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Material Engagements with Fog in Lima

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In the Peruvian capital of Lima, local NGOs, conservationists and residents on the urban periphery try to harness ground-touching clouds as part of alternative water-supply systems and environmental infrastructures of underground water production. While NGOs set up fog-capture nets to respond to the absence of state infrastructure, conservationists adopt similar methods to repair damaged more-than-human relations and forestall desertification. Amid these attempts to bring about new environmental–infrastructural relations, the fog-catchers have re-attuned residents to previously backgrounded features of the city and the atmospheric: whereas the sky now abounds with water in atmospheric suspension, urban asymmetries are rendered conspicuous through the foregrounding of airborne pollutants. These occasions of "mutual" or "reciprocal capture" (Stengers 2010: 36; Choy 2018: 71) encourage a redescription of infrastructures as always and already bio.

Morning fog blanketing the city.
Photo: Chakad Ojani, Winter 2019.

Scholarly inversions have shown that infrastructures are the conditions of possibility for (certain forms of) life while at the same time being held together by a plethora of more-than-human relations (Carse 2012; Morita 2017; Barua 2021; Ojani 2023a). This means that infrastructures are reciprocal in their very nature: they are prone to modification by the processes and entities they animate and enfold – a point that is productively laid bare by attempts to infrastructuralize (Ballestero 2019) ground-touching clouds in Lima. Here, an evasive and transitory atmospheric phenomenon is granted leeway to reconfigure residents' relations to their socio-environmental surrounds, sometimes with significant consequences for how they understand and situate themselves vis-à-vis the broader urban landscape. Taking its cue from this issue's introductory framing of infrastructures as biosocial, this article contends that it is through the recognition of the inevitable mutuality of capture that the bio of urban infrastructures might be given due relevance. The article speaks to recent scholarship on the experimental qualities of Latin American infrastructures more broadly (Alderman and Goodwin 2022), albeit in the context of non-governmental and small-scale interventions that, while difficult to sustain, have proved remarkably generative with respect to their speculative ramifications.

Infrastructuralizing Ground-touching Clouds

In the informal and recently formalized neighborhoods on the hilly peripheries of Lima, lack of state infrastructure is widespread – not least water and sewage. In 2019, around 1.5 million inhabitants remained disconnected from the city's water infrastructure grid. Once squatters obtain rights to reside on state territory, they are also entitled to demand various forms of infrastructural connectivity, but it can take decades for reservoirs and other infrastructures to arrive. Water-delivery trucks try to fill this gap. However, this water is expensive, not always safe to consume, and it is often unclear where it is actually coming from (see Ioris 2015).

Improvised housing in Villa María del Triunfo, southern Lima. Photo: Chakad Ojani, Winter 2018.

In this context, ground-touching clouds have emerged as an alternative water source, initially among scientists who set up fog-catchers to study fog–plant relations along the Peruvian coast (Ojani 2022), and more recently among civil society organizations who adopt similar methods to provide alternative micro-infrastructures to residents on the Limeñan periphery. In brief, fog-catchers consist of large plastic nets situated perpendicular to the direction of incoming coastal winds. Lima is built on a desert with very little rain, yet coastal fog is ubiquitous, especially during the winter. These low-lying clouds consist of tiny water droplets too small to precipitate but which are easily entrapped in the nets. As they grow larger, the droplets trickle down and are led into a plastic water cylinder for later distribution, first through a gutter and then usually a larger pipe.

Installation of fog-catchers in Lima. Photo: Chakad Ojani, Winter 2018.

The water collected by the fog-catchers is contaminated with heavy metals and mostly used for irrigation; filtering it exceeds residents' financial capacity and lies well beyond the scope of what local NGOs can deliver. Besides, the meshes must be taken down each summer to be protected from the sun, and they require continuous cleaning and maintenance work as they tend to capture sand and dust. But the challenges extend beyond the recalcitrance of aerosols and the materiality of fog-catchers. Often, the apparatus is assembled by or for residents lacking formal permits to occupy state-owned land and is therefore at risk of removal or destruction by the authorities. As a result of these various obstacles, the fog-catchers repeatedly fail to live up to their promise as an alternative water-supply system and are eventually left uncared for. Even so, in some cases they have turned into technics of mediation for reading and sensing the city in a new key.

For example, in the Villa María del Triunfo district of southern Lima, an NGO-led fog-capture project not only brought to residents' attention the quality of the air they are breathing, but also helped articulate understandings of their urban condition in terms of state absence (Ojani 2023b). By gathering airborne pollutants on the surface of the rapidly blackened nets, the fog-catchers rescaled the atmosphere and, in doing so, threw into relief the broader socio-economic geometries of the city as well as the residents' place within it. As it happens, local researchers are now deploying fog-catchers as "[a]pparatuses of atmospheric attunement" (Choy 2018: 61) for turning the city's unequally distributed air qualities into a matter of public concern.

Blackened fog-capture nets.
Photo: Chakad Ojani, Winter 2018.

While gradually falling out of use, another fog-capture project in the same district also explicated (Sloterdijk 2009) or rendered explicit an atmosphere abounding with water. In combination with the residents' observations of drying-out springs and the historical clearance of trees, the surprising volumes of airborne water collected by the fog-catchers prompted conceptualizations of the hills as an environmental infrastructure with the capacity to produce groundwater and even rivers, thus also spurring a reassessment of Lima's ecological history: the city is no longer perceived by the residents in question as necessarily arid but rather as subject to desertification. Following this newfound understanding of the hills as a bioinfrastructure whose capacity to accommodate ground-touching clouds had gradually degraded, the residents formed a local conservation association that sought to remedy the problem through the reforestation of what conservationists had come to call "natural fog-catchers" (Ojani 2023a: 27). Trees, they speculated, would restore the hills as ecologies of fog capture and, with time, help reactivate the districts' many ebbing springs – an endeavor that proved difficult due to unabating land occupations by squatters and what the conservationists described to me as organized networks of land traffickers, which further highlights how the urban precarity occasioned by Lima's neoliberal politics of housing also results in ecosystem devastation.

As an evanescent presence there one moment and gone the next, fog presents significant challenges to infrastructuralization. Whenever a momentary grip on the atmosphere is achieved, these low-lying clouds are not easily disjointed from their atmospheric background, instead turning the nets into indices of deep-seated asymmetries that condition residents' experiences of life on the urban periphery. Hence, attempts to establish relations of capture to fog reciprocally feed back into and modify actors' relations to the city. In some cases, this has amounted to a re-apprehension of Lima's hilly peripheries as aquatic landscapes in need of care and repair.

Reforested trees in a fog oasis ecosystem in Villa María del Triunfo. Photo: Chakad Ojani, Winter 2019.

Bioinfrastructures Beyond Control

Understandings of infrastructures as socio-material assemblages that facilitate various kinds of flow are now widespread in the social sciences (Larkin 2013). Yet, as a means to mediate human and nonhuman agency, infrastructures are also subject to transformation by the unruliness of energies and their resistance to being captured and re-channeled, often with profound consequences for more-than-human relationality and the political (Jensen and Morita 2017).

While infrastructural capture and circulation rely on a "paradoxical generativity through constraint" (Degani, Chalfin and Cross 2020: 4), such enclosures also produce inevitable leaks, unexpected openings, and other, often unanticipated lines of flight (Ojani 2021; Simone 2022). For instance, energy capture "always generates some excess or surplus that may spin off into new directions" (Degani, Chalfin and Cross 2020: 4). The material properties of the substances to be infrastructuralized play a central role in the manner in which this unfolds. Timothy Mitchell (2011) describes how infrastructures of extraction and transportation of carbon and oil, respectively, produce different possibilities for agency and resistance among workers who ensure their smooth circulation. Transport by train or pipes requires distinct socio-material arrangements and these, in turn, enable and foreclose workers' influence on the flow of goods in critical ways. Akin to how fog capture entails processes of mutual capture whereby residents' relations to the city and the atmospheric become vulnerable to transformation, here, too, the

affordances of the materials to be captured reshape socio-political realities in ways not immediately evident.

The same holds true for any infrastructure, for if infrastructural (dis)connections extend beyond gray materials to enfold forests (Carse 2012), rice (Morita 2017) and air (Vonderau 2019), then this also means that infrastructuralization always holds an element of reciprocal capture: a dual process of co-emergence whereby humans, materials and other-than-human actors enfold references to one another in their own constitution (Stengers 2010: 36). The contingency entailed by such mutuality needs to be acknowledged in order for urban bioinfrastructures to move beyond paradigms of control and become more than just another socio-technical fix.

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