

Urban Bioinfrastructures: An Introduction

Raúl Acosta and Lukas Ley

Cities rely on numerous infrastructures to support life: pipes, cables, antennas, roads and other technologies facilitate the distribution and use of water, energy, information and people. Current theories of urban flows undergirded by infrastructural systems, however, often focus on the perseverance of human life at the expense of other lifeforms. But does this conceptualization of life limit our understanding of the true liveliness of urban infrastructure? The contributions to this themed collection interrogate urban infrastructure as sociobiological configurations that not only sustain life in the city but in turn are constituted, patterned and modified by it.

Electricity lines that form an urban arboreality for macaques. Canals that double as biotopes. Gardens that turn into wetlands. These distinctly urban phenomena attest to the manifold and often unexpected appropriations of city infrastructure created by (and for) humans. They raise urgent questions about multispecies design, ownership and stewardship of infrastructure, as well as of what qualifies as ‘environmentally friendly’ town planning. Such phenomena also indicate that multiple metabolisms intersect in the city, and reach beyond it. Infrastructure is never just a single entity or one discrete thing but rather an evolving set of multispecies and material relations. As Maan Barua states, the “more-than-human enfleshments and enmeshments with infrastructure, where corporeality and substrate meld or the habitat and habits of living beings become synonymous with infrastructural environments, point to a wider infrastructural ontology” (2021: 1467). With him, we contend that this wider ontology is necessarily lively, and is directly related to a dynamic temporality whose rhythms do not necessarily align with those of humans (Barua 2023). In fact, one could argue that most of the predicaments that urban planning confronts in the Anthropocene derive from a historical underappreciation and misconception of other-than-human patterns (see [Roadsides Collection no. 008](#)).

Residents of the subdistrict Kemijen removing water hyacinth, a prolific weed of waterways, from the Banger River, a drainage and sewage canal in North Semarang, Indonesia.

Photo: Puji Sarwono, 2023.



While exploring the multiplicity and liveliness of urban infrastructures, this collection also responds to debates surrounding the use of ‘green’ and ‘blue’ infrastructures – plant- and water-based infrastructural systems – to help reduce environmental risks such as flooding, drought or heat. These attempts emerge from criticism of the carbon footprint of conventional infrastructures; in response, they favour involving nature in urban design. Delegating infrastructural work to animals, plants, fungi or indeed entire ecosystems raises interesting questions, as such projects attempt to turn nature into infrastructure (Wakefield 2020). For instance, how can we assume that nature will work as we intend it to? What are the philosophical and economic premises of designs that delegate work to non-human others? In our view, though, both nature-based infrastructures and conventional designs fail to consider the complex interplay of ecology, technology, labour and materials at the core of urban worlds. Both ignore the fact that infrastructures regularly refuse to work as planned and/or get repurposed by other processes. As we remain sceptical regarding the green and blue turns in infrastructural provision, the articles in this collection suggest that the increasing popularity and perceived need for such infrastructures reveal much about the current moment of urbanization. There is clearly a desired return to liveliness in the

face of the “death of nature” (Rademacher and Sivaramakrishnan 2021: 1). Introducing the term ‘urban bioinfrastructures’ responds to that desire, while also interrogating the ambivalent politics of this turn to nature.

Bioinfrastructures raise important questions about the meanings of life and its unequal distribution through infrastructure. In the remainder of this introduction, we elaborate our notion of life and bios – differentiating both from the liveliness envisioned by nature-based solutions. Our view is that neither life nor bios are politically innocent concepts. The notion of life as opposed to nonlife was proposed by the natural sciences, but even scientists have come to agree that this division gets “in the way of understanding the force and formation of existence” (Povinelli 2016, 2019). Instead of simply assuming that something is alive, this collection explores how it becomes a figure of life in historically specific contexts, to the extent in which existence always elicits questions about value and morality. Exploring existence at the nexus between organic, material and political transformations, we follow new materialist scholars who embrace the vibrancy of non-organic matter – such as stone or plastic – without romanticizing a presupposed liveliness of such substances. We rather posit that existence unfolds in encounters with this stuff. When this existence becomes the subject of political or technical reasoning (Rose 2007), it may be configured as bios. Bios falls squarely in the realm of politics.

Michel Foucault coined the term biopolitics to capture the “attempt, starting from the eighteenth century, to rationalize the problems posed to governmental practice by phenomena characteristic of a set of living beings forming a population: health, hygiene, birthrate, life expectancy, race” (2008: 317). As we know, modern state bureaucracies seek to extend their control into the capillaries of society so as to sustain specific biological functions of life, human or otherwise, while suppressing and eradicating others. During colonialism, the suppression of undesirable lifeforms (viruses, bacteria, animals) went hand in hand with the extinction of Indigenous culture and human–environment relations in the colonies. For example, colonial city-building destroyed coastal wetlands (Scaramelli 2021) in order to facilitate ‘modern’ water management and prevent the spread of malaria into the new European quarters, as was the case in Indonesia (Ley 2021). Bioinfrastructures, in our view, can embody biopolitical projects. In absorbing and channeling various material and organic logics, they can, however, also “undercut” them (Bremner 2020).

In cities, many lively urban environments are enjoying a comeback. Wetlands, for instance, are not only recognized for their many indispensable ecosystem services and as carbon sinks, but also for their hosting of multiple species which escape utilitarian principles. This multiplicity of life is therefore recognized as intrinsically beneficial and leads to the displacement of other forms of existence (see Scaramelli 2021). In *The Probiotic Planet*, Jamie Lorimer (2020) argues that after having lived through an anti-biotic age, humanity is now considering the pro-biotic path. This route entails using other lifeforms to help ecosystems recuperate after decades if not centuries of human predation. “The probiotic interest in rewilding is part of a wider rethinking of the management of biophysical systems, including forms of natural flood management and coastal realignment, localized methods for weather modification, and nature-based, planetary-scale schemes for geoengineering through afforestation, ocean

seeding, or solar radiation management” (Lorimer 2020: 2). Today, cities are no longer considered as separated from nature, but rather as peculiar configurations of natural order themselves (Gandy 2022).

Another concern is to distinguish ecology from bios to explain our preference for the prefix bio- over the qualifier ‘ecological’. We recognize in ecology a set of lively processes that emerges as a flexible pattern of connections. A forest, however, is not necessarily ecological, as Elkin (2022) puts forward based on her critique of afforestation. To Elkin (2022: 8), plantation techniques are actually “political and distressingly social.” Yet while forests are not always ecological, they are lively – they grow, proliferate, infringe on other spaces, and provide niches for many organisms, such as fungi.

The recent emergence of bioinfrastructures remains under-theorized. With this collection of *Roadsides*, we start a conversation across academic disciplines that we hope will gain traction. We want to engage critically with the surging interest in blue and green infrastructures, as we believe they may offer a path to undermine some of the anthropocentric tenets of modernity. By paying attention to cities as botanical (Gandy and Jasper 2020), and their infrastructures as necessarily alive (Hetherington and Campbell 2015; Hetherington 2018; Krieg, Barua and Fischer 2020), a radically different type of urbanism starts to take shape. This is not simply about particular vital configurations of agentic members in infrastructures (Durham, Ferme and Costa 2019), or about facilitating novel ways of distributing water (Radonic 2018). It is rather a whole reconsideration of urban metabolic processes, which could have far-reaching implications.

For these reasons, we believe that the role of the imagination is crucial. We thus consider it useful to remember that humanity has produced other forms of city life. From a *longue durée* perspective, lessons from historical ecology (Balée 2012) provide examples of forgotten urban experiments. In what is now the Brazilian Amazon, for instance, researchers have uncovered evidence of ancient ‘garden cities,’ so called because they resembled those considered a future ideal by Ebenezer Howard at the beginning of the twentieth century (Howard 1902; Heckenberger et al. 2008; Mann 2008). Looking at other cases of controversial urban development promises opportunities for rethinking not only the role of bioinfrastructures but also their significance for larger political projects, emancipatory movements and Indigenous sovereignty (Newitz 2021).

We are grateful to all the authors in this collection for engaging with this idea and for enriching our vocabulary and imaginary.

References:

- Balée, William L. 2012. *Advances in Historical Ecology*. New York: Columbia University Press.
- Barua, Maan. 2023. *Lively Cities: Reconfiguring Urban Ecology*. Minneapolis: University of Minnesota Press.

Barua, Maan. 2021. "Infrastructure and non-human life: a wider ontology." *Progress in Human Geography* 45 (6): 1467–89. <https://doi.org/10.1177/0309132521991220>

Bremner, Lindsay. 2020. "Sedimentary Logics and the Rohingya Refugee Camps in Bangladesh." *Political Geography* 77 (March): 102109. <https://doi.org/10.1016/j.polgeo.2019.102109>

Calkins, Sandra. 2020. "Writing planetary futures: plants, loss, and intersections of STS and anthropology in Germany." *Zeitschrift für Ethnologie* 145 (1): 93–110.

Durham, Deborah, Mariane C. Ferme and Luiz Costa. 2019. "Vital infrastructures." *HAU: Journal of Ethnographic Theory* 9 (2): 231–35. <https://doi.org/10.1086/705988>

Elkin, Rosetta S. 2022. *Plant Life: The Entangled Politics of Afforestation*. Minneapolis: University of Minnesota Press.

Foucault, Michel. 2008. *The Birth of Biopolitics: Lectures at the College de France 1978–1979*. London: Palgrave Macmillan.

Gandy, Matthew. 2022. *Natura Urbana: Ecological Constellations in Urban Space*. Cambridge: The MIT Press.

Gandy, Matthew and Sandra Jasper. 2020. *The Botanical City*. Berlin: Jovis.

Glikson, Andrew Y. 2014. *Evolution of the Atmosphere, Fire and the Anthropocene Climate Event Horizon*. Dordrecht: Springer.

Graham, Stephen. 2016. *Vertical: The City from Satellites to Bunkers*. London: Verso.

Heckenberger, Michael J., J. Christian Russell, Carlos Fausto, Joshua R. Toney, Morgan J. Schmidt, Edithe Pereira, Bruna Franchetto and Afukaka Kuikuro. 2008. "Pre-Columbian Urbanism, Anthropogenic Landscapes, and the Future of the Amazon." *Science* 321 (5893): 1214–17. <https://doi.org/10.1126/science.1159769>

Hetherington, Kregg. 2018. *Infrastructure, Environment, and Life in the Anthropocene*. Durham, NC: Duke University Press.

Hetherington, Kregg and Jeremy M. Campbell. 2015. "Nature, infrastructure, and the state: rethinking development in Latin America." *The Journal of Latin American and Caribbean Anthropology* 19 (2): 191–94.

Howard, Ebenezer. 1902. *Garden Cities of Tomorrow*. London: Sonnenschein.

Jordan, Montine, William B. Meyer, Robert W. Kates, William C. Clark, John F. Richards, Billie Lee Turner and Jessica T. Mathews. 1990. *The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the Past 300 Years*. Cambridge: Cambridge University Press.

Kabisch, Nadja, Horst Korn, Jutta Stadler and Aletta Bonn. 2017. *Nature-based Solutions to Climate Change Adaptation in Urban Areas: Linkages between Science, Policy and Practice*. Cham: Springer.

Kolbert, Elizabeth. 2015. *The Sixth Extinction: An Unnatural History*. New York: Picador.

Krieg, Lisa, Maan Barua and Josh Fischer. 2020. "Ecologizing infrastructure: infrastructural ecologies." *Society and Space*. <https://www.societyandspace.org/forums/ecologizing-infrastructure-infrastructural-ecologies>

Latour, Bruno. 2018. *Down to Earth: Politics in the New Climatic Regime*. Cambridge: Polity.

Ley, Lukas. 2021. *Building on Borrowed Time: Rising Seas and Failing Infrastructure in Semarang*. Minneapolis: University of Minnesota Press.

Lorimer, Jamie. 2020. *The Probiotic Planet: Using Life to Manage Life*. Minneapolis: University of Minnesota Press.

Mann, Charles C. 2008. "The Western Amazon's 'Garden Cities.'" *Science* 321 (5893): 1151.

Moore, Amelia. 2016. "Anthropocene anthropology: reconceptualizing contemporary global change." *Journal of the Royal Anthropological Institute* 22 (1): 27–46.

Newitz, Annalee. 2021. *Four Lost Cities: A Secret History of the Urban Age*. New York: Norton.

Oliver-Smith, Anthony. 2013. "Disaster risk reduction and climate change adaptation: the view from applied anthropology." *Human Organization* 72 (4): 275–82.

Povinelli, Elizabeth A. 2016. *Geontologies: A Requiem to Late Liberalism*. Durham, NC: Duke University Press.

Povinelli, Elizabeth A. 2019. "Life/Nonlife: a response." *Somatosphere*. <http://somatosphere.net/forumpost/life-nonlife-a-response/>

Rademacher, Anne and K. Sivaramakrishnan (eds). 2021. *Death and Life of Nature in Asian Cities*. Hong Kong: Hong Kong University Press.

Radonic, Lucero. 2018. "When catching the rain: a cultural model approach to green infrastructure in water governance." *Human Organization* 77 (2): 172–84.

Rose, Nikolas S. 2007. *The Politics of Life Itself: Biomedicine, Power, and Subjectivity in the Twenty-First Century*. Information Series. Princeton, NJ: Princeton Univ. Press.

Scaramelli, Caterina. 2021. *How to Make a Wetland: Water and Moral Ecology in Turkey*. Stanford, CA: Stanford University Press.

Singer, Merrill, Jose Hasemann and Abigail Raynor. 2016. "'I Feel Suffocated': Understandings of Climate Change in an Inner City Heat Island." *Medical Anthropology* 35 (6): 453–63.

Swyngedouw, Erik and Lucas Pohl. 2023. "Enjoying climate change: Jouissance as a political factor." *Political Geography* 101: 102820.

Tippett, Michael K. 2018. "Extreme weather and climate." *NPJ Climate and Atmospheric Science* 1 (1): 45.

Tsing, Anna. 2016. "Earth stalked by man." *The Cambridge Journal of Anthropology* 34 (1): 2–16.

Cite as:

Acosta, Raúl and Lukas Ley. 2023. "Urban Bioinfrastructure: An Introduction." *Roadsides* 10: 1-8. <https://doi.org/10.26034/roadsides-202301001>



Raúl Acosta is an anthropologist at the Institute of Social and Cultural Anthropology of the Goethe University Frankfurt in Germany. He obtained his doctorate at the University of Oxford. He is author of [*Civil Becomings: Performative Politics in the Amazon and the Mediterranean*](#) (The University of Alabama Press, 2020), along with several articles and book chapters. His research interests are novel forms of political engagement, environmental governance, urban anthropology and sociocultural diversity.



Lukas Ley is an environmental and urban anthropologist working at the Max Planck Institute for Social Anthropology in Halle, Germany, where he leads a DFG-funded Emmy Noether research group on the infrastructural lives of sand in the Indian Ocean world. His research is broadly concerned with marginalization, temporality and the material environment within urban landscapes. Current research projects investigate the role of sand in building urban commons and dispossession in Denpasar, Indonesia, and the future of concrete in Marseille, France. Ley's first book, *Building on Borrowed Time: Rising Seas and Failing Infrastructure in Semarang* (University of Minnesota Press, 2021), was awarded the Social Science Prize by European Association for Southeast Asian Studies and received an Honorable Mention for the Harry J. Benda Prize of the Association for Asian Studies.

Roadsides is a diamond Open Access journal designated to be a forum devoted to exploring the social, cultural and political life of infrastructure.



⊕ **roadsides.net**
✉ **editor@roadsides.net**
🐦 **@road_sides**
📷 **@roadsides_journal**

Editorial Team:

Julie Chu (University of Chicago)
Tina Harris (University of Amsterdam)
Agnieszka Joniak-Lüthi (University of Fribourg)
Madlen Kobi (University of Fribourg)
Galen Murton (James Madison University, Harrisonburg)
Nadine Plachta (James Madison University, Harrisonburg)
Matthäus Rest (Max-Planck-Institute for Evolutionary Anthropology, Leipzig)
Alessandro Rippa (University of Oslo and LMU Munich)
Martin Saxer (LMU Munich)
Christina Schwenkel (University of California, Riverside)
Max D. Woodworth (The Ohio State University)

Collection no. 010 was edited by: **Raúl Acosta** and **Lukas Ley**
Managing editors: **Agnieszka Joniak-Lüthi** and **Tina Harris**
Copyediting: **David Hawkins**
Layout: **Chantal Hinni** and **Antoni Kwiatkowski**

ISSN 2624-9081

Creative Commons License

This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/).



**University of
Zurich**
UZH



**Swiss National
Science Foundation**

**UNI
FR**

UNIVERSITÉ DE FRIBOURG
UNIVERSITÄT FREIBURG