Geographien Südasiens

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Geographien Südasiens

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Arbeitskreis Südasien

Der Arbeitskreis Südasien in der Deutschen Gesellschaft für Geographie (DGfG) wurde im Januar 2011 gegründet. Hauptziel ist die Vernetzung von Geographinnen und Geographen, deren regionaler Arbeitsschwerpunkt in Südasien 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 Südasien 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 Wiese 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.

Schriftenreihe: Geographien Südasien

Die vorliegende Schriftenreihe wurde vom Arbeitskreis Südasien mit dem Zweck gegründet, Einblicke in aktuelle geographische Forschung zu Südasien zu ermöglichen. Um einen möglichst großen Leserkreis zu erreichen, sind die Beiträge über Heidelberg Asian Studies Publishing (HASP) kostenlos im Sinne des OpenAccess zugänglich. Die Schriftenreihe dient in erster Linie dazu, die vielfältigen Forschungsarbeiten der Arbeitskreismitglieder vorzustellen. Hierzu werden Beiträge der Mitglieder auf den jährlichen Arbeitskreistreffen in Form von Extended Abstracts in einem jährlichen Sammelband zusammengefasst. Zusätzlich besteht darüber hinaus die Möglichkeit, neuere Beiträge zur Südasienforschung in zusätzlichen Bänden ausführlicher zu behandeln.

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Inhalt

Health impacts of e-waste processing in India

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At the end of their life cycles, electronic consumer goods like personal computers, mobile phones, TV sets, etc. turn into a specific category of waste, namely electronic waste, or in short "e-waste". In 2016, an estimated 44.7 million tons of e-waste were generated globally (World Economic Forum, 2019). Only 20% of this waste was collected and recycled (ibid).

This emerging category of waste has certain characteristics, which result in its specific treatment. Most important is that e-waste contains several valuable resources like rare earths and valuable metals like gold or copper. Thus, recovering these resources from abandoned devices can be profitable – under certain circumstances. This is connected to the second important characteristic: the valuable resources are hard to extract, since they are bound in composite structures, which require complex treatment. Due to the high diversity of the design of electronic consumer goods, the process of extracting resources is difficult to standardize or to automate. In many cases, e-waste thus needs to be dismantled manually. This labor intensity is one of the most important reasons for the high exports of e-waste to low income countries (for an overview: Abalansa et al., 2021). The export of electronic waste was officially banned in 1989 by the "Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal" – yet the export of electronic goods for second-hand use is still legal.

Thus, there is a lively trade of e-waste labelled "second-hand use" moving from countries of the Global North to countries of the so-called Global South, where an active industry transforms waste to treasures – at times at high cost to human health. North America, Western Europe, South Korea and Japan are the sources of illegal e-waste trade, while Mexico, Brazil, Senegal, the Ivory Coast, Benin, Ghana, Nigeria, Eastern Europe, Egypt, India, China, Thailand and Vietnam are the largest recipients (Abalansa et al., 2021). It is estimated that from the European Union alone, 1.3 million tons of e-waste are exported without documentation – and the amounts are rising.

Basically, there are two routes e-waste takes in different sites of the Global South. Either e-waste is upcycled by repairing and re-using older electronic devices – one famous site for this is Accra's Agbogbloshie market (R. Grant & Oteng-Ababio, 2012) – or the waste is dismantled to recover valuable materials. This usually takes place under precarious conditions with multiple adverse health effects for the workers directly involved in e-waste processing, their families and the communities in places adjacent to the processing sites. Recent literature focuses on Ghana (Agyei-Mensah & Oteng-Ababio, 2012; Almazán-Casali et al., 2021; Amankwaa, 2013; Amoabeng Nti et al., 2020; Caravanos et al., 2011; Feldt et al., 2014; Fischer et al., 2020), Nigeria (Ohajinwa et al., 2017), China (Li & Achal, 2020; Zeng et al., 2019; Zheng et al., 2011), Chile (Yohannessen et al., 2019) and India (see below), reflecting spatial 'hotspots' of e-waste processing globally.

E-waste processing in India

India is at the same time a producer, importer and exporter of e-waste. For all three processes, knowledge about the volumes involved is as yet only vague, and most authors quote the same, often quite old sources. One review provides a good overview about the different estimates of the volume of e-waste that have been published in the last decade (Kaushik & Herat, 2020). The current volume of production of e-waste was estimated at 5.2 million tons in 2020 (Chaudhary et al., 2017; Kaushik & Herat, 2020). This is a relatively high estimate compared to other figures given in the same publications, e.g. 1.8 million tons in 2017 (Chaudhary et al., 2017) or a breakup for different types of e-waste adding up to 360,000 tons for 2020 (Kaushik & Herat, 2020). More contradicting figures could be added here from other sources (Bhaskar & Turaga, 2018; Dasgupta et al., 2017; Joon et al., 2017; Ramchurjee & Ramchurjee, 2016; Singh & Kumar, 2013). The Central Pollution Control Board, which is responsible for the oversight of e-waste processing estimates for the financial years 2017–2020, reports the following amounts of e-waste to have been produced in India:

- "For financial year 2017-18, the estimated generation of e-waste is 708,445 tons for 21 types of EEE.
- For financial year 2018-2019, the estimated generation of e-waste is 771,215 tons for 21 types of EEE.
- For the financial year 2019-2020, the estimated generation of e-waste is 1,014,961.2

tons for 21 types of EEE (Central Pollution Control Board, 2020, p. 4).

The amount of imports is likewise uncertain, with a figure of 50,000 t said to be imported to India every year – an amount quoted in almost every scientific paper that can be traced back to a report by the German development agency GTZ, which has remained unchanged ever since (GTZ & MAIT, 2007). Thus, the amount of e-waste generated and imported remains largely unknown. The same holds true for the export volume of e-waste.

Another repeatedly quoted and unquestioned estimate from that report is that 95% of e-waste is processed in the informal sector. One recent paper challenges this figure, estimating the percentage at 85% – 94% (Bhaskar & Turaga, 2018). The rationale for exporting e-waste is that high-tech facilities in European countries can use pre-processed e-waste (by informal workers) to extract valuable resources (Chaudhary & Vrat, 2017a; Vrat & Chaudhary, 2019).

Fig. 1: Informal processing of e-waste in Delhi (C. Butsch)

In India, several authorities are involved in the management and control of e-waste: the Ministry of Environment, Forest and Climate Change (MOEF), the State Pollution Control Boards (SPCB), the Directorate General of Foreign Trade (import and export under the Basel convention) and the Port Authorities and Custom Authorities.

The legal framework for handling hazardous waste was set up by the Environmental Protection Act (1986) (Chaudhary & Vrat, 2017b). In 2008, e-waste was first explicitly mentioned in the hazardous waste rules, and in 2011 the first e-waste handling rules were released, becoming effective in the year 2012 (Chaudhary & Vrat, 2017b; Joon et al., 2017; Singh & Kumar, 2013). These rules introduced two principles: Extended Producer Responsibility (EPR) and Restriction of Hazardous Substances (RoHS). While, under certain preconditions, EPR assigns the producers of electronics responsibility for the handling of electronic goods, RoHS restricts the amount of certain hazardous components, like heavy metals in electronic goods. With new rules released in 2016, these principles were operationalized. They forced producers of electronic goods to form Producer Responsibility Organizations (PRO) in order to jointly set up state-of-the-art collection centers for e-waste collection and recycling. According to the Central Pollution Control Board (CPCB), 400 collection centers were registered all over India in 2021, with a capacity to handle 1,068,542 tons of e-waste annually (Central Pollution Control Board, 2021).

The state-certified processing sites set up by the PROs (i.e. "the formal sector") could, even according to optimistic estimates, only handle a minor share of India's e-waste. There are multiple reasons for this. One study identifies 16 different barriers to the effective implementation of existing rules, including poor infrastructure in the "formal sector", inadequate consumer information, shirking responsibility by producers, the limited capacity of the concerned government agencies and a dominance of the "unorganized sector" (Chaudhary et al., 2017). This dominance is linked with, e.g., political patronage (Vrat & Chaudhary, 2019) or lack of capacities in the "formal sector" (Ramchurjee & Ramchurjee, 2016). Other studies highlight the consideration that "waste" is regarded as the base of livelihoods for waste-pickers, waste-traders and refurbishers, who are part of a complex value chain (Fig. 2) (Borthakur & Govind, 2017; Chaudhary et al., 2017; Corwin, 2018; Dasgupta et al., 2017; Laser, 2016; Ramchurjee & Ramchurjee, 2016).

This value chain starts at the doorstep of consumers, where so-called *kabadiwalas* collect all types of discarded electronic devices to sell them to smaller waste dealers. Here, devices are sorted and either sold to refurbishers or enter the stream where they are dismantled. From some devices, spare parts are collected and sold to the service industry for repairing older devices, while the rest are dismantled to extract valuable components (Ramchurjee & Ramchurjee, 2016). Thus, only a small share of electronic products can be considered "waste", but they re-enter the market through several routes. It is important to distinguish between the different actors involved in this "informal" processing of e-waste, as the health burden differs significantly. It is highest where waste is dismantled without adequate occupational safety. Thus dismantlers are usually those experiencing the highest health burden (Joon et al., 2017) and often this dangerous work is conducted by marginal groups (Fig. 1) (Ramchurjee & Ramchurjee, 2016; Vrat & Chaudhary, 2019).

Health effects of informal e-waste processing

High occupational health risks are especially prevalent for dismantlers in informal settings, while they are lower for refurbishers and workers in formal settings (Annamalai, 2015; Joon et al., 2017). Here, the lack of occupational standards results in multiple exposures towards the hazardous materials

contained in e-waste. Among the hazardous materials are chemical elements and compounds like aluminum, cadmium, chromium, lead, mercury or nickel, which are included in cables, connectors and batteries. Printed circuit boards, coatings and linings contain various potentially poisonous flame retardants, phthalate plasticizers and polymers (Ádám et al., 2021; Agyei-Mensah & Oteng-Ababio, 2012; Annamalai, 2015; Joon et al., 2017; Perkins et al., 2014). As the majority of e-waste processing takes place in informal settings, occupational standards are not maintained, and often primitive means are used to extract potentially valuable components. Plastics are burned in order to access metal components, exposing workers to toxic fumes. Furthermore, the use of acids for leaching exposes workers to skin contact with acids, inhalation of acidic fumes causes health problems, and dismantlers suffer injuries and burns, often because primitive techniques are applied (Fischer et al., 2020; Perkins et al., 2014). The adverse health effects of the poisonous substances in e-waste (named above) and occupational conditions are in principle well known and have been described in several studies (Grant et al., 2013; Zeng et al., 2019). Dismantlers suffer physically from the unsafe working conditions (e.g. Agyei-Mensah & Oteng-Ababio, 2012; Akormedi et al., 2013; Fischer et al., 2020; Ohajinwa et al., 2017; Yohannessen et al., 2019). Besides occupational injuries and various forms of poisoning, workers suffer from respiratory and skin diseases, and various diseases of the nervous system, kidneys and endocrine disruption (Grant et al., 2013; Noel-Brune et al., 2013; Ohajinwa et al., 2017; Perkins et al., 2014).

In some places, the families of e-waste workers are directly exposed, too, because e-waste processing takes place in or around the home. In others, workers take home poisonous substances on their clothes or hair (e.g. brominated flame retardants or Cadmium) and thus expose their family members (Grant et al., 2013). Communities in the vicinity of e-waste sites are likewise exposed to various hazardous components of e-waste, which are dispersed via air (dust, smoke), water (runoff, groundwater) and soil (Awasthi et al., 2016; Caravanos et al., 2011; Leung, 2019; Li & Achal, 2020; Orisakwe et al., 2019).

In communities in the vicinity of e-waste processing facilities, it is often difficult to link negative health consequences (and diseases) to single sources. One literature review shows higher concentrations of hazardous, potentially carcinogenic substances in the blood and hair of persons living close to e-waste processing sites (Awasthi et al., 2016). Several studies found pregnancy complications in communities close to e-waste processing sites, resulting in an increased number of stillbirths and children with neurological deficits (Chen et al., 2011; Grant et al., 2013). In China, a number of studies show the effects of exposure to toxic substances from e-waste processing on human DNA in populations residing close to e-waste sites (Liu et al., 2009; Xu et al., 2015; Yu et al., 2018).

Several studies address negative effects on children's health. A study analyzing a cohort of pre-school children close to Guiyu found elevated levels of several toxins, especially lead, in their participants' blood samples. These were correlated with growth and mental deficits compared to a control group (Zeng et al., 2019). Similar adverse effects were found in other studies (Cai et al., 2019; Leung, 2019; Li & Achal, 2020). Negative impacts occur where children are actively involved in e-waste processing (Annamalai, 2015).

Fig. 2: E-waste collection center near Kolkata (C. Butsch)

Questions for future research

Existing literature covers the structures, processes and actors of different streams of e-waste quite well. Likewise, the pathogenic pathways of substances released during e-waste processing are well understood. What is not yet well understood are questions around the structural production of health vulnerabilities of e-waste workers. A research approach rooted in the syndemics concept (Singer et al., 2017) would allow for analyzing the parallel occurrence of disease patterns in certain population groups and may provide valuable insights. Further, the health resilience strategies of e-waste workers may also provide valuable insights: What kinds of coping strategies do they employ to deal with health threats and ill health and why do they adopt them?

Going beyond the mapping of pathogens and disease, answers to these questions will allow for a better understanding of the underlying causes of health inequities for these highly exposed groups. At the same time, understanding of the agency of e-waste processors may help to increase general understanding of the coping strategies of marginalized groups.

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Urban eris: water body transformation in peri-urban Chennai, South India

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Keywords: peri-urbanisation, urban political ecology, Tamil Nadu, eri cultural landscape

Introduction

The landscape of Tamil Nadu is characterised by the presence of semi-natural irrigation tanks, called "eri" in Tamil. Eris are connected to each other and act as the defining features of the cultural landscape (Ariza-Montobbio et al., 2007; Janakarajan, 1993; Mukundan, 2005; Palanisami et al., 2010; Shah, 2013; Vaidyanathan and Sivasubramaniyan, 2001). This eri landscape retains water for irrigation, drinking and domestic purposes in villages, groundwater recharge and flood protection of downstream areas through water retention. The eri itself is a shallow, widespread water body, defined by an elongated embankment called *bund,* which contains sluices to lead water through irrigation channels into the fields, and overflow weirs to release surplus water into downstream eris. An eri's water table changes throughout the year due to monsoonal rainfall, drought periods and cropping seasons. Therefore, a large portions of the water body may be dry for months or even years. Eris form cascades, in which water runs from small eris upstream through medium-sized eris into large eris downstream (Ariza-Montobbio et al., 2007; Mukundan, 2005; Vaidyanathan and Sivasubramaniyan, 2001).

In peri-urban Chennai the eri landscape is being transformed. Chennai has undergone drastic changes within the last three decades to change from regionally important, yet provincial Madras to the aspiring global city Chennai (Homm and Bohle, 2012), where industrial growth was boosted from the 1990s onwards (CMDA, 2008). This research explores how eris in peri-urban Chennai are major subjects of conversion, either to meet the city's freshwater demand or to make way for urban construction.

The objective of this research is to examine peri-urbanisation through the lens of water body development from a planning, sociological and political perspective. Bartels et al. (2020) propose a Situated Urban Political Ecology (UPE) approach on peri-urbanisation, in which theory is derived from case studies. The endeavour of this work is to follow this situated approach in order to add a new aspect to the peri-urban discourse, the *urban eri* concept. A medium-sized eri in peri-urban Chennai serves as an example to show how a rural water body is being urbanised. Bartels' four steps of spatial transformation, 1. ecological conquest, 2. physical transformation, 3. change in use and 4. change in property (Bartels et al., 2020; Swyngedouw, 1996), are used as an analytical stencil to prepare further theorisation.

Research area and research methods

The research area is located in the southwestern peri-urban zone of Chennai. Hydrologically, it belongs to the Adyar River Basin, and administratively it is part of Kancheepuram District. It comprises the medium-sized Manimangalam Eri, seven small eris and their surroundings (figs. 1 and 2).

I conducted 52 interviews with local experts from the research area (fig. 2) as well as from administration, science and non-governmental organisations. Interviews were anonymised and ciphered according to their interview category. Interviews with local residents were ciphered chronologically, while interviews with administrators, scientists and NGO members were ciphered as "A+numerus currens" for "administration", "S+numerus currens" for "science" and "NGO+numerus currens" for "non-governmental organisations". The sampling method was exploratory and qualitative. The interviews were coded in RQDA, a qualitative data analysis tool of the R environment, to serve as basis for written analysis.

To study the hydrological situation of the research area, I undertook a watershed delineation and channel calculation using a digital elevation model (DEM) of the Adyar Basin, with the help of System for Automated Geoscientific Analyses (SAGA) tools in QGIS (Conrad et al., 2015). As a following step, the calculated channels with mapped data of existent water bodies and streams were overlaid to understand the degree of anthropogenic modification of the landscape in the research area.

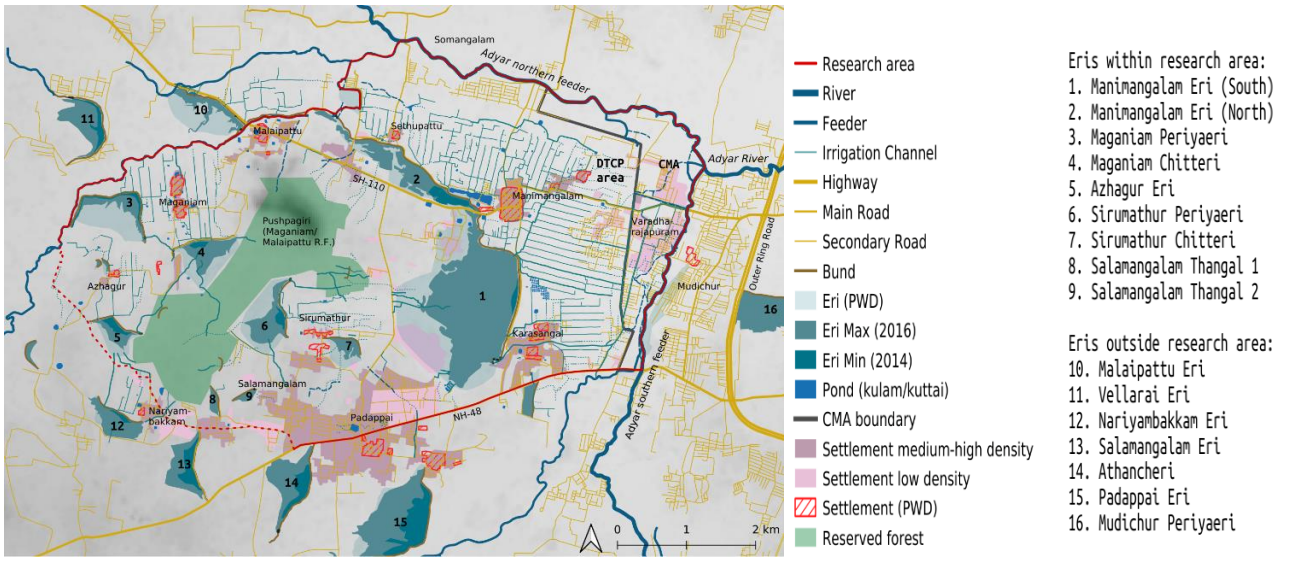

Fig. 1: Research area (own draft; Base data: Field observations, village block maps (Public Works Department), Google aerial imagery)

Transforming Manimangalam Eri

During the field research phases in 2018 and 2019, rural land uses such as farmland, common land, village settlements and forests were intact and still dominating. However, farmland conversion into residential and industrial area was a common sight already.

Manimangalam Eri is the only medium-sized eri in the research area and serves as multi-village eri, which irrigates the farmlands of three villages: Manimangalam, Karasangal and Sethupattu.

From 2017 onwards Manimangalam Eri has been undergoing profound modernisation under the Kudimaramath Scheme, a state governmental programme launched in 2016 to restore and modernise eris all over Tamil Nadu (GoTN, 2020, 2018). Maintenance work at Manimangalam Eri had been neglected before the implementation of the scheme. Through the latest modernisation works, especially desilting and bund strengthening, the eri is expected to reach its former water-holding capacity and again provide sufficient yield for agricultural irrigation (LA2).

The Public Works Department (PWD) Padappai is in charge for the maintenance of water bodies in the Adyar Basin, including Manimangalam Eri and its supporting structures, i.e. inflow, irrigation and surplus channels (A1, A2, LA5). The village panchayats of Manimangalam, Karasangal and Sethupattu have no official share in maintenance decision-making for the eri (A1, A2, LA4). As a result, one panchayat seems to be consulted for maintenance decisions informally, while another is excluded from the same, based on personal connections and preferences of the PWD officials (LA2, LA4). In consequence, the PWD alone holds formal authority and is the implementing agency of the Kudimaramath-funded modernisations of Manimangalam Eri, which are supervised by the Kancheepuram District Collectorate and the Revenue Department of Tamil Nadu (A2). The formal exclusion of village panchayats in eri maintenance decisions has

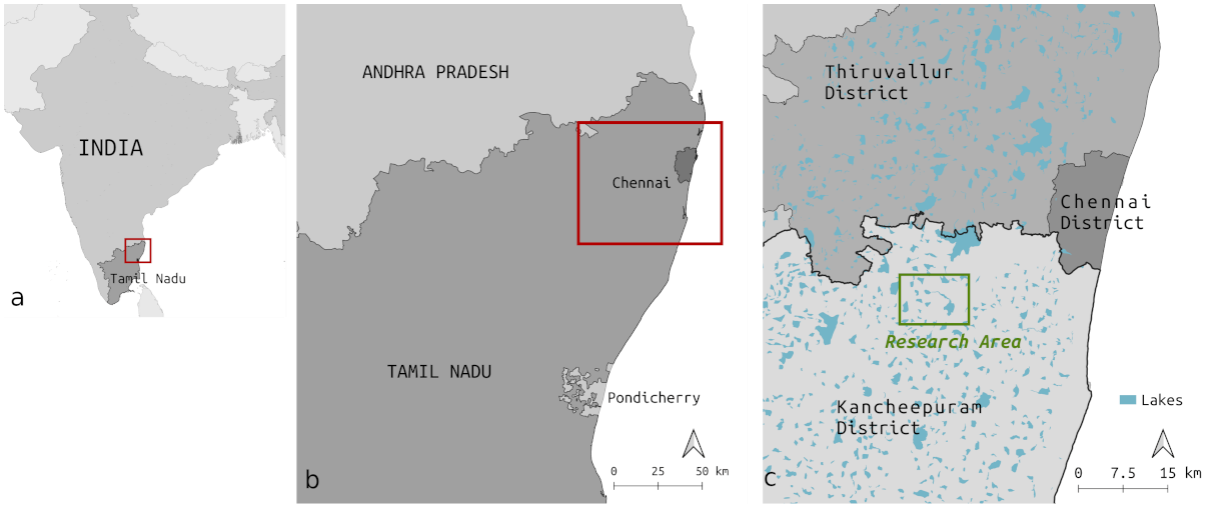

Fig.2: Location map (own draft)

led to resentment and conflict in the research area (LA4).

Fig. 3: Manimangalam Eri bed during a drought season, February 2019 (Photo: L. Haufe)

Orathur Reservoir is a new drinking water reservoir to supply Chennai in the future, and is formed of two small eris five km south from Manimangalam Eri (Fig. 3). Apart from supplying drinking water to the city, the reservoir shall also serve as water retention zone to mitigate flood events in South Chennai (Mariappan, 2019, A1, LA5, NGO3). As drinking water source to Chennai, Orathur Reservoir will be maintained through the city's water providing agency, Chennai Metro Water, instead of local bodies, as before. Moreover, a new hydrological connection between Orathur Reservoir and Manimangalam Eri is planned (Madhavan, 2018; Mariappan, 2019, 2018, The Hindu 09/02/2019). This is where the Kudimaramath measures carried out at Manimangalam Eri can be set into context: the new hydrological connection will assign a new role to the eri as surplus reservoir of Orathur Reservoir to support drinking water supply to Chennai City. Consequently, Chennai Metro Water might become a more important stakeholder, if not the authority in charge for Manimangalam Eri in the future. As peri-urban PWDs are often disempowered in favour of higher city authorities (A1), the same may occur in the research area for Manimangalam Eri.

During our field research at Manimangalam Eri, we observed sand mining in connection with restoration efforts, which caused conflict between local stakeholders and miners (LA4). Even though sand mining was not the focus of this research, it needs to receive attention because it impacts the eri's development, its ecological state, its accessibility for various users and its role. According to local officials, the PWD had allowed sand miners to extract sand from the bed of Manimangalam Eri to supply the building industry under the pretext of eri restoration. This disturbed the flow regime of the eri and eventually even led to a reduction of the eri's water holding capacity due to flow obstructions from excavations (LA4). Inspecting the eri bed ourselves, we realised that level differences in the eri bed were quite prominent, as well as a high number of sand transporting trucks from Manimagalam Eri. Whether the water-holding capacity was actually reduced could not be verified. Nevertheless, large quantities of sand were being removed from the eri and the research area. That sand mining in eris is being done illicitly and under the pretext of eri restoration was confirmed by a higher official (A1).

Conclusion

Bartels' four steps of spatial transformation (Bartels et al., 2020) can be detected in the case of Manimangalam Eri, which shows that it follows a rather clear development process. Firstly, the ecological conquest of the water body as a new resource is a historical fact, since the eri is already semi-anthropogenic and has traditionally been used for agricultural irrigation. However, through a set of top-down planning and engineering decisions (Kudimaramath Scheme, Orathur Reservoir construction) the eri is "conquered" by more distant and more powerful stakeholders and integrated into their design in a process that can be seen as a "secondary conquest". What follows is the physical transformation of the eri, first its restoration and modernisation, then its new hydrological connection to Orathur Reservoir. Eri modernisation is a form of physical transformation, which in fact preserves and enforces the physical shape of the water body, while the connection to Orathur Reservoir alters the wider shape of the eri network. This enables the eri to facilitate the next step of transformation, change in use, in which the eri is turned from an irrigation tank into a drinking water reservoir. Eventually, change in property takes place, which in this case is actually a shift of administrative responsibility from lower, local towards higher, regional authorities. I propose yet another step of spatial transformation: change of location occurs as sand mining leads to actual dispersion of eri material to be irreversibly integrated into urban matter through the construction industry. In addition, the remote use of eri water to supply the city with drinking water can be interpreted as eri material relocation. This material dispersion opens yet another aspect of the urban eri as a water body, which partly becomes dissolved in remote urban fabric.

The eri as defining landscape feature acts as peri-urban development nucleus. Hence, the term "urban eri" is coined here to define a water body, which has undergone disconnection from its rural surroundings to be reintegrated into its later urban surroundings, thus (re)shaping the future urban form.

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Primary field sources:
Interviews A1, A2, LA2, LA4, LA5, NGO3

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Nation-making through maps: analysing the lines of power in India

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Keywords: Cartography, nationalism, border

Introduction

During an interview conducted with Kuldip Nayar, an Indian journalist, Cyril Radcliff, the chairman of the Boundary Commission of India 1947, revealed that he had no fixed rules to go by when he drew the India-Pakistan border. He said, "given the same amount of time, I would do the same thing again. However, if I had two or three years, I might have improved on what I did. If the aspirations of some people were not fulfilled, the fault lies in the political arrangement, with which I am not concerned" (Nayar 2006: 34). A similar concern was shared by Jawaharlal Nehru emphasising the complexities involved in defining territorial boundaries during the period. Jawaharlal Nehru in the newly created Indian Parliament in his remark about the Boundary Commission said "one side of the river is sometimes described as the other side. Maps are attached to this description but they do not tally. Sometimes a river is named and there is doubt as to which river is meant." (Nehru 1961: 49). The creation of borders, especially in a postcolonial state like India, is marked with many of such ambiguities.

This paper highlights the role of cartography as an instrument employed by state officials in tackling the ambiguity of nation state borders and describes strategies through which borders become justified. I argue that national boundaries are rather incomprehensible, insensate lines, that only "speak the language of the State, bureaucrats, politicians or the army" (Vijayan 2021), and not of the common people.

From the colonial period, maps were used by the governments to legitimise territories (Harley 1989, Wood 2010, Edney 1997). The concept of a nation frequently evokes the idea of fixed borders and definite shape and is often fed into the memory of its citizens. Establishing political borders on maps fosters civic unity by demonstrating a common territorial heritage. This unity is underpinned by the invocation of historical and geographical knowledge upon which the nation essentially relies to reinforce territoriality. In other words, geography grounds the nation in space while history roots it in time (Schulten 2012).

The "power of map" lies in its impunity. It applies specific social forces on the subjects that is the land and people mapped, to bring into being a "socialised space" (Wood 2010). The force here is that of the authority or the state. The map, therefore, functions not only as a representation of the space or as an indicator of landscape and its specialties, but as a tool that controls, manipulates and produces a social order and knowledge (Wood 2010).

This paper uses a recent example involving cartographic alteration, and discusses how national governments draw on the power of maps to formulate relations between themselves. In 2019, India published a new map (The New Indian Express 2019) comprising the territories of its two neighbouring countries, Pakistan and Nepal. A few lines in the map initiated a cartographic war, between the three nations, through which the states expressed their sovereignty and identity. Thus, we see the concerns raised by Radcliff and Nehru remain an unresolved predicament and are reflected time and again in different forms.

Two nations, two states: disparate tales of cartography

In August 2019, the Government of India abrogated Article 370, which gave special status to Jammu and Kashmir. Article 370 along with 35 (A) was nullified which gave the erstwhile state special status and mandate to define its domicile rules. Together with it, a new political map of the country produced by the Survey General of India was published with certain changes. The new map included Pakistani-controlled Kashmir and Gilgit-Baltistan, a disputed region between India and Pakistan, which initiated a response from Pakistan. The map also declared some areas of Nepal (Kalapani, Lipulekh, and Limpiyadhura), as Indian territory, which the Government of Nepal refuted.

As anticipated, there were responses to the new map from several actors, especially from those directly affected by the cartographic representation - the people living at the borders. The response of the Indian state to these criticisms reflects how maps become a catalyst in the everyday affairs of the modern state and how it formulates and operates its agenda. The initial responses from both Pakistan and

Nepal were to publish their own redrawing of maps (The New Indian Express 2020, The Hindu 2020), incorporating the disputed territories, initiating a cartographic debate, which led to bilateral dialogues and territorial tensions.

In the case of Nepal, along with publishing a map with its disputed land, the Indian government also inaugurated a link road to Lipulekh, which would shorten the Kailash-Manasarovar pilgrimage, without consulting the Government of Nepal. It further flared up the border issue between Nepal and India. Nepal's parliament soon unveiled a new political map with few changes from its earlier versions and all the public and private institutions were asked to circulate the new map. Changes were made in government circulars, school textbooks and other institutionalised agencies that circulate maps. According to the Foreign Affairs Ministry of Nepal, the map increased Nepal's total area by 335 square kilometres (Bhattacherjee 2020). The areas included Gunji, Navi, and Kuti near Kalapani, which had been left out in earlier maps, were also included in the new map. India's government, however, refuted the claim and called it an "unjustified cartographic assertion" (Bhattacherjee 2020: 1). In a strongly worded statement, Ministry of External Affairs spokesperson Anurag Srivastava said, "The Government of Nepal has released a revised official map of Nepal today that includes parts of Indian territory. This unilateral act is not based on historical facts and evidence" (Bhattacherjee 2020: 1). Asserting that this move was contrary to "bilateral understanding" to resolve issues through dialogue, Srivastava asserted, "such artificial enlargement of territorial claims will not be accepted by India" (Bhattacherjee 2020: 1). He noted that Nepal is well aware of India's consistent position and urged Nepal to "refrain from such unjustified cartographic assertion and respect India's sovereignty and territorial integrity" (Bhattacherjee 2020: 1).

In the context of Pakistan, with whom a historically hostile relationship exists, the release of a new map by the then Prime Minister, Imran Khan, further escalated tensions. The map was promptly passed in parliament and Khan in his speech stated that "this political map of Pakistan we are unveiling to the world firstly represents the desire of the Pakistani people, and the principle stands of the people of Kashmir. And it rejects the illegal step which India took on August 5 last year in Kashmir." (New Indian Express Report, 2020: 5). He asserted that the only solution to the Kashmir issue lies in the United Nations Security Council Resolutions, which grant Kashmiris the right to determine their political affiliation through a vote. Imran Khan's objective was to link the new map to the ongoing dispute between India and its citizens in Kashmir. By appeasing the people of Kashmir and referring to the UN resolutions, he sought to legitimize Pakistan's territorial claim and attract international attention to the issue. India, on the other hand, dismissed the map of Pakistan as a political absurdity, contrasting it with its characterization of Nepal's map as a violation of cartographic standards. In an official statement, India's Ministry of External Affairs denounced Pakistan's assertions as legally invalid and lacking international credibility. The statement further claimed that Pakistan's actions reinforced its obsession with territorial expansion, supported by cross-border terrorism (Roche 2020).

Both countries have seemingly bolstered their military presence along their respective borders, marking yet another occasion where both nations have alluded to the possibility of war. This event serves as another example of the nation-state reminding its citizens of the importance of territorial sovereignty and highlighting the other nation's perceived lack of territorial integrity. Additionally, it underscores the commitment of each nation to safeguard its territory and, by extension, its citizens. While Nepal resorted to making the circulation of the map more stringent through its textbooks and other means and ideologically placed the map in the minds of its citizens, Pakistan engaged around the rhetoric of territorial claims. However, it is often the frontiers that witness the violent forms of discourses surrounding nationality. In the case of Kashmir, every "cartographic anxiety" (Krishna 1994: 507) of the nation, since partition, has been unleashed in this space. "Since independence (or more accurately, since partition) the anxiety (of the State) has been showcased perfectly in the space of desire called Kashmir. The 'accurate' representations of the body politic in maps and insignia are watched with an intensity that is perhaps un-equalled elsewhere" (Krishna 1994: 510).

The idea of cartography, sovereignty, territorial integrity and claims to "historical evidence" are amalgamated to legitimise the territorial dispute. The map here serves as objective, real knowledge based on pre-given, scientific/historical facts which cannot be refuted even with empirical evidence. It acquires a historical validation or a "subterfuge of antiquity" (Kaviraj 2010: 44) where in order to conceal the recent origin, the nation-state claims to have a long, deep-rooted past. The Indian State here replicates the same pattern in its response. Territorial and geographic authenticity is attained by invoking historical claims using cartography. The redrawing of maps served as an opportunity for both the state and mainland nationalists to demonstrate their loyalty to the nation's territory and its continuous borders. However, it also marked one of the most severe violations of human rights in recent history for the people of Kashmir. The government harshly suppressed the voices of its citizens by implementing

a communication blockade and employing aggressive policing methods to suppress dissent and opposition (Maheshwari 2020). Any action or attempt to alter the map was met with severe consequences, including charges of sedition and other unbailable charges. The confrontations between the state and the people along the borders reflect the contested and troubled construction of state sovereignty in a nation that was formed through territorial division.

Conclusion

Maps become the symbol or reminder of a stringent border that demarcates an inside and outside, the primary object of a nation-state. In a postcolonial or yet-to-become nation-state like India, cartography is predominantly used to transform the once fluid colonial frontier into a fixed nation. While in the colonial period mapping was a tool to enhance trade and administration, in the postcolonial period it became a signifier of nationalism, a tool to represent the nation-state. As Dennis Wood (2010) argues, the modern state affirms the map and vice versa through various governmental and non-governmental policies and methods.

While the state uses its mechanism and agencies to conceal its formation, cartography is used to legitimise these practices. In the post-colonial period, it palpably deals with the consequences of its ambiguous formation time and again. The discourse associated with cartography is often evoked to address the immanent questions of citizenship, belonging, territorial disputes, knowledge building etc. The incomprehensible, insensate lines continue to determine the lives of hundreds of people who struggle to belong between them

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Urban food environments in India and Mexico

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Keywords: Food environment, food system transformation, consumption practices, urban malnutrition

Introduction

Food environments are the interface in which food systems meet the consumption practices of people. It is important to understand food environments especially in the urban context of emerging economies, taking into account that the metropolises of those countries with recent economic growth have a particularly high prevalence of diet-related diseases and socio-environmental degradation (GBD Ng et al. 2014, Pingali et al. 2017, Swinburn et al. 2019). The metropolises of India and Mexico are some of the most affected by the synchronous occurrence of multiple forms of malnutrition (ibid.). These include nutrient insufficiencies, obesity, and underweight, as well as associated non-communicable diseases and chronic illnesses, such as diabetes (FAO 2019). Additionally, socio-environmental degradation is occurring in food systems under the current food regime. It fosters unfair labor and trade, climate change, and biodiversity loss by way of the relative power of the food industries' profit interests over social and environmental wellbeing (Friedmann 2005).

The research question here is how individual food consumption practices in India and Mexico relate to disease-prone and unsustainable urban food environments. More precisely, I ask how food practices lead to the reproduction of such food environments on the one hand, and how these food environments help reproducing disease-prone and unsustainable food practices on the other hand. This paper identifies blind spots in the literature and proposes a food consumption practices based approach to the study of urban food environments in India and Mexico. It aims at adding to the debate from a qualitative angle by exploring the empirical "outside foods" trend and the ambiguous "healthy-wealthy-chubby" phenomenon as two contradictory dynamics of a regime that I conceive as aspirational eating. Furthermore, it explores initial findings of biographical turning points in individual food practices and proposes promising research perspectives.

Food environments

Various scholars added to our current understanding of the role of food environments in promoting sustainable and healthy diets. Sobal et al.'s (1998) systems theory approach stresses the importance of a comprehensive understanding that takes into account the broader cultural and social context in which food choices are made. Glanz et al. (2008) build a strong concept on the notion of the environment of individual and community food consumption, which helps to understand neighbourhood food availability but lacks a broader scope. Popkin et al.'s (2012) work sets the cornerstone for debates on obesogenic environments and proposes intervention points to improve access to healthy foods and reduce the availability and promotion of unhealthy foods. Swinburn et al.'s (2013) key framework defines food environments as the collective physical, economic, policy, and socio-cultural surroundings, opportunities, and conditions that influence people's food and beverage choices, and ultimately determine their nutritional status. The authors call for a comprehensive, multi-level, and multi-disciplinary approach to improving food environments. The UN's Panel of Experts (HLPE 2017) build on that framework and foreground that it is different scalar contexts in which consumers engage with the food system to make their decisions. The latter definition is arguably the most widely used.

This brief literature review shows the development of the conceptual approach. It highlights the importance of food environments as the central interface between consumer demands and the food systems' offer. At this point of contact, contextually asymmetrical relations offer an uneven playing field for individual consumption practices. It is transversal to the intersectional axes of socio-material inequalities of class/caste, generational difference, gender, and colonial legacy. For the Indian and Mexican contexts, it seems imperative to pay closer attention to the digital, the corporeal, and the agri-food platforms' economic dimensions of food environments (see Müller-Hansen et al. 2023) to outline inequalities that constrain or enable healthy and sustainable dietary practices in cities.

Food consumption practice theory

Retrieving ideas from consumption practice analysis (Warde 2007), it is important to note that individuals and their behaviours are not solely responsible for creating healthy and sustainable food environments. Systemic and structural factors, such as power relations between consumers and the food industry

or economic policies that prioritize profit over people's and planetary well-being, significantly contribute to the development of healthy and sustainable food environments. Nonetheless, particularly the consumers of that more privileged urban population can play a crucial role in creating healthy and sustainable food environments for all. Examples include: making informed choices, being aware of the impact of their consumption practices on their corporeality and on the environment and society at large, by demanding systemic changes, and by networking and mobilizing to make their voices heard.

With this prologue to food consumption theory in mind, it is worthwhile to examine individual practices of procuring, preparing, eating, and disposing of food. Individual food practices follow certain patterns. In the terms of consumption theorists, those patterns can best be understood as sets of interconnected doings or "practice bundles", and "material arrangements" or the preconditioning stuff arraying possibilities (Schatzki 2014). Daniel Welch (2017) contributed significantly to the understanding of macro-level developments of practices. He differentiates between such socially shared affective commitments that engage with individually differentiated motives, and such more general affective engagements that represent Schatzki's (2002) "common understandings". The first macro-level dynamics are conceptualized as "teleoaffective formations" (Welch 2017: 61), meaning more or less loose conjunctures of emotional affect expressed through individually purposeful practices. The latter are conceptualized as "teleoaffective regimes" (Welch and Warde 2017: 3). Within these regimes, the purpose of practices is shared.

Methods

In order to capture the nuanced individual motives relevant to the theoretical understanding, a fine-tuned methodological approach is indispensable. In this study, in-depth interviewing and participatory mental mapping were employed to retrieve data in the metropolis of Hyderabad in India and Mérida in Mexico. The two data sets allow for a more precise distinction of culturally specific aspects, respectively of South Asian and Latin American food environments. All 53 interviews were held in person between September 2022 and January 2023. Most of them took place in the interviewee's homes, they were recorded with fully informed consent, and they were transcribed in parallel to the interviewing process to allow for an iterative reflection on questions. For the coding with the MAXQDA software, some categories were deductively built, but the most salient ones emerged inductively during the research. The study participants were recruited via snowball sampling, and selected based on various criteria, including belonging to the urban middle class, covering a range of adult age groups and genders, including individuals from different middle income groups, professions, castes, religions, and neighbourhoods. In the end, the Indian sample n=31 was a bit larger, since the author was less familiar with the context in comparison with the Mexican study site, where data saturation was reached at n=22.

"Outside foods" and "healthy-wealthy-chubby"

The study reveals that intersectional socio-material inequalities of class/caste, generational difference, and gender, as well as colonial legacy, determine individual urban food environments in India and Mexico significantly. In the Indian context, aspirational expressions like "outside foods" and the synonymously used terms "wealthy-healthy-chubby" let on the cultural and historical ambivalences. There are the shifting normative patterns when it comes to the body images conveyed through digital media as opposed to those of older generations in families. Moreover, some turning points for shifts in food consumption practices and corporeality were identified. They include individual turning points like taking up a sedentary occupation, marriage, performing parenthood, and increased screen time. They include also general turning points like the increased availability of digital food services, and the Covid-related restrictions and their repercussions.

Outside foods refers to comestibles that are prepared and sold outside of the home, often in restaurants, street food stalls, and fast-food chains. I intend to establish outside foods as a term that contributes to geographical perspectives on food. Outside foods take the food vending setting as point of reference, rather than the increasingly diversifying modes of food distribution and settings of food consumption. As an empirical term commonly used in India and Mexico, "outside foods" reflects not only the space where the food is prepared but also the social and cultural meanings associated with it. Particularly for young generations, consuming "outside foods" is often associated with upward social mobility and modernity, as well as the desire to distance oneself from traditional home-cooked meals that may be seen as less sophisticated. That last aspect of sophistication when it comes to other cuisines can be linked to the countries' colonial legacy. In Indian society, the British constructed their empire across India on the notion of cultural superiority that also inferiorized Indian food culture. This tale of hierarchies of cuisines made its way to contemporary conceptions of modernity, as established by the former colonizers. Young people seek to explore the pre-conceived modern foreign foods. Also in Mexico, the convenience and colonially-infused imaginaries of allegedly uniform rather than diverse modern processed and ready-made foods is overriding the cultural heritage of the community culture cuisine. It

shows through an omnipresent availability of sodas, alcohol, and energy-dense but nutrient low snacks at the lowest prices. Their consumption has a ritualized character, for example during the morning snack time between breakfast and lunch that used to be dominantly corn and fruit based. In connection, this trend towards consuming certain "outside foods" from certain popular venues has been linked to negative health outcomes because of those foods' high share in saturated fats, salt, and simple sugars. This holds true particularly for lower-income and geo-socially marginalized populations who may not have access to healthy and affordable outside food options. Nonetheless, all sorts of outside foods are promoted through digital media and have become very popular due to their convenience, relatively low prices, and digitally translated lifestyle aspirations. Especially in India, online delivery services have had significant growth (Patgiri, 2022) and now form part of many middle-class household's everyday food practices. At first, apps like "Swiggy" and "Zomato" provided services solely for delivering prepared meals, such as chicken, which is often ordered by young Indians from the lovingly dubbed "Generation Chicken" to supplement their vegetarian family meals. During Covid lockdown and because of the fear of restaurants and service personnel as potential virus carriers (ibid.), the delivery apps included grocery delivery in their portfolio. This was well received by the urban consumers since they were already used to placing orders for example at neighbourhood corner stores. The availability of such services and the changing job market with more work opportunities for women and relatively less time for food have set the premise to recur to outside foods. From a gender perspective, outside foods can be interpreted as a tool of liberating some women from the handed-down food duties. Currently, much of the urban middle class Indians' food procurement has shifted to ordering in "outside foods" and groceries digitally or by phone call – a significant post-Covid repercussion on the food practices.

The "wealthy-healthy-chubby" nexus was identified by their usage in India and Mexico as synonyms, and gives way to complex cultural and historical ambivalences, such as the shifting normative patterns when it comes to young generation's body images, conveyed through digital media, as opposed to those of older generations. Until recently, a larger body size was associated with wealth and social status as it suggested that one had access to an abundance of food and resources. However, with the younger generations, there has been a shift towards valuing thinness as the ideal body type, that is often achieved through dieting and exercise. This shift is influenced by various factors, including the rising influence of global markets and media that promote such body ideals. Moreover, the shift towards ideal-typical thinness has contributed to the rise of diet culture and a burgeoning market for material and digital dieting products. Particularly problematic is that it promotes a weight stigma that is disjunct from implications of real obesity. This weight stigma, disguised in (lay) medicalization, associates larger body sizes with personal failure and moral inferiority.

Both in India and in Mexico, these different body images and norms create negotiations between different generations, resulting in a complex relationship between food, culture, and health that reflects the changing social and cultural landscape. It shows notably in the digital, the corporeal, and the agri-food platforms' economic dimensions. In families, especially the younger generation is experiencing these ambivalences as conflicting, with older family members pressuring them to uphold their chubbiness standards, while the media at their reach promote obesogenic foods at the same time as they promote body images celebrating thinness. In response to that ambiguity, an energy balance fitness narrative settled in among the middle class. Fueled by the food industry, it promotes an overall increase in consumed and burnt calories, and disregards nutritional value balances as well as many physical and most mental responses to food. Even when following that consumerist narrative through, maintaining the required levels of physical activity is unattainable for a large proportion of the urban middle class. Besides the time and monetary constraints for sports, many Indian and Mexican cities do not count with enough walkable green space, possibilities for active transportation, or even the clean air to make that narrative operable (see Rigolon et al. 2018; Wolch et al. 2014).

In addition, biographical narratives of study participants named turning points when it comes to alterations in their dietary health, dietary sustainability, and diet-related changes in their body shape. They mentioned individual turning points like marriage and performing parenthood, taking up a sedentary occupation, or increased screen time, and general turning points like the augmented availability of digital food services, Covid-related restrictions, and the post-Covid new normal with new food practices. Given that many of these turning points aligned across the interview narratives, it is reasonable to conclude that there are both individual and shared socio-environmental events that provoke change in our food consumption practices.

Teleoaffective consumption practices in Indian and Mexican urban food environments

This study focuses on Indian and Mexican southern metropolises, where the urban middle classes represent growing segments of the populations with increasing purchasing power. They are willing to spend more money on outside foods, to aspire to certain lifestyles, and attain certain body images that

entail different health and sustainability results within the generationally ambiguous outside food and wealthy-healthy-chubby dynamics.

From a consumption practices' perspective, these dynamics can be interpreted as teleoaffective formations. The younger generations that subscribe to the outside food dynamics have a variety of motives to engage with that consumption practice. These range from the class/caste distinction through outside food consumption while maintaining embodied thinness ideals, over reinventing the gendered division of food tasks, to the upholding of colonially infused hierarchies of cuisines and globally commercialized food products. The older generations that conflate wealth with chubbiness and health possess another set of motives. They show their class/caste distinction by embodying the large abundance at their reach. I interpret this as a consumerist reconciliation with the belittling and the manifold scarcities, including in the food realm, of the colonial times. This has repercussions in socio-cultural, economic, and racial-ethnical inequalities that last until present day. Coming to a last but not least motive, the women in the families take up the handed-down gendered role of food preparation. There are many nuances to that role, in which women may take great pride and show their love and care through food, but may also put up with sacrificing their own culinary preferences and oftentimes also their profession, career, and financial freedom.

The two teleoaffective formations "outside foods" and "wealthy-healthy-chubby" thus inglobe a variety of motives that create generationally conflicting possibilities and enactments of food-related social distinction. According to this, notions of health are changing within the urban food environments of India and Mexico, from chubbiness ideals among the older generations to thinness ideals among the younger generations, who are highly perceptible to global trade and media. The sustainability aspect seems rather absent in the wealthy-healthy-chubby dynamic, since it is marked by the logics of abundance. It seems to gain concern in outside food dynamics, particularly among the wealthiest and among the youngest generations.

I conceive that both teleoaffective formations and their myriad motives have a common denominator: aspirational eating. This teleoaffective regime helps reproducing disease-prone and unsustainable food environments by overriding bodily and environmental warning signals through powerful food marketization and the thrive for convenience that is partially conditioned by the job market. Aspirational eating conveys that belonging to the modern world, the urban middle class in particular, requires adapting the dynamics of "outside food" or "wealthy-healthy-chubby" consumption lifestyles.

Research pathways

Indian and Mexican urban food environments' central dimensions reach beyond established frameworks. These frameworks require revision and expansion to meet the need for adequate qualitative scrutiny as well as standardized factorial measures.

The identified motives of "outside food" and "wealthy-healthy-chubby" consumption practice dynamics would profit from an in-depth historical analysis to examine their possible newness or how they are possibly embedded in larger cycles.

Finally, individual and shared turning points in food consumption practices are an intriguing research pathway to pursue with a mixed methods approach. This could indicate the most fruitful moments for interventions to build healthier and sustainable urban food environments, supported by the corresponding food consumption practices.

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Pauperization and migration: the continuing violence of Green Revolution in rural Punjab, Pakistan

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Introduction

This essay is based on the findings of a research started in 2018 to interrogate the rising number of rural migrant women working as maids in middle class homes in the metropolitan city of Lahore in Punjab, Pakistan. Rural–to-urban migration is an ongoing process in developing countries and the rate of urban growth in Pakistan surpasses its neighbors in South Asia. The Green Revolution (GR) in the mid-1960s introduced mechanization as well as synthetic fertilizers and pesticides, and transformed the agrarian mode of production in Punjab. GR rendered large numbers of sharecroppers and agricultural labour surplus forcing men from villages to cities in search of livelihoods. Typically, until the 1990s, women's migration to the city was marriage-based (Ahmed 2020, Arif 2005). Rural families sent men to work in the cities while the family stayed on in the village.

Post 1990s, there has been a feminization of labour and migration in the globalized economy. Domestic work has emerged as a major occupational category for rural migrant women across the world including the countries of the Global South (Killias et al. 2020, Labadie-Jackson 2008, Agrawal 2006, Ehrenreich & Hochschild 2003). The phenomenon of increased employment amongst women in the Global South increased the demand for domestic help for childcare in the absence of broad social support systems by the state. While research on maids in Pakistan is focused on conditions of work in the city (Zulfiqar 2018, Shahid 2009), our ongoing study aims to interrogate the rural conditions forcing migrations for domestic labour in urban Punjab, Pakistan.

This extended abstract is based on ongoing research which started in 2018. Our study aims to investigate the conditions in rural Punjab forcing women to seek employment as domestic help in the city. This research was conducted in the city of Lahore and some 25 villages across Punjab, a vast region with diverse agro-ecological zones. Most of the villages were in central Punjab, which is more developed and is dominated by small land holdings, fewer interviews were conducted in the south. The research methodology was qualitative interviews, and focus group discussions with maids in Lahore and a range of rural actors in villages. In the city, we recorded and transcribed detailed interviews with maids who had migrated in the last 10-15 years to Lahore city and held three focus group discussions in working class neighborhoods. In addition, we interviewed representatives of a non-government organization working to unionise domestic workers in Lahore. In the villages, we conducted interviews with landless peasants, farm labourers, rich and middle farmers, local health professionals, agricultural department personnel and school teachers. The wide range of interviews aimed to understand the social and ecological conditions of the sending village environment of the maids in the city.

Long shadow of the Green Revolution and its colonial legacy

British policies transformed the socio-ecological landscape of rural Punjab in the mid 19th century as new arrangements of land ownership, crop choices, market and infrastructure were imposed to further colonial extraction (Bhattacharya 2019, Agnihotri 1996, Ali 1988). It set the path towards a dependent, semi-feudal, and semi-colonial mode of production.

The British annexed Punjab in 1849 and carried out a comprehensive settlement of the land. In this first onslaught, the British introduced the concept of private ownership of land. Earlier, land was deemed to belong to the ruler who could award it to those he or she patronized for military or tax collection purposes but there was no concept of legal land ownership by individuals. The privatisation of land was a major social intervention in society and categorically created a class of owners and landless in the countryside (Talbot 2011, Ali 2002). According to the census of 1881, half the population of Punjab were declared non-agricultural castes and denied any ownership in land.

The colonists consolidated the existing hierarchy in the villages in a substantive way and generally made the farming upper castes owners of land. They deprived the traditional crafts and service providers of their livelihood in addition to usurping the common land on which the vast number of pastoral communities and lived through hunting, fishing and other non-settled land based subsistence. Land was the primary means of production in the vast expanse of the Punjab. With this land allocation policy the

landless people became totally dependent on the landlords for their food. They have continued to be so into the present times especially in Pakistani Punjab where no major land reforms were undertaken unlike Indian Punjab (Hussain 1984). This history, which is well documented, was corroborated in our interviews. An elite landlord in Warburton narrated how his own family had been given land by the British for providing recruits for the colonial army. All the landless informants interviewed belonged to the lowest castes of artisans or tribes and recalled that their elders subsisted through livestock keeping, hunting, fishing or crafts.

All the interventions of the GR were designed to move production away from the indigenous subsistence needs and make local production part of the global imperialist economy (Cleaver 1972). Patel (2013) refers to industrial farming as 'agriculture without farmers' as it pushed the landless sharecroppers and small farmers out of farming. Either landlords took back land for farming with machines or the sharecroppers gave up farming as they could not pay for the water intensive new seed varieties which also needed synthetic fertilizers and pesticides (Hamid 1982).

These landless tillers were at the forefront of political struggle in the 1970s when a populist government promised land reforms but never accomplished any significant change in land ownership and quickly gave up on the policy. This unsuccessful struggle for land however became a signal for the landlords to change sharecroppers into contract farmers (Ali 2020, Hussain 1984)

In the absence of land and crafts the poor peasants made livestock their source of food and insurance for adversity. The shadow of the GR looms long into the present. Livestock needs feeding: abundant grazing commons in the rural areas in the past as well as a social contract with the landlords under which as part of their labour for working on landlords lands and looking after his cattle ensured the poor peasant feed for his one or two animals on landlords lands. With the gradual increase of industrial farming, the landlords' dependence on the poor peasant has decreased. The grazing commons have been grabbed and the social contract between the landed classes and the landless peasants for food and fodder has broken down. Landlords are not ready to give away any fodder without payment in cash or kind. In the words of a poor peasant '*Mul lai kay charaa nahein paaya ja sakda, hun janwar rakhn di gunjaish naein aay* (It is not possible to feed buffaloes and goats with feed from the market, it is not possible to keep animals anymore)' (Village Hakuwala, 29.4.2023). Thus, denial of access to grazing and fodder is depriving poor peasants of livestock, their mainstay without land.

The shrinking ability to rear livestock is also depriving landless peasants of milk, butter and buttermilk. Even food sharing of *lassi* (buttermilk) and occasional vegetable, like *saag* (local leafy green) has been withdrawn by the rich peasants. Food is no longer a gift; it must be paid for by some work in the landlord's house. The poor peasants on their part are increasingly hesitant to work in the landlord's house or on his farm without payment (which is much less than the rate in the city for domestic work).

Drivers of rural-to-urban migration

Time and again our respondents spoke of life until the 1990s to be free of hunger. Their repeated refrain in Punjabi was '*bhook nahein si* (there was no hunger)'. A maid interviewed in Lahore recounted nostalgically about the quantity and quality of food she had as a child of an energetic sharecropper: 'we ate good food and always had extra grain' (Lahore, 19.8.2023). All of the interviewed landless peasants recalled that there was ample work of wheat harvesting and almost everyone in the village could amass wheat to last for most of the year and many had surplus grain as well as access to fodder and kept livestock. Amassing wheat as well as hay during the spring harvesting is the most significant activity for the poor peasants. The now ubiquitous use of harvesters and threshers in many areas has taken the work of harvesting away from the families of the landless. In a village off the main road about an hour from the metropolitan city of Lahore, a landless peasant recalled that a majority of the landless had milk animals and even the poorest had goats and chickens. In 2023, they had been unable to collect grain for the whole year and the animals had no uncultivated land to graze and consequently were confined to the courtyards, squeezing the living space The landless did not even own the land on which they had built their home. The land belonged to the local landlord. During the populist government of Bhutto (1972-77) many landless were granted land for homes, but the policy could not be uniformly implemented (Gazdar and Mallah 2012).

Socio-ecologically the rural Punjab is degraded as a living space. The Green Revolution altered the mode of production and changed the village society. Interviewees reported that it is no longer a connected community with production based on local resources. A carpenter (Kala Shah Kaku, 2022) narrated how the landlords were freed from dependence on the carpenters for tools after the coming of tractors and paid them poorly for the occasional carpentry work such as fixing cots or doors and windows. Mechanization and use of chemicals has rendered the landless unemployed and hungry. Even small landowners reported that they are selling or renting land and moving to the city as their children are educated and there are no jobs in the village and the big landlords are mostly absentee farmers. Just as the change in the mode of production has disrupted the historical social structure of the village and created poverty it has destroyed it ecologically (Niazi 2004). There is in-

situ urbanization with new consumption induced by the spread of the cash economy post GR.

The effects of environmental degradation and socioeconomic change have further pushed rural-to-urban migration. It has led to a trend to shift to flush based toilets in the villages but there is no integrated sewerage disposal in the villages and homes require individual septic tanks which leak and pollute the water. The pollution of water is cause of rise in stomach diseases as well as added burden of work. The villagers are forced to acquire filtered or clean water, either from cleaner ground water near the canals or some distant filtration plant built by state or charities for the villagers. Gross pollution of groundwater from untreated sewerage water and leaching of agro-chemicals are a major ecological issue in rural Punjab (Ali and Jabbar 1992, Raza et al. 2017).

Other financial and social stressors in the environment are increasing the burden of disease. In the words of one maid '*hun log sugar tey blood pressure nu tey bimari ai nahein samajdey aay tey har doojay banday nu hay* (Now diabetes and hypertension are not even considered diseases, as every other person has them)' (Lahore, 24.4.2022). Maternal health is another area of increasing costs. Caesarean section births in hospitals and more often small private clinics in nearby towns are perceived as the norm. Villagers mostly blame the greed of the doctors and to a certain poor health of females who have less access to nutritious food than their mothers from the previous generation.

Electrification has added to the burden of cost of living tremendously as electricity costs have spiked since the liberalization regime initiated in 1998 (Munir and Khalid 2012). Electricity is now a basic need in the villages as water is pumped by motors from the ground and mobile phones need power for recharging. Mobile use has been structured into a necessity as governance has aggressively digitized and older means of communication and entertainment have disappeared. With the community broken security has also emerged as a major issue and male migrants are apprehensive of leaving their families in the villages.

Peasants and the violence of the city

While in city the poor peasant women get maid work readily for which they have the necessary skills. They become the main source of bread. Wage labour for men is erratic and harsher, although their wage is higher in the city. Dependency on women, in turn, generates bitterness among men and they become more aggressive with their own family. Quality of food has deteriorated and the maids were deprived of community that was a source of strength in the village. The cost of living including rent and electricity bills tends to exceed their earnings. Work by landless women is nothing new. Both men and women and even children had worked in the family. But interviewees narrated that in the village it was a different type of work. One could control it to a degree and continue to run the household too; moreover, the joint family had more flexibility. The maid work for wage labour in the cities is perceived quite differently. It fully occupies you and is distant from home. It completely disrupts the household. It is also flexible, a maid could work more hours, a man too could drive his *Chingchi* (motorcycle rickshaw) for longer hours and earn more. This transaction economy has come to the village too. One could sell a share of the buffalo's milk and earn more. This flexibility, however, is compulsion in the garb of choice and eventually they end up selling all the milk, losing an important source of nourishment for the family.

Interviewees stated that the husbands have a dominant role, many beat up wives and children and use foul language. Yet the relationship continues. Interestingly it seems even when he is ill, not working and beating, his protective role is very important for the family. Divorce is uncommon; if the husband dies very early the family elders marry her off to husband's younger brother or such close relations along with her children. The second husband is generally even less caring and may not provide for the family but his protective role is valued again.

Illness is commonly reported, including typhoid, hepatitis, hypertension, diabetes and BP (high blood pressure), and respiratory diseases. Many men die early or cannot work. Many maids reported that invalid husbands may need care for many years and live off the wife. For some reason, there are more invalid and sick husbands than wives, according to interviewees.

Family debt is yet another characteristic of the maid's family in the village as well as in the city. Healthcare is one main reason for contracting debt, the other is children's marriages a third electricity. Debt is very difficult to pay back. It generally tends to become circular, to pay an old debt to A you contract a new debt from B. However, the maid's family debt is not as serious a problem as the small peasant farm debt which needs to be paid to businesses and institution (e.g. banks) and is constantly growing because of interest. Most of the family debit is paid in small installments not in one go.

Discussion and conclusion

Migration from countryside to the cities leads to the economic process of growth but is actually physical as well as social desertification. When a land becomes infertile whether for lack of water, because of too much water, or because of depletion of nutrients or organic content it is said to have become desertified. It is the same for a society.

Change in the mode of production through GR is leading the physical and social desertification of

rural areas in Punjab, finishing livelihoods, replacing moral economy, referring to livelihoods based on unpaid labour with the cash economy, and a consequent mass exodus of the landless. It is a violence in which poor peasants are losing the stability and food security they had enjoyed for centuries (Sobha 2007). The migration imposed by the GR is an irreversible linear process. It does not compare to the cycles of drought induced famines and migrations of pre-modern rural production. Those who leave the countryside would never return.

Rural culture entailed sharing, interdependence, milk based diet, home food factory, and hard work as well as leisure based activities and festivities. There was relative equality between the majority small and poor peasants in the village in terms of culture as everyone followed a similar dress, food, festivals and spoke the same language. The women and men too were more equal as women participated actively in production, farm labour and looked after the livestock. While women looked after children and did household chores in addition to their work in agriculture, it put double burden on the females, but there was a larger support of community and commons in her dual work life. The maid work in the city is atomized and psychologically stressful. Culture, community, tradition and rootedness had made security of women as well as of the rural areas in general possible.

Pakistan like so many other countries of the global south, in neo-liberal times is undergoing de-industrialisation. Women led rural-urban migration to take up work as maids cannot be considered gender participation in productive work. This is not a migration of maids. These are peasant women who were already actively involved in the productive economy of agriculture and livestock. The only jobs on offer in the city are unproductive low paid work in the service economy. This social regression is a major chapter of the multifaceted violence wrought by the GR.

In the city, the cultural roots are completely cut and even the remnants are headed for a finish. Once in the city the family further dismembers losing connection to space, history, community and *bradari* (clan). As these bindings of self-respect loosen, individualism prevails. It becomes an issue of survival. The traditional moral code and value system is damaged and weakened. In neoliberal terms it however may be called emancipation from the shackles of tradition. This huge social change has introduced a major instability in the whole society creating chaos and destroying its ability to sustain and evolve.

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Remote sensing approach to evaluate the effects of urban vegetation loss on the urban thermal environment in the fastest-growing megacity of Pakistan

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Keywords: Urban vegetation, surface temperature, urban heat islands, thermal environment, Lahore.

Introduction

One of the most significant components that contribute to ecological balance and environmental sustainability is urban vegetation (Kafy et al. 2021). Due to rapid urbanization, the ecological and thermal environment of urban areas has been negatively impacted by the growing replacement of natural landscapes by artificial surfaces (Grimm et al. 2008). Cities are a major driver of economic growth, accounting for around 60% of global GDP (Un-Habitat 2018). Urbanization is a sign of economic success and prosperity, but it also has detrimental short-and long-term effects on the development of cities (Celik et al. 2019). As populations of cities grow, pressure is put on rural areas, the boundary is expanded, and natural resources (i.e., forest, vegetation, and agriculture) are replaced. Therefore, urbanization affects changes in land use and land cover (LULC) and is a crucial indicator of LULC changes that disrupt the balance of surface energy and raise surface temperatures (Matthews et al. 2015). Despite its importance for balancing the LST in urban environments, urban vegetation globally has dramatically decreased over the past few decades (Choudhury et al. 2019). According to Xiong et al. (2012), the loss of vegetation due to urbanization results in significant changes in the urban thermal environment (UTE), which ultimately deteriorates environmental sustainability by increasing land surface temperatures (LST). This contributes to the UHI (urban heat island) effect, which negatively affects both the comfortable everyday lives of people and the sustainable growth of cities (Mohan et al. 2022). Therefore, it is crucial to comprehend the role of urban land use, as well as its relationship with changes in the pattern of the urban area, and the impact of the loss of urban vegetation on urban LST.

The application of remote sensing and geographic information systems to assess LULC and LST changes in urbanized environments has grown significantly over time (Balogun and Ishola 2017). Analysis, monitoring, and simulation of LULC and LST variations are made simpler through the use of integrated GIS and RS techniques (Fu and Weng 2018). Thermal remote sensing technology, which monitors the UHI, is regarded to be a useful tool for evaluating the adverse impacts of human activities on local climate over the previous 20 years. Several researchers used thermal infrared sensors that were available at different spatial resolutions to investigate LST features for distinct LULC categories in various urban contexts (Fu and Weng 2018; Celik et al. 2019).

This research aims to develop an appropriate method for evaluating the effects of urban vegetation loss on the urban thermal environment of Lahore, Pakistan's fastest-growing megacity, utilizing satellite remote sensing (SRS) and GIS techniques. The current study used multi-temporal Landsat 5 & 8 (TM & OLI_TIRS) data to identify the LULC change between the years 2000 and 2020 and investigates the changes from natural vegetation cover to the urban area and its effect on the LST variations in Lahore, Pakistan. Moreover, this study examines how image processing and spatial analysis can be used to enhance urban green initiatives in Lahore and contribute to sustainable urban planning, ultimately fostering a healthier and more sustainable urban environment within the city. Urban planners and policymakers have found remote sensing techniques to be a very helpful tool for determining the best course of action to promote sustainable development, conservation of the city's natural resources, and minimizing the impact of urbanization on LST (Kafy et al. 2021).

Study Area Description

Lahore is Pakistan's second-largest metropolitan city after Karachi and 100% of its population lives in urban areas (GOP, 2017). The city of Lahore is situated on the left bank of the Ravi River and is located between 31°13′-31°43′ N latitude and 74°0′-74°39.5′ E longitude. Lahore is the core of cultural activities as well as the academic, social, economic, and administrative hub of the Punjab province of Pakistan. The total area of district Lahore is 1772 km^2 (Fig. 1).

Materials and Methods

The two most recent decades (2000 to 2020) were chosen for this study. Two Landsat Multi-spectral satellite data sets were downloaded from the USGS website to assess changes in urban vegetation cover and LST dynamics in the research area (Lahore) over these 20 years. The research area includes urban vegetation as well as the surrounding agricultural fields, which have been gradually turning into built-up land over the past few decades. Therefore, to avoid the impact of cooling and heating, the spring season

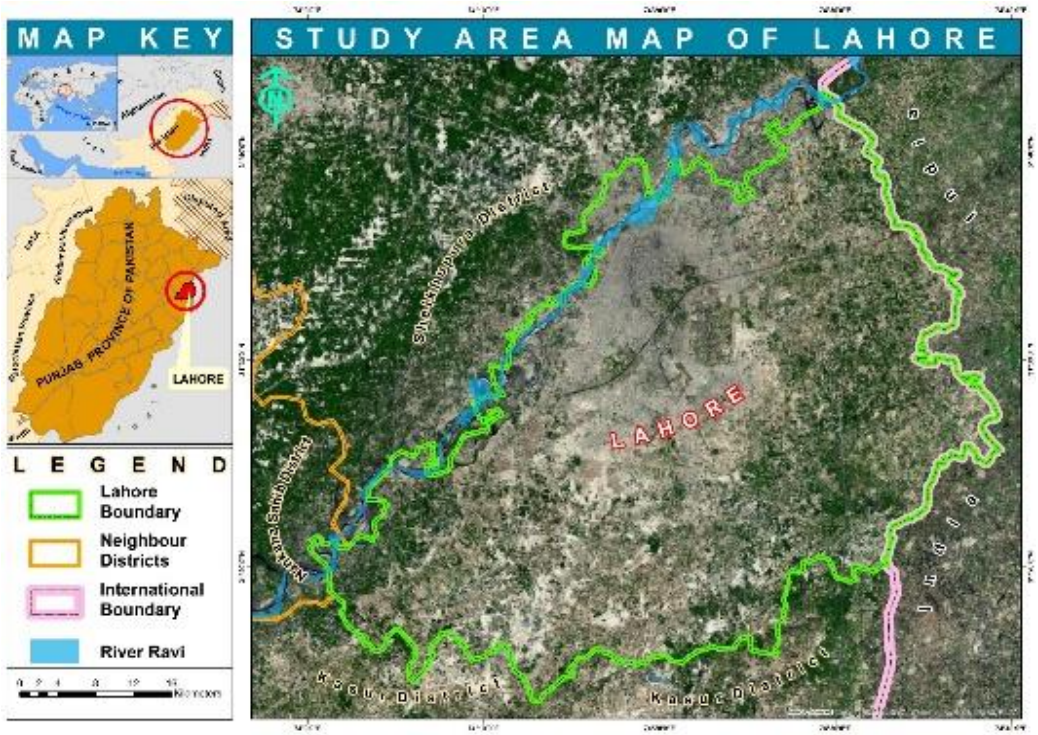

Fig. 1: Location map of the study area district Lahore (own draft)

and the month of March were selected for the analysis as it is the most suitable season for land use classification and retrieval of LST (Nasar-u-Minallah et al. 2023; Nasar-u-Minallah 2020).

The collected Landsat images between the years 2000 and 2020 were divided into the four LULC classes of built-up area, vacant land, vegetation, and water bodies. To estimate the LULC classification, the Maximum Likelihood Supervised Classification (MLSC) technique was applied (Nasar-u-Minallah et al. 2021). The Radiative Transfer Method (RTM) was employed (Nasar-u-Minallah 2019) in the study to estimate LST and examine the effects of UHI over 20 years. Fig. 2 depicts a comprehensive methodology.

Results and Discussion

LU changes and vegetation loss

With an overall 85% accuracy across all parameters for several years, the LU classification accuracy showed great results. In the LU classifications of the study period (2000-2020), two notable changes have been found. The first is an increase in the built-up area with a marked reduction in the amount of vegetation cover, vacant land, and water bodies. In 2000, Lahore had 25.12% of built-up area, 59.95% of vegetation cover, 13.67% of vacant land, and 1.26% of water bodies. However, after twenty years, in 2020, the LU distribution of Lahore has been changed to 43% of built-up area, 46% vegetation cover, 10% of vacant land, and 0.86% of water bodies. As illustrated graphically (Fig. 3), over the last two decades +17.88% of the built-up area was increased, resulting in -13.95%, -3.67%, and- 0.4% decrease in urban vegetation cover, vacant land, and water bodies, respectively.

The urban population of the city increased as a result of new employment opportunities in a variety of economic sectors, including commerce, industry, business, and transportation. A key factor in the city's urban growth was the population increase. Additionally, migration from rural to urban areas in search of jobs, an increase in commercial activity, and the availability of superior academic and medical facilities have been the main drivers of Lahore's expansion and changes in land use.

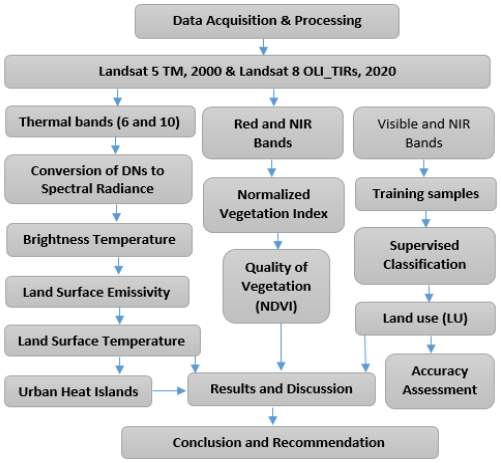

Fig. 2: Flow chart for details of the methodology (own draft)

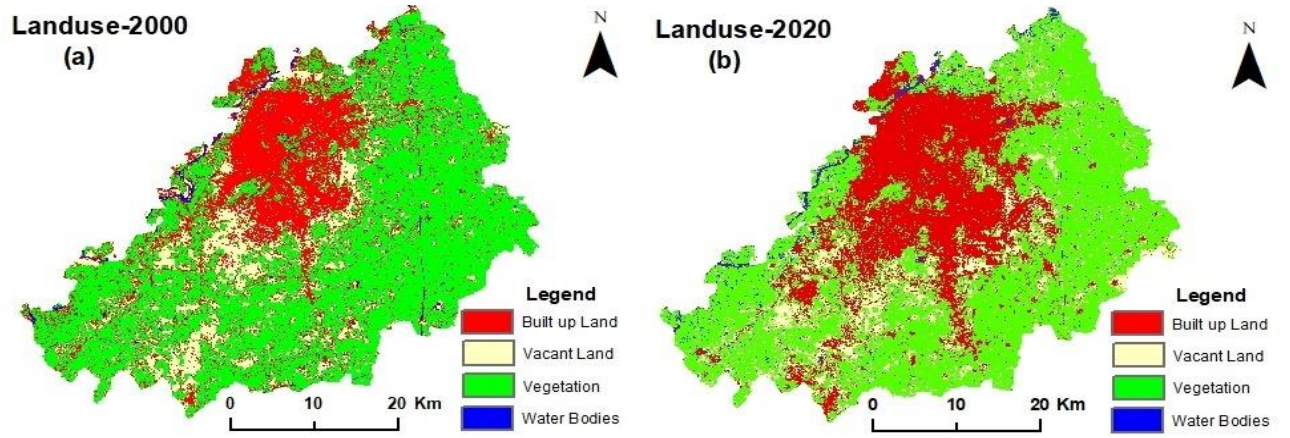

Fig. 3: Land use distribution of district Lahore between 2000 and 2020 (own draft)

The study area's built-up land grew as a result of the development of commercial areas and several new housing societies on the east and west-south sides. Our findings showed that urban vegetation cover and vacant land were transformed into roads, industrial and commercial centres, and residential areas. According to the 2017 census, the population reached 11.2 million, up from 6.3 million in 1998, with a 3% annual growth rate (GOP, 2017). Different areas of district Lahore experienced an increase in urban built-up land as a result of the growing population.

Land Surface Temperature Changes

Fig. 4 shows the spatiotemporal and areal distribution of LST for the years 2000 and 2020. Fig. 4 uses a colour gradient from dark brown to light brown to represent temperature variations. The colour scheme exhibits a smooth transition, wherein dark brown is employed to signify regions with higher temperatures, while light brown is employed to denote areas characterized by lower temperatures. The spatiotemporal patterns of LST and alterations in LST concentration show the rapid evolution of LULC classes. LST was typically measured to range between 14.32°C and 27.53°C in 2000 and 12.57°C and 31.61°C in 2020. This rise is entirely mathematical; however, a more precise increase in temperature was estimated using the spatial mean temperature (20.94°C for 2000 & 22.09°C for 2020), and it indicates that from 2000-2020, LST has increased by 1.12°C. The central area of the city exhibited a substantial rise in temperature values in 2020 (Fig. 4).

In the year 2000, there was a noticeable difference in temperature between industrial areas and the city centre. Industries consistently played a significant role in increasing localized temperatures. Specifically, the prominent industrial areas of Lahore including Badami Bagh, Chunia Industrial Estate, and Kotlakhpat had a substantial impact on rising surface temperatures compared to the areas around them in 2000 (Fig. 4a). However, over time, there was a decrease in green spaces, and with the development of urban areas and transportation networks, population density increased rapidly in the city centre of Lahore. This causes identical surface temperature values across the study area. Eventually, this trend led to a consistent, higher land surface temperature (LST) across the entire district, eliminating the initial distinctions between industrial zones and the city centre.

The study area's increased built-up area between 2000 and 2020 led to an increase in the LST (Fig 4(b). Due to more urban vegetation and agricultural fields, the study area's eastern, southern, and western regions experience cooler temperatures. In contrast, the central region of Lahore displays an intensification of LST as a result of the accelerated urbanization process, and a decrease in urban vegetation cover in the city centre and surrounding areas. Furthermore, in 2020, the Lahore central area, which is heavily urbanized, dense and rapidly expanding (Fig. 4b), where the maximum surface temperature was assessed, establishes a positive correlation between built-up areas and surface temperature.

The surface temperature data from the day of image acquisition and the air temperature data from the PMD weather station were also used for comparison and validation of the LST collected from the Landsat images. Table 1 compares the surface temperature from the Landsat images with the air temperature from the weather station, which shows a temperature difference between 2000 and 2020.

Table1. LST and air temperature comparison (own draft)

Date	LST	Air Temperature	Temperature Difference
11-03-2000	20.94	21.1	-0.16
18-03-2020	22.09	19.85	2.24

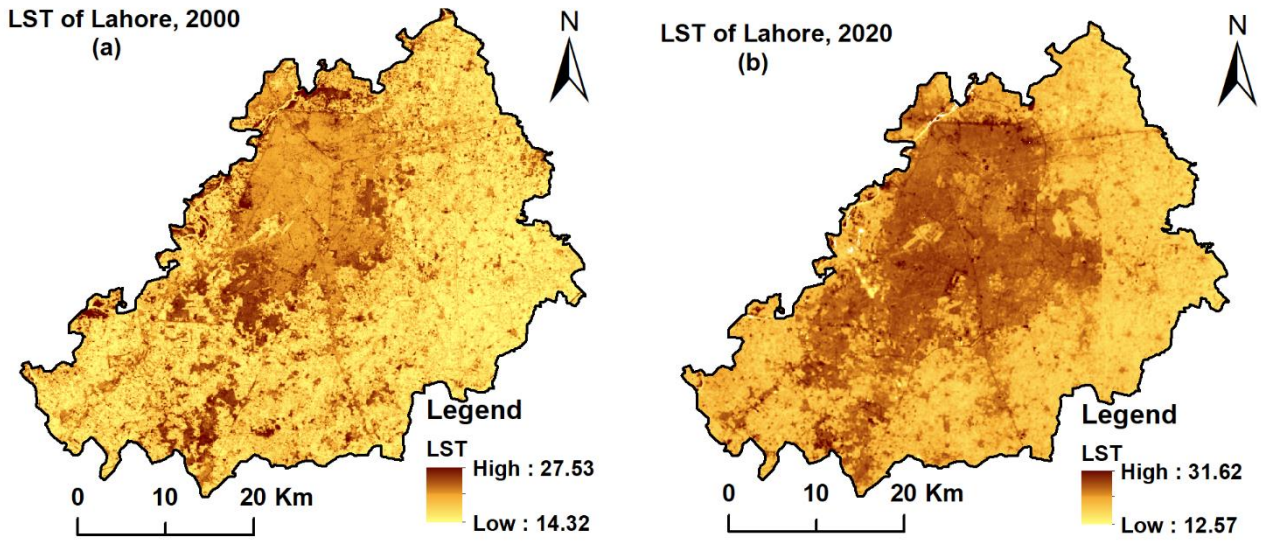

Fig. 4: LST of District Lahore for the Years 2000 and 2020 (own draft)

Urban Vegetation Cover Change

The NDVI was used to assess changes in vegetation cover using Landsat data from 2000 and 2020, as shown in Fig. 5. The NDVI images for 2000 and 2020 provide valuable insights into the temporal dynamics of vegetation in Lahore.

In the research area, the NDVI values ranged from -0.2 in light green colour to 0.7 in dark green colour from 2000 to 2020. In the first-year image, which corresponds to 2000, the landscape exhibits a vibrant spectrum of green hues, indicating dense vegetation cover. Whereas, a shift to the NDVI image of the same area for 2020 exhibits a notable transformation. The green colour shows a prominent decrease, signifying a pronounced decline in both vegetation vitality and its spatial extent. A noticeable reduction in vegetation coverage is evident adjacent to major roads and settlements.

These findings thus demonstrate that the effects of urban growth can result in a reduction of vegetation-covered regions. Changes in LULC and loss of vegetation directly influence the LST. The finding indicates that as urban areas have grown and green areas have disappeared between 2000 and 2020, the NDVI values have decreased. The dense vegetation cover has lower LST, as indicated by the negative association between LST and NDVI. LST increases are a result of the gradually declining amount of vegetation and green space.

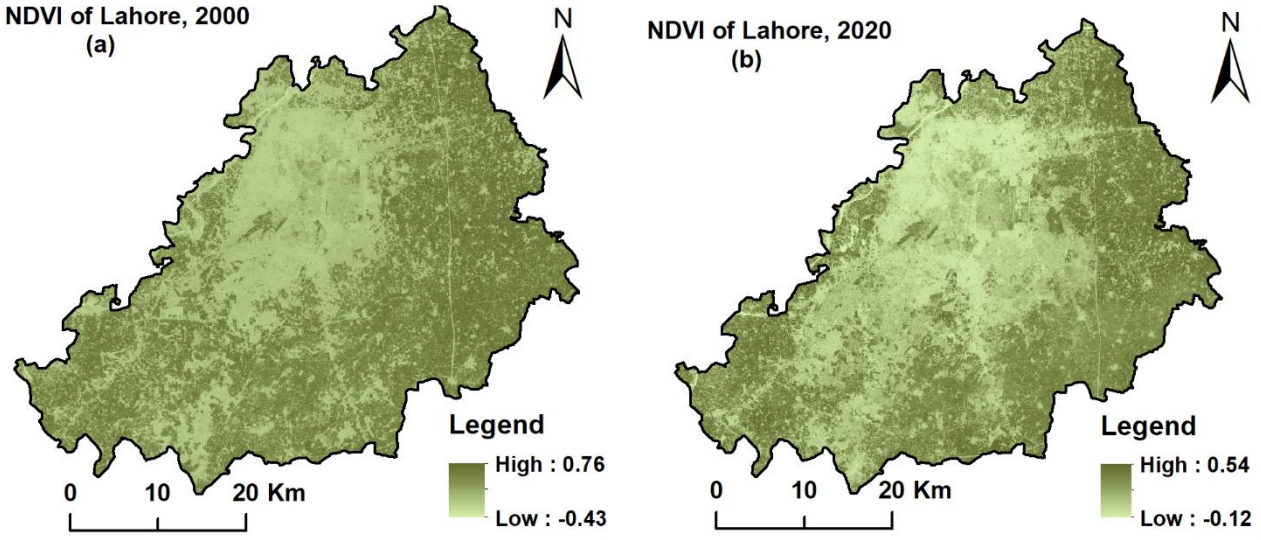

Fig. 5: The NDVI of district Lahore for the years 2000, and 2020 (own draft)

Surface Urban Heat Islands (SUHI)

Figs. 3 and 4 reveal that urban built-up areas and LST grew simultaneously, demonstrating their direct correlation. Urban growth is the primary factor contributing to the LST's growing tendency. The distinction between the urban and rural buffers reveals the impact of SUHI. To calculate surface UHI, the difference between the mean LST of urban and rural areas has also been employed. This study has found evidence of the impact of SUHI as a result of rapid urbanization. Temperature differences between urban and rural areas show that SUHI has also been rising over time. SUHI has increased from 1.91°C in 2000 to 2.41°C in 2020, and a relative change of roughly 0.50°C has been seen. However, it is noteworthy to mention that the mean minimum temperature decreased from 14.3 °C in 2000 to 12.57°C in 2020. The one of the obvious reasons for this drop in the mean minimum temperature in March 2020 were travel restrictions, lockdowns, and a downturn in economic activity, which all contributed to a reduction in man-made heat sources like transportation, industrial processes, and evening commercial activity. This reduction in anthropogenic heat emissions can result in lower nighttime temperatures (Roshan et al. 2021). In contrast to prior research, which solely focused on diurnal temperature values, this study investigates both the maximum and minimum temperatures derived from LST (Pal et al., 2021; Roshan et al., 2022). The LST map indicates the urban heat island phenomena (Fig. 4). It confirms that impervious structures, which have an impact on the local climatic conditions, are the reason for the concentration of heat in metropolitan areas.

Megacities often have surface UHI because of the heat-trapping effects of tall buildings and extensive infrastructure, which can ultimately have a negative influence on the local thermal environmental conditions and the population's health. Unfavorable ecological conditions may be brought on by the high surface UHI. Therefore, to achieve a sustainable urban environment and development in urban areas and reduce the effects of surface UHI by increasing the amount of vegetation cover that can deflect solar radiation utilizing green rooftops. This can lower the temperature by 0.5 to 3°C (Macintyre and Heaviside 2019). This study has shown how LULC changes can be used to track changes in urban climate. The urban climate is significantly affected by urbanization. The outcome of this research also showed that the effects of surface urban heat islands were not always felt in the city centres but could also occur in areas where there were active development projects aimed at bringing about urban growth.

Conclusion

The findings of this study show a significant change in land use and land cover, particularly in urban vegetation cover, agricultural land and built-up areas between 2000 and 2020. Compared to the year 2000, overall 756.44-km^2 (i.e., 43%) area urbanized in 2020 caused a 14% decrease in vegetation. The increase in urbanization brought on by the expansion of built-up regions over urban green spaces is evident when comparing the NDVI of the years 2000 and 2020. It increased to the mean and maximum land surface temperature. The result was an accelerated urban heat island effect in Lahore, which changed the nature of the urban climate of Lahore. The findings are an important consideration for environmentalists and city planners who want to mitigate the effects of urban climate change and urban heat islands effects by implementing appropriate measures, including rooftop gardening.

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