Chapter 1
Introduction: Peri-Urban Water Security in South Asia

Vishal Narain and Dik Roth

1.1 Setting the Scene

The world is rapidly urbanizing. With around 55 per cent of the world's 7.63 billion people living in urban areas (United Nations, 2019) we are facing conditions of "planetary urbanism" (Friedmann, 2016) and "planetary urbanization" (Brenner & Schmid, 2012; Swyngedouw & Kaika, 2014). The global urban population is expected to grow by 2.5 billion between 2018 and 2050, with nearly 90 per cent of this increase concentrated in Asia and Africa. An estimated 68 per cent of the world's population will reside in urban areas by 2050. Almost half of the urban population currently lives in urban settlements of less than 500,000 inhabitants, rather than in the relatively few mega-cities of the world (United Nations, 2019).

This trend is expected to continue: much future urban growth will probably take place in a large number of smaller cities with a population of one million or less in Asia and Africa (United Nations, 2015, 2019; see also Satterthwaite, 2006). In the prospects for 2018–2030 for these relatively less urbanized regions, the number of cities with 500,000 or more inhabitants is expected to grow by 57 per cent in Africa and by 23 per cent in Asia (United Nations, 2019, p. 11). The same report estimates that "all the expected world population growth during 2018-2050 will be in urban areas": while the urban population is expected to rise from 4.2 billion to 6.7 billion,

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the total world population is projected to grow from 7.6 billion in 2018 to 9.8 billion in 2050. Three sources mainly account for this urban growth: natural increase, rural-urban migration, and the expansion of cities, leading to annexation and transformation of rural areas into urban settlements (United Nations, 2019; see Leaf, 2016).

In this book we specifically engage with this last-mentioned dimension of urbanization: the ongoing expansion of cities into their rural surroundings, and the multiple water security problems resulting from these processes. Our focus is on those spaces that are transformed by urban expansion, often called "peri-urban" (Friedmann, 2016; Leaf, 2011; United Nations, 2015). This term refers to "the coming together and intermixing of the urban and the rural, implying the potential for the emergence of wholly new forms of social, economic, and environmental interaction that are no longer accommodated by these received categories" (Leaf, 2011, p.528). As a fluid resource, water is symbolic of the wider socio-ecological flows of urbanization that deeply influence the peri-urban. Taking an "underall" view of changing peri-urban water security, the book explores the *flows across boundaries* that are crucial for understanding the changing water uses, rights and controls, as well as in- and exclusions that determine water security in peri-urban spaces.

The regional focus of this book is South Asia, where urbanization has been, and will remain, a key demographic trend in the decades to come. Its urban population has grown by 130 million between 2001 and 2011, and is expected to grow by another 250 million in the next 15 years. Six of the world's mega-cities—Bangalore, Delhi, Dhaka, Karachi, Kolkata and Mumbai— are located in this region, with others (Ahmedabad, Chennai, Hyderabad, Lahore) following suit (Ellis & Roberts, 2016). The contributing authors explore water security in the peri-urban spaces of cities in three countries: Bangladesh, India and Nepal. In South Asia and elsewhere, the growth of cities entails radical changes in the control and use of nature's "resources" like land and water. The contributors to this book describe and analyse how urbanization changes access to and control over water in various peri-urban contexts, and how the inhabitants of peri-urban spaces experience and respond to these changes. More specifically, they seek to address the following questions:

How does urbanization change access to water and water security in peri-urban contexts? What are the implications of these processes for institutions and practices around water, especially for forms of conflict and cooperation? What kinds of approaches are needed to contribute to the analysis and improvement of peri-urban water access in peri-urban contexts and reconcile competing interests and claims?

The book adds to a growing body of scholarship on the peri-urban and, more specifically, on peri-urban water security in South-Asia (for a review, see Narain & Prakash, 2016). Although scientific and policy interest in the peri-urban, its emergent and often messy character, and its problematic linkages to urbanization have considerably increased in the last decades, on the whole such attention is still relatively marginal. Despite a growing body of work on the peri-urban by urban(ization)

scholars, geographers and urban political ecologists,[1] thinking in terms of an urban-rural dichotomy is still quite prominent, especially in the policy world. Such neat, often territorially defined and administratively fixed, categories provide an illusion of orderliness and manageability that continues to be reproduced in policies and intervention-focused research (see Arabindoo, 2009). More importantly, according to Angelo and Wachsmuth (2020) the last few decades have seen an "urban turn": often cities are no longer framed as part of the world's sustainability and development problems, but as a contribution to solving these problems (Angelo & Wachsmuth, 2020), mainly through the large-scale application of "smart" and "sustainable" technologies that reduce the ecological footprint. This framing of urbanization and the urban condition is most prominently expressed in ecological modernization thinking and practices and in the "sustainable" urban agendas that have been developed on its basis (Angelo & Wachsmuth, 2020; see Keil, 2020; see also below).

Although we do not deny that urbanization and the expansion of urban lifestyles can help solving a wide variety of social, economic and environmental problems, we argue that more in-depth attention to the peri-urban dynamics of urbanization provides crucial insights into the peri-urban flipside of this positive urbanization narrative. As the contributions to this book will show, peri-urban populations carry the burden of the expansion of cities in many ways. They experience and have to adapt their livelihoods to radical —often speculative and capital-driven (see Shatkin, 2016, 2019; Simon, 2008)— changes in land use, land prices and land control, and growing densities of building and infrastructure catering primarily to private investors. These changes also deeply influence peri-urban water security: while peri-urban water flows are increasingly controlled and used to provide urban dwellers and other urban users with freshwater, growing problems of pollution, excessive groundwater withdrawal and surface water depletion, and solid and effluent waste disposal threaten peri-urban land and water. To make things worse, public water provision systems tend to bypass peri-urban areas, leaving peri-urban dwellers dependent on their own alternative needs-driven access strategies and practices based on traditional water sources, the use of new technologies, privatized provision etc. (see e.g. Allen et al., 2006; Shrestha, 2019). The chapters of this book explore such dimensions of peri-urban water insecurity, including growing competition over groundwater, growing stresses over lakes and wetlands and the socio-technical mediation of water insecurity along freshwater canals in a "no longer rural, not yet urban" setting, and wastewater canals that run across rural and urban areas.

This chapter first introduces the various perspectives, themes and cases presented in the book chapters. It then discusses urbanization and the peri-urban more specifically, introducing two contrasting views — ecological modernization and political ecology — and introduces the concept of water security. Referring to the examples

[1] For a small selection, see e.g. Allen, 2003; Allen et al., 2006; Leaf, 2011, 2016; Satterthwaite, 2016; Shatkin, 2016; Simon, 2008; Tacoli, 1998; for urban political ecology, see e.g. Kaika, 2017; Swyngedouw & Heynen, 2003; Swyngedouw, 2009; see also below). For South Asia, see e.g. Narain & Prakash, 2016.

from the book, the chapter then gives an overview of some of its key themes: the role of material infrastructure; property transformations and the declining commons; socially differentiated access to water; intervening in the peri-urban; and the role of conflict and cooperation.

1.2 Peri-Urban Cases and Approaches

1.2.1 Selection of Peri-Urban Cases

Each of the countries featuring in this book has its own specific population and urbanization histories and characteristics. Bangladesh has a current total population of 165 million, around 40 per cent of which is urban. While the country's rural population is expected to decrease by 20 per cent (around 21 million people) between 2018 and 2050, the country will contribute more than 50 million to urban growth in the same period (United Nations, 2019). India currently has a 1.35 billion population. Its urbanization level, below 20 per cent in 1950, has almost doubled to 34 per cent (461 million urban inhabitants) by 2018. However, with 893 million, India still has the world's largest rural population. While India has five megacities, 55 per cent of its urban population lives in cities with less than one million inhabitants. In the 2018–2050 period, India is estimated to contribute another 416 million urban dwellers and thus almost double its urban population size again. In the same period, its rural population will decrease by around 111 million (United Nations, 2019). Nepal has a current population of around 29 million. With a 19.7 per cent urban population in 2018, it is also among the least urbanized countries in the world.[2] However, the country's urbanization level is expected to rise to 30 per cent by 2050. This growth will especially take place in Kathmandu Valley, in which the country's capital Kathmandu is located (see Muzzini & Aparicio, 2013). Its rate of urbanization (2.9% in 1990–2018; ranking fifth in the world) will decrease to 2.0% in the period 2018–2050 – ranking second in the world (United Nations, 2019).

The choice of urbanization and peri-urban cases in these countries is partly based on specific peri-urban water security issues that drew the attention of the contributors to this book, and partly on more pragmatic considerations such as the opportunity to build on earlier research projects, the existence of academic and NGO networks to cooperate with, and community engagements that made forms of action research possible. The resulting chapters cover research on peri-urban Dhaka and Khulna in Bangladesh, Bengaluru, Gurugram, Hyderabad, Kolkata and Pune in India, and Kathmandu (Valley) in Nepal. Three chapters present peri-urban case studies from India (Mundoli et al., Chap. 2; Lim and Das, Chap. 5; Mishra and Vij, Chap. 6), two are based on research in Bangladesh (Joshi et al., Chap. 4; Shah Alam

[2] It shares this characteristic with Sri Lanka, also in South Asia. Nepal's level of urbanization was 2.7% in 1960 and grew to 8.9% in 1990).

Fig. 1.1 Queuing up for water in peri-urban Hyderabad. (Photo Dik Roth)

et al., Chap. 7), while one chapter refers to cases from both Bangladesh and India (Gomes, Chap. 8), and another is on Nepal (Shrestha et al., Chap. 3). The chapters deal with various water security problems: water-waste linkages around lakes and wetlands (Mundoli et al.,); changing irrigation infrastructure and water uses, and the emergence of alternative water sources for irrigation (Shrestha et al.,; Mishra and Vij), water, agriculture and climate change (Mishra and Vij); the marginalized position of female workers and lack of access to water and sanitation facilities in the ready-made garment industry (Joshi et al.,), everyday experiences of peri-urban water insecurity in a context of urbanization-driven depletion and privatization (Lim and Das; Gomes); and participatory approaches to solving conflicts around contested water control infrastructure and ways towards solving them (Shah Alam et al.,) (see Fig. 1.1).

1.2.2 Various Engagements, Themes and Perspectives

The contributors to this volume represent a cross-section of academics, researchers, development practitioners and water professionals in Asia and Europe, including both senior and early-career researchers. Their research activities originate from various research projects with different academic and societal objectives that have co-determined the issues, questions and forms of engagement of project

contributors.[3] The different disciplinary orientations, professional backgrounds and societal engagements of contributors further mean that there is not one single conceptual or theoretical framework, research method or type of data that informs all approaches to the peri-urban as a field of research presented in this book.

Thus the chapters reflect the various ways in which academics and other professionals in Bangladesh, India and Nepali are engaging with these processes, how to research and analyse them, and how to contribute to improving the conditions of those who are at the losing end in terms of their water security. Some chapters have a mainly descriptive and critical analytical focus on changes underway in water access and water security (Mundoli et al.,; Shrestha et al.,; Joshi et al.,; Lim and Das; Mishra and Vij). Others engage with the development, application and improvement of approaches to intervention in peri-urban spaces, the need for which is rapidly growing (Shah Alam et al.,; Gomes). These latter chapters show explicit engagement with policy issues through action research and participatory approaches.

Conceptually and theoretically, the chapters are influenced by approaches like political economy and political ecology, legal anthropology, commons studies, participatory institutional analysis, development policy analysis, and negotiated and multi-stakeholder approaches. Overall, the contributions engage with issues of water security and water rights, vulnerability and resilience, gender and other mechanisms of social differentiation, equity and justice. The diversity in the units of analysis, scales and scalar relationships researched in the various chapters suggests that the peri-urban needs not necessarily be understood exclusively as a geographical area demarcated at the periphery of cities, as is still commonly assumed. Peri-urban issues can be examined at various scales and levels, the complex interlinkages between them being crucial. The chapter by Pratik Mishra and Sumit Vij, for instance, takes as its unit of analysis a zone of three canals that run parallel to each other, cutting across rural and urban areas. Its unit of analysis is not an area at the periphery of a city, but rather a water supply infrastructure that straddles the rural-urban divide. In contrast, Mundoli et al. focus on a lake and a wetland as sites for investigating peri-urban dynamics around water, particularly in how a peri-urban conceptual lens helps us analyse the urban metabolism and ecological footprint of cities. Joshi et al. focus on female ready-made garment workers to highlight the socially differentiated access to water in peri-urban contexts and their daily struggles to access water, which adds to the already high work burdens at home.

[3] Several chapters originate from the project “Climate policy, conflicts and cooperation in peri-urban South Asia: towards resilient and water secure communities”, which was part of the research program Conflict and Cooperation in the Management of Climate Change (CoCooN/CCMCC), funded by the Dutch Research Council (NWO), the Netherlands, and the Department for International Development (DFID) of the United Kingdom.

1.3 Urbanization, the Peri-Urban and Water Security

1.3.1 The Urban and the Peri-Urban

The peri-urban should be understood in relation to the processes of "urbanization of nature" and the socio-environmental changes that are at its core (Swyngedouw, 2009). Swyngedouw and Kaika (2014, p.465) distinguish three key perspectives on "the urban environmental question": urban sustainability, urban environmental justice and urban political ecology. While fully acknowledging the relevance of environmental justice approaches and the role of social movements, we focus on the other approaches here, as these are most relevant for discussing the peri-urban more specifically.

In the last few decades, urban conditions and lifestyles have made a remarkable come-back in environmental and development policies. From major problem sites, hotbeds of widespread poverty, expanding slums and environmental degradation, cities have become part of the perceived solution to major world problems, primarily environmental and developmental. Cities and urbanization processes are widely framed nowadays as basically beneficial and sustainable, as long as the right ("smart") techno-managerial arrangements are in place (see Cook & Swyngedouw, 2012; Swyngedouw & Kaika, 2014). The United Nations report cited above, for instance, states that:

> Urbanization has generally been a positive force for economic growth, poverty reduction and human development. Cities are places where entrepreneurship and technological innovation can thrive, thanks to a diverse and well-educated labour force and a high concentration of businesses. Urban areas also serve as hubs for development, where the proximity of commerce, government and transportation provide the infrastructure necessary for sharing knowledge and information. (2019, pp. 1-2).

If urbanization is acknowledged to be a problem at all by threatening "sustainability", it is regarded as a basically technical and managerial one: "Unplanned or inadequately managed urban expansion, in combination with unsustainable production and consumption patterns and a lack of capacity of public institutions to manage urbanization, can impair sustainability due to urban sprawl, pollution and environmental degradation." (2019, p.1). This framing of urbanization and the urban condition is most prominently expressed in the developmental claims, assumptions and approaches of ecological modernization thinking, in which it is argued that "human development is becoming delinked from the processes that cause environmental degradation" (Clement, 2010, p. 141; Keil, 2020; see also Kallis & Bliss, 2019).

The basic ideas of ecological modernization have increasingly influenced urban and urbanization scholars in developing agendas for "urban sustainability" (Clement, 2010; Cook & Swyngedouw, 2012). Notions like "smart growth", "smart cities", "green urban development" and "sustainable cities" are more popular than ever before, leading Angelo and Wachsmuth (2020, p.2202; see also Keil 2020) to the conclusion that "sustainable urbanism has become a new policy common sense". Kaika (2017) cites UN-Habitat's (2010) report *Cities for All: Bridging the Urban*

Divide which, in contrast to earlier reports, describes urbanisation as a "'positive force for transformation' " in the Global South and noting that 'too many countries have adopted an ambivalent or hostile attitude to the urbanisation process, with negative consequences' (2010: 26)".[4] Like the ecological modernization, on which it is based, "sustainable cities" thinking is explicitly market- and growth-based, focusing on techno-managerial and related institutional and governance principles, paying little attention for issues of inequality, conflict and justice (see Kaika, 2017; Swyngedouw & Kaika, 2014). Cugurullo (2016, p.2421), discussing Abu Dhabi's flagship "eco-city" Masdar City, characterizes ecological modernization as "one of the most international manifestations of the ideology of sustainability", in which "the city is treated as a commodity and its development is dictated by the logic of the market." (2016, p.2430).

Similarly, as an example of this kind of urban development discourse and the practices related to it, Kaika (2017; referring to work by Datta (2015), mentions India's "smart cities" programme as a form of smart city promotion with "highly questionable socio-environmental outcomes, becoming at best a form of 'entrepreneurial urbanization'" (Kaika, 2017, p.91). One of our cases in this book (Misra and Vij) concerns Gurugram, the "model" smart city for India's smart cities project.[5] Gurugram is an example of the impacts of a type of urbanization planned as a regional industrial and commercial centre in neo-liberalized India of the 1990s. It caters to those who are on the winning side of India's economic development. Planning was minimal and building largely run by real-estate developers of companies and housing projects, targeting companies and well-to-do higher middle class seekers of housing. Renamed Gurugram from its earlier, more popular name "Gurgaon", it is now propagated as "Cyber city of Haryana" (the state in which it is located). Some of the downsides of this neoliberal success story, its peri-urban agricultural and water use practices, are discussed in Chap. 6.[6]

Approaches to urbanization developed in urban political ecology stand in sharp contrast to the ecological modernization approach discussed above. Basic to urban political ecology is its rejection of an ontological divide between nature and society, approaching them instead as mutually constituted "socionatures" or "socio-natural assemblages" (Swyngedouw & Heynen, 2003). Urbanization is analysed as a "process of geographically arranged socio-environmental metabolisms that fuse the social with the physical" (Swyngedouw & Kaika, 2014, p.465). According to the

[4] Bringing in more buzzwords of the day, this line is continued in United Nations SDG goal 11: make cities inclusive, safe, resilient and sustainable, and in the New Urban Agenda of Habitat III; see https://www.un.org/sustainabledevelopment/cities/; http://habitat3.org/the-new-urban-agenda. For criticism see Satterthwaite (2016) and Kaika (2017).

[5] See:https://www.indiatoday.in/mail-today/story/gurgaon-smart-city-pm-narendra-modi-nda-250840-2015-04-30

[6] See Gurugram's website on: https://gurugram.gov.in. In contrast, the work by the French photographer Arthur Crestani painfully expresses this type of development by portraying those for whom the new city has no place; see http://arthurcrestani.com/bad-city-dreams-7/. For inequalities in the city's sewage infrastructure development, see Gururani (2017).

same authors, "the urban process has to be theorized, understood and managed as a socio-natural process that goes beyond the technical-managerial mediation of urban socio-ecological relations" (p.466). This is a crucial dimension of urban political ecology, as it brings within view the processes of mobilization, reallocation and commodification of nature across scales and boundaries and the resource flows resulting from them, which form the core of the processes of urban metabolism, and hence also of (peri-)urbanization (see Swyngedouw & Kaika, 2014). The metabolization of nature is not a neutral process: it both reflects existing power relations and inequalities in a capitalist society and produces new ones, an ongoing multi-scalar process that creates new benefits for some and burdens for others, in- and exclusions, environmental injustices, as well as the socio-political contestations that are part of these processes (Swyngedouw & Kaika, 2014).

Although sympathetic and theoretically close to urban political ecology, Angelo and Wachsmuth (2020, p.24) are also critical of how the research agenda of urban political ecology has developed. They argue that even critical studies based on urban political ecology, in which processes of transformation of nature have a central place, suffer from "methodological cityism", in which "the city has remained the privileged lens for studying contemporary processes of urban transformation that are not limited to the city". Even though authors like Heynen and Swyngedouw stress that there "is no longer an outside or limit to the city, and the urban process harbours social and ecological processes that are embedded in dense and multilayered networks of local, regional, national and global connections" (2003, p.899), Angelo and Wachsmuth (2014, p.24) state that "actually-existing UPE is mainly a research program into the politics of nature within cities". Webster (2011) also stresses the need to shift the balance from a city perspective towards a rural and peri-urban counter-perspective (for urbanization and rural transformation in China, see Muldavin, 2015).

Water security is an emerging and much debated paradigm (for an overview of how the paradigm evolved, see Cook & Bakker, 2012). It has a wide variety of, often contradictory, connotations and is used by proponents of different disciplinary orientations and backgrounds. However, it remains a relevant conceptual lens to study peri-urban processes, as it gives insight into the processes of resource reallocation consequent upon urban expansion, as the contributions in this book demonstrate. While recent years have seen a rising interest in issues of peri-urban water security in South Asia (as examples, see Narain & Prakash, 2016; Roth et al., 2018a, b), the contributions in this book take the analyses further to explore the implications of increasing peri-urban water insecurity for institutions around water and emerging forms of conflicts and co-operation.

Interdisciplinary peri-urban research that explores specific situated dimensions of the socio-ecological flows associated with the urbanization of nature (such as flows of water in this book) can be an important addition to the current, primarily urban-focused research and scientific literature (see Bartels et al., 2020). A research focus from such an interdisciplinary perspective on the constitution of the peri-urban through these processes, how they are locally experienced, perceived and acted upon, including the power differences, disjunctures, inequalities and

exclusions that are emerging and are being reproduced or transformed in the shaping of peri-urban spaces, can contribute to a better understanding of these processes, while avoiding methodological "cityism". In contrast to disciplinary urban planning or engineering approaches, an interdisciplinary perspective could encompass the rich insights from political economy, political ecology, sociology, social anthropology, human geography, social studies of science, actor-network theory and many more. Much peri-urban focused work has already been done from such a perspective on topics like water security and water rights (for South Asia see e.g. Karpouzoglou & Zimmer, 2016; Karpouzoglou et al., 2018; Mehta et al., 2014; Narain & Prakash, 2016). Such research could, however, be more explicitly integrated with critical urban research agendas, to put into perspective the "sustainable cities" narrative by explicitly showing its peri-urban socio-environmental flipside. In addition to asking questions about "the right to the city" (Harvey, 2008) or about "who owns the future city" (Sadowski, 2020), we need to more explicitly address the closely related question about "the right to the peri-urban". We will return to this point in the concluding chapter.

1.3.2 Understanding the Peri-Urban: A Diversity of Frames of Reference and Approaches

As discussed at the beginning of this chapter, a considerable share of future urban growth worldwide will occur in the spaces of urban expansion that can be described as "peri-urban". In the most general sense this term refers to processes of "becoming urban" (Leaf, 2011). Although there is no consensus definition (see Narain & Nischal, 2007), the term has been used mainly in three different ways: as a place, as a process or as a concept. While a detailed exposition of the connotations and usages of the term and the problems with spatial definitions of the peri-urban is beyond the scope of this chapter (for a review, see Singh & Narain, 2020), it is important to note that the peri-urban is increasingly understood in non-spatial and processual terms rather than as discrete bounded spaces. Iaquinta and Drescher (2000) were among the earlier writers to note that social and institutional contexts rather than spatial boundaries define the peri-urban. Moreover, approaches based on the assumption of clear spatial boundaries and stable states of being cannot deal with the dynamic, messy and volatile character of the peri-urban, nor with the flows of goods, resources, people and ideas across fluid boundaries. Another term often used to stress the dynamic character of the peri-urban and the flows and interactions that shape it is "peri-urban interface" (PUI) (see e.g. Simon, 2008). In this book we prefer to stress the processual characteristics of the peri-urban, but authors of the various chapters may use different terms.

In view of these developments in research and thinking about the peri-urban, approaches to the peri-urban as a bounded and recognizable spatial zone at the periphery of cities have lost their relevance. If the term "peri-urban" refers to a

dynamic zone of mixed rural-urban features, encapsulated in expressions like "desa-kota" (McGee, 1991), then the co-existence of the rural and the urban can be found even in the heart of the city, and not just as its periphery. Moreover, the peri-urban takes on many shapes and includes processes and phenomena that cannot be expressed in exclusively spatial and geographical terms: it also exists in a socio-cultural, legal, political, institutional and economic sense. This renders a place-based definition futile. Any alternative definition will, to some extent, be arbitrary (Narain & Nischal, 2007; see OECD, 1979; Adell, 1999).

According to Friedmann (2011, p.430) "a general theory of the periurban […] escapes us". Peri-urbanization as a process is "history in the making" (Friedmann, 2016, p.165) that "offers little scope for high-flying theorizations" (Friedmann, 2016, p.163; see also Friedmann, 2011). Despite such theoretical and definitional problems, approaching the peri-urban as a process rather than a specific type of urban region (Webster, 2011, p.632) has distinct advantages in dealing with its fluid and dynamic character. A process-based peri-urban focus emphasizes the dynamic and emergent mixes and flows of "rural" and "urban" land uses, infrastructures, economic activities, and state- and non-state institutions, identities, jurisdictions and authorities. Thus peri-urban spaces can be characterized as complex hybrid formations or socio-natural "assemblages", emergent and temporary forms of relative order and stability in highly dynamic environments reshaped by socio-natural processes and relationships (see Anderson & McFarlane, 2011; Brenner et al., 2011; McLean, 2017). This makes clear why the governing of peri-urban spaces and processes is a major problem. The dynamic character and institutional complexity of the peri-urban cannot be controlled by static structures of governance, jurisdictional boundaries, and policy institutions, while overlapping governance institutions, legal frameworks, and competing claims of legitimacy and authority are common, giving peri-urban areas their characteristic "fuzziness" (Allen, 2003; Simon, 2008; see Arabindoo, 2009) (see Fig. 1.2).

1.3.3 Peri-Urban Water Security

In disciplinary technical approaches, water security tends to be reduced to naturalized notions of water scarcity, approached through universalized and techno-managerial framings and definitions of problems and solutions, and thus depoliticized (see Joy et al., 2014; Roth et al., 2018a, b). Water (in-)security is produced in the processes of socio-natural transformation that also create peri-urban spaces, including the winners and losers that emerge in these transformations. Thus, water security is deeply social and relational, often politically contested and grounded in wider societal power structures, power relations and inequalities, (see Lankford et al., 2013; Zeitoun et al., 2016). The concept does not just refer to a technically and managerially framed "scarcity" or "water provision" but to the interplay of water access, water rights and the wider property relations around water, re-allocations

Fig 1.2 peri-urban "fuzzy" landscape, Kathmandu Valley, Nepal. (Photo Dik Roth).

and re-distributions in water use contexts that are often unequal and have a complex multi-scalar character.

Given the extremely volatile and dynamic context of the peri-urban "waterscape" (Swyngedouw, 1999; see also Budds, 2009), peri-urban water security should be researched and analysed with an awareness of its emergent and changing context, differential experiences of, and meanings given to water security, the inequalities and relations of power in such contexts, and the political, water governance and policy processes in which water securities and insecurities are produced or transformed. Following Zeitoun (2013), we argue that the main benefit of a water security focus lies not so much in using one "perfect" definition as a measuring stick for research and analysis, but rather in providing a conceptual space for interdisciplinary research of the complex interconnectedness of elements of the peri-urban assemblage. Boelens and Seemann (2014, p.1) provide a useful general description: "water security refers to people's and ecosystems' secure, sustainable access to water, including equitable distribution of advantages / disadvantages related to water use, safeguarding against water-based threats, and ways of sharing decision-making power in water governance". In view of its basically social, relational and political character, however, they prefer a plural notion of "divergent water securities" (2014, p.3).

An "integrative approach" (Zeitoun et al., 2016) to such water securities should allow for critical questions to be asked about the changing water flows and hydro-social relations, users and uses, forms of water control, access and rights, and power relations that are shaped in processes of urbanization. Whose water security gets

political and policy attention? Whose knowledge and expertise, authority and influence count? Who stand to gain or loose? Who are included or excluded from water access and decision-making? To what extent are existing power relations and power differences either reproduced or transformed by the peri-urban hydro-social dynamics of the urbanization of water? How are these processes related to existing forms of social differentiation? Which discourses are used to justify and "naturalize" certain policies, courses of action, and practices of allocation and distribution?

Both urbanization and water security are closely related to the policy world, among which the Sustainable Development Goals (SDGs)[7] and, within these, especially SDG 6 (clean water and sanitation for all) and SDG 11 (sustainable cities and communities) stand out. Although we fully subscribe to these goals, one of the downsides of such bullet lists of developmental targets is that they become separated into discrete policy domains framed as unrelated problems and turned into technical solutions in ways that hide from view the basic linkages with other societal problems and development goals (such as poverty, infrastructure and climate) and, above all, with important issues like exclusion and marginalization, political participation and power, social and environmental justice, and citizenship. By zooming in on the less conspicuous dimensions of urbanization, the peri-urban cases discussed in this book clearly show some of the tensions, contradictions and dilemmas involved in processes of urban expansion and development. The relevance of a peri-urban conceptual lens to study water flows and reappropriation processes is that it challenges the neat categorizations that underpin the framing of such targets such as "sustainable cities and communities", for instance, by raising questions as what constitutes a "city" and which "communities'" sustainability we are talking about. Chap. 2 in this book (Mundoli et al.,) examines the changing access to water in peri-urban contexts in light of the move to accomplish the SDGs.

1.4 Key Themes in the Chapters: An Overview

1.4.1 The Role of Material Infrastructure

Several chapters deal with the role of water-related technology and material infrastructure, such as irrigation and drainage canals, sluice gates, and pumping devices, as key material elements in changing peri-urban waterscapes and water (in-)securities experienced by peri-urban populations. Contrary to what is often assumed, infrastructural devices like canals or water division structures are not neutral "things". Their role can be better understood from a social-constructivist perspective in which they are seen as hybrid socio-technical elements (Pinch & Bijker, 1984) designed, constructed, managed and used through often complex social-institutional processes of water control. The socially constructed character of water

[7] See https://www.un.org/sustainabledevelopment/sustainable-development-goals/

infrastructure becomes manifest in its design, in the recipes for its use, and in its social effects (for irrigation in India, see Mollinga, 2003; see also Roth & Vincent, 2013). As water rights and access, in- and exclusion, quantity and quality are crucially mediated by water infrastructure, it is around such infrastructure that the often competing human agencies expressed in negotiations, contestations and conflicts about rights, access and socio-technical control tend to occur; hence they have been called "signposts of struggle" (Mollinga & Bolding, 1996).

Once the role of infrastructure has been redefined as basically social, it also becomes possible to ask more basic questions, beyond its "thingy" properties. Where infrastructures exclude people physically and socially, dispossess them of their land and water, destroy their livelihoods and do other damage to their life-worlds, Rodgers and O'Neill (2012) stress that these processes can be analysed as forms of "infrastructural violence". As Ferguson (2012, p. 559; cited in Rodgers and O'Neill) argues:

> The violence that is built into the massive inequalities that dominate our societies today is often naturalized, made invisible, or made to seem inevitable, by the walls, pipes, wires, and roads that so profoundly shape our urban environments [...]. Who, then, is responsible for such violence – violence that assuredly takes lives, but in ways that seem attributable less to specific acts or agents than to […] 'a faceless set of fleeting social connections'.

Whether infrastructure exerts such violence or not, and does so directly or indirectly, its design, management and uses raise basic questions about rights (e.g. water rights; the right to sufficient quantities of clean water; protection against water), agency, causality and the allocation of responsibility for anonymous "natural" processes.[8] It also points to issues of "spatial justice" in "the social production of urbanized space" (Soja 2010, pp. 6–7; in Rodgers & O′ Neill, 2012), and water justice (e.g. Boelens et al., 2018).[9]

A clear example of how peri-urban changes influence access to irrigation water and irrigation management practices is presented in the chapter by Anushiya Shrestha and co-authors. In Kathmandu Valley, urbanization is creating opportunities for new and intensified forms of exploitation, resource extraction, and opening new urban markets for water, extracted resources like sand and gravel, bricks, and agricultural produce. Through the same processes, existing (irrigated) agricultural practices and related infrastructures come under pressure. The authors discuss the gradual decay of the Mahadev Khola Rajkulo, a traditional surface irrigation canal system in Kathmandu Valley, against the background of rapid urbanization, population growth and declining water availability of this peri-urban space of Nepal's capital. Historically the stream-fed surface irrigation canals of the valley, known as *rajkulo* ("royal canals"), played a key role in local and regional food production. Configurations of land and water rights were relatively clear and stable, with water

[8] Another concept that can be used to analyse these processes is "slow violence". While it has been mainly used to analyse the gradual and often invisible workings of environmental pollution and the inequalities of their distribution, it can also be related to processes of urbanization and their place-based and unequally distributed forms of harm (see Nixon, 2011; Davies, 2019).

[9] For violence and development, see Escobar (2004).

rights strongly based in irrigators' contributions to canal management and maintenance ("hydraulic property"; see Coward, 1980). But this changed radically when urbanization took off, leading to inflow of population, massive land conversion and a growing pressure on water. Tracing the history of changes in canal use and management against the background of these broader transformations, the authors explain the gradual decline of this canal system, the changes in water rights, access and security associated with it, and the wider implications for canal-related cooperation and conflict. The issue discussed in this chapter also raises basic questions about ways to engage with the peri-urban: is it a rearguard fight, or can alternative (peri-)urban futures be imagined? We will return to this question in the concluding chapter.

Our second example concerns the role of wastewater canals in peri-urban agriculture. There has been a growing body of scholarship on irrigation canals in India and the water-related organizing practices, negotiations and conflicts among various (groups of) users (e.g. Mollinga, 2003). Less is known about the interactions of peri-urban water users with wastewater canals (for exceptions, see Narain & Singh, 2017; Vij et al., 2018). While there is growing attention to wastewater in urban settings (e.g. Karpouzoglou & Zimmer, 2016) and recognition of the potential value of wastewater in peri-urban agriculture —in particular in relation to its role in raising smallholder incomes and as a safe way of disposing of urban waste— little attention has been paid to the social-institutional dynamics around wastewater. The chapter by Pratik Mishra and Sumit Vij deepens our understanding of this peri-urban side of urban metabolism, especially how its effects are experienced by peri-urban communities. It describes their day-to-day interactions with and uses of these canals, the new collectivities and forms of social organization shaping up around these new sources of irrigation water, as well as the potential conflicts. Further, by juxtaposing this analysis with the effects of climate change, they contribute to a growing body of scholarship (for a review, see Narain & Prakash, 2016) on the combined effects of urbanization and climate change on peri-urban spaces, especially on their water security, noting them to experience "double exposure" (Leichenko & O'Brien, 2002).

Our last example focuses on the struggles around a sluice gate. Mohammad Shah Alam Khan and co-authors discuss conflicts around a sluice gate in peri-urban Khulna, Bangladesh, and experiences with stakeholder approaches to solve them. The location of this sluice gate —close to sea level in an area heavily affected by impacts of climate change, such as sea level rise, drainage problems and increasing salinity — makes for an extremely complex and conflict-prone water management setting in which freshwater and saline water, solid waste and wastewater, and storm runoff have to balanced. As this sluice gate has originally been designed and was operated in a way that primarily met urban interests and requirements, and not those of peri-urban inhabitants, it became another "signpost of struggle" between various powerful and less powerful urban and peri-urban interest groups competing for control over this piece of infrastructure to increase their water security. The authors describe how conflicts, political alliances and forms of cooperation arose around the gate, operation of which prioritized wastewater discharge at the expense of peri-urban fisheries, agricultural and other livelihoods. Climate changed-induced

salinity intrusion and high-intensity rainfall are further complicating factors in the action research and capacity development efforts of the team that attempted to solve these conflicts through dialogue and negotiation — with uncertain outcomes.

1.4.2 Property Transformations and Declining Commons: Capturing the Urban Metabolism and Ecological Footprint

The fate of common pool resources, common property and communally managed water bodies has a special place in peri-urban studies. Processes of enclosure, accumulation, dispossession and privatization —major threats to common resources and common or communal forms of property— are often the very basis of urbanization (see e.g. Swyngedouw & Heijnen, 2003). The demise of rural and peri-urban commons in processes of urbanization in India has been analysed for expanding cities like Gurgaon (e.g. Narain & Singh, 2017; Vij & Narain, 2016; Narain & Vij, 2016). Changing uses of both groundwater and surface water, and related property and access transformations, have been studied for Kathmandu Valley in Nepal (e.g. Shrestha et al., 2018; see Fig. 1.3).

The commons are known to have several functions, including livelihood support functions. As early as the 1980s, Jodha (1986) pointed out that the commons are important for small and marginal farmers, as well as for landless households who do

Fig. 1.3 Commercial groundwater exploitation, Kathmandu Valley. (Photo Dik Roth)

not have much by way of private assets to support their livelihoods. Water commons such as lakes, ponds and wetlands also have ecological and biodiversity support functions. Many of the region's wetlands are notified as IBAs (Important Birding and Biodiversity Areas). The loss of the commons in the wake of urbanization, either through their encroachment, privatization or state takeover needs to be seriously questioned: the state, while acquiring the commons for urban expansion, ignores the multiple functions performed by them. They are often seen simply as resources for urban expansion or as dumping grounds for urban waste. These transformations of the commons are further known to deepen social inequalities (Vij and Narain, 2016). There is a need for a drastic departure from this approach, one that still needs sustained policy advocacy.

The chapter by Seema Mundoli and co-authors takes a lake and a wetland each as units of analysis for studying peri-urban water insecurity. These two cases show how the peri-urban can serve as a conceptual lens for studying urban metabolism and the manner in which the ecological footprint of urbanization is borne by the populations of peri-urban spaces. The authors show how wetlands and lakes represent two different kinds of commons that witness a compounding of stresses affecting both the quality and the quantity of the resource. This is a subject of great concern for scholars of the peri-urban, as well as for planners and policy-makers: it presents grave equity implications for peri-urban communities whose livelihoods are compromised as they lose access to the commons. In cases where communities still depend on the commons, there is a need for sustained awareness and policy advocacy to protect these communities and their livelihoods. However, it is necessary to refrain from blanket prescriptions to protect them, as over time the communities' relationships with the commons may have been or be undergoing changes as well, as Singh and Narain (2019) demonstrate. The important question, then, is: given its different meanings and ambiguities of the concept, and ongoing changes in and pressures on common resources, what "commons futures" are realistically imaginable (see also Bakker, 2010)?

1.4.3 Socially Differentiated Access to Water

Hydro-social and political ecology perspectives on water use and allocation draw attention to the relationship between flows of water and social relations of power (e.g. Swyngedouw & Heijnen, 2003). It is argued that environmental processes cannot be studied in isolation from the social and political contexts and the transformations in which they are embedded, or rather: that mutually constitute each other, empowering some and disempowering others in multi-scalar socio-ecological processes. The peri-urban, with its rich socio-economic diversity and intensifying metabolic relations with the city, is a fertile ground for studying these relationships. The existence of a high degree of social and economic diversity and heterogeneity means that there are wide variations in access to water as well. A wide variety of

institutions – locally embedded norms, practices and codes of conduct — shape the differential access to water.

Recent writings on the peri-urban (see, for instance, Roth et al., 2018a, b; Shrestha, 2019) question the notion of "community resilience" in peri-urban contexts. This critique focuses, among others, on the notion of the community as a mythic, homogeneous and coherent whole. The actually existing high degree of social and economic heterogeneity, diversity and inequality in the peri-urban makes "community resilience", the latest and highly influential conceptual fashion in development policy, sound clichéd (see Kaika 2017). Analysis of water security, peri-urban or elsewhere, requires a socially differentiated analysis of access to water. There can be many axes of social differentiation: gender, age, caste, class, ethnicity, residential and occupational status – all of which intersect to co-shape access and rights to water, water-related tasks and water security.

Gender has since long been recognized to be one such axis (see Fig. 1.4). Despite this, little is known on changing gender relations around water in peri-urban contexts (for exceptions, see e.g. Narain & Singh, 2019; Vij and Narain, 2016). The chapter by Deepa Joshi and co-authors provides a situated analysis of the gendered access to water in peri-urban contexts. The authors use the case of female ready-made garment factory workers in Bangladesh to show the embeddedness of water access in wider social and power relations. They describe the daily struggles of such female workers in accessing water. Contrary to received development wisdom, their engagement with the garment factories has not resulted in "empowerment"; rather

Fig. 1.4 water and gender in peri-urban Hyderabad. (Photo Dik Roth).

it has brought increased psychological burdens of balancing home with work and living in inhospitable conditions under continuous threats of eviction and hikes in room rents.

The chapter by Nathaniel Dylan Lim and Diganta Das shows wide inequality in access to water between the core areas of the city of Hyderabad and its peripheries. Hyderabad, a growing city of South India, has appropriated water from a multitude of sources to meet the needs of its inhabitants, creating deprivation for those living at the periphery. Indeed the peri-urban is a context in which social differences translate into wide variations in access to water and water security.

1.4.4 Intervening in the Peri-Urban

The peri-urban has been described as a space "crying out for attention" (Halkatti et al., 2003). The core of the peri-urban problematique is that, as cities expand, urban planners and policy-makers focus attention on meeting the needs of the city, while neglecting the peri-urban and the resource-related needs of its inhabitants. The appropriation of land and water to meet urban needs leads to a loss of resource access and livelihood opportunities for peri-urban communities. Thus the study of the dynamics of peri-urbanization raises very basic questions about the politics of urban expansion: on what kind of assumptions are ideals, visions and policies for urban futures based? For whom are modern cities meant, planned and designed? How are the burdens and benefits of urbanization distributed, across the boundaries of the city itself? What is the role of the increasingly powerful "agents of globalization-oriented change", such as landowners, investors, real estate developers, and multinational and domestic corporate actors? (Shatkin, 2014, p.3; see also Narain & Singh, 2017). As Shatkin rightly argues, these questions basically concern issues of agency, power and social change.

There is a strong case for organized efforts to protect natural resources and the livelihoods based on them in peri-urban contexts, while at the same time building communities' capacities to demand change and to build the accountability of state institutions. Many such efforts have been made in the region in the past. These revolve mainly around community mobilization and participatory action planning approaches (Dahiya, 2003). Narain et al., (2020) describe an approach in peri-urban Gurugram in Northwest India that sought to improve local access to water by bringing peri-urban communities into direct contact with the state agencies responsible for water supply. Through a series of workshops, this led to the creation of mutual accountability relationships between the state and water users and the steering away from what Wade (1988) has described as a prisoners' dilemma situation in water.

Intervention in the peri-urban is, however, not without problems. The institutionally dynamic and heterogeneous character of the peri-urban tends to create institutional "gaps", or rather legal-institutional overlaps, pluralities and complexities between state and non-state institutions (rules, norms, institutionalized practices, codes of conduct) and practices of resource use. This has important consequences

for the governance and management of peri-urban resources like land and water, often involving conflicting claims (Allen, 2003; Allen et al., 2006; Simon, 2008). As peri-urban resource exploitation related to urban metabolic processes is uneven and inequitable (Swyngedouw & Heijnen, 2003; for a recent peri-urban focus, see Bartels et al., 2020), issues of agency, power and political representation should be given due attention. If policies and interventions do not pay sufficient attention to the inequalities and forms of social differentiation emerging in peri-urban transformations and urbanization-related metabolic processes (Swyngedouw & Heijnen, 2003; for a recent peri-urban focus, see Bartels et al., 2020), they are destined to become part of the problem rather than the solution.

The growing number of peri-urban resource claimants, users and uses, and the concomitant appropriation and re-allocation of peri-urban natural resources are creating a scope for growing competition, contestation and conflict, but for new coalitions, social networks and opportunities for forms of cooperation as well (e.g. Vij et al., 2018). Such resource-related problems are often approached through the creation of stakeholder platforms and forums for policy dialogue and conflict resolution. The creation of peri-urban forums that bring diverse actors together to negotiate peri-urban issues can be the key to creating greater awareness on them, and provide a base for policy advocacy. This can only succeed if all actors involved see such issues for what they are: political. The dangers of depoliticization of basically political issues, conflicts and processes are always present in approaches based on stakeholder participation, awareness-raising and creation of community resilience (see also Kaika, 2017).

Two chapters in this volume deepen our understanding of approaches to interventions in peri-urban contexts. The chapter by Sharlene Gomes describes the use of a negotiated approach and participatory institutional analysis in peri-urban contexts in Khulna, Bangladesh and Kolkatta, India. It focuses on efforts at building the capacity of communities to talk with state agencies and demand changes. Experiences with two approaches are explored: the Approach for Participatory Institutional Analysis (APIA) for problem diagnosis and strategy exploration in problem-solving; and the Transformative Pathways, based on the Adaptation Pathways approach to planning, through which actors can explore longer-term policy strategies for sustainable peri-urban water management in a dynamic and uncertain peri-urban context.

The chapter by Mohammad Shah Alam Khan and others describes efforts at resolving conflicts between competing resource users in peri-urban Khulna through capacity development of peri-urban communities to facilitate dialogue, negotiation and conflict mitigation around an important sluice gate (see also above). This chapter demonstrates, in particular, the importance of an element of continuity and persistence in addressing these issues: the project team gained from being associated with three projects over a span of a decade, which created trust and ensured complementarity and continuity. However, the small steps forward in these processes remain time-consuming, sensitive and also uncertain in terms of their outcomes, as shown by developments in sluice gate operation.

Both chapters demonstrate that socio-economic differences, which tend to be very high in peri-urban contexts, are key in shaping the outcomes of such practically oriented efforts. These experiences also show that interventions in peri-urban contexts need to be directed at multiple scales and levels: altering power relations between the agencies of the state and water users, and altering power relations among claimants and users themselves, both urban and peri-urban. The two chapters provide fascinating accounts of these experiences and lay ground for further action research. Needless, to say, this is an area where more concerted approaches and initiatives will be needed in the years to come.

1.4.5 Conflict and Cooperation

With natural resources under growing pressure worldwide, it is not surprising that issues of resource-related conflict and questions how to turn such conflict into cooperation have topped the development agenda since the 1990s. While this theme has long been approached from a resource-deterministic perspective that assumes a direct relationship between "scarcity" and "conflict", in recent years more nuanced approaches to conflict and cooperation have emerged (see e.g. Bavinck et al., 2014). More nuance has also meant a critical reconsideration of mainstream "post-political" notions of conflict as "bad" and "cooperation" good, of a preference for "collaborative" and "participatory" approaches to those that take the politically contested character of resource conflicts as point of departure for exploring the value of conflict and dissent in processes of more radical societal transformation (Dean, 2018; Kaika, 2017; Swyngedouw, 2009). Although the contributors to this book do not directly engage with these debates, several of them engage and struggle with issues of conflict and cooperation, also making different choices in engaging with the problems in their society.

Mundoli and co-authors specifically mention issues of waste dumping in landfills near water bodies (e.g. lakes) and grazing land, which raise questions of social and environmental justice. These and other problems involving conflicting interests are, of course, conflict-sensitive, but can at the same time lead to new forms of cooperation in solving them. Linkages between wastewater and peri-urban livelihoods, for instance, may work out in different directions and with different combinations of conflict and cooperation. Mishra and Vij note how the presence of wastewater canals can stimulate farmers to organize and engage in collective action in new ways, devise rules for water use and canal management, and thus turn canal and wastewater into a new form of hydraulic property. It is, however, important to note that such cooperative solutions also have a social, political and environmental price and may pollute the peri-urban space to make the city look "smart".

Two contributions to this book engage with conflict more explicitly. Shrestha and other authors note that changing access, rights and use practices around the irrigation canal eroded existing practices of negotiation and conflict solving. At the same time, the existence of competing interests in land and water need not necessarily

cause an increase in conflicts. Open conflicts around the canal are not common, and in-migrants engaging in commercial agriculture (and thus needing water) often get access to water in ways that do not arouse and at least temporarily "manage" or dampen conflicts: by leasing-in land, building social networks and good relationships with local farmers, and investing in alternative sources and technologies (groundwater; pumping from rivers; drip irrigation) by those who can afford the investments. This is part of a general trend away from the more or less "fixed" water rights associated with the canal as "hydraulic property" towards such more individualized and pragmatic forms of access (see also Shrestha et al., 2018).

Mohammad Shah Alam and co-authors describe conflicts and attempts to manage or solve them through persistent project engagements, featuring cooperation between academics, a local NGO, government agency representatives and other local stakeholders. Key to the long-standing conflicts were the different interests in, and benefits from, the sluice gate and, hence, competing demands on its control and operation. Conflict mitigation and reconciliation involved, among others, a long-standing engagement involving a neutral actor to create trust, capacity development and the creation of a platform for dialogue. Thus, forms of dialogue and collaboration led to agreements on, among others, redesigns of the gate and changes in its management. It also brought changes such as the cultivation of less water-intensive crops and a decrease in shrimp farming. However, this is also a never-ending story: the ongoing hydro-social processes require continuous investments of time and resources, especially in a region increasingly impacted by various effects of a changing climate.

As these themes show, the peri-urban is a vibrant context for studying changing water access and the intersection of various identities that shape the differentiated access to water, and to address questions of politics and power both among peri-urban communities as well as in relation to processes of urban planning.

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