



USFS and Partners

Street Tree Diversity Reveals a Legacy of Redlining

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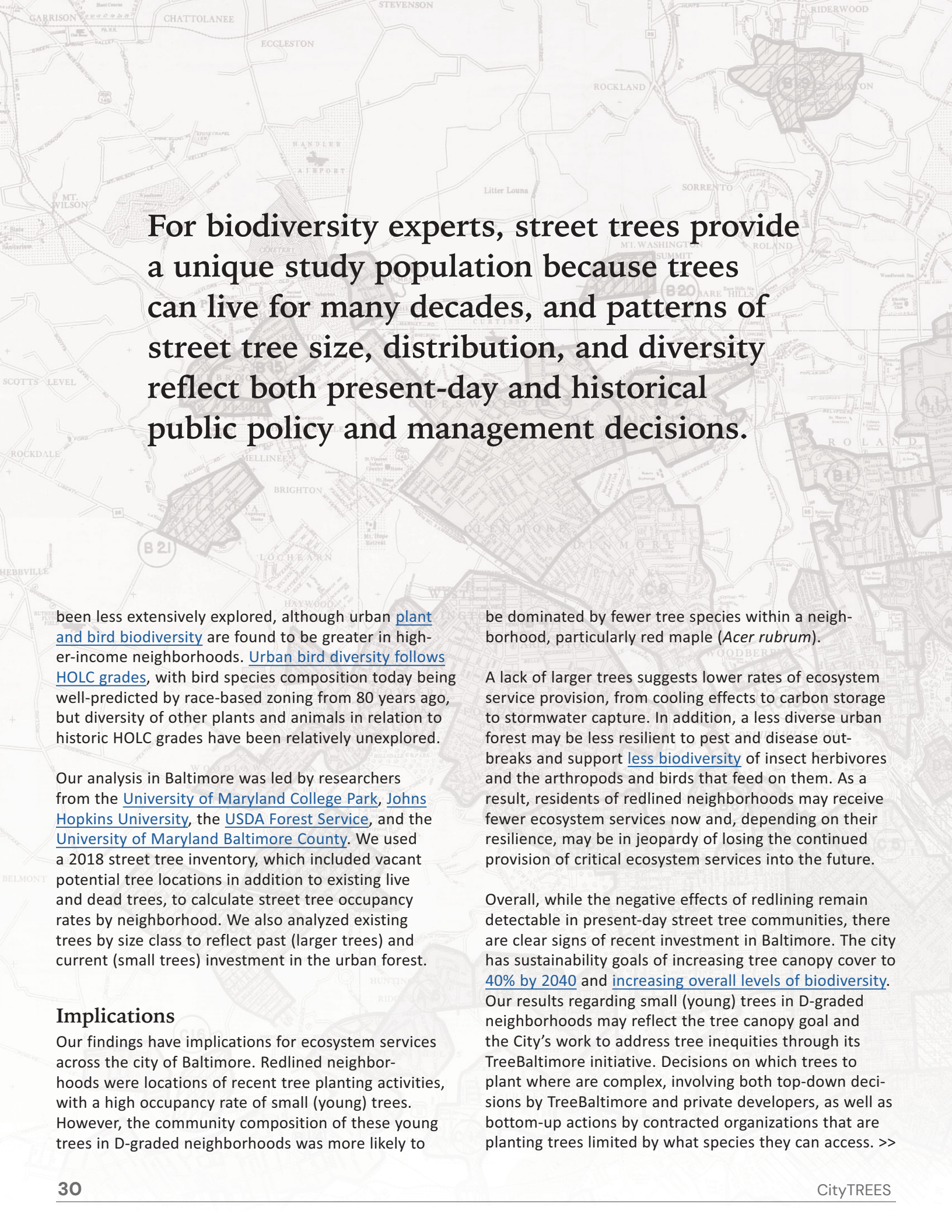
In a [recent article](#) published in the journal *Ecology*, our research team reported that neighborhoods in Baltimore that were redlined have consistently lower street tree diversity and are nine times less likely to have large (old) trees occupying a viable planting site. What does this mean for those who live in these neighborhoods, and what steps might cities like Baltimore take to mitigate this structural challenge in their urban forests?

For biodiversity experts, street trees provide a unique study population because trees can live for many decades, and patterns of street tree size, distribution, and diversity reflect both present-day and historical public policy and management decisions. [Recent studies](#) have discovered that exclusionary housing discrimination and segregation, reflected in the Home Owners' Loan Corporation (HOLC) mapping program, left an imprint on both the social and ecological landscape of American cities.

In this New Deal initiative created to expand homeownership following the Great Depression, the HOLC classified and color-coded neighborhoods in 239 cities by perceived mortgage risk—green was designated as

“best” for a loan while red was deemed “hazardous.” Neighborhoods that were “redlined” had characteristics of high-density, poor housing stock, proximity to undesirable land uses, and large percentages of Black, Catholic, Jewish, or immigrant populations. These institutionalized, race-based practices have had lasting impacts on property values, generational wealth accumulation, public health, and neighborhood investment in cities across the United States. For example, redlining has become associated with [lower homeownership rates](#), [shorter life expectancies](#), and [poorer overall health](#).

Urban ecologists have also found that formerly A-graded neighborhoods are [significantly cooler](#) than D-graded neighborhoods with [nearly twice the total vegetation](#) and [tree canopy](#), and [higher net ecosystem services](#). Thus, the investment (or dis-investment) in a neighborhood based on a program that ended in the 1960s can predict environmental conditions 60 years later. In addition, since the amount of plants, the base of the food chain, varies within cities according to HOLC grades, it has been proposed that [redlining may predict entire urban food webs](#). Correlations between historic HOLC classification and present-day patterns of biodiversity have >>



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been less extensively explored, although urban [plant and bird biodiversity](#) are found to be greater in higher-income neighborhoods. [Urban bird diversity follows HOLC grades](#), with bird species composition today being well-predicted by race-based zoning from 80 years ago, but diversity of other plants and animals in relation to historic HOLC grades have been relatively unexplored.

Our analysis in Baltimore was led by researchers from the [University of Maryland College Park](#), [Johns Hopkins University](#), the [USDA Forest Service](#), and the [University of Maryland Baltimore County](#). We used a 2018 street tree inventory, which included vacant potential tree locations in addition to existing live and dead trees, to calculate street tree occupancy rates by neighborhood. We also analyzed existing trees by size class to reflect past (larger trees) and current (small trees) investment in the urban forest.

Implications

Our findings have implications for ecosystem services across the city of Baltimore. Redlined neighborhoods were locations of recent tree planting activities, with a high occupancy rate of small (young) trees. However, the community composition of these young trees in D-graded neighborhoods was more likely to

be dominated by fewer tree species within a neighborhood, particularly red maple (*Acer rubrum*).

A lack of larger trees suggests lower rates of ecosystem service provision, from cooling effects to carbon storage to stormwater capture. In addition, a less diverse urban forest may be less resilient to pest and disease outbreaks and support [less biodiversity](#) of insect herbivores and the arthropods and birds that feed on them. As a result, residents of redlined neighborhoods may receive fewer ecosystem services now and, depending on their resilience, may be in jeopardy of losing the continued provision of critical ecosystem services into the future.

Overall, while the negative effects of redlining remain detectable in present-day street tree communities, there are clear signs of recent investment in Baltimore. The city has sustainability goals of increasing tree canopy cover to [40% by 2040](#) and [increasing overall levels of biodiversity](#). Our results regarding small (young) trees in D-graded neighborhoods may reflect the tree canopy goal and the City's work to address tree inequities through its TreeBaltimore initiative. Decisions on which trees to plant where are complex, involving both top-down decisions by TreeBaltimore and private developers, as well as bottom-up actions by contracted organizations that are planting trees limited by what species they can access. >>



A Blue Water Baltimore volunteer planting event in Baltimore's Broadway East neighborhood attended by the city's volunteer Treekeepers. Credit: Baltimore City Department of Recreation & Parks



Native tree species lined up for a TreeBaltimore giveaway event at Stillmeadow Community Fellowship in southwest Baltimore. Credit: Baltimore City Department of Recreation & Parks

New Directions

This analysis has sparked continued discussion among researchers and urban forestry professionals in Baltimore City to better understand the relationship between the city's street tree population and present-day demographics, which may not always reflect HOLC grade boundaries. In New York City, socially vulnerable neighborhoods are more likely to have lower street tree abundance and diversity, though these inequities are [diminishing over time](#). Preliminary analysis of Baltimore City's street trees shows similar trends, as well as negative correlations between neighborhood temperature and street tree biodiversity.

In order to combat historical race-based inequity, the Baltimore City Forestry Division has implemented policies that contribute to a more equitably distributed urban canopy. The division plans large, targeted plantings in different low-income neighborhoods each season. The plantings are focused primarily along popular walking routes to Baltimore City Public Schools. This is coupled with a year-round proactive tree maintenance program aimed at pruning and removing hazardous trees in neighborhoods with relatively fewer service requests. Replanting in these areas enables the City to address gaps in the canopy that might otherwise go

unnoticed. The [TreeBaltimore](#) initiative also trains residents through its stewardship program, TreeKeepers, to engage with a nursery stock program where they can access free and diverse trees for planting projects in their own neighborhoods. By increasing awareness and lowering barriers to these city resources, more trees of greater diversity get planted where they are needed.

Continued investigation into past and present policy drivers of street tree populations will help ensure that future street tree communities and their benefits are more equitably distributed across urban neighborhoods. These results and future research are particularly relevant to new investments at local, regional, and national scales in historically underserved urban neighborhoods, like [Maryland's Urban Trees Grant Program](#) and the nearly [\\$1.5 billion dollars in awards](#) recently announced by the USDA Forest Service Urban & Community Forestry program. Monitoring and evaluating the impact of these investments on biodiversity, [cascading trophic structures](#), and ecosystem benefits could provide important insights into urban ecological systems and the ability to promote healthy communities, urban sustainability, and resilience to climate change. 🌱



Native trees in TreeBaltimore's staging area in Druid Hill Park.
Credit: Baltimore City Department of Recreation & Parks



Baltimore TreeKeepers pole-pruning in the Oliver neighborhood of Baltimore City. Credit: Baltimore City Department of Recreation & Parks

Strategies to Increase Street Tree Diversity: Lessons from Baltimore

Promote Community Awareness – Make sure that tree diversity is seen as a priority for public agency and non-profit partners, as well as community members. Baltimore City's [TreeKeepers](#) program is a good model for promoting this.

Address the Urban Tree Supply Chain – Create a larger available palette of resilient tree species for difficult environments. The Baltimore City Forestry Division is expanding the City's approved street tree list, enhancing the diversity of trees they offer through [TreeBaltimore](#), and investing in their own nursery stock program to diversify production via public-private partnership.

Increase Planting Space – Formerly redlined neighborhoods are often very densely built, with limited space for street trees and highly compacted and poor-quality soils. [Baltimore City's Forestry Division](#) is expanding tree pits in these neighborhoods where possible, and is working with the Department of Transportation to make sidewalk construction guidelines more accommodating of street trees.