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

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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.

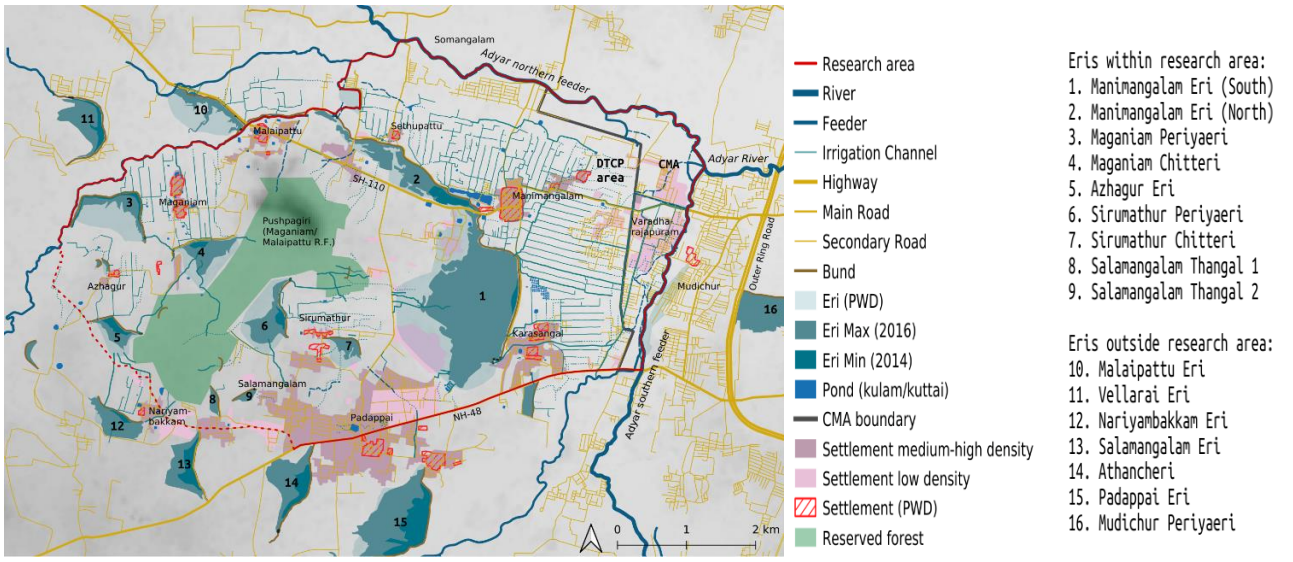

Fig. 1: Research area (own draft; Base data: Field observations, village block maps (Public Works Department), Google aerial imagery)

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

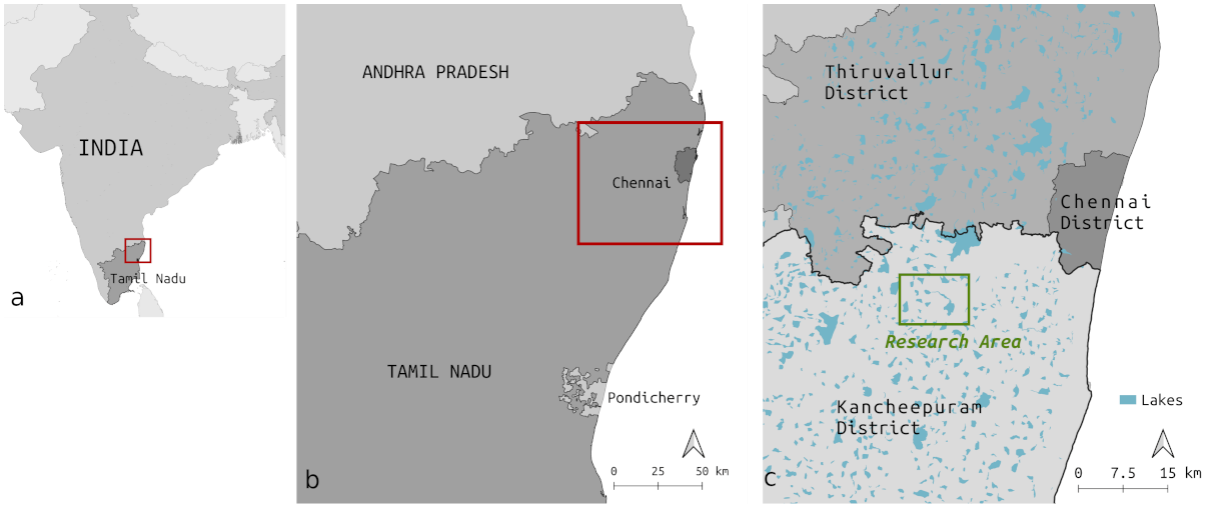

Fig.2: Location map (own draft)

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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Interviews A1, A2, LA2, LA4, LA5, NGO3

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