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Got green? addressing environmental justice in park provision

Chona Sister · Jennifer Wolch · John Wilson

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Abstract We present a pragmatic approach to assist planners in addressing racial inequities in park access. Utilizing the Los Angeles metropolitan region as an example, we used Thiessen polygons to delineate a service area for each park, and described potential park congestion or 'pressure' in each park service area. Results show that Latinos, African-Americans, and low-income groups in general were likely to live close to parks with higher potential park congestion. On the other hand, predominantly White, high-income areas were typically located close to parks with lower potential park congestion levels. The park service area analysis presented here facilitates the identification of areas with greater park need and provides a pragmatic way to redress existing disparities in park access. Built into a set of web-based decision support tools, the approach fosters greater community participation and empowers local stakeholders in the process of park provision.

Keywords Parks · Los Angeles · Environmental justice · Greenspace

C. Sister (✉)
Arizona State University, Tempe, AZ, USA
e-mail: chona.sister@asu.edu

J. Wolch
University of California at Berkeley, Berkeley, CA, USA

J. Wilson
University of Southern California, Los Angeles, CA, USA

Introduction

The benefits and value of parks and open spaces are well-recognized, and increasingly seen as critical to public health (e.g., Ulrich and Addoms 1981; Cranz 1982; Manning and More 2002; Pincetl et al. 2003; Bedimo-Rung et al. 2005; Nicholls and Crompton 2005; Rosenberger et al. 2005; Ulrich and Addoms 1981; Cohen et al. 2007); however, such resources are not always equitably distributed across communities (Allison 2000; Scott 2000; Lindsey et al. 2001; Garcia et al. 2002; Wolch et al. 2005; Comber et al. 2008). As a consequence of White flight and loss of jobs, older inner cities and inner ring suburbs of most metropolitan areas are characterized by economically marginalized populations typically belonging to minority race/ethnic groups. Faced with fiscal pressure, these areas usually have limited local resources for park acquisition and enhancement (Joassart-Marcelli et al. 2005). On the ground, this is experienced as crowded, inadequate parks with facilities that are poorly maintained. These spaces may then be perceived by local residents as unsafe or even dangerous, leading to a sharp decline in park use. Given that these localities also suffer from disproportionate exposure to undesirable land uses and pollution, poor access to parkland in these communities intensifies public health risks and deepens environmental justice challenges in metropolitan regions.

Planners can play a key role in helping communities provide more equitable access to healthier living environments (Krumholz and Forester 1990; Krumholz and Clavel 1994; Campbell 1996; Corburn 2005; Day 2006; Frumkin 2006). More than four decades ago, Frieden (1965) and Davidoff (1965) highlighted the role of advocacy planning in helping marginalized populations fight urban renewal and achieve equal opportunity. Yet, the theoretical perspectives on social justice, on which advocacy planning was based, have seldom translated into practical methods and techniques applicable in the field (Davidoff and Boyd 1983; Hoch 1993; Baum 1997; Sanchez 2001), and subsequent "equity planning" (Metzger 1996) has been criticized for failing to provide specific tools for planners to assess and address social disparities (Sanchez 2001). Indeed, the published literature on the *practical* application of equity planning remains relatively sparse, with a few important exceptions (e.g., work by Krumholz and Forester 1990; Clavel 1994; Burby and Strong 1997; Lucy 1981, 1994; Sanchez 1998; Talen 1998, 2000; Talen and Anselin 1998; Maantay 2002; Agyeman 2005; Day 2006). As a result, while planners can ideally play a key role in promoting environmental justice and equity in the distribution of public goods, the dearth of systematic methodologies with practical applicability has meant that planners have difficulty addressing environmental justice problems on the ground (Washington and Strong 1997).

The present research provides a framework designed to pinpoint areas of park need and facilitate the redress of existing disparities in park access. Built into a set of web-based decision support tools crafted with the input of community organizations as well as park and open space agencies, the approach can assist planners and community stakeholders in addressing specific questions (e.g., where to put the next park or which park to improve) in a more pragmatic way. We demonstrate the approach based on our work in the greater Los Angeles metropolitan region.

Background

Interest in equity in public service provision is certainly not new. With the peak of the US Civil Rights movement in the 1960s, the issue of race and ethnicity was brought to the fore on a number of fronts, including public service provision. During this period of heightened awareness to racial inequity, Teitz (1968) presented an analytical framework for examining public facility location, highlighting the criteria of equity alongside efficiency. He distinguished two aspects of public facility location, differentiating them from conventional location theory: (1) in the absence of a profit-seeking goal, public facility location is largely driven by governmental welfare criteria; and as such, (2) are largely constrained by a governmental system of resource allocation and distribution (DeVerteuil 2000; Dresner and Hamache 2002; Marianov and Serra 2002). The framework espoused by Teitz (1968) was a departure from classic location theory, which up to this point, was largely concerned with efficiency criteria in optimizing private facility siting. In public facility location, efficiency does not necessarily result in equitable distributions (Symons 1971; Morrill 1974). As Dear (1974: 48) points out, "because public facilities are designed to effect some kind of redistribution of resources, or, at least patch up some failure in the private market…the proper focus of (a new) public facility location (paradigm) should therefore be upon the distributive consequences of public facility location, and the manner in which those consequences are achieved".

In 1971, the United States Fifth Circuit Court of Appeals made a landmark ruling, citing that the town of Shaw, Mississippi had failed to provide public services on an equitable basis (Symons 1971). Although this case, also known as Hawkins v. the Town of Shaw, was originally about street lighting, road pavement and sewerage, it became a landmark case that established the legal precedent that if a community elects to provide a public service, such public service must be made equally accessible to all (Lineberry and Welch 1974; Marcuse 1978; Merget 1979). This prompted not only legal, but also academic interest in the examination of just "who gets what" (Lineberry and Welch 1974) in terms of public service provision (McLafferty 1982).

Environmental justice as a grassroots movement is often traced back to Love Canal, New York or to Warren County, North Carolina (Barnett 2001; Matsuoka 2001). In Love Canal, efforts were organized by the homeowners in the late 1970s to protest health authorities' lackluster efforts to address the serious health risks faced by residents exposed for years to the chemical wastes buried in an unused canal traversing their neighborhood that later became a landfill (Levine 1982). After several waves of relocations, all of the Love Canal families were eventually evacuated in 1980, and were reimbursed for their homes. Out of this disaster the Superfund law was enacted by Congress. In the same year that homeowners protested in Love Canal, over 30,000 gallons of waste oil contaminated with polychlorinated biphenyls (PCBs) were illegally discharged across 210 miles of roadside in North Carolina (Bullard 1993). The resulting 60,000 tons of PCB-contaminated soil collected from the roadways were later dumped in a landfill specifically created for such purpose in the predominantly Black and low-income community of Afton in Warren County. It was in this rural setting that local residents were joined by national civic rights leaders, church leaders, Black elected officials, environmental activists, labor leaders, and the youth to fight against the state-sponsored environmental racism, and in the process, brought the environmental racism issue into the national limelight.

The first systematic account showing race as a stronger explanatory variable compared to income in explaining the location of toxic waste dumps across the nation was published in 1987, in a report entitled, "Toxic Waste and Race in the US". Prepared by the United Church of Christ Commission on Racial Justice (UCCCRJ 1987), the 1987 report was the first nationwide study that framed the ongoing environmental struggles by people of color as a social justice issue, coining the term "environmental racism" (UCCCRJ 1987) to refer to the deliberate siting of disamenities in communities of color (Bullard et al. 2007).

The focus on disamenities in the environmental justice literature is borne out of the original struggles of the movement to fight the siting of toxic dumps and hazardous facilities in minority communities. On the other hand, it can be argued that proximity to environmental amenities, such as recreational parks, can be as important to an individual's health and well-being, as is non-proximity to disamenities (Tarrant and Cordell 1999; Barnett 2001; Boone et al. 2009). Thus, inequities in the distribution of public resources are also environmental justice struggles, and differential access to urban public facilities that privileges one group and disadvantages another may also constitute environmental injustice.

Evidence from more recent equity studies in public service provision—specifically access to greenspaces—has been mixed. Wolch et al. (2005) found that low-income and concentrated poverty areas, as well as neighborhoods of color, had lower levels of access to parks (defined as park area per capita within a 0.25-mile radius to a park) compared to White-dominated areas in the city of Los Angeles. Examining Leicester, a city in the UK, Comber et al. (2008) applied a GIS network analysis and quantitatively showed that Indian, Hindu and Sikh groups had limited access to greenspace. While Talen (1997) found low access corresponding to low housing value and high percentage of Hispanics in Pueblo, Colorado, she also observed the opposite trend of lower park access in areas with high-income White residents in Macon, Georgia. A number of results from other studies, in fact, had been inconsistent with the environmental justice hypothesis, with findings demonstrating that locations of disadvantaged populations coincided with areas having relatively higher access to amenities. Tarrant and Cordell (1999) examined the socio-economic characteristics of populations within 1,500 m ($\sim$1 mile) of Chattahoochee National Forest in North Georgia and found that census block groups with higher proportions of lower income households were more likely situated in areas associated with locally desirable land uses (i.e., campgrounds, wilderness areas, and good benthic fisheries). Furthermore, results of their study indicated that race was not a significant factor in explaining the distribution of desirable or undesirable land uses. Nicholls (2001) examined access to public parks in Bryan, Texas and Lindsey et al. (2001) examined urban greenways in Indianapolis, Indiana, with both studies showing that minorities or low-income groups were not systematically disadvantaged in terms of access to these resources. Smoyer-Tomic et al. (2004) showed similar results when they examined spatial equity of playgrounds in Edmonton, Canada; however, when they considered playground quality, they found less association between high-social-need and high-accessibility areas.

These findings could be influenced by methodological limitations that mask existing underlying inequities. Talen and Anselin (1998) evaluated different measures of accessibility and showed that the choice of access measure affects conclusions of the existence of spatial mismatches and inequities; in other words, using an inappropriate access measure for the specific question at hand can mask underlying relationships between access and socio-economic indicators. The problems with the current approaches to accessibility measurement include: (1) the inability of the unit of analysis (e.g., census areal units) to adequately represent the service area (Talen and Anselin 1998; Mennis 2002), (2) aggregation errors relating to the modifiable areal unit problem (or MAUP, Nicholls 2001; Hewko et al. 2002; Mennis 2002), and (3) limitations in the measurement of distances as a proxy for access.

Research hypothesis and objectives

The present study reexamines whether people of color are disproportionately disadvantaged in terms of access to greenspaces, using data from the greater Los Angeles metropolitan region. The motivation for this research, and for focusing on Los Angeles, is several-fold. Generally, demographic changes over the past few decades have once again impelled the issue of race and equity to the forefront (Carr and Williams 1993; Floyd et al. 1994; Floyd 1998; Allison 2000; Stodolska 2000; Stodolska and Yi 2003). But more specifically, historical patterns of urbanization in Los Angeles promoted the ideal of single family homes with private backyards, while minimal tracts of land were dedicated for public parks because of weak public planning standards (Wolch et al. 2001). This pattern was exacerbated as older parts of the city densified due to apartment construction, population growth and in-migration, redlining, and a racialized process of park finance and planning that advantaged white, suburban communities (Byrne et al. 2007). As a result, park poverty has been widely perceived as an issue for low income neighborhoods and communities of color in the region since at least the 1960s (Byrne et al. 2007).

In the late 1990s, campaigns by community-based organizations for additional parks for underserved areas became common. Governments at both state and local levels have responded by making park equity a high-profile goal. Advances in technology, specifically in geographic information systems (GIS), offering opportunities in terms of examining inherently spatial concerns such as distributional equity (Talen 1998; Tarrant and Cordell 1999; Nicholls 2001; Comber et al. 2008), have encouraged both public agency staff and community-based organizations to utilize GIS methods as a means to highlight disparities in park access, and to identify areas of park-poverty.

There are two challenges addressed by the present study. The first relates to the empirical measurement of spatial equity in the region and addresses the question, are parks and the facilities and/or amenities present therein equitably distributed across race and income groups in the greater Los Angeles region? The second relates to methodological issues, for example, how does one measure the distributional equity of parks and facilities and/or amenities in a large metropolitan region? And if there are disparities, how can we design a methodological approach that can help empower stakeholders to ameliorate existing inequities?

Methods

Methodological approach

To address the challenges above, we employed the "park service area" (PSA) approach, essentially an application of a maximum covering model in facility location (Church and Revelle 1976; Marianov and Serra 2002). This approach was developed with input from public sector park planners and a range of nonprofit organizations concerned with urban parks, open space, and environmental justice. Assuming that every resident utilizes the nearest park at some uniform rate, we can potentially assign every neighborhood space—and thus every resident—in the region to his/her closest park, thus delineating a PSA. The number of residents potentially served in every PSA can then be quantified, providing an estimate of potential congestion or "park pressure" for each service area. "Park pressure" is defined here as the *potential* demand or congestion if each resident of the PSA was to utilize the park closest to them. Areas with high park pressure, that is, areas with more residents sharing less park area (as well as the facilities therein), are deemed disadvantaged in terms of park provision.

Arguments against the PSA approach are that: (1) residents do not necessarily go to the nearest park; larger parks (e.g., regional parks) attract users from a more extensive geographic area, while users may favor some parks over others not because of proximity but because of various other reasons such as its amenities or perceived safety (Brownlow 2006; Troy and Morgan 2008); and (2) the relationship between PSA estimates and survey-based need estimates is not clear.

On the other hand, it is also the case that proximity to a park remains an important determinant in park visitation (Giles-Corti and Donovan 2002; Harnik and Simms 2004; Cohen et al. 2007). For example, Cohen et al. (2007) documented that among observed users in eight parks in the City of Los Angeles, 43% lived within 0.25 mile, another 21% lived between 0.25 and 0.5 miles, and only 13% lived more than 1 mile away. Of the local residents, those who live within half a mile reported exercising five or more times per week more often than those who live further away (Cohen et al. 2007). These observations are consistent with the fact that people generally tend to make more short visits and fewer long ones—the fundamental concept behind the “distance decay effect.” Distance decay, a fundamental geographic process, means that the greater the distance, the lesser likelihood of interaction; or inversely, the shorter the distance, the more likelihood of interaction (Tobler 1970). Although park size as well as distance (and possibly other factors, such as safety) matter as an attractive force, we can surmise that residents in closer proximity to a park, be it a small pocket park or a larger recreation area, have better park access and that deviations from this are exceptions rather than the rule.

The only way to definitely address concerns about how closely the PSA approach approximates perceptions of need in a given community is to formally validate such measures by reference to independent survey-based measures of park need. While small-scale validation studies could be useful as a way to understand the extent to which our estimates reflect perceptions of need among residents at a given point in time, most communities conduct such need estimates only rarely, and they become quickly outdated due to population shifts, new park development, and changes in park maintenance, programs, and perceived safety. Moreover, regional park agencies are unlikely to have uniform survey-based data on park need for their multi-jurisdictional service areas. Thus there is an ongoing need for more indirect estimates of park need.

In order to demonstrate the applicability of the PSA approach in facilitating the redress of existing inequities, we present a simulation evaluating the impacts of two hypothetical candidate park sites. “Before” and “after” scenarios for each site are presented, comparing which among the two candidate sites brings a more equitable solution in park distribution in its immediate area. When incorporated in a web-based decision support system accessible to the public, the approach allows hands-on involvement of communities in planning for their recreational open spaces, specifically in identifying and comparing potential park sites. Indeed our web-based system was utilized by local agencies as well as community organizations to support their state bond funding requests for land acquisition and project support, and allowed state evaluators to use a consistent metric across a large geographic region. Such involvement is fundamental in park, recreation, open space, and greenway planning (Mertes and Hall 1995).

The study site: the Los Angeles metropolitan region

The present work examines park congestion levels across the greater Los Angeles metropolitan region, defined here by the watershed boundaries of the Los Angeles River, Calleguas Creek, Santa Clara River, San Gabriel River, and Santa Monica Bay (Fig. 1). Covering an area of 11,240 km^2, this expanse includes most of Los Angeles County, a large part of Ventura County, and the northwest portion of Orange County.

Our research in Los Angeles grew out of a desire to enable park-poor communities to take advantage of funding opportunities in the region. While inequities in park access have long characterized the region, recently Los Angeles has experienced a park “renaissance” (Byrne et al. 2007:155), with an unprecedented show of support from advocates, activists, politicians and the public (Garcia et al. 2002; Pincetl 2003; Garcia and White 2006; Roth 2006). For example, voters passed Proposition 84 in November 2006, a $5.4 billion statewide park and water bond that provides for, among other things, state and local park improvements. Prior to this were several other successful bond measures, such as the State’s Proposition 40 in 2002 and Proposition 12 in 2000, the City of LA’s Proposition K in 1996, and LA County’s Proposition A in 1992 and 1996.

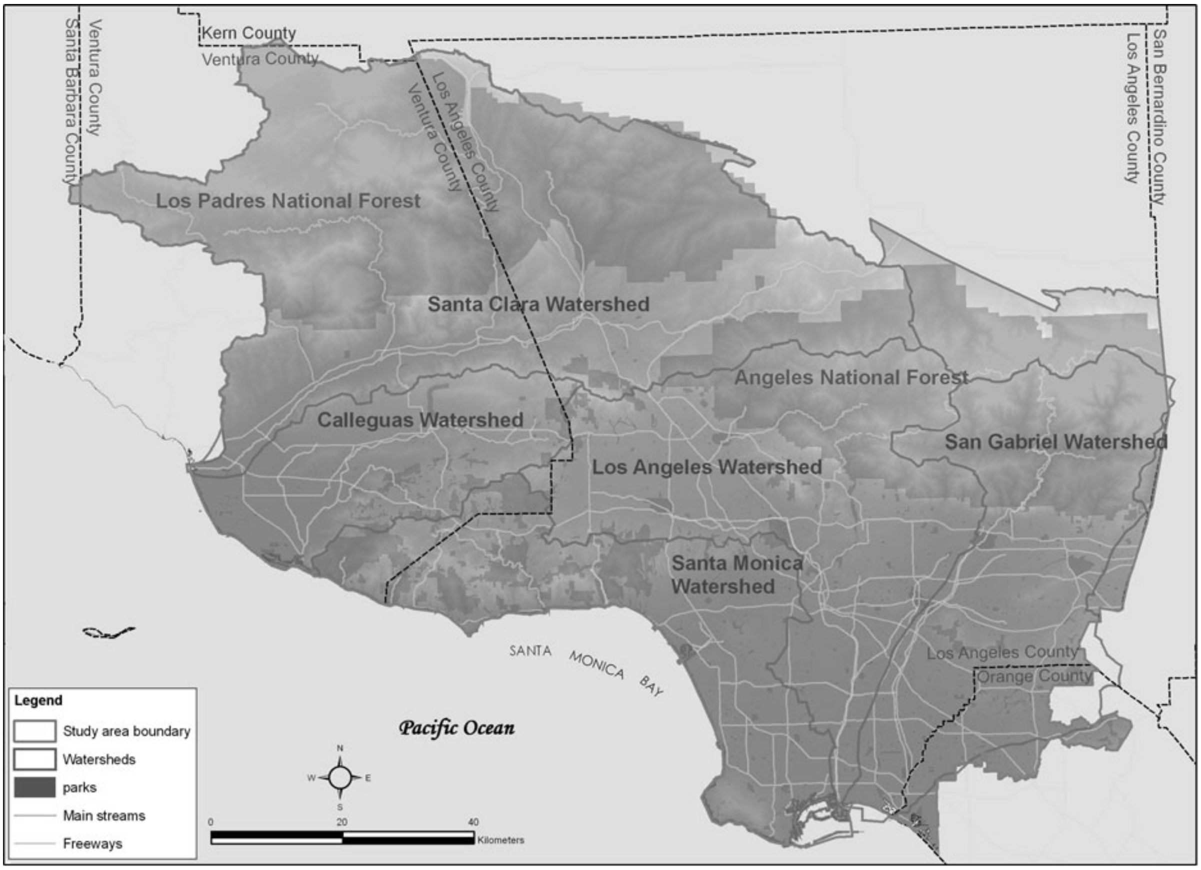


Fig. 1 The study area showing the boundaries of the five watersheds

While these park bond monies have translated into local victories in parkland development—the most prominent of which are the Chinatown Cornfields, Taylor Yards, and the expansion of the Kenneth Hahn State Recreation Area (Barnett 2001; Roth 2006; Byrne et al. 2007)—it is also clear that park-bond funding patterns have often exacerbated existing inequities, rather than ameliorated them. The project funding process used to disburse bond funds typically favored municipalities that are savvy, have long histories of successful grant funding, and have the resources to develop strong project proposals (Wolch et al. 2005). Such localities were typically more affluent, leaving many low-income park-poor jurisdictions out in the cold.

GIS park layer

The GIS park layer was created by pooling together information from the following sources: ESRI's Business Analyst, land use/land cover data from the Southern California Association of Governments (SCAG), coastal access information from the California Coastal Commission, and Thomas Brothers Maps, with the latter used mainly for cross-referencing and verification. From these sources, a total of over 1,800 park polygons were identified, all of which are verified as public, including beaches, golf courses, and other recreation areas that are for public use.

Using a detailed park audit instrument, the Systematic Audit of Greenspace Environments or SAGE tool (Byrne et al. 2005), information from websites and data from on-site field assessments were collected, and the resulting dataset was used to augment the basic park polygon layer. The web audits were exhaustive, collecting information on *all* parks (primarily from city and county web sites); where information was missing from such sites, search engines were utilized. While web audits were exhaustive, field audits were representative, with site visits carried out in 10–15% of the parks and open spaces across the study area. Since only these field-audited parks were assessed in terms of condition (for the present study, we specifically focused on litter present and overall maintenance), only these representative parks were used when we examined the condition of parks relative to potential park congestion levels.

Data collected by field audit teams were tested for reliability using Kappa analysis, and for validity through comparisons with a Gold Standard. A sample of park audits was also ground truthed by audit supervisors. Due to limitations of website information, analyses involving park facilities and amenities in the present paper are limited to field survey data.

Delineating the park service areas

In order to delineate PSAs, Thiessen polygons (TP) were generated around each park (using ESRI's ArcInfo), assigning everyone within the bounds of any one polygon to the park closest to it. TP employ an algorithm such that the resulting tessellation has every space inside the boundary of the polygon closest to the point at its center (Burrough and McDonnell 1998). For the present study, we converted the park polygon layer into a point shapefile, utilizing park polygon vertices to generate the TP; consequently, each park had multiple TPs. An additional step was then to aggregate all TPs belonging to the same park, such that all parks are now bounded by one service area (i.e., one TP for each park) that delineates the space closest to the park.

For each PSA, we assigned the corresponding population count from LandScan's North America population grid (Bhaduri et al. 2002), thus providing an estimate of the potential number of people each park is serving—that is, an approximation of "potential congestion" per park. The parks were further described in terms of the facilities present or absent, along with the population characteristics (i.e., income, race/ethnic composition, and age based on Census tract data) of those living within the PSAs. Overlays of the park, population, and demographic data were carried out using ESRI's ArcGIS. Patterns in park congestion relative to the population characteristics were examined using Pearson's correlation coefficient.

By defining the boundary of the analysis unit purposively, the present approach minimizes pitfalls associated with the imposition of a pre-defined boundary (e.g., census area units) and precludes the representation of populations or parks with a one-dimensional point. While the approach does assume that everyone uses the closest park at some uniform rate, using potential pressure over accessibility measures has the advantage of not having to define how far people are willing to walk to a park. In the present approach, instead of identifying a specific critical distance, the aim was to provide a continuous surface such that the entire region is divided into service areas that apportion every space and resident to the closest park.

Results

Potential park congestion across the region

The NRPA historically recommended 6–10 park acres per 1,000 residents (Lancaster 1983, 1990, 1995). Translated to park pressure level, this standard equates to approximately 100–167 persons per park acre (or "ppa"). Such standards are not without problems such as those associated with community heterogeneity (see Ammons 1995), and in 1995, were replaced with a recommendation that citizens ought to determine the number of acres for park and recreation land that is best for them, highlighting community self-direction (Mertes and Hall 1995: 3). Nonetheless, the earlier standards remain widely referenced and used in practical park planning applications, especially when addressing the need for a standard that facilitates measurement of distributional (in)equity across a large spatial extent. Thus we compare our PSA measures to the earlier NRPA standard, as an illustration of general trends and a pragmatic way of highlighting localized areas of park need across a large metropolitan region. For other purposes, individual communities and regional or state agencies may wish to use an alternative measure or standards that are differentiated by park type.

Of the 1,674 PSAs delineated in the study area (there were fewer PSAs than parks since adjacent parks were treated as belonging to the same service area), only 403 PSAs or 24% are within the NRPA recommended range or better (i.e., <167 ppa),

Table 1 Parks allocated to potential park pressure classes

	Park pressure class (in persons per park acre)								
	0–50	>50–167	>167–300	>300–500	>500–800	>800–1.2 K	>1.2–2 K	>2–4 K	>4 K
Number of PSAs*	230	181	138	179	201	188	205	179	165
Pop (×1,000)	963.1	757.7	484.3	946.8	1,124.8	1,131.7	1,789.9	1,778.7	1,947.9
Median park size (acre)	125.1	20.9	11.5	9.5	7.1	5.5	4.8	3.0	1.2
Mean park size (acre)	6,622.2	44.8	16.2	13.6	9.0	7.3	5.8	3.6	1.6
Types*									
Parks	229	185	141	182	204	189	205	179	164
Golf Courses	50	26	4	5	2	0	0	0	0
Beaches	33	8	0	0	1	0	0	0	0
Open Space	62	8	1	1	0	0	0	0	0
Others	16	0	1	1	0	0	0	0	0

* *Note*: adjacent parks were treated as one park when delineating the park service areas, as such, there can be more counts under "Types" than there are PSAs; for example, one PSA can have a golf course and an adjacent park at the same time

leaving 1,271 PSAs or 76% with park pressure levels higher than the recommended standard (i.e., >167 ppa). Our findings show that only 16% of the population enjoys levels of park access that fall within the NRPA standard (Table 1). Not surprisingly, PSAs with lower park pressure typically contain larger greenspaces. In the lowest park pressure class (0–50 pa), the median park size is 125 acres, with a mean of 6,622 acres; large parcels of wildland open space such as National Forests typically skew the size distribution (Table 1).

As expected, most uncongested PSAs are located in low-density neighborhoods adjacent to large expanses of open spaces, such as in the north part of the region close to the Angeles and Los Padres National Forests, and in the west where the Santa Monica Mountains are located (Fig. 2 inset). There are also PSAs with low park pressure levels located in the more populous LA basin (Fig. 2). These PSAs are typically associated with large regional parks, such as Griffith Park, Elysian Park, Ernest E. Debs Regional Park, or the large wildland open space managed by the Puente Hills Landfill Native Habitat Preservation Authority. Also included in the low park pressure class are PSAs associated with golf courses, beaches, and other large recreational spaces such as arboreta (e.g., the Los Angeles Arboretum and the Fullerton Arboretum) and preserves. Not constrained by size, the low-pressure PSAs contain the most diverse types of recreational spaces (Table 1).

At the other end of the spectrum are high park pressure levels (shaded darker in Fig. 2), mostly located in the more populous areas of the LA basin. These are locations that have limited space, and hence, greenspaces tend to be neighborhood pocket parks and relatively smaller recreation centers typically <12 acres in size (Table 1). An exception to this are areas where relatively small parks are far apart and the PSAs cover a larger areal extent, in which case, the number of people served by the parks would be high notwithstanding lower population densities; such is the case in a few PSAs in western Ventura county.

Potential park pressure and race

A large proportion of the White population lives in PSAs with relatively low park pressure (Fig. 3). The opposite pattern—almost a mirror image, in fact—is observed for the Latino population. Latinos are more likely located in PSAs with high park pressure, with the proportions of Latinos increasing as park congestion levels increase. The African-American population also exhibits this same trend, although to a less extreme degree. The proportion of Asian-Americans in the region did not exhibit a consistent discernable trend relative to the park pressure classes. These patterns are reflected in the Spearman's coefficient of rank correlations in Table 2.

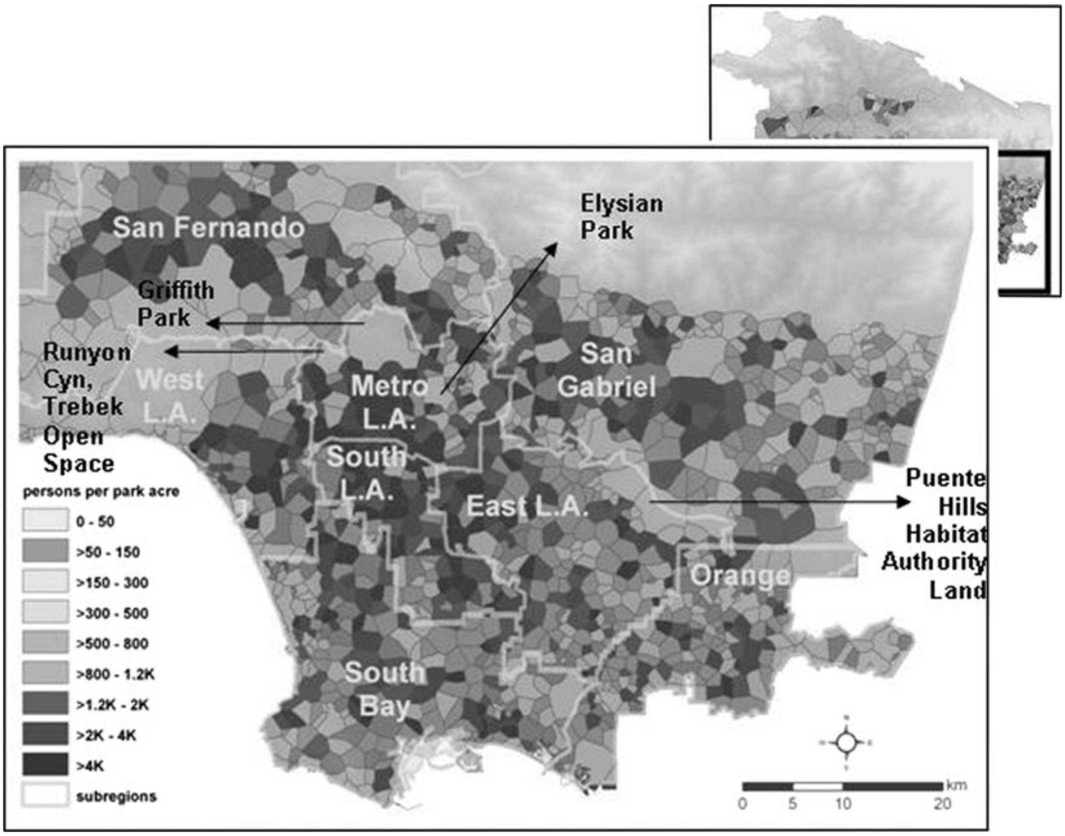


Fig. 2 Park pressure levels across greater Los Angeles metropolitan region; boundaries of the subregions identified by Sister et al. (2007) are also shown

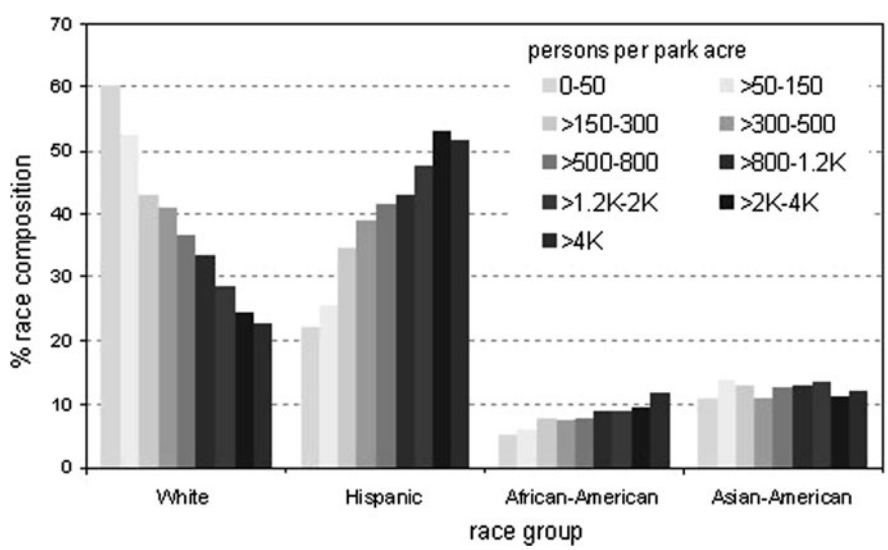


Fig. 3 Proportion of race groups across different park pressure classes

Table 2 Spearman's coefficient of rank correlations comparing park pressure levels with proportions of race/ethnic groups

	Spearman's coefficient	Significance
Race/ethnic groups		
% White	−0.44	<0.01
% Latino	0.46	<0.01
% African-American	0.26	<0.01
% Asian-American	0.03	0.27

Potential park congestion and park need

The number of children (age up to 17 years old), the proportion of households below the Federal poverty threshold level, and median household income were used as indices of park need. The rationale is that good access to parks, translated here as low potential congestion levels, is needed in areas with more children and in populations who have limited ability to purchase private recreational services (e.g., gym membership). Figure 4 shows these three indices as they are distributed across the different park congestion classes.

Not surprisingly, there were fewer children in PSAs with low park congestion, and conversely, PSAs with relatively higher proportions of children tend to have higher park pressure levels (Fig. 4; Spearman's correlation coefficient of 0.24 at $p < 0.01$). In other words, areas with high densities of children tend to have worse park access.

The proportion of households below the Federal poverty threshold level is noticeably higher in PSAs with higher park pressure levels (correlation coefficient = 0.50 at $p < 0.01$; Fig. 4). The pattern is also evident when examining median household income (Fig. 4). PSAs with low park pressure levels have relatively higher median household income compared to PSAs with high park pressure levels (i.e., \$81 K in the lowest park pressure class compared to \$39 K in the highest park pressure class; correlation coefficient = −0.54, significant at $p < 0.01$). In other words, low-income neighborhoods tend to have higher people-to-park-area ratios, compared to relatively higher-income neighborhoods, which tend to have greater park space shared among fewer residents.

Park facilities

Although less congested PSAs do not always have more recreational infrastructure or facilities, when the density of children was taken into account, the relatively uncongested PSAs have more facilities per 10,000 children (Fig. 5).

Field-audited parks equipped with play equipment, basketball courts, baseball diamonds, and soccer fields were observed in PSAs with a higher proportion of Latinos (Table 3a), lower proportion of Whites (Table 3a), higher proportion of households below the Federal poverty threshold level (Table 3b) and lower median household income (Table 3b). On the other hand, the opposite trend is observed in PSAs

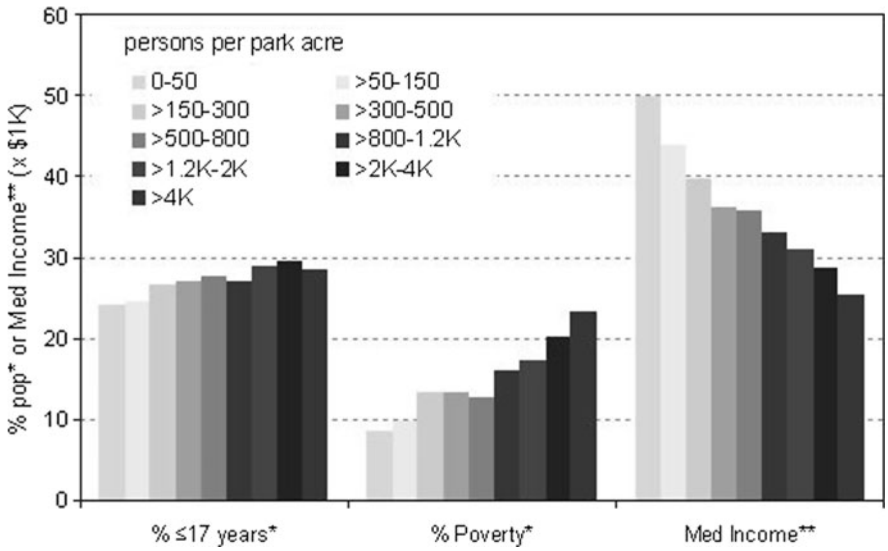
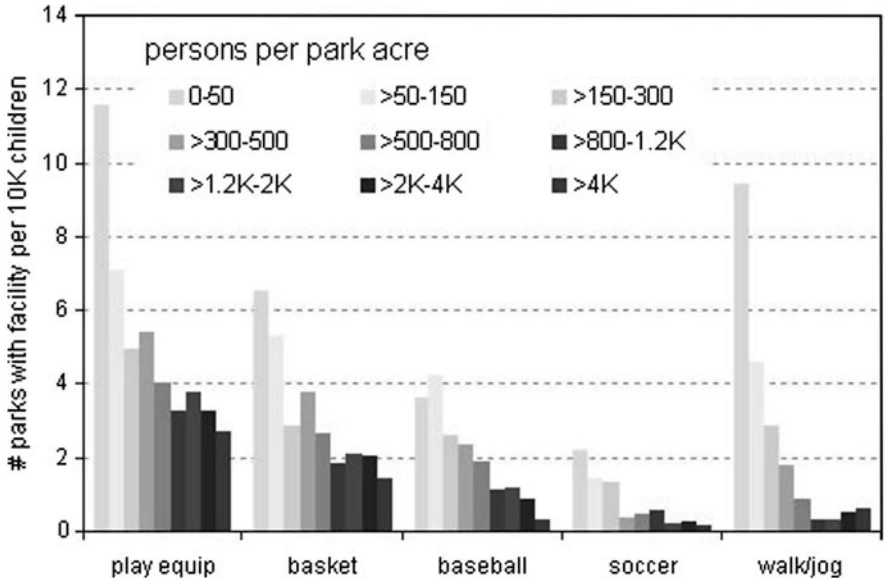


Fig. 4 Proportion of children (age up to 17 years old), percent poverty, and median household income across the different park pressure classes (* % pop on *y*-axis refers to the first two graphs from *left*; ** med income ×\$1 K on *y*-axis refers to third graph)

Fig. 5 Number of parks with specified facilities normalized per 10,000 children



with parks having pathways for walking/jogging. But then again, when the number-of-children-to-park ratio was taken into account, PSAs that were predominantly White were shown to actually have more parks with all five facilities than the other race/ethnic groups (Fig. 6).

Condition and potential park congestion

The least congested PSAs (0–50 ppa) had a relatively higher proportion of parks with litter, along with PSAs with >300–500 ppa (Fig. 7). The latter seems indicative of the wilderness-type open spaces prevalent in uncongested PSAs, while the former may be a result of limited resources for maintenance of these extensive recreational spaces. Incidence of graffiti, on the other hand, was higher in relatively congested PSAs (Fig. 7). There seemed to be no discernable trend when examining freeway noise relative to the different park pressure classes.

In terms of overall maintenance, most field audited parks across all park pressure classes were rated "good" to "excellent," with very few parks rated "poor" and none rated "very poor" (Fig. 8). What these maintenance ratings mean on the ground are detailed in the SAGE audit instrument (Byrne et al. 2005: 46); a summary description of each of these ratings are provided in Table 4. The highest proportion of parks rated "excellent" were the uncongested parks while most of the parks rated "poor" belonged

Table 3 A comparison of: (a) proportion of race groups; and (b) % poverty and median household income between PSAs having play equipment, basketball courts, baseball diamonds, soccer fields, and pathways for walking/jogging and those without

	Play equip		Basketball		Baseball		Soccer		Walk/jog	
	With	None	With	None	With	None	With	None	With	None
(a) In terms of race groups										
% Latino ($n = 104$)	46	38	49	39	47	43	56	43	38	46
% White ($n = 162$)	32	40	31	38	32	35	25	35	40	32
% African-American (=4)	6	6	6	6	6	6	8	6	5	7
% Asian ($n = 25$)	14	15	13	16	14	15	10	15	17	13
(b) In terms of % poverty and median household income										
% Poverty	16	15	17	14	15	16	19	15	15	16
Median Inc (×1 K)	34.8	41.4	34.1	38.7	33.4	37.8	34.2	36.8	37.8	36.2

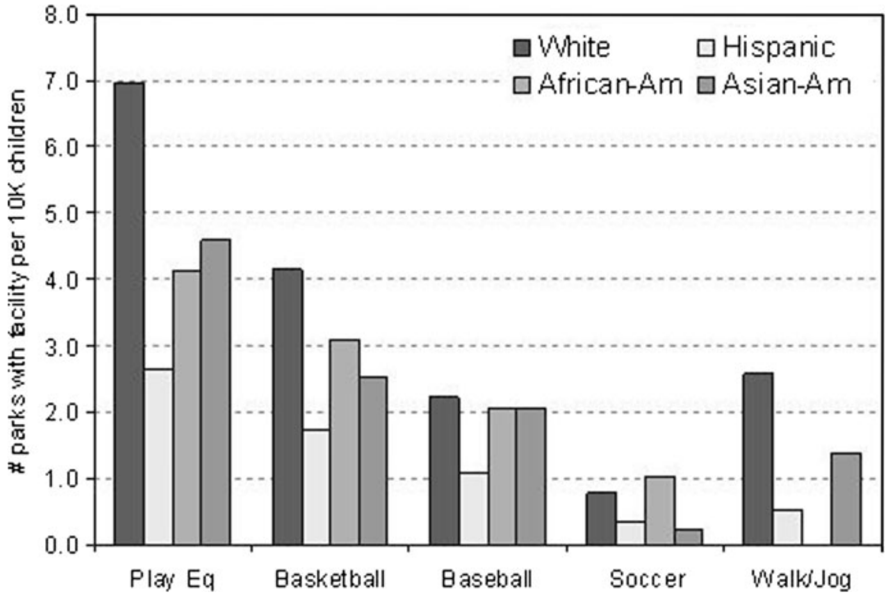


Fig. 6 Number of parks with specified facilities normalized per 10,000 children, as organized per race group

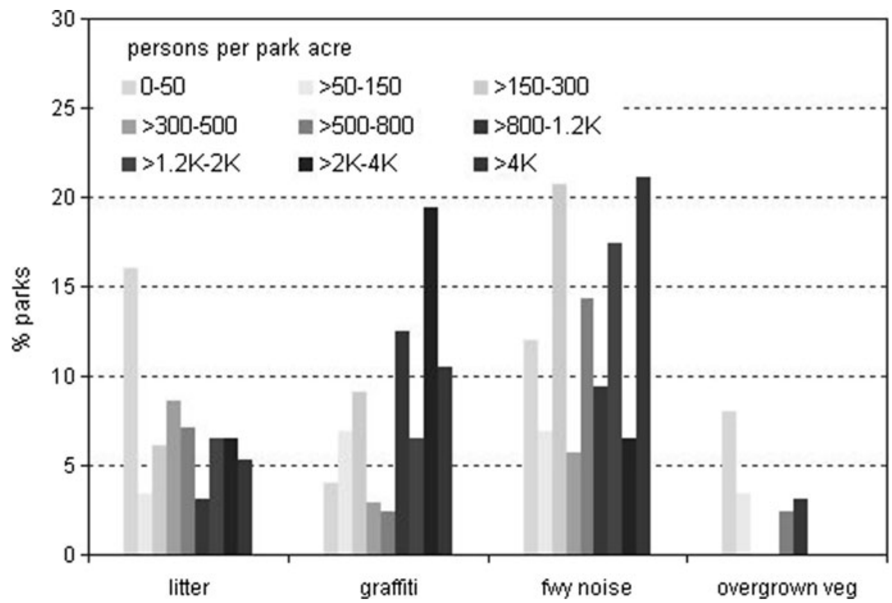


Fig. 7 Proportion of parks with litter, graffiti, freeway noise, and overgrown vegetation

to the highest park pressure class. Again, this may be indicative of wilderness-type recreational spaces that traditionally are not as manicured as neighborhood parks. When these condition ratings were examined relative to race/ethnic groups, it was evident that a higher proportion of parks in predominantly Latino service areas were in relatively poorer condition compared to parks in White PSAs (Fig. 9).

Simulating the impact of new parks on park equity

Potential park sites are in short supply in Los Angeles, increasing the pressure on planners to make each park acquisition project provide the maximum impact on park congestion and in alleviating existing inequities. In this section, we present a simulation that considers

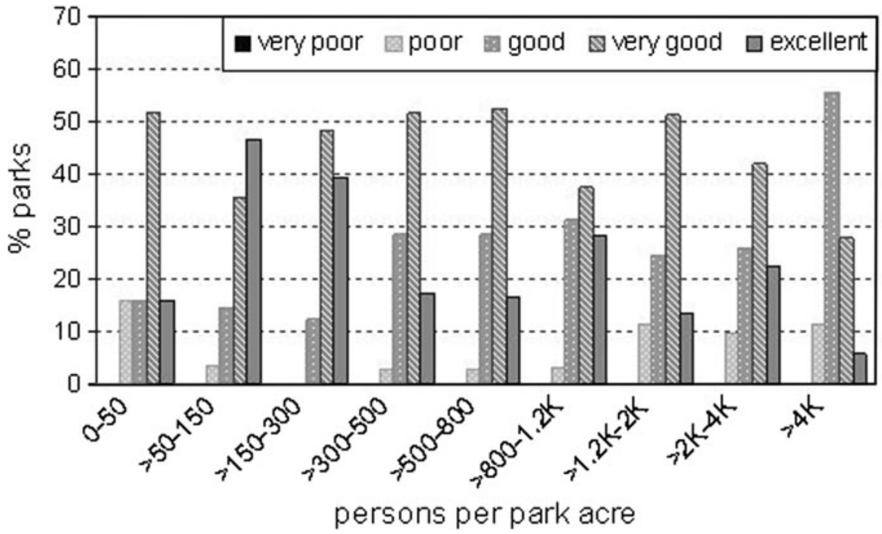


Fig. 8 Overall maintenance ratings across different levels of park pressure

Table 4 A summary description of the overall maintenance ratings for the field audited parks based on Byrne et al. (2005) SAGE audit instrument

Rating	Description
Very poor	Site unkempt, contains extensive litter and overflowing trash cans, and has broken or missing facilities
Poor	Site poorly maintained showing signs of neglect, some litter, and damage
Average	Site has acceptable appearance; facilities may be old but in sound working order; litter and graffiti only present in small amounts
Good	Site has pleasant appearance with little or no litter or graffiti, well-maintained
Excellent	Site very well maintained, facilities new, litter and graffiti are absent

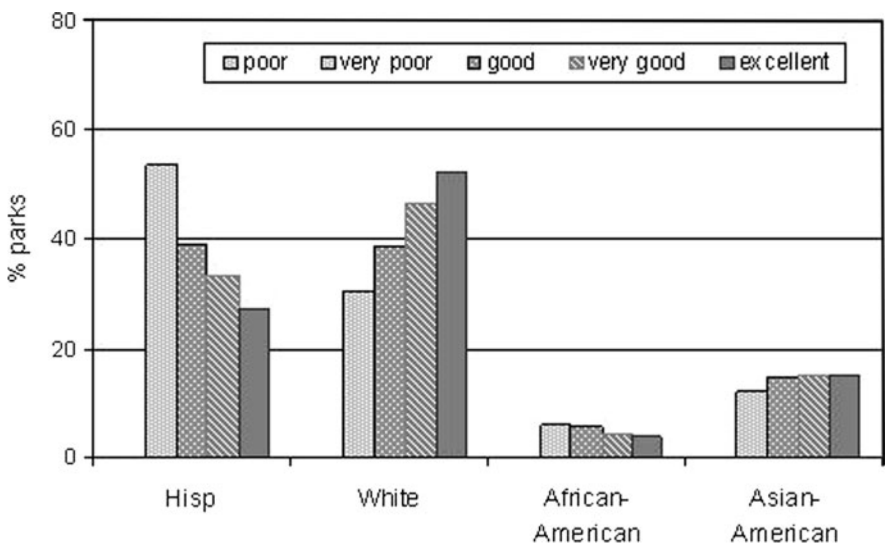


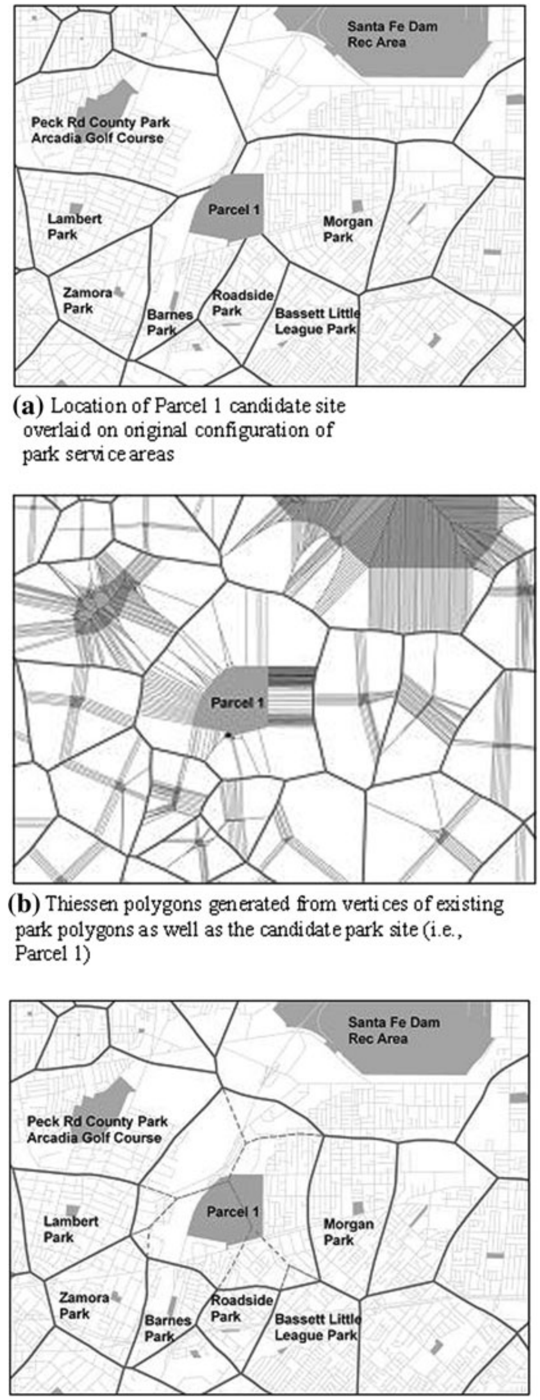
Fig. 9 Overall maintenance levels by PSA, with PSAs assigned to predominant race groups

the impact of two hypothetical potential park sites: Parcels #1 and #2, in Figs. 10 and 11, respectively. Following the approach detailed in this paper, new PSAs were delineated for these potential park sites (Figs. 10b, c, 11b, c), and the corresponding population and demographic data assigned. Below is a comparison of pressure levels before and after converting Parcels #1 and #2 to parks.

The transformation of Parcel #1, located in a low-density area with excellent park access, impacts 136,888 people living in the surrounding eight PSAs (Fig. 10a) containing a total of 2,303 park acres (Table 4). With the existing PSA configuration, the mean park congestion level in these eight PSAs was 59 persons and 20 children per park acre. With 334 acres of new parkland (i.e., Parcel #1), this existing congestion was effectively brought down to 52 persons and 17 children per park acre (Table 5). This is equivalent to a 12–15% reduction in park congestion levels.

We next examined what would happen if Parcel #2 were to be converted into parkland. Parcel #2 is located in a high density, inner city community with few park resources. The surrounding four service areas affected by the addition of this park contain a total of 36.6 park acres, all together serving a total of 68,742 people—giving a park pressure level of 1,880 people per park acre (Table 5). There are 21,934 children in this area, or 600 children per park acre. With the addition of 18 acres of new parkland, these park pressure levels decrease to 1,259 ppa and 401 children per park acre (Table 5). This is equivalent to a 33% change in park congestion.

A striking revelation from the calculations above is the fact that even though Parcel #2 is dramatically smaller than Parcel #1 (18 acres compared to 334 acres, respectively), the smaller site results in a higher percent change in the potential park pressure level. The conversion of Parcel #1 into parkland affects congestion in eight surrounding PSAs; however, four of these changed only slightly, by three to 11% (Table 5). There are two reasons for this: either: (1) these parks were more distant relative to the newly added Parcel #1 (e.g., Bassett Little League Park and Zamora Park, Fig. 10), and as such, the size of the corresponding PSAs changed to a smaller degree, with a slight corresponding change in congestion; or (2) some of these parks were in areas with lower residential densities, such that the existing pressure levels before the addition of the new parcel were relatively low and adding the new parcel resulted in only a slight change in park pressure levels. An example of the latter case is the Santa Fe Dam Recreation area (Fig. 10).

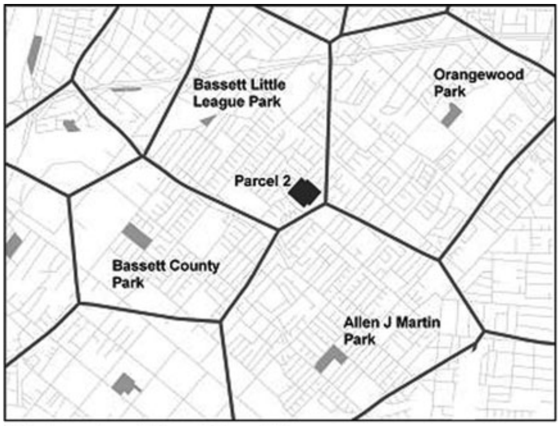


(a) Location of Parcel 1 candidate site overlaid on original configuration of park service areas

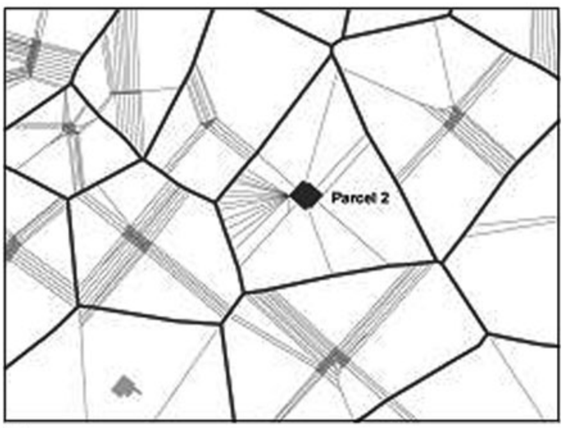
(b) Thiessen polygons generated from vertices of existing park polygons as well as the candidate park site (i.e., Parcel 1)

(c) Configuration of new park service areas with conversion of Parcel 1 into parkland

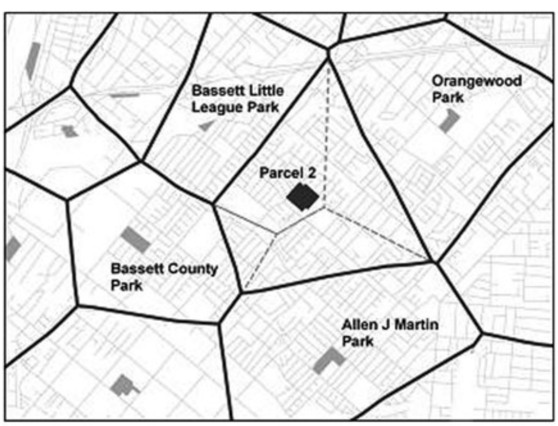
Fig. 10 Revising the delineation of park service areas following proposal to turn Parcel 1 into a new park



(a) Location of Parcel 2 candidate site overlaid on original configuration of park service areas



(b) Thiessen polygons generated from vertices of existing park polygons as well as the candidate park site (i.e., Parcel 2)



(c) Configuration of new park service areas with conversion of Parcel 2 to into parkland

Fig. 11 Revising the delineation of park service areas following proposal to turn Parcel 2 into a new park

On the other hand, although Parcel #2 was surrounded by only four parks (Fig. 11), and in terms of absolute numbers impacts a smaller population (Table 5), the *proportion* of the change relative to existing pressure levels is greater compared to that of Parcel #1 (i.e., 33% compared to 12–15%, respectively). Parcel #2 may be smaller but it is strategically located adjacent to smaller parks with high congestion levels. Thus acquisition of Parcel #2 would produce a larger proportional change.

Discussion

By characterizing every space in the region in terms of potential park congestion, we have presented a powerful picture of how park resources are distributed across the Los Angeles region and how the patterns produce an inequitable distribution that disproportionately impacts poor people of color. Latinos, and to a lesser extent African-Americans, were more likely to live in areas close to parks that have high park congestion levels. Populations in close proximity to these potentially highly congested parks also tend to be low-income. These results echo the findings of Wolch et al. (2005) in their study of parks in the City of Los Angeles.

Park congestion in the LA metropolitan region is largely a function of park size and population densities. PSAs with lower park pressure are typically areas adjacent to the larger open spaces with lower residential densities. On the other hand, PSAs in densely populated neighborhoods are constrained by size, and have smaller parks. This combination—smaller park sizes and higher residential densities—results in extraordinarily high potential congestion levels.

This spatial arrangement of park resources relative to the distribution of residents constitutes a sharply felt environmental justice issue. Areas close to large tracts of open spaces (e.g., the Santa Monica Mountains National Recreation Area in the west part of the region) are prime real estate and thus accessible only to those who can afford the high prices. Low-income groups and most people of color are relegated to older, high-density and lower-cost neighborhoods with fewer available spaces for recreation and nature appreciation.

This inequity is often exacerbated by additional factors. First, many low-income neighborhoods of

Table 5 A comparison of Parcels #1 and #2 as candidate park sites: (a) characteristics and impact on affected area, and (b) changes in park pressure levels anticipated in the surrounding parks

PARCEL #1 and its surrounding PSAs				PARCEL #2 and its surrounding PSAs			
(a) Characteristics and changes in area*							
Population	136,888			Population	68,742		
Children	45,266			Children	21,934		
Added parkland (acres)	334			Added parkland (acres)	18		
	Orig	New	% Change		Orig	New	% Change
Park acre	2,303	2,637		Park acre	36.6	55	
Pers per pk acre	59	52	12	Pers per pk acre	1,880	1,259	33
≤17 years old per pk acre	20	17	15	≤17 years old per pk acre	600	401	33
Parks affected	Orig	New	% Change	Parks affected	Orig	New	% Change
(b) Changing pressures expected in nearby parks (persons per park acre)							
Parcel 1	2,280	94	96	Parcel 2	2,828	802	72
Barnes park	1,511	640	58	Bassett county park	809	83	90
Morgan park	2,879	1,633	43	Orangewood park	1,645	331	80
Roadside park	2,673	1,706	36	Allen J Martin county park	2,125	567	73
Peck park, arcadia golf	86	66	23	Bassett little league park	6,732	2,251	66
Lambert park	1,286	1,149	11				
Santa Fe dam rec area	8	7	5				
Bassett little league park	6,732	6,475	4				
Zamora park	3,060	2,962	3				

* "Area" refers to the adjacent service areas surrounding the candidate site along with the new service area created with the transformation of the candidate site into parkland

color have parks that are often derelict and perceived as unsafe. Second, most wealthy neighborhoods have private backyards, whereas low-income neighborhoods dominated by multi-family housing seldom afford residents such assets. Third, other opportunities for recreation and physical activity, such as stand-alone recreation centers and their associated programs are less abundant in these neighborhoods (Dahmann et al. 2008) and private gyms or health clubs may be beyond the financial reach of many low-income residents. Last, the region's public transport system does not provide easy access to regional recreational open spaces that are oftentimes distant from the densely populated inner cities.

Because most PSAs with high potential congestion have parks that are small, most facilities present in these parks are those that can be accommodated in limited spaces. On the other hand, even if these facilities were to be present, the ratio of people/children-per-facility in these areas is high, and thus such neighborhoods remain wanting in park infrastructure, amenities, and facilities. All of these results imply that most low-income communities of color have limited opportunities in terms of the numbers and diversity of recreational activities readily available to them.

Using the approach presented here, our simulation reveals that to address existing racial inequities in park access in the region, enhancing or adding large parklands may not always be the most ideal solution. In fact, small parcels, acquired and transformed into a series of optimally sited parklands may actually produce more substantial change. A series of small parklands scattered across areas with high park pressure has the advantage of reaching more people (as opposed to one large park benefiting fewer adjacent residents) and thereby engendering a more spatially equitable solution. Such small potential park sites can actually come in the form of vacant lots (including brownfields), utility rights-of-way and alleys, underutilized school or other public facility sites, and abandoned riverbeds (Wolch et al. 2005). These commonly occurring spaces are of particular value in high density, disadvantaged inner city neighborhoods.

We have developed a set of open access web-based decision support tools (Ghaemi et al. 2009) that utilize the present framework. The decision support tools can, and have been used in Los Angeles, to assist municipalities and community-based groups, especially those who otherwise have limited resources for analysis of alternative park projects, to lobby for candidate sites and funding that can alleviate existing park pressure in their localities. From the standpoint of policymakers and funding organizations, the tools afford a consistent and easily understandable language to compare alternative park development opportunities.

Local community organizations and local planners can themselves use the web-based PSA tool along with other types of information about need, to help them understand where park deficits are most critical, as per the 1995 NRPA guidelines that emphasize community-based standards rather than any national norm. And since there are many types of parks, ranging from tot-lots to regional parks, PSA layers can be created for major park types, allowing a more detailed picture of gaps in access. In addition, data beyond park and demographic information, such as habitat and species distributions, watershed features, or issues related to public health and safety (e.g., fitness levels of local school children or air pollution) can be overlaid to inform parkland acquisition decisions. Other stakeholders in the parks arena—counties, land conservancies, state and federal parks agencies—can then utilize such a web-based GIS tool to compare alternative land acquisition/park opportunities in the context of other vital environmental health and quality of life goals.

In an ideal world, everyone would have pedestrian access to a park; on the other hand, in the face of real-world constraints, not everyone can live within a quarter mile of a park. Public policy and planning can harness the proposed framework and the web-based decision-support tools presented here to allocate public resources to arrive at a solution (or several potential solutions) that can be both equitable and sustainable. Their use can level the playing field for municipalities and community groups vying for park funds, minimizing the unfair advantage currently accruing to those who have more resources to put together the most convincing proposals. As such, the decision-support tools can make the politics of park funding allocation more democratic and equitable.

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References

Agyeman, J. (2005). *Sustainable communities and the challenge of environmental justice*. New York, NY: NYU Press.

Allison, M. T. (2000). Leisure, diversity, and social justice. *Journal of Leisure Research, 32*(1), 2–6.

Ammons, D. N. (1995). Overcoming the inadequacies of performance measurement in local government: The case of libraries and leisure services. *Public Administration Review, 55*, 37–47. doi:10.2307/976826.

Barnett, H. (2001). The Chinatown cornfields: Including environmental benefits in environmental justice struggles. *Critical Planning, Summer, 5*, 61.

Baum, H. S. (1997). Social science, social work, and surgery, teaching what students need to practice planning. *Journal of the American Planning Association, 63*(2), 179–188. doi:10.1080/01944369708975913.

Bedimo-Rung, A. L., Mowen, A. J., & Cohen, D. A. (2005). The significance of parks to physical activity and public health, A conceptual model. *American Journal of Preventive Medicine, 28*(2), 15–168.

Bhaduri, B., Bright, E., Coleman, P., & Dobson, J. (2002). LandScan: Locating people is what matters. *GeoInformatics, 5*(2), 34–37.

Boone, C. G., Buckley, G. L., Grove, J. M., & Sister, C. (2009). Parks and people: An environmental justice inquiry in Baltimore, Maryland. *Annals of the Association of American Geographers, 99*(4), 1–21. doi:AN-2007-0075.R.1.

Brownlow, A. (2006). An archaeology of fear and environmental change in Philadelphia. *Geoforum, 37*(2), 227–245. doi:10.1016/j.geoforum.2005.02.009.

Bullard, R. D. (Ed.). (1993). *Confronting environmental racism (voices from the grassroots)*. Monroe, ME: South End Press.

Bullard, R. D., Mohai, P., Saha, R., & Wright, B. (2007). *Toxic wastes and race at twenty, 1987–2007*. New York, NY: United Church of Christ.

Burby, R. J., & Strong, D. E. (1997). Coping with chemicals: Blacks, Whites, planners and industrial pollution. *Journal of the American Planning Association, 63*(4), 469–480. doi:10.1080/01944369708975940.

Burrough, P. A., & McDonnell, R. A. (1998). *Principles of geographical information systems*. New York, NY: Oxford University Press.

Byrne, J., Kendrick, M., & Sroaf, D. (2007). The park made of oil: Towards a historical Political ecology of the Kenneth Hahn state recreation area. *Local Environment, 12*(2), 153–181.

Byrne, J., Wolch, J., Swift, J., & Ryan, C. (2005). *SAGE (systematic audit of green-space environments): Audit form and instructions*. Los Angeles, CA: University of Southern California Center for Sustainable Cities and GIS Research Laboratory. doi:10.1080/13549830601161830.

Campbell, S. (1996). Green cities, growing cities, just cities? Urban planning and the contradictions of sustainable development. *Journal of the American Planning Association, 62*(3), 296–312. doi:10.1080/01944369608975696.

Carr, D. S., & Williams, D. R. (1993). Understanding the role of ethnicity in outdoor recreation experiences. *Journal of Leisure Research, 25*(1), 22–38.

Church, R. L., & ReVelle, C. (1976). Theoretical and computational links between the *p*-median, location set-covering, and the maximal covering location problem. *Geographical Analysis, 8*(4), 406–415.

Clavel, P. (1994). The evolution of advocacy planning. *Journal of the American Planning Association, 60*(2), 146–150. doi:10.1080/01944369408975564.

Cohen, D. A., McKenzie, T. L., Sehgal, A., Williamson, S., Golinelli, D., & Lurie, N. (2007). Contribution of public parks to physical activity. *American Journal of Public Health, 97*(3), 509–514. doi:10.2105/AJPH.2005.072447.

Comber, A., Brunsdon, C., & Green, E. (2008). Using a GIS-based network analysis to determine urban greenspace accessibility for different ethnic and religious groups. *Landscape and Urban Planning, 86*, 103–114. doi:10.1016/j.landurbplan.2008.01.002.

Corburn, J. (2005). *Street science, community knowledge and environmental health justice*. Cambridge, MA: MIT Press.

Cranz, G. (1982). *The politics of park design, a history of urban parks in America*. Cambridge, MA: The MIT Press.

Dahmann, N., Wolch, R., Joassart-Marcelli, P., Reynolds, K., & Jerrett, M. (2008). *The active city: recreation programs, public health and environmental justice*. Los Angeles, CA: USC Center for Sustainable Cities.

Davidoff, P. (1965). Advocacy and pluralism in planning. *Journal of the American Institute of Planners, 31*(4), 331–338. doi:10.1177/0739456X8300300109.

Davidoff, P., & Boyd, L. (1983). Peace and justice in planning education. *Journal of Planning Education & Research, 3*, 54.

Day, K. (2006). Active living and social justice. *Journal of the American Planning Association, 72*(1), 88–99. doi:10.1080/01944360608976726.

Dear, M. (1974). A Paradigm for public facility location theory. *Antipode, 6*, 46–50. doi:10.1111/j.1467-8330.1974.tb00583.x.

DeVerteuil, G. (2000). Reconsidering the legacy of urban public facility location theory in Human Geography. *Progress in Human Geography, 24*(1), 47–69. doi:10.1191/030913200668094045.

Dresner, Z., & Hamache, H. W. (2002). *Facility location, applications and theory*. Berlin: Springer-Verlag.

Floyd, M. F. (1998). Getting beyond marginality and ethnicity: The challenge for race and ethnic studies in leisure research. *Journal of Leisure Research, 30*(1), 3–22.

Floyd, M. F., McGuire, F. A., Shinew, K. J., & Noe, F. P. (1994). Race, class, and leisure activity preferences: Marginality and ethnicity revisited. *Journal of Leisure Research, 26*(2), 158–173.

Frieden, B. J. (1965). Toward equality of urban opportunity. *Journal of the American Institute of Planners, 31*(4), 320–330.

Frumkin, H. (2006). Health, equity and the built environment. *Environmental Health Perspectives, 113*(5), A290–A291.

Garcia, R., Flores, E. S., & Pine, E. (2002). *Dreams of fields: soccer, community, and equal justice. Report on sports in urban parks to the California department of parks and recreation*. Los Angeles, CA: Center for Law in the Public Interest.

Garcia, R. & White, A. (2006). *Healthy parks, schools, and communities: Mapping green access and equity for the Los Angeles region*. http://www.cityprojectca.org/publications/index.html. Accessed 11 March 2007.

Ghaemi, P., Swift, J., Sister, C., Wilson, J. P., & Wolch, J. (2009). Design and implementation of a web-based platform to support interactive environmental planning. *Computers, Environment and Urban Systems*. doi:10.1016/j.compenvurbsys.20.0905.002.

Giles-Corti, B., & Donovan, R. J. (2002). The relative influence of individual, social and physical environment determinants of physical activity. *Social Science Medicine, 54*, 1793–1812. doi:10.1016/S0277-9536(01)00150-2.

Harnik, P. & Simms, J. (2004). *Parks: How far is too far? American Planning Association*. http://www.tpl.org/content_documents/cityparks_Planning_mag_article12.2004.pdf. Accessed 03 February 2007.

Hewko, J., Smoyer-Tomic, K. E., & Hodgson, M. J. (2002). Measuring neighbourhood spatial accessibility to urban amenities: Does aggregation error mater? *Environment and Planning A, 34*, 1185–1206. doi:10.1068/a34171.

Hoch, C. (1993). Racism and planning. *Journal of the American Planning Association, 59*(4), 451–460. doi:10.1080/01944369308975899.

Joassart-Marcelli, P. M., Musso, J. A., & Wolch, J. R. (2005). Fiscal consequences of concentrated poverty in a metropolitan region. *Annals of the Association of American Geographers, 95*(2), 336–356. doi:10.1111/j.1467-8306.2005.00463.x.

Krumholz, N., & Clavel, P. (1994). *Reinventing cities: Equity planners tell their stories*. Philadelphia, PA: Temple University Press.

Krumholz, N., & Forester, J. (1990). *Making equity planning work*. Philadelphia, PA: Temple University Press.

Lancaster, R. A. (Ed.). (1983). *Recreation, park, and open space standards and guidelines*. Alexandria, VA: National Recreation and Park Association.

Lancaster, R. A. (Ed.). (1990). *Recreation, park, and open space standards and guidelines*. Alexandria, VA: National Recreation and Park Association.

Lancaster, R. A. (Ed.). (1995). *Recreation, park, and open space standards and guidelines*. Alexandria, VA: National Recreation and Park Association.

Levine, A. G. (1982). *Love canal: Science, politics, and people*. Lexington, MA: Lexington Books.

Lindsey, G., Maraj, M., & Kuan, S. C. (2001). Access, equity, and urban greenways: An exploratory investigation.

Professional Geographer., 55(3), 332–346. doi:10.1111/0033-0124.00288.
Lineberry, R. L., & Welch, R. E., Jr. (1974). Who gets what: Measuring the distribution of urban public services. *Social Science Quarterly, 54*, 700–712.
Lucy, W. (1981). Equity and planning for local services. *Journal of the American Planning Association, 47*, 447–457. doi:10.1080/01944368108976526.
Lucy, W. H. (1994). If planning includes too much, maybe it should include more. *Journal of the American Planning Association, 60*(3), 305–318. doi:10.1080/01944369408975589.
Maantay, J. A. (2002). Mapping environmental injustices: Pitfalls and potential of geographic information systems (GIS) in assessing environmental health and equity. *Environmental Health Perspectives, 110*(S2), 161–171.
Manning, R., & More, T. (2002). Recreational values of public parks. *The George Wright Forum, 19*(2), 21–29.
Marcuse, P. (1978). Equal access to public services. *Proceedings of the General Education Seminar, Columbia University, 7*, 23–31.
Marianov, V., & Serra, D. (2002). Location problems in the public sector. In Z. Drzner & H. W. Hamacher (Eds.), *Facility location, application and theory* (pp. 119–143). Berlin, Germany: Springer-Verlag.
Matsuoka, M. (2001). The emergence of the environmental justice movement and its challenges to planning. *Critical Planning, 8*, 4–14.
McLafferty, S. (1982). Urban structure and geographical access to public services. *Annals of the Association of American Geographers, 72*(3), 347–354. doi:10.1111/j.1467-8306.1982.tb01830.x.
Mennis, J. (2002). Using geographic information systems to create and analyze statistical surfaces of population and risk for environmental justice analysis. *Social Science Quarterly, 83*(1), 281–297. doi:10.1111/1540-6237.00083.
Merget, A. (1979). Equity in the distribution of municipal services. In H. J. Bryce (Ed.), *Revitalizing cities* (pp. 161–191). Lexington, MA: Lexington Books.
Mertes, J. D., & Hall, J. R. (1995). *Park, recreation, open space and greenway guidelines*. Ashburn, VA: National Recreation and Park Association.
Metzger, J. T. (1996). The theory and practice of equity planning: An annotated bibliography. *Journal of Planning Literature, 11*, 112–126. doi:10.1177/088541229601100106.
Morrill, R. L. (1974). Efficiency and equity of optimum location models. *Antipode, 6*, 41–46. doi:10.1111/j.1467-8330.1974.tb00582.x.
Nicholls, S. (2001). Measuring the accessibility and equity of public parks: A case study using GIS. *Managing Leisure, 6*, 201–219. doi:10.1080/13606710110084651.
Nicholls, S., & Crompton, J. L. (2005). The impact of greenways on property values: Evidence from Austin, Texas. *Journal of Leisure Research, 37*(3), 321–341.
Pincetl, S. (2003). Nonprofits and park provision in Los Angeles: An exploration of the rise of governance approaches to the provision of local services. *Social Science Quarterly, 84*(4), 979–1001. doi:10.1046/j.0038-4941.2003.08404019.x.
Pincetl, S., Wolch, J., Wilson, J., & Longcore, T. (2003). *Toward a sustainable Los Angeles: A nature's services approach*. Los Angeles, CA: University of Southern California Center for Sustainable Cities.
Rosenberger, R. S., Sneh, Y., Phipps, T. T., & Gurvitch, R. (2005). A spatial analysis of linkages between health care expenditures, physical inactivity, obesity and recreation supply. *Journal of Leisure Research, 37*(2), 216–235.
Roth, A. L. (2006). Media standing of urban parkland movements: The case of Los Angeles' Taylor Yard, 1985–2001. *City and Community, 5*(2), 129–151.
Sanchez, T. W. (1998). Equity analysis of capital improvement plans using GIS: The case of the Des Moines urbanized area. *Journal of Urban Planning and Development, 124*, 33–43.
Sanchez, T. W. (2001). Are planners prepared to address social justice and distributional equity? *Critical Planning, Summer, 9*, 100.
Scott, D. (2000). Tic, Toc, the game is locked and nobody else can play. *Journal of Leisure Research., 32*(1), 133–137.
Sister, C., Wilson, J., Wolch, J., Swift, J., & Ghaemi, P. (2007). *Green visions plan for 21st century Southern California: A Guide for habitat conservation, watershed health, and recreational open space. 15. Park congestion and strategies to increase park equity*. Los Angeles, CA: University of Southern California Center for Sustainable Cities and GIS Research Laboratory.
Smoyer-Tomic, K. E., Hewko, J. N., & Hodgson, M. J. (2004). Spatial accessibility and equity of playgrounds in Edmonton, Canada. *The Canadian Geographer, 48*(3), 287–302.
Stodolska, M. (2000). Looking beyond the invisible: Can research on leisure of ethnic and racial minorities contribute to leisure theory? *Journal of Leisure Research, 32*(1), 156–160.
Stodolska, M., & Yi, J. (2003). Impacts of immigration on ethnic identity and leisure behavior of adolescent immigrants from Korea, Mexico, and Poland. *Journal of Leisure Research, 35*(1), 49–79.
Symons, J. G. (1971). Some comments on equity and efficiency in public facility location models. *Antipode, 3*(1), 54–67.
Talen, E. (1997). The social equity of urban service distribution: An exploration of park access in Pueblo, Colorado and Macon, Georgia. *Urban Geography, 18*(6), 521–541.
Talen, E. (1998). Visualizing fairness: Equity maps for planners. *Journal of the American Planning Association, 64*(1), 22–39.
Talen, E. (2000). Bottom-up GIS: A new tool for individual and group expression. *Journal of the American Planning Association, 66*(3), 279–294.
Talen, E., & Anselin, L. (1998). Assessing spatial equity: An evaluation of measures of accessibility to public playgrounds. *Environment and Planning A, 30*, 595–613.
Tarrant, M. A., & Cordell, H. K. (1999). Environmental justice and the spatial distribution of outdoor recreation sites: An application of geographic information systems. *Journal of Leisure Research, 31*(1), 18–34.
Teitz, M. B. (1968). Toward a theory of public facility location. *Papers in Regional Science Association, 21*, 35–51.
Tobler, W. (1970). A computer movie simulating urban growth in the Detroit region. *Economic Geography, 46*, 234–240.
Troy, A., & Morgan, J. (2008). Property values, parks, and crime: A hedonic analysis in Baltimore, MD. *Landscape and Urban Planning, 87*, 233–245.

Ulrich, R. S., & Addoms, D. L. (1981). Psychological and recreational benefits of a residential park. *Journal of Leisure Research, 13*(1), 43–65.

United Church of Christ Commission on Racial Justice (UCCCRJ). (1987). *Toxic wastes and race in the United States, a national study of the racial and socioeconomic characteristics of communities with hazardous waste sites*. New York, NY: United Church of Christ.

Washington, R. O., & Strong, D. (1997). A model for teaching environmental justice in a planning curriculum. *Journal of Planning and Education Research, 16*, 280–290.

Wolch, J., Pincelt, S., & Pulido, L. (2001). Urban nature and the nature of urbanism. In M. Dear (Ed.), *From Chicago to LA: Making sense of urban theory* (pp. 367–402). Thousand Oaks, CA: Sage.

Wolch, J., Wilson, J. P., & Fehrenbach, J. (2005). Parks and park funding in Los Angeles: An equity-mapping analysis. *Urban Geography, 26*(1), 4–35.