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## Urban Densification and Recreational Quality of Public Urban Green Spaces—A Viennese Case Study

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**Abstract:** Public urban green spaces play an important role in urban sustainability. These places should provide high-quality recreation experiences for the urban residents. However, they are often overused. The Wienerberg area in the south of Vienna, Austria, was transformed from a waste disposal site into a natural recreation area. During the past years, intensive settlement densification processes have taken place, resulting in a doubling of the local population living within a few minutes walking distance. An on-site survey among green space visitors ( $N = 231$ ) revealed that the majority of them considered the area to be overcrowded on Sundays/holidays and reported a perceived increase in visitor numbers during the past years. Visitors with more past experience, as well as those who have perceived an increase in visitor numbers during recent years, reported higher crowding perceptions. A significant proportion of them try to avoid these crowds, relying on behavioral coping strategies, such as inter-area displacement. While urban regeneration has provided an attractive recreation area, urban densification around the green space appears to have reduced its recreational quality. Monitoring recreation quality indicators, such as crowding perceptions, seems to be useful for sustainable urban green space management and city planning.

**Keywords:** coping behavior; crowding; past experience; recreational quality; satisfaction; sustainability indicators; urban green space; urban sustainability; Vienna

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## 1. Introduction

Public urban green spaces are seen as an integral part of sustainable city development [1,2]. Green spaces support biodiversity and provide many ecosystem services for urban dwellers. They increase the attractiveness of the urban settlement environment, offer relaxation, restoration, stress reduction, escape from the city and provide sites for social interaction [3–5]. However, these areas are often heavily used and the resulting crowding can degrade the quality of the recreation experience [6,7].

With a growing and increasingly urbanized population, the demand for more public urban green spaces will rise [8]. While sustainable city and green space planning is often concerned with green space provision and access [3,4], measuring the perceived recreation quality of urban green spaces is rarely carried out. However, knowledge of recreation quality indicators, such as crowding perceptions, coping behaviors in response to crowding and visitor satisfaction, provides useful information for sustainable urban green space management in dealing with the social carrying capacity of green spaces [9,10].

### 1.1. Urban Densification and Recreational Quality

Several studies have shown that properties located close to urban green spaces have a higher economic value [11–13], leading property developers to take advantage of these opportunities. Densification processes—for example, in the form of high-rise apartment complexes—occur around these areas, increasing the local population with easy access to them. Seeing that distance is one important predictor in green-space use [14,15], this results in the area being visited by more people. This process leads to higher use loads and adversely affects the social and physical conditions of the green space. Crowding, recreational conflicts, and degraded environments may develop through the heavy use [6]. Green space visitors may no longer be able to find their desired recreational quality and will sometimes try to avoid such undesired conditions by applying coping behaviors such as displacement to other green spaces or even decide to stay at home or indoors.

Previous research has found that there is a connection between the amount of past use experience with a recreational site and the evaluation of social site conditions such as perceived crowding [16–19]. The question of whether long-term visitors to urban green spaces are especially affected by urban densification processes arises: As they are able to compare current with previous use loads [20], they are more likely to perceive a reduction in recreation quality and avoid these conditions. Furthermore, visitors with more past experience have often developed strong emotional ties to the area and may see this permanent increase in visitor numbers as a threat to their space.

Unfortunately, recreational crowding and coping research has rather neglected urban settings, while urban green space research has seldom investigated recreation quality indicators such as crowding perceptions. However, knowledge about the recreation quality perceived by long-time green space visitors is necessary to manage urban green spaces on a sustainable basis, particularly when the urban densification processes taking place in the direct neighborhood of green spaces result in higher use loads.

### 1.2. Crowding Perceptions in Recreational Settings

One important indicator for recreation quality is crowding. Crowding is a negative evaluation of a certain visitor density or number of visitor encounters in a given area [21,22]. Two socio-psychological

paradigms, stimulus overload and the social interference model, are predominantly used to explain the differences in crowding perceptions [23]. The stimulus overload model, derived from urban indoor settings [24], indicates that crowding perceptions are maximized when the stimulation exceeds the preferred level of contacts and individuals have no possibilities to reduce the stimulus overload [25]. Crowding as a form of social interference, prevents recreationists from achieving their personal goals such as finding solitude and silence [24]. Researchers have found visitor density, visitor activity and characteristics, type of visitor encountered, as well as visitor behavior and culture, to be factors influencing crowding [26]. Another factor influencing the perception of crowding is past experience with a recreation area. However, past experience, predominantly measured in terms of the frequency of visits and total years of area use [18,19,27], often explained very little of the variance in visitors' perceptions of social conditions [16,28].

Over the past 30 years, crowding research has made significant contributions to outdoor recreation research and management. However, the vast majority of this research dealt with backcountry settings such as wilderness areas and national parks. Crowding in urban green spaces has rarely been investigated, although most of these settings face high, and often increasing, recreational use pressures [9]. The few urban studies undertaken reported crowding perceptions [19,29]. In particular, green space visitors perceive weekends and Sundays as crowded [6,7].

### *1.3. Use Displacement in Response to Crowding*

Use displacement as a behavioral coping mechanism to reduce stress and maintain the desired recreation quality was originally described as a process of social succession [30] where the early visitors are replaced by succeeding visitors better adapted to changes in the recreation setting. Outdoor recreation researchers [31–37] have focused on use displacement as one potential explanation for the consistently low relationship between visitor satisfaction and concurrent reports of crowding [10,26,32,34]. They found that coping behaviors can successfully lessen the impact of too many people and facilitate visits with a satisfying recreation experience.

So far, researchers have observed spatial, temporal and activity displacement [10,32]: Spatial displacement occurs when green space visitors shift their use to other locations within the same area (intra-spatial) or move away from the originally chosen area to others (inter-spatial). Temporal displacement takes place when visitors change the time of their visits. Research has identified the season, day, and time of day as temporal alternatives [33,35,36]. Activity displacement is defined as visitors changing their primary activity [34].

Unfortunately, the concept of use displacement in response to crowding has rarely been explored in general [36], and for the urban context in particular, despite the high recreation use levels compared to backcountry areas. Arnberger and Brandenburg [16], for example, showed both spatial and temporal displacement caused by crowding for suburban national park visitors. Arnberger and Haider [6] found that about 50% of visitors to a heavily used urban green space stated temporal or spatial use displacement behavior.

Use displacement in response to crowding can have important implications for sustainable city management. Conflicts can arise because users may displace to urban or urban-proximate areas of high ecological value [16]. Inter-area displacement can increase traffic, traffic noise and air pollution,

impact the economic situation of on-site recreational facilities such as restaurants, and lead to more crowded conditions in other green spaces. Visitors who displace within the area shift their activity to previously low-use times and places, reducing opportunities for low-use recreation experiences during these periods [32]. Therefore, crowding perceptions and the resulting coping behaviors may be prominent issues in sustainable urban recreation management.

#### *1.4. Study Goals*

There is limited knowledge about crowding perceptions and the proportion of urban green-space visitors employing coping behaviors, the mechanisms they use, and whether long-time users have perceived a higher degradation of the recreational quality because of higher use loads driven by urban densification nearby the area over the past years. These indicators for the quality of recreational experience are useful for the management of the carrying capacity of public urban green spaces, as well as for urban sustainability.

This exploratory study focuses on a heavily-used urban green space, where intense urban densification has taken place in recent times. The following research questions guided the study:

- (1) How many green space visitors perceive the area as crowded and employ coping behaviors in response to crowding, and what types of behavior do they resort to?
- (2) Are long-time green space visitors specially affected by increased visitor use due to urban densification because they can compare past with current social setting conditions?
- (3) Are there differences in past experience, area satisfaction and the perception of crowding between visitors with and without coping behaviors?

## **2. Study Area**

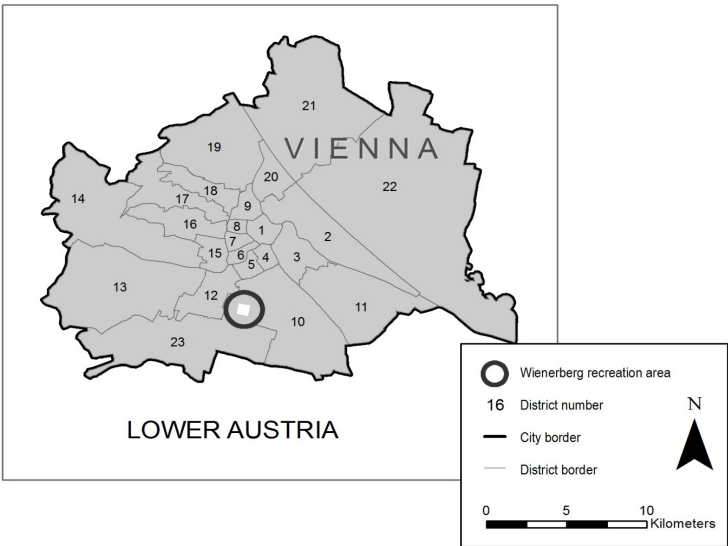
The “Wienerberg” recreation area is situated in the south of Vienna, the capital of Austria, in the 10th district (Figure 1). The municipal forest department manages this 120-hectare hilly site that is divided into two sections by a highway. The partly protected area contains about 14 kilometers of trails and several kilometers of footpaths. The main trail runs within the perimeter of the area and most of the 17 access points connect directly to it. Motorized traffic, except for trucks making deliveries to a local restaurant and the maintenance cars of the forest administration, is not allowed. Access by public transport is easy and several parking lots are provided.

The urban green space was established in the 1980s (Figure 2). In the mid-18th century, the former agricultural area started to be used for clay brick production and it had developed into the largest enterprise of this kind in Europe by the beginning of the 19th century. After production ceased in the 1960s, the area was used as a waste disposal site. In 1967, the city government decided to buy the area and transform it into a recreational setting; this was carried out between 1983 and 1995 [37]. The design principles for the site followed a naturalistic approach as much as possible. Forests, meadows, some agricultural fields and lakes characterize it.

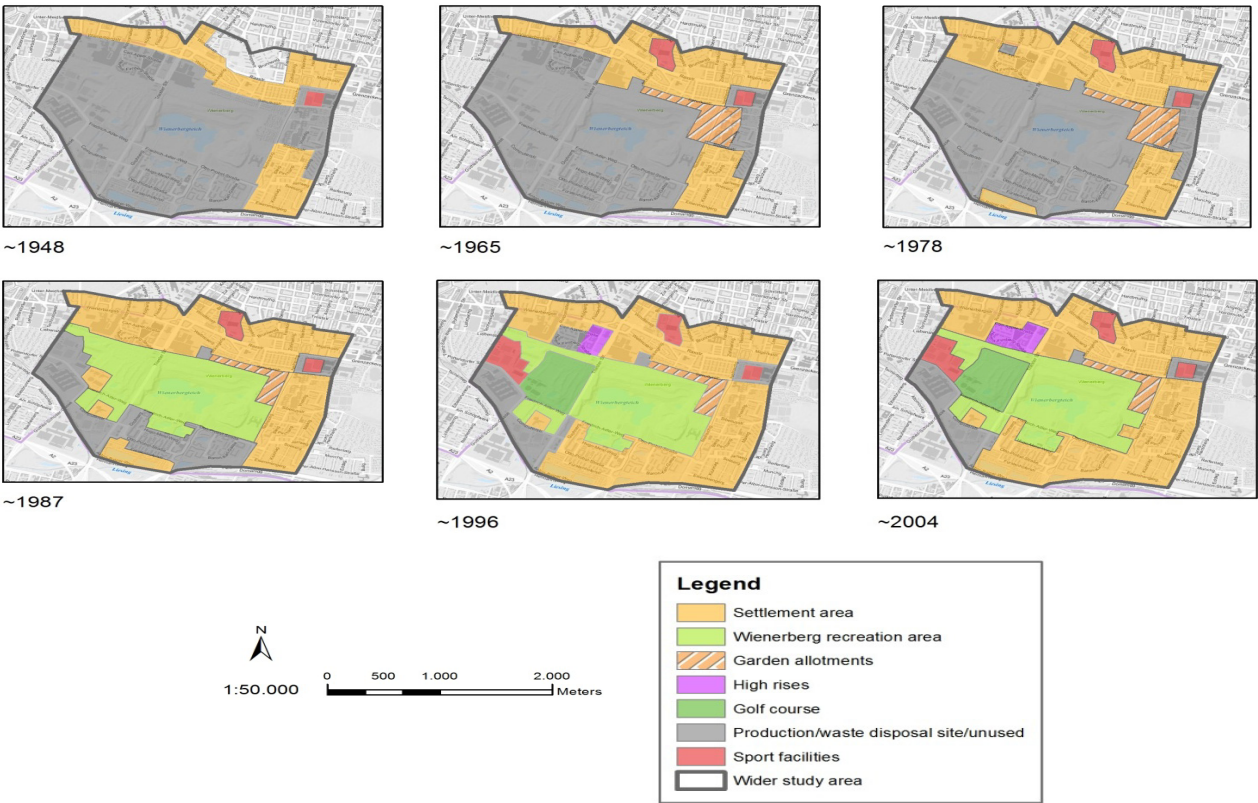
During the past decades, intensive settlement densification processes surrounding the area have taken place, resulting in the local population doubling from 15,000 to 30,000 residents living within a few minutes walking distance. Today, the area is surrounded by residential areas, including several

high-rise apartment complexes, business parks, a hospital and garden allotments. In 2002, 1.24 million visits to the green space were counted with an average of 4,300 visitors per Sunday and 3,000 visitors per workday [38]. In 2004, additional high rises for 3,000 new residents were completed in the direct neighborhood of the recreation area; it can be assumed that its recreational use has further increased as a result of this housing development.

**Figure 1.** Location of the Wienerberg area in Vienna.



**Figure 2.** Urban densification processes around the Wienerberg recreation area (modified from the Mehrzweckkarte Wien MA41–Stadtvermessung).



### 3. Method

#### 3.1. Data Sampling

On-site, face-to-face interviews were carried out on eight days between the spring and autumn of 2006. The sampling was stratified by the day of the week (four randomly selected workdays and four random Sundays). The small sample of days and the short sampling season may be a limitation of this study. The interviews, which were carried out along the main trail, started at 8am and finished at 6pm. This ensured the adequate representation of high- and low-use times per day and per week.

The interviewers, who had been thoroughly instructed in the use of the survey forms, asked visitors if they were willing to participate in a 10–15-minute interview. Once the interview had been completed, the next visitor encountered was asked to participate. If a larger group was approached, one person was randomly selected to answer the questions. Interviewers registered group size, activity type, whether the visitor was accompanied by dogs, and interview time. The following analyses include the response sample of 231 area visitors. About 42% of the questionnaires were answered on workdays. The response rate was 42.3% with higher response rates on workdays. One main reason for refusal was that the user groups of bicyclists and joggers were rather unlikely to stop for an interview. Compared to one-year counting results [38], bicyclists and joggers were therefore underrepresented.

#### 3.2. Measures

##### 3.2.1. Crowding Perceptions

Perception of crowding was surveyed by asking visitors three questions with the same wording and same evaluative scale but referring to different time periods: “How crowded do you perceive the area ...” (1) on workdays; (2) on Sundays/holidays (global measures of perceived crowding); and (3) now (actual measure of perceived crowding), using a seven-point scale ranging from “1 = far too few visitors” to “7 = extremely overcrowded”. The global measures applied in this study aggregate numerous individual crowding situations either over all Sundays/holidays or all workdays of the year. These measures draw more on experience and information than the actual measure. However, it forces respondents to recall several discrete past experiences accurately and to aggregate and average these [6,39]. The actual measure asked respondents to report perceived crowding based on the current social condition encountered and does not force respondents to aggregate and average several past discrete experiences [39]. These bi-polar measures collected information on the perceived negative and positive role of crowds. About 20.8% of workday respondents did not visit the area on Sundays, and 10.4% of Sunday visitors did not visit the area on workdays. They could therefore not answer the respective crowding measure question.

Crowding expectations were surveyed on a five-point scale that ranges from “1 = far fewer visitors than expected” to “5 = far more visitors than expected”. Another item collected information about the perceived changes in visitor numbers over the past years, using a 5-point answer scale (1 = far fewer; 5 = far more area visitors).

### 3.2.2. Coping Behaviors

A screening question identified copers by asking “Have you ever reacted because of too many people in this green space?”, with the answer categories “I have never encountered too many people in this green space” (crowding-tolerant visitors), “Despite having encountered too many people in this green space, I have never reacted” (non-copers) and “I have reacted because of too many people in this green space” (copers). If visitors agreed to the latter, they were provided with a list of nine possible coping behaviors and asked whether they have applied one or more of these. This list contained spatial, temporal, behavioral and activity-related coping mechanisms. The statement: “I was upset because of this crowded forest” was used to assess emotional reactions. Visitors were also asked whether they had applied coping behaviors on the day of their visit and, if so, what kind.

### 3.2.3. Past Experience

Past experience was addressed by asking respondents how often they had visited the area during the past year and their total years of area use.

### 3.2.4. Socio-Demographic Characteristics and Visit-Related Issues

The survey questioned socio-demographic characteristics such as age and education, activities, visiting motives and area access. Satisfaction with the area as a recreational setting and with the current Wienerberg visit were asked using a scale ranging from 1 = very satisfied to 5 = very dissatisfied. Place attachment was measured with two items only: “This recreation area is my favorite one” and “I am very attached to this recreation area” using a 4-point answer scale which ranges from 1 = totally agree to 4 = totally disagree. These two items were taken from a larger list of items presented in [27,28]. These two items may not completely capture the place attachment construct. As both items correlated positively,  $r_p = 0.515$ ,  $p < 0.001$  (Pearson correlation), an additive index was formed. The Cronbach’s alpha value of 0.679 indicated an acceptable reliability of this measure.

## 3.3. Analyses

Stepwise regressions were employed to analyze the influence of past experience and the perception of visitor number increase on the perception of Sunday, workday and actual crowding. ANOVA was used to identify differences between visitors with and without use displacement behavior and crowding-tolerant visitors. Data were analyzed using SPSS. A significance level of  $p < 0.05$  was chosen.

## 4. Results

### 4.1. Sample Characteristics

Similar proportions of males and females were interviewed (Table 1). The average age was 44 years. Most respondents were employed or retired. About 40% of the participants were academics or high school graduates. Close to three fourths of them live in the neighboring 10th district of Vienna. Most arrived on foot and their average travelling time was 12 minutes. The average length of stay was 1.7 hours. Most intercepted visitors were walkers, followed by dog walkers and joggers. Visitors were

rather satisfied with the area ( $M = 1.7$  on the 5-point scale) and their current Wienerberg visit ( $M = 1.6$ ). Agreement on both place attachment items was high.

**Table 1.** Respondents' profile ( $N = 231$ ).

| Items                                                                          | All  |
|--------------------------------------------------------------------------------|------|
| <b>Socio-demographics:</b>                                                     |      |
| Age in years (mean)                                                            | 44.4 |
| Gender (females in %)                                                          | 52.0 |
| Occupation in %:                                                               |      |
| Employees, workers                                                             | 44.6 |
| Pensioners                                                                     | 22.1 |
| Students/pupils                                                                | 12.1 |
| Housewives, housekeepers                                                       | 3.9  |
| Self-sustained                                                                 | 9.1  |
| Unemployed, civil services, others                                             | 7.8  |
| Education in %:                                                                |      |
| No qualification, primary school, apprenticeship                               | 59.2 |
| High school graduation, university                                             | 40.8 |
| Origin in %                                                                    |      |
| Vienna, X district                                                             | 71.4 |
| Vienna, other districts                                                        | 26.4 |
| Outside Vienna                                                                 | 2.2  |
| <b>Visit-related variables</b>                                                 |      |
| Access mode in %                                                               |      |
| On foot                                                                        | 61.6 |
| Car/motor bike                                                                 | 16.8 |
| By bicycle                                                                     | 10.8 |
| Public transport                                                               | 10.8 |
| Travelling time in minutes (mean)                                              | 11.8 |
| Length of stay in hours (mean)                                                 | 1.7  |
| Activity type in %                                                             |      |
| Walkers                                                                        | 55.3 |
| Dog walkers                                                                    | 18.4 |
| Bicyclists                                                                     | 7.5  |
| Joggers                                                                        | 9.6  |
| Nordic walkers                                                                 | 8.3  |
| Swimmers                                                                       | 0.9  |
| <b>Satisfaction</b> (mean; scale: 1 = very satisfied, 5 = very dissatisfied)   |      |
| Area satisfaction                                                              | 1.65 |
| Trip satisfaction                                                              | 1.55 |
| <b>Place attachment</b> (mean; scale: 1 = totally agree, 4 = totally disagree) |      |
| This is my favorite recreation area                                            | 1.70 |
| I am very attached to this recreation area                                     | 1.64 |

#### 4.2. Past Experience

The people surveyed visited the area frequently; on average, more than 120 times per year (Table 2). The average number of years of Wienerberg use was more than 10. About 4% were first time visitors. The years of area use and the frequency of visits in the past year were not correlated,  $r_p = 0.078$ ,  $p > 0.05$ . The most frequent activities carried out in the area were walking and dog walking. While area and trip satisfaction were not related with past experience, frequency of visit ( $r_p = -0.206$ ,  $p < 0.05$ ) and years of area use ( $r_p = -0.295$ ,  $p < 0.01$ ) were positively correlated with place attachment.

**Table 2.** Past area experience.

| Items                                                               | All   |
|---------------------------------------------------------------------|-------|
| Years of Wienerberg area use (mean)                                 | 10.2  |
| First time visitors (in %)                                          | 4.3   |
| Number of visits to the Wienerberg area during the past year (mean) | 122.8 |
| Frequency of activities per year (mean)                             |       |
| Walking/hiking                                                      | 68.7  |
| Dog walking                                                         | 44.2  |
| Jogging                                                             | 16.5  |
| Nordic walking                                                      | 11.1  |
| Bicycling/mountain biking                                           | 9.6   |
| Taking children out                                                 | 6.8   |
| Swimming                                                            | 0.1   |

#### 4.3. Crowding Perceptions

More than half of those questioned (52.5%) had perceived an increase in visitor numbers during the past years, while 46% thought there had been no change (Table 3). Only 1.5% thought that visitor numbers had decreased. The years of area use correlated positively with the perception of increased visitor numbers,  $r_p = 0.182$ ,  $p < 0.05$ . Similarly, the frequency of visits in the past year showed a positive correlation with the perception of increased visitor numbers,  $r_p = 0.185$ ,  $p < 0.01$ . Area and trip satisfaction and place attachment were not related with the perception of visitor number changes.

**Table 3.** Perceptions of crowding.

| Items                                                                   | Mean | Range |
|-------------------------------------------------------------------------|------|-------|
| Perceived changes of visitor numbers during past ten years <sup>a</sup> | 3.60 | 1–5   |
| Perceived global crowding Sundays <sup>b</sup>                          | 4.79 | 3–7   |
| Perceived global crowding workdays <sup>b</sup>                         | 3.92 | 1–5   |
| Perceived actual crowding <sup>b</sup> (all days)                       | 4.04 | 3–7   |
| On Sundays                                                              | 4.05 |       |
| On workdays                                                             | 4.01 |       |
| Crowding expectations <sup>c</sup>                                      | 2.86 | 1–5   |

Answer scales: <sup>a</sup> 1 = far fewer; 5 = far more area visitors; <sup>b</sup> 1 = far too few visitors; 7 = extremely overcrowded;

<sup>c</sup> 1 = far fewer; 5 = far more visitors than expected.

About 51% perceived the Sundays/holidays as crowded (global measure), while 47.3% reported no crowding. The visitors considered Sundays to be more crowded than workdays,  $p < 0.001$ , paired-samples t-test. Most perceived the use level on workdays acceptable, 11% even perceived use levels as too low, and 4.7% reported crowding perceptions. The Sunday crowding measure was also higher than the actual measure ( $p < 0.001$ , paired-samples t-test), while perceived actual crowding was higher than perceived workday crowding,  $p < 0.01$  (paired-samples t-test). Similarly to workdays, most visitors perceived the actual use levels as acceptable (90.6%) and 5.7% reported crowding perceptions. There was no difference between the actual crowding perceptions of Sunday and workday visitors ( $t = -0.921$ ;  $p > 0.05$ , unpaired-samples t-test). The more visitors perceived the Sundays as crowded, the less satisfied they were with the area,  $r_p = 0.234$ ,  $p < 0.001$ , and with their visit,  $r_p = 0.226$ ,  $p < 0.01$ . Crowding expectations and perceived actual crowding were not related,  $r_p = 0.021$ ,  $p > 0.05$ . These correlations could be characterized as small or moderate correlations.

#### 4.4. Predicting Crowding Perceptions

Linear regression found that years of area use, frequency of visits during the past year and the perceived increase in visitor numbers predicted crowding perceptions for Sundays, but not for workdays (Table 4). As suggested, the higher the level of past experience the higher the perception of Sundays as crowded. Perceived increase in visitor numbers was the strongest predictor, followed by the frequency of visits. No multicollinearity in the regressions and marginal autocorrelation were observed.

**Table 4.** Influence of past experience and perception of visitor number increase on perceived crowding (global crowding measures of Sundays and workdays) using linear regression (standardized Beta; t-value in brackets).

| Items                                              | Perceived Sunday crowding <sup>a</sup> | Perceived workday crowding <sup>a</sup> |
|----------------------------------------------------|----------------------------------------|-----------------------------------------|
| Years of area use                                  | * −0.146 (−2.036)                      | −0.111 (−1.486)                         |
| Frequency of visits past year                      | ** 0.217 (3.049)                       | 0.082 (1.103)                           |
| Perceived increase in visitor numbers <sup>b</sup> | *** 0.274 (3.746)                      | 0.024 (0.322)                           |
| N                                                  | 178                                    | 188                                     |
| R <sup>2</sup>                                     | 0.145                                  | 0.019                                   |
| R <sup>2</sup> adj.                                | 0.130                                  | 0.003                                   |
| F-Value                                            | *** 9.839                              | 1.171                                   |

<sup>a</sup> 1 = far too few visitors; 7 = extremely overcrowded; <sup>b</sup> 1 = far fewer; 5 = far more area visitors; \*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ , \*  $p < 0.05$ ; Autocorrelation (Durban-Watson-statistic) = 1.773; Variance inflation factor (VIF): 1.04–1.08.

#### 4.5. Coping Behaviors

Coping behaviors were employed by 53.2% of the respondents (copers) (Table 5). Close to 1% of the respondents expressed emotional reactions because of the crowded situation. An additional 19.5% had never perceived too many people in the area (crowding-tolerant visitors), while 26.4% said this had never caused them to react (non-copers). The coping behaviors employed were temporal and spatial displacement, activity displacement, and changes in dog-walking behavior. About 56% of the copers

changed their routes in the area and some 14% of them mentioned inter-area displacement. Temporal displacement was predominantly reported in the form of a shift of use to low-use periods. About 37% of them shifted their use from the weekend to workdays, and 47% changed their visiting time to avoid heavily used periods such as afternoons. Close to 42% shortened their stay in the area and went home earlier than planned and 11% reduced the frequency of their visits. Twelve per cent of the copers put their dog on the leash in reaction to the crowded situation and 9% employed activity displacement.

Only fifteen persons questioned had employed coping behaviors on the day of their visit. These were people with a very high frequency of visits ( $M = 202$  visits), long-time area users ( $M = 10.3$  years), who perceived the Sundays as rather crowded ( $M = 5.29$ ) and reported slightly higher actual crowding than visitors not employing coping behaviors on the days of the interview. They have also perceived a higher increase in visitor numbers during the past years ( $M = 3.93$ ).

**Table 5.** Respondents' reported coping behaviors in response to crowding (multiple responses regarding coping behaviors;  $N = 220$ ).

| Variables                                                                                            | All   | Copers |
|------------------------------------------------------------------------------------------------------|-------|--------|
| I have never encountered too many people in this green space<br>(crowding-tolerant visitors)         | 19.5% |        |
| Despite having encountered too many people in this green space,<br>I have never reacted (non-copers) | 26.4% |        |
| I have reacted because of too many people in this green space:                                       | 54.1% |        |
| Emotional reactions only                                                                             | 1.7%  |        |
| Coping behaviors (copers):                                                                           | 98.3% |        |
| Intra-area displacement                                                                              |       | 55.6%  |
| Reduced frequency of area visits                                                                     |       | 11.1%  |
| Inter-area displacement (to other green spaces)                                                      |       | 13.7%  |
| Temporal displacement (use shift from weekend use to workday use)                                    |       | 36.8%  |
| Temporal displacement (use shift to less used day times)                                             |       | 47.0%  |
| Activity displacement (other activities carried out; stopped bicycling and walked)                   |       | 9.4%   |
| Dog on the leash                                                                                     |       | 12.0%  |
| Shorter length of stay of area visit                                                                 |       | 41.9%  |

#### 4.6. Differences Between Crowding-Tolerant Visitors, Copers and Non-Copers

In the last step of the analysis, differences in past experience, area satisfaction and perceptions of crowding between crowding-tolerant visitors, copers and non-copers were analyzed (Table 6). Copers reported the highest, and crowding-tolerant visitors the lowest, crowding perceptions of Sundays. Past experience and area satisfaction did not differentiate between the three segments.

**Table 6.** Differences in crowding perceptions and past experience between area visitors with and without coping behaviors.

| Variables                                          | Crowding-tolerant visitors | Non copers | Copers | ANOVA         |
|----------------------------------------------------|----------------------------|------------|--------|---------------|
| <b>Perceived crowding</b>                          |                            |            |        |               |
| Sundays <sup>a</sup>                               | 4.33                       | 4.74       | 5.03   | F = 8.159 *** |
| Workdays <sup>a</sup>                              | 3.93                       | 3.91       | 3.91   | F = 0.017     |
| Actual crowding <sup>a</sup>                       | 4.00                       | 4.03       | 4.00   | F = 0.390     |
| Crowding expectations <sup>b</sup>                 | 2.95                       | 2.76       | 2.88   | F = 1.111     |
| Perceived increase in visitor numbers <sup>c</sup> | 3.47                       | 3.60       | 3.65   | F = 0.864     |
| <b>Past experience</b>                             |                            |            |        |               |
| Years of area use                                  | 8.2                        | 10.3       | 11.2   | F = 1.373     |
| Frequency of visits past year                      | 98.7                       | 125.8      | 138.7  | F = 1.038     |
| <b>Satisfaction</b>                                |                            |            |        |               |
| Area satisfaction (mean) <sup>d</sup>              | 1.55                       | 1.62       | 1.73   | F = 1.009     |
| Trip satisfaction (mean) <sup>d</sup>              | 1.49                       | 1.52       | 1.59   | F = 0.331     |

Answer scales: <sup>a</sup> 1 = far too few visitors, 7 = extremely overcrowded; <sup>b</sup> 1 = far fewer visitors than expected, 5 = far more visitors than expected; <sup>c</sup> 1 = far fewer area visitors, 5 = far more area visitors; <sup>d</sup> 1 = very satisfied, 5 = dissatisfied; \* Differences between crowding-tolerant visitors, copers and non-copers at \*\*\*  $p < 0.001$ .

## 5. Discussion

The study explored crowding perceptions and coping behaviors as a reaction to this in a heavily used urban green space. It further explored whether long-time users have been negatively affected in their recreational experience as a result of the higher use loads driven by urban densification processes in the direct vicinity of the green space in recent years. The study assumed that long-time visitors will report more negative impacts on their recreational quality compared to others because they have a richer cognitive basis for evaluating the recreation setting and can compare past with current social setting conditions.

The study found that more than half of the respondents perceived the Sundays/holidays as crowded and employed coping behaviors. The area's recreational quality seems to have deteriorated on those days, but not on workdays. As assumed, past experience predicted crowding perceptions but only for Sundays' use conditions. The perception of a visitor-number-increase during the past years was a stronger predictor than frequency of visits and years of area use. Thus, visitors with a higher level of past experience, who had used the area frequently over many years, were more likely to perceive an increase in visitor numbers and degradation in their recreation quality.

### 5.1. Crowding Perceptions and Past Experience

Compared to studies carried out in remote settings, this study relied on several crowding measures as indicators for recreational quality. The global measures applied in this study aggregated situations either over all Sundays/holidays or all workdays. They provide information on the general crowding perception of visitors to the area over the course of a year, except for Saturdays, and apply especially to repeat

visitors who are the main users of urban green spaces [6]. A differentiation of the global measure between different seasons including Saturdays may provide additional valuable information, because of the variation in use intensities during the year and week [38]. In this study, workdays were shown to provide acceptable use conditions. Thus, recreation quality appears to be high for the majority of days of the year. For Sundays and holidays concerns about the quality of the recreation experience arise and lead to reduced area satisfaction. For many people, however, work constraints make it difficult to visit the area on weekdays and they are restricted to the heavily-used Sundays when they have to accept a lower quality of recreational experience. Crowding-sensitive visitors may employ coping behaviors such as intra-area displacement to maintain the desired recreation quality. Currently, average use levels on Sundays were about 1.4-times higher than on workdays. A further increase in visitor numbers might bring workday use conditions closer to Sunday conditions measured in 2006. This increase would probably have a negative impact on the perceived recreational quality of most days of the year.

This study found that the perception of current use levels was not considered as having an impact on the quality of recreational experiences, even on Sundays. Previous research has also shown that actual crowding measures are always lower than the global measures, even at high use times [6]. The question arises of whether use displacement behavior, for example, visiting at low-use times or low-use places has reduced actual crowding perceptions. However, this research found that visitors employing coping behaviors on the day of the interview reported slightly higher actual crowding perceptions. On the other hand, the low proportion of visitors employing coping behaviors on the day of the interview seems to indicate that use levels on these days were not extremely high. This could be one explanation for the low actual crowding perceptions. Visitor counts during the year would be helpful in further explaining the low actual crowding measure of Sundays [6].

Past studies in remote, as well as suburban and urban, settings suggested that experienced users have a higher perception of crowding [6,16–19]. The researchers assumed that visitors with more experience were also more sensitive to deteriorating social and environmental site conditions in natural settings because their memory made it possible for them to compare past with current circumstances. Past experience, predominantly measured in terms of the frequency of visits and total years of use, however, often explained little of the variance in visitors' perception of crowding [16,28]. This research confirmed previous findings in as far as past experience predicted crowding perceptions. In addition, this study showed a low variance explanation in crowding perceptions. It also found, however, that the strongest predictor for crowding perceptions was the feeling that visitor numbers had changed over the past years. This variable seems to be an important predictor of crowding perceptions, and might be specifically useful in the context of urban densification processes. Long-time, frequent visitors were more likely to report an increase in visitor numbers. This group seems to be more vulnerable to changes in visitor numbers due to urban densification.

The question arises of whether urban densification has increased crowding perceptions because other studies in urban green spaces found lower proportions of visitors reporting perceptions of crowding [9,19]. Although comparability with these previous studies is limited, the high predictive power of the item measuring perceived change in visitor numbers may hint at the influence of urban densification on crowding perceptions.

### 5.2. Coping Behaviors in Response to Crowding

More than half of the respondents, particularly those who felt crowded, responded by employing coping behaviors such as spatial or temporal use displacement. Despite the differences in recreation use intensities and visitor activities between urban, suburban and backcountry settings, similar results regarding the proportion of copers among recreation area visitors and types of coping behaviors were gained [16,30–36]. Thus, use density may be an incomplete explanation for the proportion of visitors with coping behaviors in response to crowding and types of coping behaviors employed.

Coping behaviors requiring less effort by the area users, such as intra-area, temporal and activity displacement, were more often employed. The importance of these behaviors lies in their ability to provide visitors with satisfying experiences, even though main attractions and locations, peak periods or specific activities in the area are avoided [23]. In this study, coping behaviors seem to successfully lessen the impact of too many people for copers, because copers and non-copers reported similar satisfaction levels. The copers appear to find sufficient low-use opportunities to facilitate visits with a satisfying recreation experience.

However, several of these behaviors seem to have more severe implications for urban sustainability and human well-being. Inter-area displacement represents a rather extreme visitor response [32] and was employed by 14% of the copers. This behavior can increase traffic, traffic noise and air pollution when visitors rely on their car to access other, less used but more distant green spaces and lead to more crowded conditions in these green spaces, if alternatives exist. Inter-area displacement might impact the economic situation of the local restaurant because of fewer area visitors. Inter-area displacement, reduced frequency of visits and going home earlier than planned are frequently used visitor responses, which imply that visitors could not find their desired experiences in that area, even at low-use times. They may even decide to stay at home or indoors. However, research has indicated that reduced exposure to natural areas can result in psychological and physiological deficits to human health [1,40,41]. Consequently, undesired social conditions may negatively influence the physical and mental well-being of urban dwellers as well as their quality of life.

A previous study, carried out in the area in 2002 before the high-rises for 3,000 new residents were completed, resulted in slightly higher proportions of respondents reporting crowding perceptions [6]. The question arises of whether a process of social succession [30] is currently taking place, where more crowd-averse visitors are being replaced by visitors better adapted to the high-use densities on the Sundays and holidays. However, both studies are difficult to compare because of different crowding measures. A population survey [32], or a standardized survey across several green spaces [33], might address the effects of use displacement more accurately because they can better identify the number of users who completely displace from a recreational setting due to undesired social conditions. Therefore, the complete urban, and even suburban, green space network might be integrated into further research when comprehensively exploring the effects of coping mechanisms [36].

## 6. Conclusions

Sustainable development is a strategic framework in city planning, and public urban green space plays an important role in it [1,38]. Urban regeneration means creating sustainable places, including

green spaces. These places should provide high-quality recreation experiences for urban residents. This study investigated two indicators of the recreation quality—crowding perceptions and coping behaviors—in a heavily used urban green space and found that more than half of respondents perceived the Sundays/holidays as crowded and employed coping behaviors. Reduced frequency of area visits, shorter area visits and even the avoidance of the area are a consequence. Several of these behaviors may negatively affect human health and well-being and inter-area displacement may negatively impact the urban environment.

Although urban regeneration created an attractive recreation area by transforming a waste disposal site into a recreation area, urban densification around this green space appears to have reduced its quality because the social carrying capacity of the area seems to be exceeded on Sundays and holidays. While, to a certain degree, urban densification can provide several benefits such as reducing automobile dependence, increasing public transport efficiency, reduced land consumption for settlement, *etc.*, impacts on the character of the neighborhood, including its green spaces and their recreation use intensities, have to be considered [42]. While several urban planning policies see the compact city as a strategy to achieve more sustainable development, the impacts of urban densification on the recreational quality of green spaces, which are often chronically underprovided in cities [3], have to be taken into account. The use levels encountered on Sundays seem to be critical; in particular, for long-time, frequent visitors. This group has also developed emotional ties to the area and may see this permanent increase in visitor numbers as a threat to their territory. Thus, this user group seems to be more vulnerable and may oppose area management. This has implications for green space and urban planning policy and suggests that further densification processes must be carefully implemented through a participatory and debate-centered planning process involving long-time and frequent area users [42].

Crowding and coping is taking place in this setting, and, if sustainable urban green space management aims at offering a recreation experience with the most desirable conditions possible for the most users, it might be beneficial to regularly monitor recreational quality indicators, especially among visitors with a high level of past experience. Monitoring recreational quality indicators seems to be useful for the sustainable management and planning of cities, in particular if larger densification processes around urban green spaces take place. These indicators can indicate whether the carrying capacity of a green space, in terms of visitor density and recreation quality, has been reached or even exceeded. Such indicators are widely applied in protected area and tourism management frameworks such as Limits of Acceptable Change [43] or Visitors Experience and Resource Protection [44]. These frameworks require regular monitoring of recreational quality indicators, and the definition of standards, which indicate how much use can be accommodated in an area and the desired site conditions. Unfortunately, such monitoring efforts on a regular basis are often missing in urban green space management. The proportion of people reporting crowding and employing coping behaviors also hints at the amount of green space needed in urban areas. With an increasingly urbanized and stressed population, the demand for more public urban green spaces providing high recreation qualities will increase [8]. Thus, recreation quality may become an important indicator for urban sustainability and for the quality of life of urban citizens.

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## Conflict of Interest

The author declares no conflict of interest.

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