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REVIEW

The Multi-Scalar Inequities of Climate Adaptation Finance: A Critical Review

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Abstract

Purpose of Review Following a multi-scalar analytical approach, this critical literature review explores the factors that determine adaptation finance accessibility and allocation with particular attention to how the needs of climate-vulnerable communities are considered.

Recent Findings Our review reveals that climate vulnerability is not a primary determinant in the accessibility and allocation of climate adaptation finance at inter-state, sub-national and local scales. Instead, factors such as institutional capacities and financial and political interests exert significant influence. This leads to maladaptation and multi-scalar inequities where climate finance favours relatively resilient groups across scales with less support for more vulnerable populations.

Summary We argue that finance does not trickle down, but "ripples" within a climate finance arena – where we define the latter as a messy space of competition, negotiation and collaboration. To unlock equitable adaptation finance patterns, future research should focus on the multi-scalar configurations of adaptation finance beyond the international level and consider local and regional territorial and scalar politics.

Keywords Climate adaptation finance · Climate justice · Climate vulnerability · Maladaptation · Climate change governance · Scalar politics

Introduction

In the wake of the Paris Agreement, climate adaptation finance has emerged as a salient topic within climate governance debates. One crucial aspect that underpins these discussions is the principle of prioritising climate-vulnerable communities [1]. Fulfilling this principle would mean that financial resources effectively target assistance where it is most urgently needed, mitigating immediate climate risks while fostering equitable climate protection. However, adaptation finance has consistently fallen short of expectations in comparison to mitigation finance, and the promised 100 billion dollar pledge set during the 2009 Copenhagen climate negotiations to support (climate-vulnerable) developing countries remains unfulfilled [2, 3••]. Consequently, the dominant discourse from governments, development institutions, and multilateral agencies stresses the need to scale up adaptation finance [4].

Often idealised and promoted as a silver bullet solution to the climate crisis [4], 'finance' has become a goal in and of itself, on par with adaptation and mitigation, as illustrated by the recently agreed-upon Glasgow Climate Pact:

> "[The Conference of the Parties] Stresses the urgency of enhancing ambition and action in relation to *mitigation, adaptation and finance* in this critical decade to address the gaps in the implementation of the goals of the Paris Agreement" [5, p.2].

In line with this, we can observe that adaptation investments are repeatedly marketed as de facto win–win solutions for both private and public actors. This is evidenced, for instance, by the Global Commission on Adaptation flagship report, asserting that investments in adaptation lead to "triple

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dividends": 1) avoiding future losses, 2) boosting economic growth and 3) creating social and environmental benefits [6, p.4–5].

Yet adaptation finance does not materialise in a political and social vacuum. The aspirational character of adaptation finance at global levels, and the emphasis to scale up finance, has a danger of undermining its political nature. Indeed, efforts to mainstream climate adaptation have reproduced conventional development practices and technocratic responses, further depoliticising climate adaptation [7]. However, there is a tension—and often conflict—between the everyday realities of adaptation finance and the previously mentioned principle of prioritising the most vulnerable. The financial and political dynamics behind this equitable allocation lack cross-scalar consideration, with most attention being paid to the inter-state level [3••, 8•]. Limited analysis exists at the subnational and local levels, as well as the interconnections between scales.

This critical review aims to shed some light on the underexplored scalar politics of adaptation finance allocation and its equity dimensions [8•, 9•]. For this, we use a multi-scalar analytical approach where we categorise scholarly work on the accessibility and allocation of adaptation finance into three main typologies of spatial inequity: inter-state, subnational and local. In our deployment of this triple typology of scalar inequity, we align with Hilbrandt & Grafe's reading of space as relational and emerging through practice [9•], and with Swyngedouw and Heynen's similar proposal of scale as a process, transformed through social conflict and political struggle [10]. As we outline in the discussion, we recognise that the typologies do not capture all scalar and interconnected patterns of adaptation finance, and instead propose them as heuristic devices to provide clarity and illuminate present gaps in adaptation finance literature. Moreover, this classification allows us to enrich adaptation finance scholarship with insights from other bodies of literature operating at different scales. Finally, we focus on equity as a counterpoint to the vast body of literature dealing with justice in relation to adaptation finance allocation, whether distributive, procedural, recognition, reparative, or neoliberal justice [11]. Thus, although not the focus of this critical review, we recognise that adaptation finance may result in unjust outcomes, not just spatially, but also along intersecting racial, gender and class lines.

Concepts and methods

We use a critical review method [12] and take a pragmatic philosophical stance, where we draw from a wide range of disciplines exploring adaptation finance including development studies, international relations, political economy, critical geography, political ecology, and urban planning. Literature was identified between January 2022 and June 2023 using Google Scholar, Scopus, and ResearchGate through search terms that included "climate adaptation finance", "climate vulnerability", "allocation", "climate adaptation justice" or "climate adaptation equity". In a subsequent phase, critical articles from the bibliographies of the identified publications obtained through the search terms were analysed. For this review—and in the absence of a universally accepted definition—we understand adaptation finance as *financial resources accessed and allocated for the implementation of climate adaptation actions* [13, 14]. Other critical concepts and their definitions are compiled in Table 1.

We structure the paper around the three established typologies of spatial inequity. First, we discuss inequitable inter-state patterns of adaptation finance and elaborate on the relationship between adaptation finance allocation and vulnerability between countries. We then move to explore inequitable sub-national patterns of adaptation finance accessibility and allocation, where sub-sections focus on urban–rural disparities and inter-urban disparities as two predominant patterns of spatial inequality. Third and finally, we discuss inequitable local patterns of adaptation finance accessibility and allocation, drawing primarily from the climate urbanism literature and geographical critiques on the financialisaton of (urban) climate governance. In the discussion, we bring the different elements of the paper together and discuss and introduce the concepts of multi-scalar inequities, the climate finance arena and rippling climate finance. We assert these as concepts to bring the dispersed literature together in an attempt to make sense of the factors that underlie the varied spatial configurations of adaptation finance accessibility and allocation and its equity dimensions. Finally, we close with concluding thoughts and reflections on future research.

Inter-state Accessibility and Allocation of Adaptation Finance: What Role for Climate Vulnerability?

One of the most prominent themes in scholarly debates on adaptation centres on inter-state exchanges, responsibilities and obligations [7, 8•]. In line with this, a significant body of literature that has emerged in the past 15 years deals with the allocation of climate adaptation finance between countries [1, 3••, 18–24]. Literature of this nature frequently highlights the ethical responsibilities of developed countries towards financing climate adaptation efforts in developing countries, contributing to and resonating with conversations held at UN climate change conferences—such as the yearly Conference of the Parties (COP)—and similar international political forums [8•, 11, 25, 26]. The role of climate vulnerability in said allocation is often a central topic of concern.

Table 1 Main concepts and definitions used in this review

Concept	Definition
Climate (adaptation) finance	While there's typically a differentiation made between funding and finance—where funding implies non-repayment and finance suggests repayment—this paper, for the purpose of legibility, employs a broad definition of climate (adaptation) finance as financial resources accessed and allocated for the implementation of climate (adaptation) actions [13, 14]. This includes both public and private finance, and instruments, including grants, equity, debt, household savings and insurance [15]
Climate vulnerability	The likelihood of being negatively impacted by climate change, encompassing factors such as sensitivity to harm, susceptibility to damage, and the inability to effectively cope with or adapt to changing environmental conditions [15]
Maladaptation	Actions that heighten the likelihood of negative impacts from climate change, such as new, deepend or shifted vulnerability to climate-related risks, unequal outcomes or reduced well-being, both now and in the future [15]
Climate apartheid	A worldwide regime of discrimination, segregation and brutality, rooted in divisions of race, socioeconomic status and gender, exploiting the pretext of climate change and responses to it to justify and perpetuate its oppressive structures [16]
Scalar politics	Scalar politics involves the perpetual restructuring of spatial scales, serving as a crucial component of social strategies aimed at asserting or safeguarding authority over scarce resources and/or seeking empowerment [10]
Multi-scalar inequities of climate finance*	A form of spatial inequity where the most vulnerable groups across scales—be they vulnerable states, subnational administrations, or local communities—are not the primary beneficiaries of climate adaptation finance accessibility and allocation
Climate finance arena*	Inspired by Hilhorst & Jansen's [17] concept of a humanitarian arena, we propose the climate finance arena as a way to portray the climate finance landscape as a messy political space where decision-making involves diverse social actors at different levels collaborating, negotiating, and competing for access to and allocation of financial resources. Unlike the static imagery of a climate finance "landscape" or "architecture," this concept underscores the pivotal dynamics of territorial and scalar politics, including the agency of recipients of finance and their ability to attract and compete for finance
Rippling climate finance*	Rather than "trickling" down according to vulnerability, we hypothesise that climate finance as a political–ecological process "ripples" into opportunities for some while creating barriers for others across scales and sectors. The concept "rippling" suggests not everyone benefits from climate finance in an equitable way, and highlights the institutional and political dimensions of accessing and allocating climate finance, acknowledging both vertical and horizontal dynamics

The asterisks (*) indicate proposed concepts

Although "much depends on the timeframe of data sampling, the specific funder, whether they are bilateral or multilateral and how the data is analysed" [3••, p.205], recent research shows a country's vulnerability is not a primary determining factor in the allocation of climate adaptation finance [1, 3••, 20, 22]. A recent report [27] found that the most prominent and largest climate funds globally – the Climate Investment Funds (CIF) and Green Climate Fund (GCF)—have not provided any adaptation finance to many of the most climate vulnerable countries. Garschagen and Doshi [1] reach similar conclusions, indicating that the most vulnerable countries shortlisted by the GCF, particularly low-income developing countries in Africa, do not gain from these funds. Notwithstanding, Islam [24] argues that although there is a relationship between climate adaptation finance allocation and vulnerability, this relationship is "parabolic", meaning that moderately vulnerable countries receive relatively more climate adaptation finance than the most vulnerable countries.

If not vulnerability, what factors determine the accessibility and allocation of adaptation finance at the international level? Three main interconnected dimensions prevail according to the literature. First, some authors argue that climate finance flows to countries based on the perceived ability to manage and carry out projects, institutional capacity, and climate change and political commitments rather than adaptation needs or vulnerability [22]. In connection with the aforementioned, the allocation of adaptation finance has sparked an ongoing debate over the balance between efficiency and equity [3••]. Evidence points to the prioritisation of efficiency and cost-effectiveness being given higher priority than ensuring equity [19]. These patterns are consistent with the logic behind traditional bilateral development cooperation/aid [23]. What is more, the institutionally fragmented "architecture" of multilateral climate funds has led to misunderstanding and extraordinary bureaucratic demands on the already overburdened governance systems in developing countries [2, 23, 28, 29]. This occurs on top of the fact that the most vulnerable countries have weak institutional capacities in terms of accessing and managing climate finance [1].

The second factor is unequal power in decision-making processes, most notably the role of donor interest [3••, 7]. Ciplet et al. [8•] argue from a world-systems theory perspective that structural economic advantages are maintained and reinforced by wealthy states as well as through the power

of global capitalist elites, resulting in a global hierarchy of uneven relations between wealthy vs. deprived nations. With most climate finance flowing through conventional bilateral and multilateral mechanisms outside the UNFCCC, donor countries have a strong grip on how climate finance is spent. In contrast, countries which are part of the core (e.g. the West) have overall more agenda-setting power and power to influence the allocation of finance through intermediary institutions (MDBs, UN Agencies etc.) [4, 8•]. Even for climate finance flows outside official UNFCCC mechanisms, developing countries have limited decision-making power [8•]. Webber [30] shows that the same holds for global city networks that are predominantly headquartered in global North cities, with a considerable number of their beneficiary cities located in the Global South. Within this backdrop of global power inequality, Weiler and Klöck [23] as well as Barret [3••] contend that donor interests, encompassing geopolitical, military, and economic factors, significantly influence allocation decisions in climate finance negotiations. To the dismay of developing countries, these power imbalances also manifest in minimal additional climate finance allocated beyond existing official development aid [11, 24, 31•]. This is problematic since the primary objective of climate finance is to assist recipients in coping with the additional challenges imposed by climate change on top of already existing development challenges [32].

A third and final explanatory dynamic emerging from the adaptation finance allocation literature at the inter-state level has to do with the socio-political implications of proliferating debt-based instruments over grants. Despite repeated calls from developing countries for grant-based funding [11], the vast majority of general climate finance (both mitigation and adaptation action-oriented) are loan-based [33]. More specifically, 62% of public climate adaptation finance in 2016–2020 was allocated as loans [31•]. Roberts et al. [2] highlight the equal treatment of grants and loans in the reporting of climate finance flows. In other words, no differentiation between these two types of financial assistance is made when reporting on the progress of scaling up finance (e.g. to reach the 100-billion goal), despite their significant differences in terms of equity [2, 11]. Grants primarily serve as a way for developed countries to address their historic responsibility given their disproportionate contribution to causing climate change (also coined "climate debt") and provide developing countries with opportunities to manage the impacts of climate change without deepening indebtedness [11]. On the other hand, loans require developing countries to repay the borrowed amount along with interest, even in the case of concessional loans with interest rates below market rates [2]. Weikmans [31•] asserts that loans are entrenched within a consequentialist viewpoint predominantly advocated by developed nations and multilateral development institutions. Proponents of this stance prioritise the profitability of climate adaptation projects as a means to ensure loan repayment [30]. Indeed, the rationale behind adaptation finance seems motivated by economic growth and profitability considerations [4, 30, 34]. The abundance of debt-based climate finance instruments reflects a broader neoliberal logic that deepens the debtfare state and shifts power to market actors [35, 36]. International climate agreements, such as the Copenhagen Accord and the Paris Agreement, do not specify or distinguish between grants and loans when discussing climate finance [11], meaning that predominant political economic market logics are de facto perpetrated. Scholars have emphasised that debt-based instruments may thus reinforce dependencies, indebtedness and systemic inequities between countries [2, 11, 32, 36].

All in all, as summarised in the top section of Table 2, the literature refers to various determinants, alongside vulnerability, that underlie adaptation finance allocation at the inter-state scale, such as weak institutional capacities/low absorptive capacity [1, 3••, 22], cost-effectiveness and donor interests [3••, 23], overrepresentation of western countries in intermediary institutions [4, 8•], and the prevalence of debt-based instruments over grants [2, 11, 32, 36]. This enables the economic, financial and political interests of core nations to take precedence over vulnerability considerations, leading to inequitable inter-state patterns of adaptation finance allocation.

Allocation and Accessibility of Adaptation Finance at The Sub-National Scale: What Role for Climate Vulnerability?

Although the climate justice narrative has historically been framed primarily from an inter-state perspective [8•, 37], equity considerations do not cease at state borders. Climate vulnerability is ultimately experienced as a local issue, and local and regional inequalities exist within countries, just as they do between countries. Despite scholars identifying spatial injustice and within-country differences as a major concern relatively early on in adaptation scholarship [38], few studies focus on how adaptation finance is accessed and allocated unevenly within countries. Consequently, this remains an overlooked topic in current scholarship on adaptation finance..

Existing evidence, primarily derived from the Global South, suggests that the role of vulnerability in sub-national allocation of adaptation finance is inconclusive. For instance, in Bangladesh, disaster risk finance is positively correlated with the most vulnerable and risk-prone districts [39]. However, Barrett's study [40] in Malawi reveals that within-country allocation of adaptation finance is driven by factors such as cost-effectiveness, donor utility, and absorptive capacity,

Table 2 Multi-scalar inequitable patterns of climate adaptation finance in the climate finance arena, illustrating rippling climate finance

Scale	Driving forces behind inequitable patterns of climate adaptation finance
Inter-state Inequitable climate protection between countries	• Disparities in (perceived) institutional capacity, investment readiness and absorptive capacity [1, 3, 22, 24] • Lack of clear rules on what counts as climate finance [2] • A disproportionately high reliance on market and debt-based instruments that perpetuates systemic dependency and inequality [2, 11, 32, 36] • Cost-effectiveness and donor interests [3 ●●, 23] • Overrepresentation of core countries (the West) in climate finance intermediary organisations and unequal relations of power in adaptation decision-making [7, 8, 30] • Multiplicity of multilateral climate funds and their distinct procedures, standards and rules [28]
Sub-national Inequitable climate protection between cities & Inequitable climate protection between cities and rural communities	• Cost-effectiveness and donor interests [3,●●, 23] • Disparities in track records that demonstrates financial expertise and a commitment to financialize infrastructure [9] • Unequal access to financial markets and disparities in creditworthiness [36, 56] • Insufficient bureaucratic/administrative capacities or absorptive capacity [41, 42, 44, 49] • Sub-national actors sidelined due to disconnections and systemic barriers in multinational climate funds (the missing middle) [42] • Appropriation of resources by cities from rural communities [44●, 48] • Political representation and lobbying efforts of (big) cities vs. small cities or rural communities [44●. 99] • Lack of territorial coordination at the national level [50, 51] • Varied levels of experience among local governments to apply for competitive funds [51] • Uneven landscape of municipal fiscal vulnerability [57]
Local Inequitable climate protection within local administrations or communities	• Financial and private actors encroaching upon local governance of climate change [36, 53] • Top-down approaches that do not draw on local knowledge or local scientific data [43, 73] • Bankability of projects and the power of investors: return on investments are prioritised over public and social values [47] • Gentrification and displacement of disadvantaged communities due to urban revalorisation and rising property prices following green adaptive infrastructure [76, 80, 82, 83] • Appropriation of financial and social benefits of green adaptive infrastructure by elite groups [85]

rather than vulnerability. The latter indicates that adaptation finance allocation within countries is influenced by development aid logic similar to those observed at the international level [22, 23, 41].

The marginalisation of sub-national actors in adaptation finance governance, as well as disconnections and systemic barriers within multinational climate funds – referred to as the missing middle [42] – offer a potential explanation for the observed trends. What is more, power imbalances between different levels of government, similar to those underlying inter-state disparities, have been found to result in differential access to adaptation finance among local governments [43].

Empirical evidence from Kenya demonstrates that the introduction of structural reforms resulting in heightened levels of devolved and decentralised frameworks for climate adaptation finance has yielded notable enhancements in the allocation of adaptation finance to the most vulnerable districts [40]. The improvements described were the result of meticulous planning and the efforts exerted by coordination committees, which actively fostered heightened transparency, enhanced participation and diminished politicisation [41]. This finding confirms that sub-national adaptation finance is influenced by governance structures and political dynamics.

The existing body of literature on adaptation finance accessibility and allocation at the sub-national level can gain valuable insights from disciplines such as urban planning, climate urbanism and territorial politics. In addition, recognising the complexity and heterogeneity of the state is crucial to understanding the subnational inequities arising from climate finance. Taking the above as a point of departure, we build on Shi [44•] and structure the discussion on sub-national adaptation finance and its accessibility and allocation around two major and interrelated inequitable patterns: urban–rural inequitable climate protection and inter-urban inequitable climate protection.

Urban–rural Disparities

As society wrestles with the climate crisis, scholars have framed the dominant development and policy paradigm as one of climate urbanism [45]: "a policy orientation that (1) promotes cities as the most viable and appropriate

sites of climate action and (2) prioritises efforts to protect the physical and digital infrastructures of urban economies from the hazards associated with climate change" [46, p.1]. Considering the recognition of cities as primary locations for climate adaptation and mitigation initiatives [47] and significant recipients of climate finance [4], it is plausible that cities are gaining a head-start in terms of adapting to climate change compared to their rural counterparts.

Indeed, Shi [44•] shows the current policy paradigm of climate urbanism creates a competitive arena in which large cities appropriate resources from rural communities, turning rural communities into "sacrifice zones" (p.56). In so doing, climate change reinforces the historical extractivist relationship between the urban and the rural, deepening vulnerabilities in rural areas [48]. Recent studies indicate that this extractive relationship might extend beyond the realm of natural resources and also apply to climate adaptation finance. Although not focusing uniquely on climate adaptation, Seong, Losey & Gu [49] find that grants from the Hazard Mitigation Grant Program in the USA are disregarding rural communities, with grants primarily flowing to urban areas. This occurs because, in comparison to their metropolitan counterparts, rural towns experience more severe budgetary limitations, are unable to meet the cost-sharing requirement and lack the bureaucratic capabilities to apply for these federal grants [49].

In Europe, similar processes of urban–rural inequality can be observed, as is the case with EU Next Generation Funds. With a significant portion (over 37%) of these funds specifically earmarked for addressing climate change, the NextGeneration Funds hold substantial importance as a source of climate finance for local governments within the European Union. With grants and loans subject to intra-country distribution, territorial coordination and balance are lacking [50, 51]. For example, in Spain, despite the national recovery plan addressing both urban and rural concerns, there is a noticeable absence of crucial synergies and insufficient collaborative efforts and actions between urban and rural administrations. Moreover, limited steps have been taken to address uneven capacities and promote interterritorial collaboration [50].

Even in cases where municipal capacity imbalances are being targeted, such as in Italy, where the national government plans to hire "3,800 experts (of which 2,800 in the southern regions), where larger gaps exist between the tasks to be fulfilled and the human resources and skills available" [52, p.14] it remains questionable whether the efforts are sufficient at addressing the vast territorial unbalances that exist, not just between rural and urban administrations, but also more generally between historic north–south development inequalities and inter-urban disparities.

Inter-urban Disparities

The accessibility and allocation of climate adaptation finance also often generates inequalities *between* cities. For example, in the context of the Next Generation Funds, Ferry [51] states that in England: "Cities enter into deal-making with varied experience and resources, producing an unbalanced set of agreements across the country with competitive bidding that places funding decisions with central government" (p.51). With many cities, primarily secondary cities where climate finance is not yet the norm [9•], lacking resources and access to financial markets, adaptation will in many cases be privately led. Teicher [53] refers to *competitive resilience* to highlight how private actors such as real estate firms invest in adaptation actions to attain a competitive advantage. They raise a cautionary note that patterns of intra-urban inequity – for example, where market-driven real estate projects transfer vulnerability from the privileged onto disadvantaged groups – are particularly likely to manifest in resource-constrained secondary cities, where reliance on private sector resources for climate change adaptation is higher. In these cities, the act of welcoming and attracting private wealth may confer upon private actors an increased influence in city governance and climate adaptation planning [53]. This observation resonates with the concerns raised by other scholars who have highlighted the potential encroachment of financial actors on urban governance [36].

Ultimately, these warning signs are based on the premise that local governments do not operate at equal starting points. Shi et al. [38] argue that "the lack of adaptation by cities with fewer resources represents a fundamental form of spatial injustice, as future resilience to climate impacts will exacerbate existing developmental gaps between large, wealthy cities and 'the rest'" (p.133). While financial resources are widely recognised as a significant barrier to adaptation, certain local governments encounter more pronounced constraints [38]. Part and parcel of this inequitable dynamic is how finance interacts with race and other intersectional realities historically in space [54]; for example, Ponder [55] has shown how territorial blackness and financial risk are linked in how majority-Black cities in the USA paid more for their water infrastructures than majority-white cities.

Unequal starting positions between cities in adaptation are further compounded by uneven access to financial markets and differences in creditworthiness across local administrations. Research conducted by Rashidi et al. [56] reveals that credit ratings can be downgraded by up to three levels in the wake of climate disasters, with the severity of the event playing a significant role. Consequently, cities that require climate adaptation finance after recent climate disasters may paradoxically face challenges in accessing the necessary finance due to their lower creditworthiness. Bracking

& Level [36] argue that differential access to climate finance at the sub-national level exists because "neoliberal market-based logics reward the most creditworthy cities with direct municipal access to debt finance, while excluding those cities unlikely to produce secure derivative income streams to guarantee repayment" (p.11). Hilbrandt and Grafe [9•] demonstrate how standardising adaptive infrastructures makes them investable and bankable. They underline how this can have a catalytic effect as the first project funded establishes a track record and demonstrates financial expertise and a readiness to financialize infrastructure. This catalytic effect results, according to Hilbrandt and Grafe [9•] in a "geography of relational absences and presences" (p.3) in urban climate finance, with a restricted number of projects in a limited number of cities absorbing the majority of funds.

While the urban–rural and inter-urban disparities stand out as prominent examples of sub-national inequities, various other forms of sub-national inequity exist. For example, Shi and Varuzzo [57] show how financial incentives favoring development in flood-prone regions may alter future municipal revenue streams in the context of climate change. They conclude that coastal municipalities face varying degrees of fiscal risk from sea level rise, and argue that this uneven landscape of fiscal vulnerability may increase inequities between local administrations to cope with the impacts of climate change [57].

All in all, as summarised in the middle section of Table 2, evidence from the literature shows that vulnerability is not the main determining factor in the accessibility and allocation of adaptation finance at the sub-national level. Although vulnerability plays some role in certain contexts, it is evident that the accessibility and allocation of adaptation finance relies on a range of factors including institutional capacities, political dynamics and interests, governance structures, budget scarcity, and access to financial markets. These findings highlight the political and socio-ecological nature of adaptation finance, emphasising the importance of considering territorial and scalar politics and competition.

Local accessibility and allocation of climate adaptation finance: To what extent do local climate adaptation investments prioritise climate-vulnerable residents?

The 2022 IPCC Working Group II report [15] emphasises that "the greatest gains in well-being can be achieved by prioritizing finance to reduce climate risk for low-income and marginalized residents […]" (p.32). However, empirical data on adaptation finance flows is largely lacking [58•], making it difficult to assess how financial flows and processes relate to local equity. To outline what happens when finance reaches the local level, we consider the political economic processes shaping the deployment of local climate adaptation finance, emerging financial instruments and the equity impacts of green infrastructure investments.

To adapt to the consequences of climate change "municipalities are experimenting with a range of financial instruments, including tax increment financing (TIF), green bonds, in-lieu fees, mitigation banking and offsets, as well as credit trading […]" [59, p.3]. These forms of financial experimentation are an expression of a much broader societal and economic shift from entrepreneurial urbanism, in which the provision of public services is largely privatised and outsourced to private companies [50, 61], to financialised urbanism, in which financial markets and institutions become increasingly important in the governance of a city – a process also known as financialisation [62].

Emerging evidence from urban political ecology and the wider critical geography field suggests that the silver bullet discourse around finance needs to be problematised. Climate finance instruments such as green bonds, for example, have been shown to lead to inequitable urban socio-spatial impacts [63–65]. Similar to the dynamics of inter-state allocation of adaptation finance, this phenomenon can be attributed to the fact that green bond investments promote neoliberal economic growth logic, prioritising ideals such as profitability and a secure return on investment [66]. Under such principles, vulnerability assumes a subordinate position.

However, relatively positive evaluations on climate finance at the urban level also exist, for instance by those emphasising "healthy credit" [67] or those pointing to the potential of finance to achieve justice goals depending on the political-economic context in which it is deployed [68]. How climate finance is deployed and enacted matters, in this regard, Webber et al. [69•] make a valuable contribution by proposing a reparative logic to truly foster socially just outcomes. Additional noteworthy suggestions are made by Rubin et al. [70, p.2] who put forward four evidence-based guidelines to prioritise equity in climate adaptation finance, which involve upholding community autonomy, pursuing transformative approaches, avoiding maladaptation, and promoting integration across sectors when funding adaptation projects.

Despite contrasting proposals and positions, scholars agree on the need for caution. In the context of financialised climate governance, urban power may be shifting from the city government to financial actors and institutions [36]. Under their influence, policymakers may be tempted to ignore vulnerability indicators by prioritising less risky investments that lead to more immediate and visible results, such as high-value assets concentrated in urban centres at the expense of more climate-vulnerable areas [46, 71]. Indeed, not only do rating agencies reward and punish some cities over others, as we have seen previously, they also influence

the way in which adaptation and resilience is implemented based on their neoliberal perception of what "counts" as resilience [72].

The financialisation of urban climate governance is evident in the prevailing development and policy framework of climate urbanism, which has been described as "business-as-usual capitalism with climate characteristics" [44•, p.59], representing a "technocratic, neoliberal approach to development" [16, p.44]. One manifestation of the latter is the conventional top-down nature of planning for climate adaptation that excludes the use of local scientific data and local knowledge [73]. In the absence of local vulnerability assessments [74], poor adaptation planning and related adaptation investments are likely to lead to maladaptation or unintended negative consequences of adaptation actions [75].

By prioritising financial and political interests, and disregarding local climate vulnerability data, climate adaptation investments not only overlook vulnerability but also have the potential to worsen it. Research shows that urban climate adaptation projects are often unresponsive to vulnerability needs, leading to inequitable outcomes and uneven climate protection [44•, 59, 63, 76–79]. Studies have shown that urban adaptive infrastructures contribute to processes of gentrification and socio-spatial exclusion [76, 79–82]. For instance, (green) adaptative infrastructures may be concentrated in economically valuable areas or raise property prices in poor neighbourhoods, leading to the displacement of poor and marginalised residents [76, 79–81, 83, 84]. Garcia-Lamarca et al. [85] show how private players seeking to decrease their financial risk may co-opt public greening interventions, often part and parcel of climate adaptation responses. They argue that the allure of green areas decreases financial risk for investors by ensuring a predictable return on investment. As a result, investors choose premises adjacent to these "natural" areas, subsequently hijacking their social, economic and health benefits, in a process that they coin "urban green grabbing".

Scholars point out that climate urbanism research needs to elaborate on the shortcomings of technocratic and pro-growth urban climate interventions [86]. Though in its early stages, this need is beginning to be addressed. According to Bulkeley [87] a third wave in climate urbanism research is focusing on "scrutinising questions of power and of how, and by and for whom, climate urbanism is being enacted" [p.280]. Elementary to this body of scholarship is the realisation that urban climate projects are not neutral or win–win interventions but rather competitive processes in which vested financial and political interests operate [45, 72, 79, 88].

Such dynamics have long been identified in critical urban theory [60], for example through what Graham and Marvin [89] call splintering urbanism, which has parallels with emerging work on climate apartheid. Splintering urbanism draws attention to urban areas experiencing growing spatial divisions and fragmentation along socio-economic, racial and environmental lines. These spaces are marked by significant economic disparities and stigmatisation, which further exacerbate social and environmental injustices. In the context of climate change, the expansion of enclaves and exclusionary spaces resonates with what scholars are calling climate apartheid [16, 90, 91]. While relevant to the climate urbanism literature and debate in illustrating manifestations of climate inequities [91], this concept more broadly refers to a global system of segregation between the climate privileged and the climate vulnerable [16]. Building from Desmond Tutu's use of apartheid in a 2008 Human Development Report, stating that "adaptation is increasingly becoming a euphemism for global-scale social injustice" [92, p.166], the concept draws attention to the ways in which climate protection intersects with race and other positions and backgrounds.

Some of the emerging urban climate finance literature directs its attention toward such concerns. For example, Claussell et al. [93] demonstrate how, through a "blue-lining" process – inspired by the historic racist practice of red-lining – banks split urban areas into climate sacrifice zones and climate-safe havens and decide whether or not to give loans based on new lines of risk, such as susceptibility to flooding. These sacrifice zones disproportionately affect communities of colour who subsequently have less access to finance to adapt their neighbourhoods to rising sea levels, echoing work by Ponder [55] linking territorial blackness and financial risk. Similarly, calls have been made for adaptation finance to better take into account gender inequities by becoming gender-sensitive [94–96]. There is a need to deepen emerging research on how financial processes intersect with race, gender and other intersectional positions, to more carefully comprehend how such positions connect into multi-scalar patterns of climate adaptation finance and examine the extent to which the institutional makeup of financial processes may sustain said climate apartheid.

All in all, as summarised in the bottom section of Table 2, the literature so far demonstrates that local climate adaptation investments often overlook vulnerability, contribute to and deepen gentrification and socio-spatial exclusion, and may be co-opted by private players seeking financial returns. The financialisation of local climate governance, combined with top-down, technocratic, and pro-growth planning approaches, frequently results in maladaptation. Amidst this context, power dynamics and vested interests take precedence over the role of local vulnerability assessments (which are often missing). Thus, the drivers of local accessibility and allocation of climate adaptation finance extend beyond vulnerability, encompassing political-economic factors and the influence of financial actors prioritising profitability.

Discussion

As summarised in Table 2, the literature reviewed tacitly demonstrates that the most vulnerable groups at each scale — be they vulnerable states, sub-national administrations or local communities — are not the ones who benefit most from climate adaptation finance, giving rise to multi-scalar inequities of climate adaptation finance. Within each scale, the relatively resilient, capable and powerful actors who are better-positioned to defend their political and financial interests, seem to attract and benefit most from climate adaptation finance. Instead of narrowing the gaps in climate protection, our review shows climate adaptation finance – quite paradoxically – may exacerbate and deepen existing disparities, not just between countries, but across scales and geographies, raising questions of justice and maladaptation.

We hypothesise that the multi-scalar inequities of climate adaptation finance crystallise into safe havens and sacrifice zones across scales and geographies, and are driven by a complex interplay of competing political interests, environmental concerns, and societal dynamics. Despite climate finance's inherent political nature, there are ongoing efforts to depoliticise climate adaptation investments, either directly or indirectly. The key literature on international adaptation finance primarily focuses on institutionalised climate funds at the international level, often neglecting the accessibility and allocation processes at the subnational and local levels, as though finance will miraculously "trickle down" to effectively benefit those in greatest need once it reaches a country. In this light, we propose the *climate finance arena* as a valuable concept in relation to climate finance overall. This conceptualisation builds on Hilhorst & Jansen's [17] concept of a humanitarian arena and helps open up regional and local ontologies of climate finance [97]. While the literature speaks of a climate finance "architecture" [1, 13] or climate finance "landscape" [3••, 31•, 33], we believe a more dynamic conceptualisation like *climate finance arena* is needed to do justice to the messy actualities and scalar and territorial politics of climate finance.

In the climate finance arena, forms of domination can be subtle, such as in the case of knowledge-sharing city platforms, but also rather crude in the form of lobbying. For example, Mocca [98] shows how city coalitions and networks may reinforce "asymmetrical relationships among network members, enabling the ´soft domination' of more advanced cities over less successful ones" (p.140). While not specifically centred on adaptation finance, Payson [99] illustrates how cities advocate for funding across various policy domains within a federal framework. This lobbying results in increased state finance flowing to these cities, particularly those with more significant financial resources, thus exacerbating inequities. In many ways, the notion of competitive resilience, although intended to refer to private actors at the intra-urban level, also holds for competition between local governments. The concept of the climate finance arena recognises this competition at local and sub-national levels and puts greater emphasis on their agency. This emphasis is necessary because sub-national and local political interests and agendas are often ignored in climate adaptation planning, whereas local and sub-national actors such as cities increasingly lead climate adaptation processes [100]. By recognising the agency of various actors, such as intermediaries and local recipients, and acknowledging the pivotal role of negotiating funding conditions, including the negotiation of vulnerability, we believe that an arena approach has the potential to advance climate finance scholarship.

At the same time, adopting a heuristic approach, we acknowledge that this critical review falls short in fully capturing the intricacies and interconnectedness of scales and spatial dynamics. Inspired by the concept of scale framing, we acknowledge scale is "[…] not simply a fixed level in a hierarchy of territories that cascade downwards from the international through the national to the urban" [101, p.5], but moves in all directions, opening up avenues for alternative scalar configurations. While we bring to light the inequitable patterns "within" each of the three scalar typologies discussed, less is known about how scaled processes [102, p.21] interact with others to create the nuanced multi-scalar configurations that ultimately determine who benefit from climate adaptation finance. Future research could investigate how disparities in the accessibility and allocation of climate finance not only persist and are (re)produced within each spatial scale, but also across and between different spatial scales. This topological thinking "includes considering the ways in which these spaces are entangled in and shape extant territorial divisions and inequalities […]" [9•, p.2].

Within the climate finance arena, and following this thinking, we hypothesise that finance does not trickle or cascade down according to vulnerability, but *ripples* across scales and sectors as a political–ecological process facilitating opportunities for some while debilitating others. Naturally, climate finance involves more than just distributing resources—it also involves attracting them. Similar to how ripples in water spread out, finance as a political–ecological process moves both vertically up and down and horizontally in and out. It is attracted (inward) and distributed (outward) through the actions of political actors who negotiate access and opportunities navigating scales. For instance, local administration lobby to attract and access finance at higher levels (vertical) while competing and

collaborating with other local administrations, e.g. in city coalitions (horizontal). Simultaneously, decisions made at higher levels can impact sub-national and local levels, such as EU funding programmes affecting local communities (vertical). Within these rippling movements of negotiating the accessibility and allocation of finance, our review demonstrates finance seems to benefit the relatively resilient and powerful actors across scales and sectors who are better able to defend their interests. For this reason we propose the concept of *rippling* as a way to draw attention to political and institutional inequity, to discrepancies in allocation and access to finance and associated terms and conditions, and highlight the need and responsibility to create a more single level playing field within the climate finance arena. Understanding how public and private climate finance ripples across different scales and sectors, creating opportunities and barriers, while actors navigate, negotiate and compete in both vertical and horizontal ways, requires deeper investigation.

Conclusion

This critical literature review, bringing together a wide range of disciplines including development studies, international relations, political economy, political ecology, critical geography and urban planning, explored to what extent climate vulnerability is a determinant in the accessibility and allocation of climate finance at multiple scales. In so doing, we brought into conversation scholarly debates around international climate finance allocation and urban climate finance, while also shedding light on the relatively overlooked issue of sub-national accessibility and allocation of climate adaptation finance.

We find evidence that climate vulnerability is not the main determinant for accessibility and allocation of climate adaptation finance at inter-state, sub-national and local scales, and that climate adaptation finance can exacerbate existing vulnerabilities and create new ones. In this context, climate adaptation finance is subject to various financial and political interests, shaped by varying institutional capacities, and characterised by a highly competitive process. Table 2 summarises the driving forces behind the inequitable patterns of climate adaptation finance identified in the literature based on each of the three scalar typologies. Based on this evidence, we argue that climate adaptation finance cannot be represented as a static landscape or architecture; rather, it operates within a dynamic *arena* as a political–ecological process, creating *ripples* that manifest as opportunities for some, and barriers for others.

At the international level, climate finance debates largely neglect the agency of sub-national and local actors to attract and compete for finance accessibility and allocation, falsely assuming that sub-national and local priorities naturally align with international and national political priorities. As next steps for scholarship, we urge scholars engaged in climate adaptation finance research at the international level, particularly those addressing justice concerns, to broaden their scope and recognize the significance of regional and local actors and political processes. In essence, adopting a multi-scalar analytical approach emerges as a critical next step in effectively addressing inequitable climate adaptation. This approach underscores the climate finance landscape as a messy arena where various stakeholders, including both providers and recipients of climate finance, along with the most vulnerable, exert agency. Operating from varying levels of vulnerability and capacity to attract, access, and manage climate finance, they engage in negotiation, collaboration, and competition to secure climate protection. In light of this context, we advocate for national-level policymakers to strengthen state interventionism and facilitate national-level coordination that prioritises vulnerability to promote fair adaptation opportunities among sub-national administrations. This entails, among other factors, taking into account the disparities in climate and fiscal vulnerabilities, the divergence in financial and technical capacities, and the unequal access to financial markets for climate adaptation initiatives.

Our approach, rejecting an ideal-type "landscape" or "architecture", enables a deeper exploration of the scalar politics involved in climate finance. By illustrating how climate finance isn't distributed or accessed based on vulnerability, but instead, is entangled in complex power asymmetries that ripple into multi-scalar inequities, we draw focus away from (international) discussions centred on quantity (X billion in climate finance), towards the quality and conditions of climate finance as a political–ecological process. Through this endeavour, we aspire to enrich climate finance debates.

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Declarations

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- • Of importance
- •• Of major importance

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