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SENSE OF SECURITY AND WELLBEING ASSESSMENT IN LOCAL COMMUNITY AND DIRECTIONS OF SOCIAL WELLBEING RESTORATION WITH THE USE OF NATURE-BASED SOLUTIONS

Summary

Constant progress of urbanization and the shortage of greenspaces, may cause a poor sense of security, the feeling of alienation among urban residents, leading to low social cohesion, loss of the sense of wellbeing and intensify urban stress. This paper presents the first stage of research in which the perception of the local community's everyday life quality in relation to the place of residence and the level of integration were examined. A questionnaire survey has been carried out in the target group. 96 questionnaires were collected, 9 questions in relation to 9 demographic data were subjected to statistical analysis. The aim of the entire research is to indicate whether and to what extent, the introduced nature-based solutions are able to improve sense of security and wellbeing in the local community. The chi-square test of independence and the Spearman's rank correlation coefficient were determined. The results have revealed poor sense of security and community wellbeing in a certain group of respondents. The authors also discuss the positive impact of urban greenery on the social wellbeing parameters and point out the necessity to include NBSs in the systemic directions, on the example of the Grow Green project in the City of Wroclaw.

Key words: nature-based solutions, urban greenery, social cohesion, urban stress, urban citizens health and wellbeing.

OCENA POCZUCIA BEZPIECZEŃSTWA I DOBROSTANU SPOŁECZNOŚCI LOKALNEJ ORAZ KIERUNKÓW PRZYWRACANIA DOBROBYTU SPOŁECZNEGO Z WYKORZYSTANIEM ROZWIĄZAŃ NATURALNYCH

Streszczenie

Nieustanny postęp urbanizacji i niedobór terenów zielonych mogą powodować słabe poczucie bezpieczeństwa, poczucie wyobcowania wśród mieszkańców miast, prowadzące do niskiej spójności społecznej, utraty dobrego samopoczucia i nasilania miejskiego stresu. W artykule przedstawiono pierwszy etap badań, w którym badano postrzeganie jakości życia codziennego społeczności lokalnej w odniesieniu do miejsca zamieszkania i poziomu integracji. W grupie docelowej przeprowadzono badanie ankietowe. Zebrano 96 ankiet, analizie statystycznej poddano 9 pytań w odniesieniu do 9 danych demograficznych. Celem całego badania jest wskazanie, czy i w jakim stopniu wprowadzone rozwiązania przyrodnicze są w stanie poprawić poczucie bezpieczeństwa i dobrostanu w społeczności lokalnej.

Wyznaczono test niezależności chi-kwadrat oraz współczynnik korelacji rang Spearmana. Wyniki ujawniły słabe poczucie bezpieczeństwa i dobrostanu społeczności w pewnej grupie respondentów. Autorzy omawiają również pozytywny wpływ zieleni miejskiej na parametry dobrostanu społecznego oraz wskazują na konieczność włączenia NBS w kierunki systemowe na przykładzie projektu Grow Green we Wrocławiu.

Słowa kluczowe: rozwiązania oparte na przyrodzie, zieleń miejska, spójność społeczna, stres miejski, zdrowie i dobre samopoczucie mieszkańców miast.

Introduction

We live in times of two powerful trends affecting the conditions of the entire planet and our lives – constant progress of urbanization and climate change. According to Population Reference Bureau, the urban percentage of the world population is projected to reach 60% by 2030 (the urban share is likely to rise from 75% to 81% in more developed countries, and from 44% to 56% in less developed countries[1]). The main factors driving the trend of migration to cities are, i.a., economic factor (greater availability of jobs) and social benefits (wider access to public services and education). UN reports show that since 1950 the world's population has doubled and by 2050 it is to reach over 9 billion[2]. According to Met Office (UK), in 2021, CO2 concentration in the atmosphere will reach levels 50% higher than before the industrial revolution, due to human-caused emissions[3] and will exceed 417 ppm.

Climate change causes more frequent occurrence of extreme weather events (i.a. hurricanes and heavy rainfall), longer periods of drought and heat waves, as well as extinction of animal and plant species. The predominance of impermeable, hardened surfaces in the urban landscape, in the face of climate change, results in exacerbation of problems with rainwater management[4] (causing i.a. flooding), low humidity and the urban heat island, particularly severe in summer. The predominance of impermeable surfaces also intensifies the problem of smog pollution, as it promotes the occurrence of secondary remobilisation of particulate matter (particulate matter uplift) due to car traffic. The secondary remobilisation of particulate matter is responsible for up to 80% of traffic pollution[5].

Apart from the benefits of moving to cities, constant influx and rotation of the urban population, as well as densification of the urban development, have also numerous negative effects. One of them is the poor sense of security and the feeling of alienation among urban residents, leading to low social cohesion, deprivation and loss of the sense of wellbeing. The lack of green spaces and recreational open air areas, also affects the citizens' life quality assessment and intensify urban stress[6].

In the face of so many challenges, it is necessary to look for comprehensive solutions that would address many problems simultaneously, would be easily accessible and economically efficient, friendly to city residents and in line with the sustainable development principles. Such are nature-based solutions (NBSs), defined as: "solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic

[1] https://www.prb.org/urbanpoptobecomemajority/ (accessed on: 05.11.2021).
[2] esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf (accessed on: 05.11.2021).
[3] https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2021/2021-carbon-dioxide-forecast (accessed on: 05.11.2021).
[4] "Regulating urban surface runoff through nature-based solutions", T. Zoelch, L. Henze, P. Keilholz, S. Pauleit, *Environmental Research, 157*, pp. 135-145.
[5] https://miastojestnasze.org/smog-mimo-mniejszego-ruchu-na-ulicach/ (accessed on: 05.11.2021).
[6] https://www.eionet.europa.eu/gemet/en/concept/8843 (accessed on: 05.11.2021).

benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource--efficient and systemic interventions“[7].

In 2017-2022 in Wroclaw (Poland), the Grow Green project is being implemented. Grow Green is a research and development project from the Horizon 2020 programme, "Demonstrating innovative nature-based solutions in cities” project group[8]. The full name of the project is: "Green cities for climate and water resilience, sustainable economic growth, healthy citizens and environments" – the aim of the project is to assess the performance of selected nature-based solutions in terms of climate change adaptation and mitigation in cities, rainwater management improvement, biodiversity increase, improving the quality of life of urban residents and fostering economic growth, in accordance with the principles of sustainable development. The assessment and evaluation of these factors will be preceded by an in-depth study and several years of monitoring of project areas – before and after the intervention, i.e. before and after the introduction of selected nature--based solutions. One of the key elements of monitoring provided in the Grow Green project is social monitoring which, i.a., aims to indicate whether and to what extent, the introduced nature-based solutions are able to improve the sense of security and wellbeing assessment in the local community. In this article the authors describe and discuss selected elements of research in the framework of social monitoring, aimed at developing the directions of social wellbeing restoration.

1. Materials and Methods

1.1 Study area

The Grow Green project is realized by a consortium of 23 partners from 9 countries, with the leadership of three cities – Manchester (UK), Wrocław (Poland) and Valencia (Spain). In these cities, in selected locations, demonstrators have been created, i.e. areas where selected nature-based solutions have been introduced and where their performance is being tested using a variety of monitoring systems. In Wrocław, selected areas of the Ołbin district have been qualified for the implementation of the project – together they form a network of demonstrators (demonstration areas of the project).

Ołbin is one of the city’s most densely populated districts (Figure1), with a very dense residential development, consisting mainly of century-old tenement houses (mainly municipal housing resource buildings), with internal courtyards, mostly lacking greenery. This area, due to the fact that the buildings are mainly heated with coal, is struggling with frequent smog episodes – exceedances of the admissible concentrations of particulate matter (PM10, PM 2.5) and benzo(a)pyrene – mainly during the heating season. In addition, due to the predominance of impervious surfaces, urban heat island in this area is most severe in the whole city[9], residents also complain on local flooding (especially after heavy rains) and stagnation of water in the courtyards.

According to the information available on the Wrocław Spatial Information System website[10], around 41 thousand people live in the Ołbin district, while the population density in this area is estimated at about 25,000 people / km^2 (see Fig.1). A large proportion of the population are people at retirement age (above 25%). In recent years there has been an influx of young people

[7] https://ec.europa.eu/info/research-and-innovation/research-area/environment/nature-based-solutions_en (accessed on: 05.11.2021).
[8] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/scc-02-2016-2017 (accessed on: 05.11.2021).
[9] *Dobowa zmienność powierzchniowej wyspy ciepła wybranych miast w Polsce podczas fali upałów w sierpniu 2013 roku na podstawie danych satelitarnych*, P. I. 2, L. Dubicka, 2014, Prace Naukowe Politechniki Warszawskiej, Inżyniera Środowiska.
[10] https://gis.um.wroc.pl/imap/?gpmap=demografia (accessed on: 05.11.2021).

from outside the district[11]. The district is also inhabited by many students (around 10 thousand[12]) who rent apartments here, due to the proximity of Ołbin to the location of most of the largest universities in Wrocław.

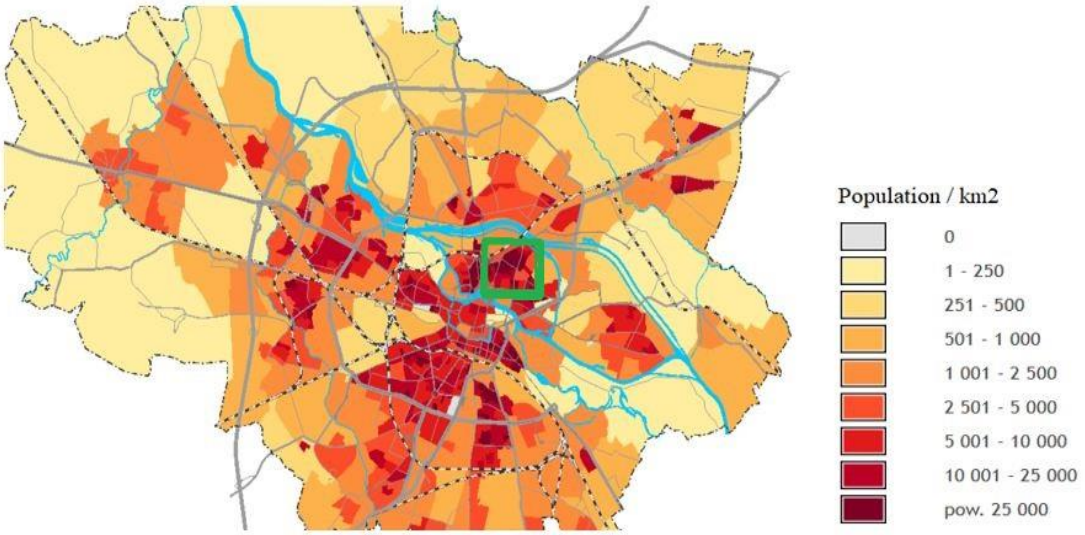

Figure 1. The City of Wrocław – division by population density. The Ołbin distict marked with green square (map legend on the right)[13].

1.2. Questionnaire survey research

Research within the Grow Green project's social monitoring was conducted in accordance with the methodology proposed by the University of Manchester (leader of the social monitoring works in the project).

As part of the research in the field of social monitoring, a questionnaire survey has been carried out in the project target group, i.e. among the inhabitants of the areas covered by the project. The surveys consisted of questions, divided into 3 thematic sections – "Your personal wellbeing", "Your community wellbeing", and "About You". The "About You" section contained a metric with questions relating to demographic data, i.a., gender, age, education, occupation, marital status, monthly income, subjective health assessment, etc. The surveys were anonymous – no personal data was collected during the survey. The survey was conducted among random inhabitants of the areas covered by the project (residents of buildings adjacent to the project demonstrator areas), using a face-to-face method.

The aim of the survey was to collect information on the perception of respondents' everyday life quality in relation to the place of residence, activities undertaken in the place of residence and the level of integration with the local community. The study was aimed at collecting data on the subjective feelings of the respondents in this regard.

The surveys were conducted in the summer and autumn of 2019 – before the construction of the demonstrators (i.e. before the introduction of selected NBSs), but after two series of project workshops with the inhabitants of the areas covered by the project.

[11] *Grow Green Wroclaw WP1 Diagnosis & Baseline Report* (internal project deliverable report), J. Zwozdziak, K. Kwiecinska, L. Szalata, 2017, Wroclaw.
[12] https://doba.pl/wroclaw/artykul/wroclawski-olbin-tu-diabel-mowi-dobranoc-foto-/11033/0 (accessed on: 05.11.2021).
[13] https://gis.um.wroc.pl/imap/?gpmap=demografia (accessed on: 05.11.2021).

96 questionnaires were collected during the pre-intervention survey campaign (before the introduction of NBSs). Within this particular study, 9 questions from 3 thematic sections, in relation to 9 demographic data were subjected to statistical analysis. Selected questions posed to the respondents (by thematic sections) are given in the Table 1.

Table 1
Questions posed to the respondents by thematic sections

Survey thematic section	Questions posed to the respondents
About You	1. Gender (1. Male, 2. Female) 2. Age (1. <25, 2. 26-40, 3. 41-55, 4. >56 years old) 3. Period of residence (1. <1, 2. 1-5, 3. 6-20, 4. >21 years) 4. No. of people in household (1. 1: one person, 2. 2: two people, 3. 3: three or more) 5. Marital status (1. single, 2.divorced / widow(er), 3. in relationship) 6. Occupation (1. fulltime, 2. part time, 3. unemployed, 4. selfemployed (full / part time), 5. pensioner (retired), 6. in full time education) 7. Monthly income [PLN] (1. <1500, 2. 1501-2000, 3. 2001-2500, 4. 2501-3000, 5. 3001-3500, 6. >3500) 8. Education (1. primary education, 2. secondary education, 3. higher education) 9. Health assessment (1. very good/good, 2. some health issues, 3. poor health)
Your personal wellbeing	1. I've been feeling optimistic about the future 2. How satisfied are you with your life nowadays? 3. To what extent do you feel the things you do in your life are worthwhile?
Your community wellbeing	1. I feel close to the people in my local area 2. I feel like I belong to this neighborhood 3. How many of your neighbors do you know by their first name? 4. How many people are there within the neighborhood, with whom you can discuss intimate and personal matters? 5. How safe do you feel generally when you are walking outside alone in this neighbourhood during the daytime? 6. How safe do you feel generally when you are walking outside in this neighborhood alone after dark?

1.3. Statistical analysis

Originally, a five-point Likert scale was used to collect responses to the questions in sections "Your personal wellbeing" and "Your community wellbeing" (frequency: never, rarely, sometimes, often, always) except for questions no. 3 and 4 from "Your community wellbeing" section. For those questions, numerical answers (1. 0; 2. 1-4, 3. 5-9, 4. 10-15, 5. >16) were given. To examine how the data is dispersed between each sample and to assess differences in perception of specific issues, the data was first statistically assessed using box and whisker plots (Figure 2). Later, in order to identify the factors influencing self-perception of wellbeing and community wellbeing, the dependent variables were points assigned to individual answers to the questions, expressed on a rating scale of 1 to 5, while independent variables consisted of demographic information.

For each question (1-9), the dependence of the answers on the individual characteristics of the respondents was examined. For this purpose, two-dimensional contingency tables were built for grouped data. The data were grouped so that there were people with a similar profile in the groups and at the same time the Pearson condition was met that in each field of the table the number of respondents was greater than or equal to 5. In many cases, this condition was not

met. Therefore, it was necessary to group both the individual characteristics of the respondents (Table 2 presents grouped individual characteristics) and the answers to the questions. Finally, the three-point Likert scale was used (frequency: 1: never/rarely, 2: sometimes, 3: often/always).

The chi-square test of independence was carried out for the constructed table and the Spearman's rank correlation coefficient was determined. In the chi-square test, the null hypothesis H0 was tested: features are independent of the alternative hypothesis, H1: features show a relationship at a significance level of 0.05 by calculating the p-value. The features for which the determined p-value was less than 0.05 were treated as dependent features and the direction of dependence was tested on the basis of the Spearman's rank correlation coefficient. Features with p-value greater than 0.05 were treated as independent features.

2. Results

2.1 Demographic information

Basic demographic data were collected in order to examine how the perception of wellbeing varies among the target groups according to gender, age, occupation, etc. The demographic data of the respondents are presented in Table 2. Most of the respondents were female (69%). The analysis of the single frequency of responses in the survey shows that most of them were over 56 years of age (40%) and aged 26 to 55 (38%), and had higher or secondary education (77%). Nearly half of the respondents were single (single or divorced) and the remaining half were in a relationship. 51% of the respondents were employees working full-time or part-time, 20% studying and 29% retirees, mainly with an average monthly income below PLN 3000. The respondents differed in terms of the time of residence in the project area – about 1/3 of the respondents lived in the studied area for less than 5 years, and about 1/3 for over 21 years. Mostly they did not complain about their health condition.

The surveys were conducted in the summer and autumn of 2019 – before the construction of the demonstrators (i.e. before the introduction of selected NBSs), but after two series of project workshops with the inhabitants of the areas covered by the project.

Table 2
The demographic data of the respondents

Gender 1. Male 2. Female	Age 1. <25 2. 26-55 3. >56	Education 1. primary 2. secondary 3. higher	Marital status 1. single 2. in relationship	Occupation 1. employed, 2. learning, 3. pensioner (orunemployed)	Monthly income (in PLN) 1. <2000 2. 2001-3000 3. >3000	Period of residence 1. <5 2. 6-20 3. >21	Healthasse--ssment 1. good 2. average
1. 31% 2. 69%	1. 22% 2. 38% 3. 40%	1. 23% 2. 47% 3. 30%	1. 47% 2. 53%	1. 51% 2. 20% 3. 29%	1. 42% 2. 34% 3. 24%	1. 36% 2. 28% 3. 36%	1. 67% 2. 33%

2.2 Perception of wellbeing

In order to examine the respondents' personal wellbeing and community wellbeing perception, the data was firstly assessed using box and whisker plots (Figure 2). The plots show the ranges of scores for selected variables and descriptive statistics in a five-point Likert scale. Comparing the interquartile ranges (that is, the box length) it follows that the most dispersed data is for the questions: „to what extent do you feel the things you do in your life are worthwhile?", „I feel like I belong to this neighborhood", „how safe do you feel generally when you are walking outside in this neighborhood alone after dark?". The question: „to what extent do you feel the

things you do in your life are worthwhile?" is a measure of individuals' psychological resources. It comprises, among others, the level of self-esteem. Here the respondents are quite diverse. The next question concerns supportive relationships. The extent and quality of interactions in close relationships with others from neighborhood. The respondents' feelings in this regard may affect the answers to the third question – because you don't feel like you belong to (you're a part of) this neighborhood, your community does not provide you support, you are afraid to walk in the dark. As it turned out later, this was a misinterpretation. How these responses differed between the different groups will be analyzed further.

In case of the following questions: „I've been feeling optimistic about the future", „how satisfied are you with your life nowadays?" the answers were similar – half of the answers ranged from 3 to 4 (sometimes, often). These questions are also a measure of individuals 'psychological resources: optimism and resilience (feeling optimistic about the future) and satisfaction in being able to deal with life's difficulties.

The respondents assessed their contacts with people from the neighborhood worse, especially in terms of "how many people are there within the neighborhood, with whom you can discuss intimate and personal matters". It means they don't trust people and don't expect support from the people from their neighborhood. It is surprising that, despite this reluctance to contact people from their neighborhood, they feel a part of the local community.

To sum up, this survey reflects that people living in the study area are generally satisfied with their lives, that they aren't generally open to contacts with other people, but at the same time they feel they're a part of the local community. People feel less safe in the neighborhood after dark than during the day, which seems to be normal in larger cities.

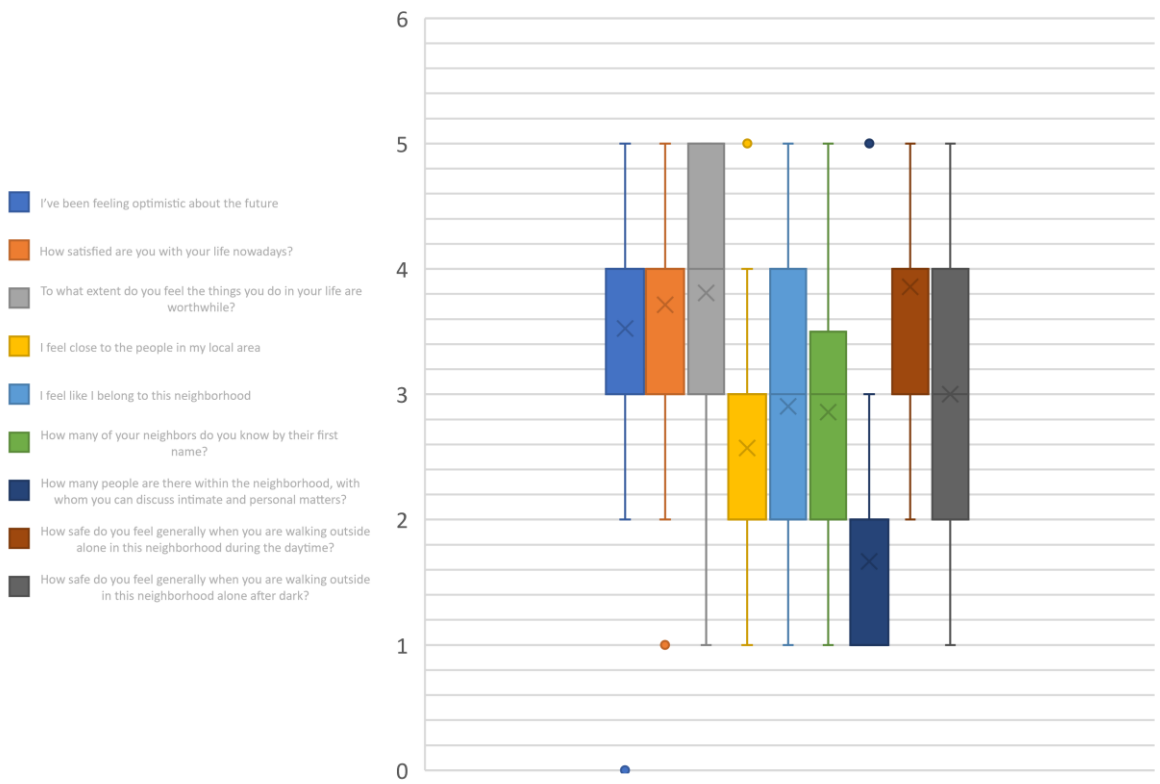

Figure 2. Boxplots of "your personal wellbeing" and "your community wellbeing" perception in a five-point Likert scale (whisker – minimum and maximum, box – 1st and 3rd quartile, horizontal line – median, crosses – mean value, dots – outliers)

Table 3
Factors influencing perception of wellbeing of the respondents

p-value/ Chi^2	Gender	Age	Period of residence	No. of people in household	Marital status	Occupation	Monthly income	Education	Health assessment
I've been feeling optimistic about the future	p=,45	p=,00	p=,13	p=,86	p=,43	p=,01	p=,00	p=,00	p=,00
How satisfied are you with your life nowadays?	p=,91	p=,15	p=,07	p=,34	p=,35	p=,04	p=,03	p=,01	p= 0,03
To what extent do you feel the things you do in your life are worthwhile?	p=,14	p=,03	p=,03	p=,04	p=,33	p=,00	p=,60	p=,13	p=,13
I feel close to the people in my local area	p=,63	p=,00	p=,00	p=,02	p=,17	p=,00	p=,14	p=,00	p=,05
I feel like I belong to this neighborhood	p=,90	p=,00	p=,00	p=,10	p=,99	p=,00	p=,03	p=,00	p=,02
How many of your neighbors do you know by their first name?	p=,89	p=,00	p=,00	p=,10	p=,65	p=,00	p=,16	p=,00	p=,00
How many people are there within the neighborhood, with whom you can discuss intimate and personal matters?	p=,99	p=,00	p=,01	p=,79	p=,01	p=,03	p=,90	p=,00	p=,23
How safe do you feel generally when you are walking outside alone in this neighborhood during the daytime?	p=,40	p=,06	p=,03	p=,14	p=,20	p=,12	p=,94	p=,41	p=,06
How safe do you feel generally when you are walking outside in this neighborhood alone after dark?	p=,019	p=,40	p=,21	p=,92	p=,85	p=,01	p=,54	p=,43	p=,51

2.3. Factors influencing well-being perception

The chi-square test of independence was used to determine whether perception of wellbeing of the respondents and their individual characteristics ("About you") are likely to be related or not. Table 3 shows the p-values for a test.

The analysis shows that optimism towards the future and satisfaction with everyday life are significantly influenced by features such as age, occupation, income, education and health assessment. The analysis of the conducted research did not show any influence of gender and marital status on the wellbeing of the respondents in this respect. The answers to the question "do you feel the things you do in your life are worthwhile" depended on age, occupation and time of residence in the studied area, and was not related to other factors. The answers to the questions concerning the "Your community wellbeing" section were influenced by factors such as age, time of residence, occupation and education, and completely independent of gender and marital status. In the case of the last two questions in this section, the dependencies were revealed for single independent variables (period of residence and occupation).

The direction of all these dependencies was estimated based on the Sperman's rank correlation coefficient. The most important results are shown in Table 4 for cases with a p-value less than $\alpha = 0.05$.

Optimism towards the future and satisfaction with everyday life were – unsurprisingly – the higher the better employment conditions of the respondents, higher level of education, higher income and better assessment of health condition. However, the analysis of the answers to the question "do you feel the things you do in your life are worthwhile" seems very interesting – the self-esteem in this respect was higher in pensioners and people living in the study area for more than 21 years (most of whom are pensioners) than in young people and living in the studied less than 5 years.

Low self-esteem of young people living in the studied area also correlates with the lack of neighborly contacts, which may cause a feeling of alienation and lack of support. Therefore, attention should be paid to building social cohesion in this age group.

According to the analysis of answers to questions in the "Your community wellbeing" section, the elderly and those who live longer in the district, with primary education, as well as people with a lower assessment of their health condition, are closer to the local community and identify with it, know more neighbors and have more social relationships with them than people with higher education, higher earnings and younger people. This may be due to the fact that the first group of respondents requires more care and help, and therefore supports each other more than the second group. However, it may also be a sign of low social cohesion in the group of younger and working people, which exposes these people to lack of help and support in case of problems. Older people and those living longer in the studied area (most of whom are pensioners) feel less safe in their neighborhood during the day, while after dark, mainly women and working people feel endangered.

Table 4
The direction of the dependencies between the perception of wellbeing and demographic data

	Gender	**Age**	**Period of residence**	**No. of people in household**	**Marital status**	**Occupation**	**Income**	**Education**	**Health assessment**
I've been feeling optimistic about the future		The older the person, the less optimistic (…)				The better the person's professional situation, the more optimistic (…)	The higher the person's income, the more optimistic (…)	The higher the person's education, the more optimistic (…)	The better the person's health assessment, the more optimistic (…)
How satisfied are you with your life nowadays?						The better the person's professional situation, the more satisfied (…)	The higher the person's income, the more satisfied (…)	The higher the person's education, the more satisfied (…)	The better the person's health assessment, the more satisfied (…)
To what extent do you feel the things you do in your life are worthwhile?		The older the person, the more often feels (…)	The longer the person's period of residence, the more often he/she feels (…)	The lower the number of people in the person's household, the more often he/she feels (…)		The less professional work the person has, the more often he/she feels (…)			
I feel close to the people in my local area		The older the person, the closer to the people (…)	The longer the person's period of residence, the closer to the people (…)	The lower the number of people in the person's household, the closer to the people (…)		The less professional work the person has, the closer to the people (…)		The higher the person's education, the less close to the people (…)	The worse the person's health assessment, the closer to the people (…)

	Gender	Age	Period of residence	No. of people in household	Marital status	Occupation	Income	Education	Health assessment
I feel like I belong to this neighbourhood		The older the person, the more (…)	The longer the person's period of residence, the more (…)			The less professional work the person has, the more (…)	The higher the person's income, the less (…)	The higher the person's education, the less (…)	The worse the person's health assessment, the more (…)
How many of your neighbors do you know by their first name?		The older the person, the more neighbors (…)	The longer the person's period of residence, the more neighbors (…)			The less professional work the person has, the more neighbors (…)		The higher the person's education, the less neighbors (…)	The worse the person's health assessment, the more neighbors (…)
How many people are there within the neighborhood, with whom you can discuss intimate and personal matters?		The older the person, the more neighbors (…)	The longer the person's period of residence, the more neighbors (…)		People in relationship have more neighbors (…)	The better the person's professional situation, the less neighbors (…)		The higher the person's education, the less neighbors (…)	
How safe do you feel generally when you are walking outside alone in this neighborhood during the daytime?		The older the person, the less safe (…)	The longer the person's period of residence the more safe (…)						
How safe do you feel generally when you are walking outside in this neighborhood alone after dark?	Women feel less safe when walking alone in the neighbor--hood after dark					The better the person's professional situation, the less safe he/she feels when walking alone in the neighborhood after dark			

3. Discussion

3.1 Benefits of green infrastructure in building wellbeing perception in urban residents

The survey campaign carried out in the framework of the Grow Green project social monitoring indicate that a large proportion of the respondents show a low sense of security and wellbeing. A low level of social cohesion is also noted in the project areas. These factors, in correlation with the nuisances associated with climate change and the lack of easily accessible green areas, cause the residents to experience increased urban stress.

According to the EU definition, urban stress is defined as *a state of bodily or mental tension developed through city living, or the physical, chemical, or emotional factors that give rise to that tension*[14]. Those factors include i.a.: congestion, overcrowding, noise levels, greenspace

[14] https://www.eionet.europa.eu/gemet/en/concept/8843 (accessed on: 05.11.2021).

unavailability, waste overburden, quality of housing, social deprivation, physical disorder, crime and inequality. It is also important to note that wellbeing is not necessarily related to a person's perception of own prosperity which – in many literature studies – is considered as a function of culture[15].

Introducing nature-based solutions in urban areas helps to restore the wellbeing of city dwellers. The introduction of NBSs also include the introduction of green and blue infrastructure elements into dense urban development, and protecting its existing elements. Green infrastructure provides numerous benefits for the urban environment – vegetation filters the air from pollution (i.a. contributes to the reduction of smog), produces moisture and oxygen, stores rainwater, improves the energy efficiency of buildings. Green infrastructure may act as a barrier to exhaust gases and noise, it also provides food and shelter for many species of animals. Introducing greenery into compact development allows to fight urban heat island. The accompanying blue infrastructure, i.e. elements related to the presence of water in the urban landscape, provides rainwater retention, contributes to increasing air humidity and also increases urban biodiversity. Among all forms of urban greenery, trees and shrubs bring the most benefits to the urban environment (also in the context of smog reduction – sometimes they are even called "dust-catching plants"[16]). In areas where planting trees and shrubs is not possible, vertical greenery (i.e. associated with the vertical surfaces of buildings) should be introduced, in the form of climbing plants – creepers, such as Common ivy (*Hedera helix*) and Boston ivy (*Parthenocissustricuspidata*), may capture over 1.7 kg/m^2 of municipal particulate matter on the leaf surface[17].

In addition, greenery beautifies the city and helps to reduce the so-called urban stress[18]. Recent studies have shown that "having 10 more trees in a city block, on average, improves health perception in ways comparable to an increase in annual personal income of $10,000 and moving to a neighborhood with $10,000 higher median income or being 7 years younger"[19]!

According to the research of Kardan et al. (2015), in terms of increasing the wellbeing of urban residents, it is even more effective to increase the number of small green areas (especially trees!) in the city center – where the built-up area is the most dense, at the cost of extending parks and other existing green areas.

Regarding social cohesion issues, studies prove that the presence of urban greenspaces can encourage positive social interactions that cultivate social cohesion in ways that enhance health and wellbeing. Urban greenspaces have also been linked to positive health behaviors and outcomes including increased physical activity and social engagement[20]. According to the study of Maas et al. (2009), less greenspace in people's living environment coincided with feelings of loneliness and with perceived shortage of social support[21].

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[15] *Europe's Growth Champion. Insights from the Economic Rise of Poland*, M. Piątkowski, 2019, Warszawa: Wydawnictwo Politex.

[16] radiokrakow.pl/wiadomosci/krakow/sprawdzamy-jak-dzialaja-rosliny-pylochwytne/ (accessed on: 05.11.2021).

[17] *Nature-Based Solutions and Buildings – The Power of Surfaces to Help Cities Adapt to Climate Change and to Deliver Biodiversity*, V. Enzi, B. Cameron, P. Dezsényi, D. Gedge, G. Mann, U. Pitha, from the book: *Nature-based solutions to climate change adaptati*.

[18] "The influence of urban green environments on stress relief measures", L. Tyrväinen, A. Ojala, K. Korpela, T. Lanki, Y. Tsunetsugu, T. Kagawa, 2014, *Journal of Environmental Psychology, 38*, pp. 1-9.

[19] "Neighborhood greenspace and health in a large urban center", O. Kardan, P. Gozdyra, B. Misic, F. Moola, L.J. Palmer, T. Paus, M.G. Berman, 2015, *Scientific Reportsvolume 5*, article number: 11610.

[20] "The RelationshipbetweenSocialCohesion and Urban Green Space: AnAvenue for HealthPromotion", V. Jennings, O. Bamkole, 2019, *International Journal of Environmental Researchand Public Health*, *16*, p. 452.

[21] "Social contacts as a possible mechanism behind the relation between green space and health", J. Maas, S.M.E. van Dillen, R.A. Verheij, P.P. Groenwegen, 2009, *Health & Place, 15*(2), pp. 586-595.

Figure 3. Infographic 'what can greenspace do' ©Scottish Green Infrastructure Forum[22].

During the talks with the residents of the project areas, the interviewees repeatedly expressed the need for green areas to appear in their place of residence – they emphasized the importance of greenery for air quality, the need to shelter during hot weather, rest during daily duties such as shopping, caring for children, dog walks etc. They also signalled their will to meet their neighbors outside the home more often, to carry out joint ventures (such as joint planting and caring for plants), and – almost always – they wanted to beautify and tidy up their neighborhood. This is due to the intuitive belief of most people that greenery is a factor in the quality of life, especially in heavily built-up areas, devoid of natural elements.

In the area of Grow Green project demonstrators, green infrastructure in the form of so-called pocket parks (small green areas designed to meet all the requirements of the nature--based solutions) has been introduced (Figure 4b, 5b). In the pocket parks, trees and shrubs were planted, low-growing, ground cover plants were also introduced (instead of lawns requiring excessive watering and care). Garbage container sheds and bicycle sheds were also built in the courtyards, enclosed with frames, which in the future will be covered with climbing plants. This solution reduces the odour nuisance (from garbage), protects garbage containers and bicycles stored in sheds, and also improves the overall aesthetics. In addition – like any other element of green infrastructure, it is a biologically active surface and an air filter. In addition to the green infrastructure elements listed above, other nature-based solutions have also been introduced, including elements of the blue infrastructure, i.e. rain gardens (small hollows in the ground, planted with

[22] https://digital.iucn.org/nature-based-solutions/nature-in-the-city/ (accessed on: 05.11.2021).

vegetation resistant to both periodic drought and flooding, also called bioretention facilities) and barrels collecting rainwater. Rainwater tanks allow to quickly drain some of the rainwater after rainfall, preventing local flooding, also collect water that can be used to watering plants during drought. Nature-based solutions also include permeable surfaces, introduced in some courtyards in the form of a concrete grid that allows rainwater to infiltrate the ground[23]. Animal houses and flower meadows (especially valuable for pollinators) have also been introduced in pocket parks. As required by the NBSs definition, only natural, biodegradable and local materials were used.

Along one of the main streets of the Ołbin district (an area of which is a part of the demonstrator network, a row of trees has been planted, parklets have also been introduced (constructions in the form of boxes in which trees and shrubs were planted and seating places were arranged). Parklets give the opportunity to take a rest in the shade, with a view of the greenery. Additionally, it is an element slowing the traffic along the street and thus reducing secondary remobilisation of particulate matter (particulate matter uplift due to car traffic), minimizing smog.

Figures 4, 5 present selected interventions (introduction of nature-based solutions) in the area of Ołbin district in Wroclaw.

(a) **(b)**

Figure 4. (a, b) One of the Grow Green project demonstrators before and after the introduction of NBSs (trees, shrubs, groundcover plants, permeable surfaces, raingardens, rainwater tanks, elements supporting biodiversity, community gardens etc.)

[23] „Wodoprzepuszczalne nawierzchnie a zrównoważony rozwój terenów miejskich", M. Siedlecka, M. Suchocka, 2017, *Drogownictwo, 2*, pp. 60-67.

(a) **(b)**

Figure 5. (a, b) one of the Grow Green project demonstrators before and after the introduction of NBSs (trees, shrubs, groundcover plants, permeable surfaces, raingardens, rainwater tanks, elements supporting biodiversity, community gardens etc.).

Conclusions

The research described in this paper was held in the framework of the pre-intervention monitoring (before the introduction of selected NBSs) in the Grow Green project. The next stage is to conduct analogical research at the end of the project, i.e. two years after the construction of new green areas in the project area. It will allow to indicate whether and to what extent, the introduced nature-based solutions are able to improve the sense of security and wellbeing assessment in the local community.

However, bearing in mind the conclusions gathered already at this stage of the project, as well as the clear pressure of the residents of the project area to increase the number of activities in the field of introducing greenery into dense development, it is already possible to recommend the introduction of nature-based solutions in the systemic directions of building social wellbeing.

The example of Grow Green project implementation in the area of the Wrocław district of Ołbin, i.e. the introduction of nature-based solutions into greenery lacking spaces, in an area where a low level of social cohesion, sense of security and wellbeing of residents have been identified, shows one of the systemic approaches of building social wellbeing.

The introduction of nature-based solutions, in particular in the form of green and blue infrastructure elements, is not only aimed to improve the environmental conditions of the studied areas, but also to improve the subjective assessment of wellbeing and safety in the local community, as well as the level of social cohesion in the studied areas

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