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RESEARCH PAPER

Political Ecology of Urban Agricultural Pollution: Cultivating the Yamuna Floodplains in Delhi

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Abstract: The Yamuna *khadar* or the floodplains of the river Yamuna in Delhi is a deeply contested agrarian space. While thousands have been involved in farming these floodplains for decades, contestations over their legality, compensation, land use, displacement, and impact on the river, soil, and city have been significant public concerns over the last few decades. In this paper, I focus on one aspect of this agrarian landscape—the toxicity associated with river water due to the pesticides and fertilizers used in agriculture. I examine how toxicity is perceived, discursively constructed, and dealt with by differently located stakeholders in this landscape. The differently located stakeholders associated with the toxic agrarian landscape of Yamuna khadar are not experiencing pollution as a homogenous community, i.e., neither all of them see themselves as suffering from pollution nor do they see themselves as contributing to the toxicity of the landscape in a similar way.

Keywords: Toxicity, Commercial agriculture, Floodplain, Uncertainty, Lay epidemiology, Urban ecologies.

1. INTRODUCTION

Yamuna *khadar* or the floodplains of the river Yamuna in Delhi, a 22 km stretch passing through the city, has historically been cultivated by the agrarian castes residing in the villages along the river. With rapid urbanization, the site has undergone deagrarianization, i.e., close to 2000 hectares of agrarian land around the river has been acquired over the last 60 years for projects like roads, flyovers, metro rails, urban parks, temples, Commonwealth Games villages, compensatory afforestation drives, and biodiversity conservation projects. However, the acquisition of the land has

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not led to the immediate dispossession of agrarian communities from the khadar. Indeed, agrarian communities and poor migrant tenants have found ways to continue cultivating in the khadar even following the acquisition of land, although in a highly precarious manner. This phenomenon can be acknowledged as a case of "incremental dispossession" (Oskarsson, Lahiri-Dutt, and Wennström 2019), whereby dispossession is not a moment/event which is followed by crisis. Instead, it is gradual, intermittent, and incremental, and it results in uncertainty and anxieties about dispossession among agrarian actors. The process reflects the changing nature of agriculture, the agrarian structure, property relations, conflictual claims to land, and speculation by agrarian actors. This kind of incremental dispossession, over the years, is legitimized via discourses of urbanization, development, encroachment by the poor, and (currently) under transnational discourses on environmentalism and the "world-class city[1]", whereby cities of the Global South are understood to be suffering from a crisis of underdevelopment, unsustainable urbanization, and ecological disorder (Rademacher 2011). In order to overcome this crisis, infrastructural, environmental, and recreational projects, which are backed by experts and state agencies, take precedence over the land-based livelihood activities of agrarian communities and poor migrants (Baviskar 2011; Nagendra 2016). Therefore, the Yamuna khadar has become a deeply contested agrarian space. While thousands have been farming these floodplains for decades, contestations over legality, compensation, land use, displacement, the toxicity of the river and groundwater, the quality of vegetables, the soil, and the city have been significant topics of public concern in the last few decades. In this paper, I focus on only one aspect of this contested agrarian landscape: the discourse on the toxicity of the river water, pesticides, and fertilizers used in agriculture.

To understand the contestations around toxicity in the khadar, I analyse the National Green Tribunal (NGT) ban[2] (discussed in detail in the section 2.1 of this essay) on cultivation in this region and the reaction of the locals to this ban. This decision to ban cultivation is premised upon "expert

[1] Phrase taken from Ghertner (2015).

[2] This ban is discussed in detail later. In short, the NGT states that "unless the river is restored to its original health, the agricultural activity would result in seriously jeopardising the environment as well as human health. The period involved in the restoration (cleaning of river and floodplains) under the project approved by the Tribunal is not very long. The prohibition of cultivation is not of [a] permanent nature but is only for a limited period of two and a half years" (44). The ban was for 2.5 years, but agriculture in the *khadar* has become more precarious since the ban.

knowledge," whose validity is contested by locals. In this paper, I first consider how the locals contest the "expert claims", which are based on "scientific evidence" provided by agencies whose reports contradict NGT claims. Second, I show how locals also invoke lay epidemiology, which is situated within a larger socio-political system based on unequal power relations (Lora-Wainwright 2013a). I demonstrate how locals' experience (and definition) of toxicity is influenced by lay epidemiology, which factors in existing concerns around livelihood, lack of affordable housing, and so on. In doing so, I depart from the existing literature on toxic experiences and popular epidemiology (Levine 1982; Brown and Mikkelsen 1990; Cable and Walsh 1991), which focuses on disputes wherein locals contest expert authorities who claim there is no toxicity. This paper highlights disputes in which expert authorities contest locals claiming that there is no toxicity.

This paper examines how toxicity is socially perceived, discursively constructed, and dealt with by differently located stakeholders in the landscape. The experience of living with pollution is not homogenous across all stakeholders because neither do they all see themselves as suffering because of pollution, nor do they see themselves as contributing to it. The Yamuna floodplains are not inert spaces. Rather, these contesting communities are embedded in the khadar, historically, socially, and economically. This paper explores the multiple experiences of toxicity in three sections: experts versus cultivators; toxicity and social life; and lay epidemiology: uncertainties and toxicities. These sections are preceded by a discussion on the methodology, aims, and objectives of this study.

2. METHODOLOGY

Between February 2019 and March 2020, I conducted an ethnographic study of agrarian communities in the Yamuna khadar to understand how the agrarian landscape is produced and experienced in their lives, and how it is affected by their understanding of the river, riverine ecology, community relations, state politics, urbanization, and market integration. The techniques of data collection included participant observation, interviews, life histories, and surveys. I examine the changing nature of agriculture and agricultural practices, cultivators' struggles and aspirations, the nature of ownership of land and labour relations, planting technologies, changing market demand, and the sociality that develops around the agrarian ecology of the khadar.

My research began with a pilot study of 10 regions in the Yamuna khadar. I conducted random surveys and interviews to explore practices of cultivation; relationships of cultivators with the land and river, and with local state

agencies/officers; the experiences accruing from the dirtiness of the river; the changing nature of agriculture; property tenurial arrangements, etc. I discovered that, firstly, cultivation in the khadar is regulated/facilitated via three property tenurial arrangements[3] which influences the social ecology of this space and vice versa. Secondly, rapid urbanization and the surge of migrants from Uttar Pradesh (primarily belonging to the Murav caste),[4] in recent years, have led to a shift from fodder crops to vegetable cultivation. Thirdly, cultivators experience toxicity differently from "experts". And lastly, the acquisition of land for infrastructural and development projects has not led to the disappearance of agriculture. Rather, agrarian communities have found ways to co-exist with these new developments.

For the purposes of clarity and rigour, I focus only on the Saapla-Ujjua[5] area of the khadar, where all the aforementioned trends were observable. I surveyed Saapla-Ujjua for two months while also conducting interviews with migrants and landowners. My primary respondent was Ganesh, a landowner who arranged a *jhopdi* (shack) on his farm for my stay, thereby facilitating my participation in community activities in the khadar. Ganesh's *khet* (agrarian field), which he rented from Sunil, another landowner, was located along the river, and could only be irrigated using the toxic river water. Ganesh introduced me to other migrants who had farms adjacent to his, and similarly used the toxic river water for irrigation. My interactions with Ganesh, Sunil, and other migrants allowed me to gain valuable qualitative insights into my field of study.

Transnational discourses on environmentalism and sustainability emphasize that biodiversity parks, clean rivers, afforestation drives, and walkways are essential to make cities "liveable". But how and for whom are cities becoming liveable (Gururani 2018)? By focusing on excluded communities, like the cultivators in the khadar, this paper highlights the problems of uneven development and exclusive urban ecologies. The NGT ban on cultivation—

[3] There are three types of property tenurial arrangements. The first is *dadalai zameen* (ancestral property), which is privately owned land. Another type is the land that was given on lease by the Delhi Development Authority (DDA) in 1949 to farmers of the Delhi Peasants Co-operative Multipurpose Society; the leases are subject to renewal every 10 years. This society became a defaulter in 1966. After many years of judicial struggle, the Supreme Court of India asked the farmers to vacate the land on 31 April 2020. The other category is the private land which got acquired in 1992 for channelization of the Yamuna River. The DDA, however, never took possession of the land. Meanwhile, the farmers got compensated for the land but are yet to be dispossessed and continue to cultivate.

[4] Classified as Other Backward Classes in Uttar Pradesh, India, they are gardening castes and are excellent at vegetable cultivation.

[5] In this paper, the names of people and places are pseudonyms.

and the contestations that followed—allows us to explore these inequities in detail. Spaces categorized as toxic by experts and environmentalists can be spaces of value for the poor and agrarian communities. Therefore, many communities continue to inhabit "toxic" spaces. Bans, of the kind imposed by the NGT, make the communities even more vulnerable and precarious. By highlighting the multiple experiences of toxicity and contestations around the NGT ban, I demonstrate the embeddedness of communities in toxic ecologies. To develop inclusive and just ecologies, environmentalist discourses must take such embeddedness into account.

2.1 Experts Versus Cultivators

> Large scale agricultural activity[,] on the river bank or floodplain, is one of the glaring examples of indirect impacts of environmental pollution. The vegetables grown in these areas, for which the direct source of irrigation is the ground water or water flowing in River Yamuna, are bound to be contaminated. We have noticed in some detail the serious health hazards, including diseases like cancer and other serious diseases from which the persons consuming such products may suffer. Thus, the agricultural activity needs to be stopped immediately to prevent further environmental and health hazards and in any case till the time Yamuna is restored to its original status and carries only wholesome water or the water which can be used for irrigation purposes, without exposing the residents of Delhi to serious diseases and health hazards…pesticides are being used and sprayed over the agricultural produce, which only makes them worse for human consumption in regard to the injury that they would cause to human health. (*Manoj Misra & Anr. Vs. Union of India & Ors. Original Application No. 6 of 2012* And M.A. Nos. 967/2013 & 275/2014, 43–4)[6].

"It is the polluted river which will become the reason for our displacement, and the irony is that we did not even dirty it. Yamuna was the reason for the continuance of our agriculture in the city since no construction could take place around the river, but now it will become the reason for our displacement." (Farmer Devki, Interview with author, January 7, 2020)

In *Manoj Misra & Anr. Vs. Union of India & Ors* (Original Application No. 6 of 2012 And M.A. Nos. 967/2013 & 275/2014; popularly known as NGT judgement in Khadar), in 2015, the NGT claimed that vegetables cultivated

[6] Available at https://nmcg.nic.in/writereaddata/fileupload/ngtmatters/NGT%20judgement%2013.01.15.pdf. Accessed on 14 April 2023.

in the Yamuna khadar were toxic. Raj Singh, an influential landowner in the khadar, questioned the report. During my interactions with him, Raj regularly stressed that he had good educational credentials. "Unlike other farmers who make emotional arguments, I collect facts which I can use in court to fight against unjust organizations like the NGT and [Delhi Development Authority] DDA", he claimed. After the NGT ban, Raj arranged for his vegetables to be tested at the Indian Agricultural Research Institute (ICAR, popularly known as PUSA Institute) and the groundwater to be tested at the Central Pollution Control Board (CPCB). He was determined to quash the rumours about khadar produce being toxic. In the reports, the toxicity levels of the vegetable and water samples were declared to be within the permissible limits. He argued that these reports could not be any less scientific than those used by the NGT to back its claims. Indeed, the reports were from prestigious science-backed institutions in the country, thereby leading to a situation of conflictual claims on toxicity based on scientific testing. As Raj's farm was relatively far from the river, he did not use the river water for cultivation. "Humara khet nadi se 1 km door hai, hum kaise lagayenge nadi ka paani. Yeh sab afwaein hai [Our farm is 1 km away from the river. How would we use the river water? It's all rumours]" (Farmer Raj Singh, Interview with author, September 17, 2019). However, he argued that, while farmers who did not use the river water were not culpable, those using the toxic water should not be blamed either. Moreover, because the Yamuna khadar is categorised as a floodplain, no other activity other than cultivation is legally permissible there.

In response to the NGT ban, Devki, a member of the Delhi Peasants Co-operative Multipurpose Society, claimed that farmers were being maligned by agencies like the NGT and DDA. He was cultivating on 30 bighas of land in the Yamuna khadar given to him on lease by the DDA in 1949, under the arrangement of *batai*.[7] He opined that it was not the chemicals used in agriculture that were toxifying the river, but rather the waste generated by city dwellers and industries. The NGT ban, in this sense, can be understood within a larger class framework, whereby the affluent get to deflect responsibility for pollution on to the poor. For Devki, the use of chemicals was a regular practice in agrarian activities everywhere in the world that did

7 In this part of the Yamuna khadar there are two types of land tenurial arrangements: *batai* (sharecropping) and *jama* (annual rent). In the case of batai, the landowner and the tenant, who is working on the land, share the input costs incurred during cultivation and the money made from selling the produce in a 50–50 arrangement. In the case of jama, the owner has no say in the type and process of cultivation. The owner is paid the rent annually, usually in two or three instalments each year.

not pollute the river or land, rather it was the pollution from cars and waste of city dwellers that flowed directly into the river, which made the river dirty. Nevertheless, he was not opposed to a shift in favour of organic farming, or other forms of nonchemical *kheti* (farming) in the floodplains, but only if the government facilitated it. Like Devki, Sunil (whose profile is discussed later in the essay) also stressed the absence of incentives for taking up organic farming. He shared anxieties about his land getting acquired following the Commonwealth Games (CWG), which further deterred him from investing in organic farming. Sunil also said that the reports about agriculture in the khadar polluting the Yamuna were exaggerated.

Devki feared that the NGT judgement would strengthen discourses on ecological ruination and reinforce efforts aimed at grabbing cultivation land[8] from farmers, leading to further precarity and dispossession. This kind of land grabbing results in an urban ecology which is often associated with markers like beautified parks rather than crops, fruits, and vegetables (Baviskar 2011). Indeed, Nagendra (2016) argues that "infrastructure, regulatory and recreational ecosystem services take precedence over productive uses of ecosystems in the minds of the members of the urban public, media, and city administration"(15). Such conceptions ignore the fact that elderly farmers in the Yamuna khadar, for instance, have been embedded in urban agriculture for decades. These people have a deep attachment to the landscape, which is bound to their sense of identity and community. As such, displacement of these people would cause considerable trauma as well as economic hardship.

In response to the recent evictions by the DDA, Devki emphasised that nobody listens to farmers in the city anymore. Farmers have no voice in the urban economy. He claimed meanwhile that his *kheti* had protected the landscape from encroachers like sand mafias, land mafias, *jhuggi-jhopri* settlements, and other illegal residential localities. He not only safeguarded the space, but also made it productive, safe, and beautiful. The green plains of the khadar, according to Devki, were rugged and uneven before the cultivators settled there. It is agricultural labour which made it even and productive. In addition, cultivators provide food and livelihood to the poor in the city. Devki recalled that cultivation became precarious in 1966, when farmers' leases were not renewed by the DDA. But they continued cultivating, routinely negotiating with the sta. However, with the NGT ban

[8] Devki told me that land belonging to one of the cooperative society members Rakesh Singh was forcefully taken away in the name of a "public project" for the Akarshdham Mandir. He asked me, "How is Akshardham a public project? It is no road or flyover".

on cultivation in 2015, cultivation is now near impossible. JCBs (Joseph Cyril Bamford), popularly known as bulldozers in the khadar, reportedly ran over the standing crops, replacing the crops with plants and trees allotted for compensatory afforestation drives. Devki, for his part, failed to see how trees enhance greenery but crops do not.

While refusing to distinguish between crops and trees, with respect to their ecological role, Devki made a distinction between the ecological impacts of individual farmers in the khadar. While discussing the toxicity of the river water, Devki pushed me to differentiate between farmers who cultivated land adjacent to the river, and those whose land was further away from the river. The latter, according to Devki, used borewell water while the former used the toxic river water for irrigation. As such, the experience of toxicity and the responsibility for toxicity, according to him, varied according to the location of the land in the Yamuna khadar. Therefore, the farmers were not one homogeneous unit that polluted the river together, but had conflicting claims even among themselves. Similarly, the blame for pollution was deflected, not merely on to the rich and affluent, but also on to fellow farmers who happened to cultivate in greater proximity to the river. Clearly, Devki associated proximity to the river with culpability.

In the forthcoming sections, I argue that along with contestations using scientific evidence, agrarian communities invoke lay epidemiology and experiences of toxicity in relation to other social problems. All these experiences and contestations are broadly influenced by class, caste, physical distance from the river, and occupation.

2.2 Toxicity and Social Life

"*Jamuna ka paani garam hai, sabzi ki growth achi hoti hai* [The water of the Yamuna is warm, which helps the vegetables grow fast]" (Migrant Tenant Ramesh, Interview with author, October 13, 2019).

"*Bilkul cream jagah hai* [The Yamuna khadar is the best place for poor migrants like us to live in the city]" (Migrant Tenant Udaylal, Interview with author, November, 2, 2019).

Auyero and Swistun (2009, as cited in Lora-Wainwright 2013a), argue that "to understand locals' experiences of pollution and their attitudes to it, they should be examined vis-à-vis all the other pressing problems they face" (82), such as affordable housing, crime, safety of the locality, potential for finding employment, lack of schooling and medical facilities, the bureaucracy involved in accessing welfare, and so on. The authors emphasise that "despite their knowledge of pollution, locals have become slowly tied to the place,

taking root in the neighbourhood through work, family, and friendship networks. Therefore, they downplay the dangers they face" (Auyero and Swistun 2009, as cited in Lora-Wainwright 2013a, 86). This is what I attempt to do in this section.

In late October 2019, Ramesh was spreading *methi beej* (fenugreek seeds) in his khet, adjacent to the river, along with his mother and father. It was late in the evening. By then the place was full of mosquitoes and the Yamuna had started to stink. This prompted me to probe Ramesh about his notions about cleanliness and the environment. Ramesh was relatively rich, owning a tractor and 30 bighas of land in his village. When asked why he did not move to the village or somewhere else, he stressed that village khetis were not profitable. "*Tubewell ke saath bhi moti fasal*[9] *mein sabzi jitna paisa nahin hai aur gaon mein sabzi ke liye market nahin hai* [In the village there isn't much money in *moti fasal* even with a tubewell, and there is no market for vegetables in the village]", he claimed. According to him, one could sell large amounts of vegetables in the khadar due to the proximity to the upper/middle class localities in the city. Green leafy vegetables have a short shelf life and hence proximity to these more affluent localities allowed farmers to sell the produce the same day it was harvested. Evidently, livelihood opportunities accruing from this proximity to the toxic landscape tended to outweigh any potential desire to relocate.

Apart from livelihood opportunities, Ramesh also found the Yamuna water to be extremely conducive to the fast growth of crops. "*Garam paani sabzi ke liye complete diet hai* [The warm water of the Yamuna is a complete diet for the vegetables]", he revealed. Indeed, the Yamuna water carries human and animal waste, which makes it "warm". Waste in the river water acts like *khaad* (manure). The river also has other nutrients like sodium and potassium. Sunil, on whose land Ramesh was cultivating, stressed that nutrients from *ganda paani* (dirty water)[10] are better than the micronutrients applied externally because plants absorb the former better. As such, proximity to the polluted river made the large-scale use of pesticides and fertilizers unnecessary, rendering cultivation more cost effective.

Sunil had leased his farms on *jama*[11] to Ramesh and a few other migrant tenants. *Kachi/nanhi fasal*,[12] according to Ramesh, it is labor intensive. Hence,

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[9] *Moti fasal* (also referred to as *pakki fasal*) refers to crops like wheat, rice, and maize.

[10] Yamuna water is also referred to as *ganda paani*.

[11] Explained in Footnote 5.

[12] Green leafy vegetables like methi, *bathua* (lamb's quarter), *palak* (spinach), *saag* (greens), and so on.

the leasing of land to migrant tenants who work on batai or jama. Tenants prefer to till land close to the river because the cost of cultivation is lower due to the aforementioned reasons. Second, the river water is freely available for water-intensive vegetable cultivation. And, third, the river bank is more conducive to growing nanhi fasal quickly and several times a year. Also, the drainage of soil near the river is good; this makes cultivation possible in monsoon months as excess water drains through the soil quickly. These factors encourage tenants to take jama land close to the river to grow nanhi fasal. Therefore, proximity to the river determines tenurial arrangements between landlords and tenants, making toxic landscapes tolerable.

Cultivators like Ramesh are well educated, having paid for their college education with earnings from cultivation. The village did not provide good opportunities for education. "*Shehar mein kheti ke sahare padh liye. Abhi naukri nahi lagi hai issiliye kheti hi kar rahe hai* [I studied in the city with the help of farming. I haven't got a job yet. That's why I am farming]", he revealed. Ramesh had failed thus far to get a government job but still took pride in his qualifications. He routinely visited a nearby private library to prepare for the upcoming government exams. He wanted his children to receive quality education in a government school located nearby, which further deterred him from relocating to the village or to another agrarian locality. Thus, he experienced and perceived toxicity in relation to his own problems concerning livelihoods, unemployment, poverty, lack of clean and affordable housing in the city, and a scarcity of educational facilities in the village.

Udaylal, another migrant tenant from Badaun, cultivated vegetables on batai with Ganesh. While Ramesh's experience and tolerance of toxicity was determined by his proximity to the river, Udaylal's case revealed that ties with landowners, in addition to the riverine ecology, were also important to the toxic ecology of the khadar. For Udaylal, ties to the landowners were vital to survival in the city. "*Bilkul cream jagah hai. Hum bhai ke saath batai mein karte hai. Humein jama paar suit nahi karta. Bhai bure samay mein humara dhyan rakhte hai* [We cultivate with Ganesh under the arrangement of sharecropping. We do not like cultivating under the arrangement of annual rent. Ganesh takes care of us in difficult times]", he said. Even after JCBs ran over his vegetables, following the NGT order in 2015, Udaylal refused to leave. Ganesh, through his contacts, negotiated with the DDA *chowkidars (a lower ranked DDA official)*, which helped him resume cultivation after a few months. Ganesh looked after Udaypal and his family even when cultivation was not possible. Occurrences like crop failure, untimely rain, and price fluctuation did not stop Ganesh from extending help and support. His support was also crucial

during weddings and medical emergencies. In this manner, Ganesh became indispensable in the survival of Udaylal and his family. While the toxic river "assisted" tenants who worked close to it, for others like Udaypal, it was the landlord in the khadar who helped ensure a livelihood. The river, along with landowners, influenced cultivators' experiences of toxicity.

Udaylal had been cultivating in Delhi for more than two decades. He was not well educated and unlikely to find a well-paying job. "*Mere jaise anpad log shehar mein naukri ya kaam karke ₹8,000–10,000 se zyaada nahi kama sakte* [Illiterate people like me cannot earn more than ₹8,000–10,000 by doing work in the city]", he confessed. A jhopdi on the farm in the khadar offered better prospects and security, compared to other urban poor localities in Delhi. Udaylal cultivated nanhi fasal, which is labour intensive, and employed his family as labourers to cultivate. A big house/space was required to accommodate his large family. He got this from the jhopdi on the farm with open space around it. It was sufficient for a big family to live together and carry out their daily chores. He said this kind of open space would cost a lot in the city. Tenants like Udaylal and Ramesh told me that their living conditions, with no water logging, no choked drains, ample lighting and ventilation, were better than those of middle class and upper middle class localities. Although there were no water and electricity connections in the floodplain zone, these people still felt they were better off than those living in dark, dingy, and cramped spaces in the city. Also since they were doing vegetable cultivation they had to stay on the farm, or close to it, to look after their crops. In addition to tilling the land and rearing cattle, most migrant peasants sold vegetables in the nearby middle class residential localities.

In the khadar, migrant tenants develop ties with members of landowning castes like the Gujjars and Chauhans, who help them access nearby schools and hospitals. With links and contacts with the bureaucracy, these landowning castes are able to help migrant tenants obtain Aadhaar cards[13] driving licences, and ration cards, which are crucial to their survival in the city and help them avail other benefits and opportunities for their children and families. Landowners also facilitate borrowing seeds, pesticides, and other kinds of chemicals from local shopkeepers. A sense of community is apparent, growing in the vicinity of the toxic river. Strong ties enhance a sense of safety, outweighing the hazards of living in a toxic landscape.

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[13] Aadhaar is a 12 digit individual identification number issued by the Unique Identification Authority of India on behalf of the Government of India. The number serves as a proof of identity and address, anywhere in India" (UIDAI n.d.).

Migrant tenants' experiences of toxicity are anchored to the local ecology of the Yamuna khadar, i.e., in the social relationships with the landowners, river, soil, and the city. The nature of the landowner–tenant relationship in the two types of land tenurial arrangements, i.e., batai and jama, is different in the sense that the batai relationship exceeds its economic implications. The batai is an arrangement employed by migrant tenants for their own safety in case of crop failure and a lack of other kinds of livelihood support in the city. The nature of the relationship in the jama case is primarily economic; the landowner does not have much say in how the labour is employed in the kheti. As the case of Ramesh suggests, some tenants are more dependent on the toxic river soil than others. But the negotiating power of the landowner, particularly during anti-encroachment drives and other emergencies, remains the common element. Hence, deep ties with the city and the local ecology, along with landowners, drive contestation and negotiation of tenants with state agencies. Tenants experience toxicity differently from tenants, based on their distance from the river, their type of property, tenurial arrangements, and the nature of their cultivation.

2.3 Lay Epidemiology: Uncertainties and Toxicities

"*Shehar ke logon ko plate par choice chahiye* [City dwellers want choice in their meals]" (Migrant Tenant Aditya, Interview with author, August 9, 2019).

Anna Lora-Wainwright (2013b) explores the issue of "uncertainty surrounding illness causation" (303) with the help of the concept of "lay epidemiology" ("perceptions of illness causation where pollution features alongside a range of other factors" [303]) in a heavily industrialized village in China, where the population of the village continues to work and live in a toxic environment. Through this work she highlights that locals are concerned about pollution but uncertain about whether they can attribute particular symptoms or illnesses to it. This is because "the embeddedness of locals'" (306) environmental health consciousness within a wider lay epidemiology is at least partially a result of the communities' dependence on the local ecology for livelihoods and on local power relations. In this section I explore lay epidemiology in relation to life in the Yamuna khadar.

Aditya, a skilled technician who helped his family grow and sell crops, was selling *bhindi* (okra) at the mandi near the khadar at a time when prices had fallen drastically. I interacted with him during his visits to the market. There was considerable anger and despair among the migrant tenants due to low prices. Excess supply was one of the causes of the fall in prices. "*Par market mein uthav nahi hai* [There is no demand in the market]", noted Aditya.

Anticipation of upcoming winter crops was growing, and people in the cities were looking for alternatives to eat. Aditya stressed that people in cities wanted "choice". "*Ab batao kisaan kaise karega choice paida* [How will the farmer create choice]?" Aditya wondered. City dwellers quickly lose interest in seasonal vegetables like bhindi which sometimes forces cultivators to advance to sowing winter crops, for instance, in the late monsoon. This encourages farmers to use diammonium phosphate (popularly known as DAP), urea, pesticides, micronutrients, and other chemicals. In doing so, cultivators provoke the ire of environmentally conscious city dwellers, the NGT, environmentalists, etc. Still, the link between unpredictable consumer behaviour and toxic cultivation practices is generally ignored. Livelihood precarities like high rents and the need for non-stop cultivation render farmers susceptible to the pressures of changing consumer demands. Like Devki, Aditya also highlighted that farmers should not be held culpable for polluting the river because, while chemicals and pesticides are used by farmers everywhere, the rivers are not similarly polluted in other places.

While the NGT indicates that vegetables grown in the khadar are toxic, Aditya denied these claims. Cultivators and their families have been consuming these crops for decades. Aditya stressed that no one in the khadar had ever developed any ailment from consuming these crops. While I interacted with Aditya at the mandi, we were joined by a group of cultivators. They clarified the reason for their good health: "*Kyunki hum shudh hawa lete hai, shoodh pain peete hai, shoodh sabzi khaate hai aur paseena bahate hai* [Because we breathe pure air, drink pure water, eat pure vegetables, and sweat it out in the fields]", they stressed. Aditya agreed with them. He emphasized that illnesses like cancer, which the NGT claims are caused by the consumption of toxic vegetables, have multiple causes and a direct correlation between toxic crops and cancer is impossible.

Raj Singh, who had challenged the NGT facts on toxicity stated in the NGT judgement, had a unique technique for testing the purity of the water. While he claimed that the groundwater in khadar was not polluted, residents of the khadar regularly lined up to take drinking water from Delhi Jal Board (DJB) tankers. Raj Singh shared that water samples collected from hand pumps and borewells in the khadar were left in plastic bottles for three months. He claimed that if the water did not turn yellow, it was not polluted. Sunil, on the other hand, claimed that he could test the pollution level in the water just by tasting it. He even identified a specific hand pump in the khadar which delivered water of "high quality" and even increased his immunity. Sunil encouraged others to drink water only from that hand pump. He had a deep

distrust of packaged mineral water, because it apparently did not have the "appropriate" taste and was not good for one's immunity. Because at least one hand pump had healthy tasting water, according to Sunil, NGT claims could be deemed false. Such informal strategies would be discounted by experts as unscientific and therefore unreliable. But limited access to formal, scientific testing has prompted khadar cultivators to adopt strategies deviating from, and to call for an expansion of, definitions of scientific evidence and citizen knowledge. Formally recognizing such knowledge and strategies may be crucial to ensuring social justice (Lora-Wainwright 2013a; 2013b).

Unlike the general trend in epidemiological studies, in which local people expose toxicity while state agencies deny its presence (Levine 1982; Brown and Mikkelsen 1990; Cable and Walsh 1991), we see here a case of state agencies claiming toxicity while the locals deny its existence. Agrarian communities in the khadar are tied to land-based livelihood activities because opportunities for them in other sectors of the urban economy are limited, and their income from non-agrarian ventures is not enough for them to live in a dignified way in a city. These conditions of dependency and limited opportunities influence the agrarian communities' uncertainty when it comes to attributing illness or poor health to pollution.

3. CONCLUSION

In this paper, I highlight that communities experience the polluted urban ecology of the Yamuna khadar in multiple ways. The various communities associated with the toxic agrarian landscape of the Yamuna khadar do not experience pollution in a homogenous way, i.e., neither do they all see themselves as suffering from pollution, nor do they all contribute to the toxicity of the landscape in the same way. My study focuses on the contesting claims about, and multiple experiences of, toxicity, not merely between the NGT and cultivators, but also between city dwellers and cultivators, and among the cultivators themselves. I highlight that cultivators feel they are being wrongly blamed for a problem created by rich and upper middle class citizens and, in this case, the non-agrarian urban poor whose locality pollutes the river. For some, pollution provides an opportunity to make a living and find a foothold in the city for themselves and their families. Others experience it in relation to problems like unemployment, with a sense of loss, displacement, and antagonism. The experiences of toxicity are embedded in the social, political, and economic context of the urban ecology of the Yamuna khadar. For instance, migrant tenants cultivating on jama react

to/experience toxicity differently from migrant tenants working on batai, as discussed in the case of Ramesh (jama) and Udaylal (batai).

Their embeddedness in the toxic ecology is part of the domination and compulsion that agrarian communities face. Firstly, migrant tenants do not have any other choice but to farm in toxic urban ecologies, as other employment opportunities do not give them enough to survive in the city. Secondly, migrant tenants cannot but accept the exploitative nature of high rents imposed on them by the landowners. Thirdly, farmers and landowners bribe or negotiate with officials to continue with cultivation. Lastly, unequal power relations, dependence on the land-based livelihood in a city, and the toxic effects of their cultivation practices make cultivators susceptible to displacement in favour of big capital projects like metro rails, flyovers, premium residential buildings, and biodiversity parks. Toxicity and the nature of contestations around it provide a means for mapping large-scale struggles around space, livelihood, knowledge systems, and materiality. These struggles intersect along the lines of class, caste, location, and occupation, highlighting that toxicity is not merely a medical or scientific fact (as advocated by "experts") but a social one that influences, and is embedded in, a community members' manners of acting, thinking, and feeling.

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