NATTOURS

Urban ecosystem services – case study: Helsinki and Tallinn

Deliverable 2.16.1

Heidi Tuhkanen, Piret Kuldna,
Meelis Uustal
SEI Tallinn Centre

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Authors: Heidi Tuhkanen (SEI Tallinn), Piret Kuldna (SEI Tallinn), Meelis Uustal (SEI Tallinn)

This report is based on the following NATTOURS reports: Literature review on urban ecosystem services with a specific reference to Helsinki and Tallinn (Tuhkanen et al. 2017), URBAN GREEN AREAS IN HELSINKI AND TALLINN (RAIT Faktum & Ariko) and Visitor Survey Report (Kuldna, Poltimäe and Uustal 2017). This deliverable has been written in the frame of the NATTOURS project, which aims to improve public recognition of natural tourist attractions in Helsinki and Tallinn and to develop joint tourist attractions and products for sustainable nature tourism between the two cities.

NATTOURS project is a joint cooperation venture of Tallinn Environment Department, Estonia; City of Helsinki, Finland; Stockholm Environment Institute Tallinn Centre

Contents

Summary:

The main aim of this study is to provide improved information about the overall relevance of and/ importance of ecosystem services (namely cultural ecosystem services) provided by the city green areas overall, the NATTOURs focus areas, as well as the green areas in the resident's vicinity. This information can be used as input into decision making processes related to planning. This study is the compilation of several studies performed in the Nattours project. First, it utilises the literature review of urban ecosystem services, which focused on northern European literature, and the collected ES indicators available in each city. It also presents the relevant results from the online resident survey and first visitor survey. Ecosystem services (ES) (or goods and services) *are the societal benefits derived from ecosystems or nature* (de Groot et al. 2002; Millennium Ecosystem Assessment 2005). Humans are dependent on the flow of these ecosystem services. For the purposes of this report, we will consider three ecosystem service categories – cultural services, provisioning services, and regulating services.

Both Tallinn and Helsinki have a range of urban green areas from pocket parks to urban forests and provide its residents with nature based recreation opportunities through maintaining public recreational areas. In 2015 Helsinki owned and maintained to some degree 7433 ha green areas, making up roughly 34% of city area. In Helsinki practically 100% of residents live within 300 m of green areas (City of Helsinki 2015). Tallinn has 3531 ha of green areas, which makes up about 22% of city area. 81% of the population lives within 300m (Tallinn City Environment Department 2016) from the nearest green area of at least 0,5 ha in size[1]. According to the online resident survey, residents of both cities consider it important to live close to a green area. Out of the urban green area types provided[2], parks were the most important type of green space to live near.

Overall, there is satisfaction and optimisim about accessibillty of local green areas in both cities. In terms of satisfaction Helsinki was in general more satisfied with the present state, Tallinn more optimistic about the future state. In both cities, there is vvariability at district level exists, but moreso in Tallinn than Helsinki. On the whole, residents in both cities felt that the closest urban green area provide at a relatively high level opportunities a range of activities. However, there are subtle differences between some of the districts and activities, as well as the results from Tallinn and Helsinki. In both cities, most respondents had spent time in their closest green area during the last year - most often in the summer and the least often in the winter. In Tallinn, slightly fewer respondents spent time in the green areas at least once a week compared to respondents in Helsinki. In both cities, physical health, mental relaxation, and spending time with other people or pets were the top 3 motivations for use of local green areas, though in different order.

In both cities, respondents felt that urban green areas were important because they provided them with places to breathe fresh air and walk, which were top rated activities or opportunities enabled by green spaces. Residents of Tallinn also felt that being in tranquillity was important. Though there were not so many differences between how Helsinki and Tallinn residents ranked the various reasons for importance, there were differences in the extent of importance placed on various reasons.

Residents were also asked to value urban green areas in their city in general. For Helsinki residents, the top four ranked values were biodiversity, recreational, therapeutic and aesthetic,

[1] More details about the cities ecosystem services provide context within the report, and are also captured in Annex 2.

[2] Types proposed include: a park, small wooded area, forest, green space alongside water, a green space with playground and/or fitness equipment, and an area where it is possible to garden

while for Tallinn residents, they were: recreational value, life-sustaining value, therapeutic and aesthetic value. Nattours case studies were valued in a similar manner but according to a shorter values list. The overall values at each of the sites was high and corresponded logically with the opportunities at each site.

Relevant to all of the above issues, identifying the differences within cities or between sites or districts can help identify opportunities for improvement. Some of these larger differences have been identified as recommended city actions in the Recommendations part of the report.

1. Introduction: Ecosystem services as input into policies

Ecosystem services (ES) (or goods and services) ***are the societal benefits derived from ecosystems or nature*** (de Groot et al. 2002; Millennium Ecosystem Assessment 2005). Humans are dependent on the flow of these ecosystem services from nature and ecosystem services contribute to human well-being. For the purposes of this report, we will consider three categories of ecosystem services[3] – cultural services (non-material benefits), provisioning services (products), and regulating services (benefits gained from the regulation of ecosystem services).[4] A CICES classification based table of ES categories is found in Annex 1. Examples from each category can be seen in Figure 1 and include food, clean air and water, as well as recreation possibilities. For further scientific literature related to specific services and their generation, please see the review of urban ecosystem services in Gomez-Baggethun and Barton (2013) and Niemelä et al. (2010). Furthermore, there is a study report which specifically discusses (in Finnish) ecosystem services, as well as the impact of densification on various ecosystem services in the Helsinki region (see Aho et al. 2011).

These ecosystem services are a foundation for our life and many of our activities. However, human activities also impact ecosystem services - ecosystem services can be either supported or degraded by human activities. Planning and regulation guide those activities and accounting for ecosystem services in decision making can help to support the ecosystem services, which in turn support society. Using an ecosystem service approach in planning can help policy makers shift from single issue policies, e.g. aimed at establishing and maintenance of green infrastructure, to integrated policies which recognise the services that green infrastructure provide (European Commission 2016). City level mapping can serve as input into planning and implementation phases of policy development (Pulighe et al. 2016). Often urban green areas can promote multiple ecosystem services (Liquete et al. 2016) and also support other societal goals (European Commission 2016). Accounting for ecosystem services in the planning phase is much more cost-efficient than covering the costs of the loss or restoration of ecosystem services in the future (Niemelä et al. 2010).[5]

2. Aims

The NATTOURs project aims to improve the public recognition of the natural tourist attractions in the two cities and develop sustainable nature tourism between the two cities. Information in Chapter 9 could be used directly in planning of the specific case study sites. In order to support

[3] CICES calls this level of categorising „section“ rather than category.

[4] Another classification method, Millennium Ecosystem Assessment (MA) includes a fourth category of supporting services (services that are needed for the production of the other 3 categories) (MA, 2003). However, CICES considers supporting services as having indirect outputs. Thus to avoid double counting them, CICES has left this category out (European Environment Agency 2017b). The classification frameworks differ slightly, but equivalences between CICES, MA and TEEB can be found at http://cices.eu/the-equivalences-between-cices-and-the-classifications-used-by-the-ma-and-teeb/

[5] Planning and decision making should also consider potential disservices, which are defined as ecosystem functions that are negative from a human perspective. Examples of these services which are in conflict with human benefits, such as allergic reaction to pollen, are given in Gomez-Baggethun and Barton (2013).

the city partners of Helsinki and Tallinn with this aim, several methods were utilised to gain a better understanding of the ecosystem services in these cities and several specific sites, and

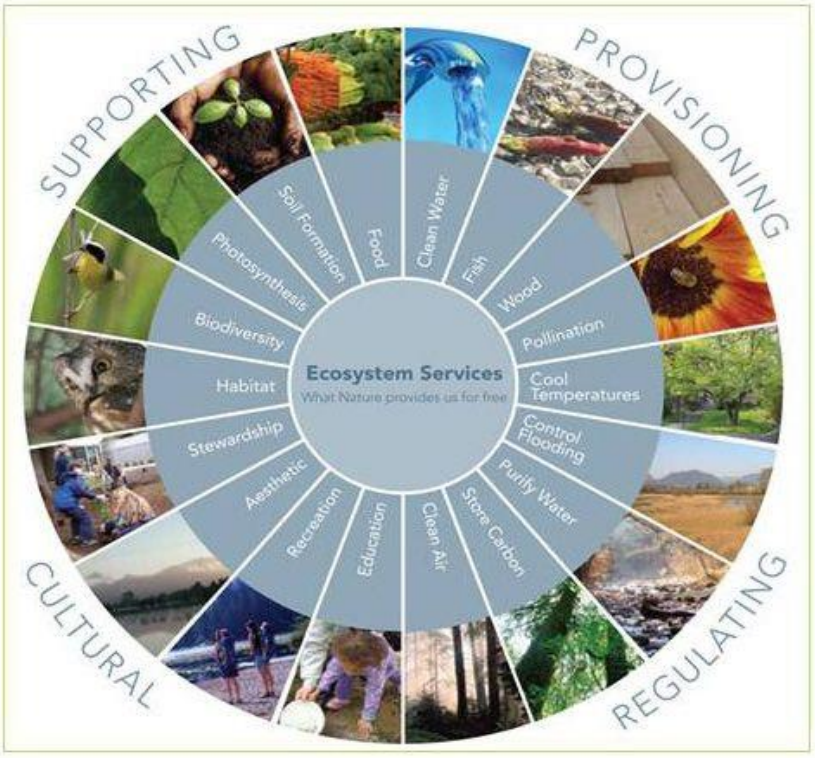

Figure 1The four categories of ecosystem services and examples of each. Source: TEEB, 2005.

to get to know more about the visitors, their expectations and how their experience at the sites can be maximised. To do so, an initial onsite visitor survey was carried out in several case study areas (1 of 2 total in the project) in each city, a desk-study of literature and indicators related to urban ecosystem service was performed, and an online survey was carried out to capture general resident preferences and uses at a city level, site level, and neighbourhood level. In this report about ecosystem services, we will briefly describe our methods, as well as and present the results of our studies: desk study, initial visitor survey (as it relates to ecosystem services) and the online visitor survey.

3. Methods

In order to better understand the ecosystem services associated with the urban green areas of Helsinki and Tallinn, we performed a **desk study** focused on, but not limited to, a review of literature from Northern Europe, namely Finland and Estonia and an assessment of indicators following the Urban MAES project. This desk study was supplemented by two surveys – one which was conducted on-site in some of the sites which were selected for an in-depth look at urban green areas – 3 in Tallinn and 2 in Helsinki, as well as an online survey of 500 residents in both Tallinn and Helsinki related to their use and perceptions of urban green areas at several levels. Questions relating to the sites were also included. Below, the desk review results will create the context for the results of the visitor and online surveys.

The **visitor survey** was conducted to gather information about visitors, their routes, destinations, and the reasons for their visit, their current knowledge of ecosystem services, interests, as well as their preferences in terms of investments. The surveys were conducted as face-to- face interviews, built on the Paljassaare visitor survey by Estonian University of Life Sciences (2012) Quantitative survey. Most of the questions are pre-defined (single- and multi-

choice responses). Visitors were interviewed in September to October 2016. The number of interviews conducted was 470 in Estonia covering 3 sites and 164 in Finland covering 2 sites.

The **online survey** was conducted to gather information about residents, the overall relevance of and/ importance of cultural ecosystem services provided by the city green areas overall, NATTOURs focus areas, as well as the green areas in the resident's vicinity. Furthermore, there were several questions related to their general awareness of regulating ecosystem services, whether they engage or would like to engage in gardening (provisioning services), as well as several demographic questions. The surveys were conducted by a survey company (Faktum & Ariko). The survey had a high response rate and took on average 23 minutes. The number of valid respondents were 500 in both Helsinki as well as Tallinn. Most of the questions are rating questions using the Likert scale. Other question formats included predefined and ranking questions. The online survey was conducted in the autumn and winter (October 2017, with a few additional respondents in December 2017). More information about the sampling and methodology are available in the initial report (Faktum & Ariko 2017).

4. Urban green areas in Helsinki and Tallinn

Both Tallinn and Helsinki have a range of urban green areas from pocket parks to urban forests to different extents. Both cities provide its residents with nature based recreation opportunities through maintaining public recreational areas. Figure 2 shows the potential recreational areas in Helsinki. For example, in 2015 Helsinki owned and maintained to some degree 7433 ha green areas (roughly 34% of city area). This includes built up parks, fields, forests, protected areas, as well as other green areas (Helsingin kaupungin tietokeskus 2017). Tallinn has 3531 ha of public green areas (22% of city area) (Tallinn City Environmental Department 2017). Helsinki has 24 swimming beaches managed by the city sports department (Helsingin kaupungin tietokeskus 2017) and Tallinn has 5 beaches (www.tallinn.ee). Both cities have UNESCO cultural and natural heritage sites. In Helsinki, it is Sveaborg, a sea fortress and in Tallinn, UNESCO cultural and natural heritage sites account for 0,7% of total area and includes the Old Town and its surrounding park (Tallinn City Environment Department 2016).

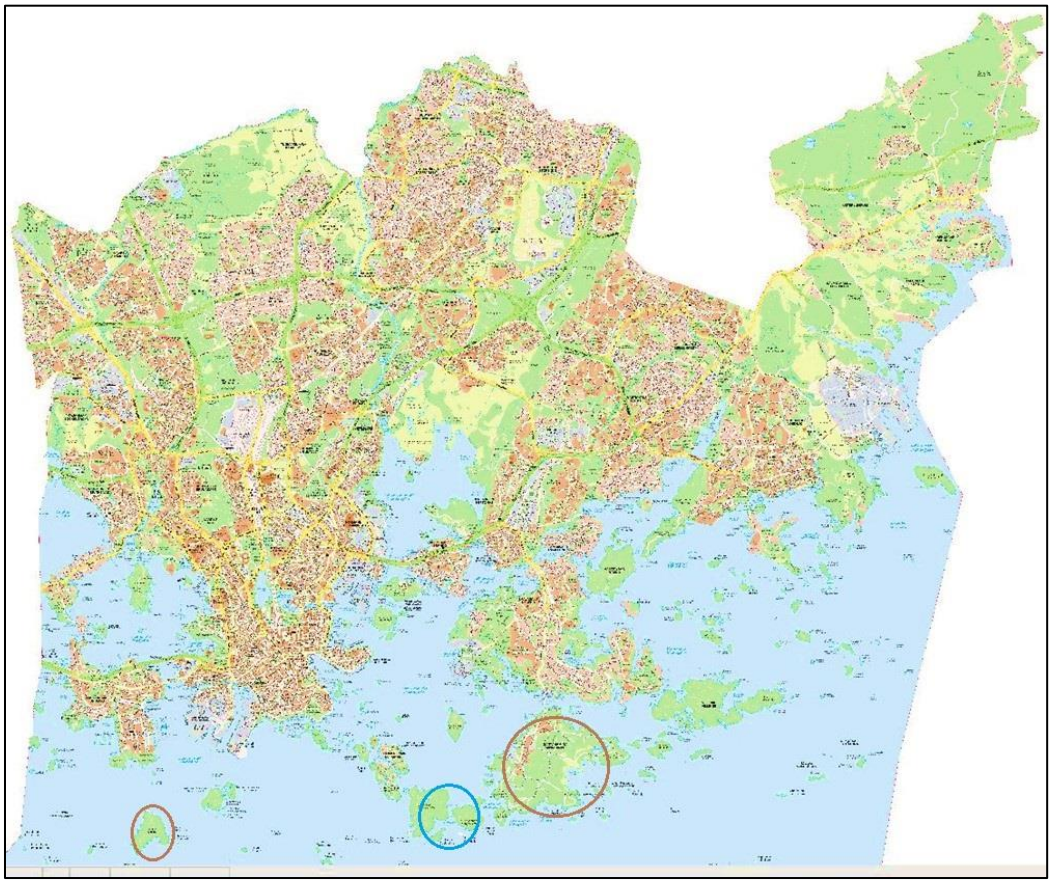

Figure 2 Recreational areas in Helsinki. The green areas are recreation areas, while the yellow areas are field, meadow and reed areas. The encircled brown areas are in military use, while the blue area in 2015 were transitioning from military use to recreational use. Source: Helsinki City Service Division, 2015

Based on the NATTOURs online survey, it is important for both residents of Tallinn and Helsinki to live close to a green area. Out of the urban green area types provided[6], parks, forest, and small wooded areas were the top three most important types to live nearby in Helsinki. In Tallinn, the top three types were parks, forests, and green space alongside water. However, the importance of the green spaces to residents does not yet reveal why they are important. For this, we should look into use and non-use values provided through ecosystem services. (See Figure 3 and Figure 4).

[6] Types proposed include: a park, small wooded area, forest, green space alongside water, a green space with playground and/or fitness equipment, and an area where it is possible to garden

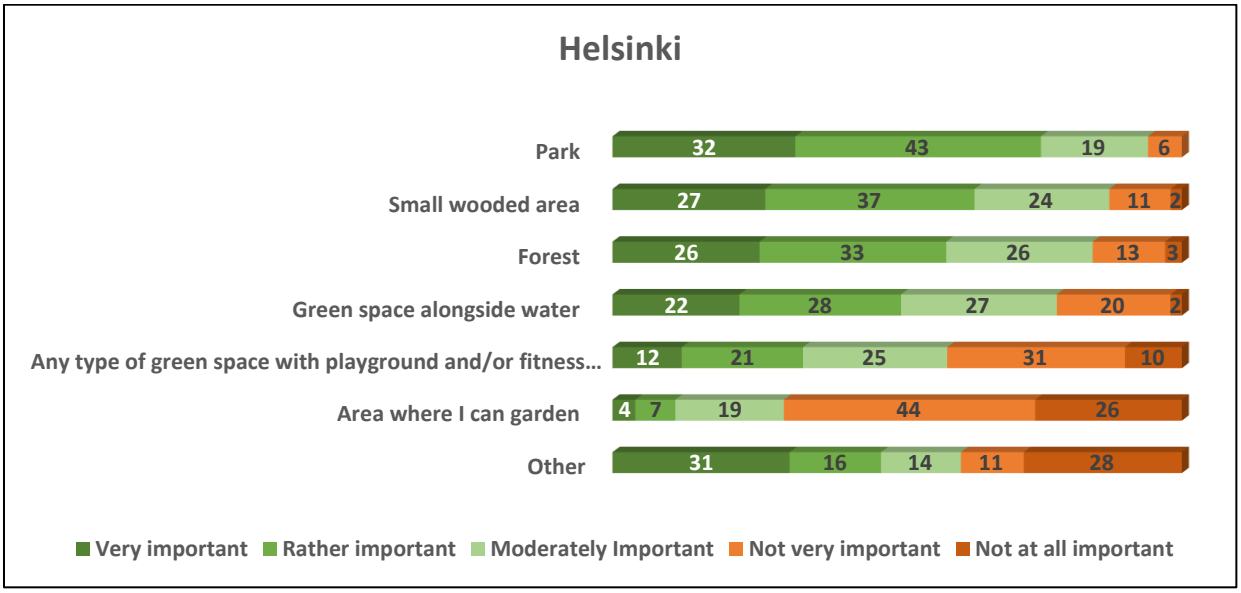

Figure 3 Of the respodents which felt it was important to live near green areas, the level of importance assigned to the type of green area is broken down. Helsinki. Source: NATTOURS online survey. N=397

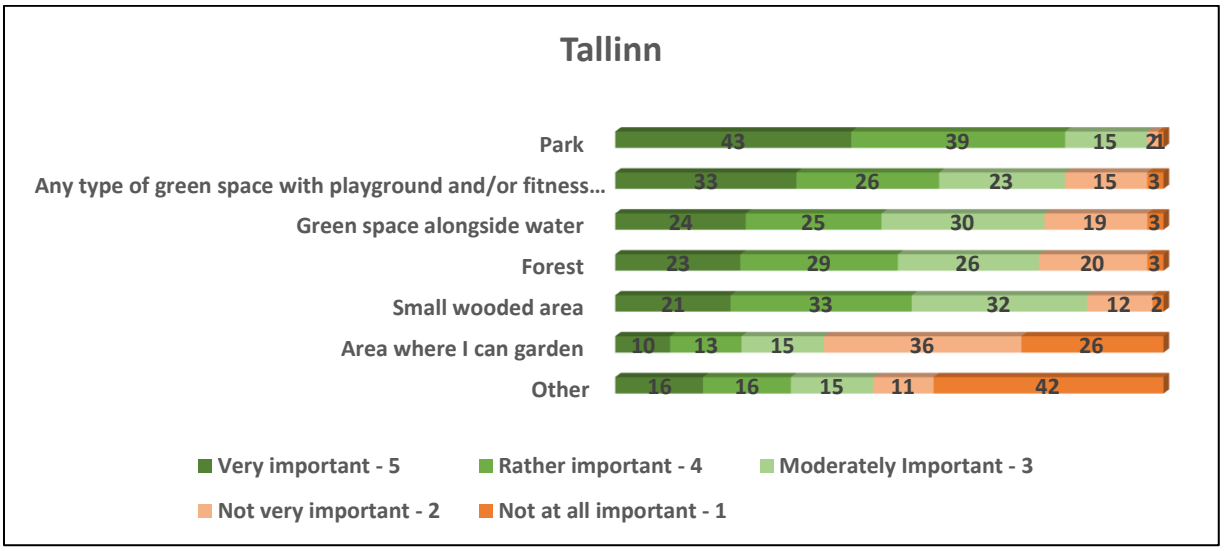

Figure 4 Of the respodents which felt it was important to live near green areas, the level of importance assigned to the type of green area is broken down. Tallinn. Source: NATTOURS online survey. N=473

5. Cultural ecosystem services

Cultural ecosystem services are defined as "non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experience" (Millennium Ecosystem Assessment 2005). Examples include watching animals, walking, boating, leisure fishing, and using natural areas for research or art. This category also includes enjoyment provided by the existence of natural areas even when one is not enjoying them on-site, as well as the preservation of them for future generations (bequest) (EEA 2013). Further examples of cultural ecosystems, their classification type and examples are seen Table 12 in the Annex.

In this report, we cover a range of cultural ecosystem services, including aesthetic value, cultural heritage values, existence and bequest values, however focus on nature based recreational ecosystem services, which is based on the „experiential…and the physical use of land-seascapes" (CICES 4.3) (EEA 2013). In urban areas, recreational ecosystem services

provide people with the possibilities for enjoying a wide range of passive and active activities including moving in nature, picking wild edibles, swimming, or enjoying a picnic, in various kinds and sizes of natural areas, from small green spaces between neighbourhood buildings to larger nature conservation areas (Niemelä et al. 2010). Cultural differences have been identified in terms of preference for passive and recreational activities, with "western countries" preferring activeness (Özgüner 2011).

Benefits of cultural services

There are a number of benefits, namely health benefits, which come from exercising in nature, stress reduction, spending time in nature, and also through decreased exposure to pollution, heat and noise (see WHO Regional Office for Europe 2016). A US based all-women study, conclude that even living in greener areas decreases mortality (James et al. 2016). These benefits are especially important for certain societal groups, such as economically disadvantaged communities, children, pregnant women and senior citizens (WHO Regional Office for Europe 2016). In Helsinki, 98% of senior citizen centres are located within 300 metres from a green area and 47% in immediate proximity within 50 metres from a green area (Figure 5) (City of Helsinki 2017).

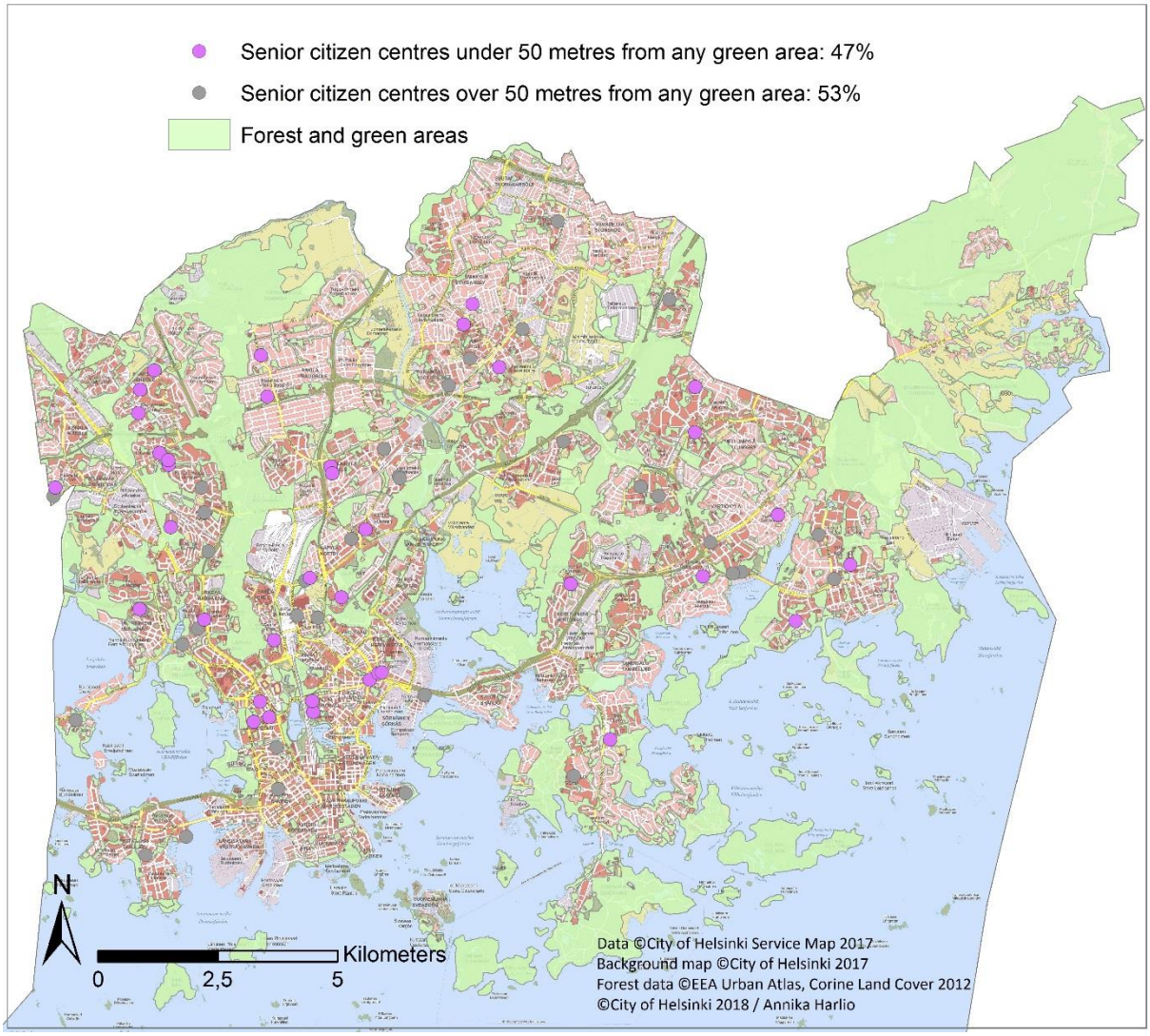

Figure 5 Senior citizen centres within 50 m from a green area. Source: City of Helsinki, 2018

The WHO report also concludes that although the „need for green space and its value for health and well-being is universal", appropriate management and design are locality specific

(2016). This connection between green areas and health is also supported by European studies (see Tzoulas et al. 2007 for a review), and Nordic studies (Kettunen et al. 2015). Numerous Finnish studies have also explored the relationship between nature and health, specifically psychological or emotional well-being (Pouta and Hauru 2015; Pasanen et al. 2014) and how it is impacted by different types of urban environment (managed urban park, large urban woodland and built-up environment) (Tyrväinen et al. 2014). These studies point to the recreational use values (cultural ecosystem services), but also regulatory services (cleaning of air), which green areas provide. Recent research has also highlighted the importance of nature for children. In addition to inspiring and providing a space for children and youth to move around, and learn about nature, there are additional benefits to children's immune systems which comes from being in contact with microbes found in nature (SYKE 2017).

The impact of green spaces on peoples' experiences, health and well-being is influenced by spatial features which influence use, such as "accessibility, design, maintenance, and plant richness and distribution" (Adinolfi et al. 2014). Small changes in design can have large impact on use, as is seen with a study of brownfield use by the coast in Northern Tallinn (Unt and Bell 2014). Accessibility and thus use is influenced by distance from a users' home, with longer distances discouraging daily use (Bertram et al. 2017). However, the relationship is actually quite complex, context dependent and sometimes contradictory (Hegetschweiler et al. 2017; Korpela et al. 2014). Tzoulas et al. (2007) developed a conceptual framework to illustrate this complex relationship. For example, varying potential mediating mechanisms have been identified as time spent in nature (Tyrväinen et al. 2014; Korpela et al. 2014), the actual experience of restoration, (Tyrväinen et al. 2014), physical activity, social engagement, depression, small particulate matter (James et al. 2016) and spatial features such as visibility of the „urban matrix" (Hauru et al. 2012). Tyrväinen et al. (2014) note that the influence of nature exposure on different groups is a research gap. It may be that some of these influences are subjective and culturally dependent. For example, while Hauru et al. (2012) concluded in a study in Helsinki that the visibility of the „urban matrix" affects how perceived restoration is experienced in nature, Hegetschweiler et al. (2017) additionally reminds us how based on results of other European studies, vegetation can also be linked to a feeling of privacy, as well as "a perceived lack of safety."

Management of urban green areas for cultural ecosystem services

All ecosystems potentially provide cultural ecosystem services, though the extent and range of services is determined by the state of that environment (including the level of biodiversity) as well as the level (Maes et al. 2012) and way of management. This means that all kinds of urban green areas, including green infrastructure such as green roofs, have potential to provide benefits, such as psychological restorative benefits (Mesimäki et al. 2017). However, the ecosystem service is only potentially supplied unless it is used. For example, a green area which is not used by the public for recreation has low provision of recreational value and associated health benefits. In order to take advantage of the potential benefits planners need to know where these potential services are provided (supplied), as well as where the services are demanded, keeping in mind that, especially in urban areas, user needs can vary (Haase et al. 2014).

Directly impacting the supply of cultural ecosystem services and their benefits are factors which influence use of the area, such as perceived safety of the area, access, level of facilities for different activities (Adinolfi et al. 2014; Ahlgren-Leinvuo et al. 2017) and the level of management of the area (high or low intensity) (Adinolfi et al. 2014). For example, in Helsinki, problematic issues limiting the extent of physical activity include street lighting and slipperiness of walking and cycling paths and roads (Ahlgren-Leinvuo et al. 2017) Appropriate infrastructure can be used to facilitate the flow of e.g. recreational services to people by, e.g.

increasing the accessibility to nature using hiking and ski trails, birdwatching towers, info centres, and harbours as well as transportation and road networks (Maes et al. 2012). Supporting the use of urban green spaces for physical activity encourages the associated positive impacts on public health (Hunter et al. 2015). However, it is also important to remember that with nature based recreation, increased accessibility can also diminish the area's ability to provide recreation or other ecosystem services, e.g. when accessibility results in environmental impacts. Thus, use should be balanced with the conservation of the green areas and/or nature areas. While increased building near green areas increases accessibility to green areas, the ability of green areas to withstand increased use and intensity is also important to consider in planning processes (Oulun kaupunki 2014).

It is recognised that there are interdependencies between ecosystem services, including cultural ecosystem services. However, more research is needed to e.g. to identify how bird diversity affects cultural ecosystem services of a certain area, and going a step further to identify the ecological requirements for reaching that level of biodiversity (Andersson et al. 2015). Also, it has been suggested that cultural ecosystem services could be a path to creating increased public awareness of other ecosystem services and promoting environmental stewardship (Andersson et al. 2015).

Tallinn and Helsinki – Supply and demand of cultural ecosystem services

Accessibility as an factor of supply

In order to maximise the use of the urban green areas, Finnish guidelines suggest a maximum distance of 300 m to a local green area, which should be 1,5-3 ha at the minimum (Pouta and Heikkilä 1998)(see also Söderman and Saarela 2011 for application in medium sized city context). Extant literature supports the idea that the closer green areas are, the more frequently they will be visited (Neuvonen et al. 2007). In contrast with Tallinn, Helsinki does not integrates the dimension of green area size into its indicator of access to green areas as is suggested in the guidelines above (see Pouta and Heikkilä 1998). However, both cities measure accessibility as to the distance from residence. However, the classification of urban areas may differ and thus impact the results. Helsinki has also created a figure to illustrate a mimimum service level in an ideal situation related to the resident interaction with the green areas. It includes the time it takes to travel to the green area, the green area size, and the description of what the area enables (City of Helsinki planning department 2013).

In order to maximise the use of the urban green areas, Finnish guidelines suggest minimum size of green areas and maximum distances from housing to recreation areas. For example, there should be maximum distance of 300 m to a local park, which should be 1,5-3 ha at the minimum (Pouta and Heikkilä 1998). As is highlighted in Neuvonen et al. (2007), extant literature supports that the closer green areas are, the more frequently they will be visited.

According to city statistics, in **Tallinn**, 81% of the population lives within 300m of a green area of at least 0,5 ha in size (Tallinn City Environment Department 2017) from public green areas. In **Helsinki** practically 100% of residents live within 300 m of green areas (Figure 6) but the size is not specified (City of Helsinki 2015). Additionally, 39% of Helsinki residents live within 300 m of forest. The definition of forest is complex in urban areas but in Figure 7 European wide comparable data has been used. It is apparent from Figure 7 that forests are not evenly distributed through the city and there are areas with less access to forest than others.

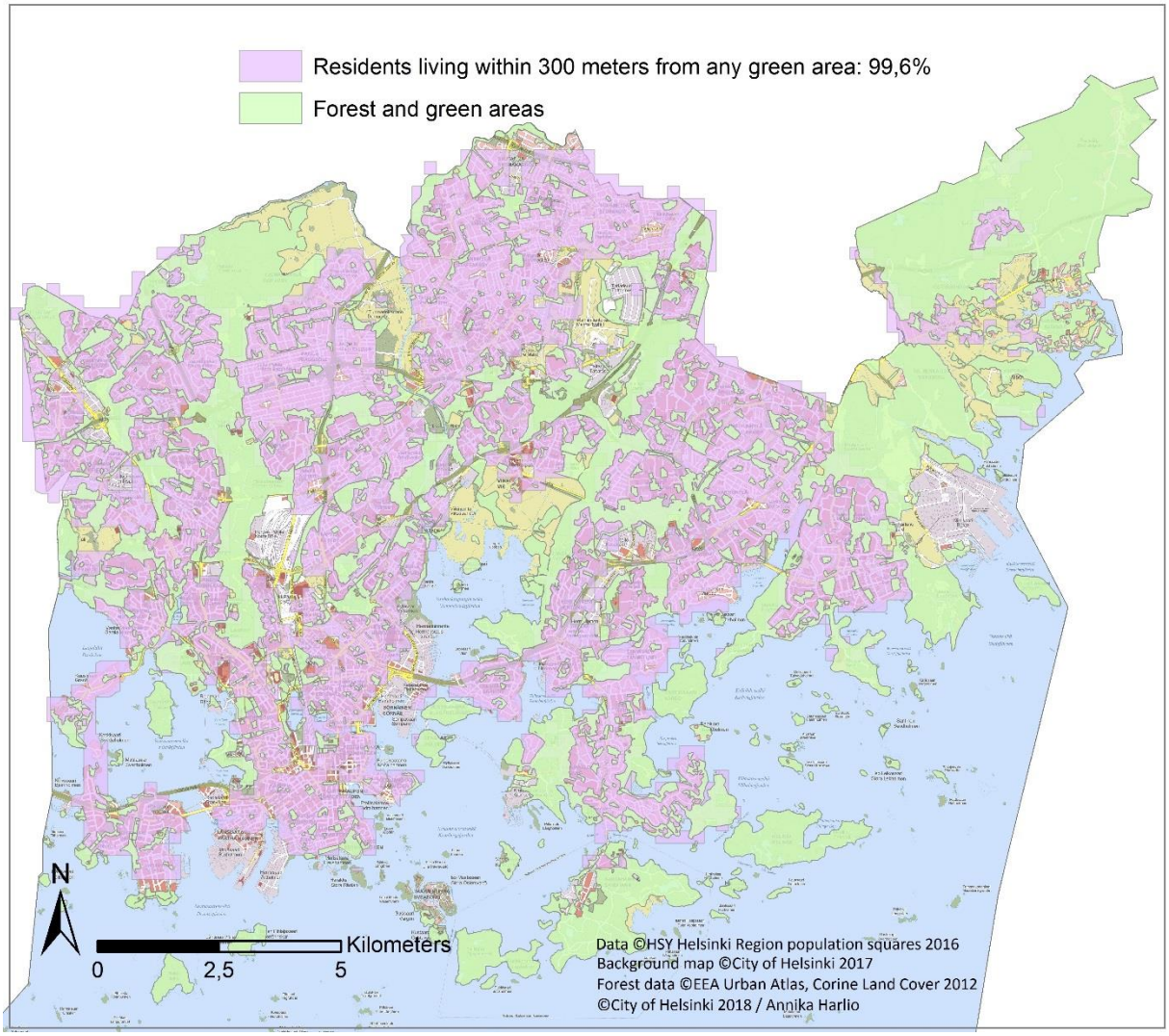

Figure 6 Residents living within 300 m from a forest or green area. Source: City of Helsinki, 2018

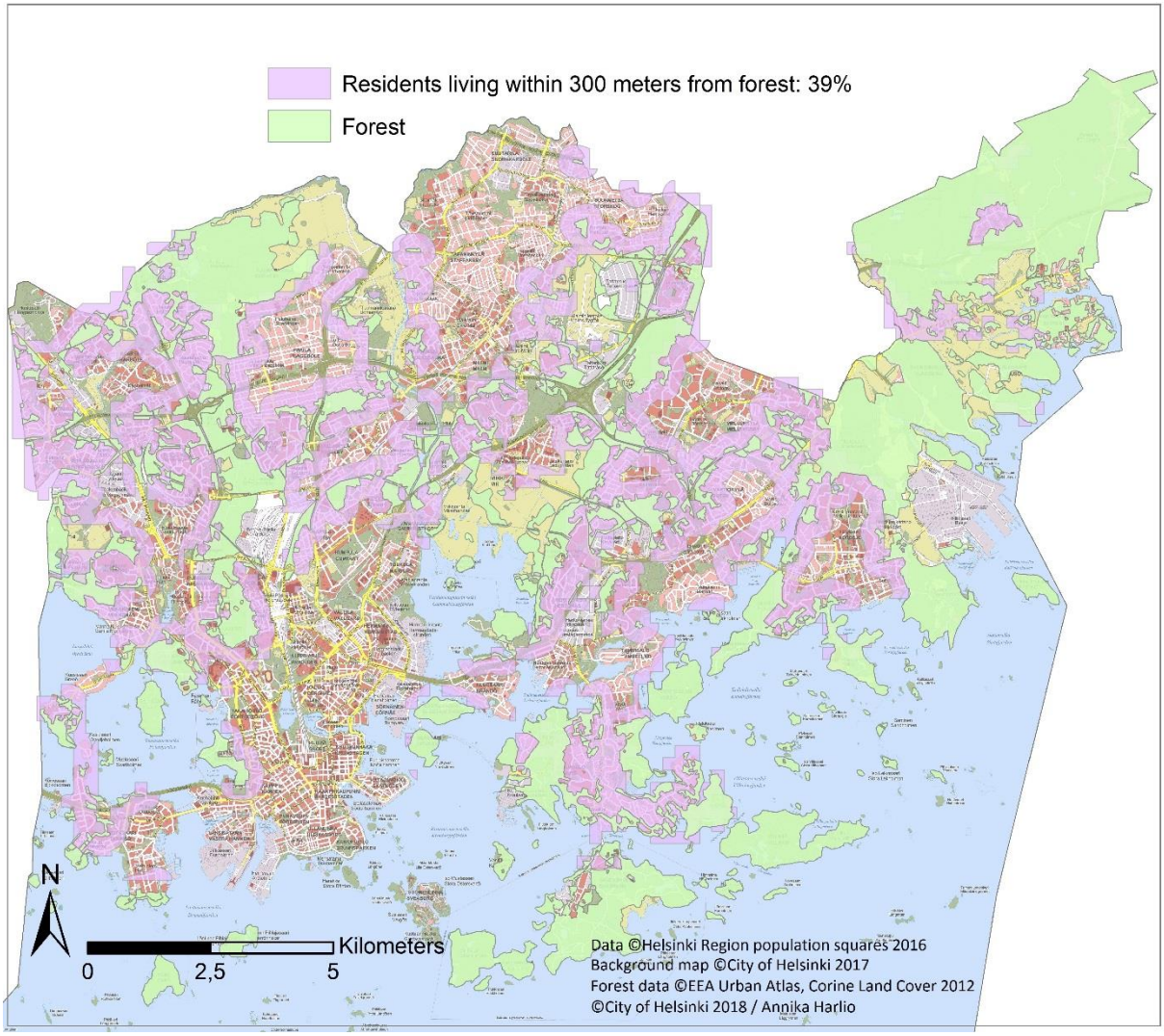

Figure 7 Residents living within 300 m from forest. Source: City of Helsinki, 2018

In Helsinki, SYKE (2017) has calculated the different opportunities accessible to children by identifying the breakdown of land-use in the 300m area surrounding daycares for the Capital region (Helsinki, Vantaa, Espoo and Kauniainen). They have made generalisations according to whether a daycare is in one of three zones: pedestrian, public transportation, or car transport zones. In the pedestrian zones, children have access to parks, while in public transport areas, it is parks and yards. In the auto transport zone, there is the highest share of fields, forest and yards. About half (561) of the daycares were over 300m from forest and in Helsinki 43% of kindergartens and 50% of schools are within 300m of the forest. The City of Helsinki's own analysis also supports this conclusion (Figure 8). It is also apparent from Figure 8 that there are also areas outside of the city center which have concentrations of daycares with less access. In the SYKE study, the situation was much improved when both forests and parks were looked at - only 21 were over 300 m from either a forest or a park and many of these are located in pedestrian zones (center areas).

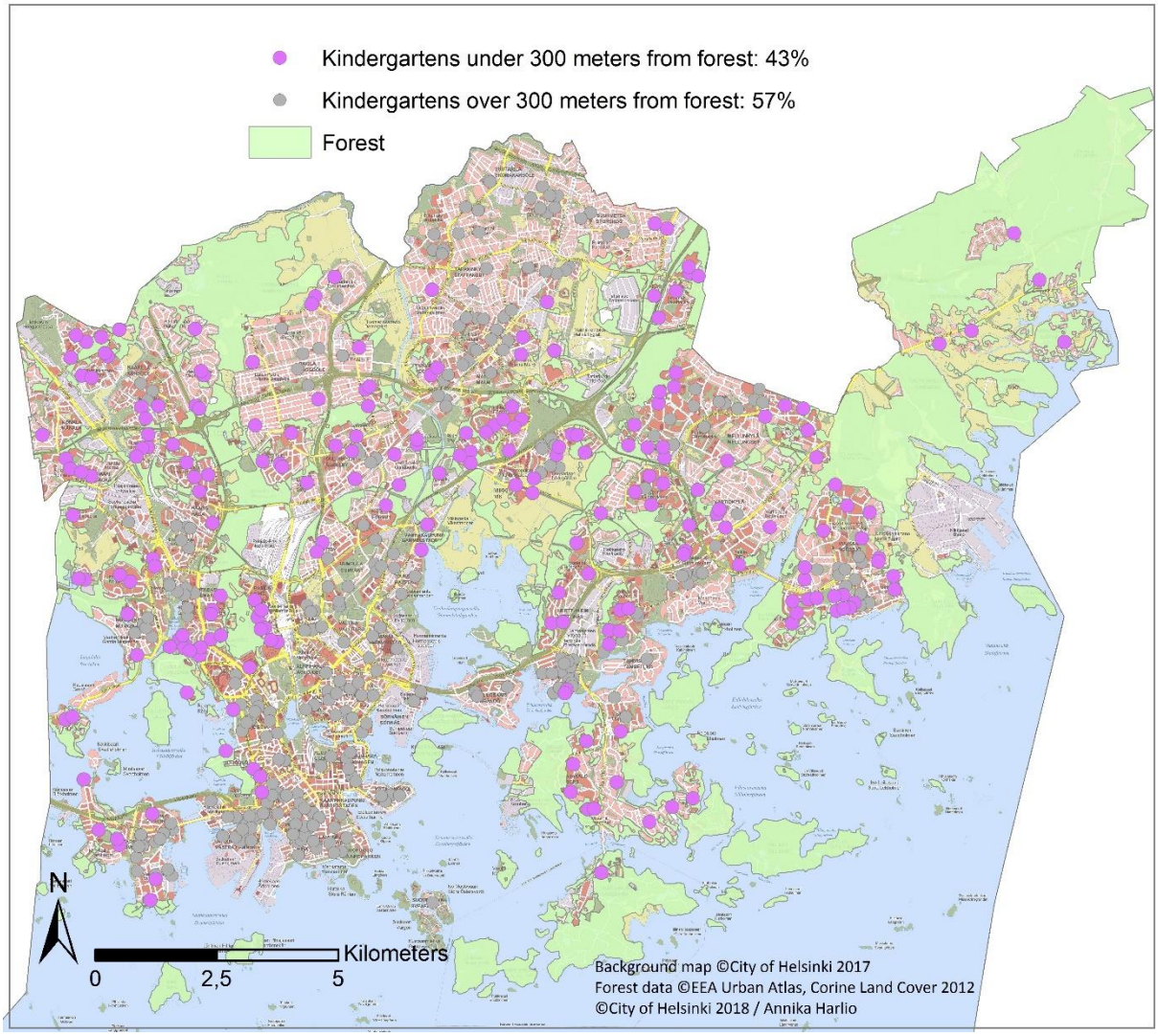

Figure 8 Kindergartens in Helsinki and the distance to closest forest. Source: City of Helsinki, 2018.

Perceived accessibility between the cities (Q12-13)

According to the residents participating in the NATTOURs online survey, the perceived distance of the green area closest to their home was longer than what is calculated by the city and research projects (as referred to in the above section). In **Helsinki**, 74% of residents claimed that the closest green area is within 300 meters (0-5 minutes walking distance) from home (compare to 99,6% in Figure 6), while in **Tallinn**, only 50% of population felt the same. This may be explained by the potential difference between the closest UGA and the closest UGA that they are using. It could also potentially be due to differences in what people consider to be an urban green area. However, the list of potential green areas was broad and did include smaller, often unofficial urban green areas, such as “small wooded area” and any type of green space with playground or fitness equipment, as well as “other”. Another possibility is that people misjudge the walking distance or that the time estimate matched with the walking distance is not correct.

In the NATTOURs online survey, residents were also asked about their agreements with statements about the present states of the green areas within the vicinity (within 2 km) of their

home[7] and beliefs about future states of the green areas[8]. The statements related to accessibility covered the pleasantness to walk or bike from one green area to another, sufficient number of green areas, sufficient size of green areas for varied use, sufficient access to urban forests and accessibility for daily use based on short enough distance to the green area.

Perceived accessibility across Helsinki and between the major districts – now and in the future

In Helsinki, residents were overall positive about the present situation of accessibility to green areas within the vicinity of their home[9]. Overall, 7-16% of respondents firmly disagreed with the positive statements about the state of accessibility to green areas. People were in less agreement with the sufficiency of access to forests. This is understandable considering that while almost 100% of the population is within 300m of urban green areas, only 39% live within 300 m of urban forest (see Figure 7). If looking at the assessment of present state of urban green areas in vicinity of a respondent according to different city districts of Helsinki, there are not big differences according to city districts, but consistently lower values (signifying less agreement) for different aspects of a present state are given by respondents of Southern District (see Figure 9 and Figure 10). This can possibly be explained by the higher building density in the Southern district including the city center, as compared to other major districts.

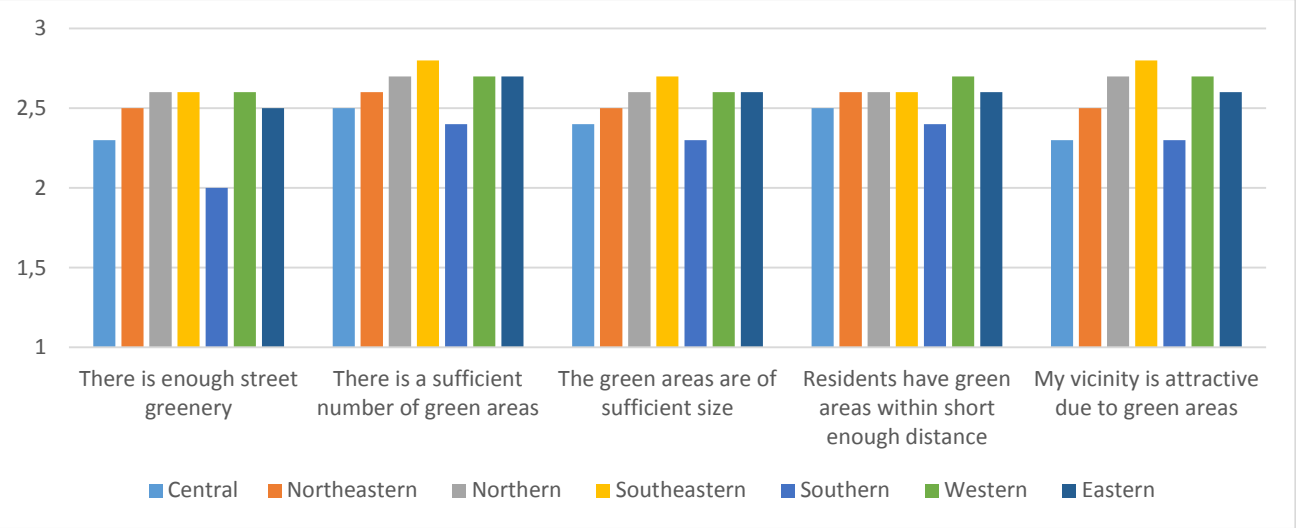

Figure 9 Assessment of present state of urban green areas in vicinity of a respondent (Q12 – part I), average by city districts (Helsinki). The Y-axis shows the average scores, where 1 = Disagree (it is not so in many or all parts of my vicinity), 2=Partly disagree (it is not so in some parts of my vicinity), and 3=Agree, (Don't know answers have been excluded).

[7] Respondents were asked to Disagree (it is not so in many or all parts of my vicinity), Partly disagree (it is not so in some parts of my vicinity), Agree, , or reply Don't know.

[8] Respondents were asked to select between the following choices:I do not believe , I partially believe, I believe, and Don't know.

[9] The statements related to accessibility covered the pleasantness to walk or bike from one green area to another, sufficient number of green areas, sufficient size of green areas for varied use, sufficient access to urban forests and accessibility for daily use based on short enough distance to the green area.

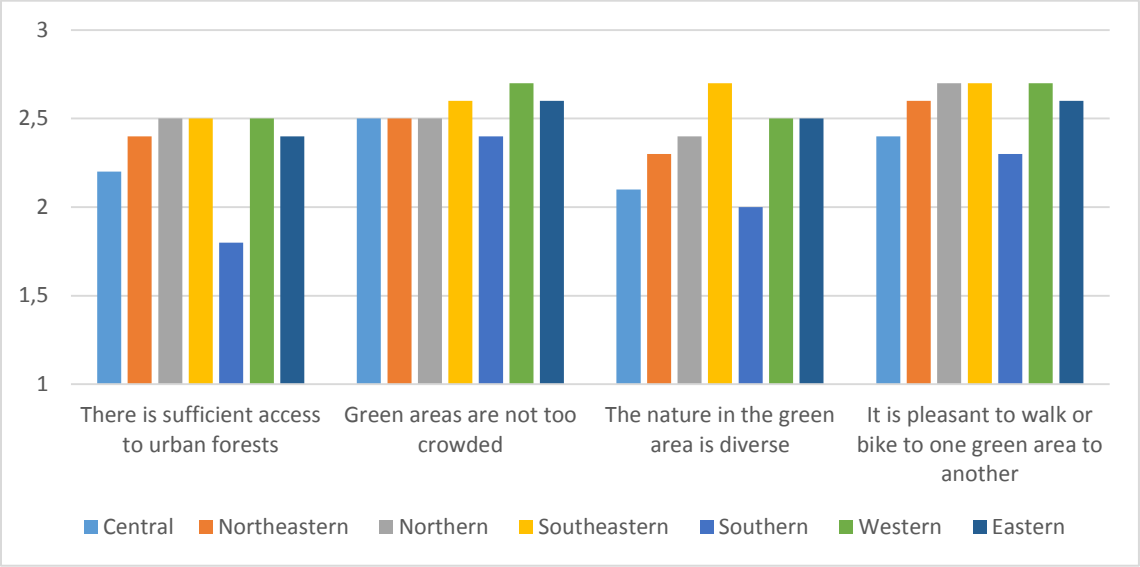

Figure 10 Assessment of present state of urban green areas in vicinity of a respondent (Q12 – part II), average by city districts (Helsinki). The Y-axis shows the average scores, where 1 = Disagree (it is not so in many or all parts of my vicinity, 2=Partly disagree (it is not so in some parts of my vicinity), and 3=Agree, (Don't know answers have been excluded).

Fewer Helsinki respondents were as optimistic about the state in the future (10-20 years). Overall, 23-38% of respondents did not believe the positive statements about the future state of accessibility to green areas. As for future state of urban green areas in the vicinity (within 2 km) of their home, there are no differences according to city major districts (see Figure 11 and Figure 12): the respondents from different city major districts have assessed their beliefs about the future state (10-20 years) similarly. Also, the different aspects of urban green areas have been assessed on similar average level. Note that the current and future scenarios were assessed on slightly different scales, as the terms of the middle choice differed. This difference creates a bias towards more positive answers in the future and negative in the present.

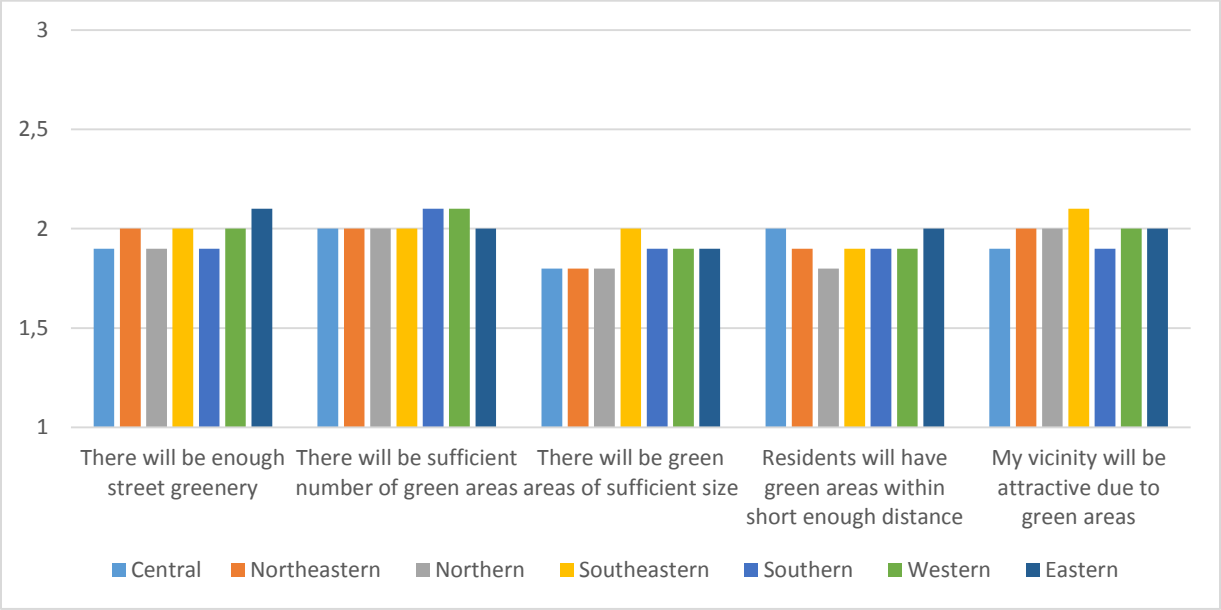

Figure 11 Assessment of future state of urban green areas in vicinity of a respondent (Q13 – part I), average by city districts (Helsinki). The Y-axis shows the average scores, where 1=I do not believe, 2=Partly believe, 3 = I believe, (Don't know answers have been excluded).

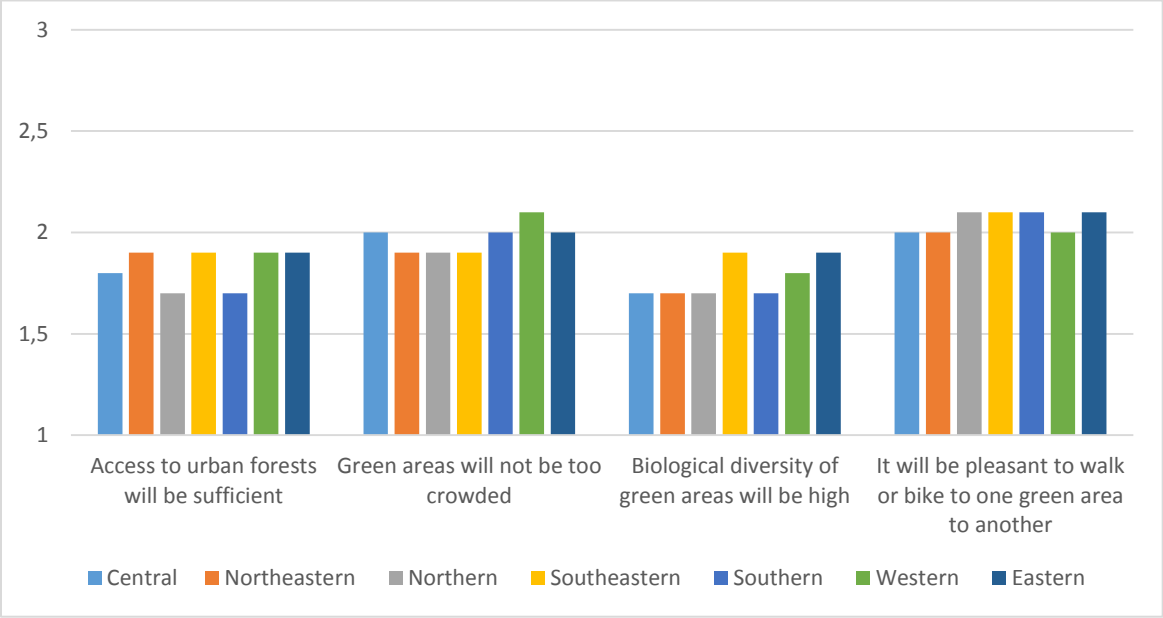

Figure 12 Assessment of future state of urban green areas in vicinity of a respondent (Q13 – part II), average by city districts (Helsinki). The Y-axis shows the average scores, where 1=I do not believe, 2=Partly believe, 3 = I believe, (Don't know answers have been excluded).

Perceived accessibility across Tallinn and between the districts - now and in the future

Similar to Helsinki, in Tallinn respondents were in general in agreement with accessibility to green areas[9], though in Tallinn there were less full agreements and more disagreements than Helsinki in all aspects related to access. This is not surprising, based on the fact that Tallinn has overall lower accessibility to green areas when compared to Helsinki. If looking at the assessment of present state of urban green areas in vicinity of a respondent according to different city districts of Tallinn, the picture is much more diverse (see Figure 13 and Figure 14). Typically the respondents from Nõmme and Pirita agree with the various positive claims of the present state of urban green areas. Nõmme and Pirita are in general areas with detached

houses, private yards, as well as urban green areas, while Lasnamäe, Kristiine and the city center are more densely built urban areas with apartment buildings.

The city districts where respondents are the least agreeing with these positive claims, are Lasnamäe, Kristiine and the city center. The respondents from **Lasnamäe** are specifically not agreeing to claims like: there is sufficient number of green areas, the green areas are of sufficient size, and there is sufficient access to urban forests. Respondents from **Kristiine** do not think that there is sufficient number of green areas, that green areas are of sufficient size, and that there is sufficient access to urban forests. The lastly mentioned claim related to access to forests is something that the respondents of **city centre** also do not agree with. The city center residents respond more favorably to those in Kristiine and Lasnamäe for many of the statements (sufficient number of green areas, sufficient size, short enough distance, etc.). This can be explained by the fact that the number and size of *urban parks* is high in the Tallinn city center (128 ha), while in Kristiine, it is as low as 14ha). (Tallinn Greenery Development Plan 2013-2025)

On average, respondents agree more with claims that residents have green areas within short enough distance and that there is sufficient number of green areas; they agree less with the statement about sufficient access to urban forests, and the size of green areas. In general there is more variety between the districts in terms of assessment of sufficiency of access to forests than access to green areas (which is represented by the statement „Residents have green areas within short enough distance) in general. This is understandable because forests are not located throughout the city, as green areas are and thus there is more unequal access to forests than green areas.

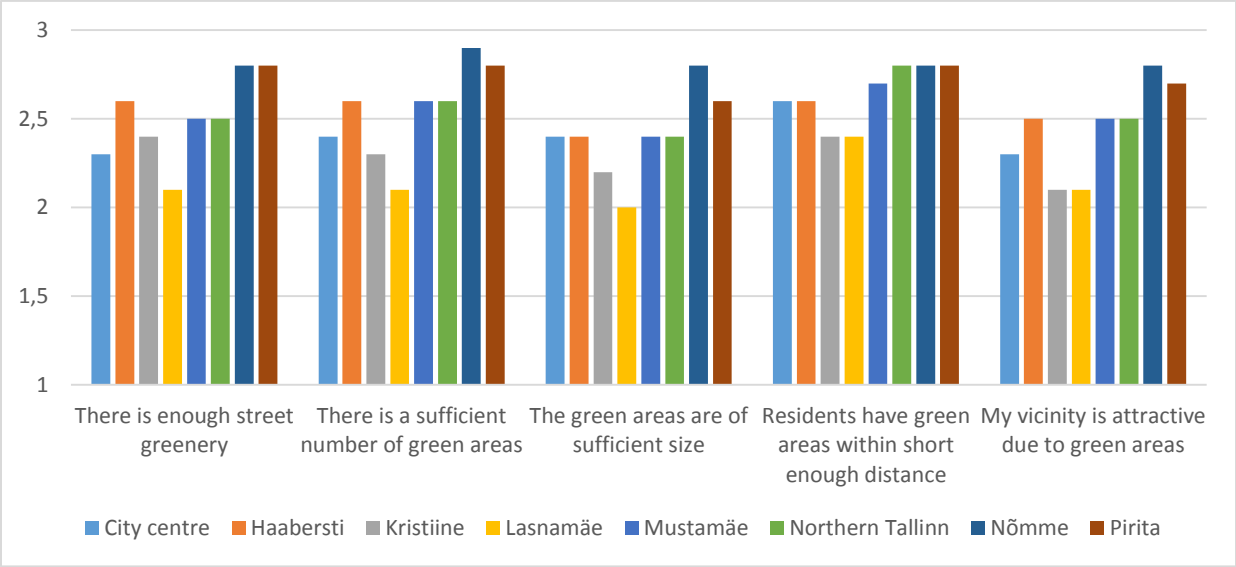

Figure 13 Assessment of present state of urban green areas in vicinity of a respondent (Q12 – part I), average by city districts (Tallinn). Note: The Y-axis shows the average scores, where 1 = Disagree (it is not so in many or all parts of my vicinity, 2=Partly disagree (it is not so in some parts of my vicinity), and 3=Agree, (Don't know answers have been excluded).

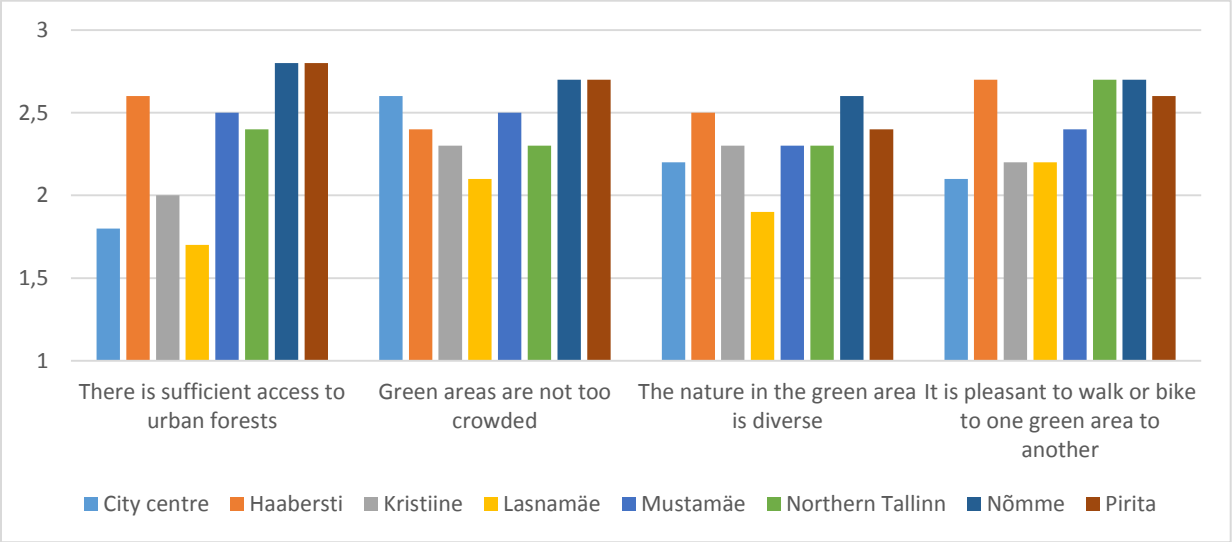

Figure 14 Assessment of present state of urban green areas in vicinity of a respondent (Q12 – part II), average by city districts (Tallinn). Note: The Y-axis shows the average scores, where 1 = Disagree (it is not so in many or all parts of my vicinity, 2=Partly disagree (it is not so in some parts of my vicinity), and 3=Agree, (Don't know answers have been excluded).

It should be noted that while fewer Tallinn respondents agreed with many of the positive statements related to the current accessibility of green areas within their vicinity than in Helsinki, the levels of optimism about the future in Tallinn is higher than in Helsinki. This could also reflect a difference in awareness about future plans in the two cities. About the future state of urban green areas (Figure 15;), it can be witnessed that residents of city centre, Mustamäe, Lasnamäe and Kristiine are more pessimistic about future state and residents of Nõmme and Pirita are clearly the most optimistic about the future state of green areas. It is interesting that Põhja-Tallinn stands out in also very optimistic view of the future, sometimes even more optimistic than respondents of Pirita and Nõmme: for example, they believe the most in claim that residents will have green areas within short enough distance.

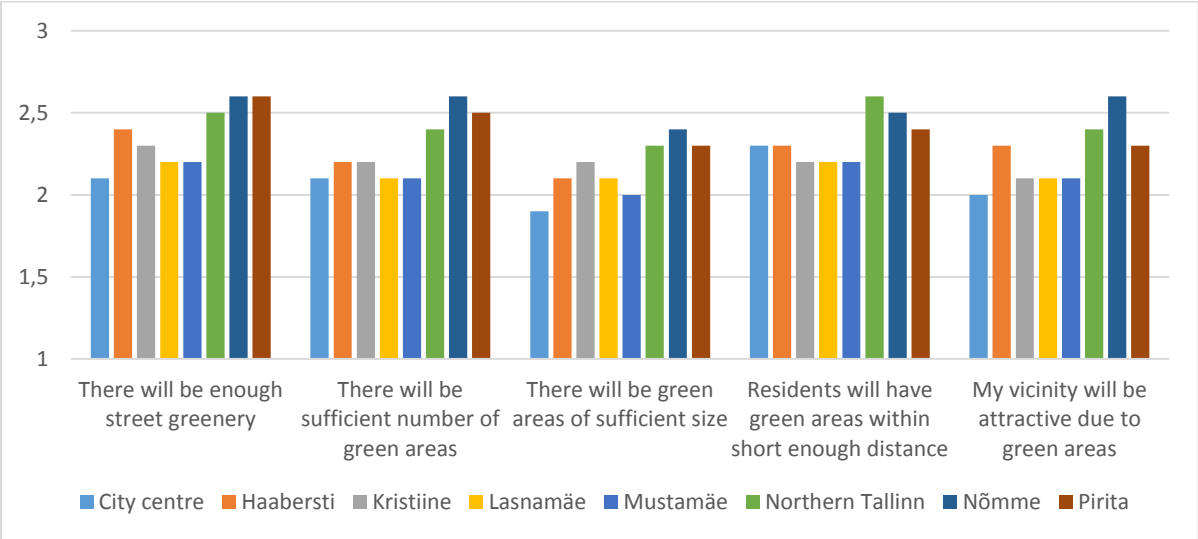

Figure 15 Assessment of future state of urban green areas in vicinity of a respondent (Q13 – part I), average by city districts (Tallinn). The Y-axis shows the average scores, where 1=I do not believe, 2=Partly believe, 3 = I believe, (Don't know answers have been excluded).

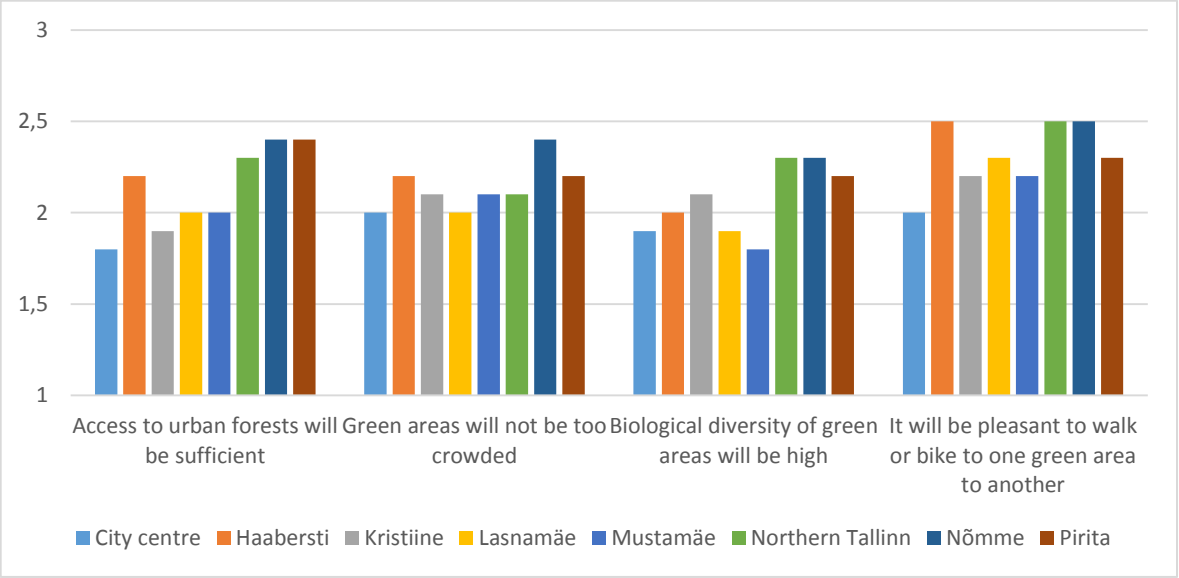

Figure 16 Assessment of future state of urban green areas in vicinity of a respondent (Q13 – part II), average by city districts (Tallinn). The Y-axis shows the average scores, where 1=I do not believe, 2=Partly believe, 3 = I believe, (Don't know answers have been excluded)

Recommendation further research:

- Helsinki and Tallinn: to analyse the online survey data (Q12-13) on the agreement with statements about the current and future state of green areas in the vicinity of the respondents at a less aggregated level than major district / district level (potentially postal code) and visualise in GIS to gain a more exact understanding of problem areas (lower scoring areas).

Recommendations for city action:

- Helsinki and Tallinn: to increase the amount of street greenery in areas where respondents agreed less with the statement that "there is enough street greenery". Increase of street greenery is a way to increase the attractiveness of an area. Greenery can also be added to courtyards and spaces between buildings, but also to buildings (green walls, green roofs, etc.). Also to create a pleasant green path to connect with other green areas may be a way provide an alternative solution in areas where it is difficult to build new green areas. For Helsinki these areas are: Southern major district (and potentially Central major district), while for Tallinn, these areas are Lansamäe, City Center and Kristiine.
- Helsinki: To ensure continued access in the future to urban forests, as this is an issue that received relatively low scores for the present state, as well as in the future. This is one of the two issues where respondents in each major district on average did not believe that access would be sufficient in the future.
- Helsinki: To improve the diversity of nature, especially in the Southern and Central major districts. Around half of the respondents either partially or completely disagreed with the statement that in the present state, the nature in their vicinity (within 2 km) of their home was diversity (biodiversity). In their beliefs about the future state of diversity, only 15% firmly believed that it would be high. This is one of the two issues where respondents in each major district on average did not believe that access would be sufficient in the future. Measures could be focused on the Southern and Central major districts, as these received the lowest scores for the present state.
- Tallinn: To decrease the gap in terms of access to green areas between the districts, not necessarily in distance, but in terms of other aspects, such as the pleasantness to use the green areas to move from one green area to another. Attention should be paid to pedestrian and bicycle paths, sufficiency in number and size for varied use, as well as access to urban forests in the areas of certain districts. Consider other innovative nature based solutions to overcome the difficulty in establishing new and sufficiently large green areas in densely populated areas.
- To assess the access to urban green areas in more detail using distance to green area, but also considering what size or type of green areas are available. To identify areas of lower access. To set more ambitious targets for distance from home to nearest green area, such as in Finnish guidelines or the UK standard (The UK benchmark standard recommends that to make the best of green areas, no one should live more than 300m from nearest green area of at least 2ha in size (Sotoudehnia and Comber 2011))

Green infrastructure as a source for aesthetic value

Green areas and overall "street greenery" can be considered green infrastructure. Green infrastructure, in addition to having other benefits for the area, also impacts the aesthetic values of an area. This is linked to how people overall experience the built up area of the city. Increase of street greenery is a way to increase the attractiveness and improve the experience people have with an area. Also, to create a pleasant green path to connect with other green areas may be a way provide an alternative solution in areas where it is difficult to build new green areas.

In both cities, residents were asked whether they agreed with the following statements: my vicinity is attractive due to green areas, and there is enough street greenery. They were also asked to which degree they felt that it would be true in the future (10-20 years). In Helsinki, it can be seen from Figure 9 that residents less satisfied with the current level of street greenery in southern major district and to Central major district. In those same areas, people agreed less with the statement that their vicinity is attractive due to its green areas. The same patterns held for their beliefs about the future (Figure 10). In Tallinn, as can be seen from Figure 13, there is less agreement with the sufficiency of street greenery in Lasnamäe, Kristiine and the City Center. Residents in these same areas also disagreed more with the statement that their vicinity was at present attractive due to the green areas. For the assessment of the future, in addition to these areas, also Mustamäe residents felt that there would not be sufficient street greenery and disagreed with the statement that their vicinity would be attractive due to green areas.

Obstacles to green area use

High levels of access and use can also lead to crowdedness, which can conflict with other uses for the green areas. For example crowded green areas may not support biodiversity nor enable some activities as watching wildlife. Also, crowdedness may be an obstacle to some people being able to gain potential benefits from use such as mental well-being.

As described earlier, according to the NATTOURs online survey, only 5% of respondents had not spent time in their closest green area during the last year in both cities. Of these people, the main reason for this was given as the lack of appropriate recreational facilities.[10] In Tallinn, there was a similar percentage of people (7%) who had not used their closest green area at some point in the last year. Of these people, the most frequent reason for not using were lack of appropriate recreational facilities and insufficient size of the green area.[11]

In the online survey, residents were asked to assess of the crowdedness of green areas in the present (Figure 14), as well as their belief of how it would be in the future (). In Tallinn, it is not seen as problematic by most people (see) in either case, and interestingly even less of a problem in the future in Tallinn. In Helsinki, although there does not seem to be an indication of green areas being too crowded in the present, respondents felt that it might be an issue in

Recommendation further research:

- Helsinki and Tallinn: to study reasons for non-use or less frequent use, as reasons for not using urban green areas is often left unstudied (Hegetschweiler et al. 2017), also to better understand the needs for appropriate recreational facilities.

[10] It should be noted that this reason received the most responses for being either the „main reason" for not using or „somewhat of a reason" for not using the green area. .

[11] It should be noted that this reason received the most responses for being either the „main reason" for not using or „somewhat of a reason" for not using the green area.

the future in the major districts of Northeastern, Northern and Southeastern major districts (See Figure 12).

Local green areas enabling different opportunities – a supply factor (Q10)

In the NATTOURS online survey, respondents were asked to rate how well the urban green areas near their home (within 300 m) provide the following opportunities: for being in nature and observation of nature; spending leisure time with friends, children, other people or pets; active recreation and sports; mental relaxation; and other. Answers are ranked from 5 (provide very well) to 1 (do not provide at all), which means that the higher average value signals the better satisfaction with this specific opportunity. This can be interpreted as the supply of cultural ecosystem services (e.g. recreational) which are engaged in more frequently and thus are important to be located close to home. In both **Helsinki** and **Tallinn**, the closest urban green areas provide all of the four proposed opportunities very well or rather well according to 57-73% of the respondents, depending on the specific opportunity. A breakdown by city is given below.

Opportunities offered by local green areas – Helsinki

In Helsinki, the four categories of „activities" are rather evenly rated and rather highly rated. 57%-67% of the respondents felt that their neighborhood green area (within 300 m) provides for all the opportunities „rather well" or „very well". At the same time, 10-18% of respondents felt that the opportunities for the activiites were provided „rather poorly" or not at all. (See Figure 17).

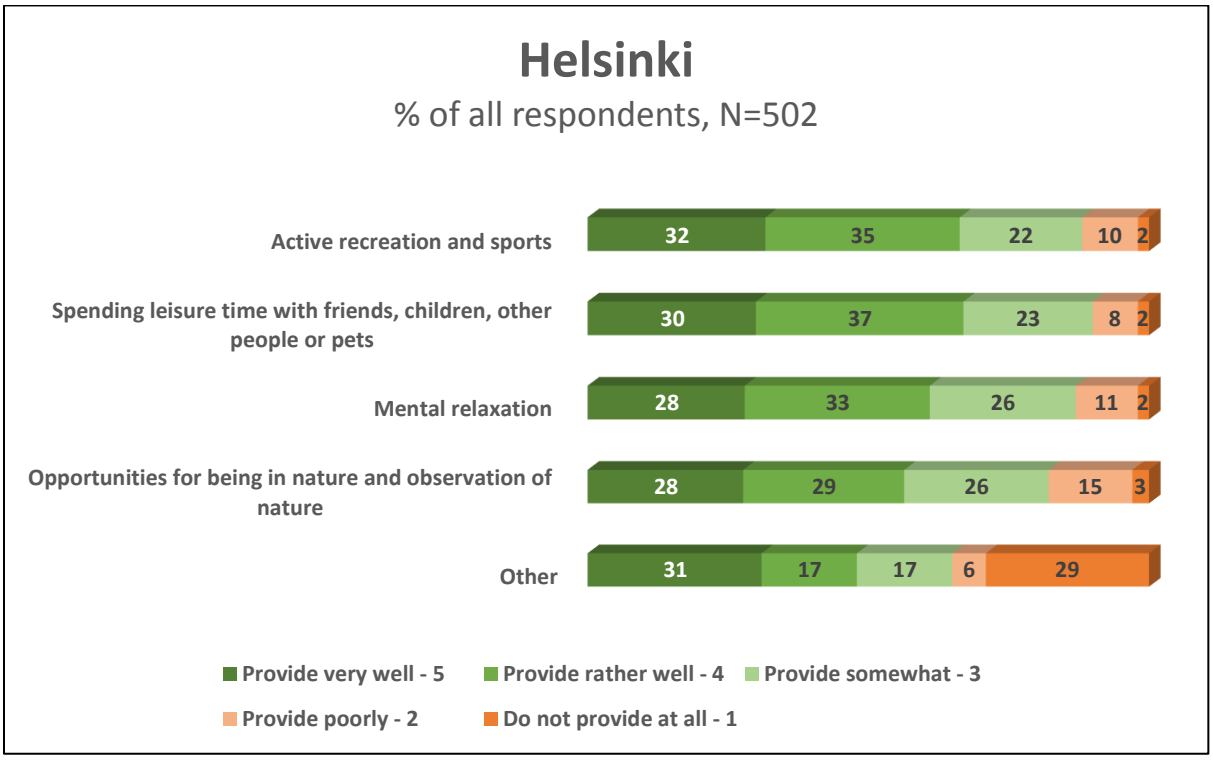

Figure 17 Helsinki resident opinion of how well urban green areas close to their home (within 300 m) currently provide for the following opportunities? (Q10) Source: NATTOURS online survey,.

In Helsinki, the respondents from Southeastern, Western and Eastern Districts are on general more satisfied with different opportunities that urban green areas in their vicinity provide. The

districts where respondents have given lower values to these opportunities, are Southern and Central Districts. This can specifically be noted for opportunities for being in nature and observation of nature, but also active recreation and sports (see Figure 18). The Southern and Central major districts are densely populated urban areas than the other major districts mentioned.

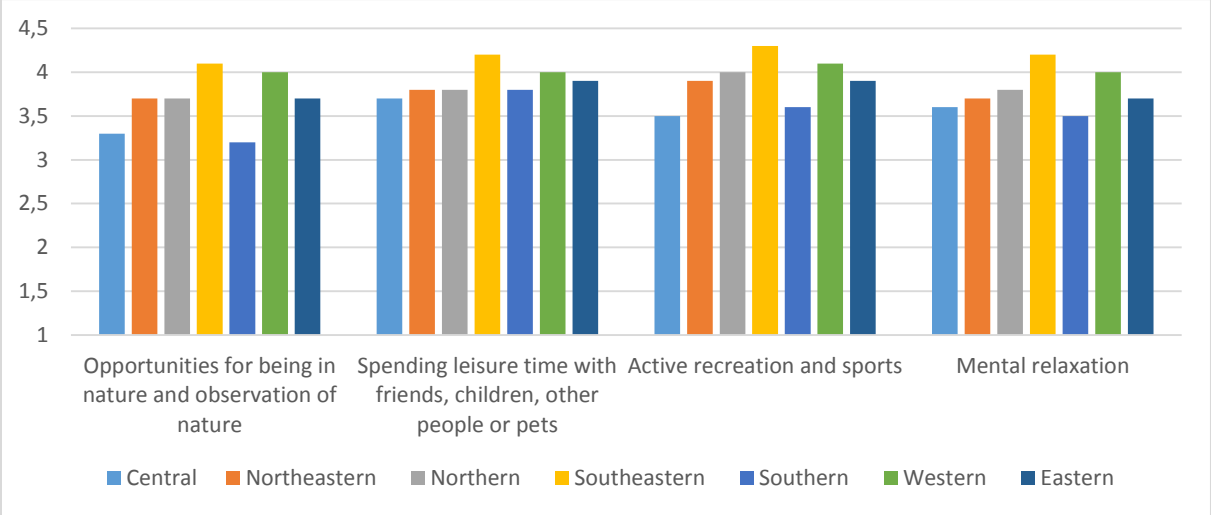

Figure 18 How well urban green areas in vicinity of a respondent provide different opportunities (Q10), average by city districts (Helsinki). The Y-axis shows the average scores, where 5= provide very well, 4=provide rather well, 3=provide somewhat, 2 = provide poorly and 1=do not provide at all.

Opportunities offered by local green areas – Tallinn

Similarly to Helsinki, in Tallinn, the four categories of „activities" are rather evenly rated and rather highly rated. 59%-73% of the respondents felt that their neighborhood green area (within 300 m) provides for all the opportunities „rather well" or „very well". At the same time, 6-16% of respondents felt that the opportunities for the activiites were provided „rather poorly" or not at all. (See Figure 19) On a general level, people are more satisfied with the opportunity to spend leisure time with friends, children, other people or pets in urban areas, and the least happy about possibilities to mentally relax in urban areas. On the district level analysis, this was especially true in the city districts of city centre, Lansamäe and Mustamäe, which are the most densely populated areas and where the difference in averages between these two activities were statistically significant.

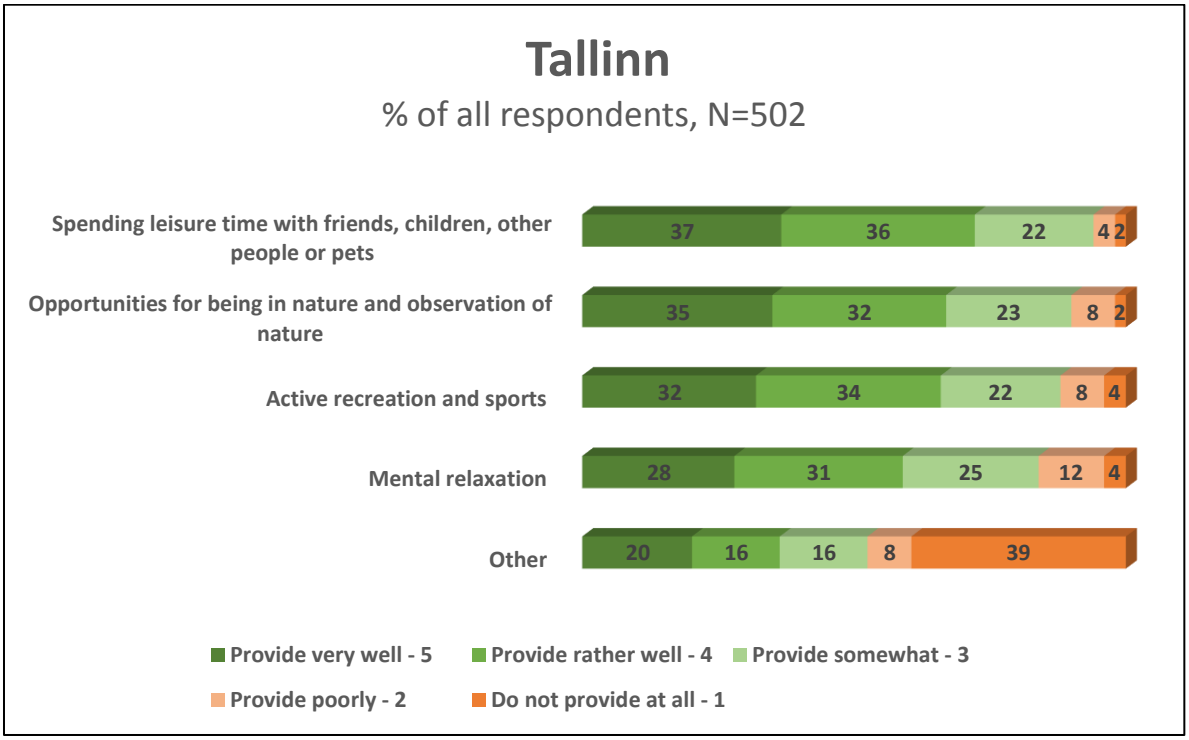

Figure 19 Tallinn resident opinion of how well urban green areas close to their home (within 300 m) currently provide for the following opportunities? (Q10) Source: NATTOURS online survey

In Tallinn, the analysis according to city districts shows (Figure 20) that city districts that are the most satisfied with different opportunities of urban green areas in vicinity provide, are Haabersti, Nõmme and Pirita. City districts where respondents have claimed lower values for the provision of different opportunities, are City Center, Kristiine and Lasnamäe.

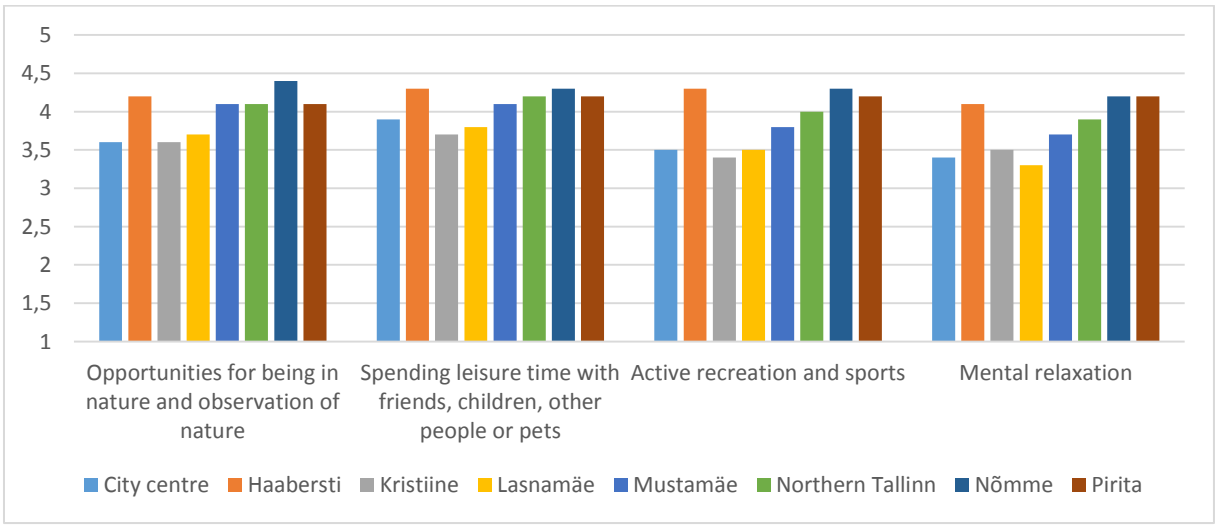

Figure 20 How well urban green areas in vicinity of a respondent provide different opportunities (Q10), average by city districts (Tallinn) The Y-axis shows the average scores, where 5= provide very well, 4=provide rather well, 3=provide somewhat, 2 = provide poorly and 1=do not provide at all.

Recommendations further research:

- Helsinki and Tallinn: to analyse online survey responses (Q10) at a less aggregated level and visualise in GIS to gain a more exact understanding of problem areas defined by areas where urban green areas provide lower levels of opportunities for activities. In Tallinn, a specific could be on the Lasnamäe, Kristiine, and City Center districts where there are lower average scores. In Helsinki, a specific ffocus could be on the Southern district where there are lower average scores.

Use of urban green areas as an indicator of the demand of ecosystem services (Q15)

Finns and Estonians are in general active users of nature, including forests, even in their cities and share what Bell et al. (2009) refer to as "northern forest culture". An earlier study of Helsinki residents shows that on average, people recreate in the green areas close to their home on average of 160 times annually. The number of recreational visits was higher in the greener suburbs than the center, which has less green space. The same study concluded that almost all residents of Helsinki had, in the last year, participated in recreation in a green area in the vicinity of their home (Neuvonen et al. 2007). Furthermore, in Helsinki, children are also being taken to the forest through school. 95% of primary schools in Helsinki reported using local forests at least twice a year in 2013 (CBI Indicator 14: 2013) even though close access within 300 metres is only from 50% of schools (Figure 8) (City of Helsinki, 2018). Previous studies of urban green area use in Tallinn could not be located.

Use of nearby green areas in Helsinki

In the NATTOURs online survey, most people had spent time in their closest green area during the last year in both cities. In both Helsinki and Tallinn during the previous year, people spent time in the green area closest to their residence most often in the summer and the least often in the winter, as is seen in Figure 21. In **Helsinki** between 55-72% of respondents spend time in the green areas at least once a week depending on the season. Residents used a variety of green areas, but mostly parks (30% of respondents), followed by green space along the water (21%), small wooded areas (19%), forests (17%), and green space with playgrounds or fitness equipment (8%). Only 1% spent time in a green space where they could garden. The three main motivations for their use was to „improve or maintain...physical health", followed by mental relaxation, and spending time with other people or pets[12].

[12] The six choices included the following: to improve or maintain my physical health; to mentally relax; to spend time with friends, child(ren), other people or pets; to enjoy nature; and to participate in activities/events organized in green areas or other. (Q15.1)

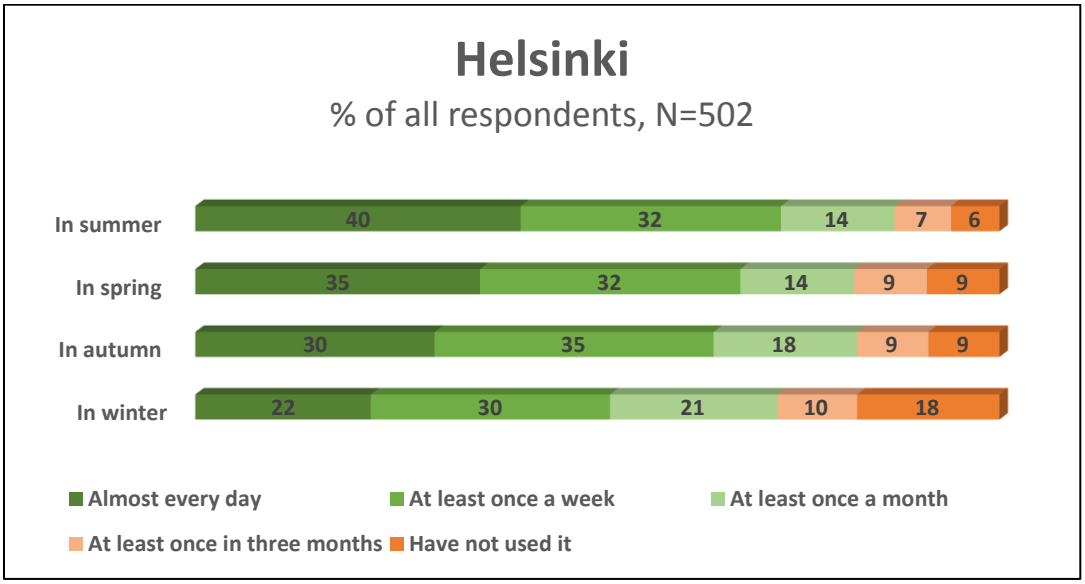

Figure 21 Frequency of use of the closest green area to their residents per season during the last year (Q15), Helsinki.

Parks, which are the most frequently visited green area type, are more heavily visited in summer and spring: more than half of the people who are living close to park visit it at least once in a week (Figure 22). Very often green space alongside water are also visited, and the frequency of visit does not depend much on season: it is the most visited in summer (78% of these who live in the vicinity of such area, visit it at least once a week) and the least visited in winter (still, 61% of these living in vicinity visit it at least once a week). The pattern for the rest of area types is quite similar: these are the least visited in winter and with quite similar frequency in the rest of the seasons.

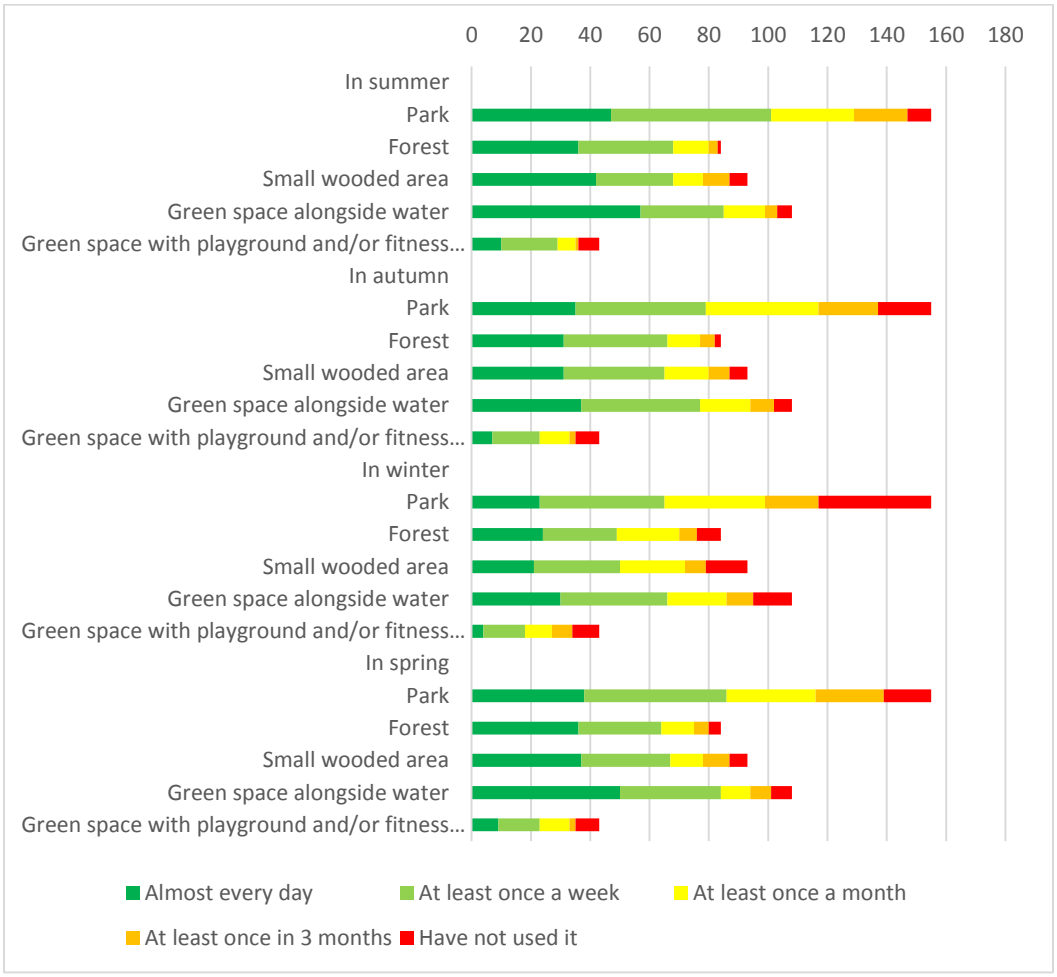

Figure 22 The frequency of use of differenty types of green areas in vicinity of a respondent (Q14 and Q15), number of respondents (Helsinki)

The frequency of visits is related to how close a respondent lives to green area: living closer than 300 m to urban green area is associated with more frequent use of the green area. This is supported by previous research in Helsinki (Neuvonen et al. 2007).

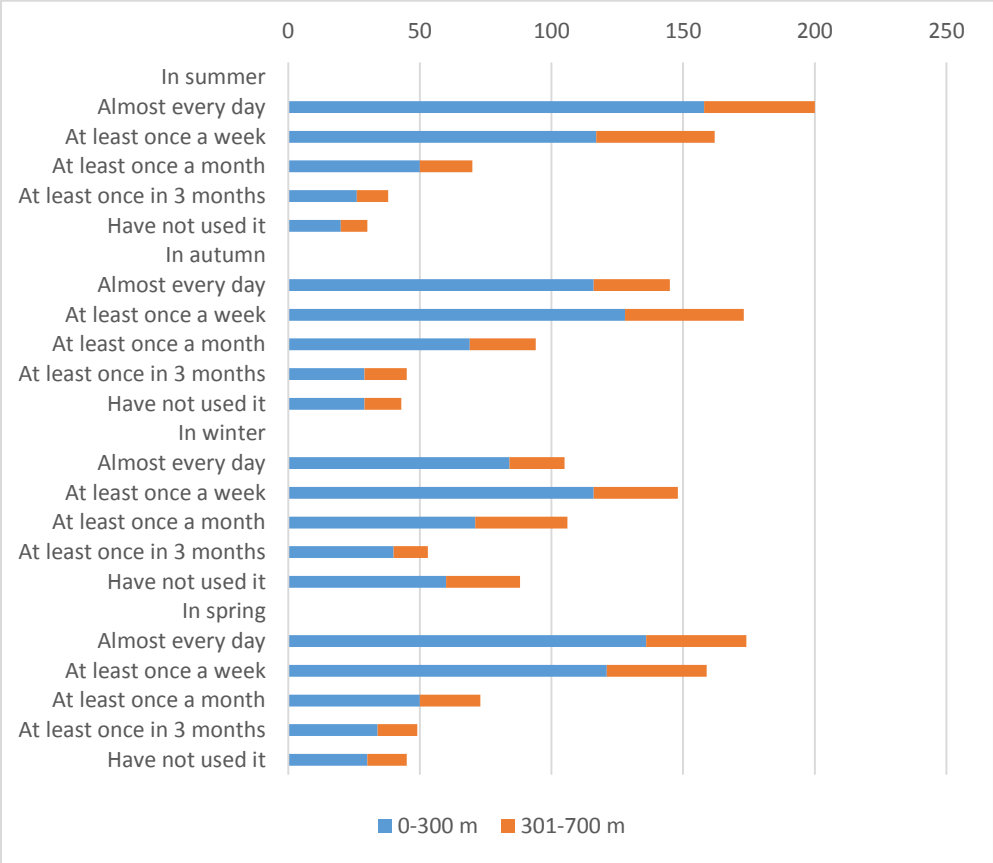

Figure 23 The frequency of use of green areas and distance to green area from residence of a respondent (Q14_1 and Q15), number of respondents (Helsinki)

Table 1 Differences in frequence of use of urban green areas (Q7) in relation to its importance for respondent (Q6) (Helsinki)

	Average if is important	Average if not important
In summer *** (sig=0.0001)	4.1	3.2
In autumn *** (sig=0.0001)	3.9	2.9
In winter *** (sig=0.0001)	3.4	2.7
In spring *** (sig=0.0001)	3.9	3.0

*Note: 1In this table: * - significant on 0.1 level, ** - significant on 0.05 level, *** - significant on 0.01 level*

Also, respondents who consider it important to live close to urban green areas, are more frequent users of these urban green areas. The same tendency can be witnessed from Table 1 and the following graph (Figure 24). Furthermore, there is a relationship between frequency, house type, and importance of living close to green areas. Respondents living in semi-detached or row houses value the importance of living close to green areas more and are more frequent visitors of urban green areas compared to the respondents living in houses with flats. In addition, there are no significant differences in frequency of use according to city districts, nor according to the most important values associated with urban green areas (Q8).

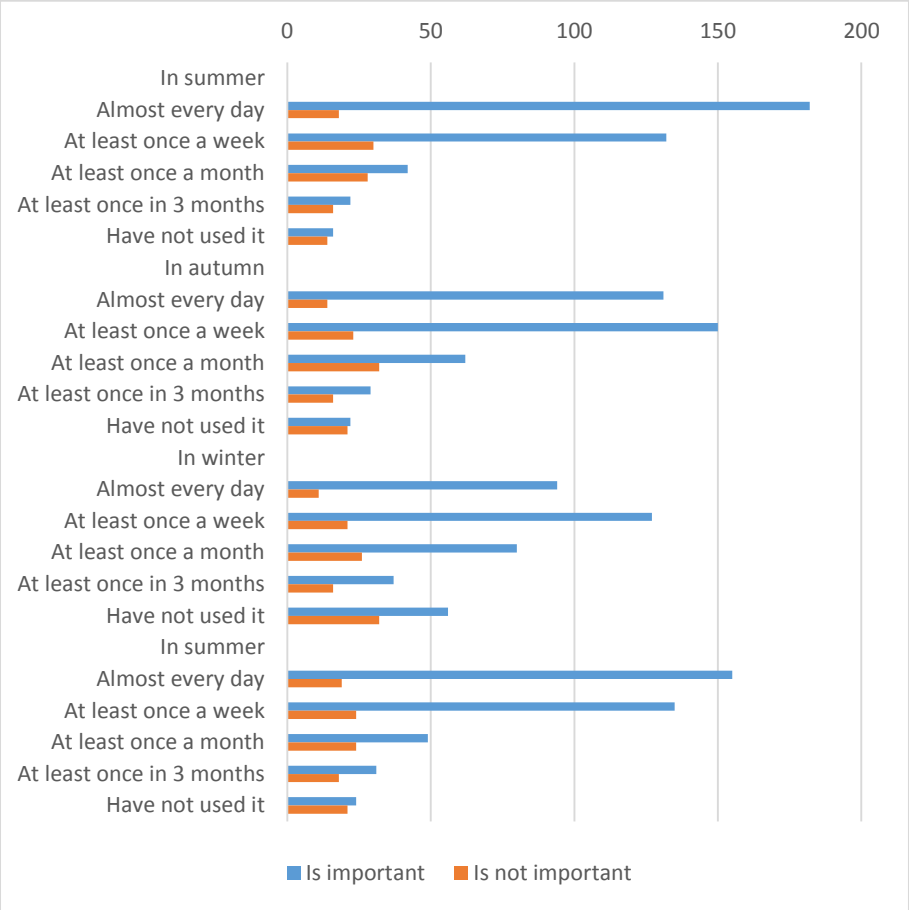

Figure 24 The frequency of use of green areas and importance of living close to these (Q15 and Q6), number of respondents (Helsinki)

Recommendation for city action:

- Helsinki and Tallinn: to maintain or improve the close distance of residents to green areas in order to maintain the frequency of use of green areas and resulting health benefits.

Use of nearby green areas in Tallinn

In the NATTOURs online survey, most people had spent time in their closest green area during the last year in both cities. In both Helsinki and Tallinn during the previous year, people spent time in the green area closest to their residence most often in the summer and the least often in the winter, as is seen in Figure 25. In **Tallinn**, (Figure 25) between 41-67% of respondents spend time in the green areas at least once a week depending on the season. This was slightly less than in Helsinki. Residents used a variety of green areas, but mostly parks (36% of respondents), followed by forest (18%), green space with playgrounds or fitness equipment (15%), green space along the water (14%), and small wooded areas (12%). Also in Tallinn, very few (2%) spent time in a green space within Tallinn where they could garden. This is most likely because it is common to have a garden outside of Tallinn.The three main motivations for their use was spending time with other people or pets, followed by to „improve or maintain...physical health“, and mental relaxation.

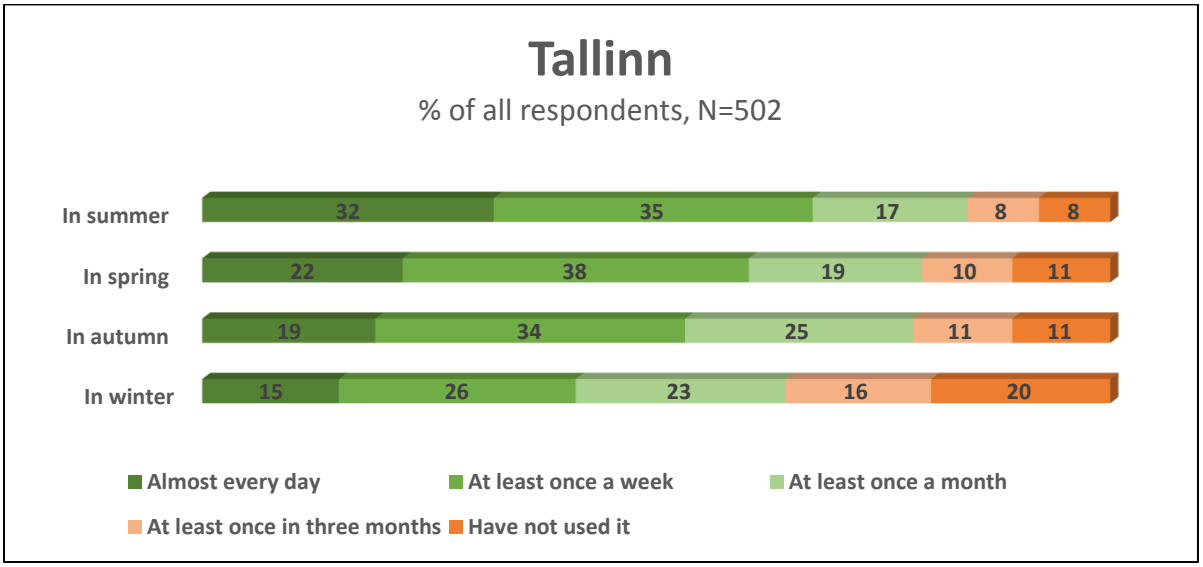

Figure 25 Frequency of use of the closest green area to their residents per season during the last year (Q15), Tallinn.

Parks, the most frequently visited green area type, are visited at least once a week by about 60% of these who live in vicinity in summertime and by about 40% in wintertime (see Figure 26). The next green area type according to frequency of use is forest (50-70% visit at least once a week, depending on season), followed by green space alongside river (35-80%) and green space with playground and/or fitness equipment (35-65%). Based on Tallinn data, it can be seen that these respondents who live close to urban green area (up to 300 m), are more frequent users of these areas (see Figure 27). The sample is quite equally divided in regards of vicinity: about 50% of respondents live up to 300 m from urban green area and 50% in a range of 300-700 m.

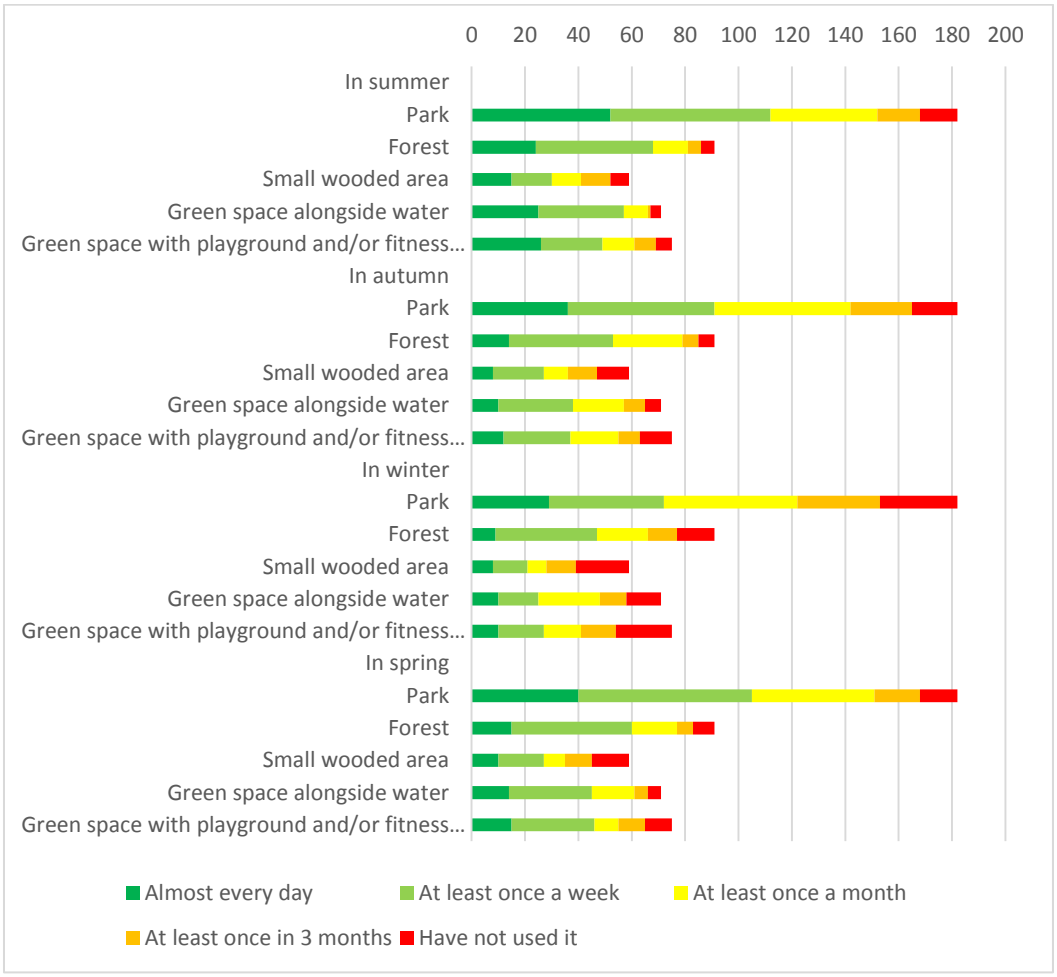

Figure 26 The frequency of use of differenty types of green areas in vicinity of a respondent (Q14 and Q15), number of respondents (Tallinn)

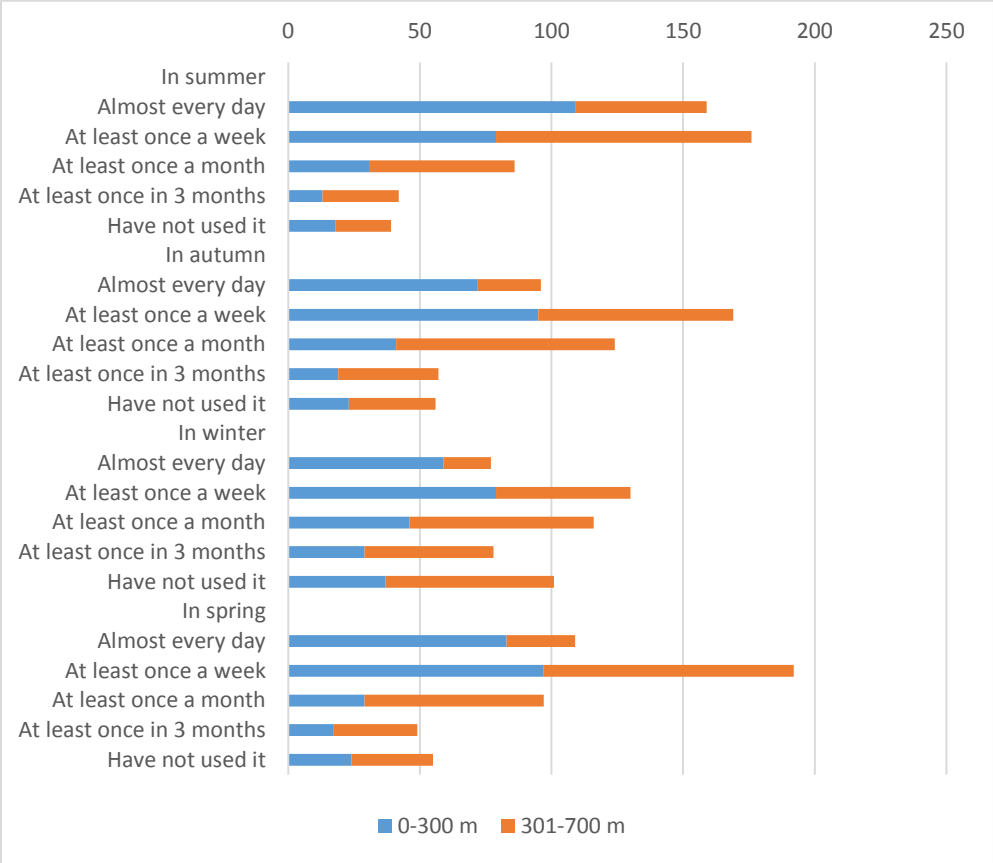

Figure 27 The frequency of use of green areas and vicinity of a respondent (Q14_1 and Q15), number of respondents (Tallinn)

Additionally, as can be seen from Table 2, those who consider it important to live close to urban area, visit it more often than who don't consider it important. This holds regardless of season, but it can be witnessed again that in summertime the green areas are most frequently visited and in winter least frequently.

Table 2 Differences in frequence of use of urban green areas (Q7) in relation to its importance for respondent (Q6) (Tallinn)

	Average if is important	Average if not important
In summer *** (sig=0.0004)	3.8	2.9
In autumn *** (sig=0.0002)	3.4	2.5
In winter *** (sig=0.0001)	3.1	2.0
In spring *** (sig=0.0002)	3.6	2.6

*Note: 2 In this table: * - significant on 0.1 level, ** - significant on 0.05 level, *** - significant on 0.01 level*

The same findings can be seen on next figure: these who consider it important to live close to green area, visit it consistently more than these people who don't consider it important: among those who did not consider it important,there is a bigger proportion of people who use it more seldom or not at all within the last year.

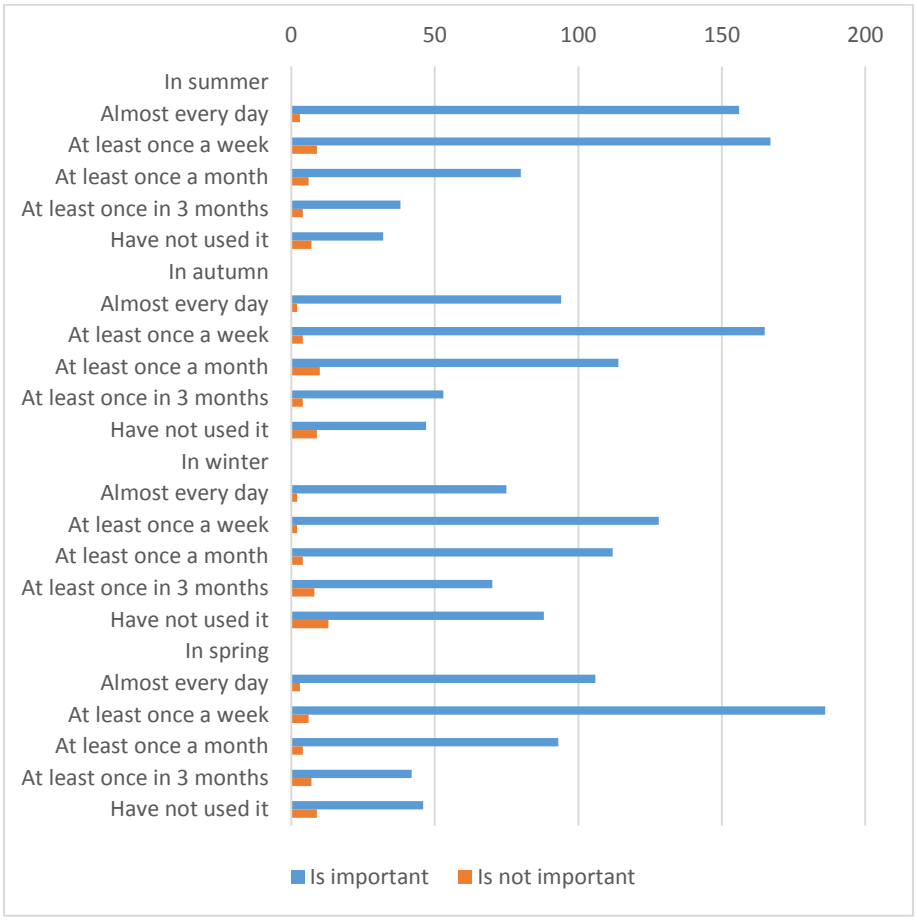

Figure 28 The frequency of use of green areas and importance of living close to these (Q15 and Q6), number of respondents (Tallinn)

There are no significant differences in frequency of use according to city districts, nor according to the most important values associated with urban green areas (Q8). Also the housing type doesn't affect the frequency of green areas visits in case of Tallinn.

The importance of green areas within the city for the opportunities they enable - a factor of demand (Q7)

Different kinds of green areas and different infrastructure in green areas enable different uses, activities and experiences. Exploring the importance of these to residents can enable the understanding of demand for related ecosystem services and green area characteristics, which according to Bertrand and Rehdanz (2015) has only been explored in a few cases of literature. In the NATTOURS online survey, residents were asked "how important is it for you that there are green areas in your city where you can do the following?" They were asked to rate the importance of having the opportunity for different kinds of activities/experiences within their cities' green areas. Respondents rated twelve different opportunities/experiences separately from very important to not important on a 5 point scale. These activities can be used to identify which characteristics of green areas may be valued by residents. For example, breathing fresh air which is a regulatory service is not something that is enabled by every type of green area, e.g. a small pocket park or small area within the urban fabric. On the other hand, coastal green areas and larger forest green areas may be more able to provide this opportunity. However, Jim and Chen (2006) suggest that even in the case the actual level of these regulatory services (air pollutant removal/air quality regulation, or noise abatement in the case of tranquillity) is

low, there is enough of a contrast from the urban milieu to create a perception of these services being provided.

The importance of green areas in the city – Helsinki

In both Helsinki and Tallinn, respondents (92% (Figure 29) and 94% (Figure 31) respectively) felt it was most important to have green areas where they could breathe fresh air, which actually represents a regulating ecosystem service (air quality regulation). Providing a place to walk in nature was also highly rated in both cities (second most important in Helsinki (81%). Overall, in Helsinki, after 'to breathe fresh air", the options rated as most important related to either movement or wellbeing (to walk in nature, to maintain/improve your physical and mental well-being, engage in active recreation or sports). Active engagement of Helsinki residents in physical or fitness activities in nearby urban green areas is supported by earlier studies (2007). The provisioning ecosystem services (picking berries, etc. and fishing were not seen as important). These results were in general also supported by the NATTOURs visitor study in Helsinki green area sites, though it can be seen that the level of importance for visitors, who are users of green areas, is often higher than the level for residents in general. A comparison of the results according to the average score of importance for each activity is seen in.Figure 30 Note: As this question was about green areas in general at the city level, this should not be seen as criteria by every green area. However, more importantly it is an indicator that some green areas in the city that provide these opportunities. This importance can also be interpreted as demand for ecosystem services (regulatory, cultural, and provisioning), as all of these categories are covered by the activities.

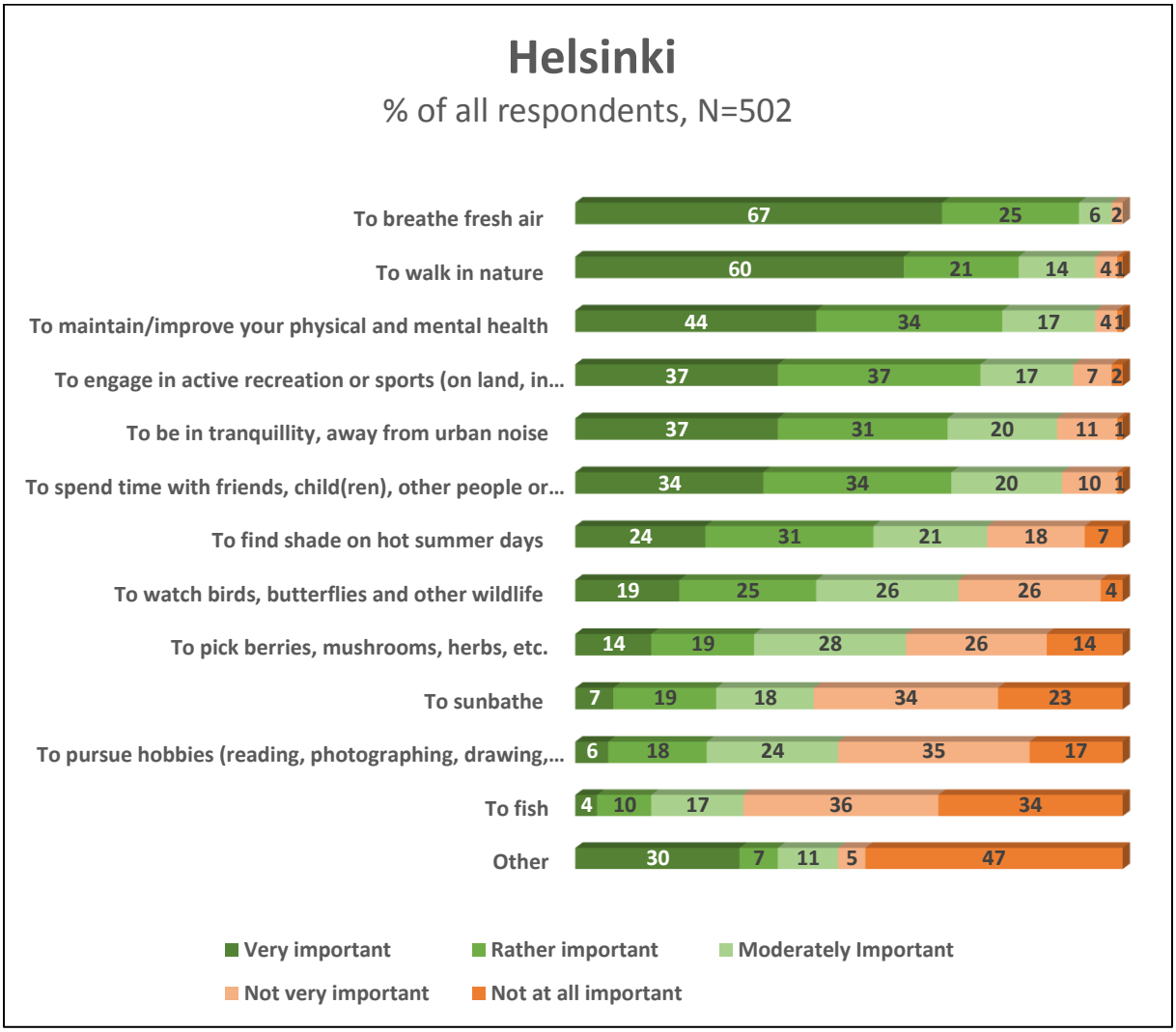

Figure 29 The importance to residents of having green areas in Helsinki where it is possible to engage in or exoerience the following activities/opportunities. Source: NATTOURS Online survey, 2017.

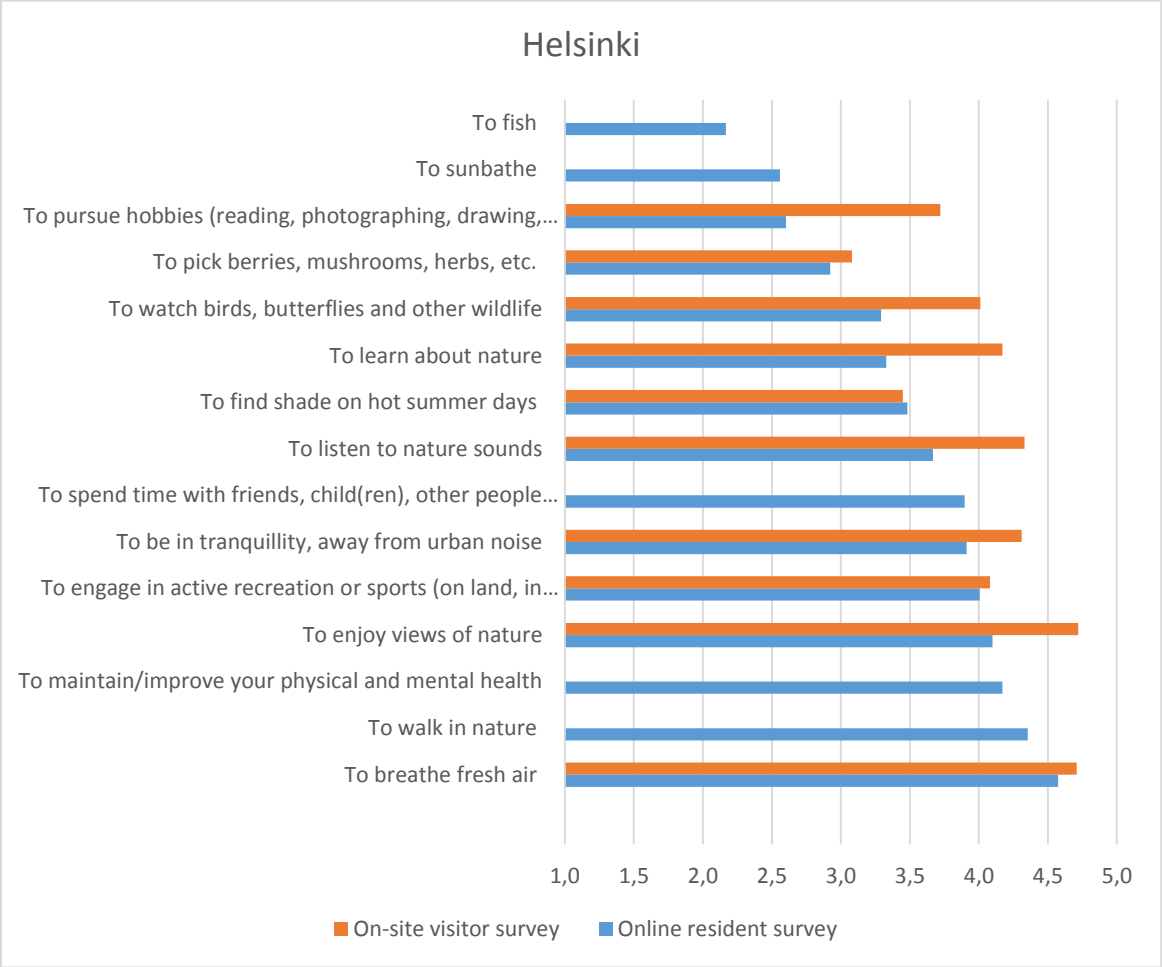

Figure 30 Activities that Helsinki residents feel should be enabled by green areas with average scores of importance. The scores were given on a 5-point scale, which ranged from "1 – not important at all" to "5 – very important ". This question was asked in both the NATTOURS green area visitor survey (2017) (Q7) and online resident survey (2017). Note: not all the same activities were asked in both surveys.

Analysis of differences according to household type in Helsinki

There are also differences in terms of how importance of activities is linked with household type. For example, there was a statistically significant difference between the importances for different households related to the following activities: of having an green area where one is able to spend time with friends, children and pets; to find shade on hot summer days; and to fish. In general households with children have given higher importance to these mentione activities compared to households without children. The influence of household types applies to more activities in Tallinn than in Helsinki.

Table 3 Differences in importance of activities related to urban green areas (Q7) according to household type (Helsinki):

	Average for singles	Average for singles with children	Average for two adults	Average for two adults with children
1.To walk in nature (sig=0.9856)				
2.To spend time with friends, children, pets* (sig=0.0550)	3.8	4.2	3.8	4.1
3.To maintain/improve physical and mental health (sig=0.8007)				

4.To engage in active recreation or sports (sig=0.1755)				
5.To sunbathe (sig=0.4380)				
6.To pursue hobbies (sig=0.2093)				
7.To enjoy views of nature (sig=0.7623)				
8.To learn about nature (sig=0.4804)				
9.To listen to nature sounds (sig=0.5209)				
10.To watch birds, butterflies and other wildlife (sig=0.3913)				
11.To breathe fresh air (sig=0.6335)				
12.To be in tranquility, away from urban noise (sig=0.8721)				
13.To find shade on hot summer days* (sig=0.0516)	3.6	3.9	3.5	3.3
14.To pick berries, mushrooms, herbs, etc (sig=0.1197)				
15.To fish* (sig=0.0609)	2.0	2.5	2.3	2.1

*Note: 3 In this table: * - significant on 0.1 level, ** - significant on 0.05 level, *** - significant on 0.01 level*

The importance of green areas in the city – Tallinn

In Tallinn, the opportunities provided by urban green areas that were viewed as most important represented regulatory services (Figure 31). Breathing fresh air (which represents air quality regulation) and being in tranquillity (which represents noise mitigation) were seen as the most important things that were provided by urban green areas. For inhabitants in Tallinn 'to be in tranquillity, away from urban noise' (91%), which is actually a regulatory ecosystem service, was rated second highest Providing a place to walk in nature, which was also highly rated in both cities, was the rated as third highest in Tallinn (90%).. The provisioning ecosystem services (picking berries, etc. and fishing were not seen as important). For many of the activities, results were supported by the NATTOURs visitor study results in Tallinn green area sites. A comparison of the results according to the average score of importance for each activity is seen in Figure 32. As this question was about green areas in general at the city level, this should not be seen as criteria by every green area. However, more importantly it is an indicator that some green areas in the city that provide these opportunities. This importance can also be interpreted as demand for ecosystem services (regulatory, cultural, and provisioning), as all of these categories are covered by the activities.

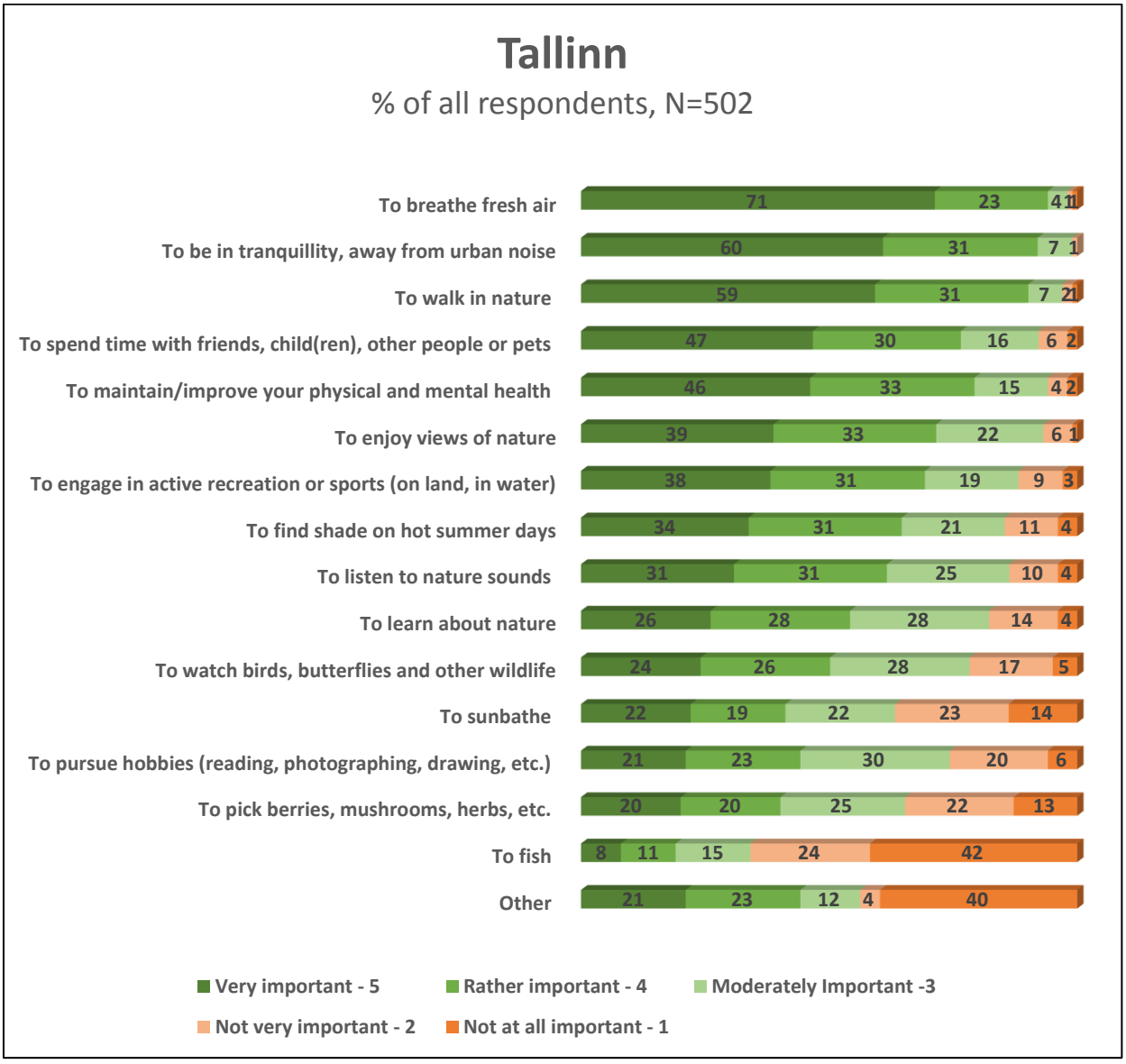

Figure 31 The importance to residents of having green areas in Tallinn where it is possible to engage in or exoerience the following activities/opportunities. Source: NATTOURS Online survey, 2017.

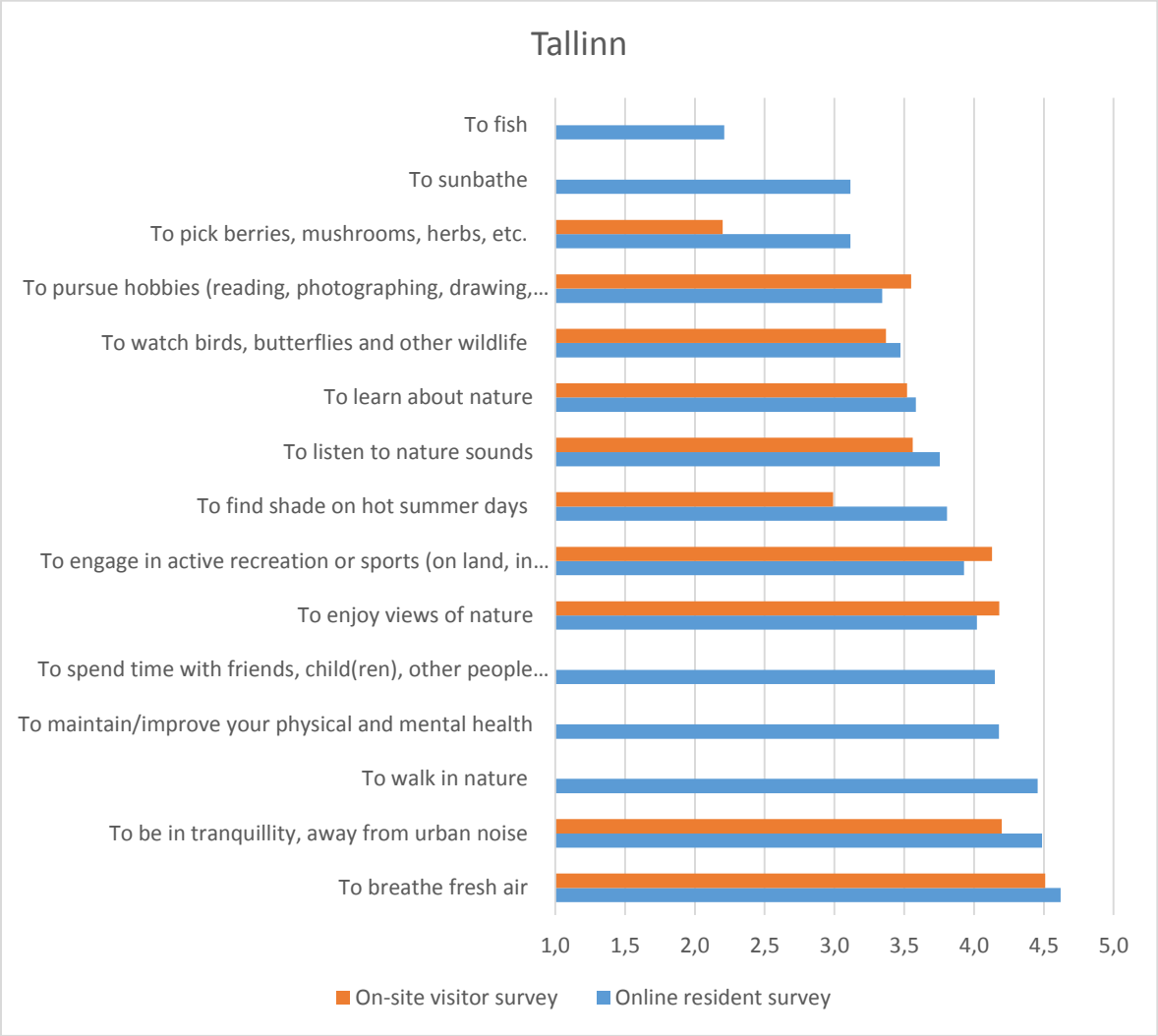

Figure 32 Activities that Tallinn residents feel should be enabled by green areas with average scores of importance. The scores were given on a 5-point scale, which ranged from "1 – not important at all" to "5 – very important ". This question was asked in both the NATTOURS green area visitor survey (2017) (Q7) and online resident survey (2017). Note: not all the same activities were asked in both surveys.

Analysis of differences according to nationality in Tallinn

As can be seen from Table 4, Russians systematically assess the importance of different activities related to urban green areas, higher than Estonians. Specifically high importance has been assigned by Russians to the following activities: to watch birds, butterflies and other wildlife (average value: 4.7), to walk in nature (4.6) and to be in tranquility (4.6). For Estonians, the sequence of most important activities on green areas are exactly the same, but with slightly lower average scores (4.6; 4.4 and 4.4).

Table 4 Differences in importance of activities related to urban green areas (Q7) according to nationality

	Average for Estonians	Average for Russians
1.To walk in nature *** (sig=0.0006)	4.4	4.6
2.To spend time with friends, children, pets*** (sig=0.0001)	4	4.4
3.To maintain/improve physical and mental health (sig=0.303)		
4.To engage in active recreation or sports (sig=0.123)		
5.To sunbathe *** (sig=0.0001)	2.8	3.5

6.To pursue hobbies *** (sig=0.0004)	3.2	3.6
7.To enjoy views of nature *** (sig=0.0001)	3.8	4.3
8.To learn about nature *** (sig=0.0001)	3.4	3.9
9.To listen to nature sounds *** (sig=0.0001)	3.5	4.0
10.To watch birds, butterflies and other wildlife *** (sig=0.0013)	4.6	4.7
11.To breathe fresh air (sig=0.091)		
12.To be in tranquility, away from urban noise *** (sig=0.010)	4.4	4.6
13.To find shade on hot summer days *** (sig=0.0002)	3.6	4.0
14.To pick berries, mushrooms, herbs, etc *** (sig=0.0001)	2.8	3.4
15.To fish *** (sig=0.0001)	1.9	2.6

*Note: 4 In this table: * - significant on 0.1 level, ** - significant on 0.05 level, *** - significant on 0.01 level*

If looking at the most important activities that respondents have been chosen, one can spot some differences between Estonians and Russians (see next figure). Among Estonians, 25% of respondents have said that the most important activity related to green areas is to walk in nature, 17% have claimed it is to breathe fresh air and 14% have claimed that it is to spend time with friends, children or pets; and to maintain physical and mental health. Among Russians, one third of respondents have said that the most important activity for them is to walk in nature, 18% have said it is to spend time with friends, children or pets, and 14% have said that it is to breathe fresh air.

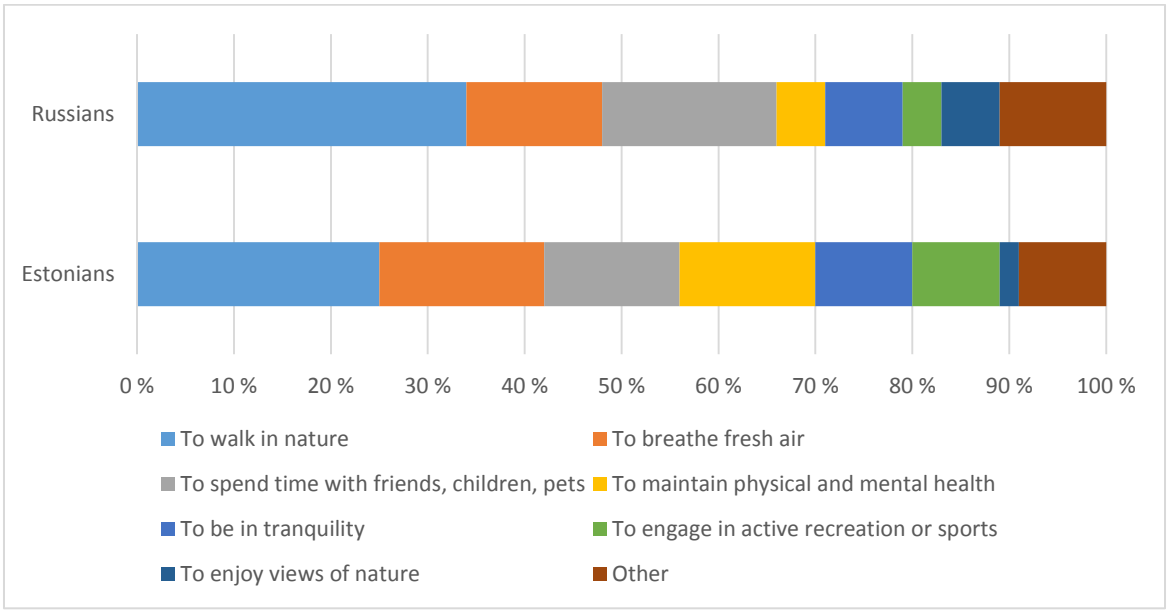

Figure 33 The most important activities of respondents (Q7_1), by nationality (% within nationality)

Analysis of differences according to household type in Tallinn

There are also differences in terms of how importance of activities is linked with household type. For example, there was a statistically significant difference between the importances for different households related to the following activities: of having an green area where one is able to spend time with friends, children and pets; learning about nature; to find shade on hot summer days; to fish; to walk in nature; to listen to nature sounds; and to breathe fresh air. Compared to Helsinki, the difference in importance appears for more activities. Furthermore, it is intersting that households of two adults have consistently lower averages, while single people have in several cases even higher values than households with children.

Table 5 Differences in importance of activities related to urban green areas (Q7) according to household type (Tallinn)

	Average for singles	Average for singles with children	Average for two adults	Average for two adults with children
1.To walk in nature** (sig=0.0355)	4.5	4.6	4.4	4.8
2.To spend time with friends, children, pets*** (sig=0.0001)	4	4.3	3.9	4.5
3.To maintain/improve physical and mental health (sig=0.109)				
4.To engage in active recreation or sports (sig=0.108)				
5.To sunbathe (sig=0.5757)				
6.To pursue hobbies (sig=0.1530)				
7.To enjoy views of nature (sig=0.0958)				
8.To learn about nature*** (sig=0.0095)	3.7	3.6	3.3	3.7
9.To listen to nature sounds** (sig=0.0167)	4	3.7	3.5	3.8
10.To watch birds, butterflies and other wildlife (sig=0.1718)				
11.To breathe fresh air** (sig=0.0393)	4.6	4.8	4.5	4.7
12.To be in tranquility, away from urban noise (sig=0.0540)				
13.To find shade on hot summer days*** (sig=0.0074)	4	3.9	3.6	3.9
14.To pick berries, mushrooms, herbs, etc (sig=0.7827)				
15.To fish*** (sig=0.0020)	1.9	2	2.2	2.5

*Note: 5 In this table: * - significant on 0.1 level, ** - significant on 0.05 level, *** - significant on 0.01 level*

Recommendation for city action:

- Helsinki and Tallinn: when assessing the urban green areas on a city wide scale, ensure that there are green areas which provide for highly demanded aspects, such as providing opportunity to "breath fresh air", listen to nature sounds, and enjoy tranquillity. As the enabling of the experiences of tranquillity and fresh air require certain types of green areas and certain locations, it is also important to enable the accessibility of green areas which provide these opportunities which are considered important to residents.
-

6. Provisioning ecosystem services

Provisioning ecosystem services are defined as ones that „describe the material or energy outputs from ecosystems...includ[ing] food, water and other resources" (TEEB 2010 p18)[13]. For the urban setting, this typically includes the production of vegetables in gardens, edible, medicinal and ornamental wild plants, fish and honey bees, as well as fresh water. According

[13] by CICES as „"includ[ing] all material and energetic outputs from ecosystems; they are tangible things that can be exchanged or traded, as well as consumed or used directly by people in manufacture.„ (EEA 2011 p4)

to the European Commission 4th Urban Ecosystems report, food and water are the most important of these provisioning services (European Commission 2016), at least in the European setting. It is important to note that the significance of services is also relative. While the production of food or raw timber material are not typically considered important urban ecosystem services, it is dependent on how far the borders of the urban area being considered extend into the surrounding (rural) areas (Niemelä et al. 2010), as well as how one defines *urban*.

In this report, we focus on provision of food. Due to the nature of urban areas, food is often grown in less dense areas outside the downtown area. However, one of the main spaces for the growing of vegetables are gardens – either private in peoples' homes or housing areas, allotment gardens, or other urban gardening spaces. Due to recent innovations, vegetation, including vegetable farming can take place in small spaces within city centres (roof top gardens, green walls, fruit trees, etc.). In addition to gardening, it is also possible to raise small animals (ducks, chickens, etc.) or insects (honey bees or edible insects) within urban areas.

Provisioning ecosystem services can overlap with regulating services, such as pollination where bee keeping results in the production of honey, as well as the delivery of pollination services to the surrounding areas. Overlaps can also be found with cultural ecosystem services, such as recreation and cultural heritage for activities such as gardening in allotment gardens, picking berries and mushrooms, etc. which may be considered culturally significant activities, as well as activities which result in an output of food.

Based on the results of the NATTOURs online residents survey, a majority (70%) of Helsinki respondents reported that it was important (moderately important to very important) for them to have green areas in Helsinki where they could pick berries, mushrooms, herbs, etc. Only 31% of respondents reported the same for fishing, another provisioning and cultural service. However, when respondents were asked to select the most important activity for them, only a very small share of respondents (1% each) felt that picking wild edibles or fishing were the most important activity for respondents. In Tallinn, the results were similar with a majority (65%) of respondents reporting that it was important for them to have green areas in Tallinn where they could forage; 34% reported the same for fishing. However, when respondents were asked to select the most important activity for them, only 3% of respondents selected picking wild edibles and 2% of respondents selected fishing. Furthermore, according to Figure 30 and Figure 32, in both cities, picking wild edibles and fishing were among the lowest average scoring activities that residents felt it was important to be able to do in green areas.

Management of urban green areas for provisioning services

In larger urban areas, issues such as contamination of wild plants and animals through pollutants distributed through water, soil and air could be a health and safety concern, though soil pollution can be avoided by using raised beds. For public authorities, it might be relevant to consider reserving and preserving safe and accessible areas for food cultivation activities. Planners can indirectly influence the provisioning services by identifying places for this in plans. According to an urban gardening study by Luokkala (2014), „by mentioning gardening and food, [planners] can trigger the next planning level to respond. Detailed plans can also make suggestions for new types of quarters that incorporate food-growing, while master plans can present edible parks and community fields." Co-benefits, such as production of local food through gardening and thus potential CO_2 mitigation of residents, health benefits through physical exercise outside, and access to affordable healthy food (food-security) (see Luokkola 2014) should be also be considered. Of course, it should be noted that the growing season in Northern Europe is relatively short. In the NATTOURs online survey, about a third of both Helsinki and Tallinn respondents who had not in the last year grown their own fruits, vegetables and/or herbs stated that they were interested in doing so.

Tallinn and Helsinki – Supply and demand of provisioning ecosystem services

The City of Helsinki has set aside city owned properties for allotment gardens. Such allotment gardens for growing food date back to the early 1900s. As they are situated at the edge of what was the city at that time, the locations are currently more urban. (Luokkala 2014) Helsinki has two types of allotment gardens – those with small cottages and those without. There are several allotment garden areas in the city and the garden plots are typically 250-500 m^2 (Suomen Siirtolapuutarhaliitto 2017). Helsinki has 103 400 ha of allotment garden area with cottages (City of Helsinki 2017). In Helsinki, there are also active urban gardening projects to promote urban gardening and raise awareness about sustainable food systems (Luokkola 2014). However, gardening also takes place in apartment building balconies and fruit trees planted in the city. In Helsinki, there is a crowd-sourced database of publically accessible fruit trees and bushes or urban harvest map online (see Satokartta.net). Helsinki also has several urban bee-hives located within the downtown area.

In Tallinn, city government rented out its land to city dwellers for growing vegetables and fruits at least since 1920s. The largest gardening areas were around Pelgulinn – a suburb consisting mostly of apartment buildings. A new type of allotment gardens or cooperatives was established during the Soviet period. A majority of these allotment gardens have always been located outside the city and currently there are very few left within the city. However, the City of Tallinn has started urban farming experiment in 2017. In Tallinn, fruit and vegetables are grown in many private family gardens all over the city, but the extent of which has been poorly studied. There are 2000 ha of private gardens in Tallinn, covering 12% of the city's area. There is no data found for Tallinn or Helsinki about the amount of food produced within the city, thus the actual levels of supply are difficult to estimate.

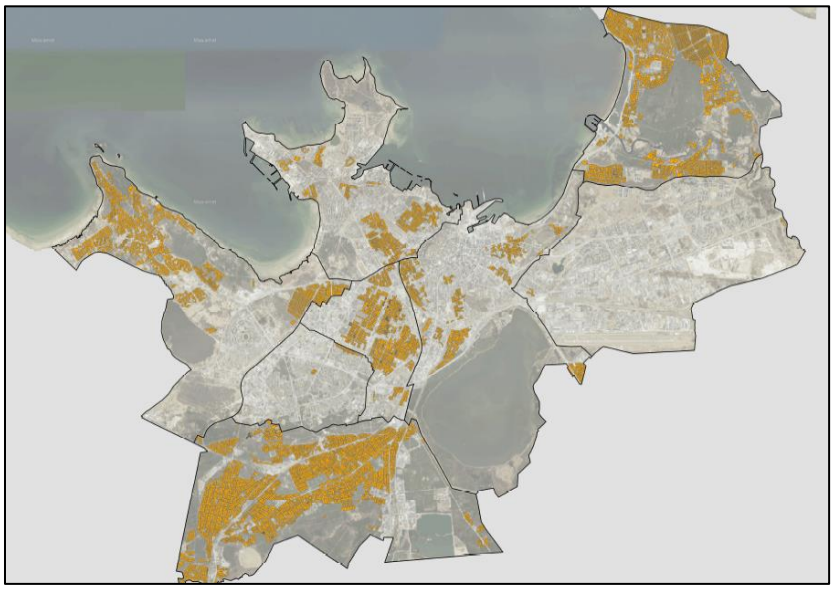

Figure 34. Gardens and yards of detached, row and smaller apartment houses cover 12% of Tallinn city area. Source: (Tallinn City Environment Department 2016)

The demand for the urban provisioning service related to food can be indicated by use or interest in growing one's own food or food related items. According to the NATTOURs online survey of residents, fruits, vegetables or herbs were grown by 35% of the population within Helsinki and by 31% of the population within Tallinn past year. People mostly grow fruits, vegetables or herbs on their balcony in Helsinki (43%) and Tallinn (48%) or in their home

garden (37% in Helsinki, 38% in Tallinn). In Helsinki, 10% of respondents grew them in allotment gardens and in Tallinn 3%. This makes sense because there are more allotment gardens than in Helsinki as compared to Tallinn. About one third of the inhabitants in Helsinki (33%) and in Tallinn (35%), who haven't grown fruits, vegetables or herbs during past year, would like to do so.

When survey respondents were asked how important it was for them to live to certain types of urban green areas, 11% of respondents from Helsinki felt it was rather or very important that they live close to areas where they could garden. It should be noted that this was considered the least important out of all the listed green area types. Similarly only 2% of respondents selected gardening areas as the most important type of green area for them to live nearby. In Talllinn, 23% of the respondents rated living close to it as very important or rather important, which although least important in both cities, is still much larger a percentage than in Helsinki. In Tallinn, 4% of respondents selected gardening areas as the most important type of green area for them to live nearby. Only 1-2% of respondents in Helsinki and Tallinn respectively reported having a gardening areas as the closest green area to their home.

Recommendation for city action:
Tallinn

- To map potential areas for allotment gardens, either raised bed plots, in the ground, or even on roofs . Soil safety and potential pollutants should be considered.
- To work with a Civil Society Organisations to promote urban gardening on private and communal properties and establish good practices, and to gather and test ideas on a small scale before scaling up.

7. Regulating ecosystem services

Regulating ecosystem services are defined as „services that ecosystems provide by acting as regulators" (TEEB 2010 p18) This includes filtration, sequestration, storage and accumulation processes, flood and storm protection, hydrological cycle and water flow maintenance, micro- and regional climate regulation, etc. (EEA 2013). The demand for regulating services can be high in urban areas due to the risk exposure, e.g. from noise, air pollution, etc. (European Commission 2016). Further examples of regulating ecosystems, their classification type and examples are seen in Annex 1.

There can be significant overlaps between regulating ecosystem services, provisioning services, and cultural services. For example, plants such as reeds or willow, which are used for making ornaments also provide important regulating functions. Vegetation also provides a setting for cultural services such as recreation and aesthetic services. While areas can produce both habitat providing services to support biodiversity and recreational services (Niemelä et al. 2010), it must also be noted that there can be conflicts between the two when e.g. animals like geese excrete in large amounts in green areas or vice versa when recreational activities impact the ability for plants and animals to utilise the green spaces, e.g. for nesting.

Awareness and valuation of regulating services (Q 16 and Q 11)

Residents in Helsinki and Tallinn were also asked about their awareness of regulating services (Q16). They were specifically asked about how familiar they were with the idea that urban green areas provide for free other benefits, such as "air filtration, pollination, water retention, noise buffering, wind protection, nutrient recycling, etc." in addition to opportunities for recreation. About a quarter of respondents in **Helsinki** were very familiar with the idea, while

around half of the respondents were somewhat familiar with the idea. The benefits from regulating services which they were most familiar with were air filtration, habitat provision, and noise buffering (in that order). In **Tallinn**, a little less than a quarter (22%) of respondents were very familiar with the idea that urban green areas provide other benefits in addition to opportunities for recreation for free and a little under half (47%) of respondents were somewhat familiar with the idea. In Tallinn, respondents living in a house with less flats, row house, semi-detached or detached house were more aware than those living in larger apartment buildings. Furthermore, 30-44 year olds were less aware than other age groups. In Tallinn, the top three benefits that respondents were most aware of were the same as in Helsinki, but in the order or air filtration, noise buffering, and habitat provision.

In our online survey (Q 11) Helsinki and Tallinn residents were also asked the importance of the green space within 2km radius of their home was for them for different reasons. Among the listed reasons of potential importance they were asked to rate were "improving the local environment (better air quality, less noise, improved storm/rainwater management, protection from wind, improved biodiversity and…)" and „maintaining/improving the preparedness of the city for the impacts of climate change".

In **Helsinki**, 79% of respondents felt that the green space within 2km of their home was very important or rather important for improving the local environment. This was the third most highly rated reason for importance. Only 4% felt it was not very important or not at all important. Another reason which residents were asked to rate is „maintaining/improving the preparedness of the city for the impacts of climate change". In Helsinki, 62% felt it was very important or rather important for this reason. Only 12% felt it was not very important or not at all important.

In **Tallinn**, 87% of respondents felt that the green space within 2km of their home was very important or rather important for improving the local environment.t. In Tallinn, this was the most highly rated reason for importance. Only 2% felt it was not very important and none felt it was not at all important. Another reason which residents were asked to rate is „maintaining/improving the preparedness of the city for the impacts of climate change". In Tallinn, 60% of respondents felt it was very important or rather important for this reason. Similar to Helsinki, only 12% of Tallinn residents felt it was not very important or not at all important.

In conclusion, although a very high percentage of Helsinki and Tallinn residents consider green areas very important for "improving the local environment," there is room for improvement in both cities about the awareness of the importance of ecosystems for their supply of regulating services, especially improving the preparedness of the city for climate change impacts.

Recommendation for city action:

- Helsinki and Tallinn: to improve awareness in both cities about the importance of urban green areas for improving city preparedness for climate change impacts. In Tallinn, targeted awareness raising measures could be considered, e.g. apartment building areas where awareness levels are lower, with city planners and apartment associations as the target groups.

Management of urban green areas for regulating services, examples

Regulation of air quality by urban trees and forests

Urban areas have high levels of air pollution due to traffic, including from studded tire use in the winter, heating and in some cases industry. Links have been made between living in proximity to busy streets and health risks (Orru et al. 2009, Kollanus et al. 2015). Theoretically,

urban vegetation improves air quality through removal (leaves, stems, and roots) or interception of pollutants (e.g. particulates, ozone, nitrogen dioxide and sulfur dioxide). The idea is that planting trees and other vegetation can improve air quality. There have also been Finnish study which estimates the green roof's impact on air quality in Helsinki (Nurmi et al. 2016). Based on studies in cities comparable with Rotterdam, NL, Derkzen et al. (2015) identified the air pollution capture capabilities of different urban green spaces, namely trees, woodlands, tall shrubs, herbaceous vegetation, gardens. Nordic TEEB report (2012) identifies studies in Stockholm and Oslo, which also links vegetation, air quality and improved health.

However, an international literature review concludes that vegetation can slightly improve air quality, though the results are mostly mixed. They also highlight the situation of „street canyons" caused by high buildings or vegetation along roadsides, which can result in a high concentration of pollutants on the road itself (Vuorinen et al. 2015). Other recent Finnish studies suggest that the effect of vegetation might not be as high in Northern climates (Setälä et al. 2013; Viippola et al. 2016; Yli-Pelkonen et al. 2017). The European Commission (2016) claims that strategically planned green infrastructure can improve local exposure to pollutants, despite the lower effect.

Noise reduction

In urban areas, the demand for noise reduction services are greater than elsewhere due to the proximity of traffic (car, plane, train, tram, bus, shipping, etc.) for transportation of people, as well as logistics related to transportation of cargo. The exposure to noise can impact human health as well as the attractiveness of an area. Noise buffers and vegetated surfaces are ways to mitigate noise (Vuorinen et al. 2015). According to the European Commission report on mapping and assessing urban ecosystem services (2016), tree and shrub buffers should be situated close to the noise source in order to mitigate noise.

Climate regulation by reduction of CO2

Cities are a significant sources of carbon emissions from traffic, heating, as well as food related choices of its residents and are dependent on non-urban areas to sequester the CO_2 emitted. In a study of Stockholm County, it was estimated that the land area was capable of capturing under a fifth of the total CO_2 emissions created and 41% of transport related emissions (Jansson and Nohrstedt 2001). However, it should be noted, that these shares are not insignificant and have „great potential for assimilating CO_2 emissions of the human population living in Stockholm County." (Jansson and Nohrstedt 2001). Green areas do have a role to play in increasing the capacity of cities' carbon storage (Rasinmäki and Känkänen 2014). While it would be a challenge for urban areas to completely neutralise their emissions, there are cities which have taken on this goal. This can often be done using low-carbon energy sources, like solar or hydropower.

Vegetation, especially trees, acts as a carbon sink (Derkzen et al. 2015; Gómez-Baggethun and Barton 2013). The Helsinki City Environmental Centre has published as part of their carbon balance mapping process (Rasinmäki and Känkänen 2014), a checklist for increasing carbon storage through urban planning. It states the criteria for the measure as well as rates the significance of impact and identifies which phase of planning it relates to. An MS Excel-based calculator (in Finnish) is also available through the related Climate-Proof City website's (http://ilmastotyokalut.fi/vihrea-infrastruktuuri/hiilinielut/) toolkit.

Urban temperature regulation

Heat and cold both have an effect on health, as well as mortality, though the effect is more significant with extreme cold (Gasparrini et al. 2015). Vegetation covered surfaces (EEA 2012; Derkzen et al. 2015; Gómez-Baggethun and Barton 2013) and water have a cooling effect in

urban areas. In urban areas, buildings and sealed soil absorb and store the sun's energy and release it later to the surrounding air. This can create an urban heat island effect, or the „increased temperature of the urban air compared to its rural surroundings" (EEA 2012 p21). Water areas and large water bodies regulate the temperature and vegetation makes an impact through evapotranspiration, shading and decreasing wind speed (Skelhorn et al. 2014). Skelhorn et al. (2014) found that in a temperate city, the effects of surface vegetation (when compared to asphalt as a surface covering) on surface air temperature are noticeable. The cooling effect has also been studied in FI cities, such as Helsinki (Drebs 2011).

Habitat provision

According to the Millennium Ecosystem Assessment (2005) destruction and decrease of habitat is the cause of species extinction locally and globally. Habitat quality and quantity are directly impacted by land-use planning and in urban environments. Here, sufficiency of green areas and connectivity between them are key. According to the green infrastructure criteria developed by Finnish Environment Institute, core natural areas (forest areas) and their buffer areas should have certain parameters. The larger the core area, the higher the level of ecological integrity (Söderman et al. 2012).

Connectivity takes place through networks of green areas. Also, the connectivity in urban areas should not end at the city borders, but extend to integrate with regional level „ecological networks" and be accounted for in both levels of planning (Niemelä et al. 2010). Niemelä et al. (2010) highlight the conclusions of the studies in favour of integration of corridors into urban planning, despite some potential conflicts with conservation. Transportation corridors such as road and railways, as well as elk fencing, and the surrounding housing areas can create an impenetrable barrier for animal movement (Väre and Rekola 2007). Following recommended corridor planning metrics (see Väre and Rekola 2007; Niemi et al. 2007; Söderman et al. 2012) can help develop green corridors which enable animal movements from habitat to habitat, ensure the maintenance of certain ecosystem functions, as well as pathways for human recreational use. According to the green infrastructure criteria developed by the Finnish Environment Institute, the more connections that core natural areas with another area, the better it functions as an ecological corridor (Söderman et al. 2012).

Water flow regulation and runoff mitigation

Urban areas are made up of dense built-up areas and paved or sealed surfaces. The impermeability of sealed surfaces, along with deforestation and decrease of wetlands in a broader area means that water cannot be absorbed. This leads to run-off and flooding in extreme cases (EEA 2012). Natural ground cover has 25% deep infiltration, 25% shallow infiltration, 40% evapotranspiration, and 10% runoff. However, when you seal the soil by 25-50%, you decrease infiltration and evapotranspiration by 5-10% and increase runoff by 30% runoff. Sealing soil 75-100% can increase runoff by 55% (Alberti 2009).

Tallinn and Helsinki – Supply of select regulating ecosystem services

Carbon sequestration

Both Tallinn and Helsinki have carried out CO_2 emissions inventories (see City of Tallinn 2015; Rasinmäki and Känkänen 2014), the results of which are included in Table 7. In the inventory by Tallinn City, the role of woody vegetation in sequestering carbon is calculated and annual carbon removal by vegetation has been calculated to be around 1000 tons. The sink percentage is rather small, which is due to the old age of the urban trees: young actively growing trees are the best for carbon sequestration. In Helsinki, carbon storage is calculated for soil and vegetation separately. The share of built-up green areas, open green areas and forests are also calculated. The indicators collected are not comparable due to differences in units used.

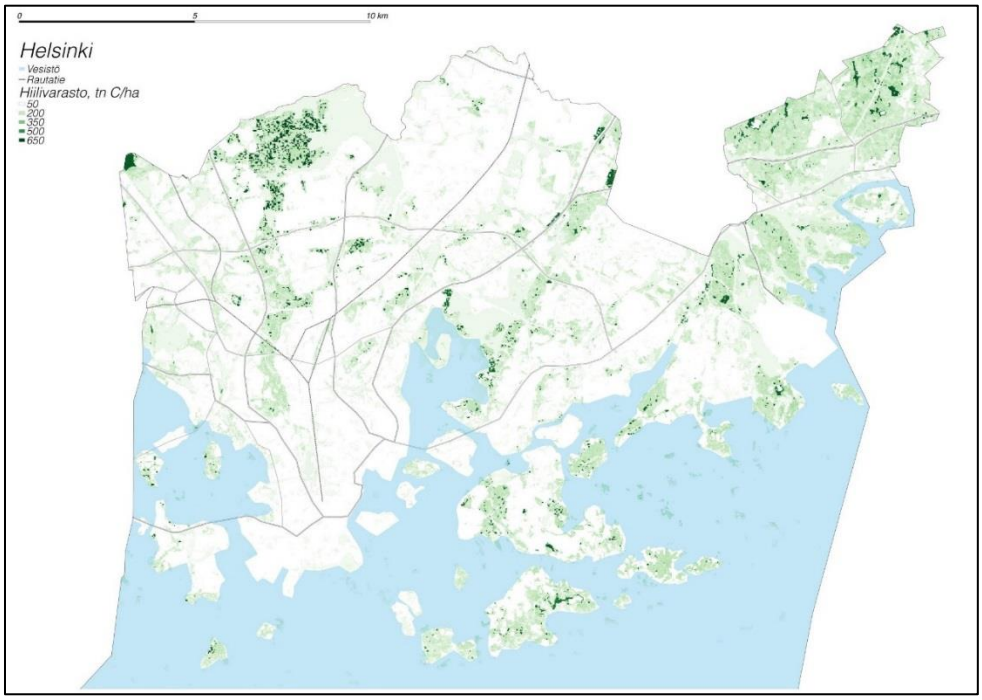

Figure 35 Helsinki soil and vegetation based carbon storage, Source: (Rasinmäki and Känkänen 2014)

Habitat provision

Helsinki and Tallinn are home to a large number of species that are protected by both Birds and Habitats directives. NATURA 2000 network of protected areas provide habitat for birds, mammals, plants and other species groups and habitat types.

Both Helsinki and Tallinn collect information on urban habitats and biodiversity, but not on yearly basis. Both cities have used the City Biodiversity Index (CBI) to monitor their indicators. Indicators that represent the situation related to habitat provision include connectivity, which represents the average amount of natural area that an individual of a certain wildlife species is connected to from any randomly chosen starting point in a landscape/city. This is calculated in terms of hectares of ecological network and used in both cities. Connectivity of green areas is important as it allows for species to move from one area to another. Nature protection or conservation areas are also important for ensuring the quality of environment for specific species. The figures below show the supply of habitat provisioning services in the two cities. The supply of ecosystem services, such as habitat provision can be analysed based on urban biotope maps - in Tallinn city this has been done for Northern Tallinn.

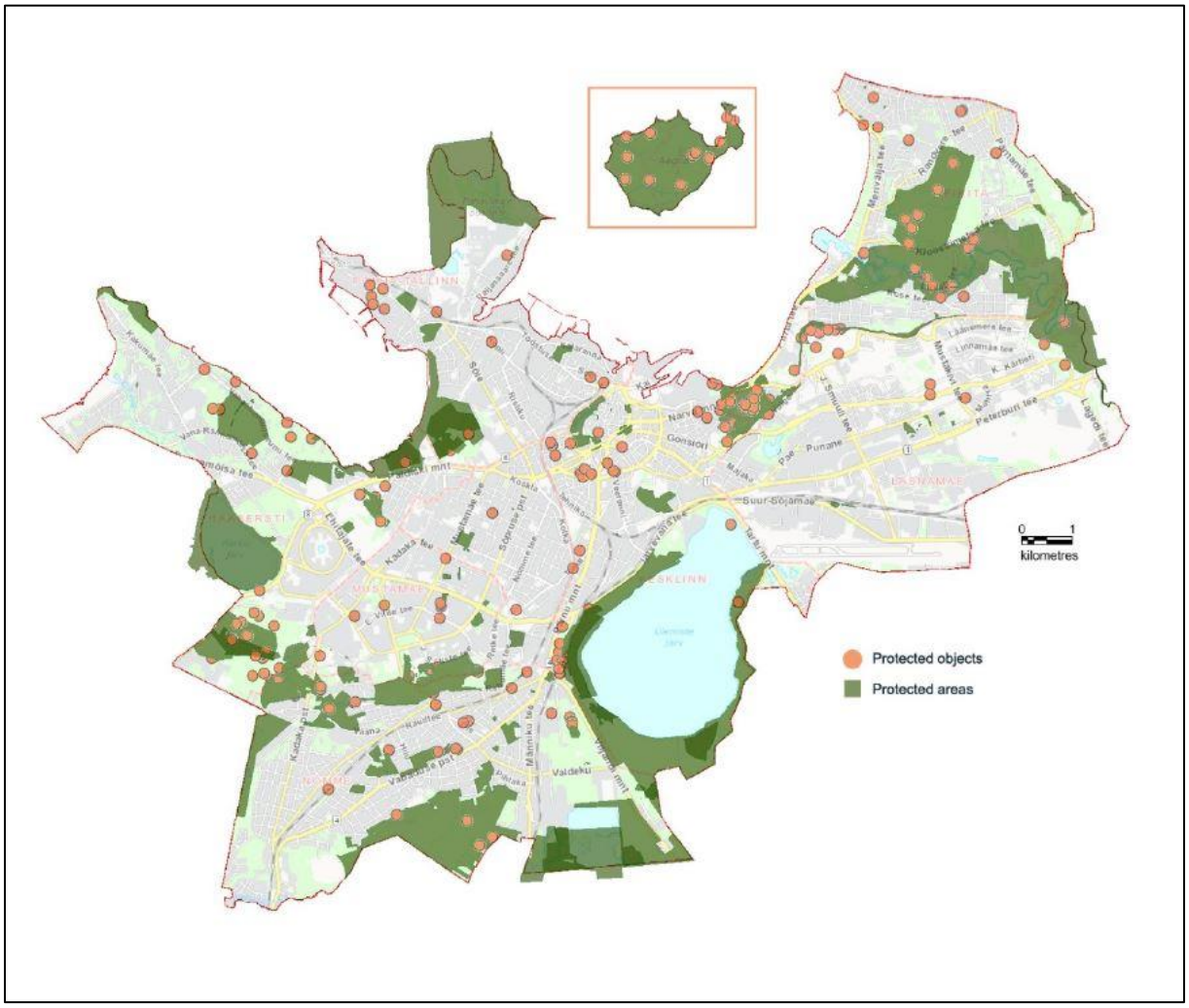

Figure 36. Protected species and conservation areas in Tallinn 2017. Source: (http://www.tallinn.ee/est/Indikaator-5_Tallinn-2020)

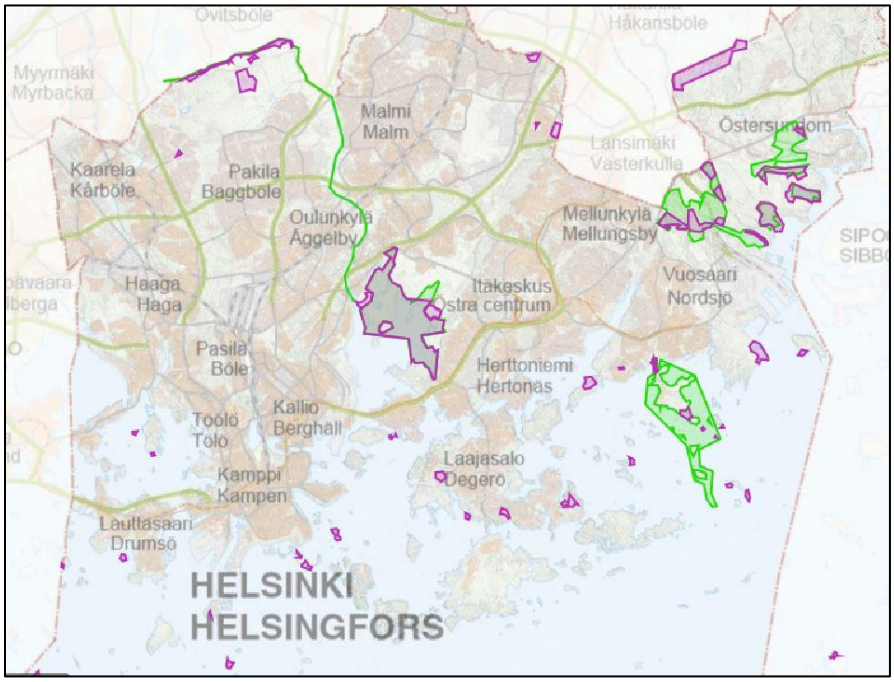

Figure 37 Helsinki nature protection areas (purple) and Natura 2000 areas (in green). Note: some Natura 2000 areas are covered by the nature protection areas Source: Helsinki Map Service, 2016

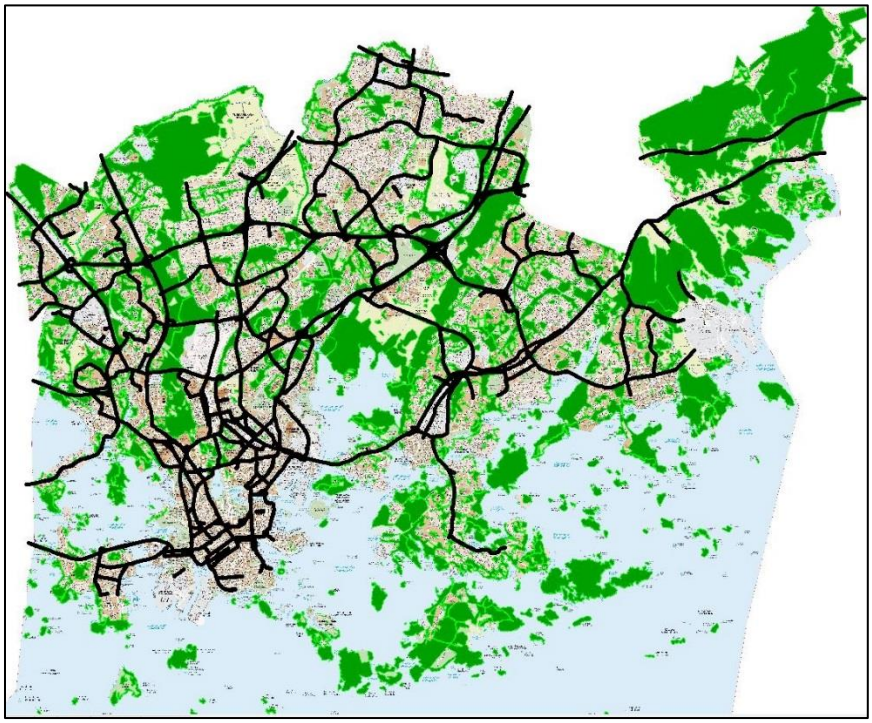

Figure 38 Ecological corridors in Helsinki. Corridors are the continuous green areas. The black lines show roads with high traffic (>5000 cars/day) which fragment corridors. One should also note areas with distances between various green areas, where the connection is broken due to distance. Source: Milja Heikkinen, 2015 using City Survey Department map (2015) in CBI indicator 2. http://www.hel.fi/static/ymk/indikaattorit/cbi-ekologiset-verkostot.pdf

Tallinn and Helsinki – Demand of select regulating ecosystem services

Noise mitigation

Both Tallinn and Helsinki have been monitoring the noise situation in the city area, modelled noise maps and compiled action plans (see http://www.tallinn.ee/est/Mura and http://www.helsinginymparistotilasto.fi). However, based on the NATTOURS visitor studies, users of the green areas in the study did cite getting away from the urban noise as one of the reasons for visiting green spaces. More specifically, “being in tranquillity” was rated as being between 4 - 4.4 in importance on a scale of 0 - 5 where 5 represents very important.

Urban temperature regulation

The risk for such effects in Northern Europe are much lower, than places closer to the equator (Baccini et al. 2008), though the level of discomfort is relative to location as well. For Helsinki, the threshold temperature (due to combined heat and high humidity) was 23,6 C, while for Athens it was 32,7 C. Neither Helsinki nor Tallinn are projected to have the problematic combined warm nights and days between 2071-2100 (EEA 2017), though heat may still be an issue at a lower level due to the lower threshold for heat in Northern Europe (Baccini et al. 2008). In Figure 39, it can be seen that there are areas of Tallinn where there is a large and very large impact on residents. For the EEA (2017) heat wave risk indicator , the blue and green areas are calculated by the areas classified in the Urban Atlas (2006) as water bodies, forests, agricultural areas, semi natural areas and wetlands, sports and leisure facilities, green urban areas, and Discontinuous low and very low density urban fabric. The share of green and blue urban areas in Helsinki was over 39%, while in Tallinn was calculated to be 20-29%.

In the NATTOURS project visitor survey of five different green areas (Paljassaare, Rocca al Mare, Kadriorg, Pornaistenniemi-Lammassaari, Harakka) in Tallinn and Helsinki, “getting shade on hot summer days” was one of the reasons for visiting these green areas. On average, shade was rated as having between 3 and 3.6 importance on a scale of 0 – 5 where 5 represents very important.

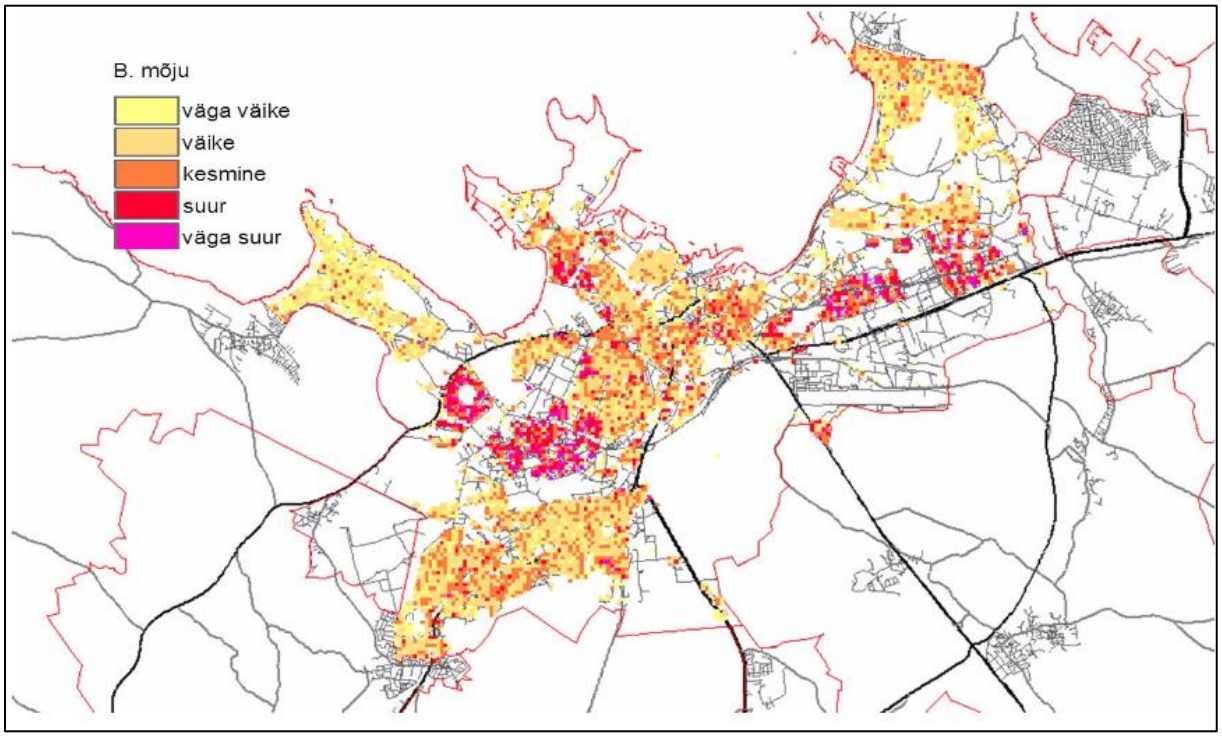

Figure 39. Vulnerability of citizens aged 0…4 and 65…, sensitiive to urban heat island effect in Tallinn. Yellow color: very small impact, Light orange: small impact, Orange: medium impact, Red: Large impact, Pink: Very larage impact. Source: Kliimamuutuste mõjude hindamine ja kohanemismeetmete väljatöötamine planeeringute, maakasutuse, inimtervise ja päästevõimekuse teemas" (KATI) http://www.geograafia.ut.ee/et/teadus/kati-kliimakohanemine

Water flow regulation and runoff regulating services

In the EEA projections related to the percentage of the city flooded in case rivers rise one meter, Finnish cities are listed as vulnerable (>40% flooded). The Estonian cities are all in the 20-40% category (EEA 2012). As Northern Europe is projected to have an increase in the number of intensive rainfall events, urban areas with higher levels of soil sealing are at higher risk. There is work active projects within Helsinki to improve permeability through increased green infrastructure (https://www.integratedstormwater.eu/pilot-site/helsinki). According to the EEA, Finnish cities have lower levels of sealing than Estonian cities (EEA 2012). However, according to city statistics, Tallinn and Helsinki have a comparable level of soil sealing. Tallinn has a 37% share of soil sealing, while Helsinki has a 32% share of soil sealing. Helsinki's permeability is visualised in Figure 40. More information will be available about soil sealing in Tallinn from the ENROUTE project after mid-2018.

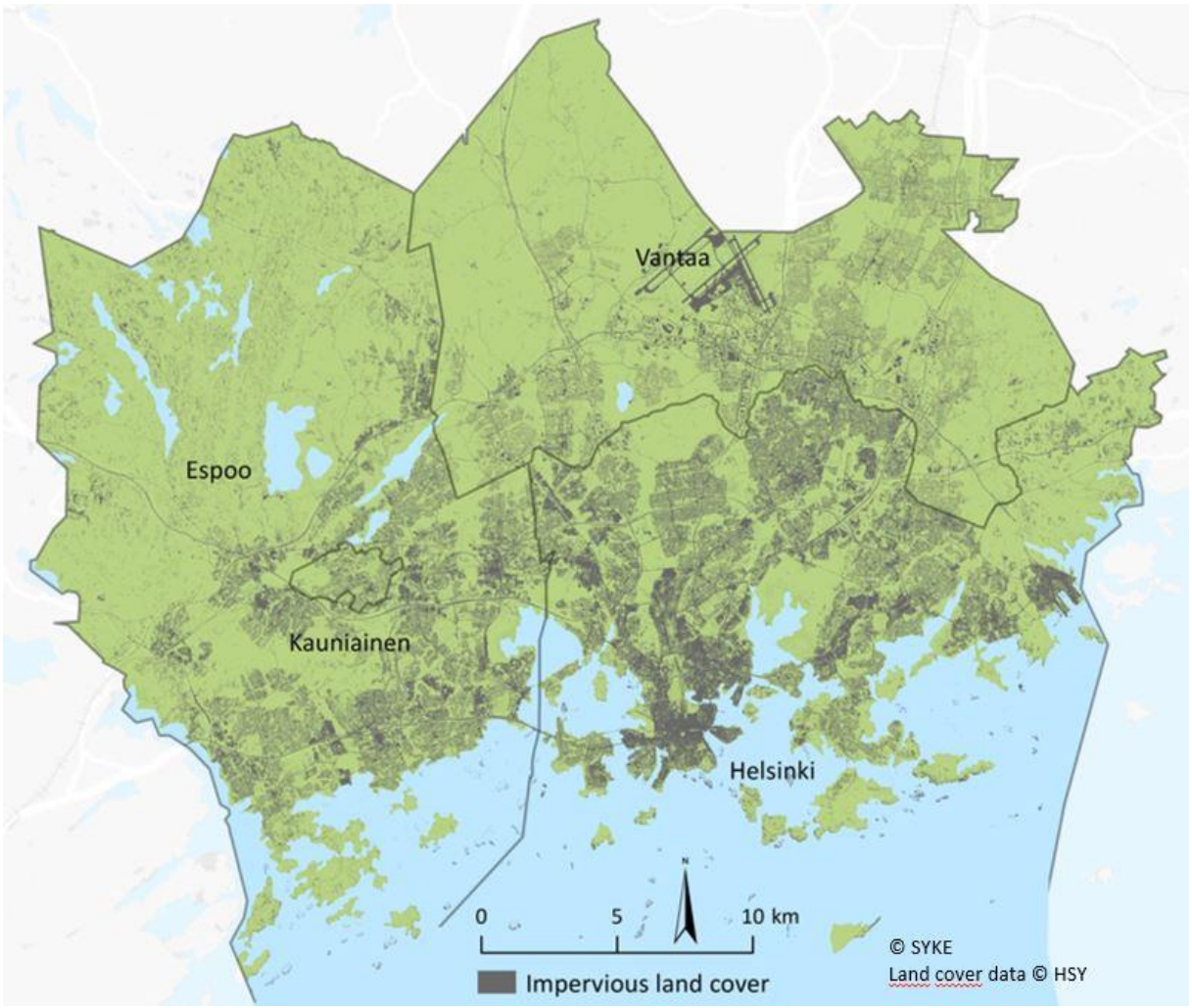

Figure 40 Figure 41 Soil sealing (impervious areas) in Helsinki (2017). Source: Arto Viinika, 2017

8. Values related to urban green areas in general

In Finland, numerous studies related to valuation of recreational services have also been performed (e.g. Horne et al. 2005), including some which relate to urban recreational services (Lankia et al. 2015; Ovaskainen et al. 2001; Tyrväinen 2001). One way to think of the value of such recreational services is the cost of physical inactivity related to physical and mental health (e.g. avoided healthcare costs) which can result from the lack of suitable spaces for activity (Kettunen et al. 2015). Though perhaps not a recreational service, the effects of green areas on apartment prices have also been studied in Helsinki (Votsis 2017). Valuation can also be performed in a non-monetary way exploring peoples' preferences, importance, or demands (Chan et al. 2012). In Estonia, examples of such are studies of recreational services of urban green infrastructure e.g. by Unt and Bell (2014) in the example of a former fishing harbour site, and Reimann et al (2013) in a visitor preference study on Paljassaare green area.

Non-monetary values associated with urban green areas in general - Helsinki and Tallinn (Q8)

In the online survey, residents of Helsinki and Tallinn were asked to select and rate the three most important values (out of 11 values) related to urban green areas. Respondents were asked to assess the values more broadly than just values related to your own personal use of urban green areas. (For site based valuation, see Chapter 9). These values can be associated with various types of ecosystem services. For example, economic value can be attached to the carbon cycle (regulatory ecosystem service), as well as recreational services. However, it should be noted that in our survey specific definitions of the values were given.. Cultural ecosystem services are associated with recreational, therapeutic and aesthetic values, which can be seen as directly beneficial to residents from time spent in the green areas. Recreational value comes from having space(s) where one can spend free time, therapeutic value comes from feeling better mentally and/or physically from being there, and aesthetic value is a holistic sensory experience that enhances feelings. Cultural-historic value and educational value are also considered as related to cultural ecosystem services. Biodiversity value can be considered a regulatory value, as can life-sustaining value.

Ranking of values by Helsinki residents

For **Helsinki** residents, the top four ranked values were biodiversity[14], recreational, therapeutic and aesthetic. Biodiversity and recreational values were ranked in the 3 most important values by a little over half of the respondents, while therapeutic and recreational were ranked in the 3 most important values by a little over 40% of respondents. Then there is a jump with future value, cultural-historic value and intrinsic value which were ranked as a top 3 value for about 25% of respondents and the rest of the values by an even smaller percentage of respondents. See Figure 41.

An analysis was carried out to see whether there was a correlation between the ranking of the 3 most important values (Q8) and the rating of values performed for a specific urban green area in each city (Q9). In Helsinki, people who assessed aesthetic, future, intrinsic, educational and therapeutic value as ranking in the 3 most improtant values in abstract terms, have also given higher rating to this value in case of specific urban green area considered. For the recreational value this pattern is not seen. This means that the way that people ranked recreational values people did not affect how they assessed the value or specific sites for recreational values. Also it cannot be distinguished in case of cultural-historic value. [15] In contrast with Tallinn, Helsinki residents who have ranked educational value among three most important ones, assess it more highly also in case of a specific green area they selected. [16]

[14] The value was translated as „nature value (provides space for biodiversity and its preservation)“

[15] In case of cultural-historic value, there are 126 respondents who have considered this value among three most important ones, in case of recreational value, there are 225 people who have considered this among three most important ones.

[16] The number of people who have chosen educational value among three most important ones, is merely 27 respondents.

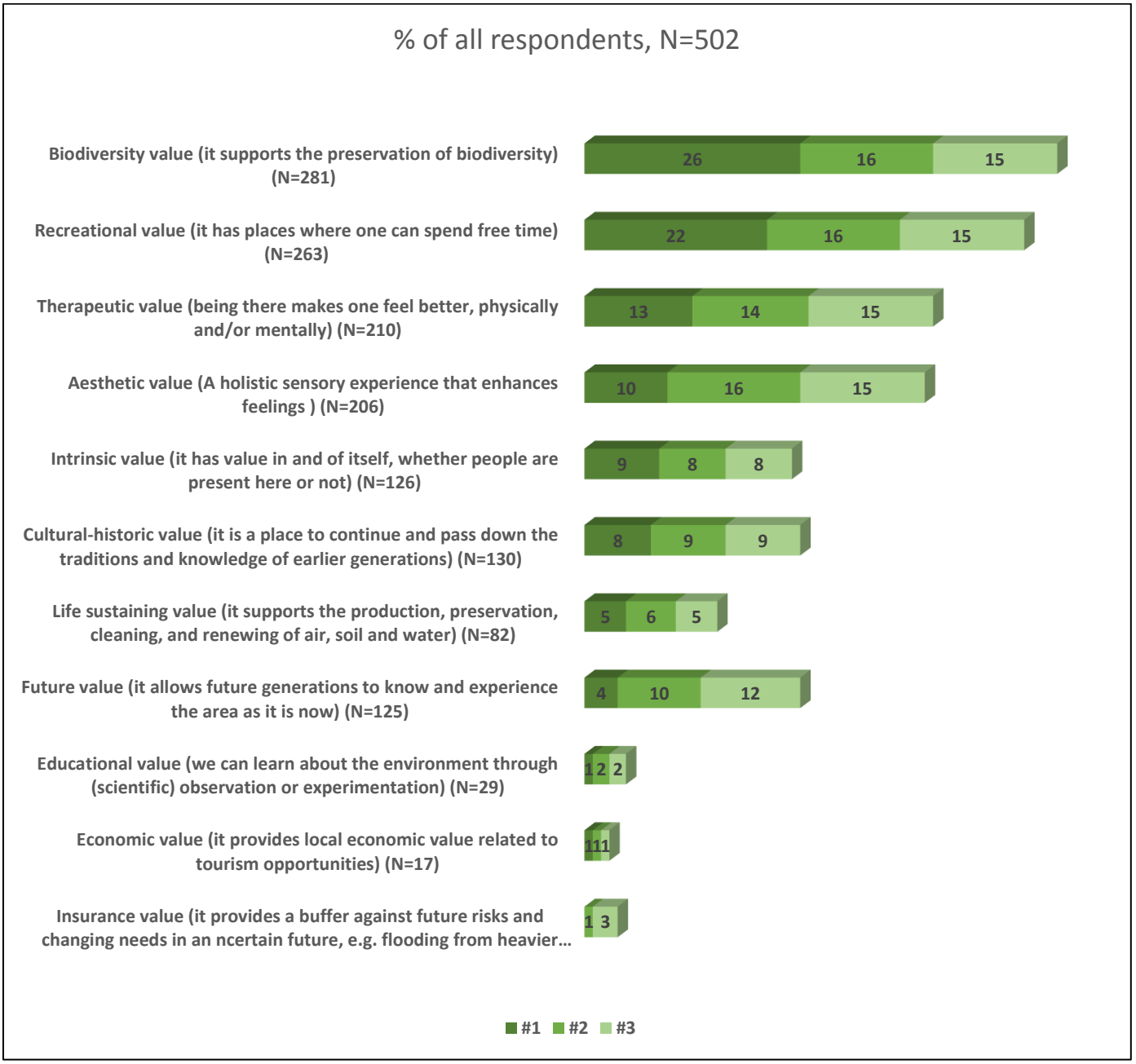

Figure 41 Selection and ranking of the three (3) most important values related to urban green areas in the order of mportance to the respondent (Helsinki). Source: Faktum & Ariko, 2017.

Recommendation for city action:

- Helsinki: to increase awareness of the values provided by urban green areas which are considered less important (not ranked as top 3 by as many residents), such as the life-sustaining value and insurance value provided by regulatory ecosystem services. Citizen awareness and demands can impact land use planning policies through politics. This could be broadened to include awareness related to urban green infrastructure, which may also factor into the decisions related to increasing the green factor of private properties.

Ranking of values by Tallinn residents

For **Tallinn** residents, the top four ranked values were **recreational value and life-sustaining value** which were ranked in the 3 most important values by a little over half of the respondents, while **therapeutic and aesthetic value** were ranked in the 3 most important values by 44% and 38% of respondents (respectively). Biodiversity and future value were ranked as a top 3 value for 34% and 28% of respondents and the rest of the values by an even smaller percentage of respondents. See Figure 42.

An analysis was carried out to see whether there was a correlation between the ranking of the 3 most important values (Q8) and the rating of values performed for a specific urban green area in each city. For Tallinn, there is a correlation between the people who ranked aesthetic value, cultural-historic value, future value, intrinsic value and therapeutic values as most important ones in abstract terms (Q8) and the assignment of higher values for a specific urban areas of this specific value type (Q9), compared to these people who didn't rank this value among most important ones. The only value types where there was no correlation between two things, are educational value and recreational value, meaning that „abstract" value ranking did not influence how people ranked the values attached to the specific green urban areas they assessed (Q9). [17]

[17] It must be noted that in absolute terms, the number of people who ranked the values among the most important ones, are different as well: for educational value, there were only 32 people who ranked it among three most important ones, but for recreational one, there were 252 people who ranked it among three most important ones (the biggest number of respondents chose this value as among three most important ones).

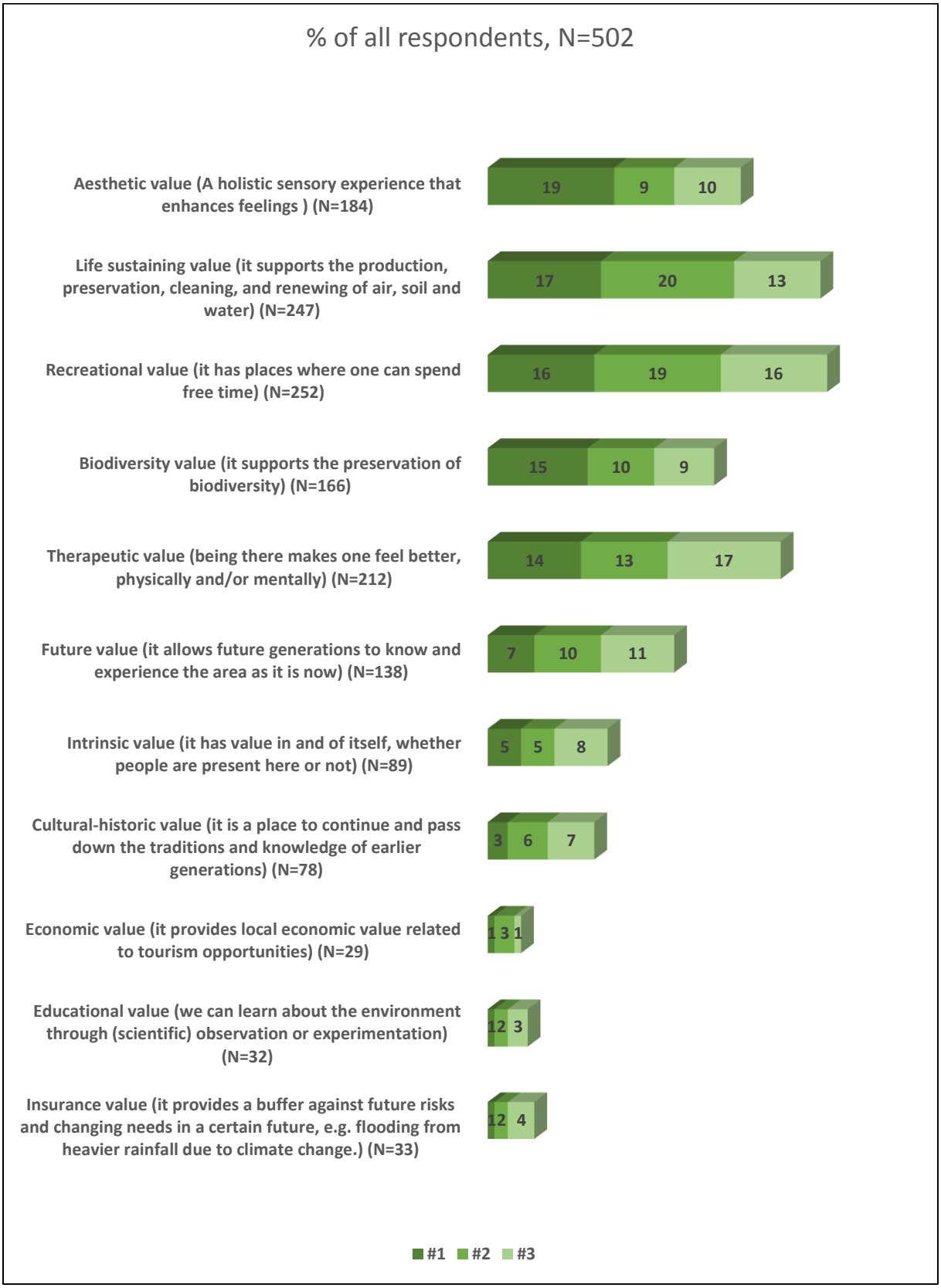

Figure 42 Selection and ranking of the three (3) most important values related to urban green areas in the order of importance to the respondent (Tallinn). Source: Faktum & Ariko, 2017.

9. NATTOURS case studies and ecosystem services – supply and demand of ecosystem services

In both the visitor and resident surveys performed in NATTOURs, the importance of specific ecosystem services were asked for green areas in general. This can be likened to **demand** for ecosystem services. The demand-based results are explored earlier in the report in the ecosystem service specific sections). Both surveys also asked participants to rate the level of ecosystem services in specific sites, which can be interpreted as the **supply** of ecosystem services. Together, these can be analysed to see whether specific green areas are in general meeting residents need. It should be kept in mind that green areas should vary in terms of characteristics and the activities they enable.

In the visitor survey, visitors were asked to rate the satisfaction with the possibility for each activity at the interview site. The scores were given on a 5-point scale, which ranged from "1 – not satisfied at all" to "5 – very satisfied". In the visitor survey, as well as an online resident survey, respondents were asked to rate the importance of being able to do these activities in green areas within the city. The scores were given on a 5-point scale, which ranged from "1 – not important at all" to "5 – very important". Furthermore, in the online resident survey, city residents selected a site within their city from the list and rated seven types of values (recreational value, future value, therapeutic value, intrinsic value, aesthetic value, educational value, and cultural-historical value) associated with the particular site. The scores were given on a 5-point scale, which ranged from "1 – very low or no value" to "5 – very high value". Of course, it should be noted that the rating of values is based on resident perceptions and familiarity with or use of the site is unknown.

The results will be discussed per site:

Pornaistenniemi (Helsinki, FI)

In the NATTOURS visitor survey in 2016, visitors were asked about their satisfaction specific to the possibility of engaging in various activities at this site, and both in the visitor survey and the online resident survey (2017) respondents were asked about importance of green areas for enabling certain activities. See Figure 43 for more details. On average, visitors **are at least slightly satisfied will all the possibilities provided** at the site and **very close to being satisfied (score of 4) with all the possibilities that were considered of relatively higher importance**. However, they are the least satisfied with picking berries/herbs/mushrooms. Technically, however, Pornaistenneimi-Lammassaari area is a nature conservation area type of site and does not allow for foraging. Also, the importance of this possibility was also not rated as highly as other possibilities.

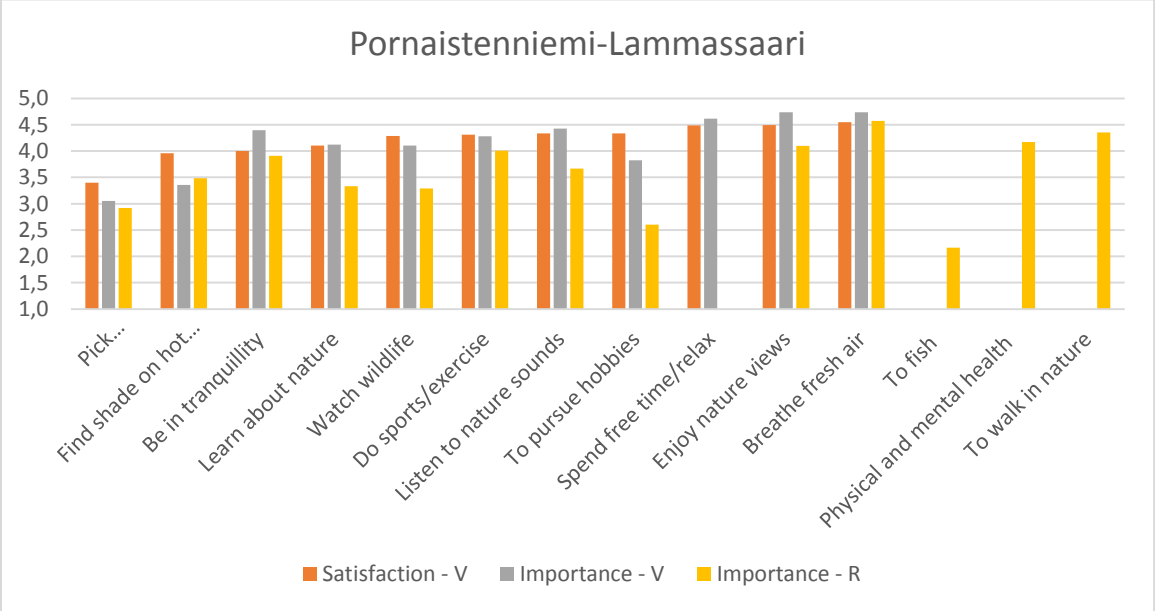

Figure 43 Importance of possibilities to be provided by green areas in general (not site specific) and satisfaction with possibilties in Pornaistenniemi green area in Helsinki. Source: Nattours visitor survey 2016 and online resident survey (2017). The scores were given on a 5-point scale, which ranged from "1 – not important/satisfied at all" to "5 – very important/satisfied". Visitor survey results are marked with a „V", while resident survey results are marked with a „R".

In our online survey, 122 respondents rated the level of personal value to them according to seven types of values associated with Pornaistenniemi. On the rating scale from "very low or no value" to "very high value," **area received a rating of "very high value" or "high value" for all the listed types of values by over 60% of the respondents**. The most highly rated values to the lowest rated values were recreational (88% of respondents scored it as "high" or "very high value"), aesthetic (84%), therapeutic value (84%), future value (83%), educational value (80%) and intrinsic value (79%). The high rating of recreational values, therapeutic and aesthetic values supports the high satisfaction of visitors with the ability to engage related activities/have specific experiences at the site. The lowest rated value was cultural-historical value, where 61% of respondents still rated it as high or very high value. [18] A ranking according to average scores is seen in Table 6.

[18] Note: correlation between the ranking of the 3 most important values (Q8) and the rating of values performed for a specific urban green area was analysed for each city. In Helsinki, people who assessed aesthetic, future, intrinsic, educational and therapeutic value as ranking in the 3 most improtant values in abstract terms, have also given higher rating to this value in case of specific urban green area considered. For recreational value and cultura-historical value, this pattern is not seen. This means that the way that people ranked recreational values and cultural-historical values did not affect how they assessed these values at the specific sites. This was also true for educational value, but only 27 respondents chose it as among three most important values in general.

Table 6 Average ratings of values related to Pornaistenniemi-Lammassaari. Source: Online resident survey.

Corresponding level	Average rating	Value
Very high value	5	
	4,4	recreational value
	4,3	therapeutic value
	4,2	aesthetic value
	4,2	future value
	4,2	intrinsic value
High value	4,1	educational value
	3,8	cultural historical value
Medium value	3	
Low value	2	
Very low value or no value	1	

The two studies look at different aspects but in general show that Pornaistenniemi is **highly valued for a variety of cultural ecosystem service values** by visitors to the site and in general by residents of Helsinki.

Harakka Island (Helsinki, FI)

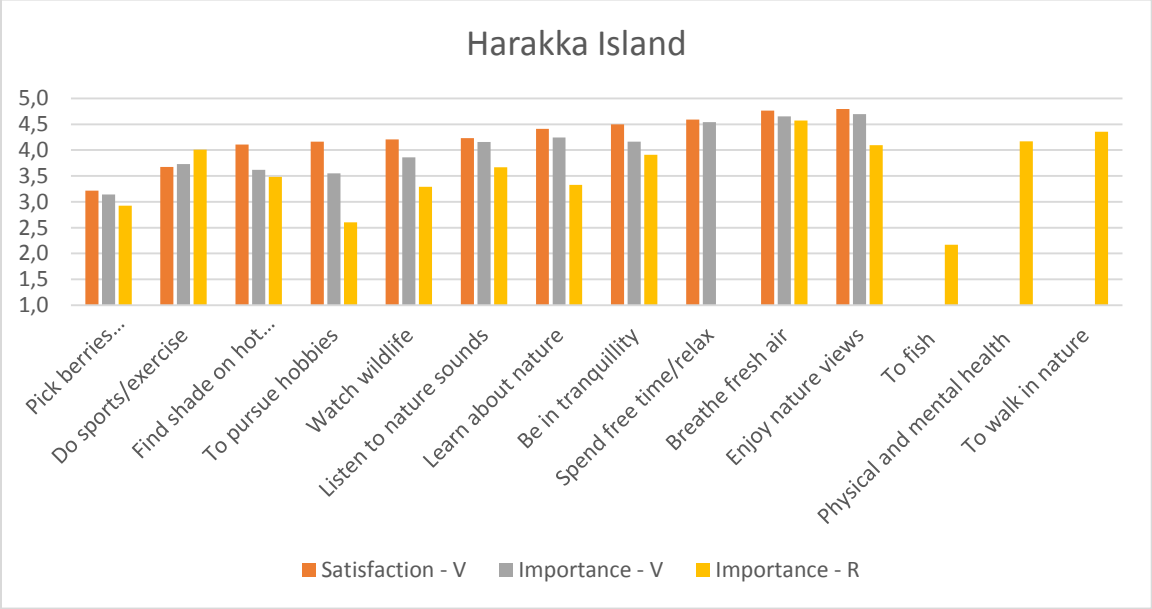

Figure 44 Importance of possibilities to be provided by green areas in general (not site specific) and satisfaction with possibilties in Harakka Island in Helsinki. The scores were given on a 5-point scale, which ranged from "1 – not important/satisfied at all" to "5 – very important/satisfied". Source: Nattours visitor survey 2016 and online resident survey (2017). The scores were given on a 5-point scale, which ranged from "1 – not important/satisfied at all" to "5 – very important/satisfied". Visitor survey results are marked with a „V", while resident survey results are marked with a „R".

In the NATTOURS visitor survey in 2016, visitors were asked about their satisfaction specific to the possibility of engaging in various activities at this site, and both in the visitor survey and the online resident survey (2017) respondents were asked about importance of green areas for enabling certain activities. See Figure 44 for details. On average, **visitors reported being at least slightly satisfied (score of 3) with all the possibilities provided at the site.**

However, the least satisfaction is with picking berries/herbs/mushrooms, which was rated on average providing moderate satisfaction. However, the generally rated importance of this activity was also not as high as other activities.

On average, visitors **are at least slightly satisfied will all the possibilities provided** at the site and **very close to being satisfied (score of 4) with all the possibilities that were considered of relatively higher importance**.

In our online survey, only 26 respondents rated the level of value to them personally according to seven types of values associated with Harakka Island in Helsinki. On the rating scale from "very low or no value" to "very high value," the **area received a rating of very high value or high value for all the listed types of values by over half the respondents (54%).** The small number of respondents choosing this site might be explained by the fact that Harakka is an island which requires ferry access that has an additional fee. Due to the small size of respondents, the responses can only be seen as an indication. As a green area, the Harakka Island received a rating of very high value or high value for all the listed types of values by over half the respondents. The most highly rated values to the lowest rated values were aesthetic (88%), intrinsic value (73%), cultural-historical value (73%), recreational (62%), future value (62%), educational value (65%) and therapeutic value (54%). The high level of aesthetic values perceived by residents supports the visitor satisfaction with being able to enjoy nature views in Harakka Island. A ranking of values according to average scores is seen in Table 7.

Table 7 Average ratings of values related to Harakka Island. Source: Online resident survey.

Corresponding level	Average rating	Value
Very high value	5	
	4,3	aesthetic value
	4,3	intrinsic value
	4,1	future value
	4,0	cultural historical value
High value	4,0	therapeutic value
	3,9	recreational value
	3,9	educational value
Medium value	3	
Low value	2	
Very low value or no value	1	

The two studies look at different aspects but in general show that **Harakka is highly valued for a variety of cultural values by visitors to the site and in general by residents of Helsinki. Both studies highlight the high aesthetic value (enjoy nature views).**

Central Park (Helsinki, FI)

Central Park in Helsinki was not part of the visitor surveys in 2017. However, in our online resident survey, 71% of the respondents (354) chose to rate seven types of values associated with Central Park in Helsinki. On the rating scale from "very low or no value" to "very high value," the Central park green area **received a rating of very high value or high value for all of the listed types of values by almost half the respondents (at least 46%).** The most highly rated values to the lowest rated values were recreational (82%), aesthetic (67%),

therapeutic value (76%), future value (73%) and intrinsic value (68%). The lowest rated value were cultural-historical value and educational value. However almost half (47% and 46%) of respondents rated them as high (very high value and high value) respectively. A ranking of values according to average scores is seen below.

Table 8 Average ratings of values related to Central Park. Source: Online resident survey.

Corresponding level	Average rating	Value
Very high value	5	
	4,4	recreational value
	4,3	therapeutic value
	4,1	future value
	4,0	intrinsic value
High value	4,0	aesthetic value
	3,6	cultural historical value
	3,5	educational value
Medium value	3	
Low value	2	
Very low value or no value	1	

Kadriorg (Tallinn, EE)

In our visitor survey, visitors were asked about their satisfaction specific to the possibility of engaging in various activities at this site. On average, respondents reported **satisfaction (average score of 3) with all the possibilities provided at the site, except for picking berries/herbs/mushrooms** which was rated on average providing only slight satisfaction. However, the generally rated importance of this activity was also not as high as other activities. Activities that were considered to be relatively more important by visitors and residents, but received lower level of satisfaction by visitors in Kadriorg Park include breathing fresh air, enjoying nature views, being in tranquillity and being in tranquillity. This is understandable considering that Kadriorg Park is a park with buildings and infrastructure and surrounded by the city centre. According to the online resident survey cultural-historical value was considered the most highly rated value associated with Kadriorg. It should also be noted that female visitors assessed the importance of several activities higher than males, but no patterns could be identified.

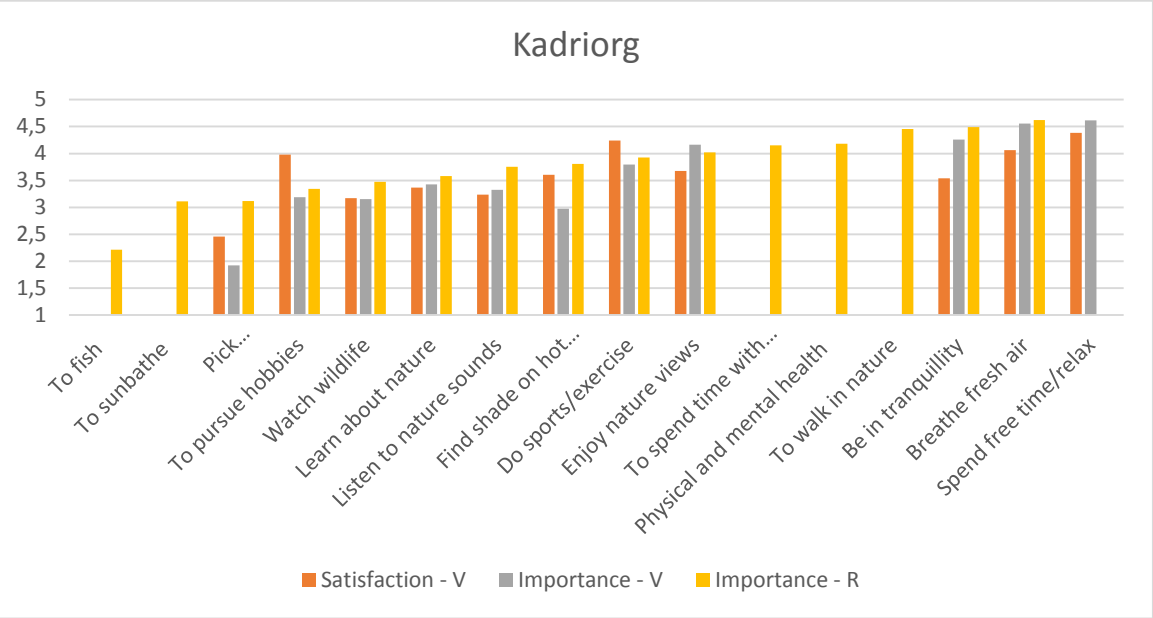

Figure 45 Importance of possibilities to be provided by green areas in general (not site specific) and satisfaction with possibilties in Kadriorg Park in Tallinn. The scores were given on a 5-point scale, which ranged from "1 – not important/satisfied at all" to "5 – very important/satisfied". Source: Nattours visitor survey 2016 and online resident survey (2017). The scores were given on a 5-point scale, which ranged from "1 – not important/satisfied at all" to "5 – very important/satisfied". Visitor survey results are marked with a „V", while resident survey results are marked with a „R".

In our online survey, 330 respondents rated the level of value to them personally according to seven types of values associated with Kadriorg Park. On the rating scale from "very low or no value" to "very high value," Kadriorg park green area received an average rating of very high value or high value for all of the listed types values except educational value (Table 9). Based on the score distribution analysis, the area **received a rating of very high value or high value for all the listed types of values by over 60% the respondents (63%).** The most highly rated values to the lowest rated values were cultural-historical value (94%), aesthetic (88%), recreational (85%), future value (82%), and intrinsic value (80%). The lowest rated values were therapeutic values (77%) and educational value (63%) respectively.

Table 9 Average ratings of values related to Kadriorg. Source: Online resident survey.

Corresponding level	Average rating	Value
Very high value	5	
	4,6	cultural historical value
	4,4	aesthetic value
	4,3	future value
	4,3	recreational value
	4,2	intrinsic value
High value	4,1	therapeutic value
	3,9	educational value
Medium value	3	
Low value	2	
Very low value or no value	1	

The two studies look at different aspects but in general show that **Kadriorg is highly valued for a variety of cultural values by visitors to the site and in general by residents of Tallinn**. **Cultural-historical values rise to the top for residents**. Spending free time and relaxing is the activity that visitors are most satisfied with on average.

Rocca al Mare (Tallinn, EE)

In our visitor survey, visitors were asked about their satisfaction specific to the possibility of engaging in various activities at this site. On average, respondents reported satisfaction (average score of 4 or more) will the following the possibilities provided at the site: the opportunity to breathe fresh air, do sports/exercise, pursue hobbies and spend free time/relax. This points to the infrastructure available at the site, including the promenade boardwalk which allow for people to walk along the coast and is often used for recreation. However, visitors are least satisfied with getting shade on hot summer days and picking berries/herbs/mushrooms, the latter of which visitors were on average slightly unsatisfied with. However, the generally rated importance for visitors (note: more important for residents) of these activity was also not as high as other activities. Furthermore, the area is quite urban and not as suitable for providing berries/herbs/mushrooms. Enjoying nature views received an average satisfaction score of 4.2 and watching wildlife received 3.6 rating. Currently a birdwatching tower is being built on the premises, which should increase the satisfaction with opportunity to engage in these two activities.

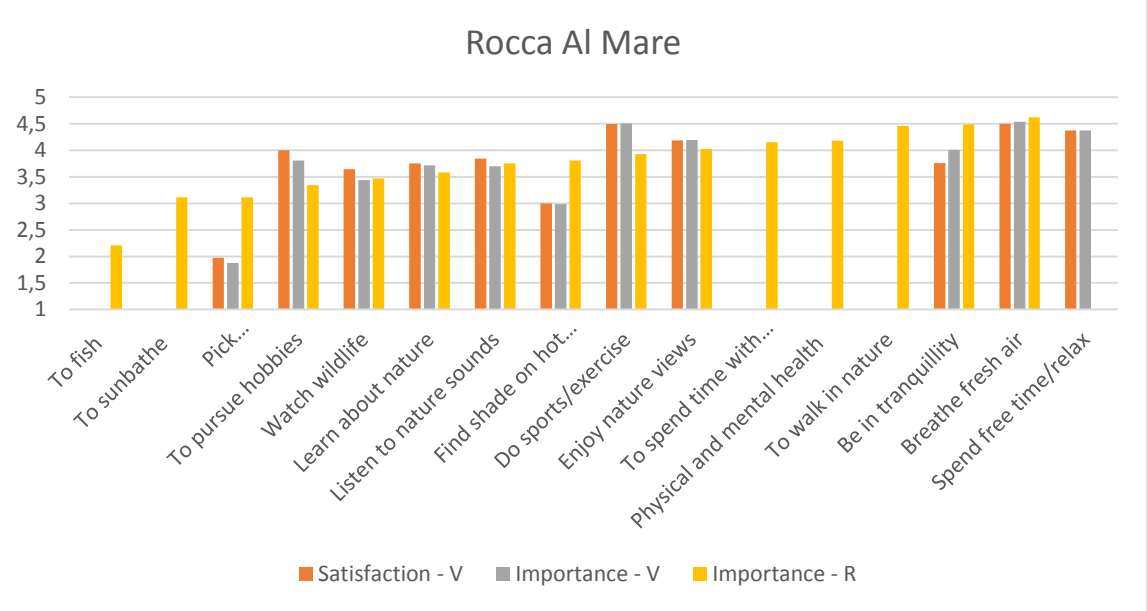

Figure 46 Importance of possibilities to be provided by green areas in general (not site specific) and satisfaction with possibilties in Rocca Al Mare promenade in Tallinn. The scores were given on a 5-point scale, which ranged from "1 – not important/satisfied at all" to "5 – very important/satisfied". Source: Nattours visitor survey 2016 and online resident survey (2017). The scores were given on a 5-point scale, which ranged from "1 – not important/satisfied at all" to "5 – very important/satisfied". Visitor survey results are marked with a „V", while resident survey results are marked with a „R".

In our online survey, 133 Tallinn respondents rated the level of value to them personally according to seven types of values associated with Rocca Al Mare. On the rating scale from "very low or no value" to "very high value," this green area received an average rating of very high value or high value for all of the listed types of values (Table 10). In a further analysis of the distribution of these responses, **the area received a rating of very high value or high value for <u>many</u> of the listed types of values by over half the respondents:** recreational

(88%), therapeutic value (81%), future value (75%) and aesthetic (72%), intrinsic value (60%). Educational and cultural-historical values received a rating of very high or high value by 38% and 30% of respondents respectively.

Table 10 Average ratings of values related to Rocca Al Mare. Source: Online resident survey.

Corresponding level	Average rating	Value
Very high value	5	
	4,4	recreational value
High value	4,3	therapeutic value
	4,0	aesthetic value
	4,0	future value
	3,9	intrinsic value
	3,4	educational value
	3,1	cultural historical value
Medium value	3	
Low value	2	
Very low value or no value	1	

The two studies look at different aspects but in general show that Rocca Al Mare promenade and its surroundings is **highly valued for a variety of cultural values by visitors to the site and in general by residents of Tallinn.** However, its **cultural-historical value is low for residents, which makes sense as there is nothing particularly associated with this value there. Breathing fresh air and doing sports and exercise are the activity that they are most satisfied with on average.** This is logical as it is on the coast and has a boardwalk which facilitates walking, running, cycling, etc.

Paljassaare (Tallinn, EE)

In our visitor survey, visitors were asked about their satisfaction specific to the possibility of engaging in various activities at this site. The average satisfaction scores were rather high with all activities relating to at least moderate satisfaction. The least satisfaction is with getting shade on hot summer days and picking berries/herbs/mushrooms, which was rated on average as being at the level of slight satisfaction. However, the generally rated importance of these activities was also not as high as other activities. **Enjoying nature views received 4.2 satisfaction rating and watching wildlife received 3.7 rating.** Currently two birdwatching towers exist on the premises, but a boardwalk is being built in order to increase the access. This may in the future increase the satisfaction with the various activities.

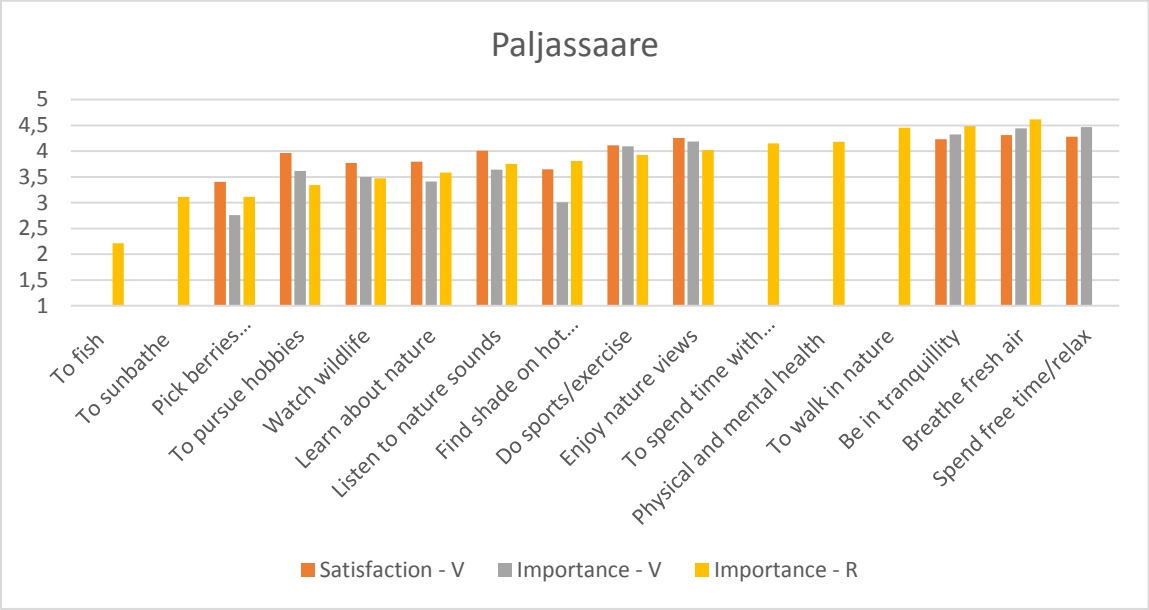

Figure 47 Importance of possibilities to be provided by green areas in general (not site specific) and satisfaction with possibilties in Paljassaare green area in Tallinn. The scores were given on a 5-point scale, which ranged from "1 – not important/satisfied at all" to "5 – very important/satisfied". Source: Nattours visitor survey 2016 and online resident survey (2017). The scores were given on a 5-point scale, which ranged from "1 – not important/satisfied at all" to "5 – very important/satisfied". Visitor survey results are marked with a „V", while resident survey results are marked with a „R".

In our online survey, only 39 Tallinn respondents rated the level of value to them personally according to seven types of values associated with Paljassaare in Tallinn. This might be explained by the fact that Paljassaare is less visited green area in Tallinn than Kadriorg and Rocca al Mare. Due to the small size of respondents, the responses can only be seen as an indication. On the rating scale from "very low or no value" to "very high value," area received a rating of very high value or high value for all the listed types of values, except cultural-historical, by over half the respondents. In a further analysis of the distribution of these responses, these ratings were given by over half in the following value categories: future value (79%), recreational (77%), intrinsic value (77%), educational value (72%) and therapeutic value (72%) and aesthetic (69%) and cultural-historical value (36%). As can be also seen from Table 11, this green area received an average rating of very high value or high value for all of the listed types of values, except for aesthetic and cultural historical values.

Table 11 Average ratings of values related to Paljassaare. Source: Online resident survey.

Corresponding level	Average rating	Value
Very high value	5	
	4,3	recreational value
	4,2	future value
	4,2	intrinsic value
	4,1	therapeutic value
high value	4,0	educational value
	3,9	aesthetic value
	3,3	cultural historical value
Medium value	3	
Low value	2	
Very low or no value	1	

The two studies look at different aspects but in general show that **Paljassaare is highly valued for a variety of recreational values by visitors to the site and in general by residents of Tallinn**. However, its **cultural-historical value is low for residents**, which refers to the potential value of disseminating further information about the history of Paljassaare. Future value is considered quite high, which is interesting because there are numerous plans for real estate development in Northern Tallinn, some of them are being implemented and therefore it is possible that people perceive the increasing importance of maintaining the Paljassaare green area for future residents. Breathing fresh air is the activity that they are most satisfied with on average, which is logical as it is located on the coast.

10. Summary of recommendations for future research

- to analyse online survey responses (Q10) at a less aggregated level and visualise in GIS to gain a more exact understanding of problem areas defined by areas where urban green areas provide lower levels of opportunities for activities. For each city, areas of potential focus which received lower average scores are indicated in the report.
- to analyse the online survey responses (Q12-13) on the agreement with statements about the current and future state of green areas in the vicinity of the respondents at a less aggregated level than major district / district level (potentially postal code) and visualise in GIS to gain a more exact understanding of problem areas (lower scoring areas).
- to study reasons for non-use or less frequent use of local green area as well as to better understand the needs for appropriate recrational facilities. Reasons for not using urban green areas is often left unstudied (Hegetschweiler et al. 2017).

11. Summary of recommendations for city action

Helsinki

- To improve the diversity of nature, especially in the Southern and Central major districts where less respondents indicated satisfaction with the present and future state of the green areas within their vicinity. Diversity of nature in green areas is also one of the two issues where respondents in each major district on average felt there may be issues in the future.
- To ensure continued access in the future to urban forests, as this is an issue that received relatively low scores for the present state, as well as in the future. This is also

one of the two issues where respondents in each major district on average did not believe that access would be sufficient in the future.

Tallinn

- to assess the access to urban green areas in more detail using distance to green area, but also considering what size or type of green areas are available. To identify areas of lower access. To set more ambitious targets for distance from home to nearest green area, such as in Finnish guidelines or the UK standard (The UK benchmark standard recommends that to make the best of green areas, no one should live more than 300m from nearest green area of at least 2ha in size (Sotoudehnia and Comber 2011)
- to decrease the gap in terms of access to green areas between the districts, not necessarily in distance, but in terms of other aspects, such as the pleasantness to use the green areas to move from one green area to another. Attention should be paid to to pedestrian and bicycle paths, sufficiency in number and size for varied use, as well as access to urban forests in the areas of certain districts. Consider other innovative nature based solutions to overcome the difficulty in establishing new and sufficiently large green areas in densely populated areas.
- to map potential areas for allotment gardens, either raised bed plots, in the ground, or even on roofs . Soil safety and potential pollutants should be considered.
- to work with a Civil Society Organisations to promote urban gardening on private and communal properties and establish good practices, and gather and test ideas on a small scale before scaling up.
-

Helsinki and Tallinn

- to increase the amount of street greenery in areas where respondents agreed less with the statement that “there is enough street greenery”. Street greenery is a way to increase the attractiveness of an area and can be used to create a pleasant green path to connect to green areas. The latter could be used as a way to provide an alternative solution in areas where it is difficult to build new green areas. Greenery can also be added to courtyards and spaces between buildings, but also to buildings (green walls, green roofs, etc.) For both cities, specific areas of focus are indicated.
- to maintain the frequency of use of green areas, which may have health benefits, maintain (Helsinki) or improve (Tallinn) the close distance of residents to green areas.
- to ensure that urban green areas on a city wide scale, include areas that provide for highly demanded aspects, such as providing opportunity to “breathe fresh air”, listen to nature sounds, and enjoy tranquillity.As the enabling of the experiences of tranquillity and fresh air require certain types of green areas and certain locations, it is also important to enable the accessibility of green areas which provide these opportunities which are considered important to residents.
- to increase awareness of the value of ecosystem services provided by urban green areas which were by online survey residents considered less important (not ranked as top 3 by as many residents) (e.g. life-sustaining value and insurance value) and the importance of urban green areas for improving city preparedness for climate change impacts. Citizen awareness and demands can impact land use planning policies through politics. This could be broadened to include awareness related to urban green infrastructure, which may also factor into the decisions related to increasing the green factor of private properties.

Annex 1 Ecosystem services divisions, class types and examples

Table 12. Cultural ecosystem services listed based on CICES v. 4.3 classification (Haines-Young & Potschin, 2013). http://cices.eu/ Modified table based on Kopperoinen and Itkonen/SYKE in Uudenmaan Liitto (2015)

Ecosystem service division (CICES)		**Ecosystem service class type /**	**Examples**
Cultural services	**K1**	Nature based recreation	Plants, animals and land-/seascapes physically used for recreation / for example bird-watching, diving, swimming, walking, hiking, climbing, boating, leisure fishing (angling) and leisure hunting
	K2	Nature-based education	Nature as a subject matter of education and for research both on location and via other media, school forests, on-site education etc.
	K3	Aesthetics and Cultural heritage	Historical records, cultural heritage, nature as an inspiration for art, aesthetic appreciation of nature.
	K4	Cultural and spiritual values, identity and experience	National, regional land locally emblematic species and locations, sense of place, sacred places, etc.
	K5	Existence and bequest values	Willingness to preserve plants, animals, ecosystems, land-/seascapes for the experience and use of future generations; moral/ethical perspective or belief
Cultural ecosystem services are defined as "non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experience. " (Millennium Ecosystem Assessment 2005),			

Table 13. Provisioning ecosystem services listed based on CICES v. 4.3 classification (Haines-Young & Potschin, 2013). http://cices.eu/ Modified table based on Kopperoinen and Itkonen/SYKE in Uudenmaan Liitto (2015)

Ecosystem service division (CICES)		**Ecosystem service class type /**	**Examples**
Provisioning services	**T1**	Agriculture and aquaculture products	Plants grown in fields and gardens, meat products, honey, harvested fish, and other aquaculture.
	T2	Wild plants and animals and the products from them	Wild fish, berries, fruit, mushrooms, wild honey, wild herbs. Includes products harvested for own and commercial use.
	T3	Drinking water	Drinking water
	T4	Non drinking-water	Household non-drinking water use, commercial use, cooling water and heating water.

Table 14 Regulating ecosystem services listed based on CICES v. 4.3 classification (Haines-Young & Potschin, 2013). http://cices.eu/ Modified table based on Kopperoinen and Itkonen (SYKE) in Uudenmaan Liitto (2015)

Ecosystem service division (CICES)		**Ecosystem service class type /**	**Examples from EE and FI**
Regulating services	S1	Bio-remediation by micro-organisms, algae, plants, and animals; Filtration/sequ	Bio-chemical detoxification/decomposition/mineralisation in land/soil, freshwater and marine systems including sediments; decomposition/detoxification of waste and toxic materials e.g. waste water cleaning, degrading oil spills by marine bacteria, (phyto)degradation, (rhizo)degradation etc.; Biological filtration/sequestration/storage/accumulation of pollutants in

		estration/storage/accumulation by micro-organisms, algae, plants, and animals	land/soil, freshwater and marine biota, adsorption and binding of heavy metals and organic compounds in biota
	S2	Noise mitigated by urban vegetation	Visual screening of transport corridors e.g. by trees; Green infrastructure to reduce noise and smells
	S3	Mass stabilisation and control of erosion rates	Erosion / landslide / gravity flow protection; vegetation cover protecting/stabilising terrestrial, coastal and marine ecosystems, coastal wetlands, dunes; vegetation on slopes also preventing avalanches (snow, rock), /
	S4	water flow regulation, runoff mitigation and flood protection[d]	Capacity of maintaining baseline flows for water supply and discharge; e.g. fostering groundwater; recharge by appropriate land coverage that captures effective rainfall; includes drought and water scarcity aspects.
	S5	„Regulation of air flows“ and air quality [c]	Natural or planted vegetation that serves as shelter belts and enable ventilation and improve air quality through absorption
	S6	pollination and seed dispersal	Pollination by bees and other insects; seed dispersal by insects, birds and other animals
	S7	Maintaining nursery populations and habitats	Natural or planted vegetation that serves as shelter belts
	S8	Pest and disease control	Pest and disease control including invasive alien species as well as in cultivated and natural ecosystems and human populations
	S9	soil formation and decomposition [a]	Maintenance of bio-geochemical conditions of soils including fertility, nutrient storage, or soil structure; includes biological, chemical, physical weathering and pedogenesis; Maintenance of bio-geochemical conditions of soils by decomposition/mineralisation of dead organic material, nitrification, denitrification etc.), N-fixing and other bio-geochemical processes;
	S10	Chemical condition of freshwaters and saltwaters	Maintenance / buffering of chemical composition of freshwater and saltwater columns and sediment to ensure favourable living conditions for biota e.g. by denitrification, re-mobilisation/re-mineralisation of phosphorous, etc.

[a] In CICES, this is a group level classification

[b] In CICES and Urban MAES (European Commission 2016), climate regulation by reduction of CO2 is separate from local climate regulation

[c] In CICES, this is called „Ventilation and transpiration“, while in Urban MAES (European Commission 2016), it is labelled „Regulation of air quality by urban trees and forests“

[d] Flood protection is a separate category in Urban MAES(European Commission 2016)

Annex 2: Ecosystem services and indicators for Tallinn and Helsinki

Table 15 Ecosystem service indicators related to nature based recreation in Tallinn and Helsinki, identified in literature review.

Class type (UES)	Indicator for assessment of ES	Indicator data from Tallinn	Indicator data from Helsinki	Information source for Tallinn	Information source for Helsinki
Nature-based recreation	Accessibility to public parks, gardens and playgrounds (10- 50 ha) - inhabitants within 700 m from a park	Not calculated	99,77% within 700 m Accessibility to green areas, 2015		HKI Env Statistics: Availability of services, green areas undefined. 2015 data only in FI language tables. (City of Helsinki 2015)
	Accessibility to public parks, gardens and playgrounds (0,75-2,5 ha or smaller but important UGS) - inhabitants within 300 m from a park	within 300 m to 0,5 ha: 81%	99,67% within 300 m Accessibility to green areas, 2010	Tallinn City Environment Department via Tallinn EGCA application 2019	(City of Helsinki 2015)
	Nature based recreation opportunities (includes Natura 2000; includes bathing water quality) (dimensionless)	35% urban green space 5 beaches managed by Tallinn city districts	18,5% urban green space 24 beaches managed by the HKI Sports Dept, 2015 7251 ha green areas owned by municipality	Tallinn City Environment Department via Tallinn EGCA application 2019 http://www.terviseamet.ee/keskkonnatervis/vesi/suplusvesi/avalikud-supluskohad.html	Helsinki: CBI Indicator 13: Recreatioinal possibilities, 2012. 7251 ha (75,21 km2) green area. Liiteri: HKI Maapinta-ala 214,21 km2 (Helsingin kaupungin tietokeskus 2017) Helsingin tilastollinen vuosikirja, 2015: CBI Indicator 13: recreational areas 74,33 km2 Green areas managed by the city's Public Works Department's Street and Park Unit
	Green related social service provided to population (dimensionless)	No data	95% of primary schools reported utilizing local forests at least once per month or twice a year 9,08 km2 of built playgrounds managed by Public Works Dept, 2016		CBI Indicator 14: Primary school children's trips, note: irregular reporting, 2013 Helsingin tilastollinen vuosikirja, 2016: Tab 1.3, Source: Rakennusvirasto, yleisten alueiden rekisteri
Nature-based education	Accessibility of parks from schools(# of public parks and gardens within a defined distance from a school)	Not calculated			CBI Indicator 14: Primary school children's trips, note: irregular reporting, 2013

Cultural heritage	Cultural and natural heritage sites (e.g. Unesco world heritage sites) (number per unit area, % per unit area)	0,7% (1,13 ha) – Old Town of Tallinn		www.unesco.ee	Possible calculation: Karpalo – count # of UNESCO sites in HKI / area

Table 16. Tallinn and Helsinki indicators related to food provisioning services.

Class type (UES)	Indicator for assessment of ES	Indicator data from Tallinn	Indicator data from Helsinki	Information source for Tallinn	Information source for Helsinki
Vegetables produced in urban allotments	Surface of community gardens, public gardens and private gardens for self-consumption (ha)	2000 ha (private gardens)	103 400 ha or 10,34 km^{2a} (allotment garden area)	European Green Capital application 2019, Tallinn City Planning Department, 2016	HKI Karttapalvelu (map service): allotment gardens (2 types)*see[a] in cell below
	Percentage of the area of community gardens, public gardens and private gardens for self-consumption within city borders (%)	12% land area private gardens	Allotment garden area: 5% (Allotment garden area: 10,34 km^{2} [a]/Total area: 214,21 km^{2} [b])	Tallinn City Planning Department via Tallinn EGCA application 2019	HKI Karttapalvelu (map service): allotment gardens (data available for only allotments with cottage (not garden alottments without a cottage) [a]
	Number or area of food producing units	115 200 fruit trees in 2011; 99900 berry bushes; 22 ha of soft fruit and vegetable beds	Not quantified	Statistics Estonia	Satokartta.net

Table 17. Tallinn and Helsinki indicators related to air quality regulating services

Class type (UES)	Indicator for assessment of ES	Indicator data from Tallinn	Indicator data from Helsinki	Information source for Tallinn	Information source for Helsinki
Regulation of air quality by urban trees and forests	PM_{10} captured grams per m^2 UGS per year	Woodland (3121,44 ha) = 83 966 736 g Garden (1920 ha) = 15 744 000 g	Garden (103 400 ha [a]) = 847 880 kg	Calculations transferred from Derkzen et al. (2015), data based on Tallinn City Environment Department via Tallinn EGCA application 2019	Derkzen, et al. 2015; HKI Karttapalvelu (map service): allotment gardens (data available for only allotments with cottage (not garden alottments without a cottage) [a]
	Pollutants (O_3, SO_2, NO_2, CO, $PM_{2,5}$ and PM_{10}) removed by vegetation (in leaves, stems and roots) (kg ha-1 year -1)	Using calculations above: forests and gardens remove ca 100 tons of PM_{10}, no data or basis for calculation for other pollutants.	Uptake (kg/ha/yr) by green roofs O_3: 30-44 NO_x: 16-23 PM_x : 8-12 SO_2: 4-6	Calculations transferred from Derkzen et al 2015.	Nurmi et al. 2016 Could in the future be used with https://kartta.hsy.fi/ green roof data

	Modelled loss of expected life years per inhabitant	-0,64 years with $PM_{2,5}$ (2007)	Between -0,43 and 0,74 years (life-expectancy effect / 10 micrograms $PM_{2.5}$	https://www.envir.ee/sites/default/files/hia_tallinn_ohk_arth.pdf	(Tainio et al. 2007) Table 4. Estimate for Helsinki Metropolitan Area.
	Max number of days per year on which EU target value for PM10 was exceeded (8h mean)	13 days in 2015	21 exceedances of PM10 limit value in Helsinki Metropolitan area, 2012	Based on data in Tallinn application for European Green Capital Award 2019	(City of Helsinki 2015)# of PM10 limit value exceedances in Helsinki Metropolitan area, 2012

Figure 48. Helsinki and Tallinn indicators to measuring the condition of the urban ecosytems based on framework presented in the MAES Urban pilot work by the European Commission (2016).

Pressures indicators					
Class	**Indicator (MAES)**	**Helsinki**	**Tallinn**	**Data source (link in initial mention)**	**Comment on methodology**
Urban Sprawl	**% of built up area**	65% excluding blue areas	71,5% (excl blue areas)	Helsinki: 100%-35% (Total-Urban Green Space – see below) CBI Indicator 13: Recreatioinal possibilities, 2012. 7251 ha (75,21 km2) green area owned by municipality. Tallinn: Tallinn City Planning Department via Tallinn EGCA application 2019	
Air Pollution	Concentration of NO_2, PM10, PM2.5, 0_3 (ug m^{-3})	PM10 (12-21) PM2.5 (6.60-8.30) NO2 (7-37)		Helsinki: http://www.helsinginymparistotilasto.fi Annual averages for thoracic particle (PM10) and fine particle (PM2.5) concentrations per monitoring station ; Annual nitrogen dioxide concentration averages in the Helsinki Metropolitan Area, range listed	*Helsinki Metropolitan Area
	# of annual occurrences of max. daily 8 hour mean of 0_3>120 ug m^{-3}		0 days (2015)	Tallinn: Tallinn EGCA application 2019	
	# of annual occurrences of 24 hour mean of PM10>50 ug m^{-3}	21 occurrences	13 days (2015)	Helsinki: http://www.helsinginymparistotilasto.fi; Number of PM10 limit value exceedances in Helsinki Metropolitan area, 2012 Tallinn: Tallinn EGCA application 2019	*Helsinki Metropolitan Area
	# of annual occurrences of hourly mean of NO_2>200 ug m^{-3}	11 occurrences	0 days (2015)	Helsinki: http://www.helsinginymparistotilasto.fi Number of cases where the numeric value for NO2 limit (200 mikrog/m3) was exceeded (2012) in Helsinki Metropolitan area Tallinn: Tallinn EGCA application 2019	*Helsinki Metropolitan Area
State Indicators of Urban Ecosystems					
Built infrastructure					

Population density	**# of inhabitants per area (number ha^{-1})**	2933 inhabitants/km^2	2759 inhabitants /km^2	Helsinki: http://liiteri.ymparisto.fi/ (väestöntiheys as/km2, 2015) Tallinn: Tallinn arvudes 2016. http://www.tallinn.ee/est/Tallinn-arvudes-2016.pdf	
Land use and land use intensity	**Artificial area per inhabitant (m^2 $person^{-1}$)**	195 m2/person	Total area per inhabitant= 364m^2/inh Sealed areas= 29%=105,56m^2/inh	Helsinki: http://liiteri.ymparisto.fi/ (maankäyttö pinta-ala km^2, 2012 (SYKE, osittain METLA, MMM, MML, VRK) ja väestöluku as/km2, 2015 (Statistics Finland)) Tallinn: Tallinn City Planning Department via Tallinn EGCA application 2019 Tallinn arvudes 2016. http://www.tallinn.ee/est/Tallinn-arvudes-2016.pdf	
	Land annually taken for built-up areas per person (m^2 $person^{-1}$)		2011/2016: 22 m2 taken per person, 4,4 m^2 yearly	Tallinn: Tallinn arvudes 2016. http://www.tallinn.ee/est/Tallinn-arvudes-2016.pdf Tallinn arvudes 2011. http://www.tallinn.ee/est/g2677s56143	Tallinn: area of lost green areas per person
Road density	**Length of road network per area (km ha^{-1})**	7,38 km/maa-km^2	6,2 km/km^2	Helsinki: http://liiteri.ymparisto.fi/ tie-ja katuverkiston pituus maapinta-alaa kohti (2014, Liikennevirasto): 1580 km road network total Tallinn: Tallinn arvudes 2016. http://www.tallinn.ee/est/Tallinn-arvudes-2016.pdf	
Green infrastructure					
Urban forest pattern	**Canopy coverage (ha)**	39% on average	22,46% (=3578,1 ha)	Helsinki: CBI Indicator 12: Canopy Cover, 2013. 3 (29.1-59.7% : 0-4 range) Tallinn: EO4CBI project report by Space4Environment	
Connectivity of urban green infrastructure	**Connectivity of GI** (Mesh density per pixel)	383,87 ha ecological network	280 ha ecological network	Helsinki: CBI Indicator 2: ekologinen verkosto 383,87 ha ecological network (201-500 ha (1:4 points) luontoalueet ja tiet Tallinn: EO4CBI project report by Space4Environment	
State Indicators of Urban Ecosystems					
Land use	**Proportion of urban green space (%)**	35%	18,5%	Helsinki: CBI Indicator 13: Recreatioinal possibilities, 2012. 7251 ha (75,21 km2) green area. Liiteri: HKI Maapinta-ala 214,21 km2 Tallinn: Tallinn City Environment Department via Tallinn EGCA application 2019	HKI: *valid in 2015, but as of 2016, more spaces (islands) have become open for recreational use, e.g. Vallisaari. ** Does not include every man's right to use private

					lands for recreation.
	Proportion of impervious surface (%)	32%	37% (excl blue areas) 29% (incl blue areas)	Helsinki: SYKE: Arto Viinika ENROUTE presentation (2017) Tallinn: Tallinn City Planning Department via Tallinn EGCA application 2019	
	Proportion of natural area (%)	42,3%	18,5%	Helsinki: Liiteri: maankäyttö pinta-ala km$^{2:}$: metsä ja muu luonnonalueet; Liiterii: HKI Maapinta-ala Liiteri: 90,65 km2 metsä ja muu luonnonalueet; HKI Maapinta-ala 214,21 km2 Tallinn: Tallinn City Environment Department via Tallinn EGCA application 2019	
	Proportion of protected area (%)	3,3%	18,5%	Helsinki: HKI Karttapalvelu: Ympäristö ja luonto: Rauhoitetut kohteet: Luonnonsuojelualueet 711,4 ha & Liiteri: HKI Maapinta-ala 214,21 km2 Tallinn: Tallinn City Environment Department via Tallinn EGCA application 2019	*close to the CBI Index data: Indicator 9 (2015) 3,5% (only land-area)
	Proportion of agricultural area (%)	2,4%	0%	Helsinki: 1 Liiteri: maankäyttö pinta-ala km$^{2:}$: maatalousalueet, 5,3 km2	
	Proportion of abandoned area (%)		1,2%	Tallinn: Tallinn City Planning Department via Tallinn EGCA application 2019	
Indicators of Urban Biodiversity					
Species diversity	# and abundance (number ha^{-1}) of bird species	68 species (2013)	252 species (1,6 species/ha)	Helsinki: personal communication, 2017 Tallinn: Tallinn City Environment Department via Tallinn EGCA application 2019	
Conservation	Number and abundance (number ha^{-1}) of species of conservation interest		178 species (1,1 species/ha)	Tallinn: Tallinn City Environment Department via Tallinn EGCA application 2019	
Introduction	Number of alien species	64 (58 vascular plants = 5%; 6 mammals = 13%; 0 reptiles and amphibians =0%)		Helsinki: CBI indicator 10: 3:4 points 1.0%-11% share of invasive alien species of total species (2015)	

Annex 3: Nattours online resident survey

Dear Helsinki/Tallinn resident,

This survey aims to elicit the attitudes of Helsinki and Tallinn residents towards and their use of the urban green areas. The survey is part of an EU funded project NATTOURS in which the cities of Helsinki and Tallinn are partners. Your answers will help inform the planning and management of urban green areas in these cities. The survey is anonymous and the answers will be used only for the purpose of this study. The survey should take around 20 minutes. We would be grateful if you agree to answer the following questions.

Thank you for your time!

1. **In which language do you wish to fill in the questionnaire?**

(To survey company: In Helsinki survey use "Finnish" and "English" and in Tallinn use "Estonian", "English" and "Russian".)

2. **What is your home postcode? ____**

3. **How long have you lived in this place of residence?**
   - ❑ Less than 1 year
   - ❑ 1-5 years
   - ❑ 6-10 years
   - ❑ 11-15 years
   - ❑ More than 15 years

4. **In what kind of house do you live?**
   - ❑ House with more than 12 flats
   - ❑ House with 12 flats or less
   - ❑ Semi-detached or row house
   - ❑ Detached house
   - ❑ Other:

5. **Do you grow or have you grown fruits, vegetables or herbs within Helsinki/Tallinn this past year?** *(To survey company: In Helsinki survey use "Helsinki" and in Tallinn use "Tallinn".)*
   - ❑ Yes (*next to Q 5.1.*)
   - ❑ No (*next to Q 5.2.*)

   5.1. **Where do you grow/have you grown fruits, vegetables or herbs?**
   - ❑ In my home garden
   - ❑ On my balcony garden
   - ❑ In an allotment garden
   - ❑ Other (please specify):

5.2. **Would you like to grow fruits, vegetables or herbs?**

- ❑ Yes
- ❑ No

6. **Is it important for you to live close to a green area? "Close to" is defined as within 300 meters.**

- ❑ Yes, living close to a green area is important to me (*next to Q 6.1.*)
- ❑ No, living close to a green area is not so important to me (*next to Q 7*)

6.1. **How important is it for you to live close to the following types of green areas? "Close to" is defined as within 300 meters.**

Please rate the importance of all options.

	Very important - 5	Rather important - 4	Moderately Important -3	Not very important - 2	Not at all important - 1
1. Park					
2. Forest					
3. Small wooded area					
4. Green space alongside water					
5. Any type of green space with playground and/or fitness equipment					
6. Area where I can garden					
7.Other: what?					

6.2 The most important type of green area to have nearby is number (#): _____

Urban green areas in Tallinn/Helsinki *(To survey company: In Helsinki survey use "Helsinki" and in Tallinn use "Tallinn".)*

7. In general, how important is it for you that there are green areas in Tallinn/Helsinki where you could do the following? Please rate all options. *(To survey company: In Helsinki survey use "Helsinki" and in Tallinn use "Tallinn".)*

	Very important - 5	Rather important - 4	Moderately Important -3	Not very important - 2	Not at all important - 1
1. To walk in nature					
2. To spend time with friends, child(ren), other people or pets					
3. To maintain/improve your physical and mental health					
4. To engage in active recreation or sports (on land, in water)					
5. To sunbathe					
6. To pursue hobbies (reading, photographing, drawing, etc.)					
7. To enjoy views of nature					
8. To learn about nature					
9. To listen to nature sounds					
10. To watch birds, butterflies and other wildlife					
11. To breathe fresh air					
12. To be in tranquillity, away from urban noise					

13. To find shade on hot summer days					
14. To pick berries, mushrooms, herbs, etc.					
15. To fish					
16. Other (what?):					

7.1. The most important activity for me is number (#): ____

8. Please select and rank the three (3) most important values related to urban green areas in the order of importance to you (i.e. 1st, 2nd and 3rd most important). Please assess the values more broadly than just values related to your own personal use of urban green areas. *(To survey company: please find a technical solution that supports this ranking, e.g. that it is not possible to mark 4 values, and that they are easily ranked.)*

Values	**3 most important values ranked**
1. **Aesthetic value** (A holistic sensory experience that enhances feelings)	
2. **Biodiversity value** (it supports the preservation of biodiversity)	
3. **Cultural-historic value** (it is a place to continue and pass down the traditions and knowledge of earlier generations; it has places and things of natural and human history that matter to people)	
4. **Economic value** (it provides local economic value related to tourism opportunities)	
5. **Future value** (it allows future generations to know and experience the area as it is now)	

6. **Intrinsic value** (it has value in and of itself, whether people are present here or not)	
7. **Educational value** (we can learn about the environment through (scientific) observation or experimentation)	
8. **Life sustaining value** (it supports the production, preservation, cleaning, and renewing of air, soil and water)	
9. **Recreational value** (it has places where one can spend free time)	
10. **Therapeutic value** (being there makes one feel better, physically and/or mentally)	
11. **Insurance value** (it provides a buffer against future risks and changing needs in an uncertain future, e.g. flooding from heavier rainfall due to climate change.)	

9. *(To survey company: In Helsinki survey use "Helsinki" and in Tallinn use "Tallinn".)*

Tallinn: Please choose one of the following green areas and rate its values for you.

- ❑ Paljassaare bird conservation area
- ❑ Rocca al Mare promenade and its surroundings
- ❑ Kadriorg park

Helsinki: Please choose one of the following green areas and rate its values for you.

- ❑ Central Park
- ❑ Porsnaistenniemi: Viikki nature protection area/Lammassaari
- ❑ Harakka island

"To me, this green area has…"						
	Very high value- 5	High value - 4	Medium value - 3	Low value- 2	Very low or no value - 1	I don't know -0
1. **Aesthetic value**						

(A holistic sensory experience that enhances feelings)						
2. **Cultural-historic value** (it is a place to continue and pass down the traditions and knowledge of earlier generations; it has places and things of natural and human history that matter to people)						
3. **Future value** (it allows future generations to know and experience the area as it is now)						
4. **Intrinsic value** (it has value in and of itself, whether people are present here or not)						
5. **Educational value** (we can learn about the environment through (scientific) observation or experimentation)						
6. **Recreational value** (it has places where one can spend free time)						
7. **Therapeutic value** (being there makes one feel better, physically and/or mentally)						

Urban green areas in the vicinity of your place of residence

10. In your opinion, how well do urban green areas close to your home (within 300 m) currently provide for the following opportunities?

	Provide very well - 5	Provide rather well - 4	Provide somewhat - 3	Provide poorly - 2	Do not provide at all -

1. Opportunities for being in nature and observation of nature					
2. Spending leisure time with friends, children, other people or pets					
3. Active recreation and sports					
4. Mental relaxation					
5. Other (what?)					

11. Please rate how important you feel the green space in the vicinity of your home (within 2 km) is for you for the following reasons. Green space is defined as vegetation as well as green areas of all sizes.

	Very important - 5	Rather important - 4	Moderately Important - 3	Not very important - 2	Not at all important - 1
1. For maintaining/improving mental well-being					
2. For maintaining/improving physical well-being					
3. For visual enjoyment of the green area from afar					
4. As a source for aesthetic appreciation and inspiration (to experience/enjoy the area with multiple senses: scenery, sights, sounds, smells, etc. and experience associated feelings)					
5. For improving the local environment (better air quality, less noise, improved storm/rainwater management, protection from wind, improved biodiversity and habitats)					
6. For maintaining/improving the preparedness of the city for impacts of climate change					

7. For providing a site for environmental education					
8. For providing a site for cultural activities					
9. Providing access to broader/other green areas					
10. Strengthens the emotional connection of residents to the area and contributes to the area's identity.Creates a sense of place					
11. Other (what?)					

12. Do you agree with the following statements about the present state of green areas and greenery only in your vicinity (within ~2 km)?

	Agree	Partly disagree (it is not so in some parts of my vicinity)	Disagree (it is not so in many or all parts of my vicinity)	Don`t know	Comment
1. There is enough street greenery in my vicinity					
2. There is a sufficient number of green areas (parks, forests etc) in my vicinity					
3. The green areas are of sufficient size for varied use					
4. Residents have green areas within short enough (walking) distance of their home for daily use					
5. My vicinity is attractive due to the green areas					

6. There is sufficient access to urban forests					
7. The green areas are not too crowded					
8. The nature in the green areas is diverse					
9. It is pleasant to walk or bike from one green area in my vicinity to another green area					

13. How strongly do you believe in the following statements about the future (in 10-20 years)?

	I believe	I partially believe	I do not believe	Don`t know	
1. There will be enough street greenery in my vicinity in 10-20 years					
2. There will be a sufficient number of green areas (parks, forests etc) in my vicinity in 10-20 years					
3. There will be green areas that are of sufficient size for varied use in 10-20 years					
4. Residents will have green areas within short enough (walking) distance of their home for daily use in 10-20 years					
5. My vicinity will be attractive due to the green areas in 10-20 years					

6. Access to urban forests from my vicinity will be sufficient in 10-20 years					
7. The green areas will not be not too crowded in 10-20 years					
8. Biological diversity of green areas will be high in 10-20 years					
9. It will be pleasant to walk or bike from one green area in my vicinity to another green area in 10-20 years					

Questions about an urban green area closest to your home

14. How do you characterise the urban green area that is located closest to your home?

If there are several, then choose the one you visit the most.

Is this area mainly…?:

- ❑ Park
- ❑ Forest
- ❑ Small wooded area
- ❑ Green space alongside water (creek, river, lake, sea)
- ❑ Any type of green space with playground and/or fitness equipment
- ❑ Area where I can garden
- ❑ Other (what?)

14.1. **What is the distance to this green area from your home?**

- ❑ 0-300 meters – 0-5 minutes walk
- ❑ 301-700 meters – 6-15 minutes walk

15. To what extent have you used this green area for the purpose of recreation or spending free time there during the last year? *(To the survey company: If the respondent responds with "almost every day", "at least once a week", "at least once a month", or "at least once in 3 months" in any season, this question should be followed by Q15.1. If the respondent responds with "have not used it" for each season, this should be followed with Q15.2.)*

	Almost every day	At least once a week	At least once a month	At least once in three months	Have not used it
In summer					
In autumn					
In winter					
In spring					

15.1. What has motivated you to visit this green area for the purpose of recreation or spending free time? Please choose only one main reason. *(To the survey company: This question is followed by Q15.2.)*

	Main reason (only one)	To some extent a reason	Not a reason
1. To improve or maintain my physical health			
2. To mentally relax			
3. To spend time with friends, child(ren), other people or pets			
4. To enjoy nature			
5. To participate in activities/events organised in green areas			
6. Other (what?):			

15.2. Are there other nearby urban green areas that you could use if this one is no longer available as a green area? *(To the survey company: This question is followed by Q16.)*

❑ Yes
❑ No

15.3. Why have you not used your closest green area for the purpose of recreation or spending free time during the last year? Please choose only one main reason. *(To the survey company: This question is followed by Q16.)*

	Main reason (only one)	To some extent a reason	Not a reason
1. The green area is too small			
2. The green area is too far away			
3. The green area is lacking appropriate recreation facilities			
4. The green area has too many recreation facilities			
5. The green area has too many people			
6. The green area is poorly maintained			
7. The green area is unsafe			
8. Other (what?):			

Concluding questions

16. In addition to providing opportunities for recreation, there are numerous benefits that people obtain from urban nature, either directly or indirectly, for free. Some of these benefits include air filtration, pollination, water retention, noise buffering, wind protection, nutrient recycling, etc.

How familiar are you with this topic?

- ❑ Very familiar with the idea
- ❑ Somewhat familiar with the idea
- ❑ Not very familiar with this idea
- ❑ I haven`t heard of this before

16.1 From the benefits listed above, which one are you most familiar with? (If respondents check "very familiar", "somewhat familiar" or "not very familiar")

- ❑ Air filtration
- ❑ Pollination
- ❑ Water retention
- ❑ Noise buffering
- ❑ Wind protection
- ❑ Nutrient recycling
- ❑ Temperature regulation

- ❑ Habitat provision

17. What is your age?

18. Are you:

- ❑ Employed
- ❑ Self-employed
- ❑ Student/pupil
- ❑ Retired
- ❑ At home, not working
- ❑ Other (please specify):

19. How would you describe your household?

- ❑ Single person
- ❑ Single person with dependent child/children
- ❑ Two adults
- ❑ Two adults with dependent child/children
- ❑ Other (please specify):

20. Are you:

- ❑ Female
- ❑ Male

21. Your nationality:

Thank you!

(NOTE: Most questions were followed by a comments text box)

Annex 4: Improved online resident survey

Dear (City) resident,

Insert introduction

1. **In which language do you wish to fill in the questionnaire?**

2. **What is your home postcode? ____**

3. **How long have you lived in this place of residence?**
   - ❑ Less than 1 year
   - ❑ 1-5 years
   - ❑ 6-10 years
   - ❑ 11-15 years
   - ❑ More than 15 years

4. **In what kind of house do you live?**
   - ❑ House with more than 12 flats
   - ❑ House with 12 flats or less
   - ❑ Semi-detached or row house
   - ❑ Detached house
   - ❑ Other:

5. **Do you grow or have you grown fruits, vegetables or herbs within (City) this past year?**
   - ❑ Yes (*next to Q 5.1.*)
   - ❑ No (*next to Q 5.2.*)

   5.1. **Where do you grow/have you grown fruits, vegetables or herbs?**
   - ❑ In my home garden
   - ❑ On my balcony garden
   - ❑ In an allotment garden
   - ❑ Other (please specify):

   5.2. **Would you like to grow fruits, vegetables or herbs?**
   - ❑ Yes
   - ❑ No

6. **Is it important for you to live close to a green area? "Close to" is defined as within 300 meters (about 5 minutes walking distance).**

❑ Yes, living close to a green area is important to me (*next to Q 6.1.*)

❑ No, living close to a green area is not so important to me (*next to Q 7*)

6.1. **How important is it for you to live close to the following types of green areas? "Close to" is defined as within 300 meters (about 5 minutes walking distance).**

Please rate the importance of all options.

	Very important - 5	Rather important - 4	Moderately Important -3	Not very important - 2	Not at all important - 1
1. Park					
2. Forest					
3. Small wooded area					
4. Green space alongside water					
5. Any type of green space with playground and/or fitness equipment					
6. Area where I can garden					
7.Other: what?					

6.2 The most important type of green area to have nearby is number (#): _____ (To survey company: only show this question if there are no competing options for the most important)

Urban green areas in general

7. In general, how important is it for you that there are green areas in (City) where you could do the following? Please rate all options. (Note: activities should be relevant to city)

	Very important - 5	Rather important - 4	Moderately Important - 3	Not very important - 2	Not at all important - 1
1. To walk in nature					
2. To spend time with friends, child(ren), other people or pets					
3. To maintain/improve your physical health					
4. maintain/improve mental health					
5. To engage in active recreation or sports (on land, in water)					
6. To sunbathe					
7. To pursue hobbies (reading, photographing, drawing, etc.)					
8. To enjoy views of nature					
9. To learn about nature					
10. To listen to nature sounds					
11. To watch birds, butterflies and other wildlife					
12. To breathe fresh air					
13. To be in tranquillity, away from urban noise					
14. To find shade on hot summer days					
15. To pick berries, mushrooms, herbs, etc.					
16. To fish					

16. Other (what?):					

7.1. The most important activity for me is number (#): ____ **(***To survey company: This question is skipped if there only 1 response in the highest rated column – whatever it may be ratings 1-4. This question should pop up only if there is no clear winner - in the highest rating column marked in (1-4).)*

8. How much do you agree or disagree with the following statements? Please think of parks in general in [name of the city]. *(modified from Bertram and Rehdanz 2015)*

The urban green areas in [name of city] are important....	Strongly disagree	Disagree	Agree	Strongly agree	Don't know
...for the people to beauty of nature and be inspired by it.					
...as habitats for plants and animals and to support biodiversity.					
... they contain sites and things of cultural importance that matter to people and places where people can pass down traditions.					
...to increase the attractiveness of the city for tourism.					
...to allow future generations to know and experience nature.					
...because they have value in and of themselves, whether people are present there or not.					
...to provide a place where we can learn about nature.					
...to support regulatory functions such as, the production, preservation, cleaning, and renewing of air, soil and water.					
...to support regulatory functions such as cooling and providing shade in the summer, reducing noise and/or filtering air.					
... to provide places where one can spend free time and engage in recreational activities.					

...for the physical and/or mental health of residents.					
...to provide a buffer against future risks and changing needs in an uncertain future, e.g. flooding from heavier rainfall due to climate change.					

Note: *If a specific site or areas is to be assessed, the above question can be modified to pertain to a specific site*

Urban green areas in the vicinity of your place of residence

9. In your opinion, how well do urban green areas close to your home (within 300 m) currently provide for the following opportunities?

	Provide very well - 5	Provide rather well - 4	Provide somewhat - 3	Provide poorly - 2	Do not provide at all -
1. Opportunities for being in nature and observation of nature					
2. Spending leisure time with friends, children, other people or pets					
3. Active recreation and sports					
4. Mental relaxation					
5. Other (what?)					

10. How important or unimportant do you consider each of the following attributes to be for your visits to the urban green areas in your vicinity (within 2 km)? Please rate this on a scale of 1 to 5, where „1“ means „not important at all“ and „5“ means „very important“. (modified from Bertram and Rehdanz 2015)

	Very important - 5	Rather important - 4	Moderately Important - 3	Not very important - 2	Not at all important - 1	Don’t know
Tranquility						

Good accessibility (*DEFINE as relevant*, e.g. number and location of entrances, pleasant walking routes, etc.)						
Scenic beauty, landscape						
Existance of a playground						
Existance of exercise equipment, trail or other recreation infrastructure						
Existance of facilities (benches, kiosks, toilets, etc.)						
Low density of visitors						
Low crime						
Rich in plant and animal species						
Existance of water body(ies)						
Cleanliness						
Large size of area						
Varied landscape						
Good opportunity to meet new people						
Opportunities for sports activities						
Good connection to commuting route						
Other (what?)						

11. Do you agree with the following statements about the present state of green areas and greenery only in your vicinity (within ~2 km)?

	Strongly agree	Agree	Disagree	Strongly disagree	Don`t know
1. There is enough street greenery in my vicinity					
2. There is a sufficient number of green areas (parks, forests etc) in my vicinity					
3. The green areas are of sufficient size for varied use					
4. Residents have green areas within short enough (walking) distance of their home for daily use					
5. My vicinity is attractive due to the green areas					
6. There is sufficient access to urban forests					
7. The green areas are not too crowded					
8. The nature in the green areas is diverse					
9. It is pleasant to walk or bike from one green area in my vicinity to another green area					

12. How strongly do you believe in the following statements about the future (in 10-20 years)?
(*Here, a scenario or assumptions of that future could be presented)*

	Strongly believe	Believe	I do not believe	I strongly do not believe	Don`t know

1. There will be enough street greenery in my vicinity in 10-20 years					
2. There will be a sufficient number of green areas (parks, forests etc) in my vicinity in 10-20 years					
3. There will be green areas that are of sufficient size for varied use in 10-20 years					
4. Residents will have green areas within short enough (walking) distance of their home for daily use in 10-20 years					
5. My vicinity will be attractive due to the green areas in 10-20 years					
6. Access to urban forests from my vicinity will be sufficient in 10-20 years					
7. The green areas will not be too crowded in 10-20 years					
8. Biological diversity of green areas will be high in 10-20 years					
9. It will be pleasant to walk or bike from one green area in my vicinity to another green area in 10-20 years					

Questions about an urban green area closest to your home

13. How do you characterise the urban green area that is located closest to your home?

If there are several, then choose the one you visit the most.

Is this area <u>mainly…?</u>:

- ❑ Park
- ❑ Forest
- ❑ Small wooded area
- ❑ Green space alongside water (creek, river, lake, sea)
- ❑ Any type of green space with playground and/or fitness equipment
- ❑ Area where I can garden
- ❑ Other (what?)

13.1. **What is the distance to this green area from your home?**

- ❑ 0-300 meters – 0-5 minutes walk
- ❑ 301-700 meters – 6-15 minutes walk

14. To what extent have you used this green area for the purpose of recreation or spending free time there <u>during the last year</u>? *(To the survey company: If the respondent responds with "almost every day", "at least once a week", "at least once a month", or "at least once in 3 months" in any season, this question should be followed by Q15.1. If the respondent responds with "have not used it" for each season, this should be followed with Q15.2.)*

	Almost every day	At least once a week	At least once a month	At least once in three months	Have not used it
In summer					
In autumn					
In winter					
In spring					

14.1. What has motivated you to visit this green area for the purpose of recreation or spending free time? Please choose only one main reason. *(To the survey company: This question is followed by Q15.2.)*

	Main reason (only one)	To some extent a reason	Not a reason
1. To improve or maintain my physical health			
2. To mentally relax			

3. To spend time with friends, child(ren), other people or pets			
4. To enjoy nature			
5. To participate in activities/events organised in green areas			
6. Other (what?):			

14.2. Are there other nearby urban green areas that you could use if this one is no longer available as a green area? *(To the survey company: This question is followed by Q15.)*

- ❑ Yes
- ❑ No

14.3. Why have you <u>not</u> used your closest green area for the purpose of recreation or spending free time during the last year? Please choose <u>only one</u> main reason. *(To the survey company: This question is followed by Q15.)*

	Main reason (only one)	To some extent a reason	Not a reason
1. The green area is too small			
2. The green area is too far away			
3. The green area is lacking appropriate recreation facilities			
4. The green area has too many recreation facilities			
5. The green area has too many people			
6. The green area is poorly maintained			
7. The green area is unsafe			
8. Other (what?):			

Concluding questions

15. In addition to providing opportunities for recreation, there are numerous benefits that people obtain from urban nature, either directly or indirectly, for free. Some of these benefits include air filtration, pollination, water retention, noise buffering, wind protection, nutrient recycling, etc.

How familiar are you with the following as benefits?

	Very familiar	Somewhat familiar	Not very familiar	Not familiar at all
Air filtration				
Pollination				
Water retention/absorbtion				
Noise buffering				
Wind protection				
Nutrient recycling				
Temperature regulation				
Habitat provision				

16. What is your age?

17. Are you:

- ❑ Employed
- ❑ Self-employed
- ❑ Student/pupil
- ❑ Retired
- ❑ At home, not working
- ❑ Other (please specify):

18. How would you describe your household?

- ❑ Single person
- ❑ Single person with dependent child/children
- ❑ Two adults

- ❑ Two adults with dependent child/children
- ❑ Other (please specify):

19. Access to a car

- ❑ Own a car
- ❑ Do not own a car, but have access to a car
- ❑ Rely on public transportation
- ❑ Other _____

20. Are you:

- ❑ Female
- ❑ Male

21. Your nationality:

Thank you!

(NOTE: Most questions were followed by a comments text box)

References

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