

# ASSESSMENT OF GREEN SPACES DEVELOPMENT IN PRAGUE DURING YEARS 1901–2010

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Although the issue of urban greenery is a frequently discussed topic and numerous case studies have already documented the beneficial functions of green spaces in the cities, studies on the balance of urban greenery during the past 20<sup>th</sup> century are few. This research follows up the issue of Prague urban green spaces during the years 1901–2010 and documents the changes in Prague public greenery in that period. The analysis specifies the development of public greenery and characterizes its categories in the individual decades of the 20<sup>th</sup> century. The percentage of public greenery and its area in hectares are given for each decade. Furthermore, the total green area is confronted with the number of inhabitants then living in Prague. The results have shown a continuous development and expansion of urban greenery. Their application will be beneficial to the city planning for sustainable development and further management of current and future public green areas as a part of the capital's urban structure.

public greenery, urban greenery, 20<sup>th</sup> century, city



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## INTRODUCTION

Despite the issue of urban greenery is a frequently discussed topic, there is dearth information and research on the balance of urban green spaces (UGS) during the past 20<sup>th</sup> century. Researches analysing the balance of UGS (area in hectares of each public greenery category, percentage of the total public green area, amount of the total public green area per inhabitant) are few (e.g. Mass et al., 2006; M'ikiugu et al., 2012). Gupta et al. (2012) have dealt with the research on percentage of public greenery (so-called Green Index). They also dealt with quality and quantity of UGS.

UGS is seen as an integral part of cities providing a range of services to both the people and wildlife living in urban areas (James et al., 2009). According to Kabisch, Hasse (2013), prolonged urbanisation has many negative environmental impacts and UGS counteract with those factors and help to maintain the urban quality of life. This fact is really important mainly because in many European cities more than 70% of population is living in urban areas. Migration from the countryside to urban areas was a continuous

process in the 19<sup>th</sup> century. UGS are an important part of the municipal structure and its ecosystem. As more people live in cities, restoration, enhancement and preservation of biodiversity in urban areas has become important (Savard et al., 2000). Greenery in urban environment helps to improve and protect the biodiversity in the city's ecosystem (Kabisch, Hasse, 2013). Its irreplaceable function enriches the quality of life in the city environment and helps to shape the city's image.

The presence of the natural areas such as greenery and urban greenery contributes to the quality of life in many ways (Duggal, Chib, 2014) and provides a range of benefits at both the national and local level (Nijkamp, Levent, 2004). Urban greenery is unquestionably an inseparable part of the living environment (Coolen, Meesters, 2012) and plays a key role in improving the liveability in urban areas (Nijkamp, Levent, 2004). Its importance is very well known for maintaining the environmental quality and sustainability (Gupta et al., 2012). UGS provide numerous benefits to urban residents for example by acting as urban lungs – absorbing pollutants and releas-

ing oxygen (H a u g h t o n , H u n t e r, 1994), providing clean air, water and soil, and balancing the city's natural environment (N i j k a m p , L e v e n t, 2004).

L e e and M a h e s w a r a n (2010) have stated in their paper that UGS provide at least three benefits: (1) physical health, (2) mental health and wellbeing and (3) socioeconomic benefits. They also have affirmed that their presence itself is unlikely to explain the public health benefits suggested and the relationship is likely to be complex and influenced by multiple factors such as accessibility, quality and availability. The availability, personal preferences and sociological survey were dealt with by M i o v s k a (2010). International studies underline the importance of nature for human well-being. It is commonly accepted that urban spaces are essential for the health and well-being of citizens (V a n H e r z e l e , W i e d e m a n n, 2003) and oftentimes mediate first contact with the nature (C h i e s u r a , 2004). Urban nature in the city environment provides important social and psychological benefits which enhance human life with meanings and emotions and has generally psychological benefits by reducing stress, restoring attention, reducing criminal and anti-social behaviour (J a m e s et al., 2009).

The most important factor related to the use of UGS is its accessibility. According to S c h i p p e r i j n et al. (2010) the most important reasons for visiting UGS are to enjoy the weather and get fresh air, reduce stress, relax, do exercises as well as keeping in shape and doing something together with family or friends.

It has been proved in many researches that green areas help to recuperate from physical and mental stress (D e V r i e s et al. 2003; S c h i p p e r i j n et al., 2013). However, according to H i l l s d o n et al. (2006) there is no clear evidence to be associated with population levels of recreational physical activity and access to UGS.

A research by M a s s et al. (2006) on how strong the relationship between green spaces and health is, showed that the percentage of green space in urban surroundings has a positive association with the perceived general health of residents. There is a relation between green space and socialising as well. UGS contribute to social interaction and to bringing people together (J a m e s et al., 2009). People feel less lonely while there are more UGS in their living environment and experience a less shortage of social support (M a s s et al., 2009). The presence of green space can also promote a general sense of community (K i m , K a p l a n , 2004), at the same time reduces negative social behaviour such as violence and aggression. These psychological, physical and social health effects of UGS make them an important component of public health provision. Aesthetic contributions of UGS to city life are equally important (J a m e s et al., 2009).

Despite the enormous benefits of UGS, there is a scarcity of information on their quantity and quality (G u p t a et al., 2012). Aspects such as 'amount of

public green areas per inhabitant', 'public parks' and 'recreation area' are often mentioned as essential factors to make city more liveable, pleasant and attractive for its inhabitants. Also, UGS are of a strategic importance for life quality of our increasingly urbanised society (C h i e s u r a , 2004).

K a b i s c h , H a s s e (2013) dealt with public greenery in European cities at the turn of the 20<sup>th</sup> and the 21<sup>st</sup> centuries. They concluded that within the last decade of the 20<sup>th</sup> century the area of public greenery slightly decreased while in the first decade of the 21<sup>st</sup> century a general increase was recorded. Further they argued that public greenery was practically decreasing in Eastern Europe due to the socio-economic transformation process after 1990. This period is characterised by an increasing urban building density that might have contributed to the loss of public greenery.

## MATERIAL AND METHODS

### Study area

This research took place in Prague – the capital city of the Czech Republic. It is simultaneously the biggest city in the Czech Republic and the fifteenth largest in the European Union. The city has a unique location on the banks of the Vltava River, one of the crucial elements of the city's landscape.

During the 20<sup>th</sup> century the city area has increased along with the rising number of its inhabitants. In the city enlargement, there have been two distinctive peaks. First, during the formation of 'Great Prague' (1921–1923), second, in 1974, when the total city area reached 496 km<sup>2</sup> and this withholds until nowadays (Fig. 1).

The location of Prague public greenery is mainly predetermined by the unique and rugged terrain. According to P a c a k o v a - H o s t a l k o v a (2000), other factors that predestined the location of public parks were the medieval fortification of the city and later the urban fabric in Renaissance and Baroque. The creation of city parks as a prototype took place during the industrial development of the city in the 19<sup>th</sup> century. The system of public greenery as we know it today had practically been formed before World War I.

New impulses and initiatives appeared in the 20<sup>th</sup> century; nevertheless, it is hard to define the changes in the forms of public greenery. At the same time there are a number of different approaches and concepts in creating public parks. At the end of the 1930s the consequences of the economic crisis were shown. But paradoxically the public greenery flourished due to emergency labor compensating for unemployment (N o v o t n y , 1977).

The prosperous development in all sectors of culture, consequently also the creation of public green

spaces, was interrupted by forced German occupation. At this period creation of new parks as well as orchard maintenance were prohibited and therefore, forbidden. After World War II the formation of public greenery stagnated, just historical gardens were maintained. Some historical gardens such as Vrtbovská and Valdštejnská gardens and the Deer Moat were open to the public. As affirmed by Kupek (2006), after World War II, two significant influences dominated in creating public greenery forms: the Scandinavian art with its simplicity and geometricity and the Japanese meditative art forms.

Unpleasant events occurred in the 1960s. Towards the end of the 1960s, the project of Prague arterial road was carried out that led to destruction or reduction of many public parks, e.g. Šverma's park, Vrchlický's park and Čelakovský's park (Skalická, 2007). According to Baseová (1991), simultaneously a new trend appeared that time – massive construction of housing estates. This caused the disruption of the city borders and changed the character of the suburban forests.

During the 1970s the construction of the housing estates continued (e.g. Jižní Město (South City), Bohnice, Ďáblice and Čimice) and people living in these areas utilized forests nearby for their daily recreation. This decade meant a turning point – the city parks were coming back to the public area and public life. The most famous is Friendship park in Prosek constructed in the years 1976–1983 (Skalická, 2007).

Since the 1990s an emphasis has been put on rehabilitation and reconstruction of the existing gardens. Experiences in reconstruction of historical objects have been followed from the previous periods. A good example of a new garden design is the park nearby Chodov fortress designed by prof. Jiří Mareček, which evokes the feeling of the Central Bohemia open natural landscape (Skalická, 2007).

Novotný (1958) wrote that during the first half of the 20<sup>th</sup> century the design of public spaces lacked a clearly defined style. Unlike in the past, any new dominating form was missing.

#### Data source and categorization of urban green spaces

The main data source for this research were the documents from the Archive of the Capital City of Prague (1961, 1964, 1967). We also utilised data undertaken from scientific researches (Poleno, 1977) and other historical materials and publications (Novotný, 1958; Pacáková-Hostalková, 2000; Master Plan Z1000/00, 2006; Esterka, 2009).

The categorization of UGS used in this research was based on historical documents and historical maps mentioned above. Based on this knowledge Prague are divided into four categories: (1) Public Parks (including city parks on the squares and sport fields as a part of city parks, the Vltava River islands and historical parks accessible to the public); (2) Cemetery Greenery;

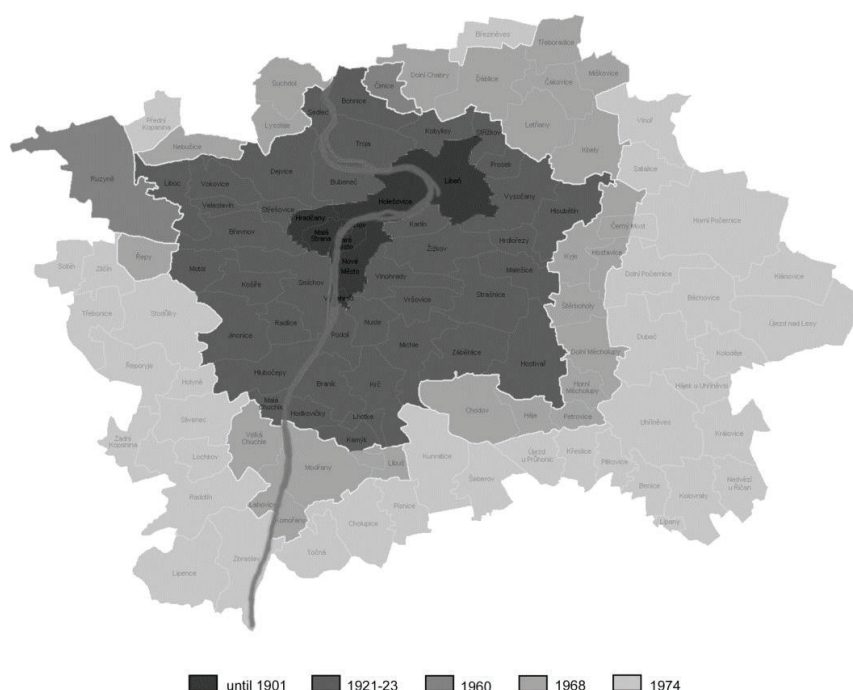


Fig. 1. City enlargement during the 20th century  
Sources: <https://www.stoletistatistiky.cz/uzemni-vyvoj-mesta-prahy/>

Table 1. Monitored factors of public greenery during the 20th century

Public greenery	1901-10	1911-20	1921-30	1931-40	1941-50	1951-60	1961-70	1971-80	1981-90	1990-00	2000-10
Total area (ha)	144.8	144.8	695.3	873.3	1 051.3	2 179.3	2 559.3	6 321.2	7 494.8	8 427.8	9 267
Percentage (%)	6.9	6.9	4	5.1	6.1	12.7	8.8	12.7	15.1	17	18.7
m <sup>2</sup> per inhabitant	2.6	2.6	9.5	9.2	10.8	20.6	25.5	55.5	63.4	69.6	78

Tab 2: Representation of public greenery categories in the individual decades in 20<sup>th</sup> century

	1901-10	1911-20	1921-30	1931-40	1941-50	1951-60	1961-70	1971-80	1981-90	1990-00	2000-10
Public parks (ha)	143	143	194	272	513	754	683	869	1000	1465	1888
Cemetery Greenery (ha)	1,76	1,76	101,25	101,25	101,25	101,25	101,25	148,5	154,75	154,75	161
Recreational forests (ha)	-	-	400	500	650	1324	1735	4860	4840	4797	5207
Settlement Greenery (ha)	-	-	-	-	-	-	40	443,71	1500	2011	2011

(3) Recreational Forests; (4) Housing estate green spaces. In the Prague city the categorization is much more complicated. For the purposes of this research, botanical and zoological gardens were not included because their areas have not changed distinctly over the reporting period. Moreover, greenery of courtyards was not included because of their semi-public character. The sports and leisure facilities include several areas, such as race courses and areas of sport courts and stadiums, but without significant representation of greenery. These facilities were not included into the examined categories of public greenery. Due to insufficient data, the alleys and green areas of embankments were not covered in this research.

#### Time period and monitored factors

The area of public greenery was defined according to the individual decades of the 20<sup>th</sup> century, i.e. for the periods: 1901–1910, 1911–1920, 1921–1930, 1931–1940, 1941–1950, 1951–1960, 1961–1970, 1971–1980, 1981–1990, 1991–2000. Moreover, the period 2001–2010 was added to transcend into the 21<sup>st</sup> century and for comparison with the 20<sup>th</sup> century trends. This division into decades allows defining and characterising Prague UGS in more detail, considering also the increasing area of the city. For each decade the following parameters are given: (1) Area of each public greenery category in hectares; (2) Percentage of public greenery in each category; (3) Percentage of the total public green area from the total actual city area; (4) Total public green area in m<sup>2</sup> per inhabitant.

The opinion on how many square metres of public greenery are needed per inhabitant varied during

the whole 20<sup>th</sup> century. The first figure was published by Novotný (1958) as 30 m<sup>2</sup> per inhabitant. Furthermore, he specified figures for the city parks (15 m<sup>2</sup> per inhabitant), school and botanical gardens (6 m<sup>2</sup> per inhabitant), sport fields (4 m<sup>2</sup> per inhabitant), cemetery (4 m<sup>2</sup> per inhabitant) and alleys (1 m<sup>2</sup> per inhabitant). Another figure from the year 1964 was found in the archives indicating at least 50 m<sup>2</sup> per inhabitant. By the end of the 20<sup>th</sup> century Wagner (1990) quoted the interval of 50–75 m<sup>2</sup> per inhabitant including all production greenery. Šupuka (2002) also mentioned the interval of 50–75 m<sup>2</sup> per inhabitant for cities of the future in Slovakia.

#### RESULTS

During the decades 1901–1910 and 1911–1920 Prague had 144.8 ha of public greenery. At this time only two categories were represented – public parks and cemetery greenery. This corresponds to 6.9% from the actual city area (21 km<sup>2</sup>) and 2.6 m<sup>2</sup> of public greenery per inhabitant (Table 1). The majority of public greenery with the area 143 ha is in the category public parks (99% from all categories, Table 2). Štulc's park from 1902 and Rieger's park created in 1904 are examples of newly created parks.

The formation of 'Great Prague' (1921–1923) meant a new era for the city parks. The public greenery gained another character. The total amount of the public greenery rapidly grew at this period. There were 695.3 ha of public greenery corresponding to 9.5 m<sup>2</sup> of public greenery per inhabitant (Table 1). This increase was caused by the green urban spaces of the



villages connected to Prague in the years 1921–1923. As the area of Prague amplified, the percentage of public greenery decreased to 4% (Fig 1). At this time Prague was systematically afforested and a green belt was shaped around the city leading to a new category of public greenery – recreational forests with the area of 400 ha (Table 2). The Praguers used the forests outside the city area for their recreation, too.

In the 1930s the area of public parks rose by 78 ha to 272 ha in 1938 (Table 2). Public greenery covered 873.3 ha in total. It was 5.1% of the city area (172 km<sup>2</sup>) and 9.2 m<sup>2</sup> of public greenery per inhabitant (Table 1). In the historical and archival materials no usable data was found for the decades 1941–1950 and 1951–1960. To assess these periods we used a qualified estimation based on historical maps.

During the 1960s almost every public park or even every urban green area was neglected in consequence of a low level of maintenance in previous years and the area of public parks decreased. In the year 1964, public parks covered 754 ha and three years later their area was just 683 ha. With the construction of housing estates, a new type of public greenery appeared – housing estate green spaces. At this time, it was just 40 ha in whole Prague, but during the following years there was a huge increase in this category (Table 2). Also, the category of recreational forests had the tendency to rise in further decades, at the turn of the 20<sup>th</sup> and 21<sup>st</sup> century the city had 1 735 ha of recreational forests (Table 2). In the 1960s, the total amount of public greenery was 2 559.3 ha (i.e. 8.8% of the 291 km<sup>2</sup> city area) and the area of public greenery per inhabitant was 25.5 m<sup>2</sup> (Table 1).

A significant moment came in 1974 when the area of Prague extended up to today's 496 km<sup>2</sup> (Graph 1). Total public greenery reached 6321.2 ha which corresponded to 12.7% of the total area of the city and public greenery per 1 inhabitant amounted to 55.5 m<sup>2</sup> (Table 1). Public park area covered 869 ha, greenery on cemeteries was 148.5 ha, area of recreational forests has rapidly risen from 1 735 ha to 4 860 ha, and housing estate green spaces covered 443.7 ha (Table 2).

In the historical and archival materials no usable data was found for the decade 1981–1990. To assess this period we used a qualified estimation based on historical maps.

At the end of the 20<sup>th</sup> century, public green area occupied approximately 17% of the total area of the city, which made 69.6 m<sup>2</sup> of public greenery per inhabitant (Table 1). In 1995, the newly established register of public green areas reported on 8 427.8 ha of public greenery in Prague. Almost a half of public greenery was represented by recreational forests (4 797 ha), the second largest proportion showed housing estate green spaces (2 011 ha), public parks covered 1 465 ha, and 963 ha referred to greenery on cemeteries (Table 2).

Data for the last decade are from the year 2006 and are retrieved from the Master Plan Z1000/00 (2006).

The area of public greenery continues in a growth tendency. The area of public parks has risen to 1 888 ha, cemetery greenery was 161 ha and recreational forests spread over 5 207 ha (Table 2). The figure for the housing estate green spaces was not available but it is expected that there is no increase. For that reason, the figure from 1995 (2 011 ha) was used. The area of public greenery was 9 267 ha, i.e. 18.7% from the total city area, meaning that for one inhabitant 78 m<sup>2</sup> of public greenery was available (Table 1).

## DISCUSSION

The results in this paper are part of the research on Prague's public greenery and show the development and changes of UGS within its categories. The results are consistent with the research on green spaces in European cities (Kabisch, Haase, 2013), indicating the extension of public greenery, with green spaces located primarily outside the city (recreational forests).

We examined four categories of urban greenery. Of course, the categorization of greenery in the city is more complicated. There are other significant and publicly accessible areas of greenery in the urban structure of the city like embankments, alleys etc. Due to insufficient data for the whole 20<sup>th</sup> century, these categories were not processed.

The analysis confirms Novotný's (1977) statement on the increase of public greenery during the 1930s. In 1964, Prague had only 754 ha of public parks and three years later their area was even smaller – 683 ha. This is in line with Skálíková's (2007) opinion that the 1960s did not favour the public greenery; she stated 25.5 m<sup>2</sup> of public greenery per 1 inhabitant. This is a bit less than published Novotný (1958) – 30 m<sup>2</sup> of public greenery per inhabitant. The figure detected in archives for this period is higher – 50 m<sup>2</sup> per inhabitant. In the 1970s Prague provided 55.5 m<sup>2</sup> of public greenery per 1 inhabitant. This figure corresponds with the interval 50–75 m<sup>2</sup> of public greenery per inhabitant published by Wagner (1990) in his book *Landscape Gardening 2*.

The research has shown that in the 1960s a new type of public greenery appeared – the housing estate green spaces (40 ha). In the 1970s, this type of urban greenery rapidly spread to 443.7 ha. This is consistent with Skálíková's (2007) statement on the ongoing construction of housing estates at that time.

## CONCLUSION

To our knowledge, this study is the first to examine the balance of UGS in the capital city of Prague during the past 20<sup>th</sup> century based on archival materials. This paper presents research concerning the changes in UGS during the past 20<sup>th</sup> century.

The analysis of the balance of Prague's public greenery indicates that the development of urban greenery, urban area and population size have dramatically changed over the last century. The public greenery area grew during the whole century in relation to the city area. The largest increase happened during the formation of 'Greater Prague' in the 1920s and then in 1974 (Table 2, Fig. 2). In the beginning of the 20<sup>th</sup> century, there existed only two categories of public greenery: public parks (almost 99%) and cemetery greenery (Table 2, Fig. 2). There were merely 144.8 ha of public greenery and 2.6 m<sup>2</sup> per inhabitant. At the first sight it might seem that in the beginning of the 20<sup>th</sup> century the Praguers did not have enough public greenery. However, recreational forests and other types of landscape greenery were located in close surroundings and used for everyday recreation. Gradually, as Prague has grown, these forests have become part of the city. At the end of the 20<sup>th</sup> century they made up almost half of the total public greenery area with 4 797 ha (Table 2, Fig. 2). With the trend of settlement construction in the 1960s, the new category of public greenery appeared – the housing estate green spaces. By the end of the 20<sup>th</sup> century this category occupied a quarter of the total public greenery area (Table 2, Fig. 2). The biggest problem with this type of public greenery is its fragmentation and non-functionality. In the future, it is important to integrate this type of greenery to the urban green structure appropriately and to ensure its proper recreational and relaxation functions. By the end of the 20<sup>th</sup> and in the early 21<sup>st</sup> century the area of public greenery occupied almost a fifth of the total city area.

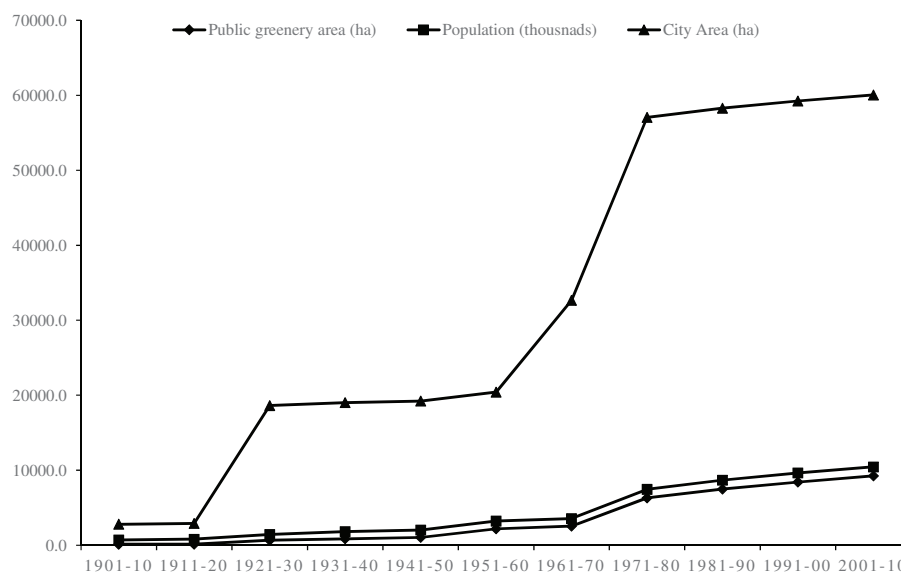
Many figures on public greenery had to be found out in historical material. However, simultaneously

these figures have been shown to possess different predictive value. It has not always been clear what exactly the individual authors have included in each category. These figures also do not reflect the quality, but only the area –i.e. the quantity.

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Fig. 2. Public greenery area vs. Population vs. City area



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