The Hydrosocial Cycle: Understanding Water as a Socionatural Production

Rubén Alejandro Villar Navascués and Ana Arahuetes Hidalgo

Interuniversity Institute of Geography, University of Alicante, Alicante, Spain

Definition

The lack of attention to the social, political, economic and cultural dimensions of water conflicts and water policies has led to the production of the hydrosocial cycle framework since the beginning of the new century (Bakker 2002, Budds 2008, Linton 2010, Swyngedouw 2004, 2009). This concept understands water as a socionatural hybrid formed as a result of the interrelationships between water flows and social, economic, political and cultural processes. Linton and Budds (2014) define the **hydrosocial cycle** as a socionatural process by which water and society influence and transform each other along different spatial and temporal scales. As a result, water cannot be managed solely from technical and quantitative perspectives, since the environmental problems surrounding this resource are fundamentally social and political issues.

Understanding water beyond its biophysical characteristics, such as its chemical composition (H_2O), quality and quantity, implies becoming aware of how its circulation is influenced by society through hydraulic infrastructures, legislation, cultural practices and symbolic meanings (Budds and Hinojosa 2012). The aim of this concept is to try to overcome dualistic visions that separate water and society through a relational-dialectic approach that allows identifying how water, at the same time as it is produced by society, reconfigures social relations and highlights power relationships involved in this process (Linton and Budds 2014). In this way, it can be identified how the distribution and control of water resources in local contexts are influenced by processes of capital accumulation and unequal power relations produced at different scales (Swyngedouw 2004). Therefore, the hydrosocial cycle analysis provides a better understanding of how water flows shape and are shaped by institutions, practices and human discourses that determine, in turn, ways of control, management and decision making (Linton and Budds 2014).

Introduction

Water in a global context presents itself as one of the most important challenges of the future. The inequalities around the supply and sanitation of drinking water cause that 844 million of people lack basic water services; 2.1 billion do not even have safely managed drinking water; 4.5 billion lack access to safely managed sanitation; 892 million still practice open defecation; and only 27 per cent of the population in the least developed countries has access to soap and water for handwashing on premises (UN-Water 2018). According to the United Nations, water pollution is worsening and lack of funding hampers to meet the Sustainable Development Goal on water and sanitation (SDG6) targets in 80 per cent of countries. Achieving universal access to water and sanitation services by 2030 would require doubling the current annual rate of progress. In addition, conflicts over water access and

control, as well as political and economic decisions that promote the commodification of water and its conception as a mere economic resource are expected to be aggravated by climate change (Sultana 2018).

The diagnosis of its implementation discloses that SDG6 targets are not on track to be met. Moreover, some authors have remarked the weakness of the link between means of implementation and SDG6 outcomes (Bartram et al. 2018). Many of these objectives are poorly developed and some of the monitoring indicators are difficult to interpret. Likewise, the large investment needed to attain the SDG6, as well as the leading role that would carry out the public sector are some of the main obstacles identified in order to fulfil this goal. It is necessary to understand the interdependency of the Sustainable Development Goals (SDGs), since ensuring availability and sustainable management of water and sanitation implies the partial achievement of other goals, such as end poverty, good health and wellbeing, reduced inequalities or life on land and below water, for instance. However, despite its multiple relationships with anthropic factors of all kinds, water is still understood as a resource that can be managed separately from a technical and politically neutral perspective. Therefore, it is necessary to adopt approaches that consider the social and political nature of the processes that are creating and perpetuating the problems around water to understand how water management can facilitate or prevent the achievement of the human right to water and sanitation, recognized by the United Nations in 2010. These issues reinforce the interest in new ontological and epistemological approaches that redefine what water is, proposing new methods to identify the social and political origin of water problems that overcome purely technical visions.

In this line arises the concept of the hydrosocial cycle, which identifies the relationships between the circulation of water flows and social, political, economic and cultural processes. This concept, coined in the field of Anglo-Saxon critical geography and Political Ecology, seeks to overcome the separation between society and nature to show that the water cycle is an inseparable combination of both areas, which are interrelated (Swyngedouw 2009). In this way, it is recognized that water cannot be understood only from a technical and hydrological perspective, as its social, economic, political and cultural dimensions affect its natural conditions modifying them in a dialectical relationship, which also transforms anthropic factors of the specific context where water is produced (Linton and Budds 2014).

This conceptual framework may enhance the understanding of some of the water issues raised, as well as new perspectives to address SDG6 targets. The recognition of the political nature of water and the identification of the mechanisms that generate inequality around water policies, discourses or forms of governance, allow identifying the social roots of some of the problems pointed out in the SDGs and invoke the need for renewed critical frameworks that treat the natural and the social issues from a holistic point of view.

Background: From the Hydrological Cycle to the Integrated Water Resources Management

The concept of hydrosocial cycle is born as opposed to the concept of hydrological cycle, which has become the hegemonic discourse of representing the water cycle from its widespread dissemination in manuals of hydrology and, above all, school textbooks (Linton and Budds 2014). Consequently, to understand the contributions of the hydrosocial cycle it is

necessary, first of all, to deepen the understanding of the hydrological cycle as a social construction which has influenced the way of addressing water policies (Linton and Budds 2014).

The hydrological cycle is defined in 1931 by the American hydrologist Robert Horton as natural circulation of water over the Earth's surface and in the underground, powered by solar energy and driven by gravity (Horton 1931). It was also used as a framework for the emerging science of hydrology, which was originally defined as the science that studied the phases of the hydrological cycle (Wisler and Brater 1949). Although this cycle is understood independently of the human being, it can be modified by him to adapt the natural water circulation to his needs and obtain the greatest possible benefit from water resources (Thomas 1956). This vision has dominated water policies in the most industrialized countries throughout the 20th century, forming the so-called old paradigm of water (Gleick 2000), hydraulic-state paradigm (Bakker 2003), or modern waters (Linton 2014). The hegemony of this concept has had epistemological consequences on water, which is conceived in quantitative terms and as an economic resource, reducing water management to the field of hydraulic engineering (Linton and Budds 2014). Under this paradigm, water policies were developed focusing on the increase of available water resources through the construction of large hydraulic infrastructures, intensive extraction of underground resources and the realization of transfers between river basins. These actions based on the manipulation of the hydrological cycle allowed the growth of the modern state, but they occurred without addressing their social and ecological consequences (Linton 2014).

Over time, ecological and social repercussions of human intervention in the natural water cycle have led to the emergence of a new dominant paradigm in the field of water management (Linton and Budds 2014). This new conception was reflected in the Dublin Declaration of 1992, which laid the foundations of Integrated Water Resources Management (IWRM) (Gleick 2000). This new paradigm tries to integrate the cultural, ecological and economic aspects of water with purely hydrological ones, while claiming the need to include all the relevant actors in the decision-making processes that affect water resources, in a procedure called governance (Linton and Budds 2014). This new conception supposes a historical turn with regard to the previous stage, since new policies of water management are proposed through the implementation of efficient, equitable and sustainable solutions, socially agreed. In this way, the target 6.5 of the SDG6 declares that by 2030 IWRM should be implemented at all levels, including transboundary cooperation. However, this concept continues to consider water and society as separate and disconnected areas that must be integrated through water policies (Linton and Budds 2014). In addition, some critical readings of the IWRM paradigm consider that governance processes imply a liberalization of the technical approach previously developed by government agencies, linked to the growing role of the private sector in the management of public water services (Bakker 2003, Swyngedouw 2005). Additionally, the IWRM approach assumes that the different interests around water resources can be reconciled by means of water policies based on technical optimization and decision-making processes but without recognizing the unequal power relations between stakeholders, which make it difficult to identify the causes and resolution of water conflicts (Linton 2014).

In summary, paradigm changes around water arise as a reflection of the relationships between water and society and of historical circumstances. However, the separation

between the natural and the social areas coincides in the different dominant paradigms around water management, which limits the understanding of their interrelationships and the implementation of new ways to solve water problems. In contrast, the hydrosocial cycle presents a new ontological approach whereby the notion of nature is reconsidered and the traditional dualistic separation is broken to characterize water as a hybrid socionatural production. These conceptual bases enable to identify that a large part of the current water problems, presented in terms of water crisis, are fundamentally social (Linton 2014).

Conceptual Basis: Water as a Socionatural Hybrid

From the discipline of Political Ecology, it is proposed to abandon the concept of nature to consider the world from a hybrid socionatural perspective (Swyngedouw 1996, 2011). This approach challenges the dualist view of society-nature from the combination of dialectical Marxist thought with posthumanist approaches (Latour 1993). On the one hand, Marxist influence derives from the adaptation to the social sciences of the concept of metabolism as a metaphor to define the dialectical relationship of humanity and nature (Marx 1867). Through the work process, the human being metabolizes the natural environment transforming society and nature at the same time, forming hybrid realities. From this point of view, the result of society-nature interactions is conceived as socionatural productions, influenced by historical, economic or political questions as well as by biophysical processes (Syngedouw 2009). On the other hand, the theoretical contribution of posthumanist approaches contemplates that hybrid objects or socionatures participate dialectically as both product and an active agent of socio-environmental changes (Linton and Budds 2014). This means that water is not an inert background of social relations, but plays an active role, for example, as a vehicle of political power through hydraulic engineering (Swyngedouw 1999). This idea was applied by Karl A. Wittfogel in the ancient civilizations of China, Egypt, Mesopotamia or India, where water played an active role in the creation of a centralized state power strengthened through the control of hydraulic infrastructures (Linton and Budds 2014). For this reason, the dialectic relationship between nature and society and the understanding of the active role of water and hydraulic infrastructure in social and political transformations allow affirming that water is at the same time a product and producer of history (Linton and Budds 2014).

Then, the concept of the hydrosocial cycle allows understanding water as a socionatural production resulting from the interactions between water itself (H_2O), social power structures and technology/infrastructure (Linton 2014). In the dialectical-relational process by which water is socially produced, water intervenes as an active agent that can stabilize or alter the social power structure, modifying the circulation, quantity and composition of water, and producing changes in the hydrosocial cycle successively (Linton 2014). Therefore, the cyclical aspect of this process implies that any change in one component of the hydrosocial cycle may affect the set of relationships established. These changes can be generated by a technical intervention, new water regulations, changes in water availability or the different social aspects, as actors, water uses, modes of governance, discourses over water and so on (Linton and Budds 2014). In some cases, hydrological studies not only are insufficient to solve conflicts related to water scarcity but also are at the root of the problem. For instance,

in her research about the hydrosocial cycle of the La Ligua Valley in Chile, Budds (2012) shows that the different actors involved in the cycle have different perceptions of water scarcity and how based on their interests and their location on the basin they develop particular discourses about water problems. Downstream irrigators are affected by the growth of the groundwater abstraction upstream, illegally in many times, and criticize the over-allocation of water rights by the Chilean Water General Directorate based on lax hydrological studies. This situation provoked the overexploitation of the aquifer that is shared by all the irrigators on this basin, although its impact is unevenly distributed since water scarcity affects mainly downstream small farmers. In this case, the hydrosocial cycle analysis enables a more complete and legitimate assessment of the relationships of all water users, identifying that water problems must be addressed taking into account historic, political and socio-economic context, incorporating local knowledge and fostering public participation.

Therefore, the alleged political neutrality and the prevalence of technical focus in assigning the causes and the solutions of water problems identified in the SDGs do not allow identifying the root causes of the lack of universal access to water and sanitation. Next, the research areas where this theoretical framework improves the understanding of water conflicts and the unequal consequences of socio-environmental change processes will be evaluated, as well as its relationship with some of the targets of the SDG6.

The Hydrosocial Cycle: Identifying Practical Applications Through a Brief Review of its Research Areas

Conflicts over water are never socially or ecologically neutral, as their consequences are not homogenous between social classes or territories (Swyngedouw 2009). Therefore, the hydrosocial cycle approach focuses on answering questions about how, by whom, through which strategies and with what interests water circulation, distribution and control occur through the interrelation of natural, social and technological issues (Boelens et al. 2016). These analyses help explain how social power is distributed in a society, as the clearest example of the differences in water access between social classes in the large cities of the Global South (Swygedouw 2009).

The understanding of water as a socionatural production places population and policies at the centre of water issues (Linton 2014). This implies new dimensions in water policies and management, as the fulfilment of universal access to safe and affordable water supply and sanitation as a human right or the incorporation of the particularities of the social context in the water governance processes (Linton 2014). As a result, the research areas addressed from the perspective of the hydrosocial cycle revolve around the right to water and environmental justice (Sultana 2018). Consequently, to promote new governance frameworks that respond to questions of socioeconomic equity, political democracy and ecological integrity will require the identification of the social and political roots of water conflicts (Boelens et al. 2016). Understanding the underlying causes of lack of access to water and sanitation requires, therefore, to jointly address water policy with the problems identified in the rest of SDGs.

In this sense, the hydrosocial cycle framework may help to identify the limitations of the IWRM paradigm in the definition of the SDG6 targets and tracking indicators. The first studies that incorporate the concept of hydrosocial cycle focused especially on analysing the

socioeconomic and political causes that explain the unequal access to urban water and the social struggles for their control, as exemplify the paradigmatic case of Guayaquil (Ecuador) (Swyngedouw 2004). This approach also allows unravelling the political use of the concept of water scarcity, which tries to justify the problems of water supply to natural causes when, in most cases, it is socially produced (Kaika 2006). Other research areas link the power imbalance between large water users with other users, as small farmers and indigenous peasants, as the cause of the social production of scarcity. The pollution produced by mining activities in water resources for downstream settlers (Perreault 2014), or the abusive extraction of groundwater for the agro-export sector by large farmers benefiting from a favourable legislative configuration (Budds 2012), deepen socioeconomic inequalities among the beneficiaries and victims of the current hydrosocial configuration.

Likewise, under the hydrosocial perspective, non-human objects, such as hydraulic infrastructure or legislation, have an active role in shaping social relations and power structure around water resources. For instance, the development of water laws, flood control and drinking water supply were central to the organization and production of state power in Tijuana (Mehaan 2014). Likewise, other non-human objects as some indicators used to manage water resources (Fernandez 2014), or hydrological information (Usón et al. 2017) contribute to shaping specific hydrosocial cycles. For instance, minimum flow requirements in the south-west of France are shown to be a tool that contributes to naturalize water scarcity and that shape power and financial relations (Fernandez 2014). In other case studies, hydrological information, often seen as an apolitical and objective, resolve conflicts over water allocation and distribution reinforcing asymmetrical relationships between stakeholders over access to groundwater (Usón et al. 2017). Other examples show the role of hydraulic megaprojects, such as rural-urban water transfers in the Lima Region, in producing unequal effects between urban and rural users in terms of economic benefits, loss of autonomy and environmental impacts (Hommes and Boelens 2016). These cases are made possible by governance processes supported by institutional and financial visions that favor the interests of drinking water companies and hydropower companies without considering the unequal power positions among all stakeholders (Hommes and Boelens 2016). Regarding this, the target 6.A defines that “by 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programs, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies”. To meet this goal the indicator used is the “amount of water- and sanitation-related official development assistance that is part of a government coordinated spending plan”. In other words, this goal prioritizes the capital spending (CAPEX) framed in development aid programs above other types of international cooperation such as the assistance offered in the form of advice or knowledge for solving a particular challenge or problem (Bartram et al. 2018). Likewise, the implementation of the SDG6 will require enormous financial expenses in the context of the operational and maintenance costs of the water services (OPEX) and capacity building deficit, which cannot be covered solely by the international support, since it requires heavy investments at the national level. Nevertheless, there are no references to that in the SDG6, and neither to the need for comprehensive legislation, robust policy or detailed financing planning (Bartram et al 2018). In this sense, the target 6.A seems to indicate that water and sanitation access problems should be solved deepening the international expansion of the water lobby through infrastructure development. These reasons indicate that the IWRM

framework lacks to identify the social and political roots and interrelationships of the water challenges.

Apart from that, other non-human objects reveal their active role in reproducing existing hydrosocial relationships that deepen unequal access to water and sanitation, as the example of climate change adaptation plans in the metropolitan area of Santiago (Chile) and the Piura region (Peru) shows (Mills-Novoa et al. 2016). These plans tend to exclude the population that accesses water by informal means, with alternative cultural values around water, and that are outside the dominant economic sectors (Mills-Novoa et al. 2016). In this way, the imbalance in access to water is reinforced and the rural actors located at the headwaters of the rivers are marginalized. These plans reflect the hydrosocial configurations perceived by the ruling elites, which identify the impediment to maintaining current uses as the greatest threat due to climate change. By contrast, the population and water issues outside the legal framework, such as informal supply water systems in mountain communities, are ignored. In this case, the focus is on possible future climate risks instead of addressing the existing challenges (Mills-Novoa et al. 2016). Generally, water laws and policies do not adequately recognize hydrosocial indigenous relations, since they privilege other hydrosocial relations in the same political space (Wilson 2014). In the face of this challenge, the hydrosocial cycle approach may improve water governance considering the legal recognition of indigenous water rights (Wilson 2014). This limitation is reflected inthe target 6.B, which pursues “support and strengthen the participation of local communities in improving water and sanitation management”. To meet this goal the tracking indicator is the “proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management”. However, the possibility of the existence of different management systems and conflicts of interest between urban and rural users does not arise. For this reason, it is decisive to adapt SDG6 targets into country contexts creating multi-stakeholder partnerships to strengthen regional integration and foster public participation in decision-making. In this respect, some studies identify how everyday practices carried out through informal water supply networks confront the dominant paradigms of water management (Boelens et al. 2016). Collective action carried out at the local level to overcome the deficiencies of water governance and territorial planning shows the political nature of the dominant discourses and the lack of recognition of water inequalities. These practices are based on alternative knowledge systems and water management, in many cases linked to traditional indigenous practices. Through them, collective identity as well as communal cohesion is reinforced, proving to be more effective in specific contexts than those practices posed by hydraulic engineers (Boelens 2014). In this way, local forms of collective self-governance and territorial autonomy reduce vulnerability to scarcity and water insecurity. The construction of new multi-scale networks to connect actors with the same interests allows defending material and discursive practices regarding water access and distribution that are in contradiction with hegemonic practices (Boelens et al. 2016). Thus, different parallel hydrosocial territories, understood as physical, cultural, legal and political spaces that imply different conceptions for water control, can be identified (Boelens et al. 2016). This pluralism of hydrosocial territories, or territorial expressions of the hydrosocial cycle in certain specific scales, represents the multiple relationships of historical-geographical processes (Boelens et al. 2016). Therefore, hydrosocial territories or waterscapes are conceived as dynamic landscapes interdependent of the surrounding areas, shaped by the interaction between society, technology and nature

(Boelens et al. 2016). In them, the functions, values and meanings around water are disputed, since through them occur processes of inclusion-exclusion, development-marginalization and unequal distribution of benefits-burdens among different users and population groups (Boelens et al. 2016). The waterscapes analysis has guided several studies, such as the framework analysis of the modernization process in Spain through the hydraulic politics that express shifting power positions (Swyngedouw 1999) or the reconfiguration of water governance in Peru by the mining sector (Budds and Hinojosa 2012). Hence, the analysis of the hydrosocial cycle, understood in a specific context such as hydrosocial territory or waterscape, should imply a reformulation of some of the targets and indicators of the SDG6, since are proposed from an apolitical approach without taking into account the unequal power relations between users and stakeholders built through historical-geographical processes.

Drawing from the premise that the territory is substantial to the society that forms it, embodying its contradictions, conflicts and struggles (Boelens et al. 2016), one of the most prolific research areas in hydrosocial research refers to the reconfiguration of decision-making scales and the growing participation of the private sector in water governance (Bakker 2002, 2003). In fact, the policies of scalar territorial reconfiguration connect the network of local hydrosocial territories with greater political, economic, cultural and ecological scales through the state, market or civil society action (Boelens et al. 2016). This reconfiguration of water governance towards broader spatial scales is especially relevant in the agricultural and mining sectors, which have greater economic power and political influence, as have pointed out many studies related to water conflicts in the Andes (Perreault 2014). This water governance changes reshape local hydrosocial territories through export production chains, which generate asymmetric relationships between transnational and local companies and communities (Vos and Hinojosa 2016). Thus, it is necessary to perform a multiscale analysis to understand the uneven socio-spatial processes, articulated through, in the Ceres Valley (South Africa) case, the liberalization of agricultural markets and the financialization of water supply (Debanné 2013). Another field of research that opens up in this regard is the growing participation and influence of financial power over water supply systems (Loftus and March 2016, Loftus et al 2016), or how the process of water circulation is increasingly being articulated from the financial nexus (Swyngedouw 2009). This issue has added more complexity to the hydrosocial cycle, introducing new actors, logics and economic instruments (Loftus et al. 2016). Under the current neoliberal hegemony, water rights and water ownership are increasingly being articulated from commercialization dynamics and private appropriation, in a tactic known as accumulation by dispossession (Harvey 2003). Market mechanisms transform public water rights socially, politically and economically into exclusive rights. The systematic inclusion of parts of the hydrosocial cycle in the tactics of accumulation by dispossession carried out by the private sector is reconfiguring the mechanisms and procedures that regulate and organize access and exclusion to water and consequently alter the social mechanisms surrounding water rights (Swyngedouw 2009). Identifying these issues is vital for the achievement of universal access to water and sanitation services since experience has shown that the privatization of water supply services has systematically failed to alleviate water crises in cities such as Manila, Jakarta or Lagos. (Swyngedouw 2009).

Finally, another theme developed from the hydrosocial cycle approach has been the analysis of the socionatural repercussions that have involved the introduction of unconventional resources, especially the desalination and reuse of treated wastewater (Arahuetes et al. 2018), that are intimately linked to the financialization of the water sector (Loftus and March 2016). Swyngedouw and Williams (2016) explore this topic analysing the development of desalination in Spain as an alternative to water transfers. This solution adapts the old hydraulic paradigm, based on water policies that promote the continuous growth of available resources, under a neoliberal logic and a hegemonic consensus around a roof-managerial solution. This vision obviates several contradictions of the implementation of large-scale desalination plants, such as high energy requirements, that produces an increase in the price of desalinated water and in CO_2 emissions, the entry of multinational private companies into the hydrosocial cycles thanks to large investments of public funds or the assumption that continuous economic and water resources growth are unquestionable. These contradictions, in the end, reflect the depoliticization of this market-driven technocratic form of environmental governance. Likewise, although desalination is conceived as a solution to solve water scarcity in coastal urban areas, it does not solve the perceptual scarcity, since most of the population continues to buy bottled water for drinking uses (Fragkou and McEvoy 2016). Other impacts generated by the introduction of these new water sources are addressed in studies based on hydrosocial cycle theoretical framework, such as the intensification of the water-energy nexus (McDonell 2014), or the inequality of access to quality water among farmers and their impact on production (Barnes 2014). Thus, the introduction of non-conventional resources not only changes the nature of water, but also the relationships within and between different communities of water users and managers (Barnes 2014). These changes imply rethinking social, political, economic and power relations which may involve the introduction of non-conventional resources that eventually could affect the compliance of the SDG6.

Future Directions: Integrating the Hydrosocial Cycle in Water Policies and SDGs

To meet the SDG6 targets by 2030 and achieve universal access to water and sanitation services will require solving major issues such as water pollution or lack of funding. Moreover, climate change is expected to aggravate conflicts over water access, water control and the commodification of this resource, since a likely increase in frequency and intensity of droughts and floods will probably impact in the reduction of water availability. In addition to these barriers, some authors have identified the weakness of the means of implementation of the SDG6 targets, since the leading role that should carry out the public sector and large investment needs are not identified as priority issues. Likewise, ensuring water availability and sustainable management of water and sanitation requires the reduction of poverty and inequality, since water policy may not be addressed from a politically neutral perspective and neither address water policy without taking into account the problems identified in the rest of SDGs.

However, to address these challenges it would be mandatory the recognition of the social and political issues that are in the core of the water-related problems, which require the adoption of new water management approaches and conceptual frameworks for overcoming purely technical visions. In this sense, the concept of the hydrosocial cycle is an analytical

tool that allows identifying the different ways in which social power and its economic, cultural and political expressions are linked to water management, hydraulic infrastructure and water distribution and control (Swyngedouw 2009). The conception of water as a socionatural production can reveal the influence of unequal relations of power, the historical-geographical processes, and the political, economic, and sociocultural relationships that explain the lack of universal access to water and sanitation. The incorporation of this approach can help to improve the diagnoses made on the causes and possible solutions in conflicts over water and the definition of targets and indicators in the SDG6. This can complement technical approaches, as the IWRM paradigm that understands water as a commercial good (Melo Zurita et al. 2015). These perspectives, whose implementation arises in the target 6.5 as a condition to ensure access to water and sanitation for all, do not help to explain the political nature of water and the difficulty of reconciling, in some cases, conflicts of interest. Through the hydrosocial cycle approach, the relationship between water and politics is repositioned, since water is not just treated as the object of policies, but also as an active agent that can express multiple socionatural interactions. In addition, water circulation is not external to the influence of discourses on how water is interpreted and other economic, political or social processes produced at various scales, especially at present where the circulation of capital flows is producing increasing participation of the private sector in water management. Therefore, it can be argued that there is no single approach to water resources management that allows compliance with the SDG6, since it will depend on the territorial context. The analysis of the hydrosocial cycle can identify the current social and power structures that explain the relationships that lead to the non-compliance of the human right to water and sanitation.

This theoretical approach can be useful to identify the causes of the lack of access to water, especially in the large cities of the Global South, where it is the first cause of premature mortality and that, nowadays, exceeds the expected consequences of climate change. This situation in many cases is related to the deliberate inaction of water services that is based on issues such as illegal land tenure, low political priority or fear of default (Linton and Budds 2014). Therefore, new institutional agreements between public and private sector and multi-stakeholder partnerships must identify the mechanisms that have allowed situations of lack of access to water supply and sanitation, and recognize the interests of vulnerable local actors in order to meet the SDG6.To achieve this goal, it is necessary to improve participatory processes in strategic decision-making incorporating the most vulnerable actors to scarcity from more democratic modes of water governance. Especially in areas with strong competition for water use and where there are significant sociopolitical tensions that can lead to the use of water as a geopolitical weapon (Swyngedouw 2009). In this way, more inclusive, sustainable and equitable hydrosocial organizations adapted to each specific context should be fostered (Swyngedouw 2009). The articulation of different notions of water among the actors involved in each context will imply the recognition of different interests and the necessary mediation between them (Linton 2010). However, a deep knowledge of the social specificities of each context is necessary to deepen the understanding of local hydrosocial realities (Mollinga 2014).

This concept not only helps to improve the understanding of current and past relationships between water and society but also opens the possibility of imagining new hydrosocial configurations to solve current conflicts and face the challenges of the future. Because of

this, formal education should include these new perspectives on the water-society relationship in its academic program, since the social and cultural knowledge over water directly relates to the lives of the students and their community (Sammel 2016). Finally, the hydrosocial cycle approach contributes to both imagine and construct real possibilities of change, since, if any change in the cycle has the potential to change the whole set of socionatural relationships, the identification of the processes that generate the injustices and social inequalities produced through water could raise the foundations of fairer hydrosocial territories (Linton and Budds 2014).

Cross-References

Ethics in Water Resource Management: Roles, Frameworks, and Principles

Human Right to Water and Water Rights

Local Community Participation in Water Management and Sanitation

Transboundary Water Cooperation: The Southern African Development Community Revised Protocol

Urban Water Deficit

Urban Water Deficit in Sub-Saharan African Cities

Urban Water Governance and Sustainability

Water and Gender Issues

Water and Sanitation Poverty in Informal Settlements of Sub-Saharan Africa

Water Availability and Access

Water Ethics: Methodology of Engagement to Help Achieve SDG6

Water Governance and Social-Learning: Approaches, Tools and Challenges

Water Planning

Water Provision, Rights, and Poverty in the Context of Sustainable Development Goals

Water Resources Management

Water Scarcity: Classification, Measurement, and Management

Water Values: Discourses and Perspective

Water-Energy-Food Interconnections: Methods, Tools, and Cross-Sectoral Decision Making

References

Arahuetes A, Hernández M, Rico A (2018) Adaptation strategies of the hydrosocial cycles in the Mediterranean Region. Water 10(6):790. https://doi.org/10.3390/w10060790

Bakker K J (2002) From state to market?: Water mercantilization in Spain. Environment and Planning A 34(5):767–790. https://doi.org/10.1068/a3425

Bakker K J (2003) An Uncooperative Commodity: Privatizing Water in England and Wales. Oxford University Press, Oxford.

Barnes J (2014) Mixing waters: the reuse of agricultural drainage water in Egypt. Geoforum 57:181-191. https://doi.org/10.1016/j.geoforum.2012.11.019

Bartram J, Brocklehurst C, Bradley D, Muller M, Evans B (2018) Policy review of the means of implementation targets and indicators for the sustainable development goal for water and sanitation. npj Clean Water 1:3. https://doi.org/10.1038/s41545-018-0003-0

Budds, J (2008) Whose scarcity? The hydrosocial cycle and the changing waterscape of La Ligua River Basin, Chile. In: Goodman M K, Boykoff M T, Evered K T (eds.) Contentious geographies: environmental knowledge, meaning, scale. Surrey: Ashgate, p. 59–68.

Budds J (2012) La demanda, evaluación y asignación del agua en el contexto de escasez: un análisis del ciclo hidrosocial del valle del río La Ligua, Chile. Revista de Geografía Norte Grande 52:167-184. https://doi.org/10.4067/S0718-34022012000200010

Budds J, Hinojosa L (2012) Restructuring and Rescaling Water Governance in Mining Contexts: The Co-Production of Waterscapes in Peru. Water Alternatives, 5(1):119-137.

Boelens R (2014) Cultural politics and the hydrosocial cycle: Water, power and identity in the Andean highlands. Geoforum 57:234–247. https://doi.org/10.1016/j.geoforum.2013.02.008

Boelens R, Hoogesteger J, Swyngedouw E et al (2016) Hydrosocial territories: a political ecology perspective. Water International 41(1): 1-14. https://doi.org/10.1080/02508060.2016.1134898

Debanné A M (2013) Dis/articulations and the hydrosocial cycle:postapartheid geograpies of agrarian change in the Ceres Valley, South Africa. Environment and Planning A 45:2553-2571. https://doi.org/10.1068/a45693

Fernandez S (2014) Much ado about minimum flows…Unpacking indicators to reveal water politics. Geoforum 57:258-271. https://doi.org/10.1016/j.geoforum.2013.04.017

Fragkou M C, McEvoy J (2016) Trust matters: Why augmenting water supplies via desalination may not overcome perceptual water scarcity. Desalination 397:1-8. https://doi.org/10.1016/j.desal.2016.06.007

Gleick P H (2000) The changing water paradigm: a look at twenty-first century water resources development. Water International 25(1):127-138. https://doi.org/10.1080/02508060008686804

Harvey D (2003) The New Imperialism. Oxford University Press, Oxford.

Horton, R E (1931) The field, scope, and status of the science of hydrology. Transactions, American Geophysical Union, 12:189-202. https://doi.org/10.1029/TR012i001p00189-2

Hommes L, Boelens R (2016) Urbanizing rural waters: rural-urban water transfers and the reconfiguration of hydrosocial territories in Lima. Political Geography 57:71-80. https://doi.org/19.1916/j.polgeo.2016.12.002

Kaika, M (2006) The Political Ecology of Water Scarcity: the 1989-91 Athenian Drought. In N. Heynen, M. Kaika and E. Swyngedouw (eds.), In the Nature of Cities: Urban Political Ecology and the Politics of Urban Metabolism, Routledge, London, 157-72.

Latour, B (1993) We Have Never Been Modern. Harvard University Press, Cambridge.

Linton J (2010) What is Water? The History of a Modern Abstraction. UBC Press, Vancouver.

Linton J (2014) Modern water and its discontents a history of hydrosocial renewal. WIREs Water 1:111-120. https://doi.org/10.1002/wat2.1009

Linton J, Budds J (2014) The hydrosocial cycle: Defining and mobilizing a relational-dialectical approach to water. Geoforum 57:170-180. https://doi.org/10.1016/j.geoforum.2013.10.008

Loftus A, March H (2016) Financializing desalination: rethinking the returns of big infrastructure. International Journal of urban and regional research 40(1):46-61. https://doi.org/10.1111/1468-2427.12342

Loftus A, March H, Nash F (2016) Water infrastructure and the making of financial subjects in the south east of England. Water Alternatives 9(2):319-335.

Marx K (1867) Capital, vol. I. Vintage Press, New York.

McDonell R A (2014) Circulations and transformations of energy and water in Abu Dhabi's hydrosocial cycle. Geoforum 57:225-233. https://doi.org/10.1016/j.geoforum.2013.11.009

Mills-Novoa M, Borgias S L, Crootof A et al (2016) Bringing the Hydrosocial cycle into climate change adaptation planning: lessons from two Andean mountain water towers. Annals of the American Association of Geographers 107 (2): 393-402. https://doi.org/10.1080/24694452.2016.1232618

Mehaan K M (2014) Tool-power: Water infrastructure as wellsprings of state power. Geoforum 57:215-224. https://doi.org/10.1016/j.geoforum.2013.08.005

Melo Zurita M L, Thomsen D C, Smith T F et al. (2015) Reframing water: contesting H_2O within the European Union. Geoforum 65:170-178. https://doi.org/10-1016/j.geoforum.2015.07.022

Mollinga P P (2014) Canal irrigation and the hydrosocial cycle: the morphogenesis of contested water control in the Tungabhadra Left Bank Canal, South India. Geoforum 57:192-204. https://doi.org/10.1016/j.geoforum.2013.05.011

Perreault T (2014) What kind of governance for that kind of equity? Towards a theorization of justice in water governance. Water International 39(2): 233-245. https://doi.org/10.1080/02508060.2014.886843

Sammel A (2016) Her beauty and her terror: A case study exploring the framing of water and extreme water events within formal education in Queensland, Australia and Saskatchewan, Canada. Geoforum 76:164-175. https://doi.org/10.1016/j.geoforum.2016.09.015

Sultana F (2018) Water justice: why it matters and how to achieve it. Water International 43(4):483-493. https://doi.org/10.1080/02508060.2018.1458272

Swyngedouw E (1996) The city as a hybrid: On nature, society and cyborg urbanization, Capitalism Nature Socialism 7(2):65-80. https://doi.org/10.1080/10455759609358679

Swyngedouw E (1999) Modernity and hybridity: nature, regenacionism, and the production of the Spanish waterscape, 1890-1930. Annals of the Associaton of American Geographers 89(3):443-465. https://doi.org/10.1111/0004-5608.00157

Swyngedouw E (2004) Social Power and the Urbanization of Water: Flows of Power. Oxford University Press, Oxford.

Swyngedouw E (2005) Dispossessing H2O the contested terrain of water privatization. Capitalism Nature Socialism, 16(1), 81–98. https://doi.org/10.1080/1045575052000335384

Swyngedouw E (2009) The political economy and political ecology of the hydro-social cycle. Journal of Contemporary Water Research and Education 142:56–60. https://doi.org/10.1111/j.1936-704X.2009.00054.x

Swyngedouw E (2011) Depoliticized environments: the end of nature, climate change and the post-political condition. Royal Institute of Philosophy Supplement 69: 253-274. https://doi.org/10.1017/S1358246111000300

Swyngedouw E, Williams J (2016) From Spain's hydro-deadlock to the desalination fix. Water International 41(1):54-73. https://doi.org/10.1080/02508060.2016.1107705

Thomas, H E (1956) Changes in quantities and qualities of ground and surface water. In: Thomas, W.L., Jr. (Ed.), Man's Role in Changing the Face of the Earth. University of Chicago Press, Chicago.

UN-Water (2018) Sustainable Development Goal 6 Synthesis Report 2018 on Water and Sanitation. https://www.unwater.org/app/uploads/2018/12/SDG6_SynthesisReport2018_WaterandSanitation_04122018.pdf Accessed 30 Ago 2019

Usón, T J, Henríquez C, Dame J (2017) Disputed water: competing knowledge and power asymmetries in the Yali Alto basin, Chile. Geoforum 85:247-258. https://doi.org/10.1016/j.geoforum.2017.07.029

Vos J, Hinojosa L (2016) Virtual water trade and the contestation of hydrosocial territories. Water International 41(1):37-53. https://doi.org/10.1080/02508060.2016.1107682

Wilson N J (2014) Indigenous water governance: insights from the hydrosocial relations of the Koyukon Athabascan village of Ruby, Alaska. Geoforum 57:1-11. https://doi.org/10.1016/j.geoforum.2014.08.005

Wisler C O, Brater E F (1949) Hydrology. John Wiley & Sons – Chapman & Hall, New York and London.