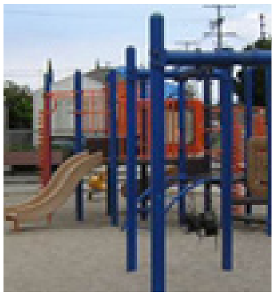
THE GREEN VISIONS PLAN

for 21st century southern california

DECEMBER 2007



15. Park Congestion and Strategies to Increase Park Equity

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The mission of the Green Visions Plan for 21st Century Southern California is to offer a guide to habitat conservation, watershed health and recreational open space for the Los Angeles metropolitan region. The Plan will also provide decision support tools to nurture a living green matrix for southern California. Our goals are to protect and restore natural areas, restore natural hydrological function, promote equitable access to open space, and maximize support via multiple-use facilities. The Plan is a joint venture between the University of Southern California and the San Gabriel and lower Los Angeles Rivers and Mountains Conservancy, Santa Monica Mountains Conservancy, Coastal Conservancy, and Baldwin Hills Conservancy.

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EXECUTIVE SUMMARY

The present technical report describes park congestion levels across the Green Visions Plan study area and presents an approach that can be used as a framework for decision-support tools that directly addresses how existing inequities can be ameliorated.

Utilizing the concept of Thiessen (Voronoi) polygons, a catchment or service area was delineated for each park, such that *every* neighborhood in the region was assigned to the park closest to it. By doing so, we were able to characterize potential park congestion for every communities across the region. Potential park congestion (or “park pressure”) is defined here as the number of people per park acre if each person were to utilize the nearest park. A service area that has high levels of park pressure implies a dearth of park resources relative to the potential demand in that particular area.

Results of the present study show that Latinos, and to some extent African-Americans, were more likely to live in areas close to parks that have higher park congestion levels. Populations in close proximity to these potentially highly congested parks also tend to be low-income, with relatively higher proportions of the population below the Federal poverty threshold. On the other hand, predominantly White, high-income groups are mostly located in low-density residential areas with larger parks, and thus faced potentially lower levels of park congestion.

Utilizing the catchment area analysis as a framework, the present report also presents a ‘before and after” simulation evaluating two hypothetical candidate park sites. Each of the candidate sites is added to the existing park layer, as if it were an additional park, and a new configuration of park service areas is drawn. After the corresponding demographic data are assigned, new park pressure levels are recalculated for the new park distribution. This allows potential park projects to be compared, and assessed on the basis of relative ability to reduce park congestion.

The catchment area analysis presented here is aimed at providing a framework that can specifically pinpoint areas of greater park need and facilitate a pragmatic way to redress existing disparities in park access. Built into a set of web-based decision support tools, the approach allows for a more participatory and empowering stance for local stakeholders in the process of park provision.

1 INTRODUCTION

In the Southern California region, there exist disparities between the locations of park resources and the locations of populations that are disadvantaged and in most need. For example, it was shown by Sister et al. (2007) that areas located close to large expanses of open spaces (e.g., West L.A., East Ventura, and parts of the San Fernando Valley that are close to the Santa Monica Mountains National Recreation Area) and relatively less dense neighborhoods enjoyed park acreage ranging from 32 to 126 park acres per 1,000 residents. These areas are typically affluent White neighborhoods. On the other hand, older communities that typically have higher residential densities and smaller parks, such as the South, West, and Metro L.A. subregions, have park resources ranging from 1.2 to 4.8 acres per 1,000 residents—ratios considerably lower than the oft-used National Recreation and Park standard (i.e., six to 10 acres per 1,000 residents). Neighborhoods that have lower park acreage are typically inner-city, low-income communities of color.

Explicitly accounting for distance, Sister et al. (in prep.) employed the radius technique, and demonstrated that only 14% of the region's population has pedestrian access to greenspaces (i.e., 0.25 mi or 0.50 mi round trip); this leaves 86% of the population without easy access to such resources. Different race and income groups were equally likely to fall inside or outside these buffers. However, the results generated with the radius technique showed that minority groups effectively had less access because they were typically located in areas with high residential densities inside the quarter mile distance threshold, implying that the parks they were most apt to visit were the most congested. When accounting for the effect of density—that is, defining access as the amount of greenspace per capita—predominantly White areas were shown to have disproportionately greater access. Latinos and African-Americans were likely to have up to six times less park acreage per capita compared to Whites.

On the other hand, while inequities in park access have long besieged the region, of late, Los Angeles has experienced a park "renaissance" (Byrne et al., 2007:155), with an unprecedented show of support from the public, from advocates and activists, as well as from politicians (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. In 2002, California's Proposition 40 or the "Resources Bond Act" passed, providing $2.6 billion for local assistance grants towards "Clean Water, Clean Air, Safe Neighborhood Parks, and Coastal Protection". In 2000, the State's Proposition 12 or "Parks Bond Act" allocated $2.1 billion for local assistance grants towards "Safe Neighborhood Parks, Clean Water, Clean Air and Coastal Protection". In 1996, the City of L.A.'s Proposition K or the "Citywide Parks, Recreation and Community Facilities Assessment Referendum Ordinance" provided $298.85 million for improvements to the children and youth infrastructure in the City, including parks, community and recreation facilities and childcare. L.A. County's Proposition A or "Safe Neighborhood Parks Act" allocated $540 million on its first round in 1992 and an additional $319 million on its second round in 1996 for the acquisition, restoration or rehabilitation of real property for parks and park safety, senior recreation facilities, gang prevention, beaches, recreation, community or cultural facilities, trails, wildlife habitats, or natural lands, and maintenance and servicing of these projects.

While these park bond monies have translated into local victories in parkland development—the most prominent of these 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 has also been shown that park-bond funding patterns have often exacerbated existing inequities, rather than ameliorated them, as the process typically favors groups and municipalities that are savvy and have funding histories (Wolch et al., 2005).

How then can we take advantage of the existing confluence of opportunities such that existing inequities in park access can be redressed rather than exacerbated? While a good number of studies have reiterated the existence of disparities, there remains a dearth of approaches that pragmatically address ways to ameliorate these inequities.

Using "equity maps", Talen (1998) presented a framework for investigating spatial equity and demonstrated the use of GIS as an exploratory tool to uncover and assess current and potential future equity patterns. Employing ArcView (version 3.2), Talen (1998) mapped out accessibility measures (i.e., gravity potential, minimizing travel cost, covering objectives, minimum distance) as well as socioeconomic data (i.e., housing values, percent Hispanic at the census block level) for a visual assessment of equity in the distribution of parks in Pueblo, Colorado. Reiterating the utility of equity maps as an exploratory tool, she presented a framework that utilized the visualization capabilities of GIS in mapping accessibility measures and demographic data such that planners can gauge (i.e., qualitatively) the degree of equity associated with any particular geographic arrangement of public facilities (Talen, 1998:35).

However, the approach presented by Talen (1998) made use of existing accessibility measures, and as such, is largely constrained by the limitations imposed by these traditional measures (Sister et al., in prep; Talen and Anselin, 1998). For example, the "container" approach, which delineates a unit inside which the total number or amount of amenities is quantified (the more amenities, the higher the access), discounts the spatial arrangement of amenities within the delineated boundary or "container"—a boundary that may be entirely arbitrary. On the other hand, the "minimum-distance" approach, which conceptualizes access as the distance between a point of origin (e.g., population center) and a destination (e.g., park), represents populations as a one-dimensional point and discounts the effect of densities on access. Additionally, the framework presented by Talen (1998) utilized census blocks as the unit of analysis, thereby constraining the results to the limitations imposed by a pre-defined boundary. Furthermore, it does not provide a straightforward way to identify potential candidate park sites and to compare how these sites fare over others in terms of alleviating potential congestion in existing parks.

How can we design a framework that allows for the identification and comparison of specific candidate park sites, and thus directly facilitates the redress of existing park inequities? The present report takes on this challenge, and demonstrates an approach (Section 2) that identifies park congestion or "pressure" levels across the region (Section 3) and examines how well sites proposed for new parks might be expected to alleviate existing park pressure levels and the present-day inequities in access to park resources (Section 4).

1.1 Park provision, health, equity, and urban sustainability

Park provision lies at the nexus of a myriad of concerns. The approach developed here, when used as a framework to guide park provision (as elaborated in Sections 2.6 and 5), addresses these multiple and intertwined planning issues—including public health, environmental justice, and urban sustainability.

Research on active living and preventive medicine have pointed out the significant role the built environment plays in promoting an active lifestyle (King et al., 1995; Sallis et al., 1998; Frank and Engelke, 2001; Giles-Corti and Donovan, 2002; Handy et al., 2002; Ewing, et al., 2003; Saelens et al., 2003; Lake and Townshend, 2006; Aytur et al., 2007; Frank et al., 2007; Rundle et al., 2007). Recreational parks and open spaces, when they are well-designed, can provide active and passive recreation opportunities that are key to an individual's health and well being. An important dimension of being "well-designed" is the strategic location of these public resources such that they serve a greater proportion of the population who otherwise have limited opportunities (e.g., marginalized groups such as people of color and those with low-income).

In addition to promoting health, parks and open spaces are essential elements in the sustainability of cities. They provide ecosystem services, for example, mitigating urban heat, pollution, and flooding (Pincetl et al., 2003). Parks also offer direct economic value to communities, by increasing real estate property values (Burgess et al., 1988; Lutzenhiser and Netusil, 2001). Additionally, even if difficult to quantify, perhaps one of the important benefits of parks are the "intangibles", such as the sense of place and well being they impart to residents, even to those who rarely use parks (Cranz, 1982).

With the characteristically sprawling nature of suburban development and White flight, older inner city neighborhoods and inner ring suburbs in the GVP region are left with economically marginalized populations, typically of color, who have limited choices in terms of residential location. The resulting poverty concentration in these areas has imposed fiscal pressure on these municipalities, which in turn, translates to limited resources for park acquisition and enhancement (Joassart-Marcelli, et al., 2005). On the ground, this is experienced as highly congested parks and/or parks that are heavily used, not well-maintained and/or in poor condition in low-income communities of color. With lower levels of access to park resources (i.e., fewer parks, crowded parks, parks in poor condition), coupled with undesirable land uses (e.g., industries) in inner cities, low income communities of color have disproportionately lower access to healthier environments—a case of environmental injustice.

The approach presented in this report (Section 2.1) is aimed at providing a framework that can specifically pinpoint areas of greater park need and facilitate a pragmatic way to redress existing disparities in park access. Built into a set of web-based decision support tools (as described in Section 4), the approach allows for a more participatory and empowering stance for local stakeholders in the process of park provision, as elaborated in the concluding section (Section 5).

2 METHODS

2.1 Methodological approach

If we assume 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 the latter, thus delineating a park service area (PSA) for each park. The number of residents potentially served in every PSA can then be quantified, thus providing an estimate of congestion or "potential park pressure" for each service area. "Potential park pressure" is defined here as the demand or congestion level if each park in the region were to serve all residents closest to it; it is therefore akin to potential demand or potential congestion. Areas with high potential 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.

It can be argued, however, that residents do not necessarily go to the nearest park, or that larger parks (e.g., regional parks) attract users from a more extensive geographic area. Users may favor some parks over others not because of proximity but because of various other reasons (e.g., amenities present, perceived safety). On the other hand, it can also be argued 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; Frank 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 mi, and another 21% lived between 0.25 and 0.5 mi of the park these residents were using. Only 13% of the users lived more than 1 mile away. Of the local residents, they found more infrequent users among residents living more than 1 mile away, compared with those living less than 0.5 mi (i.e., 38% of the latter group, compared to 19% of the former). Residents living within 0.5 mi of a park reported leisurely exercising five or more times per week more often than those who live 1 mile away (Cohen et al., 2007: 513). 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" (Gould, 1985). 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. Although park size as well as distance matters as an attractive force, we can surmise that residents in close 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 more exception the than the rule.

In order to delineate service areas, Thiessen polygons were generated around each park, assuming that everyone within the bounds of any one polygon uses the park at its center, and that there is no attenuation in park "desirability" or use with increasing distance within Thiessen polygons. Thiessen polygons employ an algorithm such that the resulting tessellation has every space inside the boundary of the polygon closest to the point at its center, in this case a park (Burrough and McDonnell, 1998). For each PSA (i.e., Thiessen polygon), we assigned the corresponding population count from LandScan USA's 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 "park congestion" per park. The parks were further described in terms of the facilities present or absent and the population characteristics (i.e., income, race/ethnic composition, and age based on census tract data) of those living within the PSAs in order to elucidate patterns in park congestion as they relate to these population characteristics.

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 areal 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 thus each resident to the closest park.

In order to demonstrate the applicability of the catchment area approach in facilitating the redress of existing inequities, we present a simulation study to evaluate and compare the impacts of the addition of two hypothetical candidate park sites. Two hypothetical brownfield parcels were selected and each of them added to the existing configuration of park polygons. The PSAs were then redrawn after the addition of the candidate parcels, and the park pressures recalculated. "Before" and "after" scenarios for each candidate site are presented, describing the changes in park pressures in the neighboring PSAs, and evaluating which among the two candidate sites brings the "biggest bang for the buck".

2.2 The study site

The present report examines park congestion levels across the Green Visions Plan (GVP) study area. This area is delineated by the boundaries formed by the Los Angeles River, Calleguas Creek, Santa Clara River, San Gabriel River, and Santa Monica Bay watersheds (Figure 1). Covering an area of 11,240 km^2, this area includes most of Los Angeles County, a large part of Ventura County, and the northwest portion of Orange County. In the present report, this area is referred to hereafter as the "GVP region", or simply the "region".

2.3 Parks layer

The park layer utilized in this study was created by pooling together data 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 (park count is higher than the PSA count since adjacent parks were treated as a single unit for the PSA analysis).

This parks layer was further augmented with audit information on facilities present at each park. Using the SAGE (Systematic Audit of Greenspace Environments, see Byrne et al., 2005) audit instrument, we collected information from websites and data from on-site field surveys. The web audits were exhaustive, collecting information on all parks, primarily from city and county web sites; where information was missing in such sites, we utilized search engines. Field audits were performed in order to collect additional data, verify information found in web sites, and get information on parks without website information. 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. Data collected by the field audit teams were tested for reliability and validity through comparisons with a “gold standard”, as well as with ground truth data. Results of these reliability and validity tests are detailed in Sister et al. (2007). For the present purpose, the results of the audits from different teams were consistent and accurate enough to provide a moderately detailed picture of the parks and open space resources across the region.

It should be noted that the absence of a particular facility in a park web site does not necessarily mean that such a facility is not present in the park. This is because lack of facility information on a website could either mean that: (1) the facility is absent; or (2) the facility is present, but the website failed to mention the presence of such a facility. Thus, absence of a facility on a park website does not necessarily confirm a facility’s absence or presence in a park. As such, analyses involving park facilities and amenities in the present report are limited to field survey data.

Park data (e.g., area, facilities present) were assigned to each PSA by overlaying the park data layer onto the latter using the <intersect> tool in ArcToolbox. In cases when two or more

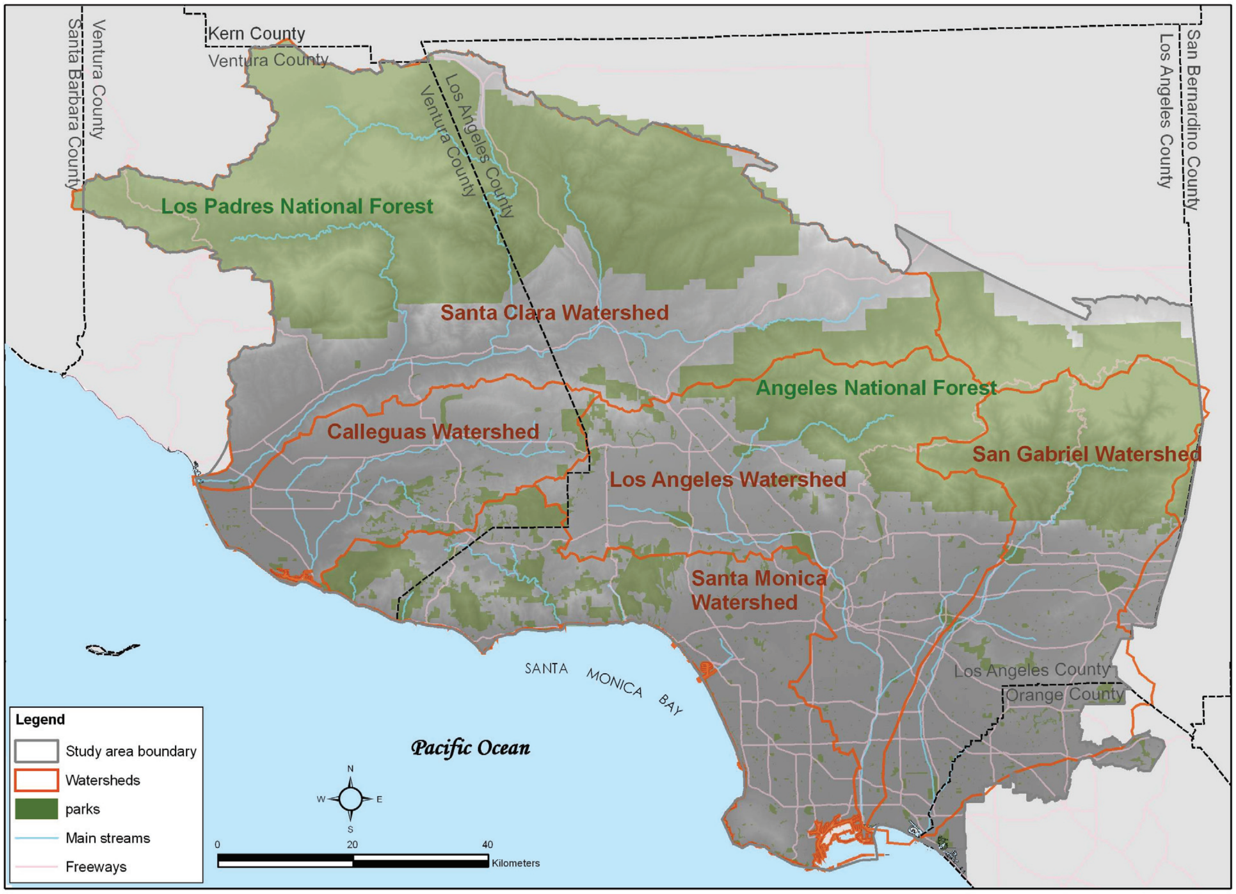


Figure 1. The GVP area showing the boundaries of the five watersheds.

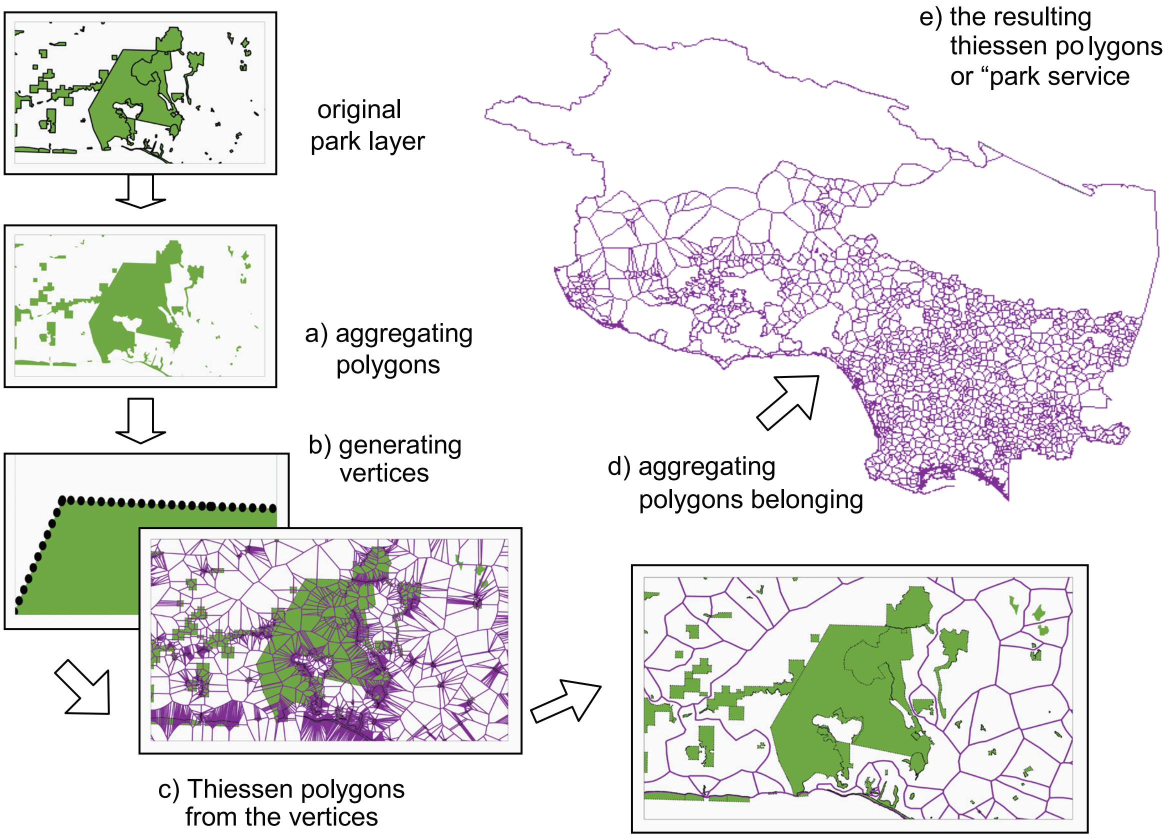
contiguous parks belong to the same park service area (i.e. enclosed in the same Thiessen polygon; see preceding section), the facilities present among these parks were summed and the value assigned to the corresponding PSA.

2.4 Delineating park service areas

An overview of the process we employed to delineate PSAs is shown in Figure 2. For the purpose of the present analysis, we treated parks sharing a boundary as a single unit since these parks typically have the same service area (for the remainder of the paper, “park” is used to refer to both single parks and adjacent contiguous parks). As such, we proceeded to dissolve the boundaries of adjacent parks using the <dissolve> function in ArcToolbox (Figure 2a). This approach means that the park count is higher than the PSA count since adjacent parks were treated as a single unit for the PSA analysis.

Since a park itself is a polygon (and not a point), we utilized the vertices around the perimeters of parks as the points from which the Thiessen polygons were generated. Centroids, which are typically utilized to represent the location of facilities, could not be used for the present

Figure 2. Schematic diagram summarizing procedure used to generate park units and the corresponding park service areas utilizing the concept of Thiessen polygons.



analysis because generating Thiessen polygons from these would not prevent cases where Thiessen boundaries crossed or fell inside the park. Such cases happen when larger parks are located near smaller parks; the former would end up with PSAs smaller than the parks themselves, with portions of the service areas for the smaller parks falling inside the adjacent larger parks. In order to avoid this result, we first generated additional vertices along the perimeter of the parks using the <densifyarc> command in ArcInfo (Figure 2b). These vertices were then converted into points using the <feature-vertices-to-points> tool in ArcToolbox; these, in turn, were converted into a coverage in ArcInfo. Thiessen polygons were generated from this point coverage using the <Thiessen> command in ArcInfo (Figure 2c), after which, polygons belonging to the same park (i.e., the vertices are from the same parks) were then aggregated using the <dissolve> function in ArcToolbox (Figure 2d). The result is a lattice consisting of 1,666 PSAs, with every space in the region assigned to the park closest to it (Figure 2e).

Park data (e.g., area, facilities present) were assigned to each PSA by overlaying the park data layer onto the latter using the <intersect> tool in ArcToolbox. In cases when two or more contiguous parks belong to the same park service area (i.e. enclosed in the same Thiessen polygon; see preceding section), the facilities present among these parks were summed and the value assigned to the corresponding PSA.

2.5 Assigning population characteristics

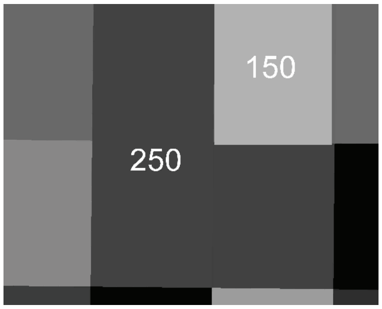
The following socio-economic characteristics were examined: proportion of Latinos, Whites, African-Americans, and Asian-Americans (representing the major race groups in the region), proportion of population up to 17 years old, proportion of the households below the Federal poverty threshold level, and median household income. Census 2000 tract data were used as the source for demographic information, but the population counts and the resulting proportions were refined using the LandScan population distribution data.

LandScan applies a “likelihood” coefficient to the census count for each of its 30-arc second (approximately 90 m x 90 m) grid cells based on key indicators of population, namely, land cover, roads, slope, and nighttime lights (Bhaduri et al., 2002). As such, LandScan is a more spatially refined population grid compared to the original Census 2000 data. In order to assign the socio-economic data from the Census tracts into the re-distributed counts from LandScan, Census tract data were overlaid onto the LandScan layer. To accomplish this, LandScan, which comes in a grid format, was first converted into a vector layer.

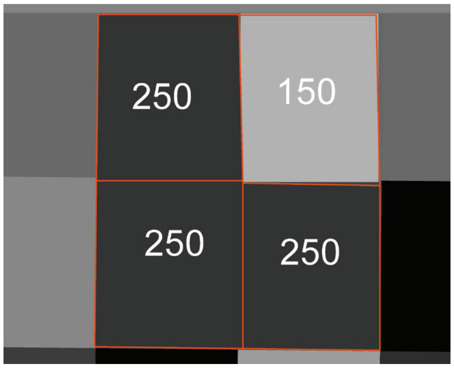
The grid-to-polygon conversion in ArcToolbox or the <gridpoly> function in ArcInfo allows grid to polygon conversions, however, these two functions aggregate adjacent grid cells having similar values, effectively underestimating the LandScan population cell counts. For example, given three adjacent LandScan grid cells with a population count of 250 each (Figure 3a), and a fourth cell with a value of 150 (that is, a total of 900 people in all four cells together), using either of the grid-to-polygon or <gridpoly> functions will convert the three adjacent “250” cells to one polygon, assigning the latter a non-additive value of 250 (Figure 3b). This new

Figure 3. A comparison of the effect of converting a LandScan population grid (a) using (b) ArcToolbox's grid-to-polygon function or the <grid-to-poly> function in ArcInfo, and (c) the implementation of Voronoi polygons using grid center points as the input coverage.

(a) The original LandScan layer with four cells, three of which have a value of 250 and one with a value of 150. Total population count for all four cells is 900.



(b) The result of a grid-to-polygon conversion in Arctoolbox or the <gridpoly> function in ArcMap. Both aggregate adjacent cells of the same value, and assign the aggregated result a non-additive value. As a result, total counts are underestimated. In this example, the original population total of 900 is underestimated by 500 because the three "250" cells are aggregated as one cell with a value of 250.



(c) By generating Voronoi polygons as the input point layer, square polygons are drawn and the counts preserved. This approach was implemented in the present study and effectively converted population grids into vector polygons, while at the same time preserving the counts. The total population for the four squares after implementing this approach remains 900.

area, together with the "150" polygon would add up to only 400, underestimating the original LandScan counts in three of the four cells.

Considering the shortcomings of these two conversion functions, we carried out the LandScan grid-to-polygon conversion applying a series of steps that employed the concept of Thiessen (Voronoi) polygons (Figure 3c) to preserve the original grid population data. First, the LandScan grid was converted into a point coverage (<gridpoint> in ArcInfo), utilizing the grid cell centroids. Using this point coverage, Voronoi polygons were generated; since the points were equidistant, the resulting tessellation mainly consisted of rectangles (except along the boundaries of the study area and the coastline), approximating a vector version of the LandScan grid (for the present purpose, the termed "cell" loosely to refers to polygons in the LandScan vector layer, even if the resulting polygons are not technically grid cells). The census tract layer was then overlaid (using <intersect> in ArcToolbox) on this LandScan "vector" layer.

Population and household estimates of the output layer resulting from the intersection of the Census tract with the ("vectorized") LandScan layer were calculated using a simple area-weighted average. That is, the population (or household) P of any given polygon in the output layer 1 is equivalent to the proportion of the population count P_0 in the input layer to the size of the area A_0 in the input layer, multiplied by the size of the new area A_1 in the output layer:

$$P_1 = \frac{P_0}{A_0} A_1$$

For example, if a LandScan cell originally with a population count of 200 is bisected by a Census boundary into two polygons—one a quarter of the original LandScan cell size and the other three-quarters of the original size, these two polygons will be reassigned population counts of 50 and 150, respectively, the former being one-quarter and the latter, three-quarters of 200.

Since census tract data on race, children, and poverty level are reported as percentages, these proportions were simply multiplied with the new population estimates (or household counts for poverty level). For example, if a polygon having a population count of 200 intersects a Census tract with the following demographics: 40% Latino, 30% White, 25% African-American, 4% Asian-American, 15% age up to 17, and 10% below the Federal poverty level, the new layer will be assigned the following counts: 200 x 40% = 80 Latinos, 200 x 30% = 60 Whites, 200 x 25 = 50 African-Americans, 200 x 4% = 8 Asian-Americans, 200 x 15% = 30 children up to 17 years old, and 200 x 10% = 20 households under the Federal poverty threshold level. For median household income, a "*total* median household income" value was first calculated by multiplying the median household income from the Census tract by the number of households estimated in a polygon. After the overlay, the number of households contained in the resulting polygons was calculated (as described above), and the weighted *total* household income was calculated using the new household counts. In the final layer, the median household income was recalculated by dividing the total median household income by the number of households per polygon.

The LandScan-Census layer (i.e., the map layer generated from the intersection of the LandScan and Census layers, and as such, contains both LandScan population estimates and Census demographic data, as explained above) was then overlaid onto the PSA layer (Section 2.4). The new demographic data resulting from the intersection were recalculated in the same manner described above; that is, utilizing areal weighting. After re-assigning the values, polygons belonging to the same PSA were re-aggregated (using the <dissolve> function in ArcToolbox), such that once again, there is one PSA for each park; during this aggregation, the counts were simply summed.

2.6 The approach as a framework for evaluating candidate parks

For the simulation study, two parcels were selected as hypothetical candidate park sites. Each of the parcel polygons was added to the existing park layer, and treated as a regular park polygon. That is, the set of procedures described in Sections 2.4 (delineating the park service areas) and 2.5 (assigning population counts and demographic data) were applied to the park polygon layer containing the added candidate parcels, and the aforementioned analysis was repeated. After the new configuration of PSAs was redrawn and the corresponding demographic data assigned, new park pressure levels were recalculated for the new layer. The resulting changes in park pressure that each candidate site generated were then compared, and the merit of each site evaluated in terms of alleviating existing park congestion.

3 RESULTS

We present here the results of examining levels of service in every park service area—that is, the potential park pressure levels—across the GVP region relative to race, income, and youth density. We also present a specific example demonstrating how the proposed approach facilitates the comparison of policy alternatives, by showing how proposed candidate park sites differentially alleviate existing inequities in park access.

3.1 Park congestion across the region

The NRPA has historically recommended six to 10 park acres per 1,000 residents—translated to park pressure level, this ratio is approximately 100 to 167 persons per park acre (or "ppa"; Lancaster, 1983, 1990, 1995). Although such standards are not unproblematic (see Ammons, 1995), and are no longer officially disseminated by the National Recreation and Parks Association, they remain widely referenced and used in practical park planning applications. Of the 1,674 PSAs delineated in the study area (the PSAs are fewer than the total number of parks because, as previously mentioned, adjacent parks were treated as having one service area), only 403 PSAs or 24% are within this range or better (i.e., <167 ppa), leaving 1,271 PSAs or 76% with park pressure levels higher than the recommended standard (i.e., >167 ppa).

Approximately 946,947 people live in PSAs with park pressure levels of 0-50 ppa and another 763,884 live in PSAs with pressure levels of >50-167 ppa; together, these data show that 15% of the population enjoy park access within the recommended standard. PSAs with lower park

Table 1: Parks allocated to potential park pressure classes.

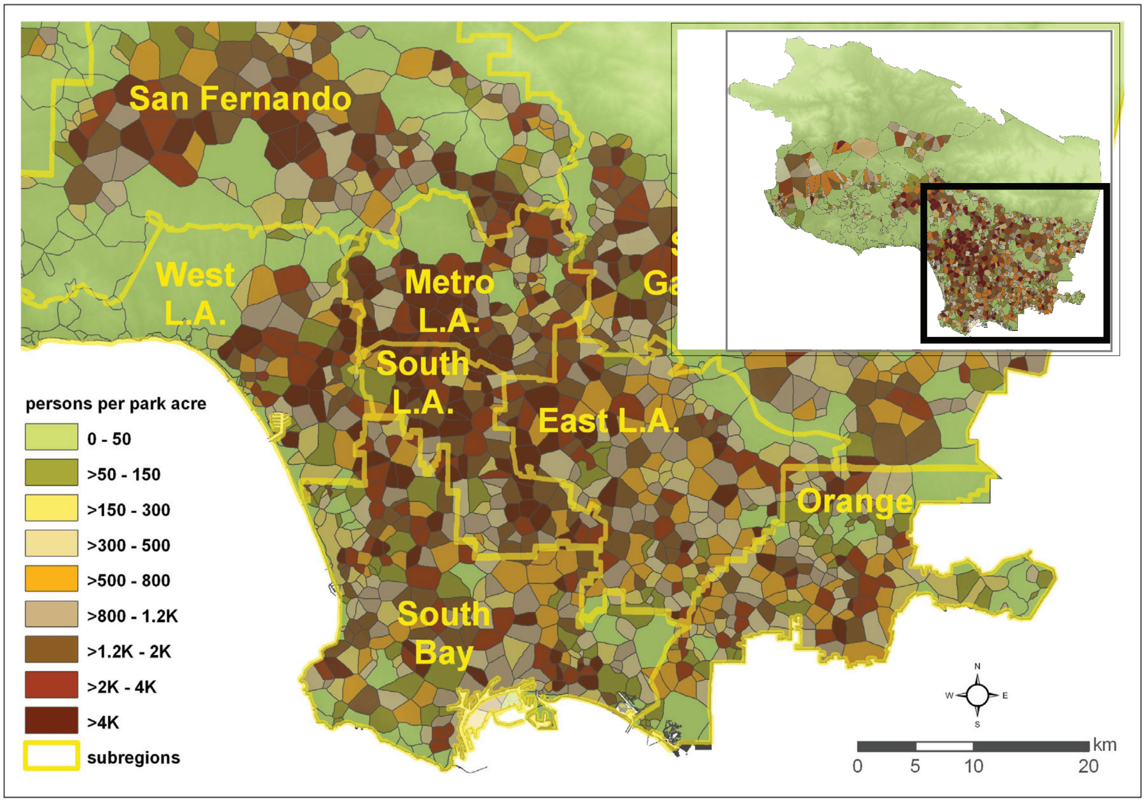
	0-50	>50-167	>167-300	>300-500	>500-800	>800-1.2K	>1.2K-2K	>2K-4K	>4K	Totals
Number of PSAs*	221	182	149	171	210	188	201	185	167	1,674
Pop (x 1,000)	951	760	475	902	1,121	1,240	1,763	1,741	1,941	10,993
Median park size (acre)	125	20.4	11.5	9.3	7.4	5.3	4.8	2.9	1.1	98.9
Mean park size (acre)	5,580	44.7	14.4	13.4	9.3	6.8	5.8	3.4	1.6	6.82
Types*										
Parks	220	182	153	175	213	190	200	185	166	1,684
Golf Courses	82	27	4	5	2	0	1	0	0	121
Beaches	39	2	0	0	1	0	0	0	0	42
Open Space	61	8	1	1	0	0	0	0	0	71
Others	20	2	1	2	1	0	1	0	2	29

*note: adjacent parks were treated as one park when delineating the park service areas, as such, that 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.

pressure typically contain larger greenspaces. In the lowest park pressure class (0-50 ppa), the median park size is 125 acres; large parcels of recreational spaces such as the National Forests belonging to this class typically skew the size distribution, such that the mean park size for this class is 5,580 acres. The >50-167 ppa size class has a median of 21 acres with a mean size of 45 acres. As expected, most uncongested PSAs are located in low-density neighborhoods adjacent to large expanses of open spaces, such as in the north portion of the region close to the Angeles and Los Padres National Forests, and in the west where the Santa Monica Mountains are located (Figure 4 inset)—areas that correspond to the west portion of the West L.A., San Fernando, and East Ventura subregions delineated by Sister et al. (2007).

There are also PSAs with low park pressure levels located in the more populous L.A. basin however (Figure 4; green in color). These service areas are typically associated with large regional parks, such as the Griffith Park, Elysian Park, Ernest E. Debs Regional Park, Trebek Open Space, and Runyon Canyon—all located in an area delineated as the Metro L.A. subregion (Figure 4)—and the large unit managed by the Puente Hills Landfill Native Habitat Preservation Authority that includes Hellman Wilderness Park, Sycamore Canyon, and Arroyo Pescadero, as well as the adjacent Schabarum Regional Park—located along the boundary of the East L.A. and San Gabriel subregions (Figure 4). Also included in the low park pressure class are service areas 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 park pressure service areas contain the most

Figure 4. Park pressure levels across the Southern California region; boundaries of the subregions identified by Sister et al. (2007) are also shown.



diverse types of recreational spaces, as opposed to the high park pressure service areas that are usually limited to neighborhood parks.

At the other end of the spectrum are high park pressure levels (shaded dark brown in Figure 4), mostly located in the more populous areas of the L.A. basin. These are locations that typically have limited space, and hence, greenspaces tend to be neighborhood pocket parks and relatively smaller recreation centers mostly <12 acres in size. An exception to this trend 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 the western portion of the region, specifically the dark brown areas in the subregion identified as West Ventura by Sister et al. (2007).

3.2 Potential park pressure and race

Figure 5. Proportion of race groups across different park pressure classes (means are provided as lines across each race group).

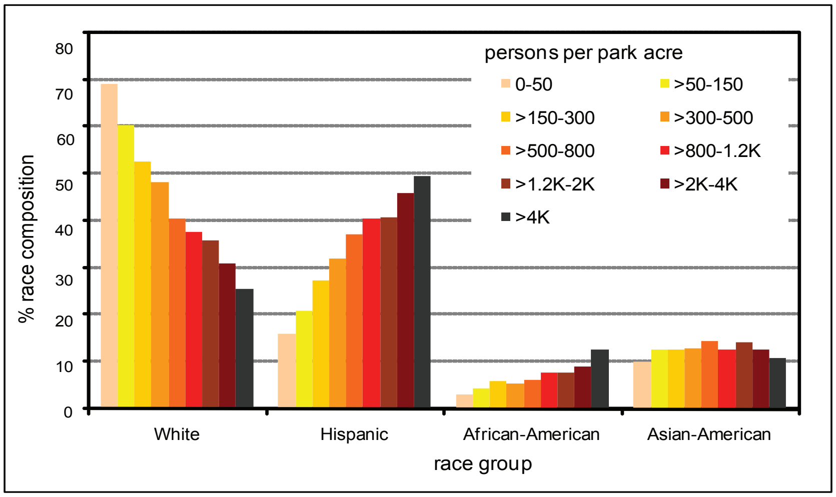


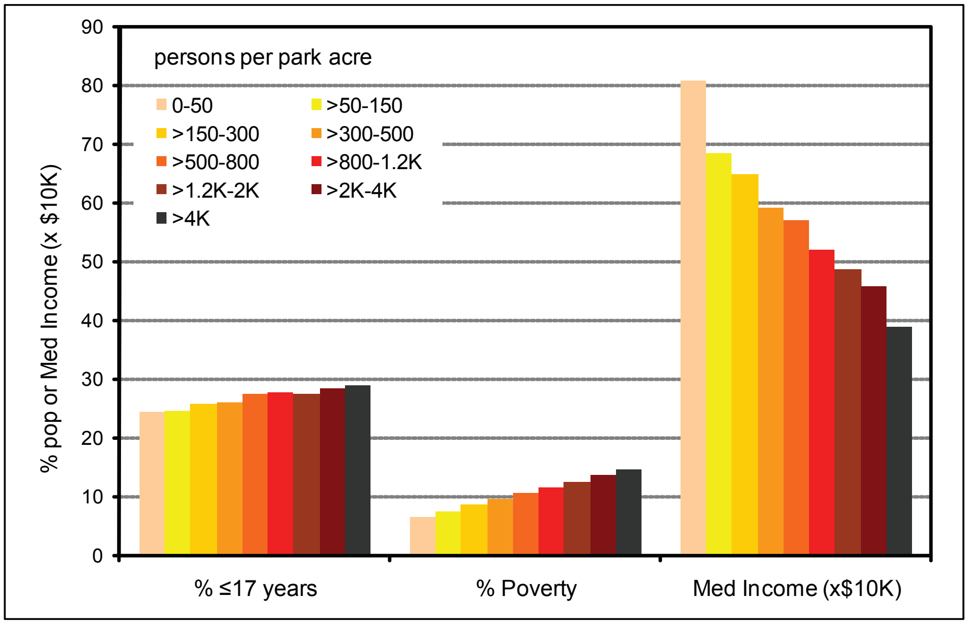
Figure 5 clearly depicts the trend in park congestion relative to race/ethnic groups. A larger proportion of the White population live in PSAs with relatively lower park pressure—that is, areas with large expanses of recreational parks and open spaces and relatively low residential densities. The opposite pattern—almost a mirror image, in fact—is observed in the Latino population. Latinos are more likely located in service areas with high park pressure, with the proportions increasing as park congestion levels increase. This same trend is also exhibited by the African-American population, although to a smaller extent. 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.

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	- 0.48	<0.01
% Latino	0.44	<0.01
% African-American	0.23	<0.01
% Asian-American	< 0.01	0.86

3.3 Park congestion, youth density, and income

Figure 6. Proportion of children (age up to 17 years old), percent poverty, and median household income across the different park pressure classes (means are provided as lines across each category).



The density 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 need for park access. The rationale is that good access to parks, translated here as low park congestion levels, is needed in areas with more children, higher poverty levels, and lower median household income. Figure 6 shows these three indices as they are distributed across the different park congestion classes.

There were fewer children in service areas with low park congestion, and conversely, park service areas with relatively higher proportions of children tend to have higher park pressure levels with a Spearman's correlation coefficient of 0.24, ($p<0.01$); that is, areas with high densities of youthful population 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 (Spearman coefficient of 0.50, significant at $p <0.01$). The pattern is also evident when examining median household income. PSAs with low park pressure levels typically have relatively higher median household income compared to PSAs with high park pressure levels (i.e., $81K in the lowest park pressure class compared to $39K in the highest park pressure class; the Spearman's correlation coefficient of -0.54 is significant at $p<0.01$). In other words, low-income neighborhoods tend to have smaller park people-to-area ratios, compared to relatively higher-income neighborhoods which tend to have greater park space shared among fewer residents.

3.4 Facilities and park congestion levels

While most parks had play equipment present, when the numbers are normalized per-10,000-children, PSAs with the lower park congestion levels tend to have more parks with this type of facility (Figure 7). This trend is also true for soccer fields and pathways for walking/jogging; it should be noted that for both of these, somewhat larger spaces are required. Basketball courts and baseball diamonds also tend to occur in areas with relatively low park pressure, with the highest numbers per 10,000 children recorded in service areas in the 0-50 and >50-150 ppa size class. Although baseball diamonds also require large spaces, the present field audit included backstops and batting cages under the “baseball category”, with the latter two requiring less space compared to baseball diamonds.

Although less congested park service areas do not always have more facilities in terms of absolute numbers, when the density of children was taken into account, the relatively uncongested PSAs were shown to have more parks with basketball courts, baseball diamonds, soccer fields, and pathways for walking/jogging per 10,000 children (Figure 7).

Figure 7. Number of parks with facility normalized per 10,000 children.

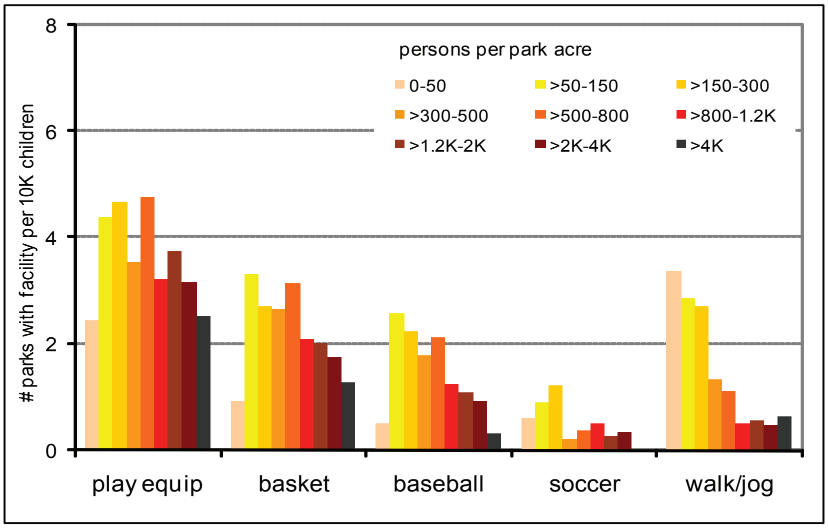
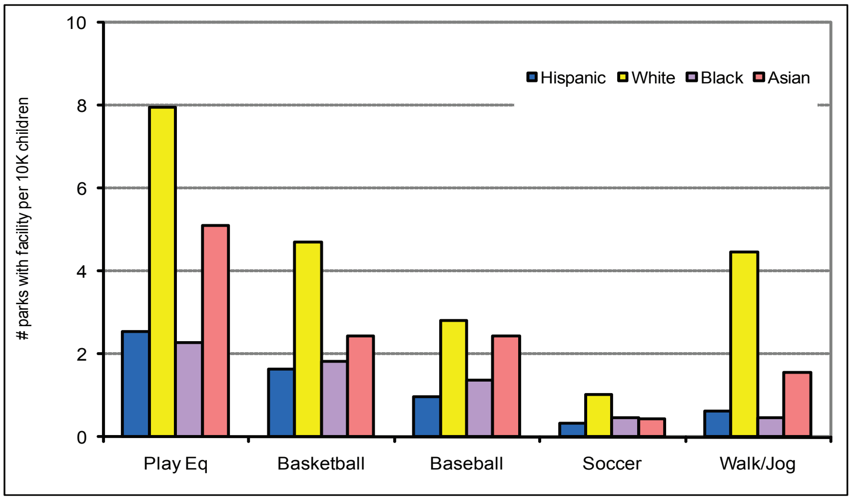


Figure 8. Number of parks with facility normalized per 10,000 children, as organized per race group.



Field-audited parks equipped with play equipment, basketball courts, baseball diamonds, and soccer fields were observed to have PSAs with a higher proportion of Latinos, lower proportion of Whites (Table 3a), higher proportion of households below the Federal poverty threshold level and lower median household income (Table 3b). On the other hand, the opposite trend is observed in PSAs with parks having pathways for walking/jogging. These trends mirror the patterns described above, whereby more congested parks (typical of Latino communities in the region) had parks that were more likely equipped with play equipment, basketball courts, baseball diamonds, and soccer fields, but with fewer pathways for walking/jogging. But then again, when the number-of-children-to-park ratio was taken into account, PSAs that were

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.

(a) in terms of race groups

	Play Equip		Basketball		Baseball		Soccer		Walk/Jog	
	with	none	with	none	with	none	with	none	with	none
% Latino (n = 104)	37	27	39	30	39	32	40	34	29	36
% White (n = 162)	41	55	40	49	39	47	41	46	51	43
% Af-Am (= 4)	5	5	6	5	5	5	5	5	4	6
% Asian (n = 25)	15	12	14	14	14	14	13	14	14	14

(b) in terms of % poverty and median household income

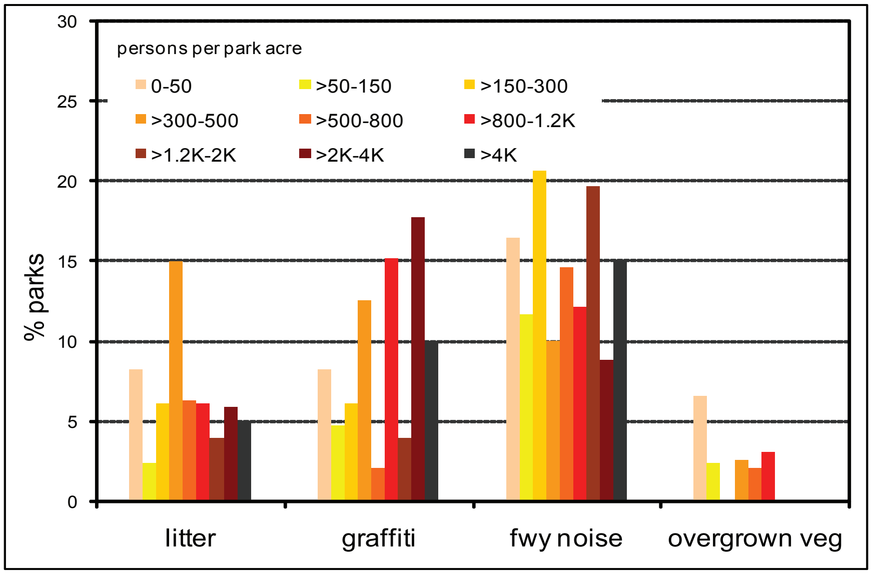
	Play Equip		Basketball		Baseball		Soccer		Walk/Jog	
	with	none	with	none	with	none	with	none	with	none
% Poverty	12	11	13	11	12	12	13	12	11	12
Median Inc (x 1K)	54	62	52	59	53	58	57	56	58	56

predominantly White were shown to actually have more parks with all these five facilities than the other race groups (Figure 8).

3.5 Condition and park congestion levels

Surprisingly, perhaps, the least congested PSAs (0-50 ppa) along with PSAs belonging with >300-500 ppa (8% and 15%, respectively) have the highest proportion of parks with litter. The least congested PSAs have the highest proportion of overgrown vegetation (7% compared to 0-3%) (Figure 9). This seems indicative of the wilderness-type open spaces prevalent in uncongested PSAs. Although graffiti were also

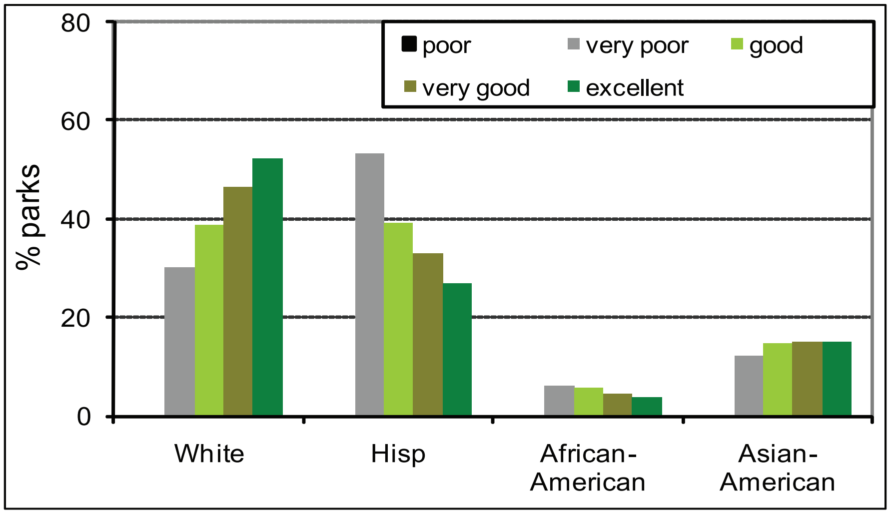
Figure 9. Proportion of parks with litter, graffiti, freeway noise, and overgrown vegetation.



encountered in less congested PSAs, incidence was higher in relatively congested PSAs (15 -18%). There seemed to be no discernable trend when examining freeway noise relative to the different park pressure classes.

Figure 10. Overall maintenance ratings across different levels of park pressure

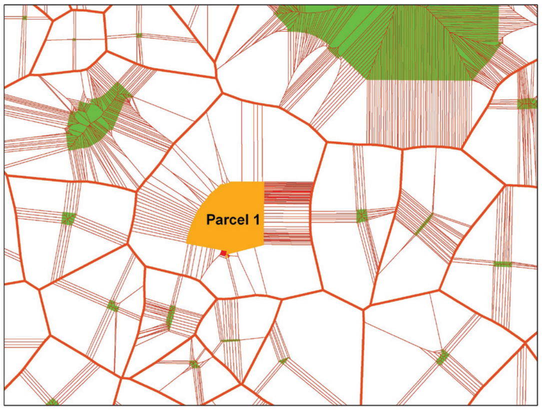
Figure 11. Overall maintenance levels by PSA with PSAs assigned to predominant race groups.



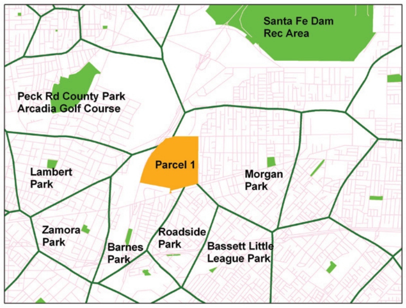
In terms of overall maintenance, most field audited parks across all park pressure classes were rated “good” to “excellent”, with very few parks rated “poor” and none rated “very poor” (Figure 10). The highest proportion of parks rated “excellent” were the uncongested parks (25-36%) while most of the parks rated “poor” belonged to the highest park pressure class. The lowest park pressure class had 10% of the parks rated poor; 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 predominantly White PSAs (Figure 11).

Given multiple alternative sites competing to host a new park, planners need to evaluate which candidate site has the greatest potential to alleviate existing inequities. In this section, we present a simulation that considers the impact of two potential park sites. These two sites (i.e., Parcels #1 and #2, colored orange and purple in Figures 12 and 13, respectively) have been promoted as potential new park sites. Following the protocol detailed in Section 2.6, Thiessen polygons were generated using vertices along the boundaries of the parks, including the added parcels (Figures 12b, 13b). Thiessen polygons belonging to the same park/parcel were then aggregated to create one service area for each park/parcel (Figures 12c and 13c). Park pressure levels (i.e., persons per park acre) and demographic data were recalculated using the same areal weighting method used to calculate the initial (present-day) park pressure measures. Presented below is a comparison of the results from converting Parcel #1 and Parcel #2 to parks.

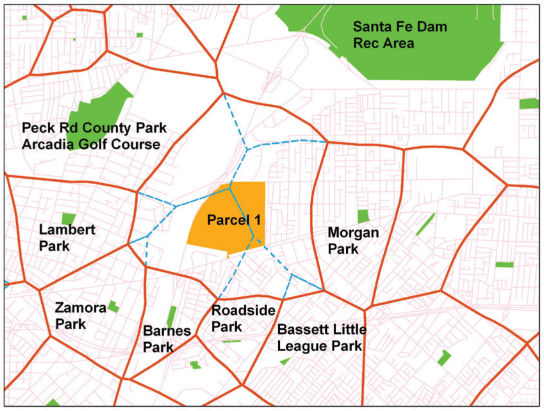
Figure 12. Revising the delineation of park service areas following proposal to turn Parcel 1 into a new park.



(a) Original configuration of park service areas; also shown is the location of Parcel 1 candidate site



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



(c) The configuration of the new park service areas with the conversion of Parcel 1 into parkland.

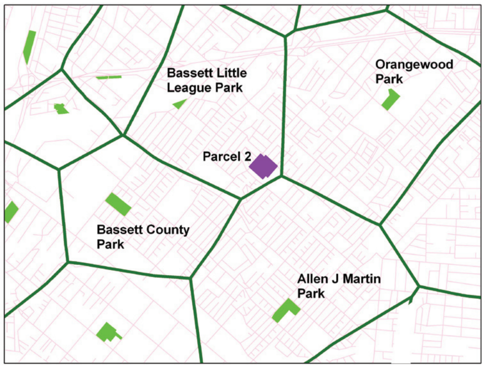
The transformation to parkland of Parcel #1, located in a low-density area with excellent park access, impacts a total of 136,888 people living in the surrounding eight service areas (Figure 12a) containing a total of 2,303 park acres (Table 4). With the existing park service area configuration, the park congestion level in these eight PSAs was 59 persons per park acre and 20 children per park acre. With the added 334 acre from the new parkland, this existing congestion was effectively brought down to 52 persons per park acre and 17 children per park acre (Table 4). This is equivalent to a ratio (i.e., original pressure level to new pressure level) of 1.15; that is, for every 115 persons or children served by a given park area in the original park configuration, this level is now reduced to 100 persons or children per unit park area with the addition of the new parkland. This is equivalent to a 13%

reduction in park congestion levels, where percent change is the ratio of the difference between the original park pressure level, P_{orig}, and the new park pressure, P_{new}, to the original pressure level P_{orig} as given below:

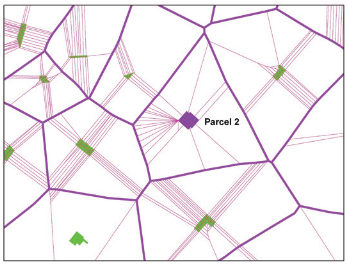
$$\% \text{ change} = \frac{P_{orig} - P_{new}}{P_{orig}} \qquad (2)$$

We can next examine what happens when Parcel #2 is 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 acres of park, all together serving a total of 68,742 people—giving a park pressure level of 1,880 people per park acre. There are 21,934 children in this area, giving us a park pressure level of 600 children per park acre. With the addition of 18 acres of new parkland, these pressure levels decrease to 1,259 persons per park acre and 401 children per park acre. This is equivalent to a ratio (original park pressure to new park pressure) of 1.5; that is, for every 150 persons or children served by a given park area in the original park configuration, this level is now reduced to 100 persons or children per unit park area with the addition of the new parkland. This is equivalent to a 33% change in park congestion levels (refer to Equation 2 for the calculation).

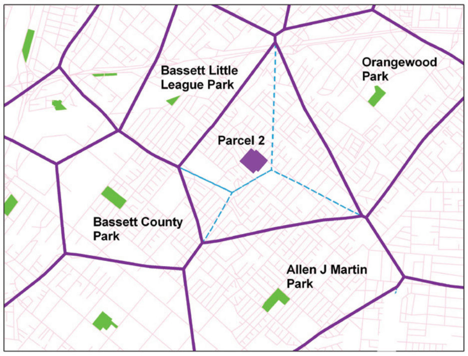
Figure 13. Revising the delineation of park service areas following proposal to turn Parcel 2 into a new park.



(a) Original configuration of park service areas; also shown is the location of Parcel 2 candidate site.



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



(c) The new configuration of park service areas with the conversion of Parcel to into parkland.

A striking revelation from the calculations above is the fact that even though Parcel #2 is smaller than Parcel #1 (18 acres compared to 334 acres, respectively), the ratio of the original park pressure levels to the new levels with the added park in the former was not too different from the latter; in fact, the ratio was a little higher with the conversion of Parcel #2 into parkland. The conversion of Parcel #1 into parkland affects park congestion in eight surrounding service areas, however, four of these changed only slightly, by three to 11%. 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, Figure 12), and as such, the size of the corresponding PSAs changed to a smaller degree, which correspondingly changed the congestion levels only slightly; or (2) some of these parks were large and had lower residential densities, such that the existing pressure levels before the addition of the new parcel was 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—with a large areal extent and with lower residential densities immediately adjacent to it, it currently serves. With

Table 4. 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.

(a) Characteristics and changes in the area*

PARCEL #1 and its surrounding PSAs				**PARCEL #2 and its surrounding PSAs**			
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 arce	2,303	2,637		Park acre	36.6	55	
Pers per pk acre	59	52	13	Pers per pk acre	1,880	1,259	33.1
≤17 yrs old per pk	20	17	13	≤17 yrs old per pk acre	600	401	33.1

(b) Changing pressures expected in nearby parks (persons per park acre)

Parks affected	**Orig**	**New**	**% Change** $^{+}$	**Parks Affected**	**Orig**	**New**	**% Change** $^{+}$
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	8	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

\+ "% change is calculated using Equation 3.1

the addition of Parcel #1, the service area covered by the recreation area changed only to a small degree, such that the park would now serve 8 persons per park acre.

On the other hand, although Parcel #2 was surrounded by only four parks (Figure 13), and in terms of absolute numbers, the transformation of this parcel into parkland would impact a smaller population, the *proportion* of the change relative to existing levels is greater compared to that of Parcel #1 (i.e., 33% compared to 13% 27%, respectively). Parcel #2 may be smaller compared to the latter; however, since Parcel #2 is strategically located adjacent to smaller parks with high pressure levels, its addition produces a larger proportional change relative to existing pressure levels.

What the above revelation leads to, is that, in the case of existing 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 parklands may actually produce substantial change—at times even more so than large parcels as shown in the case presented above—in terms of alleviating highly congested park service areas. 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 a few adjacent residents) and thereby engendering a more spatially equitable solution. Additionally, these small greenspaces can also potentially improve hydrological function (e.g., using unpaved ground to increase local groundwater recharge) or serve as habitat stepping stones. Such a series of small parklands can actually come in the form of vacant lots, alleyways, underutilized school sites, public or utility-owned property, unnecessarily wide streets, and abandoned riverbeds (Wolch et al., 2005). These commonly occurring spaces can be viewed as opportunities in inner city neighborhoods that are typically disadvantaged with respect to park access.

5 DISCUSSION AND CONCLUSIONS

In the present report, we have shown that delineating park service areas allowed an examination of potential congestion levels—or park pressure levels—at a finer and more appropriate scale than the traditional container approach use in most park equity studies. One drawback of the container approach is the use of pre-defined boundaries (e.g., Census tracts) with the implicit assumption that populations inside the boundaries have equal access to all the amenities inside the "container". The approach becomes problematic if the delineated boundaries do not match the service areas of the amenities of interest. For example, a park along the boundary of a Census tract may be more accessible to populations in the adjacent tract than those within it. This issue is largely avoided in the approach presented here.

By implementing the concept of Thiessen polygons, we assigned residents to their closest parks, and delineated a corresponding service area for each park. As such, the present approach accounts for density—which is the strength of the container approach—and at the same time considers the spatial arrangement of amenities—which is the strength of the radius technique that looks at pre-set buffers surrounding each park (e.g., quarter mile). The use of the Thiessen polygons, therefore, incorporates the strengths of existing traditional approaches while at the same time circumventing their weaknesses.

By characterizing every space in the region in terms of park congestion, we have presented a powerful picture of how park resources are distributed across the GVP region and how the patterns produce an inequitable distribution that disproportionately impacts poor people of color. Residents who live in areas of high park pressure have higher probabilities of encountering conflict, resulting in lower levels of satisfaction (Heywood, 1993; Jakus and Shaw, 1997; Manning 1999); this in turn can lead to an aversion to park visitation, thus displacing some stakeholders (Manning and Valliere, 2001). Since displacement and a shift away from park use are possible responses to crowding, measurement of park pressure as *potential* congestion is more apt than measuring *actual* congestion rates, given our research goals. Thus, in highly congested park service areas, access to park resources can be deemed lower.

Latinos, and to some extent African-Americans, were more likely to live in areas close to parks that have higher park congestion levels. Populations in close proximity to these potentially highly congested parks also tend to be low-income, with relatively higher proportions of the population below the Federal threshold of poverty. On the other hand, White populations and high-income groups are mostly located in less dense areas with larger parks, and hence in neighborhoods with lower levels of park pressure. These results echo the trends presented by Wolch et al. (2005), although the latter was confined to the analysis of park equity in the City of Los Angeles.

Park congestion in the Southern California region is largely a function of park size and population densities. Park service areas with lower park pressure are typically areas adjacent to the larger open spaces with lower residential densities. On the other hand, park service areas in densely populated neighborhoods are constrained by size, and hence have smaller parks. This combination of smaller park sizes and higher residential densities result in potential congestion levels that exceed the recommended standard.

This spatial arrangement of park resources relative to the locations of residents becomes an environmental justice issue due to the fact that 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 properties and thus accessible only to the portion of the population who can afford the high prices. Low-income groups, disproportionately people of color, are mostly relegated to the high-density lower-cost neighborhoods with fewer available spaces for recreation and nature appreciation.

These inequities are often exacerbated by several additional factors. First, many low-income neighborhoods of 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. 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 park congestion have parks that are small, most facilities present in these parks are those that can be accommodated in the limited space available. Most parks have play equipment, whereas pathways for walking/jogging and larger playfields (e.g., for baseball, soccer, etc.) are usually absent in high-density PSAs. It should be noted that this is not necessarily so; some parks, such as Augustus F. Hawkins Natural Park in south Los Angeles, is relatively small (8 acres) but has a walking path that is heavily used by park visitors. But, even if these facilities were to be present, the number-of-people/children-per-facility-ratio in these areas is high, and thus these neighborhoods remain wanting in terms of park infrastructure, amenities, and facilities. All these results imply that low-income communities of color, located in the denser park service areas, have limited opportunities in terms of the numbers and diversity of recreational activities readily available to them.

Play is an important aspect of a child's development, helping to develop motor skills and co-ordination, teaching the value of teamwork, leadership, and dedication, and providing healthy outlets to youthful energies. Play is so important, in fact, that it is recognized as one of the basic rights of children as declared in the 1989 United Nations Convention on the Rights of the Child. When communities are deprived of these resources, the fate of future generations is at stake. Opportunities provided by public park facilities are crucial to disadvantaged populations who have more limited resources. In the face of competing needs, this implies that congested park service areas that have a higher proportion of disadvantaged populations should be prioritized in terms of park and facility provision.

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 to a park. However, public policy and planning can harness tools such as the framework presented in this report to allocate public resources to arrive at a solution (or several potential solutions) that can be both equitable and sustainable. Inner cities that are largely constrained by available space but are in dire need of parks and open space, can harness under utilized parcels—vacant lots, alleyways, portions of school sites, public or utility-owned property, unnecessarily wide streets and abandoned river beds—and convert these into parklands.

Web-based decision support tools that utilize the present approach are currently being developed by the University of Southern California's Center for Sustainable Cities and the GIS Research Laboratory. These tools can be readily used to evaluate the merit of one or multiple proposed park sites, comparing these to alternative sites or possibly alternative development. These decision support tools can assist municipalities and community-based groups, especially those who otherwise have limited resources, to lobby for candidate park sites and/or park development that can largely alleviate existing park pressure levels in their localities. From the standpoint of policymakers and funding organizations, the tools afford a consistent and easily understandable language to compare alternative park sites. Thus, the adoption of these web-based tools in decision-making will have the effect of leveling the playing field for municipalities and community groups vying for park funds, minimizes the unfair advantage that currently accrues to those who have more resources to put together the most convincing proposals (which can be a factor why park funding exacerbates existing inequities in park access; Wolch et al., 2005), and as such, makes the politics of park funding allocation a more democratic process.

Active local communities and grass roots involvement in the evaluative process of proposing alternative park sites that best address their needs increase their stake in the decision-making process. This will empower local stakeholders and potentially change the ways park provision has been traditionally carried out (McInroy, 2000; Byrne et al., 2007). For instance, the moralistic overtones of park provision during the early 20th Century reformist era (Cranz, 1982)—and still carried out today in subtle and not too subtle ways (e.g., Byrne et al. 2007)—with parks designed to target the delinquency of youth and unlawful conduct, were predicated on a top-down approach to service provision that is oftentimes disempowering. In most cases, top-down approaches with little local community involvement seldom address the main problem, and in the long run present unsustainable solutions (or non-solutions).

Additionally, web-based decision support tools, because they use GIS layers, can easily be designed to address the interplay of multi-purpose projects. For example, there is a growing need to increase and/or sustain existing rates of groundwater recharge, as well as water quality in urban stormwater runoff. These concerns can potentially be addressed along with the issue of park and open space provision. Utilizing the decision-support tools, the GIS park layer can be overlaid with hydrography and watershed layers, such that candidate park sites can be evaluated in terms of their potential as groundwater recharge sites, in addition to their potential for alleviating existing park pressure levels. Another example involves habitat conservation needs which, again, can be addressed together with park provision, by overlaying a habitat layer on top of the park layer. The layers can be queried such that locations of priority park sites that can also serve as critical habitats for native wildlife can be identified and prioritized. These are but few examples that show the potential of the framework presented in this report in assisting users to arrive at equitable, sustainable, and more democratic solutions to a myriad of interconnected issues that face the southern California region.

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