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How perceived sensory dimensions of urban green spaces are associated with teenagers' perceived restoration, stress, and mental health?

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HIGHLIGHTS

- Perceived sensory dimensions of urban green spaces and teenagers' perceived restoration, stress, and mental health were investigated.
- Nature, refuge, and prospect were positively associated with teenagers' perceived restoration and mental health in general and in stratified analyses.
- Space was negatively associated with teenagers' perceived restoration and mental health in general and in stratified analyses.
- Contrary to the expectation, serene was not significantly associated with teenagers' perceived restoration, stress, and mental health.

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ABSTRACT

Teenagers face unprecedented levels of stress and mental health issues. However, this age group is understudied in terms of which green environments are restorative for them. This study investigates associations between perceived sensory dimensions (PSDs) of urban green spaces (UGSs) and teenagers' perceived restoration, stress, and mental health. Data were collected through surveys with 384 teenagers ages 13–19 in 2018 in eight different UGSs in Aydın, Turkey. Measures included the PSDs (i.e., nature, serene, space, rich in species, social, prospect, culture, and refuge), the Perceived Restorative Components Scale for children (PRCS-C) (i.e., fascination, being away-physical, compatibility, being away-psychological, and extent), and health indicators (i.e., stress and mental health). Multivariate linear regression and stratified analyses were conducted to examine associations and differences between boys and girls controlling for confounding factors. Regression analyses showed that 'nature' was positively associated with teenagers' perceived restorativeness (i.e., fascination, being away-physical, and extent). Whereas, 'refuge' was positively associated with perceived restorativeness (i.e., being away-physical) and negatively associated with teenagers' stress. The results also showed that while 'space' was negatively associated with perceived restorativeness (i.e., fascination), 'prospect' was negatively associated with stress and positively associated with mental health. Stratified analyses revealed that 'nature' was both positively associated with boys' perceived restorativeness (i.e., being away-physical) and girls' perceived restorativeness (i.e., fascination). While 'space' was negatively associated with boys' perceived restorativeness (i.e., fascination), 'prospect' was negatively associated with boys' stress and positively associated with boys' mental health. The findings also showed that 'prospect' and 'refuge' were negatively associated with girls' stress. The findings suggest that providing characteristics of 'nature', 'refuge', and 'prospect' in UGSs may provide restorative effects and mental benefits to teenagers. However, further research is needed before using these characteristics as a tool by landscape architects and city planners.

1. Introduction

Over the last 20 years a substantial increase in mental health issues has been experienced by teenagers in Turkey (Erol, Kılıç, Ulusoy, Keçeci, & Şimşek, 1998; Ercan, et al., 2019). A Turkish study showed that 17.5% of teenagers ages 13–18 scored at or above the cut-off point on the Children Depression Inventory (Eskin, Ertekin, Harlak, & Dereboy, 2008). A recent nationwide study aiming to determine the prevalence of mental health disorders among children and teenagers in Turkey also revealed a high percentage of mental health problems among children

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and teenagers (Ercan, et al., 2019). This study showed that the prevalence of any psychopathology without and with impairment criterion are 37.6% and 17.1%, respectively. On the other hand, teenagers' poor mental health issues are not confined to Turkey. Other developed and developing countries have similar problems. For example, a recent study conducted in Europe showed that mental health disorders among teenagers in European countries range from 2.9% to 22.5% (Ravens-Sieberer & Ottová-Jordan, 2016). Another study conducted in developing countries showed that the prevalence of mental health issues among teenagers in five developing countries range from 5.8% to 15% (Atilola, Balhara, Stevanovic, Avicenna, & Kandemir, 2013). Mental health issues among teenagers is a serious worldwide issue. According to the World Health Organization, 16% of the global burden of disease and injury among teenagers is caused by mental health problems and if not addressed, teenagers' mental health issues extend to adulthood (WHO, 2018).

Governments around the world awareness of an increase in the mental health status of teenagers has led to the promotion a variety of different services to combat the problem (Department of Health, 2004; T.C. Sağlık Bakanlığı, 2011; European Commission, 2015). While providing appropriate services for teenagers to combat mental health problems are clearly critical, focusing on preventative measures is also important. For instance, the European Union (EU) has initiated Nature-Based Solutions (NBSs). With NBSs, the EU aims to be a leading actor in innovating cities with nature and will improve the environment, make cities more attractive, and enhance human well-being (European Commission, 2015). Public health researchers also use socio-ecological model to understand the impacts of environment on human health and behavior (Sallis, et al., 2006; Sallis, Owen, & Fisher, 2008). In this context, the restorative effects of green spaces on human health have been investigated as a mechanism to increase the public's mental well-being and quality of life (Berman, Jonides, & Kaplan, 2008; Roe & Aspinall, 2011; Wells & Rollings, 2012).

Two primary theories argue for the positive effects of contact with nature on human mental health as being "restorative:" The Attention Restoration Theory (i.e., ART) (Kaplan & Kaplan, 1989) and the Psycho-evolutionary Theory (i.e., PET) (also known as Stress Reduction Theory) (Ulrich, 1983). A place that promotes restoration is considered a restorative environment (Hartig, 2004). The ART theorizes that nature has restoration potential on individuals' directed attention capabilities; PET theorizes that natural environments have a stress-reducing and calming effect on people, which results the rapid short-term recovery from stress. Researchers have generally used these two main theories to understand and explore the restorative environment and its potential effects on human mental health. An increasing number of studies based on the ART and the PET show that green spaces have potential restorative settings that promote human mental fatigue restoration (Felsten, 2009; Berto, 2014), attention restoration (Lu & Fu, 2019), and psychological restoration (Gulwadi, Mishchenko, Hallowell, Alves, & Kennedy, 2019; van den Bogerd et al., 2020). In addition, ART studies show perceived restorativeness as an environmental condition contributing to people's better mental health and psychological restoration experiences (Berto, 2014; Malekinezhad, Courtney, Lamit, & Vigani, 2020). Perceived restorativeness involves the perception of characteristics of fascination, being away, extent, and compatibility (Hartig, Kaiser, & Bowler, 1997; Hartig, Mitchell, de Vries, & Frumkin, 2014), which are the restorative factors of the ART. To assess the degree of perceived restorativeness of an environment various self-report measures have been developed which include the Perceived Restorativeness Scale (Hartig et al., 1997), the Restorative Components Scale (Laumann, Garling, & Stormark, 2001), the Short-Term Revised Restoration Scale (Han, 2003), the Perceived Restorative Characteristics Questionnaire (Pals, Steg, Siero, & van der Zee, 2009), and the Restorative State Scale (van den Berg, Jorgensen, & Wilson, 2014). In addition, the Perceived Restorative Components Scale for children (PRCS-C) was specifically developed for children to assess the perceive restorativeness of children (Bagot, 2004).

Considering the ART and the PET, a growing number of increasingly focused studies suggest that exposure to green spaces provides restorative and health benefits, improves emotions and positive moods, and lessens physiological and psychological stress of children and teenagers (Collado & Corraliza, 2012; Markevych, et al., 2014; Akpinar, 2016a; Li, Deal, Zhou, Slavenas, & Sullivan, 2018). Children who live in neighborhoods with more greenery had fewer emotional problems than those children who live in less green neighborhoods (Flouri, Midouhas, & Joshi, 2014). Similarly, a study in the UK found that teenagers who spent time in natural green environments showed greater restoration of stress and mental fatigue comparing those teenagers who spent time in indoor environments (Greenwood & Gatersleben, 2016). Studies also reveal that access to green spaces around homes or neighborhoods reduces children and teenagers' rate of depression (Maas, et al., 2009; Bezold, et al., 2018), helps them cope with stress (Wells & Evans, 2003; Mennis, Mason, & Ambrus, 2018), improves their general health and cognitive development (McCormick, 2017; Tillmann, Tobin, Avison, & Gilliland, 2018). In addition, green spaces promote attention restoration, memory, competence, self-discipline and improve behaviors of children and teenagers (McCormick, 2017). Green playgrounds and school campuses were also found to be more restorative (i.e., reduced stress and increased attention) than playgrounds without green (Bagot, Louise Allen, & Toukhsati, 2015; Akpinar, 2016a). Furthermore, exposure to green spaces can provide physiological health benefits to children and adolescents. Students who spent more time in green spaces had significantly lower levels of skin conductance, heart rate variability, and blood pressure (Kelz, Evans, & Röderer, 2015; Li & Sullivan, 2016).

Studies indicate that girls in general report higher stress levels and mental health issues than boys (Akpinar, 2016a; Van Droogenbroeck, Spruyt, & Keppens, 2018). Studies have shown that associations between greenspace exposure and teenagers' perceived restoration and health differs between boys and girls (Bagot et al., 2015; Akpinar, 2016a). On one hand, Akpinar (2016a) investigated the associations between perceived restorativeness of high school greenness and students' perceived restoration and health. Boys reported better perceived restorativeness (i.e., being away, fascination, and compatibility) and less stress compared to girls. Similarly, Bagot et al. (2015) investigated the predictors of perceived restorativeness of children's school playgrounds and found that boys were significant predictors of perceived restorativeness compared to girls. On the other hand, the associations between greenspace exposure and perceived restoration and stress did not differ between boys and girls (Mennis, Mason, & Ambrus, 2018). The effects of green spaces on teenagers' perceived restoration and mental health as related to the sexes needs further investigation.

Although significant positive relationships between green spaces and adolescents' restoration and mental health were reported, some longitudinal studies found negative or non-significant associations between them. For instance, Weeland, et al. (2019) investigated whether greenness is a protective and/or a promotive factor for respiratory sinus arrhythmia recovery after stress. Contrary to expectations, the authors found that adolescents who grew up in greener neighborhoods reported more stressful life events compared to those who grew up in less green neighborhoods. In another longitudinal study, Gubbels, et al. (2016) investigated whether changes in greenery impact adolescents' physical activities and mental health. Overall, the authors found non-significant associations. These contradictory findings indicate that not all green spaces have the same impact on adolescents' restoration and mental health. Some green spaces may be more attractive or motivating than others for adolescents' green space visits as well as their perceived restoration and mental health (Wang, et al., 2018). Therefore, the type or quality of green spaces needed for adolescents' restoration is not yet exactly known (Harper, 2017). In this respect, researchers began investigating the quality (Akpinar, 2016b), type (Akpinar, Barbosa-Leiker, & Brooks, 2016), and characteristics of green spaces (Grahn & Stigsdotter, 2010; Peschardt & Stigsdotter, 2013; Zhao, Xu, & Ye, 2018).

Researchers have develpoed a tool which is called the Perceived Sensory Dimensions (PSDs) to assess landscape quality and characteristics for public health. The PSDs consist of eight characteristics namely 'nature', 'serene', 'space', 'rich in species', 'social', 'prospect', 'culture', and 'refuge'. Using these eight characteristics, researchers investigated how these landscape characteristics are associated with people's restoration and health. For instance, Lottrup, Grahn, & Stigsdotter (2013) found that 'social', 'serene', and 'nature' were significantly associated with users' perceived restorativeness. Whereas, 'serene', 'rich in species', 'refuge', and 'nature' were found to be psychologically restorative dimensions in Stigsdotter, Corazon, Sidenius, Refshauge, and Grahn's (2017) study. People's preferences may also differ. For instance, Grahn & Stigsdotter (2010) found that people's preference of the dimensions from most to least were 'serene', 'space', 'nature', 'rich in species', 'refuge', 'culture', 'prospect', and 'social', respectively. On the other hand, Chen, Qiu, & Gao (2019) found that 'social' was the most common, whilst 'culture' and 'rich in species' were the least common dimensions. These inconsistent findings cause confusion and make it difficult for policy-makers to take decision. Furthermore, researchers recommended that the PSDs need to be investigated further to be used by policy makers and practitioners as tools to promote health in cities (Grahn & Stigsdotter, 2010; Peschardt & Stigsdotter, 2013). Most importantly, to date, as far as the author knows, no studies have investigated how PSDs of green spaces are associated with teenagers' restoration, stress, and mental health.

Despite the benefits of green spaces on teenagers' restoration and mental health, teenagers remain understudied age group (Greenwood & Gatersleben, 2016; Weeland, Laceulle, Nederhof, Overbeek, & Reijneveld, 2019). Gascon, et al. (2015) conducted a review to investigate whether access to green space affects children mental well-being. Only 6 out of 28 studies included adolescent participants. None of these studies investigated the impact of neighborhood green spaces on adolescents' mental health. Having not made the distinction between teenagers and adults, generalizations derived from adults' findings may not be appropriate for teenagers (Weeland, Laceulle, Nederhof, Overbeek, & Reijneveld, 2019). Such generalizations should be questioned even further because most green space studies have been conducted in developed countries (Gardsjord, Tveit, & Hordh, 2014; Kabisch, Qureshi, & Haase, 2015). In this respect, studies from developing countries are needed in order to establish a global framework for the use of green spaces (Chawla, 2015; Kabisch, Qureshi, & Haase, 2015).

The inconsistent findings from previous studies as well as the lack of studies from developing countries necessitate more researches. Hence, the primary aim of this study was to investigate the associations between the PSDs of urban green spaces (UGSs) and teenagers' perceived restorativeness (the Perceived Restorative Components Scale for children (PRCS-C)), stress, and mental health. The secondary aim of this study was to explore the differences between teenagers' sex cohorts. The following questions were explored in this study:

1- What are relationships between the PSDs of UGSs and teenagers' perceived restorativeness?
2- How are the PSDs of UGSs associated with teenagers' stress and mental health?
3- What are the differences among these relationships for teenagers' sex cohorts?

2. Methods

2.1. Study sites, PSDs evaluation, and participants

Data collected in Aydın, Turkey (Fig. 1) identified 33 potential UGSs throughout the city. From these initially identified UGSs, eight different UGSs (i.e., recreational areas, neighborhood parks, an urban park, and a greenway) were chosen. The UGSs were chosen based on their degree of the presence of the specific PSDs created by Grahn & Stigsdotter (2010) as outlined in Table 1, locations, quality and characteristic features, neighborhoods' socio-economic-status (SES), and potential usage rates.

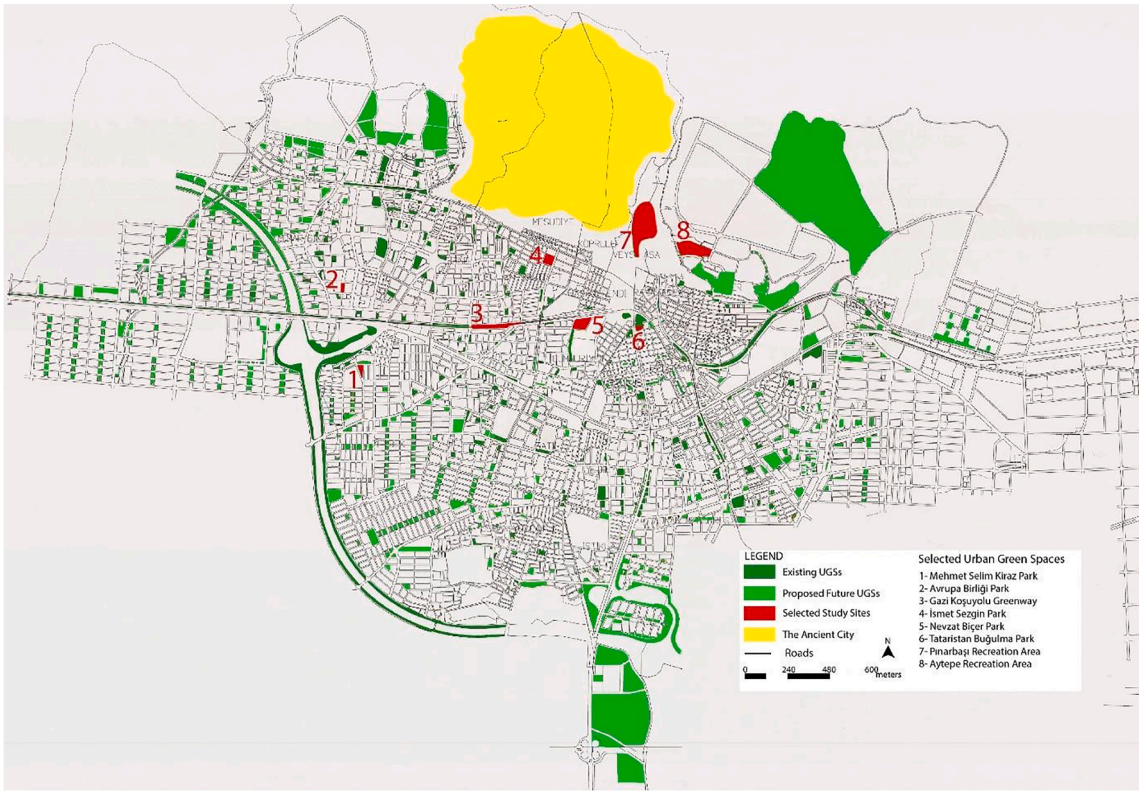


Fig. 1. Study sites within the city limit (Anonymous, 2013).

Table 1
The eight Perceived Sensory Dimensions based on Grahn & Stigsdotter (2010) which was used for evaluating UGSs.

PSDs	Factors	Interpretation in relation to UGSs
Nature	- Nature quality- Wild and untouched- Free growing lawns- Not crowded- Feels safe	It defines a green environment that has the quality of a natural green area, does not contain much structure, and where the grass grows spontaneously. This green environment should make people feel safe.
Culture	- Fountains- Statues- Foreign plants- Flowers	It defines an environment that reflects cultural features such as fountains, monuments, and exotic plants. This green environment can be defined as an environment that contains the characteristics of basic human culture.
Prospect	- Plane, well-cut grass- Prospect- Cut lawns- Football fields on grass	It describes open and visible green areas that are covered with grass, with small football playing venues.
Social	- Entertainment- Restaurant- Paths made of gravel- General good lighting- Access to restrooms- Places sheltered from the wind- Sunny and shady places- Several tables, seats and benches- Plenty of people- Feels safe- Paths with hard surfaces	It describes the environment where restaurants and entertainment venues are located. In this place, the roads are covered with hard floors, there are tables and benches for sitting. Both sunny and shaded areas are present. Lighting is available, it is a place where people can chat and feel safe.
Space	- Spacious- Areas not crossed by paths- Lots of trees- Places sheltered from the wind- Sunny and shady places- Places where people can gather	Its most important feature is connectedness. This area should be a space that is not interrupted by different paths or roads, and is a different world in itself. There should be a lot of trees and both sunny and shady areas where people can gather.
Rich in species	- Natural plant and animalpopulations- Many native plants to study	It defines the environment in which of variety of plants and animals are exist in the green area.
Refuge	- Many bushes- Tables and benches- Watching people being active- Animals that people can feedand pet- Play equipment- Feels safe	It is an environment where playground equipment, tables and benches are available. There should be many bushes in the environment and people should feel safe and can feed and pet animals.
Serene	- Silent and calm- No bikes or mopeds- Not crowded- Clean and well maintained- No traffic noises- Feels safe	It describes a quiet and calm environment. It should be a non-crowded environment where motorcycles or cyclists do not bother people. The green area should be clean, has no traffic noises, and also make people feel safe.

The selected UGSs (Fig. 2) were used as sites in which to study teenagers.

The PSDs of UGSs (i.e., nature, serene, space, rich in species, social, prospect, culture, and refuge), were evaluated and rated by two professional landscape architects on sites. In this evaluation, a qualitative approach was adopted (Peschardt & Stigsdotter, 2013). The rating of each UGS was based on a discussion between the two landscape architects until consensus was reached on the degree of the presence of the specific PSDs according to the factors that were created by Grahn & Stigsdotter (2010) as outlined in Table 1. A seven-point Likert scale (from 0 to 6) was used where zero indicates a site does not meet any criteria of the specific PSDs outlined in Table 1, while a 6 indicates that the site meets all criteria. A high degree of reliability was found between the landscape architects' evaluations. The average measure Intraclass Correlation Coefficient was 0.967 with a 95% confidence interval from 0.946 to 0.980 ($p < .001$). The scores from the analysis of the PSDs in each UGS are presented in Table 2.

Before conducting the study, the ethics approval was obtained from the Research Ethics Committee at Aydın Adnan Menderes University (Protocol Number: 2018/1530). Then, face-to-face personal interviews were conducted with 384 teenagers ages 13–19 between March 1st and May 31st, 2018 on and/or around UGSs. Permission for those teenagers who were under 18 years of age were sought from parents. Consents of those parents who were not with teenagers during the survey were obtained by cell-phones. During the survey, teenagers provided their demographic and SES information such as sex, age, weight, height, monthly family income, education level, perceived restorativeness, stress, and mental health levels.

2.2. Data collection

Survey samples were collected during both weekends and weekdays lasting 2–3 h. The target group was the general population of teenagers in Aydın. First, surveyors observed teenagers who were on and/or around UGSs. Then, the surveyors approached and explained the context of the study to teenagers and invited them to participate in the study. Teenagers who agreed and got permission from parents completed the questionnaire in approximately 6 min. The surveys were written in Turkish and then translated to English for publication. The surveyors administered surveys verbally in Turkish.

The questionnaire consisted of three parts. The first part asked for teenagers' demographic and SES information such as sex, age, weight, height, monthly family income, education level. In the second part, the perceived restorativeness of UGSs was measured with the Perceived Restorative Components Scale for children (PRCS-C) (Bagot, 2004; Bagot et al., 2015). PRCS-C consists of 15 questions which form five proposed factors of a restorative environment: four questions were evaluated for "fascination" (e.g., "There are many things that fascinate me in this green space"), three questions were evaluated for "being away-physical" (e.g., "When I am in this green space, I feel as if I am in a different environment than I am at home / in the classroom"), three questions were evaluated for "compatibility" (e.g., "The things I enjoy doing can be done in this green space"), three questions were evaluated for "being away-psychological" (e.g.," When I am in this green space, I feel free from what my parents / teachers want me to do", and two questions were evaluated for "extent" (e.g., "I can do many different things in one part of this green space"). The teenagers were asked to think about how accurate each statement applied to them and to choose the most appropriate answer for them. The participants evaluated the PRCS-C on a five-point Likert scale with 0 = not at all and 4 = completely (Bagot et al., 2015). A factor analysis was conducted to reduce the PRCS-C questions to five components (i.e., fascination, being away-physical, compatibility, being away-psychological, and extent). The questions for each component were summed and then the mean score was calculated (Akpinar, 2016a). The reliability was good (i.e., Cronbach's Alpha: Fascination: 0.87, Being Away-physical: 0.78, Compatibility: 0.74, Being Away-psychological: 0.81, and Extend: 0.73). Teenagers were also asked to rate their stress and mental health status (Peschardt & Stigsdotter, 2013; Akpinar, 2016a). The question for the stress level was: "How would you evaluate your stress level considering your last two weeks (on a five-point Likert scale, with 1 = none/very low to 5 = very high)". For the mental health status, teenagers were asked "How would you evaluate your mental health status considering your last two weeks (on a five-point Likert scale, with 1 = very bad to 5 = very good)."

2.3. Statistical analysis

First, the normality of the variables was checked with Kolmogorov–Smirnov test. The distributions of responses to PRCS-C (i.e.,

Green Space & Type	Size	Plans (Not to Scale)	Photos from the Sites
Pınarbaşı Mesire Alanı & Recreational Area	25570 m²		
Aytepe Mesire Alanı & Recreational Area	19123 m²		

Fig. 2. Data collection sites in the study areas.

fascination, being away-physical, compatibility, being away-psychological, and extent), stress, and mental health were normal. Prior to performing multivariate linear regression analyses, multicollinearity issues between independent variables were checked. In this analysis, rich in species and social characteristics were excluded from the model due to multicollinearity issues. Then, the associations between PSDs of UGSs (i.e., nature, serene, space, prospect, culture, and refuge) and (i) perceived restorativeness (i.e., fascination, being away-physical, compatibility, being away-psychological, and extent) and (ii) stress and mental health were examined with the multivariate linear regression analyses while controlling for confounding factors. In addition, the differences between boys and girls were explored with stratified analyses. A p-value of 0.05 was used to indicate statistical significance. SPSS version 24 was used for all statistical analyses (IBM

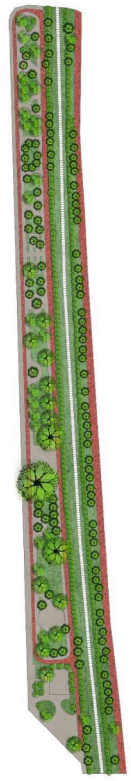
Gazi Koşuyolu Yeşilyolu & Greenway	8541 m²		
Nevzat Biçer Parkı & Urban Park	11910 m²		

Fig. 2. (*continued*).

Corp., 2016).

3. Results

3.1. Descriptive characteristics of teenagers

The data consisted of 384 participants aged between 13 and 19 years (Mage = 15.57 years). The collected responses from the eight UGSs were as follows: Aytepe Mesire Alanı: 42, Avrupa Birliği: 39, Gazi Koşuyolu Yeşilyolu: 67, İsmet Sezgin Parkı: 34, Mehmet Selim Kiraz Parkı: 34, Nevzat Biçer Parkı: 46, Pınarbaşı Mesire Alanı: 52, and Tataristan Buğulma Parkı: 70. As seen in the Table 2, highest age and sex groups of participants were 13–15 years old and boys, respectively. According to the Turkish Statistical Institute (TUIK) data, 13–15 years old (%40.16)

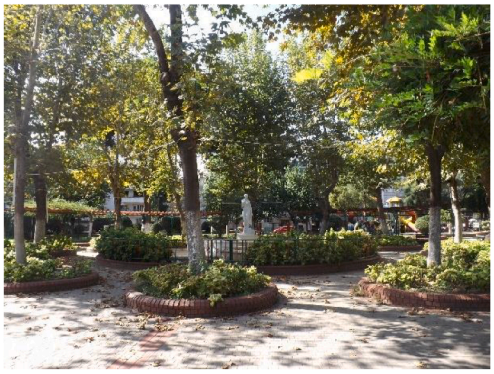
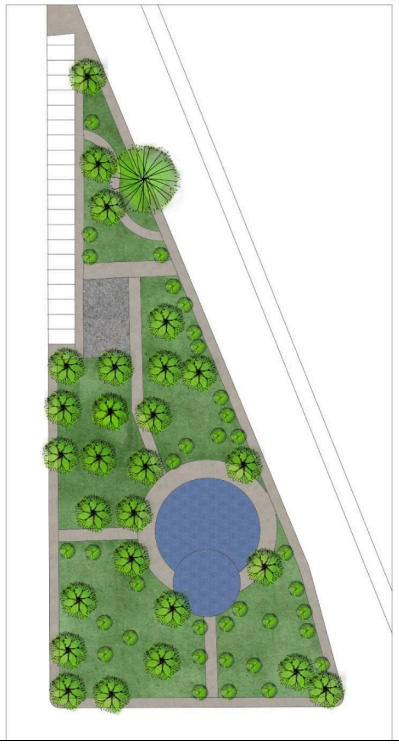
İsmet Sezgin Parkı & Neighborhood Park	9700 m²		
Mehmet Selim Kiraz Parkı & Neighborhood Park	3100 m²		

Fig. 2. (*continued*).

and boys (%51.13) are the highest age and sex groups among teenagers in Aydın, respectively (TUIK, 2020). Body Mass Index (BMI) of participants was ranged from 12.11 to 33.30 ($M_{BMI} = 21.58$). Most participants (77.9%) were high school students. Participants' monthly household income varied from less than 999 Turkish Liras (TL) to more than 6000 TL (Mdn_{income} = 2000 – 2999 TL, which is just over the families' monthly household income in Turkey (TUIK, 2019)). In terms of stress and mental health, 18.8% of self-reported having 'very high stress', while 12.5% self-reported having 'very bad mental health'. These scores were based on the response categories. When comparing boys and girls, it is seen that girls in general reported more stress and mental health problems than boys.

3.2. The associations between perceived sensory dimensions of UGSs and teenagers' perceived restorativeness, stress, and mental health

A series of multivariate linear regression analyses were conducted to investigate the relationships between the PSDs of UGSs and teenagers' perceived restorativeness, stress, and mental health while controlling for covariates (adolescents' sex, age, BMI, and monthly income). As seen in Table 3, regression analyses showed that nature was positively associated with fascination, being away-physical, and extent, whereas refuge was positively associated with being away-physical and negatively associated with stress. While prospect negatively associated with stress and positively associated with mental health, space was negatively associated with fascination. In terms of covariates, boys were positively associated with extent and mental health and negatively associated with

Avrupa Birliği Parkı & Neighborhood Park	2322 m²		
Tataristan Buğulma Parkı & Neighborhood Park	2270 m²		

Fig. 2. (*continued*).

stress, whereas older teenagers were positively associated with extent and stress. In addition, higher income was negatively associated with fascination. No other significant relationships were found.

3.3. Stratified analyses of sex groups

To further examine differences among girls and boys, stratification analyses were also conducted. As seen in Table 4, for boys the findings showed that nature was positively associated with being away-physical, whereas space was negatively associated with fascination. Prospect was also negatively associated with stress and positively associated with mental health. In terms of co-variates, the findings revealed that higher income was negatively associated with fascination and stress, while age was positively associated with stress. No further significant relationships were found.Table 5.

For girls, the findings revealed that nature was positively associated with fascination, whereas refuge and prospect were negatively associated with stress. In terms of covariates, the findings showed that age was positively associated with extent. No other significant relationships were found.

Table 2
Ratings of the PSDs in each UGS, ranging from 0 to 6.

UGSs	Nature	Culture	Prospect	Social	Space	Rich in species	Refuge	Serene
Aytepe Mesire Alanı	4	2	2	3	2	4	3	4
Avrupa Birliği Parkı	0	0	4	1	1	1	1	0
Gazi Koşuyolu Yeşilyolu	2	1	2	1	1	1	3	0
İsmet Sezgin Parkı	1	4	0	2	5	1	4	1
Mehmet Selim Kiraz Parkı	1	1	5	0	2	2	1	2
Nevzat Biçer Parkı	1	5	2	5	2	1	1	1
Pınarbaşı Mesire Alanı	5	2	3	1	3	5	3	5
Tataristan Buğulma Parkı	0	3	0	6	0	0	1	0

Table 3
Descriptive characteristics of the sample (N = 384).

	General	Boys (55.2%)	Girls (44.8%)	
Age	13–15:	49.0%	41.5%	51.8%
	16–17:	41.9%	46.7%	36.1%
	18–19:	9.1%	11.8%	5.8%
Education Level	Primary School:	0.5%	0.5%	0.6%
	Middle School:	21.6%	21.7%	21.5%
	Higher School:	77.9%	77.8%	77.9%
Monthly Income	Less than 999 TL:	3.6%	5.7%	1.2%
	1000–1999 TL:	24.5%	25.9%	22.7%
	2000–2999 TL:	33.6%	29.2%	39.0%
	3000–3999 TL:	20.6%	18.4%	23.3%
	4000–4999 TL:	7.0%	5.7%	8.7%
	5000–5999 TL:	5.5%	7.1%	3.5%
	More than L6000:	5.2%	8.0%	1.7%
BMI Percentile	less than5th (underweight):	6.0%	4.7%	7.6%
	5th to 85th(normal):	75.3%	75.9%	74.4%
	85th to 95th (overweight):	14.1%	15.1%	12.8%
	greater than95th (obese):	4.7%	4.3%	5.2%
Stress	None/very low:	5.2%	7.1%	2.9%
	Low:	16.4%	19.3%	12.8%
	Average:	36.7%	38.2%	34.9%
	High:	22.9%	20.8%	25.6%
	Very High:	18.8%	14.6%	23.8%
Mental Health	Very bad:	12.5%	9.4%	16.3%
	Bad:	16.7%	16.5%	16.9%
	Normal:	34.6%	34.4%	34.9%
	Good:	24.2%	26.4%	21.5%
	Very good:	12.0%	13.2%	10.5%

4. Discussion

The aims of this study were to explore (a) the relationships between PSDs of UGSs and teenagers‘ perceived restorativeness, stress, and mental health and (b) the differences between teenagers‘ sex groups. In regard to first objective, the findings showed that ‘nature’ was positively associated with the components of perceived restorativeness (i.e., fascination, being away-physical, and extent). ‘Refuge’ was positively associated with perceived restorativeness (i.e., being away-physical) and negatively associated with teenagers’ stress. The results also showed that while ‘space’ was negatively associated with perceived restorativeness (i.e., fascination), ‘prospect’ was negatively associated with teenagers’ stress and positively associated with mental health. Regarding the second aim of the study, the findings revealed that ‘nature’ was both positively associated with boys’ perceived restorativeness (i.e., being away-physical) and girls’ perceived restorativeness (i.e., fascination). While ‘space’ was negatively associated with boys’ perceived restorativeness (i.e., fascination), ‘prospect’ was negatively associated with boys’ stress and positively associated with boys’ mental health. The findings also showed that ‘prospect’ and ‘refuge’ were negatively associated with girls’ stress. Some expected and unexpected results were found. The possible explanations were discussed below.

The first PSDs component that is similar to the previous studies examining adults is ‘nature’ (Peschardt & Stigsdotter, 2013; Memari, Pazhouhanfar, & Nourtaghani, 2017). The finding of this study is compatible with PET that the characteristic feature of ‘naturalness’ creates a positive restoration effect on teenagers. According to PET, people are biologically compatible with safe natural environments with water, trees, plants, and shades of green (Ulrich, 1983, 1984). For this reason, when people enter a natural green environment, the human body unintentionally feels relief by establishing a perceptual connection with this environment, which enables people to reduce stress and restore themselves spiritually (Ulrich, 1983, 1984). Kaplan (1995) explains how naturalness provides restoration in this way as a green environment that reflects nature and gives a sense of natural environment, provides relief to mentally tired people through cognitive restoration and that nature is effective on cognitive restoration. Pálsdóttir, Persson, Persson, and Grahn (2014) suggest that the restoration effect of nature on people is rich in detail, and that nature can positively affect restoration, as it is experienced as inspiring to discover nature and find new things. Pálsdóttir et al. (2014) stated that the natural green environment, which does not make any demands for human attention, gives people the freedom to do nothing, and offers perceived restoration opportunities because it helps to stay away from the harsh daily environments in the context of urban life by offering mental restoration. In addition, due to the nature characteristics, it is considered likely to provide perceived restoration since it is likely to have four ART components (Chang, Hammitt, Chen, Machnik, & Su, 2008). Kaplan (1995) also explains that in natural green environment extent comes easily, because it is rich enough and coherent enough to create a whole other world that engages people’s mind. For instance, a recent study conducted by Birch, Rishbeth, and Payne (2020) investigating how urban nature supports young people aged 17–27 showed that nature provides a sense of self and escape to young people and lets them ‘being themselves,’ helps them not to worry about what other people think about them, and provides escape from loneliness and social media. It seems that like adults, teenagers are also positively affected by ‘nature’. Therefore, considering the finding of this study, ‘nature’ seems to be one of the important characteristics of PSDs in UGSs for teenagers. For this reason, the design of UGSs with the characteristic of ‘nature’ may be essential for the teenagers in cities to relax and get away from the stress of the city environment and mental fatigue. However, it is important to note that given the low R^2 value in the regression model further research is needed to draw a strong conclusion.

Another PSDs‘ component that showed similar significant results to previous studies is ‘refuge.’ ‘Refuge’ is a dimension that includes the opportunities or possibilities of being in a small, safe place where people can be alone, intertwined with vegetation, and have the opportunity to use all the senses (Grahn & Stigsdotter, 2010). Lückmann, Lagemann, and Menzel (2013) investigated the landscape preferences of teenagers aged 14 to 17. In that study, teenagers described the ‘refuge’ characteristic as a place where trees and plants surround the area and a person can be alone in it (Lückmann et al., 2013). Teenagers in that study described the important landscape characteristics for a green environment to be perceived as a supportive, safe, and sheltered location that

Table 4
The relationships between the PSDs of UGSs and teenagers' perceived restorativeness, stress, and mental health.

	Fascination		Being Away Physical		Compatibility		Being Away Psychological		Extent		Stress		Mental Health	
	b	95% CI	*b*	95% CI	*b*	95% CI	*b*	95% CI	*b*	95% CI	*b*	95% CI	*b*	95% CI
Sex (boys)	−0.12	−0.32 to 0.08	−0.18	−0.38 to 0.01	0.01	−0.17 to 0.22	0.06	−0.15 to 0.27	**0.34****	**0.13 to 0.56**	**−0.45*****	**−0.66 to −0.23**	**0.29***	**0.05 to 0.53**
Age	0.05	−0.02 to 0.11	0.02	−0.05 to 0.08	0.02	−0.02 to 0.10	0.04	−0.03 to 0.11	**0.09***	**0.02 to.16**	**0.13*****	**0.06 to 0.20**	−0.07	−0.15 to 0.01
BMI Percentile	−0.01	−0.17 to 0.16	−0.08	−0.24 to 0.08	−0.10	−0.07 to 0.01	−0.05	−0.23 to 0.13	0.15	−0.03 to 0.33	0.06	−0.12 to 0.24	−0.05	−0.25 to 0.15
Income	**−0.08***	**−0.15 to −0.01**	0.06	−0.01 to 0.13	0.03	−0.04 to 0.09	0.05	−0.03 to 0.12	0.04	−0.04 to 0.11	−0.07	−0.14 to 0.01	0.01	−0.07 to 0.09
Nature	**0.09***	**0.00 to 0.18**	**0.10***	**0.01 to 0.19**	0.05	−0.12 to 0.20	0.09	−0.01 to 0.19	**0.10***	**−0.01 to 0.19**	0.03	−0.07 to 0.13	−0.05	−0.15 to 0.06
Refuge	0.04	−0.08 to 0.16	**0.12***	**0.00 to 0.23**	0.01	−0.24 to 0.23	0.01	−0.11 to 0.14	0.05	−0.08 to 0.18	**−0.14***	**−0.26 to −0.01**	0.11	−0.03 to 0.25
Culture	0.08	−0.01 to 0.17	0.09	0.00 to 0.18	0.02	−0.40 to 0.15	0.07	−0.03 to 0.17	0.07	−0.03 to 0.17	0.01	−0.09 to 0.10	0.03	−0.08 to 0.14
Prospect	0.01	−0.11 to 0.13	−0.02	−0.14 to 0.10	0.01	−0.04 to 0.27	−0.10	−0.23 to 0.03	0.02	−0.12 to 0.15	**−0.25*****	**−0.38 to −0.12**	**0.16***	**0.01 to 0.30**
Space	**−0.12***	**−0.22 to −0.01**	−0.10	−0.21 to 0.01	−0.04	−0.11 to 0.06	−0.03	−0.14 to 0.09	−0.05	−0.17 to 0.07	0.03	−0.09 to 0.15	−0.12	−0.25 to 0.01
Serene	−0.06	−0.27 to 0.15	−0.16	−0.36 to 0.04	−0.09	−0.22 to 0.17	−0.06	−0.28 to 0.16	−0.15	−0.38 to 0.07	0.17	−0.05 to 0.40	−0.06	−0.31 to 0.18
R^2	**0.04***		**0.06****		0.02		**0.05***		**0.07****		**0.14*****		**0.06***	

Note: * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$. *b*: Unstandardized Coefficients, CI = Confidence Interval. Girls are the reference group. Bold indicates the relationship is significant.

Table 5
The relationships between the PSDs of UGSs and teenagers' perceived restorativeness, stress, and mental health, stratified by sex.

	Fascination		Being Away Physical		Compatibility		Being Away Psychological		Extent		Stress		Mental Health	
	b	95% CI	*b*	95% CI	*b*	95% CI	*b*	95% CI	*b*	95% CI	*b*	95% CI	*b*	95% CI
Boys														
Age	0.01	−0.08 to 0.08	0.01	−0.07 to 0.10	−0.01	−0.10 to 0.08	0.02	−0.07 to 0.12	0.05	−0.04 to.14	**0.18*****	**0.08 to 0.27**	−0.05	−0.15 to 0.05
BMI Percentile	−0.13	−0.36 to 0.10	−0.10	−0.33 to 0.13	−0.01	−0.25 to 0.24	−0.09	−0.35 to 0.17	0.21	−0.04 to 0.46	−0.04	−0.30 to 0.21	0.12	−0.16 to 0.39
Income	**−0.12****	**−0.20 to −0.05**	0.06	−0.02 to 0.14	0.06	−0.02 to 0.15	0.03	−0.06 to 0.12	0.04	−0.05 to 0.12	**−0.13****	**−0.21 to −0.04**	0.06	−0.03 to 0.16
Nature	0.05	0.06 to 0.17	**0.14***	**0.03 to 0.26**	0.02	−0.10 to 0.14	0.07	−0.06 to 0.20	0.09	−0.03 to 0.22	0.01	−0.12 to 0.14	−0.02	−0.16 to 0.12
Refuge	0.12	−0.04 to 0.27	0.11	0.05 to 0.26	0.08	−0.08 to 0.25	0.02	−0.15 to 0.20	0.10	−0.07 to 0.26	−0.03	−0.20 to 0.15	0.12	−0.07 to 0.30
Culture	0.05	−0.08 to 0.17	0.09	−0.04 to 0.21	−0.02	−0.15 to 0.11	0.01	−0.12 to 0.15	0.02	−0.11 to 0.15	0.03	−0.10 to 0.17	−0.00	−0.15 to 0.14
Prospect	−0.06	−0.22 to 0.10	−0.02	−0.18 to 0.14	−0.02	−0.19 to 0.15	−0.11	−0.29 to 0.07	0.01	−0.17 to 0.18	**−0.28****	**−0.46 to −0.10**	**0.24***	**0.05 to 0.43**
Space	**−0.18***	**−0.32 to −0.04**	−0.06	−0.20 to 0.08	−0.02	−0.17 to 0.14	0.02	−0.14 to 0.18	−0.03	−0.19 to 0.12	0.00	−0.16 to 0.16	−0.06	−0.23 to 0.11
Serene	−0.03	−0.30 to 0.25	−0.24	−0.52 to 0.03	−0.10	−0.39 to 0.19	−0.10	−0.41 to 0.21	−0.29	0.59 to 0.01	0.18	−0.12 to 0.48	−0.18	−0.51 to 0.15
R^2	**0.09***		**0.08***				0.05		0.07		**0.17*****			
					0.03								0.07	
Girls														
Age	0.09	−0.01 to 0.20	0.02	−0.08 to 0.13	0.07	−0.02 to 0.16	0.05	−0.06 to 0.16	**0.14***	**0.02 to.26**	0.06	0.05 to 0.17	−0.10	−0.23 to 0.03
BMI Percentile	0.09	−0.16 to 0.33	−0.05	−0.28 to 0.19	−0.19	−0.39 to 0.02	−0.01	−0.26 to 0.25	0.08	−0.19 to 0.35	0.19	−0.06 to 0.45	−0.19	−0.49 to 0.10
Income	0.03	−0.10 to 0.16	0.05	−0.07 to 0.18	−0.04	−0.15 to 0.07	0.08	−0.05 to 0.22	0.04	−0.10 to 0.19	0.07	−0.07 to 0.20	−0.11	−0.27 to 0.05
Nature	**0.14***	**0.00 to 0.28**	0.04	0.10 to 0.17	0.10	−0.02 to 0.22	0.11	−0.03 to 0.26	0.11	−0.05 to 0.26	0.05	−0.10 to 0.20	−0.08	−0.25 to 0.09
Refuge	−0.06	−0.24 to 0.12	0.12	−0.05 to 0.30	−0.06	−0.22 to 0.09	−0.01	−0.19 to 0.18	0.02	−0.18 to 0.22	**−0.31*****	**−0.50 to −0.12**	0.13	−0.08 to 0.35
Culture	0.12	−0.02 to 0.25	0.09	0.05 to 0.22	0.07	−0.05 to 0.18	0.13	−0.01 to 0.27	0.12	−0.03 to 0.27	−0.03	−0.17 to 0.12	0.07	−0.09 to 0.23
Prospect	0.09	−0.09 to 0.28	−0.03	−0.22 to 0.15	0.07	−0.09 to 0.23	−0.11	−0.30 to 0.09	0.06	−0.15 to 0.26	**−0.23***	**−0.43 to −0.04**	0.06	0.17 to 0.28
Space	−0.03	−0.20 to 0.13	−0.16	−0.32 to 0.01	−0.09	−0.23 to 0.06	−0.08	−0.26 to 0.09	−0.08	−0.28 to 0.11	0.07	−0.10 to 0.25	−0.20	−0.40 to 0.00
Serene	−0.13	−0.44 to 0.18	−0.04	−0.35 to 0.26	−0.11	−0.38 to 0.16	−0.01	−0.33 to 0.31	−0.05	−0.39 to 0.30	0.19	−0.14 to 0.51	0.08	−0.29 to 0.46
R^2	0.06		0.05				0.07		0.05		**0.12***			
					0.07								0.08	

Note: * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$. *b*: Unstandardized Coefficients, CI= Confidence Interval. Bold indicates the relationship is significant.

addressed their emotions or life situation and let them rest and be alone in the nature (Lückmann et al., 2013). In times of sadness and stress, people often seek a quiet, safe, secluded, and if possible, hilly place that overlooks its surroundings, which is compatible with 'refuge' (Lückmann et al., 2013; Pálsdóttir et al., 2014). In addition, the 'refuge' characteristic is one of the qualities explaining the landscape preference. As Prospect-Refuge Theory explains, places with certain landscape characteristics (such as 'refuge') in which people's preferences are reflected make people feel better since human survival was depended on the ability to hide, in other words, seek refuge (Appleton, 1996). Therefore, as previous studies stated, teenagers like adults seek refuge in green environments for perceived restoration and reduced stress (Lückmann et al., 2013; Birch, Rishbeth, & Payne, 2020). As this study supports previous findings, 'refuge' seems to be an important component of the PSDs for teenagers' perceived restoration and reducing their stress. Hence, the finding suggests that UGSs could be designed with the 'refuge' characteristic in cities. However, further research is needed before any strong conclusions can be made.

One of the other significant findings of this study was 'prospect', which showed positive relationships with stress reduction and improved mental health of teenagers. The feature of 'prospect' has been mostly described as an open area with a good view (Grahn & Stigsdotter, 2010; Lückmann et al., 2013). One of the important theories of landscape perception used in many studies of landscape perception is Prospect-Refuge Theory (PRT) (Appleton, 1975; Fischer & Shrout, 2006; Mumcu, Düzenli, & Özbilen, 2010). The PRT argues that landscapes with prospect and a panoramic view were preferred by people. Therefore, the PRT suggests that landscapes that allow "seeing without being seen" are preferred by people (Appleton, 1975) and provide restoration (Stigsdotter et al., 2017). Studies also found that teenagers' preferences and restoration could be related to each other (Patuano, 2020). On the other hand, closed dense green environments lead to feelings of insecurity and increases in pulse rate and brain activity (An, Kim, Jeon, & Setsu, 2004). Supporting the theory, studies revealed similar results. For instance, Lückmann et al. (2013) investigated the landscape preferences of teenagers aged 14 to 17. The authors found that when teenagers had landscapes that provide a wide view (i.e., prospect), they provided a positive landscape assessment, which seems to provide restoration. Supporting the notion, Birch, Rishbeth, and Payne (2020) investigated how urban nature supports youths aged 17–27 mental health and well-being. The authors found that open views were helpful landscape features to support young people's mental health and well-being. In addition, open/visible and well-maintained UGSs were also found to be significantly associated with adults' health (Akpinar, 2016b). In line with the previous studies, this study also found that 'prospect' was significantly associated with teenagers' stress and mental health. Considering the findings of this study and previous studies, 'prospect' seems to be another important component of PSDs in teenagers' stress and mental health. Hence, when planning and designing UGSs, 'prospect' could be one of the characteristics of UGSs in cities. However, further research is needed.

Contrary to the expectation (Grahn & Stigsdotter, 2010; Annerstedt, et al., 2012), 'space' was negatively associated with teenagers' perceived restorativeness (i.e., fascination), while previous studies showed positive relationships between 'space' and adults' perceived restorativeness (i.e, compatibility and extent) (Peschardt & Stigsdotter, 2013). 'Space' is defined as a place that has a lot of trees, is not disturbed by too many paths, and allows people to gather (Grahn & Stigsdotter, 2010). One of the reasons for this negative relationship could be about the teenagers' expectation. As Kaplan & Kaplan (2002) argue teenagers prefer places where their personal needs are supported. In Lückmann et al.'s (2013) study, for instance, teenagers prefer places surrounded by plants rather than people. Since 'space' allows people to gather, it is possible that teenagers are negatively affected by gathered people in 'space' especially in the time of their sadness and stress (Lückmann et al., 2013). This possibility needs to be investigated in future studies.

Another unexpected finding was that 'serene' did not show statistically significant result with teenagers' perceived restorativeness, stress, and mental health. This result was unexpected considering the previous studies found positive associations between 'serene' and adults' perceived restorativeness (i.e., fascination, being away, compatibility, and extent) and restoration (Peschardt & Stigsdotter, 2013; Memari, Pazhouhanfar, & Nourtaghani, 2017). One of the possible explanations for this unexpected result could be teenagers' concern for safety. A 'serene' environment is defined as a quiet and calm place in which a person does not get disturbed by people, bikes or traffic (Peschardt & Stigsdotter, 2013). Even though a 'serene' environment should make people feel safe, this safe perception could differ from person to person. Studies, for instance, show that teenagers' safety concerns were associated with their mental health (Meltzer, Vostanis, Goodman, & Ford, 2007). In Lückmann et al.'s study (2013), fears were reported by teenagers (i.e., especially by girls) about green spaces. Similarly, in a recent study, teenagers especially girls and youngers were concerned about the safety issue when visit UGSs (Akpınar, 2020). Therefore, teenagers' safety concerns may have hindered the positive effects of 'serene' on teenagers perceived restoration, stress, and mental health. Considering the limited studies about teenagers, this speculation needs to be investigated in future studies.

Findings of the study also showed some differences in restorative effects between teenagers and adults. For instance, the findings revealed significant associations between 'nature' and teenagers' 'being away physical' and 'extent', while previous studies showed no significant correlation (Peschardt & Stigsdotter, 2013). Similarly, while 'refuge' was significantly associated with teenagers' 'being away physical', previous studies showed no significant associations (Peschardt & Stigsdotter, 2013). Considering the features of 'extent' and 'being away', it seems that teenagers prefer structured elements in natural areas which usually include safeguarding and promoting comfortable movement that support teenagers' desire for adventure (Lückmann et al., 2013). This possibility needs to be investigated in future studies. Another difference between teenagers and adults is 'culture.' While the present study showed no significant correlation between 'culture' and teenagers' perceived restoration, while previous studies showed significant correlations between 'culture' and adults' perceived restoration (i, e., fascination, being away, and extent) (Peschardt & Stigsdotter, 2013). This finding suggests that teenagers may not prefer cultural features in the time of their sadness and stress, hence they may seek or prefer small and safe green places where they can be alone and engage with nature. Given the luck of studies, future studies should investigate this speculation.

Moreover, 'compatibility' and 'being away psychological' of PRCS-C were not significantly associated with any PSDs, which raises the question whether PSDs are fully compatible with teenagers' expectations. The possible explanation for this result may be teenagers' changing behavior towards nature and their expectations. The biophilia hypothesis which is used by researchers in social sciences posits that children innately affiliate to nature; therefore, they are interested in exploring outdoors (Wilson, 1984; Hand et al., 2017). However, studies showed that videophilia (i.e., the attraction to electronic media) replaces biophilia (Larson, Green, & Cordell, 2011; Robison & Ridenour, 2012). A recent review, for instance, showed that adolescents prefer social indoor recreation over natural areas and indoor recreation could provide restoration for them (Patuano, 2020). When considering the 'compatibility' and 'being away psychological' of PRCS-C, they consist of question such us 'Things I want to do or I like to do can be done in this green space' and 'When I am in the green space, I am away from things I must do.' These questions assess if green spaces are compatible with children's preferences and provide psychological restoration. It seems that because of the shift from biophilia to videophilia, teenagers prefer indoor and online activities rather than spending time in green spaces (Akpınar, 2020) and those activities may provide restoration from them (Patuano, 2020). Therefore, these possible explanations need to be investigated in future studies.

Differences between boys and girls with respect to the relationships between the PSDs of UGSs and perceived restorativeness, stress, and mental health were also investigated in a stratified analysis. The findings showed that 'nature' was positively associated with both boys' and girls' perceived restorativeness (i.e. fascination and being away physically, respectively), whereas 'prospect' was negatively associated with both boys' and girls' stress. On the other hand, while 'refuge' was negatively associated with girls' stress, it was not significantly associated with boys' stress. The possible explanation for this difference could be girls' mental health issues. As previous studies showed girls in general report higher stress level and mental health issues than boys (Akpinar, 2016a; Van Droogenbroeck, Spruyt, & Keppens, 2018). Therefore, to reduce stress and sadness girls may seek or prefer small, safe places where they can be alone, engage with nature, and have the opportunity to use all their senses in the surroundings, which is well-matched with the 'refuge' characteristics. That is why 'refuge' may have been negatively associated with girls' stress and positively affected girls stress level. The other difference between boys and girls was that while 'space' was negatively associated with boys' perceived restorativeness (i.e., fascination), it was not significantly associated with girls' perceived restorativeness. The possible explanation for this difference could be boys' expectation. For instance, a recent study showed that boys were concerned about characteristic features and design of UGSs, while girls were not concerned (Akpınar, 2020). Connectedness is the most important feature of 'space' (Grahn & Stigsdotter, 2010.) On the other hand, UGSs in Aydın are unconnected having low quality and inappropriate characteristics' features for teenagers (Kılıçaslan, et al., 2016). Therefore, inappropriate characteristics' features of UGSs may have negatively affected boys' perceived restorativeness. In addition, boys' expectations in times of stress may also be the other reason for the negative relationship between 'space' and boys' perceived restorativeness. As mentioned, teenagers would rather places surrounded by plants than by people when they feel stressed and sad (Lückmann et al., 2013). Since 'space' has large spaces that allow people to gather, it is possible that boys were negatively affected by gathered people in 'space' especially when they feel stressful. Given the lack of studies, in future studies these possible explanations should be investigated.

4.1. Implications, strengths, and limitations of the study

The findings of this study provide practical implications for design guidelines for places that promote teenagers' perceived restoration, stress, and mental health. First of all, this study's findings suggest that UGSs should be designed with structured nature characteristics in which the quality of a natural green area is provided and teenagers feel safe. However, those natural green areas should not contain much structure, and the grass can grow spontaneously. The findings also suggest that landscape prospects should be provided in UGSs. A prospect is an open, visible green area covered with grass and small football playing venues. It seems that plane green areas that has well-cut grass and football fields on grass would helpful for teenagers to reduce their stress and promote their mental health. The findings also suggest that providing refuge characteristics in UGSs should be restorative for teenagers' mental health. Refuge describes environments that are surround by shrubs and playground equipment, tables, and benches. People should be able to watch others and be watched by others. Teenagers should feel safe in that environment and can feed and pet animals. Lastly, the findings of this study suggest that a green space that is large having lots of trees where people can gather seems to negatively affect teenagers' mental health, which does not agree with previous studies. Therefore, further research is needed to draw a strong conclusion.

As strengths, to the author's best knowledge this study is one of the first examinations of the associations between PSDs of UGSs and teenagers' perceived restoration, stress, and mental health. The other strength of this study is that face-to-face personal interviews were conducted with teenagers. On the other hand, this study is not without limitations that need to be addressed in future studies. First, due to the nature of the study, causal relationships cannot be drawn from the cross-sectional results. While teenagers provided the data themselves, social desirability may have influenced their response. The selection of the participants could have also biased the sample. Last, the low R squared values of regression models suggest that there might be other factors that influence teenagers' perceived restoration, stress, and mental health. Hence, future research is needed on this topic to further assess the stability of these relationships across other samples.

5. Conclusion

This study revealed important findings about which characteristics of PSDs could affect teenagers' perceived restoration, stress, and mental health. It concluded that 'nature' could positively affect teenagers' perceived restoration, while 'refuge' could positively affect teenagers' perceived restoration and stress. It also found that 'prospect' could positively affect teenagers' stress and mental health, whereas 'space' could negatively affect their perceived restoration. In terms of sex group, the findings revealed that 'nature' could positively affect both boys' and girls' perceived restoration, whereas 'prospect' could positively affect boys' stress and mental health and girls' stress. It also concluded that while 'refuge' could positively affect girls' stress, 'space' could negatively affect boys' perceived restoration. Contrary to the expectation, 'serene' was not significantly associated with teenagers' perceived restoration, stress, and mental health. This suggests that teenagers' experience in UGSs may differ from adults and they may be affected by PSDs in UGSs differently than adults. Hence, more research is needed to shed light on how PSDs are associated teenagers' perceived restoration, stress, and mental health. Findings also showed that some of the PRCS-C components were not significantly associated with any PSDs. Hence, in future studies researchers should investigate whether PSDs are fully compatible with teenagers' expectations. Findings of this study suggest that more study is needed of teenagers' point of view in regard to perceived restoration, stress, and mental health before landscape architects and city planners use PSDs as tool to design UGSs.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.landurbplan.2021.104185.

References

Akpinar, A. (2016a). How is high school greenness related to students' restoration and health? *Urban Forestry & Urban Greening, 16*, 1–8.

Akpinar, A. (2016b). How is quality of urban green spaces associated with physical activity and health? *Urban Forestry & Urban Greening, 16*, 76–83.

Akpınar, A. (2020). Investigating the barriers preventing adolescents from physical activities in urban green spaces. *Urban Forestry & Urban Greening, 53*, 126724. https://doi.org/10.1016/j.ufug.2020.126724.

Akpinar, A., Barbosa-Leiker, C., & Brooks, K. R. (2016). Does green space matter? Exploring relationships between green space type and health indicators. *Urban Forestry & Urban Greening, 20*, 407–418.

An, K. W., Kim, E. I., Jeon, K. S., & Setsu, T. (2004). Effects of forest stand density on human's physiopsychological changes. *Journal of the Faculty of Agriculture, Kyushu University, 49*, 283–291.
Annerstedt, M., Ostergren, P.-O., Björk, J., Grahn, P., Skärbäck, E., & Währborg, P. (2012). Green qualities in the neighbourhood and mental health – results from a longitudinal cohort study in Southern Sweden. *BMC Public Health, 12*, 337.
Anonymous. (2013). Aydın Büyükşehir Belediyesi Nazım İmar Planı. Aydın: Aydın Büyükşehir Belediyesi.
Appleton, J. (1975). The experience of landscape. New York, NY: John Wiley.
Appleton, J. (1996). Landscape evaluation: The theoretical vacuum. *Transactions of the Institute of British Geographers*, 120–123.
Atilola, O., Balhara, Y. P., Stevanovic, D., Avicenna, M., & Kandemir, H. (2013). Self-reported mental health problems among adolescents in developing countries: Results from an international pilot sample. *Journal of Developmental & Behavioral Pediatric, 34*(2), 129–137.
Bagot, K. L. (2004). Perceived restorative components: A scale for children. *Children, Youth and Environments, 14*(1), 120–140.
Bagot, Kathleen L., Allen, Felicity Catherine Louise, & Toukhsati, Samia (2015). Perceived restorativeness of children's school playground environments: Nature, playground features and play period experiences. *Journal of Environmental Psychology, 41*, 1–9.
Berman, Marc G., Jonides, John, & Kaplan, Stephen (2008). The cognitive benefits of interacting with nature. *Psychological Science, 19*(12), 1207–1212.
Berto, R. (2014). The Role of Nature in Coping with Psycho-Physiological Stress: A Literature Review on Restorativeness. *Behav. Sci., 4*, 394–409.
Bezold, Carla P., Banay, Rachel F., Coull, Brent A., Hart, Jaime E., James, Peter, Kubzansky, Laura D., … Laden, Francine (2018). The Association between natural environments and depressive symptoms in adolescents living in the United States. *Journal of Adolescent Health, 62*(4), 488–495.
Birch, Jo, Rishbeth, Clare, & Payne, Sarah R. (2020). Nature doesn't judge you – How urban nature supports young people's mental health and wellbeing in a diverse UK city. *Health and Place, 62*, 102296. https://doi.org/10.1016/j.healthplace:2020.102296.
Chang, Chun-Yen, Hammitt, William E., Chen, Ping-Kun, Machnik, Lisa, & Su, Wei-Chia (2008). Psychophysiological responses and restorative values of natural environments in Taiwan. *Landscape and Urban Planning, 85*(2), 79–84.
Chawla, Louise (2015). Benefits of nature contact for children. *Journal of Planning Literature, 30*(4), 433–452.
Chen, Hong, Qiu, Ling, & Gao, Tian (2019). Application of the eight perceived sensory dimensions as a tool for urban green space assessment and planning in China. *Urban Forestry & Urban Greening, 40*, 224–235.
Collado, Silvia, & Corraliza, José A. (2012). Perceived restoration and environmental orientation in a sample of Spanish children. *Procedia - Social and Behavioral Sciences, 38*, 264–274.
Department of Health. (2004). National Service Framework for Children, Young People and Maternity Services: The Mental Health and Psychological Wellbeing of Children and Young People. London: HMSO.
Ercan, Eyup Sabri, Polanczyk, Guilherme, Akyol Ardıc, Ulku, Yuce, Deniz, Karacetın, Gul, Tufan, Ali Evren, … Yıldız, Nazike (2019). The prevalence of childhood psychopathology in Turkey: A cross-sectional multicenter nationwide study (EPICPAT-T). *Nordic Journal of Psychiatry, 73*(2), 132–140.
Erol, N., Kılıç, C., Ulusoy, M., Keçeci, M., & Şimşek, Z. (1998). Türkiye ruh sağlığı profili raporu. Ankara: T.C. Sağlık Bakanlığı Temel Sağlık Hizmetleri Genel Müdürlüğü.
Eskin, M., Ertekin, K., Harlak, H., & Dereboy, Ç. (2008). Lise Öğrencisi Ergenlerde Depresyonun Yaygınlığı ve İlişkili Olduğu Etmenler. *Türk Psikiyatri Dergisi, 19*(4), 382–389.
European Commission. (2015). Nature-based solutions & re-naturing cities. Final report of the Horizon 2020 Expert Group on nature-based solutions & re-naturing cities. Luxembourg: Publications Office of the European Union.
Felsten, G. (2009). Where to take a study break on the college campus: An attention restoration theory perspective. *Journal of Environmental Psychology, 29*(1), 160–167.
Fischer, Mary Ann, & Shrout, Patrick E. (2006). Children's liking of landscape paintings as a function of their perceptions of prospect, refuge and hazard. *Environment and Behavior, 38*(3), 373–393.
Flouri, Eirini, Midouhas, Emily, & Joshi, Heather (2014). The role of urban neighbourhood green space in children's emotional and behavioural resilience. *Journal of environmental psychology, 40*, 179–186.
Gardsjord, H. S., Tveit, M. S., & Nordh, H. (2014). Promoting youth's physical activity through park design: Linking theory and practice in a public health perspective. *Landscape Research, 39*(1), 70–81.
Gascon, M., Triguero-Mas, M., Martínez, D., Dadvand, P., Forns, J., Plasència, A., & Nieuwenhuijsen, M. J. (2015). Mental health benefits of long-term exposure to residential green and blue spaces: A systematic review. *International Journal of Environmental Research and Public Health, 12*, 4354–4379. https://doi.org/10.3390/ijerph120404354.
Grahn, Patrik, & Stigsdotter, Ulrika K. (2010). The relation between perceived sensory dimensions of urban green space and stress restoration. *Landscape and Urban Planning, 94*(3-4), 264–275.
Greenwood, Alison, & Gatersleben, Birgitta (2016). Let's go outside! Environmental restoration amongst adolescents and the impact of friends and phones. *Journal of Environmental Psychology, 48*, 131–139.
Gubbels, Jessica S., Kremers, Stef P. J., Droomers, Mariël, Hoefnagels, Cees, Stronks, Karien, Hosman, Clemens, & de Vries, Sjerp (2016). The impact of greenery on physical activity and mental health of adolescent and adult residents of deprived neighborhoods: A longitudinal study. *Health & Place, 40*, 153–160.
Gulwadi, G. B., Mishchenko, E. D., Hallowell, G., Alves, S., & Kennedy, M. (2019). The restorative potential of a university campus: Objective greenness and student perceptions in Turkey and the United States. *Landscape and Urban Planning, 187*, 36–46.
Han, K.-T. (2003). A reliable and valid self-rating measure of the restorative quality of natural environments. *Landscape and Urban Planning, 64*, 209–232.
Hand, K. L., Freeman, C., Seddon, P. J., Recio, M. R., Stein, A., & van Heezik, Y. (2017). The importance of urban gardens in supporting children's biophilia. *Proceedings of the National Academy of Sciences, 114*(2), 274–279.
Harper, Nevin J. (2017). Outdoor risky play and healthy child development in the shadow of the "risk society": A forest and nature school perspective. *Child & Youth Services, 38*(4), 318–334.
Hartig, T. (2004). Restorative environments. In C. Spielberger, Encyclopedia of applied psychology (Vol. 3, pp. 273–279). Oxford: Academia.
IBM Corp. (2016). IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.
Hartig, T., Kaiser, F. G., & Bowler, P. A. (1997). *Further development of a measure of perceived environmental restorativeness*. Gävle: Institute for Housing Research Uppsala Universitet.
Hartig, T., Mitchell, R., de Vries, S., & Frumkin, H. (2014). Nature and Health. *Annual Review of Public Health, 35*, 207–228.
Kabisch, Nadja, Qureshi, Salman, & Haase, Dagmar (2015). Human–environment interactions in urban green spaces — A systematic review of contemporary issues and prospects for future research. *Environmental Impact Assessment Review, 50*, 25–34.
Kaplan, R., & Kaplan, S. (1989). The Experience of nature: A psychological perspective. New York: Cambridge University Press.
Kaplan, R., & Kaplan, S. (2002). Adolescents and the natural environment: A time out? In P. H. Kahn, & S. R. Kellert (Eds.), *Children and nature: Psychological, sociocultural, and evolutionary investigations* (pp. 227–257). Cambridge: MIT Press.
Kaplan, Stephen (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology, 15*(3), 169–182.
Kelz, Christina, Evans, Gary William, & Röderer, Kathrin (2015). The restorative effects of redesigning the schoolyard: A multi-methodological, quasi-experimental study in rural Austrian middle schools. *Environment and Behavior, 47*(2), 119–139.
Kılıçaslan, Ç., Deniz, B., Kara, B., Polat, Z., Göktuğ, T. H., … Kesgin Atak, B. (2016). Mekansal Yeterlilik Kapsamında Aydın Kentsel Alanındaki Parkların Analizi. Proje No: ZRF-11003: Adnan Menderes Üniversitesi Ziraat Fakültesi Peyzaj Mimarlığı Bölümü.
Li, Dongying, & Sullivan, William C. (2016). Impact of views to school landscapes on recovery from stress and mental fatigue. *Landscape and Urban Planning, 148*, 149–158.
Larson, L. R., Green, G., & Cordell, H. (2011). Children's Time Outdoors: Results and Implications of the National Kids Survey. *Journal of Park and Recreation Administration, 29*(2), 1–20.
Laumann, K., Garling, T., & Stormark, K. (2001). Rating scale measures of restorative components of environments. *Journal of Environmental Psychology, 21*, 31–44.
Li, Dongying, Deal, Brian, Zhou, Xiaolu, Slavenas, Marcus, & Sullivan, William C. (2018). Moving beyond the neighborhood: Daily exposure to nature and adolescents' mood. *Landscape and Urban Planning, 173*, 33–43.
Lottrup, Lene, Grahn, Patrik, & Stigsdotter, Ulrika K. (2013). Workplace greenery and perceived level of stress: Benefits of access to a green outdoor environment at the workplace. *Landscape and Urban Planning, 110*, 5–11.
Lu, M., & Fu, J. (2019). Attention Restoration Space on a University Campus: Exploring Restorative Campus Design Based on Environmental Preferences of Students. *International Journal of Environmental Research and Public Health, 16*(14), 2629.
Lückmann, Katrin, Lagemann, Verena, & Menzel, Susanne (2013). Landscape assessment and evaluation of young people: Comparing nature- orientated habitat and engineered habitat preferences. *Environment and Behavior, 45*(1), 86–112.
Maas, J, Verheij, R A, de Vries, S, Spreeuwenberg, P, Schellevis, F G, & Groenewegen, P P (2009). Morbidity is related to a green living environment. *Journal of Epidemiology and Community Health, 63*(12), 967–973.
Malekinezhad, F., Courtney, P. R., Lamit, BinH., & Vigani, M. (2020). Investigating the Mental Health Impacts of University Campus Green Space Through Perceived Sensory Dimensions and the Mediation Effects of Perceived Restorativeness on Restoration Experience. *Frontiers in Public Health, 8*, 874.
Markevych, Iana, Thiering, Elisabeth, Fuertes, Elaine, Sugiri, Dorothea, Berdel, Dietrich, Koletzko, Sibylle, … Heinrich, Joachim (2014). A cross-sectional analysis of the effects of residential greenness on blood pressure in 10-year old children: Results from the GINIplus and LISAplus studies. *BMC Public Health, 14*(1). https://doi.org/10.1186/1471-2458-14-477.
McCormick, Rachel (2017). Does access to green space impact the mental well-being of children: A systematic review. *Journal of Pediatric Nursing, 37*, 3–7.
Meltzer, H., Vostanis, P., Goodman, R., & Ford, T. (2007). Children's perceptions of neighbourhood trustworthiness and safety and their mental health. *Journal of Child Psychology and Psychiatry, 48*(12), 1208–1213.
Memari, Sanaz, Pazhouhanfar, Mahdieh, & Nourtaghani, Abdolmajid (2017). Relationship between perceived sensory dimensions and stress restoration in care settings. *Urban Forestry & Urban Greening, 26*, 104–113.
Mennis, Jeremy, Mason, Michael, & Ambrus, Andreea (2018). Urban greenspace is associated with reduced psychological stress among adolescents: A Geographic Ecological Momentary Assessment (GEMA) analysis of activity space. *Landscape and Urban Planning, 174*, 1–9.
Mumcu, S., Düzenli, T., & Özbilen, A. (2010). Prospect and refuge as the predictors of preferences for seating areas. *Scientific Research and Essays, 5*, 1223–1233.

Pals, R., Steg, L., Siero, F., & van der Zee, K. I. (2009). Development of the PRCQ: A measure of perceived restorative characteristics of zoo attractions. *Journal of Environmental Psychology, 29*, 441–449.
Pálsdóttir, A., Persson, D., Persson, B., & Grahn, P. (2014). The journey of recovery and empowerment embraced by nature – clients' perspectives on nature-based rehabilitation in relation to the role of the natural environment. *International Journal of Environmental Research and Public Health*, 7094–7115.
Patuano, A. (2020). Biophobia and Urban Restorativeness. *Sustainability, 12*, 4312. https://doi.org/10.3390/su12104312.
Peschardt, Karin Kragsig, & Stigsdotter, Ulrika Karlsson (2013). Associations between park characteristics and perceived restorativeness of small public urban green spaces. *Landscape and Urban Planning, 112*, 26–39.
Ravens-Sieberer, U., & Ottová-Jordan, V. (2016). Children's mental health in Europe: The current situation and its implications. In M. Matthes, L. Pulkkinen, B. Heys, C. Clouder, & L. M. Pinto (Eds.), Improving the Quality of Childhood in Europe (pp. 98–111). Brussels, Belgium: Alliance for Childhood European Network Foundation.
Robison, K. K., & Ridenour, D. (2012). Whither the Love of Hunting? Explaining the Decline of a Major Form of Rural Recreation as a Consequence of the Rise of Virtual Entertainment and Urbanism. *Human Dimensions of Wildlife, 17*, 418–436.
Roe, Jenny, & Aspinall, Peter (2011). The restorative outcomes of forest school and conventional school in young people with good and poor behaviour. *Urban Forestry & Urban Greening, 10*(3), 205–212.
Sağlık Bakanlığı, T. C. (2011). T.C. Sağlık Bakanlığı Ulusal Ruh Sağlığı Eylem Planı (National Mental Health Action Plan) (2011-2023). Ankara: T.C. Sağlık Bakanlığı.
Sallis, J. F., Owen, N., & Fisher, E. B. (2008). Ecological models of health behavior. In K. Glanz, B. K. Rimer, & K. Vismanath, Health behavior and health education: Theory, research, and practice (pp. 565-485). San Francisco: Jossey-Bass.
Sallis, James F., Cervero, Robert B., Ascher, William, Henderson, Karla A., Kraft, M. Katherine, & Kerr, Jacqueline (2006). An ecological approach to creating active living communities. *Annual Review of Public Health, 27*(1), 297–322.
Stigsdotter, U. K., Corazon, S. S., Sidenius, U., Refshauge, A. D., & Grahn, P. (2017). Forest design for mental health promotion—Using perceived sensory dimensions to elicit restorative responses. *Landscape and Urban Planning, 160*, 1–15.
Tillmann, S., Tobin, D., Avison, W., & Gilliland, J. (2018). Mental health benefits of interactions with nature in children and teenagers: A systematic review. *Journal of Epidemiology and Community Health*, 1–9.
TUIK. (2019, 09 23). Gelir ve Yaşam Koşulları Araştırması Bölgesel Sonuçları, 2018. (Türkiye İstatistik Kurumu) Retrieved 10 21, 2019, from http://www.tuik.gov.tr/PreHaberBultenleri.do?id=30756.
TUIK. (2020, 01 29). İstatistiksel Tablolar ve Dinamik Sorgulama: İl, tek yaş ve cinsiyete göre nüfus, 2007-2018. Retrieved from Türkiye İstatistik Kurumu: http://tuik.gov.tr/PreTablo.do?alt_id=1059.
Ulrich, R. S. (1983). Aesthetic and Affective Response to Natural Environment. In *Behavior and the natural environment* (pp. 85–125). Boston, MA, USA: Springer.
Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *American Association for the Advancement of Science, 224*(4647), 420–421.
van den Berg, Jorgensen, A., & Wilson, E. R. (2014). Evaluating restoration in urban green spaces: Does setting type make a difference. *Landscape and Urban Planning, 127*, 73–181.
van den Bogerd, N., Dijkstra, S. C., Koole, S. L., Seidell, J. C., de Vries, R., & Maas, J. (2020). Nature in the indoor and outdoor study environment and secondary and tertiary education students' well-being, academic outcomes, and possible mediating pathways: A systematic review with recommendations for science and practice. *Health & Place, 66*, 102403.
Van Droogenbroeck, F., Spruyt, B., & Keppens, G. (2018). Gender differences in mental health problems among adolescents and the role of social support: Results from the Belgian health interview surveys 2008 and 2013. *BMC Psychiatry, 18*(1), 6.
Wang, Jing-jing, Wang, Mei, Lau, Patrick W. C., Ainsworth, Barbara E., He, Gang, & Gao, Yang (2018). Physical activity as a mediator of the associations between perceived environments and body mass index in Chinese adolescents. *Health & Place, 54*, 37–42.
Weeland, Joyce, Laceulle, Odilia M., Nederhof, Esther, Overbeek, Geertjan, & Reijneveld, Sijmen A. (2019). The greener the better? Does neighborhood greenness buffer the effects of stressful life events on externalizing behavior in late adolescence? *Health & Place, 58*, 102163. https://doi.org/10.1016/j.healthplace.2019.102163.
Wells, Nancy M., & Evans, Gary W. (2003). Nearby nature: A buffer of life stress among rural children. *Environment and Behavior, 35*(3), 311–330.
Wells, N. M., & Rollings, K. (2012). The natural environment in residential settings: Influences on human health and function. In S. Clayton (Ed.), *The Oxford handbook of environmental and conservation psychology* (pp. 509–523). Oxford: Oxford University Press.
WHO. (2018). Adolescent mental health. Retrieved 10 15, 2019, from https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health.
Wilson, E. O. (1984). *The biophilia hypothesis*. New York, NY: Island Press.
Zhao, Jingwei, Xu, Wenyan, & Ye, Li (2018). Effects of auditory-visual combinations on perceived restorative potential of urban green space. *Applied Acoustics, 141*, 169–177.