

Assessment of Recreational-Health Function of the Complex Green Zone Ternopil City, Ukraine

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Abstract

The article highlights the problem of using and assessing the natural-recreational potential of the complex green zone of the city. Natural-recreational resources of the complex green zone of the city consists of green planting of common and limited use, urban forests, gardens of private buildings, pastures, hayfields and land under water. The purpose of the article is the coverage of approaches to the assessment of the natural-recreational potential of the complex green zone of the city, on the example of the regional cent of the Ternopil city, Ukraine. In the study found that the total area of natural recreational resources of the complex green zone Ternopil city is 14 292 ha. It has been determined that the natural-recreational potential of the near intracity recreational zone of the complex green zone Ternopil city is 77%. The potential of the middle intracity recreational zone of the complex green zone Ternopil city is 22%. The potential of far intracity recreational zone of the complex green zone Ternopil city is 29% and is mainly represented by the parks recreational capacity - 13370 people. The natural-recreational potential of the near suburban recreational zone Ternopil city is 8.18%. The potential of the middle suburban recreational zone of the complex green zone Ternopil city is 0.8%. The main objects of the of far suburban recreation zone of Ternopil city are the National Nature Parks «Dnistrovskyi kanion» and «Kremenetsky Hory». Thus, the results of the assessment show that the natural-recreational potential of the complex green zone Ternopil city is 27.4%.

Key words: City, Green zone, Potential, Recreation areas, Recreational capacity

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I. Introduction

Within the conditions of enhancing growth of urbanization, green zones play an important role in the balanced development of the cities and the creation of ecologically safe life-conditions for citizens. The main functions of the complex green zone of the city are organized into 4 groups: ecological, social, economical and climate-regulating (Kuzyk 2019). Except the ecological and social ones, scientists also distinguish historical-cultural, economical and architectural functions of green planting (Kucherjavij 2005). Complex green zone of the city is a socio-ecological object of the research with priority given to environmental and social functions. If ecological functions of the green zone are sanitary and hygienic, nature conservational, oxygen production and carbon dioxide absorption, neutralization of the atmosphere pollutants, noise level reduction, water-protection and other, sufficiently covered in modern scientific publications, then the social ones are ignored. The social functions of the green zone include recreational, aesthetic, ecological-educational, historical-cultural ones and creation of the conditions for doing sports as well as arts and cultural activities (Kuzyk 2019). The main social functions of green planting in the urban environment are providing areas for recreation, doing sports, and the realization of different citizens' artistic events (Kucherjavij 2005). Thereby, providing the recreation areas for citizens is one of the priority functional tasks of the complex green zone of every populated place.

The term complex green zone of the city (CGZC) is understood the system of landscaped, plant-covered areas of the city and suburbs that forms the system of interrelated city landscape elements (towns, groups of urban populated places) and the adjacent area. It provides the complex solution of issues on greening and watering of the territories, environment protection and recreation and it is oriented on the improvement of the citizens' labour, routine and recreation (Kuzyk 2019). Natural recreational resources (NRR) are factors, substances and properties of components of the natural environment that have qualitative and quantitative parameters favorable for recreational activities and serve or can serve for the organization of people's recreation, tourism, treatment and rehabilitation (Bila 2013). The natural-recreational potential of the complex green zone of the city are the properties and factors of the environmental components of the city and suburban area that can be used for recreation, tourism, treatment and rehabilitation of people. The objectives of the study are to highlight the

approaches to the assessment of the natural-recreational potential of the complex green zone of the city, on the example of the regional centre Ukraine of the Ternopil city.

II. Materials and methods

Study area

Ternopil city is situated in the western part of Ukraine, it covers the area of 59.00 km² (5900 ha) with a population of 218 228 people as of 01.01.2019 (Ternopil investment passport 2019). The complex green zone of Ternopil city consists of two major parts – forest-park and forestry (Kuzyk 2019). The forest-park part includes the green planting of common use - 577 ha, of restricted use - 321 ha and of special-purpose - 433 ha (Ternopil city greening scheme 2017). A separate group of the forest-park planting of the CGZC is forests, which are 357 ha in Ternopil (Zvit 2016). Thus, the total area of the forest park green planting of the complex green zone of Ternopil city is 1688 hectares (Table 1).

Table 1: The structure green spaces of the forest-park part complex green zone Ternopil city (compiled from source materials Ternopil city greening scheme 2017)

	Groups of green planting	The name of the landscaping objects	Area, hectares		
Forest-park part complex green zone of Ternopil city	Green planting of common use	Regional Landscape Park «Zahrebelia»	320,0	577,0	
		«Topilche» Park	60,0		
		Taras Shevchenko Park	18,0		
		«National Revival Park»	45,0		
		«Staryi Park»	7,0		
		«Health Park»	0,37		
		Taras Shevchenko Square	1,0		
		Chornovil Square	0,5		
		Kobzar Square	0,3		
		B. Lepky Square	1,4		
		Myru Square	1,6		
		Colontay Square	0,3		
		Metropolitan Sheptytsky Square	0,4		
		Kachaly Square	0,5		
		Yunosti Square	3,5		
		Voli Square	1,0		
		Danyla Halys`koho Boulevard	2,5		
		Vyshnevetsky Boulevard	0,7		
		Kulisha Boulevard	1,3		
		Petliuri Boulevard	0,8		
	Green area Tantsorova street	0,2			
	Green planting of restricted use	Planting of residential quarters	110,76	321,0	
		Planting of residential district	100,8		
		Planting of private buildings	134,5		
		Planting the territory of educational institutions	52,0		
		Planting the territory of healthcare facilities	30,6		
		Planting the territory of cultural and entertainment and leisure facilities	0,6		
	Special-purpose green planting	Planting of territories of sports grounds, stadiums and fitness facilities	2,5	433,0	
		Sanitary protection zones	334,0		
		Planting along roads and highways	83,5		
		Cemetery planting	15,5		
	Forests of green city zone			357,0	

In the structure of green planting of common use, the area of parks, including the regional landscape park (RLP) «Zahrebelia» (excluding the territory of Ternopil reservoir), is 450 ha, the area of squares is 10.5 ha, the area of boulevards - 5.5 ha and the area of greenery of the residential quarters - 111 ha. There are 5 parks in the city of Ternopil: «National Revival Park» of 45 hectares, «Topilche» Park of 60 ha, Taras Shevchenko Park of 18 ha, «Staryi Park» – 7 ha and «Health Park» (0,37 ha), which is included in RLP «Zahrebelia» (Ternopil city greening scheme 2017). The Nature Reserve Fund of the city is represented by ten objects with a total area of 724.91 hectares, which is about 12% of the total area of the city. The largest is the regional landscape park «Zahrebelia» (630 ha). It includes the woodland (320 ha) and the water area of the Ternopil reservoir (310 ha) (Tsaryk & Poznijak 2016).

The forestry part of Ternopil CGZC includes the territory of the village councils adjacent to the city within the radius of 15 km (while in Lviv this limit is 30 km, in Chernivtsi - 20 km). This conditional zone includes 28 administrative units with a total area of 50 017 ha, including 4 550 ha of forests (Zvit 2016) (Fig. 1).

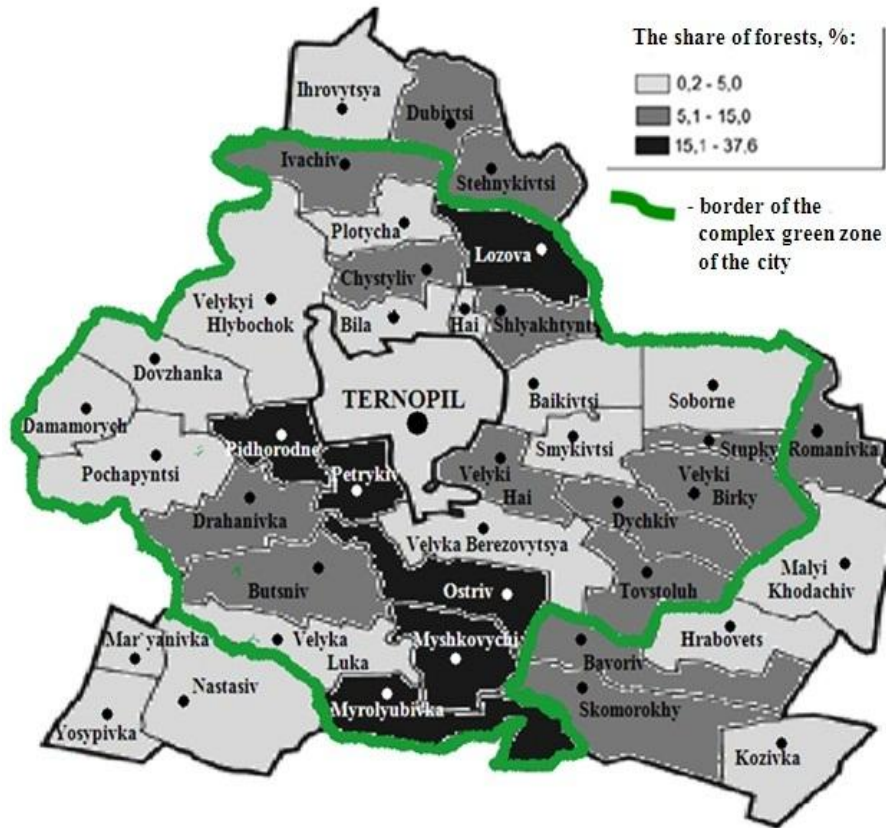


Figure 1: Border and the share of forests of the complex green zone the Ternopil city

So, the complex green zone of the Ternopil city consists of a forest-park and forestry part, with a total area of 55 917 hectares of land. The forest park includes 1 688 ha of green space, forestry part - 4 500 ha of forests. The structure of the complex green zone Ternopil city will be dominated by: forests - 64%, water bodies and swamps - 18.5%, 7.5% are green planting of common use, 5.5% - special-purpose green planting and 4.5% - green planting of restricted use (Fig. 2) (Kuzyk & Tsaryk 2020).

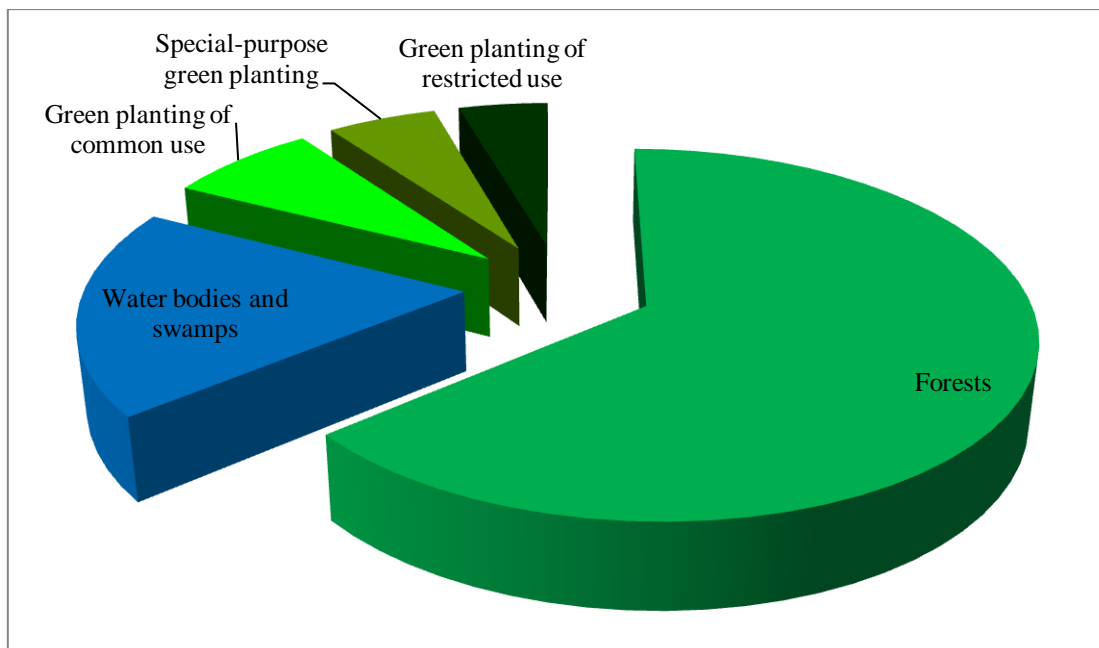


Figure 2: The structure of the complex green zone Ternopil city

Based on the structure of the natural and recreational resources of CGZC (urban gardens and parks, squares and boulevards, embankments, country parks, forest-parks, national natural and local landscape parks, recreation sites) as well as the very recreational activity of people, the recreation of city settlements residents is divided into intracity and suburban. In both there are zones of near, middle and far recreation (Kucherjavij 2005).

Near intracity recreation zone

Includes with the recreation near accommodation, place of work and teaching (residential blocks, educational, public health institutions, organizations and enterprises). This includes balconies, terraces, roofs greenery, vertical and container landscaping. The elderly, parents with infants and children are resting here the most often (Kucherjavij 2005).

According to the State building codes (DBN B.2.2-12: 2018 «Planning and Building of Territories»): «the area of planted land of restricted use in the neighborhood, including areas for recreation, games, physical training, walking paths, if they occupy not more than 30% of its total area, should be taken not less than 6 m² per 1 people (excluding the territories of pre-school and general secondary education institutions)».

For characterizing the near intracity recreation zone of the complex green zone of the city, there is used the indicator of «Norm of landscaping of the residential area», which is determined by the formula:

$$N_{oc} = P_z + P_{pt} + P_{tk} + P_{zm} / K \quad (1)$$

where:

H_{oc} is norm of landscaping of the residential area (m²/people); P_z is the area of plantations of residential buildings; P_{pt} is the area of plantations of industrial territories; P_{tk} is the area of plantations along transport communications; P_{zm} is the area of green space (common and restricted use, special-purpose); K is the number of inhabitants of the city (Kucherjavij 2005).

Middle intracity recreation zone

Located within 10-20 minutes of pedestrian or 10-15 minutes of transport accessibility from accommodation. Commonly, these are the district parks, residential neighborhoods parks, squares, boulevards, walkways where there are many types of recreational activities to do - from strolling to participation in various games and attractions (Kucherjavij 2005). The main characteristics of middle intracity recreation zone are the norm of providing urban population with the green planting of common use (N), namely planting of free recreational accessibility, and the coefficient of common use of urban green planting (K_{3k}). The provision of urban population with the green planting of common use is determined by the formula:

$$N = P_p + P_s + P_b / K \quad (2)$$

where:

N is norm of green planting of common use (m²/person); P_p is the area of parks; P_s is the area of squares; P_b is the area of boulevards; K is the number of inhabitants of the city (Kucherjavij 2005).

The coefficient of common use of urban green planting is defined as the ratio of the norm of green planting of common use and the norm of landscaping of the residential area:

$$K_z = N / N_{oc} \times 100\% \quad (3)$$

where:

K_{3k} is the coefficient of common use of urban green planting (%); N is norm of green planting of common use; N_{oc} is norm of landscaping of the residential area (Kucherjavij 2005).

Far intracity recreation zone

Located within 20-30 minutes of transport accessibility from accommodation. These are city parks, forest-parks, water parks and meadow parks. Zoos, arboretums, botanical gardens, where adults and children come for educational purposes, also belong to the zone of distant intracity recreation (Kucherjavij 2005).

According to the State building codes (DBN B.2.2-12: 2018 «Planning and Building of Territories»): the maximum permissive simultaneous number of visitors of green areas of public use within the settlements for city parks is 100 people/ha. Correspondingly, the maximum permissive simultaneous number of visitors of green areas of public use (parks, forest-parks, water parks and meadow parks) is the characteristic of far intracity recreation zone of CGZC. The maximum permissive simultaneous number of visitors of green areas of common use is determined by formula:

$$K_{max} = K \times S \quad (4)$$

where:

K_{max} is the maximum number of visitors to the green areas of common use (people); K is maximum permissible number of visitors to the green area of public use per unit area (according to DBN B.2.2-12:2018); S is the area of the green area common use.

If there are water objects that perform recreational functions and are used for bathing and recreation within the CGZC their ecologically acceptable recreational capacity is calculated. The evaluation of the ecologically acceptable recreational vacationer capacity scope is determined by formula:

$$W_o = (S_o / N_n) \times K \quad (5)$$

where:

W_o is ecological capacity water body (persons); S_o is area of water body, hectares; N_n is normative load factor (0,02 hectares/person); K is coefficient of the reducing the load on the water body (0,2) (District planning 1986).

Near suburban recreation zone

Located on contact of the city and suburbs with its forests, meadows, waterbodies and fields. In the majority of cases, this area is located close to the new city neighbourhoods within 10-15 minutes of pedestrian accessibility (Kucherjavij 2005).

According to the methodology of Vladymyrov V. (and others) (District planning 1986), 40% of city population need recreational area for improvement and rest in the «peak» period. In the temperate zones countries, 75% of those 40% spend the short time vacation in forest and 25% - near water. In other words, 30% of the city population should be able to rest about at the forest areas. The characteristic of the near suburban recreation zone of CGZC is the capacity of the territory for the conditions of forest recreation organization, which is calculated by the formula:

$$D = T \times L \times 0,5 \times 1000 / 100 \times H \times M \quad (6)$$

where:

D is recreational capacity of the forest territory (persons), T is area forest for recreation (hectares), L is forested territory (%), 0,5 is coefficient, that takes into account the need to organize green zone of the city, H is norm of recreational areas for 1 thousand inhabitants of the city (2 km²), M is coefficient, that takes into account the distribution of residents of the city for recreation in the forest and near water bodies (for cities of moderate climate $M=0,3$) (District planning 1986).

Middle suburban recreation zone

Located within 1-1,5 hour of transport accessibility. Boarding houses, sanatoriums, children's camps, private cottages providing recreation and health improvement services are often located in this area. In addition to the leisure in forests and near waterbodies, it includes the recreation in suburban areas, gardening plots, etc (Kucherjavij 2005).

The capacity of the territory for the organization of suburban agricultural activities, taking into account the possibility of land allocation for agriculture works conduction, is determined by the formula:

$$D_{ag} = T \times E \times 1000 / P \quad (7)$$

where:

D_{ag} is capacity of the territory suitable for the organization of agriculture in a suburban area (persons), T is the area of land suitable for agriculture (hectares), E is coefficient, that takes into account the possibility of using agricultural land in a suburban area (0,3), P is indicator, that reflects the need for 1 thousand inhabitants of the city in agricultural lands (1250) (District planning 1986).

III. Results and discussion

Areas, that can be considered, under the environmental characteristics, purpose and the conditions of landscapes, as a potential recreation and treatment resources, are the subject to recreational assessment. Recreational-wellness lands are very important for the organization of suburban recreation. This is due to the availability in these territories of natural and social conditions to accommodate citizens' recreational need (Bila 2013).

Natural-recreation resources of the complex green zone Ternopil city

Territories that are able to meet the recreational needs of the population of the city include, in the first place, suburban land and gardens of private households, since their primary purpose corresponds to the function of rest (Bila, 2013). Territories such as summer cottages, gardens of private buildings are appertain as structural elements of the complex green zone of the city (Elbakidze, Zavadovych & Yamelynets 2005). In the structure of the land-usage of the Ternopil CGZC territory, the percentage of the perennial plantings of the private buildings, pastures, and hayfields is 13% (7872,5 ha).

The existence of objects and territories of the natural-reserved fund significantly increases the recreational attractiveness of CGZC. This is particularly referred to the development of the eco-educational, culturological, sports (equestrian, bicycle, ski), qualified (hunting, fishing) types of tourism (Bila 2013). The conservation of the Ternopil CGZC is 6,8%, the area of natural-reserved objects is 1535 ha (Zvit 2016). It is

worth to be noted that the areas of all the objects of the nature reserve fund of Ternopil CGZC are included in the corresponding land categories they are situated on - forests, floodplains (pastures and hayfields), land under water and green planting of common use.

Water bodies are also included in the structure of CGZC and plays the special role in the organization of recreation (Kucherjavij, 1999). Recreation complexes used for beach, family rest, summer bathing, watersports and fishing are placed exactly at the shores of water bodies (Bila 2013). Generally, the share of water surface of Ternopil CGZC is 4% (714,5 ha), 1,7% of which are natural water courses (rivers, brooks), and 2,3% are reservoirs and ponds (Zvit 2016).

Forest areas of CGZC are also important for recreational activities provision. Their important, qualitative feature is readiness for mass recreation that is achieved through the conforming territory adjustments, a fairly dense road-trail network and the use of small architectural forms (Bila 2013). Forest lands constitute 8% (4907 ha) of the structure of Ternopil CGZC (Zvit 2016). The green plantings of common and restricted use, square which are in amount of 898 ha in Ternopil, make up a separate group of recreationally suitable areas of CGZC (Table 2).

Table 2: Structure of natural-recreation resources of the complex green zone Ternopil city

Structural parts complex green zone of the city	Plantation groups		Area, hectares			
	Forest-park part	Green planting of common use	Parks	450	577	2258
Squares			10,5			
Boulevards			5,5			
Planting of residential quarters			111			
Green planting of restricted use		321,0				
Forests		357,0				
Pastures and hayfields		407,5				
Gardens of private buildings		256,5				
Land under water		339				
Forestry part		Forests		4 550	12 134	
	Pastures and hayfields		5 562,5			
	Gardens of private buildings		1646			
	Land under water		375,5			

Therefore, the total area of the natural-recreational resources of the Ternopil CGZC is 14,392 ha including the green planting of common and restricted use, forests, pastures and hayfields, the perennial plantings of the private buildings and land under water . Thus, the share of the natural and recreational resources of the Ternopil CGZC is 26%, which are practically natural lands in the structure of land useage of administrative units within the complex green zone of the city. For justifying the necessity to increase the share of natural lands we'll calculate the capacity of the natural and recreational areas of Ternopil CGZC.

Determination the potential of near intracity recreation zone of the complex green zone Ternopil city

First of all, the intracity recreation zone includes the green planting of restricted use of residential areas which are located in close proximity to the city residents. The area of green planting of restricted use of residential areas is 100.8 ha in Ternopil (Table 1). According to the State building codes, the area of the green planting of the restricted use areas in the neighbourhood must be not less than 6 m² per people (DBN B.2.2-12:2018). Correspondingly, the providing of the neighbourhood population with the green planting of restricted use in Ternopil is: 100,8 ha / 218 228 people = 0,00046 hectares /people, or 4,6 m²/ person (norm 6 m²/ person).

Since not only the green planting of the restricted use, but other groups of green planting of CGZC are used in the Ternopil intracity recreation zone, it is necessary to determine the norm of landscaping of the residential area. For Ternopil this norm is 95 m²/person, according to the calculations results of formula 1. It should be noted that the greening of the Ternopil residential area is quite high. However, it should be mentioned that this indicator is absolute. It is determined for the entire city and does not take into account the time accessibility and the dispersion of the green areas.

As it was mentioned above, such types of local landscaping as vertical, container, the creation of green areas on the roofs and other ones play an important role in the near intracity recreation zone. In the modern Ternopil artistic and aesthetic decoration, such types of greening are practically not used. In some houses there are single ornamental plants on balconies and terraces. More practically, in the city, vertical greening used, especially in private or new shopping, entertainment and office buildings. Examples of stationary and mobile container greening are much more common in Ternopil. Flower containers are used on the Ruska Street, S. Bandera Ave., containers with tree planting and bushes can be seen on the Valova (city centre), Metropolitan Sheptytskyi and Mykhailo Hrushevskiyi streets

Determination the potential of middle intracity recreation zone of the complex green zone Ternopil city

The green planting of common use (parks, squares, boulevards, which are within 10–20 minutes of accessibility for citizens) play the core role in the middle intracity recreation zone. The square of parks in Ternopil is about 450 hectares, squares - 10.5 hectares and boulevards - 5.5 hectares (Table 2). The norm of providing urban population with the green planting of common use is determined by the formula 2, and it is 21,3 m²/people for Ternopil. This indicator is absolute and does not take into account the time accessibility and the dispersion of the green areas.

For more objective assessment of the recreational use of forest-parks green planting of CGZC, use the coefficient of common use of urban green planting, which is determined by the formula 3 and it is 22% for Ternopil. For comparison, this indicator is 29% in Lviv, 32,6% - in Kyiv, 44,4% - in Tbilisi (Kucherjavij, 2005). That is can be said that the residents of the capital of Ukraine and Georgia are much more likely to rest in green planting of common use zone than Ternopil residents. Thus, in Ternopil, it is necessary to not only chaotically increase the area of green zones, but to form the single system of green plantings with a balance in greening of residential areas and their periphery. The CGZC should form not the random mosaic of different purpose urban greenery, but the network of ecological axes (green corridors) at the intersection of which it is advisable to form large green arrays (cores).

Determination the potential of far intracity recreation zone of the complex green zone Ternopil city

Park arrays play the main role in the functioning of the far intracity recreation zone. Currently, there are 5 recreation parks in Ternopil: «National Revival Park», «Topilche» Park, Taras Shevchenko Park, «Staryi Park» and the «Health Park». The largest parks are located on the bound of residential areas. «National Revival Park» provides the recreation area for the residents of «Skhidnyi», «Soniachnyi», «Kanada» and «Varshavskyyi» neighbourhoods. Taras Shevchenko Park is the main recreational zone for all Ternopil residents since it is located near the Ternopil reservoir. However, there mainly rest residents centr and neighbourhood «Novyi svit». «Topilche» Park connects «Druzhba», «Podil» and «Obolonia» neighbourhoods (Fig. 3).

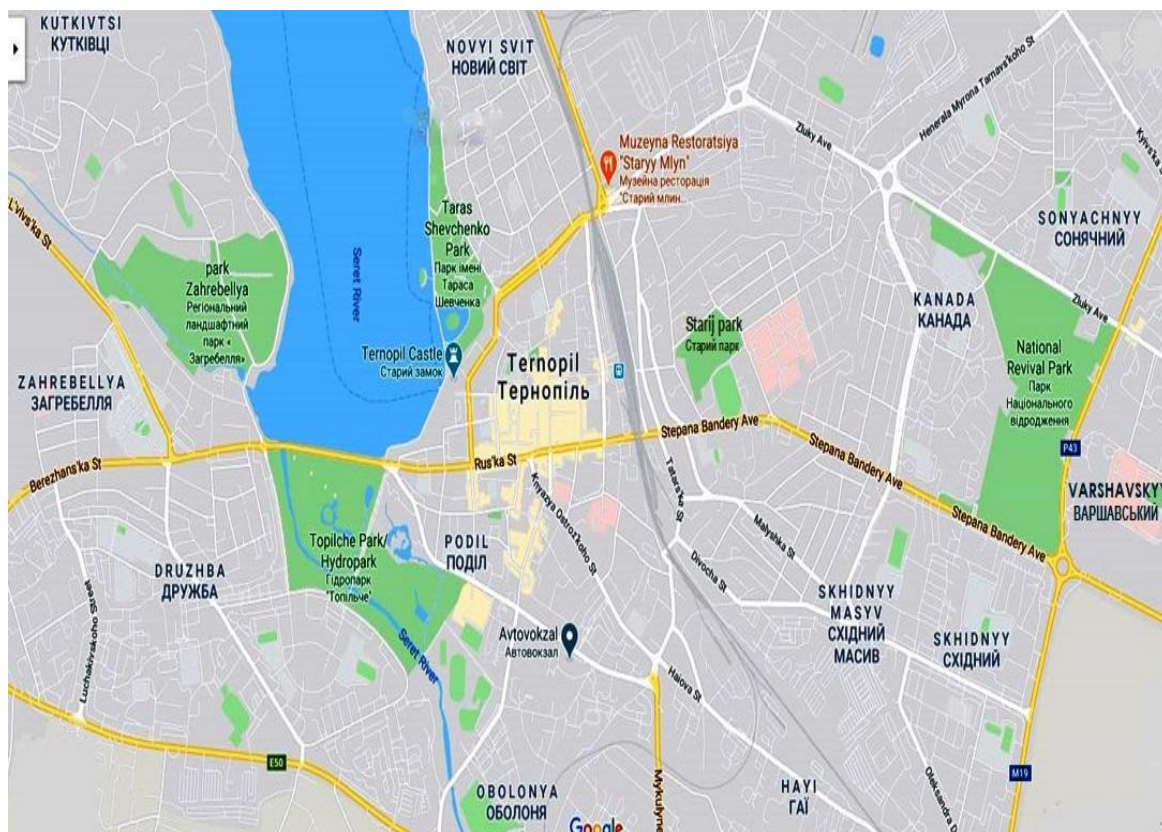


Figure. 3: Scheme of placement of the main parks in Ternopil city

For Ternopil, the maximum permissible simultaneous number of visitors of all park zones is 13 370 people, or 6.1% of the city population. For the «National Revival Park» - 4500 people, for the Taras Shevchenko Park - 1800 people, for the «Staryi Park» – 700 people, for the «Health Park» – 370 and for the «Topilche» Park - 6000 people (Table 3) (Tsaryk et al. 2019).

Table 3. The maximum amount of attendance is permissible of Ternopil city parks

Name of the park	Maximum number of concurrent visitors is allowed, people per 1 ha	Maximum number of concurrent visitors for the whole landscaping facility
«Topilche» Park	100	6000 people
«National Revival Park»	100	4500 people
Taras Shevchenko Park	100	1800 people
«Staryi Park»	100	700 people
«Health Park»	100	370 people

It is worth to note that Taras Shevchenko Park, located along the embankment of Ternopil reservoir, is simultaneously visited by a lot more than 1800 people in summer. A similar situation is observed in the «Health Park», where garden houses for leisure are equipped. Due to that we can make the conclusion that in «peak» periods (holidays) the recreational demand of Ternopil parks exceeds the limit permissive levels.

The recreational capacity of the regional landscape park (RLP) «Zahrebelia» as a protected object is defined separately. The conducted assessment of the recreational demand and calculations of the recreational capacity of the park showed that its minimal recreational capacity is 126 592 people, middle –171 995 people, maximum – 217 157 people (Tsaryk et al. 2019). The RLP «Zahrebelia» includes 300 ha of Ternopil pond . The water reservoir plays an important recreational role and it is a particular tourist «highlight» of the city. In the summer, Ternopil residents and the city guests bathe on the equipped beaches and conduct various motor-water sports competition. The tourist steamer regularly runs along the reservoir. Due to this, there is a need to determine the ecologically acceptable recreational capacity Ternopil reservoir. Of course, the Ternopil reservoir has a seasonal recreational load. We make calculations on average for the year, because the pond is located in close proximity to the parks, rest near it is a common occurrence at any time of year. According to the calculations made by formula 5, it is established that the ecologically acceptable recreational capacity of the Ternopil reservoir is 3000 people. It is worth to note that, according to the research of Tsaryk L. and Pozniak I., the recreational capacity of the Ternopil pond official beaches is only 1000 people, and of all water storage reservoir coastline - about 2,5 thousand people (Tsaryk, Poznijak 2016).

Thereby, the maximum of persons that can simultaneously rest in Ternopil reservoir is 5500, which is about 2,5% of city residents. If necessary, at least 10% of the city residents, in the settlements of temperate zones, should be provided with the opportunity to rest near water in summertime (District planning 1986).

Determination the potential of near suburban recreation zone of the complex green zone Ternopil city

Since the near suburban recreation zone is formed mainly by forests, then we will focus on determining the recreational capacity of the forests located in Ternopil. According to table 2, 357 hectares of forests are concentrated within the forest-park area of the Ternopil CGZC. The determination of the recreational capacity of the forests of Ternopil is done by formula 6: $D = 357 \times 6 \times 0,5 \times 1000 / 100 \times 2 \times 0,3 = 1\,071\,000 / 60 = 17\,850$ people. Thus, 8,18% of the city residents can simultaneously rest in Ternopil forests, with the norm of 30% at a «peak» period (holidays) (District planning 1986).

Determination the potential of middle suburban recreation zone of the complex green zone Ternopil city

Since the suburban areas and gardening plots belong to the natural and recreational resources of the CGZC and their primary functional purpose is rest and health improvement, the considerable part of the Ternopil residents spend their free time exactly on such territories. Lands suitable for agriculture constitute 7208.5 hectares (hayfields, pastures and perennial plantations) in the structure of the agriculturally used lands of the forestry part of the Ternopil CGZC (Table 2). Urban community gardens offer unique social and ecological benefits in cities. Understanding the distribution and morphology of green spaces like community gardens in relation to the landscape context across changing urban regions is critical for informing city policy and planning (Anderson, Egerer, Foush, Clarke, Davidson 2019). Here we calculations by formula 7, the capacity of the territories of the Ternopil CGZC forestry part suitable for the organization of agricultural activities is 1730 people. Thus, the potential of the middle suburban recreation zone of the Ternopil CGZC for the organization recreation is fairly low and it is 0,8%. In other words, only 0,8% of the Ternopil residents can be provided agricultural areas within the suburban zone of the complex green zone Ternopil city.

IV. Conclusions

During the conducted research it was revealed that the natural-recreational potential of the complex green zone of the city, is mainly formed by green planting of common use (parks, squares, boulevards) and restricted use, forests and other natural lands (pastures and hayfields, perennial plantations, land under water etc.). Within the CGZC there are intracity and suburban recreational areas which are divided into near, middle and far. According to the results of the calculations made, it is determined that the potential of the near intracity recreation zone of the Ternopil CGZC is about 77%, the potential of the middle intracity recreation zone - 22%,

and the potential of the far intracity recreation zone at the average is 29%. The potential of the near suburban recreation zone of the Ternopil CGZC is 8,2%, the potential of the middle suburban recreation zone - 0,8%. Therefore the total natural-recreational potential of the complex green zone Ternopil city is 27,4%. That makes us to make the conclusion that the area of green zones has to be increased in Ternopil city. At the same time, it is worth paying attention to the functional purpose of green spaces, especially their recreational potential.

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