Periurban Water: Recognizing the Margins for Sustainable Urban Water Futures

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Periurban Water: Recognizing the Margins for Sustainable Urban Water Futures

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Synonyms

Rurban (water); Semi-urban (water); Suburban (water); Urban Fringe (water); Urban sprawl (and water)

Definitions

Periurban space refers to transitional regions, outside of the city boundaries, which show a mix of fragmented rural and urban characteristics in terms of institutions, land uses, activities, services (Allen 2003; Woltjer 2014). *It is a rapidly changing space that is transformed by the extension of urbanization processes into the surrounding rural areas. These areas are generally characterized by diverse urban and rural actors, often with conflicting stakes* (Dupont 2007).

Institutions here refer to the constellation of actors and the rules and norms developed to determine their relationships, agreed-upon rights, interactions, and transactions (North 1990; Ostrom 2005). *While governance systems such as urban municipalities and rural local governments are formal state institutions, other coalitions based on market, contracts, social identity and norms, or a shared cause can also be considered as institutions* (Ostrom 2005). *The means and processes by which relationships and interactions are operationalized comprise institutional mechanisms.*

Introduction

As engines of neoliberal economic growth cities have become the focus of policy, investments, opportunities, migration, and resource demand. Urbanization has thus become one of the most significant processes of transformations of social, economic, political, and natural systems. 54% of world's population lives in urban areas and by 2025 the center of gravity of urbanization globally is projected to shift to the developing countries of Latin America, China, and India (UN 2018). Much of this growth is coming from the large cities and megacities which are predominantly located in the developing countries. The continuing rapid expansion of these large cities brings with it an expanding appetite for resources such as land and water. As core cities become increasingly congested and exclusionary with high land values, constrained resources, unequal distribution of services, much of the new urban growth takes place at the margins or the peripheries of the

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cities (Kundu and Saraswati 2016; Sheng 2018; Hamel and Keil 2016).

Drivers and processes of peripheral urban development have varied in different local spatial contexts of cities globally. Settler colony states (e.g., USA, Canada, Australia), postindustrial cities (e.g., USA, UK), social welfare states (e.g., Western European countries), postsocialist countries (e.g., China, Eastern European countries), postcolonial countries (e.g., in Asia, Africa, South America) have seen peripheral urban development through different historical, political, and socioeconomic processes and experience varied types and levels of resource outcomes (Hamel and Keil 2016; Couch et al. 2008). In most postcolonial developing countries of Asia, Africa, and Latin America with dense rural population, limited state capacity, emerging rapid urbanization, periurban development has been spontaneous, heterogenous, and largely informal. On the other hand in most countries of the postindustrial global north periurban developments comprised of the middle and upper class population, high capital services, and planned developments moving outward toward the resource rich rural hinterland yet closely connected to the urban economy. However, in recent years, even in these countries many cases show an emergence of proliferating landscape of poverty mixed with the gated upper class developments emerging in the outer periurban areas (Hamel and Keil 2016; Ranganathan and Balazs 2015). Thus, behind the particularities of local contexts, there also lie universalisms of global capital, labor, rural transformation, and urban growth processes.

Population migrating from rural areas for opportunities of urban employment and services as well as those migrating out of city centers for improved resources and quality of life is settling in the peripheral regions commuting daily to the city leading to high population growth rates at the peripheries, exceeding that of the core city (Kundu et al. 2002; Leaf 2011; Couch et al. 2008; Parés et al. 2013). Availability of land and lower land values coupled with proximity to the city has made the urban peripheries highly conducive for locating residential real estate, industries, business districts, special economic zones, research institution campuses, and other urban development (Dupont 2007; Woltjer 2014; Hamel and Keil 2016). In addition to urban developments, waste generated from cities also tends to be directed to the urban peripheries through wastewater channels and designation of peripheral areas for city landfills and dump yards. Large megacities thus expand by seeping into the surrounding peripheries through channels of transportation, daily labor movement, industrial corridors, streams of outward and inward migration, real estate expansion, and resource and waste transfers, setting in motion a process of periurban development (Leaf 2011; Douglas 2006). The linkages between the periurban areas and the core city significantly sustain the labor, capital, and resource demands of city and in turn transform the periurban areas and its resources.

The periurban space makes for a unique contested resource space with mixed urban and rural characteristics, functional linkages with the city, and reciprocal flows of people, resources, and services. Urban actors, land uses, services often compete with rural livelihoods, land uses, and institutions for periurban resources (Dupont 2007; Allen 2003; Leaf 2011). Focus on contested land resources and land use changes predominate in the literature on the periurban space. However, the complex dynamics of water resources of periurban areas has received more recent and increasing focus over the past decade. Urban growth and the consequent periurban development have significant implications for periurban water resources, access, and vulnerability. In the binaries of urban and rural categories in planning and policy, the unique complex character of the periurban space and the specific consequent outcomes for its water resources and access is often overlooked (Simon 2008; Mehta and Karpouzoglou 2015; Maheshwari et al. 2012). The present chapter aims to bring focus to the periurban space, the changing water ecologies of this region, their impact on water access for the local community, and the specific processes that produce these resource outcomes.

Periurban Water Ecologies: Transformations and Processes

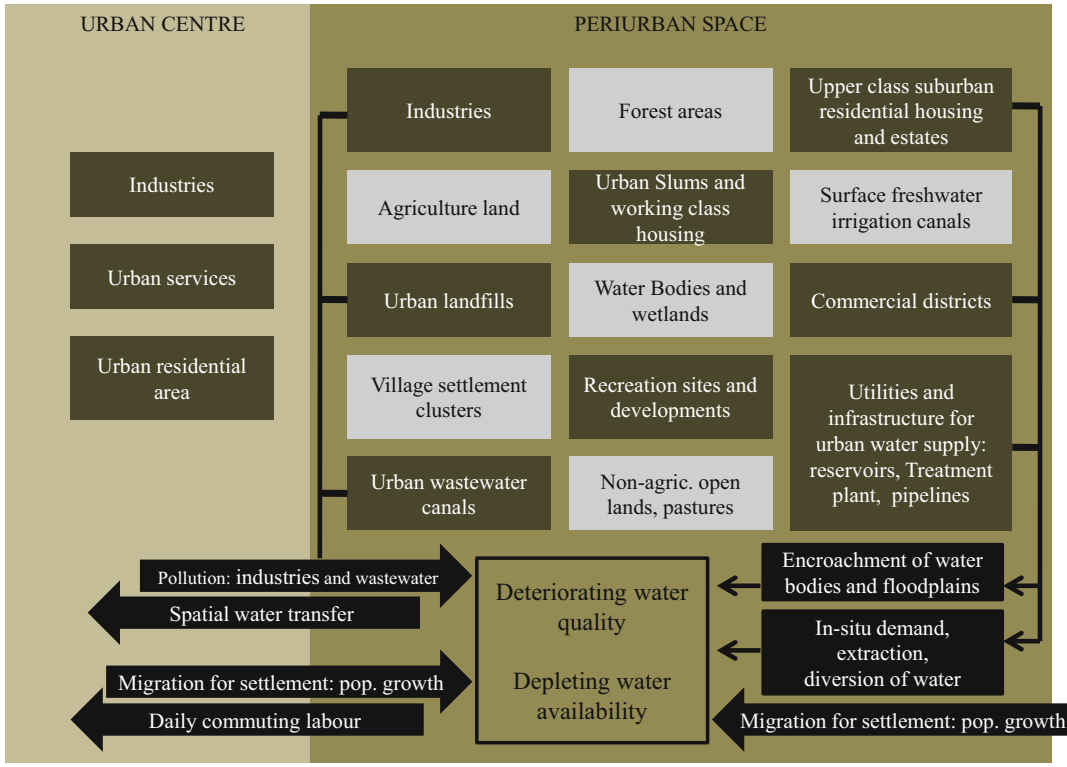
Water ecologies at the peripheries of cities are characterized by rapid transformations in the face of urban expansion and consequent changes in land use and water demands (Douglas 2006; Roth et al. 2019; Haase and Nuissl 2007; Morote and Hernández 2016; Tu et al. 2007; Leaf 2011). This section will elaborate some of the processes and conditions that predominate in the periurban space and the impacts they have on the periurban water ecologies. Figure 1 summarizes these through a diagrammatic illustration.

Land Use Changes and New In Situ Water Demands

As the city spills over into the peripheral rural areas, several new urban and industrial land uses emerge in these periurban areas. Industrial clusters, special economic zones, business and IT hubs, urban recreational facilities such as water parks and golf courses, and upper class residential housing with lush watered lawns and swimming pools get located in these areas which create new water demands in the periurban space (Domene 2014; Mehta et al. 2014; Askew and McGuirk 2004). In contexts where the urban governance system caters to the water provision for the urban sprawl developments, new consumptive water demands increase the economic and resource burdens of the urban governance system (Gillham 2002; Domene 2014). On the other hand, in cities where the urban governance system does not, or only selectively, provide water supply to establishments outside of its administrative boundaries, these emerging developments tend to depend on privately and/or informally accessed local periurban surface and ground water resources to meet their high water demands (Malano et al. 2014; Ranganathan and Balazs 2015). These processes create a burden on the urban and local periurban water resources which get increasingly depleted producing water scarcity (Narain 2009; Sen et al. 2019; Parés et al. 2013). Agricultural lands, forested areas, and open rural spaces are converted into a concretized landscape which impacts surface water infiltration and runoff (Dupras and Alam 2015; Gillham 2002; Maheshwari et al. 2012). The emerging new water demands and water stress in the periurban space create contestations between traditional livelihoods and household water demands of the rural communities and the emerging urban water uses.

Complex Jurisdiction and Governance Vacuum

The periurban space exists within a fuzzy institutional milieu. The proliferating urban, private, and industrial actors of the periurban space spill into the jurisdiction of adjacent municipalities, village governance systems, or the larger regional/provincial levels of governance – as different country contexts may be. In some contexts, adjacent municipalities and agglomerations that absorb periurban development, particularly upper class and high capital developments, may grow and express more political autonomy and aspiration increasingly competing for investment and resources within the larger metropolitan or provincial regions (Hamel and Keil 2016). This can impact competition and inequality between the city centers and periurban developments for water access (Parés et al. 2013). In most developing countries where rural governance is devolved to the local levels, the village governance with limited local political mandate has to compete for stressed local water resources with disproportionately stronger political urban and private actors who are often backed by the market and/or the state. This power imbalance between the local rural institutions and urban actors limits the local governance capacity to regulate the urban and industrial activities in this space (Zhu 2013; Marshall and Dolley 2019; Kennedy 2007). Uncertain jurisdictions are thus conducive for contestations and rampant breach of regulations around resource extraction, environmental standards, construction, and industrial production (Sajor and Ongsakul 2007; Karpouzoglou et al. 2018). It creates a space for flourishing illegality, informality, privatization, and hybrid institutional forms (Marshall and Dolley 2019) that enable the circumvention of policies and costs designed to



Periurban Water: Recognizing the Margins for Sustainable Urban Water Futures, Fig. 1 Mosaic of landuses in the periurban space and its transforming water ecologies

protect water bodies and water resources (Dávila 2012).

Encroachment

Water bodies, river flood plains, stream channels, and catchments are in most countries often protected by regulations around flood plain management and zoning, buffer zones demarcated around water bodies, wetlands, and water bodies conservation policies, etc. The high demand for land for urban expansion and weak institutional regime of the periurban space encourages rampant illegal encroachment of water bodies, catchment areas, and flood plains (Montz and Gruntfest 1986; Vij and Narain 2016; Chigurupati 2008; Mao et al. 2018). These encroachments affect urban flood vulnerability and surface water availability and access, particularly during extreme climatic and rainfall conditions. Water bodies and wetlands are filled up and reclaimed for land for construction purposes. Inlet channels to water bodies are encroached for developing built up areas, which obstructs the inflow of water into tanks and ponds, reducing their water storage and drought proofing capacity (Prakash 2014). Rivers and streams are stifled with constrained channels and concretized catchments creating increased risk of flooding and water logging during rainfall seasons. Encroachments of water sources thus create immense vulnerability of water scarcity and resource uncertainties for local communities.

Pollution

In its reciprocal relationship with the city, periurban areas provide resources for urban expansion while receiving waste and pollution from the city. As industries were relocated from the industrial cities of the global north, the industries often got located at the peripheries of major cities in the developing countries. Polluting industries particularly got located outside the cities, in the periurban areas, due to their harmful environmental

and health impacts. Unregulated and untreated release of industrial effluents into local water bodies and streams creates severely deteriorated surface water and groundwater quality in the periurban areas (Karpouzoglou et al. 2018; Dimitriou et al. 2008; Douglas 2006; Simon 2008). Urban waste is released through wastewater canals and rivers that run through the city carrying urban waste and urban agriculture runoff into the periurban villages. While urban wastewater is considered an important irrigation source for agriculture at the peripheries of the city, it also causes declining quality of the groundwater of adjacent periurban villages (Jampani et al. 2018; Ullah et al. 2012). Without adequate provision of sanitation and waste management infrastructure, increasing population at the urban peripheries also leads to an increased release of domestic waste in local water bodies or on village wastelands (Shivendra and Ramaraju 2015; Büsser et al. 2007). Association of periurban developments with declining water quality is also found strongly in postindustrial developed countries occurring due to the landuse changes, increase in run-off carrying more pollutants, and agriculture intensification (Tu et al. 2007; Gillham 2002).

Spatial Water Transfers

As cities grow, so do their appetites for water resources. Urban water resources are constrained by the high water demands of the large urban population, the concretized landscape that limits groundwater recharge and surface water storage, and water pollution from waste disposal. In order to meet its increasing water demands, the city sources its water supply from water transfers from the periurban areas. These transfers are carried out in different ways. Constructing dams, reservoirs, and freshwater canals over major streams and rivers originally feeding the peripheral rural areas diverts water from the upstream periurban villages to meet the increasing water demands of the city (Mishra and Narain 2018; Hommes and Boelens 2017; Parés et al. 2013). The policy construction of the urban water priorities against rural water demands legitimizes such large scale resource transfers and reallocation. Another form of water transfers to the city is through the private informal water tanker markets which have proliferated across many major populous cities in developing countries. A nexus between periurban agricultural borewell owners and private tanker providers extract and transfer subsidized agricultural water from the periurban areas to meet urban residential and commercial water demands (Packialakshmi et al. 2011; Prakash 2014; Díaz-Caravantes and Wilder 2014). Weak regulatory mechanisms and the involvement of rich farmers in this market make it hard to contain this water extraction and selling (Vij et al. 2019). This heavy water extraction causes declining groundwater levels affecting water access for periurban communities and water-based livelihoods. In the context of many countries of the global north, the increased consumption of municipal water supply for ornamental lawns and swimming pools in the suburban upper class residential areas have reduced availability of municipal water for both the urban and periurban poor communities (Ranganathan and Balazs 2015; Parés et al. 2013).

Periurban Water Access Outcomes and Vulnerabilities

The various demographic, economic, and institutional developments in the periurban context that are brought about by the urbanization process have an impact on the periurban water ecologies. These in turn affect water availability and water quality for the periurban community. This section will discuss the various ways in which these transforming water ecologies impact water insecurity, health, socioeconomic inequalities, and local livelihoods. The focus will be more on the dominant experiences of the developing countries where urban expansion directly interacts with a dense rural population touching every aspect of rural life and resources.

Institutional Outcomes for Water Access

As periurban water resources are transferred or diverted for core city's water demands, the periurban community faces the burdens of reduced water access and scarcity, particularly the rural

poor and slum population. For instance, as cities divert increasing amounts of water from freshwater canals, water availability for irrigation is reduced downstream of the city (Mishra and Narain 2018; Hommes and Boelens 2017). Alternatively freshwater streams and rivers running through the city collecting urban waste get released into the periurban environment as wastewater, thereby changing access to freshwater for irrigation. In the case of water supply, the limited mandate and financial resources of the rural governance systems and splintered provision of municipal services are inadequate to meet the water resource demands of the rapidly growing periurban population (Britto et al. 2019; Groot and Bayrak 2019, Wright-Contreras et al. 2017). This splintered provision of municipal water supply may also be found in some cities of the global north where poor settlement colonies have emerged alongside or beyond elite gated settlements (Ranganathan and Balazs 2015; Jepson and Vandewalle 2016; Deda and Tsenkova 2006). With rapidly increasing population and water consumption on the one hand and declining local water resources on the other, this public water provision becomes increasingly scarce and unreliable.

In response to this reduced and insecure water access from the traditional sources and rural public water provision, periurban communities resort to a myriad of alternate or new institutional arrangements for water access (Allen 2010). In many highly urbanized countries of the global north, new institutional arrangements may emerge through formal policy about regulating or controlling urban sprawl (Buxton 2014; Gillham 2002; Couch et al. 2008). New suburban regimes and administrations may emerge expressing more authority and autonomy in metropolitan or regional governance to affect policies and investments on urban infrastructure and resource distribution (Hamel and Keil 2016). In many developing countries where inadequate state involvement in the periurban space leads to more informal development, new conflicts and cooperation can emerge to enable or sustain better access to limited resources and services (Roth et al. 2019; Shrestha et al. 2018; Marston 2014). For instance, this may be seen in the coalitions between rich farmers and borewell owners of the periurban areas, tanker owners, and real estate builders or even the municipal water supply departments (Ruet et al. 2007; Packialakshmi et al. 2011). New power coalitions allow for exclusive capture of a declining resource for a profit-making enterprise at the cost of easy water access for the larger periurban community. Cooperation based on social capital using identity groups such as caste and tribal communities to access irrigation water also emerges more strongly (Narain et al. 2019; Shrestha et al. 2018). New technologies and strategies negotiated based on local norms and rights emerge in response to the reduced water access.

Similarly in the case of household water supply, alternate water sources and institutional mechanisms can range across formal and informal private, community, public, and hybrid arrangements (Allen 2010; Allen et al. 2017; Ranganathan and Balazs 2015; Mapunda et al. 2018). Periurban water access, particularly in the poor rural and slum settlement clusters, is thus characterized by a multiplicity of water sources and associated institutional arrangements each with its own burdens of cost, flexibility of payments, actual and perceived quality, and physical ease of access. Household water access thus entails significant choices, decision making, and trade-offs between different types of risks for the periurban communities (Nastiti et al. 2017; Orgill et al. 2013; Ezenwaji et al. 2016; Jimenez-Redal et al. 2014; Jeuland et al. 2016). For instance, informal water suppliers and markets, while having a wide community reach in filling the gaps in public water supply, tend to have poor financial and organizational capacities and can entail significant financial costs and mobilization of social capital for access (Cain 2018; Alba et al. 2019).

Inequality in Access

Conditions of stressed local water resources, complex jurisdiction, and constrained public supply of water produce a space ripe for the sprouting of a complex of informal and private institutions to fill the demand-supply gap created by the resource stress (Peloso and Morinville 2014; Sen et al. 2019). Private tanker supplies and commercial

treated bottled water plants are predominant examples of these emerging forms of water institutions. However, many of these emerging private supply mechanisms are also commercial and therefore entail costs for accessing water. The limited capacity of poor households to endlessly spend on purchasing water creates unsustainable and insecure water access for poor periurban 'consumers' (Allen et al. 2006; Fonjong and Fokum 2017; Sen et al. 2019). On the other hand benefits of the market accrue to the wealthy and powerful who are able to afford access to individual or private water sources in order to sell water for profits (Vij et al. 2019; Sen et al. 2019; Bartels et al. 2018).

Inequalities in water access can occur at different levels. There are inequalities in water access between the city and the periurban areas as evidenced by the spatial water transfers from periurban areas to the city or vice versa. Within the periurban areas, there is inequality between the new urban developments such as the elite residential estates and the periurban village and lower class settlements (Wright-Contreras et al. 2017; Karpouzoglou et al. 2018. This is also relevant for the contexts of the new mixed periurban developments in cities of the global north where inequalities in water access exist based on class, race, and immigrant status of periurban settlements (Ranganathan and Balazs 2015, Jepson and Vandewalle 2016, Deda and Tsenkova 2006). In many developing countries where the city grows into densely populated rural areas, periurban processes also lead to inequalities within the villages between those who are able to benefit from the urbanization process and others who become more vulnerable to the changes. These tend to be aligned with traditional social hierarchies based on class sections and social groups (Sen et al. 2019; Rusca and Schwartz 2018). For instance, rich farmers with access to deep borewells are able to secure water while poorer households and slum residents have to depend on common sources or informal markets. Institutional arrangements that depend on new power coalitions and identity-based social capital while being innovative in ensuring water access in the face of emerging scarcities can also be exclusionary for some. As a result traditional socioeconomic disparities in the social fabric can be further sustained and even deepened in the responses to water scarcity.

Disparate access to financial and social capital thus creates inequalities in water access between different economic classes of households within the periurban space. Affluent communities and elite residential colonies are able to mobilize their financial and social capital to gain secure access to infrastructure and water, while poorer communities of periurban villages do not receive comparable access to secure water supply. This creates fragmented landscapes and "infrastructural archipelagoes" within the periurban space (Wright-Contreras et al. 2017; Karpouzoglou et al. 2018; Bakker 2003; Rusca and Schwartz 2018). With the deteriorating local water resources, low governance capacities and the consequent increase in privatization and commercialization of water in the periurban areas have enhanced the cost burdens of water and therefore the water insecurities for poor households (Sen et al. 2019; Karpouzoglou et al. 2018). To compensate for the lack of affordability, poor households therefore often have to make trade-offs with other water sources and their related resource burdens such as water quality or physical burdens of water collection.

Physical Burdens and Health Impacts

Water quality is a major concern in periurban areas. These create significant physical burdens of water collection and health impacts on the for the periurban communities, particularly the poor households. Households that are unable to afford priced treated water tend to make a trade-off towards low cost common public water sources. Most low cost public water supply is through common sources such as public standpipes located outside of the household premises. These entail the physical burdens of travelling a significant distance, time to travel and wait in queues for water collection, and physically carrying large quantum of water (Prakash and Singh 2012). These physical burdens of water collection are largely borne by women in the household making the burdens of household water security gendered. Physical burdens and health related vulnerabilities

emanating from water access issues are important risks taken into consideration for household choices and compulsions with regard to decisions on water sources used to attain household water security for periurban communities.

Accessing low cost common water sources for the poor households also comes with a trade-off of unreliable water quality (Ezenwaji et al. 2016; Groot and Bayrak 2019). Even priced informal water markets such as unregulated non-standardized water treatment plants and tankers provide water supply of unreliable quality. Consumption of poor quality untreated water leads to water borne diseases (Narain 2012). Insufficient water access for sanitation and personal hygiene lead to water washed diseases among the periurban community. Wastewater is considered a crucial resource for irrigation in the downstream periurban villages. However, wastewater agriculture also comes with associated health impacts for the farmers engaged in it. Farming in standing untreated wastewater in the fields leads to skin rashes and parasitic infections for the farm labor (Narain 2012). In addition, the toxins, heavy metals, and other domestic and industrial waste get accumulated in the food crop which can have adverse health impacts on consumption (Ullah et al. 2012). Since water from the wastewater channels also seep into the groundwater, it can affect the water quality of household borewell water used for domestic or cooking purposes. These can cause water borne diseases and parasitic stomach infections.

Shifting Livelihoods

Declining water availability and quality adversely affects traditional water based livelihoods such as agriculture and fisheries (Butsch and Heinkel 2020). Chemical and industrial pollution of surface water reduces the aquaculture potential and agriculture land quality as well as contaminant accumulation in fish and crops. However, wastewater that is predominantly affected by domestic and organic waste is also considered as beneficial for wastewater fisheries and agriculture (Mukherjee 2012; Miller and Atanda 2011). On the other hand water depletion and drying up of water sources leads to reduced availability and increasing costs of water for water-based livelihoods and thereby reduces their productivity and profitability. Distressed livelihoods lead to communities being compelled to diversify occupations, seek new employment options in urban sectors, and gradual decline in these traditional livelihoods.

This decline in land and water based traditional rural livelihoods further eases the transfer of land and water resources to urban and industrial uses. For instance, as farmers lose easy and low cost access to water for irrigation, the profitability of agriculture reduces, which leads farmers to sell their land for increasing land values of periurban areas. Some farmers, who can afford deep borewells and can continue to access water, shift to the water-selling business as this fetches significantly higher profits than agriculture (Vij et al. 2019). Poor marginal farmers tend to be pushed into agricultural and urban labor. Similarly, as periurban agriculture declines, the agriculture labor also shifts towards urban and industrial labor. Periurban areas thus offer not only aspects of livelihoods marginalization but also opportunities. Proximity to the city provides a lucrative market for goods and services from agriculture and allied livelihoods such as aquaculture and livestock. New opportunities for employment and businesses also emerge. However, the livelihood marginalities and opportunities are not equally distributed (Sen 2016). Marginal farmers, landless laborers, and women face increased marginalities from the periurban livelihood shifts, whereas the rich and powerful communities such as large landowners are able to capitalize on these changes and utilize it for increased capital accumulation.

Recognizing and Centering the Margins for Sustainable Urban Water Futures

The discussion thus far has elaborated on the various water resource and access vulnerabilities of the periurban space that emanate from the urbanization processes occurring beyond the boundaries of the city at the fringes of the urban core. The processes of urban expansion and

periurban development vary significantly by local contexts of different countries and cities based on governance structures, geography, hydrology, history, and social structures. As a result, different types and levels of the outcomes discussed in this chapter may manifest in different contexts. Yet, in recent decades of increased globalization of capital and labor, many commonalities are developing now between historically dissimilar, or even contrasting, contexts and patterns of urbanization and periurban development. Heterogeneity and informality have become common features of periurban developments not only across many developing countries, but more recently also for many cities in developed countries (Hamel and Keil 2016). Periurban spaces are deeply integrated with the urban milieu and thereby "simultaneously sustained and imperiled by the urban dynamics" (Freidberg 2001). While the urbanization process creates both marginalities as well as opportunities, the capitalization of these opportunities often creates exclusions for some and profits for others. In the rural-urban binaries on which policy and planning is based often misses the much needed focus on the periurban areas as a particularly vulnerable and rapidly transforming region that does not identify perfectly with either the rural or the urban problem space.

Spatial transfers of water resources, land use changes to urban and industrial purposes, and ease of urban expansion at the cost of periurban water ecologies are some of the ways in which the periurban resource space sustains the resource demands of a growing city. However, the peripheries of today are the cities of tomorrow and therefore unsustainable development of the periurban areas will result in unsustainable urban resource futures as well. Periurban resource vulnerabilities and marginalities not only affect a large and growing population that migrates and settles in these areas for accessing the city and its labor demands, but also translate into marginalities of future cities. Some recent studies have engaged with pathways and responses of the affected and marginalized communities to the resources vulnerabilities and exclusions of the periurban space. The new hybrid informal institutions that emerge in response to the gaps in resource provision are considered as active responses of the community to respond to resource scarcity. There are many proponents for greater recognition and support for these alternate bottom-up institutional frameworks of resource access that challenge dominant state or commercial institutions (Allen et al. 2017; Schramm and Wright-Contreras 2017). Cases of local resistances and conflict against resource appropriation by new power coalitions have been documented, bringing together networks of civil society and affected local community (Roth et al. 2019). Such actor alliances and networks help build platforms for new coalitions of multiple-stakeholders against dominant development paradigms and seeking more alternate pathways for sustainable futures (Scoones et al. 2020; Narain et al. 2020). Formal regulation of urban sprawl through government policies has also been practiced in many countries of global north. Alternate pathways for sustainable periurban futures are much needed. Dominant development pathways have created unequal power relations between the city and its peripheries and the reciprocal flows between the city and the periurban areas have provided means for resource appropriation and degradation. The margins need to be thus recognized and centered in urban planning, metropolitan area planning, and urban policy.

Conclusion

Urban and periurban development has been identified by the Global Sustainable Development Report 2019 as one of the six entry points for progress across all the Sustainable Development Goals (SDGs). Supporting positive economic, social, and environmental links between urban, periurban, and rural areas is identified as one of the targets of the SDG 11 for Sustainable Cities. These links are considered essential for more balanced regional development to reduce the gaping inequalities between binaries of urban and rural areas. However, in a neoliberal urban-growth centric economic paradigm where cities form the heart of global and national capital, and policy, the urban-rural linkages can distribute flows and

resources in favor of urban centers often at the cost of rural areas and their resources. In order to achieve targets of SDG 6 to ensure access to safe water for all, the periurban water marginalities call for particular recognition given that the specific character of this region lacks focus in rural-urban binaries in planning and policy. Declining water quality, increasing commercialization of water, deepening inequalities in water access, and deteriorating water ecologies of the periurban space significantly challenge the SDG 6 targets of safe, affordable, and equal water access (target 6.1) and protected water related ecologies (target 6.6). Rampant and unregulated effluent release from polluting industries located in periurban spaces challenge SDG 6 targets of reducing pollution and minimizing release of hazardous chemicals and materials in water sources (target 6.3). Innovative bottom-up institutions, participatory collective management, new citizen-activist-civil society-state coalitions against dominant growth paradigms and power centers, stronger metropolitan governance, and greater focus in policy can offer alternate pathways towards sustainability of the periurban space.

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Cross-References

- Acceptability of Alternative Water Sources
- Cities of the Future and Water
- Urban Water Governance and Sustainability
- Water and Gender Issues
- Water Provision and Poverty
- Water Related Ecosystems

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References

Alba R, Bruns A, Bartels LE, Kooy M (2019) Water brokers: exploring urban water governance through the practices of tanker water supply in Accra. Water 11(9):1919

Allen A (2003) Environmental planning and management of the peri-urban interface: perspectives on an emerging field. Environ Urban 15(1):135–148

Allen A (2010) Neither rural nor urban: service delivery options that work for the Peri-urban poor. In: Kurian M, McCarney P (eds) Peri-urban water and sanitation services: policy, planning and method. Springer, Dordrecht, pp 27–61

Allen A, Dávila JD, Hofmann P (2006) The peri-urban water poor: citizens or consumers?. Environment and Urbanization 18(2):333–351

Allen A, Hofmann P, Mukherjee J, Walnycki A (2017) Water trajectories through non-networked infrastructure: insights from peri-urban Dar es Salaam, Cochabamba and Kolkata. Urban Res Pract 10(1):22–42

Askew LE, McGuirk PM (2004) Watering the suburbs: distinction, conformity and the suburban garden. Aust Geogr 35(1):17–37

Bakker K (2003) Archipelagos and networks: urbanization and water privatization in the South. Geogr J 169(4): 328–341

Bartels LE, Bruns A, Alba R (2018) The production of uneven access to land and water in peri-urban spaces: de facto privatisation in greater Accra. Local Environment 23(12):1172–1189. https://doi.org/10.1080/13549839.2018.1533932

Britto AL, Maiello A, Quintslr S (2019) Water supply system in the Rio de Janeiro metropolitan region: open issues, contradictions, and challenges for water access in an emerging megacity. J Hydrol 573:1007–1020

Büsser S, Pham TN, Antoine M, Nguyen VA (2007) Characteristics and quantities of domestic wastewater in urban and peri-urban households in Hanoi. Annual report of FY 2006. The Core University Program between Japan Society for the Promotion of Science (JSPS) and Vietnamese Academy of Science and Technology (VAST), pp 395–397.72

Butsch C, Heinkel SB (2020) Periurban transformations in the global south and their impact on water-based livelihoods. Water 12(2):458

Buxton M (2014) The expanding urban fringe: impacts on peri-urban areas, Melbourne, Australia. In: The Security of Water, Food, Energy and Liveability of Cities. Springer, Dordrecht, pp 55–70

Cain A (2018) Informal water markets and community management in peri-urban Luanda, Angola. Water Int 43(2):205–216

Chigurupati R (2008) Urban growth, loss of water bodies and flooding in Indian cities: the case of Hyderabad. Water and Urban Development Paradigms: Towards an Integration of Engineering, Design and Management Approaches, pp 121–125

Couch C, Petschel-Held G, Leontidou L (eds) (2008) Urban sprawl in Europe: landscape, land-use change and policy. Wiley

Dávila J (2012) Falling between stools? Policies, strategies and the peri-urban interface. In: The Peri-Urban Interface. Routledge, pp 67–79

Deda L, Tsenkova S (2006) Poverty and inequality in Greater Tirana: the reality of peri-urban areas. In: The Urban Mosaic of post-socialist Europe. Physica-Verlag HD, pp 151–170

Díaz-Caravantes RE, Wilder M (2014) Water, cities and periurban communities: geographies of power in the context of drought in Northwest Mexico. Water Altern 7(3):499–417

Dimitriou E, Karaouzas I, Sarantakos K, Zacharias I, Bogdanos K, Diapoulis A (2008) Groundwater risk assessment at a heavily industrialised catchment and the associated impacts on a peri-urban wetland. J Environ Manag 88(3):526–538

Domene E (2014) Changing patters of water consumption in the suburban Barcelona: lifestiles and welfare as explanatory factors. Invst Geográficas (Esp) 61:39–53

Douglas I (2006) Peri-urban ecosystems and societies: transitional zones and contrasting values. In: McGregor D, Simon D (eds) The peri-urban interface: approaches to sustainable natural and human resource use. Routledge, pp 41–52

Dupont V (2007) Conflicting stakes and governance in the peripheries of large Indian metropolises–an introduction. Cities 24(2):89–94

Dupras J, Alam M (2015) Urban sprawl and ecosystem services: a half century perspective in the Montreal area (Quebec, Canada). J Environ Policy Plan 17(2):180–200

Ezenwaji EE, Ahiadu HO, Otti VI (2016) Safe water supply determinants in Peri-urban communities of South-East Nigeria. In: Maheshwari B, Singh VP, Thoradeniya B (eds) Balanced urban development: options and strategies for liveable cities. Springer International Publishing, Cham, pp 221–233

Fonjong L, Fokum V (2017) Water crisis and options for effective water provision in urban and peri-urban areas in Cameroon. Soc Nat Resour 30(4):488–505

Freidberg S (2001) Gardening on the edge: the social conditions of unsustainability on an African urban periphery. Ann Assoc Am Geogr 91(2):349–369

Gillham O (2002) The limitless city: a primer on the urban sprawl debate. Island Press, Washington, DC

Groot R, Bayrak MM (2019) Achieving water security in peri-urban Yangon: exploring the local governance processes. Water Policy 21(5):980–998

Haase D, Nuissl H (2007) Does urban sprawl drive changes in the water balance and policy?: the case of Leipzig (Germany) 1870–2003. Landsc Urban Plan 80 (1–2):1–13

Hamel P, Keil R (2016) Governance in an emerging suburban world. Cadernos Metrópole 18(37):647–670

Hommes L, Boelens R (2017) Urbanizing rural waters: rural-urban water transfers and the reconfiguration of hydrosocial territories in Lima. Polit Geogr 57:71–80

Jampani M, Huelsmann S, Liedl R, Sonkamble S, Ahmed S, Amerasinghe P (2018) Spatio-temporal distribution and chemical characterization of groundwater quality of a wastewater irrigated system: a case study. Sci Total Environ 636:1089–1098

Jepson W, Vandewalle E (2016) Household water insecurity in the global north: a study of rural and periurban settlements on the Texas–Mexico border. Prof Geogr 68(1):66–81

Jeuland M, Orgill J, Shaheed A, Revell G, Brown J (2016) A matter of good taste: investigating preferences for in-house water treatment in peri-urban communities in Cambodia. Environ Dev Econ 21(3):291–317

Jimenez-Redal R, Parker A, Jeffrey P (2014) Factors influencing the uptake of household water connections in peri-urban Maputo, Mozambique. Util Policy 28:22–27

Karpouzoglou T, Marshall F, Mehta L (2018) Towards a peri-urban political ecology of water quality decline. Land Use Policy 70:485–493

Kennedy L (2007) Regional industrial policies driving peri-urban dynamics in Hyderabad, India. Cities 24 (2):95–109

Kundu A, Saraswati LR (2016) Changing patterns of migration in India: a perspective on urban exclusion. In: International handbook of migration and population distribution. Springer, Dordrecht, pp 311–332

Kundu A, Pradhan BK, Subramanian A (2002) Dichotomy or continuum: analysis of impact of urban centres on their periphery. Econ Polit Wkly 37:5039–5046

Leaf M (2011) Periurban Asia: a commentary on "becoming urban". Pac Aff 84(3):525–534

Maheshwari BL, Simmons BL, Singh VP (2012) Role and complexity of integrated water-resources management for periurban landscapes in Australia. J Hydrol Eng 17 (2):229–236

Malano H, Maheshwari B, Singh VP, Purohit R, Amerasinghe P (2014) Challenges and opportunities for peri-urban futures. In: The security of water, food, energy and liveability of cities. Springer, Dordrecht, pp 3–10

Mao D, Wang Z, Wu J, Wu B, Zeng Y, Song K, . . . Luo L (2018) China's wetlands loss to urban expansion. Land Degrad Dev 29(8):2644–2657

Mapunda DW, Chen SS, Yu C (2018) The role of informal small-scale water supply system in resolving drinking water shortages in peri-urban Dar es Salaam, Tanzania. Appl Geogr 92:112–122

Marshall F, Dolley J (2019) Transformative innovation in peri-urban Asia. Res Policy 48(4):983–992

Marston A (2014) The scale of informality: community-run water systems in peri-urban Cochabamba, Bolivia. Water Altern 7(1)

Mehta L, Karpouzoglou T (2015) Limits of policy and planning in peri-urban waterscapes: the case of Ghaziabad, Delhi, India. Habitat Int 48:159–168

Mehta L, Allouche J, Nicol A, Walnycki A (2014) Global environmental justice and the right to water: the case of peri-urban Cochabamba and Delhi. Geoforum 54:158–166

Miller JW, Atanda T (2011) The rise of peri-urban aquaculture in Nigeria. Int J Agric Sustain 9(1):274–281

Mishra P, Narain V (2018) Urban canals and Peri-urban agrarian institutions. Econ Polit Wkly 53(37):51

Montz B, Gruntfest EC (1986) Changes in American urban floodplain occupancy since 1958: the experiences of nine cities. Appl Geogr 6(4):325–338

Morote ÁF, Hernández M (2016) Urban sprawl and its effects on water demand: a case study of Alicante, Spain. Land Use Policy 50:352–362

Mukherjee M (2012) Waste-fed fisheries in Peri-urban Kolkata. The Peri-Urban Interface: Approaches to Sustainable Natural and Human Resource Use, 104

Narain V (2009) Gone land, gone water: crossing fluid boundaries in peri-urban Gurgaon and Faridabad, India. South Asian Water Stud 1:143–158

Narain V (2012) Periurban water use, human health and Well-being. Emerging Issues in South Asia. Int Asienforum 43(1–2):33–45

Narain V, Vij S, Dewan A (2019) Bonds, battles and social capital: power and the mediation of water insecurity in peri-urban Gurgaon, India. Water 11(8):1607

Narain V, Ranjan P, Vij S, Dewan A (2020) Taking the road less taken: reorienting the state for periurban water security. Action Res 18(4):528–545

Nastiti A, Muntalif BS, Roosmini D, Sudradjat A, Meijerink SV, Smits AJM (2017) Coping with poor water supply in peri-urban Bandung, Indonesia: towards a framework for understanding risks and aversion behaviours. Environ Urban 29(1):69–88

North, D.C. Institutions (1990) Institutional change and economic performance. Cambridge University Press, Cambridge

Orgill J, Shaheed A, Brown J, Jeuland M (2013) Water quality perceptions and willingness to pay for clean water in peri-urban Cambodian communities. J Water Health 11(3):489–506

Ostrom E (2005) Understanding institutional diversity. Princeton University Press, Princeton

Packialakshmi S, Ambujam NK, Nelliyat P (2011) Groundwater market and its implications on water resources and agriculture in the southern peri-urban interface, Chennai, India. Environ Dev Sustain 13(2):423–438

Parés M, March H, Saurí D (2013) Atlantic gardens in Mediterranean climates: understanding the production of suburban natures in Barcelona. Int J Urban Reg Res 37(1):328–347

Peloso M, Morinville C (2014) "Chasing for water": everyday practices of water access in PeriUrban Ashaiman, Ghana. Water Altern 7(1):121–139

Prakash A (2014) The periurban water security problem: a case study of Hyderabad in southern India. Water Policy 16(3):454–469

Prakash A, Singh S (2012) Gendered and caste spaces in household water use: a case of Aliabad village in peri-urban Hyderabad, India (Working paper). SaciWATERs, Andhra Pradesh. Retrieved from https://idl-bnc-idrc.dspacedirect.org/handle/10625/50902

Ranganathan M, Balazs C (2015) Water marginalization at the urban fringe: environmental justice and urban political ecology across the North–South divide. Urban Geogr 36(3):403–423

Roth D, Khan MSA, Jahan I, Rahman R, Narain V, Singh AK, … Yakami S (2019) Climates of urbanization: local experiences of water security, conflict and cooperation in peri-urban South-Asia. Clim Pol 19(sup1):S78–S93

Ruet J, Gambiez M, Lacour E (2007) Private appropriation of resource: impact of peri-urban farmers selling water to Chennai metropolitan water board. Cities 24(2):110–121

Rusca M, Schwartz K (2018) The paradox of cost recovery in heterogeneous municipal water supply systems: ensuring inclusiveness or exacerbating inequalities? Habitat Int 73:101–108

Sajor EE, Ongsakul R (2007) Mixed land use and equity in water governance in peri-urban Bangkok. Int J Urban Reg Res 31(4):782–801

Schramm S, Wright-Contreras L (2017) Beyond passive consumption: dis/ordering water supply and sanitation at Hanoi's urban edge. Geoforum 85:299–310

Scoones I, Stirling A, Abrol D, Atela J, Charli-Joseph L, Eakin H, Ely A, Olsson P, Pereira L, Priya R, van Zwanenberg P, Yang L (2020) Transformations to sustainability: combining structural, systemic and enabling approaches. Curr Opin Environ Sustain 42:65–75

Sen S (2016) Gendered exclusions in the work spaces of Peri-urban areas in a neoliberal environment: learning from the experiences of large metropolitan cities in India. Environ Urban ASIA 7(1):76–92

Sen S, John A, Chakraborty S, Jatav M (2019) Geographies of drinking water (in) securities in Peri-urban Hyderabad. Econ Polit Wkly 54(39):43

Sheng YK (2018) Peri-urban transformations in Southeast Asia. In: Routledge handbook of urbanization in Southeast Asia. Routledge, pp 31–42

Shivendra BT, Ramaraju HK (2015) Impact of onsite sanitation system on groundwater in different geological settings of peri urban areas. Aquatic Procedia 4:1162–1111

Shrestha A, Roth D, Joshi D (2018) Flows of change: dynamic water rights and water access in peri-urban Kathmandu. Ecol Soc 23(2)

Simon D (2008) Urban environments: issues on the peri-urban fringe. Annu Rev Environ Resour 33:167–185

Tu J, Xia ZG, Clarke KC, Frei A (2007) Impact of urban sprawl on water quality in eastern Massachusetts, USA. Environ Manag 40(2):183–200

Ullah H, Khan I, Ullah I (2012) Impact of sewage contaminated water on soil, vegetables, and underground water

of peri-urban Peshawar, Pakistan. Environ Monit Assess 184(10):6411–6421
United Nations (2018) The World's cities in 2018: data booklet. United Nations
Vij S, Narain V (2016) Land, water & power: the demise of common property resources in periurban Gurgaon, India. Land Use Policy 50:59–66
Vij S, John A, Barua A (2019) Whose water? Whose profits? The role of informal water markets in groundwater depletion in peri-urban Hyderabad. Water Policy 21(5):1081–1095
Woltjer J (2014) A global review on peri-urban development and planning. J RegCity Plan 25(1):1–16
Wright-Contreras L, March H, Schramm S (2017) Fragmented landscapes of water supply in suburban Hanoi. Habitat Int 61:64–74
Zhu J (2013) Governance over land development during rapid urbanization under institutional uncertainty, with reference to periurbanization in Guangzhou metropolitan region, China. Environ Plan C 31(2):257–275