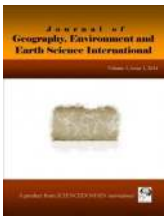

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Waterscapes Asia: Concepts and Practices

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Authors' contributions

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Editorial

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ABSTRACT

Our paper provides an introduction to, and context for, the 10 papers that comprise this special volume: *Waterscapes Asia: Concepts and Practices.* We discuss the various interpretations of what is meant by a "waterscape" and suggest some ways forward that may provide a bridge between the theoretical waterscapes framework and practical considerations that we hope will make the waterscapes concept more broadly useful. These 10 papers, representing contributions from India, Vietnam, Cambodia, Thailand, and Indonesia are decidedly applied and consider issues of inequitable socio-hydrological conditions that are impacted by flows of capital, political relations, and policy. Yet, they also represent efforts in quantifying water quality and quantity within the human-natural system nexus, and most importantly, the central theme of familiarisation as a path to more effective waterscape management.

Keywords: Waterscape; hydrosocial cycle; integrated water resources management; nature-society dualism; Southeast Asian Geography Association.

1. WHY WATERSCAPES? WHY ASIA?

The collection of 10 papers in this special volume explores various concepts and practices related to waterscapes from India, Vietnam, Cambodia, Thailand, and Indonesia, with the majority of the papers being delivered at the Southeast Asian Geography Association (SEAGA, http://www.seaga.info/) 2014 meeting held in Siem Reap, Cambodia. One of SEAGA's goals is to strengthen geographic research and education within the region through its bi-annual meetings and special publications, such as this volume. There was a focus on water-related issues at the SEAGA 2014 meeting that is reflected in these 10 papers and we hope that the volume will

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spark further discussion and research related to Asian waterscapes.

The second of the questions posed in this section's heading, Why Asia?, can be more concisely addressed, so let us start there, by way of introduction to this volume. While water inarguably is essential to all life, water resources and management increasingly are critical issues in Asia. Zhao et al. [1] reported that less than 50% of the domestic wastewater in Asia is treated, compared with 80% in the developed world and furthermore, greater than 95% of wastewater from Asian cities is discharged directly into receiving waters without any treatment. Given this treatment situation perhaps it is not surprising that the diarrhoea burden in Southeast Asia, as reflected by mortality and disability-adjusted life years (DALYS), is second behind sub-Saharan Africa in the regional analysis recently conducted by Pruss-Ustun et al. [2]. Stress on waterscapes of Asia will be further exacerbated by projections of increasing urbanization, waste generation, and climate change. Asia is one of the fastest urbanizing regions of the world and it is projected that by 2050, 64% of the population will live in urban areas [3]. Water is a matter of national security in Singapore and issues of water availability and water management occupy a central place in the country's secondary school Geography curriculum [4,5,6]. Worldwide, the acreage equipped for irrigation increased from 193 to 277.1 million hectares between 1980 and 2003 with the largest proportion of this irrigated land being in Asia (http://www.fao.org/nr/water/aquastat/dbase/index.stm). Southeast Asia is one of the world's most vulnerable regions to climate change due to its long coastlines, high concentrations of population and economic activity in coastal areas, as well as a reliance on the agricultural, natural resources, and forestry sectors [7]. For all of these reasons, and more, it is timely to focus on waterscapes in Asia (see also, for example, [8]).

Why focus on the concept of waterscapes? Swyngedouw [9] was one of the first to explicitly elucidate a conceptual framework for "waterscapes" *insisting* that "…nature is an integral part of the metabolism of social life" and using this socionatural framework to describe how water development programs in Spain were a modernization strategy from the late 1800's to help the country recover from the morass of losing its last colonial possessions and inadequate agricultural production that had been based on a socio-economic class system. Certainly, water and modernization are closely intertwined as part of the Singapore story since its independence in 1965 [5], but also has been well-documented as part the Mekong Delta development in Vietnam [10] and is a cornerstone of the Cambodian government's poverty alleviation strategy [8]. The waterscapes conceptual framework evolved to include the idea of the *hydrosocial cycle* [11,12,13,14]. Swyngedouw [11] observed that "…interventions in the organization of the hydrologic cycle are always political in nature and therefore contested and contestable." Linton [14] crystallizes the ideas in a more accessible fashion:

> "We will begin this section by describing an emerging concept developed by researchers in political ecology to theorize and analyze hydrosocial relations: The *hydrosocial cycle* borrows somewhat from the concept of the hydrologic cycle, but modifies it in important ways. While the hydrologic cycle has the analytical effect of separating water from its social context, the hydrosocial cycle represents water as a hydrosocial fact, thus putting people and politics at the center of all water issues".

Linton [14]) sees this cycle as an interaction between social power structure, technology / infrastructure, and water. Bouleau [13] might see the process more as a spiral where society envisions how things are and how they ought to be, so that "A new understanding of what the waterscape should be is therefore a vehicle for institutionalising a new water management system." Perhaps it is fair to conclude that waterscapes are a reflection of the multiple outcomes of a hydrosocial cycle.

Schmidt [15] criticizes proponents of the hydrosocial cycle for ignoring earlier water management concepts proposed by American geologist and anthropologist, W.J. McGee, in the late 1800's and early 1900's, lamenting: "And how did his [McGee's] version of vitalism atrophy into the anthropological lens that seems almost invisible to contemporary claims about the hydrosocial cycle?" Elements of political ecology certainly are part of the underpinnings for waterscape and hydrosocial cycle theory that may help to frame questions of causation and social difference such as: Why are particular populations vulnerable? How are they vulnerable? Who precisely is vulnerable? [16,17]. The

concept of waterscape, then, dismisses nature-social dualism and can help us better understand human-environment interactions which may lead to better and more inclusive water management policy [18]. However, per Schmidt's [15] concern, it is important to critically examine conceptual frameworks to ensure open and healthy development and reduce duplication of theoretical effort. The next section of the paper considers whether "waterscapes" and the "hydrosocial cycle" suffer from "re-gifting syndrome".

2. WATERSCAPES, HYDROSOCIAL CYCLE, AND THE RE-GIFTING SYNDROME

One of the characteristics that defines "re-gifting" is that a person takes a gift they had previously received, re-packages it, and gives to another friend as new. The question, then, is whether the concepts of waterscape and hydrosocial cycle really are new or whether they simply are a re-packaging of existing water management theories and practices.

Over the past 25 years, Integrated Water Resources Management (IWRM) has become one of the leading management frameworks for water projects in the developing world and has been supported by major donor and funding organizations such as USAID, SIDA, JICA, CIDA, the European Commission, and the ADB [8]. The concept has best been defined by the Global Water Partnership [19]:

> IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

The United Nations University, as part of its UN-Water Virtual Learning Centre provided a clear and concise summary of the eight IWRM principles (as noted by [8]):

- Water source and catchment conservation and protection are essential
- Water allocation should be agreed to between stakeholders within a national framework
- Management needs to be taken care of at the lowest appropriate level
- Capacity building is the key to sustainability
- Involvement of all stakeholders is required
- Efficient water use is essential and often an important "source" in itself
- Water should be treated as having an economic and social value
- Striking a gender balance is essential

Most certainly, there has been debate and criticism of IWRM [20,21,22,23], with claims that it is too broadly defined and therefore provides poor guidance for water resource management. Biswas [21], for example, listed 41 sets of water-related issues that would need to be "integrated" under the IWRM rubric and he concluded when faced with this type of complexity we may simply go back to the business as usual approach, camouflaged by the IWRM banner. Jewitt [24] expressed similar concerns, but also noted "Despite the conceptual goal of an holistic management strategy involving all role-players, it is necessary to start in the framework of existing institutions and adopt a pragmatic and at times even piecemeal approach." UNESCO [25] also suggested that successful implementation of IWRM does not necessarily demand whole-sale integration; each IWRM plan and approach will be different and a "one size fits all" solution is highly unlikely. Again, as suggested by Schmidt [15], these types of critical discussion and refinement of theory are healthy in forming successful policy frameworks.

While IWRM has been adopted as a management philosophy particularly in the developing world (see, for example, the Mekong River Commission (MRC), http://www.mrcmekong.org/about-mrc/programmes/mekong-integrated-water-resources-management-project/; and [26]), Irvine et al. [8] also drew parallels between IWRM and management of the Laurentian Great Lakes in North America. Guided by the Boundary Waters Treaty of 1909 between the U.S. and Canada and more recently, the Remedial Action Plan (RAP) process for restoration of environmentally-impaired areas, the management philosophy here more commonly is termed "the ecosystem approach" than IWRM, but many of the principles are the same. In particular, the RAP process, initiated in the mid-1980's, legally requires stakeholder involvement and in some areas such as the Buffalo River, New York, watershed, this has been successful to the extent that citizen run not-for-profits lead and manage the process (e.g. [27]). Rabe [28]

pointed to the Great Lakes water management as an example where "…physical scientists, policy analysts, and policy makers worked hand-in-hand to bring unprecedented precision to the concept of integrated environmental management." As evidenced by the recent series of Smart Water Grid International Conferences organized by the Smart Water Grid Research Group of Korea (http://www.swgic.org/sub/information/schedule.htm) aspects of IWRM are now being embraced within smart water grid theory and applications. Smart water grids aim to integrate large data sets using Information and Communications Technology (ICT), to improve water distribution and treatment efficiency and make water systems more resilient and therefore must include information on physical and human aspects of the system [29,30,31].

How do the concepts of waterscape and the hydrosocial cycle differ from IWRM or an ecosystem management approach? To take the concept of "re-gifting" further, the resultant idea of what makes for waterscape should be useful, in that the receiver of the "re-gift" must find value in the repackaged idea. In other words, the idea of waterscape should be based on tried and tested empirical work on a range of issues and not just a theoretical construct dreamed up in an armchair. Indeed, the keyword "waterscape" has been identified with a range of research topics that includes psychological assessment of feelings of tranquility and preference (tranquility rating higher for field/forest and large waterscape scenes), to water quality assessments that address urban ecological design and the impact of land use change in the watershed, to gender issues, to issues of water supply and access in both urban and rural communities [32,33,34,35, 36,37,38,39,12,18,40]. Most of this research has been done by academic geographers, although to a lesser extent, environmental engineers, environmental scientists, urban planners and designers, government agencies and not-for-profits have been involved. The majority of these research efforts explicitly establish a link with some school of socio-economic theory and philosophy as a basis to explore the waterscape and then use a case study to help illustrate and contextualize the theory, while some of the research efforts only implicitly link to waterscapes. It is clear that the central theme of the waterscape concept is the human-environment interaction, which also is a foundation of geographic theory and one of Cutter et al.'s [41] "Big Questions in Geography". Most certainly, the waterscape concept reflects renowned hydrologist and geographer, R.J. Chorley's [42] observation that"…the study of water provides a logical link between an understanding of physical and social environments." None of the literature reviewed had a common set of theoretical tenants, with the exception that most drew upon aspects of political ecology. The question then remains, how does this work differ from IWRM or ecosystem theory approaches, or is it simply a case of re-gifting syndrome? Perrault et al. [43] probably address this question most succinctly in their evaluation of environmental justice issues related to first nations and low income communities of color in the Onondaga Lake area of New York State, U.S.A. There are two defining characteristics of the waterscape concept that might be taken from Perrault et al. [43]:

i) "waterscapes explore the ways in which flows of water, power, and capital converge to produce uneven socio-ecological arrangements over space and time, the particular characteristics of which reflect the power relations that shaped their production" (also see [44,45]); and

ii) "…a waterscape does not exist at a fixed, pre-given spatial scale…". This infers that while a watershed (for example) may be a fundamental hydrologic and geomorphologic unit with distinct physical boundaries (useful for determining water, sediment, and chemical mass balances), the waterscape concept may include the watershed, but also often extends beyond these physical boundaries to consider external flows of capital, political relations, and policy that interact with the physical watershed. It can be concluded that there is a need to consider the geographical perspective in advancing the theoretical construct of "waterscapes" so that questions of location, boundaries and scales can be included, in addition to those that tackle the nature-social dualism or the socio-political imperative.

Perhaps these signature characteristics, for the moment, are sufficient so that we can dismiss concerns about the re-gifting syndrome. Perhaps smart water grids reflect one potentially practical application of the broader waterscape theory.

3. WATERSCAPES, LANDSCAPES, THE HYDROSOCIAL CYCLE AND SOME OBSERVATIONS ON THE WAY FORWARD

Landscape ecology is considered "…the study of the pattern and interaction between ecosystems within a region of interest, and the way the interactions affect ecological processes, especially the unique effects of spatial heterogeneity on these interactions."[46]. While the concept of landscape ecology was first explored about 60 years ago, it is within the last 20 years that the sub-discipline has expanded and flourished with contributions from geographers and those with more formal ecological training [47,48]. More recently, Wang and Eagles [49] reviewed the state of landscape ecology and suggested that a natural progression in landscape ecology theory was to explicitly explore waterscape ecology since they felt landscape ecologists more traditionally focus on terrestrial ecosystems, relegating water to being a connecting factor in critical transition zones or an element of the landscape mosaic. Interestingly, however, Wang and Eagles [49] did not include a single reference from the geographic literature on waterscapes and the hydrosocial cycle. It appears, then, that diffusion of these geographical concepts beyond the discipline of Geography (and perhaps, Anthropology) essentially has not occurred, as is also evidenced by the general absence of references in the non-academic international development literature.

Perhaps, as Wang and Eagles [49] suggest, there can be some valuable discussions to link and expand on landscape and waterscape theories. Perhaps, as Swyngedouw [11] suggests, "There is an urgent need, therefore, to theorize and empirically substantiate the processes through which particular socio-hydrological configurations become produced that generate inequitable socio-hydrological conditions." The 10 papers of this special volume are decidedly applied in nature, possibly with the exception of D. Ghosh's paper [50] that was part of a keynote address at the SEAGA2014 conference and combines both new theoretical considerations on ecological learning and wastewater as a commons based on his experiences in the peri-urban communities and treatment wetlands of East Kolkata, India. While this collection may not eloquently and explicitly connect waterscape theory and practice (with the exception of D. Ghosh's paper [50]), they represent an earthy, on-the-ground, extension of theories outlined in this introduction that address real-world water problems in Asia. Most certainly, the papers by Ghosh [50] Das et al. [16], Nguyen et al. [51], Ly and de Fraiture [52], Chea et al. [53], and Irvine et al. [54] consider issues of inequitable socio-hydrological conditions that are impacted by flows of capital, political relations, and policy that originate outside of the watershed borders. However, some additional themes can be identified in the papers of this special volume that perhaps suggest a way forward in the evolution of the waterscape framework:

3.1 Familiarisation

Ghosh [50] explicitly explores the importance of understanding both the physical and human actors and their interactions in order to effectively manage an ecosystem. This understanding can only be a product of familiarisation, as Ghosh notes "Familiarisation is a tool, a method that is an antithesis of superficial knowledge." Familiarisation can be facilitated by techniques of observation and community surveys and interviews, as explicitly discussed by Das et al. [16], but also applied by Nguyen et al. [51], Ly and de Fraiture [52], Chea et al. [53], and Irvine et al. [54]. Kooy [18] also used familiarisation techniques to argue that informal water distribution in the case of Jakarta, Indonesia, should not be seen as a development (or modernization) failure, but as an effective outcome of adaptation to urbanisation that can be more effective at increasing community resiliency than implementation of a traditionally centralized technological ideal.

3.2 Modeling

One aspect of the waterscape and hydrosocial cycle discourse that has been remarkably absent to date is the application of mathematical modeling to describe the physical and socio-economic characteristics of the system under consideration. Long et al. [55], Yim et al. [56], Azman et al. [57], and Kusratmoko et al. [58] applied different deterministic and statistical models to explore aspects of flood prediction, provision of clean water, and community adaptation. Mathematical models should be seen as effective decision-making tools, but need to be made more accessible to non-technical policy-makers and the public [59]. Models of the physical system need to be integrated with economic and policy models within a decision support system to facilitate this accessibility

[60,59]. Integration of physical system, economic, and policy models is starting to be done in the context of smart water grids, but much more work in this area is needed, particularly in relation to developing countries.

3.3 Water Quality

Long et al. [55] and Chea et al. [53] explore different aspects of water quality, impact on community and community adaptation and resiliency. Although issues of water quality have been explored within the waterscape framework (e.g. 33, 34, 43, 38), we believe this is an important aspect of human-environment relations that deserves greater attention, particularly since the issues can differ in the developed and developing worlds.

3.4 Rural-Urban Continuum

The papers of this special volume examine issues covering a range of land use characteristics, from rural to peri-urban to urban. Because of this encompassing nature, the application of a waterscape framework becomes relevant to everyone and as such there should be great scope for the integration of waterscape theory into both academic studies and applied policy-making.

Ultimately, we believe the value of theories is only as good as their ability to address and help solve real world challenges. The waterscape and hydrosocial cycle concepts establish an interestingly nuanced approach to addressing water management challenges. What are the differences in flow of power and capital when comparing water resource development and management in west and east, developed and developing countries, urban, peri-urban, and rural areas? What does this mean for local communities? Fuller development and application of these theories will require a multidisciplinary, transdisciplinary approach. The barriers (and bridges) to these types of collaboration are well-known [61,62,63,64,65] and geographers who often take a broad and integrative approach to research should be well-positioned to move these conversations forward. Let the discussions continue! Intended challenge

DISCLAIMER

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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