

# Storm Drains as Assemblages: The Political Ecology of Flood Risk in Post-Colonial Bangalore

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**Abstract:** Cities around the world are increasingly prone to unequal flood risk. In this paper, I “materialize” the political ecology of urban flood risk by casting stormwater drains—a key artifact implicated in flooding—as recombinant *socionatural assemblages*. I examine the production of flood risk in the city of Bangalore, India, focusing on the city’s informal outskirts where wetlands and circulations of global capital intermingle. Staging a conversation between Marxian and Deleuzian positions, I argue, first, that the dialectics of “flow” and “fixity” are useful in historicizing the relational politics of storm drains from the colonial to the neoliberal era. Second, flood risk has been heightened in the contemporary moment because of an intensified alignment between the flow/fixity of capital and storm drains. Storm drains—and the larger wetlands that they traverse—possess a force-giving materiality that fuels urban capitalism’s risky “becoming-being”. This argument raises the need for supplementing political-economic critiques of the city with sociomaterialist understandings of capitalism and risk in the post-colonial city. The paper concludes with reflections on how assemblage thinking opens up a more distributed notion of agency and a more relational urban political ecology.

**Keywords:** assemblage urbanism, science and technology studies, materiality, post-colonial urbanism, second-generation urban political ecology, more-than-human geography

## Interrogating the Storm Drain Map

Rather than a wholly new network of technical components, drainage networks consist of a jumble of natural and technical elements (ditches, existing waterways, natural depressions, streets, rooftops, downspouts, and so on) that defy tidy descriptions (Karvonen 2011:5).

Studying a large map of Bangalore’s stormwater drain system with an assistant engineer in his office one day, I was struck by the number of different labels the engineer used verbally to describe what appeared to be a uniform feature on the map. Interchanging English and vernacular (Kannada) words, the engineer referred to the wavy blue lines on the map variously as “rivers”, “irrigation canals”, “*raja kaluves*” (large drains), “*katcha* (unfinished) drains”, “sanitary drains”, “box drains”, and even “roads” and “residential layouts”. Given my interest in Bangalore’s seemingly heightened flood risk over the last decade, I had asked the engineer to explain the intricacies of the city’s stormwater network and wetland ecology. He was tasked with maintaining one section of the drainage network in a densely populated zone at the city’s southernmost, largely informal outskirts

and implementing measures to address “critical flood-prone areas”. His use of multiple descriptors invoking both flow and fixity to refer to something simply labeled “SWD” or “stormwater drains” on the map provides a starting point for this article.

This article theorizes the production of flood risk in Bangalore, a rapidly urbanizing, landlocked city of 8 million people in south India widely claimed to flood more frequently now than in the past. Following in a lineage of critical geographical scholarship that posits the origins of flooding and other environmental risks as deeply historical and social (eg Hewitt 1997; Mustafa 2005; Pelling 1999; Ribot 2014; Wisner et al. 1994), I define risk as the conditions that threaten and endanger in socially and spatially differentiated ways.<sup>1</sup> I “materialize” this understanding of risk by placing the relational politics of storm drains at the center of my analysis, and setting the concept of “assemblage”—loosely interpreted as a multiplicity of interlocking meanings, materials, and capacities (Deleuze and Guattari 1987)—to work. Stormwater drains (as they are known today) are recombinant *socionatural assemblages*. Interwoven with changing social, discursive, and non-human elements over space and time, they are assemblages that not only “defy tidy descriptions”, as Karvonen (2011:5) puts it in his study of the politics of urban runoff. They are also integral to the making of capitalism, space, and ecological risk in cities of the global South.

My specific argument is twofold. First, I argue that urban flood risk is the product of the shifting relations embodied by stormwater drain assemblages. Crucially, as seen by storm drains’ multiple incarnations across pre-colonial, colonial, and post-colonial eras as things associated with *flow* (eg irrigation water, stormwater, sewage, capital) as well as *fixity* (eg social orders, state forms, intransigent discourses, settlements, solid waste), the tension between flow and fixity has always been a defining feature of the socionatural relations comprising “storm drains”. Fixity and flow thus provide powerful analytics through which to narrate the political ecology of flood risk. I further argue that in the new millennium, flood risk is the product of an intensifying alignment between storm drains and the flow/fixity of real estate capital. Specifically, the dizzying flow of speculative and global real estate capital through Bangalore’s storm drains and the fixity of resulting informal developments in wetlands have rendered the flow of stormwater especially unpredictable and risky.

I show through archival and ethnographic research that flood risk manifests both materially and discursively. Although flood risk is overdetermined by a complex set of socionatural relations, blame is primarily attributed to—and disciplinary action directed at—lower-income “encroachers” who settle in storm channels and low-lying wetlands. This discourse of “encroachment”, rooted in a longer legacy of colonial planning, continues to animate world-class imagineering and flood remedial measures in Bangalore today. While the Bangalore case pushes us to take seriously the dangerous, historically rooted entanglements that produce socionatural risk in all cities, it also asks us to envision whether, through a more distributed notion of agency opened up by assemblage thinking, a more enabling set of relationships might be possible.

In theorizing the production of what I call “risky urban socionatures”, this article aims to strengthen cross-fertilization between urban political ecology (UPE) and

assemblage geography literatures, and to thereby contribute to a “second wave” of UPE sensitive to post-colonial and post-structural frames (Heynen 2014). Marxian-rooted UPE is invaluable for tracing the power relations that shape unequal urban metabolism. Yet, as recent reviews of the field have suggested, its theoretical compass could be broadened with respect to capitalism (Gabriel 2014; Lawhon et al. 2013). Here, supple treatments of the “para-sites” of capitalism (cf Gidwani 2008; Mitchell 2002) in which non-human elements interact in surprising ways to both fuel and destabilize capitalist processes are useful for producing “a new kind of urban theorization which eschews the meta-narratives associated with neo-Marxian approaches” (Gandy 2005:30–31). Conversely, while the “more-than-human” turn in geography (Whatmore 2002)—in which assemblage is a central motif—signals a rematerialization of geographic thought (Anderson and McFarlane 2011; Braun 2005b; Robbins and Marks 2010), some have argued that it fails to articulate a cogent political-economic critique of the city (Brenner et al. 2011). I suggest that an explicit focus on the historic *production* of uneven urban flood risk (cf Smith 1984), and the deployment of flow and fixity to map risky assemblages of capital *and* socrionatures, can counter this criticism. Indeed, as I show below, assemblage thought is not opposed to structural political economy; it is simply an alternative reading of it. That flow and fixity comprises a shared vocabulary in *both* Marxian (eg Brenner 1998; Harvey 1982; Swyngedouw 2004) and Deleuzian urban theorizing (eg Amin and Thrift 2002; Dovey 2005; Tonkiss 2013) provides a compelling basis from which to further build out resonances (eg Desfor and Laidley 2011; McCann and Ward 2011).

The article’s findings are based on archival and ethnographic research in Bangalore in 2012, with a focus on the southern flood-prone zone<sup>2</sup> of Bommanahalli. At first glance, Bangalore appears an unlikely site to study the production of flood risk. Sitting 3000 ft above sea level in the rain shadow of the Western Ghats with an ancient wetland and drainage system, but no proximal river of its own (it is unique in this regard), the city is not often thought of as one that floods—at least not relative to India’s highly flood-prone coastal and fluvial cities (eg Mumbai and Surat). Yet, sustained monsoonal downpours inevitably wreak havoc, as was the case in late 2005, when over half of the city’s road network was inundated and thousands of homes and commercial establishments damaged following four days of continuous rainfall (*Times of India* 2005). In the aftermath of floods over the next decade, the city government identified over 1000 flood-prone areas, many of which are in low-lying, densely populated neighborhoods at the city’s southern peripheries where its globalizing technology and service economies are concentrated (*New Indian Express* 2013).

In order to “trace the socioecological networks” (Braun 2005a:654; see also Meehan and Rice 2011) that underpin this uneven geography of flood risk, my fieldwork tacked back and forth between flood-prone informal neighborhoods in Bommanahalli, real estate businesses, municipal engineers’ and land surveyors’ offices, the Survey of India’s map archives, debris- and sewage-infested storm drains, and the intricate and expansive ecology of southern Bangalore.

In this larger mesh of connections, I immersed myself in the flood-prone neighborhood of Madina Nagar in Bommanahalli, located inside of a large storm canal

between two major lakes, to gain a situated understanding of how capital is “fixed” or anchored in particular ways to produce risky effects in the world. As we will see, places like Madina Nagar exemplify the millennial city’s frontiers of capitalist accumulation. Located 20 km southeast of Bangalore, the neighborhood is flanked by multinational corporations (eg the German giant Bosch) and informal developments that have rapidly expanded Bangalore’s peripheries over the last decade as global capital has flooded the city. Such developments typically take place on the basis of dubiously legal land and environmental clearances by state agents.<sup>3</sup> In concert with local and parastatal officials, and awash with circulating capital, fly-by-night developers have abetted in a frenzy of “unauthorized” settlement and speculation in wetlands and inside storm channels in Madina Nagar. (Wet)lands are, after all, a particular form of *land* with a “consequential materiality” (Moore 2005:24) that *matters* for millennial capitalism’s “becoming-being”. Accompanying such settlement, sewage and solid waste clog Madina Nagar’s roads, empty plots, and drainage pathways—a dangerous concoction in the face of even the most modest of rains. I show below that the move by the city to decongest Madina Nagar by selectively labeling and disciplining poorer “encroachers” is a narrow reading of the much more complex and historic assembling of flood risk, and one that further exacerbates the precarious conditions of its residents.

I begin by detailing why a rapprochement between UPE and assemblage geography is useful in deciphering urban ecological risk. Following a discussion of the historic origins of Bangalore’s stormwater drains and their flow/fixity dynamics, I trace two key assemblage realignments: the first involving a reconfiguration of stormwater drains into “sanitary water drains” in the colonial city, and the second involving a reconfiguration of storm drains into commodified (wet)land in the neo-liberal era. In both these realignments, the agency of both non-humans and humans matters. I conclude with a broader discussion on the attribution of agency in an age of socionatural risk.

## Assembling Risky Urban Socionatures

This work stages an encounter between Marxian-rooted UPE and assemblage geography to grasp the urban as “a decidedly more-than-human space” (Braun 2005b:646). While it is not my intention to “cherry pick” from two intellectual traditions, as McCann (2011:145) puts it, I suggest that an urban political ecology of risk—in which historic configurations of the state, non-human agents, discourses, and capital are implicated—can effectively be analyzed through such a cross-fertilization. Despite dismissals that assemblage urbanism exhibits a “naïve objectivism” evacuated of political-economic critique (Brenner et al. 2011), or that Marxian UPE and assemblage thinking should be kept apart because UPE fails to open up the type of empirical inquiry afforded by actor-network theory (ANT)-assemblage positions (Holifield 2009), a number of scholars have offered a compromise of sorts (eg Castree’s 2002 “weak” version of ANT) or deftly navigated the resonances between the two. I proceed in the vein of identifying and building on resonances between the two. After briefly sketching how Marxian and Deleuzian positions complement each other, I suggest that their shared vocabulary of flow/fixity is

underappreciated and can be creatively leveraged in the study of how capitalism and socio-natures are riskily assembled.

As the urban problematic has increasingly captured scholarly attention over the last two decades, UPE has been at the forefront of critical inquiry into the uneven production of urban nature and space. A central feature of Marxian UPE is its historicization of unequal socio-natural “metabolism” through a critique of capitalist political economy across the rural–urban divide. Another strength of the field is its insistence on the social and natural as ontologically inseparable, framed through a number of post-structural optics, including hybridity, cyborg urbanism, and actor-networks (eg Gandy 2005; Heynen et al. 2006; Swyngedouw 1996). However, even while UPE has drawn on certain post-structural logics to grasp at hybrid socio-natural relations, commentators have argued that there is a prevailing reluctance to imagine an urban sphere outside of narrowly construed capitalist relations (Gabriel 2014; Grove 2009)—a framework that tends to be especially limited in analyzing post-colonial cities. Signalling a second generation of UPE, then, Grove (2009) has pushed for broader engagement with post-structural currents in geography and related fields, while Lawhon et al. (2013) have called for attention to situated practices in the global South.

Such provocations are especially apt for political-ecological studies on risk and vulnerability in cities in the global South, which have thus far been limited in their reading of capital–nature relations. That is, while political-ecological critiques of earlier risk-hazards models have been invaluable in emphasizing the social and political roots of risk and vulnerability (eg Pelling 1999; Ribot 2010; Watts and Bohle 1994; Wisner et al. 1994), the relationship between capitalism and risk tends to be assumed rather than fleshed out. In this vein, Collins (2010) has recently found that the concept of marginalization prevalent in the political ecology literature—the postulate that the least powerful economic groups come to inhabit the most ecologically dangerous places—does not sufficiently explain the production of unequal urban flood risk at the US–Mexico border. Moreover, non-human actants rarely appear as agents shaping the risky contours of capitalist urbanization in their own right. Second-generation UPE can therefore clarify how precisely “flood risks are influenced by the circulation of capitalism” (Collins 2010:260) and, specific to this research, how capital becomes enmeshed in and activated by imbrolios comprising wetlands, storm flows, and informal state actors, among other agents.

Among other theoretical apparatuses, the assemblage philosophy of Deleuze and Guattari can rise to this challenge, and has been offered as a contribution to critical urban theory (Amin and Thrift 2002; Farias and Bender 2010; McFarlane 2011). “Assemblage”, an imperfect translation of the French *agencement*, implies a provisional “alignment”, as Deleuze and Guattari put it, of human and non-human agents across space and time. Local or translocal agents or “matter-flows” may align in one moment and disperse in the next, only to resurface and become “territorialized” (fixed) in a different assemblage with different interactions. Certain material or discursive relationships in an assemblage may hold more weight or be given priority at different points in time. Crucially, non-human elements do not simply provide the context in which unequal social processes occur; rather, they are agential actors in their own right, possessing of a sometimes terrifying

“margin of indeterminacy” (Braun and Whatmore 2010:xxi). As a mode of inquiry, assemblage thinking is loyal to on-the-ground practices, processes of becoming, and the capacities of human and non-human matter alike to make history.

How can assemblage as a mode of inquiry provide a more nuanced rendering of the political economy of urban ecological risk? Despite Brenner et al.’s (2011:230) contention that assemblage urbanism accords a “highly ambiguous status” to political economy, and is therefore incompatible with Marxian thought, there are important examples in the wider Marxian literature that take seriously capital’s entanglements with non-human agency and the political-economic *stakes* of these entanglements. For instance, Henderson (1998) has argued that “nature” is an agent embedded in complex relationships with capital, and thus poses both opportunities and threats to agricultural commodification. Similarly, Fredericks (2014: 536) analyzes how urban citizenship is shaped through “material assemblages” of trash and labor in Dakar and Bakker (2004) documents how water is “uncooperative” in the process of commodification (see also Bakker and Bridge 2006), while Gidwani (2008) and Moore (2005) explicitly deploy assemblage as an analytic to recover the agency of non-humans in their deep explorations of agrarian capitalism. In brief, several scholars have already embarked on a productive rapprochement between Marxian political economy and Deleuzian thought.

One underappreciated area that could further strengthen cross-fertilization is the fact that “fixity” and “flow” comprise a shared vocabulary in both traditions. For instance, inspired by Adorno, David Harvey’s (1996:81) casting of capitalist political economy as “flows [that] often crystallize ... into isolable ‘domains’ or ‘systems’ which assume a relative permanence (and sometimes even acquire limited causal powers)” bears striking resemblance to Deleuze and Guattari’s (1987:407) variegated “matter-flow” that is “crystallized into codified complexes” (1987:12) at critical conjunctures (see also Featherstone 2011 on the resonances between articulation and assemblage). Just as Marxists have deployed the metaphors of flow and fixity for grasping the workings of capitalism, so too have scholars deployed these metaphors for tracing mobile policy regimes (McCann and Ward 2011) and complex socio-technical systems at specific political-economic moments (Gopakumar 2015; Hannam et al. 2006). In brief, there is no reason why political economic analysis should not be compatible with an assemblage optic, especially when deployed with due attention to the stakes of capital’s flows and fixities and the role of non-human matter in political-economic processes.<sup>4</sup> An assemblage optic can supplely leverage Marxian and Deleuzian analytics, while also underscoring the political stakes by “populating the field of causality with new and troubling actors” (Robbins and Marks 2010).

Flow/fixity is a particularly fitting dialectic to analyze the political ecology and physicality of flooding. Storm drain assemblages embody, quite corporeally, the politics of circulation and immobility, thus begging for theoretical reflection across Marxian and Deleuzian vantages. As I detail next, the flow of stormwater through Bangalore’s wetlands has always gone hand-in-hand with efforts to fix and domesticate it through state institutions, concrete structures, and economic orders. The intensifying relationship between capital and storm drains in the new millennium—a moment marked by a particular neoliberal “crystallization” (cf Harvey and Deleuze) in India’s cities—has enabled a new and dangerous agency to storm flows. I discuss

the inherent flow/fixity dynamics of storm drains next before turning to the historic realignments that have heightened flood risk.

## The Flow and Fixity of Storm Drains

In 2005, the same year that Hurricane Katrina in New Orleans revealed that fixed levees and concrete developments on wetlands tragically exacerbate storm flows—and that disasters are shaped by profound racial and social inequalities—Bangalore experienced one of its worst floods in recent memory. In October that year, most of south Bangalore was inundated when heavy monsoonal rainfall brought down lake embankments and caused storm drains to overflow. Low-lying informal areas located inside or adjacent to sewage-blocked storm drains were especially badly affected. To begin to understand the geography of flooding in this landlocked city, we must bring into view the phenomenon of South Asia's rogue monsoons, as well as the relationality and indeterminacy of fixed structures designed to domesticate monsoons.

Rain is deeply consequential; to see it as such is not to embrace an environmental determinism, but to recognize its complicity in an “entangled landscape” saturated with humans and non-humans, meaning and materiality (Moore 2005:25). South Asia's monsoons are notoriously rogue with both “bad” years and “good” years spelling crisis. In “bad” years, the lack of rain is thought to exacerbate the city's drinking water shortage since Bangalore depends on upstream rain-fed reservoirs on the Cauvery River and groundwater recharge for its water needs. Thus in one particularly “bad” year”, Alexander Frater's (1990) irreverent and now classic travel memoir (and British television series) *Chasing the Monsoon* caricatures officials from the Bangalore Water Supply and Sewerage Board (BWSSB) propitiating the “rain gods” with coconuts and alms. On the other hand, in “good” years, rain lures people out in celebration, drums craters into roads, and brings traffic to a grinding halt. Small rivulets thwarted by paved surfaces and truant muck quickly turn into gushing overflows—the force of which may, ironically, be more catastrophic when fixed structures meant to control and channel storm flows are erected.

Nearly 1000 such fixed structures known as *keres* (lakes or tanks) interconnected through *raja kaluves* (large canals) once crisscrossed the wetlands of Bangalore. *Keres* are shallow lakes and human-made water-harvesting systems first developed four centuries ago in response to the vagaries of monsoonal rainfall in the region. *Raja kaluves* were eventually re-engineered as the city's “stormwater drains”. Together, this system worked as gravity-fed contraptions that allowed for excess water at a higher gradient to be directed through canals to a catchment at a lower gradient. Such a cascading, interconnected system was engineered to domesticate monsoonal storm flows and ensure that each tank in the chain received an adequate volume of water for cultivation (D'Souza and Nagendra 2011). With no major river of its own, but four major valleys draining a number of smaller streams and lakes, Bangalore's undulating wetland terrain was ideally suited to such an engineered irrigation-cum-storm flow system (Ramachandra and Majumdar 2009). Starting from the mid-sixteenth century when the city was founded until the colonial period,

new tanks were developed extensively to harvest and control water, as well as to create the physical and institutional moorings to entrench state power and caste orders (Srinivas 2001).

Crucially, the city's stormwater infrastructure with its flow/fixity dynamic has always been *agential*—playing a role, for instance, in “cultivating or delimiting state power” (Meehan 2014:215) by wielding a certain “margin of indeterminacy” (Braun and Whatmore 2010:xxi). Tank-canals were “simultaneously celebrated and feared, for they [carried] with them at one and the same time the promise of a glorious future and the threat of a catastrophic end” (Braun and Whatmore 2010:xxi–xxii). An anthropologic reading of Kannada folktales, as Shah (2008:669) provides us with, is particularly instructive here:

The tanks in many stories and songs are a source of anxiety either because they have not received any water, or because they are faced with the threat of flood ... Earthen embankments and foundations subjected to alternate drying and wetting become structurally weak and breach easily during heavy downpours...

Mosse's (2003:35) anthropology of South India's wetlands further explains: “in times of exceptionally strong monsoons, poorly maintained embankments breach, releasing surges of water which bring down tank bunds through the system in domino-like fashion”.

Note the vivid evocation of both flow and fixity here: the very fixity of tank-canal systems, designed to domesticate cascading overflows and consolidate political and social power, did nothing to insure against the potency of storm flows during heavy rainfall—and in fact exacerbated flooding then. The relationality between fixity and flow is palpable. This unpredictable, corporeal relationship between solid embankments and rollicking surges, between fixity and flow, can thus be seen as definitive of the agential powers of storm drains. This flow/fixity dynamic is made even more agential by virtue of the fact that storm drains are *recombinant*. As Braun and Whatmore (2010:xxi) have argued, the potency of sociotechnical assemblages stems from the fact that “they can be recombined and deployed in relation to countless other elements, gestures, practices, and institutions”. Two key historic realignments—one in the colonial era and one in the post-colonial era—have made storm drains especially risky as I detail next.

### **Realignment I: SWDs as “Sanitary Water Drains”**

In early 2012, the assistant executive engineer for stormwater drains in Bommanahalli had taken me on a field inspection to Madina Nagar, an area designated as “critically low-lying” in the engineer's storm drain upgrading and flood proofing plans. It was January—a few months after the last monsoon season had ended and well before the next one was to start. Yet, over 1 ft of putrid water sat doggedly on Madina Nagar's roads, making houses look like they were floating on a cesspool of slimy, sewage- and garbage-infested water. Residents had built makeshift bridges out of wood planks to access their houses and cross roads (see Figure 1). Open storm drains reinforced by concrete slabs bordered the edges of houses, and were connected to a larger storm drain carrying a murky, slow-moving sludge.





**Figure 1:** Storm drains as assemblages

“Here’s our contractor! You ask him what does ‘SWD’ stand for?”, he asked me in his office after the visit. The engineer continued: “He will say it’s ‘*Sanitary Water Drains*’. Even they [the contractor] don’t know what the original purpose of these drains was. Just imagine the filth they will be immersed in while working!”.<sup>5</sup>

“SWD”, the acronym for “stormwater drains”, is especially easy to mistake for “sanitary water drains”. This slippage is rooted in a historically specific realignment of storm drain relations. In this section, I trace the recombinations that repurposed “SWDs” (the erstwhile tanks and canals discussed above) materially and discursively as “sanitary water drains”. This was a move that has had dire consequences for contemporary flood risk. I emphasize the origins of this realignment in the city improvement projects of the colonial project.

When the British established themselves in Bangalore in the early nineteenth century, the ancient tank-canal assemblages described above began to lose favor as a source of irrigation water for the city. The Orientalist Lewis Rice (1897), deputed to document the region, lamented the inadequacy of Bangalore’s existing tanks for meeting the needs of British officers stationed in the east, much less for an expanding population of “natives” in the western half (the city was racially segregated along an east–west axis). When it was clear that even the new tank built by the British engineer Sankey in 1882 “would not suffice to provide for the water supply of the Civil and Military Station [the British area], much less for that of the whole of Bangalore” (Rice 1897:53), colonial administrators set about exploring more distant state-engineered alternatives to fuel a growing textile industry (Heitzman 2004).

In line with water modernization paradigms taking root globally, in the late 1800s, the colonial regime commissioned the first major capital-intensive waterworks scheme on the Arkavathy River, located 25 km to the northwest of the city. This marked the beginning of what Swyngedouw (2004:20) aptly refers to as the

“commodification and urbanization of water”, in which the spatial expansion of the city was predicated on sourcing water from expanded distances, as well as the rapid circulation of water and money through the city. Expanded flows of money and water required new fixities: the Arkavathy project set in motion a pattern of heavily engineered schemes to fuel the city’s burgeoning garments, machine, and technology industries over the course of a century—while also mooring state power and decision-making in centralized parastatal agencies. Continuing this trend into the latter half of the twentieth century, the city turned with even greater water demands to the Cauvery River located 100 km to the southwest. Today, no portion of the city’s domestic water demands is met by local tanks/canals: the BWSSB sources the entirety of its supply from the Cauvery River with its latest and most ambitious augmentation scheme commissioned in 2012.<sup>6</sup>

Coinciding with the commissioning of heavily engineered water projects, the South Asia-wide plague epidemic erupted in Bangalore in 1898, prompting the widespread deployment of city “improvement”, or, as the British engineer in charge of plague-proofing Bangalore, J.H. Stephens (1922:235) reported, “a gospel of fresh air and sanitation”, to reform the “impure and filthy surroundings” of the natives. Improvement in the context of disease outbreaks in colonial cities was racially inflected, premised on discursively constructing non-European cities as indelibly inferior and unsanitary and in dire need of moral and physical purification (Kidambi 2004; McFarlane 2008; Swanson 1977). Colonial administrators felt compelled to create a modern bacteriological city cleansed of social and physical ills, an adjunct to capitalist urbanization, by laying a sewerage network for the city (Gandy 2006). Storm canals that followed the natural dips and peaks of the city’s topography provided the ideal location for a sewerage network (Ramachandra and Majumdar 2009)—with upper castes and European areas being prioritized for improvements (Nair 2005).

The recasting of “stormwater drains” as “sanitary water drains” set in motion by the colonial project of improvement is consistent with experiences in other post-colonial cities. As Mustafa (2005) explains in the case of Pakistan’s urban flooding, the semantic shift in which the Lai River was renamed as the “Lai Nullah” (synonymous with “gutter” or “drain”) on colonial survey maps succeeded in sealing the river’s fate as a repository for the city’s sewage with dire consequences for flood risk. In Bangalore, since local tanks and storm canals were no longer seen as necessary for water supply, most trunk sewers were laid *inside* of the city’s erstwhile storm canals in the aftermath of the plague—a practice that continued well beyond decolonization. As I was repeatedly told by the city’s stormwater professionals, the water utility continues to locate sewer infrastructure within stormwater drains with grave consequences for flood risk since sewer hardware causes blockages and the redirection of storm flows to low-lying areas such as Madina Nagar (see also Ramachandra and Majumdar 2009).

In sum, the massive paradigm shift in the city’s water supply prompted a major realignment in storm drain assemblages, underscoring that assemblages indeed operate as wholes characterized by “relations of exteriority” (DeLanda 2006); that is, “component parts may be detached and plugged into a different assemblage in which its interactions are different” (McFarlane 2011:208). With local tanks and

canals being devalued over distantly sourced piped water, “stormwater drains”, as they eventually came to be called in the colonial period, came to be enrolled into a vastly different set of state projects in the twentieth century. This was not a preordained trajectory; rather, assemblages are always provisional alignments “emerging from historical sedimentations yet not dictated by them” (Moore 2005:22). New fixities—in this case, sewerage infrastructure distributed unequally in the city—were instrumental for producing risky storm flows. Compounding the problem of sewerage infrastructure being located within storm channels, raw sewage is also discharged directly from home septic systems into stormwater drains in informal areas that lack sewerage connectivity such as Madina Nagar. An explosion in apartment buildings and industries at the outskirts in the last two decades—owing in large part to the influx of capital I describe in the next section—has also led to the release of sewage and industrial wastes directly into storm drains, only reinforcing the materiality and narrative of “storm drains as nothing but sanitary water drains”.<sup>7</sup> Assemblages are not simply multiplicities of objects; they also establish connections between “a field of reality (the world) and a field of representation (the book) and a field of subjectivity (the author)” (Deleuze and Guattari 1987:25).

Yet, assemblages are not just simultaneously material and meaningful; they are also “*eventful*” (Braun and Whatmore 2010:xxi). The discursive and physical recasting of stormwater as “sanitary water” has rendered flood risk even more potent and unpredictable, especially for low-lying informal areas that lack stormwater outlets and serve as the locus of speculative real estate development. The dark and murky sludge winding its way through Madina Nagar’s canals is emblematic of the indeterminacy of contemporary storm drain assemblages, made even more indeterminate and risky through recombinations with capital. In the next section, I discuss a second key realignment that has heightened risk for areas like Madina Nagar, focusing on the fixity and flow of real estate capital, the production of informal space, and the discourse of “encroachment”.

## **Realignment II: Capital Flows, Storm Flows, and the Politics of Encroachment**

...for shortages and surfeits of money would prove as disastrous to business as floods and droughts in primitive society. (Polanyi 2001:76)

When so much capital *floods* an industry that requires access to large plots of land, whole new dynamics unfold. (Goldman 2011:570, emphasis added)

Writing about the disastrous consequences of commodifying land—an entirely “fictitious commodity” in that it cannot be “produced for sale”—Karl Polanyi likely was not talking about wetlands. Nor did he anticipate that his “floods and droughts in primitive society” analogy was not simply an analogy. Polanyi could not have found a more fitting way to describe the relationship between capital, flooding, and wetlands in cities of the global South today. In this section I argue that heightened flood risk is a product of a recombinant relationship between storm

drain assemblages (and the wetlands they traverse) and the city's "surfeits of money". Simply put, rogue capital floods have aggravated physical floods. While storm drain assemblages continue to be "sanitary water drains"—reflecting the historically sedimented nature of assemblages—they are also being valued as fixed real estate today. To grasp the mechanics of capital flows into urban real estate and the commodification of wetlands and storm channels in places like Madina Nagar, I start with a brief overview of the city's recent political-economic "crystallizations" and their repercussions on the production of space.

Recent scholarly analyses of Bangalore by Goldman (2011) and others make clear that stormwater and sewage are not the only things flooding the city. "Matter-flows" of capital—recombinant with world-classing, reform-oriented discourses and state forms—are part of a dense and peculiarly neoliberal crystallization in India's cities. Accounting for more than a third of India's \$40 billion information technology export economy by the early 2000s, Bangalore had assumed the position of India's high-technology capital by the start of the new millennium. As numerous accounts of the city have documented (Heitzman 2004; Nair 2005), its meteoric rise was based on important comparative advantages, not least of which was the city's longstanding engineering expertise, a relatively large English-speaking workforce, and pro-reform politicians and bureaucrats who embraced a range of globally indexed neoliberal logics at pivotal junctures (Baindur and Kamath 2009; Pani 2006). As multinational companies like Dell, IBM, and Bosch turned to Bangalore to cheaply outsource their operations in the post-liberalization era, state leadership sought to secure surging (and unpredictable) inflows of foreign and domestic capital by facilitating access to land, resources, and infrastructure.<sup>8</sup> Reinforced through globally circulating discourses and aesthetics that conjured Bangalore up as a "world-class" tech hub, foreign and local capital influxes contributed to a 500% increase in built up area in just three decades.<sup>9</sup>

From Marxian political economy, we know that for capital to reproduce and circulate, it must be periodically stabilized and spatially "fixed" in a "secondary circuit" comprising the built environment; thus the profound inextricability of capital and space (Harvey 1982; Smith 1984). In Bangalore, capital flows to the real estate sector have gravitated disproportionately towards the southern/southeastern peripheral zone of Bommanahalli, where the city's high-tech industries *and* wetlands happen to be concentrated. This is, for instance, where a number of glass-faced office buildings with questionable land and infrastructure clearances have cropped up seemingly overnight in and around the storm channels surrounding Madina Nagar. This is where new highways and mega-infrastructure projects and their experimental market logics are destined, as I have documented elsewhere (Ranganathan 2014b). In conjunction with private developers and landed politicians, large state players such as the Bangalore Development Authority (BDA) and the Karnataka Industrial Areas Development Board (KIADB) have been powerful partners in speculating on and developing real estate for corporate and residential projects, thereby skyrocketing the price of land and enhancing market liquidity. State-led land reforms in Karnataka post-liberalization have also provided an "invitation to predatory capitalism" or investment in irregular (i.e. on sensitive or

agricultural land) real estate projects over the last two decades (Nair 1996:252). Often carried out by undercutting rural landowners, or through illegal property transfers and illicit environmental clearances, informality comprises both high-income as well as lower-end developments, confirming what Roy (2011) posits as the highly internally differentiated, state sanctioned nature of urban informality under millennial capitalism (see also Ranganathan 2014a).

While critical urban scholarship has shed light on the relationship between the post-colonial state and informal space, we know less about the relationship between capital flows and informal space (for exceptions see Desai and Loftus 2013; Doshi 2013; Weinstein 2008). We need a clearer—and, I would argue, more *sociomaterialist*—understanding of how capital circulates through land in cities of the global South. An assemblage optic is useful here because it allows us to bring into focus capital’s “para-sites” and what Moore (2005:24) calls “the *consequential materiality* of milieu, of nonhuman entities and artifacts”. If, as Deleuze and Guattari (1987:20) suggest, “capitalism is at the crossroads of all kinds of formations”, then we must come to grips with how capital “draws its force by attempting to divert or attach itself to other kinds of energy or logic—cultural, political, nonhuman” (Gidwani 2008:xix). Bangalore’s wetlands and storm channels possess such force-giving qualities because they afford the opportunity for squeezing out and commodifying additional “fictitious” land in ways so stark that even Polanyi would have balked. To illustrate this point, I return to Bommanahalli’s storm water engineers. In describing the mechanics of how storm channels are commodified in places like Madina Nagar, one engineer said:

The developer there [Madina Nagar] has leveled the land. *Wherever there were existing canals, they covered them with mud to make more money and hid them in the revenue survey maps.* Then the developer forms the layout and sells it to people without providing inlets and outlets for water. So this is how an area becomes flood-prone.<sup>10</sup>

Ditches, canals, bunds, lake beds—the stuff of urban wetlands in other words—comprise the “site-specific materialities” (Moore 2005:23) that give life force to this “becoming-being called capitalism” (Gidwani 2008:xxv). Two qualities of wetlands are particularly amenable to being recruited into the “para-sites” of capital. First, as described in the quote above, are physical properties: wetlands tend to be “wet” only during seasonal monsoons and dry at other times of the year. Empty canals and shallow tanks can quite literally be capitalized—turned into tangible (if fictitious) commodities by covering with mud or concrete—and quickly sold to unsuspecting buyers. Second is contested ownership: wetlands technically fall under the category of “government land” (Balasubramaniam 2011; Ramaswamy 2007). Today, tanks are assigned to multiple land-use categories, and are governed by multiple state agencies with overlapping jurisdictions (Nagendra and Ostrom 2014; Sudhira and Nagendra 2013; Sundaresan 2011). Prompted by developmental imperatives and malaria-eradication strategies, a number of tanks and canals were transformed by various state agencies to civic amenities, including the Dharmabudhi tank (now the city bus station), the Sampangi tank (now a major cricket stadium), and the Challaghatta tank (now a preeminent golf course). In sum, the very physicality of wetlands and contested ownership have effectively

rendered them colonizable by capital and claimable by a wide array of public and private interests.

Madina Nagar—an area classified as an “encroachment” in planning lexicon—exemplifies this intensified alignment between capital and storm drains in the current moment. Here, unruly flows of capital are transacted through storm channels and an opaque web of relations enjoining transnational companies, developers, state agents, and settlers in ways not easily legible to outsiders. Ever indeterminate and unpredictable, the sociomateriality and agency of storm channels are deeply implicated in this web of relations. As I was told by the storm engineer in charge of the area, “until and unless heavy rains come, residents don’t know they are sitting on a *raja kaluve* [large storm drain canal]”. Interviews with residents in Madina Nagar confirmed this point. Several claimed to be caught unawares of the fact that they had settled in storm channels. Lured by the chance to buy property, one family complained they had moved to the area because “the developer had promised that the area would develop just like the rest of Bangalore with amenities and nice houses”. The developer for the area had physically filled in the storm canals crisscrossing the area with mud and concrete, manipulated land survey maps to show that storm canals were simply part of the property purchased, and sold the land to lower-middle-class buyers. Local elected representatives had abetted in the process in an effort to cater to their constituents. Unfortunately, it was only a matter of time (and a few rains) before powerful storm flows, negotiating the fixity of human wastes, sewage, and the built environment, ran amok in recurrent floods between 2005 and 2013, destroying homes, belongings, and hopes for a “developed” Bangalore.

Although flood risk in the area is overdetermined by a complex set of socationatural relations, disciplinary action is primarily directed at the lower-middle-income “encroachers” of Madina Nagar. Houses labeled as “encroachments” are liable to be demolished with little warning, adding to the already precarious condition of residents. “Encroachment” is a term “loaded with illegality” (Ramanathan 2004:11, quoted in Bhan 2009:139). While use of the word “encroachment” can be traced to colonial planning documents, its use experienced a resurgence in Indian cities in the early 1990s in conjunction with the increasing incursion of the courts and idioms of property rights into city planning and decision-making (Bhan 2009). The removal of illegal encroachments forms a centerpiece of flood remedial measures and calls for a less corrupt city today. A number of expert reports, for instance, demand the immediate removal of illegal encroachments on tank beds and the decongestion of drains.

“Decongestive” efforts do political work in that they seek to do away with undesirable and undesirable blockages and reprioritize desirable fixities and flows in an era of urban reform and world city making (Gopakumar 2015). Crucially, what gets labeled as an encroachment in the first place matters. The labeling and removal of lower-income encroachments is more politically and logistically feasible than the removal of larger and more prestigious encroaching fixtures, such as corporate buildings, apartments, and golf courses. In addition to the state-driven tank conversion projects discussed above, a number of private real estate projects are also responsible for encroaching on storm channels and heightening flood risk. Bordering Madina Nagar, for instance, is the glass-faced offices of German multinational Bosch. In-depth interviews with residents and local engineers confirmed that Bosch

is unlawfully situated on low-lying wetlands connecting two major south Bangalore lakes. In addition, a new industrial project was recently given clearance by state environmental permitting agencies and urban utilities despite the fact that it is located on “sensitive” wetland as designated by master planning documents.

It is only much more recently that the complicity of higher-end “encroachments” in heightening flood risk is being recognized in the city. This is a welcome move: there is a need to identify the range of precipitating socio-natural relations and factors that have produced flood risk over time. An assemblage optic affords opportunities for identifying unusual suspects and putting into practice a radically relational civic politics for reducing socio-natural risk, though challenges undoubtedly exist. This a point I turn to in the conclusion.

### **Conclusion: Distributed Agency and Relational Politics in an Age of Risk**

To conclude, I return to the storm drain map that I opened with. Prepared in 2010 by the French multinational engineering design firm, STUP Consultants Private Ltd,<sup>11</sup> the map’s neat and monotonous depiction of Bangalore’s storm drains belies the fact that storm drains are a messy, historically constituted socio-natural assemblage—a recombinant “rhizome” that “ceaselessly establishes connections” between words, things, and “organizations of power” (Deleuze and Guattari 1987:7). The map and the new master plan project for “remodeling” the city’s stormwater drains are a microcosm of an inherited twentieth century paradigm of flood risk management, one that is fixated on heavy-handed technomanagerial solutions for controlling flood and other ecological risks (Karvonen 2011; Melosi 2008). More generally, this fixation is reflected in the global discourse on climate change “adaptation”, which trains attention on the technical “adjustments” needed to confront human-induced extreme and unpredictable weather events, thereby occluding the historic, generative causes of risk (Ribot 2011) and the myriad subtle connections between humans and nature that underlie it.

In this paper I have tried to locate the production of urban flood risk—a phenomenon on the rise globally—in the radical relationality and sociomateriality of urban drainage systems—in both human and non-human agency. Conceptualizing storm drains as socio-natural assemblages, I argued, first, that flow and fixity are useful analytics for mapping their indeterminate workings. This was key not only because flow and fixity characterize the very corporeality and agential powers of storm drains, but also because they comprise a shared vocabulary to think across Marxian and Deleuzian positions. Thinking across these vantages is especially crucial for developing a nuanced account of capital–nature relations and the political ecology of risk, where capital recombines riskily and contingently with various social and material formations. Second, I argued that a powerful alignment between capital flows and wetlands/storm canals in the new millennium has heightened unequal flood risk, with informal areas at the city’s southern outskirts especially implicated in the disastrous consequences of capital mobility and fixity. These arguments raise a larger theoretical point for critical urbanists who theorize “from” the South: we need a sociomaterialist understanding of how and through which *agents* capital

circulates through land in cities of the global South in order to supplement political-economic critiques of informal urbanism. This paper suggests that wetlands and storm drains provide a site-specific materiality, a life-giving force that fuels capitalism's risky becoming-being and inextricability with informal urbanism.

I traced the production of flood risk historically, focusing on two key realignments: (1) the recasting of storm drains as "sanitary water drains" under the colonial project of improvement; and (2) the revaluing of storm drains and wetlands as real estate in the new millennium. With its murky sewage-filled storm canals, high concentration of lower-income informal settlements, and spurt in legally dubious global corporate and residential projects, Madina Nagar exemplifies why these recombinations matter. Here, storm canals and wetlands long treated as sanitary channels are also "fictitiously" commodified—literally, by surreptitiously filling in with mud and concrete—in order to maximize capital accumulation. The results have been disastrous: even modest monsoons wreak havoc on the neighborhood, destroying homes, possessions, and the propertied aspirations of the city's subaltern middle-class. The effects of flood risk are not simply material. Technocratic flood mitigation plans pivot on labeling and disciplining particular drain "encroachments". Despite the fact that state-led wetland conversion projects and corporate real estate projects are also "encroachments", the politics of the encroachment discourse—in which illegality is narrowly equated with lower-income settlements—obscures the full range of "encroachers" and their agential capacities.

The power of an assemblage orientation is that it makes visible unusual suspects involved in the production of flood risk, disrupting how we conceive of agency and perform critique (McFarlane 2011). We saw, for instance, that the material and discursive conflation of "stormwater" and "sanitary water"—a phenomenon rooted in a much longer legacy of colonial planning—is implicated in contemporary flood risk. We also saw that a diversity of actors beyond those typically labeled "encroachers", including state agents, developers, and corporate actors, are complicit in the risky encroachment of storm channels. Indeed, the footloose nature of capital flows, characteristic of a particular neoliberal crystallization in India's cities, can also be conceived of as "agential" if a more distributed notion of agency is adopted.

The reduction of flood risk in the city must account for this larger "web of agentic capacities" (Bennett 2005:464). Practically speaking, however, it is not immediately obvious how a distributed notion of agency could be implemented in the day-to-day functioning of stormwater engineers, state actors, residents, and other urban citizens. What does it mean to say that sewage, concrete, and capital are also flood-inducing agents, or that, following Braun and Whatmore (2010), storm drain assemblages are *eventful*, possessing of a terrifying margin of indeterminacy? What, in other words, are the stakes of displacing "humans as the sovereign makers of history" (Moore 2005:23)? These are difficult questions that engender few clear directives as to who or what should be held accountable for flood risk. However, these vexing questions do provide the basis for imagining a more *relational* urban politics, a politics that engages with humans and non-humans simultaneously, that recognizes the "partial, hybrid, and messy connections of the world" (Karvonen 2011:188), and that rethinks the relationship between "history and potential, or the actual and the possible" (McFarlane 2011:205).



If the relationships between sewage, storm drains, capital, real estate, and the state have thus far produced urban flooding and inequalities, is a more enabling set of relations possible? How can storm drain assemblages be *reassembled*, in other words? Can a more relational civic politics assemble a more safe and just city? The beginnings of such an urban politics are already underfoot. For instance, engineers already recognize the complex relationality of storm systems as evidenced by the diverse vocabulary they used in discussing the map, and recognition that their jobs require “thinking about land, history, water, sanitation, pipes, everything ... even politics and sociology!”<sup>12</sup> The challenge for urban struggles in Bangalore and globally is to use a relational sensibility to bring forth and deem valid multiple forms of connective knowledge, not simply that which is codified in expert plans. Furthermore, there is growing public recognition in Bangalore about the connections between global and domestic real estate capital, the state, and flood risk. While current citizen science campaigns are not focused on ameliorating the flood proneness of poorer areas of the city *per se*, they are nevertheless working to expose the *political ecology* of flood risk in the city by demanding transparency around the granting of infrastructure and environmental clearances to large real estate projects on wetlands.<sup>13</sup> In a related vein, citizen groups have increasingly sought to expand the discourse of “encroachment” beyond its typical connotation of the poorer, informal settler to also including large-scale corporate (wet)land grabbing.<sup>14</sup> Finally, a number of civic campaigns seek to rejuvenate the city’s wetlands and lakes across the city with varying agendas and success rates.

A key component of these campaigns is the recognition that the city has a complex relationship with its storm canals and wetlands. A more enabling set of relationships might bring together the state and housing activists in the formulation of a robust plan for flood-safe low-income housing. A more enabling set of relationships might also lie in bringing wetlands and groundwater recharge/rainwater harvesting policies under the same purview to underscore the connections between different *waters* rather than treating these as isolated domains. Finally, a more enabling set of relationships might lie in assembling storm drains, progressive state actors, and social justice activists to disrupt dangerous processes of capital accumulation in the city. Laying bare these relational politics is invaluable in creating more flood-safe and socially-just urban siconatures.

## Acknowledgements

I am grateful to Sharad Chari, Majed Akhter, Jesse Ribot, Trevor Birkenholtz, Tom Bassett, and three anonymous reviewers for their invaluable feedback at various stages of this work. This research was made possible through post-doctoral funding from the Social Dimensions of Environmental Policy initiative at the Beckman Institute of the University of Illinois, Urbana-Champaign.

## Endnotes

<sup>1</sup> My definition of risk is closely aligned with the definition of social vulnerability put forth by critical social scientists as being the historical, contextual, and political-economic factors that reduce the ability of groups to cope with and recover from harm. The terms risk and vulnerability are often used interchangeably. However, I specifically use the term risk and not

vulnerability in this article because my interest is not in the capacities and entitlements of a specific group of people (as vulnerability often tends to be analyzed), but rather the historic alignments that differentially produce flood-proneness.

<sup>2</sup> The Greater Bangalore City Corporation (BBMP) is divided into eight major zones and 200 wards.

<sup>3</sup> See, for instance, the recent expose by Navya (2013) writing for Bangalore-based Citizen Matters, <http://bangalore.citizenmatters.in/articles/5332-how-govt-helps-sez-trump-bellandur-greens>

<sup>4</sup> I am grateful to an anonymous reviewer for this important point.

<sup>5</sup> Interview with stormwater engineer, 20 January 2012.

<sup>6</sup> By all estimates, this is also the final augmentation scheme because of a longstanding riparian agreement between Karnataka and neighboring Tamil Nadu.

<sup>7</sup> Interview with stormwater engineer, 14 January 2014.

<sup>8</sup> This is a privileging that imparted a more general ethos of public–private “partnership” onto the city’s governance (Ghosh 2005).

<sup>9</sup> The increase in impervious area causes flood peaks by up to three times as compared to permeable areas and also does not allow the replenishment of aquifer water.

<sup>10</sup> Interview with stormwater engineer, 25 January 2012 (emphasis added).

<sup>11</sup> The acronym “STUP” translates from the French into “Technical Corporation for the Utilization of Pre-stressed Concrete” according to the corporation’s website (<http://www.stupco.com/intro.htm>) reflecting, again, a contemporary preoccupation with using fixities to tame flows.

<sup>12</sup> Interview with stormwater engineer, 20 January 2014.

<sup>13</sup> See for instance <http://bangalore.citizenmatters.in/articles/5331-iisc-report-says-mantris-agara-project-encroaching-lake-side>

<sup>14</sup> See for instance <http://lsecities.net/media/objects/articles/bangalore-high-tech-and-the-monsoon/en-gb/>

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