*Filatov V.M., student*
*V. N. Karazin Kharkiv National University*
*Sscientific supervosor: Krivitskaya I.A., PhD of Biology*
*Cherkashyna N. I., English Language Supervisor*

**ANALYSIS OF KHARKIV'S RECREATIONAL AREAS DEGREE OF SHAPE OPTIMALITY**

This article contains an analysis of recreational areas degree of shape optimality. Five recreational areas of Kharkiv city were selected for studying. The analysis included calculation of the optimality index by perimeter and the square of these recreational areas.

*Key words:* the degree of shape optimality, recreation area, human load, integrated green areas, urban environment.

A balance between the natural and anthropogenic systems is necessary for exisence of the city's ecosystem. Thus, Ukrainian cities represent a certain urbanized territory, separated into zones by functional purpose. These zones include: industrial, service, residential, transport and recreational zones. Just, the natural framework counterbalances the technical system of the city.

A complex green areas form the natural framework of the city [3]. These are various green spaces, such as city parks, squares, protective green spaces, forest parks, suburban forests and other green spacesor.

Small green areas such as alleys and squares should connect large-scale gardens, parks and forest parks for the sustainability of the natural system. This combination creates a green network in the middle of the city. It can block pollutants from anthropogenic sources from entering residential areas. According to the engineering design, green spaces can have noise-absorbing and wind-protective properties [3].

But in urban planning, it is important to take a sensible approach to determining the type of recreational area, considering the parameters of the area and shape.

If the territory of the green zone is too small, the pollution, coming from various anthropogenic sources, accumulates both in recreational areas and throughout the city. If the shape of the recreational area is too elongated, it will quickly lose natural stability.

Foreign scientists believe that it is possible to optimize the structure of an isolated natural area according to certain geometric principles [1,2].

Most of the anthropogenic objects have a line type shape. These are roads and railroads, bridges and city buildings. Scientists believe that the round shape of the natural zone can reduce contact with anthropogenic sources. However, rectangularly shaped recreational areas have more points of contact and will be vulnerable to intense pollution.

The optimal shape calculation for recreation area is based on the principle of approaching the shape of green zone to the circle (Table 1). To do this, you need to know the perimeter and square of the selected zone. The optimality index is calculated by the formula:

$$D=P/(2* \sqrt{\pi*A}),$$

where,

D – the degree of the shape optimality;

P – is the perimeter of the object;

A – is the area (square) of the object.

With a rounded shape the optimality index = 1. With a rectangular shape index = 1.2. With an elongated rectangular shape the index = 1.6. At the ribbon shape – 2 or more [1,2]

For studying the green areas shape optimality in the urban environment we chose 5 recreational areas of Kharkiv city.

The square and perimeter of the recreational zones were determined in the program Googl Earth Pro, using the panel "ruler" (Table 1). As closer the degree of optimality index to the one, as a greener zone's shape close to a circle.

Table 1

Data for calculating the degree of shape optimality for Kharkiv's recreational areas

| Name of recreation area | Square of the area (km$^2$) | Perimeter of the area (km) | Steps of optimality |
|---|---|---|---|
| Machine-Builder's Park | 0,789 | 4,18 | 1,33 |
| Park «Peremoga» | 0,503 | 3,22 | 1,28 |
| Park «Yunist» | 0,104 | 2,01 | 1,76 |
| Park named after Kvitka Osnov'yanenka | 0,048 | 0,91 | 1,17 |
| Kholodnogirsky Park | 0,0217 | 0,65 | 1,24 |

Results of geometric indicators analysis of Kharkiv's recreational areas

1) The shape of Machine-Builder's Park is almost completely in line with rectangular. The park is closely adjacent to industrial enterprises and highway. Thus, it takes maximum number of pollutions around.

2) Park «Peremoga» has as many smoothed angles, as at Machine-Builder's Park. However, the shape of this park also seems to be rectangular.

3) Park "Yunost" has a very narrow shape. It is closely adjoined to «Poltavsky shlyah» highway, which leads to the Zalutinskiy bridge. There is a heavy traffic flow here.

4) The shape of the park named after Kvitka Osnov'yanenka is closest to the shape of a circle. Only a small area of the park is adjacent to the highway along Moskalivska street.

5) Kholodnogirsky Park has a very small area. Its shape looks like an elongated rectangle. A significant disadvantage is the reduction of the square area as a result of building up. This decreases the sustainability of this natural system in the urban environment.

Thus, after the calculation of geometric indicators, we see that park named after Kvitka-Osnovyanenka has the most optimal shape of all selected green areas.

## CONCLUSIONS

Analysis of Kharkiv's recreational areas degree of the shape optimality shows that all recreation areas have a complex rectangular shape. This indicates that natural framework in the urban environment is a vulnerable. It means that pollutions can get into the middle of these green areas. To achieve the environmental sustainability, these recreation areas need square expansion and shape optimization.

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