Spring 2025

EARTH STUDIO

LANDSCAPES OF REPAIR

COLUMBIA GSAPP URBAN DESIGN

COLUMBIA CLIMATE SCHOOL
MA in Climate and Society

COLUMBIA CRCL

In Collaboration With:

Federal University of Brazil Rio de Janeiro, FAU
Universidad Diego Portales, FAAD
Columbia Global Centers: Santiago and Rio de Janeiro Climate Hub

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EARTH STUDIO

This innovative program brings together design, policy, communication, and climate science to explore climate action in communities facing the most severe impacts of climate change.

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Seminar speakers: High Voltage! Landscape, Energy and Industry in the Aconcagua Valley
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Landscapes Of Repair Rio Roundtable

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ACONCAGUA VALLEY, CHILE

GUANABARA BAY, BRAZIL

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INTRODUCTION

Earth Studio: Landscapes of Repair

The race to decarbonize is driving large-scale landscape change, and its intersections with climate adaptation and climate justice.

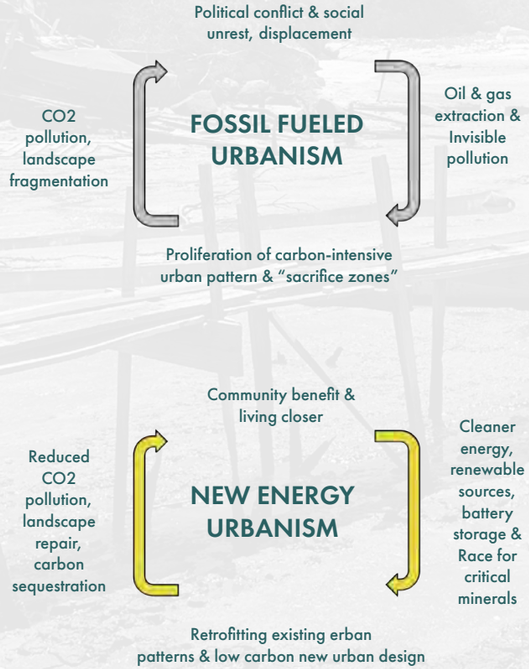
While a rapid transition to a clean energy economy is urgent and necessary, it also requires wholesale changes in both existing built patterns and rapid change in the mining frontiers where minerals for batteries and technological devices are extracted. Rapid urbanization necessitates at once a consciousness about the material demands of what hasn't yet been built as well as the retrofitting and adapting of what is already there. While critical minerals need to be unlocked to spark a low carbon future, this must be done in a manner that does not ravage communities and their landscapes - inside AND outside of the "city" - and doesn't define the same 'self-devouring' urbanism that define the current paradigms. For example: lithium, cobalt, manganese, nickel, and graphite mining are concentrated in Chile while Brazil, cobalt mining is concentrated in the Congo, and small Pacific Island states like Papua New Guinea are grappling with deep sea mining.

The water bodies, bays, and rivers, in both Santiago (Aconcagua River Valley) and Rio (Guanabara Bay) that we visited and studied are in a period of transition, where extraction infrastructure is present but the new energy landscapes are in formation. This studio explored how the race to decarbonize will drive future landscape change and future practice of urban design. We also examined urban design's relationship to the past century of fossil fuel extraction. The relative abundance of cheap, subsidized oil has shaped settlement patterns of self-devouring growth, locking in carbon dioxide emissions at dangerously high levels and imperiling life on planet earth (Petrochemical America, 2012).

We explored two water bodies in two contexts (Chile and Brazil) and traced their relationship to energy including sites of former oil extraction, processing and refinement. We also investigated how and where positive investments in urban design and in local, national, global policy and practice can be coupled with the clean energy transition in the form of community benefit agreements and landscape repair strategies.

The Studio developed bold and layered concepts for retrofitting existing urban patterns and imagining new urban and landscape forms that are less carbon consumptive and more just.

Pedagogical Approach to Action

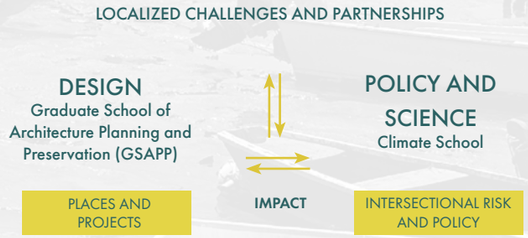


Uniting the disciplines of urban design and climate science can powerfully support and harmonize the living planet's massive critical ecosystems with people and power. With an increasing proportion of the world's population living in cities, and the pressure of urbanization impacting urban and non urban places alike, the built environment is central to both emission reductions and adaptation. These challenges demand new and intersectional pedagogies to train the next generation of designers, policymakers, and change-agents while also meaningfully supporting municipal, civil society, academic, and community-based partners on the ground.

Earth Studio is an inter-school course taught jointly between GSAPP MS Architecture and Urban Design and Climate School Masters of Climate and Society. Over the Spring semester, a cohort of urban design students and Climate School students work together to create urban design, spatial analysis and visions for an adapted and new energy future that responds to local challenges and planning efforts. Students accepted into the program travel to global cities each spring, and work in collaboration with local governments, industry actors, community organizations, and local academic partners, explore the entanglements of urbanization, design decisions in the built environment, climate policy, and social justice at global and local scales.

Conceived as one large initiative, Earth Studio imagines next century urbanism that co-exists with ecosystem revitalization and justice. Our class worked with colleagues, to whom we owe our gratitude and amplification. Each was invaluable and generous with their time, knowledge, and insight and helped us to pull the classroom and the local stakeholders outside the University a step closer together. As colleagues, we explored the successes and failings of case studies globally, workshopped and tested policies and practices to support implementation, and tested a set of design scenarios and policy principles that can inform a climate just future.

Columbia University and our class does not exist outside of or independent from the systems of power that perpetuate climate change and its risks. So, along the way we inquired into our own roles and identities as these relate to the work of climate justice and engagement with impacted communities. While these may never disentangle fully in our lifetimes, we practiced the process and ethic of multidisciplinary, international, and multiscalar learning, partnership, and activism as a Columbia GSAPP and Climate School community and future collaborators. We entrust our ideas and learnings to the administration, faculty, and future students as we urgently work together to create a non-extractive and connected community of learning and partnership. Latin America is a major voice on the global stage and can help redefine the priorities and approaches to the global climate crisis.



PRINCIPLES FOR A JUST FUTURE | CLIMATE x DESIGN

Throughout Earth Studio, we worked together to hone a value system that reflects what we learned, the relationships we built, and the assumptions that underpin our work - today and into the future.

IMPACTS OF CLIMATE RISK ARE ASYMMETRICAL

While the most vulnerable and marginalized communities have contributed the least to the crisis, they are the ones who bear the brunt of its effects and have the least capacity to adapt. Vulnerability is not static, but dynamic.

PATH DEPENDENCY UNDERMINES CLIMATE ACTION

Features of the political, financial, and infrastructural systems that guide urban development in a short-term and site-based paradigm undermine the ability to imagine post extractive landscapes and can subvert climate goals.

DESIGN AT THE LANDSCAPE SCALE

Historically, extractive industries like mining and fossil fuels have been designed as massive scales that cut across ecologies, infrastructure sectors, economics, and cultures. Our thinking, alternative proposals, and actions must match these scales to inform change.

INFORMALITY CAN INFORM DESIGN

Underserved and informal urban settlements – often seen as 'sacrifice zones' usually a result of political 'othering' - are not necessarily at odds with climate goals. Vulnerable communities should be equal partners in climate action, urban design, and policy making. Informal processes – whether physical or social – can be looked to for design inspiration.

ABUNDANCE AS AN INSTRUCTOR OF RESILIENCE

Approaching policy through the lens of resilience and abundance for all invites innovative solutions that harness available resources sustainably. It results in stronger and more adaptable systems for the future that do not replicate fragility or lack.

TRANSITIONS OVER TIME AND SYSTEMS

Responses to the climate crisis are temporal. However, being bound only to short-term targets, such as profit margins or political elections, takes away the focus on long-term and systemic solutions. We need to transition fast as well as right.

ACCOUNT FOR EXTERNALITIES OF RISK

Financial and adaptive risks are often too narrowly defined, ignoring social and environmental externalities and real costs to society, businesses, and physical assets. Addressing one risk may create new, unforeseen challenges. So, we must broaden our understanding to include these broader impacts.

POLICY NEEDS TO BE 3D

Policy cannot and does not just exist on paper. Designing and implementing policy multi-dimensionally means incorporating historically marginalized people, places, and thinking. In this way it will be more relevant, more feasible, and more resilient over time.

COMPETING INTERESTS ARE INEVITABLE

The systems of extraction, specifically of critical minerals, is currently driving our global economy and the transition to a post-fossil fuel economy. The challenge lies in finding more sustainable and just legal, financial, and political mechanisms to manage competing interests.

IMAGINARIES CAN BECOME REALITIES

The environmental and social crises today demand innovative and big ideas. We do not need to be bound by current limitations of knowledge but be bold in imagining a resilient future for all, while balancing practicality and urgent incremental actions.

STUDIO SITES & CHALLENGES

This map shows the studio study location within the **Aconcagua Valley** and highlights a network of interconnected environmental risks. These include sea level rise along the coast, intensive industrial activity such as sand mining and energy production, and the heavily polluted "sacrifice zones" of Quintero Bay. Further inland, the drying of the Aconcagua River signals growing water scarcity and stress on local ecosystems and agriculture. Together, these overlapping threats expose a vulnerable and highly impacted landscape, underscoring the need for integrated, resilient approaches to planning and development.

Nogales

Ventanas

Quintero

SEA LEVEL RISE + COASTAL SACRIFICE ZONE

TAILING STORAGE IN THE EARTHQUAKE ZONE

ACONCAGUA VALLEY

CONTESTED WATER RIGHTS

Quillota

PACIFIC OCEAN

Estuary

Concon Dunes

DEPLETING RIVER WATER RESOURCE

POLLUTION FROM OIL REFINERY

TECTONIC AND TSUNAMIS

Nazca Plate

South American Plate

REAL ESTATE DEVELOPMENT PRESSURES

N

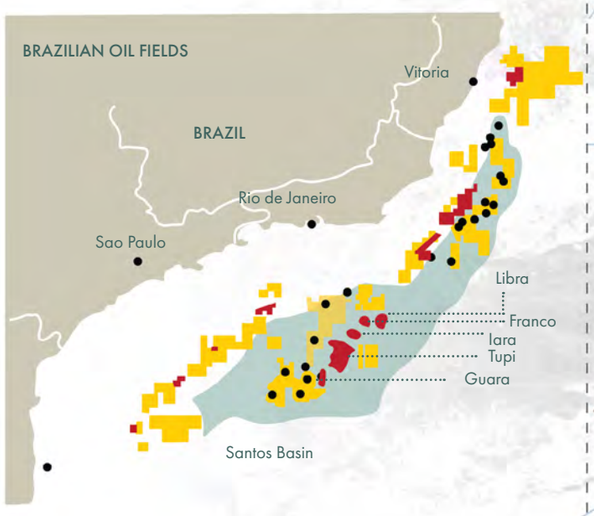
0 5m

LEGEND

- Tailing - Active
- Tailing - Inactive
- Water Treatment Plant
- Water Bodies
- Industrial Area
- Residential Area
- Sea Level Rise
- Power Line
- Roads
- Interconnected Risks

STUDIO SITES & CHALLENGES

Guanabara Bay is a site of intense environmental conflict, where industrial development, urban sprawl, and inadequate infrastructure collide with ecological and social systems. The Bay suffers from chronic pollution due to untreated sewage, industrial discharge, and oil spills, despite decades of public cleanup pledges. Surrounding communities bear the brunt of health and environmental risks, underscoring deep social inequalities. The Bay embodies the struggle between economic priorities and environmental justice in an urbanizing coastal landscape.



Exploration Blocks
Oil Fields
Pre-Salt Region

LEGEND

Landfill
Industry
Pipeline
River
Sea Level Rise
Interconnected Risks

POLLUTION FROM THE FOSSIL FUEL REFINERY

REDUC

Gramacho

LACK OF CONNECTIONS AND OPPORTUNITIES AMONG ISLANDS

Oil Archipelago

MILITIA CONTROL OVER COMMUNITY WASTE MANAGEMENT

Ilha do Governador

RIGID URBAN-INDUSTRIAL ZONES THREATEN ECOTONES

Ilha da Conceicao

ABANDONED BOATS, POLLUTION AND LOSS OF LIVELIHOODS

Niteroi

LACK OF PUBLIC TRANSPORTATION AND PUBLIC SPACES

N

WHERE THE OIL IS:

Oil is stored in the pores of the reservoir rock layers in the pre-salt layer.

LIBRARY OF (DIS)REPAIR

SCAN FOR MORE

Processes and projects - be them physical, legal, cultural, or financial - that attempt to reconcile harm are layered and complex. **The Library of (Dis)Repair** includes case studies that explore where lines are drawn between extraction and what earth can support and what society is willing to accept.These cases unpack the processes that are set in motion to manage the risks or correct if/when the balance has been skewed and position our collective understanding of solutions, implementation, and inevitable tradeoffs.

ECOLOGY AS INFRASTRUCTURE

CLIMATE ADAPTED HOUSING IN TETO VERDE FAVELA
What locally-led adaptation initiatives are being performed in Rio De Janeiro?

Pablo Ya ez-Mena

MID-BARATARIA SEDIMENT DIVERSION
A genuine adaptation and restoration strategy or guise to sustain fossil fuel dependence?

Caroline Sacher

FRESHKILLS PARK
How can we engineer nature's resilience in dense, urban environments?

Samantha Dady

VALE ENCANTADO
How can decentralized sanitation and waster-management solutions empower community-led initiatives?

Samantha Dady

DECENTRALIZED SUSTAINABLE RURAL WATER – HAITI
Bridging crises: From environmental devastation to resilience in the Yanomami Territory and Haiti

Anar Amarjargal

AGROFORESTRY IN C TE D'IVOIRE
How might climate finance be reimagined to strengthen rural communities.

Amina Diop

SUSTAINABLE FAVELA NETWORK AND CITY-WIDE NATURE-BASED INFRASTRUCTURE
How do favelas instruct pluriversal solutions?

Tatianna Sitounis

ARCS OF RESTORATION – AMAZON RAINFOREST
How does data, theory, and policy translate to practice?

Julia Goldsamt

LEGAL AGREEMENTS AND LITIGATION

POST-BRETTON WOODS AGENDA
What are the consequences of the Bretton-Woods consensus and what role do Brazil's cities play in its transformation?

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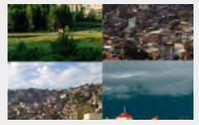

LEGAL EMPOWERMENT FUND
How is climate litigation being used by communities and Brazil to repair extractive practices?

Jarrod Sims

THE RAGLAN AGREEMENT – NUNAVIK CANADA
What might be the role of community beneits agreements in guaranteeing compensation?

Jarrod Sims

HERMOSA MINE – PROMISES ON PAPER
How are community benefit agreements developed in mining towns?

Ches Rotich

LABOR AND INDUSTRY

ILLEGAL GOLD MINING IN THE YANOMAMI TERRITORY
Bridging Crises: From environmental devastation to resilience in the Yanomi territory and Haiti

Anar Amarjargal

GUANABARA BAY OIL SPILL
How do industries of extraction shape physical and abstracted landscapes?

Tatianna Sitounis

GRANGEMOUTH REFINERY
How does labor transition as fossil fuels phase out?

Ches Rotich

SOMOS CHOAPA
What prompts private investment in vulnerable communities?

Carissa O'Donnell

THE ANTHRACITE COAL STRIKE OF 1902
What is the role of organized labor in extraction and repair?

Carissa O'Donnell

NARRATIVE AND SOCIAL LICENSE

DEEPWATER HORIZON
How did BP use the deepwater horizon disaster to reshape its public image, control narrative, and reinforce its dominance in offshore drilling?

FAVELA PAINTING – RIO DE JANEIRO
How does puboic art enact physical and social repair?

Julia Goldsamt

FUNDING AND CAPITAL

LOSS AND DAMAGE FUNDS
How might loss and damange funds be a vehicle for local action?

Amina Diop

INVISIBLE RIO – MARACANA MULTIETHNIC VILLAGE
How much land trusts for relocation and environmental restoration be operationalized?

Amina Diop

EMERGENCE OF FORM

SITE SPECIFIC URBAN CHANGE & THE MATERIALITY OF EXTRACTION

How can we understand Chile and Brazil's cultural and material landscape – where cities, towns and villages nest within bays, mountains, beaches, thick lush tropical forests and desert plateaus? Land, for indigenous scholar Max Liboiron, **"the unique entity that is the combined living spirit of plants, animals, air, water, humans, histories, and events."** We documented and traced the materials of the energy transition, their relationships to the built environment, and the climate justice imperatives that overlay across geographic scales and modes of power. In-so-doing, we aim to establish a state-of-play of policy, practice, and movements.

MINING AS HEGEMONY: FROM SALTPETER TO RIO TINTO AND ENERGY MINERALS
Pablo Yanez-Mena

SCAN FOR MORE

SALTPETER

Saltpeter's trajectory in Brazil—from a key ingredient in imperial warfare to a strategic fertilizer mineral—reveals how extractive practices shape and are shaped by hegemonic geopolitical forces. Today, corporations like Rio Tinto and Vale carry forward these legacies through mining operations that often deepen local vulnerabilities under the guise of energy transition. Achieving climate justice in this context demands not only safer and more inclusive mining practices, but also a radical shift in how resource extraction aligns with indigenous knowledge, equity, and planetary well-being.

THE NEW RUSH: IRON AND STEEL
Jarrod Sims

SCAN FOR MORE

IRON

Mineral extraction—particularly in Brazil—supports urbanization and renewable infrastructure while perpetuating environmental harm and social injustice, particularly as it relates to the global iron and steel industry. This research analyzes the geopolitical dynamics of iron ore trade, especially Brazil's relationship with China, and the systemic inequities experienced by local and Indigenous communities affected by mining. As decarbonization efforts increase global mineral demand, the paper argues for integrating climate justice principles—recognitional, procedural, and distributive—into mining and urban development policies.

CLAY IS EVERY~~WHERE~~ THING: MAPPING CLAY AS EXTRACTION, HERITAGE, AND RESISTANCE THROUGH THE TRANSATLANTIC SLAVE TRADE
Julia Goldsamt

SCAN FOR MORE

CLAY

Clay is both a vital natural resource and a vessel of cultural heritage, embodying stories of climate, colonization, and resistance. Tracing its journey from the riverbanks of West Africa to Brazilian quilombos and enslaved communities in the U.S., this work reveals how clay has been used not only for construction and industry but as a medium of survival, spirituality, and decolonial expression. In confronting the extractive practices of modern clay mining, it calls for a return to land connection, sustainability, and the material memory embedded in clay as a form of climate justice.

EXTRACTION AND SOCIAL MOVEMENTS: HOW CRUDE OIL INFORMS ENVIRONMENTALISM
Tatianna Sitounis

SCAN FOR MORE

CRUDE OIL

This paper examines the complex entanglement of Brazil's crude oil industry with national identity, global economic systems, and social movements and NGOs. Through a historical overview and a case study of the Guanabara Bay oil spill, it highlights how Petrobras's actions have undermined environmental justice and weakened civil society capacity. It argues that advancing climate justice in Brazil requires reimagining extractive landscapes through inclusive design, community resilience, and institutional empowerment.

SALT EXTRACTION IN BRAZIL: FLOWS, POLICIES, AND CLIMATE JUSTICE IMPLICATIONS
Amina Diop

SCAN FOR MORE

SALT

Salt extraction in Brazil reveals deep entanglements between natural resource flows, climate vulnerability, and socio-environmental injustice. This work traces how saline landscapes—particularly in the Northeast—are shaped by colonial legacies, state policies, and contemporary industrial practices that disproportionately impact marginalized communities. By examining extraction through a climate justice lens, it challenges dominant development models and calls for more equitable and ecologically attuned approaches to managing Brazil's salt economies.

MINING, REFINING, SELLING CONCEPTS OF COPPER "EXTRACTION" OVER TIME AND SPACE
Samantha Dady

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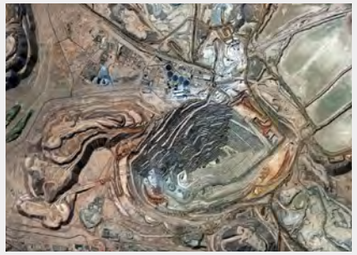

COPPER

Copper is both a linchpin of the global energy transition and a vessel of complex socio-economic extraction, particularly in Chile and Brazil, where its mining symbolizes the entwined histories of national independence, labor exploitation, and imperial control. As demand for copper rises sharply due to its indispensability in renewable energy technologies, the challenges of declining ore quality, supply chain vulnerabilities, and environmental injustices grow increasingly urgent. This study traces copper's material and symbolic journey—from the mining town of Chuquicamata to geopolitical trade agreements and climate injustices—revealing how its extraction continues to shape power, place, and people across time.

NICKEL MINING IN BRAZIL: CONSENT AND THE COST OF EXTRACTION
Chesang Rotich

SCAN FOR MORE

NICKEL

Nickel mining in Brazil sits at the heart of the global energy transition, yet its extraction is marked by deforestation, pollution, and Indigenous rights violations. As demand for Class 1 nickel grows, tensions between corporate interests and community sovereignty highlight the urgent need for stronger enforcement of Free, Prior, and Informed Consent (FPIC) and ethical sourcing practices. A just transition requires centering Indigenous leadership, improving regulatory accountability, and transforming the nickel supply chain to align with climate justice principles.

THE CURRENCY, NOT THE CULPRIT, OF EXPLOITATION
Carissa O'Donnell

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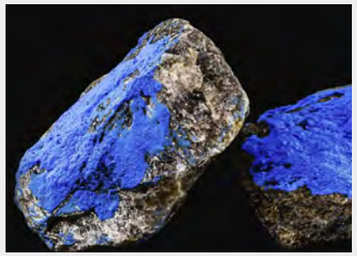

COBALT

Cobalt is not the root of exploitation, but a mirror reflecting deep-seated systems of greed, global power asymmetries, and neocolonial labor practices. Tracing cobalt's transformation from a cursed impurity in European silver mines to a critical mineral powering the clean energy transition, the paper critiques the moral and economic contradictions embedded in its global supply chain. By analyzing historical legacies, contemporary market dynamics, and geopolitical shifts—particularly in the DRC and Brazil—it calls for a reframing of responsibility away from the mineral itself and toward the human decisions that shape its value and impact.

BEYOND EXTRACTION: THE SOCIAL AND ENVIRONMENTAL TRADE-OFFS OF LITHIUM MINING
Anar Amarjargal

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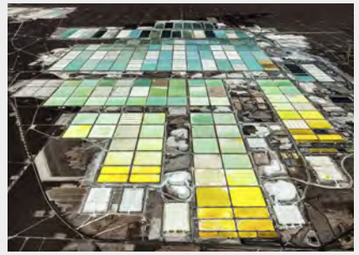

LITHIUM

This paper examines the paradox of mineral extraction in Brazil—specifically lithium and iron—as essential inputs for the global energy transition, yet deeply entangled with environmental degradation, community displacement, and social injustice. As extraction zones transform into industrialized landscapes governed by global demand, the benefits of decarbonization are unevenly distributed, often bypassing the communities who bear its greatest costs. By centering climate justice and exploring tools like Community Benefit Agreements, the paper argues for a more equitable transition—one that acknowledges the ethical trade-offs of sustainability and prioritizes human rights alongside emissions reduction.

THE PARADOX OF SAND: A CATALYST FOR DESTRUCTION AND PROGRESS
Caroline Sacher

SCAN FOR MORE

SAND

Sand is both a driver of development and a source of deep ecological and social harm, underpinning everything from coastal infrastructure to high-tech manufacturing. In cities like Rio de Janeiro, sand is essential to climate adaptation and urban growth, yet its extraction accelerates environmental degradation, water insecurity, and inequality—often through illegal and violent means. This paradox reveals how sustainability goals can be undermined by the very materials meant to achieve them, demanding a reimagining of development that centers justice, regulation, and alternative futures.