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Outdoor recreation and nature's contribution to well-being in a pandemic situation - Case Turku, Finland

Nora Fagerholm ^{*}, Salla Eilola, Vesa Arki

Department of Geography and Geology, University of Turku, University of Turku, 20014, Finland

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ABSTRACT

Urban green infrastructure provides a range of experiences for people and various health benefits that support human well-being. To increase urban resilience, exceptional situations, such as the COVID-19 pandemic, are important to learn from. This study aims to understand how the residents in Turku, a middle-sized city in Finland, perceived their outdoor recreation changed and how nature contributed to their subjective well-being during the early phases of the COVID-19. Sites of outdoor recreation and associated ecosystem service benefits were gathered through a map-based survey. In addition, the contribution of nature on subjective well-being was measured through Likert scale statements and the perceived changes in outdoor recreation behaviour were measured through self-reported number of days and from responses to open survey questions. Data was analysed through quantitative, qualitative and spatial methods.

The results show that nearly half of the respondents increased outdoor recreation and the majority of outdoor recreation sites were visited more or as often as before the pandemic. The spatial analysis revealed that the most often visited recreation sites were near forests, semi-natural areas and housing areas as well as relatively close to respondent's residence. Respondents had various reasons for changes in outdoor recreation behaviour. For some a shift to working remotely and changes in everyday routines led to spending time outdoors more often and for some spending less while others avoided recreation in crowded areas due to social distancing. The results also indicate that people's opportunities to adapt to the pandemic conditions differ greatly. The nature's contribution to subjective well-being during COVID-19 was important regardless of respondent's outdoor recreation behaviour. Our study highlights that urban planning should respond to different needs for outdoor recreation in order to widely, and in a just way, promote the well-being benefits of urban nature during a pandemic, and to increase the resilience of the city and its residents. Participatory mapping can capture the variety in resident's values and identify key recreation sites of multiple ecosystem service benefits.

1. Introduction

Urban dwellers globally have experienced changes in their everyday life due to the COVID-19 pandemic caused by the virus SARS-CoV-2 (Chen et al., 2020). To avoid spreading the virus, measures have been taken to ensure social distancing in most countries. A side effect of social distancing is increased boredom, frustration and anxiety (Brooks et al., 2020), and decreasing the mental health burden during a pandemic requires attention (Holmes et al., 2020). Hence, spending time outdoors in green and public areas in the city during a pandemic can provide a source of resilience for maintaining well-being, while enabling social distancing (Samuelsson et al., 2020).

Research across a wide spectrum of disciplines has empirically

explored the linkages between nature or ecosystems and human well-being with the conclusion that nature generally makes people happier and healthier, both physically and mentally (e.g., Hartig et al., 2014; Kondo et al., 2018; Russell et al., 2013). Urban green infrastructure such as urban trees, parks, forests, community gardens, grassy verges, and green roofs (EC, 2012) provides a range of experiences for people, including opportunities for physical activities (e.g., walking, jogging, and using playgrounds) and various health benefits (e.g., relaxation, socializing with friends, and enjoying nature) (e.g., Brown et al., 2014; Faehnle et al., 2014). These multiple well-being benefits of green infrastructure relate to ecosystem services (Fagerholm et al., 2019; Hegetschweiler et al., 2017), and denote the mainly nonmaterial contributions to the quality of life generated by nature (IPBES, 2019).

^{*} Corresponding author.

E-mail address: nora.fagerholm@utu.fi (N. Fagerholm).

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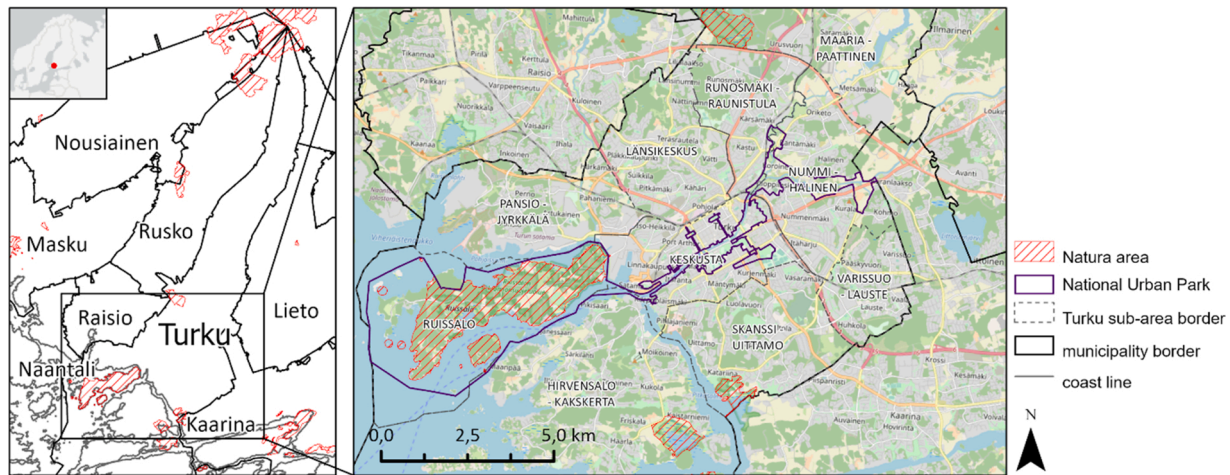


Fig. 1. Study area: the city of Turku in Southwestern Finland. Background map © National Land Survey and OpenStreetMap.

In urban planning, amidst housing intensification, infill development, and effective transportation and service development, green infrastructure has an increasingly important role in achieving the sustainability transformation (Elmqvist et al., 2019), particularly to achieve United Nations Sustainable Development Goals 3 and 11 about good health and well-being and sustainable and resilient cities. Green infrastructure in cities also plays a role in achieving biodiversity targets set at the political level – for example, in the European Union (EU), where ambitious Urban Greening Plans are being developed in all cities by 2021 (EC, 2020). To reach such targets, it is important to include urban dwellers' perceptions of the type of natural landscapes, green elements and structures that relate to various perceived well-being benefits in green infrastructure development. To increase the resilience of cities and their residents through urban green infrastructure planning in both the long and short term, exceptional situations, such as the COVID-19 pandemic, are important to learn from.

In the context of COVID-19, several empirical studies have explored changes in people's outdoor recreation behaviour. Mobile phone and Google location-tracking data reveal the spatial patterns in people's mobility at a coarse scale (Poom et al., 2020). Studies using such big data in England (Day, 2020) and Norway (Venter et al., 2020) revealed that use of green areas increased during the pandemic. However, for urban planning, it is crucial to understand in more detail usage as well as perceptions of urban nature during a pandemic. Social surveys performed in the U.S. (Fisher et al., 2020; Lopez et al., 2020) confirm the increase in green space usage and highlight that the perceived importance of these spaces has also increased during the pandemic. For example, Lopez et al. (2020) observed in New York that green spaces were more important for mental than physical well-being. A European survey by Ugolini et al. (2020), then again, showed that in Spain and Italy, where outdoor recreation was restricted by the governments, the majority of those who previously visited urban green spaces on a regular basis stopped doing so but expressed the need for urban greenery. An additional dimension to surveys follows from integrating them to a participatory mapping approach (public participation GIS, PPGIS; Brown and Kyttä, 2014). Such map-based surveys offer a possibility to study both the behaviour of individuals and the perceptions behind their behaviour in a place-based way. Participatory mapping has been widely applied to elicit perceptions on green infrastructure, ecosystem services and well-being in an urban context (e.g., Ives et al., 2017; Kajosaari and Pasanen, 2021; Pietrzyk-Kaszyńska et al., 2017; Rall et al., 2017).

This study adds to the literature by implementing a participatory mapping approach to understand perceived changes in outdoor recreation behaviour and nature's contribution to well-being in the city of Turku, Finland, during the early phase of the COVID-19 pandemic in

spring 2020 (hereafter, COVID-19 spring). Turku is among the largest cities in Finland, and the COVID-19 restrictions in the country did not limit access to open public areas and nature. Through implementing an online map-based survey targeted to the residents, we respond to the following research questions:

- 1 How did people perceive their outdoor recreation behaviour changed during COVID-19 spring and what were the perceived causes of these changes?
- 2 What are the spatial patterns of outdoor recreation sites and how do they relate to different land uses?
- 3 How does visitation frequency relate to the spatial patterns of mapped outdoor recreation sites and underlying land use?
- 4 What cultural ecosystem service benefits are perceived in outdoor recreation sites and are there differences depending on the frequency of visitation? Where are the clusters of multiple ecosystem service benefits?
- 5 What is the contribution of nature to the subjective well-being of the residents and how does it vary according to outdoor recreation behaviour?

Based on the results, we discuss the implications of the study findings for urban green infrastructure planning during the extended pandemic and long-term.

2. Methods

2.1. City of Turku and restrictions due to COVID-19 in spring 2020

The city of Turku (245.7 km²) is the sixth-largest city in Finland with a population of 192,962 inhabitants (Statistics Finland, 2019). The city is located on the Baltic Sea coast and has several islands within its proximity, some of them accessible by public transport. In the most populated area, the city centre, there are several small urban parks as well as a recreational area along the Aura River that runs through the centre (Fig. 1). Similarly, as in many cities in Finland, residential areas further away from the centre are surrounded by semi-natural urban forests and green areas that have been spared from urban infill. Furthermore, the city has 18 conservation areas (13.9 km² Natura areas, 5.7 % of land area) that include, for example, protected wetlands, old oak forests and marshland. The population of the city is expected to increase by 10 % (19 000) inhabitants in the next 20 years (MDI, 2019), which puts pressure on the supply of green space and reaching the urban greening targets set by the European Commission by 2030 (EC, 2020).

During COVID-19 spring in Finland, people were allowed to spend

Table 1

Relative shares (%) and statistically significant differences in the characteristics of the respondents divided to the four categories (A-D) formulated based on the change in the number of weekly outdoor recreation days before and during COVID-19 situation in spring 2020.

Variable	A. Respondents who increased weekly outdoor recreation days (n = 246; 41.8 %)	B. Respondents who recreated seven days a week regardless of COVID-19 situation (n = 165; 28.0 %)	C. Respondents whose amount of weekly outdoor recreation days remained same (n = 137; 23.3 %)	D. Respondents who decreased weekly outdoor recreation days (n = 41; 6.9 %)
Gender				
($\chi^2(3) = 28.512, p = 0.000^{***}$)	n = 242	n = 161	n = 133	n = 40
male	21.1	24.8	45.9	37.5
female	78.9	75.2	54.1	62.5
Age group				
($\chi^2(6) = 4.292, p = 0.637$)	n = 245	n = 163	n = 135	n = 39
15-44	62.0	55.2	61.5	64.1
45-64	28.2	35.0	25.9	25.6
65-	9.8	9.8	12.6	10.3
Level of education				
($\chi^2(6) = 3.038, p = 0.804$)	n = 244	n = 164	n = 137	n = 41
Primary level and other	2.90	3.7	2.2	2.4
Secondary level	30.30	28.7	35.0	39.0
Tertiary level	66.80	67.7	62.8	58.5
Occupation				
($\chi^2(9) = 17.258, p = 0.045^*$)	n = 239	n = 152	n = 131	n = 39
Employed	66.9	68.4	64.9	46.2
Unemployed	3.3	6.6	6.1	10.3
Student	17.6	11.2	12.2	30.8
Retired	12.1	13.8	16.8	12.8
Household composition				
($\chi^2(3) = 10.070, p = 0.018^*$)	n = 157	n = 93	n = 79	n = 29
Households with children (under 18 years old)	51.0	65.6	54.4	34.5
Household without children under 18 years	49.0	34.4	45.6	65.5
Remote working during COVID-19 restrictions				
($H(3) = 25.262, p = 0.000^{***}$)	n = 246	n = 165	n = 136	n = 41
Yes	69.9	61.2	50.7	85.4
To some extent	12.6	7.3	12.5	0.0
No	17.5	31.5	36.8	14.6

**= $p < 0.01$.

*** $p < 0.001$.

* $p < 0.05$.

time outdoors freely in groups of less than 10 persons, even after mid-March, when the government enacted the state of emergency measures to restrict movement and infection rates (Finnish government, 2020). At the same time, schools for the most part switched to online teaching, parents of kindergarten-aged children were encouraged to keep their children at home, and remote work was recommended to employees. Over-70-year-olds and those belonging to the COVID-19 risk groups were particularly urged to social distance and to avoid all unnecessary time spent outside home. All public events over 500 people were prohibited. Theatres, museums and indoor sports facilities were closed, and the opening hours of restaurants restricted. All citizens were instructed to self-quarantine for 14 days when arriving from countries deemed high-risk as well as in cases of possible COVID-19 exposure. The rate of infections in the country slowed down by June 2020, and during the summer most of the restrictions were gradually removed.

2.2. Survey contents and data collection

Data were collected through a map-based online survey operating on Maptionnaire platform and accessible to respondents in a browser using smartphone, tablet, or computer. Each respondent was asked, "Where do you spend time outdoors?" and instructed to map an optional number of sites and routes they use for outdoor recreation (the routes not reported in this article due to low-quality data). During the mapping tasks, the respondents were able to change the background map between Google maps and Google satellite view. Additional structured questions addressed whether the sites were related to the COVID-19 situation or to normal everyday life, which activities and values (i.e. cultural ecosystem services) related to the specific site, and how often the sites were visited before and during COVID-19. The list of cultural ecosystem service benefits was based on previous studies applying a participatory mapping approach (Balram and Dragičević, 2005; Brown and Fagerholm, 2015;

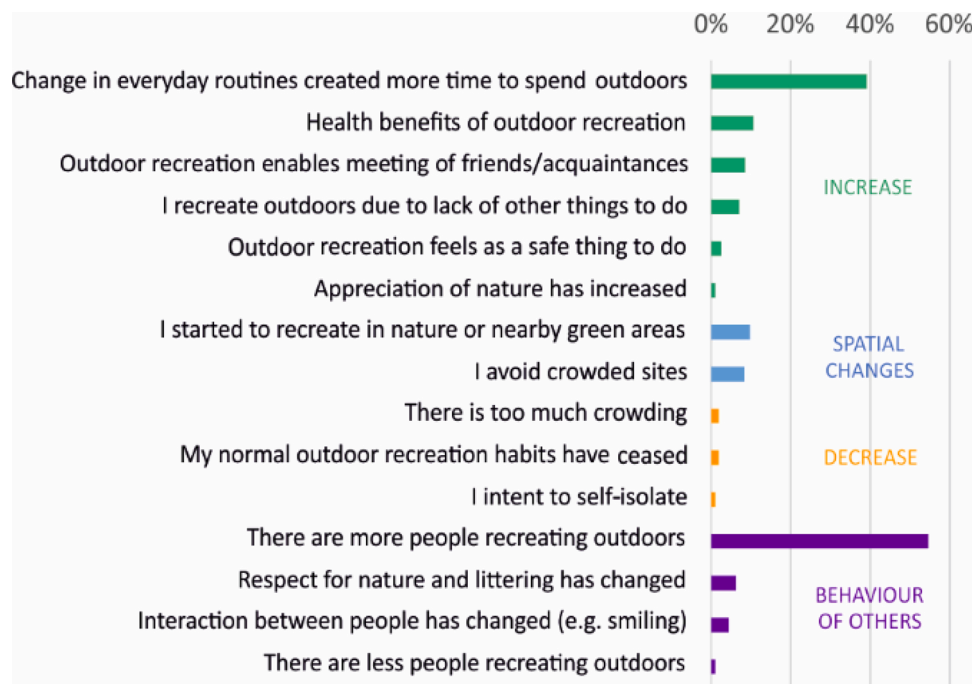


Fig. 2. Relative share (%) of perceptions related to changes in outdoor recreation behaviour during COVID-19 spring in 2020 (n = 480). Items are derived from content analysis of open survey questions.

Ives et al., 2017; Pietrzyk-Kaszyńska et al., 2017; Rall et al., 2017). Sites could also be described in the respondent's own words. In addition, the respondent was asked to mark the location of their home.

The contribution of nature to the subjective well-being was measured through nine 5-point Likert scale statements (e.g., "Natural environment has been an important supporting factor for my well-being during COVID-19"). These statements denote particularly the eudaemonic well-being benefits of nature, namely, the profound long-term effects of nature on people's subjective well-being (Ryff, 1989). These benefits focused on self-transcendence, perspective taking, prosocial behaviour and meaningfulness of the nature experience (Ryan and Deci, 2001; Ryff, 2014). Perceptions regarding changes in a respondent's own or other people's behaviour in and use of the natural environment during COVID-19 spring were asked through open questions. Background information included gender, age, level of education, occupation, the number of days in a week when the respondent spends time outdoors normally and in the COVID-19 situation, and questions on whether the respondent had shifted to remote work and or aimed to avoid social contacts during the pandemic.

The survey was targeted to all inhabitants of Turku above 15 years old. Data collection took place in May–June 2020 (11.5.–21.6.2020) and the survey was available in all the common languages spoken in the city, namely Finnish, Swedish, English, Russian, Arabic, and Somali. Respondents were reached through a crowdsourced sampling, similarly to other PPGIS surveys (e.g., Kahila-Tani et al., 2016; Rall et al., 2017) by distributing press releases and marketing the survey through social media channels of the city of Turku and several local social and print media. Different language groups were targeted through promotion in their respective languages in local associations and their e-mail lists.

2.3. Analysis

Descriptive statistics were calculated to compare the sample population to that of the city of Turku and to describe respondent background variables. Background variables were analysed through Chi square and Kruskal-Wallis H tests to identify significant associations. Age was categorised into three classes (15–44 yrs: young and young adults; 45–64

yrs: middle-aged; and elderly: >65 yrs) based on the common national age bracket classification by the Statistics Finland. The working-age bracket of 15–64 years was divided into two classes to enable comparison of young and young adults, and middle-aged.

Perceived changes in outdoor recreation were analysed, firstly, by analysing the self-reported number of weekly outdoor recreation days. The respondents were divided into four categories based on the change in the number of outdoor recreation days before and during COVID-19:

- A respondents who increased their outdoor recreation days,
- B respondents whose number of recreation days did not change (since they recreated outdoors seven days a week regardless of COVID-19),
- C respondents whose number of outdoor recreation days did not change (despite the possibility of increase or decrease), and
- D respondents who decreased their outdoor recreation days.

Secondly, perceived changes in outdoor recreation behaviour from responses to open survey questions were analysed by inductively and iteratively coding the data (by S.E.) in line with conventional content analysis (Yin, 2011). The coding results were then presented through relative frequencies and exemplified using extracted citations.

The overall spatial patterns of mapped sites were analysed through visual interpretation and by creating Kernel density surfaces denoting the intensity (Silverman, 1986). The parameters for the analysis, cell size of 100 m and search radius of 200 m, were selected on the basis of the mapped sites, their locations in relation to each, and the mapping scale.

To understand the relationship to land use, mapped sites were spatially overlaid with Corine Land Cover (CLC) (2018), Natura areas, recreational areas in the city master plan, Turku National Urban Park, and sub-areas of Turku to calculate relative share of coverage and vicinity. Spatial data were downloaded from the Finnish Environment Institute (<http://paikkatieto.ymparisto.fi/lapio/latauspalvelu.html>), except the Turku data, which were downloaded from the city of Turku (<http://dev.turku.fi/wfs/>). When analysing the spatial relationship to these data layers, mapped sites were buffered with 250 m radius. Based on the mapping scale, the survey aim to address local everyday outdoor

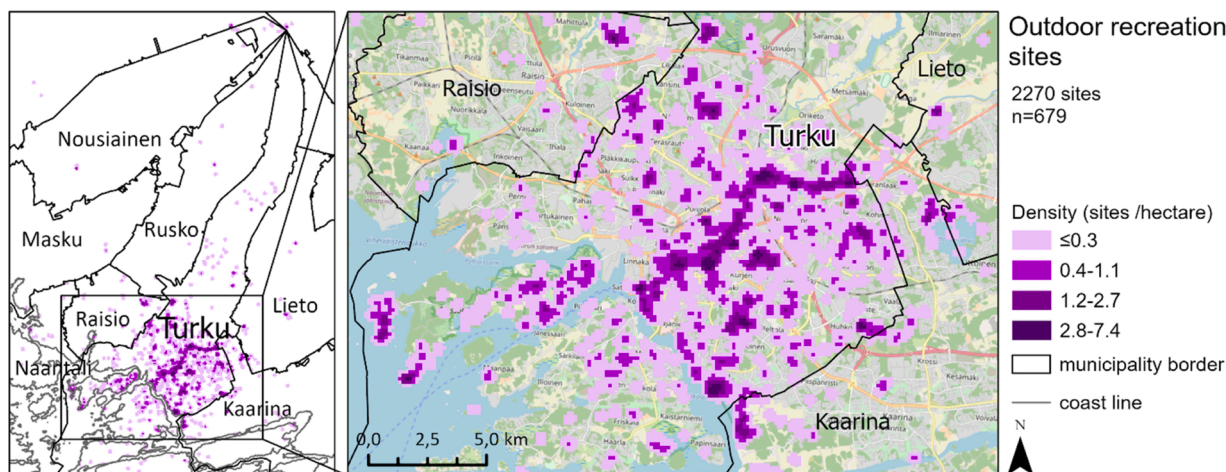


Fig. 3. Mapped outdoor recreation sites in Turku region (left pane) and within the city of Turku core area (right pane) presented as Kernel density surface (sites/ha, 100 m cell size). Background map © National Land Survey and OpenStreetMap.

recreation, and our experience from previous surveys, a 250 m buffer was chosen. CLC data was reclassified to 9 classes (Table A1): housing areas, service areas, green urban areas, sport and leisure facilities, other artificial surfaces, agricultural areas, forests and semi-natural areas, wetlands and open bogs, and waters.

The mapped outdoor recreation sites were divided into four categories based on the indicated visitation frequency during COVID-19 spring to understand how visitation relates to spatial patterns:

- A sites visited less frequently (decrease),
- B sites with no change (no change),
- C sites visited more frequently (increase), and
- D completely new sites (new site).

To understand if specific land cover and land use classes are over- or under-represented, the relative shares (%) of different classes were compared across the four groups of visitation frequency within the area of the city of Turku. Z scores were calculated for each group and land cover and land use pair to determine whether specific outdoor recreation sites were represented statistically significantly more (z score >+1.96) or less (z score <-1.96) frequently than expected (two-tailed test, $\alpha = 0.05$; Brown et al., 2015).

Euclidian distance between respondent home and each outdoor recreation sites was calculated and reported with median and median absolute deviation (MAD). The differences between coverage of land

Table 2
Relative share of land cover and land use classes (Corine Land Cover), conservation areas, recreational areas allocated in the city plan, National Urban Park, and waters within 250 m distance from each mapped outdoor recreation site.

Land cover and land use class	%
Housing areas	18.2
Service areas	7.4
Green urban areas	2.3
Sport and leisure facilities	5.0
Other artificial surfaces	9.0
Agricultural areas	9.7
Forests and semi-natural areas	38.9
Wetlands and open bogs	1.8
Waters	7.7
Total	100.0
Other areas	Appears within or in the vicinity (yes)
Natura conservation areas	16.8
Recreational areas of the city plan	72.4
National Urban Park of Turku	40.5
Waters	49.5

cover and land use classes around each site (250 m buffer) and the four groups of visitation frequency were analysed with two-tailed independent samples Kruskal-Wallis H test. Post hoc analysis using Dunn's (1964) procedure was performed with a Bonferroni correction for multiple comparisons.

To analyse perceived ecosystem service benefits in outdoor recreation sites, their relative shares were calculated across the visitation frequency groups. Clusters of sites with multiple ecosystem service benefits were analysed through optimized hot spot analysis, applying a fixed distance of 1408 m based on an average distance of 30 nearest neighbours, and corrected for multiple testing and spatial dependence using the false discovery rate correction method (Ord and Getis, 2010).

Statements related to urban nature's contribution to subjective well-being were analysed through relative shares. Differences in statements across the four groups denoting change in the number of outdoor recreation days were analysed through the Kruskal-Wallis H test. All statistical analyses were performed in SPSS and spatial analyses in ArcGIS Pro.

3. Results

3.1. Survey respondents

In total, 730 residents of Turku responded to the survey. A comparison to the population of the city shows that women (71.3 % of respondents vs. 52.2 % of Turku inhabitants), young and working-aged (between 15–64 years 90.0 % vs. 76.2 %) and highly educated (65.3 % vs. 35.0 %) are over-represented in the sample (Table A2). Under-represented are single-person households (31.2 % vs. 53.1 %), retired (13.3 % vs. 24.1 %) and unemployed (7.8 % vs. 11.2 %). The different areas in the city are represented well.

Nearly all respondents (98.1 %) stated they practiced social distancing due to the COVID-19 situation. Amongst employed people and students, four out of five (80.3 %) shifted entirely or partly to remote working. Furthermore, remote work or school was more common among the highly educated (82.5 %) compared to people with other levels of education (57.6 %) ($\chi^2(4) = 52.92, p = 0.000$).

3.2. Changes in outdoor recreation behaviour

In general, before the COVID-19 restrictions, respondents stated that they spent time outdoors on average 4.7 days (± 1.9) per week, which increased to 5.5 (± 1.7) days during the restrictions. Nearly half of the respondents (41.8 %, n = 246) increased their weekly outdoor recreation days (group A, Table 1). This occurred regardless of whether the

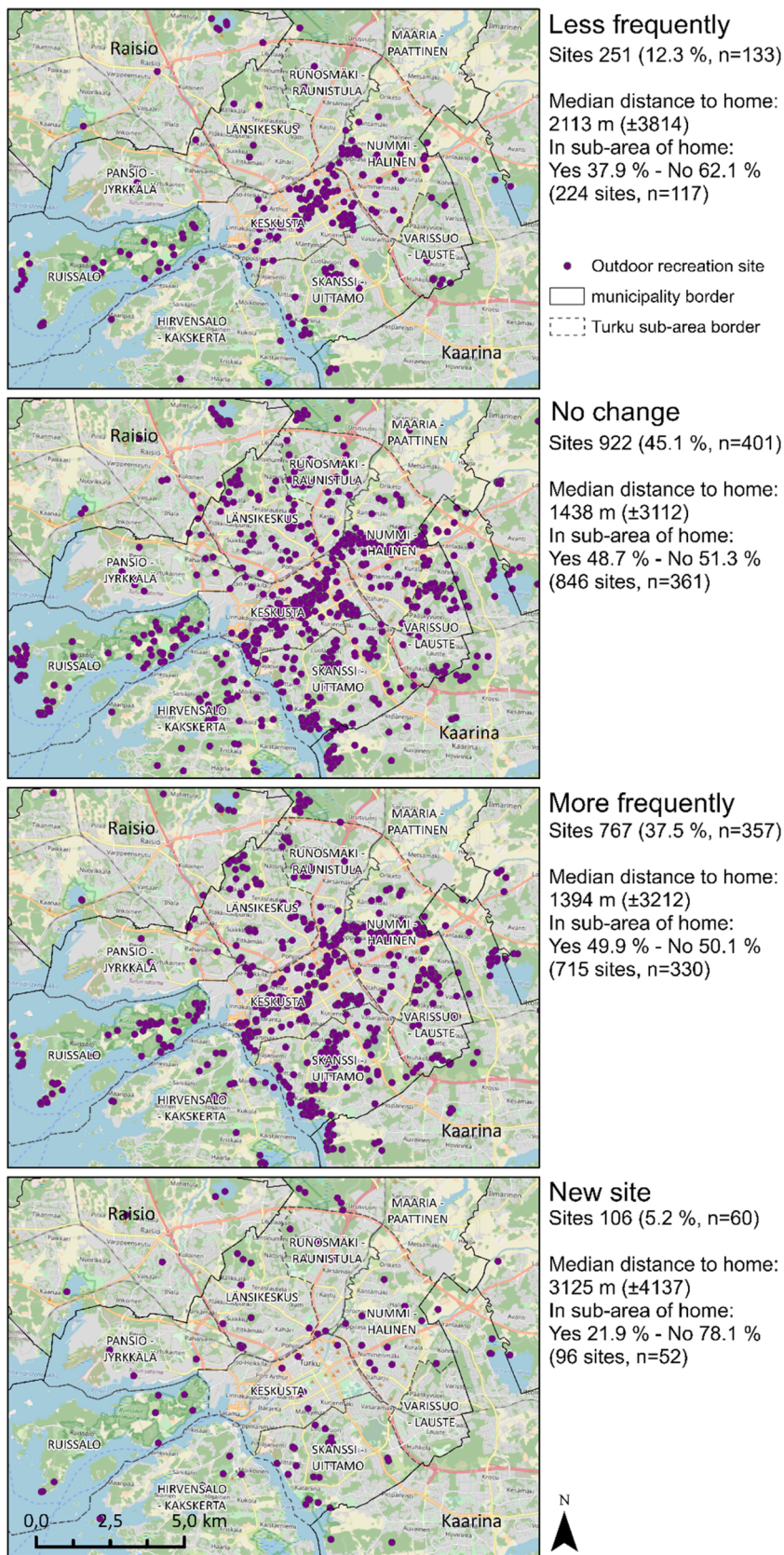


Fig. 4. Mapped outdoor recreation sites categorized into four classes based on frequency of visitation during COVID-19 spring in 2020. Background map © National Land Survey, city of Turku and OpenStreetMap.

Table 3

Relative share (%) of land cover and land use classes (Corine Land Cover) within 250 m distance from each mapped outdoor recreation site that was visited during COVID-19 spring in 2020 less frequently, with similar frequency, more frequently or that were new sites. Sig. denotes significance of Kruskal-Wallis test.

Land use class	Less frequently	No change	More frequently	New site	Sig.
Housing areas	17.7	17.8	18.0	17.1	0.349
Service areas	11.8	7.2	6.7	4.4	0.000

Green urban areas	4.0	2.0	2.2	0.9	0.000

Sport and leisure facilities	6.5	5.0	5.1	2.8	0.001

Other artificial surfaces	11.0	9.1	8.1	9.7	0.001

Agricultural areas	7.8	9.2	10.6	7.8	0.123
Forests and semi-natural areas	29.1	40.1	39.9	47.3	0.000

Wetlands and open bogs	2.1	1.9	1.7	2.8	0.147
Waters	10.0	7.6	7.6	7.3	0.001

*** Statistically significant difference between categories ($p < 0.001$).

respondent spent time outdoors rarely or frequently before the COVID-19 restrictions. Most commonly the number of weekly outdoor recreation days was increased by one (31.3 % of respondents) or two (37.4 %) days. Women increased outdoor recreation more often (78.9 %) compared to men (21.1 %) ($\chi^2(3) = 28.512, p = 0.000$).

No change in the number of outdoor recreation days was observed for 28.0 % of respondents who stated that they recreated outdoors seven days a week regardless of the COVID-19 situation (group B) and for 23.3 % of the respondents who whose amount of weekly outdoor recreation days remained same (group C, Table 1). Most often those who recreated everyday were living in households with children (65.6 %, $\chi^2(2) = 10.070, p = 0.018$). A small number of respondents (6.9 %) decreased their outdoor recreation days (group D), and most of them (65.5 %) do not have children in the household ($\chi^2(2)=10.070, p = 0.018$). Level of education, occupation or housing area did not show statistically significant differences on the number of outdoor recreation days. Some of those respondents who reported no change or a decrease (groups B–D), however, described in the open responses that their outdoor recreation had increased during the COVID-19 spring compared to a normal spring (41.2 % of group B, 20.4 % of group C, and 17.1 % of group D).

Regarding the shift to remote working, there are statistically significant differences between the groups ($H(3) = 25.262, p = 0.000$). Post hoc test revealed that those who did not change the number of recreation days despite the possibility for it (group C), were significantly more often respondents who did not shift to remote working compared to respondents who did experience a change in their outdoor recreation days (group A: $p = 0.000$; group D: $p = 0.001$).

When respondents described the reasons for increasing outdoor recreation, change in their everyday routines that created more time to spend outdoors (39.2 %, Fig. 2) was most commonly stated, followed by the health benefits of outdoor recreation (10.6 %) and meeting friends and acquaintances outside due to COVID-19 restrictions (8.5 %). Additionally, 9.8 % of the respondents described that they had started to spend time outdoors in green areas near their homes or further away in different nature sites or conservation areas:

In my case recreation has decreased, but I feel immense gratitude for the communal garden plot near my home where I can potter around nearly the same way as before the COVID-19. – female, 70 years.
I do all my exercise outdoors at the moment instead of, for example, going to the gym, so I spend a lot of time outdoors every day. The

Table 4

The distribution (%) of activities and values, namely ecosystem service benefits, attached to the mapped outdoor recreation sites and categorized based on the change in visitation frequency due to COVID-19. The respondents were able to indicate several activities and values in each mapped site. Hence, percentages indicate the relative share among all sites (denoted in brackets for each column) where a certain activity or value was identified. The five most common activities/values are highlighted.

	All sites (2072)	Category describing the frequency of outdoor recreation visits			
		Less frequently (251)	No change (921)	More frequently (764)	New site (106)
Ecosystem service benefits / outdoor recreation site (st. dev.)	5.3 (± 3.2)	4.9 (± 3.4)	5.2 (± 3.0)	5.6 (± 3.1)	5.0 (± 3.3)
Activities	%	%	%	%	%
Being outside	65.8	53.0	66.2	69.2	72.6
Walking	61.9	57.4	60.6	66.4	55.7
Sports/exercising	39.6	35.5	38.2	43.5	34.9
Observing nature	31.5	23.5	30.8	35.2	33.0
Spending time with family or other people	28.5	31.1	27.7	29.3	26.4
Walking a pet	17.8	11.6	23.9	12.6	16.0
Hiking	15.1	15.9	14.3	14.7	19.8
Playing with children	9.7	7.2	8.9	11.9	7.5
Everyday connection (e. g., a way to work or shopping)	6.4	18.3	5.4	4.2	0.0
Values					
Beautiful place or scenery	49.2	43.8	48.0	53.0	50.9
Closeness to nature or nature itself	48.3	36.3	48.0	52.2	52.8
Possibility to relax or freshen up	38.1	37.5	37.4	40.1	37.7
Closeness to water	28.3	32.3	27.5	29.3	18.9
Enjoyable sounds or silence	26.6	23.1	26.5	29.6	17.9
Biodiversity	19.9	16.7	18.8	22.5	17.9
Emotions, ideas and experiences triggered by the place	13.7	17.9	12.6	14.9	7.5
Cultural or historical significance	13.8	17.1	13.2	13.5	14.2
Pleasant smells	11.0	10.0	10.3	12.3	10.4
Religious or spiritual experience	1.7	2.0	1.5	2.0	0.9

nearby green areas are very important during this time when one cannot do anything else. – female, 47 years.

We have started to hike every weekend in some new location. We have visited Raisio, Naantali, Turku, Rusko and Teijo in different nature reserves. We have chosen the places on the basis that they should be less crowded. In normal situation, we would not be hiking as often nor pay attention to the crowdedness of the route. – female, 37 years.

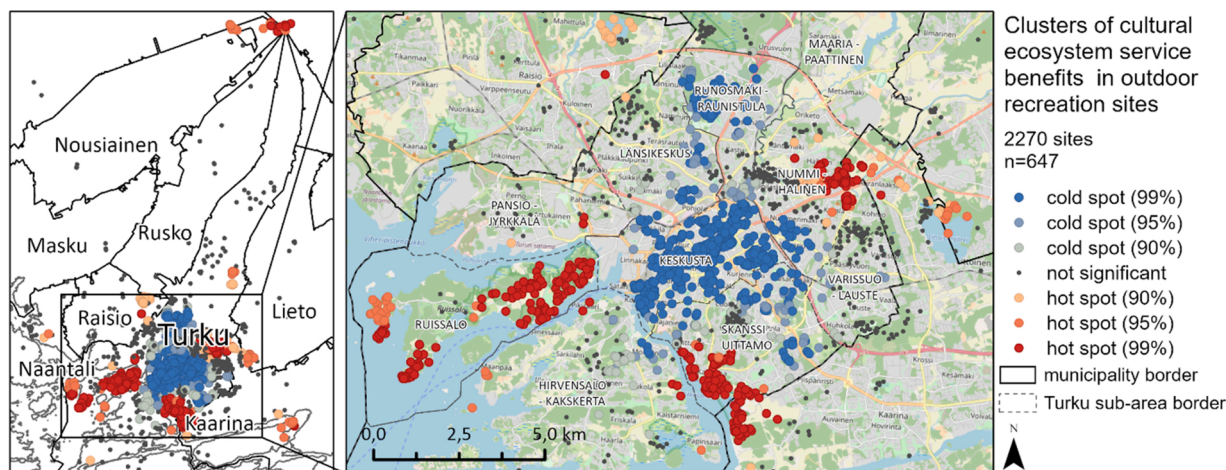


Fig. 5. Statistically significant clusters of outdoor recreation sites offering multiple (hot spots) and few (cold spots) ecosystem service benefits. Percentage denotes confidence level of clusters.

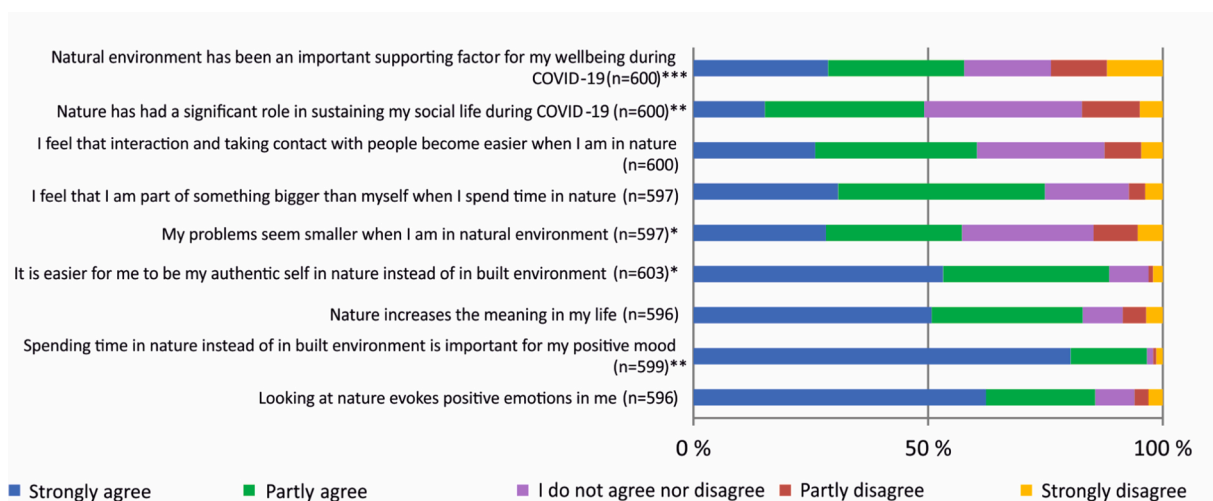


Fig. 6. Responses to nine statements concerning subjective well-being benefits of nature. Asterisks denote statistically significant differences of Kruskal-Wallis test ($p < 0.001^{***}$, $p < 0.01^{**}$, $p < 0.05^*$, Table A4) between the four groups formulated based on the change in the number of outdoor recreation days before and during the COVID-19 situation in spring 2020 (groups A-D).

Out of respondents, 8.2 % mentioned they had started to avoid the most crowded recreation sites. Furthermore, reasons for the decrease in outdoor recreation were mentioned by 4.8 % of respondents, including the perceived risk of COVID-19 infection, the intent to self-isolate, and the change in habits, for example, when biking to work ceased (Fig. 2). The varying effects of COVID-19 restrictions on people’s outdoor recreation behaviour reflect also people’s different opportunities to adapt to a pandemic, indicated in the responses, such as:

During COVID-19, I have recreated outdoors mostly in the urban environment in the immediate proximity to my home, but felt it is not sufficient as a nature environment. I would like to go further away to nature, but I have felt the situation is too difficult to arrange that. – female, 26 years.

Too much work. Also my routine to go outdoors is gone, because I need to be home all the time: while working, having lunch and all sport activities are cancelled. I have become a bit apathetic and lazy, my routines are messed up. Sometimes I have gone for a walk too late or failed to go completely for several days. Which felt bad. – female, 33 years.

I cannot spend time in nature as usual. Every place is full of badly behaving people. People who litter and spit. They make horrible racket and one cannot enjoy the peace of nature. – male, 37 years.

We hike a lot even at normal times, but at this time maybe even more because there are no commitments in the calendar. At work some of the customer meetings have been arranged outside in parks or nature. – female, 33 years.

My other sport activities stopped because of COVID-19 in March. I used to do badminton 3 h a week and group sports 4–5 times a week. I immediately took up and increased walking, biking and roll-erblading to at least an equivalent amount. – male, 53 years.

Over half of the respondents (54.6 %) perceived that outdoor recreation had increased among Turku residents during COVID-19 spring and there were more people in their nearby green areas than usual (Fig. 2). Overcrowding was observed in certain recreation sites, such as on the riverside in the city centre. Changes in respect for nature and in social interaction had also been observed in both a positive and a negative direction.

3.3. Spatial patterns of mapped outdoor recreation sites and relation to land cover and land use

In total, 2270 outdoor recreation sites were mapped in the survey. Each respondent ($n = 679$) marked on average 3.3 ($SD \pm 3.2$) sites. They are mostly located at the city centre and form a longitudinal pattern along the river and clusters in park and sport areas (Fig. 3). In addition, individual clusters are located in forest and recreational areas close to suburbs and in the vicinity to the sea. One out of six sites (16 %) is located outside of Turku, mostly in well-known recreational areas and national parks.

Outdoor recreation sites relate most often to forests and semi-natural areas (38.9 % of land within 250 m vicinity of mapped sites) and housing areas (18.2 %) (Table 2). Over 70 % of sites are within or in the vicinity of the official recreational areas of the city and 40.5 % within the National Urban Park. Conservation areas are within or in the vicinity of 16.8 % of the sites. When comparing the land cover and land use within the vicinity of mapped sites to that of the entire city, forest and semi-natural areas are heavily over-represented ($z = 16.1$, $p \leq 0.05$), whereas water ($z = -9.4$, $p \leq 0.05$) and artificial surfaces ($z = -7.9$, $p \leq 0.05$) are under-represented (Fig. A1).

3.4. Visitation frequency in outdoor recreation sites

Of all mapped outdoor recreation sites, 90.2 % of sites included information on how COVID-19 affected the frequency of visiting the specific site. Most sites (82.6 %) were visited with similar frequency (no change) or more frequently compared to pre-COVID-19 (Fig. 4). These sites are located close to respondents' homes (median distance to home 1438 m and 1394 m, respectively), with half of them (48.7 % and 49.9 %, respectively) in the same area of the city as respondents' home.

Some sites (12.3 %) were visited less often during COVID-19 spring (Fig. 4) and comparison to Turku sub-areas shows statistically significant differences ($\chi^2(30) = 84.788$, $p = 0.000$) for these sites. Less-visited sites are particularly located in the city centre (36.7 %), mapped by both those who live in this area (55.7 %) and in other parts of Turku (44.3 %), and on the Ruissalo recreational island (12.7 %). Completely new outdoor recreation sites were mapped least (5.2 % of sites; Fig. 4). Compared to other categories, these sites are located furthest from respondents' homes (3125 m) and often outside the area where they live (78.1 %).

In terms of land cover and land use (within 250 m vicinity of sites), particularly less-visited sites differ from other categories with higher share of service areas ($p = 0.000$), green urban areas ($p = 0.000$), sport and leisure facilities ($p = 0.001$), other artificial surfaces ($p = 0.001$) and water areas ($p = 0.001$), and lower share of forests and semi-natural areas ($p = 0.000$; Table 3; Table A3).

3.5. Ecosystem service benefits and sites offering multiple benefits

In relation to each outdoor recreation site, the respondents (2072, $n = 647$) marked on average 5.3 (± 3.2) activities or values, namely cultural ecosystem service benefits (Table 4). Out of these, the most commonly identified activities were being outside and walking, and the most common values cited were beautiful places or scenery and closeness to nature or nature itself. More frequently visited sites received the highest number of different ecosystem service benefits (mean 5.6) compared to other categories of visitation frequency (Table 4). These relate particularly to nature, pleasant environment, playing with children and sports. In the less frequently visited sites, culture and everyday connection (e.g., biking to work) were more common than activities or values related to nature. Walking a pet was more common in sites that were visited as often as normal, whereas being outside, closeness to nature and hiking were more common in new sites.

More than one-third (38.9 %) of the sites offered multiple ecosystem service benefits (6–18 activities/values). Spatial hotspots of multiple

benefits sites are located on Ruissalo Island, Uttamo coast, and the riverside in Halinen, and in the northern part in the national park (Natura area) (Fig. 5).

3.6. Contributions of nature to subjective well-being

In general, respondents find looking at or recreating in nature meaningful and positively affecting their mood and social interaction (49.2–96.6 % strongly or partly agree with all the statements, Fig. 6). More than half statements exhibit statistically significant differences based on the changes in respondent's outdoor recreation behaviour during COVID-19 (Fig. 6, Table A4). Among the respondents who decreased their weekly outdoor recreation days (group D), significantly fewer agreed with or more were undecided about the five statements compared to other respondents (groups A–C). In particular, significantly fewer of those who decreased outdoor recreation (group D) agreed (63.4 %) with the statement "Spending time in nature instead of inbuilt environment is important for my positive mood" compared to all the other respondents (in groups A–C, over 80 % agreed; $H(3)$, 12.605, $p = 0.006$, for pairwise comparisons refer to Table A4). There is also a significant reduction in agreement with the statement "Natural environment has been an important supporting factor for my well-being during COVID-19" between those who recreated seven days a week (in group B 88.4 % agreed) and those who recreated one day a week (60.0 % agreed) ($p = 0.046$)($H(6)$, 18.702, $p = 0.005$).

4. Discussion

4.1. Increased outdoor recreation but different adaptation opportunities to a pandemic situation

In this study, we aimed at understanding how people perceived their outdoor recreation had changed and how urban nature contributed to their subjective well-being during the early phases of the COVID-19 pandemic in spring 2020 in the context of a middle-sized Nordic city.

Nearly half of the respondents, particularly women, increased outdoor recreation in spring 2020, and especially families with children recreated every day. The shift to remote working and change in everyday routines positively contributed to increased outdoor recreation. However, the number of reported outdoor recreation days gave somewhat different results as the open responses further revealed that many of those (17.1–41.2 %) who did not report an increase in weekly recreation days nevertheless felt they had increased outdoor recreation. Over half of the respondents had observed an increase in other residents' outdoor recreation. Overall, our results provide empirical evidence regarding the important role of outdoor recreation and urban green infrastructure for urban dwellers during the pandemic. This is not unexpected in the Finnish context where no outdoor movement restrictions were applied. Similar observations have been made in other Western cities regardless of the restrictions on going outdoors (Day, 2020; Fisher et al., 2020; Lopez et al., 2020; Ugolini et al., 2020; Venter et al., 2020). In circumstances where outdoor movement was not restricted, Venter et al. (2020) found that in Oslo, Norway, outdoor recreation increased regardless of weather and season and was distributed more equally across different times of day. Our study does not go into such detail, but we expect the situation to be similar in Turku. The increase in outdoor recreation in Turku did not, however, come without trade-offs, as some respondents (8.2 %) experienced crowding at recreation sites or negative changes in respect towards nature and littering.

Respondents described the importance of urban nature near their residence as very important, but sites located further away were also mentioned. This is confirmed by the spatial patterns of mapped outdoor recreation sites, out of which over 70 % are within or in the vicinity of the city's official recreation sites, over-represented at forests and semi-natural areas, and one out of six mapped sites is located outside Turku in well-known recreational and conservation areas. Further exploration

revealed that the majority, over 80 %, of sites were visited with similar frequency or more often compared to pre-COVID-19 times. These are generally located close to home, supporting the evidence from empirical studies in normal times (Kajosaari and Pasanen, 2021) and during COVID-19 (Lopez et al., 2020; Ugolini et al., 2020), and the established theory of geographic discounting of values (Norton and Hannon, 1997).

Then again, the small amount (5 %) of completely new sites were located furthest away from residences and indicate an exploration of the recreation possibilities in Turku and beyond. The trend is confirmed by visitor counts at Finnish national parks, which increased in 2020 by 20 % compared to the previous year (Metsähallitus, 2020). Also Fisher et al. (2020) noticed in Vermont, U.S., that many visits to natural parks during COVID-19 were by infrequent visitors or first-timers who considered these visits very important. Furthermore, Kajosaari and Pasanen (2021) point out that infrequently accessed nature destinations located further from home may contribute to restorative experiences by offering a distance from everyday issues and activities, which can be a crucial push motive (cf. Hartig et al., 2014) to visit these sites during a pandemic.

Although the spatial patterns indicate that the city centre, particularly the riverside park and sport areas, has a high density of outdoor recreation sites, these very same areas were also among the 12 % of sites visited less often during the COVID-19 spring, and distinguished by land uses from other types of sites. Also, the cultural ecosystem service benefits provided by the less-visited sites reveal that these are located mostly in built-up areas and less in nature. In general, the urban core is highlighted as a spatial cold spot of ecosystem service benefits, which can connect to the narrow variability of outdoor recreation environments at the centre. This again, is challenging for those who do not have the ability to access sites elsewhere. Our results provide further evidence for the interpretation by Venter et al. (2020), who also revealed a pattern of decreased outdoor activities in the city centre but pointed out that despite of this, the centre might offer important pockets of green space to groups with limited mobility such as children and elderly residents.

In fact, the more frequently visited sites received the highest number of ecosystem service benefits, also observed by Rall et al. (2017) in a non-crisis situation, which indicates that engagement with nature may increase the meaning of it (Bieling et al., 2014) and further confirms that urban nature gained importance during the pandemic. The ecosystem service benefits offered by these sites particularly relate to nature, pleasant environment, playing with children and sports – that is, both to activities and values. Notably, a difference to previous studies (Garcia-Martin et al., 2017; Ives et al., 2017; Rall et al., 2017) addressing a non-crisis situation is that social interaction was not among the most important benefits, also evident in the survey by Fisher et al. (2020) in the COVID-19 situation. This indicates that, most often, people move outdoors alone or in small companies, such as family (Venter et al., 2020).

All hot spots of cultural ecosystem services are in the vicinity of the sea or river, indicating areas appreciated for their nature. The importance of water in green space experience has also been noticed in other coastal Finnish cities (Kytä et al., 2013) and, in general, is not surprising, as water elements are favoured by people and offer multiple psychological and social benefits (Bell et al., 2015; Newell, 1997). From the ecosystem service benefit perspective, this reveals interesting tendencies, as the popular recreational island of Ruissalo has several hot spots of benefits, but some people also visited it less often, potentially due to crowding or not being able to access it using public transport due to COVID-19 risk.

The results also indicate that the contributions of nature to perceived well-being during COVID-19 spring were strong regardless of the frequency of outdoor recreation. Even among those respondents who recreated very little, only one day per week in the COVID-19 spring, the

majority stated that the natural environment was an important supporting factor for well-being during COVID-19. A study from Canada also showed that physical activities, especially when done outdoors, during the pandemic times have a positive impact on well-being and mental health regardless of the individual's activity levels before COVID-19 (Lesser and Nienhuis, 2020). Most of our statements measuring nature's contributions to subjective well-being were, though, perceived more positively among those who recreate more often outdoors. These results may indicate that the crisis situation can strengthen the nature connection for the majority of people, which can eventually lead to increased environmental awareness and motivate environmental stewardship actions (Bennett et al., 2018) (Bennett et al., 2020).

Specific attention should be given to the fact that COVID-19 affected people and their adaptation opportunities during a pandemic in different ways. This is highlighted by the open-ended responses in the survey. For some respondents, life was slowed down in a positive way and outdoor recreation increased. On the other hand, some respondents had more work and less free time, avoided the risk of infection, disliked crowds or littering, had limited access to nature further away, or were paralyzed by the fact that their normal indoor physical exercise routine or active commute was disrupted, which narrowed the opportunities to benefit from urban nature. In a study from Ireland, Lades et al. (2020) show that, while outdoor activities support mental well-being, other everyday activities such as home-schooling forced by the pandemic situation can have an opposite effect on well-being. Nature experiences increase the capacity to manage life tasks and other aspects of psychological well-being (Bratman et al., 2019) and this role is stressed during a pandemic. Responding to the various needs should be a priority in green infrastructure development and crisis response of municipal authorities to increase overall adaptation strategies in a pandemic situation.

Future studies should address how outdoor recreation behaviour changes during the extended pandemic. For example, in the Finnish context, usage of green urban areas decreases in winter (Tyrväinen et al., 2007), and this raises questions on how the well-being benefits supported by urban green infrastructure change during the extended pandemic in the winter months (Rice and Pan, 2020). Furthermore, the role of small-scale greenspaces within residential areas offering purposeful and unplanned, incidental nature experiences for human well-being in the context of a crisis would deserve further attention (Beery et al., 2017). There is also a need for greater exploration of the proportion and type of green infrastructure that relates to specific outdoor recreation sites and related ecosystem service benefits (see e.g. Palliwoda et al., 2020; Wood et al., 2017). In addition, further research should address the outdoor recreation behaviour among those residents who were most affected (e.g., risk groups, youth) by the COVID-19 restrictions and among those who do not respond to online surveys in order to address their needs.

Due to the quick reaction to the COVID-19 situation in spring 2020, we applied a crowdsourced sampling approach. Hence, it is not surprising that the sample is biased in terms of some socioeconomic and demographic characteristics, and only a few responses in the minor languages spoken in the city were captured. However, we observed that women, middle-aged people, and highly-educated people seem to respond more often to studies on green areas (Pietrzyk-Kaszyńska et al., 2017; Rall et al., 2019; Tyrväinen et al., 2007). It can also be expected that those who recreate outdoors actively have more interest in responding to the survey (Ugolini et al., 2020). These biases should be recognized when the results are used to inform planning.

4.2. Implications for urban green infrastructure planning

Overall, the importance of nearby urban green infrastructure is well-

reported in Finnish cities (Kajosaari and Pasanen, 2021; Tyrväinen et al., 2007) and recognized internationally at a political level (EC, 2013; UN, 2015). During the COVID-19 pandemic, the importance of urban green infrastructure and outdoor recreation to human well-being has also been highlighted in several recent international and country-specific studies (e.g. Dzhambov et al., 2021; Hanzl, 2020; Jackson et al., 2021; Pouso et al., 2020; Soga et al., 2021). Our results on the general level confirm these observations. Our results indicate that the city of Turku has a green infrastructure network that is used intensively, as indicated by the high number of mapped sites coinciding with the official recreation areas (>72 %) and the National Urban Park (>40 %). However, our study highlights that urban planning should respond to different needs for outdoor recreation in order to widely, and in a just way, promote the well-being benefits of urban nature during a pandemic (Derks et al., 2020; Lennon, 2020; Raymond et al., 2016; Wolch et al., 2014). For example, in the case of Turku, the crowding of the city centre was a challenge for nearby outdoor recreation among some residents. It is important to consider how the outdoor recreation possibilities in this core public space of the city can be ensured during the extended pandemic and in future possible crises, but also under the ongoing urban densification process promoted to achieve sustainable urban environments (OECD, 2012). One suggestion could be to close the main streets to car traffic in the centre on weekends in order to have more space for active mobility (Slater et al., 2020). In addition, the development of biking and public transport infrastructure is required to enable safe access to pleasant nature experiences outside the urban core. Developing green infrastructure on roofs, walls and balconies might offer important small-scale greenery experiences, particularly in the urban core, and could offer connection to nature even for those who have limited possibilities for mobility. Participation of local residents in the development of outdoor recreation and green infrastructure can be effective through a place-based approach applied in the UK during the COVID-19 pandemic ("Edinburgh Spaces For People," 2020). Overall, a participatory mapping approach is effective in capturing a heterogeneity of values related to green infrastructure, targeting attention to various types of outdoor recreation sites (Ives et al., 2017) and also illuminating their intangible qualities (Pietrzyk-Kaszyńska et al., 2017).

From the perspective of green infrastructure development, particularly valuable are areas that provide multiple ecosystem services for people but are at the same time of ecological importance (Andersson et al., 2014). Such truly multifunctional sites offer real potential to improve biodiversity conservation and well-being outcomes simultaneously (Ives et al., 2017; Lachowycz and Jones, 2013). This is important in the midst of urban densification pressures and to reach the political targets, for example on Urban Greening at the EU (EC, 2020). Multiple ecosystem service benefits including, for example, air quality improvement, runoff water management and positive well-being effects often bring along economic benefits as well (Elmqvist et al., 2015). One approach to start identifying these multifunctional sites is the participatory mapping approach applied in this study.

The extending COVID-19 pandemic situation, and also any future crises that are likely to be caused, for example, by climate change, set new challenges for cities. In the current pandemic, people are anchored to place in unprecedented ways causing a fundamental shift in our relationships with place (Devine-Wright et al., 2020). Our results highlight that green infrastructure is crucial for people during a crisis. The future resilience of cities is based on sustainable pathways in the present (Elmqvist et al., 2019) and urban nature is an important part of increasing the resilience (Gómez-Baggethun and Barton, 2013). For urban resilience the particular sites offering outdoor and nature experiences have a key role in maintaining well-being, social interaction (among some residents), and connection to nature. Hence, accessibility

to green infrastructure needs to be at the core of urban planning (Samuelsson et al., 2020). Governance in green infrastructure development requires actions that enable and stimulate active citizenship (supported, for example, by the participatory mapping approach Kahlila-Tani et al., 2016), co-development, and cultural and regional diversity (Buijs et al., 2016; Faehnle et al., 2014). In other words, participation of urban dwellers is important in order to bring people and groups from different backgrounds into green infrastructure development to support the provision of outdoor recreation possibilities to everyone.

5. Conclusions

In this study, we showed that overall Turku citizens used the green infrastructure in the city and beyond intensively during the COVID-19 spring. Respondents increased outdoor recreation particularly at sites that offer multiple cultural ecosystem service benefits. Nature gained importance in the exceptional situation and people considered that the contributions of nature to subjective well-being during COVID-19 spring were strong regardless of how actively they recreated outdoors. Importantly, our results also highlight, firstly, a significant share of respondents who experienced crowding or negative effects caused by the overall increased outdoor recreation patterns and, secondly, the differences in needs and levels of resilience among the respondents. This stresses that urban planning should better respond to different needs for outdoor recreation in order to widely, and in a just way, promote the well-being benefits of urban nature during a crisis, and to increase the resilience of the city and its residents. Based on our results, we suggest some good practices for urban planning (see discussion) and the promotion of more inclusive, place-based, participation of urban dwellers coming from different backgrounds. In terms of crisis situations, such as the COVID-19 pandemic, further studies should strive to address the views of those residents who are most affected by it and not reached with online surveys.

Data statement

The survey data is available at the University of Turku Geospatial Data Service at: <https://geonode.utu.fi/layers/geonode:Places>

Author statement

Nora Fagerholm: Conceptualization, formal analysis and visualization, writing - original draft, review and editing, project management, and funding acquisition. **Salla Eilola:** conceptualization, formal analysis, and visualization, writing - original draft, review, and editing. **Vesa Arki:** data curation, formal analysis, and visualization.

Declaration of Competing Interest

The authors report no declarations of interest.

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Appendix A

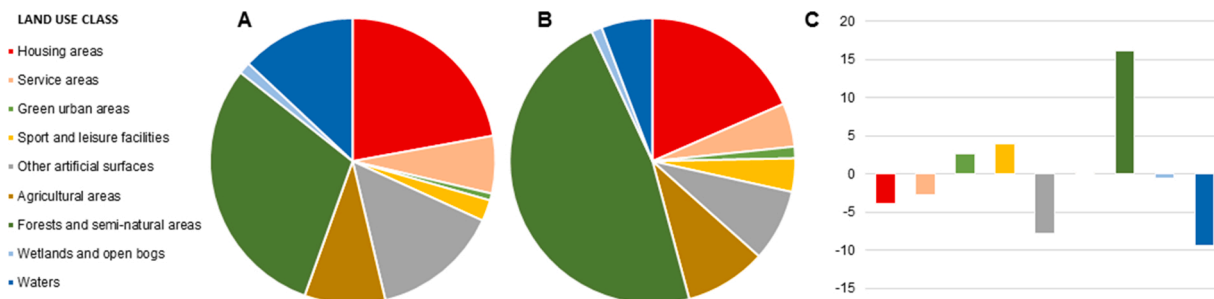


Fig. A1. Relative share (%) of each land cover class in the city of Turku (A) and within a 250 m buffer around each mapped outdoor recreation site (B). Graph C shows z-scores (y-axis) of mapped sites by land cover class (x-axis). Z-score bars higher than +1.96 and lower than -1.96 indicate that the specific ecosystem service benefit is statistically significantly ($p \leq 0.05$) over- or under-represented in a specific land cover class based on the proportion of that land cover class in the city of Turku.

Table A1
Reclassification scheme for the Corine Land Cover (CLC) data.

Reclassified categories	CLC Level 4 codes	CLC Level 4 names
Housing areas	1111	Continuous urban fabric
	1121	Discontinuous urban fabric
Service areas	1211	Commercial units
Green urban areas	1411	Green urban areas
Sport and leisure facilities	1421	Summer cottages
	1422	Sport and leisure areas
	1423	Golf courses
Other artificial surfaces	1212	Industrial units
	1221	Road and rail networks and associated land
	1231	Port areas
	1241	Airports
	1311	Mineral extraction sites
	1321	Dump sites
	1331	Construction sites
Agricultural areas	2111	Non-irrigated arable land
	2221	Fruit trees and berry plantations
	2311	Pastures
	2312	Natural pastures
	2431	Arable land outside farming subsidies
	2441	Agro-forestry areas
Forests and semi-natural areas	3111	Broad-leaved forest on mineral soil
	3112	Broad-leaved forest on peatland
	3121	Coniferous forest on mineral soil
	3122	Coniferous forest on peatland
	3131	Mixed forest on mineral soil
	3132	Mixed forest on peatland
	3241	Transitional woodland/shrub cc <10 %
	3242	Transitional woodland/shrub, cc 10–30%, on mineral soil
	3243	Transitional woodland/shrub, cc 10–30%, on peatland
	3311	Beaches, dunes, and sand plains
Wetlands and open bogs	3321	Bare rock
	4111	Inland marshes, terrestrial
	4112	Inland marshes, aquatic
	4121	Peatbogs
Waters	4211	Salt marshes, terrestrial
	4212	Salt marshes, aquatic
	5111	Water courses
	5121	Water bodies
	5231	Sea and ocean

Table A2
Comparison of survey respondents (n = 730) to population in the city of Turku (192,962 inhabitants).

	Survey respondents	Turku population ^{a,d}
Gender % (n* = 719)		
Male	26.8	47.8
Female	72.3	52.2
Other	0.8	NA
Age distribution % (n = 717)		
15–44	60.4	51.5
45–64	29.6	24.7
65+	10.1	23.8
Education level % (n = 465)		
Only primary education completed	2.2	23.5 ^b
Secondary education completed	31.7	40.8 ^b
Post-secondary non-tertiary education	NA	0.7 ^b
Tertiary education completed	65.2	35.0 ^b
Households (n = 462)		
Households of one person %	31.2	53.1 ^b
Households of five persons or more %	4.1	2.6 ^b
Average household size (persons)	2.2	1.8 ^b
Proportion of unemployed from workforce %	7.8	11.2 ^e
Pensioners %	13.3	24.1 ^b
Proportion of population per subareas of Turku % (n = 657)		
Keskusta	34.9	29.6 ^c
Hirvensalo-Kakskerta	4.3	5.9 ^c
Skanssi-Uittamo	14.5	12.6 ^c
Varissuo-Lauste	7.6	9.8 ^c
Nummi-Halinen	17.7	11.6 ^c
Runosmäki-Raunistula	5.5	8.0 ^c
Länsikeskus	10.4	12.3 ^c
Pansio-Jyrkkälä	2.3	5.0 ^c
Maaria-Paattinen	3.0	5.1 ^c

* n denotes the amount of informants per survey question.

^a 2019 statistics unless otherwise stated.

^b 2018 statistic.

^c 2016 statistics.

^d Source Statistics Finland unless otherwise stated.

^e Source ELY-Centre of Southwestern Finland.

Table A3

Comparison between categories of changes in visitation frequency in outdoor recreation sites during COVID-19 spring in 2020 (less frequently, no change, more frequently, new site) and land uses analysed using the Kruskal-Wallis test and Dunn's procedure with a Bonferroni correction for multiple comparisons. Table shows only land use classes with statistically significant differences between categories shown in Table 3.

Land use class	Less frequentlyNo change	Less frequentlyMore often	Less frequentlyNew site	No change-More frequently	No change-New site	More frequently-New site
Service areas	0.000***	0.002**	0.000***	0.708	0.199	0.027*
Green urban areas	0.000***	0.042*	0.000***	0.273	0.613	0.063
Sport and leisure facilities	0.001***	0.003**	0.014*	1.000	1.000	1.000
Other artificial surfaces	0.000***	0.017*	0.025*	1.000	1.000	1.000
Forests and semi-natural areas	0.000***	0.000***	0.000***	1.000	0.141	0.214
Waters	0.011*	0.005**	0.001*	1.000	0.252	0.447

* $p < 0.05$.

** $p < 0.01$

*** $p < 0.001$

Table A4

Comparisons between the four categories of change in the number of outdoor recreation days before and during COVID-19, and statements of nature's contribution to subjective well-being. The differences between the respondent groups were analysed using the Kruskal-Wallis test and Dunn's procedure with a Bonferroni correction for multiple comparisons. Respondent groups: A = respondents who increased their outdoor recreation days, B = respondents who recreated everyday regardless of the COVID-19 situation, C = respondents whose amount of outdoor recreation days did not change despite the possibility of it, and D = respondents who decreased their outdoor recreation days.

Statements	Sig.	Pairwise comparisons of responses of respondent groups A, B, C and D					
		A-B	A-C	A-D	B-C	B-D	C-D
Natural environment has been an important supporting factor for my well-being during COVID-19	0.000 ***	0.225	0.000 ***	0.000 ***	0.331	0.001 ***	0.072
Nature has had a significant role in sustaining my social life during COVID-19	0.002 **	0.052	0.074	0.012 *	1.000	0.848	0.936
I feel that interaction and taking contact with people become easier when I am in nature	0.187	NA	NA	NA	NA	NA	NA
I feel that I am part of something bigger than myself when I spend time in nature	0.277	NA	NA	NA	NA	NA	NA
My problems seem smaller when I am in natural environment	0.028 *	1.000	0.772	0.024 *	1.000	0.127	0.418
It is easier for me to be my authentic self in nature instead of in built environment	0.046 *	1.000	1.000	0.072	1.000	0.030 *	0.142
Nature increases the meaning in my life	0.076	NA	NA	NA	NA	NA	NA
Spending time in nature instead of in built environment is important for my positive mood	0.006 **	1.000	1.000	0.004 **	1.000	0.006 **	0.009 **
Looking at nature evokes positive emotions in me	0.029 *	0.326	0.332	0.076	1.000	1.000	1.000

Multiple comparisons are not performed when the overall test does not show significant differences across samples.

*** p < 0.001.

** = p < 0.01.

* p < 0.05.

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