A Research Agenda for Geographies of Slow Violence

Making Social and Environmental Injustice Visible

Edited by

SHANNON O'LEAR

Professor, Department of Geography and Atmospheric Science, and Environmental Studies Program, University of Kansas, USA

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7 Enduring infrastructure

Kimberley Anh Thomas

Introduction

All along the lower reaches of the Mekong River, it was clear in late 2019 that something was afoot. People were paying more attention than usual to the long belt of water as it swept past the Laotian capital of Vientiane, curved along the northeastern border of Thailand, and merged with the Tonle Sap River in Cambodia. Tourists and fishermen alike were captivated by the river's sparkling, aquamarine waters. Sightseers in northeastern Thailand ventured out into the river to play on bare sandbanks, while laborers in central Laos drove trucks down to the water's edge and collected exposed rocks and sand for construction. It was a marvel to witness, yet it was all wrong. Riverside dwellers had never experienced anything like it, water so clear it reflected the color of the sky. The river, ever opaque with a muddy brown hue, was suddenly flowing as if filtered from a city tap. Despite the river's unexpected beauty, people's wonder quickly gave way to concern, and the hyaline waters became increasingly viewed with suspicion and fear.

It did not take long to attribute blame for the river's unprecedented appearance, as scientists and lay people quickly linked the clear water to the recently commissioned Xayaburi Dam in Laos. Under normal conditions, the spidery network of streams and rivers of the Mekong Basin discharges approximately 160 million tons of sediments into the East Sea every year. According to regional hydrologists and ecologists, the newly minted dam had trapped so much sediment that it starved the river's lower mainstem within a matter of weeks. The water became crystalline for lack of its usual cargo of silt.

Dams are notorious for displacing people and destroying habitats during dam construction and reservoir filling, as well as for altering downstream flows and impeding fish migration. However, less known are the additional and extensive risks that sustained sediment deprivation poses to riparian communities, both human and non-human. Notable among these is the 'hungry water effect,' whereby rivers robbed of sediment become hyper-charged with kinetic energy. These faster flowing currents scour riverbeds, erode banks, and destabilize vegetation and structures along the rivers' edge.

Fish and invertebrates that rely on sediments for habitat and nutrients are additional casualties of sediments held captive behind dams. The Mekong River ranks only second to the Amazon in terms of biodiversity, and these organisms sustain the largest inland fishery in the world. The Mekong supplies an astonishing 15% of the global freshwater catch, which provisions roughly 60 million fishing households with livelihoods and food security. Sediments of various sizes create microhabitats for a wide array of fauna to rest, lay eggs, and hide from predators, all essential for healthy aquatic systems. Yet, these critical ecosystem processes hinge on the delivery of water and sediment according to the steady tempo of the monsoon climate. Therefore, while anti-dam protests highlight the deleterious impacts of disrupted flows of water and fish, changes to long-standing patterns of sediment transport are equally significant for the structure and function of many riparian socioecologies.

In Southeast Asia, as elsewhere, hydropower dams generate electricity that courses along transmission lines into homes, schools, businesses, and hospitals. They impound water that may be conducted along irrigation canals and pipes and into rice fields and kitchen sinks. Dams may double as roads across deep valleys that may otherwise be impassable, thereby connecting towns and villages to each other, as well as to cities beyond. Such energy, water, and transportation infrastructures "comprise the architecture for circulation, literally providing the undergirding of modern societies, and they generate the ambient environment of everyday life" (Larkin 2013: 328). Yet, they are also critical sources and sites of violence.

The carnage of flattened homes, razed trees, clogged waterways, and skies choked with dust index the violence wrought by bulldozers and saws, wrecking balls and eviction notices. Researchers, journalists, and members of impacted communities have filled volumes documenting the spectacular offenses wrought by large infrastructure projects, particularly during and immediately after their construction. Substantially less attention has been paid, however, to the quiet violence that unfolds after infrastructure 'goes live.' Such violence operates over longer stretches of time and is less overt in its effects. As I signaled in my sketch of the lower Mekong River in the wake of the Xayaburi dam, my goal is to focus on these slower forms of violence inflicted upon complex socionatures through the quotidian operation of water management infrastructure.

Such inquiry poses a unique challenge, as slow violence by definition does not accommodate itself well to examination. By virtue of its temporality and invisibility it often goes undetected by all but its victims (Davies 2019). Even then, causal threads can be difficult to disentangle. In the process of articulating the insidiousness of slow violence, Rob Nixon (2011: 14) lays out the task through the language of apprehension:

> How do we bring home—and bring emotionally to life—threats that take time to wreak their havoc, threats that never materialize in one spectacular, explosive, cinematic scene? ... To engage slow violence is to confront layered predicaments of apprehension: to apprehend—to arrest, or at least mitigate—often imperceptible threats requires rendering them apprehensible to the senses through the work of scientific and imaginative testimony.

I approach this task from the presupposition that social and environmental systems are co-constitutive. It makes little sense in any case to attempt to cordon off 'nature' as somehow distinct from human spheres of life. This is especially true when considering the dialectical relationship between biophysical processes and social [re]production, as it is mediated by various infrastructures.

In the case above, non-human natures create the preconditions for human flourishing in the Mekong River Basin, supplying the fertile soils, diverse plant and animal life, water, climate, and abundant fisheries that have sustained human life for millennia. As part of complex socioecological systems, plant cultivation, fishing, harvesting, resource management, and other social practices have likewise shaped regional climates, resource availability, and the spatial and temporal distribution of various life forms. The introduction of extensive or large-scale infrastructures significantly alters these dynamics by redirecting material flows, often with violent social and environmental consequences. To 'apprehend' these consequences requires us to consider infrastructure in relational terms. In other words, infrastructures are not standalone objects but rather "articulated components" (Star and Ruhleder 1996: 111) within a complex web of relations.

Infrastructure studies have flourished since the mid-1990s, and we now have at our disposal a rich body of research interrogating the political and social lives of infrastructure. This work has rightly emphasized the assaults on human and non-human natures that occur during the course of infrastructural construction, abandonment, and decay. However, my goal here is to illuminate the violences enacted elsewhere during infrastructural life—namely, that beguiling period when infrastructures are humming along as planned, when the indispensable services they deliver obscure the socioecological costs of provision.

Indeed, it is difficult to conceive of everyday life without the systems that deliver drinking water to our homes, enable long-distance communication, and convey us between domestic, work, and recreational spaces. It is by virtue of the fact that these amenities have become essential to daily life that the full complement of their socioecological costs is neither captured in even the heftiest price tags of infrastructure projects nor widely appreciated by the diverse publics that rely on networked services. My argument here is that beyond the more visible and well-documented violence associated with infrastructural construction, abandonment, and deterioration, infrastructure also metes out gradual, accretive violence in the course of its normal, even optimal, functioning. As I illustrate through several examples of water infrastructure, violence is not incidental to infrastructure but intrinsic to it. This is lamentably the case because of the way that spatial, temporal, and social horizons are written into infrastructural designs. However, these same factors reveal opportunities for producing more egalitarian ecologies, thus pointing a way toward non-violent infrastructural relations. In the remainder of the chapter, I summarize relevant insights from ethnographies of infrastructure and interpret additional cases of infrastructural violence. I conclude by articulating key questions to guide investigations of slow violence in the aftermath of novel landscape engineering.

Social science of infrastructure

Anthropologists have advanced our collective understanding of infrastructure by theorizing the materiality, aesthetics, imaginaries, governance, and temporalities of infrastructure (see Larkin 2013; Anand et al. 2018; and Hetherington 2019 for helpful syntheses). According to this and related work in geography, infrastructure is less defined by its *thingness* than by its processes and relations (Cousins 2019). Even such unambiguously material objects as cables, satellites, aqueducts, roads, communication towers, and rail lines are embedded in networks of relations that regulate every aspect of their operation, ranging from their access and use to their functioning and upkeep. Infrastructures also require continuous inputs of labor, be they for planning, construction, maintenance, monitoring, or repair. In summary, they are brought into existence and sustained through a combination of environment-derived materials, human ingenuity, and labor.

To approach infrastructures relationally is to recognize that they are in a constant state of becoming. This ongoing-ness belies any assumed teleology in which infrastructure neatly progresses from conception to construction and culminates in completion or decommission. Indeed, the reality of infrastructural life is marked by fits and starts, hiccups, delays, and even abandonment. “If infrastructure is processual … then one might conclude that finishedness is illusory—that everything is unfinished” (Carse and Kneas 2019: 13).

While this may be the case, many infrastructural projects realize some period during which they fulfill their intended functions. We do experience lights coming on, water flowing from taps, and trains running along tracks, after all. It is when systems operate as we expect them to that they have the tendency to slip into the background and become invisible, even when their enabling infrastructures—irrigation canals, telephone wires, pipelines—are plain for anyone to see (Harvey 2018). Thus, it is often, though not uniformly (Larkin 2013; Schwenkel 2015), observed that infrastructure is most visible when it malfunctions (Star and Ruhleder 1996, Edwards et al. 2009). The challenge of apprehension is doubled, therefore, by the difficulty of perceiving slow violence *and* the infrastructural media that engenders such violence. How then do we render visible the slow violence of infrastructure?

Star and Ruhleder emphasized infrastructure as a relational property when they posed the provocative question, “when is an infrastructure?” (1996: 112). I suggest that one way to apprehend its slow-onset harms is by reworking their query and asking: When is infrastructural violence? Or, as Rodgers and O’Neill (2012: 402) put it, “A key conceptual challenge, then, is to understand when it is that infrastructure becomes violent, for whom, under what conditions, and why.” That infrastructural violence is enacted during construction, neglect, breakdown, and decay is well established. However, the creeping violence that unfolds when infrastructure ‘works’ is arguably more insidious and as such has escaped equivalent critical attention. I will argue that such violence is written into infrastructural blueprints due to the spatial, temporal, and social horizons around which infrastructures are designed. But first, I will present a few cases to illustrate how slow violence operates through infrastructure.

Infrastructural violence

A moment’s consideration of the role of infrastructure in our lives quickly leads to an awareness of its ubiquity. We need look no farther than our own homes to recognize that infrastructure is integral to the distribution of water, electricity, information, people, manufactured goods, finance, food, and more. Among these, water is especially well-suited to elucidating the relationship between infrastructure and slow violence, as water itself is a "total social fact"—a social phenomenon that cuts across virtually all domains of society (Orlove and Caton 2010). Every aspect of life is touched in some way by water, and rarely does it arrive in our lives unmediated by a pipe, canal, sewer, pump, hose, or faucet. Despite our utter dependence on such infrastructure, "structural forms of violence often flow through material infrastructural forms" (Rodgers and O'Neill 2012: 405), and how these infrastructural forms articulate into sites and moments of violence varies over time. A good deal of research has focused on abuses arising at the inception and demise of infrastructural life, two moments onto which I map three categories of infrastructural violence: displacement, failure, and decay.

During the building of large-scale infrastructure, communities are often forced from their homes and the productive resources that support their livelihoods. Attending such displacement, communities may be relocated onto marginal land, un- or under-compensated for their losses, or subject to social and cultural disruption through relocation across dispersed sites. Such was the case for an ethnic minority of Laos, 2,700 of whom were resettled to clear space for hydropower development but without compensation and onto land already occupied by another minority group (Green and Baird 2016). Government officials typically rationalize such violence by invoking imperatives for development and progress, or increasingly climate change adaptation, but the damages are inflicted all the same.

A second set of grievances is associated with infrastructural failure. On one level, problems arise when projects are abandoned as a result of projects running out of funding or political winds shifting in favor of some alternative. Even incomplete projects may exact a toll, however, as communities suffer the effects of displacement, as well as landscapes scarred by habitat destruction and construction debris. Partial but non-functional structures can also persist as monuments of unfulfilled promises and serve as painful reminders of what could have been. Even when infrastructures do come online, they may fall woefully short of their intended service delivery in terms of expected quality or duration. One paradigmatic example is the catastrophic failure of Louisiana's levees during Hurricane Katrina in 2005 that resulted in over 1,500 deaths as well as untold social traumas that persist today.

Periods of neglect or decay mark a third notable moment of infrastructural violence. While technologists and capitalists champion innovation and disruption, others argue that the "mundane labor" of maintenance is what really warrants acclaim (Russel and Vinsel 2016). Maintenance keeps things running long after the sparkle of a novel infrastructure has worn off and people have come to expect and rely on timely performance. Maintenance also has indirect benefits, such as the social cohesion fostered among farmers in Egypt through their practice of communal upkeep of irrigation ditches (Barnes 2016). However, when neglected, as opposed to intentionally decommissioned, water infrastructure wreaks its own havoc beyond the termination of essential services. In Cambodia, for instance, combined sewer systems quickly become clogged with trash when pipes are not regularly cleaned. Congested pipes become overwhelmed during heavy rains, thereby increasing the occurrence of flooding and sewage overflows, as well as their attendant health risks (Jensen 2017). Human health and safety were even more dramatically sacrificed when up to 12,000 children in Flint, Michigan were exposed to lead leached from aging pipes. An entire generation of the predominantly African American population was subjected to gradual poisoning as a result of progressive devaluation and underinvestment in the city and its infrastructure (Ranganathan 2016).

This cursory survey merely hints at innumerable other cases of violence that unfold during various stages of infrastructural life. But if a key challenge to addressing slow violence entails rendering it visible, then it behooves us to focus on that period when infrastructure is most obscured from view: those times when it functions ‘properly,’ when it delivers services so fundamental to everyday activities that it is taken for granted as part of the background of social life. What violences do we begin to notice when we focus on infrastructure at its most benign?

The [un]working of water infrastructure

The most familiar water infrastructures are likely those systems that underpin domestic water supply and sewerage. However, as the example of levees and floodwalls in Louisiana indicate, people may be equally dependent on those landscape modifications that offer protection *from* water. Given that water is necessary for all life, it is unsurprising that 70–80% of the human population lives within 5 km of a waterbody (Kummu et al. 2011). This close proximity to water presents opportunities for health and sanitation, food production, manufacturing, and commerce, but it also poses greater risk. Striking the balance between optimizing the benefits of water while minimizing its hazardous potential has increasingly meant managing the timing, distribution, and quality of water using engineered solutions such as wastewater treatment, irrigation canals, pumps, and dams. Flood management structures in Vietnam, for example, powerfully convey the violence of deflected risk, but to understand this infrastructural violence requires first placing it within historical context.

Upstream dikes, downstream risk

Vietnam is the world's third largest exporter of rice, but this has not always been the case. The country periodically faced acute food shortages during the 20th century and was a net importer of rice as recently as 1985. Much of this dramatic shift in food security can be accounted for by looking to the Mekong Delta, where 90% of Vietnam's rice exports are sourced. Here, rich deposits of alluvial soil are highly conducive to agriculture, but their benefits were limited by the six-month monsoon season, during which the region receives over 90% of its annual rainfall and surface water, and severe floods can reach depths up to 3 m. In addition to contending with extreme seasonality that constrained what they could plant and when, farmers were also strongly influenced by political economic factors. Rice yields were particularly low under state-led attempts at collectivization of agricultural and industrial production, first starting in the North in the 1960s and then in the South after reunification in 1975 (Raymond 2008). Against a backdrop of chronic grain shortfalls and pervasive malnutrition, the central government implemented sweeping economic reforms in the late 1980s, including land and water management practices geared toward optimizing rice production.

This national 'rice first' food security policy entailed the widespread adoption of high-yield rice varieties and agrochemicals in conjunction with physical engineering of the hydrological regime to regulate fresh and salt water flows tuned to these modern rice varieties (Tran and Kajisa 2006). Water management schemes were modeled on Dutch polders, swaths of land encircled by earthen embankments for flood protection. Such structures had been introduced to the Mekong Delta in the 1930s, but the central government was not able to develop them in earnest until the economic reforms of the late 1980s (Biggs et al. 2009). The drive to increase rice production for domestic and international markets encountered significant challenges in the upper delta, where naturally deep floodwaters were not conducive to high-yield rice varieties that had short stems compared to the 'floating rice' typical of the region. Engineers and planners therefore implemented a vast network of embankments across the upper delta to exclude floodwaters from the paddy fields.

The dikes were immediately effective and instantly popular. Farmers could now plant multiple crops per year, boosting rice production 39%, from 3.03 tons per hectare in 1985 to 4.2 tons per hectare in 2000 (Le Coq and Trebuil

2005). Gains for farmers were short-lived, however, even though Vietnam has consistently generated an annual grain surplus of an average 3 million tons of rice. Trading companies have captured the lion's share of the benefits of market liberalization, while smallholder farmers have become one of the poorest segments of the population (Biggs et al. 2009). Part of the explanation for this disparity lies in the fact that in addition to requirements for chemical inputs associated with Green Revolution crops, the altered hydrology introduced its own costs. Namely, the installation of high dikes in the upper delta, particularly after disastrous floods in 2000, had the unfortunate but predictable consequence of excluding river-borne sediments from depositing on the land. As a result, farmers had to apply ever greater amounts of expensive fertilizers to compensate for the associated loss of nutrients. Moreover, flooded fields are an important fishing site for poor farmers and landless people, and the removal of the flood period has eliminated opportunities to save money from fishing, as well as time for farmers to rest while their fields sat fallow (Kakonen 2008). Accordingly, one recent study concluded that the shift to triple-cropping is only optimal for wealthy, large landowners and only for a period of about ten years, given the cost of replacing sediment-bound nutrients with artificial fertilizers as soil fertility progressively declines (Chapman and Darby 2016).

The gradual impoverishment of smallholders and soil fertility represents one type of slow violence brought on by the normal functioning of high dikes in the upper delta. However, the characteristic feature of water as a flow resource means that river systems are highly interconnected, and waterbodies rarely align themselves with the administrative units that people impose on them. For the central delta, this connectivity has translated into increased flood risk, as the onrush of monsoon water has to go somewhere. When high dikes in the upper delta confine floodwaters to the channels, the water will empty out at the first opportunity. Such has been the case for Can Tho, the largest city in the Mekong Delta, which experienced a 27% increase in annual water levels after a wave of dike construction in 2007 (Dang et al. 2016). In 2019, Can Tho experienced its worst flooding in 30 years as monsoon rains coincided with high tides, even though the city is 80 km from the coast. Roads and homes were inundated with muddy water, creating an array of hardships for 30,000 people who lost work, missed school, struggled to move around the city, and faced days of clean-up after the waters receded. High dikes have been instrumental to Vietnam's economic growth and food security in recent decades, but flood protection and rice production in the upper delta have come at the expense of rising inequality among farmers and greater flood risk and damages in unprotected areas downstream.

I will pause here for a moment to point out two salient dimensions of infrastructural violence based on the cases above. First, it has a *temporality*, which logically derives from the focus on slow violence. It takes time for soils to become depleted and for flood channels to clog with silt. It likewise takes time for agrarian livelihoods to become increasingly tenuous as the margin between agricultural inputs and rice yields narrows. Second, the displacement of flood hazards in the Mekong Delta reveals that infrastructural violence has a *spatiality*. An infrastructural system and the violent effects it engenders are not necessarily co-located. Regulating water in one area may cause spillover effects elsewhere. Rendering the slow violence of infrastructure visible thus entails adopting a wide spatial and temporal scope. Turning our attention to sea wall protection in Nigeria allows us to add to this list a third dimension of *sociality*—a who to the when and where of infrastructural violence.

Sacrifice zones

In many cases, the victims of infrastructural violence are readily identifiable. It is evident that poor and marginalized communities in New Orleans, children in Flint, and ethnic minorities in Southeast Asia have been crushed under the weight of failed levees, corroded pipes, and massive dams. But how do we account for those not easily recognized as casualties of infrastructural violence? By following the water, it becomes possible to see how the strict designation of a target population for service provision can increase the precarity of those located just beyond it.

The most populous and fastest growing city in Africa is pushing the boundaries of its growth. Like many coastal cities, Lagos, Nigeria only has so much room to expand. This geographical constraint helps to explain a massive land reclamation effort to develop a 10 km^2 residential and business complex adjacent to the affluent neighborhood of Victoria Island. It would seem that such an endeavor is well timed given the astounding housing deficit that has left 70% of the city's 21 million residents living in slums precariously located in wetlands and floodplains. Eko Atlantic's high-rise apartment buildings will accommodate up to 300,000 people once complete, but the luxury units will do nothing to alleviate the affordable housing crisis. Instead, the developers of the US$6 billion undertaking have their sights set on those in an entirely different income bracket. The exclusive enclave is billed as "one of the world's cutting-edge new cities" and is modeled on Manhattan's skyscraper district (ekoatlantic.com). It also boasts the Great Wall of Lagos, an 8.5 km-long sea revetment designed to protect the artificial peninsula from flooding, sea level rise, and coastal erosion.

Flood and erosion protection are noteworthy features given that Eko Atlantic was first conceived in 2003 as a retaining wall to help Lagos as a whole contend with these very hazards (Brisman et al. 2018). Plans for collective shoreline protection were later reconfigured into a narrowly focused sea defense barrier that only shelters the new city and a portion of Victoria Island. Constructed of 100,000 five-ton concrete blocks, the 25-ft-high sea wall is intended to withstand 1 in 1,000-year storm events, as its design also took "into consideration global warming and rising sea levels" (Eko Atlantic 2017). However, beyond the wall's covered range, unprotected and predominantly slum areas face greater threats from erosion, sea level rise, and coastal flooding, as the sea wall deflects incoming waves and storm surge down the shore (Ajibade 2017).

As in the Mekong Delta, sea water carried shoreward by storms and tides will find a path to expend itself. The difference here is one of stark social differentiation, whereby environmental protection for the wealthiest comes at the expense of heightened risk for impoverished groups who already suffer higher mortality from recurring and intensifying floods (Thomas and Warner 2019). "Even more than other gated communities, Eko Atlantic says to the world, *No, we are not all in this together*" (Goodell 2017: 219). Of course, it is possible to rank the risks of flood damage and erosion based on property values, according to which prioritizing Eko Atlantic for sea wall protection makes economic sense. Indeed, such a pointed calculus is what keeps Lagos off the list of top megacities most at risk from sea level rise, in spite of the sizable population there likely to be displaced by inundation, as other cities like Guangzhou, Mumbai, and New York have more valuable infrastructure (Goodell 2017). However, cost-benefit analysis also leads to outcomes like the well-being of hundreds of thousands of residents in floating slums being sacrificed to enhance the security of those already well-poised to weather Nigeria's more frequent storms. The ubiquity of this approach in infrastructural planning means that there are many more examples of such cold calculation and harsh outcomes elsewhere in the world, and they are likely to proliferate, particularly where social inequity is high.

The importance of social difference to slow violence is underscored in a recent article that challenges Rob Nixon's (2011) assertion that slow violence persists due to a paucity of compelling stories. Thom Davies (2019: 13) mobilizes ethnographic work on toxic landscapes in Louisiana to argue instead that "slow violence persists because those 'arresting stories' do not count. Crucially, a politics of indifference about the suffering of marginalized groups helps to sustain environmental injustice, allowing local claims of toxic harm to be silenced." Building on his conclusions, we can recognize that the accounting behind the design of the Great Wall of Lagos facilitates infrastructural violence through two distinct mechanisms. It discounts the suffering of the city's most vulnerable from the outset to justify callous decisions in terms of rational economics, and it ensures that any telling of residents' ensuing struggles do not count. The fact that the communities most impacted by the sea wall are the city's poorest is of central importance, as their marginal political status affords them no recourse against the development's powerful stakeholders.

Scripted violence

In her clear-eyed examination of the ongoing violence of water poisoning in Flint, Malini Ranganathan (2016) invites her audience to read against the grain of environmental racism. Her motivation for doing so is that, while environmental racism is frequently invoked as an explanation for the water crisis, such an interpretation encounters two pitfalls. One either runs into a burden of proof problem when attributing environmental racism to individual prejudice, or one takes race for granted and neglects to address the causal forces behind its production. Instead, she lays bare liberalism's entrenched contradictions and ambivalences to demonstrate how "racial hierarchy is foundational—and not simply incidental—to the workings of capitalism and an ostensibly democratic, liberal market society" (Ranganathan 2016: 5).

In the cases described above, I sacrificed depth for breadth in the hope of staking a parallel claim about infrastructural violence. Slow violence is not an exception to the smooth operation of infrastructure, an unfortunate by-product of otherwise well-conceived plans, but is constitutive of it. I submit that slow violence is hardwired into infrastructure. It is written directly into every infrastructural blueprint, mock-up, model, and promo video. And this is where the three dimensions of infrastructural violence come into play.

From the outset, every project envisions and demarcates a social, spatial, and temporal scope: a population of beneficiaries, a target region, a time horizon for service delivery. This is standard practice for any infrastructural design. However, it is also a techno-managerial mechanism by which slow violence becomes normalized, because what may lie beyond any of these social, spatial, and temporal horizons is of little to no consequence to the project. All those spillover effects and unintended outcomes that manifest as slow violence either do not register or are diminished in the logic of generating essential services. Shifts in sediment loads, soil nutrient concentrations, stream velocity, sea level, and water chemistry may be imperceptible to our blunt senses, but they are cumulative and mightily consequential to those who suffer their terrible effects.

They can also be surprisingly predictable if you know where and when to look. Few today are surprised that dams decimate fish populations, jetties wash away beaches, and dikes redistribute flood risk, for example. Yet, these interventions continue to be implemented all over the world under the banner of modernization, climate change adaptation, and progress. That they are perpetually introduced as solutions despite their repeated failings demands greater scrutiny of the logics that underpin them (Thomas 2020). Peering into the social, spatial, and temporal workings of infrastructure thus becomes a necessary act of revolt: "To imagine and to make environments of justice, then, is necessarily to engage in the 'boring' technopolitics of infrastructure; to reveal, refuse, and revolt against the ways in which their vital and violent politics are frequently obscured and buried from view" (Anand 2017). Envisioning socially and environmentally just alternatives to violent infrastructures entails broadening the social, spatial, and temporal horizons that overly circumscribe who is to benefit from or pay the socioecological costs of infrastructural services, where, and for how long.

Accounting for infrastructural violence

This chapter advances two key arguments. First, infrastructure has long been recognized to be a key site and moment of violence, and, increasingly, slow violence. However, this awareness tends to revolve around infrastructure at its inception and demise, particularly during episodes of displacement, failure, and decay. Attention to the period when infrastructure functions as intended and provides valuable services reveals another, yet underexamined, array of violent effects. Second, infrastructures give rise to slow violence through the delineation of time scales, spatial areas, and social groups that are strictly focused on a network's immediate outcomes, service delivery region, and customers. Lag times and knock-on effects for human and non-human communities outside these boundaries are woefully omitted from infrastructural design processes, and thus the creeping injustices they suffer remain unaccounted.

While it is likely unfeasible to account for every instance of infrastructural violence, many of its dynamics have been well characterized, and it may therefore be possible to anticipate and intercept slow violence in the making. Interrogating planners and proponents about a project's social, spatial, and temporal scope is one important starting point. What is the full spectrum of downstream impacts of the infrastructure? How will the system disrupt existing socioecological dynamics, and with what effects? Who is responsible for mitigating violence once it comes to light? To whom is the project responsible? What would make it responsive to non-beneficiaries in non-target areas? Such questions anticipate slow violence from the outset and help stretch an infrastructure's social, spatial, and temporal horizons to encompass all those who pay the dreadful costs of their vital services.

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