NEW WATER CULTURE UNDER FUZZINESS: using complexity to reframe water policy debates

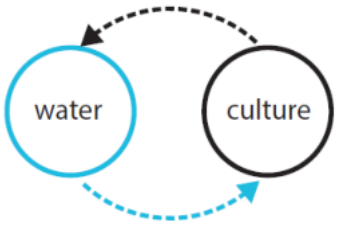
Ing. Martina Lazarová[1], Ing. arch. Daniela Gazová, PhD.[2]

The paper focuses on the idea that the language of current urban water management is full of fussiness what address different forms of uncertainty within the city territory. Therefore the importance of water governance and its cultural adaptation has become a major issue of discussion. At the same time, concerns have been raised that traditional water culture is wrongly adapted to challenges associated with climate change, population growth, ecological and social imbalances. Integrated water management represents fully complex approach to governance in functionally specified field of ecosystem planning policy. The aim of the paper is to examine calling for new water ethics and its new culture of managing. In addition, the paper contributes to the debates about co-designing with nature and reviving success of old traditions. Indeed, management in the sense of new water culture requires knowledge of the system in its full complexity. While time lasts there will always be a struggle around water, but as Jerome Delli Priscoli (1998) states water is far more humanity's learning ground for building communities. In fact, the social learning and collective knowledge of the system are recognized as crucial step for water management. Therefore, partnerships through water sharing plans can be seen as a way to increase water resilience to such events as droughts and floods. The paper's findings are supported by theoretical arguments and practical experiences from the project: Redevelopment of residential neighborhood Šilina-Hájik, which potential is in the way how to share specific area of urban fringe.

Keywords: water resilience, cultural diversity, social learning

[1] Slovak Technical University in Bratislava, Institute of Management, Department
martina.lazarova@stuba.sk
[2] Slovak Technical University in Bratislava, Institute of Management, Department
daniela.gazova@stuba.sk

1. INTRODUCTION



Picture 1 Water shapes culture and culture shapes water
Resource: Author

Historically nobody has doubt about the importance of water as essential lifeblood for every civilization. Most settlements were founded to take advantage of and to be in harmony with the water element. Some of these were even built on water, whether in the river, lake or in the sea. Water has become crucial for the flourishing of cultures, and vice- versa (Figure 1). On the one hand, water has always had cultural significance. The first societies were irrigation-based cultures with ingenious water management structures as for example China, India, Mesopotamia or ancient Rome. It is therefore not surprising that water carries humanity s collective memory of management practice. A key challe for water resilience is therefore to reclaim the proven solutions of the past, though another context, to present day. And according to Cabreba et. al (2010) this is not an easy task. On the other hand, throughout history, a cultural stewardship relation towards water was crucial for the sustainability of the water resources. Especially in the urban context this becomes even more obvious, as the higher urbanization puts higher pressure on local water resources. (Nilsson, 2006) Within this view culture shapes both conflict and consensus in understanding, valuing, using, and managing water. In summary, it is our values, faiths, and ethic that ultimately drive our management solutions (Priscsoti, 2012).

The research focuses on the idea that the language of current urban water management is full of fussiness what address different forms of uncertainties within the city territory (Pahl-Wostl, 2002, Pearson et at., 2010, Brown et al., 2001). Therefore the importance of water resilience and its cultural adaptation has become a major issue of discussion. Until just a few decades ago, the changes of water culture have caused a number of problems. Nowadays, concerns have been raised that traditional water management is wrongly adapted to challenges associated with climate change, population growth, ecological and social imbalances. Much of the call to action has been, understandably, dominated by fear and pessimism: for example, fear of destroying the ecology or fear of social conflicts. (Priscoli, 1999, Pahl-Wostl, 2002, Pearson et at., 2010, Brown et al., 2011) The core concepts utilized in this paper draw upon the traditional knowledge, stewardship and time-tested management solutions, which can help to meet the complex needs of a changing environment. The aspiration for change has been tagged in variety of way, but in this paper is referred to the concept of water resilience . The motivated by the core research question: **How can cultural diversity and social learning contribute to future urban water resilience?**

Although extensive academic research has explored the shifting from posting simple system to using more complex frameworks to understand the diversity of water resilience·s puz Falkenmark, M. Allan, M., Folke, C. Gordon, L. J gerskog, A. Kummu, M., 2014 (Folke S.R. Walker, B. Scheffer, M. Chapin, T. Rockstr m, J., 2010), a little attention has been attribute of cultural diversity and social learning in the concept of water resilience (Cabrera, 2010).

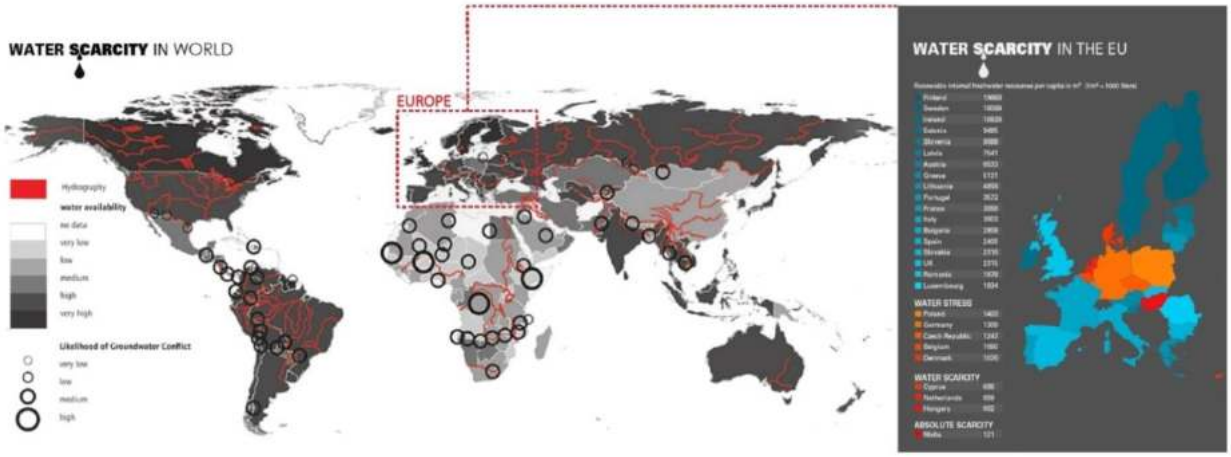


Figure 2 World water availability and water scarcity in the E , Likelihood of water

A) Global water availability map (2011) estimates based on current projections for future water sustainability problems. Actual emissions and climate variations could alter projected drought patterns.
B) The global-level maps and graphs provide the reader with a detailed impression of where our water and sustainability problems are located.
C) Renewable internal freshwater resources map (2011) provides a detailed impression of where water scarcity problems are located in E

Resource: A) University Corporation for Atmospheric Research. 2014
B) The institute of Internal and European Affairs, 2011

2. LITERATURE REVIEW: WATER RESILIENCE

According to United Nations predictions, by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world's population could be living under water stressed conditions (Arup, 2011). It is because, in many cities all over the world, current water is poorly managed and water policies are simple unsustainable. Great historian Edward Gibon, while walking around Rome·s ruins, wondered how such an impressive culture had fallen can be found in his statement that what does not evolve, is decadent. For this reason the challenge that the present-day society has to face is to match up to its ancestors: to give the adequate response to the moment in which that society is living (Cabrera, 2010).

Despite the recent hype in the literature around resilience, agreement on key aspects of the concept of water resilience is still missing. Resilience in general has been variously defined and its conceptualization in recent years has been called fuzzy and contested . It shares similarities with sustainable development in that it is frequently used as an umbrella concept to describe a broad array of in terrelated issues (Dovers, Handmer, 1996). The concept of general resilience has occurred in modern times primarily through the work of Canadian ecologist C.S. Holling in1973, who defined resilience as persistence of a system through change. Since then, the term started to run through almost all the disciplines and languages concerning individuals and institutions, as well as cities and territories. Its multidisciplinary and its adaptability within dynamic systems and complexity theories make the concept more and more attractive (Garschagen, 2011). Now, over 40 years later, the CMAs (Catchment Management Authorities, 2012) sustains that resilience consists of two related aspects;

- **general resilience** - the resilience of the system as a whole to any and all kinds of disturbances.
- **specified resilience** - the resilience of what, to what , which calls for ide particular limits in the system, beyond which it begins to function in a different kind of way, impacting on the quality of ecosystem services (Catchment Management Authorities, 2012)

water resilience - sets an ambitious goal by tackling the world s ke in the spotlight of global change

school of water landscape

school of water engineering

According to CMA, we distinguish between general and specific resilience in relation to water management, because this provides an important conceptual differences in our understanding. The general resilience is defined as resilience of an entire system to all kind of shocks. On the other hand, specific resilience is described as the ability of a particular part of the system related to specific control variable, to cope with disturbances. Specific resilience is possible to quantify and analytical explore, while general resilience is more complex and often impossible to measure analytically. Following Rockstr m et. al (2014), water play a fundamental role in supporting both specific and general resilience. Therefore, in order to usefully define resilience of water sector it is necessary to look at its origins and the current academic uses of the term **water resilience .** The foundation for this research was to compare the perspective of water landscape with perspective of water engineering, and to find out general definition for their possible interrelationships in the context of spatial planning.

2.1 A BRIEF HISTORICAL PERSPECTIVE OF WATER RESILIENCE

In the recent years, researchers have developed the concept of water resilience; however, it is not fully new. For the purpose of this paper we have reviewed some of the past literature, in order to determine the evolution of water resilience-based concept and simultaneously to outline new perspective of the concept based on cultural diversity (Figure 3). The historical roots of the concept reached the early 1990s. Before this period the management focus were on blue water as fully fragmented and sectorial approach to water resources that has led to poor services and unsustainable resource use (Bartone et al., 1994, GWP, 2010). After that, in response to the deepening understanding of water s fundamental roles in the life-support systems of our planet, water resource thinking has broadened from blue water only to integrated blue-green approach (also known as green water concept) (Fiorino, 2001). Put another way, as Scheffer et al., (2001) stated in his definition, the ecosystem processes modify the hydrological cycle and the hydrological cycle affect ecosystem processes. These mutual interactions affect the ability to buffer stress and shocks. Both traditional concepts were followed by a more systems-oriented approach of integrated land and water resources management in the early 2000s. During that time the attention was focused on the new situation, in which abrupt, large-scale changes in the hydrological cycles can no longer be overlooked (Rockstrom et al. 2014). However, over the last 15 years, the definition of water resilience appeared and evolved. The core of mainstream thinking has become the idea that water resilience refers to the ability to deal with change while continuing to develop (Folke et al., 2010).

Synthesizing the evolution of the water resilience-based concept, the need for a new focus on water management has recently been recognized by science community (Montanari, 2013; Cabrera, 2010). This implies a deeper insight into fundamental role played by culture in water management practice. Drawing on the huge uncertainties concerning the water hazard, it is needed to build on local knowledge,

historical experience and cultural diversity. Therefore, this study brings together a set of unsettled water-culture related challenges.

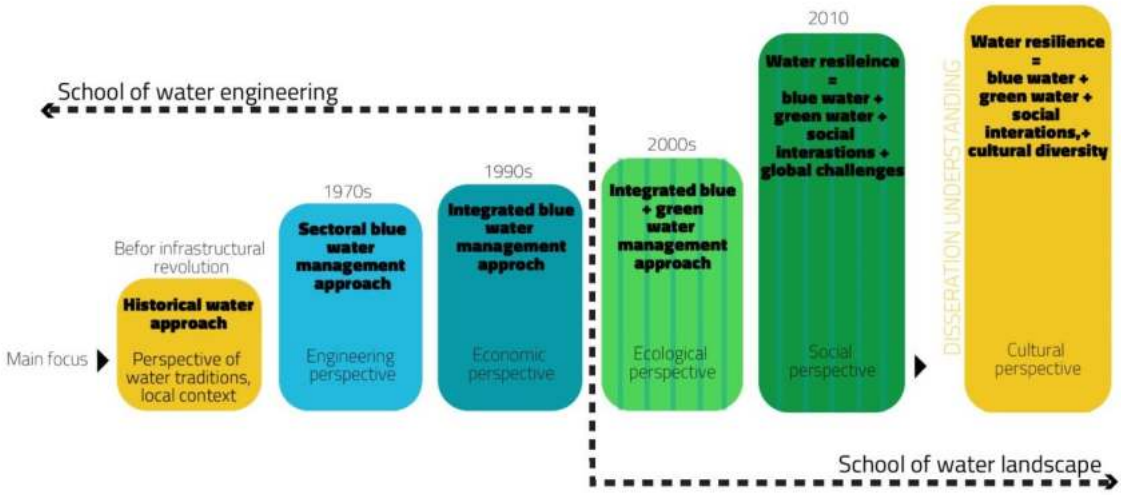


Figure 3: The evolution of the water resilience-based concept and new perspective of the concept based on cultural diversity
Resource: Author according to (Rockstr m et al, 2014)

2.2 THE MEANING OF WATER RESILIENCE

Although the idea of water resilience is a bit messy in and by itself, in this paper two conflicting schools offer explanations of water resilience. Even Canadian theoretical ecologist, C.S. Holling (1973), who firstly developed the general concept of resilience, made a distinction between engineering and ecological resilience. On the one hand, **water engineering school** defines resilience as the ability to return to an equilibrium or steady-state after disturbances. The effectiveness of a resilient infrastructure then depends upon its ability to predict, absorb, adapt to, and rapidly recover from a potentially disruptive event such as droughts and floods (Holling, 1986, Wallace et al. 2010). In light of this definition, water resilience is mostly about delivering services regardless of disruptive events that may occur the ability to take a licking and keep on ticking (to quote the old Time resilience is mostly defined according to how long it takes for the system to recover after a shock. The emphasis is on return time, efficiency, constancy and predictability , all o qualities for a fail-safe engineering design (Holling, 1996, p. 31). Despite, this understanding is rooted in most of current water management practices.

At the other hand, the second **school of water landscape** considers water system as more than the sum of their engineered parts. They can be described as socio-ecological systems, as they require complex interactions between human, technological and environmental components. In this perspective, ecological resilience is more complex and has very broad implications (Folke et al. 2010). School of water landscape defined water resilience as the magnitude of the disturbance that can be absorbed before the system changes its structure (Holling, 1996). Therefore, it is focused on the ability to persist and the ability to adapt within critical thresholds (Adger, 2003, p. 1). The main difference between these two schools is that ecological resilience rejects the existence of a stable equilibrium and requires a mind shift in water thinking (Rockstrom et al., 2014).

To sum up, the literature review indicates that the water resilience is another intuitively appealing buzzword. However, it is worth questioning whether water resilience has simpl of intuitively appealing yet unclear concepts (such as resilience and sustainability). It s certainly no easy to define, or specify what a resilient water system might look like. Following Folke et al. (2010) and Rockstrom et al. (2014) for the purpose of this research water resilience is defined as, the complex, multi-dimensional system that is not at equilibrium. It periodically or constantly changes and adjusts. The key is to shift away from yesterday s focus on how to reduce environmenta activities, towards reconnecting economic, ecological, social as well as cultural attributes. Simply put, the research is motivated by question: Are two different approaches of water landscape and water engineering mutually exclusive? The paper considers them to be complementary and both useful at different territories and different scales.

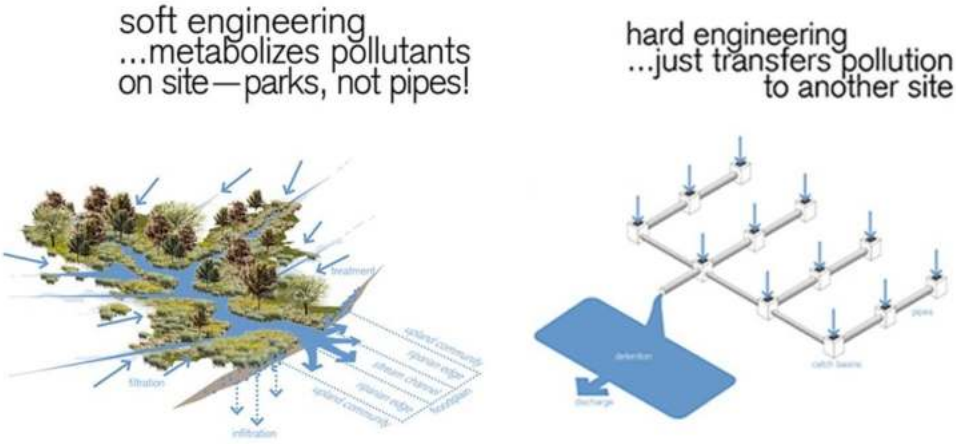


Figure 4A: An example of water landscape perspective:
Figure 4B: An example of water engineering perspective
Resource: University of Arcansas, Community Design Centre, 2011

3. CORE CONSTRUCT: LINKING WATER RESILIENCE WITH CULTURAL DIVERSITY

In keeping with the intent to promote both, cultural diversity and water management, this paper offers an array of ideas to understand mainly the cultural implications for growing water resilience. Therefore, the foundation for the research was the extant (Jonson, 2012, Donahue, Johnston. 1998) literature on the relationship between water and culture. Therefore the paper points out, that water resilience is shaped by the cultural perspective and historically embedded urban water values, expressed through institutional arrangements, regulatory frameworks, and physically represented through water systems infrastructure. The focus is made on the question: How to transform cities through reviving time tested solutions in urban water management, urban design, and governance.

A classical overview of **theories of culture** was provided by Keesing (1974). He distinguishes between culture as an ideational system and culture as an integrated adaptive socio-cultural system (most classical anthropological theories and schools). In the first case, culture is ultimately in the head of a collective mind and it only refers to perceptions, beliefs, norms and values. Culture in this sense can be used to explain social practices. Culture as an integrated system integrates the social practices in the concept. It emphasizes the interrelation between ideas and practices. Cultural diversity, as recognized by UNESCO (2009) is crucial to environmental sustainability; it generates the multiple human

possibilities necessary for generating sustainable adaptations in a changing world . It is with understanding in mind that human history and the evolution of culturally diverse understandings of life reflect in many ways our interactions with, need for, and use of water. Because culture is learned, lived, and expressed in broader social relationships, it is a significant dimension that shapes water resilience. This paper involves not only managing flows to sustain ecological processes, but also ensuring that the water flows are sufficient to recognize and sustain cultural ways of life.

Some of water management solutions have only been developed recently, whilst others have a considerable history behind them. While there is no one model, or concept that will be universally applicable and effective in every circumstance, there are certain universal conclusions that can be recognized (Johnson,2012, Gleick, 2006). Here, these are briefly outlined:

1) The increasing vulnerability of water resources calls for **holistic strategies** and **diverse approaches** to water management to be recognized and supported.
2) **Indigenous and local communities** are invaluable partners in this regard, representing a vast array of adaptive knowledge and practices which have not only sustained engagements with water for millennia, but also offer much potential for creativity and innovation.
3) Local water practices **do not exist in a vacuum**. A key challenge for water resilience is therefore to reclaim the proven solutions of the past, though another context, to present day.
4) Water issues must be tackled at **various levels**. Water governance therefore requires a dance between levels . When water resources are brought under centralized, bureaucratic control, the resilience of local forms of governance is often diminished. Therefore, soft path complements the twentieth-century s large-scale, centralized infrastructure with lower cost systems, decentralized and open decision-making
5) **Social learning** and **collective knowledge** of the system are recognized as crucial step for resilient water management. Collaborative practices aim at developing a shared construction of reality through the understanding of local contexts.

To conclude, trough time, societies have developed different technologies, practices, and institutions for managing water, what brought enormous benefits to humankind. But they have also failed to solve some of our most water problems, and in key ways they are unsuited to our new challenges. This paper brings to the fore the increasing scientific evidence for a rapidly changing global water agenda, shifting from a general focus on water management under assumptions of stability and predictability, to a focus on water resilience in a world of instability and surprise (Rockstr m et al., 2014). The core cor utilized in this paper draws upon water resilience and importance of cultural values and traditional management solutions in it. The next section of the paper discusses in more detail also the role of social learning.

3.2 LINKING WATER RESILIENCE WITH SOCIAL LEARNING

In recent years the engineering paradigm dominated by technical end-of-pipe solutions, has been replaced by a paradigm based on the notion of living with water (school of water landscape) approach the limits of control and the importance of uncertainties are clearly acknowledged. Acceptable risks and decisions are negotiated. This cultural framing supports integrated solutions and the implementation of multi-functional landscape with an increased adaptive capacity of the system. New paradigm argues for an integrated approach however, most international regimes are focused on single issues such as flood protection. The clearly perceived need to adapt to climate change requires a whole range of measures to be implemented. The processes by which adaptations to be judged at different scales will involve new and challenging institutional processes (e.g. Adger et al., 2005). Moreover, water transboundary cooperation demands improving processes of **social learning** to integrate distinct cultural frameworks that agents at different locations use to deal with their issues at stake. As Pahl- Wost (2007) states, within governance perspective, social learning is an essential element of policy development and implementation. It refers to both the learning process and to its outcome. The e moving from the need to simply know more and placing even more information to policy and ex circles to developing adaptive cross-sectoral strategies and new types of knowledge to respond adequately the changing dynamics of current world. The problem that we face when we deal with resilience lies not so much in our lack of understanding of the functioning of ecological systems, but in our lack of understanding of the governance and cultural systems and how they are structured and managed and interact with ecological systems, and how we produce science and knowledge for policy. Following Mostert ·s (2005), new institutional arrangements are needed to structure the more sustainable framework for collaborative water governance in transboundary water management (Figure 5). Therefore, the problem lies in developing new identities, as well as institutions and individual capacities, that are more socially and ecologically robust with the common goal of water resilience.

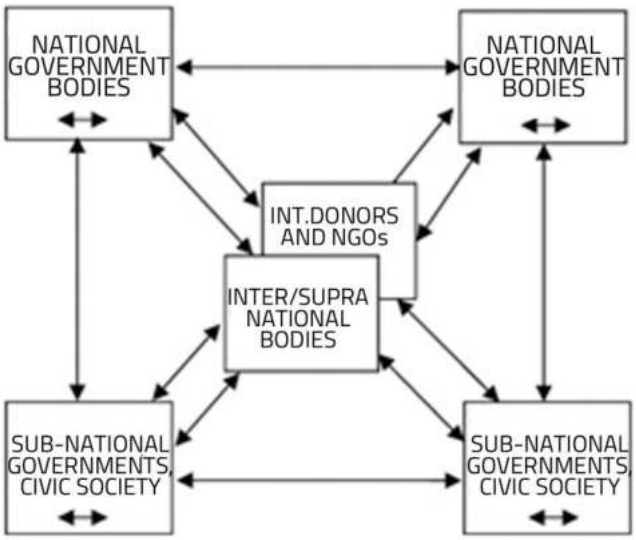


Figure 5: Organizational famework for collaborative water governance in transboundary water management.
Resource: Mostert, 2005

Mostert·s model outline the organizational framework within which social learning unfolds. It needs to take place between formal governmental authorities and stakeholder groups organized formally or

informally at different scales. Integrated water management typically requires cooperation across these sectorial boundaries:

- **National cultures** determine the nature of transboundary cooperation. They shape legislation and negotiation strategies and influence the nature of the participatory processes (Patel and Stel, 2004).
- **An individual** holds different social roles and belongs to more than one social and thus cultural group. Hence, it is possible that different cultural frames occur within individual persons and may be activated in different social contexts. They act as representatives of an interest group and represent the cultural values of these groups
- **Professional cultures** (e.g. farmers' beliefs and practices) may be more important than national cultures for some stakeholder groups and establish an identity across national scales. The influence of national cultures seems to be stronger than the influence of the technology/expert culture characterizing the community of water resource practitioners across national boundaries (Langaas and Timmerman, 2003).

4. SHYNTEHSIS: BUILDING WATER RESILIENCE

Based on the aforementioned theoretical discussion in literature review, the paper defines the concept of water resilience and its interrelationship with culture and social learning. The focus of the paper is to study the adaptability of water systems and to meet the new challenges in navigating ecosystem dynamics without compromising long-term sustainability. Through this chapter, we argue that:

- **H1**: Water resilience is combination of water landscape perspective and water engineering perspective
- **H2**: Water resilience is built on local knowledge and cultural diversity.
- **H3**: Social learning is a tool how to address water resilience.

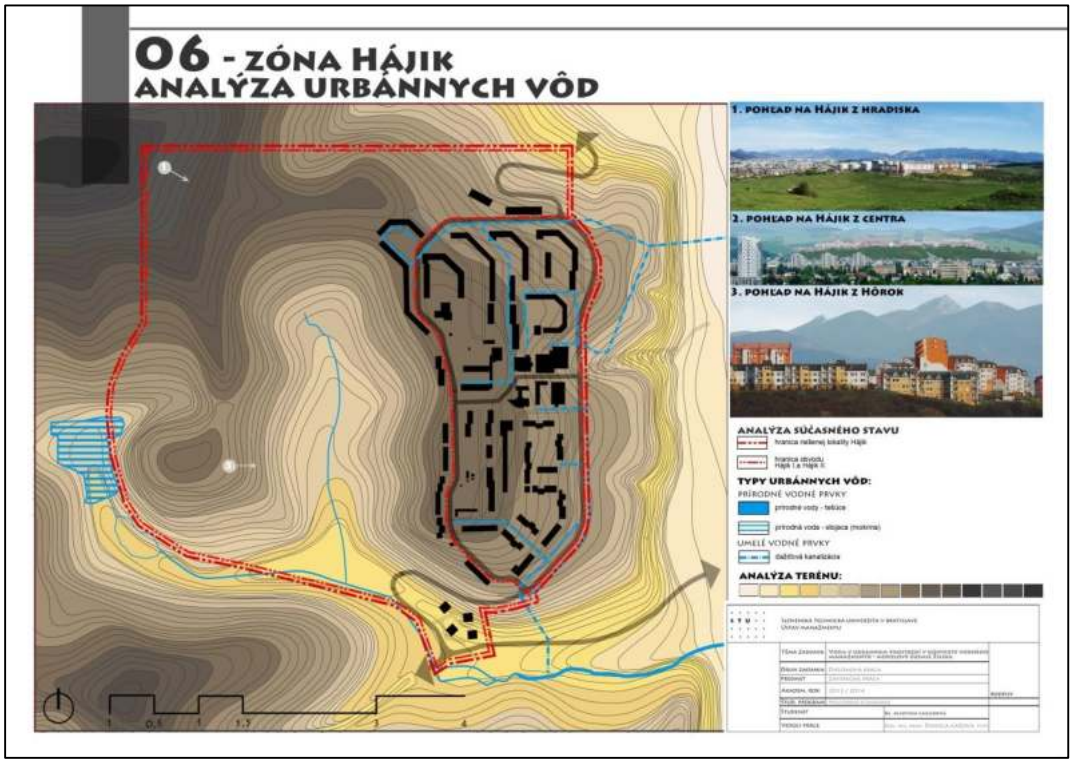
Here, we outline combined nature/engineering perspective, with emphasis on cultural diversity and local knowledge. The challenge is to anticipate change and shape it for resilience in a manner that does not lead to loss of future options. It involves enhancing the capacity of social learning. In this chapter we explore the above hypotheses and present some provisional conclusions on resilient water cycles. Currently, we are living in period of constant changes. Such periods caused by disturbances or crisis are the most neglected and the least understood in conventional water management practice. This implies a shift in water management towards those institutions and organizations that can deal with nature·s dynamics in a fashion that build not only ecological or social but also cultural resilience of water resources. Otherwise, the development and well-being of human societies will become increasingly vulnerable to environmental changes.

5. CASE STUDY

After the literature review this section implements outlined assumptions in the model territory of southern Slovak city ilina and its residential neighborhood HÆjik. Going deeper in research on water resilience should result an understanding of the strength and limitation of resilient water system with regard to the scale in which the process take place. The model territory of HÆjik is characterized as interplay of wild natural landscape with panel housing estate. The area is widely acknowledged as holding a wealth of water resources, but on the other hand the neighborhood hides several controversies. For example the rich local diversity is continuously shift to dense urban structure

of housing estate, or hilly terrain is alternated by several lowlands. Then, local waters from underground aquifers rushes past the hills and lowlands, are infused with symbolic and cultural meanings, and after they flows into the metal pipes of modern urban infrastructure. Moreover, HÆjik is a social melting pot of native populations, mixed with other communities.

Map 1 of HÆjik, shows the location of the neighborhood within the city and the traditional drai water system, while the Map 2 introduces proposal for resilient management solution based on the combination of the water engineering mechanisms with the tools of water landscape approach. The aim of the project was to linked different type of water with leisure time activities, and most other cultural manifestations. This case demonstrates how can be designed a small-scale urban water system sustainably and how can we revive small water cycles in theory of urban fringe. To sum up, long-term ecological and economic resilience requires a multiscale institutional mechanism that acknowledges not only the biological, but also cultural diversity of the region. Effective decision-making processes that integrate local knowledge and ideas about traditional water management must be included in any development plans. Cultural difference particularly historical experience has become crucial in managing the watershed for this key shipping lane. In the best case, the new water plan will be used for social learning process of the local community.



Map 1: Location of the residential neighborhood HÆjik, ilina Resource: LazarovÆ, 2014

Map 2: Proposal of water resilient urban design in the specific area
Resource: LazarovÆ, 2014

6. CONCLUSION

Water is one of the most pressing development challenges of our time. Water management model built on the paradigm of engineering expertise has been dominating the water management community for decades. Such perspective requires system behavior as highly predictable. The failure to implement water resilient systems may be due less cultural-based expertise. A better understanding of cultural values and water management traditions is essential to catalyze change for integrated and adaptive water management regimes. This new approach requires knowledge of the system in its full complexity and calls for a shift to strategies that can deal with high uncertainty. The new water dynamics facing the world will require changes in governance in order to sustain and develop human wellbeing within scientifically defined resilience criteria. Water is at the heart of such a transition to global resilience as it constitutes the bloodstream of the biosphere. Therefore a planning process based on deeply uncertain predictions provides only a crude approximation of the future and is a weak basis for robust decision-making. As history has shown, this can result in problematic decisions, such as high operational costs and lock-in effects. Therefore, collaborative practices develop a shared construction of reality through the understanding of local contexts from the perspective of the involved parties in order to derive knowledge informed by context and suitable solutions. However, doing so is not easy. Paper·s contributions emphasize the role that local knowledge and underlines the physical manifestations of the water/culture relationship in the concept of water resilience. Local leadership will be vital in addressing the challenges in the decades to come. The project Redevelopment of residential neighborhood ilina-HÆjik, represents the hope for the future of urban water, which has been for ages the lifeblood for the region.

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