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The Political Ecology of Uneven Urban Green Space

The Impact of Political Economy on Race and Ethnicity in Producing Environmental Inequality in Milwaukee

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This article investigates the role of urban political economy, private-public property relations, and race and ethnicity in the social production of Milwaukee's urban forest. By integrating urban-forest canopy-cover data from aerial photography, United States Census data, and qualitative data collected through in-depth interviews, this analysis suggests that there is an inequitable distribution of urban canopy cover within Milwaukee. Since urban trees positively affect quality of life, the spatially inequitable distribution of urban trees in relation to race and ethnicity is yet another instance of urban environmental inequality that deserves greater consideration in light of contemporary and dynamic property relations within capitalist societies.

Keywords: *environmental inequity; urban political ecology; Milwaukee's urban forest; private property; race/class*

Scholars are beginning to relate the social production of urban space to the complexities that create material inequality in urban environments. Specifically, by investigating political economy, scholars working within the growing field of urban political ecology have contributed important insights into how we understand the social formation of urban environments (see Keil 2003; Heynen, Kaika, and Swyngedouw 2006). In an effort to better demonstrate the interdependent and intertwined power relations

that lead to the social production of uneven environments, research done within the context of Marxist urban political ecology has paid special attention to the "interwoven knots of *social process, material metabolism* and *spatial form* that go into the formation of contemporary urban socionatural landscapes" (Swyngedouw and Heynen 2003, 906, emphasis in original). Swyngedouw and Heynen go on to suggest this is important because "it is on the terrain of the urban that [the] accelerating metabolic transformation of nature becomes most visible, both in its physical form and its socioecological consequences" (p. 907).

There have been attempts to better articulate the causes of environmental transformation (see Schmidt 1971; Smith 1984; Benton 1996; Foster 2000), especially within cities (see Swyngedouw 1999, 2004; Gandy 2002; Desfor and Keil 2005) and between cities and their rural peripheries (see Williams 1973; Cronon 1991). From these varied perspectives, we see the emergence of a growing discussion about the social production of nature as a means of explaining why so few urban residents benefit and so many suffer from unevenly distributed environmental amenities (also see Dobson 1999; Wenz 1988). Capitalism, and more specifically, neoliberal capitalism, although geographically differentiated across global axes, is now the ubiquitous mode of production affecting the development and environments of cities across the planet (Keil 1995; Keil, Werkerle, and Bell 1996; Luke 2003; Heynen and Perkins 2005; Heynen and Robbins 2005; McCarthy and Prudham 2004). Accordingly, cities have emerged as centers for the production, exchange, and consumption of their environments as commodities (Lefebvre 1991, 1996, 2003; Robbins, Polderman, and Birkenholtz 2001).

Though urban forests too often are seen as naturally occurring, Marxist formulations of political economy (Marx 1867 [reprint]; Harvey 1996; Smith 1984; Swyngedouw 1999) and resulting urban political-ecological investigations contribute to progress in our thinking about the social production of urban green environments as a process of commodification of urban nature (Castree 2000; Keil and Desfor 2003; Kaika 2005; Swyngedouw, Kaika, and Castro 2002). Thus, these relational processes of commodification produce urban forests that epitomize past and present structural processes inherent in urban political economy, such as income inequality, uneven property ownership, and the increased marketization of nature.

As a commodified element of the urban environment, urban forests can be thought of collectively as a facet of capital's consumption fund (see Harvey 1982 [reprint], 1989). This is because urban trees ultimately give form to a portion of cities' physical frameworks for consumption. People in urban areas, although potentially unaware of doing so, consume urban forests'

many positive externalities or benefits. As such, these stocks of urban trees become a part of the secondary circuit of capital in which "there must obviously be a "surplus" of both capital and labor in relation to current production and consumption needs in order to facilitate the movement of capital into the formation of long-term assets, particularly those constituting the built environment" (Harvey 1989, 64–65). In thinking about this statement's importance for theorizing the role and ramifications of urban trees, *built* can substitute for *physical*. Either way, the collective redistribution of resources generated by state taxation is necessary for public investment in urban canopy cover.

However, this investment is geared only toward public property, as dictated traditionally by liberal forms of property ownership in the United States and western Europe. The lack of attention to and investment in private property inevitably leads to environmental tensions, given the multiplicity of power relations that are embedded within urban space, and more concretely, within the political economy of property relations (see Heynen 2006). As a result, poor urban residents who lack the financial resources to purchase and maintain trees are often unable to produce local and healthy urban ecologies for themselves. Thus, they remain dependent on public investment in street trees and parks for their collective consumption of urban ecological amenities.

Central to these issues, research within urban-forest ecology and environmental social sciences has shown that urban trees offer myriad positive externality effects that increase the quality of life within cities. Urban trees help conserve energy and water and reduce carbon dioxide (Heisler 1986; McPherson 1990; Meier 1991; Rowntree and Nowak 1991; Nowak and McPherson 1993). Oke (1989) has shown how urban forests moderate urban climate. Furthermore, research has shown that urban trees improve the quality of air (Smith 1990), help mitigate flooding and rainfall runoff (Sanders 1986), reduce urban noise levels (Cook 1978), provide habitat for wildlife (Johnson 1988; Jim 2004), reduce human stress levels (Ulrich 1984), enhance the attractiveness of cities (Schroeder 1989), and have many sociopsychological benefits for young and old alike (Taylor et al. 1998; Kweon, Sullivan, and Wiley 1998).

Despite public-sector investment in the maintenance of trees along streets and within parks, urban poor and minorities remain underserved, because these public trees represent only a small portion of cities' urban forests. Uneven forest development resulting from the conditions of increasing privatization of the land upon which urban forests grow is therefore likely to impact these groups the hardest. A more comprehensive focus on the ramifications of privately managed urban forests, therefore, will foster a better

understanding about long-term issues of urban-forest consumption and social equity in cities.

This kind of research is important because there has been relatively little published on urban-forest inequity within the broader urban-studies literature. A few exceptions include Talarchek (1990), Pedlowski et al. (2002), Heynen (2003), Heynen and Lindsey (2003), and Perkins, Heynen, and Wilson (2004), who have contributed to a better understanding of general structural processes that shape urban-forest inequity. Schmid (1975), Dorney et al. (1984), Emmanuel (1997), and Iverson and Cook (2000) are also notable exceptions, but their findings rely on partial data concerning specific land uses. Because existing research is limited, there is a need to examine urban forest-inequity critically, especially through concrete historical-geographical data that connect land use and property relations to the spatial distribution of urban trees.

Despite the fact that urban trees contribute to the general ecological health of cities, urban-forest inequity has remained outside the realm of traditional environmental-justice (EJ) research. This is because traditional EJ research has focused primarily on issues related to the distribution of toxic wastes and related facilities (Bullard 1990; Szasz 1994; Girdner and Smith 2002). But as Di Chiro (1996, 301) suggests, in place of mainstream notions of a pristine and removed nature, environmental-justice activists increasingly define the environment as "the place you work, the place you live, the place you play." Integral to their activism is the notion that the urban environment is a product of nature and human activity. Here, Marxist urban-political ecology contributes to the activists' expanded definition of environmental justice and injustice as people working within this area recognize that the ecology of urban environments, including trees, is produced socially within uneven relations under capitalism. What remains for scholars working within the context of Marxist urban-political ecology is making the links between capitalist processes and the injustices of uneven urban ecologies more explicit.

To better understand the social production of urban environments through the interdependent context of urban-political economy and race/ethnicity, this article investigates the distribution of Milwaukee's urban forest by focusing not only on those trees located on public property but also those located on residential property. By integrating urban-forest canopy-cover data from aerial photography, United States Census data, and qualitative data generated through in-depth interviews, this research shows that there is a socially inequitable distribution of urban trees within Milwaukee. Uneven canopy cover has social relevance because urban trees produce positive externalities; their uneven distribution in Milwaukee can be interpreted as contributing to an inequitable quality of life for Milwaukeeans (Perkins, Heynen, and Wilson

2004; Heynen and Perkins 2005). This research thus expands the parameters of environmental justice and injustice by linking the deprivation of beneficial consumptive ecologies to race and ethnicity based on the impact of private-property relations.

Understanding Urban Forest Dynamics

Milwaukee's urban forest is celebrated nationally because of historical efforts by the city's Urban Forestry Department (American Forests 1996). However, Milwaukee also is known for its prevalence of structural racial segregation and high levels of socioeconomic inequality (Massey and Denton 1993; Gurda 1999) that makes this city an interesting context for studying issues of environmental injustice. Because the Milwaukee Forestry Department's responsibilities are to maintain the city's public trees, processes inherent in urban political economy have produced inequities here with regard to the spatial distribution of trees on private property. Also important is the history of Dutch elm disease (first noticed in 1956), destructive storms, and other historical-ecological factors that have affected the spatial pattern of Milwaukee's contemporary forest. However, the demise of tens of thousands of elms in Milwaukee by these combined events (especially Dutch elm disease) underscores the importance of how political-economic factors and the racial and ethnic patterns of urban settlement since the 1960s influence the rebirth of the city's trees.

Addressing the inequitable distribution of trees as related to urban political economy requires the incorporation of both urban-forestry data and socioeconomic data. Therefore, the methods used within this research follow and build upon increasing efforts to link remotely sensed data measuring canopy cover with urban social scientific data (see Craig, Harris, and Weiner 2002; Robbins 2003; Turner 2003). Related to this, Rindfuss and Stearn (1998, 13) suggest:

> Environmental quality has been a major concern of citizens and policy makers for over a quarter-century, and there is a compelling need to understand human-environment interactions. Such understanding depends on better knowledge of biophysical systems, of human activity, and above all, of the relations between the two. Linking remote sensing and social science is a necessary part of developing this knowledge.

Data representing socioeconomics and urban-forest canopy cover were collected for 223 census tracts within Milwaukee. As is common in other

United States urban geographical studies, neighborhoods in this research are defined along census boundaries (Talen 1997). Although the relationship between census tracts and residential areas is often inconsistent, census data do represent social information within a discrete space, which is a necessity for this research. Some variation of characteristics exists within census-tract areas, but because of the ease with which these data can be generalized, census data are still useful at this scale of analysis. The socioeconomic data were obtained from the United States Census Bureau.

Data representing urban-forest canopy cover were collected via a spatial sampling method called the dot method (see Nowak et al. 1996) and integrated into a GIS. Aerial photography (1:400 scale) from the year 2000 was used as the basis of the data collection. Several measures to gauge urban forests, including tree cover and total green space, exist within urban-forestry research (Nowak et al. 1996). Urban tree-canopy cover is a measure of the percentage of a predetermined spatial unit (in this research, census tracts) covered by the canopy of trees or tree crowns (Nowak et al. 1996). Because it is measurable and can be defined concisely, urban tree-canopy cover will be used as the variable as opposed to broader definitions of the urban forest that would include essentially all urban vegetation or green space. Broad definitions of urban forests can be useful because large patches of other vegetation, such as grass or other herbaceous species, perform many of the same functions as trees (Rowntree 1986). However, a broad definition obfuscates an explicit understanding of urban-forest unevenness.

Some variability in lot size exists throughout Milwaukee, which has important ramifications for our analysis. Parcels nearer the central city tend to be smaller, and those particularly in the newer northwest part of the city tend to be slightly larger. However, no direct provision for differences in lot size was made in this analysis, since the social-demographic data are aggregated at the census-tract level. Although the data do not address the issue of local lot size, they are adjusted for the spatial area of census tracts. We acknowledge the importance of taking the variability of lot size directly into account and see it as a next step in an expanded research project.

To better situate the findings based on quantitative data, 29 in-depth interviews were conducted with people that had a direct knowledge of the city's urban forest, including 1 former Milwaukee mayor, 11 Common Council members, the director of Milwaukee's environmental operations, the forestry operations manger, 3 district managers, 2 forestry crew leaders, 6 urban-forestry specialists of Milwaukee's Forestry Department, and 4 key not-for-profit stakeholders. The interviews enabled us to ask questions concerning the relationship between urban trees, housing tenure, class, and

race and ethnicity. The respondents' insight provides detail otherwise lost in purely quantitative research methods into urban-forest variability.

Interpreting Milwaukee's Urban Forest

It is necessary to consider the spatial breakdown of Milwaukee's urban forest across different property types to understand to what degree the forest is managed by public institutions versus private-property owners and how political economic processes contribute to the production of urban-forest variability. Past investigations erroneously have estimated Milwaukee's total canopy cover at 16% (American Forests 1996). The inflated estimate is a result of inadequate sample size and inappropriate sampling methods. The American Forests study looked at 16 predetermined sites that constituted less than one-tenth of 1% of the city's total area (American Forests 1996). This is particularly problematic because these estimates are used widely in planning efforts within Milwaukee, including efforts by the not-for-profit reforestation group Greening Milwaukee.

Urban land uses affect the distribution of trees, so a more nuanced analysis of urban canopy cover across and between land-use categories should shed more light on the varied distribution of urban trees. From this, a composite yet comprehensive breakdown of canopy cover can be established and related to urban socioeconomic and demographic variables. Accordingly, a more realistic estimate derived within this research suggests that only 7.1% of the city of Milwaukee is covered by canopy.[1] This figure for total canopy includes trees found across all land-use classifications throughout the city. Importantly, there is variation within the total canopy cover, particularly as it is related to public and private divisions of property.

Whereas street trees managed by the city of Milwaukee constitute only 4.3% of its entire urban canopy cover, about 27.8% of the canopy cover is composed of trees located on residential properties. Despite this difference in canopy composition, it is important to point out that as a function of their placement within the urban landscape, street trees are much more visible than their counterparts on private properties. This is likely the reason why street trees so often are discussed within past research and why Milwaukee's forestry department has received notoriety.[2] The remainder of the canopy cover is distributed across other property types: commercial/industrial constitutes approximately 27.1%; non–city-managed public, composed mostly of public schools and other types of related properties, constitutes approximately 12.7%; and parks constitute approximately 28.1%.

Figure 1 represents the spatial distribution of Milwaukee's urban forest both in its entirety as estimated across property types as well as within explicitly residential property. Within Milwaukee's census tracts, the maximum residential canopy cover is only 9.6%, and there are many tracts that do not have any residential canopy cover. Although it is important to point out that some tracts have very little residential land use, and as such, they likely would not have much residential canopy cover, these figures overall are low percentages. Figure 1 also illustrates the distribution of several socioeconomic and demographic variables that seemingly affect residential canopy cover, including median household income, rentership, and the most dominant racial and ethnic settlement patterns. The maps illustrate a positive relationship between both types of canopy cover and median household income, but they suggest an inverse relationship between both types of canopy cover and rentership and percentages of African-American and Hispanic residents. To clarify this, the variables were correlated statistically.

Table 1 indicates that there is an inequitable spatial distribution of Milwaukee's urban forest. Despite a few aberrant tracts, citywide urban-forest canopy cover across all property types is positively statistically correlated with median household income (.285) and those tracts inhabited largely by non-Hispanic Whites (.138) at $\alpha = .01$. Furthermore, total urban-forest canopy was negatively statistically correlated with housing vacancy (–.195) and Hispanic residents (–.149) at $\alpha = .01$. There was not a significant correlation between total canopy cover and housing rentership (–.124) and African-American residents (–.059). As such, these data suggest that those census tracts with higher median household income, non-Hispanic White residents, and low housing-vacancy rates are more likely to have greater total canopy cover.

With specific reference to residential canopy cover, Table 1 shows that canopy cover is positively correlated with median household income[3] (.436) at $\alpha = .01$ and non-Hispanic White residents (.133) at $\alpha = .05$. However, it is negatively statistically correlated with housing rentership (–.473) and housing vacancy (–.434) at $\alpha = .05$ and $\alpha = .01$, respectively. Furthermore, Table 1 shows that tracts that are home to Hispanic residents (–.250) are negatively statistically correlated with residential canopy cover at $\alpha = .01$ and $\alpha = .05$, respectively.

Household Income and Housing-Market-Based Inequity

Let us now consider the political-economic basis of these uneven relations within Milwaukee's urban environment. Political-economic factors play a key role in producing urban environments, including where urban trees are planted and/or allowed to grow. Urban trees—especially those located on residential

Figure 1
Urban Forest-Canopy Cover, Household Income, African-American Population, and Hispanic Population Distributions for Milwaukee

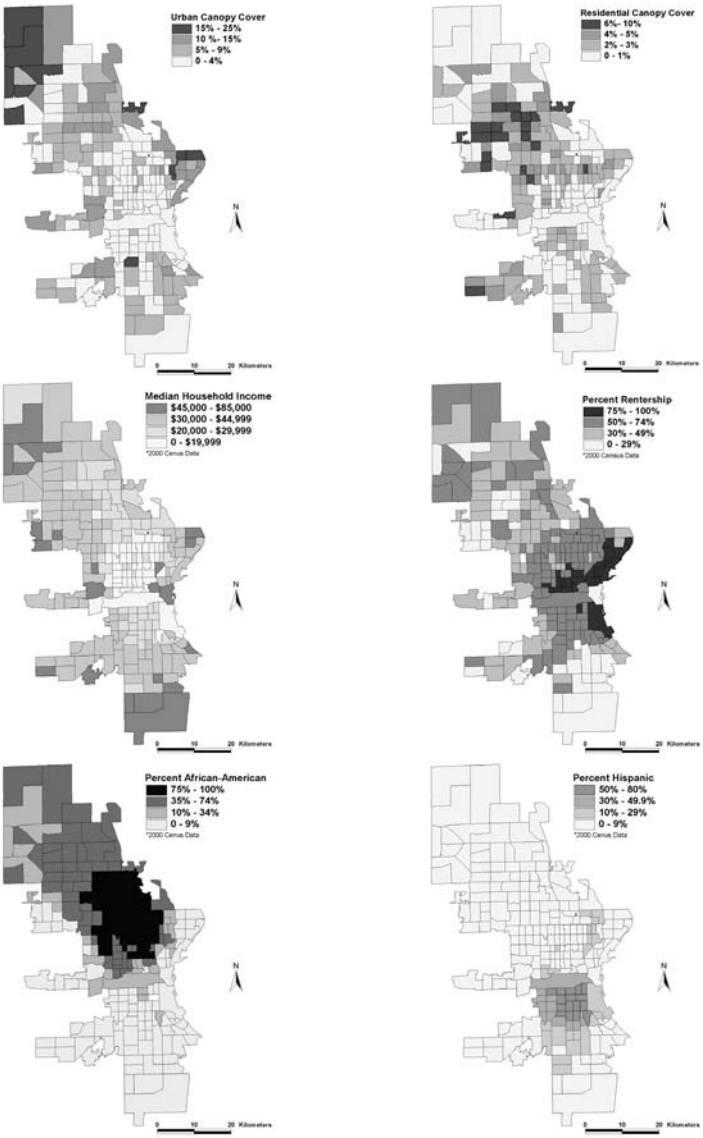

Table 1
Bivariate Correlations Between Canopy Cover over All Land Uses, Canopy Cover on Just Residential Land and Median Household Income, Percent Rentership, Percent Vacancy, Percent Non-Hispanic White, Percent African-American, and Percent Hispanic for 2000

Pearson's Correlation	Canopy	Residential Canopy
Median household income	.285**	.436**
% Rentership	–.124	–.473*
% Vacancy	–.195**	–.434**
% Non-Hispanic White	.138**	.133*
% African-American	–.059	–.013
% Hispanic	–.149*	–.250*

*significant at $\alpha = .05$.
**significant at $\alpha = .01$.

property—largely have been maintained privately, making the relationship between household income and the distribution of residential canopy cover important. Because of the strong link between trees on residential property and property value (Anderson and Cordell 1988), trees assume similar use patterns as other housing amenities under urban capitalism. As with other housing amenities, households with higher incomes tend to have greater disposable resources that can be used for tree planting and maintenance. Hence, upper income residences tend to have more, and better maintained, canopy cover on their properties (Talarchek 1990; Heynen and Lindsey 2003).

However, those households without sufficient disposable income cannot, in many cases, afford to maintain trees on their property. Therefore, we see a tenure-based disparity in the distribution of canopy cover within the city. Uneven urban development with regard to the city's built environment is not a new concept (Harvey 1989; Smith 1984). Yet, an examination of differential investment into the built environment and the maintenance incentives therein for private individuals and institutions can provide important insight into the formation of uneven urban environments.

The statistically positive correlation between residential canopy cover and median household income in this study illustrates the degree to which private investment in the urban-forest resource is beneficial to wealthy rather than poor residential areas. Based on the notions of private-property ownership, Milwaukee's municipal tree ordinances do not give it the right or responsibility to plant trees on private property to compensate for this disparity; they

only require that residents promptly remove Dutch elm–diseased trees on private property. Whereas the ordinances are meant to preserve the health of the entire urban forest, their narrow scope precludes public expansion of the forest in impoverished locations that lack canopy on private property.

Lower-income groups, therefore, rely on the investment of surplus capital into small segments of the urban forest found on public property. This in part explains the variation in correlations concerning total canopy cover versus residential canopy cover. In other words, rentership and minority status tend to be less negatively correlated with total canopy cover because of public investment in trees on street spaces in residential areas. But limiting collective investment into the production of a relatively small number of public trees renders the trees' benefits less significant in comparison to the negative effects created by a lack of canopy cover found on private property encompassing a much larger total area of the city. Although high percentages of canopy cover found in wealthier tracts are generally good for all communities within a city, from an ecological perspective, the local benefits of urban forests are disproportionately consumed by higher-income citizens because of their proximity to trees on their privately owned properties. Marginalized communities, by contrast, living mostly in inner cities and unable to maintain trees on their properties, remain largely underserved as the diminishing return of the positive externalities of urban trees elsewhere in the city fails to produce sufficient benefit for their local environments (see Heynen 2003).

Because of the various environmental and economic benefits derived from trees, many cities realize trees are cost-effective investments on public property. But the price tag placed on planting and maintaining trees on private property is considered too expensive by most municipalities; these activities are not identified readily by municipalities as productive and cost-effective forms of public investment. This is a common approach for the provision of urban ecologies (Costanza et al. 1997; Daly and Cobb 1994), but it is problematic because it bases investment in urban trees on personal purchasing ability. This is especially important for those people living in urban poverty who bear the cost of living without trees, as they have to prioritize the purchase of food and paying rent over enhanced environmental amenities. The planting of trees on private property in poor neighborhoods, therefore, depends more upon nonprofit activity.

Because of the perceived success of Milwaukee's municipal forestry program, however, only one nonprofit tree-planting program exists in the city. Greening Milwaukee, a local nonprofit, offers several hundred free trees to city residents every year. Its mission is to replace trees being lost on private property because of Dutch elm disease, especially in poor communities.

However, the recipients of the nonprofit's free trees are not usually poor or renters (see Perkins, Heynen, and Wilson 2004). To this end, the director of Greening Milwaukee suggested in a personal interview, "My clients are homeowners with incomes greater than $60,000. Those are the greatest numbers of participants that I have." As a result, the production and distribution of trees remain controlled largely by liberal private-property rights except where directly controlled by the city forestry department for common benefit on small sections of fragmented public land.

In addition to the link between household income and housing tenure, there are specific processes inherent in housing markets that necessitate greater attention for the sake of understanding their effect on the distribution of urban trees. For instance, within low-income neighborhoods, processes of disinvestment can spiral via spatial lag effects (see Odland 1982) and contribute to physical decay within the urban built environment. Although this process has yet to be discussed thoroughly within the context of the distribution of urban trees, processes of disinvestment can be expected to have a similar negative effect on urban forests (see Heynen 2003; Perkins, Heynen, and Wilson 2004; Heynen and Perkins 2005). Massey and Denton (1993, 13) suggest, "Each property owner who decides not to invest in upkeep and maintenance . . . lowers the incentive for others to maintain their properties." Urban-forest changes should be expected to function in a similar way and ultimately lead to variation in canopy cover. Therefore, continued neighborhood-scale disinvestment implies decreasing levels of residential canopy cover, especially in the city's poorest communities, thus leading to greater environmental injustice and more ecological problems for marginalized urban residents.

Massey and Denton's (1993) notion of residential disinvestment has important ramifications for the relationship of housing-market characteristics to trees, especially concerning landlord and tenant investment in rental properties. Although landlords have potential long-term benefits to gain by investing in trees, positive investment decisions often are not made when neighborhood stability is in question. In the case of neighborhoods that exhibit property devaluation, Massey and Denton suggest that landlords are unlikely to spend more than the minimum necessary for upkeep of their properties, which is unlikely to include expenditure on trees.

As it is not their property, renters also have less direct ability and incentive to invest in the planting and maintenance of trees on rental property. Furthermore, because they are unlikely to live on the property when a slow-growing tree matures and begins to produce its substantial benefits, they do not have the motivation to invest in tree planting and maintenance. Not surprisingly, then, the bivariate correlations within this article indicate that

renters lack canopy cover, and thus, as a group, experience uneven access to the positive externalities provided by urban trees. This is an environmental injustice, but because renters often face other issues regarding their satisfaction with rental property, seeking advocacy for trees is seldom a priority.

The very last stages of private-property disinvestment lead to abandonment as the municipality confiscates derelict properties from tax-delinquent absentee owners. Continued disinvestment in vacant housing structures after their confiscation often leads to their demolition; trees also are removed if they get in the way of demolition or are found to be hazardous or diseased. In Milwaukee, for both aesthetic reasons and health issues (e.g., mosquito habitat), the city pays contractors to mow these vacant lots, reducing the number of volunteer trees found growing on them. The large number of vacant lots found in Milwaukee represents an unrealized potential as tree spaces that contribute to the increased unevenness of urban canopy.[4]

Our research suggests that housing rentership and housing vacancy, both variables used to measure Milwaukee's housing-market dynamics, help illustrate that less stable housing situations have negative impacts on the distribution of urban trees. Because of the feedback mechanisms that exist between individual and collective disinvestments in neighborhood upkeep, certain residential neighborhoods often fall into the self-perpetuating disinvestment process leading to constant deterioration of available urban amenities including trees. Given the degree that Milwaukee's rentership and housing-vacancy rates have increased during the past several decades, these factors are likely to have a catastrophic effect on Milwaukee's urban forest in the future if the trend is allowed to continue. This already is affecting particular groups of people living in Milwaukee.

Racial- and Ethnic-Based Inequity

As expected, in Milwaukee, non-Hispanic White populations are correlated with more canopy cover and Hispanic populations with less. Given the strong relationship between race and ethnicity and housing tenure within Milwaukee, these findings are not surprising. This is, however, an environmental circumstance that provides an empirical basis for expanding the traditionally narrow discussion of environmental justice to include urban-forest ecology. Accordingly, the urban ecological injustices present within Milwaukee's predominantly inner-city and minority neighborhoods cannot be understood via the lens of political economy alone; a discussion of the

impact on race and ethnicity is also necessary. In-depth interviews here shed light on the relationship between urban trees, political economy, and race and ethnicity.

Despite the uneven distribution of trees in Milwaukee, qualitative data suggest that the distribution of trees is complex in relation to the specific composition and placement of many trees within Milwaukee's predominantly minority neighborhoods. In particular, the interviews conducted for this article indicate the problematic nature of central Milwaukee's poorly maintained forest found on disinvested private property. Of primary concern is the fence-line forest, composed of trees that volunteer along fences and the foundations of buildings. Not specifically quantified in this study, these trees contribute to the overall canopy cover in some neighborhoods, likely explaining why largely African-American census tracts do not exhibit strong negative correlation with total canopy cover or residential canopy cover (see Table 1).

Because the fence-line forest is allowed to grow to considerable size because of a lack of yard maintenance, it is considered by some African-American residents as a nuisance and a liability. Whereas these trees provide benefits similar to their purposefully planted counterparts, qualitative data collected suggest that the trees at times create tension between residents as they cause damage to residential infrastructure including fences, building foundations, and roofs.

As they grow large enough to damage property, these fence-line trees force property owners to remove them. On a large enough scale, this process contributes to spatial variability of residential canopy cover between census tracts. Most interviewees suggest that the rate at which these residential "weed" trees are being removed is greater than the rate that others are intentionally planted or the rate they can grow back. Concerning the perilous existence of the fence-line forest, a resident living and working in a predominantly African-American neighborhood suggested the following:

> New trees planted on private land are barely keeping up with the ones being taken down. The fence-line forest is being taken down. Many of the trees are unwelcome as they chose to grow there due to neglect. They can be fifteen feet in their first year. It gives illusion to a significant green patch that is not intended.

Similarly, two other respondents suggested that many trees present in the neighborhood are becoming a hazard, or at least a nuisance, in many locations, because property owners are not maintaining them. Trees in alleys are

getting large enough that many are blocking the right of way, while trees in yards are causing conflict as they do damage to roofs. A resident of another neighborhood stated, "With many homeowners, trees are not favorably received because of small lots, where they are on the roof or on the gutter—or dealing with the fall of leaves into gutters. Around here [another predominantly African-American neighborhood], these trees are perceived as a problem, especially with maintenance." He went on to characterize a situation that he currently was dealing with:

> Most homeowners, especially new homeowners, are cutting down trees—those that are too close to the house. They cause problems with the roof and can cause tension between homeowners. I am experiencing that right now. A neighbor of mine, his tree is in the middle of their yard, it's probably never been trimmed. I have a duplex with a back cottage. [The tree] covers the whole roof of my cottage, and it is hurting the roof. I have thought about calling [my neighbor's] insurance company, because somebody has to pay for that roof.

This is especially problematic because urban trees in spaces of disinvestment actually can be a greater liability than a benefit to residents. A lack of an ability to maintain trees that grow on private property or to eliminate the trees that volunteer along fence lines translates into increased property damage for landlords and residents alike. Because of these relations, trees can be viewed as a negative aspect of the urban environment, causing people to remove them to mitigate property damage and diminished neighborly relations. Wide-scale removal of poorly maintained trees may lead to heightened urban-forest inequity between poor African-American sections of the city and wealthier owner-occupied portions. Our qualitative data suggest that these processes are already underway. More investigation into the dynamics of the fence-line forest is needed as it is not clear how much fence-line forest contributes to aggregate levels of canopy cover, how quickly it is disappearing, or what its capacity is to recover from removal. It certainly appears, however, that the fence-line forest is a paradoxical component of urban environments that results from disinvestment, only to be removed with minor reactionary investments in property upkeep as it causes damage to structures.

In relation to the contribution of fence-line trees to canopy cover, some of the interviewees with whom we spoke suggested that a lack of fence-line forests such as those found in poorly maintained African-American communities contributes to diminished canopy cover in other minority neighborhoods. In particular, the fence-line forest is not perceived by the interviewees to exist in Milwaukee's densely settled Hispanic communities.

From his perspective, the director of Greening Milwaukee sees a difference in canopy cover based on minority status in neighborhoods:

> If we look at correlations by ethnicity, the south-side Latino area, there is an inequitable distribution of trees there. In areas where we have larger African-American populations, we see a disproportionately high distribution of urban trees, which runs counter in some ways to the notion that environmental politics, money, whatever these things are that lead into where trees are in the city.
>
> Midtown and Northside [predominantly African-American] have the housing footprint. Big houses on small parcels, so why should there be more trees there? The Hispanic Southside is the densest populated area in the state, so it tells me that there is something else going on.

A private arborist who also works for Milwaukee's forestry department attributes the spatial variation of trees between predominantly African-American and Hispanic neighborhoods in relation to differences in the degree and timing of property maintenance:

> [In African-American neighborhoods] my greatest moneymaker is the lot-line tree—the property-line tree—the tree that grows at the fence line. Now, in areas where I rent, if you rent property, you don't clean the fucking fence line. That's the landlord—that absentee bastard's job. In the meantime, he's growing fifty fucking trees. Right? So they start off small and *fooofy*. Now, you got a whole damn backyard full of weed trees, volunteers, my friends, all in these backyards. Now, if you're going to the Hispanic side of town, where those guys are taking a little more care of their damn property, where they're killing the weed before it's small, before you even knew it was a damn tree, it's being cleaned at the fence line. . . . That's where my forest grows—in the central city.

Our quantitative analysis indicates that as one of the fastest growing minority groups in Milwaukee, the Hispanic population suffers from an inequitable distribution of canopy cover in conjunction with a lack of the fence-line trees that are found in other disinvested communities. But these quotes concerning the fence-line forest tell us that the situation is more complex than the descriptive statistics alone suggest. Whereas the weed-tree removal that occurs in Hispanic neighborhoods is a form of preemptive maintenance, similar actions in African-American neighborhoods are different. In these locations, it seems, the trees are removed after disinvestment in property maintenance results in property destruction by the growth of large and poorly maintained trees. The timing of property maintenance, therefore, further suggests the variable nature of urban-forest disinvestment

in Milwaukee, especially as it relates to a dependence on forestry located on private property. This variability across the city as it relates to the political economy of race and ethnicity is an important consideration when formulating equitable urban ecologies in minority communities.

For example, the census tracts in Milwaukee defined by high Hispanic populations are the most densely populated tracts in all of Wisconsin (United States Census Bureau 2000). This is an important consideration because research on other issues related to inequality and environmental justice (Elliot and Sims 2001; Lejano and Iseki 2001) have shown that urban Hispanic populations are at greater risk of facing inequality because of the speed that their population is growing and their lack of political mobilization fostered within cities. These factors, combined with language barriers that impede greater cohesion with other urban residents, create structural barriers that render the problem of canopy cover qualitatively different in non-Hispanic White and Hispanic census tracts than in African-American census tracts.

Regreening the City

The simple statistical analyses within this article suggest that Milwaukee's residential canopy cover is distributed unevenly based on household income, housing-market characteristics, and racial and ethnic factors. The qualitative data compiled from in-depth interviews suggest that this variability in canopy cover in Milwaukee is more complicated than it first seems. The data indicate that minority communities differ in their maintenance abilities, population densities, and housing densities. More quantitative and qualitative research in this area is warranted as African-American and Hispanic census tracts in Milwaukee have problematic urban-forestry issues underway, whether or not these issues are associated with the fence line. The removal of the fence-line forest in African-American communities is likely to create substantial spatial unevenness in the future as a significant component of these communities' forest is lost. Continued tree growth within peripheral urban areas recently converted to residential property and primarily occupied by higher-income non-Hispanic whites likely will contribute to an increase in canopy cover for this particular group while increasing citywide forest inequity.

The environmental-justice literature has made limited progress in establishing the importance of "fair access for all to the full range of resources" (Di Chiro 1996, 307-309), including urban trees. Yet, the fact that reduced urban forest canopy for specific groups creates disparities in quality of life

is important enough for us to move beyond the narrow understanding of social justice and environmental racism and engage critically in planning efforts to produce more equitable urban environments for everyone.

The political mobilization of minority-group protests against environmental or economic injustice has won many battles in the past (see Pulido 1996) and can become an important means of rectifying spatial disparities related to the urban political economy and ecology of race and ethnicity. But before that can take place, a greater awareness must be fostered about the various benefits of urban forest and how its uneven distribution is diminishing the overall quality of life for those lacking access to trees.

Since Milwaukee exhibits many of the same characteristics as other large United States cities, it is intuitive that these trends exist within other major United States cities as well. Based on these observations, then, we offer some general suggestions regarding a more equitable management of urban forests in the future. From an urban planning and policy perspective, the contemporary distribution of urban canopy cover within Milwaukee should be viewed as a form of injustice requiring amelioration. Because urban trees undergo natural mortality cycles and take time to regrow, questions of redistributive justice with an eye toward the distant future must be central in progressive environmental policies. In the United States, the federal, state, county, and municipal governments should begin to recognize that the degradation of urban forests on private property not only has local-scale ramifications for quality of life but also has broader urban and regional ramifications for continued social reproduction (Heynen 2003; Heynen and Perkins 2005).

Therefore, issues related to future environmental policy should strive to create mechanisms that enforce equitable and collective processes of reforestation or afforestation in areas that could support more trees, particularly on private property in devalued neighborhoods. But this seems unlikely, as the degree to which privatization of urban-service provision has affected urban environments has increased within the past several years (see Brenner and Theodore 2002).

This article's analysis has suggested some negative implications of relegating the responsibility for urban forests to private-property owners. Accordingly, increasing privatization of urban environmental management under neoliberal political economy is suggested to intensify inequity in the availability of resources such as urban trees (Heynen 2003; Heynen and Perkins 2005). In a similar note, Faber (1998) indicates that shrinking public intervention in urban environments is one of the key factors responsible for the continuing deterioration of the overall quality of life for minorities.

Therefore, greater attention paid to the impact of changing property-ownership arrangements within contemporary urban political economy is essential for considering possible solutions to the race- and ethnicity-based inequitable distribution of urban forests present today. Municipal ordinances limiting public responsibility for trees on private property to Dutch-elm removal are not enough to address uneven urban-forest ecologies. Rectifying these inequalities must be accomplished in part by greater public intervention in urban-service management including those portions of the urban forest growing on private property. In other words, greater consideration ought to be given for more collective involvement in maintaining and managing not just the 4.3% of Milwaukee's urban forest found on its street edges but also the remaining 95.7% found everywhere else.

Notes

1. Figure computed with a standard error of .004.

2. According to Milwaukee's forestry-department manager, public spaces suitable for trees under his jurisdiction are 99% planted to their capacity citywide.

3. Values in census tracts in the northwest and southern portions of Milwaukee, as depicted in Figure 1, seem to defy the statistical link between residential canopy cover and median household income. Discrepancies within these tracts result from the relative newness of residential development in higher income areas and the lack of residential land use in relation to the size of those census tracts. It is possible that in time, trees planted in these tracts will grow larger, better fitting the expected positive relationship between median household income and canopy cover. This illustrates the fact that these correlations are citywide and that tracts may vary somewhat by context.

4. In this analysis, the impact of vacant lots was not assessed statistically. Housing-vacancy statistics used to calculate urban canopy-cover correlations in this research included only those properties with a vacated residential structure on the premises.

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