



From past, persisting, and consolidating ecologies of segregation to ecologies of repair

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Across the United States and Europe, urban and periurban spaces have historically been shaped by land dispossession and enclosure that systematically exclude marginalized, non-White communities from the benefits of society, including access to nature. These dynamics, which have played out and perdured over centuries as part of historic land dispossession and recent green racial capitalism, form the bedrock of contemporary urban segregation and socioecological inequalities. As a result, we see that minoritized and low-wealth groups continue to be deprived of ecological resources and suffer perturbations and loss in urban ecosystem functions and balances. This piece examines the complex relationship between segregation and urban ecologies, drawing on examples from the United States and Europe. We identify five concurrent pathways through which exclusionary land use results in unequal urban ecologies that undermine both social well-being and ecological health. In doing so, we explore how legacies of racial capitalism, colonialism, and segregation create ecologically unbalanced urban landscapes and ecosystems and entangle periurban and rural areas in unequal urbanization. We conclude by advocating for emancipatory and reparative planning practices that confront unequal ecologies and green racial capitalism. These integrate reparations, community-led solutions, equitable green infrastructure, and a radical rethinking of exclusionary socioecological systems.

green segregation | racial capitalism | nature gap | green gentrification | redlining

Urban and periurban spaces have long been developed and shaped by historical processes of racial capitalism, land dispossession, and enclosure, which have systematically excluded low-wealth and racialized groups from access to nature. These processes have evolved into contemporary forms of urban spatial segregation, where marginalized communities of color have been separated from or deprived of access to ecological resources and their benefits due to White and environmental privilege (1). Environmental privilege—a flipside of environmental injustice and racism (2)—results from the economic, political, and cultural power accumulated by some, which grants them exclusive access to valued environmental amenities and their benefits (1). In return, segregation alters the socioecological fabric, relations, and balance of the environments and ecosystems these marginalized communities inhabit (3). In these contexts, the interplay between racial capitalism, dispossession, segregation, and ecology creates systemic positive feedback

through which such communities are caught in a cycle of nature deprivation and racial exclusion, with long-term impacts on social well-being, ecological health, and resilience of natural environments.

In this *Perspective*, our critique of past and current practices of ecological and land use planning acknowledges that greenspaces—including parks, gardens, greenways, or natural protected areas—are vital components of everyday life, offering health, well-being, and environmental benefits (4, 5) in addition to climate protection, and biodiversity and habitat preservation (6, 7). Greenspaces serve as crucial sites for recreational and physical activities, relaxation and stress relief, and social interaction, all of which contribute to improved mental and physical health (4, 5).

However, as a growing literature illustrates, many current and past green infrastructure interventions, nature-based solutions, and other ecosystem protection projects have resulted in a disconnection from nature for some, particularly when the natural space being introduced generates new exclusions (8), absences (9), dispossessions and displacement (10), or underinvestment (11). Specifically, new greenspaces may not effectively address legacies of exposure to industrial contamination, or climate and environmental injustices, among other effects (12). Thus, we start from a critique of the argument often advanced in the health (e.g., environmental epidemiology) and ecology (e.g., urban ecology) literatures of “universal” or straightforward links between urban greenspace and improved human and ecosystem health (13, 14).

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We explore here the complex relationships between various forms of sociospatial and environmental segregation and their impacts on ecologies produced by historic trends of racial capitalism and new manifestations of what we identify as *green racial capitalism*, looking both at the ecologies of segregation and the segregations of ecology in a dialectical manner. Although our argument concerns mostly urban areas, periurban and rural areas are entangled in the production of segregated ecologies in cities, whose development and growth have massive impacts on those so-called peripheries or hinterlands, a process commonly described as planetary urbanization (15).

We offer critical insights into how enduring land and nature dispossession, control, and exclusion (that is sociospatial and environmental segregation) have created landscapes of socioecological inequalities in and around cities, and how those segregated landscapes, where non-White groups live mostly separated in nature-deprived areas, are themselves ecologically unbalanced, unhealthy, and less biodiverse and resilient. Through what we analyze as *ecologies of segregation* we argue that there exist multiple processes of separation, loss and disruptions affecting socioecological systems which are products of historic, contemporary, and emerging forms of segregation denying marginalized groups access to ecological benefits. In doing so, we also highlight *segregations of ecology*—how segregation processes undermine the well-being of natural ecosystems, perpetuate social and environmental injustices across human and nonhuman species, and affect the balance, diversity, and functions of natural environments. This account of human and more-than-human relations alongside processes of racial and ethnic segregation serves to ground our call for a radical ecological and planning practice that repairs exclusionary social-ecological processes. While we focus our analysis on the United States, we draw on relevant parallels in Europe and Canada.

1. Racial Capitalism or the Historical Foundations of Dispossession and Green Segregation

Our starting point in this *Perspective* is the assertion that current ecologies of segregation and segregation of ecologies cannot be explained without historic land theft, occupation, and exploitation of Native or Indigenous nations as part of the racial capitalism project—a process by which the devaluation of non-White bodies and their exclusion has been part of economic dynamics of resource and land extraction for the profit of White ruling classes and their supremacy (16), both in rural land and in cities (17). Overall, throughout North America, Indigenous land dispossession has been estimated to represent a density and spread loss close to 99% (18). As part of this, racial capitalism authorized violence against non-White bodies and produced environmental racism to enact dispossession (16). In return, racism as part of this structural logic of capital accumulation (19), justified associated logics of settler-colonialism (20), as a past and on-going political and ecological project (21) whose goal has been and remains to gain control of land by dispossessing, displacing, and erasing Indigenous and other minoritized groups and to replace them with a White settler population (22, 23).

Yet, much of the literature on greenspace access pays inadequate attention to deliberate policies produced to reinforce racial segregation through the control of nature (24). At the same time, much of the racial capitalism lens on environmental racism has historically focused on the disproportionate burdens of industrial pollution as state-sanctioned violence (e.g., ref. 16). Yet, as we argue through the paper, racial capitalism and settler-colonialism are part of the foundational ethos of modern environmentalism (25), including the creation of national parks, urban greenspaces, and conservation policies (26), and of segregated access to nature. In cities, the broader political economy of racial capitalism through urbanization has produced and exploited highly unequal urban spaces (17), through extracting value of urban places and accumulating capital. This has been feasible through dispossession of land and property (through displacement or not) together with ghettoization, segregation, neighborhood disinvestment and later reinvestment through gentrification (17, 27). Such a logic is reproduced in contemporary green racial capitalism processes which shape a continued unequal access to nature and new forms of green segregation and displacement (28, 29). All in all, communities of color and other racialized groups suffer from what have been identified as compounded environmental racisms (30).

To illustrate those practices, the cultural norm of making biodiverse, green, and/or natural ecological spaces like parks, forests, and rivers as “off-limits” to anybody racialized as non-White can be traced back to early narratives of “manifest destiny,” the construction of “the wilderness” and the outdoors as sites for White (and male) leisure (31, 32). For example, US National Parks were built through the violent dispossession of Indigenous peoples for settler environmentalist recreation, timber, mining, and other corporate interests. The removal of Indigenous peoples from these lands reflected a well-known material configuration of the Euro-American myth of uninhabited, virgin wilderness. The Indigenous Ute, Shoshone, Cherokee, and others were deemed obstructions to unconditional access to these spaces by White settlers and forcibly displaced from what would become Yellowstone National Park, White River National Park, and Great Smoky Mountain National Park, among others (1, 33). In other words, green segregation (e.g., segregation away from land and nature), as a racial and spatial phenomenon, has historically occurred and continues to occur on Indigenous lands. In the following decades, the movement to protect parks and public lands remained dominated by White Americans (34), while contemporary dynamics associated with uneven greenspace access are a legacy of White supremacist control over public lands.

Green segregation in cities is another manifestation of the hegemonic tentacles of racial capitalism and settler-colonialism, although how race intersects with settler-colonial forms of urban greening remains underresearched (35–37). In US cities, for example, dispossession and land loss have led to a circumstance wherein the livelihoods of dispossessed people were shaped by institutions that sorted residents in place according to racial and ethnic characteristics through the well-known process of redlining (38). This pattern of segregated residences extended to public and private finance and decided where investments would flow, including greenspaces

(39). Consequently, it generated exclusive access to high-quality greenspace and environmental protections granted de jure and de facto to White residents in segregated neighborhoods throughout most of the XXth century (39). Cities like Baltimore, Kansas City, Dallas, and Phoenix are illustrative of this relationship, as formerly redlined neighborhoods in these cities and elsewhere have been shown to have a thinner tree canopy, more impervious surfaces, and overall little greenspace (40–42).

In Europe, Laura Pulido argues that racism predated capitalism and was used by different economic projects to justify and enable colonization (16). Here, the “other” within Europe and outside Europe became racialized and then excluded from having a share in production and reproduction processes (19). From the early middle ages onward, nature conservation was pursued through the establishment of enclosures for “sustainable” resource management, such as game, timber, or mineral resources, mostly for the enjoyment or benefit of White economic and political elites (43, 44). In Spain, for example, wild game reserves permitted large landlords and ruling socioeconomic classes to create new property regimes over some land, resources, and wild game, particularly from the XIVth century onward (45).

Today, proconservation actors throughout Europe tend to have values, views, and interests that collide with those of people whose livelihoods rely on primary sector activities or who can significantly benefit from land-use change practices, including urbanization (46, 47). Although protected areas often represent an important source of economic development (48), their socioeconomic benefits are rarely evenly shared with nonruling classes, and conflicts of interest and “illegal” resource use practices by local, working-class farming people as an active form of resistance are not uncommon (49, 50).

In European cities, as in the United States, the legacy of inequitable access to the benefits of nature has also informed inequities in urban greening. Many cities were historically designed with green spaces catering to elite and White populations (51), often at the expenses of marginalized communities. Large urban parks such as Hyde Park in London or Bois de Boulogne in Paris were built for affluent recreation, leaving working-class and immigrant neighborhoods undergreened. Urban renewal projects (e.g., Paris’s Haussmannization) throughout the XIXth century displaced impoverished and immigrant communities to peripheral neighborhoods, leaving them with limited access to green infrastructure built in the proximity of new boulevards and avenues. This exclusion persists, as historically marginalized neighborhoods in European cities often have less green coverage today, including Paris (52).

Last, those historic dynamics of devaluation, expropriation, and loss have also been expressed in terms of risk exposure to “natural” events. In the United States, in the aftermath of slavery and throughout Jim Crow, the segregation of Black Americans was also a matter of land separation that shaped risks, particularly exposure to marshy, riparian, and other low lying green spaces where flooding occurred (53). Effectively, land set aside for Black settlement or offered for purchasing was land perceived as undesirable by Whites due to location, land quality, topography, and associated natural risks (54). Prior to modern infrastructure, Blacks had to live

in “topographical segregation.” Over time, humans learned how to counterengineer certain risks and how to better manage natural hazards using both gray and green systems (55). Decades later, with these engineering advancements, land previously risky and undesirable was no longer such, particularly river, lake, and coastal fronts. Consequently, Blacks often got pushed out of these spaces or new infrastructure did not extend into these Black-inhabited spaces, particularly when a modern shift occurred in the valuation of green space (55).

2. Five Concurrent Pathways of/toward Segregated Urban Ecologies

These historical foundations of racial capitalism, land and nature dispossession, and ensuing segregation have shaped what we see as five concurrent pathways (*SI Appendix, Fig. S1*) that describe contemporary segregated urban ecologies, which we examine next.

2.1. Undergreening Combined with Displacement from Greenspace. First, as a result of multiple forms of land control and segregation, persistent legacies of exclusionary policies have prevented marginalized peoples from access to greenspaces (39) and shaped present-day unequal “undergreening.” Undergreening refers to “the systematic reluctance of municipalities to provide greenspace in communities of color” linked to the “burden” of cost for initial installation or maintenance (11). It is particularly present where widespread landscape conversion for housing, industry, and commercial businesses collides with human population pressures, high densities, and diverse sociodemographic factors. Conversely, in many neighborhoods of color, there is also often some perverse mapping of what is classified as parks and assumed to be greenspace (in order to justify underinvestment), when many greenspaces in Black and low-wealth neighborhoods are actually smaller, often paved surfaces (the opposite of heat or flood-resilient greenspace), have little canopy cover (56), and are overall of poor quality (57–59)—a phenomenon often referred to as the Nature Gap (60).

The complexities of this Nature Gap are largely attributed to substandard housing, paired with deprioritization of environmental stewardship interventions and municipal goods and services to maintain green, blue, and gray infrastructure in majority low-wealth and people of color communities during and after segregation and redlining (24, 60). Previously greenlined neighborhoods (42, 61–63) as well as majority-White and wealthy neighborhoods (64, 65) still overwhelmingly have greater access to nature as well as tree canopy cover, vegetation, and parks (24). A four-decade history (1980–2020) of greenspace creation in cities across the United States further reveals that segregated residential land patterns have produced multiple pathways through which White residents primarily retain or capture urban greening benefits (66). For example, between 1980 and 2010, between 3.2% and 8.5% of populated tract areas across Austin, Seattle, Portland, Philadelphia, New York, San Francisco, Detroit, Baltimore, and Cleveland shifted Whiter, and those tracts were overrepresented with new greening initiatives (66). Recent US-wide analyses of greenspace access by race and

ethnicity find that the quantity and quality of nature and parks, especially those with environmental cooling capacity, remain positively predicted by the percentage of White individuals in a neighborhood (59, 67).

Similarly, in the United Kingdom, Black and other racialized groups are most likely to live in areas deprived of greenspace (68) and with less access to urban greenspace (69) in comparison with White groups. Black communities are also least likely to derive health benefits from visiting urban greenspaces due to their poor quality (70). In the White British racial imaginary, Blacks are often seen as uninterested in nature, and people displaced by environmental disasters are often seen as the creators of their own misfortune (69, 71). Other research has found that protected area managers rarely highlight social benefits in their outreach and fail to target minoritized groups, prioritizing environmental education and knowledge instead. Those practices also often reflect Anglo-normative approaches to natural area management (72). In other cases, Blacks' social natures are invisibilized or erased in new urban green projects (73).

Further, in a different process, when financial investments are made to improve the green infrastructure of impoverished neighborhoods, the lack of antidisplacement protections contributes to new displacements of minoritized communities to periurban edges through a process known as green gentrification (10, 74, 75) both in North America and Europe. Recent investments in urban greening through greenways, resilient parks, restored shorelines, or community gardens have been strongly associated with land speculation and green gap captures, which directly or indirectly displace residents of color from greened areas through green gentrification (74) and climate gentrification (76, 77). For example, in Philadelphia the census tracts that most gained Black and Hispanic residents between 2000 and 2016 (e.g., around North Philadelphia) are also tracts with the least investment in green resilient infrastructure, which creates landscapes of unequal climate protection and maladaptation (77). These processes of racialized dispossession and urban green grabbing (78) through the appropriation by real estate investors of the accrued value of land and property in greened areas are creating "green sacrifice zones," whereby vulnerable residents are forced away from greener neighborhoods, often segregated to grayer and climate-insecure areas, where they can afford to live (28).

2.2. Imposition of White Rules and Norms in Nature. Modern-day racial capitalism and segregation is further embodied in the imposition of certain behaviors in green space, that is in White supremacist rules, codes, and norms in nature. Through the erasure of the roles and influence of Black conservation stewardship in knowing, navigating, and caring for the land as well as through the policing of Black bodies in natural areas, whiteness and White supremacy have sought to eradicate and undermine Black and Indigenous place-making (79, 80). In the United States, minoritized and racialized populations are absent from larger and more remote national parks while overrepresented at closer and smaller national parks, which suggests that they visit natural areas that not only entail a lower economic cost and time

investment (81) but also those that might offer comfort and familiarity.

Most recently, we see forced erasure, surveillance, and policing (82) across green and gray infrastructures in urban areas. While planners have contributed mightily to environmental or green privilege through (re)zoning, urban renewal, and land redevelopment, so have vigilantes—often White residents denouncing the public space practices or presence of Black and brown residents—perpetrating control to maintain such exclusions (83). In her work discussing the construction of transit-oriented development (TOD) along H street in Washington, D.C., Brandi Summers delineates how the initiative capitalized on the main thoroughfare's Black cultural assets while forcing Black residents onto a "just passing-through" conveyor belt via reduced bus stops, a train line, and a conversion of businesses from social and essential services to amenities and elite shops for a new clientele (84). This seen/unseen dynamic produced by racial capitalist logics in urban redevelopment uses Black people to create cultural caché while minimizing any meaningful interactions between racial groups, and most importantly minimizing Black residents' claim to public space (84).

Similar practices of policing and exclusions have shaped unequal access to urban nature in Europe. Recent racialized greening in places such as Berlin (85) or Lyon (30) through the renovation and greening of a public plaza has led to the "segmentation of the place into several sectors" [White, Arab, and Black]. It has also "created a divide that did not exist before" through a process of microsegregation and police control and video surveillance. In Barcelona, research we conducted among green space users revealed that Maghrebi women reported instances of discrimination when trying to use some new park infrastructure with their children, through derogatory comments such as "they don't even know how to speak Spanish." Similarly, recent research in the United Kingdom found that Muslim women are deterred from enjoying nature by a lack of inclusive marketing and imagery, perceived whiteness in those spaces, and prior discrimination (86).

As for the United States, access to European semirural or rural protected areas as places for leisure and nature-based tourism is mediated by historical, geographical, and socioeconomic factors. In the United Kingdom, research has found that Black residents feel unwelcomed and excluded from the countryside (87) and they are less likely to use natural areas due to feeling unsafe and fear of encountering racial violence (86, 88). Here and elsewhere, this blaming of the victim ignores how systemic racism functions as a barricade around nature and keeps it as a White space for both labor and leisure. Historically, non-White groups have been erased from the mythology of the English rural idyll and the history of the countryside (89), discouraging minoritized residents from accessing them. In contemporary times, more accessible natural sites tend to have higher population density and provide more tourist facilities, such as transport and accommodation, and are more often visited by local and distant populations, both national and foreign (90). In Southern Europe, some of our recent research reveals that migrants and racialized groups are more likely than White residents to visit urban parks rather than periurban natural protected areas, especially women born in the Global South, quoting safety.

The erasure of people of color has also taken a violent turn. Some of the most vicious attacks on US civil rights movement demonstrators during the 1960s took place in and around greenspaces like Kelly Ingram Park in Birmingham, AL—reflecting the longstanding practice of excluding and controlling Black people's access to recreational spaces (31). Police and White vigilante violence perpetrated against people of color in swimming pools, beaches, and other outdoor recreational venues continues to haunt many communities (60). In 2020, a young Black man, Ahmaud Arbery, was targeted and fatally shot while jogging near Brunswick, GA. In these instances, the enduring policing and criminalization of Black and brown bodies in public space creates traumatic relations in nature and demonstrates both rapid and “slow violence” (91).

2.3. Extreme Segregated Ecologies in Carceral Systems. Moving to greater extremes in segregated ecologies, we draw attention to segregation reflected within the US carceral system—an important dimension of institutionally supported racialized land use and natural exploitation in and around cities. To start with, most incarcerated persons are from the same populations experiencing environmental injustices and toxic contamination in nonincarcerated residential communities. Specifically, the overwhelming majority of persons in the US carceral system are people of color and low-wealth individuals. Further, prisons, jails, and immigrant detention centers in and around cities are highly segregated environments with only access to gray and contained spaces and where incarcerated persons and staff are dehumanized and exposed to a broad spectrum of environmental risks, including contaminated water, polluted air, hazardous waste, and unhealthy food. Prisons fail at protecting inmates from different hazards. Yet, the US Environmental Protection Agency issued the following statement highlighted by the Prison Ecology Project in 2024: “[C]orrectional institutions have many environmental matters to consider in order to protect the health of the inmates, employees and the community where the prison is located. Supporting these populations [...] requires heating and cooling, wastewater treatment, hazardous waste and trash disposal, asbestos management, drinking water supply, pesticide use, vehicle maintenance and power production, to name a few potential environmental hazards” (92). Compounding these challenges is the substandard healthcare in most US prisons, jails, and detention centers. Poor healthcare contributes to heightened morbidity and mortality for populations that disproportionately experience greater susceptibility to cardiovascular illness, respiratory conditions, and “weathering”—the physiological harms associated with living in a racist and culturally repressive society. In response to the extreme dehumanization of incarceration, some carceral facilities have developed gardening and other green access programs for the incarcerated. Yet, this process has been shown to serve to legitimize the entire prison system and naturalize the prison-industrial complex in the name of the “rehabilitative” opportunities of nature in the prison, rather than question its deep segregation and violence (93).

More broadly, the construction and maintenance of carceral facilities and the labor and industrial activities in and around prisons in the context of US mass incarceration contribute significantly both to harms facing nonhuman species

(94) and GHG emissions (95). Many carceral facilities, such as the ominous “Alligator Alcatraz” migrant detention center in the Big Cypress National Preserve, are in critical ecological habitats where threatened and endangered species are at further risk of sewage spills, increased motorized traffic, air pollution, and hazardous waste generation associated with operating such institutions. Heatwaves and floods also have inequitable impacts on incarcerated communities, as many prisons lack AC and prisoners are rarely evacuated by state authorities during disasters. Prisoners in Alligator Alcatraz are meant to be close to dangerous reptiles and mosquitoes. All in all, incarceration of people of color and low-wealth persons is a foundational policy within US statecraft, reflecting the core tenets of racial capitalism, such as producing and maintaining violent racialized hierarchies that enable the control of people and land.

2.4. Degraded Ecosystems and Unequal Restoration. Fourth, sociospatial and environmental segregation has complex ecological and evolutionary consequences for nonhuman organisms (3). Taken together, low-wealth and segregated neighborhoods tend to have less biodiversity, habitat diversity, species survival, and by extension a more limited provision of ecosystem services (provisioning, regulating, cultural, and supporting) (3, 96, 97), as well significantly less species richness (61, 98, 99). Further, meta-analyses suggest that wildlife genetic diversity is reduced in neighborhoods with greater proportions of Black and Latine residents (100), in part due to the uneven distribution of primary producers (e.g., trees, other vegetation), which spatially limits wildlife habitat. Last, increased pollutant exposures, novel species introductions, elevated zoonotic diseases, and amplified human activities present significant challenges on organisms residing in impoverished neighborhoods with poor environmental quality (61, 101).

Hence, segregation functions as a pivotal driver shaping habitat suitability for nonhuman ecosystems while perpetuating health and environmental inequities (102), by compromising the resilience of both plant, animal, and human populations—including to climate risks. When examining the current demographic composition of segregated neighborhoods, those neighborhoods with higher percentages of Latine and Black residents in cities like Chicago, Minneapolis, New York, and LA are consistently associated with low or maladaptive greening in comparison with White neighborhoods and are thus least resilient to climate impacts (103, 104). In short, the unequal creation and management of urban environments and natural systems introduce a reduction in ecological functions and contribute to degraded urban ecologies and ecosystems throughout—in ways that reinforce the resilience of some groups and the environmental and climate protection deprivations of others.

More broadly, while solutions are being implemented to restore ecological functioning (e.g., nature-based solutions), urban and urbanizing spaces fundamentally have changed and continue to change below and above ground terrestrial and aquatic ecosystems. For example, a consolidation in soil carbon and texture (and thus a reduced variability in organic carbon content) (105) and a loss of the B horizon (a critical soil layer that supports vegetation) (106) have been recorded in 11 US cities. While some variability within cities exists

across sample sites (e.g., parks, boulevards, residential lawns), “urbanization fundamentally reshapes the soils that underlay landscapes” creating a universal urban soil profile (105), and reducing resilience to environmental stressors. Documented changes in precipitation patterns and intensity, negative impacts to surface water quality (e.g., fecal coliform, total suspended solids) and hydrology (e.g., channelized streams) have also been attributed to urban and urbanizing systems. In addition, responses to degraded ecological functions are often embedded in a selective process of remediation that displays contemporary manifestations of green or environmental privilege and its production in segregated and dispossessed geographies while overlooking biocultural knowledge and holistic needs of communities, especially Indigenous and other minoritized groups (107). Remediation also tends to obscure blame and to overlook responsibility from industry and government for past environmental degradation (108).

Furthermore, we see the urban form itself homogenizing on a global scale (109) which drives not just a homogenization of biota (110, 111), flora and fauna, but a homogenization of stratified access to resources, including green space. In *Walking Cities: Toronto*, Black Canadian poet Dionne Brand discusses the familiar imprint and mark of (British) colonial landscapes that follow city after city with British-Indian poet Vahni Capildeo (112). The globalized economy and network of multiconglomerate XXIth century corporate landowners, and uniformity of contractors that drive “luxury” housing also displace lower-income residents to the city periphery, disrupting sense-of-place connections and reifying ecologies of segregation.

2.5. Opportunistic Greening as Global Development Strategy. Last, as urban greening becomes consolidated as a global planning orthodoxy (113), opportunistic, growth-connected, and esthetic-focused “glossy” greening has increasingly become part of competitive urbanism and racial capitalism logics in cities (66, 114). This occurs in part when greening becomes attached to growth and branding mindsets (78)—in Amsterdam, Glasgow, San Francisco, Cleveland, or Washington—which in return undermine system-wide urban ecological improvements. This embeddedness stems in part from an entrepreneurial approach wherein the practice of urban greening is opportunistic, guided by opportunities to develop green infrastructure alongside new construction projects (115). While this pragmatic approach generates many new urban greenspaces within resource-constrained environments, to the extent that opportunities are linked with new high-end development the types of greenspaces produced generally reflect preferences of elite residents.

This push also favors aesthetic and recreational dimensions of the cultural ecosystem services provided, which are more linked with gentrification, as research has revealed (116). Often, this entrepreneurial opportunism translates to more “park-like” rather than “forest-like” spaces, with reduced biodiversity (e.g., lower native species richness) (117) and decreased carbon sequestration (118). Thus, an opportunistic approach to urban greening tends to reduce social and ecological functioning precisely because the result is that most

of the spaces produced maximize aesthetic and investment returns. Seemingly race-neutral approaches become the latest manifestation of overtly segregated greening and green racial capitalism via a greening-development-race link (119).

Demonstrating the persistence of this link, as it becomes clear that current investment approaches cannot be sustained relative to climate mitigation goals, the greening agenda in many cities has translated into strategies that are transferring environment impacts of development toward peripheral, marginalized regions whose resources are extracted for privileged urban residents. A planetary urbanization (15) and latest manifestation of the tentacles of racial capitalism in remote lands of nature extraction, displacement, and green segregation is the push—by both environmentalists and many policymakers—to embrace electric vehicles even though those use lithium-ion batteries, whose extraction can reproduce old colonial resource extraction and alienation of Indigenous Peoples rights, lives, and livelihoods (120). Most EVs also contain cobalt, which has been linked to ecological and social harms, including human rights abuses (121). Ultimately, EVs and much of the broader push for a renewable energy transition has thus far resulted in benefits for wealthier and whiter communities enjoying newly greened urban neighborhoods without resolving the roots of the climate crisis. Renewables are characterized as energy additions rather than transitions (122) while creating green sacrifice zones (123) due to multiscalar racial capitalism logics.

3. Addressing Segregation through Emancipatory Approaches

3.1. Reparations and Repossession. First, any responses to the nature gap, green gentrification, White supremacy in nature, lasting degraded ecosystems, and opportunistic greening must acknowledge and fight the racial capitalism processes that are part of where renaturing and green infrastructure projects are carried out. To counter the impacts of racial capitalism and its present embodiments, we argue for “historical diagnostic” tools that illuminate “hidden histories” (124) and for decolonial, antisubordination, and reparative agendas as alternative framework to urban renewal and exclusionary development in and outside cities (125, 126). In doing so, this framework would enable strategies for enhancing ecosystems in a manner that responds to historical dispossessions.

In practice, such an agenda would recognize that the structural exclusion of racialized groups from a safe and protected access to nature cannot be solved without the legal return of stolen land and property to dispossessed groups in rural and urban areas. Policies such as the Portland’s N/NE Preference Policy for residents displaced by urban renewal (127) or projects such as the 11th Street Bridge Park project in Washington DC whereby urban greening is actually preceded by the recognition of land theft and establishment of the Douglass Community Land Trust and new affordable housing (66, 114) are steps toward repairing property loss or ensuring land control for Black and other minoritized residents. In rural territories Canada has advanced land devolution in the Yukon as a pathway to Indigenous self-determination while in

Vancouver it has returned land to the Squamish nation for their own property development projects.

Regarding critical green resilient infrastructure, the equitable distribution and planning of new projects in the face of climate change and the fight against green gentrification is also fundamentally a matter of securing permanent housing affordability and high levels of inclusionary zoning in marginalized communities where new resilient green development is taking place (128). Planners must ensure that where projects of green resilient infrastructure currently exist, there is a diversity of housing options in close proximity for people across backgrounds and income levels to partake. In practice this approach includes affordable multifamily housing and mixed-use upzoning across income ranges that allow for vertical building on elevated ground and efficient use of space in order to increase housing density. This approach also “releases” open space that can then be converted into resilient green space and green corridors.

Additional priorities to enact reparations include targeted investments to ecologically and holistically restore historically disenfranchised communities who have lacked greenspace and lost ecosystem services. This process involves reclaiming and repurposing the public right-of-way and shifting from automobile dependency, leading the way with centralized strategies and incentivizing decentralized approaches, and reallocating budgets to prioritize greenspace and critical climate resilience infrastructure in gray landscapes and degraded ecosystems. Some cities have developed equity-centered indexes and indicators for urban greening designed to enable priorities for equity-driven actions apart from leveraging opportunities generated by high-end development (129). Others are working to preserve community-owned and informal spaces that represent Indigenous, Black, or Latinx greening practices. Promising examples include the Cully Park in Portland, Eastie Farm in Boston, or informal green spaces as part of the Equitable Development Plan of the 11th Street Bridge Park in Washington DC (114).

Last, regarding the extractive and racial capitalist carceral regime, EJ and antiprison advocates and scholars have, for decades, worked to build spaces for intersectional analyses and action that promote social justice, ecological sustainability, human rights, and prison abolition. These are spaces where incarcerated persons are leading the fight for dignity, human rights, and environmental justice. They have done so with the understanding that since mass incarceration is both a form of human enslavement and a method of perpetrating environmental harms, and extreme extraction, prison abolition, and environmental justice are goals that are inseparable (130, 131). Therefore when prison abolitionists, climate justice, and Green New Deal (and related frameworks) advocates call for decarceration and the cessation of prison construction in favor of policies and institutions that offer social protections and basic needs such as education, health-care, and employment in the renewable energy sector, they are promoting robust green infrastructure.

3.2. An Inclusive and Recognition-Driven Practice of Ecological Management. Moving away from dispossession and exclusion in ecological management, planners and technicians involved in green infrastructure, nature-based solution, and land protection projects should support Black and other minoritized

communities’ place-making and identities in and around nature as well as nurture their often invisibilized relationships toward natural spaces, many of which community-driven or -built. Ecological management should recognize and center traditional ecological knowledge practices and support the comanagement of land by non-White groups. Here there is also a need to draw on Black and Indigenous people’s cosmology, connections, and caring practices for the land and other non-White conservation practices in periurban and rural areas that are inclusive and intersectional. One such initiative among Black communities is the Federation of Southern Cooperatives which supports Black farmers in land ownership and sustainable forestry through cooperative economic development, land retention, and further advocacy. Other initiatives draw on Indigenous land practices such as “land-based” healing in Canada and illustrate the importance of valuing land as an essential component of healing, well-being, and community resilience (132). Recent struggles for land remediation such as the one led by the Diné (Navajo) people affected by uranium mining in the Southwestern United States also highlight the role of valuing traditional ecological knowledge about tribal land in order to ensure decolonial and just ecological restoration (107).

Furthermore, acknowledging the fact that the EJ movement is in large part a public health movement, the “public” in public health should extend to more-than-human relations, just as justice itself must embrace multispecies communities. Such a statement might have sounded overblown prior to the global spread of diseases like COVID-19, M pox, and Langya, but the fact that these diseases are zoonotic—spreading between humans and nonhumans—reveals the inherent necessity for action around multispecies health and justice (131). Indigenous Studies and decolonial scholars have long engaged with these ideas. For example, concepts such as *kincentricity* and *radical relationality* reflect a view that humans, nonhumans, and ecosystems are part of an extended family with shared origins and ancestry. That is, these scholars reject the modernist, colonial separation between humans and nonhumans (133, 134).

Ultimately, to advance any form of multispecies justice will likely include what Yusoff calls an “inhumanities” framework (135)—a set of imaginings and practices that acknowledge that the very concept of the “human” is rooted in Western Enlightenment ideologies of racism, White supremacy, genocide, and ecocide. In other words, a more inclusive ecological management must redefine what it means to be human in order to challenge speciesism, racism, heteropatriarchy, and other forms of dominance and segregation between humans and nonhumans.

3.3. Community-Led Solutions and Future Directions. Community-led solutions that address segregation from nature must also be made visible and further encouraged, also as a way to address the whiteness of urban (136) which pathologize Black and other racialized communities while obscuring whiteness and its power. In myriad cases of displacement and erasure, communities of color have fought back with great determination, which can serve as reference points to community-led solutions for an inclusive greening that can fight XXIth century green racial capitalism. In the 1970s, when White-dominated policymaking bodies bisected

and disrupted the majority Chicana-Latina neighborhood of Barrio Logan in San Diego to build an interstate and a bridge to the resort of Coronado Island, activists responded by creating Chicano Park, a recreational space and site of extraordinary Chicana murals, directly underneath the Coronado bridge. In contemporary times, Black and Indigenous scholars, activists, artists, and everyday people successfully push back against green erasure narratives and make visible the diverse knowledges about nature and ecology and uses of nature that non-White residents hold (137). The study and practice of Black ecologies and Black geographies guide us in seeing how actions like mutual aid, Black farming, and partnerships across academia and organizing can generate, maintain, and bank Black ecological ways of being. They also remind us of the ways Black communities and individuals have and will continue to build and rebuild ecological lives as a practice of freedom (137).

Furthermore, COVID-19 did somewhat change the visuals on who belongs in nature. Pre-COVID saw few Black people on social media accounts of nature, conservation, or outdoor recreation organizations (138). The absence of Black people created a visual apartheid in nature and reified it as a White space (139). As the pandemic encouraged Black people to explore nature, those social media accounts became flooded with diversity. Furthermore, the emergence of Black peoples, Indigenous peoples, people of colour nature groups on both sides of the Atlantic, such as Latinx Hikers, Outdoor Afro, Latino Outdoors, Muslim Hikers, Outdoor Asian-Europe Collaborations, Black Girl Hike UK, or Flock Together or We are Justice Outside illustrates how people can organize and make nature-based events visible, such as the Black Birders Week or Community Hikes. Those events are based on their sociocultures and reclaim previously White-exclusive spaces. Yet, one cannot ignore a risk of a backlash and whitelash around the ecological capacity of these greenspaces and around White groups mobilizing to denounce or criminalize non-White practices. In that regard, it is essential to desegregate green leisure management while cultivating interconnected communities (86, 140). Here, working toward equity also means addressing the time and transportation poverty that many Black and Brown families suffer from.

In planning for climate-related interventions, supporting community-driven climate adaptation is an important alternative to individualized and privatized adaptation and its related loneliness and stress, by developing and valorizing practices that address trauma, care, and healing (141). These form of abolitionist practices against racial capitalism (and the way it has dehumanized and endangered non-White bodies) and for climate justice (141) also would allow planners to move away from the opportunistic green approaches described above and should integrate social and ecological resilience goals more robustly in climate planning.

4. Final Thoughts

In this Perspective, we have explored how systemic historic and contemporary segregation have shaped unequal urban ecologies across the United States and Europe and presented five pathways that create and illustrate diverse forms of segregated ecologies.

As argued, historical practices of racial capitalism like land dispossession, redlining, and exclusionary conservation have systematically deprived marginalized communities of access to greenspaces and ecological benefits. Yet these patterns have evolved through new forms of green segregation, displacement or undergreening in neighborhoods with a high proportion of non-White residents. Those past, persisting, and consolidating practices perpetuate the environmental privilege of White groups (SI Appendix, Fig. S2). In addition, efforts to address inequities, such as new green infrastructure in historically marginalized neighborhoods, can inadvertently lead to green gentrification, further displacing residents to generally grayer and climate exposed, yet affordable, areas. We also showed how systemic racism shapes access to greenspaces through cultural norms, policing, and exclusionary policies in natural areas. In those spaces, Black, Latinx, and Muslim communities often feel unwelcome due to fears of discrimination and violence as well as the marketing of environmental practices and sociocultures catering to White groups. Racial capitalism and extreme segregation of non-White bodies from nature operate at their extreme in carceral systems that exploit and impact natural resources and condemn prisoners to toxic spaces in a continuum of dehumanization from their neighborhoods to the jail.

In turn, we also exposed how ecological impacts of segregation are profound. In marginalized neighborhoods, inadequate greenspace and degraded soils disrupt biodiversity and ecological functions, which can exacerbate climate vulnerabilities and affect urban wildlife through reduced habitat quality and connectivity. Further, the link between greening and global development agendas has a dual effect of leaning new greenspace toward high-end development projects and limiting possible ecological gains. In short, capital accumulation, greening and rewilding, and racial exclusion are tightly interlocked qualities of unequal urban and nonurban space creation, investment, and extraction rooted in historic land dispossession-driven racial capitalism and XXIth century green racial capitalism.

To respond to these ecologies of segregation and segregations of ecology, we have called for a shift toward emancipatory lenses within ecological practice. Reparative and repossession approaches, such as land returns and community land trusts, are essential to overcoming historical injustices and ensure equitable greenspace access. Further, by addressing systemic racism in environmental policy and ecological management and integrating traditional ecological knowledge and resource use, cities and their hinterland can move toward socioecological resilience and justice in ways that advance recognition and procedural justice.

From a research standpoint, there is space to examine how racial capitalism and segregation affect urban biodiversity and ecosystem services, combining urban ecology, environmental justice, and political economy, and that reconnect nonhuman and human species. Furthermore, a refined understanding and measurement of equitable access to nature and its drivers through intersectional analyses is much needed: How intersecting identities—such as race, gender, sexuality, ability, and class—affect access to and experiences in greenspaces and how tools from urban development, greenspace management, and ecological restoration can support those goals. Last,

understanding what political processes, civic organization, and financing can make antidisplacement tools effective in view of racial capitalism remains a key limit of green gentrification research, especially as cities straddle the polycrisis of climate change and housing affordability.

All in all, we move away from a somewhat disaggregated analysis of access to green space through individual, disparate measures of racial exclusion toward a systemic analysis of the

ways that ecological well-being and functions are impacted by racial capitalism and exclusion, and vice versa. Through our diagnosis, we hope to provide tools for urban ecological interventions to work toward racial justice and address White supremacy in relation to nature and ecology across borders.

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