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Factors Affecting the Productivity of Urban Parks

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Abstract

The park system of two Massachusetts cities—Holyoke (pop. 44,819) and Fitchburg (pop. 39,332)—produced an estimated 605,608 visitor-hours of use during the summer of 1979. The average park produced 7,877 visitor-hours in Holyoke and 9,624 in Fitchburg, though use levels varied widely. Contrary to original expectations, neighborhood characteristics had little influence on use levels. Rather, park characteristics, particularly activities and amenities, had a significant effect on use. City officials wishing to maximize the use of their park system should consider investments in these resources while researchers build a more thorough, systematic body of knowlege about urban parks and their users.

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Introduction

Urban parks are among the foremost of our Nation's recreation resources, providing service to millions of people each year. While many cities contain parks that are gems, the kinds of lands managed by most city park departments vary widely—for each gem there are likely many others of lesser stature. They range from downtown parks in the heart of business and shopping districts to neighborhood parks with varying characteristics. Some are large, some are small. Some contain facilities for organized recreation, others are oriented toward preserving open space. Some are little more than islands in the midst of busy streets.

This bewildering array of resources poses the challenge of managing such lands in ways that provide maximum benefit to city residents. Where should a city spend its money? Is it better to develop a series of small parks throughout densely populated city neighborhoods? Or should the city try to redevelop one large but older, worn down park on the outskirts? What combination of services will provide the maximum level of long-term benefits to city residents? In an era of budget tightening, these are crucial concerns for many cities.

Parks offer city residents a variety of benefits ranging from visual amenities and the preservation of wildlife habitat to monuments and memorials. Their primary value, however, may be in the opportunities they offer for on-site recreation. Yet, some parks attract much greater use than others. In fact, the absence of use can be a significant problem (Gold 1972, 1977, 1980; Jacobs 1961; Whyte 1980) so that, in terms of on-site use, some parks may be little more than waste space, islands of non-use maintained at public expense. These do little more than consume the budget of the Parks Department, diverting resources from other, more functional parks.

We know little about factors that affect the amount of use a park receives. Dwyer (1988) and More (1985, 1989) found that use levels vary by season, day of week, and time of day. In Baltimore, children's use of playgrounds was affected by distance from a child's home to the playground, distance between competing playgrounds, size and type of playground, and the presence or absence of a variety of physical facilities (Dee and Leibman 1970). Use rates for six city parks in California varied with aesthetic qualities, particularly the number of trees present (Gold 1977). Mitchell and Lovingood (1983) examined 13 parks in Columbia, South Carolina, and concluded that use is related more to the facilities a park offers than to socioeconomic variables.

In a 1978 study of two large parks in central business districts in New England, More (1985) found that a combined 300,074 visitor-hours of use were generated during July and August. Use level peaked at lunchtime and in the afternoon. The greatest use occurred on Sundays while the least use was on Saturdays.

In a study of four large parks in several New England cities, Hayward and Weitzer (1983) interviewed neighborhood residents living within a mile of each park. They found that 31 percent of the sampled households had not used the park in the preceding two years. Nonusers tended to be older, had lived in the neighborhood longer, and had fewer children at home relative to users. Factors associated with a positive park image included accurate knowledge of park features, convenient access, specific facilities related to people's recreational interests, attractive natural landscaping, and good overall maintenance. In general, public awareness of local parks varies with personal characteristics like interest level, and such park characteristics as size and location, degree of development, popularity of the activities and facilities offered, age of the park, and media attention (Stynes 1988; Spotts and Stynes 1984).

Similar factors are important to the elderly. In a study of elderly users of urban parks in five major cities, Godbey and Blazey (1983) identified the quality of safety, maintenance, and program features as factors influencing use. Clearly, many of the facilities commonly present in urban parks are of little use to this group.

Perception of safety also can have an important influence on park use. This can vary with personal characteristics such as sex (Westover 1988) and the level of crowding (Whyte 1980; Westover 1988). Westover (1988) found that women were more concerned about safety in urban parks than were men, and also were more likely to favor high-profile law enforcement. Perceived safety also is influenced by physical features such as vegetation. The perception of safety is greatest in areas that are visually open, though this may result in low scenic quality (Schroeder 1988; Schroeder and Anderson 1984).

In a study of small parks and plazas in downtown Manhattan, Whyte (1980) found that 80 percent of all use occurred between noon and 2 p.m., and was negligible after 6 p.m. However, there were great differences in use rates among the plazas he studied. Successful plazas were characterized by comfortable seating, sun, trees, water, food vendors, a good relationship with the street, and hospitable management. Similarly, Joarder and Neill (1978) found that "busy" city plazas in Vancouver had dense furnishings, attractive focal points, and well-defined edges.

Given the variety of lands managed by city park and recreation departments, these studies provide a spotty view of the use of city parks. In this report I examine park system use in two cities and discuss how various factors influence use levels. Specifically, I hypothesized that the amount of use that a particular park receives is a function of attributes of the park itself (e.g., size, aesthetic character, facilities offered) plus attributes of the neighborhood (population density, economic conditions, etc.) in which it is located. An understanding of the relationship between these factors and use should enable us to increase the benefits of city park systems for the people they serve.

Methods

To examine the relationship between park attributes and neighborhood characteristics, I determined use rates for all the parks in two Massachusetts cities: Holyoke (pop. 44,819) and Fitchburg (pop. 39,332) during the summer of 1979. These cities share much in common: both are old New England mill towns with decaying centers; both have neighborhoods ranging from upper middle class to poor. Holyoke is especially poor—in some neighborhoods, up to 25 percent of the residents fall below the poverty line (U.S. Bureau of the Census 1982 a,b).

Both cities offer a variety of parks ranging from downtown central squares to athletic fields to large, forested parks. Some parks are well maintained, some are in disrepair, and others are in transition. Holyoke has 50 parks, Fitchburg 22.

Use data for all of the parks in each city were obtained during July and August 1979 using a time-sampling frame. To establish the sample, the week was divided into six strata: weekday mornings (9 a.m. to noon), afternoons (noon to 6 p.m.), evenings (6 p.m. to 9 p.m.), and weekend mornings, afternoons, and evenings. The actual dates of the observations were assigned at random with the stipulation that each day of the week be represented twice. This resulted in a 22-percent sample of weekday time periods and a 31-percent sample of weekend periods.

Instant-count sampling procedures were used to obtain use data (Tyre and Sideleris 1978). With this technique an observer records a photographic-like impression of the number of users in a park at a particular time. It assumes that the number found at that point is representative of the number that would be found at any other point within the stratum.

On an observation date, the observer randomly selected a park in which to start, inventoried the number of users within it, and followed a fixed route throughout the city until a circuit of the entire park system had been completed. Three observations (morning, afternoon, and evening) were made on each observation date.

The dependent variable, total use of $park_i$, was formed by summing the number of people observed in parks over all observation periods.[1] A Box-Cox test specified the logarithmic form as the most appropriate for analysis.

Forming the independent variables proved more challenging, primarily because of the great variability in the physical attributes and facilities of the parks. To convert these differences into meaningful measures that could be applied across parks, four variables were selected: an activity index, an amenity index, park size, and an aesthetic rating. The activity index, designed to indicate the degree to which a park was developed for organized recreational activities, was constructed by counting the number of ball diamonds, tennis courts, basketball courts, amount of playground equipment available, etc. However, these resources contribute differentially to total attendance because not all receive equal use and it would be unfair to give them equal weight in the analysis. Consequently, the log of total attendance was regressed over the types of facilities and the resulting betas were used as weights.[2] Thus, the actual value of the activity index for $park_i$ consisted of the sum of the weighted activity resources for $park_i$:

$$\text{Activity index park}_i = \sum_{j=1}^{n} b_1 j_1 + b_2 j_2 + \ldots + b_n j_n$$

where j = the number of facility units for a particular activity in $park_i$ (e.g., tennis courts) and b = a weight.

In addition to activity resources, parks also contain features like benches, flowerbeds, trees, landscaping, comfort stations, drinking fountains, and statuary. These features formed the amenity index. At first glance, this seems an odd assortment to lump together in an index; what they have in common is that all contribute in some way to the amenity of a park—they make the park a more pleasant place for people, either physically (benches, drinking fountains) or visually (trees, landscaping).

The amenity index was calculated in the same way as the activity index. First, a panel of three observers rated each park to obtain values for landscaping and tree resources. Park landscaping was rated from 1 (none) to 3 (extensive). Trees were rated on two dimensions: quantity (1 = none, 3 = extensive) and the effectiveness of their distribution throughout the park (1 = ineffective, 3 = very effective). These were multiplied to obtain a single rating for trees. Next, the tree and landscape ratings along with objective

[1] Total use rather than use per acre was used because facilities such as baseball diamonds or football fields have regulation sizes that invalidate use per acre in this study. Also, calculations based on use per acre would maximize the effective use of city land; calculations based on total use maximize the total return of the park system to city residents. Of these two, I suspect that the second is more often the goal of municipal officials.

[2] This procedure can create statistical problems because it uses some of the degrees available for prediction twice, thereby artificially inflating the R^2 values somewhat. The alternative—simply entering unweighted values—seems worse because the facilities differed so greatly in the use they attracted. Moreover, because not all resources are present in all parks, entering activities and amenities directly would create a large number of zeroes, distorting the regression. Future research must both refine the indices and develop weights for the individual elements independently.

measures of other amenity variables (number of benches, number of flowerbeds, etc.) were entered in a regression analysis to determine their relationship to the log of total attendance. The resulting betas were used as weights in constructing the amenity index:

$$\text{Amenity value of park}_i = \sum_{k=1}^{n} b_1 k_1 + b_2 k_2 + \ldots b_n k_n$$

where k = the value of a particular amenity resource, b = a weight determined by the relationship between that resource and total attendance.

Aesthetics also may play an important role in park use. To obtain aesthetic ratings for each park, a panel of nine senior environmental design students judged a series of 5 by 7 color photos of the parks. The photos represented the typical, "dominant" views in each park; no attempt was made to make them either attractive or unattractive. They were presented to the students in a systematically varied order to avoid order effects in the ratings. The students used a Q-sort method (Zube et al. 1974) to rate each photograph from 1 (most attractive) to 7 (least attractive). The scores from each photo of a particular park were summed and averaged to obtain a mean aesthetic rating for that park. The parks of each city were rated separately.

At this point it is important to interject a caveat—a number of studies suggest that the aesthetic judgment of professionals may differ significantly from that of the laity (cf. Clark et al. 1971; Twight and Catton 1975). Consequently, it would have been most desirable to obtain aesthetic ratings from the people who actually use the parks. To do so, however, would have been well beyond the scope of this study—the 72 parks were used by different groups of users with diverse backgrounds and interests. Several parks were used so seldomly that it would have been difficult to obtain any information. Therefore, my panel of "experts" included the kinds of people who actually make decisions about park aesthetics. Still, this potential source of bias should be recognized.

Data on the final set of independent variables—the social characteristics of the neighborhood—were obtained from block statistics from the 1980 Census (U.S. Bureau of the Census 1982 a,b). For each park, data were combined to obtain one overall value for each variable for all census blocks bordering directly on the park. The variables measured were population density, percent of total population less than 18 years old in 1980, percent of population over 62 years old, average housing value, and the average number of structures of more than 10 units on blocks surrounding the parks, i.e., apartments and housing projects.

Originally, I planned to analyze the data by conducting separate regression analyses for each city. However, preliminary analysis of the correlation coefficients revealed multicollinearity in both data sets, particularly among the neighborhood characteristics, some of which correlated as high as 0.95. Since multicollinearity inflates standard errors, it becomes impossible to sort out the unique relationships between the various independent variables and the dependent variable. There are three ways to overcome this problem (Morzuch 1980): first, the sample size can be expanded by collecting additional data; second, a data reduction technique, like factor analysis or principal components analysis, can create a new variable to enter into the regression; third, ridge regression may be appropriate.

I began by conducting factor analyses on both data sets. These revealed that four variables were creating the problem: population density, percentage of population less than 18 years of age, percentage of population over 65 years of age, and the number of 10-unit structures per block. Thus, young and old tended to be concentrated in apartment buildings and housing projects in the center of the city.

Further use of principal components regression or ridge regression was not warranted because the small (n = 22) sample size in Fitchburg would have yielded unstable estimates. I therefore pooled the data sets to evaluate the effects of the independent variables on the combined set. After the covariance matrix had been adjusted for differences in sample size, the resulting data set did not show evidence of multicollinearity; the highest single correlation coefficient was 0.83 while the R^2 dropped substantially to 0.44. In effect, pooling the data represented a way of increasing the sample size as noted in option one, and allowed the data to be analyzed by ordinary least-squares regression.

Results

Projecting from the time sample, I estimated that, at the 95-percent confidence level, the two park systems together produced a total of 605,608 visitor-hours of use during 1979—393,871 ± 6,639 in Holyoke and 211,737 ± 1,814 in Fitchburg. On a per-capita basis, these figures indicate the Holyoke system produced approximately 8.8 visitor-hours of use for each city resident, while the Fitchburg system produced about 5.4 visitor-hours for each resident. The difference in these figures may reflect the differences in the number of parks in the two cities; the average per park was 7,877 visitor-hours in Holyoke and 9,624 in Fitchburg.

Of the factors that influence use, only the activity and amenity indices were significant ($p < 0.01$, Table 1). Both were positively related to use. Aesthetics was marginally significant ($p < 0.07$) and negatively related to use. None of the neighborhood characteristics were significantly related to use.

To confirm these results I conducted two additional analyses. First, I regressed the log of use over the neighborhood characteristics only; the R^2 was 0.03 and none of the

Table 1.—Influence of park attributes and neighborhood attributes on park use

Variable	Beta coefficient[a]	Significance
Park attribute		
Size	0.0004	0.879
Activity index	0.7783	0.000
Amenity index	0.4857	0.006
Aesthetic rating	- 0.0962	0.067
Neighborhood attribute		
Population density	- 0.0008	0.901
Number of 10-unit structures per block	- 0.0068	0.763
Percentage of population younger than 18	0.0224	0.153
Percentage of population older than 62	- 0.0023	0.934
Average housing value (thousands)	- 0.0000	0.923

[a] y intercept = 2.1442.

Table 2.—Components of activity index

Variable	Beta coefficient[a]	Significance
Swimming	0.560	0.037
Basketball	0.104	0.121
Tennis	0.090	0.172
Baseball	0.220	0.005
Playground	0.019	0.041

[b] y intercept = 1.846.

variables were significant. Second, I regressed the log of use over the park characteristics only; the R^2 was 0.42 with both indices significant ($p < 0.01$). Clearly, the use of these parks depended more on their attributes than on the characteristics of the neighborhood.

The significant relationships between park use and the two indices suggests that the indices should be examined in detail. As noted, the activity index was formed by regressing the log of park use against the various activity resources. All of the activities except the "other" category (which contained uncommon activities) were significantly related ($p < 0.20$)[3] to park use. Of these activities, swimming obviously had the greatest impact on use, followed by baseball/softball diamonds (Table 2). Basketball end tennis courts contributed to attendance but their significance levels were marginal, perhaps indicating that their effect was inconsistent across the parks. Conversely, playground equipment contributed less to use than other activities, but did have a consistent positive impact on use.

[3] The significance level $p < 0.20$ was set deliberately to avoid the possibility of Type II errors; that is, I wanted to ensure that all activities and amenities that had real effects were included in the indices.

Discussion and Conclusion

A productive, well-used park system is a major goal of most cities. Although productivity levels probably will vary across regions and city sizes, this study suggests that it may be reasonable to expect average productivity levels of 8,000 to 10,000 visitor-hours per park during summer months. This represents a system-wide average; it would be unrealistic to expect this level of productivity from each individual park. Additional research should establish productivity goals by park size and facility categories. In this sense, it would be desirable to work toward both productivity and space standards to guide investments in urban parks.

The study results suggest that park attributes may be more important influences on productivity than neighborhood characteristics. This lends support to the philosophy behind programs such as urban heritage or urban cultural parks. Such programs use parks as a form of investment in city neighborhoods, attempting to revitalize neighborhoods by attracting additional use. It does not necessarily follow that increased attendance at a park will automatically benefit the neighborhood: in fact, some evidence suggests that high attendance levels can reduce the value of surrounding residential property (More et al. 1982, 1988; Weicher and Zerbst 1973). This seems to be particularly true of parks that are developed for organized athletic activities. Nevertheless, if increased use is a goal, it may be possible to achieve this by prudent investments in both facilities and amenities.

High use is most often associated with park activities, particularly swimming facilities and ball diamonds. Basketball and tennis courts may contribute to use, but lower significance levels suggest that their effect is not consistent across parks. Playground equipment has more modest but also more consistent positive impacts on use.

It is tempting to suggest that parks departments seeking to increase use should consider adding swimming pools and ball diamonds. But it is important to note that these data represent associations only—not demand. Obviously, one could not continue to add more and more pools to community parks and expect continued increases in attendance. In the absence of demand information, the associations between use levels and park activities presented here provide a guide for park planning, but a guide that must be tempered with a knowledge of local situations.

Much the same holds true for amenity resources (Table 3). These are more difficult to interpret than activity resources, perhaps because they bear a less direct casual relationship to park use. For example, restrooms and drinking fountains are associated with high use parks but may more likely be the result of high use rather than a cause of it. Similarly, landscaping and flowerbeds are associated with relatively low use, open-space parks providing passive recreation.

There are difficulties in making decisions about parks based solely on use levels. First, quantity measures provide no information about qualitative aspects of use: who uses the parks? For what purposes are they used? What is the quality of the user's experience? The results of this study suggest that the way to obtain maximum park use is to emphasize parks with multiple athletic facilities. While this type of park certainly meets a genuine need in communities, it also serves a limited clientele. Other segments of the community with different recreation needs also have a legitimate claim to park services, as has been clearly demonstrated for the elderly (Godbey and Blazey 1983). Similarly, one individual may have different needs at different times. Obviously, communities must offer a spectrum of opportunities.

Second, on-site use, though extremely important, is only one function of an urban park. Others can include the preservation of open space, beautification, and the preservation of wildlife habitat. The economic value of many of these functions theoretically is captured in the value of properties that surround the park. As noted earlier, however, high use levels may depress property values around urban parks, while parks that emphasize preservation of open space combined with low levels of recreation use tend to maximize property values. Optimizing both values should challenge park planners and designers. In fact, mitigating the negative impacts of use probably is a key function of park amenities.

Table 3.—Components of amenity index

Variable	Beta coefficient[a]	Significance
Picnic tables	0.217	0.259
Fountains	0.458	0.088
Flowerbeds	-0.494	0.165
Restrooms	0.616	0.013
Monuments	-0.013	0.960
Landscaping	-0.321	0.064
Benches	0.028	0.002
Trees	0.017	0.663
Surface	0.013	0.871

[b] y intercept = 1.945.

Third, to guide investment decision making, we need additional information on the costs of providing recreation in urban parks. The true criterion for making decisions about urban parks must be the benefit/cost ratio. Unfortunately, we know little about the various provision costs (capital, operation and maintenance, overhead, etc.) for urban parks. While an individual park may be well used, the cost of maintaining it also may be high. For example, urban park directors often express dismay over the costs involved in operating small parks that require special trips by maintenance crews with equipment. We need much more systematic information on the costs of providing all forms of recreation.

The study results are plagued by two additional problems. First, is it possible to rule out neighborhood characteristics as factors that influence use? While this study suggests that park characteristics outweigh neighborhood characteristics as influences on attendance, that may be true only for *these* neighborhood variables; there may be others that are significantly related to use but which were not included in this study. An example might be the presence of a small neighborhood store that enables children to make a variety of purchases for a small amount of money. These kinds of microsite characteristics may exert influences that do not appear in census-block data.

A second problem concerns the measurement of park characteristics. I had not anticipated the tremendous variability that exists in park resources: there is huge variation is size, facilities, features, etc. Dealing with this variation statistically is difficult because of the small numbers involved. My solution was to create two composite variables, one for activities and one for amenities. While this technique is less than desirable, it enables these important variables to be incorporated into the statistical analysis.

Overall, this study suggests that city officials wishing to maximize the use of their park system should consider investments in activities (especially swimming facilities and ball diamonds) and amenities (park benches and drinking fountains). Generally, the parks that attracted the greatest use were those offering some combination of these activities and amenities. There was, however, much variability and these results require a great deal of additional study to be confirmed. In the meantime, research must concentrate on building a body of technical knowledge about urban parks and their users that will be useful in guiding investment decisions.

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