Alexander Follmann

Governing Riverscapes

Urban Environmental Change along the River Yamuna in Delhi, India

Geographie

Franz Steiner Verlag

Megacities and Global Change
Megastädte und globaler Wandel
Band 20



Alexander Follmann
Governing Riverscapes

MEGACITIES AND GLOBAL CHANGE

MEGASTÄDTE UND GLOBALER WANDEL

herausgegeben von

Frauke Kraas, Martin Coy, Peter Herrle und Volker Kreibich

Band 20

Alexander Follmann

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Umschlagabbildung:
Old Railway Bridge over the Yamuna in New Delhi, India © Alexander Follmann

Bibliografische Information der Deutschen Nationalbibliothek:
Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über <http://dnb.d-nb.de> abrufbar.

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© Franz Steiner Verlag, Stuttgart 2016
Druck: Hubert & Co, Göttingen
Gedruckt auf säurefreiem, alterungsbeständigem Papier.
Printed in Germany.
ISBN 978-3-515-11430-1 (Print)
ISBN 978-3-515-11435-6 (E-Book)

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GLOSSARY

akhada	a traditional wrestling ground and training center on the riverbank
bāngar	older alluvial soils along rivers, generally safe from floods
bhag	garden, orchard
crore	ten million
dhobi	washerman
ghat	riverside area with a series of steps leading down to the river
headworks	barrage
jamuna par	Trans-Yamuna, East Delhi
jheel	lake
jhuggi jhopdi	huts of the poor, slum (also JJ cluster)
jhuggies	huts of the poor in a slum
khadar / khādir	fertile soils of the low-lying, flood-prone areas along the river
kuccha / kacha houses	houses made of wood, mud and other organic materials
lakh	one hundred thousand
mahābhārata	major Sanskrit epics of ancient India
nadī	river
nallah / nala	stream or drain
Panchayat	local (village) governing body, elected council in rural areas
pandit / panda	Hindu religious scholar and teacher (pundit)
pooja	prayer, worship
pucca houses	solid and permanent houses made of brick, stone and concrete
pushta	bund or embankment, also referred to as riverbank
samādhi	shrine, memorial site

LIST OF ABBREVIATIONS

ANT	actor-network theory
ASL	above sea level
BAPS	Bochasanwasi Shri Akshar Purushottam Swaminarayan
BBMB	Bhakra-Beas Management Board
BCM	billion cubic meter
CGWA	Central Groundwater Authority
CGWB	Central Groundwater Board
CNG	compressed natural gas
CPCB	Central Pollution Control Board
CPWD	Central Public Works Department
CRZ	Coastal Regulation Zone
CSE	Centre for Science and Environment
cusec	cubic feet per second
cumec	cubic meter per second
CWC	Central Water Commission
CWGs	Commonwealth Games
DBU	designated best use
DCB	Delhi Cantonment Board
DDA	Delhi Development Authority
DIT	Delhi Improvement Trust
DJB	Delhi Jal Board
DMRC	Delhi Metro Rail Corporation (in short: Delhi Metro)
DND	Delhi-Noida-Delhi
DPCC	Delhi Pollution Control Committee
DTTDC	Delhi Tourism and Transportation Development Corporation
DUAC	Delhi Urban Arts Commission
DUSIB	Delhi Urban Shelter Improvement Board
EAC	Environmental Appraisal Committee
EIA	Environmental Impact Assessment
FDI	foreign direct investment
GAP	Ganga Action Plan
GDP	Gross Domestic Product
GNCTD	Government of the National Capital Territory
GoI	Government of India
HFL	High Flood Level

HLC	High Level Committee
IAS	Indian Administrative Service
ICT	information communication technology
IFCD	Irrigation and Flood Control Department
INTACH	Indian National Trust for Art and Cultural Heritage
IPCC	Intergovernmental Panel on Climate Change
ITO	Income Tax Office
JJ	Jhuggi jhopdi (JJ-cluster = 'slum')
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
JNU	Jawaharlal Nehru University
L&DO	Land and Development Office
LG	Lieutenant Governor
LIFE	Legal Initiative for Forests and Environment
MCD	Municipal Corporation of Delhi
MoEF	Ministry of Environment and Forests
MoHuPA	Ministry of Housing and Urban Poverty Alleviation
MoU	Memorandum of Understanding
MoUD	Ministry of Urban Development
MoUEPA	Ministry of Urban Employment and Poverty Allevation
MoWR	Ministry of Water Resources
MPD	Master Plan for Delhi
NCRPB	National Capital Region Planning Board
NCT	National Capital Territory
NDA	National Democratic Alliance
NDMC	New Delhi Municipal Corporation
NEERI	National Environmental Engineering Research Institute
NGO	Non-Government Organisation
NGT	National Green Tribunal
NH	National highway
NHF	Natural Heritage First
NOIDA	New Okhla Industrial Development Authority
NRCD	National River Conservation Directory
PIL	Public Interest Litigations
RRZ	River Regulation Zone
PWD	Public Works Department
RTI	Right to Information
SANDRP	South Asia Network for Dams, Rivers and People
SKAD	Sociology of Knowledge Approach to Discourse
SPA	School of Planning and Architecture

STP	Sewage Treatment Plan
TAG	Technical Advisory Group
UN	United Nations
U. P.	Uttar Pradesh
UPE	Urban Political Ecology
UYRB	Upper Yamuna River Board
Rs.	Indian Rupees
WWF	World Wide Fund for Nature
WYC	Western Yamuna Canal
YAP	Yamuna Action Plan
YJA	Yamuna Jiye Abhiyaan
YRDA	Yamuna River Development Authority
YREMC	Yamuna Removal of Encroachments Monitoring Committee
YSC	Yamuna Standing Committee
ZDP	Zonal Development Plan

SUMMARY

The inherent complexity of environmental change along urban rivers in the megacities of the Global South requires a change of perspective going beyond the riverfront. In order to overcome the binary conceptualizations of nature/culture and river/city, this study uses the notion of *riverscapes* as a single terminology referring to the riverine landscape formed by the natural forces of the river and human interventions. By linking a discourse analytical approach with theoretical concepts from governance research and urban political ecology, this study develops the theoretical framework of *riverscapes* to study environmental change along urban rivers.

Interlinked with the opening and liberalization of the Indian economy, the vision to make Delhi a 'world-class' city has transformed the urban landscape of the megacity in manifold ways. The river Yamuna, which divides the city into two parts, was historically degraded to a foul-smelling drain by the city's untreated sewage and was the neglected 'backyard' of the megacity for a long time. The reclamation of the floodplain areas for the planned development of the city has been discussed in Delhi since the late 1970s. For decades, models of European riverfronts dominated the discourses around the river and the urban imaginaries of the planners.

Ecological risks and opposition from environmental groups have prevented large-scale channelization of the river. However, the perception of the river's floodplain as 'wasted land' has transformed it into a pivotal space in the remaking of the city in the twenty-first century. The large-scale slum demolitions and development of urban mega-projects along the banks of the Yamuna are characteristic for dynamic land-use changes in post-liberalization urban India.

The research presented in this book focuses on the multiple city-river relationships and current processes of urban environmental change. The results highlight that dynamic land-use changes and the reclamation of ecologically sensitive spaces are deeply connected to changing discursive framings of the role and function of these socio-ecological hybrids in the remaking of cities. Through analysis of the discourses surrounding Delhi's riverscapes, the study shows how dominant discourses and their associated story-lines have remained persistent over long periods of time and how these discourses have influenced the current processes of urban environmental change and governance.

ZUSAMMENFASSUNG

Für ein besseres Verständnis der Komplexität von urbanen Landnutzungsveränderungen und Umweltproblemen entlang von Flüssen in den Megastädten des Globalen Südens bedarf es empirischer Untersuchungen, die über eine enge räumliche Fokussierung auf die *riverfront* hinausgehen. Hierzu ist es notwendig, die moderne Dichotomie von Natur und Kultur sowie Fluss und Stadt aufzubrechen, um das Fluss-Stadt-Verhältnis neu zu definieren. Diese Studie entwickelt in diesem Kontext ein neues Verständnis für die Erforschung von urbanen Flusslandschaften als sogenannte *riverscapes*. Das theoretische Konzept der *riverscapes* basiert auf einer Verknüpfung von Governance-Forschung und Ansätzen der Urban Political Ecology mit diskursanalytischen Ansätzen.

Im Zuge wirtschaftlicher Liberalisierung sowie fortschreitender Globalisierungsprozesse ist es das Ziel der Stadtentwicklungspolitik, die indische Hauptstadt Delhi in eine „Weltklasse-Stadt" zu verwandeln. Diese ambitionierte Zielsetzung der Stadtentwicklungspolitik verschärft die urbanen Landnutzungskonflikte innerhalb der Megastadt. Ein räumlicher Fokus der Stadterneuerungsmaßnahmen liegt hierbei insbesondere auf der Flussaue der Yamuna, die in der Vergangenheit auf Grund der monsunalen Überschwemmungen sowie der starken Verschmutzung des Flusses städtebaulich unberücksichtigt blieb und im Zuge dessen Raum für Marginalsiedlungen bot. Eine städtebauliche Entwicklung der Uferbereiche nach dem Vorbild westlicher Flüsse wurde bereits seit den späten 1970er Jahren diskutiert, jedoch auf Grund ökologischer Risiken nicht umgesetzt. Eine Eindeichung und Entwicklung von ausgewählten Arealen der Flussaue erfolgte erst im Zuge städtebaulicher Großprojekte nach der Jahrtausendwende. Zusammen mit großflächigen Slumräumungen sind diese Entwicklungen charakteristisch für aktuelle Landnutzungsveränderungen und -konflikte in den indischen Megastädten.

Der Fokus der Untersuchungen liegt auf den vielfältigen Fluss-Stadt Beziehungen und dynamischen Veränderungen in der Flussaue der Yamuna. Die Studie zeigt, dass aktuelle Stadtentwicklungsprojekte eng verknüpft sind mit sich verändernden Stadtentwicklungs- und Umweltschutzdiskursen.

PREFACE

This study was submitted as a doctoral thesis to the Faculty of Mathematics and Natural Sciences of the University of Cologne and was defended on 17th June 2015. Prof. Dr. Boris Braun and Prof. Dr. Frauke Kraas were the reviewers.

ACKNOWLEDGEMENTS

Although it seems impossible to acknowledge everybody who supported me in Delhi and Cologne during the last few years, I would like to thank some key individuals here.

Very special thanks go to my supervisor, Boris Braun, who always encouraged me in my work and gave me all the support a PhD student needs, including a great office environment and plenty of freedom to do my research. I would like to especially thank Boris for the confidence and motivation he gave me through reading and critiquing my drafts. I thank my Indian 'supervisor' N. Sridharan from the School of Planning and Architecture (SPA) in Delhi for the great support provided throughout the years.

I am especially grateful to my interview partners in Delhi. Without their patience and explanations this study would not have been possible. My special thanks goes to Manoj Misra, who welcomed me so many times, introduced me to the farmers along the Yamuna, invited me to court proceedings and conferences, and shared his knowledge on the river with me during multiple hours of discussions. Further, I would like to thank Sudha Mohan for providing additional help and always arranging snacks and drinks for the long talks on the river.

My thanks also goes also to Ravi Agarwal, Manu Bhatnagar, Anupam Mishra, Suresh Rohilla, Diwan Singh, Vikram Soni, and Himanshu Thakkar. All of them have shared their own understandings of the river with me, which have had a lasting effect on my understanding of Delhi's riverscapes. I am grateful for the wonderful talks we had. I further need to thank Rahul Choudhary and Rittwick Dutta from the Legal Initiative for the Environment (LIFE) for digging out all the old court files.

Special reference needs to be given to the late Ramesh C. Trivedi, who explained to me almost everything related to the pollution of the Yamuna. Also to the late Ramaswamy R. Iyer, who helped me enormously to better understand the governance of water and rivers in India. With their deaths, India's rivers have lost important spokesmen. I am grateful for the opportunity to learn from them.

I am further very thankful for the hospitality of my interview partners within the different government departments. A special thank goes to the members of the DDA Landscape Unit, who openly discussed with me their planning schemes for Delhi's riverscapes. I gained the most impressive insights into the everyday changes and governance of Delhi's riverscapes from talks with the farmers (who for their own security shall remain anonymous). I have rarely met friendlier people. Talking to many of them would not have been possible without my translators in the field. I thank Sarandha Jain and Kavita Ramakrishnan for accompanying me on some of the visits and providing this translation

A word of appreciation goes to the German Academic Exchange Service (DAAD) providing the initial scholarship for my time at the SPA in 2009–2010 and the German Academic Scholarship Foundation (Studienstiftung des deutschen

Volkes) for funding my studies for two and a half years (2011–2013). Thanks for institutional support go to the team of Max Mueller Bhavan, and Robin Mallick in particular, who helped to organize the Yamuna Future Workshop in March 2013.

My personal research greatly benefited from the affiliation with the 'Chance2Sustain - Urban Chances, City Growth and the Sustainability Challenge' project. Sincere thanks to Loraine Kennedy and Isa Baud for taking me on-board and inviting me to workshops and conferences and to Véronique Dupont for her inspiring work on Delhi and her thoughtful advice. In Delhi, discussions with Amita Baviskar, Bérénice Bon, Timothy Karpouzoglou, and Awadhendra Sharan have been a source of inspiration. As part of the urban workshop series, organized by the Centre de Sciences Humaines (CSH) and the Centre for Policy Research (CPR), I was able to discuss my work on the river in November 2011 with a larger audience in Delhi. I would like to thank Marie-Hélène Zerah and Partha Mukhopadhyay for inviting me, and the participants for their comments.

A series of discussions with Anna Zimmer over the last few years has influenced my growing interest in Urban Political Ecology and socio-ecological hybrids. Her insightful remarks and sharp feedback helped me enormously. A thousand thanks for the great support. The theoretical concept made major progress based on the valuable comments by Erik Swyngedouw and the other participants during a PhD workshop at the Politecnico di Milano in May 2014. I am grateful to Gloria Pessina for the opportunity to participate.

Heartfelt thanks for all the support also go to the whole team at the Institute of Geography. Special thanks go to Frauke Kraas for her valuable comments on the conceptual framework and the research design, to Regine Spohner and Ulrike Schwedler for preparing the excellent maps, Veronika Selbach for her advice, and Peter Dannenberg for giving me support and time to finish this book. My wonderful colleagues at the institute made long office days enjoyable: thank you Amelie, Annika, Benjamin, Birte, Carsten, Fabian, Franziska, Gerrit, Harald, Holger, Katharina, Madlen, Mareike, Marie, Pamela, Petra, Sebastian, Steffi, Tibor, Tine, and Valerie.

In the final phase, Anna Zimmer, Jürgen Schiemann, Tine Trumpp, Veronika Selbach, Valerie Viehoff, Megha Sud, Lisa-Michéle Bott, Birte Rafflenbeul, and Marie Pahl provided important support in proof reading, as well as Regine Spohner, Benjamin Casper and Benedict Vierneisel in cartography and graphics. Additionally, I thank Hannah Stanley for final proofreading. Special thanks for the wonderful time in Sheikh Sarai B-24 go to my wonderful flat mates and friends Adil, Anna, Dawa, Imran, Karen and Nanu, as well as the Barista group from SDA market, New Delhi.

Finally, the great support of my family deserves my heartfelt thanks. My parents supported me wholeheartedly in all respects. I am also grateful to my siblings and grandparents who were always interested in my work. Lastly, my deepest gratitude to Natalie for all her support and love during the stressful years and long stays abroad. I owe you so much.

I INTRODUCTION AND RESEARCH CONTEXT

1 INTRODUCTION

The megacities of the Global South have emerged as hot spots of global environmental change; both as drivers of this change, as well as experiencing the intense adverse effects (KRAAS 2003, 2007, KRAAS & MERTINS 2014, PARNELL et al. 2007, SINGH 2015, SORENSEN & OKATA 2011). Due to their scale, dynamics and complexity, the largest cities of the world face multiple socio-environmental challenges and their future development is at the center of public debate and scientific research (DAVIS 2006, KRAAS et al. 2014, PARNELL & OLDFIELD 2014, SORENSEN 2011, UN HABITAT 2010).

The dynamic processes of urbanization and associated land-use changes in the megacities of the Global South are driven by a multiplicity of actors embedded in complex global-local relations (HEINRICHS et al. 2012, HOMM 2014). In many cases the governance of megacities in the Global South is characterized by sectoral approaches lacking integrated planning and inter-sectoral coordination (BAUD & DHANALAKSHMI 2007, FARIA et al. 2009, KRAAS & MERTINS 2014, MITTAL et al. 2015). An omnipresent urban informality adds to the multiple challenges for urban governance in many cities of the Global South (ALSAYYAD & ROY 2004, MCFARLANE 2012, MCFARLANE & WAIBEL 2012, ROY 2005, 2009b).

In light of climate change, urban transformations in the megacities of the Global South are intimately linked to the challenge of making cities less vulnerable and more resilient (AßHEUER 2014, AßHEUER & BRAUN 2011, BIRKMANN et al. 2010, GARSCHAGEN 2014, HANSJÜRGENS & HEINRICHS 2014, HORDIJK & BAUD 2011, OTTO-ZIMMERMANN 2011, 2012). Along with specific local challenges of resource overexploitation, environmental degradation and associated health problems ongoing processes of mega-urbanization raise multiple questions of sustainability and socio-environmental justice (AGGARWAL & BUTSCH 2011, RADEMACHER & SIVARAMAKRISHNAN 2013b).

The environmental question is "generally often circumscribed to either rural or threatened 'natural' environments or to 'global' problems", but the central role of the global urbanization process is still under-represented in the environmental debate (SWYNGEDOUW 2004: 9). This neglect of urban nature has been connected to the modern separation of nature and society through which 'the city' has for a long time been considered to be the very antithesis to nature (see among others ANGELO & WACHSMUTH 2014, CHILLA 2005b, HARVEY 1996b, HEYNEN et al. 2006b, KEIL 2003, KEIL & GRAHAM 1998, TREPL 1996). The city, seemingly entirely created by humans, was not considered as a natural ecosystem. As a result, environmental problems in the cities of the Global South have long been largely ignored (HARDOY & SATTERTHWAITE 1991). Only since the turn of the millennium

have urban environmental problems in the Global South, especially air and water pollution, come into increasing focus of both state and non-state actors. As a result, a growing 'urban environmentalism' has resulted in new forms of urban environmental governance (BENTON-SHORT & SHORT 2013, BRAND & THOMAS 2005, FARIA et al. 2009, SHUTKIN 2001, VÉRON 2006, WHITEHEAD 2013).

Within this evolution, the modern city/nature dichotomy is challenged. 'Nature' is to some extent brought back into the city, yet this 'reintroduction of nature' into the urban realm does not follow any consistent narrative, but is rather fragmented in space and time, and often emerges as contradictory and highly politicized. Furthermore, despite a growing recognition of the importance of the urban environment, "a paradoxical form of inaction is the norm when it comes to implementing urban environmental solutions" (SHEPPARD 2006: 299). With regard to environmental conflicts in the cities of the Global South, numerous authors have argued that priority has often been given to ecological issues linked to larger questions of intergenerational equity, climate change and natural resource depletion ('green agenda') over the basic needs of the poor and the multiple challenges of the poverty-environment nexus ('brown agenda') (BARTONE et al. 1994, MCGRANAHAN & SATTERTHWAITE 2000, WATSON 2009).

In this context, the current urban environmental politics and socioecological transformations in India's megacities appear as an especially interesting case. Due to continuing population growth and the multiple effects of economic liberalization, India's megacities have been facing dynamic transformations raising manifold questions of urban sustainability and socio-environmental justice. India's current urbanization process poses multiple challenges for urban environmental governance to balance environmental protection and economic development, and the desires of a growing and increasingly assertive middle class[1] and the basic needs of the urban poor (BAVISKAR 2003, 2011a, DE MELLO-THÉRY et al. 2013, MAWDSLEY 2009, RADEMACHER & SIVARAMAKRISHNAN 2013a, TRUELOVE & MAWDSLEY 2011, VÉRON 2006).

Taking the case study of the river Yamuna in India's capital city Delhi, this study seeks to study these multiple governance challenges by linking questions of urban land-use change and urban redevelopment strategies to questions of river pollution and environmental degradation. City-river relationships reflect larger changes in socio-natural configurations and socioecological transformations (HOLIFIELD & SCHUELKE 2015, RADEMACHER 2011). Or more broadly, as HEIKKILA (2011: 33) frames it: "The manner in which societies interact with 'their' rivers tells us as much or more about themselves as it does about the rivers per se." By analyzing the river-city nexus, this study aims to shed light on the socioecological transformation in urban India beyond the physical space of the river Yamuna in Delhi.

1 Writings on the role of India's (emerging) urban middle class(es) tend to use a vague definition (BROSIUS 2010, ELLIS 2011, FERNANDES 2006, GHERTNER 2011d, MAWDSLEY 2004, SRIVASTAVA 2009). For a more detailed discussion see among others SRIDHARAN (2011).

1.1 Delhi: a tale of two cities, but only one river

Delhi has experienced rapid urbanization since India's Independence in 1947. With a population of approximately 17 million India's capital is today one of the largest megacities in the world. The long history of the city has always been closely connected to the river Yamuna, which is often referred to as the lifeline and the green lung of the city (DDA 2007). The ecologically sensitive river zone is the largest remaining natural feature and a crucial life supporting ecosystem of the megacity. The river Yamuna divides the city of Delhi into two parts, referred to as West Delhi and East Delhi (see Map 1, page 385).

The two parts of the megacity are characterized by distinctly different urban morphologies. The historic cores of the city and all major institutional areas are located in West Delhi. West Delhi is a comparatively 'green' city; especially the central, planned areas of the city which feature large green and recreational spaces. In contrast, East Delhi has largely grown informally and unplanned. The area is characterized by higher densities and generally poorer residential areas (CENSUS OF INDIA 2011a, MISTELBACHER 2005: 25). East Delhi is considerably lacking in terms of infrastructure provisions and adequate open and green spaces. An increasing number of bridges and new metro lines connects both parts of the city today, but the river's remaining 'undeveloped' floodplain is between one and three kilometers wide and still forms a major physical barrier separating the 'two cities'. This dichotomy of West Delhi and East Delhi needs to be taken into account because it influences the city-river relationship and the discourses associated with the river.

The growth of the megacity on both sides of the river has come at a large social and environmental cost. The extraction of the river's freshwater for agriculture and drinking water purposes, and increasing quantities of sewage released by the ever growing city have turned the sacred river, worshipped by Hindus since time immemorial, into a "sewage canal" (CSE 2007). The degradation of the riparian zone to a foul-smelling drain expresses a state of neglect regarding its protection and socio-ecological importance (see Figure 50 and Figure 51, page 392). A World Bank funded study in 2003 suggested that the Yamuna in Delhi "is perhaps the most threatened riverine ecosystem in the world because of the immense anthropogenic pressures on this riparian habitat" (BABU et al. 2003: 1).

The river's ecological importance for the city is acknowledged by several environmental policies and legislations. In the city's Master Plan, the city's central planning body, the Delhi Development Authority (DDA), has defined the River Zone (Zone O) as a special planning zone (see Figure 1). By using capital letters for 'River Zone' the author intends to highlight that this spatial demarcation and its associated planning regulations are defined by the DDA. The demarcation of the 'River Zone' itself is problematic and the policy-making process surrounding it is outlined in this study.

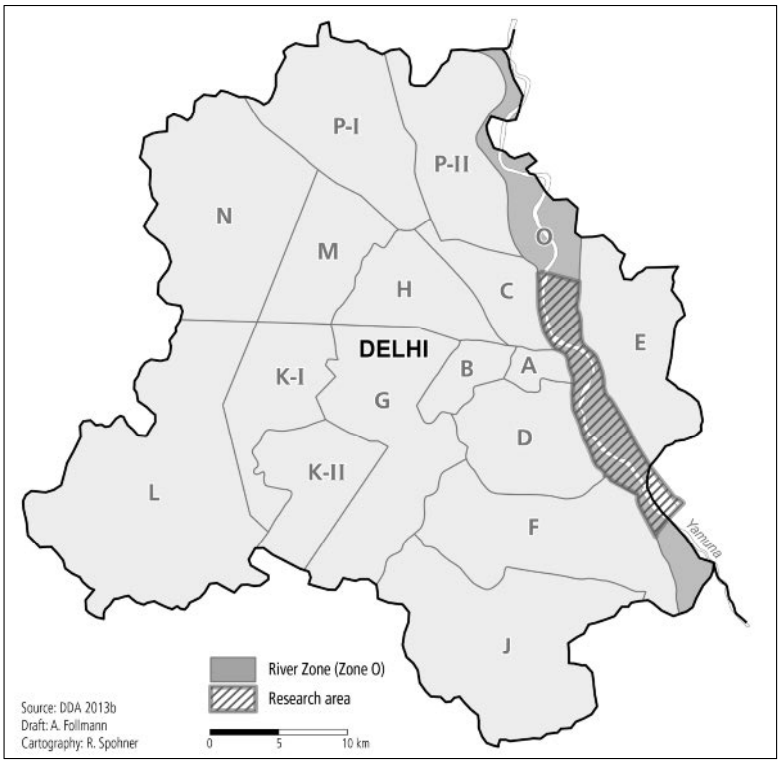

Figure 1: River Zone (Zone O) and research area

The ecologically sensitive River Zone covers about 97 square kilometers and stretches through the heart of the National Capital Territory (NCT) of Delhi for which the DDA envisaged "strict pollution control measures and eco-sensitive land use controls" (DDA 2007). The River Zone has been further earmarked as a groundwater recharge zone (CGWB 2012). Its fertile land is still widely used for agriculture and horticulture. While the area along the river has faced considerable development pressures in the last decades, it has not been decisively protected by law.

For decades the flood-prone and vulnerable riparian zone was a place where the marginalized 'urban poor' were forced to settle in default of sufficient residential provisions for the poorest sections of the population (DUPONT 2008). The slums used to be home to a population of several hundred thousand before massive slum demolitions in 2003 to 2006 'reclaimed' the riverfront areas for the 'planned' redevelopment of the city in the twenty-first century. Since the opening and liberation of the Indian economy in the early 1990s, the development of the city experienced

a massive boost which found expression in the idea of transforming Delhi 'from walled city to world city' (BAVISKAR 2007a, DUPONT 2011).[2]

Along with a major city beautification drive, the riverfront was envisioned to be transformed into a 'world-class' space through the development of urban mega-projects, and the creation of extensive green and recreational areas. The riverfront emerged as a pivotal space in the remaking of the city on its way to become a global metropolis, especially in the course of the preparation for the Commonwealth Games held in Delhi in 2010 (BATRA & MEHRA 2008, BAVISKAR 2011c, BHAN 2009, FOLLMANN 2014, 2015, FOLLMANN & TRUMPP 2013, SHARAN 2015).

The river Yamuna in Delhi tells *a tale of two cities, but only one river*: West Delhi versus East Delhi; the informal, unplanned city versus the formal, 'planned' city; the needs of the urban poor versus the desires of the emerging urban middle class; the environmental challenges of a highly polluted river versus the dream of a beautified riverfront; the old, traditional versus the new 'world-class' urban India. These multiple framings of the changing river-city discourses are the focus of this book.

Analyzing urban environmental change along the river Yamuna in Delhi, its underlying governance structures, and the associated discourses aims to engage simultaneously with the multiple, and often contradictory, material and discursive realities of the complex river-city nexus. The overarching research motivation of this study is a better understanding of urban environmental change and governance in the megacities of the Global South. Delhi and the river Yamuna are an especially instructive case study for similar processes in other megacities in India and beyond.

1.2 Change of perspective: from the riverfront to riverscapes

Recent riverfront developments from around the world show that the river-city interface is of particular importance for the long term economic, social and environmental sustainability of cities (SANDERCOCK & DOVEY 2002: 151). Pushed by real estate interests and an ever more recognized aesthetic and recreational value of the urban waterfront, cities around the globe have redeveloped their riverfronts (see among others CHANG & HUANG 2011, HEIKKILA 2011). In order to transform the cities' economic landscapes and enhance their competitiveness, in many cases urban mega-projects have played a key role in riverfront revitalization (cf. DEL CERRO SANTAMARÍA 2013, FAINSTEIN 2008, REN & WEINSTEIN 2013).

Urban geographers, architects and planners have typically viewed urban rivers as elements of the urban landscape and, thus, the lens which they deployed was generally calibrated from a city-centric point of view. This nexus between the river

2 The slogan 'from walled city to world city' originates from a campaign of India's largest English-language daily newspaper 'The Times of India' in 2004. The campaign targeted at rebranding the city's image.

and the city is commonly referred to as *the riverfront* or *waterfront*[3], demarcating the actual material space where the city and the river meet. On a global scale, the literature on urban rivers has focused on riverfront redevelopments, and the analysis most often sticks to the seemingly clear boundary demarcating the aquatic realm of the river from the terrestrial realm of the city (see among others DESAI 2012b, SANDERCOCK & DOVEY 2002, SAVAGE et al. 2004).

Concentrating on the riverfront, the city-river nexus in urban planning, architecture and urban studies is generally reduced spatially and functionally to the redevelopment of the riverfront for either recreational uses or real estate development. In many cities around the globe riverfronts further hold key transportation infrastructure; especially roads and highways. The term 'river*front*' points to a liminal space at the edge of the water, and thereby implicitly refers to fixed spatial boundaries. Furthermore, the term reflects a certain notion of urban (real estate) development. Despite these common associations, the city-river nexus is much more complex and stretches far beyond the water's edge.

An analysis focusing on the riverfront without taking into account the multiple connections between the city and the river at large is therefore inappropriate for a better understanding of urban environmental change. Holistic approaches to urban rivers as constitutive elements of the urban landscape, which highlight their importance for urban development and their multiple connections to urban sustainability are rare. Overall, little research has been done on the governance and socio-nature of urban rivers (CASTONGUAY & EVENDEN 2012b, DESFOR & KEIL 2000, 2004, GANDY 2006a, HAGERMAN 2007, HOLIFIELD & SCHUELKE 2015, LEIGH BONNELL 2010, RADEMACHER 2007, 2008, 2011).

The problem of the 'riverfront approach' becomes clear when trying to demarcate the spheres of the river and the city. Rivers and their internal landscapes are complex. They comprise of the (active) river channel(s), where the water flows, and the land along the river, which is often made up of alluvial materials transported and deposited by the river. Together with other fluvial features such as meanders and ox-bow lakes, the water channel and the river banks form what is generally referred to as the floodplain or riverbed.[4] Floodplains are the result of complex interaction of fluvial processes. The geomorphological characters of a floodplain are essentially influenced by the stream power (e.g. velocity of the river) and the sediment character of the river course. As the name implies, a floodplain is inundated by the river's water during floods. Despite the fact that these definitions are simple, a diverse and ambiguous scientific terminology of floodplain exists. Hydrologists and engineers generally consider the floodplain to be the surface next to the river channel, which is underwater during the floods of a given time period. Such a definition disregards the geomorphological process responsible for the creation of any

3 Waterfront also refers to seafronts or lakefronts. While these *-fronts* share certain characteristics, they are not directly comparable. Therefore the discussion here sticks to the term riverfront referring to the waterfront along the river.

4 The term riverbed, generally referring to the bottom of the river, is often used synonymously to floodplain.

floodplain (geomorphic history). Therefore focusing on a genetic definition of floodplain, NANSON & CROKE (1992: 460) define floodplain "as the largely horizontally-bedded alluvial landform adjacent to a channel, separated from the channel by banks, and built of sediment transported by the present flow-regime" under the present hydro climatic conditions.

In summary, the short discussion presented here reveals that if one engages with different terminologies denoting certain elements of (urban) rivers, competing definitions exist and difficulties arise defining their spatial extent. Multiple questions arise: Where to draw the boundaries between the floodplain of the river and adjacent land? How to demarcate the riverfront? Where to draw the boundary between the river and the city?

These kinds of questions reveal the problematic modern dichotomy of nature and culture, non-human and human. Critical thinkers consequently hold that it is time, especially for geographers, to think beyond these binaries, since

> "the stuff of the world is made up of both things and relationships that simply cannot be separated into boxes labelled 'nature' and 'society'. [And] ontologically, the society–nature distinction makes no sense as the basis for an understanding of our world" (LOFTUS 2012: 2–3).

Similar to how NEIL SMITH (2006: xi) has framed it: "[…] few ingrained assumptions will look so wrongheaded or so globally destructive as the common-sense separation of society and nature". Yet, the "distinction between society and nature is so familiar and fundamental as to seem unquestionable" (CASTREE & MACMILLAN 2001: 208) and geographical research has often been unable to overcome this dichotomy; especially with regard to urban rivers.

The literature going beyond the riverfront perspective and aiming to develop a more holistic understanding of the city-river relationship concentrates to a large extent on urban rivers in Western, industrialized countries and often focuses on questions of river restoration (see among others CASTONGUAY & EVENDEN 2012b, DESFOR & KEIL 2000, 2004, EDEN & TUNSTALL 2006, EDEN et al. 2000, GANDY 2006a, HOLIFIELD & SCHUELKE 2015, KELMAN 2003, LEIGH BONNELL 2010, WHITE 1995, WORSTER [1985] 1992). The character of these urban rivers has often been determined by an urban-industrial riverine landscape including large areas of land occupied by industries, shipyards and ports. Studies focusing on urban rivers beyond the 'West' have concentrated on, for example, the pollution of urban rivers (cf. for China ECONOMY 2004, HEIKKILA 2011, for Nepal RADEMACHER 2011) or the challenges and opportunities of delta regions (cf. for the Mekong RENAUD & KUENZER 2012).

It is important to acknowledge that multiple non-human and human processes from the flow and meandering of the river itself (including all physical, chemical and biological processes) to the use and disposal of water and the development of its banks (including human interventions) have formed urban rivers. As such, a 'natural' or 'fixed' boundary separating the river (nature) from the city (culture) consequently does not make sense, but is rather a social construction applied especially by urban and environmental planners.

The inherent complexity of urban environmental change along urban rivers in the megacities of the Global South – as indicated for the case of Delhi above – requires a change of perspective looking beyond the riverfront. Therefore, in order to overcome the binary conceptualizations of nature/culture and river/city, this study uses the notion of *riverscapes* as a single terminology referring to the riverine landscape coined by the natural forces of the river and numerous human interventions. Thus, first of all the notion of riverscapes is to be understood to refer to a physical space and an observable environment: a river, its riverbed, its floodplain and its surrounding environment. This study, however, aims to develop riverscapes into a spatial and analytical conceptual framework.

The idea of conceptualizing riverscapes as a theoretical framework for research has evolved from ERIK SWYNGEDOUW's writings on the waterscape (SWYNGEDOUW 1999, 2004, 2009) and the progression of his thoughts by others (BAGHEL 2014, BAVISKAR 2007b, DOVEY 2005, KAÏKA 2005, MOLLE 2009, NÜSSER 2014, NÜSSER & BAGHEL 2010, RADEMACHER 2011, ZIMMER 2012b).

ARJUN APPADURAI's (1990, 1996) concept of *scapes* is also important, since the development of urban rivers has certainly been shaped by technology and engineering expertise as well as the globalized, modern ideas of controlling rivers in the name of development and progress (cf. BAGHEL 2014: 17, NÜSSER & BAGHEL 2010: 231). According to APPADURAI, globalization has resulted in "new cosmopolitanisms" constituted by "transnational cultural flows" (APPADURAI 1996: 49). While being influenced by these deterritorialized flows, Delhi's riverscapes are not deterritorialized spaces. The suffix 'scapes' "allows […] to point to the fluid, irregular shapes" (APPADURAI 1990: 297) which are characteristic both for the physical landscape coined by a river, as well as the multiple discursive representations of a river. Therefore, like landscapes (COSGROVE 1984, COSGROVE & PETTS 1990), riverscapes need to be understood as something socially constructed and discursively produced over time. Riverscapes are cultural landscapes being shaped by human and nature. Thus, besides their physical materiality they are loaded with cultural meanings and discursive representations (WINCHESTER et al. 2003: 4).

With regard to APPADURAI's understanding of *scapes*, and in order to emphasize the multiple nexuses between the river and the city, the inherent spatial heterogeneity of an urbanized river, and the temporal dynamics of its making and remaking both physically and discursively, the term riverscapes is intentionally used in plural in this book.

1.3 Discourse and urban environmental policy-making

This study deals with Delhi's riverscapes as a matter of discourse being shaped by different narratives and knowledges[5] of a multiplicity of actors. A discourse, as DRYZEK (2005: 9) frames it, "is a shared way of apprehending the world" and through the use of language in its multiple forms (spoken and written) a discourse is formed and eventually "enables those who subscribe to it to interpret bits of information and put them together into coherent stories". Thus, the discursive representation is a process which involves multiple actors and multiple acts of interpretation of different narratives. A discourse can therefore be defined as "a specific ensemble of ideas, concepts, and categorizations that are produced, reproduced, and transformed in a particular set of practices and through which meaning is given to physical and social realities" (HAJER 1995: 44). It is assumed that dominant, and especially hegemonic, perceptions and ideas shaping discourses find their way into environmental and spatial policies and eventually (if implemented) affect the physical ground realities.

In addition to analyzing urban environmental change in terms of its material transformations in space and time, this research is dedicated to trace, interpret and deconstruct the history and development of discursive representation of Delhi riverscapes in order to be able to understand the different actors' perceptions and ideas. Bringing these two perspectives (material and discursive) together, allows a holistic perspective on the making of urban environmental policies (cf. among others DESFOR & KEIL 2004, FISCHER & FORESTER 1993, HAJER 1995).

In this context, urban environmental polices need to be understood to be "co-constructed" through networks of different actors from the local to the global level (KEELEY & SCOONES 2003: 3, cf. LATOUR 1993, LATOUR 2004). Environmental science plays a central role in this process since scientific facts create authority and legitimacy for other actors (especially the state) to press for an institutionalization of policies based on these 'facts' (FORSYTH 2003, STOTT & SULLIVAN 2000). As outlined by KEELEY & SCOONES (2003: 26–27), science aims at "generating universalizable statements". Furthermore, the making of policies is not a straight process from problem-setting to policy decisions and their implementation, but is rather a contested field. Scientific results "create facts by closing controversies" and are often used by actors to legitimize a certain framing of a policy in order to "shortcut" political bargaining processes on otherwise contested governance terrains (LATOUR 1993).

KEELEY & SCOONES (2003: 26–27) further highlight that "policy-makers delimit areas for scientific enquiry" and thereby determine to some extent the production of specific 'facts' to please certain interests. Moreover, the 'facts' found by scientists are often negotiated with the sponsors and commissioners of the studies before the scientific 'facts' are published. Accordingly, there is skepticism surrounding facts and policies as they are co-constructed and co-produced through an

5 The term 'knowledges' is intentionally used in plural in this book to highlight different forms and sources of knowledge.

argumentative process (HAJER 1995). This study will outline this co-production of science and policy with regard to Delhi's riverscapes.

1.4 Governance and urban political ecology

The theoretical and conceptual roots of this study are grounded in governance research and urban political ecology (UPE). Governance in this study is understood as the processes of interactions, negotiations and bargaining among a multiplicity of state and non-state actors (KOOIMAN 2003, RHODES 1996). Governance researchers have intensively studied urban and environmental policy-making (cf. DANIELL & BARRETEAU 2014, DAVIDSON & FRICKEL 2004, HOHN & NEUER 2006, REED & BRUYNEEL 2010). Nevertheless, the theoretical concepts and explanation value of governance research are limited and the governance approach emerges to be of limited epistemological value to explain the underlying motives, driving forces and powers of the involved actors. This study aims to widen the analytical perspective in governance research on the urban environment by combining it with theoretical perspectives originating from the heterogeneous field of UPE. Such an approach seems to offer the opportunity to develop a deeper understanding of urban environmental change and urban environmental policy-making.

While governance research has often focused on the 'management' and 'coordination' of urban environmental challenges (UNESCAP 2005), UPE scholarship has often been marked by a radical critique of both the triggers (e.g. capitalism, domination of nature) and the solutions (e.g. new technologies) offered by technocratic governance approaches (HEYNEN et al. 2006a, KEIL 2003, LAWHON et al. 2014, LOFTUS 2012). Drawing on political ecology's long established "central theme" of the "politicized environment" (BRYANT 1998: 79, cf. BRYANT & BAILEY 1997: 27), UPE scholarship has highlighted that urban environmental governance "is not a mere matter of proper management but equally one of power and politics" (VÉRON 2006: 2093).

Recent post-structuralist research within political ecology[6] (ESCOBAR 1996b, FORSYTH 2003, NATTER & ZIERHOFER 2002, PEET & WATTS 1996) has highlighted the importance of ideas and discourses influencing environmental policy-making, rather than drawing on structuralist approaches often prevailing in governance research. While more traditional approaches in political ecology have also tended to focus on structural explanations, a second generation of political ecology has been highly influenced by post-modernist, post-colonialist and post-structuralist thoughts (cf. BENTON-SHORT & SHORT 2013, ESCOBAR 1996b, 2010, FORSYTH 2003, 2008, NATTER & ZIERHOFER 2002, PEET & WATTS 1996), as well as feminist approaches, actor-network theory (ANT), and other concepts originating from the

6 The term post-structuralist political ecology is used in the following as a broad headline to subsume newer strands in political ecology, which have considerably refrained from deploying structural explanations (see for a similar classification ESCOBAR 1996a, NÜSSER & BAGHEL 2010, ROCHELEAU 2008).

field of science studies (cf. HARAWAY 1991, LATOUR 1993, 2004, ROCHELEAU 2008, ROCHELEAU et al. 1996, WHATMORE 2002).

Furthermore, UPE scholarship has been motivated by writings highlighting that the city is not to be understood as the antithesis to nature (see among others HARVEY 1996b, HEYNEN et al. 2006b, KEIL 2003, TREPL 1996). This school of thought has further aimed to bring together the binaries of nature and society by understanding the city as a hybrid (SWYNGEDOUW 1996) and "retheorize urbanization itself as a process of socionatural and not only social transformation" (ANGELO & WACHSMUTH 2014: 3).

> "[…] poststructuralist thought offers us not only a different way of thinking about nature, but a different way of understanding and doing environmental politics. […] the domain of politics is no longer understood as limited to political institutions – parliament, law, etc. – but enlarged to include concepts and knowledges that inform debates within these arenas" (BRAUN & WAINWRIGHT 2001: 60).

The aim of adopting these thoughts in this study is to develop a holistic understanding of the driving actors and discourses of urban environmental change by deconstructing the binary thinking of nature and society – the river and the city.

1.5 Research agenda and questions

As outlined above, there is a lot written about environmental change from the global to the local scale. Despite this, scholars have only recently started to engage with the complexity of urban environmental change in fast-growing megacities of the Global South. Many studies on urban environmental governance in the Global South focus on sectoral approaches. In the case of Delhi, studies have been dedicated to topics including, but not limited to, water supply (MARIA 2008, SELBACH 2009, ZÉRAH 2000), wastewater (SINGH 2009, ZIMMER 2012b, 2015a), air pollution (ESCUDERO 2001, GHOSH 2007, KUMAR 2012, SHARAN 2013, VÉRON 2006) or solid waste management (GIDWANI 2013).

This study provides an alternative perspective to existing research by focusing on Delhi's riverscapes. The aim of this is to gain insights into urban environmental change starting from a spatial rather than a sectoral approach. Therefore, this study focuses explicitly on an ecologically sensitive space of the urban landscape – the riverscapes – in order to draw a holistic picture of how and why urban environmental change occurs, which spatial and ecological impacts are connected to this, and how and why urban environmental change might have accelerated in recent decades. In doing so, this study focuses on the river Yamuna in Delhi with regard to both the river's role in the process of mega-urbanization and the impacts of mega-urbanization on the river. Such an approach follows CASTONGUAY & EVENDEN's (2012a) appeal to study urban rivers with regard to their associated risks as well as opportunities. The multiple city-river relationships are examined from a geographical perspective. This perspective, while emphasizing the historical spatial changes, relates those to current socio-environmental challenges and governance processes.

When applying such a spatial approach it is essential to take into account different scales. Within this research, scales are understood as descriptive and analytical, since both the administrative limits of cities and the boundaries of the river basins are based on social constructions rather than being naturally given (COLTEN 2012, MARSTON 2000). While using different analytical scales to fully understand the relationship between the city and the river, from a spatial perspective this study focuses on Delhi's riverscapes in the very heart of the megacity from Wazirabad in the north, to Okhla in the south (see Map 1, page 385). This segment of the river has been facing the highest development pressures and is characterized by the highest levels of environmental degradation and dynamic land-use changes. Together these two aspects pose multiple challenges for the urban environmental governance of Delhi's riverscapes, which are exemplary for similar processes in other megacities of the Global South.

The ensuing four key research questions follow from the described approach. The first question of this study addresses the process of urban environmental change:

What are the urban environmental changes in Delhi's riverscapes?

This first research question is addressed in this study through a detailed analysis of the dynamic land-use changes in Delhi's riverscapes and the mutual relations between land-use change and environmental degradation.

Urban environmental change is caused by multiple actions from a range of different actors. In the context of urban environmental governance the different actors' actions and interests are understood to be controlled, coordinated, planned and synchronized – in short governed – through urban environmental policies and regulations (e.g. land-use plans, pollution policies). Thus, the first key question needs to be specified through a second question engaging with the ways environmentally sensitive urban spaces like riverscapes are governed:

How are Delhi's riverscapes governed?

This question explicitly includes an exploration of the roles and responsibilities of the different institutions involved in governing environmentally sensitive urban areas. In this context, DE MELLO-THÉRY et al. (2013: 214) argue that urban and environmental policies "comprise of a set of laws, norms, rules and institutions, but they are also anchored in a set of cultural and social representations". Traditionally, policies have been understood as approaches to govern problems, and policy research has focused on the implementation of these laws, regulations and institutions (ibid.). This perspective has evolved, and social science research has shown that the *process* of problem framing (the social construction of problems and seeing the problem first of all) and the making of public policies, is at least as important as questions of implementation (see among others DESFOR & KEIL 2004, FISCHER 2000, 2003, FISCHER & FORESTER 1993, HAJER 1993, 1995, KEELEY & SCOONES 1999, 2003, LASCOUMES & LE GALES 2007, LEES 2004, MELS 2009). In addition, often