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Water, Infrastructure and Political Rule: Introduction to the Special Issue

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ABSTRACT: This introductory article sets the scene for this special issue on water, infrastructure and political rule. It makes the case for revisiting the complex relationships between these three dimensions which have fascinated scholars since Wittfogel's pioneering – if much criticised – work on causal links between large-scale irrigation systems and autocratic leadership. Scholarship on water, on infrastructure, as well as on political rule has made huge advances since Wittfogel's days, requiring a wholesome reappraisal of their triangular relationship. In this article, we review the relevant advances in scientific knowledge and epistemological approaches on each dimension. We subsequently summarise the different ways in which each of the following papers takes up and interrogates the relationship between water, infrastructure and political rule prior to the final paper which synthesises the principal findings emerging from the special issue.

KEYWORDS: Water, infrastructure, rule, Oriental despotism, Wittfogel

WITTFOGEL REVISITED

Ever since Karl Wittfogel published his signature book *Oriental Despotism. A comparative study of total power* in 1957, his 'hydraulic hypothesis' on causal linkages between large-scale irrigation systems and autocratic leadership has attracted massive attention, ranging from admiration to admonition. He has been admired for his ambition in seeking fundamental interdependencies between water resources management, infrastructure systems and political organisation (cf. Price, 1994) and in devising explanations from this for the emergence and persistence of particular types of hierarchical rule. However, predominantly his work has been seriously admonished by his commentators – thus generating a significant stream of water scholarship 'in counterpoint' (Leach, 1959; Mote, 1961; Steward, 1978; Offner, 1981; for further references, see the synthesis paper of this collection). In a nutshell the criticism levelled at Wittfogel is that his thesis is conceptually too rooted in technological determinism, empirically too selective in its attention to certain states, and ideologically too motivated by anti-communism (Worster, 1985). This resounding critique has, however, not curtailed interest in

Wittfogel's 'hydraulic thesis', which has – for all its faults – continued to inspire and provoke scholars to tussle with the relationship between nature, technology and society for decades. The "Wittfogel Watershed" (Bailey and Llobera, 1981) has, over the decades, engaged scholars in archaeology, anthropology and environmental studies as well as other disciplines intrigued by the 'big picture' of how political regimes shape water management systems in their image, but also how the systems sustain these regimes so long as they work, or undermine them when they fail (cf. Swyngedouw, 2015).

With this special issue we bring together leading water researchers with different disciplinary roots and epistemological perspectives to revisit the relationship between water, infrastructure and political rule that so fascinated Wittfogel. The purpose – to make it clear from the start – is not to rehabilitate Wittfogel's 'hydraulic hypothesis' against the valid criticism it has attracted over the decades, still less to advocate some revanchist notion of technological determinism. We are interested, rather, in exploring how the relationship between water, infrastructure and political rule can be re-interpreted and explained from the vantage point of contemporary scholarship, which has travelled far since the days of Wittfogel. It makes sense, therefore, before we introduce the individual papers of this special issue, to reflect first on how each of our three core categories is conceived in current research. It is only on the basis of the state-of-the-art on how water, infrastructure and political rule are understood today that it is possible to appreciate what new avenues of connectivity between them can be revealed and what fresh insights this can bring.

TODAY'S PERSPECTIVES ON WATER, INFRASTRUCTURE AND RULE

Water

Contemporary public and policy water discourse is peppered with grand statements; 'water is life' is arguably the grandest. Water – it has been claimed – is also god-given and the probable cause of the wars of the 21st century. Increasing global water scarcity underpins many a proposal to save the world from climate change disasters and food insecurity. As such, these notions are not really new – water has always had multiple meanings and functions, has been associated with religiosity and spirituality since time immemorial, there have always been conflicts (and collaboration) around water, and there have always been places and times of water scarcity. The present prominent and emotive role of these ideas in public and academic discourse can be understood as a counterpoint to the dominance of the natural science + economics discourse of 'harnessing' water for growth and development beginning in the 19th century. This has been called modernity's 'hydraulic mission' (Allan, 2006). This notion of 'modern water' (Linton, 2010) has become questioned in the last decades of the 20th century in a variety of ways. Most prominently perhaps from an environmental/ecological angle, but also from a growth and inequity perspective, from a (human) rights and justice perspective, from a consideration of water as inherently political and a contested resource, from an ethics angle, and from many other critical standpoints. Water as a subject of public policy and action is no longer predominantly associated with hydrology, engineering and cost-benefit analysis, even when in the 'professional sphere' of the water resources sector these fields of expertise still do predominate.

In this subsection we briefly discuss central fields of research under three rubrics: ecology and equity, culture, and commodification and materiality. Our sketch is by no means exhaustive, but highlights some understandings of water that are particularly topical for this collection.

Water, ecology, and equity: For water resources management in some parts of the world it has been claimed that it has experienced an 'ecological turn' (Disco, 2002). Under pressure from environmental movements in the 1960s and 1970s in the western part of the world, and in the south prominently in India and Brazil for instance, the natural water science + economics thinking that had dominated since the 19th century came to be questioned and amended. This was expressed in documentation of the negative consequences of large-scale water infrastructure building, notably of dams, through forest

submergence, the disturbance of river and coastal fisheries by a changed hydrograph and altered sediment loads, effects on flooding and bank erosion, and other impacts (Goldsmith and Hildyard, 1984; WCD, 2000). It was also expressed in the growing attention paid to (disappearing and threatened) wetlands (Dugan, 1990; MEA, 2005) and more recently in the documentation and increasing worry about water pollution and related health effects as a result of rapid industrialisation and urbanisation (McMichael, 2000; Alirol et al., 2011). The increasing attention to climate change as a main challenge for human society in the 21st century has further pushed water to prominence on the global policy agenda (Conca and Dabelko, 2014).

It was quickly pointed out and documented that the social distribution of these environmental consequences is highly unequal (Kirkby et al., 1995). The livelihoods of the poor are systematically more negatively affected than those of more affluent groups. Indeed, affluence itself, and the striving for it, is, arguably, part of the problem. Indigenous groups have disproportionally suffered the consequences from, for instance, dam building and mining, often without receiving adequate compensation. This has triggered social movements advocating 'water justice' as a part of a broader understanding of 'environmental justice' (Special issue: Out of mines, out of site, 2016)

That water is not just H_2O, a neutral substance to be harnessed for economic growth, but an essential and intricate element of biological life, is now well accepted in academic research and public policy discourse. However, the translation of that insight into environmentally responsible policy and practice leaves much to be desired, notwithstanding the introduction of concepts like 'environmental flow' (Poff and Zimmermann, 2010) and 'ecohydrology' (Olden et al., 2012). The main thrust in the neoliberal era is the use of market mechanisms and technological fixes as a solution to environmental problems. The counterview holds that these market mechanisms and the strong belief in technological progress themselves are the main cause of environmental degradation (York and Rosa, 2003). Whether the ecological turn will gyrate beyond 'ecological modernisation' perspectives remains to be seen.

Water, commodification and materiality: A highly controversial element of contemporary water debates is the treatment of water as an 'economic good', notably in the context of liberalisation and privatisation policies. Mainstream economics has tended to treat water, water services and water infrastructure as if they were commodities like any other. Mainstream perspectives incorporating such an understanding of commodity status include payment for ecosystem services approaches (Wendland et al., 2010), perspectives focused on 'willingness to pay' for water services (Whittington et al., 1991), economic approaches to 'benefit sharing' at (transboundary) basin level (cf. Crow and Singh, 2000; Turton, 2008), and in general approaches assuming that valuing water, water services and water infrastructure means giving them a (market) price.

Critical perspectives have offered more nuanced understandings of the commodity status of water. Water, water use and water management have not been as easy to commodify and 'marketise', as mainstream economic theory and neoliberally inspired development interventions have tended to assume. In the context of the privatisation of urban water supply in England and Wales, Bakker (2003) has called water an 'uncooperative commodity'. The introduction of water markets for water distribution in large-scale canal irrigation was designated a 'neo-liberal fallacy' by Moore already in the late 1980s (Moore, 1989), even before the age of 'tradeable water rights' broke out in the 1990s, the decade of 'market triumphalism' (Rosegrant and Binswanger, 1994; Peet and Watts, 1993). Molle and Berkoff (2007) have documented the history of the idea of 'water pricing' and found that there are, in the South, virtually no examples in which pricing does the allocative- and efficiency-enhancing work that mainstream economics wants it to do.

The work of Espeland on decision making on dam building in the USA (Espeland, 1998) raises the problem of incommensurability in valuation exercises, in water resources situations and also more generally (Espeland and Stevens, 1998). Incommensurability exists in at least two ways: the different values of water may not fit a single metric, and neither may the value(s) of water be measurable in a

way that makes them comparable to the value of other elements or dimensions of natural resource-based livelihoods and cultural political economies. This makes valuation an inherently political process in which meanings and interests need to be negotiated.

Urban political ecology has analysed how water is inserted into capitalist accumulation processes, through the reconfiguring of 'urban metabolism' (Newell and Cousins, 2015) involving reshaping of water, water services as well as water infrastructure (see below). Critical (resource) geography has generated lively debate on the 'neoliberalisation of nature', and seeks to incorporate new understandings of the 'materiality' of things like water into social analysis (Castree, 2010 a,b,c).

The understanding of water in development research and policy has moved way beyond that of being a chemical compound or physical substance useful for expanded reproduction and societal modernisation. While the multiplicity and multidimensionality of water has always existed, its appreciation in dominant, sanctioned or hegemonic discourses is something that needs to be accomplished through intellectual and political struggles over the meaning of water.

Water and culture: Like the ecological turn referred to above, there has been a 'cultural turn' in social analysis. While anthropology has a long tradition of a cultural interest in water, notably irrigation societies (cf. Geert, 1972; Wilkinson, 1977), many other fields have only much more recently acknowledged the importance of the cultural dimension of social process. We understand culture in the broad sense of 'webs of significance' spun by humans themselves (Geertz, 1973: 4-5) or of 'structures of meaning' (Archer, 1996), including systems of norms and legitimacy, rituals, symbols, discourses, narratives, identities, and other representations of meaning and knowledge, and material culture.

Seen from a cultural viewpoint (both in an anthropological and a more general cultural science sense), water in different epochs and across the borders of different cultures is of great material but also of cultural and religious significance. For example, it is an element of many rites de passage. More broadly, whole societies have been defined by their relationship with water, as in ancient Egypt, Bali and the Netherlands. The symbolism of water (infrastructure) has been frequently enrolled in nation building and reproducing legitimacy and social identities. Due to its high symbolic value, it is being used for metaphors and thus was, and still is, present as a symbol in communications on social and political issues. Representations of rule and power use the symbolic content of water.

This high symbolic value is related to the life and death-significance of water. In different cultures, water stands not only for the cycle of life, but also for life itself. It can, however, not only give birth but also be deadly; it is not only necessary for life but is also threatening, e.g. when coming as a flood or when polluted. Therefore, water symbolises not only life and the transition between life and death, and vice versa (e.g. the river Jordan), but also the live-or-death struggle (Strang, 2005).

With reference to the cultural and symbolic meanings of water, a whole array of possible research topics opens up, many of which are still understudied. Similar to the quest to bring ecological perspectives into the research on water as a resource, the cultural dimensions should be more connected to socio-technical ones. Since the 19th century, the disciplinary division of labour has led to one-sided and incomplete views on water. For example, the connection between navigation as a transportation and technical enterprise should be re-connected with the mythopoeic history of the sea and navigation (Böhme, 1988: 12). The civilisational, cultural dimension of irrigation should equally be more connected to its technical history.

The focus of the present special issue is the modern era beginning in the 19th century. In this period, in many societies the spiritual meanings of water have been maintained in the religious sphere but have generally become less important. As a consequence of the enlightenment and secularisation, society has greatly changed its view on 'nature'. The understanding of nature has become more scientific and technical (cf. Radkau, 2008: 221-225 who argues that, at the same time, a new enthusiasm for nature was a product of the enlightenment). Water is now being regarded as a natural power to be 'tamed' and as a natural resource to be used, and the modern transformational zeal of humans applies to water

to a great extent. Technical novelties as for example the invention of the hydraulic turbine greatly expanded humanity's possibilities to direct and use water, and these new technical options contribute to higher expectations regarding the transformation of water and nature (Obertreis, forthcoming).

Infrastructure

Our understanding of what infrastructure is and does has undergone radical change since Wittfogel's days. The most significant shift is that infrastructures, today, are generally viewed as being sociotechnical, rather than merely technical. Building on insight from science and technology studies, social scientists and historians are in wide agreement that an infrastructure system for, say, water irrigation or supply cannot be reduced to its material/physical components alone. Instead, it needs to be seen as a combination of technical artefacts, regulatory frameworks, cultural norms, environmental flows, funding mechanisms, governance forms, etc. that get configured in particular ways in particular places at particular times. The significance of this socio-technical understanding is not simply that infrastructure systems are more complex than previously conceived, but that they co-evolve in myriad relations between society, nature and technology. This relational understanding of infrastructure as being part of broader societal and environmental structures and processes but also itself consisting of social and ecological dimensions has opened up new avenues for understanding the societal constitution and workings of infrastructure. Of particular interest to this special issue is the attention paid by research to the ways in which infrastructures simultaneously shape and are shaped by social and political forces (Coutard et al., 2005; Edwards, 2003). Terminologies of co-construction, co-evolution and co-production are used to highlight and investigate the interdependence between components of what some have called the 'seamless web' of a socio-technical system (Star, 1999). Within the burgeoning literature on infrastructure by historians and sociologists of technology, political scientists, economists and human geographers, three aspects are especially relevant to the relationship between water, infrastructure and political rule: the obduracy, the politics and the ecologies of socio-technical systems.

Socio-technical obduracy and change: Infrastructure systems have long become symbols of stability and durability. Designed for decades in advance, embedded physically in the landscape and sustained by complex institutional arrangements, these systems conjure up notions of immobility, obduracy and resilience (Summerton, 1994; van Laak, 2001; Hommels, 2005). Given the high degree of path dependence attributed to urban infrastructures as a result (Melosi, 2000), the pertinent question is how they change at all, once established. Historians of technology have tended to favour an evolutionary approach, interpreting change in terms of typical development trajectories, passing from 'invention and development' via 'innovation and competition' to 'consolidation and rationalisation' (Hughes, 1983; cf. Tarr and Dupuy, 1988). Social scientists researching present-day transitions to socio-technical systems generally prefer to conceive of change as 'reconfiguration', whereby a socio-technical system is opened by pressures for change to one or more of its components and becomes re-stabilised around a new configuration (Summerton, 1994; Coutard, 1999; Graham and Marvin, 2001; Geels and Kemp, 2007). Socio-technical change is conceived of here less as a transition from one path to another, but rather as a largely messy, contested and discursive process strongly framed by contexts of action and contingent events (Moss, 2014).

Politics of infrastructure: Research on socio-technical change – in particular within the 'transitions' school (Kemp, 1994; Rotmans et al., 2001; Geels, 2002) – has come in for recent criticism for downplaying issues of power and politics in infrastructure systems (Smith and Stirling, 2010; Lawhon and Murphy, 2011). Historians of technology have for some time addressed the ways in which infrastructures have been used to build and sustain political regimes, whether as instruments of territorial integration for nation states (van Laak, 2001; Swyngedouw, 1999) or of municipal aggrandisement (Rose and Tarr, 1987; Schott, 2008). It is only relatively recently, though, that social scientists have developed a keen interest in the politics of infrastructure (Jasanoff, 2006). Today,

political scientists are exploring the role of power relations in guiding or hindering socio-technical transitions (Smith and Stirling, 2010) and the 'everyday politics' of infrastructures (Meadowcroft, 2009). Human geographers are demonstrating how differentiated infrastructure provision is accentuating uneven development within and between cities (Graham and Marvin, 2001; Anand, 2015) and how urban infrastructure systems come to embody and represent power constellations (McFarlane and Rutherford, 2008). Anthropologists are being drawn to the 'technopolitics of infrastructures' (Larkin, 2013) with their powerful combination of political rationality, administrative techniques and material structures. Many of these contributions are entertaining notions of power not as something that is held by (human) actors, but as a force that comes into effect through connections between human and non-human actors, drawing in particular on the role of discursive frames and governmentality (Lawhon and Murphy, 2012). The importance ascribed here to non-human actors in power relations is especially relevant to the focus of this special issue.

Ecologies of infrastructure: This brings us to the third pertinent development in recent scholarship on infrastructures: on their relationship to nature and 'natural' resources, such as water. As with the politics of infrastructures, it is fair to say that research on networked infrastructure systems has tended to overlook the role of the natural resources, physical contexts, material flows and landscape sinks upon which these systems depend (Monstadt, 2009). Put bluntly, fixation on the socio-technical has subverted the social-ecological. Bringing the ecological (back) in to infrastructure studies has recently been gaining traction in science and technology studies (Smith and Stirling, 2008) as well as urban studies (Monstadt, 2009). Most credit is due, though, to the field of urban political ecology, especially those studies addressing networked infrastructures as "material mediators between nature and the city" (Kaika and Swyngedouw, 2000: 120). Just as science and technology studies eschew the separation of the social from the technical, so urban political ecology transcends the nature/culture dichotomy underpinning modernist thinking (Heynen et al., 2006), addressing instead how infrastructures and the territories they serve are co-produced in complex socio/techno/natural assemblages embodying and reproducing power relations (e.g. Swyngedouw, 2004; Gandy, 2003).

Political rule and power

Notions of power and political rule have greatly changed since the late 1950s. Three strands of research reflect these shifts in understanding and approach and how they have enhanced water research. These relate to the power of discourse, water politics and the governance of water.

Discursive strategies of power: One of the most important contributions has undoubtedly been by Michel Foucault, who depicted power not as being directed top-down and exercised by human actors but as being a decentralised, pervasive force that is omnipresent and productive. It is embodied in discourse, 'regimes of truth' and knowledge (Foucault, 1977, with a partial revision: Foucault, 1982). Power is constituted and legitimised by discursive strategies and confirmations.

The discursive dimension of power has been invoked in many recent studies on water power struggles, which can range from the local to the national and international levels. The same is true for the political nature of water. Anthropologists examine social and political relations through water and understand water as "a medium through which social and political relations are negotiated." (Tilt, 2015: 5) Water is thus directly related to power relations: "Although water may be a 'natural' resource, its allocation and use are inherently political, involving questions of power and justice" (ibid: 36).

Politics of water: Critical water studies, too, emphasise the inherently political nature of water. They explicitly look at the power and politics at play in water resources situations (see, for instance, the first issue of *Water Alternatives*). Water politics here refers to water use, management and governance as processes of contestation, in which different actors negotiate and struggle in a variety of ways over meanings of, rights to, use of, benefits derived from, and many other aspects of water. One way to identify different types of water politics is to distinguish different domains of it – each with their own

stakeholders, stakes and modes of engagement (Mollinga, 2008). In 'everyday politics' local actors contest the daily use and management of water itself. In the 'politics of policy' decision-makers, social movements, researchers, and other actors contest the normative frameworks that inform policy and the institutional arrangements for their effectuation – traditionally in the arena of the state, but also in corporate and civil society arenas. In 'hydropolitics', the water version of transboundary resource governance, different actors, mostly still state actors, negotiate water allocation and derived benefits and costs, and through that broader issues like national security and geopolitical relations. In the domain of 'global politics', which has emerged in the past decades as part of the general growth of global environmental governance, international agencies, national governments, multinational corporations and various advocacy groups and expert organisations attempt the framing of global rules and regulation mechanisms for water use, management and governance. (cf. Boelens and Doornbos, 2001, Suhardiman, 2014, Mirumachi, 2015, Conca, 2006) These four domains interact in various dynamic ways.

Water governance: Studies using a *governance* concept focus on (institutional) actors and institutional levels. Governance can be seen in the context of various institutionalist theories and is nowadays a central subject of social science research. The concept aspires to overcome the exclusive concentration on formal governments (elected or not) and to take into account all actors involved in the making of policies, including private stakeholders, municipal authorities or NGOs but also family clans and patron-client networks. Typically, governance studies are concerned with the delivery of services in the spheres of security, rule, and welfare, explaining the circumstances under which these services can be provided effectively and legitimately (Risse and Lehmkuhl, 2007).

One of the points of criticism raised against the governance concept is that the discussions centring on it use the terminology of modern, developed statehood. Often Western-determined notions of private and public, state and non-state etc. do not necessarily fit non-Western examples. In "spaces of limited statehood" central elements of statehood cannot be taken for granted, and non-state actors are involved very much in political guidance (Ibid: 23, 26). On the one hand, governance studies tend to regard non-state regulation very positively as 'new' forms of governance being effective and contributing to general welfare. On the other hand, studies operating with the governance concept often devote themselves to developments in authority fragmentation that frequently evoke criticism of lack of transparency, lack of accountability, clientelism and the like (cf. Mullin, 2009). Studies of water governance pay particular attention to issues of integration between different territorial orders (international, national, regional, municipal, basin, etc.) as well as between different levels of institutions, from micro to global institutions (Water Governance, 2011; Künneke and Groenewegen, 2009).

The study of power in relation to water (infrastructures) has targeted a variety of political regimes. Historians, in particular, have demonstrated how power has been legitimised, represented and sustained through the materiality of infrastructure and the metabolism of water in highly diverse political orders (Engels and Schenk, 2015).

First, in *imperial, colonial and postcolonial regimes* water usage and water infrastructures have played an important role in imperial integration. Hydro-engineering constructions such as dams have produced and manifested imperial and colonial power. Social and material inequalities of the colonial period have been cemented by water infrastructure projects and thus prolonged into the post-colonial period (Mikhail, 2011; Tischler, 2015).

Second, *nation-building and nationalism* can be very fruitfully analysed through water-related infrastructural projects as demonstrated in the influential study by David Blackbourn on the "making of modern Germany" (Blackbourn, 2007). Blackbourn presents various landscape transformation projects including land reclamation in the Oder Marshes, the 'correction' of the Rhine, and the (National Socialist) plans for the colonisation of Eastern Europe. All these endeavours, he argues, were formative

for and indicative of the (Prussian-)German nation building from the 18th to the 20th centuries but also represent other political ideas like democracy or communism.

Third, *state-building and state operations* are an important political context of water infrastructure projects in very different settings. The seminal study *Seeing like a state* by James C. Scott has directed our attention to the modern state's quest for 'legibility' of nature and populations (Scott, 1998). In what Scott terms 'high modernism' regimes, authorities and planners cooperate and realise grandiose schemes of social and natural engineering which ultimately have to fail because of their neglect of local and ecological conditions. Scott has been criticised for his narrow concentration on the state and his overevaluation of its capacities (Mann, 1999). But he has inspired research and reflections on the nexus between water infrastructure and state politics, especially for non-European settings (Bichsel, 2012; Obertreis, in press; Tilt, 2015). Next to state authorities and planning agencies, non-state actors such as hydropower corporations and international investors come into play in the process of state-making as well, as Bryan Tilt has recently shown for dam building in Yunnan, China (Tilt, 2015: 6-8, 193-194; cf. Tischler, 2015: 267). Even the weak and failing state is concerned with hydro-infrastructures, as Harry Verhoeven's study of Sudan shows (Verhoeven, 2015). The rulers' 'hydro-agricultural mission' can be traced from the colonial period to the present Al-Ingaz regime. While the Sudan state is "centralised, weak and violent", it still functions as an agency for "elite accumulation and control". The state building efforts are concentrated in the riverine heartland by the Nile. Power is accumulated in the centre while the peripheries are exploited (Verhoeven, 2015: 251).

Fourth, *socialist and postsocialist settings* have been the object of water-related research. The analysis of large dam construction and also of irrigation in Russia, Siberia, Slovakia and Soviet Central Asia has demonstrated how tightly water infrastructure projects and irrigation construction systems were interwoven with socialist visions of remaking landscapes and society (Gestwa, 2010; Štanzel, 2013; Obertreis, in press). Research on the post-1991 period shows how difficult and disillusioning the transformation of irrigation agriculture has turned out to be after the collapse of the socialist regimes (Wegerich, 2003; Yalcin and Mollinga, 2010).

Finally, *contemporary Western societies and neoliberal tendencies*, primarily privatisation and globalization, have become another nucleus of research. Marxian perspectives argue that nature's relationship with capitalism is deepening (Moore, 2015). Nature is reconfigured, conceptually, semiotically, and materially, to be integrated into new accumulation regimes (Smith, 2007; Sullivan, 2013). Loftus and March (2015) suggest that the financial crisis has attracted a growing number of financial investors to the water sector; water is becoming increasingly financialised (Bayliss, 2014). A global movement to increase the involvement of the private sector in water supply and distribution began in the late 1970s, culminating in the 1990s in a paradigm shift towards privatisation (Allouche and Finger, 2002). Empirical studies since then have generated a substantial body of scholarship refuting many of the claims made in favour of privatisation/private-sector participation. These relate, for instance, to the loss of influence of water users in England and Wales (Page and Bakker, 2005), the effect on water pricing (Molle and Berkoff, 2007) or the increasing role of transnational water companies (Robbins, 2003). At the same time, research is also highlighting how water privatisation has unwittingly mobilised considerable opposition and, with it, alternative models for the collective organisation of water supply services (Hall et al., 2005; Becker et al., 2015). Budds and McGranahan (2003) ask whether debates on privatisation are missing the point, and answer in the affirmative. Commenting on recent developments, anthropologists remind us that long-lasting cultural values, worldviews and social norms exert a powerful influence over water management decisions and thus have to be taken into account (Strang, 2004).

CROSS-CUTTING PERSPECTIVES OF THE SPECIAL ISSUE

Our special issue builds on this enriched scholarship on water, infrastructure and political rule that has emerged since the publication of Wittfogel's pioneering study. Our selection of papers has, indeed, been guided by the desire to reflect the diversity and depth of new research on these three categories. The ambition of the special issue, though, is to go further by exploring how new ways of conceptualising water, infrastructure and rule can raise our understanding of the relationship between them: the core to Wittfogel's thesis. Our brief sorties into the state-of-the-art in the previous section have hinted at previous studies at the interface of two or all three categories. Examples include the relationship between water infrastructure and political regimes (e.g. Förster and Bauch, 2015) or between the socio-technical (infrastructures) and the social-ecological (water) (e.g. Gandy, 2003; Swyngedouw, 2004). This collection seeks to facilitate further steps, by assembling different ways of approaching and analysing the relationship between water, infrastructure and rule, in order to interrogate the salient contributions of each one and, by way of a synthesis, to draw general conclusions to inform and inspire future research.

We conclude this introductory piece by summarising how each of the eight papers in this special issue addresses this relationship. Maimuna Mohamud and Harry Verhoeven analyse the construction of the Merowe Dam in Sudan through the lens of a Political Economy framework as a symbolic site of modernity and nation-building in the context of nationalist and Islamist ideologies. Maurits Ertsen adopts an Actor-Network Theory perspective to explore the Gezira irrigation system in colonial British Sudan to reveal its empirical instability and contingent outcomes despite the prevailing rhetoric of domination and control. Peter Mollinga and Gert Jan Veldwisch examine the relationship between the physical design of irrigation systems and forms of (environmental) governance in India and Uzbekistan, applying a sociotechnical approach informed by Social Construction of Technology (SCOT) to investigate how technological choices were shaped by the social orders in which they emerged and how far they enabled the reproduction of dominant political regimes. Timothy Moss explores obduracy and change in Berlin's water supply infrastructure during the 20th century, using theories of path dependence and assemblage to unpack institutional, discursive and material framings of power over the issue of water conservation across multiple political regimes. Jiri Janáč and Erik van der Vleuten interpret the Danube-Oder-Elbe project through an actor-centred approach on system builders, drawing on Large Technical Systems theory with a transnational focus to reveal the lasting appeal of an evocative imaginary. Veronica Strang combines approaches to socio-materiality and human/nonhuman relations to explore the shifting cultural and historical forms of water management with a focus on case studies in the UK and Australia, thereby seeking to explain their increasingly despotic nature through a combination of privatisation and transnational governance. Alexander Loftus, Hugh March and Fiona Nash mobilise an Urban Political Ecology perspective to explore metering and billing practices of utilities in the UK as a form of governance through financialisation which produces new forms of subjectivities. Lucy Rodina and Leila Harris adopt a Political Ecology approach to investigate the transition from communal to private in-house access to drinking water access in Khayletisha, Cape Town for its effect on subjectivity, citizenship and state-society relations. The special issue concludes with a synthesis paper by Christine Bichsel, reflecting on Wittfogel's hydraulic thesis and its legacy and then drawing out key messages emerging from across the eight papers on ways of reinterpreting the relationship between water, infrastructure and political rule.

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