Research Updates

Perceived Stress Reduction in Urban Public Gardens

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Summary. The negative effects of the urban situation on human well-being are well documented, contribute to stress, weaken coping skills, and evoke a negative self-appraisal from residents continually surrounded by bleak settings (Stainbrook, 1973). The following research suggests that urban residents may visit public gardens as a means of coping with the stresses of city life. Results of a survey of urban visitors to two urban public gardens indicate that stress reduction is an important reason for visiting the gardens. The research also indicates a trend of reduced levels of self-perceived stress after a garden visit.

That cities are stressful is a well-established fact supported by a large body of research (Glass and Singer, 1972; Krupat, 1985; Torrey and Bowler, 1990). Stress is defined as an event or force (a stressor) that is sufficiently unpleasant to

threaten the well-being and existence of the affected individual (Krupat, 1985).

Three classes of stress have been described by Lazarus and Cohen (1977). Cataclysmic phenomena are sudden and powerful events, such as floods, earthquakes, and other natural disasters, affecting large numbers of people. Second and just as powerful are stresses focused on one person or a small group of people, such as job loss, divorce, or a death in the family. The third class, daily hassles, are minor or semi-minor annoyances that occur continuously or repeatedly and encompass the stresses in the city arising from density, crowding, noise, air pollution, commuting pressures, and many similar sources (Krupat, 1985). Large amounts of physical or social stimulation caused by daily hassles may overload the city dweller, resulting in feelings of loss of control over the environment. Yet, people are able to develop mechanisms for coping to meet the demands of daily hassles in the city (Milgram, 1970).

Individual stress. Pressures of the modern world demand increasing amounts of attention from human beings. Stephen Kaplan (1992) discussed the psychological process of attention with regard to mental fatigue. Involuntary attention is an effortless reaction evoked by an interesting or exciting stimulus in the environment. Directed attention, on the other hand, is a voluntary reaction that requires effort from the individual (James, 1892). Because directed attention requires effort, it is subject to fatigue. As the world becomes more complicated, humans use directed attention with increasing frequency to block unwanted stimuli, resulting in mental fatigue. This result may have a variety

of debilitating effects, which in some people may lead to excessive drug or alcohol consumption and violent behavior (Kaplan, 1992).

As stresses build within the urban resident, the individual reacts by trying to reduce or eliminate the stress (coping). Two types of coping are described by Lazarus (1984): problem-focused and emotion-focused. Problem-focused coping is characterized by an individual's striving to change the event causing stress. An urban resident, however, will find it difficult to change urban stressors, such as crowding, noise, and air pollution. Emotion-focused coping is characterized by an individual's trying to deal with feelings about a stressful event and commonly occurs when an individual perceives that nothing can be done to modify the problem. Because the stresses of urban life are not easily controlled, this method of coping is more likely to occur when dealing with the daily hassles of urban living. If a visit to a public garden is used as a means of stress reduction by an urban resident, such a visit may, therefore, be considered a method of emotion-focused coping, the goal being restoration of the individual to prestress levels of psychological well-being.

Restoration. Any experience that results in recovery from mental fatigue and stress can be considered a restorative experience. The four components of a restorative experience are being away, extent, fascination, and compatibility (Kaplan and Kaplan, 1989).

Being away suggests that the restorative environment is in a setting different from the usual. This concept does not necessarily require physical distance from the source of one's stress, but a distinctiveness and separateness from the everyday experience. Therefore, a visit to a public garden may feel to the urban resident like being very distant or separate from the usual pressures and stressors of daily life.

Extent suggests that the restorative environment must be of a large enough scope that one can move around in it without having to be careful of going beyond limits. The restorative environment need not necessarily be physically large; the individual, however, must conceptually feel that there is freedom to move about unhindered, whether that movement is physical or mental. Although its size may seem limited, an important aspect

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of the public garden is the sense that there might be more to explore than is immediately visible to the human eye.

The component of fascination suggests that the restorative environment is extremely interesting to the individual, thus drawing on involuntary or effortless attention; self-enforced concentration is not required to pursue the interest. As with other nature elements, features within a public garden easily draw involuntary attention and allow reflection and rest from directed attention (Kaplan, 1992).

Finally, the restorative environment displays compatibility among environmental patterns, the individual's inclinations, and the actions required by the environment. The person must want to be there and must be able to do the required action, and the environment must be appropriate to the action. Visiting a public garden appears to be highly compatible for many people.

Humans may find restoration in natural environments because of an historical relationship with nature. It has been hypothesized that, because humans evolved in natural environments, we exhibit a special link with and positive response to nature (Wilson, 1984). Public gardens may provide the link to nature that is not immediately available in other aspects of urban life. This research was undertaken to examine the beneficial effects of public gardens on urban residents.

Methodology

Two urban public gardens were chosen as sites for this research: Brooklyn Botanic Garden (BBG), located in Brooklyn, New York, and New York Botanical Garden (NYBG), in Bronx, New York.

The research tool was designed as

an on-site, exit survey administered to visitors after they had just experienced the garden environment. The survey consisted of one page with ten questions in three formats: Likert scale, fill-in-the-blank, and multiple choice. Designed specifically for this research, the survey was clarified with a pretest. Visitor surveys have become an integral management tool within public gardens today. As such, we also reviewed other visitor surveys during the design process. The short and easily understandable format allowed visitors to complete surveys in 3 to 4 minutes. The surveyor approached every tenth visitor (groups were counted as one visitor) exiting the gardens who appeared to be 18 years of age or older; visitors were asked to complete the survey voluntarily. Surveys were collected during Spring and Fall 1994 on weekdays and weekends.

Two survey questions requested information about visitors' perceived stress levels before and after the garden visit [rated on a scale from 1 (completely stressed) to 7 (completely relaxed)]. The remaining eight questions focused on the respondents' reasons for visiting the gardens, the most enjoyable garden aspects, who accompanied the respondent to the garden, and whether the respondent was a first-time or a repeat visitor. Three demographic questions were included: age, sex, and zip code. Only those respondents identified by zip code to be residents of the five boroughs of New York City were included in analyses.

Respondents. A total of 206 surveys was completed by BBG and NYBG visitors, of which 156 visitors (76%) were identified to be residents of the five boroughs of New York City. Of the respondents, 57% was female. The average age of respondents was 40 years (ranging from 20 to 78), with 60%

between 26 and 45, and 8% over 65.

Of the 156 urban respondents, 22.5% visited alone, 41% visited with friends, and 34% visited with family. Of the respondents, 88% had visited this or other gardens before.

Results and discussion

Enjoyment of garden aspects

Survey respondents rated their enjoyment of eight garden aspects on a scale of 1 (not at all enjoyable) to 7 (extremely enjoyable). Means for the enjoyment of garden aspects were calculated and ranked in decreasing order of enjoyment. A single-factor analysis of variance (ANOVA) revealed statistically significant differences among the means within this range of data. (All statistical analyses were performed using a 95% confidence level.) Further analyses, using the Student-Newman-Keuls (SNK) multiple-range test, identified significant differences between enjoyment of the individual garden aspects (Table 1).

As a result of statistical analyses, the garden aspects can be grouped as follows, from most to least enjoyable: trees, flowers, wooded areas, ponds, bright colors, lawn areas, fountains, and conservatories.

Because the survey did not define the individual garden aspects, respondents were not provided with an explanation of the differences among similar aspects, such as flowers and bright colors or trees and wooded areas. Yet, there were significant differences among the enjoyment of these similar garden features. The preference for flowers over bright colors may suggest a recognition of a living entity (flower) compared to a nonliving, intangible entity (bright colors). The preference for trees over wooded areas may suggest a recognition of a more formally landscaped and easily used feature

Table 1. Means and significant difference among enjoyment of garden aspects

	Mean	Trees	Flowers	Wooded areas	Ponds	Bright colors	Lawn areas	Fountains
Trees	5.85							
Flowers	5.72	NS						
Wooded areas	5.09	*	*					
Ponds	5.07	*	*	NS				
Bright colors	5.04	*	*	NS	NS			
Lawn areas	4.63	*	*	*	*	*		
Fountains	4.25	*	*	*	*	*	NS	
Conservatories	3.74	*	*	*	*	*	*	*

NS, *Nonsignificant or significant at $P < 0.05$. Mean separation within columns by Student-Newman-Keuls multiple-range test.

(trees) compared to a less-maintained feature that includes trees, understory plants, and groundcovers (wooded areas). The latter feature may be less functional to the urban resident and may be a source of fear with regard to crime (Schaffer and Anderson, 1985; Talbot and Kaplan, 1984).

Reasons for visiting. Survey respondents rated the importance of 10 reasons for their visit to the garden that day on a scale of 1 (not at all important) to 7 (extremely important). Means for importance of the reasons for visiting the gardens were calculated and ranked in decreasing order of importance. Analysis of the means of the importance of reasons for visiting the gardens (using a single factor ANOVA) revealed statistically significant differences among the means. An SNK multiple-range test identified significant differences among the importance of individual reasons for visiting (Table 2).

As a result of statistical analyses, the reasons for visiting the gardens can be grouped as follows, from most to least important: relaxation, stress reduction, inspiration, fun-social, change of pace, education-awareness, special event, nothing better to do, tour of the garden, and class at the garden.

The three most important reasons urban residents identified for visiting the two gardens—relaxation, stress reduction, and inspiration—represent feelings or affective responses evoked by the visit. These affects resulting from the garden visit appear to be paramount to other benefits that might be derived from visiting the gardens.

Survey respondents identified reasons with more tangible results as relatively less important than the affective

reasons for visiting the gardens. Such tangible reasons include education-awareness, special events, tour of the garden, and class at the garden. In these cases, the visit results in something tangible (knowledge, a new skill, etc.).

Stress reduction. Survey respondents rated their perceived stress levels before and after the garden visit on a scale of 1 (completely stressed) to 7 (completely relaxed) in response to two questions: A) How did you feel during the past week? and B) How do you feel after today's visit to this garden? The difference between the numerical responses to A and B were calculated. A negative score from this formula represents a reduction in self-perceived stress; the more negative the score, the more self-perceived stress reduction occurred. Positive scores represent increased self-perceived stress levels, and zero represents no change in self-perceived stress levels (Fig. 1).

Of the respondents, 91% (142 respondents) reported some level of perceived stress reduction after visiting the gardens; 9% (15 respondents) reported no change or an increase in perceived stress levels. A paired two-sample *t* test for means determined significant difference between self-perceived stress levels the week before visiting and immediately after the visit.

The high percentage (91%) of visitors reporting self-perceived stress reduction, and the fact that stress reduction is reported as an important reason for visiting, supports the hypothesis that urban residents visit public gardens as a means of stress reduction. It appears that urban residents seek out public gardens as means of coping with urban stress. Because public gardens meet the criteria for restor-

ative settings—being away, extent, fascination, and compatibility (Kaplan, 1992)—they may be considered havens of restoration where urban residents may recover from stress.

Although the two gardens are unique with regard to appearance, atmosphere, and audience, responses from visitors to BBG and NYBG showed no significant differences in self-perceived stress reduction (means = -3.00 and -2.82, respectively; *p* = 0.25). Visitors during two different seasons, or on different days of the week, or first-time versus repeat visitors also showed no significant differences. Two-sample *t* tests assuming equal variance were performed to obtain these results.

Further analysis using a two-sample *t* test showed no significant differences in self-perceived stress reduction between males (mean = -2.83) and females (mean = 2.99; *p* = 0.28). Correlation analyses found no relationship between age and self-perceived stress reduction experienced by respondents.

Conclusions and recommendations

This research indicates that urban residents may seek public gardens to achieve feelings of relaxation, stress reduction, and inspiration. Although the tangible rewards of public garden visits are of great significance to the community, this research suggests that they may be secondary to the affective rewards of the garden visit. Administrators should embrace the notion that urban residents visit public gardens for the affects, or feelings, and restoration that result.

Table 2. Means and significant difference among importance of reasons for visiting gardens

	Mean	Relaxation	Stress reduction	Inspiration	Fun or social	Change of pace	Education or awareness	Special event	None	Tour
Relaxation	5.58									
Stress reduction	4.78	NS								
Inspiration	4.76	NS	NS							
Fun-social	4.48	*	*	*						
Change of pace	4.20	*	*	*	*					
Education-awareness	3.78	*	*	*	*	NS				
Special event	1.99	*	*	*	*	*	*			
None	1.25	*	*	*	*	*	*	NS		
Tour	1.23	*	*	*	*	*	*	NS	NS	
Class	0.77	*	*	*	*	*	*	*	*	*

NS, *Nonsignificant or significant at *P* < 0.05. Mean separation within columns by Student-Newman-Keuls multiple-range test.

Fig. 1. *Magnitude of self-perceived stress reduction. The difference between perceived stress reported before and after the visit resulted in the above scores. Negative scores represent a reduction in perceived stress.*

Two important concepts emerge: 1) stress reduction is an important reason for visiting public gardens, and 2) a self-perceived reduction in stress levels results from a garden visit. These concepts provide a strong case for garden administrators in their ongoing efforts to obtain funding. Stress reduction and restoration are important services to the community that could improve the quality of life for city dwellers; these services should be emphasized by garden administrators when applying for funds from public and private sources.

Garden administrators should further use the results of this research, combined with findings from other research, in promoting their institutions to the public. Gardens should emphasize the stress-reducing and restorative qualities of the garden visit in promotional materials.

Urban public gardens provide urban residents with an exposure to nature in an environment where such exposures are rare. Administrators of public gardens must recognize the strong affects, or emotions, they produce in urban visitors and enhance the restorative experience for all their constituents.

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Release Rates of Soluble and Controlled-release Potassium Fertilizers

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Additional index words. leaching

Summary. Release rates for 13 commercially available soluble and controlled-release K fertilizers were determined in sand columns at 21°C. Potassium chloride, KMgSO_4 , and K_2CO_3 were leached completely from the columns within 3 or 4 weeks. Osmocote 0N-0P-38.3K, Multicote 9N-0P-26.7K, the two S-coated K_2SO_4 products, and Nutricote 2N-0P-30.8K Ty 180 all had similar release curves, with fairly rapid release during the first 20 to 24 weeks, slower release for the next 10 to 12 weeks, and virtually no K release thereafter.

Potassium release from Osmocotes 0N-0P-36.7K and 0N-0P-37.5K and Polyon K_2SO_4 occurred very slowly over a 2 to 3 years.

High cation-exchange capacities of most soils prevent leaching losses of soluble nutrient cations such as K^+ or Mg^{++} , but do not retard leaching of anions such as NO_3^- (Tisdale and Nelson, 1975). Controlled-release fertilizers were developed to reduce the rate of NO_3^- leaching loss (Maynard and Lorenz, 1979; Sharma, 1979). Although coated N-P-K fertilizers are used widely in container production of ornamentals, their use in landscapes or field nurseries has been limited due to their high cost and the perception that only NO_3^- is leached readily from most soils.

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