Beech groves provided wood, oil, and fodder for the cattle, which demonstrates aspects of circularity. Local bird- and fish-life profited from the continuous flow of fresh groundwater (Fig. 3).

FIGURE 3 Cultivators: fish farmers Fish farmers at work in 1927. The presence of running fresh water allowed to establish trout cultivation. To stimulate employment during the crisis years of the early 19th century fish ponds and brooks were constructed, some of which are in use up until today. Fish farming took also place in the fish ponds in the parks and grounds of the land lords (landscapers) and in the mill ponds (utililers). Source: Spaarnestad Photo.

2 Utilisers are water workers related to production: stream digger, stream cleaner, millers (corn, oil, paper), laundry, copper production, and drinking water production. How water workers interacted with the cyclical processes, like day and night and seasonal changes, is demonstrated in the case of the millers. Flour millers would collect water in their millponds at weekends. Today's ponds in the forests are therefore relics related to flour milling. Paper- and laundry mills worked continuously throughout the winter, while in drier periods of spring and summer they would have to stow the water in the brooks overnight to use it during the day (Fig. 4).

FIGURE 4 Utilisers: stream diggers Beekgravers (stream diggers) at work in 1927. With their knowledge and experience of the terrain beekgravers were essential water workers who supported the water powered milling industries and shaped the water system. Today the main utilizer within this landscape is the drinking water company. Source: Spaarnestad Photo.

3 Regulators are water workers related to water and land-governing and regulating bodies such as water boards. Historically, regulating agencies were the legal landowners and/or cooperatives of farmers. They ruled in case of water conflicts. The question of ownership (legal, functional, cultural, or spiritual) and the effects of water interests between the different water workers have not been addressed in these

analyses. Nevertheless, stories about these conflicts reveal information about the multiple usages and cyclical processes.

4 Landscapers are water workers and users associated with pleasure gardens: moat digger, fountain maker and maintainer, designer, landowner, and guests. The map (Fig. 5) shows how the landscapers'beautify' a multifunctional landscape. The ponds of Castle Rozendaal were huge fishing ponds where large quantities of water could be stowed to irrigate the pleasure gardens as well as guaranteeing water supply for their own mills.

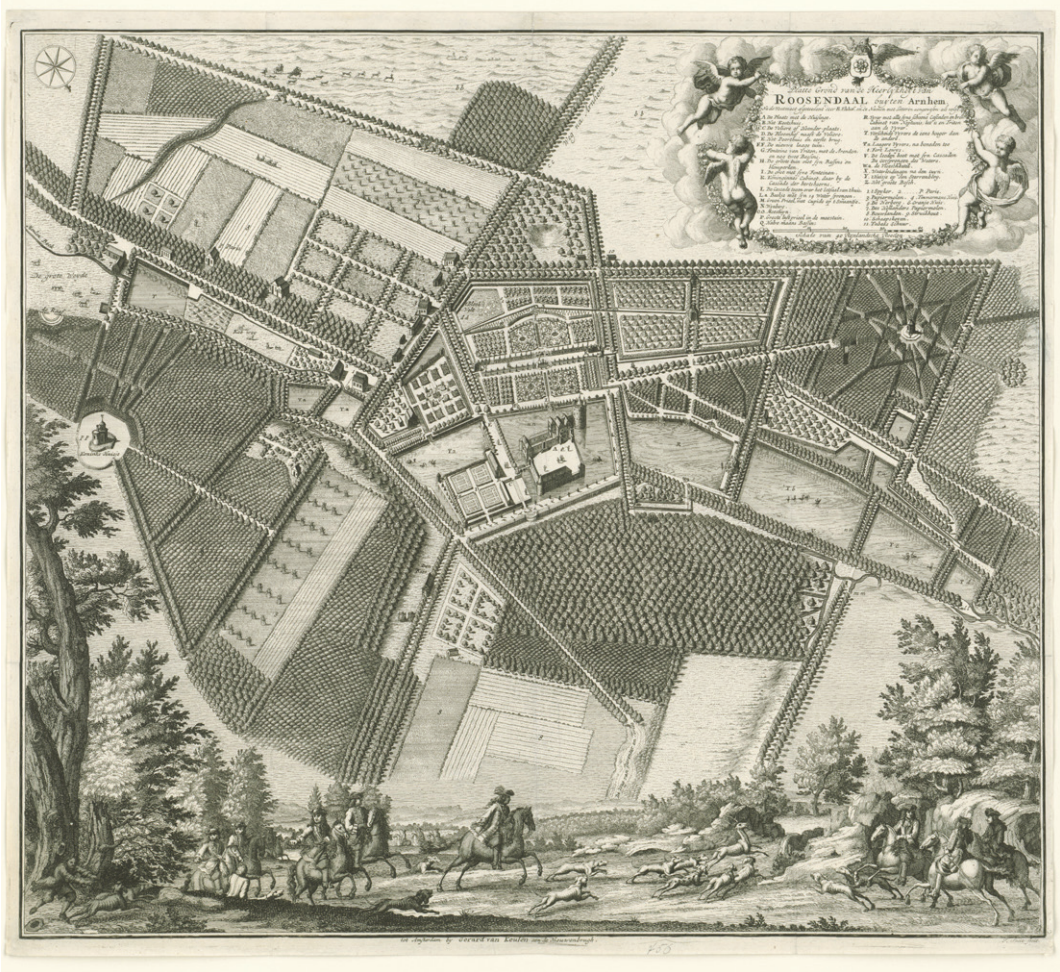


FIGURE 5 Landscapers: landlords The historical map of the gardens and grounds of Kasteel Rosendael, as created by Janne Magriete & Jan van Arnhem gives insight in the many ways the landscapers beautified the landscape while also engaging in and allowing for the activities of utilisers and cultivators. The drawing explains, with both, artistic quality as well as technical accuracy the function of the water works, such as fountains for the pleasure gardens, the irrigation system for the kitchen garden and the channels digged to bring the water to the mills. *Platte grond van de heerlykheyt van Roosendaal buyten Arnhem* (Dutch titel of the object) By: Jan Smit, Berend Elshof and Gerard van Keulen. Date: 1718. Source: Rijksmuseum.

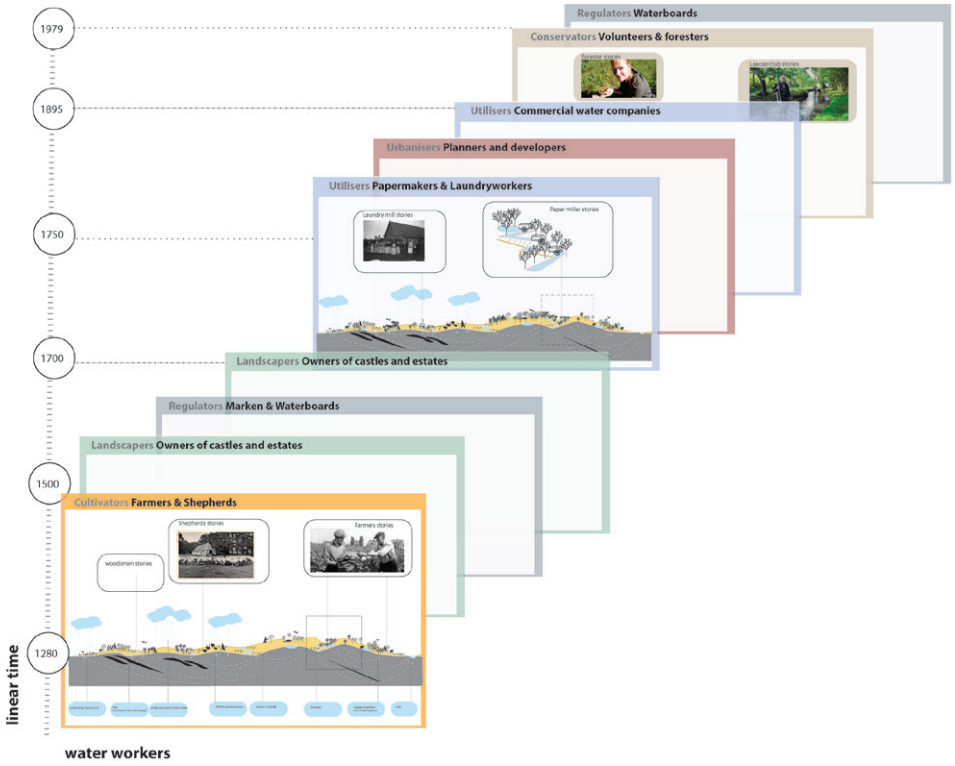
5 Urbanisers are water workers and users associated with the urban area: public space designer, swimmer, citizen, and stroller. Urbanisers transformed the living water system into a more passive system for the beautification of the residential area, while at the same time ignoring and interrupting the system to make a place for urban development (Fig.6).

FIGURE 6 Urbanisers: users
The postcard (ca. 1920) depicts a picknick in the park of Kasteel Rosendael. When the towns and villages around the estate expanded the grounds and the surrounding cultural landscape became an important backdrop for leisure and recreation. Today recreation and tourism are an important pillar of the local economy.
Source: Collection T. Nelemans / www.mijngelderland.nl.

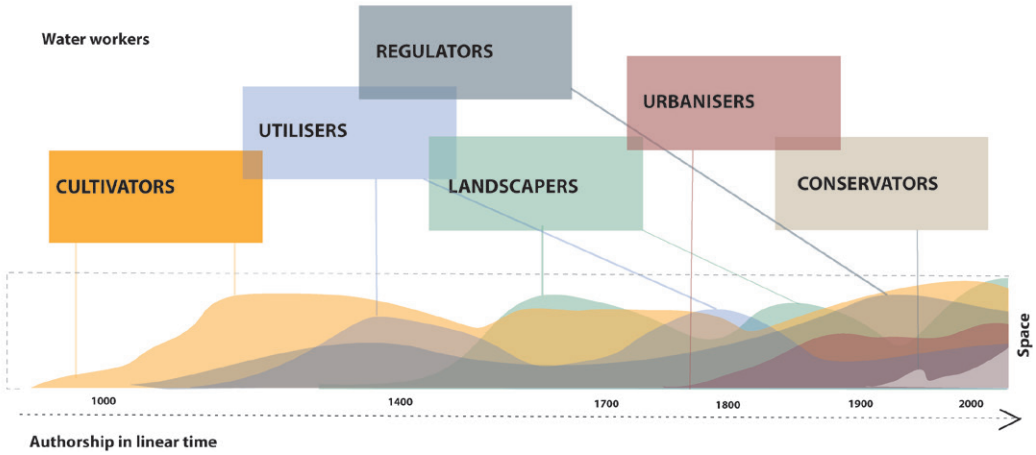
FIGURE 7 Conservators: citizen groups
Conservators at work in the early 1980's restoring the Sprengen and Brooks system while a jogger passes by. The conservators, a citizen's organization collaborating with the Bekenstichting, made a profound impact of this neglected water living system by advocating and collaborating with the regulators (water boards and local governments) to preserve and manage the system in an appropriate manner and to increase knowledge on this historical water- and ecosystem.
Source: Photo collection Bekenstichting.

6 Conservators[14] are water workers and users related to heritage and nature preservation: members of the *Sprengen- en Bekenstichting*, *Natuurmonumenten*, nature lovers (citizen). The *Sprengen* and Brooks system is no longer used and managed by the traditional water workers since the decline of the paper and laundry industry, and has lost its economic benefit. When the traditional water workers' (who designed, built, and managed it) involvement in the living water system with its distinctive flora and fauna declined, it slowly fell into a state of disrepair and overgrowth. Only relics of the system remained. Nevertheless, local people discovered the system because of its historical significance, its cultural and ecological specificity, and were inspired by stories from the past, leading them to advocate for its conservation. Alarmed by the mismanagement and the lack of knowledge within local governments and water boards, illustrated by the way clay layers from brook beds were demolished, they started building up conservation networks and a body of knowledge (Fig. 7).

14 The nature and heritage conservation movement came to light at around the industrial revolution as bottom up movements by local individuals and groups and public figures started to oppose the bringing into culture of primal nature areas such as woodlands and marshes. This eventually stimulated the development of institutional nature and heritage organisations and policies while NGO and local activists still play an important role in the discourse around nature and heritage conservation. (Van der Meulen, 2009)



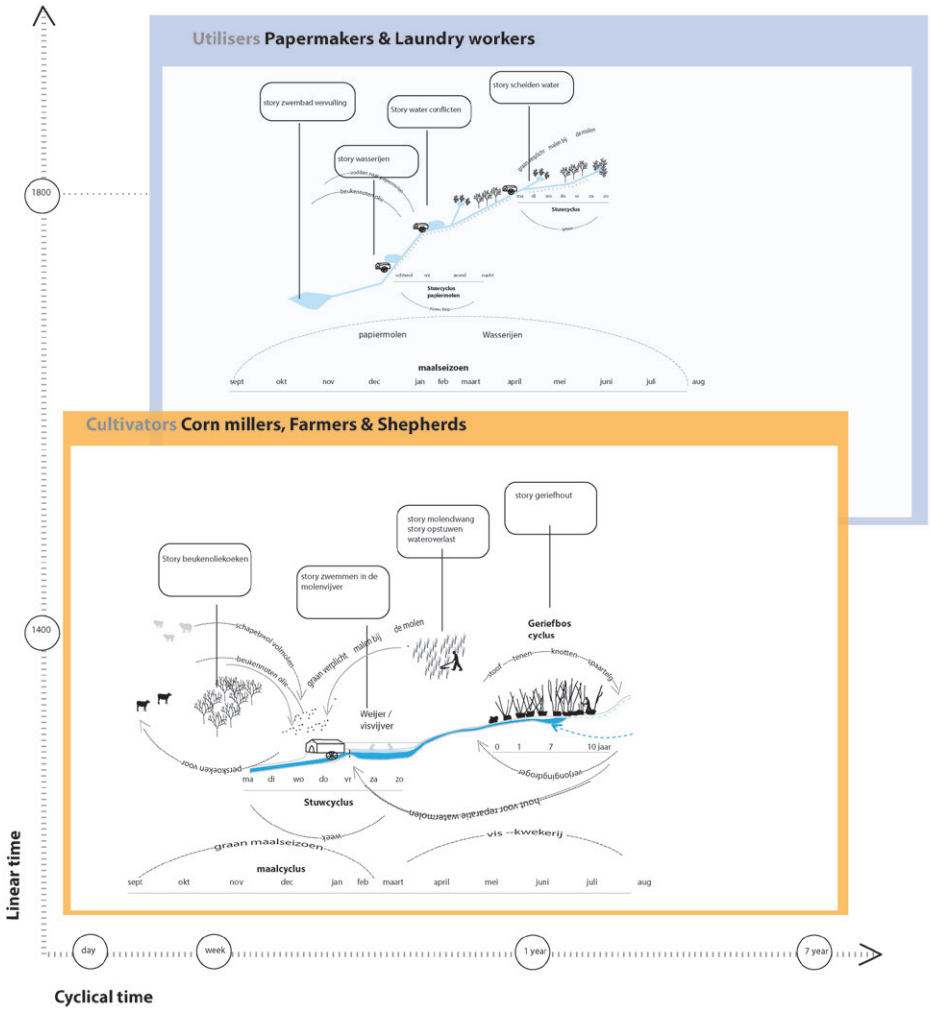
a



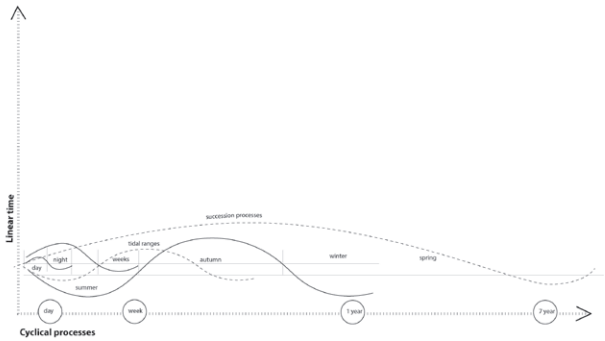
b

FIGURE 8

a. Water workers and authorship in the Sprengen and Brooks water system.
With this diagram we explore how to communicate and visualise the engagement of water workers and their specific spatial impact through time. This diagram shows the multi-layered usage and transformation of the landscape and the water living system. The drawings are abstract and at the same time site specific and describe the dynamic of the landscape. It becomes, for instance, apparent that utilisers are still dominant in the landscape. In the 18th century the utilisers left their marks as paper makers, today the water companies leave their mark on the system by restraining groundwater.
b. Water workers and authorship through linear time.
This diagram is a tool to gain insights on the impact and dominance of diverse authors on the landscape through time. The diagram identifies and communicates by analysing space and stories different categories of water workers, who have left their mark (or continue to do so) on the landscape by creating a water living system through time. It shows the complexity through time as more different categories of water workers engage in the cultivation and exploitation of the landscape. Note that the dominance of a category or certain type of water worker in a water living system may vary through time, or disappears altogether.



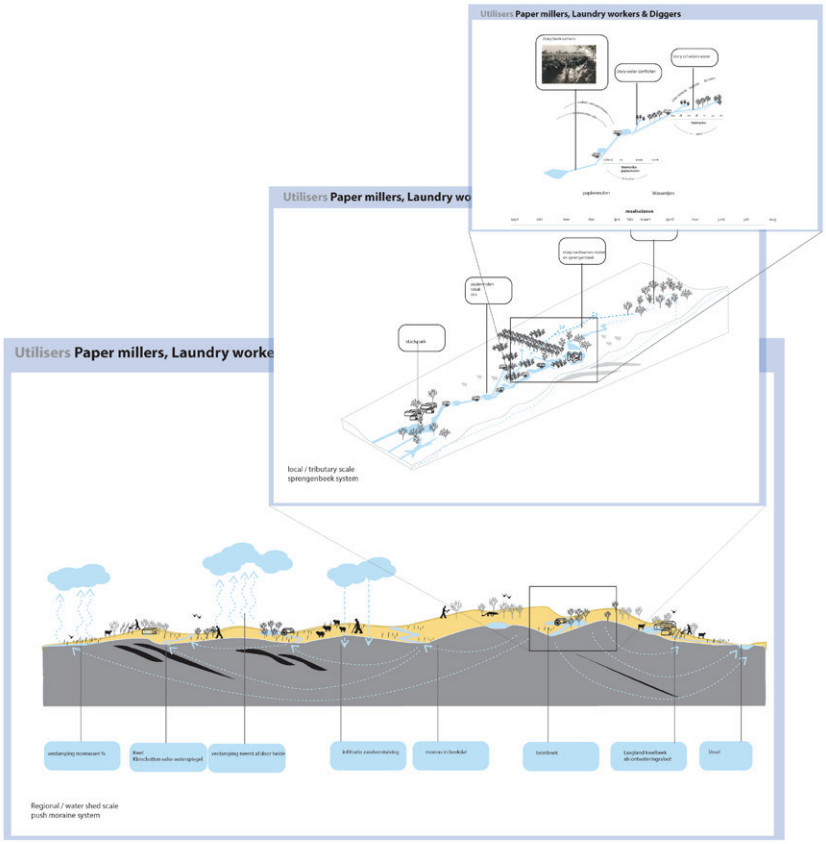
a



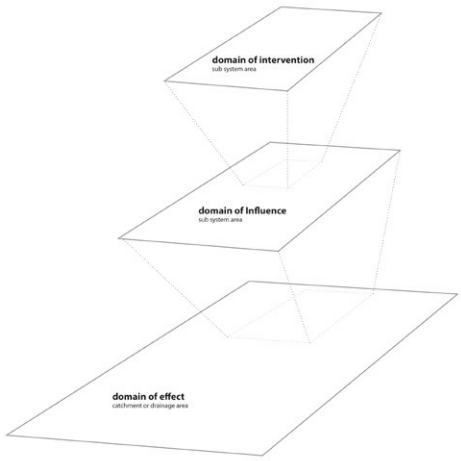
b

FIGURE 9

a. Cyclical and Circular processes in the Sprengen and Brooks water system.
This diagram reveals how different types of water workers in the case area, even within the same category and/or simultaneously, may live and work with different cyclical processes and time scales. For instance, paper makers needed a continuous flow of water for their mills, while corn millers collected water in the milling ponds at weekends, resulting in conflicts with farmers who wanted to flood their fields. Diagrams by S. Loen / LILA landscape (2020).
b. Cyclical and Circular processes.
This diagram is a tool to identify, by analysing space and stories, the cyclical processes, like seasonal cycles and tidal ranges, which occur in a water living system and shows how water workers make use of, adapt to, or develop their life according to it.



a



b

FIGURE 10

a. Range of territorial scales in the Sprengen and Brooks water system.
The diagram of study area Rozendaalse Beek in the Sprengen and Brooks system shows the three selected domains or territorial scales related to the utilisers, and more specific of the paper millers.
b. Range of territorial scales.
This diagram is a tool to identify by analysing space and stories the relevant spatial scales in a water living system. These scales are, as explained in the method paragraph not fixed or premeditated. The scales, or rather domains, are related to the category of water workers within the water living system.

Findings

The analyses of the VWB approach provide insights in a more societally integrated, site-specific, and adaptive water management approach. It offers an analytical tool to visualise the complex interaction between people and water through time and space, systematically and engagingly (living water system). By using the method, spatial planners, researchers, and designers can identify and understand these systems and their value, for the betterment of society.

Defining the categories of water workers seems easy but is, in fact, subject to great discussion. The visualisation of groups of water workers and the acknowledgement that these groups are fluent and layered is, however, a fundamental notion. The categories of water workers are a tool to understand the interaction between people and space in time, but should not be a restrictive framework. Other authors can be considered, depending on the goal of the research.

The topics of cyclical and circular processes are concepts that are often overlooked in spatial analyses and planning, with the exception of flood-proof design. Stories of authors and users reveal a wealth of cyclical and circular principles that could not be exposed and understood in its complexity through spatial analyses alone. Living landscapes are based on the notion of using and caring for the elements the landscape has to offer.

Living water systems deal with the tension between the social, legal, and geographical definition of space and ownership. Each living water system will have its own specific features in this regard.

It is important to stress that the analysis of the living water system is not steeped in a motivation to idealise or romanticise the systems and the way communities live (or have lived). It is merely a method to gain knowledge and inspire future water workers to think more holistically.

Discussion and Conclusion

The development of the VWB analyses method is an ongoing 'research through drawing' process. The presented drawings in this article are a selection of the many that were made for this study. We needed to experiment on how we could draw the main topics of the visual water biography in the best way. This whole process could be elaborated in another article, which might discuss the choices one has to make in analytical drawings that reveal live circumstance and its influence on the landscape.

Such research into the past need's further elaboration, since the landscape, as well as the climate, must have changed over this long time period. Change in the brook flow, flood frequency, rainfall distribution, and agricultural practices are among the factors that have changed the system over the past centuries and are not yet illustrated in the presented drawings.

Besides, there are more stories, for example, about flora and fauna, sounds and smells of specific locations passed on through generations that are interesting to present. In addition, precise maps in this article are unleashed since we decided to focus on a higher level of abstraction to illustrate the method of the Visual Water Biography.

In this phase of the research, we focused on the interaction between humans and their surroundings from a 'functional' perspective related to cyclical and circular processes. However, we expect that the VWB method

could help to reveal the influence of spiritual or ideological beliefs on the interaction between humans and their surroundings, as well as reveal conflicts in the system between legal, functional, cultural, and spiritual ownership in (living) water (systems).

A digital version of the VWB, open for continuous additions, able to include the vast material of the landscape biography, needs a lot of extra work and requires a lot of testing but ultimately seems to be the most appropriate way to show the complexity and richness of these living water systems.

The Visual Water Biography method needs more testing on other cases, different types of living systems and scales and should develop further according to the comments of the professionals. We use it already in education to teach landscape architectural students to be more aware that landscape needs to be approached holistically; a design is a process needing to be 'carried' by people and needs constant adaptation.

The method offers an approach in which complex relations between people, landscape form, water dynamics, water use, water meaning, water adaptation, technical development, related programme, and ecosystems can be illustrated and explained comprehensively. By understanding the role of people and the concept of cyclical and circular processes, designers can act accordingly. The method, therefore, can be used for other living landscapes with a focus other than water.

To conclude, the Visual Water Biography method illustrates that taking workers as the starting perspective of landscape analyses helps to reveal aspects of human and environment interactions that are generally overlooked or misunderstood. The research of the VWB underlines that, as the interest in human and intangible aspects of landscape grows, researchers and practitioners in the field of landscape architecture do not need to do the work of historians or anthropologists themselves. It instead asks for a different way of 'reading' the available oral and other historical 'material' and is an incentive for interdisciplinary collaboration; through collaboration it is more likely that we can understand and are able to develop resilient living water systems for the future.

Acknowledgements

This research was made possible by financial support of the NWO (*Nederlandse Organisatie voor Wettenschappelijk Onderzoek* / Netherlands Organization for Scientific Research). The KIEM (*Kennis Innovatie Mapping*) project offered the opportunity to think and work freely, together with different water professionals, A. Haytsma and E. Vreenegoor from the Dutch National Heritage Agency (*Rijksdienst voor het Cultureel Erfgoed*), E. Ottevanger Union of Water Boards (*Unie van Waterschappen*), M. Pouderoijen, and G. Verschuure (TU Delft), and E. de Hullu and Z. Hottinga-Doornbosch (*Bekenstichting, Stichting tot Behoud van de Veluwse Sprengen en Beken*). The project - investigation into the interaction between people and living water systems - was initiated by Inge Bobbink and Suzanne Loen. Discussions and the input of professionals made it possible to develop the Visual Water Biography, a good experience in which practice and science joined forces.

References

Bobbink, I. & Loen, S. (2016). The water-rich landscape: from a reclaimed landscape to an enjoyable landscape. In: Heuvel, M., van den (Ed.) Blue Bliss, the art of enjoying water. Zwolle: WBOOKS.

Bobbink, I. & Loen, S. (2013). *Water inSight, an exploration into landscape architectonic transformations of polder water.* Retrieved from http://repository.tudelft.nl

Brink, van den A., Bruns, D., Tobi, H., & Bell, S. (2017). *Research in Landscape Architecture: Methods and Methodology*. p.17. New York: Routledge.

Burns, C. & Kahn, A. (2005). *Site matters: Design concepts, histories, and strategies.* New York: Routledge.

Foque, R. (2010). *Building Knowledge in Architecture.* Brussels, Belgium: University Press Antwerp

Ellen MacArthur Foundation. (n.d.). *Circular Economy.* Retrieved from https://www.ellenmacarthurfoundation.org/circular-economy/concept.

Hein, C., van Schaik, H., Six, D., Mager, T., Kolen, J. J., Ertsen, M., ... & Verschuure-Stuip, G. (2020). Introduction: Connecting Water and Heritage for the Future. In C. Hein (Ed.), *Adaptive Strategies for Water Heritage.* pp. 1-18. Cham, Switzerland: Springer Open.

Kolen, J. C. A. (2005). *De biografie van het landschap. Drie essays over landschap, erfgoed en geschiedenis. [The biography of the landscape, Three essays on landscape, heritage and history.]* Vrije Universiteit: Amsterdam.

Loen, S. (2019). Thirsty Cities: Learning from Dutch Water Supply Heritage. In C. Hein (Ed.), *Adaptive Strategies for Water Heritage.* pp. 79-105. Cham, Switzerland: Springer Open.

Mäkelä M.A., Nimkulrat N., & Heikkinen T. (2014). Drawing as a research tool: Making and understanding in art and design. Studies in Material Thinking, Retrieved from www.materialthinking.org. Vol. 10 *The Art of Research,* ISSN 1177-6234, AUT University.

Pangare, V. & Pangare, G., (2015). Ancient Water Wisdom: Traditional water systems India. In Willem J.H. Willems & Henk P.J. van Schaik (Eds.), *Water & Heritage: material, conceptual and spiritual connections*, pp. 57-69. Leiden, Netherlands: Sidestone Press.

Pangare, V., Pangare, G., & Das, B. (2006). *Springs of Life: India's Water Resources.* New Dehli, India: Academic Foundation.

Renes H., & Samuels, M. S. (1979). The Biography of Landscape. Cause and culpability. In D.W. Meinig (Ed.), *The interpretation of ordinary landscapes. Geographical essays*. New York, Oxford: University Press.

Pedroli, G. B. (2007). *Europe's living landscapes: Essays exploring our identity in the countryside.* Zeist: KNNV Publ.

Spek, T. (2004). *Het Drentse esdorpenlandschap: Een historisch-geografische studie. [The esdorpen landscape of Drenthe: a historical-geographical study.]* Utrecht: Uitgeverij Matrijs.

Steenbergen, C.M., Meeks, S., & Nijhuis, S. (2008). *Composing Landscapes; Analysis, Typology and Experiments for Design.* Basel, Boston, Berlin: Birkhäuser.

Steenbergen, C.M. & Reh, W. (2003). *Architecture and Landscape; the Design Experiment of the Great European Gardens and Landscapes.* Basel, Boston, Berlin: Birkhauser.

Steenbergen C.M., Reh W., Nijhuis S., & Pouderoijen M. (2009). *Polderatlas of the Netherlands. Pantheon of the Low Lands.* Uitgeverij THOTH, Bussum.

Slijkhuis, H. & Poorthuis M. *Veluwse Waterverhalen, de economische kracht van Sprengen en Beken.* Enschede: Stichting tot behoud van de Veluwse Sprengen en Beken.

Stowa (2018). *Handboek Beken en Erfgoed. [Handbook Brooks and Heritage.]* Amersfoort: STOWA & RCE.

IJzerman, A.J. (1981). *De Srengen en Sprengbeken van de Veluwe, Ontstaan beheer en watervoorziening [The springs and springbrooks of the Veluwe, Origins, management and water supply.]* Wetenschappelijke mededelingen K.N.N.V.

Watson, J. (2019). Lo-TEK, *Design by Radical Indigenism.* pp. 328 and 335. Cologne: TASCHEN.

Wilson, R. L. (2005). *Inside Japanese ceramics: A primer of materials, techniques, and traditions.* New York: Weatherhill.