Environmental Racism and Green Space: How Concrete Jungles Hurt Public Health
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What is Environmental Racism and Why Does It Matter?

As the world reckons with the fallout of historical prejudices and the practices that resulted from discrimination, less-visible prejudices are often the last to go. One of these is environmental racism, which is especially expressed institutionally. Environmental racism deprives certain groups of equitable policy surrounding their living- and work-spaces. A general pattern of confinement to these spaces usually follows, denying targeted groups the mobility required to move away from disadvantaged spaces.

Environmental racism can take place very broadly, such as the exposure of countries in the Global South to waste from the Global North. It can very clearly appear on a national level, for instance against communities whose lands are unprotected, such as campaigns by the United States government in the 19th century against hunting grounds for Indigenous plains communities. At more of a "micro" scale, environmental racism occurs on a neighborhood-to-neighborhood basis within cities and is identifiable by conspicuous boundaries as concrete as two sides of a street.

In essence, environmental racism is a denier of social mobility, and through this denial, targeted groups are left with fewer rights, worse outcomes, and no way of escape. Therefore, environmental racism is often less visible due to its deep structural and institutional roots. The enabling of environmental racism is often left to policymakers, governments, and community institutions, who are made up of elites and often have little interest in non-elite concerns. Despite this lesser visibility, environmental racism can be clearly stated as one of the most egregious and dangerous forms of discrimination because of how it can disable entire communities and leave them behind.

Brief History of Environmentally Racist Policy in the United States

In the United States, environmental racism has specifically manifested against non-White communities since the founding of the country. Besides the aforementioned campaigns against Indigenous communities, the federal government, along with state governments, used environmentally racist policy to secure White security, deny rights to other marginalized groups, enforce Jim Crow laws, and posture an idea that White people should be associated with the most clean and beautiful parts of the country (Zimring, 218).

Redlining is the most recent and impactful measure that defined the "boundaries" of environmental racism. Starting in the 20th century, entire neighborhoods that were dominated by lower-income people of color began to be excluded from investment and services, creating massive urban deserts where things like healthcare and food were reliably inaccessible. Furthermore, loans were made unavailable to people of color who intended to leave redlined neighborhoods, effectively denying any form of social mobility.

Redlining therefore cordoned off entire neighborhoods through urban policymaking, leaving them underdeveloped, underserviced, and especially vulnerable to land misuse. This textbook environmental racism created the urban situation that still creates huge gaps between White and non-White neighborhoods today.

Unbelievably, the practice of redlining existed in various legal forms into the 21st century, long after nationwide civil rights efforts had supposedly defeated such egregious forms of systemic racism. The severity of redlining and its impacts finally entered the nationwide conversation in the late 1980s, when an investigation into Atlanta loan practices according to race revealed that "Whites receive five times as many home loans as Blacks," and that this discrimination was legal (Dedman, 1). The effects of discriminatory housing policy will still be felt for decades to come thanks to widened socio-economic disparities and reinforced prejudices.

Gradual public consciousness of redlining and other forms of environmental racism arose when coinciding movements surrounding the abysmal state of U.S. environmental policy took force in the 1970s (Johansen, 2). The realization that the most environmentally degraded places in the country usually were poorer areas inhabited by people of color was obvious. Some cases of environmentally racist policy were deliberately designed to spite or contain non-White communities. Others arose due to simply disregarding such communities when it came to policymaking.

The outcomes of environmentally racist policies had many different teeth. In the case of one African American community in North Carolina that had coal plants built directly adjacent, ignoring pleas from local leaders, the home values dropped to the point of worthlessness, notwithstanding the sudden health hazards from the constant fall of soot and ash (Talbot 2018).

By the end of the 20th century, the enabling of the most extreme cases of prejudice had largely ended, but the long-term effects remained. Many people of color remained in underprivileged neighborhoods that had been redlined, and these neighborhoods proved nearly possible to escape. Environmental racism became less of a tree to cut down, and more of a root to dig up.

Overview of Neighborhoods Impacted by Environmental Racism

What is characteristic of a neighborhood that was redlined? There are many common features between regions of the United States. For one, urban deserts are still rampant. Residents of historically redlined neighborhoods might find that the low socioeconomic status of these neighborhoods discourages market entry from grocery stores, public transit providers, and healthcare providers, creating food, transit, and healthcare deserts respectively.

The lack of current investment furthers lack of future investment. Residents in historically redlined neighborhoods will share little of the economic growth experienced by adjacent neighborhoods that did not experience discrimination. While property values will naturally grow in areas that experience long-term investment, investment into historically redlined areas will usually be hostile, pushing out existing residents to "make over" the area and beautify it. Therefore, residents of historically redlined areas are unlikely to benefit from any investment at all.

Benefits characteristic of recent city planning such as beautification, walkability, and good lighting at night will have most likely been overlooked in historically redlined neighborhoods. Though some issues can be immediately resolved, others are a result of neglect from citywide planning and would require complete demolition and renovation, which prove impossible to neighborhoods that receive little investment. This leads to neighborhoods that are characterized by concrete, outdated facilities, little beautification, and a lack of walkability.

The last point about beautification is not a trivial one. There is an undeniable psychological association rooted in environmental racism linking beauty to richer White neighborhoods, while poorer neighborhoods inhabited by people of color are associated with ugly urban dystopic scenery. This has proven to be a self-fulfilling prophecy, and an intentional one at that, as the White elites refused to invest in any neighborhoods outside of their own.

Green Space and Cooling Effects

One facet of many beautification projects is the expansion of greenery. The intertwining of the natural environment with the urban one has been a goal of urban planners who seek to create a beautiful and livable city. This idea can be loosely wrapped into the term "green space." Green space includes parks, fields, and even forms of urban agriculture. Spaces as small as sidewalk strips or pathways covered by the shade of a tree can be considered "green."

The benefits from green space are not limited to beautification. They also provide a countermeasure to the negative effects from concrete.

Concrete is a highly reflective surface: light, heat, and sound are likely to reflect at high volume from concrete. Besides creating high levels of noise and light pollution, concrete is responsible for a high amount of urban heat. Massive concrete jungles lead to "heat sinks" or "heat islands" which reflect the sun's energy to such a high degree that the entire neighborhood can become over 12°C hotter than outside of the neighborhood. Lower-income populations are the most vulnerable to extreme heat because of inadequate housing and healthcare options (USGCRP 2008).

Green space counters heat islands by limiting surface area covered by concrete. A large park covering at least 1 kilometer squared can reduce urban temperatures by as much as 1-2°C within a neighborhood (Aram 2019). Planting trees and replacing concrete with greenery does well to duplicate this effect on a small scale.

How Green Space is Measured

To adequately consider where green space access is prevalent by distinguishing between neighborhoods, there are a few methods used that empirically analyze and attempt to "score" green space levels with an index measure. The prevailing mode of measurement is through satellite data, which is easily accessible. There are further benefits to using satellite data: it primarily measures aerial coverage—that is, places where sunlight hits green space rather than concrete—and can reflect different levels of greenery through differentiating color levels. For

instance, a large park will have an intensely green hue compared to a sidewalk shaded by a small tree.

This paper considers two studies that each provide an index score to measure green space. The first, a 2012 study by Gupta et al, creates an Urban Neighborhood Green Index with four measurable parameters: percentage area of green, proximity to green, green density and height of nearby structures. The second, Zhang et al, utilizes publicly accessible Google API data to construct a map of assumed green space. Both studies provide in-depth analysis of their respective focus cities, Delhi and Shanghai.

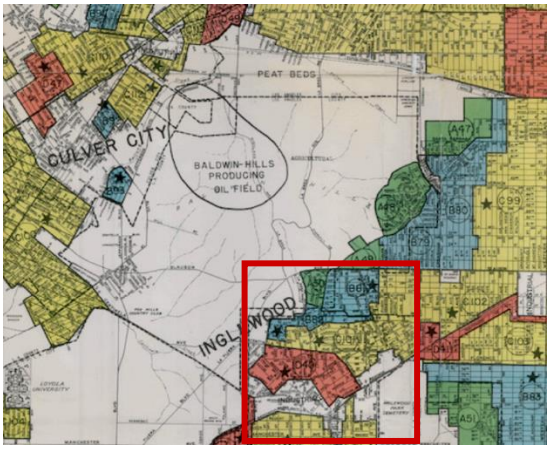
These studies will provide a future groundwork for implementing worldwide green space analysis. Unfortunately, measurements at this level are not provided for cities outside of the study scopes.

This paper therefore uses data from the Environmental Protection Agency (EPA) to analyze Green Space. The EPA provides in-depth analysis of select cities in the United States through its EnviroAtlas program, including measurements such as green space per capita.

Green Space and Low Socioeconomic Status

The link between historical redlining causing low socioeconomic status due to environmental racism is already well-established. This suggests that historically redlined neighborhoods would be most likely to lack vital green space access. Spatial studies indicate that both non-White and socioeconomically deprived neighborhoods are least likely to have access. Based on census data, "poverty and ethnic minority concentration were negatively associated with green space coverage in most [urban] areas" in the United States (Wen 2013).

Consider the following map of Inglewood, Los Angeles, California from 1939 that shows neighborhoods declared "hazardous" for investment by the Federal Home Loan Board.



(Division of Research and Statistics 1939)

The neighborhoods shaded in red were ones categorized as "D – Hazardous." Thus, these mostly non-White neighborhoods were assigned designations that discouraged investment for the following decades.

Now consider maps that show green space data and income levels for the same area. The historically redlined neighborhood in Inglewood is traced in red. *(see:* ***Graphic A****, pg. 9)*

Measure A follows the initial predicted pattern: a historically redlined neighborhood that now experiences abject levels of poverty. Though the EPA data does not account for race, the census data for 2020 holds that over 95% of Inglewood is non-White, and over 90% Black or Latino (U.S. Census Bureau 2020).

Measure B clearly displays the lack of greenery in impoverished Inglewood neighborhoods, nearly all of which were once redlined. Despite a nearby park and wooded areas to the north, residents in these areas are specifically deprived as compared to other Inglewood residents.

Greenery can have a direct impact in reducing daytime temperatures, as Measure C indicates. Many non-redlined neighborhoods have sufficient greenery to reduce urban heat levels from what would be expected. The redlined area does not have a sufficient amount of green space to counteract urban heat to a nonnegligible degree.

Green space also impacts walkability, which itself affects access to green space. Urban walkways that lack tree cover and road insulation discourage pedestrian activity and negate the positive effect of park proximity. The less walkable a street is, the less likely its residents are to utilize nearby green space. Measure D shows that a higher proportion of walkable roads in the historically redlined district lack green space.

The brief case study of Inglewood implies that expectations based on historical patterns and recent analysis can be assumed to be true. Redlined districts will be poorer, less White, and less green due to environmental racism.

Green Space and Public Health

If historically redlined neighborhoods are much more likely to be poor, then concluding that public health will also suffer in these neighborhoods is a fair assumption. Most public health indicators correspond with socioeconomic status to a high degree. Which of these indicators can be attributed to green space access? The answer is quite a few.

Many questions about public health and green space are psychological. How does a beautified area impact quality of live? There is much room for growth when it comes to future studies in this area. The literature gap is significant, but there are some recent studies that grapple with the psychological aspect of green space and urban life.

An Indian study considered how green spaces foster urban interconnectivity and improve quality of life through the “cultural ecosystem.” It suggested that one of the greatest benefits of green space is the community-focused aspect, providing not only walkable areas but also areas that facilitate interconnectivity as compared to non-green space, especially prudent to underdeveloped neighborhoods that feel “broken” or “disconnected” (Sen 2021). One of the most intriguing and promising studies discussing green space impact on psychological public health poses the conjecture that improved green space access is correlated with better behavior from children. It concluded through strong statistical correlation that green space access does indicate improved behavior, but specifically that “poor urban children living in greener [neighborhoods] had fewer emotional problems” (Flouri 2014).

Though the question of green space psychology needs much more addressing, both of these studies conclude that green space is especially valuable psychologically to poorer or underdeveloped urban areas. On the other hand, this indicates that poorer neighborhoods that have been deprived access to equitable environments will suffer disproportionately.

More obvious indicators of public health rely on concrete measurability. Data sets considering publicly available per capita numbers are easy to reconcile with green space. For instance, urban heat is colloquially known to be harmful, especially in the summer months. By cross-referencing mortality rates and temperature measurements, studies indeed show that higher ambient temperatures are "associated with increased risk for those dying from cardiovascular, respiratory, cerebrovascular, and some specific cardiovascular diseases," and further show that "vulnerable subgroups [including] Black [people] … [and] those with lower socioeconomic status" have a strong correlation with increased risk (Basu 2009). Given that higher urban ambient temperatures are directly related to inadequate green space access, lack of green space contributes directly to higher mortality rates, especially to vulnerable subgroups (Aram 2019).

Another way to measure public health concretely is through medical service usage rate. This could include frequency of emergency room visits separated by reason for visit, total value in purchases of certain medicines, or broader measurements like total value lost in health insurance deductibles. One longitudinal study compared green space and tree canopy proximity to diagnosis rates for cardiovascular and other related diseases, finding that residents living in areas with ample green space are less likely to receive a diagnosis of cardiovascular disease, hypertension, or incident diabetes (Astell-Burt 2020). The study concluded that increasing tree canopy may reduce rates of these diseases and should be explored.

Though such a conclusion could be countered by bringing up intersecting and correlated factors like income levels and ethnicity, it furthers the idea that green space and socioeconomic levels are inescapably intertwined. A Japanese study dealt with the issue of separating socioeconomic causes and green space influence by using public death records to analyze mortality rates of the elderly in relation to green space walkability. Across the board, senior citizens who [lived in areas with walkable green spaces" had a positive relation towards longevity "independent of their…socioeconomic status" or other statuses. While acknowledging the clear "association between higher income and a lower risk of mortality," the study took care to conclude that there was a "clear and significant association between walkable green spaces and longevity, even after excluding the influence of socioeconomic conditions on longevity" through data manipulation (Takano 2002).

Improving Public Health through Green Space – A Problem of Equity

In the end, there is little need to pinpoint individual factors of public health and relate them to green space accessibility. What remains clear is that green space access improves public health, and communities that have been denied green space deserve more equitable urban planning. Though redlining as a practice has ended, residents of historically redlined neighborhoods are still experiencing environmental racism. On the basis of their ethnicity, their homes have been denied access to green space and therefore residents are denied public health benefits that White people experience at a high rate.

Neighborhoods that were never designed to be attractive to investors, beautiful to residents or appealing to prospective homebuyers will not only lack green space but also lack the proper infrastructure or space to add green space in the future. Among other issues, these neighborhoods are characterized by sardine-like development with no additional space for parks, thin medians and sidewalks that fail to allow room for tree coverage, and most importantly, little money to make changes.

Smaller Changes for Equity

It is difficult to build new green space when there is no space for it at all. Smaller changes such as planting new trees, replacing excess concrete with natural groundcover and improving or repairing sidewalks are important steps towards transforming neighborhoods. Projects such as tree-planting initiatives require relatively few resources and are an easy way to facilitate community involvement. Trees are probably the most quickly effective method to increase green space percentage. However, many stark, treeless neighborhoods cannot handle new trees without significant changes. Old foundations are too close to the street and will be cracked by tree roots, if there is even room for planting a tree at the ground level. Furthermore, investing in trees requires patience. It could be years before enough shade is provided to make a difference.

Natural groundcover is much less demanding but has many intersecting benefits. Besides immediately beautifying an area, it can help deal with storm runoff as opposed to the expanse of concrete. Furthermore, groundcover does not need to be limited to grass. Native plants can be used.

These small changes are a reasonable step towards starting to improve individual neighborhoods that have been long neglected. Large cities might find it beneficial to invest money into making small changes like sidewalk repairs and tree planting because it improves the image of the city as a whole. For cities that can hardly afford to make large improvements, small changes are the only way to make a difference.

Each of the posited improvements immediately address the problem of walkability: increased street walkability by expanding roadside green space lengthens the walking distance possible to reach other green space, therefore exponentially providing more green space access. However, this can only go so far. Walkability is useful to the extent that there is larger green space, like a park, available to accommodate residents.

Larger Changes for Equity

Most studies considered in this paper believe that large green spaces are vital for reaching the public health benefits that they discuss. When it comes to underdeveloped neighborhoods that are not within walking distance of a park or any other comparable green space, the only solution is to make one. However, in most cases, this would mean making room by removing something else.

Eminent domain is a useful tool for government-sponsored projects that benefit residents. However, this would mean seizing the property of residents who would then be displaced. Given

the history of historically redlined neighborhoods, displacement for residents was almost never an option because no other neighborhood would consider them. Relocating residents poses a great moral issue because the stated goal is to improve public health. Though the government agrees to buy the land at a fair price, many residents in poorer neighborhoods are not property owners – rather, they are renters. Using eminent domain to expand green space would effectively displace an entire portion of the neighborhood, and the purchasing funds would not even reach many of the former residents' pockets.

Therefore, some neighborhoods have to make do with what they can. Many inner urban neighborhoods have begun to innovate with urban space, finding new ways to turn it green. Rooftop green spaces can serve as gardens and provide food for the neighborhood. Empty lots, when truly vacant, are easily cultivated into a green space with permission and a little investment.

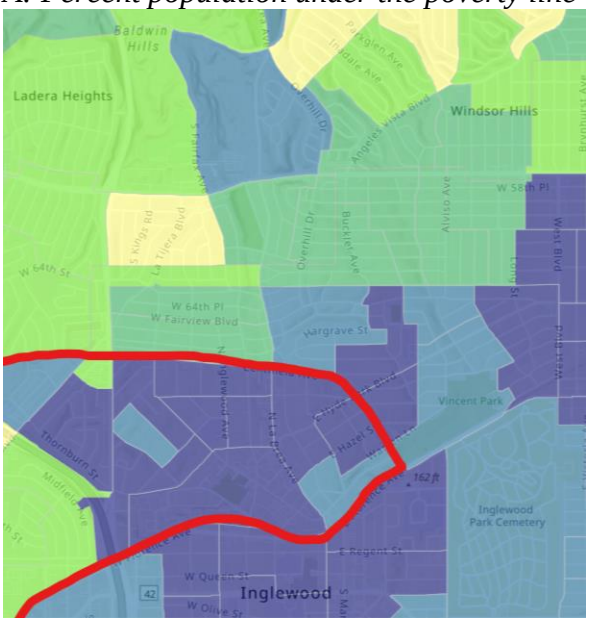
The Future for Increasing Green Space

In conclusion, there is no clear solution when it comes to expanding green space in urban neighborhoods. Although it is evident that poorer and less White neighborhoods have been systematically denied access to green space and will struggle to find equitable access in the future, much remains to be solved. How will policymakers invest in these neighborhoods in a way that is fair to all?

Expanding green space access is necessary to improve public health of vulnerable populations. In the coming decades, more research is needed on psychological aspects of green space and to what extent, unrelated to socioeconomics, it benefits urban dwellers. Nonetheless, socioeconomically disadvantaged people are much less likely to have access to green space, and need it more than ever in the face of climate change. As societies look to remove the ugly influence of environmental racism, new creative solutions to expand green space and better public health are necessary. The future of sustainable and equitable city planning is green.

Graphic A: *Redlining Case Study, Inglewood, CA*

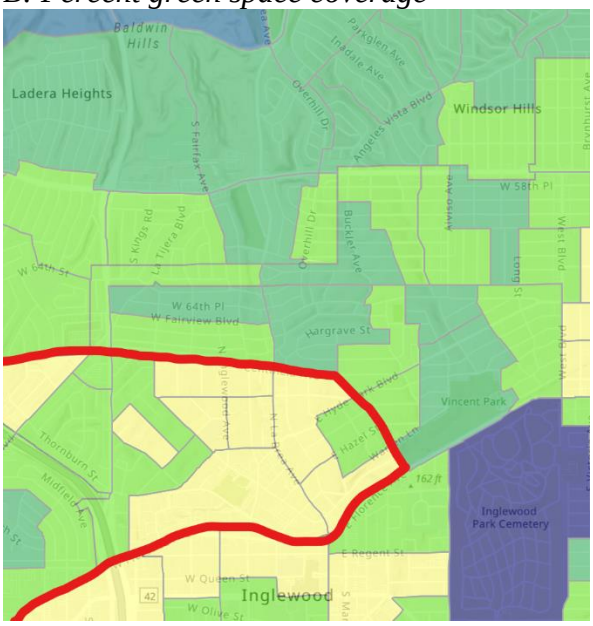
A: Percent population under the poverty line



(Pickard 2015)

Blue: over 80% below the poverty line
Green: under 50% below the poverty line

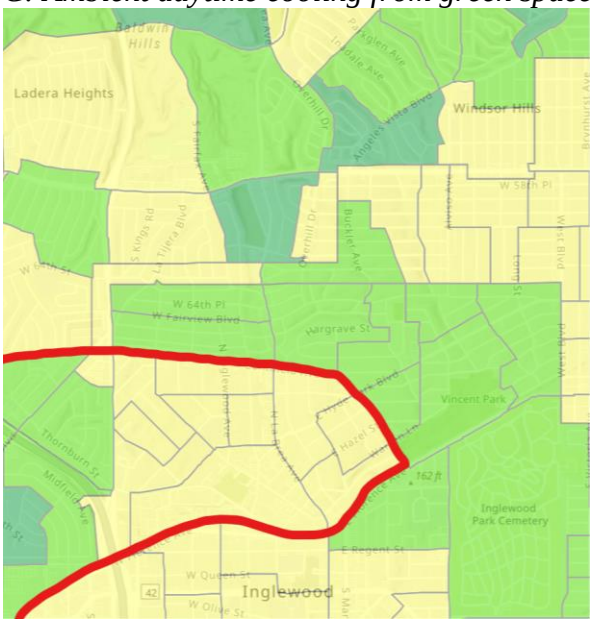
B: Percent green space coverage



(Pickard 2015)

Dark green: over 40% green space
Yellow: under 20% green space

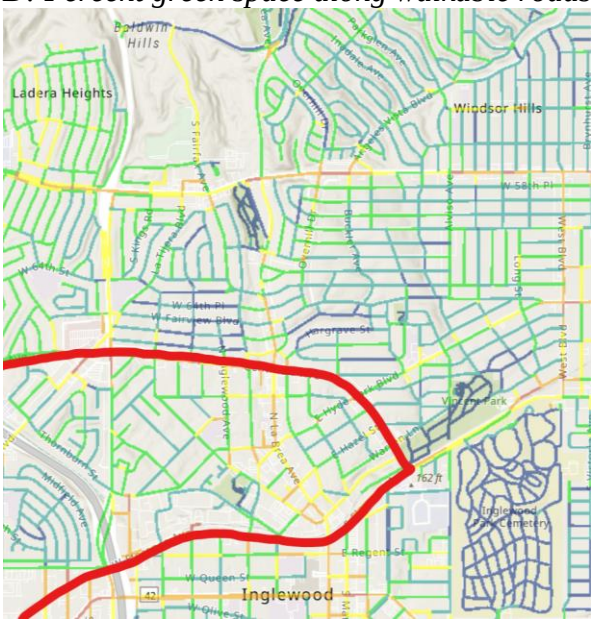
C: Ambient daytime cooling from green space



(Pickard 2015)

Green: over 0.3°C reduction (significant)
Yellow: under 0.3°C reduction (insignificant)

D: Percent green space along walkable roads



(Pickard 2015)

Blue: over 30% green space
Orange: under 20% green space

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