

Geographien Südasiens

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Geographien Südasiens

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Arbeitskreis Südasiens

Der Arbeitskreis Südasiens in der Deutschen Gesellschaft für Geographie (DGfG) wurde im Januar 2011 gegründet. Hauptziel ist die Vernetzung von Geographinnen und Geographen, deren regionaler Arbeitsschwerpunkt in Südasiens liegt. Hierzu gehört die Diskussion aktueller Forschungsergebnisse in der gesamten Bandbreite des Fachs, der Dialog zwischen Geographinnen und Geographen aus Praxis, Wissenschaft und Schule, der Austausch über die konkrete Arbeit in Südasiens sowie die gemeinsame Erörterung aktueller Entwicklungen in einer sich rapide wandelnden Region. Der Arbeitskreis richtet sich hierbei gleichermaßen an physische Geographen und Anthropogeographen. Auf diese Weise bündelt der Arbeitskreis vorhandene Expertisen und verdeutlicht die Regionalkompetenz der Geographie, auch in der Außenwirkung.

Zu den weiteren Zielen des Arbeitskreises gehören die Erstellung gemeinsamer Publikationen, die Vermittlung geographischen Regionalwissens, die Förderung der Kooperation zwischen Universität und Praxis und gemeinsame Forschungsaktivitäten der Mitglieder. Ein besonderes Anliegen ist die Förderung des intradisziplinären Austauschs zwischen physischer und Anthropogeographie. Aktuelle Informationen zum Arbeitskreis und seinen Aktivitäten finden sich unter: www.geographien-suedasiens.de.

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Zugang zu Wasser in periurbanen Räumen Indiens – Ein Werkstattbericht

Carsten Butsch

Schlagworte: Periurbaner Raum, Indien, Wasser, Livelihoods

Die periurbanen Räume Indiens – also die Räume, welche die Agglomerationsräume umgeben und auf vielfältige Weise sowohl mit der Kernstadt als auch dem ländlichen Raum in Austausch stehen (Simon 2008, Narain, Banerjee & Anand 2014) – sind aus mehrfacher Perspektive als *zones in transition* oder Übergangsräume zu bezeichnen: (1) Die Landnutzung in diesen Räumen verändert sich kleinräumig und innerhalb kurzer Zeiträume; (2) Durch Ihre Lage zwischen städtischen und ländlichen Räumen stellen sie den Übergang von hochverdichteten urbanen Strukturen zu ländlichen Räumen dar, wobei die Unterschiede im indischen Kontext in Bezug auf Lebens- und Wirtschaftsweise, Zugang zu Infrastruktur etc. sehr stark ausgeprägt sind; (3) die *governance*-Strukturen der periurbanen Räume verändern sich grundlegend, da die etablierten dörflichen Mechanismen der Selbstverwaltung – auch mit den Disparitäten, die sie zum Teil perpetuieren – durch den Zuzug neuer Gruppen erodieren und durch neue Akteure und sich verändernde Machtverhältnisse ersetzt werden. Gleichzeitig sind periurbane Räume Orte des Austauschs zwischen dem Städtischen und dem Ländlichen, weshalb in der englischsprachigen Literatur auch der Begriff des periurban interface verwendet wird (Singh & Narain 2020) (Abb. 1).

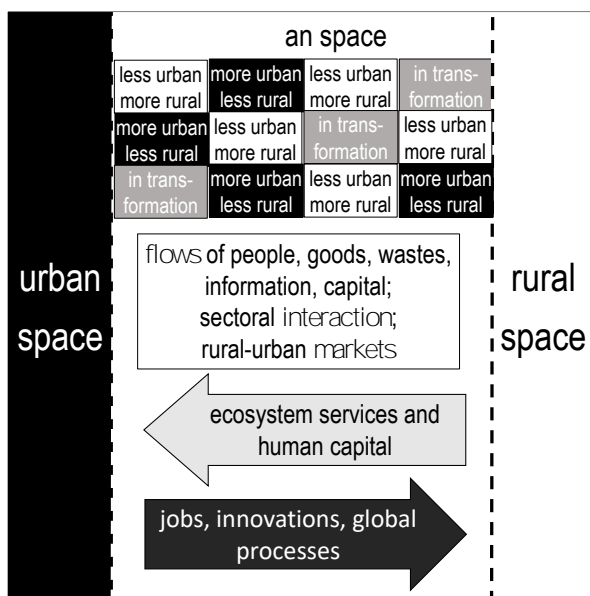


Abb. 1: Periurbane Räume (Butsch & Heinkel 2020)

In aller Regel werden periurbane Räume als zukünftiger Stadtraum oder städtischer Ergänzungsraum konzeptualisiert, zum Beispiel zur Sicherstellung der städtischen Nahrungsmittel-

produktion, Standort verschmutzender Industrien etc. Das hat zur Folge, dass sie nicht als eigenständige Räume wahrgenommen und beplant werden, sondern vielmehr als unfertige Verfügungsmasse betrachtet werden (Butsch & Heinkel 2020). So sind beispielsweise die Infrastrukturen in aller Regel auf die Kernstadt ausgerichtet, für die periurbane Räume unter anderem Ökosystemdienstleistungen, wie die Bereitstellung von Trinkwasser und Agrarprodukten, die Reinigung der Luft von Abgasen und die Vorhaltung von Flächen für Erholungs- und Freizeitwecke, bereitstellen. Zugleich werden sie als Entsorgungsorte angesehen, in denen Mülldeponien angelegt und in Abwässer „entsorgt“ werden.

H2O-T2S

Das durch das Belmont-Forum/das BMBF geförderte internationale transdisziplinäre Forschungsprojekt *H2O – Transformation to Sustainability in Urban Fringe Areas* befasst sich vor diesem Hintergrund in drei Teilprojekten mit der (1) Auswirkung von Periurbanisierungsprozessen auf Governancestrukturen, (2) der Verfügbarkeit von Wasser für Haushalte und (3) Verfügbarkeit von Wasser als Erwerbsgrundlage, z.B. in der Landwirtschaft. In einem partizipativen Forschungsprozess wird die übergeordnete Frage bearbeitet, wie periurbane Transformationspfade zukünftig nachhaltig gestaltet werden können. Im Rahmen des Projektes werden Prozesse in den periurbanen Räumen Punes, Hyderabad und Kolkatas untersucht.

Hier werden im Folgenden die Ergebnisse eines ersten, explorativen Feldaufenthaltes vorgestellt, der im März 2019 stattfand sowie Zwischenergebnisse einer laufenden Erhebung, die zum Zeitpunkt der Arbeitskreissitzung noch im Gange war. Es werden die Ergebnisse narrativer und leitfadengestützter Interviews zusammengefasst, die als Komponenten eines Mixed Methods Research Ansatzes (Johnson & Onwuegbuzie 2004) erhoben wurden. Zum Zeitpunkt des Vortrags waren die Erhebungen in Pune und Hyderabad abgeschlossen, die Feldarbeit in Kolkata stand unmittelbar bevor. Daher handelt es sich hier lediglich um einen Werkstattbericht, bei dem Zwischenergebnisse präsentiert werden.

Drei Städte sechs Dörfer

In allen drei Agglomerationsräumen wurden jeweils zwei Dörfer untersucht. Die Auswahl der Untersuchungsgebiete erfolgte gemeinsam durch alle drei Projektpartner auf Grundlage gemeinsam

entwickelter Kriterien. Da alle drei Projektpartner in jeweils einer der drei Städte bereits früher Projekte durchgeführt hatten, lagen bereit erste Informationen über mögliche Untersuchungsgebiete vor, die eine kriteriengeleitete Auswahl der Dörfer ermöglichte (für Kolkata: Gomes 2019, für Hyderabad: Sen et al. 2019, für Pune: Butsch et al. 2017).

Die bisherigen Erhebungen zeigen deutlich die Heterogenität des periurbanen Raums. Die sechs Dörfer haben sehr unterschiedliche Entwicklungspfade genommen. Trotz dieser unterschiedlichen Entwicklungen weisen einige Dörfer ähnliche Problemlagen auf. Da in diesem Rahmen eine differenzierte Darstellung aller sechs Dörfer nicht möglich ist, werden im Folgenden verkürzend und zuspitzend zwei Paare von Dörfern vergleichend dargestellt, die ähnliche Entwicklungspfade genommen haben sowie zwei Dörfer, die für einen sehr weit fortgeschrittenen Transformationsprozess bzw. einen gebremsten Transformationsprozess stehen.

Das erste Paar besteht aus den Dörfern Paud, 30 km westliche von Pune in den West Ghats gelegen, und Bowrampet, ca. 25 km nördlich von Hyderabad. Beide Dörfer zeichnen sich durch einen großen Bevölkerungszuwachs aus, weil am Rande der ursprünglichen Besiedlung von Immobilienunternehmen neue Wohnsiedlungen entstanden – allerdings in unterschiedlichem Entwicklungsstand und unterschiedlichem Umfang.

In Paud befand sich ein sogenanntes Township zum Zeitpunkt der Erhebung im Bau. Der Highway nach Paud wurde vor wenigen Jahren ausgebaut, so dass Paud inzwischen zum Pendlereinzugsgebiet von Pune gehört. Oberhalb des alten Dorfkerns entsteht derzeit das Township Playtor. Die Rechtsform des Townships verpflichtet die Bauträger dazu, einen hohen Versorgungsgrad sicherzustellen und Infrastruktur und Dienstleistungen, die üblicherweise durch die lokale Verwaltung bereitgestellt werden müssten (Wasserversorgung, Müllentsorgung, Gesundheitsversorgung), mit einem hohen Versorgungsgrad sicherzustellen. Beispielsweise müssen Wasser- und Stromversorgung rund um die Uhr zur Verfügung stehen – anders als im benachbarten Paud, wo die Bewohner mit zwei Stunden Wasserversorgung durch die Dorfverwaltung zufrieden sein müssen. Ähnlich stellt sich die Entwicklung in Bowrampet dar, allerdings auf einem anderen Niveau. Hier haben die Dorfbewohner einen sehr großen Teil ihrer landwirtschaftlichen Nutzflächen an private Bauträger verkauft. Für viele bedeutet dies die Aufgabe ihrer landwirtschaftlichen Tätigkeit. In Bowrampet ist neben dem alten Dorfkern ein großer Suburb entstanden, der aus mehreren Teilen besteht. Entlang einer Hauptstraße haben sich mehrere Schulen angesiedelt, deren Schüler*innen aus der Kernstadt in diese neuen

Bildungsenklaven für die wohlhabende Mittelschicht gebracht werden. Abseits davon sind in mehreren *gated communities* luxuriöse Einfamilienhäuser entstanden, für einige wurde die besten landwirtschaftlichen Nutzflächen Baugrund geopfert.

Davon ausgehend, dass beide Dörfer einen ähnlichen Entwicklungspfad verfolgen, befindet sich Bowrampet bereits weiter in einem fortgeschrittenen Stadium dieser Entwicklung. Die parallel zum alten Dorf entstandenen Siedlungsteile sind um ein vielfaches größer als in Paud. Ebenfalls ist die Transformation der Erwerbsstruktur bereits weiter fortgeschritten. Der Anteil derjenigen, die noch in der Landwirtschaft oder der Fischerei tätig sind, ist wesentlich geringer. In beiden Dörfern ist festzuhalten, dass vor allem diejenigen, die auf diese traditionellen Erwerbsgrundlagen angewiesen sind, zu den Verlieren des Transformationsprozesses zählen, da es für sie immer schwieriger wird ein Auskommen zu finden. Besonders deutlich wird dies am Beispiel der Fischer, die es in beiden Dörfern gibt. Sie verlieren den Zugang zu ihren traditionellen Fischgründen und sehen ihre Erwerbsgrundlage schwinden.



Abb. 2: Fischer in Paud (Foto: C. Butsch 2019)

Die beiden Dörfer Anajpur, südlich von Hyderabad gelegen, und Hadia, nördlich von Kolkata haben ebenfalls ähnliche Transformationspfade beschritten. Ihre Entwicklung wird im Wesentlichen durch das Auftreten finanziell potenter, externer Akteure beeinflusst, die das wirtschaftliche Gefüge grundlegend verändert haben und in Konkurrenz zu den traditionellen Erwerbsquellen stehen.

In Anajpur haben zwei Unternehmensansiedlungen zu einer grundlegenden Transformation des Dorfes beigetragen. Bereits Ende der 1980er Jahre siedelte sich in Anajpur eine Fabrik an, die Synthetikfasern herstellte. Durch deren Abwässer wurden ab Ende der 1990er Jahre die Felder einer zunehmenden Zahl von Landwirten unfruchtbar und auch einige Geflügelzuchtbetriebe mussten aufgeben, weil durch kontaminiertes Wasser ihre Tiere verendeten. Zusätzlich entstand ab 1996 direkt an das Dorf angrenzend mit Ramoji Film City das weltweit größte

Filmstudio, das seit seiner Gründung kontinuierlich expandierte. Dieses Filmstudio lockt eine Vielzahl temporärer Beschäftigter an, die zum Teil in Anajpur leben. Zudem bietet es den Dorfbewohnern eine alternative Erwerbsquelle. Zahlreiche Dorfbewohner arbeiten zumindest zeitweise hier.

In Badai siedelten sich seit Ende der 1990er Jahre zunehmend Industrieunternehmen aus den Bereichen Leichtindustrie und Färberein an. Vor allem die Färberein, von denen keine einzige über eine Kläranlage verfügt, geben in großem Umfang verunreinigte Abwässer in die Umwelt ab. Durch diese Abwässer sind, ähnlich wie in Anajpur zahlreiche Felder unfruchtbar geworden. Allerdings bietet sich hier den Landwirten kaum eine Erwerbsalternative, da die meisten Industrieunternehmen gezielt Arbeitskräfte von Außerhalb anwerben, nach Überzeugung der Dorfbewohner, um die Organisation der Arbeiterschaft von vorneherein zu unterbinden. Die Bewohner Badais geben also ebenfalls eher unfreiwillig ihre tradierten Erwerbsgrundlagen auf, sind aber gezwungen, neue Erwerbsgrundlagen außerhalb, etwa als Tagelöhner in Kolkata, zu erschließen.



Abb. 3: frisch gefärbte Stoffballen in einer Färberei in Badai (Foto: C. Butsch 2019)

Eine im Vergleich dazu eher gebremste Entwicklung hat das Dorf Hadia südöstlich von Kolkata genommen. Das Dorf liegt in den East Kolkata Wetlands. Hier werden die Abwässer Kolkatas in ein großes Feuchtgebiet geleitet, das zwar natürlichen Ursprungs ist, seit britischer Zeit aber grundlegend anthropogen umgestaltet wurde. Die Bewohner dieses Dorfes sind nahezu ausschließlich Dalits, die das städtische Abwasser nutzen, um Fischzucht zu betreiben. Durch Umstrukturierung wurde das Land, das einst Großgrundbesitzern gehörte, ab Mitte der 1980er Jahre, in die Hand einzelner Familien gegeben. Die Folge ist ein massiver Ausbau der

abwasserbasierten Fischzucht in kleinen Teichen. Andere Veränderungen sind in diesem Dorf nicht möglich, da Bauvorhaben aufgrund des Status der East Kolkata Wetlands als Schutzgebiet der Ramsar-Konvention. In Hadia kommt es also zu einer Intensivierung der Landnutzung, aber nicht zu Urbanisierungsprozessen.

Ganz anders stellt sich die Situation in Uruli Kanchan, 30 km östlich von Pune dar. Das ehemalige Dorf, verkehrsgünstig gelegen, an einem Highway und einer Bahnlinie, verzeichnete in den letzten Jahren eine massive Bautätigkeit und es entstanden zahlreiche mehrgeschossige, nach außen abgeriegelte Wohnkomplexe. Das Dorf ist massiv urbanisiert und viele der Bewohner sind inzwischen zugezogene Pendler, die in Pune arbeiten. Diejenigen, die weiter in der Landwirtschaft tätig sind, haben ihre Produktion auf ertragreiches Zuckerrohr umgestellt, dessen Anbau durch die Anlage eines Kanals möglich wurde. Als neue wasserbasierte Erwerbsquelle ist die Blumenzucht hinzugekommen. In Treibhäusern werden hier in sehr großem Maßstab und hochprofessionell Blumen gezüchtet, die indienweit vertrieben werden. Auch hierbei handelt es sich um eine Intensivierung wasserbasierter Erwerbsquellen.



Abb. 4: Fischereikooperative in Hadia (Foto: C. Butsch 2019)

Fazit

In den sechs Fallbeispielen, wird deutlich, dass die periurbanen Waterscapes (Swyngedouw 1999) durch Urbansierungsprozesse grundlegende Änderungen erfahren. Die hydro-sozialen Kreisläufe (Budds, Linton & McDonnell 2014) der sechs Dörfer werden derzeit grundlegend transformiert. Dadurch verändern sich die Zugänge zu Wasser mit Folgen für die Erwerbstätigkeit und den Zugang zu Trinkwasser der einzelnen Haushalte. Die Gestaltung der Transformation der hydrosozialen Kreisläufe wird Gegenstand der nächsten Projektphase sein. Dann werden in Workshops mit partizipativen Methoden mögliche alternative Transformationspfade für die Zukunft der Dörfer entwickelt.

Literaturverzeichnis

- Budds, J., Linton, J. & McDonnell, R. (2014): 'The Hydrosocial Cycle'. In: *Geoforum* 57 (November): 167–69.
- Butsch, C., Kumar, S., Wagner, P., Kroll, M., Kantakumar, L., Bharucha, E., Schneider, K. & Kraas, F. (2017): Growing "Smart"? Urbanization Processes in the Pune Urban Agglomeration'. In: *Sustainability* 9 (12): 2335
- Butsch, C. & Heinkel, S. (2020): Periurban Transformations in the Global South and Their Impact on Water-Based Livelihoods. In: *Water* 12 (2): 458.
- Gomes, S.L. (2019): An Institutional Approach to Peri-Urban Water Problems: Supporting Community Problem Solving in the Peri-Urban Ganges Delta. Delft University of Technology.
<https://doi.org/10.4233/UUID:4E2900CD-1FA1-4BCE-B0F5-C99F23A13C6C>.
- Johnson, R. B. & Anthony J. Onwuegbuzie (2004): Mixed Methods Research: A Research Paradigm Whose Time Has Come. In: *Educational Researcher* 33 (7): 14–26.
- Narain, V., Banerjee, P. & Anand, P. (2014): The Shadow of Urbanization: The Periurban Interface of Five Indian Cities in Transition. East-West Centre Working Papers Vol. 68. <https://www.eastwestcenter.org/system/tdf/private/envwp068.pdf?file=1&type=node&id=34419> (1.8.2020).
- Sen, S., John, A. Chakraborty, S. & Jatav, M. (2019): Geographies of Drinking Water (In) Securities in Peri-Urban Hyderabad. In: *Economic & Political Weekly* 54 (39): 43.
- Simon, D. (2008): Urban Environments: Issues on the Peri-Urban Fringe. In: *Annual Review of Environment and Resources* 33 (1): 167–85.
- Singh, A. K. & Narain, V. (2020): Lost in Transition: Perspectives, Processes and Transformations in Periurbanizing India. In: *Cities* 97 (February): 102494. <https://doi.org/10.1016/j.cities.2019.102494>.
- Swyngedouw, E. (1999): Modernity and Hybridity: Nature, Regeneracionismo, and the Production of the Spanish Waterscape, 1890–1930. In: *Annals of the Association of American Geographers* 89 (3): 443–65.

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Urbane *waterscapes* im Hochgebirge: Eine integrative Analyse in Leh, Ladakh

Schlagworte: Ladakh, Waterscapes, Urbanisierung, Wasser-Governance, Hochgebirge

Einleitung

Kleine Städte im Himalaya sehen sich zunehmenden sozial-ökologischen Herausforderungen gegenüber, die sich im Zuge rasanter Urbanisierung und tiefgreifender sozioökonomischer Transformation ergeben. Insbesondere die Qualität und Quantität von Wasser sowie adäquate Infrastrukturen werden von diesen Prozessen beeinflusst (Gondhalekar et al. 2015, McDuie-Ra & Chettri 2018, Kovács et al. 2019, Dame et al. 2019, Prakash & Molden 2020). Daneben stellen die Auswirkungen des Klimawandels ein wachsendes Problem für die Wasserversorgung dar (Krishnan et al. 2019).

Die hier vorgestellte Fallstudie ist in der Kleinstadt Leh verortet. Seit dem 31. Oktober 2019 ist Leh die Hauptstadt des neu geschaffenen Unionsterritoriums Ladakh. Auf über 3500 Metern gelegen, herrschen in der Region im indischen Transhimalaya kalt-aride klimatische Bedingungen.

Aufgrund der ausgeprägten Aridität basiert die lokale, lange vorwiegend subsistenzorientierte Landwirtschaft in der Hochgebirgsregion auf durch Schnee- und Gletscherschmelzwasser gespeister Kanalbewässerung. Die Wasserressourcen sind seit jeher limitiert, doch hat die Nutzungsintensität in den letzten Jahren aufgrund von wirtschaftlichen Entwicklungen und Urbanisierungsprozessen stark zugenommen (Dame et al. 2019).

Die hier vorgestellten Forschungsergebnisse geben Antworten auf zwei Forschungsfragen: Erstens, wie sich aktuelle urbane Transformationen auf die Wassernutzung und -infrastrukturen auswirken und zweitens, welche Diskurse die Wasser-Governance beeinflussen und wie diese sich wiederum auf *water citizenships* auswirkt. Hierbei werden unterschiedliche Akteur*innen miteinbezogen und es wird nachgezeichnet, wie sich Veränderungen innerhalb der urbanen *mountain waterscape* (Nüsser 2017, Müller et al. 2020) auf lokale Bevölkerungsgruppen auswirken.

Im Folgenden werden zuerst kurz der theoretische und methodologische Rahmen vorgestellt, bevor zentrale Ergebnisse der Studie präsentiert und diskutiert werden.

Theoretischer Rahmen

Die Kontrolle von Wasser spielt eine grundlegende Rolle für urbane Expansion. Wasser wird dabei innerhalb des Konzeptes der Urbanen Politischen

Ökologie (UPE) als Hybrid zwischen städtischer Ökologie und Gesellschaft verstanden (Swyngedouw 2004: 36f.). Der *waterscapes*-Ansatz wurde aus der UPE als holistisches und relationales Konzept entwickelt. Materielle und diskursive Aspekte werden mit den beteiligten Akteur*innen (auch in räumlicher Hinsicht) in Beziehung gesetzt (Budds & Hinojosa 2012, Karpouzoglou & Vij 2017).

Einen weiteren Ansatzpunkt bietet das Konzept der *hydromentalities* (Hellberg 2018, Lankford 2013), das ein vertieftes Verständnis der Relevanz von *Governance*-Diskursen im hydro-sozialen System ermöglicht. Es wurde aus dem Gouvernamentalitätsansatz von Foucault entwickelt und analysiert, welche Diskurse dominant genug sind, um sich in der Praxis durchzusetzen, und aus welchen Gründen sie das können.

Die im Zuge der aktuellen Prozesse verstärkt sichtbare soziale Ungleichheit wird schließlich durch den Ansatz der *water citizenships* (Paerregard et al. 2016) gerahmt. So hat die praktische Umsetzung von *hydromentalities*, etwa durch den ungleichen Zugang zu Wasser-infrastrukturen, einen direkten Einfluss auf das Verhältnis der Bürger*innen zu staatlichen Strukturen (Rodina & Harris 2016).

Methodologische Vorgehensweise

Die empirischen Daten wurden im Rahmen mehrerer Feldaufenthalte zwischen Herbst 2014 und Sommer 2018 erhoben. Dem Ansatz der methodologischen Triangulation folgend wurden quantitative und qualitative Methoden der Sozialforschung miteinander kombiniert. Dabei dienten Haushaltsbefragungen (n=312), semi-strukturierte Interviews, teilnehmende Beobachtung, partizipative Photographie und Dokumentenanalyse der empirischen Datenerhebung.

Die Haushaltsbefragungen wurden in sechs Stadtteilen Leh durchgeführt, die unterschiedliche sozialräumliche Strukturen repräsentieren. Abgefragt wurden der sozioökonomische Status der Haushalte sowie verschiedene Aspekte der Wassernutzung und die Bedeutung landwirtschaftlicher Tätigkeiten. Interviews wurden mit politischen Entscheidungsträger*innen der lokalen Regierung, Mitarbeiter*innen von Nichtregierungsorganisationen, Akteur*innen im Tourismusgewerbe, Landwirt*innen, Journalist*innen und zufällig ausgewählten Einwohner*innen von Leh geführt.

Urbanisierungsdynamiken

In den letzten Jahrzehnten fand neben natürlichem Bevölkerungszuwachs außerdem ein starker Zuzug der ländlichen Bevölkerung nach Leh statt. Laut den Zahlen des letzten Zensus stieg die Bevölkerung Leh von 3,546 im Jahr 1951 auf 30,870 Einwohner*innen im Jahr 2011 an (Census of India 2011).

Die Analyse der Interviews und Fragebögen zeigt, dass Menschen aus den ländlichen Regionen Ladakhs insbesondere aus drei Gründen in das urbane Zentrum ziehen. Neben familiären Gründen (wie z.B. dem Umzug wegen Hochzeit) ist der Zuzug vor allem durch vielfältigere Beschäftigungsmöglichkeiten und das bessere Bildungsangebot für Kinder in der Stadt motiviert. Nicht berücksichtigt werden bei den offiziellen Zahlen allerdings die temporären Migrant*innen, die vor allem während der touristischen Hauptsaison im Sommer nach Leh ziehen, um in einem der vielen Bereiche zu arbeiten, die mit dem Tourismussektor in Zusammenhang stehen. Neben Arbeitsmigrant*innen aus Ladakh gibt es auch einen starken Zustrom aus anderen indischen Regionen (wie Kashmir oder Bihar) und aus Nepal. Daten aus den Haushaltsbefragungen belegen, dass ladakhische Migrant*innen insbesondere in den seit wenigen Jahrzehnten existierenden Bezirken am Stadtrand, d.h. außerhalb der Bewässerungsoase, leben. Migrant*innen aus anderen Teilen des Landes sowie dem Ausland wohnen hingegen oftmals in der Altstadt, die zu einem großen Teil von verfallener Baustruktur gekennzeichnet ist.

Neben den dauerhaften und temporären Zuzügen übt die saisonale Konzentration der touristischen Übernachtungsgäste während der Sommermonate Druck auf das hydro-soziale Gefüge der Stadt aus. Die Anzahl der nach Ladakh reisenden Tourist*innen stieg in den letzten Jahren stark an und hat sich alleine in den letzten fünf Jahren mehr als verdoppelt (Abb. 1). Der Tourismussektor ist wasserintensiv und es fehlen bislang effektive Möglichkeiten der *Governance* sowie Infrastrukturen, um den Konsum zu regulieren.

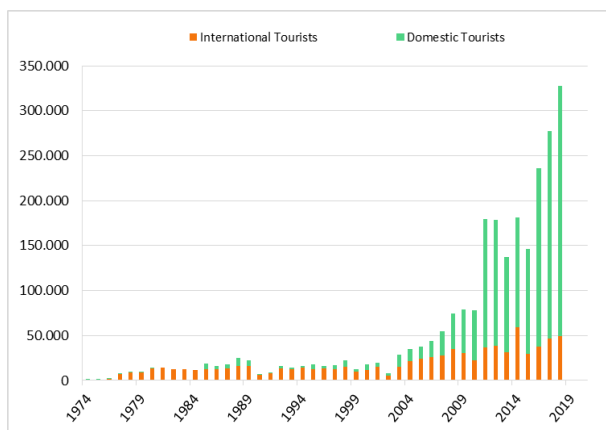


Abb. 1: Entwicklung der internationalen und nationalen Tourismuszahlen in Ladakh (Daten: Dpt. of Tourism, Leh 2019)

Zudem findet durch den wachsenden Tourismussektor eine Ausweitung der Bebauung in die landwirtschaftliche Bewässerungsfläche Leh hinein statt (Dame et al. 2019). Hier entstehen insbesondere neue Hotels, Restaurants, aber auch Privathäuser. Touristische Infrastrukturen werden meist von Landbesitzer*innen erbaut, die sich von der Landwirtschaft abwenden und sich stattdessen für den Gewerbebetrieb entscheiden. Im Bereich der Bewässerungsoase werden landwirtschaftliche Nutzparzellen vermehrt als Bebauungsflächen genutzt. Sie bieten aufgrund der hydrologischen Bedingungen einen ausreichenden Zugang zu Wasserressourcen. Durch den hoch anstehenden Grundwasserkörper können private Grundwasserbrunnen gebohrt werden, die einen unlimitierten und nicht regulierten Wasserzugang ermöglichen (Abb. 2). Diese werden insbesondere von der Tourismuswirtschaft genutzt, da diese auf deutlich höhere Wasserverfügbarkeit angewiesen ist.



Abb. 2: Bohrung eines Grundwasserbrunnens auf Privatgrundstück (Foto: J. Müller 2015)

Herausforderungen für die Wasserversorgung

Die öffentliche Wasserversorgung basiert auf einer Kombination von frei zugänglichen Wasserstellen, von Haushalten selbst initiierten und bezahlten Wasserleitungen sowie der ergänzenden Versorgung durch Wassertanklastwagen, insbesondere im Winter, wenn Leitungen regelmäßig gefrieren.

Neben dem Tourismussektor ist das indische Militär, das in der geopolitisch umstrittenen Grenzregion in großer Truppenstärke stationiert ist, ein wichtiger Wasserkonsument. Die Armee nutzt eigene Bohrbrunnen sowie auch öffentliche Pumpen, sodass Anwohner*innen weniger Wasser zur Verfügung steht, wie Interviews belegen.

Die zunehmende Entnahme durch Privathaushalte und Tourismusgewerbe sowie die Nutzung von Grundwasser durch das Militär hat in den letzten Jahren zum Versiegen von Quellen geführt, wie in Interviews angeführt wird. Ein Hotelbesitzer wies darauf hin, dass es für die Tourismussparte jedoch keine andere Option gibt, als das Grundwasser anzuzapfen:

„There is not any alternative. We hear people saying, there have been so many boreholes coming up in Leh town, numbers are too much. It is not that much, but yes, definitely, it is a real fact that people are depending on the bore well. We are using it till such time, when we have an alternative or you have to say no, stop the tourists, which is not possible“ (Interview, Hotelbesitzer).

Neben Wasserknappheit ist auch die Qualität des Wassers zunehmend problematisch. Es existiert bislang kein Abwassersystem in Leh. Abwässer werden in Sickergruben der Privathaushalte, Hotels und Restaurants gesammelt und anschließend in den Boden infiltriert. Die Abwassermenge der Privathaushalte beschränkt sich auf ein geringes Maß, da ein Großteil der Bevölkerung, wenigstens zusätzlich, die regional typischen Trockentoiletten nutzt (92%/n= 312). Die Abwässer der touristischen Einrichtungen dagegen stellen ein Problem dar. In diversen Interviews wurde thematisiert, dass die Abwässer die Qualität des Grundwassers beeinträchtigen. Im Rahmen dieser Studie wurden an vier verschiedenen Wasserquellen mikrobiologische Schnelltests durchgeführt, wobei eine der meistgenutzten Trinkwasserquellen eine Verunreinigung mit Enterobakterien und *Escherichia coli* Bakterien aufwies. Diese Quelle wurde ein Jahr später (2017) wegen Verunreinigungen von der lokalen Regierung komplett geschlossen.

Ansätze der Wasser-Governance

Staatliche und nicht-staatliche Organisationen haben in den letzten Jahren verschiedene Strategien implementiert, um die zunehmend problematische Situation zu regulieren. Ein nationales Infrastrukturprojekt unter der „Jawaharlal Nehru National Urban Renewal Mission“ (JNNURM) soll seit 2014 neben anderen städtischen Infrastrukturen auch die Wasserver- und entsorgung zentralisieren und verbessern. Allerdings verhindern ganz unterschiedliche spezifische Bedingungen wie lange Forstperioden im Winter, schlecht zugängliche und eng bebaute Wohngebiete, lokale Widerstände sowie bürokratische und organisatorische Defizite den erfolgreichen Abschluss des Projektes. Während mittlerweile einige Stadtteile, mindestens teilweise, an das Wasserversorgungsnetz angebunden sind, ist das zentrale Abwassersystem bislang nicht realisiert worden. Die Tourismusindustrie muss sich deshalb alternative Strategien für den Umgang mit den steigenden Abwassermengen überlegen.

Nur sehr wenige große Hotels folgen bislang der offiziell geltenden Regel, dass Hotels ab 20 Zimmern selbst ihre Abwässer klären müssen. Als kurzfristige

Lösung hat die „Hotel Union“ Ladakhs in Kooperation mit NGOs im Jahr 2017 eine „Faecal Sludge Treatment Plant“ (Anlage zur Behandlung von Fäkalschlamm) errichtet, die einen geringen Anteil der anfallenden Abwässer behandeln kann.

Diskussion: Hydromentalities und Auswirkungen auf water citizenships

Wasser in Leh wird zunehmend als ein privatwirtschaftliches Gut wahrgenommen, für dessen Zugang Investitionen notwendig sind und das die Voraussetzung für wirtschaftlichen Erfolg ist. Es ist zudem ein Symbol für eine „moderne Entwicklung“ in der Stadtplanung, indem es von der Oberfläche, den Kanälen, in den Untergrund verlegt und von dort in private Haushalte geleitet wird. Wasser wird nun nicht mehr dezentral als gemeinschaftliche Ressource verwaltet, sondern der Zugang wird einerseits auf der privaten Haushaltsebene geschaffen oder ist andererseits staatlichen Institutionen unterstellt.

Neben Veränderungen der Wasser-Governance entstehen durch die veränderte Wassernutzung auch räumliche Ungleichheiten. Als Folge der Urbanisierungsdynamik leben Migrant*innen in Gebieten, in denen sie auf staatliche Versorgung angewiesen sind. Im Unterschied zu den Landbesitzer*innen, die im Bereich der Bewässerungsflur leben, haben sie nicht die Möglichkeit, privaten Zugang zu Grundwasser zu erlangen. Für sie ist als Konsequenz aus unzureichendem Zugang zu Wasser, fehlendem Landbesitz sowie Investitionskapital der Besitz eines Hotels erschwert.

Bestimmte Nutzer*innengruppen haben materielle Vorteile durch einen besseren Zugang zu Wasserressourcen, was zu zunehmender Ungleichheit innerhalb der urbanen *mountain waterscape* von Leh. Unzureichende Wasserquantität sowie eine Verschlechterung der Wasserqualität treffen in Leh vor allem einkommensschwächere Gruppen, die meist in die Stadt migriert sind. Ternes (2018: 366) betont wie relevant jedoch gleicher Zugang für die Formierung von *citizenships* ist: „access to natural resources plays an important role in how the boundaries of citizenship are defined“.

Auch in anderen kleinen Städten des Himalaya sind ähnliche Konsequenzen von Urbanisierungsprozessen für die lokale Bevölkerung zu beobachten (z.B. Kovacz et al. 2019, Prakash & Molden 2020). Aufgrund der rasanten Entwicklungen sind weitere Fallstudien von großem Interesse, um regional übergreifende Strategien einer nachhaltigen urbanen Entwicklung im Hochgebirge zu entwerfen.

Literaturverzeichnis

- Budds, J. & Hinojosa-Valencia, L. (2012): Restructuring and Rescaling Water Governance in Mining Contexts: the Co-production of Waterscapes in Peru. *Water Alternatives* 5(1): 119–137.
- Census of India (2011): District Census Handbook Leh (Ladakh). Village and Town Wise Primary Census. [http://www.censusindia.gov.in/2011census/dchb/0103_PART_B_DCHB_LEH%20\(LADAKH\).pdf](http://www.censusindia.gov.in/2011census/dchb/0103_PART_B_DCHB_LEH%20(LADAKH).pdf). (11.12.2018).
- Dame, J., Schmidt, S., Müller, J. & Nüsser, M. (2019): Urbanisation and Socio-ecological Challenges in High Mountain Towns: Insights from Leh (Ladakh), India. *Landscape and Urban Planning* 189: 189–199.
- Gondhalekar, D., Nussbaum, S., Akhtar, A. & Kebschull, J. (2015): Planning Under Uncertainty: Climate Change, Water Scarcity and Health Issues in Leh Town, Ladakh, India. In: Leal Filho, W. & Sümer, V. (Hrsg.): *Sustainable Water Use and Management*. Springer, Cham, 293–312.
- Hellberg, S. (2018): *The Biopolitics of Water: Governance, Scarcity and Populations*. Routledge, Abingdon, UK, New York, USA.
- Karpouzoglou, T. & Vij, S. (2017): Waterscape: A Perspective for Understanding the Contested Geography of Water. *Wiley Interdisciplinary Reviews: Water* 4(3), e1210.
- Kovács, E.K., Ojha, H., Neupane, K.R., Niven, T., Agarwal, C., Chauhan, D., Dahal, N., Devkota, K., Guleria, V., Joshi, T., Michael, N.K., Pandey, A., Singh, N., Singh, V., Thadani, R. & Vira, B. (2019): A Political Ecology of Water and Small-town Urbanisation across the Lower Himalayas. *Geoforum* 107: 88–98.
- Krishnan, R., Shrestha, A. B., Ren, G., Rajbhandari, R., Saeed, S., Sanjay, J., Abu Syed, M., Vellore, R., Xu, Y., You, Q. & Ren, Y. (2019): Unravelling Climate Change in the Hindu Kush Himalaya: Rapid Warming in the Mountains and Increasing Extremes. In: Wester P., Mishra A., Mukherji, A. & Shrestha A. (Hrsg.): *The Hindu Kush Himalaya Assessment*. Springer, Cham, 57–97.
- Lankford, B. (2013): Infrastructure Hydromentalities; Water Sharing, Water Control and Water (In)Security. In: Lankford, B., Bakker, K., Zeitoun, M. & Conway, D. (Hrsg.): *Water Security*. Taylor & Francis, London, UK, 256–272.
- McDuaie-Ra, D. & Chettri, M. (2018): Himalayan Boom Town: Rural–Urban Transformations in Namchi, Sikkim. *Development and Change* 49 (6): 1471–1494. [10.1111/dech.12450](https://doi.org/10.1111/dech.12450).
- Müller, J., Dame, J. & Nüsser, M. (2020): Urban Mountain Waterscapes: The Transformation of Hydro-Social Relations in the Trans-Himalayan Town Leh, Ladakh, India. *Water* 2020, 12: 1698.
- Nüsser, M. (2017): Socio-hydrology: A New Perspective on Mountain Waterscapes at the Nexus of Natural and Social Processes. *Mountain Research and Development* 37(4): 518–520.
- Swyngedouw, E. (2004): *Social Power and the Urbanization of Water: Flows of Power*. Oxford University Press, Oxford, UK, New York, USA.
- Ternes, B. (2018): Groundwater Citizenship and Water Supply Awareness: Investigating Water-Related Infrastructure and Well Ownership. *Rural Sociology* 83 (2): 347–375..
- Prakash, A., Molden, D. (2020): Editorial: Mapping Challenges for Adaptive Water Management in Himalayan Towns. *Water Policy* 22 (S1): 1–8.
- Rodina, L., Harris, L.M. (2016): Water Services, Lived Citizenship, and Notions of the State in Marginalised Urban Spaces: The Case of Khayelitsha, South Africa. *Water Alternatives* 9 (2): 336–355.

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Disruptions and continuities in taxi driving - the case of Mumbai

Keywords: Mobilities, digitization, urbanization, social space, social inequalities, ridesharing

Background

Digital mobility platforms such as “Uber” – also termed transportation network companies or cab aggregators – are forms of passenger transportation that have become integral parts of the mobility landscape of cities. The policy response to these services has varied across the world, from complete abolition to integration into local transportation laws.

The global business model of Uber has been met with fierce resistance by local taxi service providers and resulted in open conflicts in cities such as Barcelona, Berlin, Paris and even stirred violence e.g. in Johannesburg. In all these cities, taxi operators feared and experienced a substantial loss of patronage. Due to the legal challenges and increased competition in almost every part of the world, the consequences have been widely reported and discussed in the media. However, the dynamics of the changing mobility landscapes in cities have been poorly understood so far, partially because they have been observed without taking into account global as well as specific local processes of urban change.

Although being a universal business model making use of similar sets of digital tools, I point towards the fact that the actual operation of these services is embedded in the local social, political and economic fabric. While being a “disruptive” business model, I argue that these services are also part of a wider process of urban change. At the same time, the operation of such services builds on pre-existing social inequalities, socio-spatial fragmentation and exploitation that are defining characteristics of the capitalistic city in both the global North and South. This PhD project aims at better understanding the nature of the apparent conflict between the “new” and “old” forms of mobility. I chose Mumbai, with its iconic black-and-yellow taxi, as a case study.

Drivers’ perspectives

Since the conflict in Mumbai appears as a result of two competing modes of taxi operation – the conventional street-hailed black-and-yellow taxi and the new app-based services – part of my PhD study is exploring the overlaps and continuities of taxi driving. This aspect of the study will be discussed in this contribution.

I chose the drivers’ perspective to understand how the operators of taxi services deal with the new business model and the digital platform technology. Thereby, I explore how drivers of conventional and

platform-based taxi services appropriate these new elements and integrate them into their daily routines and biographies or resist and reject them.

Drivers of commercial vehicles mostly have a migrant background and belong to marginalized and discriminated groups of Mumbai’s urban society. The majority of drivers is from Muslim communities or lower caste background. With a history and presence of social, economic and spatial polarization in Mumbai, the social position of taxi drivers is negotiated in the everyday practice of driving as well as in their individual biographies. Population growth, particularly in the wider metropolitan region, a shift to more polycentric urban structures and massive infrastructure expansion have further taken effect on driving practices, drivers’ lives and economic practices. These wider urban conditions and changes are explored and become visible in the stories and experiences of individual drivers.

Theory and methodology

This study is based on a relational understanding of cities and urbanization, linking spatial and mobilities theory (Urry 2007). Argued with Lefebvre, driving is understood as a spatial practice that produces social space (Lefebvre 1991). I argue that, on one hand, mobilities are strategies to navigate the city and urban life: on their everyday routines, taxi drivers are making use of the many resources that cities are offering – the algorithm of the app and new business models being two of these resources. At the same time, taxi driving is a way of circumventing the uncertainties and adversities of urban life, including marginalization and discrimination that drivers are facing. On the other hand, mobilities are a substantial part of driver’s biographies: labour migration and residential mobility are forms of mobility that serve as strategies to bring stability into urban existence and linearity into biographies, but also into families, communities and social networks. Thereby an important assumption of the “mobilities turn” is taken very seriously here: that mobility and immobility are two sides of the same coin (Hannam et al. 2006). When mobility is understood as a strategy, then the question where, when and how to move (in the city) is as important as the question where, when and how to stop and “anchor”. This study furthermore analyses how drivers organize themselves as a group and collectively appropriate urban resources, thereby taking inspiration from the works of AbdouMalik Simone (e.g. Simone 2004).

This ongoing qualitative study is based on fieldwork in 2019 and early 2020 in Mumbai. Interviews were conducted with drivers of conventional black-and-yellow-taxis (*Kaali Peelis*) and of the mobility platforms “Uber” and “Ola”. Interviews were also conducted with vehicle owners and fleet managers, and with researchers, urban planners, mobility experts and representatives of the companies and authorities for transport on state and federal level.

The changing taxi sector of Mumbai

Backed by venture capital, when the mobility platforms *Uber* and *Ola* started in Mumbai in 2013, they tried to take over the taxi market by offering discounts to passengers and high *incentives* (=bonus for completing a fixed number of rides in a fixed time period) to drivers. The app-based services respond to a constantly increasing demand: with rising incomes and living standards, a growing number of commuters seeks to avoid the crowded conditions in public transport but is hesitating to acquire private cars due to shortage in parking space and notorious traffic jams. While the introduction of mobility platforms was by the far the most disruptive change in the taxi sector so far, impulses for change had occurred earlier, partially driven by authorities’ initiatives to modernize and standardize an “outdated” service (Bedi 2016). Within only a few years, electronic meters and new vehicles became mandatory for taxis to operate and new air-conditioned taxis and fleet taxi operators appeared.



Fig. 5: *Kaali Peelis* and app-based taxis awaiting their turn at a gas station (Photo: T. Kuttler 2020)

Shaken by these drastic disruptions, taxi (and rickshaw) unions started a series of protests and strikes against the new services. However, they could not prevent that the number of app-based taxis in the city rose to almost 75,000 in 2019 and the number of metered taxis in the city shrank drastically from 48,000 in 2014 to 41,000 in 2019. However, in 2016, Uber and Ola started to raise commissions and lowered incentives for drivers, creating frustration among them (Surie 2018). This culminated in a 10-day strike in fall 2018. Since then, new regulations for the taxi sector are awaited from the state of Maharashtra (Sharma 2019).

Two different taxi spaces and logics

The conventional local taxi sector and new-app based services can be understood as two separate, competing sectors with different logics. First, they differ in terms of the spaces in which they operate and places and people they serve. *Kaali Peelis* in Mumbai are mainly organized around taxi stands that are located in neighbourhoods and at railway stations, hence operate as a feeder system for Mumbai’s lifeline, the suburban railway system. Cab aggregators instead mainly operate as door-to-door service and are rarely part of a trip chain. As they are hailed via the app, journeys of an app-based cab driver are steered by the algorithm of the platform. Hence, regular place-based routines of drivers are precluded by the design of the platform.

The second difference refers to the regulation of the two taxi modes. While the conventional taxi sector in Mumbai is highly regulated – including fare fixation, operating areas and routes, vehicle licensing and driving permits – app-based taxis in the state of Maharashtra to date are subject to minimum regulation. Operating areas are not restricted; pricing is demand-driven and remuneration schemes for the self-employed drivers change frequently.

Thirdly, the customer base is different. *Kaali Peeli* drivers rely on the long-established middle classes as a customer base. Many drivers have their fixed customers and regularly scheduled rides. Although fares are fixed by a meter, drivers often negotiate fares with unknown passengers or refuse to serve particular destinations during rush hours. As a result, among middle classes and urban elites, *Kaali Peeli* drivers have gained a negative reputation as being unruly and closed to outsiders. App-based services are popular among the higher income strata and young professionals who newly arrived in Mumbai. Passengers value the reliability guaranteed by the app, the comfort of AC vehicles and minimal interaction needed with the drivers. Passenger-driver match is completely up to the current design of the platform algorithm (which is changing over time).

From this birds-eye view, the conventional taxis appear as bound to spaces and places, with operating rules and logics differing from place to place within Mumbai, restricted to a limited set of “insider” customers. To authorities and consumer organizations, the conventional taxi sector appears as being inflexible, unruly and subject to disciplinary action. (e.g. Deshpande 2017). The app-based taxi instead is the opposite of it – free-floating in space and time and flexible to respond to elaborate customer needs and changing conditions in the city.

These characteristics seem to suggest only one mid to long term conclusion – the complete replacement of the traditional taxi sector by app-based services in Mumbai. However, such predictions largely take the perspective of the drivers out of the equation, as well as the complexity of urban dynamics in Mumbai.

Shared spaces and networks

Adopting a more “mobile” understanding of the taxi sector in Mumbai by employing the drivers’ perspective, the practices and imaginations of drivers that produce the social space of driving come to the fore. In doing so, the sectoral view presented above is dissolved, and the many overlaps between the different forms of taxi driving become apparent. Furthermore, the image of disruption and conflict is adjusted by highlighting the continuities of taxi driving in Mumbai.

First, different taxi operations share similar social networks. It has been found that the operations of mobility platforms are run by family and community networks, as it has been the case in the conventional taxi sector for a long time. Especially among communities that have been traditionally involved in taxi driving, often several family members are driving different forms of vehicles, including app-based taxis and *Kaali Peelis*. Switching between different forms of driving is also common, according to whatever mode offers the higher income prospects momentarily or is suitable to the personal situation. Constant switching between modes is made possible by a large informal market of rental vehicles for commercial operations and a growing availability of pre-owned cars. Especially since the mobility platforms raised commissions and lowered incentives for drivers, driving for these platforms has become less attractive; many drivers have returned to operating *Kaali Peelis* or auto rickshaws.

Secondly, I experienced that taxi drivers are often united in their distrust towards the state, the companies they work for and even the unions they are organized in. While *Kaali Peeli* drivers feel betrayed by the authorities for neglecting their demands, drivers of platform-based services often feel exploited by the platform companies they are attached to. Hence, the competition between the taxi modes rarely turns out as a conflict between drivers. Rather, interviewed drivers frequently expressed solidarity with their colleagues, acknowledging that all drivers were in the same boat eventually.

Thirdly, despite being coordinated via digital platforms, operations of app-based taxis are as much rooted in urban social space as conventional taxi operations. Frequently visited places comprise gas stations, garages, washrooms, but also places of social interaction, such as tea stalls and mosques. To make marginal gains, drivers usually negotiate special arrangements with providers of services such as car cleaning and maintenance, provision of spare car parts or handling of paperwork for licenses and permits. Such networks are based on mutual trust and are developed on the recommendations of acquaintances. These actors, places and infrastructures co-produce the space of taxi driving and do not differentiate between “old” and “new” forms of taxi modes. Furthermore, similarly to taxi

and rickshaw operations, often two drivers operate on one vehicle, which requires arrangements for shift change. In my fieldwork, I encountered several such places where vehicle owners organize and supervise the change of drivers at two time periods of the day.

Fourth, similar to *Kaali Peeli* drivers, drivers of app-based taxis try to work around the rules and norms of the “system”. The driver interface only allows the drivers to get to know the destination of a ride once the passenger enters the car. Drivers react to this by calling the passenger in advance asking for the destination. This strategy is mostly exerted during rush hours: since the companies only marginally remunerate the time delay of a ride due to traffic jams, drivers seek to avoid congested routes and destinations. The companies respond to such tactics by frequently changing and tightening the rules for drivers, and compelling intermediate fleet owners to quickly lay off drivers in case of “misbehaviour”.

Conclusion and Covid-19

As I outlined above, operations of both conventional taxis and app-based taxis are based on social networks and a web of institutions that are embedded in Mumbai’s history and fabric. Drivers variously employ and discard new opportunities and tools at specific points in time. Similarly, drivers make use of different strategies according to their location in the city, according to daily, weekly and monthly variations. These variations are characteristic for everyday life in Mumbai, highlighting that “rhythms” are quintessential for urban life (Lefebvre 2004). Hence, drivers rarely fully embrace or reject new developments such as the platform-based technology and associated income model. Instead, they cautiously navigate through overlapping digital, social and physical spaces in order to stay in control over one’s daily routines and biographies. This highlights that drivers are not passive receivers of change, but conscious actors who align their livelihood activities with social activities and personal hopes and dreams. However, drivers remain in a vulnerable position, and the ability to make conscious decisions and stay in control is constantly undermined by Uber and Ola changing the working conditions for the drivers. Hence, the platform system increasingly appears as a black box to the drivers.

In recent months, many Uber and Ola drivers were found in a depressed state. Due to shrinking incentives, those who owned their cars could not pay back their loans. They resorted to driving 14-17 hour shifts, some sleeping in their cars. Those drivers were visibly sleep-deprived and in alarming health states.

The last period of my fieldwork was completed just before a complete lockdown was imposed in Mumbai due to Covid-19. Since then, all taxi operations are stalled indefinitely, leaving drivers without any income. Those who managed left Mumbai for their places of origins. At the time of writing, the future of taxi drivers in Mumbai is completely uncertain.

References

- Bedi, T. (2016): Taxi drivers, infrastructures, and urban change in globalizing Mumbai. In: *City & Society*, 28(3): 387–410.
- Deshpande, S. (2017): Uber - the competition killer or the competition trigger ? Paper presented at the Research Partnership Platform 8th meeting, 5 July 2017, Geneva
- Hannam, K., Sheller, M. & Urry, J. (2006): Mobilities, immobilities and moorings. In: *Mobilities*, 1(1): 1–22.
- Lefebvre, H. (1991): *The production of space*. Oxford.
- Lefebvre, H. (2004): *Rhythmanalysis: Space, time and everyday life*. London, New York
- Sharma, C. (2019): Aggregators, Driver-partners and the State. In: *Economic & Political Weekly* 54(46): 55.
- Simone, A. (2004): People as infrastructure: intersecting fragments in Johannesburg. In: *Public culture*, 16(3): 407–429.
- Surie, A. (2018): Are Ola and Uber drivers entrepreneurs or exploited workers? In: *Economic & Political Weekly* 53: 1–7.
- Urry, J. (2007): *Mobilities*. Cambridge.

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Arsenic in drinking water in Bangladesh: causes and measures

Keywords: Arsenic, Bangladesh, geochemical processes, water treatment

Arsenic in groundwater

Arsenic in groundwater is a global problem. However, in some particularly affected countries such as India (West Bengal), Bangladesh, Pakistan and Vietnam, the groundwater is used directly as drinking water. Regular ingestions of even very small amounts of arsenic has multiple negative health effects and it increases the cancer risk significantly, which is why the World Health Organization (WHO) recommends a maximum threshold of 10 µg/l for drinking water. In Bangladesh, around 40 million people are affected by high-arsenic drinking water, about 25% of the mostly very poor population. The problem has been known for almost 30 years, but mitigation measures are progressing very slowly or are lacking in rural areas.

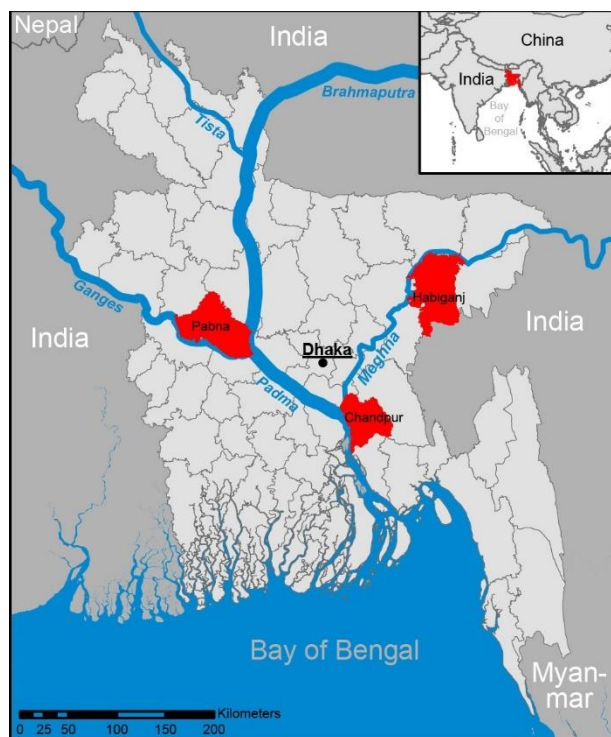


Fig. 6: Map of the three research areas in Bangladesh

The arsenic contamination is widely distributed within Bangladesh, although some regions are severely affected. These areas are not necessarily related to sedimentary arsenic concentrations, which are commonly low. Different natural and anthropogenic factors are considered as causes for arsenic mobilization.

Geomorphology and hydraulic situation

According to the current state of knowledge, natural processes are the main cause of the high arsenic levels. They often occur together with fluvial inundation and young deltaic sedimentation respectively (Chakraborty et al. 2015). Additionally, the geomorphology is a relevant factor where groundwater levels reach the influence of anthropogenic land use, especially during rainy season. In these areas, the groundwater is extremely vulnerable towards insufficiently filtered recharge from the surface. Consequently, the areas with a high groundwater table seem to be mostly affected by the arsenic problem (Fig. 2, right side). Therefore, either the infiltration of surface water is a trigger for arsenic release (Sahu et al. 2015, Kulkarni et al. 2018) or the fluctuating release of arsenic from the confining top layer covering Bangladesh almost entirely (Polizzotto et al. 2005, 2006, Aziz et al. 2008, Biswas et al. 2014). A special hydraulic situation is given by the very low gradient of groundwater table together with mainly fine-grained sediments, leading to slow groundwater flow velocities. This means, that the vertical fluctuations of the groundwater table are higher than the horizontal annual flow distance, leading to increased recharge and an oscillating movement of groundwater (Mukherjee et al. 2007, Dhar et al. 2008). This can possibly lead to an enrichment of infiltrated substances (e.g. organic carbon) and thus the enhancement of geochemical processes.

Geochemical processes

Two main processes are regularly regarded as the main cause of arsenic mobilization from sediment into groundwater. First, phosphate is considered to behave geochemically very similar to arsenic in building up surface complexes on iron (hydr-)oxides and calcite (Smedley et al. 2002, Sørensen et al. 2008, Anawar et al. 2011). High phosphate concentrations, as found frequently in Bangladesh, might lead to the exchange of arsenic by phosphate from mineral surfaces and consequently arsenic enrichment in the groundwater (Maier et al. 2017, 2019).

The second release mechanism is based on geochemical dissolution. Biochemical degradation of organic carbon is combined with the depletion of oxygen and nitrate in the groundwater. Becoming successively more anoxic, manganese and iron are

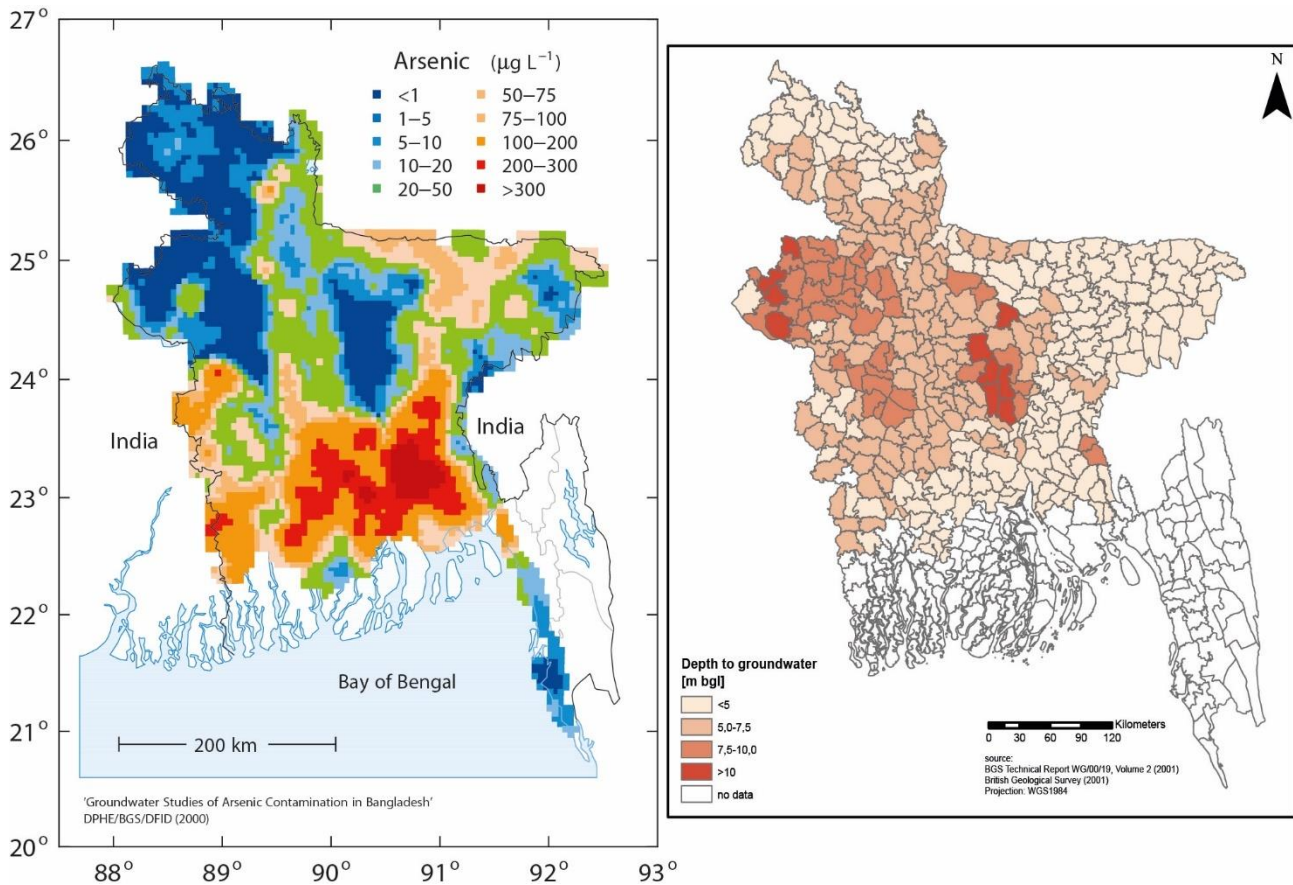


Fig. 7: Arsenic groundwater contamination in relation to groundwater level (BGS et al. 2001).

chemically reduced. Under iron reducing conditions, sedimentary adsorbed arsenic is getting released. Within these processes the adsorbed Arsenate As(V) is chemically reduced to Arsenite As(III) that is considered not to form stable complexes with the sediment. For driving the microbial processes, and thus the dissolution of iron minerals, the decomposition of organic carbon, i.e. peat plays a central role (McArthur et al. 2001, Ravenscroft et al. 2001).

Both substances, organic carbon and phosphate, are frequently investigated for their role in arsenic release (Anawar et al. 2013, Mailloux et al. 2013, Lawson et al. 2016, Aziz et al. 2017, Neidhardt et al. 2018), but the processes are very complex and might vary in space and time.

Anthropogenic factors

Besides the natural factors involved with arsenic release processes, there are more recent theories of negative anthropogenic influences (Neumann et al. 2010, McArthur et al. 2012, Whaley-Martin et al. 2017). This is supported by the observation that at least in some areas of Bangladesh the high arsenic groundwater contamination is in accordance with densely populated areas. The increased cultivation of wet rice instead of dry rice, combined with increasing seepage of phosphate fertilizer and young bioavailable organic carbon into the groundwater, are supposed to contribute to the arsenic problem. Another probably significant role plays domestic

wastewater from latrines or household ponds. Distributed directly into groundwater by open-pit latrines, septic tank infiltration or indirectly by wastewater receiving surface waters, wastewater might at least worsen the problem. Negative influences of sewage by tracing *E. coli* frequently indicates a human impact on groundwater quality (van Geen et al. 2011).

Own research

The aim of our own investigations at three locations in Bangladesh from 2014 to 2020 was to consider the interactions between sediment and groundwater in a temporal and spatial context. In addition to the investigation of geogenic processes, possible anthropogenic influences via domestic wastewater (latrines) were also taken into account, since this organic- and phosphate rich sewage usually seeps into the underground and thus the groundwater without any treatment. This wastewater could explain the high levels of phosphate, ammonium and partially of chloride, which all correlate with the arsenic levels according to our studies. Similar observations are also described by other studies and considered as primarily geogenic (Anawar et al. 2004). Furthermore, we found in the northeast of Bangladesh (Sylhet) and the southeast (Chandpur) that arsenic is related with dissolved organic carbon (DOC) and methane.

In the course of further work, we plan to examine the complex processes in the subsoil through vertical

groundwater sampling over one year to understand the seasonally varying impact of different factors (geogenic, anthropogenic) on groundwater quality. In the past two years, around 1,500 wells were sampled and the corresponding households interviewed about their sanitary infrastructure (wells, drinking water use and latrines) through a cooperation project between the Institute for Geosciences and the Heidelberg Institute for Global Health, financed by the Heidelberg Center for the Environment (HCE).

As a result, we found that less than 10% of the families used a water filter to remove the iron, which is perceived as a bad taste. Examination of these simple filters showed that they are not suitable for the removal of arsenic. No arsenic filters are currently available on the markets in the examined areas, which is why another project in cooperation with the

Karlsruhe Institute of Technology (KIT) is developing and testing inexpensive filters with innovative filter media. In addition to the simple maintenance of these filters, the sustainability aspect is focus of these investigations, since disposal of the used filter media is no option in Bangladesh due to the lack of the necessary infrastructure.

In cooperation with the German non-governmental organization AGAPE e.V. we set up arsenic filters at household scale and investigate the social acceptance of the volunteer participants of the study. The filters are constructed with rechargeable cartridges and are regularly controlled and sampled by the NGO. A preliminary study already shows that the acceptance is very good and the filters fit within quality and socioeconomic perception of their users.

References

- Anawar, H. M., Akai, J., Mihaljevič, M., Sikder, A. M., Ahmed, G., Tareq, S. M. & Rahman, M. M. (2011): Arsenic Contamination in Groundwater of Bangladesh: Perspectives on Geochemical, Microbial and Anthropogenic Issues. In: *Water* 3(4): 1050–1076.
- Anawar, H. M., Akai, J. & Sakugawa, H. (2004): Mobilization of arsenic from subsurface sediments by effect of bicarbonate ions in groundwater. In: *Chemosphere* 54(6): 753–762.
- Anawar, H. M., Tareq, S. M. & Ahmed, G. (2013): Is organic matter a source or redox driver or both for arsenic release in groundwater?. In: *Physics and Chemistry of the Earth, Parts A/B/C* 58–60: 49–56.
- Aziz, Z., van Geen, A., Stute, M., Versteeg, R., Horneman, A., Zheng, Y., Goodbred, S., Steckler, M., Weinman, B., Gavrieli, I., Hoque, M. A., Shamsudduha, M. & Ahmed, K. M. (2008): Impact of local recharge on arsenic concentrations in shallow aquifers inferred from the electromagnetic conductivity of soils in Araihasar, Bangladesh. In: *Water Resources Research* 44(7): 1–15.
- Aziz, Z., Bostick, B. C., Zheng, Y., Huq, M. R., Rahman, M. M., Ahmed, K. M. & van Geen, A. (2017): Evidence of decoupling between arsenic and phosphate in shallow groundwater of Bangladesh and potential implications. In: *Applied Geochemistry* 77: 167–177.
- BGS & DPHE (2001): Arsenic contamination of groundwater in Bangladesh Vol 2: final report, Technical Report, WC/00/19, 2. Available at: <http://www.opengrey.eu/item/display/10068/617700>.
- Biswas, A., Neidhardt, H., Kundu, A. K., Halder, D., Chatterjee, D., Berner, Z., Jacks, G. & Bhattacharya, P. (2014): Spatial, vertical and temporal variation of arsenic in shallow aquifers of the Bengal Basin: Controlling geochemical processes. In: *Chemical Geology* 387: 157–169.
- Chakraborty, M., Mukherjee, A. & Ahmed, K. M. (2015): A Review of Groundwater Arsenic in the Bengal Basin, Bangladesh and India: from Source to Sink, In: *Current Pollution Reports* 1(4): 220–247.
- Dhar, R. K., Zheng, Y., Stute, M., van Geen, A., Cheng, Z., Shanewaz, M., Shamsudduha, M., Hoque, M. A., Rahman, M. W. & Ahmed, K. M. (2008): Temporal variability of groundwater chemistry in shallow and deep aquifers of Araihasar, Bangladesh. In: *Journal of Contaminant Hydrology* 99(1–4): 97–111.
- van Geen, A., Ahmed, K. M., Akita, Y., Alam, M. J., Culligan, P. J., Emch, M., Escamilla, V., Feighery, J., Ferguson, A. S., Knappett, P., Layton, A. C., Mailloux, B. J., McKay, L. D., Mey, J. L., Serre, M. L., Streatfield, P. K., Wu, J. & Yunus, M. (2011): Fecal Contamination of Shallow Tubewells in Bangladesh Inversely Related to Arsenic. In: *Environmental Science & Technology* 45(4): 1199–1205.
- Kulkarni, H. V., Mladenov, N., Datta, S. & Chatterjee, D. (2018): Influence of monsoonal recharge on arsenic and dissolved organic matter in the Holocene and Pleistocene aquifers of the Bengal Basin. In: *Science of The Total Environment* 637–638: 588–599.
- Lawson, M., Polya, D. A., Boyce, A. J., Bryant, C. & Ballentine, C. J. (2016): Tracing organic matter composition and distribution and its role on arsenic release in shallow Cambodian groundwaters. In: *Geochimica et Cosmochimica Acta* 178: 160–177.
- Maier, M. V., Isenbeck-Schröter, M., Klose, L. B., Ritter, S. M. & Scholz, C. (2017): In Situ-mobilization of Arsenic in Groundwater – an Innovative Remediation Approach?. In: *Procedia Earth and Planetary Science* 17: 452–455.
- Maier, M. V., Wolter, Y., Zentler, D., Scholz, C., Stirn, C. N. & Isenbeck-Schröter, M. (2019): Phosphate Induced Arsenic Mobilization as a Potentially Effective In-Situ Remediation Technique—Preliminary Column Tests. In: *Water* 11(11): 2364.
- Mailloux, B. J., Trembath-Reichert, E., Cheung, J., Watson, M., Stute, M., Freyer, G. A., Ferguson, A. S., Ahmed, K. M., Alam, M. J., Buchholz, B. A., Thomas, J., Layton, A. C., Zheng, Y., Bostick, B. C. & van Geen, A. (2013): Advection of surface-derived organic carbon fuels microbial reduction in Bangladesh groundwater. In: *Proceedings of the National Academy of Sciences* 110(14): 5331–5335.
- McArthur, J. M., Ravenscroft, P., Safiulla, S. & Thirlwall, M. F. (2001): Arsenic in groundwater: Testing pollution mechanisms for sedimentary aquifers in Bangladesh. In: *Water Resources Research* 37(1): 109–117.
- McArthur, J. M., Sikdar, P. K., Hoque, M. A. & Ghosal, U. (2012): Waste-water impacts on groundwater: Cl/Br ratios and implications for arsenic pollution of groundwater in the Bengal Basin and Red River Basin, Vietnam. In: *Science of The Total Environment* 437: 390–402.
- Mukherjee, A., Fryar, A. E. & Howell, P. D. (2007): Regional hydrostratigraphy and groundwater flow modeling in the arsenic-affected areas of the western Bengal basin, West Bengal, India. In: *Hydrogeology Journal* 15(7): 1397–1418.
- Neidhardt, H., Schoeckle, D., Schleinitz, A., Eiche, E., Berner, Z., Tram, P. T. K., Lan, V. M., Viet, P. H., Biswas, A., Majumder, S., Chatterjee, D., Oelmann, Y. & Berg, M. (2018): Biogeochemical phosphorus cycling in groundwater ecosystems – Insights from South and Southeast Asian floodplain and delta aquifers. In: *Science of The Total Environment* 644: 1357–1370.
- Neumann, R. B., Ashfaq, K. N., Badruzzaman, A. B. M., Ashraf Ali, M., Shoemaker, J. K. & Harvey, C. F.

(2010): Anthropogenic influences on groundwater arsenic concentrations in Bangladesh. In: *Nature Geoscience* 3(1): 46–52.

Polizzotto, M. L., Harvey, C. F., Sutton, S. R. & Fendorf, S. (2005): Processes conducive to the release and transport of arsenic into aquifers of Bangladesh. In: *Proceedings of the National Academy of Sciences* 102(52): 18819–18823.

Polizzotto, M. L., Harvey, C. F., Li, G., Badruzzman, B., Ali, A., Newville, M., Sutton, S. & Fendorf, S. (2006): Solid-phases and desorption processes of arsenic within Bangladesh sediments. In: *Chemical Geology* 228(1–3): 97–111.

Ravenscroft, P., McArthur, J. M. & Hoque, B. A. (2001): Geochemical and Palaeohydrological Controls on Pollution of Groundwater by Arsenic. In: Chappell, W. R., Abernathy, C. O. & Calderon, R. (eds) *Arsenic Exposure and Health Effects IV*. Oxford: Elsevier Science Ltd., pp. 53–78.

Sahu, S. & Saha, D. (2015): Role of shallow alluvial stratigraphy and Holocene geomorphology on groundwater arsenic contamination in the Middle Ganga Plain, India. In: *Environmental Earth Sciences* 73(7): 3523–3536.

Smedley, P. L. & Kinniburgh, D. G. (2002): A review of the source, behaviour and distribution of arsenic in natural waters. In: *Applied Geochemistry* 17: 517–568.

Sø, H. U., Postma, D., Jakobsen, R. & Larsen, F. (2008): Sorption and desorption of arsenate and arsenite on calcite. In: *Geochimica et Cosmochimica Acta* 72(24): 5871–5884.

Whaley-Martin, K. J., Mailloux, B. J., van Geen, A., Bostick, B. C., Ahmed, K. M., Choudhury, I. & Slater, G. F. (2017): Human and livestock waste as a reduced carbon source contributing to the release of arsenic to shallow Bangladesh groundwater. In: *Science of The Total Environment* 595: 63–71.

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From blessing to curse? The Return of Pink Bollworm and its impacts on the livelihoods of Bt cotton farmers in Telangana, India

Keywords: Bt cotton, genetic engineering, India, pink bollworm, rural livelihoods, Telangana, vulnerability

Introduction

While early scientific literature on Bt (*Bacillus thuringiensis*) cotton documented its positive agronomic effects on yields, revenue and reductions in pesticide use (Qaim 2003, Sadashivappa & Qaim 2009, Choudhary & Gaur 2015, Kathage & Qaim 2012, Veetil et al. 2016), the recent return of pink bollworm (*Pectinophora gossypiella*) pests in India raises doubt in regard to the technology's longevity. Especially its long-term effects on farmers' livelihoods need critical re-investigation. Based on 42 problem-centred interviews conducted in Karimnagar District, Telangana, this study assesses the socio-economic impacts of the recent return of the pest on cotton farming households. Methodologically, it follows an explorative livelihood approach. It examines the risks that have arisen in the context of the recent crisis and discussed the farmers' strategies to cope with and adapt to this shock.



Fig. 8: Boll infected with pink bollworm (Photo: K. Najork 2018)

Bt Cotton in India

Genetically engineered (GE) seed technologies were developed in the 1990s to tackle the problem of *lepidopterans*, like bollworms, which are considered a major limiting factor in cotton production (Choudhary & Gaur 2015, Kaviraju et al. 2018). Producing endotoxins of the *Bacillus Thuringiensis* bacterium, Bt crops have lethal effects on lepidopteran insects and thus provide built-in protection against them (Khan et al. 2018).

Developed by Mahyco Monsanto Biotech Limited (MMBL), Bt cotton was the first GE crop to enter the Indian market in 2002 (Sadashivappa & Qaim 2009). The first Bt generation (Bollgard-I) has now been

almost completely replaced by hybrids based on the Bollgard-II technology containing two induced Bt genes (Cry1Ac and Cry2Ab) instead of one (Cry1Ac) (Choudhary & Gaur 2015, ISAAA 2017).

With proliferating adoption rates, the area under Bt cotton has drastically increased throughout India since the GE-technology was introduced. Today, it amounts to an estimated 93% of the total Indian cotton area (Choudhary & Gaur 2015, ISAAA 2017). Hence, Bt technology plays an essential role for India's cotton sector which currently accounts for 26% of global cotton production, thereby taking the lead in the same (Statista 2020, Fand et al. 2019).

However, recent attacks of pink bollworm pests have now reignited the debate, not only about potential resistances in lepidopteran pests towards the endotoxins produced in Indian Bt cotton plants, but also about severe setbacks in regard to peasant farmers' livelihood security due to the technology's failure and the resulting collapses in yields.

Early Effects of Bt Cotton Adoption on Farmers' Livelihoods

Especially studies rooted in agricultural economics (e.g. Qaim 2003, Kathage & Qaim 2012, Sadashivappa & Qaim 2009, Veetil et al. 2016) emphasize the drastic increase in yields and the parallel decrease in pesticide usage – apparently related to Bt cotton diffusion. Bt is claimed to have strongly 'outperformed' conventional cotton (Kathage & Qaim 2012: 2, Qaim 2003, Veetil et al. 2016). Sadashivappa & Qaim (2009) assert yield advantages of up to 40%, which accordingly have led to higher profits among smallholders, up to 44% according to Morse et al. (2007), resulting in an increased standard of living (see also Kathage & Qaim 2012, Yadav et al. 2018). Thus, the technology has been praised for its contribution to 'positive economic and social development' (Kathage & Qaim 2012: 1).

Critical voices on the technology are scarce. Yet there are some studies rooted mainly in cultural anthropology, which suggest that 'the yield advantage of Bt over non Bt is not statistically significant' (Gaurav & Mishra 2012: 12), that it is unrelated to the technology but rather to different cultivars and agronomic practices, or that yields were stagnating or even falling during the last years, and that Bt cotton cultivation is paralleled by an increase in riskiness (Stone & Flachs 2015, Stone 2011, Flachs 2017).

In regard to the technology's reported positive effects on pesticide usage, academic criticism is rare, too. The majority of scientific findings on the topic suggest Bt technology to be the reason for decreases in pesticide applications. Qaim (2003) found reductions of more than 60% and Veettil et al. found such reductions 'across all toxicity classes over time for both Bt and non-Bt cotton' (2016: 118). Kathage & Qaim even claim that a 'widespread adoption of Bt has led to area wide suppression of bollworm populations' (2012: 2). However, some scholars relate pesticide reductions to other factors than Bt cotton. Flachs (2017: 2) purports that a decrease in pesticide usage can only be assigned to the initial phase of Bt cotton introduction and that 'total insecticide applications had largely returned to their pre-GM levels' by 2010, when Bt adoption was ubiquitous in India.

In our study, the vast majority of interviewed farmers confirmed the positive effects of Bt cotton by affirming the technology's initial successes in regard to yield in- and pesticide decreases. They even termed the sharp early increases in yields as 'boom' (V02-I07, V02-I08) and stressed the initial improvement of their economic situation, as they were able to conduct significant long-term investments, such as building houses or buying machines, or investing in their children's education, due to increased cotton-related profits (V02-I08, V02-I11, V03-I08, V03-I10). Yet, the target pest's recent return to the central and southern zone of Indian cotton production in the season of 2017/18, is now overshadowing the technology's initially posed success story (Fand et al. 2019, Naik et al. 2018).



Fig. 2: Farmer in his Bt cotton field. (Photo: K. Najork 2018)

Pink Bollworm Causes New Risks

Late research in the field has taken up a tone of scepticism (Kranthi & Stone 2020) as the promise of built-in protection against lepidopteran pests has failed and Bt cotton apparently 'lost the battle' (Fand et al. 2019: 314). In recent studies, yield losses of up to 30% are reported (Fand et al. 2019) fuelling concerns among smallholders and other actors in the cotton industry. Thus, the question of immediate livelihood risks and thereto related coping strategies is immanent and a critical re-investigation of the technology seems requisite.

In accordance with the recent critique, in our study, the majority of interviewed farmers shared the increasing scepticism: While they described cotton yield performance as a curve starting with the above-mentioned 'boom', they claimed yields to have recently declined, accompanied by concurrent re-increases of pesticide applications (V02-I07, V02-I09). Altogether, non-Bt cotton was described as more reliable than its GE counterpart (V02-I06, V02-I12).

Concerning the late return of the target pest to Indian cotton fields, all interviewed farmers attested to have been impacted by pink bollworm infestations in their fields with yield decreases of up to 80% – despite the implementation of Bt II by all interviewees (V01-I01, V02-I02, V03-I01, V03-I09). The collapses in yields have resulted in devastating financial losses, paralleled by according effects on farmers' livelihoods. The shock's severity is underlined by a 70-year-old farmer claiming that he 'cannot remember a similar shock like this' (V02-I13).

Moreover, interviewees described the infestation as unforeseeable and emphasized the notion of surprise in its occurrence: 'I opened nearly 50 cotton bolls just to make sure that they were not affected, but unfortunately the whole field was infected by pink bollworm' (V02-I01). Similarly, another farmer mentioned this aspect of unexpected risk: Having started the construction of his house with the surplus of the early years of Bt cotton implementation, he was unable to finish the house after the return of pink bollworm, so that it still remains unfinished today (V02-I07).

Farmers' (In-)Ability to Cope and Adapt

These recent risks have led to new livelihood strategies of Bt cotton farmers: (1) Responsive short-term strategies directly applied in order to cope with the shock and (2) preventive strategies pursued to adapt to the changed conditions in the long run to avoid a recurrence of the recently experienced financial shock. These newly implemented strategies have, in turn, varying effects on farmers' livelihoods, depending on socio-economic as well as agronomic variables.

One coping strategy adopted by almost all interviewees was to take loans in order to buffer their financial losses resulting from the collapses in cotton yields (V01-I10, V02-I06, V02-I07, V02-I13, V02-I14, V03-I05, V03-I06). The formal bank system was

generally preferred since informal sources, such as money lenders or commission agents, demanded higher interest rates. The access to this system was, however, restricted to land-owning farmers or those who were able to provide another kind of deposit, for example gold or jewellery (V01-I10, V02-I06, V02-I08, V02-I13). Farmers who did not own any land, had to revert to the above-mentioned informal sources (V02-I13, V02-I14, V03-I05, V03-I06).

As a result, the coping strategy of taking loans varied in success depending on the socio-economic preconditions of the respective farmer. Farmers with less financial capital were disproportionately affected when trying to overcome their financial crisis than those farmers who were economically better off by default. This inequality became manifest as some resource-poor farmers got into debt traps as they were not able to pay off their loans (for example V02-I14). As last resort to cope with the incurred losses, several interviewed farmers had to sell some of their land (V02-I14, V03-I05, V03-I07, V03-I10).

A rather long-term adaptive strategy implemented by some farmers was to grow a second season on their cotton fields. Growing a second crop, which was usually maize, was possible due to the significantly shortened crop cycle of Bt cotton. This was stated as the major benefit of Bt cotton, as the second crop resulted in additional household income and served as balance, especially in times of crisis (V02-I13, V02-I11, V03-I09).

This privilege was, however, limited to those farmers with sufficient access to irrigation facilities (V2-I10, V2-I14). Insufficient water supply, on the contrary, either impeded the bowery altogether, or exposed the crop to new risks. One interviewee described that, after having lost his first crop (Bt cotton) to pink bollworm, he also lost his second crop (maize) due to a lack of water supply (V2-I13). Hence, instead of balancing his losses, his second crop indebted him even further. As a consequence, economically weaker farmers were again hit unequally hard by the shock due to their impeded access to irrigation facilities.

A general strategy, independent of the crisis and yet related thereto, was the non-compliance of refuge requirements. Refuge crops (or refugia) consisting of non-Bt crops are required to surround each Bt cotton field in a ratio of 95:5 (Bt:non-Bt) in order to lower the target pest's evolutionary pressure and thus prolong the effectivity of the technology (Carrière et al. 2005, Flachs 2017, ISAAA 2017, Kranthi 2015). The strategy not to grow a refugia was implemented by all

respondents. As the realization of this requirement would entail economic disadvantages for farmers, all interviewees reported to follow the alternative strategy of non-compliance (V02-I06, V02-I07, V02-I08, V02-I12). Despite the fact that farmers follow what has to be acknowledged as a comprehensible livelihood strategy to enhance their economic well-being in the short term, they jeopardize their livelihood systems as a whole in the long run. As the ISAAA (2017) states, this mismanagement erodes the technology's resistance to pink bollworm and threatens the longevity of the technology.

Conclusion

Our findings show the altered impacts of Bt cotton implementation over time. While positive agronomic effects of the technology were confirmed for the initial years of Bt cotton diffusion, a durability of the technology's early successes must be negated.

The return of the lepidopteran target pest, pink bollworm, witnessed by all interviewed farmers, must be interpreted as alarm signal for the failure of Bt technology. The in-built pest resistance promised by seed companies is no longer reliable. As a result of this recent breakdown, farmers faced severe financial losses due to collapses in cotton yields. Forced to react to these new risks, farmers implemented responsive coping strategies in consequence. While these have proved beneficial for *some* farmers in balancing financial losses, it meant a deepening of crisis for others. At that, already poorer, and more vulnerable farmers are affected disproportionately severe as they fail to revert to promising adaptive strategies, such as the growing of a second season. Additionally, the general strategy of non-compliance with refugia requirements not only jeopardizes the longevity of Bt technology itself, but corrodes the foundations of Bt cotton farmers' agricultural livelihood systems. By pursuing livelihood strategies oriented toward short-term economic profits, farmers put the socio-ecological sustainability of their own biotechnology-driven livelihoods at stake.

Since the proper implementation of refuge crops requires high investments by farmers which often cannot be met, the responsibilities of political officials as well as seed companies must be emphasized in this regard. They cannot simply pass the buck to farmers when it comes to prolonging the technology's longevity and spurn own responsibilities.

References

- Carrière, Y., Eilers-Kirk, C., Kumar, K., Heuberger, S., Whitlow, M., Antilla, L., Dennehy, T.J. & Tabashnik, B. (2005): Long-term evaluation of compliance with refuge requirements for Bt cotton. In: *Pest Management Science: formerly Pesticide Science* 61(4): 327–330.
- Choudhary, B. & Gaur, K. (2015): *Biotech Cotton in India, 2002 to 2014: Adoption, Impact, Progress & Future. Series of Biotech Crop Profiles. ISAAA: Ithaca, NY.*
- Fand, B.B., Nagrare, V.S., Gawande, S.P., Nagrale, D.T., Naikwadi, B.V., Deshmukh, V., Gokte-Narkhedkar, N. & Waghmare, V.N. (2019): Widespread infestation of pink bollworm, *Pectinophora gossypiella* (Saunders) (Lepidoptera: Gelechiidae) on Bt cotton in Central India: a new threat and concerns for cotton production. In: *Phytoparasitica* 47: 313–325.
- Flachs, A. (2017): Transgenic cotton: High hopes and farming reality. In: *Nature Plants* 3: 1–2.
- Gaurav, S. & Mishra, S. (2012): To Bt or not to Bt? Risk and Uncertainty Considerations in Technology Assessment. In: Narayanan, L. & Viswanathan, P. (eds.): *India's Tryst with Bt Cotton: Learning from the First Decade*. Mumbai, 1–34.
- ISAAA (International Service for the Acquisition of Agri-Biotech Applications) (2017): *Global Status of Commercialized Biotech/GM Crops in 2017: Biotech Crop Adoption Surges as Economic Benefits Accumulate in 22 Years*. ISAAA Brief No. 53. ISAAA: Ithaca, NY.
- Kathage, J. & Qaim, M. (2012): Economic impacts and impact dynamics of Bt (*Bacillus thuringiensis*) cotton in India. In: *Proceedings of the National Academy of Sciences of the United States of America* 109(29): 1–5.
- Kaviraju, S., Kumar, D., Singh, N. & Kumar, S. (2018): A Comparative Study on Socio Economic Impact of Bt cotton and Non-Bt cotton Farm Households in Warangal District of Telangana State. In: *International Journal of Current Microbiology and Applied Sciences* 7(5): 1561–1567.
- Kranthi, K.R. (2015): Pink Bollworm Strikes Bt cotton. In: *Cotton Statistics & News* 35: 1–6.
- Kranthi, K.R. & Stone, G.D. (2020): Long-Term impacts of Bt cotton in India. In: *Nature Plants* (6): 188–196.
- Morse, S., Bennett, R. & Ismael, Y. (2007): Inequality and GM Crops: A Case-Study of Bt Cotton in India. In: *The Journal of Agrobiotechnology Management & Economics* 10(1): 44–50.
- Naik, V.C.B., Kumbhare, S., Kranthi, S., Satijaa, U. & Kranthi, K.R. (2018): Field-evolved resistance of pink bollworm, *Pectinophora gossypiella* (Saunders) (Lepidoptera: Gelechiidae), to transgenic *Bacillus thuringiensis* (Bt) cotton expressing crystal 1Ac (Cry1Ac) and Cry2Ab in India. In: *Pest Management Science* 74: 2544–2554.
- Qaim, M. (2003): Bt Cotton in India: Field Trial Results and Economic Projections. In: *World Development* 31(12): 2115–2127.
- Sadashivappa, P. & Qaim, M. (2009): Bt Cotton in India: Development of Benefits and the Role of Government Seed Price Interventions. In: *AgBioForum* 12(2): 172–183.
- Statista (2020): Cotton production by country worldwide in 2018/2019. <https://www.statista.com/statistics/263055/cotton-production-worldwide-by-top-countries/> (07.05.2020).
- Stone, G.D. (2011): Field versus Farm in Warangal: Bt Cotton, Higher Yields, and Larger Questions. In: *World Development* 39(3): 387–398.
- Stone, G.D. & Flachs, A. (2015): Seeking Sustainability for Smallholders: Bt cotton in India. In: Mitton, P. & Bennett, D. (eds.): *Analyses: Africa's future ... can biosciences contribute?* Cambridge, 119–128.
- Veetil, P., Krishna, V. & Qaim, M. (2016): Ecosystem impacts of pesticide reductions through Bt cotton adoption. In: *Australian Journal of Agricultural and Resource Economics* 61: 115–134.
- Yadav, S., Godara, A.K. & Yadav, V. (2018): Impact of Bt Cotton Production Technology in Haryana. In: *Indian Research Journal of Extension Education* 18(2): 66–71.

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Values, social inclusion and development. Looking at Nepalese tea cooperatives through the lens of moral economy

M r i a m W e n n e r

Keywords: Moral economy, development geography, conflict, livelihoods

Introduction

Development initiatives such as the 2030 Agenda for Sustainable Development stress the importance of social inclusion and cohesion as one basis for sustainable livelihoods and peace (UNDESA 2020). Cooperatives are assumed to have the potential to contribute to various Sustainable Development Goals, i.e. to end poverty, hunger, achieve gender equality and to promote sustained, inclusive and sustainable economic growth, besides others (ibid.). By definition, cooperatives are “people-centered enterprises owned, controlled and run by and for their members to realize their common economic, social, and cultural needs and aspirations” (International Co-operative Alliance 2016). One important element of cooperatives are moral values such as “self-help, self-responsibility, democracy, equality, equity, and solidarity” besides “honesty, openness, social responsibility and caring for others” (ibid.). This description suggests that shared moral values are the glue that sticks together diverse people in this voluntary enterprise. This explicit value-based character of cooperatives, along with their assumed potential for inclusive development, provides an opportunity to shed light on the role of moral values in developmental processes. While this is a very broad field for inquiry, this paper aims to better understand what role cooperative members ascribe to moral values for the functioning of their cooperatives and in how far such values informed their decision to join, to stay in, or to leave their cooperatives. By explicitly researching moral values as one basis for such decisions, this paper also attempts to better understand the rationalities of people’s livelihood practices beyond simplistic logics of benefit maximization (see Kaiser & Rothfuß 2013). Conceptually, this paper uses a “moral economy” approach which stresses the interrelatedness of social and economic domains (Friberg & Götz 2015). Drawing on an explorative case study of Nepalese tea cooperatives, the paper proposes an understanding of cooperatives as multifaceted spaces where norms and values concur, intersect and/or clash to create new rationalities for social inclusion and exclusion.

Moral economy in a nutshell

Moral economy is an ambivalent term that is used in a variety of contexts and with different meanings (for a discussion see Götz 2015). Its origin stems from the

work of social scientists who contested the (perceived) division between moral values and a rational economy that followed the emergence of a liberal market economy and the associated “externalization of moral issues in economic models” (Friberg & Götz 2015: 144). Thompson (1971) and Scott (1976), for instance, analyzed how clashes between established ethical systems (such as the social contract or the right to subsist) and the modern market economy were linked to social riots and collective action. Following Götz (2015: 147), these early analyses also offered an “antithesis to the ‘rational choice’ imperatives that conflate rationality and utility maximization in a crude material sense”. Yet, while many authors use “moral economy” in a dualist way in form of a distinction to what could be termed an “immoral economy” (i.e. capitalism), Palomera & Vetta (2016) suggest to always think values and economy together, since “any economy is suffused with the norms of the community of which is it a part” (ibid.: 7). For them, a moral economy approach has the potential to understand how ambiguous logics and incommensurable values intersect to create different value regimes (i.e. capitalism) or put simple: how different values are linked to patterns of accumulation and inequality.

Unlike Thomson or Scott, I am not interested in clashes between ‘modern’ and ‘traditional’ forms of exchange. Rather, I use moral economy as a lens to research the relationships between actors’ moral values and their economic practices. The economy is thereby understood as both informed by and interwoven with social norms and values. More precisely, this paper asks: In how far do moral values inform ideal imaginations of a just and fair society, and in how far do persons draw on moral values to explain their economic conduct (i.e. the participation in cooperatives) and to justify the inclusion or exclusion of others? I refer to moral values here to describe a person’s imagination of good or bad and right or wrong behaviour or interpersonal relations.

Tea cooperatives in Eastern Nepal

To research the functioning of cooperatives, this paper draws on an explorative case study from rural Nepal. Here, the cooperative movement is explicitly supported by the government and international donors. For instance, in its 2015 constitution, the government has recognized cooperatives as one of

the three pillars of the national economy. In 2019, there were over 34,500 active cooperatives, with a membership of 6.3 million (or around one third of the Nepalese population) (UNDP 2020). While there are cooperatives in a variety of sectors (including credit/savings, health, education), this study focuses on agricultural cooperatives, more specifically on tea cooperatives.

Black tea is amongst the top-11 export products from Nepal (International Trade Center 2020). Its production increased eight-fold between 1998 and 2016 (National Tea and Coffee Development Board 2020). This trend is also spurred by small-farmers who in 2017 produced 41% of all tea (the rest stems from plantations) (ibid.). Data show that these small-tea-growers increasingly organize themselves in cooperatives which raises the question of why they consider this form of organization useful (see Fig. 1). This trend is nicely illustrated by Ilam district in Eastern Nepal (Map 1), where, in 2015, about 2,870 (of 7,000) tea farmers were organized in 38 cooperatives (Central Tea Co-operative Federation Ltd. Nepal 2020). The growing importance of cooperatives in Ilam makes it a suitable place to study farmers' motivations for choosing this form of organization and to shed light on the role of moral values for their functioning.

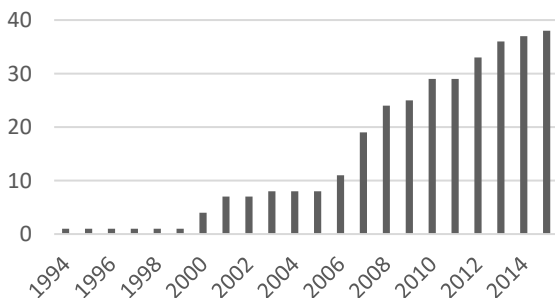
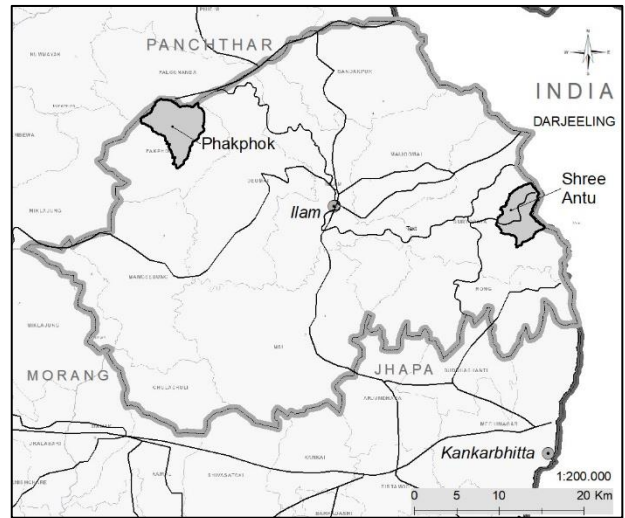


Fig. 9: Cumulative number of registered tea cooperatives in Ilam (Central Tea Co-operative Federation Ltd. Nepal 2020)

The role of moral values in cooperatives

To study the role of moral values in cooperatives and farmers' motivations to join (or leave) them, my research assistant and I visited three different tea cooperatives in Ilam district, two of which are included in this study. The first, the *Tinjure Tea Producer Cooperative Society*, was established in 1995. In 2017, it had 185 members from three different Village Development Committees (including Phakphok, see map 1). In 2016 and 2017, we conducted seven semi-structured interviews with cooperative members, ex-members, and the president, in addition to informal talks with farmers. The second cooperative, the *Sri Antu Organic Tea Producer Cooperative Society*, was established in 2016 and had only 25 members at the time of visit in 2017. Here, we conducted two semi-structured interviews with two groups of members and one with the

president/founder of the cooperative. While interviews at both sites included questions on the practical functioning of the cooperatives and farmers' incentives for joining (or leaving) the group, the first case study required more careful inquiries into conflicts that will be described below.



Map 1: Ilam district and study area (cartography: Bea Bardusch) (Esri 2018, HDX 2018, OpenStreetMap)

Cooperatives as spaces of possibility and change

In both cooperatives, farmers saw their membership as a means to increase their financial income (e.g. through access to credit) and to reduce risks associated with investing in higher-value activities. This view was also informed by the assumed anti-individualist character of cooperatives, as one member in *Sri Antu* explained. For him, cooperative work basically meant to accomplish aims by "working together" (Interview, 31.1.2017). Further, farmers in both cooperatives aspired to reduce the influence of brokers selling their green leaves (unprocessed tea) to private factories by building their own tea factories. Especially farmers in *Tinjure* (who opened their own tea factory in 2014) wanted to export their high-quality produce to the European Union or other Western markets (what they accomplished in 2017 with the support of a Netherlands-based NGO). In this way, the cooperatives were also informed by imaginations of a fairer economic system where rewards remain with producers (i.e. higher prices, upgrading in the value chain). In this way, cooperatives were regarded as an instrument to change unequal and exploitative relations that favoured brokers and private tea factories. The assumption that joining a cooperative could improve one's livelihood was strongly informed by the valuation of community strength and cooperation.

Cooperatives as spaces of conformity

The role of morality in cooperatives became also visible in statements that described them as spaces of shared values. The president of the *Sri Antu* cooperative, for instance, underscored the importance of trust amongst the members (interview,

31.1.2017). This is flanked by the perception that the cooperative was a joint (and not an individualistic) enterprise: “More than saying ‘this is my cooperative’ we say ‘this is ours’”, as one member stated (interview, 1.2.2017). Other values mentioned were discipline, equality, democracy, respect, unity and honesty. This emphasis on shared values also seemed to inform the selection of the founding members. For instance, in *Sri Antu*, only those persons were considered as viable founding members whom the initiators regarded as financially strong enough and conform with these values: “We selected members based on whether they agree to the same aim...education, financial strength, and those who want the development and progress of the society” (interview, member, 1.2.2017). Those who were suspected to misuse the cooperative for personal gains (“saying ‘this is mine’”, *ibid.*) were not invited. In both cooperatives, members also distinguished persons “who understood” from those “who do not understand”. This indicates that social distinctions are being made based on the (perceived) knowledge and education of others by those who see themselves as speaking from a moral high ground. As the case of *Tinjure* indicates, such moral distinctions can also be an element of conflict within a cooperative.

Discontents and disappointments

While for the Ilam tea industry, *Tinjure* is a flagship of successful high-quality produce for the international market, in interviews, several (former) cooperative members expressed their anger and disappointment with the way the cooperative was governed. The main conflict (besides others) concerned the tea factory. Besides pointing at the too low capacity to process the green leave of all the members, they criticized that the factory was built in a place that not all members could reach easily and that factory shares were distributed unevenly to the members. Further, they criticized the management for a lack of transparency and their alleged individualistic behaviour. A former member of the managing committee hinted at the exclusion of members and lack of democracy within the cooperative since the manager wielded too much power and kept his knowledge to himself (interview, 26.1.2017).

In sum, we read their critique as an expression of their perception that their contribution and trust had been misused for the benefit of a few. Certainly, with the risky investment into the tea factory and the international market opening up for the cooperative, there was more at stake to win or lose. In turn, members of the management alleged that when the factory was built, two cooperative members wanted to spoil the whole project and disrupt the functioning of the cooperative for their private gain. These members were then expelled and since, “the cooperative became even stronger” (interview, 24.1.2017). Although we could not fully grasp the

whole story behind the conflict, it became clear that all respondents mobilized moral values (honesty, unity, anti-individualism, democracy) to establish their own point of view and to justify their actions. For those who left the cooperative, it had turned from a space of opportunity into an anti-social space of exclusion and individualism which contradicted their aspirations for inclusion, respect, and participation. For those who still governed it, their resignation increased the conformity amongst the remaining members.

Recognising values in Development Geography

This paper aimed to shed light on the role of moral values in people’s economic conduct. By doing so, it scrutinized the assumption that cooperatives are important instruments to foster social cohesion and inclusive development. Concurring with one important assumption of moral economy approaches, this explorative research indeed underscored the importance of shared moral values as the ‘glue’ that holds diverse persons together (beyond simplistic motivations of financial benefit maximization). However, the case study also indicated how the same moral values can be mobilized to justify the exclusion of those persons who are labelled to be less “understanding”, or of those who disagree with the agendas set by those in power. Thus, while in an idealized way, cooperatives appear to be guided by a set of moral values that foster social cohesion and peace, perceived violations of these values lead to disappointments, frustration, and conflict. Such contradictions could also stem from possible overlaps of cooperatives with other value domains (such as family, market, subsistence) what would render them multifarious spaces, where aims, values, and interests overlap and possibly clash.

While findings of this research should be considered preliminary and longer stays in cooperatives are required to get a fuller picture of their functioning, the project nevertheless suggests the usefulness of moral economy to shed light on the role of values in broader processes of development. This could also be one interesting – and so-far less studied field – in development geography, be it, to complement livelihood analyses (see Kaiser & Rothfuß 2013), to better understand people’s rationalities for actions, to inquire about different persons’ or organizations’ idealist imaginations of a desirable society and/or economy, or to shed light on the definition of what “value/s” (more generally) mean(s) in a society.

A further field of study could be a focus on different scales of moral economies and their intersections, for instance in form of an evaluation of how universalist, value-based initiatives (e.g. fair trade, donor-led developmental policies) intersect or clash with local moral economies, and to research which new rationalities for action emerge from these encounters.

References

Central Tea Co-operative Federation Ltd. Nepal (2020): Tea Producer District Cooperative Federation Ltd. Ilam. https://www.ctcf.org.np/associate_members.php?id=18 (02.07.2020).

Esri (Environmental Systems Research Institute) (2018): India District Boundaries 2018. <https://esri.maps.arcgis.com/home/item.html?id=12fc8ff238e7420ea43906a9a33a9aab> (28.09.2018).

Friberg, K. & Götz, N. (2015): Introduction to the Thematic Issue 'Moral Economy: New Perspectives. In: Journal of Global Ethics 11(2): 143–46.

Götz, N. (2015): Moral Economy': Its Conceptual History and Analytical Prospects. In: Journal of Global Ethics 11(2): 147–62.

HDX (Humanitarian Data Exchange) (2018): Nepal administrative level 0-2 and district polygons, points, and lines. https://data.humdata.org/m/dataset/administrative-bounadries-of-nepal?force_layout=light (14.08.2018).

International Co-operative Alliance (2016): What Is a Co-Operative. <http://ica.coop/en/what-co-operative> (2016).

International Trade Center (2020): Nepal. Country Brief. <http://www.intracen.org/country/nepal/> (02.07.2020.)

Kaiser, C. & Rothfuß, E. (2013): Vom Individuum Zum Kollektiv. Eine Moralökonomische Reformulierung Des Livelihoods-Konzeptes. Working Paper Series No. 12. Passau.

National Tea and Coffee Development Board (2020): Statistics. <http://www.teacoffee.gov.np/teainfo/statistics2> (02.07.2020).

Palomera, J. & Vetta, T. (2016): Moral Economy: Rethinking a Radical Concept. In: Anthropological Theory 0(0): 1–21.

Scott, J. C. (1976): The Moral Economy of the Peasant: Subsistence and Rebellion in Southeast Asia. New Haven/London: Yale University Press.

Thompson, E. P. (1971): The Moral Economy of the English Crowd in the Eighteenth Century. In: Past and Present 50(1): 76–136.

UNDESA (United Nations Department of Economic and Social Affairs) (2020): Social Development for Sustainable Development. <https://www.un.org/development/desa/dspd/2030-agenda-sdgs.html> (02.07.2020).

UNDP (United Nations Development Programme) (2020): Strength in Numbers: How the Cooperative Movement Could Help Make Good on the SDGs. <https://www.np.undp.org/content/nepal/en/home>

</presscenter/articles/2019/Development-Advocate-strength-in-numbers.html> (02.07.2020).

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Towards the governmentality of risks and disasters? Urban floods and their mitigation in Mumbai

Theresa Zimmermann

Keywords: Governmentality, regimes of praxis, flood risk management, Mumbai

Introduction

Several large Indian cities faced severe floods in recent years, such as Mumbai in 2005, 2017 and 2019, Surat in 2006, Kolkata in 2007, Srinagar in 2014, Chennai in 2015 and Kolhapur in 2019. Floods are reported to be the most destructive type of disaster event in India and account for 77% of the overall economic losses (Chatterjee 2010: 38). More than 2000 Indian cities and towns are located in districts which experienced floods in the past two decades (SEEDS & CRED 2018). Urban floods are not a recent phenomenon in India, as the severe floods in Hyderabad in the year 1908 demonstrate. However, due to the growth of cities, more people are affected, and more attention is drawn towards urban floods (Gupta & Nair 2011, Rafiq et al. 2016). Urban growth and changes in land use as well as climate-induced changing patterns of monsoonal rainfalls can lead to an increasing number, scale and impacts of urban floods (NDMA 2010, Zope et al. 2015, Nithila Devi et al. 2019). Research on urban floods reveals how population, assets and potentials to cope with flood risks and impacts are unevenly distributed spatially and socially. Studies from Mumbai show that people forced to live in environmentally fragile locations have been most severely affected by the 2005 floods (Parthasarathy 2009, Chatterjee 2010, Samaddar et al. 2011). Hence, urban floods are entangled with a city's socio-economic and physical development and can disclose existing patterns of vulnerability. Correspondently, strategies, mechanisms and practices to mitigate and cope with flood risks are linked to urban socio-cultural fabrics and power relations. This contribution draws on approaches of Foucauldian governmentality studies (Foucault 2007) and more specifically regimes of practice (Dean 2009) to analyze how floods are problematized and made governable in Mumbai. From a socio-constructivist perspective, it reveals how urban flood disasters, the risks of future floods and practices that have evolved to prevent them and mitigate impacts can be studied. Thereby, the contribution explores the potential of governmentality as an analytical approach for geographical research on risks and risk reduction in the Indian context.

Theory and methodology

From a sociological constructivist understanding, risks and disasters are socio-cultural constructions

(Quarentelli 1985, Douglas & Wildavsky 1985, Dombrowsky 1989, Tierney 2015, Voss & Dittmer 2016, Oliver-Smith 2017). What is considered as risk or disaster depends on the perceived stabilized order; a disaster is then the deviation of normality. Actors construct disaster risks and their causes, consequences and remediation strategies differently according to their social position, experiences and interests (Tierney 2015, Voss & Dittmer 2016). Risk management strategies are considered as expressions of dominant risk constructions.

Governmentality studies, the analytics of a Foucauldian understanding of government, help to assess the way the specific form of urban disaster risk reduction has historically evolved, to identify the elements that constitute it and to investigate the processes and relations by which these elements are assembled into practices and forms of organizations (Dean 2009: 31). Foucault's notion of governmentality has often been described as "conduct of conduct" (Foucault 2007, Dean 2009: 17) of individuals or groups, either by others or by processes of self-governance. Individuals or collectives conform to, produce, resist or negotiate rules in order to achieve a joint objective, such as reduced flood risks. Whereas a variety of different conceptual approaches exist, this contribution understands governmentality as the entirety of institutions, practices and technologies that enable the exercise of power (Dean 2009: 18, Bohle 2018: 127). Considering all persons to govern and to be governed, the focus does not solely rest on political institutions. It enables the systematic analysis of relationships between power techniques and forms of knowledge across different scales and their interconnections. This allows to research the historic development and the specific characteristics of, as well as changes and transformations within, a regime of practice. Such a regime of practice, e.g. a risk management regime, is understood as a historically grown „assemblage of policies, strategies, and regulations that collectively define a dominant paradigmatic management approach" – a specific type of risk governance (Dean 2009, Solecki et al. 2017). Mitchell Dean (2009: 41-43) suggests the analysis of such regimes along four dimensions (see Fig. 1): the fields of visibility (Who and what is to be governed?); the technical aspects of government (How is authority and rule accomplished?); the

episteme or rationality (How do thoughts and knowledge enable to render the issues and problems governable?); and the formation of subjects and identities (What forms of person, self and identity are presupposed and elicited by practices of government?). An analysis along these lines can disclose the enmeshed power relations and negotiations in the respective field as well as contradictions, contestations, and conflict potentials.

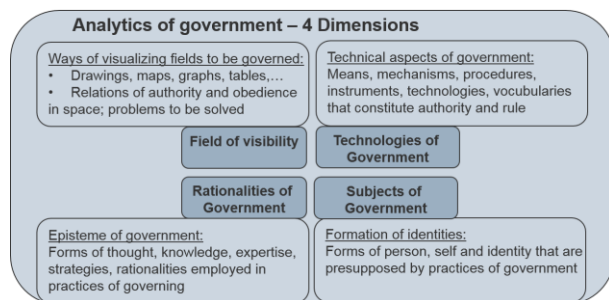


Fig. 1: Four dimensions for the analysis of regimes of praxis based on Dean (2009: 41–43)

Drawing on Mitchell Dean's analytics of government, this study focuses on the governmentality of flood risks and assesses the formation of the specific urban risk governance regime, the elements that it consists of and their origin, and the processes and relationships through which these elements are assembled into relatively stable organizational forms and institutional practices. The research work draws on literature review, the analysis of national-, state-, city- and ward-level policy and planning documents, as well as semi-structured interviews with government officials, researchers, journalists and NGO workers. Furthermore, a case study in the northwestern suburb Dahisar was conducted, including field visits with observations, transect walks, ad-hoc focus groups and informal discussions. Field work was conducted between October 2015 and January 2016 and between January and May 2019.

Urban floods and their mitigation in Mumbai

Mumbai is an interesting case study as the city has a history of both, annual floods and water logging as well as disastrous floods. Especially the floods triggered by intensive rainfall in the end of July 2005 had devastating impacts. More than 100 low-lying areas and up to 60% of Mumbai's surface were severely inundated through waterlogging or river overflow. Hundreds of people lost their lives by drowning, electrocution, landslides or flood-related illnesses and hundreds of thousands suffered from water-borne diseases (Gupta 2007). Both authorities and affected people considered the floods as *disastrous* due to the unimaginable amounts of rainfall, the unprecedented and exceptional scale and the devastating impacts of the floods (Zimmermann 2019). Affecting the financial capital of India with a very high population density, heterogeneous communities and scarce space, the 2005 floods revealed Mumbai's vulnerabilities. After 2005, the

Municipal Corporation and the State of Maharashtra have augmented and constantly enhanced the city's disaster management system. Flood governance has become a component of Mumbai's pluralized urban governance structures (Parthasarathy 2015). Mumbai has a large number of poor and marginalized inhabitants as well as informal settlements and workforce, and faces socio-spatial fragmentation, a shortage of (public) space, water and housing and intense development pressure, especially in the core city. In addition to these conditions, flooding has become a factor that constantly needs to be negotiated in the city and amongst its residents. As a complete governmentality study on urban flood risk management in Mumbai would exceed the scope of this contribution, it focusses on questions on Mumbai's dominant flood risk management regime through Dean's four dimensions (see Fig. 1) and exemplarily reveal contestations.

Visibility: Visualizations depict and construct risk in a certain manner. Dominant forms of visualization can highlight specific understandings of risk and support respective techniques of governing this risk while neglecting or downplaying others. Main questions to study the field of visibility include how urban floods and flood risk reduction are constructed as problems and how they are represented and visualized. In Mumbai, both authorities and residents portray the 2005 floods as "wake up call" and "focusing event". Thereafter, perceptions of flood risks, discourses and practices surrounding floods and risk reduction have considerably changed. The evolving flood risk management regime draws on existing statistics and produces new data regarding flood risks, such as rainfall projections and mappings of flood prone spots. Media coverage surrounding the monsoon season – including the status of monsoon preparedness measures – has considerably increased. Individuals and communities use further practices like the observation of the heights of the river to visualize the risk of floods in the neighborhood, as this quote by a resident of the field study location demonstrates: *"The color from the pillars was washed away by the water. This helps us to see now the danger level of the water. When it passes the point where color was washed away, we know that it is getting dangerous."* (Resident_14 2019)

Technologies of government: A study of the techniques to cope with flood risks include forms of action that have been or are newly established and procedures, instruments, technologies and vocabularies that constitute authority and rule with regard to floods, both on institutional and individual levels. In Mumbai, individual measures include the upgradation of buildings and property, the seasonal safe storage of goods and belongings, the use of messengers and other communication channels for warnings. Institutional measures comprise the compilation of disaster management plans and annual flood management guidelines, but also hazard-focused

measures (Texier-Teixeira & Edelblutte 2017), including the installation of rainfall gauges or surveillance cameras, the establishment of disaster control rooms, management practices like the dredging of rivers before monsoon and education and training of residents, volunteers and professionals. Furthermore, authorities initiated structural measures like constructing flood retention walls along rivers and evicted or resettled several settlements close to water bodies (Fig. 2). These government techniques are contentious as they do not benefit all communities equally and have been challenged, e.g. by environmentalists who oppose the channeling of rivers.



Fig. 2: Flood retention wall in Mumbai's northwestern suburb Dahisar (Photo: T. Zimmermann 2019)

Rationalities: Discourses and practices of governing flood risks are drawing on certain forms of knowledge and expertise. Central questions are: How is the need for action and the types of actions justified and augmented for? How are risks conceptualized? Why and how are floods considered *disastrous*? In Mumbai, flood risks are often debated in the context of vulnerabilities (of individuals or certain societal groups, areas and localities or the city as a whole) and resilience (of both communities and of "Mumbaikars" more generally). In recent years, climate change and changing monsoonal patterns have emerged as discursive framings of urban floods. Government agencies like the Disaster Management Unit of the Municipal Corporation use these discourses to rationalize the installation of e.g. rainfall gauges. In contrast, representatives of NGOs and academia highlight the role of mangrove destruction, larger development and infrastructure projects. All these arguments draw on expertise of global players and inter-scale interactions.

Subjects and formation of identities: A flood risk management regime builds on, presupposes, elicits and forms subjects and identities: specific practices presuppose certain forms of person, self and identity. Certain forms of conduct are expected from those who govern and those who are governed. Who is considered responsible for both risks and measures to prevent new risks or reduce existing risks? How do individuals perceive their own role? In the case of Mumbai, (informal) settlements and their residents close to riverbanks are often considered as aggravating flood risks and official plans foresee their

eviction or resettlement. Additionally, individuals are held responsible for increasing flood risk, e.g. by throwing solid waste into rivers or the drainage system. Citizens even blame each other, as the following quote demonstrates: *"People in the vicinity – in slum areas – are main cause of the flood. They don't allow the passage of water; they throw garbage in the river."* (Resident_7 2019)

These four dimensions overlap and substantiate each other. For example, the eviction and resettlement of settlers close to rivers is part of plans and procedures to mitigate flood risks both for themselves and other nearby settlements. Local and state level authorities as well as some NGOs justify this procedure with arguments that consider (informal) settlements as responsible for clogging the water bodies – both by buildings and by waste. Academicians, NGOs, civil society groups and affected residents contest the construction of walls and evictions both discursively, e.g. in media reports, and through their practices, e.g. by moving back after being evicted. While government agencies and engineers highlight the potential benefits of the retention walls, ecologists protest the channelization of rivers and others see their lives and livelihoods affected: *"The removal takes place because of the flood. We have nothing against the widening, all we want is to get a house. It should be here or nearby. We were offered land (...), but people there did not want us to come."* (Resident_3 2015) and *"People were living close to the river; they have been resettled to various places, [...]. But some have come back on rental basis because they have their jobs here."* (Resident_6 2019)

Conclusion

Mumbai's flood risk management regime has evolved over decades and has seen considerable modifications after the devastating floods of 2005. As increased heavy rainfall events and subsequent floods are projected for the future, it is important to understand how its risk management regime is embedded in societal power-knowledge structures. The visualization and problematization of flood risks and techniques to govern floods are backed by sets of thoughts, rationalities and knowledge that presuppose and form subjects and identities.

In sum, drawing on Foucault's governmentality and Dean's four analytical dimensions complements the existing body of research on risk management by expanding the understanding of risks, by acknowledging the socio-political, historical, spatial and scalar embeddedness of a certain regime and by identifying contestations surrounding a dominant regime. It furthermore enables the analysis of changes and transformations of risk management regimes. For example, the Covid-19 crisis and the weeks-long lockdown in spring and summer 2020 might significantly change the way risks are perceived and approached upon in Mumbai.

References

- Bohle, J. (2018): Hurricane-riskscape and governmentality. In: *Erdkunde* 72(2): 125–134.
- Chatterjee, M. (2010): Slum dwellers response to flooding events in the megacities of India. In: *Mitigation and Adaptation Strategies for Global Change* 15(4): 337–353.
- Dean, M. (2009): *Governmentality. Power and rule in modern society*. 2. ed., reprint. Los Angeles.
- Dombrowsky, W. R. (1989): *Katastrophe und Katastrophenschutz. Eine soziologische Analyse*. Wiesbaden.
- Douglas, M. & Wildavsky, A. (1985): *Risk and Culture. An Essay on the Selection of Technological and Environmental Dangers*. Berkeley and Los Angeles.
- Foucault, M. (2007): *Security, Territory, Population. Lectures at the Collège de France 1977-1978*. Houndmills.
- Gupta, A. K. & Nair, S. S. (2011): Urban floods in Bangalore and Chennai: risk management challenges and lessons for sustainable urban ecology. In: *Current Science* 100(11): 1638–1645.
- Gupta, K. (2007): Urban flood resilience planning and management and lessons for the future. A case study of Mumbai, India. In *Urban Water Journal* 4(3): 183–194.
- NDMA (2010): *National Disaster Management Guidelines. Management of Urban Flooding*. Government of India. New Delhi.
- Nithila Devi, N., Sridharan, B. & Kuiry, S. N. (2019): Impact of urban sprawl on future flooding in Chennai city, India. In: *Journal of Hydrology* 574: 486–496.
- Oliver-Smith, A. (2017): The social construction of disaster risk: Seeking root causes. Editorial. In: *International Journal of Disaster Risk Reduction* 22: 469–474.
- Parthasarathy, D. (2009): Social and environmental insecurities in Mumbai. Towards a sociological perspective on vulnerability. In: *South African Review of Sociology* 40(1): 109–126.
- Parthasarathy, D. (2015): Decentralization, pluralization, balkanization? Challenges for disaster mitigation and governance in Mumbai. In: *Habitat International* 52: 1–9.
- Quarentelli, E. L. (1985): What is disaster? The need for Clarification in Definition and Conceptualization in Research. Article #177, Delaware.
- Rafiq, F., Ahmed, S., Ahmad, S. & Khan, A. A. (2016): Urban Floods in India. In: *International Journal of Scientific & Engineering Research* 7(1): 721–734.
- Samaddar, S., Misra, B. A., Chatterjee, R., Tatano, H. (2011): Identifying Vulnerability Pattern in a Flood Prone Micro-Hotspot of Mumbai, India. In: 2nd International Conference on Environmental Science and Development 4: 104–109.
- SEEDS & CRED (2018): *Decoding the Monsoon Floods in Bangladesh, India, Myanmar and Nepal*. New Delhi.
- Solecki, W., Pelling, M., Garschagen, M. (2017): Transitions between risk management regimes in cities. In: *Ecology and Society* 22(2):38.
- Texier-Teixeira, P., Edelblutte, E. (2017): Jakarta: Mumbai—Two Megacities Facing Floods Engaged in a Marginalization Process of Slum Areas.' In: Sudmeier-Rieux, K., Fernández, M., I. Penna, M. Jaboyedoff, J. Gaillard (Eds.): *Identifying Emerging Issues in Disaster Risk Reduction, Migration, Climate Change and Sustainable Development*. Basel, 81–99.
- Tierney, K. (2015): Foreword. In Egner, H., Schorch, M., Voss, M. (ed): *Learning and Calamities: Practices, Interpretations, Patterns*. New York.
- Voss, M., Dittmer, C. (2016): Resilienz aus katastrophensoziologischer Perspektive. In: Wink, R. (ed) *Multidisziplinäre Perspektiven der Resilienzforschung*. Wiesbaden, 179–197.
- Zimmermann, T. (2019): Exceeding the imaginable - changing perspectives on monsoon in Mumbai. In: Bremner, L. (Ed.): *Monsoon [+ other] waters*. London, 235–244.
- Zope, P. E., Eldho, T. I., Jothiprakash, V. (2015): Impacts of urbanization on flooding of a coastal urban catchment: a case study of Mumbai City, India. In: *Natural Hazards* 75(1): 887–908

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Agriculture in flux: Insights into agricultural transformations and possible scenarios in South Punjab, Pakistan

Keywords: Agricultural intensification, Green Revolution, Climate Change Adaptation, Pakistan

Multifaceted challenges and myopic solutions

The Global Climate Risk Index 2019 lists Pakistan as one of the most vulnerable countries to long-term climate risk (Germanwatch 2019). In Pakistan, the agricultural sector employs nearly 40% of the national labor force (Government of Pakistan 2019) and almost 65% of farmers are characterized as smallholders with equal to or less than 2 hectares of plot size (Government of Pakistan 2010). Thus, a majority of the population are agrarian actors with limited resources. Therefore, climate change induced losses in agricultural yields will have devastating and irrevocable consequences.

At the same time, climate change is but one of the many pressures on agriculture. The population is growing at an annual rate of 2.4% (Pakistan Bureau of Statistics 2017). Rural to urban migration is estimated to increase a staggering 3% per year—and it has been partly attributed to climate change induced decrease in agricultural productivity (Saeed, Salik & Ishfaq 2016). Concurrently, political instability and poor governance especially in rural areas exacerbates the food security situation and adds to widespread prevalence of malnourishment (Newman 2018). The ongoing Covid-19 pandemic highlights the precariousness of a food network marked by severe inequality as millions struggle to meet basic needs as country-wide containment breaks down agricultural production chains. Market instability and price shocks have been brought into public scrutiny for their role in increasing food inequity (Arab News PK 2020). Available productive land is also shrinking; desertification and land degradation is noted to affect 68 million hectares of land due to wind and water erosion as well as depleting fertility of soil (Khan, Ahmed & Hashmi 2012).

Currently, the government's approach to these multifaceted challenges is a policy of agrarian intensification—widely understood as an increase in agricultural output per unit of input—through technological innovation, in continuation of the spirit behind the Green Revolution of (Byerlee & Siddiq 1994). The recently announced 2019 agriculture policy focuses on improving yields of 'high-value' crops through modernization and mechanization (The Express Tribune 2019). Furthermore, under the Chinese Belt and Road Initiative, locally termed

China-Pakistan Economic Corridor (CPEC)—currently the largest source of foreign direct investment in Pakistan—major investments to 'modernize' agriculture in Pakistan are planned (The News 2020). Moreover, public research is also investing heavily in genetically modified varieties that are expected to ensure stable cotton supply (ISAAA 2019).

The history of the Green Revolution in Pakistan has demonstrated that intensification and modernization strategies to increase productivity is a myopic solution to agricultural problems as they neglect social and ecological side effects and render the above mentioned challenges as problems to be solved merely by technological solutions. Thus, there is a need of delineating solutions to agrarian problems that include careful consideration of processes of environmental change as well as the needs of lesser affluent strata of farmers.

Context and research methodology

Given the multifaceted challenges and changes faced by agriculture, I attempt to inquire how these changes are manifested and confronted in one of the most significant growing regions of Pakistan: South Punjab. This area is representative of commercial agriculture in Pakistan. Although it grows most of the major cash crops, it is mainly known for cultivating cotton in the monsoon growing season and thus figuratively termed the 'cotton belt'.

The region underwent major agricultural transformations in light of the Green Revolution of the '60s and '70s with the introduction of agricultural intensification via high-yielding varieties, chemical fertilizers, and agricultural machinery. Historical analyses of the Green Revolution in South Punjab have demonstrated that the use of high yielding inputs in Pakistan spawned land degradation and exacerbation of social inequality for decades (Amjad 1972, Byerlee & Siddiq 1994, Murgai, Ali & Byerlee 2001, Niazi 2004). Despite some early productivity gains (Amjad 1972), the strata of society most in need remained deprived of the benefits as the yield benefits remained highly concentrated in the hands of higher classes of farmers who could afford to adopt the new varieties (Niazi 2004).

Furthermore, the threat of ecological devastation in the form of reduced genetic diversity and increased

vulnerability to wide-spread pest infestation also emerged as a major concern with the advent of the Green Revolution in the region (Freebairn 1995). Most importantly, it has been argued that the yield gains of the Green Revolution came at the expense of resource degradation due to expansion of fertilizer use, increased cropping intensity, and switching from rain fed to groundwater irrigation. (Byerlee & Siddiq 1994).

Currently, South Punjab is particularly subjected to ecological degradation as well as extreme weather events linked to climate change, such as floods and heat waves. Despite these complex challenges, recent scholarship on agricultural adaptation in this region has been largely preoccupied with measures related to maintaining or improving yields under changing ecological conditions. (Hussain & Mudasser 2007, Ahmad, Mustafa & Iqbal 2015, Khan et al. 2016, Ali et al. 2017).

I aim to counter this productivity narrative in agrarian studies by investigating the path dependent land use changes in the cotton belt of South Punjab to uncover: (1) ecological impacts of intensification, particularly in the post-Green Revolution era (post-1974), (2) smallholder perspectives on expensive technological solutions, and (3) actors and elements that are overlooked in productivity focused solutions, which ultimately fail to address the complex question of food security in a changing climate. This study is part of my doctoral research on socially and ecologically sustainable alternatives to agrarian intensification in South Punjab.

As a first step, an explorative field research was held from November till December 2019 in four districts in the cotton belt of South Punjab involving 57 farmers and relevant local experts, such as agricultural extension officers, NGO representatives, and academic researchers. I used guiding questions about recent land use changes, the concerns of farmers, and the changing farming practices to approach (current and future) ecological and social challenges.

Insights on changing ecological elements

Farmers perceive climate change as a warming trend with an increase in extremely hot days per year. Although the source of these microclimatic changes remain to be determined, the slightest temperature increase here is serious as this region historically has the highest nationwide maximum-recorded temperatures (Salma, Rehman & Shah 2012). High temperatures reduce the phenological crop phase of cotton, for instance, and thereby negatively affect the development of the economically significant cotton boll. Erratic rain patterns are also reported by the informants. Drought is of particularly less concern as far as agriculture is concerned, as the region is dominated by irrigated agriculture. However, the untimely post-monsoon rains and storms cause damage to cotton stands and negatively impact yields.

A general adaptive response reported by farmers is to intensify the use of inputs such as irrigation water and chemical fertilizers to “guarantee” sufficient yields and economic gains, which, on the contrary, renders farming so expensive that most smallholders barely break even. Some farmers also vary the sowing and harvesting times to avoid high mean temperatures as well as to capture high prices towards the end of crop season when market supply has diminished. This, however, is an option limited to major landowners as small and medium-size farmers are tied in repeated cycles of debt with middlemen who demand timely payment of debt in the form of agrarian output.

Recurring bouts of pest infestations complicate the situation; the genetically modified (Bt) cotton varieties, once celebrated as the solution to farmers’ woes, are now defenseless against the pink bollworm (*Pectinophora gossypiella*), which affects lint and seed quality and has developed resistance against Bt cotton (see Fig. 1). Since its introduction in Pakistan in early 2000s, the overtime cross-breeding of Bt cotton with local varieties is one the factors that has diminished the effectiveness of Bt. This has rendered progressively more area under cotton cultivation vulnerable to pest infestations. Farmers report an overtime increase in pest sprays, partly due to the recurring pest infestations and partly due to the ineffectiveness of “fake” pesticides.



Fig. 1: Farmer showing pink bollworm in Bt cotton boll (Photo: M. Zuberi 2019)

Farmers also report over irrigation and reduced fallowing in an attempt to secure output despite unfavorable weather conditions and fields rife with pest attacks. This is owing to a continuing trend towards mechanization of agriculture. Technological developments and availability of agricultural credit over the previous couple of decades made machinery such as tractors and rotavators a staple on the field that intensify soil use.

Motorized ground water pumps make sole reliance on canal water for irrigation obsolete—a recourse only available to the more affluent landholder. Resultantly, farmers report that land under cultivation has increased significantly in comparison to some decades ago when parcels of land could be left fallow for a season. These practices, together with a deficient irrigation network—dating back to the colonial era—

with ground water seepage and in the absence of a proper drainage system, contribute to salinization which renders land infertile.

Insights on socio-economic developments

In light of the various climatic and pest related problems facing agriculture, some stakeholders place hope in technological remedies. Despite the unfavorable outcome of genetically modified Bt cotton, the public and private research is investing in development of genetically modified and hybrid heat tolerant varieties of crops. In recent decades, hybrid varieties of rice, maize, vegetables, and fruits have become a significant source of agricultural income for more affluent farmers.

This development has been facilitated by multidimensional factors. The Seed (Amendment) Act 2015 and the Plant Breeders' Rights Act 2016 are some of the policy related underpinnings that have made investment in patented hybrid varieties profitable for local and international agribusiness. This has resulted in a boom for local agribusinesses. Although multinational agribusinesses are attributed to having introduced hybrid varieties, the previous two decades has seen a proliferation of locally owned agribusinesses that distribute imported seeds. Thus, transnational agricultural cooperation also plays a major role in the recent 'hybrid boost'. Especially in the case of CPEC, Chinese agri-investments will likely expand cultivated area in Punjab under hybrid production.

Currently, production of hybrids in combination with tunnel farming was observed (see Fig. 2). Farmers report that the increased income from year-long cultivation of previously only-seasonal fruits and vegetable was a major attraction. Despite questions of loss of genetic diversity and seed sovereignty being raised by academics, the increasing commercialization and modernization of agriculture plays a major role in the wide-spread acceptance of genetically modified and hybrid seeds by most farmers.

Through these developments, in a region that has historically only cultivated cotton in the monsoon growing season, diversification towards other food crops is rampant. Farmers opine that the golden era of cotton, both in terms of yields and market rate, ended around 2014-2015 and so they search for alternatives. While some cotton field have been permanently converted into tunnel farms by affluent farmers, some so called "progressive" farmers have responded to the alleviated market for fruits such as mangos and citrus by slowly but steadily converting cotton fields into mango orchards, a process that entails several years of going without economic returns from those plots while fruiting trees mature. This development especially occurs in areas where farmers receive access to the regional markets due to infrastructural development such as roads or

highways through the sway of elected political leadership or, in some cases, the Chinese Belt-and-Road Initiative.

Another socio-economically important development is the process entailing reduction of average farm sizes can be discerned as land is passed from generation to generation. Small scale farmers can no longer afford to live from agriculture as their farm plots shrink while they are forced to compete with the economies of scale of affluent farmers investing in high-yielding hybrids. When asked about alternative livelihoods in light of unprofitability of agriculture, one farmer answered despondently: *"And do what? There is nothing else to do."*



Fig. 2: Tunnel farms in district Multan (Photo: M. Zuberi 2019)

Conclusion and outlook

The productivity narrative in agricultural policies results in a clear divergence between private profit and public well-being as far as incentives to farmers are concerned. Productivity centered public incentives, such as subsidies for mechanical inputs, begot intensification led increase in yields, however with a degradation of resources overtime. These exacerbate social disparity between the different strata of farmers: the affluent ones accrue profits from their intensive farming practices while poorer stakeholders suffer the brunt of the ecological degradation risks. Secondly, intensification related incentives are by default aimed at enterprising or "progressive" farmers and they further distort already unequal relations of production. The trend towards intensification and higher productivity varieties is pricing smallholders out of agriculture with limited recourse. In a country where the majority of farmers are smallholders this is an alarming situation and deserves a revision of agricultural policy priorities.

Two comparative case studies are planned to investigate the processes, drivers, consequences of, and alternatives to productivity centered agrarian approaches in selected villages. Investigating the diversity of local challenges and adaptive strategies to change should help to demonstrate feasible future sustainability pathways that go beyond yield increases.

References

- Ahmad, M., Mustafa, G. & Iqbal, M. (2015): Impact of Farm Households' Adaptations to Climate Change on Food Security: Evidence from Different Agro-ecologies of Pakistan. In: *The Pakistan Development Review*, 55: 561-588.
- Ali, S., Liu, Y., Ishaq, M., Shah, T., Abdullah, Ilyas, A. & Din, I. U. (2017): Climate Change and Its Impact on the Yield of Major Food Crops: Evidence from Pakistan. In: *Foods*, 6(13).
- Amjad, R. (1972): A critique of the green revolution in West Pakistan. In: *Pakistan Economic and Social Review*, 10: 17-41.
- Arab News PK (2020): After wheat crisis, Pakistan is facing sugar shortages. www.arab.news/n7rfr (23.01.2020).
- Byerlee, D. & Siddiq, A. (1994): Has the green revolution been sustained? The quantitative impact of the seed-fertilizer revolution in Pakistan revisited. In: *World Development*, 22(9): 1345-1361.
- Freebairn, D. K. (1995): Did the Green Revolution Concentrate Incomes? A Quantitative Study of Research Reports. In: *World Development*, 23(2): 265-279.
- Germanwatch (2019): Global climate risk index 2019. Germanwatch, Bonn.
- Government of Pakistan (2010): Agricultural Census Report.
- Government of Pakistan (2019): Pakistan Economic Survey 2018-2019.
- Hussain, S. S. & Mudasser, M. (2007): Prospects for wheat production under changing climate in mountain areas of Pakistan – An econometric analysis. In: *Agricultural Systems*, 94(2): 494-501.
- ISAAA (2019): Pakistan Announces National Coordinated Trials of 85 Bt Cotton Varieties. www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=17397 (17.04.2019).
- Khan, M. A., Ahmed, M. & Hashmi, H. S. (2012): Review of Available Knowledge on Land Degradation in Pakistan. International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo.
- Khan, M. A., Khan, J. A., Ali, Z., Ahmad, I. & Ahmad, M. N. (2016): The challenge of climate change and policy response in Pakistan. In: *Environmental Earth Sciences*, 75(412).
- Khan, M. H. (1981): The Political Economy of Agricultural Research in Pakistan. In: *The Pakistan Development Review*, 20(2): 191-213.
- Murgai, R., Ali, M. & Byerlee, D. (2001): Productivity Growth and Sustainability in Post-Green Revolution Agriculture: The Case of the Indian and Pakistan Punjab. In: *The World Bank Research Observer*, 16(2): 199-218.
- Newman, E. (2018): Food security and political unrest in Pakistan: Case study report. School of Politics and International Studies, University of Leeds.
- Niazi, T. (2004): Rural Poverty and the Green Revolution: The Lessons from Pakistan. In: *The Journal of Peasant Studies*, 31(2): 242-260.
- Pakistan Bureau of Statistics (2017): Press Release on Provisional Summary Results of 6th Population and Housing Census. www.pbs.gov.pk/content/provisional-summary-results-6th-population-and-housing-census-2017-0 (n.d.).
- Saeed, F., Salik, K. M. & Ishaq, S. (2016): Climate induced rural-to-urban migration in Pakistan. Sustainable Development Policy Institute (SDPI), Islamabad.
- Salma, S., Rehman, S. & Shah, M. A. (2012): Rainfall Trends in Different Climate Zones of Pakistan. In: *Pakistan Journal of Meteorology*, 9(17): 37-47.
- The Express Tribune (2019): With focus on modern methods, Punjab unveils agri-policy. www.tribune.com.pk/story/1914873/2-focus-modern-methods-punjab-unveils-agri-policy/ (20.02.2019)
- The News. (2020): CPEC: the bigger picture. www.thenews.com.pk/print/606083-cpec-the-bigger-picture (30.01.2020)

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