GREEN AREAS AND NATURAL POTENTIAL OF THE POLISH CITY OF CIESZYN IN THE OPINION OF RESIDENTS

Edyta Rosłon-Szeryńska
Department of Landscape Architecture, Faculty of Civil and Environmental Engineering, Warsaw University of Life Sciences, 02 787 Warsaw, Poland

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Abstract
Cieszyn is located in the Silesian Voivodeship. It is a border town, divided into the Czech part on the west and the Polish part on the east bank of the Olza River. Cieszyn is characterized by specific physiographic features resulting from its location in an upland and hilly area, characterized by a strongly undulating platform at the foot of the Beskids, crossed by numerous ravines and watercourses in narrow valleys, which are tributaries of the Olza River. Although the city's forest cover is only 7%, and green areas cover 3% of the city's area, open areas, communal fields and meadows (45%) have great natural potential here.
Natural areas, including protected areas and green areas of Cieszyn, were assessed. Opinions of residents about the nature of Cieszyn were surveyed. You included the results of scientific research and research for the valorization of greenery, and then you used and used it to develop the natural system and indications for the management of green areas of the city

Key words: city green of Cieszyn, anthropropression to nature protection areas, the the valorization of greenery, green ifrastructure.

Introduction

The spatial structure of Cieszyn is determined by the varied topography and hydrographic system. About ¾ of the city's area is raised land. Surface waters cover 1.96% of the city's area. The city has an area of 2,861 ha, of which built-up areas account for 39.65%, and agricultural land and wasteland as much as 45.82% (GUS data, 2022).
In the natural structure of the commune, the most important role is played by the Olza valley and the Bobrówka river together with its tributaries, forming a hydrographic network connecting areas of valuable nature. A threat to the functioning of ecological corridors are ecological barriers in the form of buildings, roads and railway lines. A small share of forests (7%), woodlots (2.55%) and landscaped green areas (0.79%) causes the risk of over-exploitation and, consequently, degradation of environmentally valuable areas. This problem also applies to protected areas, including forest reserves: Lasek nad Olza, Lasek nad Puńcówką and Kopce.
One of the basic conditions for the sustainable development of a modern city is the presence of a developed and efficiently functioning system of green infrastructure (Borowski J. et. al,. 2018). Sustainable management of green infrastructure, reconciling the well-being of the inhabitants with nature protection and adaptation to climate change, is an important task for the commune (Rosłon-Szeryńska E., 2022).
Many studies prove the degradation of environmentally valuable areas as a result of anthropopressure (Rosłon-Szeryńska E., Korbik M. 2022). Existing plants, including trees, shrubs and herbaceous plants, are destroyed. Native species are displaced by expansive and invasive plants (Sikorski P., et al. 2014).
Social participation is a prerequisite for the effectiveness of public authority activities and the basis for creating an effective system for meeting social needs. The aim of the article is to assess the existing green areas and the potential of Cieszyn's natural system in the opinion of its inhabitants. The results of the survey, in conjunction with the valorization of the city's greenery, will allow the development of indications for shaping, maintaining and protecting the natural system of Cieszyn.

Material and methods

The study is based on field research carried out in 2022, where data on green areas and trees in the estates of Cieszyn city were collected. The condition of green areas was assessed using a valuation scale 1-5 points, where 1- means bad, 3- average, and 5- good conservation of the greenery. Factors such as plant condition, species composition, and the presence of invasive plants were taken into account.
Spatial analyzes of green areas were also carried out on the basis of indirect data. Strategic documents of the city and acts of local law were used to prepare the document.

The data compiled by the Central Statistical Office was used to compare the state of preservation of greenery in Cieszyn and the way of managing trees over a period of 10 years (2012-2021).
Public opinion polls on the greenery of Cieszyn were carried out. The survey questionnaire consists of 3 sections: the respondent's profile, questions about the assessment of existing green areas and the assessment of Cieszyn's natural system. Questions were sent to 166 people via the Internet. This article presents a synthesis of the most important results of the survey.

Results

Cieszyn's natural system

The natural system of the city is based on valleys of rivers and streams as well as forested and meadow areas of slopes. The area of the Cieszyn Foothills, due to fertile soils and relatively small hills, quickly began to be used for agriculture, and the vegetation was completely transformed. Semi-natural communities have been preserved in a small area and they are forests that cover about 206 ha, which is only 7% of the city's area. There are 17 types of forest habitats in Cieszyn. The largest share has: subcontinental oak-hornbeam forest (*Tilio-Carpinetum*) with common hornbeam and small-leaved linden, Norway maple and common hazel in the stand, fertile Carpathian beech forest (*Dentario glandulosae-Fagetum*) with the main share of common beech and an admixture of fir, spruce, sycamore and rowan in sapling layer. Riverside stands have special natural values, including: riparian ash and alder (*Circaeo-Alnetum*) with common ash and black alder and riparian elm and ash (*Ficario-Ulmetum campestris*) with ash, field elm and wild cherry.
A characteristic element of the vegetation of the Cieszyn Foothills are also thermophilic mid-field thickets, xerothermic grasslands and foothill hay meadows (*Gladiolo-Agrostietum*). Combined with the diversified relief, these areas increase the landscape values of the city. In built-up areas, segetal and ruderal communities as well as arranged greenery predominate (SUiKZP, 2016).

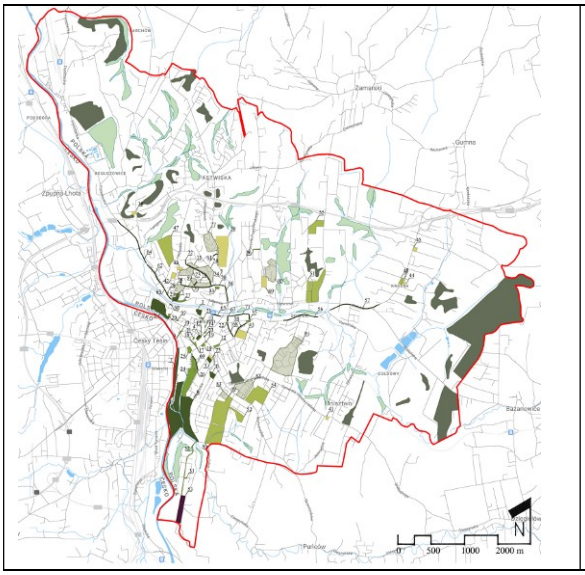

Fig. 1: The structure of green areas in Cieszyn (aut. Justyna Jastrzębska)

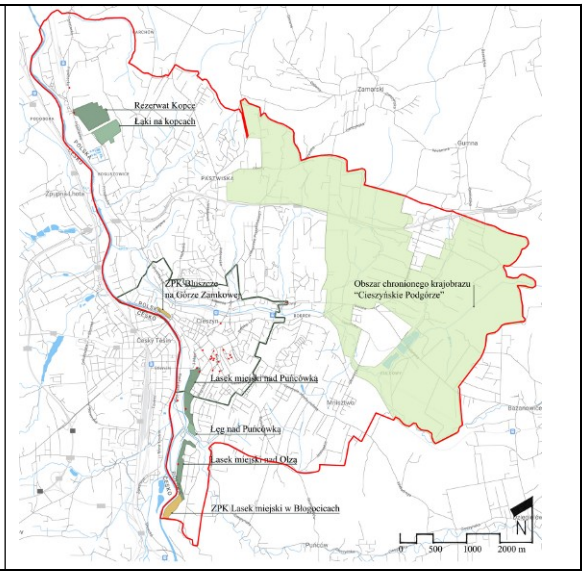

Fig. 2: Forms of nature protection in Cieszyn (aut. Justyna Jastrzębska)

The most valuable natural areas in the city are under legal protection in the form of nature reserves (26.6 ha), ecological lands (16.3 ha), nature and landscape complexes (4.5 ha), documentation sites (0.1 ha) and protected landscape area (830.8 ha). It is worth noting that these areas are made available to residents for educational and recreational purposes. There is a relatively small share of expansive and invasive trees, i.e. black locust, ash maple, red oak, bird cherry or plum. In the reserve areas in the coastal zone, invasive herbaceous vegetation and expansive species of ornamental plants can be noticed, including mainly Japanese redwood, Impatiens glandular and Virginia Cress.

Public green areas of Cieszyn

According to the Local Data Bank of the Central Statistical Office, the balance of green areas in the city is as follows (Central Statistical Office data, 2021). They occupy an area of 133.93 ha, including parks - 41.2 ha, green areas - 13.6 ha, street greenery - 4.0 ha, housing estate greenery - 49.2 ha, cemeteries - 13.8 ha, forests – 22.6 hectares. In total, this gives an indicator of only 9.8 ha/1000

inhabitants (for the county it is 166 ha, for the voivodeship 89 ha). According to the commune list, green areas and other areas maintained as green, owned by the Cieszyn Commune as of October 25, 2022, cover an area of 82.86 ha, of which almost half (39.62 ha) is undeveloped greenery. The main largest municipal parks are: 1) Park pod Wałką with an area of 8.4 ha and 2) Lasek Miejski nad Puńcówką with an area of 8.96 ha, which is both a nature reserve and a forest area. More than a hectare is occupied by the following parks: 3) Góra Zamkowa with an area of 1.109 ha and 4) Park Liburnia with an area of 1.382 ha. Less than a hectare has 5) St. Trinity (0.7082 ha), 6) Kasztanowy Park (0.824 ha), 7) Church Park (0.485 ha) and 8) Peace Park (0.299 ha). All parks are maintained by the Municipal Road Administration.

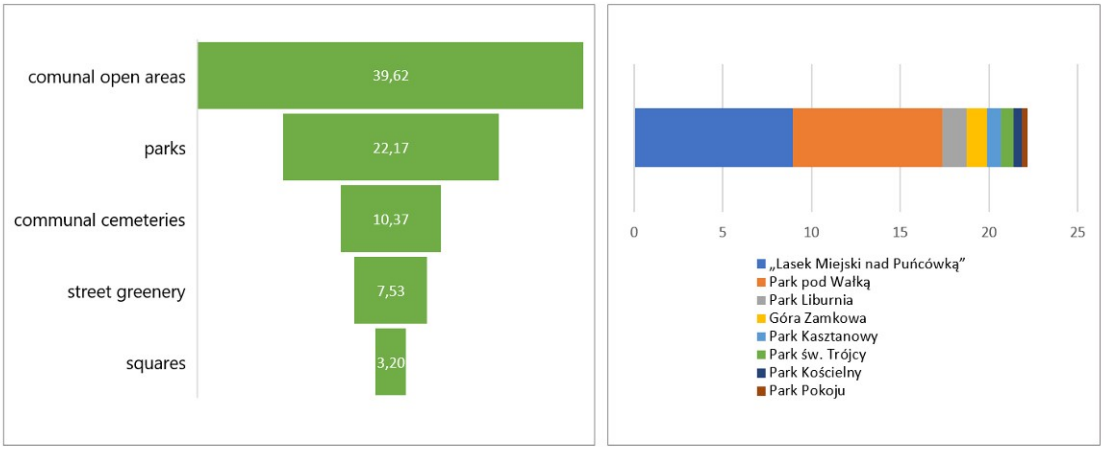

Fig. 3: Share of green areas (left) and park areas (right) in Cieszyn based on the communal list (as of October 25, 2022).

A large share of green areas is partially arranged or not arranged on municipal plots (39.62 ha maintained by MZD and 105.91 ha maintained by GK). These are spaces of various sizes, from as little as 70 m2 (plot no. 3/295) to 2.15 ha (plot no. 3/295) to 2.15 ha (plot no. 10/35). Some areas are today used as rest and recreation areas. They constitute a green potential intended for parks, squares, housing estate greenery, but also communal forests.

The development of green areas and the number of plantings and felling of trees and shrubs in Cieszyn in 2012-2021 were analysed. During this period, the area of communal forests, parks, lawns, cemeteries and street greenery did not change. Insignificant fluctuations concern the area of estate green areas. In 2012, the area of estate greenery was 38.5 ha. In 2013-2014, it decreased to 32.47 ha. In 2015, it amounted to 38.51 ha, and in 2016-2017 to 34.86 ha. From 2018 to 2021, the area of estate green areas is 37.23 ha.

Taking into account the management of dendroflora, the trend is downward both in terms of tree losses and tree plantings. Most trees were lost in 2013 (465), 2012 (244) and 2017 (223). The fewest trees were removed in 2021 (79), 2018 (81) and 2015 (112 specimens). The average number of trees removed each year in this period is 179, and 90 are planted. The number of new plantings in relation to the number of felled trees is almost twice lower, which means that one planted tree replaces as many as two removed trees. The coefficient of compensatory plantings is therefore 0.505, while it should be at least 1.0. With regard to shrubs, the situation looks favourable. The average annual replacement of one removed shrub in 2012-2017 is almost 12. The largest number of shrubs were planted in 2017 (1375 items) and 2012 (1015 items), the least in 2019 (151 items) and 2015 (201 specimens).

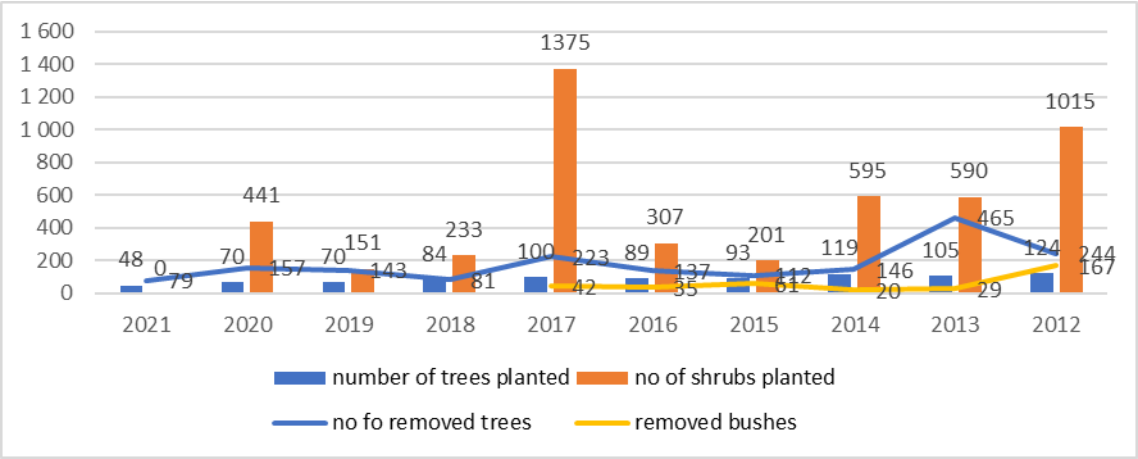

Fig. 4: Management of trees and shrubs in the commune of Cieszyn in 2012-2021 according to data from the Central Statistical Office.

Trees growing in representative places, in the downtown area, in parks and developed squares are in a relatively good health condition. Limited cuts to sanitary and emergency services are visible. Trees that are topped and deformed by excessive and incorrect reduction are not visible. Physiological drought can be noticed (especially in poplars, ashes and chestnuts, as well as in pines) and signs of fungal diseases, which is a phenomenon typical of mature and older trees growing in cities. Lindens, most species of natural maples, oaks and hornbeams are in good condition, which is influenced by soil conditions and a favorable microclimate for these trees. It should be emphasized that trees from oak-hornbeam habitats function well in Cieszyn, such as: dogwood, hornbeam, field maples, elms, as well as fruit trees (cherries, apples, hazel and walnut).
The trees in the zones of housing estates with multi-family buildings and in the greenery accompanying industrial plants are in a worse condition. There are topped, damaged trees with strong reduction and pruning of crowns. Canada poplars in particular are heavily infested with mistletoe and exude significant deadwood. Neighborhood greenery is largely coniferous and topiary plants (compact crown with a geometric habit). Often there is a lack of a well-thought-out arrangement of plants and interconnections between them.
Parks, squares and along the roads of Cieszyn lack perennial flowerbeds and ground cover shrubs that create free compositions, varied in terms of colours, scents, structure, form and shape. Due to the presence of narrow roadsides and relatively small spaces of squares, low greenery and vines are an important alternative to trees.

The green spaces of Cieszyn in the opinion of the residents
The survey was addressed to the inhabitants of the city of Cieszyn, including social activists. The largest group is represented by respondents aged 41-60 (100 people), 50 respondents were aged 25-40, 10 people aged >60.
A large group of respondents visit the green areas of Cieszyn "several times a week" (42%) and every day (35%), which means a high demand for public recreation areas. As many as 96% of respondents declared that there are available green areas within 15 minutes of their place of residence. This is a positive phenomenon for the implementation of the idea of a fifteen-minute city.
Large city parks and boulevards located along the Olza River were considered the most popular green areas by residents. In addition, downtown greenery (including Peace Park) due to its availability and rich program. Residents value green areas for the possibility of rest and recreation, accessibility and close location, equipping the areas with the necessary elements of small architecture and the presence of pedestrian and bicycle paths. Equally often, the answers included natural aspects, including the presence of trees providing shade, vegetation, including natural monuments and the presence of water (Olza river and Puńcówka stream and others). Some of the respondents emphasized the preference for wild undeveloped green areas.
The development, program, selection of plants and the state of preservation of the landscaped greenery in Cieszyn were assessed on a 5-point grading scale. The program received relatively the lowest rating (average score - 2.84 points out of 5 possible to obtain), development (average score - 2.94 points) and the condition of land (average - 2.83 points), with the prevailing assessment of these elements in the range of 1-3 points. The average evaluation of the plants was 3.1 points.

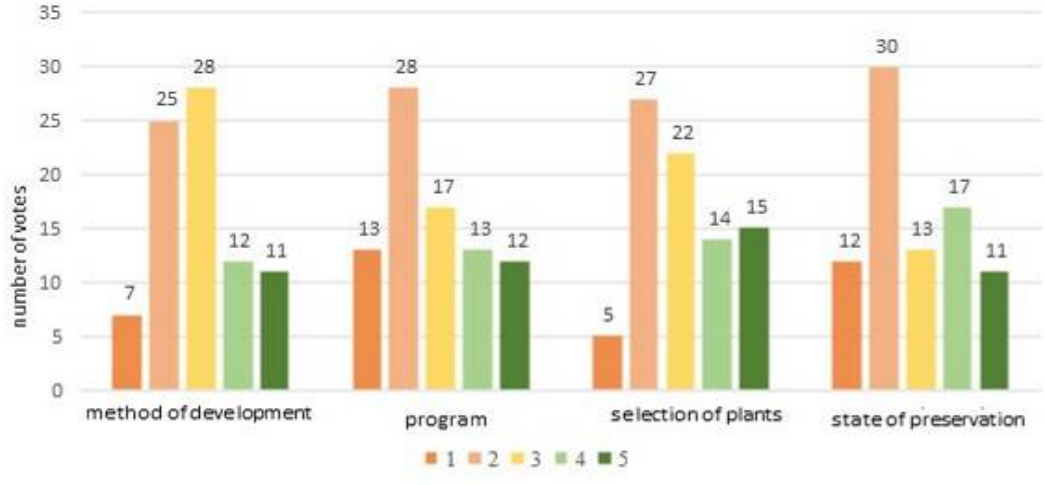

Fig. 5: Evaluation of aspects of green areas (own study, 2022).

Green areas indicated for modernization (revitalisation) included:

- revitalized market in Cieszyn - due to the lack of trees,
- parks next to churches established in the place of former cemeteries and Kasztanowy Park - due to the poor recreational program,
- intensively used facilities, i.e. the City Forest, Park Pokoju, Aleja Łyska for fear of degradation
- communal open areas, the potential parks - Cieślarówka, due to the presence of invasive plants and poor equipment (often in poor technical condition)
- an amphitheater which has lost its recreational value and is now used as a car park.

The respondents also pointed to the need to introduce trees along the streets and in housing estates, greater attention to the care and proper pruning of trees, the introduction of melliferous plants, as well as the enrichment of Cieszyn with pocket parks, benches and places for passive recreation, bicycle paths and places for jogging.

For ¼ of the respondents, the number of green areas in Cieszyn is sufficient. According to 33%, there is never too much green. For 31% of the respondents, greenery is not enough. Residents point to the need to make existing places more attractive, to protect old trees, to introduce more plants and trees, and to improve the care and development of green areas.

The open question concerning nature-related problems in Cieszyn was answered by 162 out of 166 respondents. 14 people (8.5%) indicated no problems with nature in Cieszyn. Some respondents gave several comments (tab. 1).

The open question concerning nature-related problems in Cieszyn was answered by 162 out of 166 respondents. 14 people (8.5%) indicated no problems with nature in Cieszyn. The respondents' answers were divided into 7 categories. The most frequently indicated problem is the inadequate care of greenery in Cieszyn, including: excessive logging or cutting of trees. This problem was indicated by 29% of all respondents. Excessive mowing and inadequate care of greenery were also often indicated (12% of respondents)

Deficiency and low diversity of greenery, incompetent use of natural values and low attractiveness, or the presence of invasive plants are the problems of the existing greenery in Cieszyn.

When assessing the management of greenery, the lack of a planned nature management strategy and education of residents (10.8%), the development of valuable natural areas, including meadows, as well as insufficient involvement of the city authorities in social participation were emphasized.

In the last question, the respondents were asked to answer the question about the potential of nature in Cieszyn. Only 12% of respondents do not see the natural potential in the commune or did not answer the question asked. The vast majority of respondents claim that the potential for the development of nature in Cieszyn is large or even huge, but not always used. Many people pointed out the high natural values of Cieszyn, including: its location on hills, among forests, meadows and areas by watercourses. The indications for development included the introduction of greenery to the market, construction of pocket parks, increasing biodiversity in existing parks by planting flowerbeds, increasing the degree of afforestation in the city, including along the streets. In addition: preserving wastelands, open, natural and wild areas intact or preserving and making them available to users.

According to the respondents, it is necessary to take care of the existing greenery and use its potential, exposing its values.

Tab. 1: Respondents' answers about nature-related problems in Cieszyn (own study, 2022).

Category	Problem	Number of votes	Total votes
Green spaces maintenance	excessive felling / trimming of trees and shrubs	46	94
	inadequate plant care	20	
	excessive mowing	20	
	use of herbicides	4	
	insufficient protection of trees during construction	4	
Problems of the existing green spaces	Green spaces deficiency	16	64
	neglected green spaces	12	
	incompetent exposure of natural values, low attractiveness	8	
	no new plantings	8	
	low plant diversity / shortage of natural areas	6	
	littering	4	
	expansion of invasive plants	4	
Nature management and social participation	lack of a planned strategy for nature management and education of residents	18	50
	development of green areas and wastelands	12	
	low awareness of nature and insufficient involvement of residents in the care of nature	10	
	no action on with adaptation to climate change	6	
	lack of understanding, cooperation and communication between the city and the inhabitants	4	
No problems		14	14
I have no opinion		12	12
other		6	6

Discussion and Conclusion

Although the statistics on the green areas and the degree of afforestation in Cieszyn are not optimistic, the city, both in the opinion of the residents and in the visual assessment of experts, seems green. This is mainly due to the favorable location of Cieszyn on the hills, in the valley of the Olza River and its numerous tributaries. Diversified topography allows you to borrow views with green massifs of trees, opens up the perspective of attractive landscapes, giving designers another tool for shaping space.

The diversified topography of Cieszyn and the large share of flowing waters should be considered as the basic value and determinant in planning and shaping the natural system of the city. The advantages of the functional and spatial structure of Cieszyn are the concentration of the industrial and service zone and the intensive, multi-family downtown development in the central and western parts of the city within a radius of 2 km from the main bridge on the Olza River (along the railway tracks and main road routes), leaving open areas used for agriculture with extensive homestead and single-family housing in the coastal zones of the north-western and eastern parts of the city. Cieszyn has potential in the implementation of the fifteen-minute city spatial policy.

In the opinion of some residents, Cieszyn has an optimal size, it is the green lung of Cieszyn Silesia, and in terms of natural values, it stands out positively among Silesian cities. Noteworthy are the picturesque meadows on the slopes of the hills and the plantations of watercourses. The advantage of the city is the presence of valuable nature reserves, protected landscape areas, ecological lands, nature and landscape complexes and documentation sites. However, there is a threat of their degradation with excessive use.

The advantage of large green areas (Town Forest, parks related to the Olza valley) is the combination of arranged greenery with natural (nature reserves, riparian forests) and semi-natural (meadow communities) systems. Thanks to such solutions, the recreational attractiveness of these areas increases, but also the risk of degradation of "wild" areas by destruction, trampling and encroachment of invasive plants increases. Among the invasive plants, perennials and climbers dominate: *Impatiens*

glandulifera; Japanese knotweed (*Reynoutria japonica*) and Virginia creeper (*Parthenocissus quinquefolia).*
It is recommended to carry out landscape valorization of the city, taking into account the scenic analysis. It will be the basis for assumptions regarding further development, the manner of shaping, maintaining and protecting the city's natural system.
A change in the management of trees in the city of Cieszyn is necessary. Trees should not decrease due to the low forest cover of the commune. Proven and already well-functioning species in the city should be used due to the specificity of soil and habitat conditions. The choice of plants should strictly depend on the type of soil.
Topographic and landscape diversity as well as the intensity of use of facilities should be taken into account in the management of green areas. Intensively used facilities will require intensive care and higher maintenance costs. Extensive zones (e.g. meadows, herbs, etc.) with limited access are allowed in these facilities.
If the recreational functions of the greenery maintenance zone (e.g. in the City Forest) are combined with the protection of the nature of riparian forests or nature reserves, expenditures for care and protection through the protection, trampling and expansion of invasive plants in the naturally valuable zone should be added.
It is advisable to shape new green areas and revitalize the existing facilities by enriching the recreation and leisure program and increasing biodiversity. The basis is actions that use the climate-creating role of greenery in the field of mitigation and adaptation to climate change.

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Souhrn

Výhodou rozsáhlých zelených ploch (Městské lesy, parky navazující na údolí Olzy) je kombinace upravené zeleně s přírodními (přírodní rezervace, lužní lesy) a polopřírodními (luční společenstva) systémy. Díky takovému řešení se zvyšuje rekreační atraktivita těchto ploch, ale zároveň se zvyšuje riziko degradace "divokých" ploch ničením, sešlapáváním a pronikáním invazních rostlin. Mezi invazními rostlinami dominují trvalky a popínavé rostliny: Netýkavka žláznatá (Impatiens glandulifera), křídlatka japonská (Reynoutria japonica) a devaterník pýřitý (Parthenocissus quinquefolia).
Doporučuje se provést valorizaci krajiny města s přihlédnutím ke krajinářské analýze. Ta bude podkladem pro předpoklady dalšího rozvoje, způsobu utváření, udržování a ochrany přírodního systému města.
Je nutná změna v hospodaření se stromy ve městě Cieszyn. Stromů by nemělo ubývat vzhledem k nízké lesnatosti obce. Měly by se používat osvědčené a ve městě již dobře fungující druhy vzhledem ke specifičnosti půdních a stanovištních podmínek. Výběr rostlin by měl striktně záviset na typu půdy.
Při správě zeleně by měla být zohledněna topografická a krajinná rozmanitost a intenzita využívání objektů. Intenzivně využívaná zařízení budou vyžadovat intenzivní péči a vyšší náklady na údržbu. V těchto zařízeních jsou přípustné extenzivní zóny (např. louky, byliny atd.) s omezeným přístupem.

V případě kombinace rekreační funkce zóny údržby zeleně (např. v Městských lesích) s ochranou přírody lužních lesů nebo přírodních rezervací je třeba připočítat výdaje na péči a ochranu prostřednictvím ochrany, sešlapávání a rozšiřování invazních rostlin v přírodně hodnotné zóně.
Je vhodné utvářet nové plochy zeleně a revitalizovat stávající zařízení obohacením rekreačního a volnočasového programu a zvýšením biodiverzity. Základem jsou opatření, která využívají klimatotvornou roli zeleně v oblasti zmírňování a přizpůsobování se klimatickým změnám.

Contact:
Edyta Rosłon-Szeryńska
E-mail: edyta_roslon_szerynska@sggw.edu.pl