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Beyond unintentionality: considering climate maladaptation as cyclical

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Abstract
Climate adaptation is imperative; however, instances of maladaptation are increasingly documented in sectors and locations around the world. Despite the prevalence of maladaptation, researchers and intergovernmental actors, including the Intergovernmental Panel on Climate Change, consistently frame it as "unintentional." Drawing from environmental injustice, critical development studies, critical race theory, and coloniality scholarship, we argue the impossibility of characterizing maladaptation—now a global-scale phenomenon—as an unintended consequence of well-intentioned adaptation planning. This paper reframes the (re)production of climate maladaptation as a foreseeable result of the unequal systems of colonial racial capitalism through which adaptation is implemented and refracted. Systems-level change that confronts uneven relations of power, rather than incremental institutional reform, can address the prevalence of maladaptation. Treated as such, tackling climate maladaptation becomes a "political project"— not merely a "planning project."

Keywords Climate maladaptation · Climate vulnerability · Transformative adaptation · *Longue durée* · Colonialism · Injustice

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1 Introduction

Adaptation is now an imperative, not an option, for communities on the frontlines of climate change. Its dominant modes of planning and implementation are, however, intensively critiqued (Eriksen et al. 2021; Mills-Novoa 2023). To this end, many adaptation activities have not demonstrably contributed to sustained and long-term climate vulnerability reduction (Berrang-Ford et al. 2021). In fact, mounting evidence demonstrates their tendency to aggravate climate-related risks, particularly for marginalized groups—a phenomenon called "climate maladaptation" (Magnan et al. 2016; Schipper 2020; Intergovernmental Panel on Climate Change (IPCC) 2022a). Today, calls abound to identify the drivers that cause adaptation activities to go awry and to develop strategies to reduce these supposedly "unanticipated" outcomes. It is often assumed that these efforts will help adaptation live up to ideals of equitable and sustainable risk reduction under climate change.

In this article, we offer a different interpretation for understanding climate maladaptation—one that departs from considering it as an "unexpected and unwanted outcome of an adaptation strategy […] originally implemented with good intentions" (Schipper 2020, p. 413). To us, what is in fact unexpected is how climate maladaptation—now a global, multisectoral, and repeatedly occurring phenomenon (IPCC 2022a)—continues to be considered surprising, accidental, and even, unintentional. Building on prior discussions (Forsyth and McDermott 2022), we argue the prevalence at which climate maladaptation is observed cannot be summed to a series of unfortunate planning oversights and should instead be considered anticipatable, foreseeable, and *even integral to* dominant adaptation planning processes. Perspectives informed by environmental injustice, critical development studies, critical race theory (CRT), and coloniality scholarship can inform this argument—and in doing so, can help develop a more strongly theorized response to this global phenomenon. In conversation with these literatures, we introduce the concept of "cyclical maladaptation" to draw attention to the structural and relational processes that lead climate maladaptation to become, not merely a possibility or a likelihood, but a persistent reality. We conclude that "[c]atching maladaptation before it happens" (Schipper 2022, p. 617) will require fundamental change to social, economic, legal, and political relations over and above improved planning on a case-by-case basis.

2 Cyclical maladaptation

Climate maladaptation often refers to "[…] the increase of vulnerability to climate variability and change in a location, sector, or group of people" associated with adaptation practices (Magnan et al. 2016, p. 653). Researchers continue to identify important mechanisms prompting climate maladaptation. These include reducing complex problems to technical fixes, neglecting the social or "contextual" conditions[1] in which adaptation is implemented, retrofitting development programs with adaptation objectives, and measuring adaptation "success" through metrics that reflect particular configurations of power (e.g., Work et al. 2019; Schipper 2020; Eriksen et al. 2021; Shah et al. 2021; Bertana et al. 2022). The iden-

[1] For more on "contextual" or "social vulnerability", i.e., how multi-dimensional social and political-economic contexts shape disparities in climate change risk, refer to Dow et al. (1992), Bohle et al. (1994), Kasperson and Kasperson (1996), Eakin and Luers (2006), O'Brien et al. (2007) and Thomas et al. (2019).

tification of these drivers is critical for explaining specific instances or cases of climate maladaptation. However, if positions like these suffer one weakness, it is that they often convey "poor planning [as] the primary cause of maladaptation" (Schipper 2020, p. 409) and recommend "multi-sectoral, multi-actor and inclusive planning with flexible pathways" (IPCC 2022a, p. 27) for reducing maladaptation. The perspective that improved planning will redress maladaptation is reminiscent of critiques in international development. Development efforts have largely operated as an imperial project entrenching capitalist relations and exploitation in the global South and therefore represent, for post-development scholars, "not the cure for poverty but the cause of it" (Ferguson 1994, p. 11). Proponents continue to emphasize the implementation of more effective practices within these same institutions. Thus, such approaches have (and continue to):

> "[…] remain technical and managerial. […] [A]lways with an eye to locating what goes 'wrong,' why, and how it can be fixed. Even the broader and more speculative discussions in this vein remain a brand of policy science, locating problems and arriving at recommendations addressed to planners within 'development' institutions" (Ferguson 1994, p. 10).

While many adaptation scientists do not endorse, and even explicitly resist these "development" projects (e.g., Eriksen et al. 2021), there seems to be a broader shared focus on planning improvements. We do not contest that "poor planning" helps explain instances of maladaptation, nor do we believe that "better" planning is futile. Rather, we consider current emphases on planning to be (i) limited in their potential to explain the prevalence of climate maladaptation and (ii) somewhat presumptive of their ability to minimize maladaptation. Presenting poor planning as a primary culprit signals that maladaptive outcomes can be minimized through a set of technical and institutional adjustments intended to limit otherwise unforeseeable and undesirable adaptation effects. The fixation on what *lacks* in planning processes risks promoting incremental solutions, such as increasing public participation for a specific adaptation program, which could stand in for transformative changes that may otherwise challenge and re-assemble institutional design, values, and objectives (Shah et al. 2024). Lessons from environmental justice, critical development studies, CRT, and coloniality scholarship instead emphasize how relations of power are (re)produced in ways that make climate maladaptation foreseeable, anticipatable, and even inevitable under unjust systems. In other words, the prevalence of climate maladaptation is less about the *absence* of any single planning approach or set of methods, and instead relates to how colonial, racial, capitalist and other place-based contexts integral to the reproduction of climate maladaptation continue to sustain themselves (Grove et al. 2020; Haverkamp 2021). While we focus on colonial, racial, and capitalist systems as well as their intersections, we understand marginalization as place- and context-specific. Accordingly, the broader structures of power we analyze throughout this paper are not deterministic lenses for understanding the reproduction of maladaptation. Nevertheless, it is our present argument that climate maladaptation cannot be treated as a planning project alone (cf. Shah et al. 2024). Adaptation planning can only have its intended effect when underlain by a "political project" designed to challenge uneven relations of power—else, climate maladaptation risks becoming a cyclical and persistent reality.

2.1 Adaptation channeled through unjust systems

Critical adaptation and climate justice scholars have shown how adaptation is refracted through colonial, racial, and capitalist structures to cyclically reproduce exclusion, dispossession, exploitation, and erasure. By comparison, climate maladaptation research has on the whole, remained less explicit about these fundamental structures and relations.

First, climate justice scholars highlight the long-term, cyclical nature of climate change vulnerability and adaptation injustices, as colonialism continues to reproduce the vulnerability of Indigenous and other minoritized peoples (Sultana 2022a; Rudge 2023). As Whyte (2016) argues, Indigenous Peoples are not disproportionately vulnerable to climate change and the harms of supposed climate solutions because of happenstance or geographic location, as naturalizing storylines might imply. Rather, climate injustices are caused by centuries of dispossession, relocation, assimilation, erasure and genocide—that is, "ongoing, cyclical colonialism" (Whyte 2016, p. 99). Climate maladaptation manifests through these very dynamics, given dominant adaptation discourses and practices participate in active settler and other colonialisms. For example, in working with Quechua-speaking, highland *campesinos* in Quebrada Quilcayhuanca (Peruvian Andes), Haverkamp (2021) exposes how colonial rationalities and their exclusionary impacts manifest through ecosystem-based adaptation. The region's alpine wetlands, *bofedales*, have now been incorporated into the state's conservation planning apparatus, valued for their ability to store water, enhance filtration, and sequester carbon (Haverkamp 2021). As Haverkamp documents, the state has implicated the pastoral livelihoods of campesinos in the degradation of bofedales, effectively "*re*nam[ing] the climate problem in the highlands to a problem of overgrazing and land-degradation" (Haverkamp 2021, p. 6; italics original). The same colonial logics that engender the marginalization of campesinos and their way of life now informs ongoing adaptation practices that seek ecosystem-based adaptation, namely through another round of quasi-"voluntary" and forced eviction of Quechua peoples from their ancestral lands and waters (Haverkamp 2021). The continuities of colonialism in climate change and its adaptation responses are increasingly told through ethnographic and Indigenous scholarship (Wildcat 2010; Marino 2015; Peterson and Maldonado 2016; Sheller 2020; Hernandez 2022). Climate maladaptation thus reflects the social stratification and power asymmetries set about with European colonization—a phenomenon referred to as "climate coloniality" (Sultana 2022a).

Second, adaptation practices have perpetuated racial hierarchies in many contexts: from colorblind adaptation planning (Hardy et al. 2017), to engendering racial ideologies that (re)produce difference among "vulnerable people" (Grove et al. 2020; Mikulewicz 2020; Paprocki 2021; Weatherill 2024), to maintaining racial capitalism through the devaluation of racialized adaptation laborers (Johnson et al. 2023a). As such, adaptation planning, evaluation, and monitoring frameworks have increasingly integrated equity and social justice considerations (Singh et al. 2022; Mills-Novoa 2023). Even when these considerations are documented in specific climate adaptation efforts, however limited they may be (Owen 2020; Araos et al. 2021), it is important to analyze how entrenched institutional norms, objectives, and power relations can still reproduce maladaptation. An investigation of the Greater Miami Region's resilience plan—a race-aware planning effort—demonstrates the failure of officials to acknowledge how the racial and economic injustices that produce climate vulnerability emerge from the legacies of anti-Black racism (Grove et al. 2020).

Instead, resilience planning identified, codified, and instrumentalized particular equity considerations within the overarching objective of preserving "'the economy's' well-being"—an economy that is neither innocent, nor independent in producing racialized disparities in wealth, and environmental and climate burdens (Grove et al. 2020, p. 139). Thus, Miami's climate resilience efforts "extend[ed] the structures of anti-Black violence *through* [its particular] efforts to address the region's extreme racial and economic inequalities" (Grove et al. 2020, p. 134; italics original). This study is not the only to focus on the intersection of race and adaptation. Others reveal racialized exclusion, devaluation, and exploitation (Anguelovski et al. 2019; Vaughn 2022; Rudge 2023; Shokry et al. 2023), which are unsurprising outcomes of dominant adaptation planning practices, even amid equity-reforms (Grove et al. 2020).

Third, climate adaptation is being refracted through capitalism and neoliberalism. As theorized by Thomas (2023), maladaptation has occurred in many cases because adaptation has functioned as an accumulation strategy that operates through the processes of expropriation, exploitation, and exchange. Climate adaptation practices are understood to function as a vehicle for expanding expropriation, or (often "legal" but unjust) processes of dispossession and removal (Sovacool 2018; Thomas 2023). Following Thomas (2023), expropriation is advanced through mobilizing climate adaptation through specific value- and interest-sets, and related processes of resource grabbing—removing people from property and their livelihoods (Franco and Borras 2019; Henrique and Tschakert 2019; Haverkamp 2021; Paprocki 2021). This results in the enclosure and privatization of property and / or public goods (Sovacool 2018; Thomas 2023), such as groundwater in certain contexts (Shah et al. 2021). Therefore, adaptation activities may contribute to processes of cyclical accumulation by participating in expropriation, and by subsequently producing economic value through privatized resources. In other cases, adaptation goods and services are commodified (Thomas 2023). They can circulate through marketization (Persson 2011), as private financial tools (Clapp and Isakson 2023), or through larger processes of financialization, such as subsidies and incentives (Thomas 2023). One example is "index-based agricultural insurance" (IBAI). Under IBAI, insurance payments are not based on actual agricultural losses. They instead provide fixed payments to agriculturalists in an area if a set of proxies (e.g. rainfall, vegetative greenery) understood to correlate with crop loss surpass a pre-defined threshold (Müller et al. 2017). Clapp and Isakson (2023, p. 4) argue these quantifiable indices are "[…] limited to a small number of perils [or hazards] and […] are insufficiently attuned to the particular socioecological challenges on a given farm." Similarly, in working with pastoralists in East Africa, Johnson et al. (2023b) report index-based insurance singularized drought as the foremost risk, obscuring other socio-ecological stressors such as fodder availability, disease and pest incidence, and livestock health. Moreover, scholarship demonstrates how livelihood vulnerability is not synonymous with the strength of an environmental hazard (e.g. Goldman et al. 2016), which IBAI purports to metricize. Rather, multi-dimensional social and political-economic contexts, including exclusion from decision-making and expropriation of resource access and control, enable even "weaker" environmental stressors to have meaningful impacts (Sen 1981; Bohle et al. 1994; Scoones 1998; Taylor 2015). IBAI can deepen inequalities by ignoring diverse socio-ecological risks and by linking insurance payouts to conservative threshold values, rather than considering the social contexts that enable even lower-intensity hazards to cause significant livelihood impacts. Last, IBAI can promote unsustainable and maladaptive agricultural practices—

such as increased irrigation, pesticide, or fertilizer use—when bundled with agricultural productivity schemes (Müller et al. 2017; Clapp and Isakson 2023; Stephens et al. 2023). Adaptation planning, commonly occurring within the hegemonies of capitalist accumulation and financialization, stands in stark and often irreconcilable tension with the goal of vulnerability reduction (Thomas 2023).

While we build on literature that exposes the colonial and racial-capitalist cleavages of dominant adaptation practices, we resist static and essentialized storylines that local communities are hapless victims of maladaptation. Indigenous, racialized, and gendered adaptation subjects demonstrate varying degrees of agency in adaptation processes—collaborating, disrupting, resisting, subverting and paving forward radical alternatives (Brink et al. 2023; Mills-Novoa et al. 2023; Mills-Novoa and Mikulewicz 2024; Vargas Falla et al. 2024). Examples of such are found in the co-production and co-design of climate knowledges (Vincent et al. 2018; Ravera et al. 2023); abolitionist, de-colonial and Indigenous adaptation responses (Haverkamp 2021; Leonard 2021; Ranganathan and Bratman 2019), and in the politics of subversion, refusal (cf. Simpson 2017) and resistance (Brink et al. 2023; Haverkamp 2024; Henrique and Tschakert 2019; Mills-Novoa et al. 2023). As we have elaborated throughout this **Section**, adaptation practices do not stand apart from the logics and practices of "development"—and hence, resistance efforts do not necessarily challenge separate, specific or unique adaptation planning practices per se (Mills-Novoa et al. 2023). Colonial logics of "underdevelopment" continue to pathologize adaptation subjects and objects, such as at-risk landscapes, as "vulnerable" to climate change, and materialize adaptation as incremental, productivist, and market-based (Mikulewicz 2020; Mills-Novoa et al. 2023). Unsurprisingly then, efforts to re-work and resist climate adaptation practices often reflect broader anti-colonial and anti-capitalist movements for socio-ecological, agrarian, and livelihood justice (Mills-Novoa et al. 2023).

2.2 Maladaptation and the longue durée of cyclical social inequality

While climate change threatens to exacerbate historical injustices, the reproduction of climate-related vulnerability through dominant adaptation efforts suggests that these responses also inflict their own kind of violence that cannot be separated from the longue durée of colonialism, white supremacy and capitalism—what we refer above to as, "cyclical maladaptation." The longue durée refers to long-term historical structures and relations that produce the conditions that repeatedly lead to maladaptation. Scholars of maladaptation need to be more fully attuned to these processes. Bearing them in mind, maladaptation emerges as a foreseeable outcome, rather than an unintentional or surprising one.

Critical scholarship on colonialism and race has moved beyond the superficial equation of white supremacy with the extreme racialized politics of hate groups and hate crimes. Rather, according to CRT and decolonial thought, racism and coloniality are integral to the culture of modernity and the systems that govern it (Fanon 1961; Bell 1991; Ladson-Billings and Tate IV 1995; Wynter 2003; Maldonado-Torres 2007; Quijano 2007; Escobar 2017; Mignolo and Walsh 2018). Modern institutions, policies, and discourses continue to be shaped by racial-colonial ideologies, which crystalized throughout 16th century imperialism. Not only does the coloniality of power shape the culture of modernity, but coloniality is understood as "an inevitable outcome" of modern discourse, policies, and practices (Maldonado-Torres 2007, p. 244). While the specific conditions of colonialism and the con-

comitant hierarchies of human life have shifted since the age of conquest, "settled expectations based in whiteness remain deeply embedded in the multidimensional structure of our society" (Pulido 2000; Bang et al. 2012, p. 303).

Critical race theorist Derrick Bell provocatively argues that to realize social equity, "we must address the reality that we live in a society in which racism has been internalized and institutionalized to the point of being an essential and inherently functioning component of that society" (Bell 1991, pp. 88–89). The concept of racial capitalism (Robinson 1983) draws attention to the ways in which "[r]ace is [understood as] *constitutive* of the capitalist mode of production and essential to the continuing rule of capital" (Hardt and Negri 2018, p. 443; italics original). The tripartite colonial racial capitalist hierarchies are subsequently incorporated into modern structures and redeployed through economies, institutions, discourses and practices (*recall* Grove et al. 2020). For this reason, policies and programs that reproduce social inequality cannot be understood as abhorrent failures, externalities, or accidents. Rather, these outcomes are better understood as resulting *by design* from the dominant modern social order: Western, white, hetero-patriarchal, and capitalist. Maladaptation is cyclical precisely because climate change adaptation is firmly rooted within the *longue durée* of these interrelated sociopolitical processes.

Modern climate change institutions, discourses and practices, again, do not stand apart from these interrelated sociopolitical and historical processes. Western scientific practices dominate climate change risk framings and adaptation planning. Delineating "science," as producing objective knowledge, from "society" / "politics" as defining solutions, fails to recognize "how authoritative knowledge about global environmental problems carries implicit framings that reproduce elements of social practice" (Beck and Forsyth 2015, p. 113). The physical science basis of climate change has long been privileged in the IPCC Assessment Reports (ARs)—the world's foremost assessments of climate change science, risks, and response options (Hulme and Mahony 2010). Science and Technology Studies (STS) scholars have demonstrated how the IPCC, as an institution, reflects "particular, situated commitments to forms of epistemic and social order" (Mahony and Hulme 2018, p. 402)—namely that of "Eurocentric modernity" (Nightingale et al. 2019; qtd. Wagner and Hornidge 2025). A strong reliance on positivist epistemes and methods for "objectively" documenting atmospheric changes has equated climate change risks to greenhouse gas concentrations (Beck et al. 2024). This has excluded non-positivist epistemes and knowledge-holders (Carmona et al. 2023) and as a result, obscured pathways through which climate vulnerability is socially produced and amplified. Through a positivist Eurocentric framing of risk, adaptation options—especially in earlier ARs—have often been considered technical exercises of adjusting areas to physical risks over and above redressing the historical and place-based vulnerabilities that articulate within a socially-stratified milieu (e.g., Bassett and Fogelman 2013; Beck and Forsyth 2015; Mikulewicz 2018; Beck et al. 2024). Herein, epistemic authority is "constituted relationally" through knowledge coproduction processes and the recognition and acceptance of this knowledge (Eriksen et al. 2015, p. 528). Although the IPCC has increased disciplinary representation, integrated underrepresented epistemologies, and emphasized knowledge co-production (Wagner and Hornidge 2025), conventional adaptation framings have had the larger discursive effect of privileging risk analyses that "[…] understand *who* [is vulnerable to climate change] rather than *why*" resulting in interventions that "bracket-out questions of power, inequality and social justice" (Mahony and Hulme 2018, p. 401; italics original). In this discursive context, the reoccur-

rence of maladaptation is rendered apolitical, structurally limited to a project of planning, rather than a project of transformational change to address the fundamental processes driving the *why* and *how* of climate risk (Forsyth and McDermott 2022). **Vignettes 1** and **2** provide examples of cyclical climate maladaptation.

Vignette #1: Coastal Louisiana, United States of America

Adaptation in coastal Louisiana after Hurricane Katrina represents an example of cyclical maladaptation. Cycles of colonial, racial, and capitalist projects over Louisiana's history have produced and entrenched the vulnerabilities of marginalized groups. The cycles include Indigenous dispossession during colonization; proliferation of plantations in the 19th century using enslaved labor; development of an extensive levee system that protects agricultural land from flooding but starves the Louisiana Delta of sediment for wetland habitat; and the expansion of oil and gas infrastructure starting in the 1930s that has further fragmented the coastal wetlands that protect the coast (Barra 2021; Germany 2007; Phillips and Soederberg 2023). These cycles of social and environmental harm made the coast all the more vulnerable when Hurricane Katrina hit in 2005 and famously laid bare the unevenness of impacts across racial lines (Adeola and Picou 2017). As a response to Katrina, the state created the Coastal Protection and Restoration Authority, charged with developing the state's Coastal Master Plans since 2007. The current 2023 Coastal Master Plan specifies 77 projects that range from ecological restoration to hard infrastructure, and cost billions of dollars (Coastal Protection and Restoration Authority (CPRA) 2023). The production of climate change data and modeling for the Master Plan, as well as the framing, justification, and choice of projects, has been shown to favor the interests of the oil and gas industry and other powerful stakeholders, thereby leading to adaptation decisions that reproduce vulnerabilities for marginalized groups (Barra 2021; Gotham 2016; Nost 2019; Phillips and Soederberg 2023). In fact, evidence shows that the Master Plan has demonstrably shifted vulnerabilities to certain marginalized groups, which is a form of maladaptation (Molloy et al. 2024). Given these historical and contemporary politics, it is difficult to describe climate maladaptation as "unintentional" when the root causes of it are systemic and date back centuries.

Vignette #2: Santa Rosa[2], Ecuador

Adaptation project implementors in the Ecuadorian highlands have targeted rural marginalized communities for interventions, as in many other places around the world. One example from the Ecuadorian community of Santa Rosa reflects the ways in which climate (mal) adaptation is shaped by the sedimented histories of colonial expropriation and extraction. The Indigenous and mestizo inhabitants of Santa Rosa have been under decades-long pressure from rural out-migration driven by Ecuador's cyclical fiscal crises, resource expropriation from international companies, including mining, and underinvestment due to state racism and disinvestment. In 2011, Santa Rosa received an adaptation project from the Global Environment Facility (*see* Mills-Novoa et al. 2023). The climate adaptation project was intended to enhance water management efficiency to reduce agricultural vulnerability

[2] The name "Santa Rosa" is a pseudonym. For details, see Mills-Novoa et al. (2023), from which this vignette is drawn.

in the highland area. In particular, government officials "[…] advanced an imaginary of productivist agricultural reform where campesino farmers increased their agricultural production and water use efficiency through irrigation system improvements, capacity building, and some highland reforestation" (Mills-Novoa et al. 2023, p. 2300). Interestingly, Santa Rosa's community leaders chose to site a new irrigation reservoir in the tailings of a closed mine. This act was one of resistance. Local leaders placed the climate adaptation infrastructure there in hopes it would prevent an international mining company who owned it from reactivating the mine after a bitter labor dispute. More precisely, constructing the irrigation reservoir here aimed to "gain state-recognized rights over related land and water […] strengthening their claim over their territory and providing them a legal basis by which to oppose the re-opening of the mine" (Mills-Novoa et al. 2023: 2300). Through these actions, climate adaptation became enrolled in the larger struggles for local and Indigenous self-determination. However, the adaptation project has also generated rifts. The water reservoir is failing due to poor installation and the local, grassroots irrigation association lacks the resources necessary to repair it. As the reservoir fails, the stark inequalities within the community are becoming more pronounced. The poorest within the community have failed to benefit from the project, and some were unable to shoulder the costs of installing irrigation equipment to take advantage of stored water in the first place, leaving the most marginalized, further marginalized. In Santa Rosa, we observe both the agency of a local community, as they leverage climate adaptations to resist resource expropriation, and the cyclical nature of maladaptation that deepens inequality already wrought through racial capitalism.

3 Unintentionality and its consequences

Numerous studies describing maladaptation as unintentional, even in an offhand way, risk participating within the unjust status quo by glossing over the processes that make it predictable. The tendency to characterize negative outcomes of adaptation as accidental, particularly in social sciences scholarship, should be concerning because many of its disciplines have argued that system outcomes are never external or additive to institutional contexts, but *foundational to them*. It is not uncommon for readers to see climate maladaptation described as "externalities" (Schipper 2020, p. 411), "unintended effects of adaptation" (Atteridge and Remling 2018, p. 2), "unintentional negative effects" (Antoci et al. 2022, p. 121), or "action[s] that result[] in an undesirable and unintended outcome(s)" (Magnan et al. 2016, p. 647). Table 1 provides a brief and incomplete selection of examples. Elaborating why such characterizations may exist can shed light on the power dynamics at play, and help to theorize cyclical maladaptation as a widespread, systems-level phenomenon that should be expected as long as the relevant systems remain unchanged.

First, climate adaptation is often defined as an intentional activity to reduce climate-related risks. The IPCC has long-defined adaptation in coupled human-environment systems as "the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities" (IPCC 2022b, p. 2898). Any adverse impacts outside of the benefits brought by these intentional adjustments are, by extension, *unintended*. This argument reflects elements of Beck's *Risk Society* (1992) in which he argued the intention of advancing growth and productivity has "systematically conditioned *blindness to risk*" (p. 60, italics original). Many of the risks posed to biodiversity, human safety,

Table 1 Brief selection of maladaptation characterizations from the literature

Characterizations of maladaptation
"[M]aladaptation describes an action that results in an undesirable and unintended outcome(s). This leads to increased vulnerability, which the action was meant to reduce" (Magnan et al. 2016, p. 647).
"The potential for adaptation interventions to create unintended effects, including outcomes that increase risk or vulnerability for other groups or ecosystems, is the key theme of the slowly growing literature on 'maladaptation'" (Atteridge and Remling 2018, p. 2).
"Maladaptation is when adaptation to climate change goes beyond wrong. […] At the heart is the idea that maladaptation is an unexpected and unwanted outcome of an adaptation strategy that is originally implemented with good intentions" (Schipper 2020, p. 413).
"Actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas (GHG) emissions, increased or shifted vulnerability to climate change, more inequitable outcomes, or diminished welfare, now or in the future. Most often, maladaptation is an unintended consequence" (IPCC 2022b, p. 2915).

and land fertility from nuclear energy to artificial fertilizers and pesticides were neglected and, even when recognized, were (and are) relegated as unintended "side effects" of the very intentional efforts to increase economic growth (Beck 1992). Adaptations—like a different crop variety, labor-reducing interventions, or tubewells—will always have impacts beyond the target audience, such as an individual farmer. Changes in water quality, shifting labor opportunities, or groundwater change may be anticipated adaptation outcomes. The designation of adaptation outcomes as unintentional arises from the fact that adaptation designers are often concerned with how the actors who access it are served. Unintentionality hence reflects distributions of power, not only signifying lesser concern for anticipatable adverse impacts of adaptation but reinscribing *who* adaptation is designed for. Following from Beck, this framing "[…] stands for a type of license […] which simultaneously confesses to, selectively distributes and justifies undesirable consequences" (Beck 1992, p. 34).

Second, climate maladaptations are often considered unexpected outcomes of complex social-ecological system interactions (*see* Shah et al. 2024). For example, water conservation strategies, such as drip irrigation, are commonly assumed to promote judicious water-use. In certain areas of the global South, such as India, drip irrigation is "promoted to preserve groundwater and enhance resilience to climate change" (Birkenholtz 2017, p. 663). Here, however, it is evidenced to contribute to the "Jevon's Paradox," whereby water-saving technologies unexpectedly increase resource use, or at best, result in no-net efficiency improvements (Birkenholtz 2017). Supposedly unexpected outcomes, such as these cases, are often assembled retrospectively to provide clarity: An extractive political-economy of agriculture and water, and peer-to-peer learning influenced the adoption of drip irrigation—or other water conservation initiatives (Shah et al. 2021)—in resource-intensive ways. Such is often the case when scholars use approaches such as complex and adaptive systems theory, where "self-organization," "surprise," and "emergence," are understood to be properties of coupled social-ecological systems (Berkes et al. 2003). Dilling and colleagues (2015) summarize this epistemic position:

> "Adaptation decisions can have unintended consequences both for the system in question and for people or ecosystems who are connected directly or indirectly to the outcomes of actions. Emerging vulnerabilities created by changes in the system may not be evident by examining the system only at a current time slice—some vulnerabilities

created by past decisions may only be revealed after more time has passed" (Dilling et al. 2015, p. 421).

We agree long-term regional change processes can enable adaptation activities to become maladaptive. However, we caution that the emphasis scholars often place on unpredictability can, at times, be unwarranted since integrative approaches that include the political-economy of resource use and access, critical race or (post)colonial theories, or Indigenous perspectives could help to anticipate maladaptive outcomes. In other words, the naturalization of unpredictability and surprise can obscure the roles that political-economy, social hierarchies, and uneven power relations serve in making adaptation outcomes *anticipatable*. For instance, in development studies, scholars have argued oft-called externalities or "side-effects" may be more appropriately considered "[…] inputs essential to the realization of the project's principal effect and purpose" (Hirschman 1967, p. 161). Using this logic, an equally reasonable argument using the example of drip irrigation above may be that opportunities to expand agricultural cultivation or use water in ways that are economically "productive" were *required inputs or contexts* for the adoption of drip irrigation—not unexpected side-effects of a well-intentioned water savings technology. Thus, some characterizations of maladaptation as unintended arise from a choice of theoretical frames and concepts.

Third, maladaptive outcomes may be characterized as unintentional when technical adaptation strategies neglect contexts of social vulnerability (Eriksen et al. 2021). For example, in agrarian regions of the global South, land- and asset-poor households are often excluded or disadvantaged from accessing adaptation services and products, which are biased towards capitalized users (Schipper 2020). Maladaptive contexts, such as reinforced exclusion, are easily characterized as unintentional if adaptation is understood as a depoliticized object for responding to climate change as an "external" threat (Taylor 2015; Nightingale et al. 2019). Adaptation measures are often "field-tested" under various climate stress conditions to determine their contributions to resilience. Isolating adaptation from the very sociocultural and political-economic contexts that shape its in-situ use is, in fact, often understood as a means of "objectively" evaluating its effectiveness. Given adaptation practices commonly fail to account for the complex socio-economic-political conditions that shape its distribution, access, and use (Bassett and Fogelman 2013; Eriksen et al. 2021; Bertana et al. 2022), any exclusionary or negative social outcomes can be dismissed as incidental or unintentional to the designed function of reducing the impacts of a physical, external climate stressor (Taylor 2015; Nightingale et al. 2019).

Overall, maladaptation can be described as unintentional when the political project of adaptation itself, is depoliticized. This matters because the fundamental causes of climate maladaptation can only be addressed politically—which is to say, structurally and relationally. Framing maladaptation as unintentional risks reinforcing existing adaptation projects, directing policymakers and planners toward incremental modifications. In these ways, unintentionality can subtly foreclose systemic change and reinforce cyclical maladaptation.

3.1 Confronting unintentionality: a move away from intentionality

Scholars of maladaptation, who may use the language of unintentionality, need to be aware that doing so can be seen as complicit with larger structures of inequality. This is in part for the reasons outlined above—to describe climate maladaptation as unintentional can be to

undertheorize or decontextualize it. Furthermore, intentionality is known within environmental justice circles as a strategic discourse, which itself is enmeshed with racial-colonial modes of power that maintain whiteness and white privilege. It is no accident that Robert Bullard's own definition of environmental racism—a concept widely accepted in environmental and climate policy circles—addresses the discourse of intentionality head-on: "[…] any policy, practice or directive that differentially affects or disadvantages (whether intended or unintended) individuals, groups, or communities based on race or color" (Bullard 1994, p. 1037).

While the sociological evidence amassed by early environmental justice scholars consistently demonstrated patterns of systemic racial discrimination rather than random distributions of environmental harms in the United States, legal battles were often lost through the inability to prove intentionality in the courtroom (Bullard 1994; Pulido 1996). Bullard states that "the law has been very oppressive in this process—particularly when it requires the 'victim' to prove 'intentional' discrimination" (Bullard 1994, p. 1046).

These early environmental justice struggles illuminate how skeptics of environmental racism employ intentionality as a discursive tactic for protecting whiteness (property values, health, interests and futures), allowing continued cycles of environmental harm within Black, Indigenous, and other communities of color (Pulido 1996). The discursive strategy of intentionality works to obscure the multiple ways in which structural forms of oppression operate. As Pulido argues, "[w]hile discrimination certainly is a key component of racism […] overt acts of discrimination are not the only forms of racism […]. By limiting the phenomenon to measurable discriminatory acts, we contribute to a partial understanding of racism and how it works" (Pulido 1996, p. 150). As an ideology, racism infuses and works to shape society, culture, politics, and economic structures and is at work within capital investment, development, policy, and planning (Pulido 1996, 2000).

Thus, although we oppose the characterization of maladaptation as unintentional, we do not advocate its opposite—the attribution of intention—as the most promising way forward. Instead, we encourage maladaptation scholars to move beyond the question of intention and focus instead on social, political, and economic structures and relations whose outcomes form patterns that can be observed, studied, and anticipated. When colonial racial capitalism is understood as the baseline from which modern institutions, policies, and practices operate, then the reproduction of vulnerability becomes known as a likely (if not inevitable) outcome of modern climate adaptation practices (Maldonado-Torres 2007). Reproducing inequalities may not be the conscious intention of adaptation decision-makers and practitioners, but so long as adaptation planning is immersed in these larger unjust systems, they can be expected to actively participate in the enactment of cyclical social oppression.

4 Anticipating and addressing maladaptation

In pointing out the colonial racial capitalism that underlies adaptation practice, we and other critical adaptation and climate justice scholars do not just seek to highlight injustice. We also seek transformative change that is emancipatory or liberatory, actively dismantling the oppressive structures that produce climate change vulnerability (e.g., O'Brien et al. 2007; Pelling 2011; Ribot 2014; Ranganathan and Bratman 2019; Thomas et al. 2019; Haverkamp 2021). While the definition of transformative adaptation and the processes for attaining it

remain contested (Blythe et al. 2018; Bentz et al. 2022), climate justice scholars suggest that adaptation provides an opportunity for reimagining and realizing a *radical* transformation for a more just society (Vogel and O'Brien 2022). By radical, we signal the *political project* of addressing the root, or foundational causes of injustice and vulnerability. These transformative visions include reparations (Táiwò 2022), abolitionist climate justice (Ranganathan and Bratman 2019), "care-full" climate revolutions (Sultana 2022b), adaptation "otherwise" (Haverkamp 2021), critical interrogations of crisis (Wilson et al. 2024), and transformational labor relations (Johnson et al. 2023a). Such possibilities are only viable when the structures and ideologies of colonial racial capitalism are dismantled, rather than simply reformed or planned within (Grove et al. 2020).

In countering climate maladaptation, as we have said above, the predictable response often involves using local technology, participatory governance, recognition and validation of different ways of knowing, and so forth. These are critical entry points for fostering just adaptation futures. However, as critics of the post-development tradition have argued, such approaches can fall into the trap of what Asher and Wainwright (2019) call "utopian politics" or a sort of progressive "essentialism," romanticizing local development, inadequately accounting for social difference, and neglecting relationships between capital and ideology, which shape how development proceeds locally (Wainwright 2008; Asher and Wainwright 2019). Such critics do not, of course, inherently oppose localized alternatives, participatory institutions, or community control (e.g. Yates 2014), nor are they unaware that criticism could be appropriated or misread as a call for continuing Western imperialism. What they imply, nevertheless, is important: the common failure to consider the "problematics [and workings] of capital, development, difference, and representation" (Asher and Wainwright 2019, p. 3) can (and has) led adaptation astray, producing maladaptive outcomes (Grove et al. 2020; Haverkamp 2021; Shah et al. 2021).

If adaptation projects are produced under unjust systems, maladaptation should be considered an expected outcome. Therefore, it is imperative not only to understand maladaptation more fundamentally, but also to develop methods to anticipate it. While maladaptive outcomes are often understood within the bounds of individually planned projects, we have argued that its drivers arise from recurrent and historically produced systems of injustice. Similarly, methods to anticipate maladaptation should examine both short- and long-term outcomes, given the *longue durée* of colonialism, racism and capitalism, and encompass a broader set of actors than only those directly served by adaptation projects. This is not only a project for social scientists. There are opportunities for environmental scientists to contribute to predicting future maladaptation by creating interdisciplinary modeling, simulation, or other projective methods that model adaptation impacts and transformative pathways (Balderas Guzman et al. 2023; Balderas Guzman 2025). For example, the field of critical physical geography could serve as a starting point, since it acknowledges that "socio-biophysical landscapes are as much the product of unequal power relations, histories of colonialism, and racial and gender disparities as they are of hydrology, ecology, and climate change" (Lave et al. 2014, p. 2). Developing methods to study and anticipate maladaptation is a complex and challenging proposition that will require transdisciplinary efforts. But it is necessary to move beyond the "unintentional" framing and into more precise and elucidating characterizations of maladaptation. Doing so will better inform political efforts to transform power and privilege, creating systems that ensure just outcomes by design.

5 Conclusions

This paper proposes *cyclical maladaptation* as an intervention for understanding it beyond an unintended outcome, or to quote Forsyth and McDermott, beyond the "improper implementation of an essentially good thing [adaptation]" (2022, p. 7). Our proposal, and subsequent theorization, has several implications for redressing climate maladaptation.

First, a cyclical lens draws attention to how "contextual vulnerabilit[ies]" (O'Brien et al. 2007), or entrenched systems of inequality, enable maladaptation to continue. While several important publications highlight the need to consider social contexts of vulnerability (e.g., Eriksen et al. 2021; Glover and Granberg 2021; Bertana et al. 2022), much of this work focuses on how, without such considerations, adaptation interventions become maladaptive. We make a related, but more concerted effort to explain why maladaptation proliferates at a global-scale, why we should expect its persistence, and what is needed beyond improved planning to tackle it.

Second, when scholars describe maladaptation as "unanticipated" or "unintended," we risk implicitly encouraging a focus on incremental solutions designed to "course-correct" adaptation. Increasing participation or mobilizing more inclusive institutions is often understood as an end point for alleviating maladaptation. As we have learned from scholars of environmental justice, critical development studies, CRT, and coloniality, such solutions should be considered a starting point for learning about (and sustaining engagement with) the ways in which systems of inequality continue to operate in local communities.

Third, redressing maladaptation is a *political project* that requires fundamental system change in how our societies work—it is *not* an indication of institutions failing to work in a specific *moment-of-time*, but rather an indication of modernity's colonial-racial-capitalist design. We offer these preliminary considerations in hopes of enriching the ways in which we, as adaptation scientists, conceptualize and address climate maladaptation.

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