Advances in Asian Human-Environmental Research

Judith Müller

Urban Mountain Waterscapes in Leh, Indian Trans-Himalaya

The Transformation of Hydro-Social Relations

Springer

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Preface

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Heidelberg, Germany Judith Müller

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Abbreviations

ADA	Argumentative Discourse Analysis
BJP	Bharatiya Janata Party
CEC	Chief Executive Councillor
DC	Deputy Commissioner
EC	Executive Councillor
FSTP	Faecal Sludge Treatment Plant
GLOF	Glacial Lake Outburst Flood
GoI	Government of India
GPS	Global Positioning System
HKH	Hindu Kush Himalaya
IALS	International Association of Ladakh Studies
IMD	India Meteorological Department
IPCC	Intergovernmental Panel on Climate Change
J&K	Jammu and Kashmir
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
LAHDC	Ladakh Autonomous Hill Development Council
LAMO	Ladakh Arts and Media Organisation
LBA	Ladakh Buddhist Association
LEDeG	Ladakh Ecological Development Group
LEHO	Ladakh Environment and Health Organisation
MC	Municipal Corporation
NGO	Non-Governmental Organisation
PDS	Public Distribution System
PE	Political ecology
PHE	Public Health and Engineering
PPS	Probability Proportional to Size Sampling
PWD	Public Works Department
SLC	Snow Leopard Conservancy

SPSS	Statistical Package for the Social Sciences
UIDSSMT	Urban Infrastructure Development Scheme for Small & Medium Towns
UNCED	United Nations Conference on Environment and Development
UPE	Urban Political Ecology
UT	Union Territory

Summary

Water governance in urbanising high mountain towns of the Hindu Kush Himalayan region (HKH) presents a major challenge that scholarship has only recently started to address. Climate change-related climatic and hydrological variabilities intersect with rapid socio-economic developments as well as urbanisation induced by globalisation dynamics. Drawing on the case study of Leh, a small but fast-growing North Indian mountain town in the Trans-Himalaya of Ladakh, this research investigates how these dynamics affect urban water access and distribution. Natural and socio-political conditions also have an impact on water governance. The study therefore considers both the sensitive high mountain environment in a cold-arid setting and the complex socio-economic and political aspects of this changing hydro-social environment. To investigate questions of everyday governance, the analytical framework builds on the concepts of waterscapes, hydromentalities, and water citizenships. Rooted in the wider field of urban political ecology, this framework offers a hydro-social perspective based on a relational, actor-oriented approach. A comprehensive analysis of the arena of actors in Leh's waterscape allows for a deep understanding of current water-related changes and resulting governance approaches on the one hand and highlights inequalities arising within the town population on the other. The study triangulates quantitative and qualitative methods to take into account processes from the household to the governmental scale. The fieldwork was conducted in the district capital Leh between 2014 and 2018.

The Union Territory of Ladakh is a dynamically developing region: rapid economic growth is largely based on tourism, the region has a high geopolitical importance due to its location at international borders, and Leh has increasingly received administrative importance as a governmental centre of the region. These complex historical and current political and socio-economic developments contribute to shifting livelihoods and rural-urban migration. The results show that urbanisation processes increasingly exert pressure on the already scarce water resources of the town and (re)produce unequal access to water resources and infrastructures. Current water governance approaches are dominated by a state-led infrastructure scheme that aims at centralising water supply and sanitation. While the scheme is beneficial for some, others have to bear the social and environmental costs of the urban

restructurings. This study is a case example of similar dynamics in the wider HKH, while also pointing out challenges that are unique for the study area. This study aims to contribute to the enhancement of the hitherto insufficient state of research on human-water relations in the region by critically reflecting on current governance approaches in order to build a basis for future policy-making.

Kurzzusammenfassung

Die Wasser-*Governance* in wachsenden Hochgebirgsstädten der Hindukusch-Himalaya Region stellt eine große Herausforderung dar, mit der sich die Wissenschaft erst seit kurzem beschäftigt. Durch den Klimawandel bedingte klimatische und hydrologische Schwankungen gehen mit rasanten sozio-ökonomischen Entwicklungen sowie Urbanisierungsdynamiken einher. Anhand der Fallstudie in Leh, einer kleinen, schnell wachsenden nordindischen Stadt im Trans-Himalaya von Ladakh, wird untersucht, wie sich diese Prozesse auf den Zugang und die Verteilung von Wasser sowie die Wasser-*Governance* auswirken. Die Studie berücksichtigt zudem sowohl die kalt-trockenen Hochgebirgsbedingungen als auch die komplexen sozio-ökonomischen und politischen Aspekte dieser sich verändernden hydro-sozialen Umwelt. Der analytische Rahmen baut auf den Konzepten der *Waterscapes*, *Hydromentalities* und *Water Citizenships* auf. Vor dem Hintergrund der Urbanen Politischen Ökologie, bietet dieser Rahmen eine hydro-soziale Perspektive, die auf einem relationalen, akteursorientierten Ansatz basiert. Eine umfassende Analyse der Akteurskonstellation in Lehs *Waterscape* ermöglicht einerseits ein Verständnis aktueller wasserbezogener Veränderungen und resultierender *Governance*-Ansätze und hebt andererseits Ungleichheiten innerhalb der urbanen Bevölkerung hervor. Zwischen 2014 und 2018 wurden anhand einer Triangulation quantitativer und qualitativer Methoden Prozesse von der Haushalts- bis zur Regierungsebene untersucht.

Das Unionsterritorium Ladakh entwickelt sich dynamisch: Das rasante Wirtschaftswachstum basiert zu einem großen Teil auf dem wachsenden Tourismussektor, die Region besitzt aufgrund ihrer Lage an internationalen Grenzen eine hohe geopolitische Relevanz und Leh hat zunehmend administrative Kompetenzen als Regierungszentrum der Region erhalten. Diese komplexen historischen und aktuellen politischen sowie sozio-ökonomischen Faktoren tragen zur Verschiebung der Lebensgrundlagen und zur Land-Stadt-Migration bei. Die Ergebnisse zeigen, dass Urbanisierungsprozesse zunehmend Druck auf die ohnehin knappen Wasserressourcen der Stadt ausüben und ungleichen Zugang zu Wasserressourcen und Infrastrukturen (re)produzieren. Die gegenwärtige Wasser-*Governance* wird von einem staatlichen Infrastrukturprogramm dominiert, das auf eine Zentralisierung der Wasserversorgung und Abwasserentsorgung abzielt. Für manche sind die damit einhergehenden Veränderungen von Vorteil, während andere die sozialen und ökologischen Kosten der städtischen Umstrukturierungen tragen müssen. Die Studie ist teils repräsentativ für ähnliche Dynamiken in der weiteren

Hindukusch-Himalaya Region, zeigt aber fallspezifische Herausforderungen auf. Durch die kritische Reflektion der momentanen *Governance* sollen Grundlagen für zukünftige politische Entscheidungen geschaffen werden und ein Beitrag zur Erweiterung des bisher unzureichenden Forschungsstandes zu den Mensch-Wasser-Beziehungen in der Region geleistet werden.

Résumé

La gouvernance de l'eau dans les villes de haute montagne en voie d'urbanisation de l'aire de l'Hindou-Kouch-Himalaya (HKH) présente un défi majeur que les scientifiques n'ont commencé à évaluer que récemment. Ainsi, les variabilités climatiques et hydrologiques liées au changement climatique s'entrechoquent à un développement socio-économique fulgurant et une urbanisation rapide induite par la mondialisation. En s'appuyant sur l'étude du cas de Leh, une petite ville de montagne en pleine expansion située dans le Trans-Himalaya du Ladakh au nord de l'Inde, cette thèse examine comment ces dynamiques affectent l'accès et la distribution de l'eau en milieu urbain. Étant donné que les conditions naturelles et sociopolitiques ont également un impact sur la gouvernance de l'eau, cette étude prend aussi en considération à la fois l'environnement sensible, froid et aride de la haute montagne et les aspects socio-économiques et politiques complexes particuliers de cet environnement hydro-social en pleine évolution. Pour étudier les questions de gouvernance au quotidien, le cadre analytique s'appuie sur les concepts de *waterscapes*, d'*hydromentalities* et de *water citizenships*. Enraciné dans le domaine plus large de l'*urban political ecology*, ce cadre offre une perspective hydro-sociale basée sur une approche relationnelle orientée vers les acteurs. Une analyse complète des différents acteurs dans le *waterscape* de Leh permet, d'une part, de comprendre précisément les changements actuels liés à l'eau et les approches de gouvernance qui en résultent et, d'autre part, de mettre en évidence les inégalités qui se produisent au sein de la population de la ville. Cette recherche combine des méthodes quantitatives et qualitatives pour prendre en compte les processus allant de l'échelle des ménages à celle des gouvernements. Le travail de terrain a été mené dans la capitale du district de Leh entre 2014 et 2018.

Le territoire de l'Union du Ladakh est une région en forte mutation. Tout d'abord, elle est en proie à une croissance économique rapide principalement grâce au développement du tourisme. Ensuite cette région justifie d'une grande importance géopolitique en raison de sa situation géographique spécifique située au croisement de frontières internationales contestées. Enfin, Leh joue un rôle politique toujours plus important en tant que centre gouvernemental administratif de la région. Ces développements politiques et socio-économiques complexes, anciens ou plus récents, contribuent à l'évolution des moyens de subsistance ainsi qu'à un exode rural prononcé. Les résultats montrent que les processus d'urbanisation exercent une pression croissante sur les ressources en eau déjà rares de la ville et qu'ils (re)produisent un accès inégal à ces ressources ainsi qu'aux infrastructures. Les approches

actuelles de la gouvernance de l'eau sont dominées par un programme de modernisation des infrastructures dirigé par l'État qui vise à centraliser l'approvisionnement et l'assainissement de l'eau. Si ce système est bénéfique pour certains, d'autres doivent supporter les coûts sociaux et environnementaux découlant de ces restructurations urbaines. Si cette étude peut servir d'exemple pour mieux comprendre des transformations similaires intervenant dans la région de l'Hindou Kouch Himalayen, elle met néanmoins l'accent sur les défis spécifiques à la zone de recherche. Cette étude comble aussi le manque de recherche sur les relations entre l'homme et l'eau dans cette région, en reflétant de manière critique les approches de gouvernance actuelles afin de construire une base pour l'élaboration des politiques futures.

Chapter 1
Introduction

Abstract At the intersection of human water consumption with socio-economic and climate change in high mountain areas, a multifaceted set of challenges arises. Urbanisation in fragile mountain environments causes rural exodus on the one hand and an influx into cities on the other, creating issues for local livelihoods and water availability as well as quality in urban areas. This chapter introduces the topic of the transformation of hydro-social relations in the urbanising high mountain town Leh in Northern India. After a brief introduction of current hydro-social developments in high mountain areas in general and of the Hindukush Himalayan Region in particular, the subject is further specified using the example of Leh, located in the Trans-Himalaya of Ladakh. In addition to this thematic overview, the objective and research question of this study are presented. The overall aim of the study in Leh is to examine the effects of urbanisation on water use and its governance. The analysis is situated in the conceptual and thematic field of geographical human-water research and critical governance studies.

Keywords Ladakh · Trans-Himalaya · Hydro-social relations · Water · High mountains · Urbanisation · India · Governance

1.1 Human-Water Relations in Urbanising High Mountain Towns

The United Nations Conference on Environment and Development (UNCED) in 1992 first brought mountains as rapidly changing and vulnerable social and ecosystems onto the agenda of international decision makers and scientists (Mathieu 2011, 6; Messerli 2012). In the central document of the conference, called Agenda 21, Chap. 13 was devoted to mountain issues and titled "Managing fragile ecosystems: Sustainable mountain development". In it, challenges were listed and policy directives were given. Already back then, it was acknowledged that

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> Mountains are highly vulnerable to human and natural ecological imbalance. Mountains are the areas most sensitive to all climatic changes in the atmosphere… Hence, the proper management of mountain resources and socio-economic development of the people deserves immediate action (UN 1992).

Three decades later, the social and ecological challenges for mountain regions mentioned in the Agenda 21 are ever so severe: the "water towers for humanity" (Viviroli et al. 2007) offer important water resources for mountain people and supply a large part of the world's lowland population with disproportionally high runoff as compared to the adjacent plains (Viviroli et al. 2020). High mountains are increasingly stressed by socio-economic developments and climate change, impacting their important water resources (Drenkhan et al. 2015; Fort 2015). The Special Report on the Ocean and Cryosphere in a Changing Climate, published in 2019 (Pörtner et al. 2019), builds on the Intergovernmental Panel on Climate Change's (IPCC) 5th Assessment Report and summarises scientific findings on the impact of climate change on the mountain cryosphere. Synthesised results show that, despite some atypical cases, the general trend shows massive glacier shrinkage in high mountains. A "peak water" – the initial increase of glacier runoff, which peaks and is then followed by a decline (Huss and Hock 2018) – is expected for latest around the middle of the twenty-first century, affecting mountain and downstream regions (Hock et al. 2019). In addition to the predicted shrinkage of cryospheric water resources, urbanisation processes in mountains all over the world accelerate water demand and, thus, create challenges for water resources and their governance, playing a major role for current and future development paths (Izquierdo et al. 2018; Perlik 2019, 115ff.; Borsdorf and Haller 2020). Integrative approaches relating socio-economic changes, such as urbanisation and power relations between different actors with physical-natural drivers of change, are required to solve current and future challenges for sustainable development but so far only exist to a limited extent (Drenkhan et al. 2015; Borsdorf and Haller 2020).

In 2018, 55% of the world's population lived in urban areas, with almost half of the urban dwellers living in settlements with less than 500,000 inhabitants (UN 2019). High urbanisation rates are typical for small and medium-sized towns in India (Nijman 2015), with a growing number of currently about 150 million dwellers living in settlements with less than 100,000 inhabitants (Zérah and Denis 2017). While urban development and the unequal distribution of safe water supply and sanitation infrastructure in Indian metropoles have gained wide scholarly attention (e.g. Gandy 2008; McFarlane 2008; Truelove 2011; Graham et al. 2016; Anand 2017), small and medium-sized towns are less intensively studied, despite their dynamic growth (Bell and Jayne 2009; Véron 2010; Fahmi et al. 2013; Zérah and Denis 2017). Until recently, this had also been the case for those towns located in mountain regions of the Hindu Kush Himalaya (HKH) (Tiwari et al. 2018; Dame et al. 2019). Small and medium-sized towns in the region experience rapid urbanisation rates and economic development, creating an increased demand for water supply and impact on water resources. In the last couple of years, a growing body of literature has assessed resulting hydro-social challenges in the HKH (e.g. Mohanty and Bhagat 2013; Gondhalekar et al. 2015; McDuie-Ra and Chettri 2018; Tiwari

et al. 2018; Dame et al. 2019; Kovács et al. 2019; Prakash and Molden 2020). Despite their small size, towns in the Himalayan region have historically been important political, commercial and religious places (Mathieu 2011, 70ff.). Still today, they are relevant centres for commercial activities, political institutions, health and transportation or communication infrastructures. Furthermore, they are often dynamic "hotspots of territorialisation" (Wang et al. 2019, 42), due to their strategic location in border regions (Baghel and Nüsser 2015; Dame et al. 2019).

Commercial activities and, thus, economic development in the HKH are dominated by the rapidly expanding tourism sector. Linked to the decline of rural mountain agriculture, this leads to a depopulation of rural areas and a seasonal increase of floating population in the cities, such as migrant workers (e.g. Tiwari et al. 2018; Kovács et al. 2019; Wang et al. 2019). Rising water demand caused by urbanisation and economic development often comes along with unequal water distribution within the urban areas, creating challenges for everyday water supply of urban dwellers (Kovács et al. 2019; Prakash and Molden 2020).

Yet, research on the effects of rapid urbanisation on human-water relations in the HKH region lacks integrative approaches, taking into account natural-physical parameters on one hand and in-depth studies ranging from everyday practices on the household level to supra-regional governance strategies on the other. Most of the studies mentioned above interpret statistical or remote sensing data in order to give a broader picture of urbanisation processes related to current challenges in water use. This study aims at giving a comprehensive picture of current hydro-social processes in a high mountain town by analysing material *and* discursive aspects shaping everyday water use as well as the place-specific natural conditions.

The study area is the town Leh in the Indian Union Territory (UT) Ladakh (Map 1.1). This case study exemplifies typical as well as unique hydro-social processes in comparison to other mountain towns of the HKH region. Ladakh is representative of different political, cultural, and natural contexts, and at the same time it is distinctive in its combination of these different characteristics. Politically and administratively, it is part of the Indian state, culturally influenced by centuries-long exchange between Tibet, Central and South Asia along inter-regional trade routes, and its natural and climatic conditions are comparable to other Central Asian cold-arid highlands.

The diverse history of Ladakh is marked by power influences of Tibet, Kashmir, and the Indian state, a situation that has created shifting frontiers as well as different cultural, political and economic dominations. Yet, a major impact on local livelihoods has always been Ladakh's location in cold-arid high mountains at over 3000 m a.s.l. with a limited availability of water. The region is located in the upper Indus Basin, sandwiched between the Karakoram and Himalayan Ranges, causing a rain shadow effect that limits annual precipitation to about 100 mm (Schmidt and Nüsser 2017). This combination of climatic and topographic conditions has forced the local population ever since to take specific adaptation measures for habitation and irrigated crop cultivation (Nüsser et al. 2012).

Leh is an agricultural oasis, which is typical of Ladakhi settlements. The town is divided into wards on the irrigated area stretching from the north to the south and