

Climate Finance and the Political Ecology of (Im)Mobility: Displacement Risks in the Low-Carbon Transition

Finanzas climáticas y la ecología política de la (in)mobilidad: riesgos de desplazamiento en la transición hacia una economía baja en carbono

Paola Crisci

University of Naples - L'Orientale

E-mail: paolacrisci@outlook.it

ORCID: <https://orcid.org/0009-0007-1004-214X>



Author



Climate finance is indispensable to global decarbonisation, yet its distributive effects on human mobility remain under-analysed. Using a qualitative, multi-scalar design, this article links macro patterns of climate-finance flows, meso institutional frameworks, and micro evidence from two emblematic arenas—the Atacama lithium frontier in Chile and the Noor-Ouarzazate solar complex in Morocco. It demonstrates that displacement and immobility risks arise less from technical shortfalls than from financial logics that privilege capital-intensive, debt-based assets and procedural safeguards, which restructure access to water, land and labour and compress local capability sets. The central contribution is to specify the causal mechanisms connecting the financialisation of climate governance to climate-related (im)mobility, integrating political economy, political ecology, and the economics of migration. The article concludes by proposing a shift toward more grant-equivalent adaptation finance, binding benefit-sharing and livelihood-restoration schemes, and performance metrics that incorporate mobility outcomes and hydrosocial costs alongside conventional indicators.



Abstract

La financiación climática es indispensable para la descarbonización global; sin embargo, sus efectos distributivos sobre la movilidad humana siguen estando insuficientemente analizados. Mediante un diseño cualitativo y multiescalar, este artículo vincula patrones macro de los flujos de financiación climática, marcos institucionales de nivel meso y evidencia micro procedente de dos escenarios emblemáticos: la frontera del litio de Atacama en Chile y el complejo solar Noor-Ouarzazate en Marruecos. Se demuestra que los riesgos de desplazamiento e inmovilidad derivan menos de carencias técnicas que de lógicas financieras que privilegian activos intensivos en capital y basados en endeudamiento, así como salvaguardias procedimentales, las cuales reconfiguran el acceso al agua, la tierra y el trabajo, y comprimen los conjuntos de capacidades locales. La contribución central consiste en especificar los mecanismos causales que conectan la financiarización de la gobernanza climática con la (in)mobilidad relacionada con el clima, integrando la economía política, la ecología política y la economía de la migración. El artículo

concluye proponiendo un giro hacia una financiación de la adaptación más cercana a subvenciones, esquemas vinculantes de distribución de beneficios y restauración de medios de vida, y métricas de desempeño que incorporen resultados en materia de movilidad y costos hidrosociales junto a los indicadores convencionales.

Climate finance; climate-induced migration; financialisation of climate governance; political ecology

Financiación climática; migración inducida por el clima; financiarización de la gobernanza climática; ecología política

Received: 10/09/2025. Accepted: 22/12/2025



1. Introduction

The intersection of climate change, finance, and human mobility represents one of the most pressing and complex challenges of the twenty-first century. While scientific consensus acknowledges the multi-causal nature of environmental migration (Black et al., 2011; Foresight, 2011), dominant narratives in international climate governance often present displacement as a direct outcome of environmental disruption. Early projections, such as forecasts of up to 200 million “climate refugees” by 2050 (Myers, 2002) and cumulative displacement estimates in advocacy reports (Christian Aid, 2007), played a central role in raising awareness, yet they have also been subject to sustained methodological critique (Castles, 2002; Gemenne, 2011). Such deterministic framings, which Bettini (2013) describes as portraying “climate barbarians at the gate,” continue to influence policy discussions within United Nations Framework Convention on Climate Change (UNFCCC) negotiations (Warner, 2012). More recent institutional assessments, including the World Bank’s *Groundswell* report (Rigaud et al., 2018), project up to 143 million internal climate migrants by 2050 across Sub-Saharan Africa, South Asia, and Latin America. While these estimates are more methodologically robust, they continue to emphasize environmentally induced movement and understate the role of structural drivers. What remains insufficiently examined is a critical dimension of climate governance: the extent to which mechanisms designed to address climate change may themselves create or intensify displacement risks. This article therefore advances an alternative analytical proposition: that climate finance architectures, while essential to enabling adaptation and mitigation, can inadvertently contribute to displacement and immobility through processes of resource enclosure and unequal distribution of benefits. Extensive scholarship has investigated the drivers and dynamics of climate-related migration (McLeman & Smit, 2006; Piguet, 2010), and critical research has analysed “green grabbing” and dispossession linked to environmental policies (Fairhead et al., 2012; Corson, 2012; Corson et al., 2013). Yet no systematic assessment has thus far traced how climate finance instruments translate into concrete displacement outcomes. Addressing this gap is particularly urgent given that climate finance flows to developing countries reached USD 89.6 billion in 2021 (Organisation for Economic Co-operation and Development, 2023). Empirical evidence increasingly indicates that adaptation and mitigation projects financed under global climate finance mechanisms may unintentionally exacerbate social inequalities and contribute to processes of exclusion (Scheidel et al., 2020; Scov-

ille-Simonds et al., 2020). This paradox raises an important policy challenge: under what conditions can financial instruments promoted as climate solutions avoid reinforcing existing vulnerabilities? Drawing on political economy and political ecology perspectives, environmental migration can be understood not merely as a reactive response to ecological shocks, but also as an outcome shaped by structural economic dynamics. Building on Harvey's (2003) notion of accumulation by dispossession and insights from studies on *green extractivism* and *climate colonialism* (Hanaček et al., 2024), this article highlights how climate finance—when channelled through carbon markets, green bonds, or multilateral adaptation funds—can, if poorly designed, generate new forms of resource enclosure that create migratory pressures. Evidence from climate finance and adaptation schemes demonstrates that projects without strong equity safeguards may restructure local livelihoods and entrench social inequalities (Poudel et al., 2015; Dunlap, 2020). These findings underscore the need for governance frameworks that integrate distributive justice considerations into climate finance design and implementation. This reconceptualization situates contemporary displacement within broader historical trajectories of economic and institutional change, where the financialization of nature translates ecological processes into tradable assets and can reshape access to land, water, and livelihoods (Sullivan, 2012; Büscher & Fletcher, 2015; Barbesgaard, 2017).

Against this backdrop, the study is guided by three interrelated research questions. First, through which specific mechanisms might climate finance instruments contribute to displacement risks? Second, how do interactions between global financial architectures and local contexts mediate these dynamics? Third, what does this reveal about the relationship between climate governance and migration that conventional approaches tend to overlook? These questions connect to a wider critical literature highlighting that, while climate finance has the potential to foster resilience, certain designs may inadvertently perpetuate unequal structures of resource access (Sultana, 2022; Táíwò, 2022) or reproduce asymmetries in global governance (Ciplet et al., 2015).

Methodologically, the study employs a qualitative, multi-scalar design aimed at identifying the conditions under which climate finance can better support just and inclusive adaptation. At the macro level, the analysis maps transnational climate finance flows drawing on OECD climate finance reports and underlying datasets, complemented by (UNFCCC) Standing Committee on Finance Biennial Assessments and key fund-level reporting (e.g., Green Climate Fund) to identify allocation patterns across instruments, sectors, and geographies. At the meso level, systematic document analysis is conducted on key policy frameworks—the European Green Deal and associated mechanisms (including the Global Gateway Initiative), the World Bank Climate Change Action Plan 2021-2025, and UNFCCC climate finance decisions (including Standing Committee on Finance Biennial Assessments and COP outcomes)—to examine how these texts construct relations between climate action, development, and mobility. At the micro level, the study compares two paradigmatic arenas where climate finance intersects with socio-economic pressures that can generate displacement risks. In Chile's Atacama Desert, research on lithium extraction highlights how the global energy transition intersects with local water governance, producing challenges of hydrosocial depletion, inequitable resource allocation, and pressures on Indigenous livelihoods (Jerez et al., 2021; Dorn & Gundermann, 2022; Bustos-Gallard et al., 2021). These dynamics underscore the importance of integrating equity safeguards and participatory water management into the financing of extractive projects. In Morocco's Ouarzazate region, studies of the Noor solar complex document how large-scale renewable energy infrastructure, while contributing to low-carbon goals, has been associated with contested land acquisition processes, uneven ben-

efit-sharing, and differentiated gender impacts (Cantoni & Rignall, 2019; Terrapon-Pfaff et al., 2019; Ryser, 2019). These findings illustrate how the distributional outcomes of climate finance investments depend not only on technological performance but also on governance arrangements and the extent of local inclusion.

Together, the cases show how climate finance, while advancing global decarbonisation, can generate distributional risks that, if unmanaged, produce new forms of inequality and displacement. Their selection reflects both their emblematic role in green transition narratives and the availability of robust documentation, allowing a systematic analysis of how large-scale climate investments interact with land regimes and livelihood systems. In the Atacama Desert, research on lithium extraction for electric vehicle batteries—supported by transition finance—demonstrates how water-intensive mining disrupts hydrosocial relations and constrains Indigenous water access (Liu & Agusdinata, 2020), increasing livelihood insecurity and vulnerability to out-migration, even where evidence on actual flows remains limited. This case supports the broader claim that low-carbon financial flows can reshape resource governance in ways that intensify socio-ecological pressures. In Morocco's Ouarzazate region, studies of the Noor solar complex document contested land acquisition, uneven benefit-sharing and labour market shifts that have reconfigured pastoral practices and generated new socio-economic vulnerabilities (Rignall, 2016; Cantoni & Rignall, 2019). While displacement is not directly observed, these dynamics illustrate how renewable energy finance can alter land-use regimes in ways that create livelihood risks with potential mobility implications.

Taken together, these cases illustrate how climate finance can facilitate socio-ecological transformations with uneven and sometimes adverse distributional outcomes, rather than uniformly reducing vulnerability. This argument builds on research on green/blue grabbing and accumulation by dispossession (Benjaminsen & Bryceson, 2012; McCarthy, 2019), extending it to climate finance. The analysis makes three contributions. First, it advances political ecology scholarship on migration (Radel et al., 2018; Parsons, 2018) by specifying how financial instruments mediate the relationship between environmental change and mobility, moving beyond linear push-pull models to emphasise the co-production of migration outcomes through capital flows, institutions and discourse. Second, it refines green grabbing research by tracing causal mechanisms from global financial architectures to local livelihood effects, showing how macro-level climate governance materialises in concrete socio-ecological transformations. Third, it contributes to political economy debates on climate governance (Newell, 2021; Bracking, 2019) by demonstrating how market-based climate solutions, in the absence of equity safeguards, risk reproducing and intensifying uneven development.

2. Theoretical Framework: Toward a Political Economy of Climate-Induced (Im)mobility

2.1. Political Ecology Foundations: Beyond Environmental Determinism

Political ecology provides a necessary analytical lens for understanding climate-induced (im)mobility by rejecting deterministic causalities and foregrounding power, inequality and governance. Foundational scholarship shows that environmental outcomes are always mediated by historically constituted political and economic structures rather than purely biophys-

ical processes (Blaikie & Brookfield, 1987; Peet & Watts, 1996). This perspective challenges environmental orthodoxies that obscure the social production of vulnerability through simplified causal narratives (Forsyth, 2003). Such framings have been criticised for reducing mobility to a mechanical response to environmental shocks while neglecting the institutional, social and economic mediations shaping vulnerability (Bettini, 2013; Boas et al., 2019). Building on this foundation, a political ecology of migration identifies three core insights (Marino & Ribot, 2012; Radel et al., 2018). First, environmental stressors interact with pre-existing inequalities structured by class, gender and ethnicity (Sultana, 2011). Second, immobility requires analytical attention alongside mobility, as the concept of “trapped populations” illustrates how structural forces simultaneously compel and constrain movement (Foresight, 2011; Black & Collyer, 2014). Third, migration outcomes emerge from the interaction between aspirations and capabilities, initially theorised in terms of freedoms and constraints (Sen, 1999) and later formalised into a migration theory emphasising how policies, infrastructures and institutions shape the geography of possibility (de Haas, 2021).

These insights converge with political economy approaches long established in development economics. The new economics of labour migration demonstrates how imperfect credit and insurance markets restrict households’ ability to use mobility as a risk-diversification strategy (Stark & Bloom, 1985; Rosenzweig & Stark, 1989). Segmented labour market theory highlights structural barriers that condition who migrate and under what terms (Piore, 1979), while comparative institutional analysis shows how property regimes and state capture determine differential capacities for adaptation or displacement (Acemoglu et al., 2001). Climate-induced (im)mobility thus reflects institutional asymmetries and market imperfections rather than direct responses to biophysical shocks. Temporal dynamics further complicate these processes. The concept of slow violence captures how incremental environmental degradation, such as aquifer depletion or soil salinisation, gradually undermines livelihoods while obscuring causality and institutional responsibility (Nixon, 2011). The notion of slow emergencies extends this analysis by showing how protracted crises normalise harm and erode adaptive capacity without triggering proportional institutional responses (Anderson et al., 2020).

Taken together, political ecology and political economy demonstrate that vulnerability and mobility are socially produced through institutional and financial mechanisms. This framework is essential for analysing climate finance, revealing that financial instruments are not neutral but can either expand adaptive capacity or reproduce inequalities and displacement pressures. Within this context, the concept of green accumulation highlights how ecological crises open new arenas for capital expansion. While Arrighi’s (1994) analysis of systemic cycles of accumulation remains influential, debates have centred on accumulation by dispossession (Harvey, 2003), with privatisation, marketisation, regulatory restructuring and devolution of authority identified as key mechanisms (Heynen et al., 2007).

2.2. Green Accumulation: The Financialisation of Climate Governance

The concept of *green accumulation* highlights how responses to ecological crises create new arenas for capital expansion. Building on this foundation, research on *green grabbing* documents how conservation and mitigation initiatives can generate new forms of enclosure (Peluso & Lund, 2011; Corson, 2012), signalling a qualitative shift in how value is extracted from socio-ecological systems (Büscher & Fletcher, 2015). A major driver of this shift is the financialisation of climate governance (Bracking, 2019). Carbon markets, green bonds, and blended-finance vehicles convert ecological processes into tradable assets, contributing to their as-

setization (Ouma, 2020; Christophers, 2019), a move that relies on standardising complex ecosystems into measurable units (Knox-Hayes, 2016).

Empirical patterns indicate that the architecture of climate finance is not neutral. In 2020, loans accounted for 71% of public climate finance and grants for 26%. Mitigation represented 58%, adaptation 34%, and cross-cutting activities 7%. Among multilateral development banks (MDBs), climate finance was predominantly delivered through loans (around 90% in 2016-2020). Private finance mobilisation occurred mainly through project-finance instruments, with guarantees and syndicated loans playing a key role in leveraging resources at scale (OECD, 2022). These features are consistent with the logic of project finance, which tends to privilege capital-intensive, revenue-generating investments (Gallagher & Kozul-Wright, 2019).

In scale terms, green bond issuance exceeded USD 582 billion in 2021 (Climate Bonds Initiative [CBI], 2022), while the value of traded carbon markets reached €881 billion (≈USD 949 billion) in 2023 (London Stock Exchange Group, 2024), underscoring how climate action is increasingly structured through financial logics. While indispensable for resource mobilisation, this trajectory can tilt portfolios toward large, bankable projects with significant land and resource footprints; where safeguards are weak, this may exacerbate uneven distributional outcomes. These distributive dynamics are not merely financial but social, as they intersect with livelihood security and shape adaptive capacities.

2.3. Dispossession and Displacement: Mechanisms and Modalities

Climate finance architectures can produce displacement by depoliticising distributional struggles and reframing them as technical or managerial issues, thereby reducing perceived political risk and enhancing project bankability (Mawdsley, 2018). These processes reflect value extraction through the externalisation of social and ecological costs (Stern, 2007), often legitimised by emergency discourses that enable technocratic and exclusionary responses (Rottenburg, 2009). From a welfare-economics perspective, the systematic under-pricing of social costs and off-balance-sheet risks biases cost-benefit analyses toward capital-intensive, bankable assets, generating allocative inefficiencies alongside distributional harms (Flyvbjerg & Bester, 2021).

Procedural instruments frequently reinforce these dynamics. Environmental assessments and consultations may function as a veneer of accountability, marginalising local epistemologies and compressing complex claims into simplified stakeholder categories (Goldman, 2005). While such procedures can lower compliance risk and the cost of capital, they rarely disrupt entrenched power relations (Cooke & Kothari, 2001). Recent safeguard interventions illustrate this tension: in April 2024, the World Bank suspended disbursements to Tanzania's REGROW project after resettlement activities violated the Resettlement Policy Framework, showing how procedural mechanisms can themselves become sites where displacement risk materialises (World Bank, 2024).

These procedural effects intersect with broader patterns of dispossession that operate through the reconfiguration of property regimes, access rights and market linkages rather than direct expulsion (Peluso & Lund, 2011). This is evident in REDD+ initiatives in Tanzania and Mozambique, where integration into carbon offset markets has intensified tenure insecurity (Asiyanbi, 2016). Temporal mismatches further exacerbate these dynamics, as financialised

horizons—project cycles, debt schedules and return expectations—conflict with ecological and social rhythms (Bear, 2015). Large-scale infrastructure and renewable energy investments provide parallel illustrations: the Three Gorges Dam displaced approximately 1.25 million people by 2008 (Carney, 2021), while wind projects in Colombia's La Guajira have been delayed or restructured amid disputes over consultation and land rights, leading to asset suspension or divestment despite their low-carbon profile (Vega-Araújo et al., 2024). Together, these cases underscore the limits of safeguard frameworks that prioritise procedural compliance over substantive engagement with distributional impacts and tenure systems.

Displacement, therefore, should be understood less as an unintended by-product than as a predictable outcome of incentive structures that align ecological transformation with financial-market logic. Under prevailing metrics and pipeline criteria, social costs remain under-weighted, while risk-adjusted returns favour assets that can be priced, collateralised and traded. This produces structural tensions between efficiency and equity, and between allocative and distributive outcomes, resulting in differentiated (im)mobility: some households are displaced as land and labour are reorganised to service investment returns, while others experience involuntary immobility under binding resource constraints (Carling, 2002; Black et al., 2011). Recognising these dynamics is essential for designing safeguards and financing mechanisms that mobilise capital effectively while valuing livelihood security and social resilience alongside financial performance.

2.4. Territorial Reconfigurations under Climate Finance

Climate finance reallocates access to water, land, and infrastructure through investment-driven governance mechanisms that prioritise capital efficiency and risk-adjusted returns (Gabor, 2021). Territorial restructuring is not incidental but embedded in processes of valuation and standardisation that render resources commensurable and investable, aligning local assets with global capital markets (Scott, 1998). Blended finance has become pivotal in mobilising capital for marginally bankable projects, with public capital supporting the development of transition-project pipelines and fostering risk-mitigation strategies. By combining public and private funds, these mechanisms improve the risk-return profile of investments that might otherwise struggle to attract commercial finance, thereby contributing to the scaling up of net-zero transition initiatives (Network for Greening the Financial System, 2023).

A first dimension concerns water resources, where climate finance encourages the standardisation of flows and rights into quantifiable units that can underpin investment planning. This framing reflects a broader shift toward treating water as both ecological commons and financial collateral, embedding allocation in logics of liquidity and risk management (Bakker, 2010). A second dimension involves land use regimes. Climate-linked investment requires cadastral clarity and valuation practices that reconfigure property relations and facilitate the conversion of landscapes into assets. Rather than a residual effect, this process institutionalises enclosure and marketisation under the banner of environmental sustainability (Hall et al., 2011). A third dimension is infrastructure, where climate finance operates through project-preparation facilities and long-term contracts that bind states into risk-sharing arrangements with investors. Instruments such as sovereign guarantees or power purchase agreements expand connectivity but also recalibrate fiscal space, redistributing exposure between public and private actors (United Nations Conference on Trade and Development, 2023).

Taken together, these processes show that climate finance reconfigures territories not only by shaping access to resources but also by redefining the institutional and financial logics through which they are governed. This underscores how financial architectures embed structural asymmetries, privileging landscapes optimised for capital flows over the socio-ecological needs of communities—a tension that lies at the core of this paper’s analysis.

3. Methodology and Results

This article employs a qualitative, multi-scalar design that connects global patterns of climate finance to institutional narratives and localised socio-ecological transformations. The purpose is not to generate statistical generalisations but to reconstruct the mechanisms through which financial architectures contribute to processes of dispossession, displacement, and immobility. The analysis unfolds across three levels—macro, meso, and micro—corresponding to distinct units of observation: financial flows, policy frameworks, and emblematic projects.

3.1. Macro-Level Analysis: Climate Finance Flows

The first unit of observation consists of aggregate climate finance flows. Data were drawn from the OECD Climate Finance Database, the Sixth Biennial Assessment of the UNFCCC Standing Committee on Finance, the Climate Funds Update, and the Green Climate Fund (GCF) portfolio. These datasets were selected because they represent the most authoritative and internationally comparable sources currently available. The criterion of inclusion was coverage of cross-border public finance committed under the UNFCCC climate finance mandate. Rather than exhaustive quantification, the analysis focuses on identifying allocation biases across instruments (loans versus grants), sectors (mitigation versus adaptation), and geographies (regional concentration and access for LDCs and SIDS).

Table 1. Macro-level climate finance data (2016-2025)

Dimension	Key Figures	Source
OECD Climate Finance (2022)	USD 115.9 bn total flows (first time 100 bn goal met); of which USD 91.6 bn public, USD 21.9 bn private. Loans 69% of public (USD 63.6 bn); grants 28% (USD 25.6 bn). Mitigation 60%, Adaptation 28%.	OECD (2024)
Sectoral Allocation (2016-2022)	Mitigation: 62% energy & transport. Adaptation: water 19%, agriculture/forestry/fisheries 18%.	OECD (2024)
Geographical Distribution (2022)	Lower-middle-income: 40%; Upper-middle-income: 30%; Low-income: 10%. LDCs: USD 21.2 bn (18%). SIDS: grants 53% of public flows, private mobilisation 9% (2016-2022).	OECD (2024)
UNFCCC BA6 Global Finance (2021-2022)	USD 1.3 trillion/year, up 63% vs 2019-2020. Adaptation USD 63 bn (11%), Mitigation 89%. Debt: 59% (USD 755 bn), of which 12% low-cost debt. Grants: USD 77 bn (6%), doubled since 2019-2020.	UNFCCC SCF (2025)
Regional Concentration (BA6)	Eastern Asia 42%, Northern & Western Europe 22%, North America 12%; all others combined (Africa, Latin America, South Asia, Oceania) <25%. LDCs 2.6% (USD 33 bn), SIDS 1.0% (USD 13 bn) → together <4%.	UNFCCC SCF (2025)

Dimension	Key Figures	Source
NCQG (COP29, Baku)	Commitment: ≥USD 300 bn/year by 2035 for developing countries; aspiration: USD 1.3 trillion/year by 2035. MDBs pledged USD 120 bn/year for LMICs and USD 50 bn/year for HICs by 2030.	CFF2 (2025)
Multilateral Funds (tripling by 2030)	GCF 1,504 → 4,512 mln; GEF 115 → 345 mln; AF 126 → 378 mln; LDCF 130 → 390 mln; SCCF 1 → 3 mln. Total 1,876 → 5,628 mln/year.	CFF2 (2025)
Fund for Responding to Loss & Damage	Initial pledges USD 741 mln, vs needs in hundreds of billions.	CFF2 (2025)
Green Climate Fund (2024)	Portfolio: 270 projects / 130 countries. Allocation: 29% to LDCs, 12% to SIDS. Grant-equivalent: Adaptation 55%, Mitigation 45%. Instrument mix: 42% grants, 40% loans, 12% equity. Readiness/capacity building: >USD 630 mln in 142 countries. Scale: USD 12.8 bn under GCF-2 (2024-2027).	GCF (2024)

At the macro level, climate finance has expanded rapidly in volume while remaining structurally selective in both composition and distribution. OECD data show that the USD 100 billion annual target was reached only in 2022, with USD 115.9 billion mobilised—USD 91.6 billion in public finance and USD 21.9 billion from private sources—two years later than originally pledged, reinforcing long-standing concerns about credibility. The structure of these flows reflects persistent asymmetries: loans accounted for the majority of public finance, while mitigation continued to dominate allocations, receiving more than twice the share of adaptation (OECD, 2024).

Distributional patterns further underscore these imbalances. In 2022, lower- and upper-middle-income countries captured the bulk of climate finance, while low-income countries received a marginal share. Least Developed Countries accounted for less than one fifth of total flows, and Small Island Developing States remained heavily dependent on grants and largely excluded from private mobilisation (OECD, 2024). These trends are consistent with broader global dynamics. The UNFCCC Sixth Biennial Assessment reports global climate finance of USD 1.3 trillion per year in 2021-2022, a 63% increase compared to 2019-2020, yet overwhelmingly oriented toward mitigation. Only 11% of flows, approximately USD 63 billion annually, were directed to adaptation, while debt-based instruments dominated and grants remained marginal (UNFCCC Standing Committee on Finance, 2024; Sultana, 2022). Regionally, the concentration of flows in Eastern Asia, Europe, and North America contrasts sharply with the limited shares accruing to Africa, South Asia, and other vulnerable regions, with LDCs and SIDS together receiving less than 4% of total finance.

Recent institutional reforms have largely consolidated these structural features. The New Collective Quantified Goal adopted at COP29 commits Parties to at least USD 300 billion annually by 2035, within an aspirational target of USD 1.3 trillion per year, while allowing the full inclusion of multilateral development banks' climate-related outflows. This design further entrenches the centrality of loan-based finance and deepens the alignment of climate action with global financial markets (Bracking, 2019). By contrast, the scaling-up of dedicated multilateral climate funds remains limited in absolute terms, and the initial capitalisation of the Fund for Responding to Loss and Damage, while symbolically significant, falls far short of estimated needs. Persistent barriers to access, including complex accreditation procedures and co-financing requirements, continue to constrain the ability of the most vulnerable countries to benefit from the expanding climate finance architecture (Watson et al., 2025).

Within this landscape, the GCF represents one of the most significant corrective mechanisms within an otherwise structurally constrained architecture. Its portfolio displays broader geographic reach and a comparatively stronger orientation toward adaptation in grant-equivalent terms, alongside a more balanced mix of financial instruments. Nevertheless, its overall scale remains modest relative to the trillions mobilised through broader financial channels, limiting its capacity to offset the dominant mitigation and debt-centred configuration of global climate finance (GCF, 2024).

3.2. Meso-Level Analysis: Institutional Frameworks

The second unit of observation is key policy and institutional frameworks that structure climate finance. Three were selected: the European Green Deal and associated mechanisms, the World Bank Climate Change Action Plan 2021-2025, the Global Gateway Initiative and UNFCCC finance decisions (including biennial assessments and COP outcomes). The criterion of inclusion was their centrality in defining priorities and modalities of climate finance at both multilateral and regional scales. Each document was analysed as an institutional artefact, with coding focused on three dimensions: the logics of financial mobilisation (market-based, concessional, blended), the narrative framing of resilience and development, and the recognition or omission of migration and (im)mobility.

Table 2. Meso-level climate governance and finance framework

Initiative / Actor	Financial Scale	Key Instruments	Main Priorities	Core Principles
EU – Green Deal (2019)	+€260 bn/yr (to 2030); 25% EU budget for climate	ETS extension; Energy Taxation reform; CBAM; Just Transition Fund	Decarbonisation; just transition; support to LDCs & SIDS	Social justice; global climate leadership
EU – Global Gateway (2021)	Up to €300 bn (2021-27)	EFSD+ guarantees; EU grants; NDICI-Global Europe	Digital, clean energy, transport, health, education/research	“Do no harm;” transparency; avoid unsustainable debt
World Bank – CCAP 2021-25	35% of total finance to climate; 50% IDA/IBRD for adaptation; USD 4 tn/yr infra needs	GRID approach; Paris alignment; Country Climate Reports; blended finance	Energy, agri-food-water-land, cities, transport, manufacturing; NbS	Just transition; poverty, fragility & displacement focus
UNFCCC – COP27-29	NCQG: USD 300 bn/yr by 2035 (up to 1.3 tn); Loss & Damage Fund	Article 6 rules; Santiago Network; grants & capacity building	Mobility & displacement; vulnerable groups; finance access	Market- & debt-based orientation; financialisation of governance

Across the EU and multilateral development system, the meso-institutional layer of climate governance is defined by fiscal tools, investment platforms, and rule-making that mobilise capital while steering sectoral transitions—yet largely through market-compatible and debt-reliant modalities. The European Green Deal (European Commission, 2019) highlights the expansion of carbon pricing tools—such as extending the EU Emissions Trading System (ETS) to new sectors, revising the Energy Taxation Directive, and introducing a Carbon Border Adjustment Mechanism—to prevent carbon leakage and promote decarbonization. It estimates an additional €260 billion in annual investments until 2030, equivalent to 1.5% of the 2018 EU GDP, mobilized via the Sustainable Europe Investment Plan alongside a Just Transition Mechanism and Fund to protect vulnerable workers and regions. The EU budget allocates 25% of expenditure to climate objectives, situating the EU as a global climate leader

focused on international partnerships supporting Least Developed Countries (LDCs) and Small Island Developing States (SIDS). Central to the approach is the principle of a just transition, with reskilling and social protections at its core.

The Global Gateway Initiative (European Commission & HR/VP, 2021) builds on this meso-institutional approach by mobilizing up to €300 billion between 2021 and 2027 for sustainable infrastructure worldwide, leveraging a Team Europe model that includes the EU, Member States, the European Investment Bank, and private capital. Its financial architecture combines €135 billion in EFSD+ guarantees, €18 billion in EU budget grants, and €145 billion through European financial institutions. The NDICI-Global Europe instrument allocates €79 billion with at least 35% for climate and 10% for digital priorities. Priority sectors include digital infrastructure (e.g., fibre optics, satellites, AI), climate and energy (e.g., clean energy and energy efficiency grants for Africa), sustainable transport, health (notably local vaccine production), and education and research (Erasmus+ and Horizon Europe participation). The initiative enforces principles of rule of law, environmental and social standards, transparency, and avoidance of unsustainable debt, embedding the “do no harm” principle while addressing cyber and geopolitical risks. Governed by a Global Gateway Board and Business Advisory Group, the strategy positions itself as a transparent, sustainable, and competitive alternative to other global infrastructure offers, aligned with the Paris Agreement and Sustainable Development Goals and strategically linked to international partners and G7 initiatives.

The World Bank Group’s Climate Change Action Plan 2021-2025 (World Bank, 2022) operationalizes a Green, Resilient, and Inclusive Development (GRID) approach, integrating climate with development priorities and scaling up finance. Building on mobilizing USD 83 billion climate finance in 2016-2020, including a record USD 21.4 billion in 2020, the Bank commits 35% of total financing to climate goals for 2021-2025, with half of IDA and IBRD funds dedicated to adaptation. Operations will be Paris-aligned by mid-2023, excluding fossil fuels. Country Climate and Development Reports (up to 25 in the first year) integrate NDCs, biodiversity, and macro-fiscal models to align decarbonization with development. The plan emphasizes carbon pricing reforms, nature-based solutions that currently sequester 60% of CO₂, and focuses on five key systems responsible for over 90% of emissions (energy, agriculture/food/water/land, cities, transport, manufacturing). It estimates a need for USD 4 trillion annual infrastructure investment by 2030 in developing countries, stressing private capital mobilization via de-risking and blended finance complemented by concessional flows. Partnerships with IMF, G20, and global climate to reinforce its convening role. The action plan explicitly frames climate change as a driver of poverty, inequality, fragility, and displacement, embedding just transition, resilience, gender, and social protection in all climate policies and investments.

At the UNFCCC meso-institutional governance level, COP27-COP29 developments illustrate growing recognition of mobility linked to climate impacts within a financialized response framework. COP27 (UNFCCC, 2022) decisively established the Loss and Damage Fund acknowledging displacement and migration as non-economic losses and operationalizing the Santiago Network for technical assistance. COP28 (COP28 Presidency, 2023) advanced this with a Declaration endorsing scaled-up grants, simplified access, capacity building, and direct funding to vulnerable populations while emphasizing conflict sensitivity and social protection reform within international financial architecture transformation. COP29 institutionalized the New Collective Quantified Goal (NCQG), targeting USD 300 billion

annually by 2035 for developing countries and up to USD 1.3 trillion aspirationally, alongside operationalizing Paris Agreement Article 6 rules for carbon markets and non-market approaches, and fully launching the Loss and Damage Fund. The EU reported €28.6 billion in public climate finance and €7.2 billion private mobilization in 2023 (Erbach & Meinardi, 2024). Despite explicit acknowledgment of mobility and fragile contexts, the overall architecture remains anchored in debt-based and market-oriented instruments, sustaining the broader financialization of climate governance.

This meso-institutional landscape thus reveals a complex balance: it advances climate and development goals through substantial financial mobilization, institutional innovation, and geopolitical positioning, while simultaneously perpetuating market-based, debt-financed modalities that risk reinforcing vulnerabilities tied to climate-induced mobility and fragile contexts.

3.3. Micro-Level Analysis: Case Studies

The third unit of observation consists of two emblematic projects: lithium extraction in Chile's Atacama Desert and the NOOR solar complex in Morocco's Ouarzazate. The cases were chosen through theoretical sampling based on three criteria: their paradigmatic status in global green transition narratives, their embedding in resource-constrained environments (water scarcity in Chile, arid land tenure regimes in Morocco), and the availability of robust documentation. The analysis employs process tracing to reconstruct causal sequences linking financial instruments to territorial reconfigurations (of water, land, labour) and, ultimately, to displacement and immobility outcomes.

On this basis, the two cases are selected as crucial cases for observing the mechanisms through which climate finance translates into differentiated (im)mobility outcomes. They represent two distinct but structurally comparable configurations of the low-carbon transition: extractive mitigation through critical minerals (lithium) and infrastructure-led renewable energy deployment (concentrated solar power). In both contexts, climate-aligned finance is channelled into capital-intensive projects located in resource-constrained territories, where pre-existing ecological scarcity and institutional asymmetries magnify the distributive effects of financialised interventions.

3.3.1. Micro-Level Case Study: Chile (Atacama Lithium Extraction)

The Chilean case study illustrates the multi-dimensional socio-ecological transformations generated by lithium extraction in the Salar de Atacama. Hydrological analyses by Liu and Agusdinata (2020) confirm structural stress: terrestrial water storage declined by -1.16 mm per year between 2010 and 2017, while their estimates show that mining withdrawals exceed domestic use by a factor of fifty and tourism demand by several hundredfold. According to Garcés and Alvarez (2020), extraction rights authorised for SQM (up to 1,700 l/s) and Alumar (442 l/s as of 2020) produce severe imbalances, with outflows surpassing inflows by more than 2,000 l/s between 2000 and 2015. They also note that the production of one ton of lithium requires approximately 2 million litres of water, while evaporation ponds covering 1,700 ha (2020) intensify losses and contribute to biodiversity decline, including flamingo mortality. Waste deposits now extend across ~38 km² (2020), reflecting the cumulative ecological footprint of the industry.

Labour and mobility dynamics reveal parallel processes of attraction and displacement. Liu and Agusdinata (2020) show that long-distance in-migration to mining rose sharply after 2000, reaching 2,466 workers between 2012 and 2017, while the share of local employment fell from 52% to 18% despite sectoral growth. They further document the expansion of fly-in/fly-out regimes, which covered nearly 80% of the total mining workforce by 2017, and a decline in the Migration Effectiveness Index from 68% (1997-2002) to 63% (2012-2017), signalling inefficiencies in labour absorption. Out-migration of local residents also intensified, with shifts into lower-paid activities such as construction and commerce, while social activism escalated, particularly after the 2018 CORFO-SQM agreement.

Governance and knowledge production further entrench asymmetries. Van Pampus et al. (2023) emphasise that monitoring infrastructure is almost entirely controlled by companies, with only three state inspectors for the entire basin. Community-led monitoring remains under-resourced, while corporate strategies—data release, site visits, and PR—shape public narratives. Although Chile's 2023 National Lithium Strategy proposes greater transparency and state involvement, implementation remains limited. Compensation schemes are also modest relative to extractive revenues: Garcés and Alvarez (2020) report that in 2015 SQM contributed USD 15.2 million in royalties against profits of USD 223 million, while Albemarle paid USD 1.4 million despite lithium prices averaging above USD 5,300 per ton.

Industry-oriented analyses such as Mura et al. (2025) stress Chile's comparative advantage in brine-based extraction, with costs of USD 3,000-5,000/t LCE compared to USD 10,000-15,000/t for spodumene. They also point to Direct Lithium Extraction (DLE) as a technologically promising alternative, with recovery rates up to ~90%, though potentially amplifying freshwater use and energy demand by up to tenfold. At the macroeconomic level, Mura et al. (2025) estimate that lithium exports rose from <1% to over 8% of total exports between 2013 and 2022, and that the sector contributed 3.4% of GDP in 2022.

Independent assessments provide a more nuanced perspective. The 2023 IRMA audit of Albemarle's operations (IRMA, 2023) awarded IRMA 50 certification, with strong scores on water management (89%) and waste (96%) but weaknesses in biodiversity (63%), community grievance mechanisms (50%), and community health and safety (44%). Similarly, Roche et al. (2025) conducted a comprehensive Social Life Cycle Assessment (S-LCA) of SQM's operations, which identified a bifurcated performance: formal compliance and positive worker outcomes on the one hand, but precautionary hotspots for freshwater access, agriculture, delocalisation/migration, and indigenous rights on the other, based on community testimonies.

At the regional scale, Petavratzi et al. (2022) highlight that lithium extraction across the Lithium Triangle reflects similar ESG dynamics: water abstraction threatens high Andean wetlands supporting 842 indigenous communities, social conflict persists around participation and benefit-sharing, and governance frameworks diverge between Chile's strategic concessions, Bolivia's state monopoly, and Argentina's decentralised provincial model. Despite methodological differences, these studies converge in showing that the vulnerabilities of lithium territories arise less from global demand than from local socio-ecological frictions and governance asymmetries.

Taken together, the Atacama findings demonstrate how climate finance and global energy transitions materialise through extractive frontiers that generate unequal (im)mobility outcomes. The sector attracts capital and external labour while disembedding itself from local livelihoods; it produces ecological losses and community vulnerabilities that are only partial-

ly mitigated by corporate responsibility frameworks. This evidence underscores the political-ecological paradox of lithium: a strategic “green” resource whose extraction reproduces displacement pressures, immobility, and uneven development in the very territories designated as sites of climate solution.

3.3.2. Micro-Level Case Study: Morocco (NOOR-Ouarzazate)

The NOOR-Ouarzazate complex crystallises how climate finance mobilises capital, technologies, and institutions while generating uneven local immobilities. The financing and governance architecture—public—private projects coordinated by MASEN and supported by major IFIs such as KfW, AfDB, EIB, EU, and AFD—relied on risk-mitigating PPAs and a cost-mitigation mechanism. According to the World Bank (2025), this structure integrated Morocco into global low-carbon circuits but also locked the programme into concessional logics and performance benchmarks.

At the plant level, Laaroussi et al. (2021) report that NOOR I is a 160 MW parabolic-trough facility comprising approximately 500,000 mirrors in ~800 rows over 1,308,000 m², with around three hours of molten-salt storage. Operating temperatures reach ~393 °C, using a wet-cooling steam cycle. Critical inputs include 15,000-17,000 tonnes of synthetic oil as a heat-transfer fluid, while the storage system relies on a 60% NaNO₃ / 40% KNO₃ salt mixture. Auxiliary fossil fuels are required to maintain operating temperatures and power circulation pumps during periods of low irradiance. Building on this, Laaroussi et al. (2021) and Laaroussi et al. (2023) document the environmental balance sheet, noting very high water consumption of ~6 million m³/year for wet cooling, mirror cleaning, and services—largely lost to evaporation, with only 2-3% discharged. Mitigation measures include evaporation basins, and the authors state there is “no impact on the drinking water supply.” At the same time, inherent CSP risks include hot-oil circuits, molten-salt storage tanks, and potential leaks, while construction works produced soil compaction over ~434,000 m² of tank and platform areas. On the climate side, the project is credited with ~2.9 MtCO₂ avoided over ten years (~240 kt/year) and ~6 MtCO₂ over twenty-five years.

Social dynamics are structured less by CSP physics than by governance and distributional processes. A two-phase Social Impact Assessment conducted by Terrapon-Pfaff et al. (2019) combined 87 exploratory interviews, 53 community interviews, 29 stakeholder interviews, 5 focus groups, and subsequently 20 workshops with 106 participants plus an expert survey of 25. Their consolidated framework identified 30 impacts across cohesion, participation, services, socio-economy, human capital, and health/safety. The assessment highlights persistent information gaps, perceived exclusion (especially among women and youth), rivalry between neighbouring communities, and selective inclusion of micro-SMEs despite stated local-content objectives.

Performance and labour dynamics further illustrate the mobility/immobility paradox. The World Bank (2025) notes that by closure (June 2024), the complex had reached 510 MW installed capacity (Noor I-III) but delivered an average of ~739 GWh/year (2019-2023) against a 1,144 GWh design expectation. Cumulative sales amounted to 1,500 GWh compared to a 2,624 GWh target, with 483-484 GWh delivered in peak hours against a 540 GWh target. People provided with new or improved electricity service totalled 1,269,831, 50.3% of whom were women. Avoided GHG emissions reached ~0.81–0.90 MtCO₂/year (63-71% of the 1.27 Mt/year target). Private capital mobilised was US\$ 413 million against a target of US\$ 597

million. The ERR remained modest, from 0.89% at US\$ 40/tCO₂ to 3.06% at US\$ 80/tCO₂. Operationally, Noor III suffered molten-salt tank cracks that caused prolonged outages and additional repairs.

Employment followed a typical megaproject boom-bust cycle: World Bank (2025) data indicate that 8,504 construction jobs (including 6,077 Moroccans and 2,383 from Ouarzazate) collapsed to 234 operational posts in 2022, of which 100 were local and 26 women. Domestic contractors captured ~30% of project costs, concentrated in civil works and balance-of-plant, indicating partial industrial integration but limited high-value capture.

Finally, the political ecology of Morocco's Solar Plan reveals the social tensions underpinning these dynamics. Haddad et al. (2022) document that land for Ouarzazate and future Tata sites was acquired from communal owners at below-market prices, with compensation channelled through Interior-controlled accounts, a process criticised as "green grabbing." At the same time, local actors in Tata denounced a "Decide-Announce-Defend" governance style and advocated decentralised PV/community-based solutions that are less water-intensive and more empowering.

Taken together, the Moroccan findings show that climate finance mobilised concessional debt and global expertise, built grid-relevant low-carbon capacity, and seeded selective capability formation. Yet it also immobilised: hydrosocial pressure from water-intensive cooling in an arid basin; a post-construction job cliff; procurement and credential bottlenecks that sidelined micro-SMEs; and dependence on concessional terms when technical under-performance eroded projected returns.

3.4. Triangulation and Limitations

The three units of observation are analytically distinct yet mutually reinforcing. Macro-level mapping highlights structural patterns and systemic biases; meso-level frameworks uncover the institutional logics that shape these dynamics; and micro-level case studies illustrate how they materialise in specific socio-ecological contexts. This triangulation strengthens the robustness of findings by linking aggregate trends, institutional designs, and grounded processes. It enables the analysis to specify mechanisms rather than rely on surface correlations, thereby enhancing explanatory depth.

Nevertheless, the study faces inherent limitations. It relies primarily on publicly available data and secondary sources, which are subject to information asymmetries between corporate reporting, government documents, and community perspectives. Triangulation reduces but does not eliminate these biases. To mitigate them, the analysis privileges convergent evidence, reports discrepancies transparently, and confines conclusions to mechanisms supported by multiple independent sources. While the findings are context-specific, the mechanisms identified, such as concessional lock-ins, resource reallocation, and uneven (im)mobility outcomes, are analytically transferable to other settings of climate finance and low-carbon transition.

4. Discussion

This study demonstrates that climate finance, while essential to the low-carbon transition, can generate differentiated risks of displacement and immobility when particular configurations of instruments, institutions and ecological conditions align. The evidence from Ataca-

ma and Ouarzazate shows that these risks are not incidental side-effects, but the predictable outcome of financial logics that price risk and structure incentives around bankability rather than distributive equity.

The causal story is therefore not linear, but configurational. In both cases, risks emerge where financial portfolios privilege debt-based and capital-intensive assets, where institutional safeguards formalise procedures without addressing distributional asymmetries, and where ecological scarcities or tenure ambiguities magnify the consequences of resource reallocation. This configuration explains why water extraction for lithium alters Indigenous livelihood security in Chile, or why the Ouarzazate solar complex produced hydrosocial strain and a boom-bust labour cycle even as it delivered renewable capacity. The same processes are visible in different guises across other climate-finance arenas, suggesting that the mechanisms identified here are analytically transferable.

The analysis also resonates with established theories in the economics of migration. In contexts where credit and insurance markets are incomplete, climate-finance projects that disrupt livelihoods can simultaneously induce out-migration and trap the most resource-constrained. Segmented labour market theory helps to explain why the jobs created by large-scale projects are not absorbed locally, leaving surrounding communities with heightened vulnerability but limited mobility. By linking these economic mechanisms with insights from political ecology, the article shows that climate-induced (im)mobility is socially produced, shaped less by biophysical stress than by institutional and financial architectures. At the same time, important limitations qualify these conclusions. The analysis does not establish a direct causal chain between climate-finance interventions and concrete mobility outcomes, but rather identifies mechanisms of risk production that shape exposure to displacement and immobility. Mobility decisions remain multi-causal and temporally extended, influenced by factors that exceed the scope of individual projects. Moreover, reliance on secondary sources and the focus on analytically selected cases constrain causal attribution and statistical generalisation, positioning the contribution as theory-building rather than theory-testing. The distinction between documented displacement and displacement risk strengthens construct validity, but also limits inference to potential rather than realised outcomes.

Methodologically, the multi-scalar design addresses endogeneity and case-selection concerns by prioritising mechanisms over correlations. The argument is conditional: when similar financial logics and institutional designs intersect with ecological scarcity, comparable distributive outcomes are likely. Distinguishing between documented displacement and displacement risk further strengthens construct validity and clarifies the scope of inference.

More broadly, climate finance cannot be assessed solely through technical or financial performance. Projects that externalise social costs face contestation, delays and retrofit costs, undermining bankability. Embedding distributive equity in financial instrument design is therefore not merely normative but a pragmatic strategy for sustaining long-term project performance.

5. Conclusion

The analysis presented in this article has shown that climate finance, while indispensable for global climate action, is not socially neutral. By tracing connections between global allocation patterns, institutional frameworks and local transformations in water, land and labour, the study demonstrates that displacement and immobility risks arise from the very financial logics

that underpin bankability. These findings bridge debates on the financialisation of climate governance with scholarship on migration and political ecology, while also drawing on the economics of migration to explain how altered constraint sets affect household aspirations and capabilities to move.

The results suggest that the real challenge lies not in mobilising more finance, but in determining how it is structured. Portfolios that rely heavily on loans for capital-intensive assets and that approach safeguards as procedural checklists are likely to compress local capability sets, especially in contexts of resource scarcity or fragile tenure. By contrast, financing architectures that rebalance toward grant-equivalent adaptation flows, that embed genuine benefit-sharing and livelihood-restoration mechanisms, and that measure outcomes in terms of mobility and hydrosocial opportunity costs as well as carbon metrics, are more likely to support resilience and distributive justice.

Future research should examine variation across financing mixes, governance models and technological pathways to clarify when climate finance enhances adaptive capacity and when it entrenches vulnerability. Integrating household-level data with ecological and financial modelling would further illuminate causal links between design choices and mobility outcomes. Ultimately, the credibility of the global climate regime depends not only on the volume of resources mobilised but on whether they expand freedoms and adaptive capacities. As climate finance inevitably shapes mobility patterns, the challenge for scholars and policy-makers is to ensure that it does so in ways that are both financially viable and socially durable. This article provides an analytical foundation for such alignment.

References

- Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, 91(5), 1369-1401. <https://doi.org/10.1257/aer.91.5.1369>
- Anderson, B., Grove, K., Rickards, L., & Kearnes, M. (2020). Slow emergencies: Temporality and the racialized biopolitics of emergency governance. *Progress in Human Geography*, 44(4), 621-639. <https://doi.org/10.1177/0309132519849263>
- Arrighi, G. (1994). *The long twentieth century: Money, power, and the origins of our times*. Verso.
- Asiyanbi, A. P. (2016). A political ecology of REDD+: Property rights, militarised protectionism, and carbonised exclusion in Cross River. *Geoforum*, 77, 146-156. <https://doi.org/10.1016/j.geoforum.2016.10.016>
- Bakker, K. (2010). *Privatizing water: Governance failure and the world's urban water crisis*. Cornell University Press. <https://www.cornellpress.cornell.edu/book/9780801474644/privatizing-water/>
- Barbesgaard, M. (2017). Blue growth: savior or ocean grabbing? *The Journal of Peasant Studies*, 45(1), 130-149. <https://doi.org/10.1080/03066150.2017.1377186>
- Bear, L. (2015). *Navigating austerity: Currents of debt along a South Asian river*. Stanford University Press. <https://doi.org/10.1111/1469-8676.12355>

- Benjaminsen, T. A., & Bryceson, I. (2012). Conservation, green/blue grabbing and accumulation by dispossession in Tanzania. *The Journal of Peasant Studies*, 39(2), 335-355. <https://doi.org/10.1080/03066150.2012.667405>
- Bettini, G. (2013). Climate barbarians at the gate? A critique of apocalyptic narratives on “climate refugees.” *Geoforum*, 45, 63-72. <https://doi.org/10.1016/j.geoforum.2012.09.009>
- Black, R., Adger, W. N., Arnell, N. W., Dercon, S., Geddes, A., & Thomas, D. (2011). The effect of environmental change on human migration. *Global Environmental Change*, 21(S1), S3-S11. <https://doi.org/10.1016/j.gloenvcha.2011.10.001>
- Black, R., & Collyer, M. (2014). Populations “trapped” at times of crisis. *Forced Migration Review*, 45, 52-56. <https://www.fmreview.org/crisis/black-collyer/>
- Blaikie, P., & Brookfield, H. (eds.) (1987). *Land degradation and society*. Routledge. <https://doi.org/10.4324/9781315685366>
- Boas, I., Farbotko, C., Adams, H., Sterly, H., Bush, S., van der Geest, K., Wiegel, H., Ashraf, H., Baldwin, A., Bettini, G., Blondin, S., de Bruijn, M., Durand-Delacré, D., Fröhlich, C., Gioli, G., Guaita, L., Hut, E., Jarawura, F. X., Lamers, M., Lietaer, S., Nash, S. L., Piguet, E., Rothe, D., Sakdapolrak, P., Smith, L., Tripathy Furlong, B., Turhan, E., Warner, J., Zickgraf, C., Black, R., & Hulme, M. (2019). Climate migration myths. *Nature Climate Change*, 9, 901-903. <https://doi.org/10.1038/s41558-019-0633-3>
- Bracking, S. (2019). Financialisation, climate finance, and the calculative challenges of managing environmental change. *Antipode*, 51(3), 709-729. <https://doi.org/10.1111/anti.12510>
- Büscher, B., & Fletcher, R. (2015). Accumulation by conservation. *New Political Economy*, 20(2), 273-298. <https://doi.org/10.1080/13563467.2014.923824>
- Bustos-Gallardo, B., Bridge, G., & Prieto, M. (2021). Harvesting lithium: water, brine and the industrial dynamics of production in the Salar de Atacama. *Geoforum*, 119, 177-189. <https://doi.org/10.1016/j.geoforum.2021.01.001>
- Cantoni, R., & Rignall, K. (2019). Kingdom of the sun: A critical, multiscalar analysis of Morocco’s solar energy strategy. *Energy Research & Social Science*, 51, 20-31. <https://doi.org/10.1016/j.erss.2018.12.012>
- Carling, J. (2002). Migration in the age of involuntary immobility: Theoretical reflections and Cape Verdean experiences. *Journal of Ethnic and Migration Studies*, 28(1), 5-42. <https://doi.org/10.1080/13691830120103912>
- Carney, T. M. (2021). China’s Three Gorges Dam: Development, displacement, and degradation. *Nebraska Anthropologist*, 29, 20-27. <https://digitalcommons.unl.edu/nebanthro/192/>
- Castles, S. (2002). *Environmental change and forced migration: Making sense of the debate* (UNHCR Working Paper No. 70). UNHCR. <https://www.unhcr.org/media/environmental-change-and-forced-migration-making-sense-debate-stephen-castles>
- Christian Aid. (2007). *Human tide: The real migration crisis*. Christian Aid.

- Christophers, B. (2019). Environmental beta or how institutional investors think about climate change and fossil fuel risk. *Annals of the American Association of Geographers*, 109(3), 754-774. <https://doi.org/10.1080/24694452.2018.1489213>
- Ciplet, D., Roberts, J. T., & Khan, M. (2015). *Power in a warming world: The new global politics of climate change and the remaking of environmental inequality*. The MIT Press. <https://doi.org/10.7551/mitpress/9780262029612.001.0001>
- Climate Bonds Initiative. (2022). *Sustainable debt: Global state of the market 2022*. Climate Bonds Initiative.
- Cooke, B., & Kothari, U. (eds.) (2001). *Participation: The new tyranny?* Zed Books. [https://doi.org/10.1016/S0738-0593\(02\)00022-6](https://doi.org/10.1016/S0738-0593(02)00022-6)
- COP28 Presidency. (2023). *COP28 Declaration on Climate, Relief, Recovery and Peace*. United Nations Climate Change Conference (COP28).
- Corson, C. (2012). Enclosing the global commons: The Convention on Biological Diversity and green grabbing. *Journal of Peasant Studies*, 39(2), 263-283. <https://doi.org/10.1080/03066150.2012.664138>
- Corson, C., MacDonald, K. I., & Neimark, B. (2013). Grabbing “green:” Markets, environmental governance and the materialization of natural capital. *Human Geography*, 6(1), 1-15. <https://doi.org/10.1177/194277861300600101>
- De Haas, H. (2021). A theory of migration: The aspirations-capabilities framework. *Comparative Migration Studies*, 9, 8. <https://doi.org/10.1186/s40878-020-00210-4>
- Dorn, J., & Gundermann, H. (2022). Mining companies, indigenous communities, and the state: The political ecology of lithium in Chile (Salar de Atacama) and Argentina (Salar de Olaroz-Cauchari). *Journal of Political Ecology*, 29(1). <https://doi.org/10.2458/jpe.5014>
- Dunlap, A. (2020). Bureaucratic land grabbing for infrastructural colonization: Renewable energy, L’Amassada and resistance in southern France. *Human Geography*, 13(2), 109-126. <https://doi.org/10.1177/1942778620918041>
- Erbach, G., & Meinardi, C. (2024). *COP29 climate change conference: Outcomes (EPRS At a Glance, PE 766.266)*. European Parliamentary Research Service. [https://www.europarl.europa.eu/thinktank/en/document/EPRS_ATA\(2024\)766266](https://www.europarl.europa.eu/thinktank/en/document/EPRS_ATA(2024)766266)
- European Commission. (2019, december 11). *The European Green Deal*. Publications Office of the European Union. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52019DC0640>
- European Commission & High Representative of the Union for Foreign Affairs and Security Policy. (2021). *The Global Gateway (JOIN(2021) 30 final)*. Publications Office of the European Union. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021JC0030>
- Fairhead, J., Leach, M., & Scoones, I. (2012). Green grabbing: A new appropriation of nature? *Journal of Peasant Studies*, 39(2), 237-261. <https://doi.org/10.1080/03066150.2012.671770>

- Flyvbjerg, B., & Bester, D. W. (2021). The cost-benefit fallacy: Why cost-benefit analysis is broken and how to fix it. *Journal of Benefit-Cost Analysis*, 12(3), 395-419. <https://doi.org/10.1017/bca.2021.9>
- Foresight. (2011). *Migration and global environmental change: Future challenges and opportunities. Final project report*. The Government Office for Science.
- Forsyth, T. (2003). *Critical political ecology: The politics of environmental science*. Routledge. <https://doi.org/10.4324/9780203017562>
- Gabor, D. (2021). The Wall Street Consensus. *Development and Change*, 52(3), 429-459. <https://doi.org/10.1111/dech.12645>
- Gallagher, K. P., & Kozul-Wright, R. (2019). *A new multilateralism for shared prosperity: Geneva principles for a global green new deal*. Boston University Global Development Policy Center & UNCTAD.
- Garcés, I., & Alvarez, G. (2020). Water mining and extractivism of the Salar de Atacama, Chile. *WIT Transactions on Ecology and the Environment*, 245, 189-200. <https://doi.org/10.2495/EID200181>
- Gemenne, F. (2011). Why the numbers don't add up: A review of estimates and predictions of people displaced by environmental changes. *Global Environmental Change*, 21(S1), S41-S49. <https://doi.org/10.1016/j.gloenvcha.2011.09.005>
- Goldman, M. (2005). *Imperial nature: The World Bank and struggles for social justice in the age of globalization*. Yale University Press. <https://doi.org/10.1162/GLEP.2006.6.4.130>
- Green Climate Fund. (2024). *Thirteenth report of the Green Climate Fund to the Conference of the Parties to the United Nations Framework Convention on Climate Change*. Green Climate Fund. <https://www.greenclimate.fund/document/gcf-b39-14>
- Haddad, C., Günay, C., Gharib, S., & Komendantova, N. (2022). Imagined inclusions into a "green modernisation:" Local politics and global visions of Morocco's renewable energy transition. *Third World Quarterly*, 43(2), 393-413. <https://doi.org/10.1080/01436597.2021.2014315>
- Hall, D., Hirsch, P., & Li, T. M. (2011). *Powers of exclusion: Land dilemmas in Southeast Asia*. University of Hawai'i Press.
- Hanaček, K., Kroger, M., & Martinez-Alier, J. (2024). Green and climate colonialities: Evidence from Arctic extractivisms. *Journal of Political Ecology*, 31(1), 543-562. <https://doi.org/10.2458/jpe.5512>
- Harvey, D. (2003). *The new imperialism*. Oxford University Press. <https://doi.org/10.1093/oso/9780199264315.001.0001>
- Heynen, N., McCarthy, J., Prudham, S., & Robbins, P. (eds.) (2007). *Neoliberal environments: False promises and unnatural consequences*. Routledge. <https://doi.org/10.4324/9780203946848>
- Initiative for Responsible Mining Assurance. (2023). *Mine site assessment: Public summary report – Albemarle Planta Salar de Atacama, Chile (IRMA Standard for Responsible Mining v.1.0)*. <https://responsiblemining.net>

- Jerez, B., Garcés, C., & Torres, R. (2021). Lithium extractivism and water injustices in the Salar de Atacama, Chile: The colonial shadow of green electromobility. *Political Geography*, 87, 102382. <https://doi.org/10.1016/j.polgeo.2021.102382>
- Knox-Hayes, J. (2016). *The cultures of markets: The political economy of climate governance*. Oxford University Press.
- Laaroussi, A., Bouayad, A., Lissaneddine, Z., & Alaoui, L. A. (2021). Impact study of NOOR 1 project on the Moroccan territorial economic development. *Renewable Energy and Environmental Sustainability*, 6, 8. <https://doi.org/10.1051/rees/2021008>
- Laaroussi, A., Laaroussi, O., & Bouayad, A. (2023). Environmental impact study of the NOOR 1 solar project on the Southern Region of Morocco. *Renewable Energy and Environmental Sustainability*, 8, 9. <https://doi.org/10.1051/rees/2023007>
- Liu, W., & Agusdinata, D. B. (2020). Interdependencies of lithium mining and communities sustainability in Salar de Atacama, Chile. *Journal of Cleaner Production*, 260, 120838. <https://doi.org/10.1016/j.jclepro.2020.120838>
- London Stock Exchange Group (LSEG). (2024). *Sustainability report 2024*. LSEG. <https://www.londonstockexchange.com/news-article/QED/publication-of-2024-sustainability-report/16807790>
- Marino, E., & Ribot, J. (2012). Adding insult to injury: Climate change and the inequities of climate intervention. *Global Environmental Change*, 22(2), 323-328. <https://doi.org/10.1016/j.gloenvcha.2012.03.001>
- Mawdsley, E. (2018). “From billions to trillions:” Financing the SDGs in a world “beyond aid”. *Dialogues in Human Geography*, 8(2), 191-195. <https://doi.org/10.1177/2043820618780789>
- McCarthy, J. (2019). Authoritarianism, populism, and the environment: Comparative experiences, insights, and perspectives. *Annals of the American Association of Geographers*, 109(2), 301-313. <https://doi.org/10.1080/24694452.2018.1554393>
- McLeman, R., & Smit, B. (2006). Migration as an adaptation to climate change. *Climatic Change*, 76(1-2), 31-53. <https://doi.org/10.1007/s10584-005-9000-7>
- Mura, M., Castillo, I., Torres, D., Galleguillos Madrid, F. M., Gálvez, E., Gallegos, S., Castillo, J., Varas, M., Jamett, I., & Toro, N. (2025). Global overview of the lithium market and opportunities for Chile. *Resources*, 14(2), 33. <https://doi.org/10.3390/resources14020033>
- Myers, N. (2002). Environmental refugees: A growing phenomenon of the 21st century. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 357(1420), 609-613. <https://doi.org/10.1098/rstb.2001.0953>
- Network for Greening the Financial System (NGFS). (2023). *Scaling up blended finance for climate mitigation and adaptation in emerging markets and developing economies*. NGFS.
- Newell, P. (2019). *Global green politics*. Cambridge University Press. <https://doi.org/10.1017/9781108767224>
- Nixon, R. (2011). *Slow violence and the environmentalism of the poor*. Harvard University Press. <https://doi.org/10.4159/harvard.9780674061194>

- OECD. (2022). *Climate finance provided and mobilised by developed countries in 2016-2020*. OECD Publishing. <https://doi.org/10.1787/286dae5d-en>
- OECD. (2023). *Climate finance provided and mobilised by developed countries in 2013-2021: Aggregate trends and opportunities for scaling up adaptation and mobilised private finance*. OECD Publishing. <https://doi.org/10.1787/e20d2bc7-en>
- OECD. (2024). *Climate finance provided and mobilised by developed countries in 2013-2022: Climate finance and the USD 100 billion goal*. OECD Publishing. <https://doi.org/10.1787/19150727-en>
- Ouma, S. (2020). *Farming as a financial asset: Global finance and the making of institutional landscapes*. Agenda Publishing. <https://doi.org/10.2307/j.ctv13840b0>
- Parsons, L. (2018). Structuring the emotional geographies of climate change migration: Towards climate mobilities in geography. *Progress in Human Geography*, 43(4), 670-690. <https://doi.org/10.1177/0309132518781011>
- Peet, R., & Watts, M. (1996). *Liberation ecologies: Environment, development, social movements*. Routledge. <https://doi.org/10.4324/9780203235096>
- Peluso, N. L., & Lund, C. (2011). New frontiers of land control: Introduction. *The Journal of Peasant Studies*, 38(4), 667-681. <https://doi.org/10.1080/03066150.2011.607692>
- Petavratzi, E., Sanchez-Lopez, D., Hughes, A., Stacey, J., Ford, J., & Butcher, A. (2022). The impacts of environmental, social and governance (ESG) issues in achieving sustainable lithium supply in the Lithium Triangle. *Mineral Economics*, 35(4), 673-699. <https://doi.org/10.1007/s13563-022-00332-4>
- Piguet, E. (2010). Linking climate change, environmental degradation, and migration: A methodological overview. *WIREs Climate Change*, 1(4), 517-524. <https://doi.org/10.1002/wcc.54>
- Piore, M. J. (1979). *Birds of passage: Migrant labor and industrial societies*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511572210>
- Poudel, M., Thwaites, R., Race, D., & Dahal, G. R. (2015). Social equity and livelihood implications of REDD+ in rural communities: A case study from Nepal. *International Journal of the Commons*, 9(1), 177-208.
- Radel, C., Schmook, B., Carte, L., & Mardero, S. (2018). Toward a political ecology of migration: Land, labor migration, and climate change in Northwestern Nicaragua. *World Development*, 108, 263-273. <https://doi.org/10.1016/j.worlddev.2017.04.023>
- Rigaud, K. K., de Sherbinin, A., Jones, B., Bergmann, J., Clement, V., Ober, K., Schewe, J., Adamo, S., McCusker, B., Heuser, S., & Midgley, A. (2018). *Groundswell: Preparing for internal climate migration*. World Bank. <https://doi.org/10.1596/29461>
- Rignall, K. E. (2016). Solar power, state power, and the politics of energy transition in pre-Saharan Morocco. *Environment and Planning A: Economy and Space*, 48(3), 540-557. <https://doi.org/10.1177/0308518X15619176>
- Roche, L., Link, A., Marinova, S., Coroama, V., & Finkbeiner, M. (2025). S-LCA of lithium mining in Chile and its potential impacts on water and the local community. *The In-*

- ternational Journal of Life Cycle Assessment*, 30(6), 1201-1228. <https://doi.org/10.1007/s11367-024-02378-8>
- Rosenzweig, M. R., & Stark, O. (1989). Consumption smoothing, migration, and marriage: Evidence from rural India. *Journal of Political Economy*, 97(4), 905-926. <https://doi.org/10.1086/261633>
- Rottenburg, R. (2009). *Far-fetched facts: A parable of development aid*. MIT Press. <https://doi.org/10.7551/mitpress/9780262182645.001.0001>
- Ryser, S. (2019). The anti-politics machine of green energy development: The Moroccan solar project in Ouarzazate and its impact on gendered local communities. *Land*, 8(6), 100. <https://doi.org/10.3390/land8060100>
- Scheidel, A., Del Bene, D., Liu, J., Navas, G., Mingorría, S., Demaria, F., Ávila, S., Roy, B., Ertör, I., Temper, L., & Martínez-Alier, J. (2020). Environmental conflicts and defenders: A global overview. *Global Environmental Change*, 63, 102104. <https://doi.org/10.1016/j.gloenvcha.2020.102104>
- Scott, J. C. (1998). *Seeing like a state: How certain schemes to improve the human condition have failed*. Yale University Press. <https://doi.org/10.2307/j.ctvxkn7ds>
- Scoville-Simonds, M., Jamali, H., & Hufty, M. (2020). The hazards of mainstreaming: Climate change adaptation politics in three dimensions. *World Development*, 125, 104683. <https://doi.org/10.1016/j.worlddev.2019.104683>
- Sen, A. (1999). *Development as freedom*. Oxford University Press.
- Stark, O., & Bloom, D. E. (1985). The new economics of labor migration. *American Economic Review*, 75(2), 173-178. <https://www.jstor.org/stable/1805591>
- Stern, N. (2007). *The economics of climate change: The Stern review*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511817434>
- Sullivan, S. (2012). Banking nature? The spectacular financialisation of environmental conservation. *Antipode*, 45(1), 198-217. <https://doi.org/10.1111/j.1467-8330.2012.00989.x>
- Sultana, F. (2011). Suffering for water, suffering from water: Emotional geographies of resource access, control and conflict. *Geoforum*, 42(2), 163-172. <https://doi.org/10.1016/j.geoforum.2010.12.002>
- Sultana, F. (2022). The unbearable heaviness of climate coloniality. *Political Geography*, 99, 102638. <https://doi.org/10.1016/j.polgeo.2022.102638>
- Táíwò, O. (2022). *Reconsidering reparations*. Oxford University Press. <https://doi.org/10.1093/mind/fzac055>
- Terrapon-Pfaff, J., Fink, T., Viebahn, P., & Jamea, E. M. (2019). Social impacts of large-scale solar thermal power plants: Assessment results for the NOORo I power plant in Morocco. *Renewable and Sustainable Energy Reviews*, 113, 109259. <https://doi.org/10.1016/j.rser.2019.109259>

- United Nations Framework Convention on Climate Change. (2022). Sharm el-Sheikh Implementation Plan: Decision -/CP.27 (Advance unedited version). <https://unfccc.int/documents/624444>
- United Nations Framework Convention on Climate Change Standing Committee on Finance. (2022). Sixth biennial assessment and overview of climate finance flows. <https://unfccc.int/documents/640759>
- United Nations Framework Convention on Climate Change Standing Committee on Finance. (2024). *Sixth biennial assessment and overview of climate finance flows* (Technical report). <https://unfccc.int/topics/climate-finance/resources/biennial-assessment-of-climate-finance>
- United Nations Conference on Trade and Development (UNCTAD). (2023). *Trade and Development Report 2022: Development prospects in a fractured world: Global disorder and regional responses*. United Nations. <https://unctad.org/publication/trade-and-development-report-2022>
- van Pampus, M., Hogenboom, B., Hoorn, C., & Seijmonsbergen, A. C. (2023). Uncertainties in the debate on the environmental impact of lithium brine extraction in the Salar de Atacama, Chile. *Evolving Earth*, 1, 100024. <https://doi.org/10.1016/j.eve.2023.100024>
- Vega-Araújo, J., Muñoz Cabré, M., Ramirez, Y., & Lerma, R. (2024). *Enabling factors of social acceptance of wind energy projects in La Guajira* (SEI Report). Stockholm Environment Institute. <https://doi.org/10.51414/sei2024.001>
- Warner, K. (2012). Human migration and displacement in the context of adaptation to climate change: The Cancun Adaptation Framework and potential for future action. *Environment and Planning C: Government and Policy*, 30(6), 1061-1077. <https://doi.org/10.1068/c1209j>
- Watson, C., Schalatek, L., & Evéquoz, A. (2025). *The global climate finance architecture* (Climate Finance Fundamentals No. 2). ODI Global & Heinrich Böll Stiftung. <https://www.climatefundsupdate.org>
- World Bank Group. (2022). World Bank Group climate change action plan 2021-2025: Supporting green, resilient, and inclusive development. <https://doi.org/10.1596/35799>
- World Bank Group. (2024). Tanzania: Resilient Natural Resource Management for Tourism and Growth (P150523). Project restructuring paper. <https://documents.worldbank.org/en/publication/documents-reports/document-detail/099111624034537747/p150523123dbfb0eb181fb1ca75aca77f3d>
- World Bank Group. (2025). *Morocco: Noor Solar Power Project (P131256 and P164288): Implementation completion and results report*. World Bank. <http://documents.worldbank.org/curated/en/099032625151032430>