

## Sustainable Urban Development: Urban Green Spaces and Water Bodies in the City of Kazan, Russia

Asiya Galeeva

Kazan Federal University, Institute of Management, Economics and Finance, Kazan, 420008, Russia

Nafisa Mingazova

Kazan Federal University, Institute of Management, Economics and Finance, Kazan, 420008, Russia

Iskander Gilmanshin

Kazan Federal University, Engineering Institute, Kazan, 420008, Russia  
Email: asiyagaleeva@yandex.ru

Doi:10.5901/mjss.2014.v5n24p356

### Abstract

*In recent years social, economic and environmental considerations have led to a reevaluation of the factors that contribute to sustainable urban environments. Increasingly, urban green space is seen as an integral part of cities providing a range of services to both the people and the wildlife living in urban areas. The use of urban green space, and especially increasing the use, has become a hot topic for many green space managers during the past few years as the assumed link between use of urban green space and sustainable urban development is becoming more visible. Up to this time, there is little systematic information about urban green space including natural water bodies in the City of Kazan, Russia, its use and the main factors that influence this use. As green spaces play a crucial role in supporting urban ecological and social systems, it is important to make investigations in the amount of provision, the distribution and characteristics of urban green space in the city. The main concern of this paper is to address the importance of urban nature for citizens' well being and for the sustainability of the city they inhabit.*

**Keywords:** sustainable urban development, smart city, urban green spaces, water bodies, system of lake classification

### 1. Introduction

In recent years social, economic and environmental considerations have led to a reevaluation of the factors that contribute to sustainable urban environments. Increasingly, urban green space is seen as an integral part of cities providing a range of services to both the people and the wildlife living in urban areas [1, 10, 11]. It is widely recognized that urban green space is an important part of complex urban ecosystems and provides significant ecosystem services contributing to sustainable development. It benefits urban communities environmentally, esthetically, recreationally and economically [3,4]. Therefore, protection and development of urban green-space has become recognized by international agencies and donors as important tool in improving the quality of urban livelihoods and urban environment [5].

The use of urban green space, and especially increasing the use, has become a hot topic for many green space managers during the past few years as the assumed link between use of urban green space and sustainable urban development is becoming more visible. Many recent national and local health policies, as well as city planning policies, are mentioning the positive effects of the use of green space [6].

Up to this time, there is little systematic information about urban green space including natural water bodies in the City of Kazan, Russia, its use and the main factors that influence this use. As green spaces play a crucial role in supporting urban ecological and social systems [7], it is important to make investigations in the amount of provision and the distribution of urban green space in the city. Additionally with information about the public's use and perception of natural settings in the city could contribute to the improvement of Kazan green structure as a step towards securing more sustainable city development. Through this, the possibilities of implementation of concepts and strategies for sustainable urban development, based on urban green spaces and water bodies could arise in the City of Kazan, Russia. This research proposes to analyze the current situation with urban green space in the City of Kazan (distribution, quantity,

characteristics and supply)

This paper addresses the importance of urban nature for the well being of the citizens and for the sustainability of the city they live in.

At this point, a brief explanation of what a urban green space is supposed to be seems necessary.

### 1.1 Urban green spaces

*Urban green spaces* (UGS) are defined as the sum of all green spaces within urban land uses including formal and informal green areas. [2].

*Public open spaces* are defined as urban areas which are predominantly characterized by vegetation and which combine to make up the urban green fabric which are directly used for active or passive recreation or indirectly used by virtue of its positive influence on the urban environment, serving the diverse needs of citizens and thus offering a good quality of life in cities [2].

*Formal urban green space* (formal UGS) is formally designated open spaces including paved city spaces with plants, parks, gardens, sport grounds, burial places etc.

*Informal urban green space* (informal UGS) is other actual greenspaces from formal UGS as domestic gardens, private open spaces, transport corridor verges, farmland, horticulture, derelict land, water, water margins.

*Use of urban green space* (use of UGS) is defined broadly as any sort of visit to an urban green space without looking at the duration of the stay, the reason for visiting or the activity done while visiting, e.g. passing through on the way to a destination is also counted as use [6].

Each city has its own, distinctive green structure. The specific green structure of a city is a result from the interaction of natural and human processes over time. As a result, a great variety of different green spaces can exist in a city and according to their origin three different green structure layers can be distinguished [9]:

1. The pre-urban layer of the natural and cultural landscapes that were already there before the city. This layer includes, for instance, rivers, forests, arable land, wetlands, hay meadows and pastures. It is particularly this pre-urban layer which distinguishes the greenstructure from one city to the other. For instance, in the two Nordic cities – Oslo and Helsinki – woodlands, wetlands and the sea shore are prominent and they have influenced the pattern of urban development, as results from case studies undertaken in EU COST Action C11 showed. In central European cities such as Munich and Vienna, on the other hand, open farmland is much more important around the cities.
2. Urban layer: This layer includes public parks, playing fields, cemeteries but also the green spaces within the different land uses such as gardens in residential areas, green space on institutional grounds, in commercial developments, as well as land where the former use was abandoned (derelict land). The distribution of these green spaces follows the urban development patterns. In many cities, the green space cover is very low in the densely built areas of the inner city and the 19th century extensions but much higher in low density housing areas.
3. Infrastructures such as major roads, railway lines and canals can include important green spaces. The railway lines may not be accessible but they kept land from being built over within the city. They can offer an opportunity for creating green space corridors when the railways and adjacent land are not needed anymore. Large green spaces can also be found along motorways, big roads and other linear infrastructures.

The composition of city's greenspace includes formally designated open spaces (woods, paved city spaces with plants, parks, gardens, sport grounds and burial places) and other actual greenspaces (water, water margins, transport corridor verges, farmland, horticulture, derelict land, domestic gardens and private open spaces). This spatial composition of the green spaces in the city has an influence on green space use and ecological services. [8]

## 2. Material and Methods

Both secondary (literature review and desk research) and primary data have been gathered. The information available in the Report of Green spaces and water bodies Inventory of the City of Kazan (2007) and Google Earth were used as basic UGS information. The information on all publicly owned and managed UGS as their exact location, size and different elements in the area were verified during field visits. All collected data were analyzed and processed by means of the ArcGIS program (the current version of the ArcGIS software 9.3.1).

Analyzed data of investigated UGS was processed by the means of ArcGIS and maps of UGS distribution in the City of Kazan were created including the general map of all investigated UGS in the city and the map for each of the seven districts of the city (Aviastroitely, Kirovsky, Moskovsky, Novo-Savinovsky, Privoljjsky, Sovetsky, Vahitovsky).

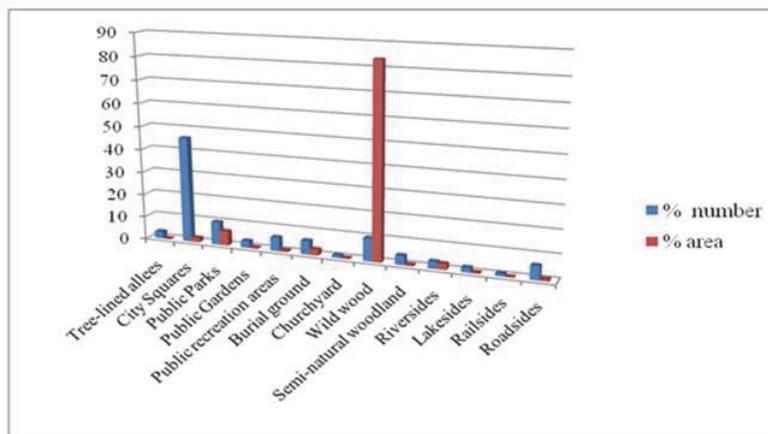
### 3. Results

During the present research it has been investigated that surface area of all UGS (included in the research) is around 39,5 km<sup>2</sup> (3 952 ha) that composes 6.45% from the overall area of the city (613 km<sup>2</sup>). On territory of the city there is a total number of 156 UGS including formally designated open spaces (number of 115, surface area of 4,7 km<sup>2</sup>) and other actual green spaces (number of 41, surface area of 34,7 km<sup>2</sup>). It has been conducted that there is on average 34,7 m<sup>2</sup> of UGS area per resident in the city (the population of the city has been estimated 1, 136, 566 people in 2009).

The data about total number and total surface area of 13 investigated categories of UGS in the City of Kazan is shown in table 1. From this table and the diagram (Figure 1) showing the percentage of each UGS category from the total number of UGS, it could be seen that the city squares are the UGS category the most presented in the city (n=71). There are 16 public parks and 16 wild woods in the city, the less presented churchyards (n=2) and railsides (n=2) and all other categories are in between as public recreation areas (n=9), burial ground (n=9), roadsides (n=9), semi-natural woodlands (n=6), riversides (n=5), tree-lined alleys (n=4) and lakesides (n=3). From the diagram showing the percentage of each UGS category from the total surface area of UGS it could be gathered that the biggest area within all investigated categories of UGS has wild wood with the surface area of 33,1 km<sup>2</sup>, which composes more than 80% of total surface area of all UGS in the city, public parks are presented with the area of 2,5 km<sup>2</sup>, burial ground with the area of 1 km<sup>2</sup>, all other categories have surface area less than 1 km<sup>2</sup> and the smallest surface area have roadsides and tree-lined alleys (less than 0,03 km<sup>2</sup>).

**Table 1.** Total surface areas and total number of different types of UGS in the City of Kazan.

UGS	UGS	Type of UGS	Total number	% of all green spaces	Total surface area (m <sup>2</sup> )	% of all green spaces
Formally Designated Open Spaces	Paved City Spaces with plants	Tree-lined alleys	4	3	22 077	0,1
		City Squares	71	46	747 787	1,9
	Parks, gardens and sport grounds	Public Parks	16	10	2 484 676	6,3
		Public Gardens	4	3	161 125	0,4
		Public recreation areas	9	6	219 615	0,6
	Burial places	Burial ground	9	6	1 045 955	2,6
Churchyard		2	1	111 594	0,3	
Other actual green spaces	Woods	Wild wood	16	10	33 103 649	83,8
		Semi-natural woodland	6	4	192 000	0,5
	Water margines	Riversides	5	3	982 219	2,5
		Lakesides	3	2	103 985	0,3
	Transport corridor verges	Railsides	2	1	45 338	0,1
		Roadsides	9	6	295 141	0,7
<b>Total</b>			<b>156</b>	<b>100</b>	<b>39 515 161</b>	<b>100</b>



**Figure 1.** Percentage of different UGS categories from the total number and total surface areas of UGS in the City of Kazan.

The general map of all investigated UGS in the City of Kazan is shown in the Figure 2. From the map it could be seen that the biggest area covered by UGS is located in the western part of the city closer to the border, the major part of which composes of Forest "Lebyajie". Another large location of UGS is situated along the river Kazanka (on the right bank of the river – Gorkii Park in Vahitovskii district, Skotskie ranges in Sovetskii district and on the left bank – Green zone along Gavrilova street in Novo-Savinovskii district). Few other large location of UGS are located closer to the border of the city on the north (Park "Krilie Sovetov" in Aviastroitelnii district), on the north-east (Park in Derbishki in Sovetskii district), east (Forest "Lebyajie 2" in Privoljskii district) and south (Forest on Orenburgskii district in Privoljskii district). A lot of small UGS primarily consisting of city squares and small recreation areas are located all around the city, mostly in Privoljskii and Sovetskii districts.



Figure 2. Map of UGS in the City of Kazan.

Few large UGS included in this research are cemeteries of the city : Cemetery "Suhaya reka" in Aviastroitelnii district, cemetery "Okolnoe" in Kirovskii district, cemetery "Novo-tatrskoe", "Archangelskoe" and "Archeiskoe" in Privoljskii district and cemetery Nagornoe in Sovetskii district.

#### 4. Discussion

It has been investigated that the distribution of UGS within the city is frequently uneven and surface area of all UGS included in the present research composes 6.45% (3 952 ha) from the overall area of the city. There are number of green spaces of different quantity and quality around the city with total number of 156 including formally designated open spaces and other actual green spaces (informal). The percentage of UGS in the city is relatively low, but it should be taken in the account that the research didn't include all possible urban green spaces as farmland, horticulture, derelict land, domestic gardens and private open spaces. It has been conducted that there is on average 34,7 m<sup>2</sup> of UGS area per resident in the city which is a relatively low parameter as well.

Our results show that the highest areas of UGS are located in the areas with lowest density of housing and buildings closer to the borders of the city and few large locations of UGS are located along the river Kazanka in the center of the city.

It has been investigated that the following types of UGS are presented in the city of Kazan : city squares, public parks, public recreation areas, churchyards, tree-lined allees, railsides, roadsides, burial ground, wild woods, semi-natural woodlands, riversides and lakesides. The most presented UGS category in the city according to the total number is the city square (n=71). However the biggest area within all investigated categories of UGS has wild wood (80% of total surface area of all UGS in the city). This category mostly composes of the forest "Lebyajie", which is located in the western part of the city closer to the boarder in Kirovsky district. A lot of small UGS primarily consisting of city squares and small recreation areas are located all around the city, mostly in Privoljsky and Sovetsky districts.

The district with the biggest surface area of UGS is in Kirovsky district with UGS area more than 29,5 km<sup>2</sup> because of the forest "Lebyajie" which is the biggest UGS of the city. The rest districts have surface area of UGS less than 3 km<sup>2</sup>.

So small number could be explained through the limitations of the research that not all possible UGS have been included in the research. Vahitovsky district has the smallest area of UGS (less than 1 km<sup>2</sup>) that could be explained through the fact that it is the city center and there are highest density of buildings in the city.

## 5. Conclusions

The study about provision and distribution of urban green spaces in the city of Kazan has shown that despite of the fact that the number of UGS in the city is high, the surface area of UGS is very low, its distribution is very uneven, available quantity of green space in the city is lower than required, there are not enough good equipped public areas for citizens where they can spent leisure time, do sport, special places for children. And taking in account that the city of Kazan covers 613 km<sup>2</sup> and inhabited by more than one million people, it is extremely important to start making contributions to the improvement of Kazan green space system for supporting urban ecological and social systems as steps towards securing more sustainable city development.

### 5.1 Suggestions for city planners and green space managers

1. The present research showed that the number of existing UGS in the city of Kazan is very low. The quantity of UGS in the city should be increased. The detailed research should be done before placing new UGS.
2. A new UGS structure plan with a comprehensive perspective needs to be elaborated. The new structure should aim to create new green spaces for the city of Kazan and should adopt a scientific approach for the interpretation of recreational behaviour of citizens when providing UGS for their use.
3. Investigations about potential users should be done before placing new green spaces or improving the existing ones..
4. Investigations about available UGS should be done to find out which experiences and possibilities each UGS offers to the users. The data on UGS is usually consist of how many square elements of each element there are while typical user as the present research proved care more about certain experiences and possibilities for activities. That's why UGS data should be gathered in more user perspective terms than to be only maintenance focused.
5. The available UGS should be matched with potential users and the green spaces in the different neighbourhoods should be adjusted according the inhabitants wishes.

## References

- James P., Tzoulas, K., Adams, M.D., Annett, P., Barber, A., Box, J., Breuste, J., Cooper, I., Curwell, S.R., Elmqvist, T., Flood, T., Frith, M., Gledhill, D.G., Goode, D., Gordon, C., Greening, K.L., Handley, J., Harding, S., Haworth, S., Hesketh, F., Home, R., Johnston, M., Kazmierczak, A.E., Korpela, K., Leeks, G., Morley, E., Nail, S., Niemelä, J., Moretti, M., Stein, N., Pauleit, S., Powell, J.A., Radford, K.G., Richardson, D., Roe, M.H., Sadler, J.P., Selman, P., Scott, A.V., Snep, R., Stern, N., Timmermans, W. and Ward-Thompson, C., 2009. Urban Green – Towards an integrated understanding of greenspace in the built environment. *Urban Forestry and Urban Greening* 8(2): 65-76.
- GreenKeys Team, 2010: GreenKeys @ Your City – A Guide for Urban Green Quality. [http://www.ioer.de/greenkeys/Greenkeys\\_Tools/manual.htm](http://www.ioer.de/greenkeys/Greenkeys_Tools/manual.htm).
- Li F., 2005: Comprehensive concept planning of urban greening based on ecological principles: a case study in Beijing, China. *Landscape and Urban Planning*, Volume 72, Issue 4, 325-336.
- Chiesura, A., 2004. The role of urban parks for the sustainable city. *Landscape Urban Plan* 68: 129-138.
- Nilsson K., 2007: Implementing urban greening aid projects – The case of St. Petersburg, Russia. *Urban Forestry & Urban Greening*, Volume 6, Issue 2, 93-101.
- Schipperijin J., 2009: Use of urban green spaces, PhD Thesis, Faculty of Life Sciences, University of Copenhagen. P. 165.
- Barbosa O., 2007: Who benefits from access to green space? A case study from Sheffield, UK. *Landscape and Urban Planning*, Volume 83, Issues 2-3, 187-195.
- Werquin A.C., Duhem B., Lindholm G., Oppermann B., Pauleit S., Tjallingii S. (Eds.), 2005. Green Structure and Urban Planning. Final Report. COST Action C11, European Commission, Brussels. <http://www.greenstructureplanning.eu/COSTC11/>
- Pauleit, S., Kaliszuk, E., 2005: Green structure patterns, Green structure and urban planning, COST Action C11, final report.
- Glebova I.S., Yasnitskaya Ya.S., Maklakova N.V. Assessment of cities in Russia according to the concept of "smart city" in the context of the application of information and communication technologies / *Mediterranean Journal of Social Sciences*.- Vol.5, No18, (2014)-pp. 55-59.
- Sibgatova K.I., Gilmanshina S.I., Khalikova F.D., Gilmanshin I.R., Akchurina I.R., Shchhaveleva N.G.Features of Pupils and Vocational College Students' Career Guidance Modeling in the Integrated System "School – Vocational College – Enterprise" // *Life Science Journal*. 2014; 11(9s) P. 592–597.