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**Citation (APA)**

Arbara, S., Longhin, E., Recubenis Sanchis, I., & Rizzetto, F. (2026). Depletion. *Journal of Delta Urbanism*, 6. <https://doi.org/10.59490/jdu.6.2025.8718>

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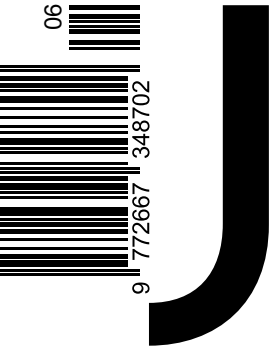
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Fall | Winter 2025

Issue #06 Depletion



# DU

Journal of Delta Urbanism  
Delft University of Technology

# *Depletion*

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We live in a state of *false abundance* - a contradiction first articulated by William Morris (Morris, 1887) in the late nineteenth century and later elaborated by Jason W. Moore (Moore, 2015) - in which the apparent material plenty of a modern consumption society depends upon the systematic depletion of the soils that sustain human and more-than-human life. Soil depletion is framed by the global market, the production of *cheap labor, food, energy, and raw materials* (Moore, 2015), and material over-extraction through mining and global construction, agro-industrial production models, and today's industrial systems. These processes operate through a deep decoupling of production from the territories and socio-ecological practices on which they depend. This separation produces the illusion that resources are limitless and available independently of climatic conditions, geography, or natural cycles (Hornborg, 2011; Moore, 2015). By abstracting material origins and obscuring ecological limits, extractive regimes operate by normalizing the ongoing exhaustion of the Earth's resources, disproportionately impacting structurally marginalized communities (Arboleda, 2020; Krausmann et al., 2009).

In turn, the cities and landscapes we operate with are designed against this backdrop, producing new soils – technosols (IUSS Working Group WRB, 2015) - that we know little about, as explored by some of the contributions in this issue. Rather than a (slow) process of degradation, we are in a pathway of designed depletion. Depletion is shaping the soils we become-with and co-produce (Haraway, 2016), just as it shapes our design practices, whether we are aware of it or not. Depletion is also shaping our future, as climate change, climate-induced migration, and territorial instability reveal that environmental damage accumulates rather than resolves itself (Nixon, 2011; Ekins et al., 2019). However, the study of soil, its cycles and dynamics, and their alterations have traditionally stood outside our disciplinary

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curriculum, knowledge, and practice. In this regard, depletion demands the reframing of our agency as designers. As landscape architects, urban designers, artists, and thinkers are starting to engage with soil and more specifically, with soil depletion (Bortolotti et al., 2025; Peleman et al., 2022), this issue aims to amplify ongoing collective interdisciplinary thought and action, and assist the complex task of articulating the agency of design. This issue of the *Journal of Delta Urbanism* addresses (soil) Depletion as a design inquiry, reframing it as a spatial, political, and material condition.

If depletion is a spatial condition, soil is where it first becomes tangible. Soil is the palimpsest of strata, materials, living organisms, and associated ecological processes, whose vitality is intertwined with nutrient cycling, water filtration and storage, carbon storage, and fertility in habitat provision. Soil also carries a territorial and cultural resonance. In many languages and cultural traditions, “soil” signifies homeland and belonging, linking material ground to lived attachment and identity (Ingold, 2000; Tuan, 1974; Williams, 1976). In Dutch, ‘bodem’, ‘grond’ (ground) or ‘aarde’ (earth) is used to reflect the collective attachment to (and knowledge of) a place, its climatic conditions and natural cycles. Seen in this light, soil emerges as a fundamental territorial component, shaped by and shaping the cultural, political, and ecological forces (Elden, 2013). In this regard, their degradation signals not only material loss, but the weakening of the socio-ecological processes and relations that sustain livable landscapes (Acka et al., 2024) and communities. Soil is a slow-forming substrate or humus subjected to rapid and accelerating depletion.

Depletion, unlike degradation, signals both the quantitative reduction of resources — fossil fuel, minerals, freshwater, fertile soils, forests and biodiversity; extracted and degrading faster than they can regenerate (Krausmann et al., 2009; Meadows et al., 1972; Steffen et al., 2015) and the qualitative degradation of the Earth's nutrients (Food and Agriculture Organization of the United Nations, 2015; Montanarella et al., 2018).

Depletion, beyond its material condition, is also relational: it can be understood as a condition actively shaped by cultural, historical, and socio-political constructs that determine how land and life forms are valued (Bonvehi Rosich & Denizen, 2025; Harvey, 2004; Martínez-Alier, 2002; Tsing, 2015). Being actively produced, depletion can also be challenged and changed. Green transitions and initiatives have emerged in response to this recognition, such as in European Union (EU) sustainability policies and frameworks; yet, in their pursuit of targets, efficiency, and rapid implementation, they often remain embedded in the same extractive logics they seek to overcome, overlooking local specificities, situated knowledge, and long term reciprocal relationships with land (Arboleda, 2020; Bonvehi Rosich & Denizen, 2025; Dunlap & Jakobsen, 2020; Sovacool et al., 2020). This inherent contradiction results in environmental transitions that tend to reorganize depletion, shifting its burdens onto already compromised landscapes and communities. This dynamic becomes visible across the case studies included in this issue, ranging from mineral extraction in Belgium, Western Sahara, and Zimbabwe; monocultures in the Po Valley, to the production of technosols in urban areas like Amsterdam, Brussels, Lausanne, Sardinia, or Zurich. These cases illustrate how environmental transitions can reproduce — and in some instances intensify — new forms of territorial, social, and ecological neglect.

Within Europe, ecological and digital transitions are increasingly framed as pathways to strategic autonomy and economic resilience in response to climate, energy, and geopolitical crises (European Commission, 2023). Policies such as the Critical Raw Materials Act (European Commission, 2023b), a series of EU regulations (European Parliament & Council, 2013, 2018a, 2018b, 2019), and initiatives like SPADES4SOILS (n.d.) reinforce this agenda, yet they risk reproducing extractive paradigms and territorial inequalities that extend beyond subsoil to land, labor, and infrastructures—particularly in rural or post-industrial regions. The renewed attention on emerging extractive practices stands in tension with

the broader economic repositioning of post-industrial territories, which Boltanski and Esquerre (2019) conceptualize as a shift toward an economy of enrichment, oriented toward cultural, ecological, and territorial value rather than renewed extractive exploitation.

In deltaic landscapes, depletion is ever more critical, as deltas are ‘running out of soil’ (Montgomery, 2007). In these environments, depletion can be understood as a systemic outcome of prolonged human intervention and technocratic land management, shaped by intensive urbanization, large-scale infrastructural projects, and protocolized engineering approaches that disconnect soil–water dynamics from ecological processes and interrupt soil-forming processes (Arbara et al., 2023). While deltas make this condition especially visible through processes such as subsidence and sediment starvation, depletion unfolds differently across other landscapes: through soil exhaustion in intensive agricultural plains, extractive infrastructures in mountainous regions, or the production of technosols in urban territories. In this sense, depletion is both a systemic and geographically differentiated condition.

*Perplexed by its urgency, we ask ourselves, how might we (designers) engage with depleted soils?*

*What might be the agency of design under the lens of depletion?*

Within the framework of Delta Urbanism, design is conceptualized not as a representational or purely solution-oriented practice, but as an active agent of socio-ecological transformation, complementing and critically engaging with the environmental transitions currently pursued through policy frameworks and institutional agendas. It functions as a boundary-spanning practice mediating between disciplines such as engineering, ecology, governance, and cultural studies, enabling shared forms of agency across scales, time, and actors. Rather than producing fixed outcomes, design operates as a systemic inquiry tool, exploring alternative futures through scenarios,

spatial strategies, and experimental interventions, translating abstract climate projections and policy ambitions into spatially grounded and culturally meaningful propositions. However, design has historically operated in the service of techno-scientific progress and environmental exploitation (Easterling, 2014; Mumford, 1934; Scott, 1998). Shifting its role requires acknowledging its complicity while repositioning design as a practice of responsibility, care, and political agency (Puig de la Bellacasa, 2017; Escobar, 2017). This involves recognizing and designing with and for the multiplicity of human and non-human actors. Addressing soil depletion by design confronts both the exhaustion of material terrains, exploitation of nature, and the political, symbolic, and ethical dimensions through which land is inhabited, governed, and sustained (Bianchettin Del Grano, 2016). Design should thus act as an analytical, speculative, and catalytic force, challenging technocratic paradigms and fostering societal engagement with long-term climate adaptation and resilience.

Learning from the contributions gathered in this issue-spanning papers, projects, practices, and dialogues – and grounded in a critical reading of existing conditions as a base for imagining desired futures, the issue proposes three interrelated modes through which design can engage depletion: designing *with*, *within*, and *beyond* it. Each mode repositions design differently: as a practice of tracing and critique (*with*), as a propositional engagement with existing constraints (*within*), and as a transformative imagination capable of challenging dominant paradigms (*beyond*). Taken together, these orientations move from diagnosing the conditions that produce depletion, to operating within its constraints, and ultimately to imagining pathways that could transform them. They resonate with the themes introduced earlier in this editorial: the need to critically trace the processes that produce depletion, to operate within already altered socio-ecological conditions, and to imagine alternative futures beyond extractive paradigms. This frames depletion not as a problem to manage, but as a socio-spatial condition from which regenerative relationships with land, water, human, and non-human actors can emerge.

## DESIGNING WITH DEPLETION

By using the preposition “with”, design frames depletion in the existing landscape. It acknowledges that architecture, urbanism, landscape architecture, and spatial planning have not only responded to but often actively contributed to depletion. While ‘construction’ is commonly perceived as an art of creation, contemporary practice is deeply entangled with extraction and exhaustion. Construction involves the mining of resources, the consumption and transportation of materials, the alteration of ecosystems and the spaces we inhabit, and, ultimately, the depletion of soil.

These dominant modes of urban expansion and reconstruction have therefore become central objects of critique. Scholars note that “to build is to destroy” (Malterre-Barthes, 2025) and that urbanization and ruralization have become modes of pervasive and long-lasting modification of the ground (Topalović, 2018). Designing with depletion thus begins by making visible the material, territorial, and ecological costs embedded in building and urbanization. Designing with depletion implies engaging with the processes through which depletion is produced –from construction and urban expansion to the extraction and circulation of materials that sustain them.

In this regard, the issue opens with the *Dialogue* between Seth Denizen and David Montgomery, moderated by Laura Thomas, which sets the epistemic foundation for this orientation. Their conversation provides an extended definition of depletion across chemical, biological, physical, and cultural registers. From this dialogue, we learn that depletion is both technical and political: a soil becomes “depleted” when it no longer supports certain human projects, yet it may still sustain entire microbial or vegetal ecologies. The conversation cautions against reducing soil health to a handful of indicators such as organic carbon, infiltration rates, and bulk density, as this risks ignoring biological complexity and the processes and trajectories through which soils regenerate or degrade. From a design perspective, Seth Denizen frames depletion as a lens through which design can

make visible how societal decisions materialize, sediment, and co-produce soils over time. From a historical perspective, David Montgomery stresses that our present relation to soil is largely *parasitic*: cities import and produce nutrients, concentrate waste, and externalize harm. Moving *beyond* depletion requires building “commensal systems” where urban metabolisms and ecological cycles sustain one another.

Aligned with Denizen’s approach to mapping what has been obscured or normalized, the contribution of Gallardo and Samson’s manuscript, the genealogies of harm, and the material relations that extraction leaves behind. Gallardo and Samson’s *Phosphopraxis* offers an incisive methodological and political reading of phosphate extraction in Western Sahara. Through archival research, fieldwork, and visual documentation, they resist the abstraction inherent in scalable, technical solutions to soil exhaustion. Instead, they “stretch and pull at the dependencies and interconnectedness of a site”, revealing the infrastructures of violence through which phosphate moves from the mine to industrial farms and into waterways and bodies.

Almarcegui’s contribution, *Waste Heaps in Germany*, approaches depletion through a collaboration between art and science that traces what has been accumulated within extractive regimes. Working with volumetric calculations derived from DEMs in QGIS and presented as a 17-meter-long wall text at Kunstmuseum Moritzburg Halle (Saale), Almarcegui makes visible what has remained largely undocumented: the composition and sheer volume of recently formed terrain produced by 175 years of large-scale mining. Her work reframes depletion not only as loss, but as sedimentation above ground, raising critical questions about the future potential, governance, and ownership of mining waste. By interrogating what counts as “mineral resources” beyond the definitions of the German Mining Act, Almarcegui invites a rethinking of waste as a contested material legacy—one that challenges design, planning, and legal frameworks to engage with the long-term material afterlives of extraction.

## DESIGNING WITHIN DEPLETION

*Within* depletion refers to the act of operating with what exists, while aiming for concrete actions and spatial impact. It addresses current transformations that seek to work towards socio-ecological change from within already altered conditions, rather than through tabula-rasa interventions. This includes projects from design practice that range from soil-inclusive urbanism (Hooimeijer & Maring, 2018), circularity, agroecological transformation, and adaptive reuse, to policies and regulatory frameworks addressing land take, soil monitoring, and soil–water relations (European Commission, 2011; European Commission, 2021; European Commission, 2023a). Designing *within* depletion moves from tracing to proposing. It treats depletion not as a terminal state but as a condition designers must engage with a set of constraints — material, social, geological — that shape what can be done now.

From a socio-environmental history perspective, the piece of Grulois, Moritz and Declève challenges assumptions that post-industrial soils are sterile or lifeless. Their work uncovers decades of ecological restoration and stewardship that transformed the hostile mining residue of the Martinet slag heap (Charleroi, Belgium) into a living, biodiverse environment and a symbol of environmental mobilization. The Martinet becomes a case of “ecological reparation”, where care practices by local citizens reshape both material landscapes and planning agendas.

Bossard and Cavalieri’s framework for “soil-sensitive urbanism” exemplifies this. Working in Brussels, they propose a method to assess soil thickness and constraints to guide unsealing and restoration. Their aim is not to reverse depletion wholesale but to design with its conditions, integrating pedology, hydrology, and life sciences. They argue that after decades of treating soil as a mere two-dimensional surface, urbanism must again recognize soil as a “material, urban, and living element.”

Simoni's work in Sardinia operates between analysis and proposition. By reading soil through the lens of anthropo-pedogenesis—the co-production of soil through human and ecological processes—he shows how depleted soils initiate new cycles of pedogenesis driven by decay, toxicity, and ecological persistence. Designing within these conditions becomes “the choreography of transformation”: calibrating exposure, managing risks, and working with inherited materials and rhythms rather than imposing form.

Vialle's *Cities as carbon pools* also moves across these modes. Beginning with empirical surveys of urban soil organic carbon in Switzerland, he deciphers how soil texture, vegetation, and maintenance drive variation in carbon sequestration. He then translates these insights into policies and, ultimately, toward future-oriented scenarios in which cities become sites of soil farming and carbon sinks. His call for shifts from “pipe logic” to “soil logic” captures the political and aesthetic shifts needed for regenerative urbanism.

### *DESIGNING BEYOND DEPLETION*

Design *beyond* depletion means designing for what is yet to come. Beyond depletion moves beyond existing regimes of operation towards imaginative transformations, radical futures, and speculative design approaches. Designing *beyond* depletion is overtly transformative: it imagines pathways and entry points to new socio-ecological paradigms.

The Denizen–Montgomery *Dialogue* sets this horizon by arguing for a reorientation from parasitic to commensal societies—an institutional and cultural shift in how soil is valued. Their discussion foregrounds imagination as a necessary design practice: envisioning alternative political ecologies of soil.

LaFleur's *Supervalley* advances this transformative agenda through a research-by-design methodology that integrates spatial grammar, metabolic analysis, and backcasting. Working in the Po Valley, he reconceives depleted agricultural lands as operational landscapes capable of circular

resource flows, regenerative capacity, and ecological-economic productivity. By positioning soil as “living infrastructure”, the project demonstrates how degraded territories can become drivers of regional transitions.

The issue is further grounded by the *Delta* (Linda Maring) and *Urbanism* (Boštjan Cotič, Liljana Jankovič Grobelšek, and Robi Koščak) Dictionary entries, which frame deltas as dynamic socio-ecological systems and urbanism as a relational practice, foregrounding how depletion emerges through shifting material flows and territorial processes.

Together, the contributions in this issue offer multiple ways of *doing*—drawing on different methods, disciplines, and forms of expertise—to engage the complexity of depletion and the need for systemic understanding. The inquiry continues beyond the pages of this journal through a forthcoming exhibition and BK Talk (March–April 2026) at the Faculty of Architecture and the Built Environment, TU Delft. Inspired by the questions and provocations gathered here, the exhibition opens the conversation to other voices, media, and formats that engage depletion differently. We warmly invite readers to enjoy the issue and to carry its questions into these extended, collective encounters.



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JDU is a project by Delta Urbanism Research Group and DIMI Delft Deltas, Infrastructure and Mobility Initiative Delft University of Technology

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*Graphic Layout*

bruno, Venice (Italy)

*Typefaces*

Union, Radim Peško, 2006  
Jlannon, François Rappo, 2019

*Publisher*

TU Delft OPEN Publishing  
<https://www.tudelft.nl/library/openpublishing>

*Frequency: 1 volume per year*

*Publication Funding*

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*N.6 | Depletion | Editorial  
Fall / Spring 2026*

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*Keywords*

soil depletion; extraction landscapes; territorial metabolism; soil as infrastructure; interdisciplinary design

*Dates*

Submitted: 05/01/2026  
Reviewed: 03/03/2026  
Published: 03/04/2026

*Citation*

Arbara, S., Longhin, E., Recubenis Sanchis, I., & Rizzetto, F. (2025). Depletion. Journal of Delta Urbanism, (6). <https://doi.org/10.59490/jdu.6.2025.8718>

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All published contributions are submitted to a Double Blind Peer Review process except for the sections Dialogues and Dictionary.

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*Funding Information*

No external funding was received for the making of this manuscript.

*Data Access Statement*

Not applicable.

*COI*

The authors declare no conflict of interest.

*Contributor Statement*

The authors are responsible for all aspects of this work unless stated otherwise.

*Use of AI*

Microsoft Copilot was used for minor language editing and formatting. No AI tools were used for content generation or analysis.