sciendo HOUSING ENVIRONMENT 46/2024 WSPÓŁCZESNA ARCHITEKTURA MIESZKANIOWA W PRZESTRZENI MIASTA / CONTEMPORARY HOUSING ARCHITECTURE IN CITY SPACE e-ISSN 2543-8700 https://doi.org/10.2478/he-2024-0001

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Transformations in residential green spaces of Kraków and Lviv today driven by urbanisation processes

Abstract
The comparative study on recent changes in greening processes in residential areas of Kraków and Lviv is intended to improve the insight into and devise a new approach to shaping and preserving urban green spaces. It aims to outline the critical current characteristics of greening in residential areas and changes in their structure brought by urbanisation in Poland and Ukraine today.

Keywords: urban green spaces, land type, residential developments, urbanisation

INTRODUCTION

Relevance

The economic development in Europe contributed to such urbanisation processes as constructing multi-family buildings according to modern technologies and increasing the number of different uses per a unit of city area. The increase in urban density leads to intensive use of the city's area, including green space as the only relatively vacant, 'not developed yet' area. It is necessary to guide changes in green spaces caused by urbanisation-related processes in a sustainable manner to avoid degrading the natural environment in urban areas.

Recent literature review

The numerous studies on urban green space can be divided into several areas: urban planning (Zachariasz, 2006), ecology (Mochocka, 2019), and cityscape planning (Bogdanowski, 1998; Bednarek, 1984; Giedych, 2003).

Considering that the city is an epicentre of intensive anthropogenic pressure and permanent changes in natural conditions regarding land use or vegetative cover (Grimm, et al., 2008), most researchers tend to focus on how to preserve the balance of various developed vs green space ratios when investigating ecology. The problem of reconciling planning tasks with those of preserving the natural areas of cities has led to the popularity of restoring once-lost natural areas (Ahern, Cilliers, Niemelä, 2014). Maintaining the ratio of the area of even the simplest urban green space, the lawn, to the area of individual yards near residential buildings helps preserve the ecological balance in the city and is its vital component. As typical methods of greening housing estates are retired, a district's character evaporates, taking part of the city's identity with it (Sobczyńska, 2021).

Urban processes in Kraków and Lviv and their impact on urban green space

The theory-focused literature on urban green space (Bednarek, 1984; Bożetka, 2010; Chmielewski, 2005; Wilkosz-Mamczarczyk, 2015) identifies three primary domains where the modern city affects its natural environment and changes in its approach to green spaces. The first focuses on designing and shaping a new quality of environment, which radically changes the landscape. The second area is linked to transforming the structure and nature of greenery in a given area by integrating new components – buildings or infrastructure – with it. The third, least prominent, area concerns the degradation of urban green spaces as a result of anthropogenic pressure. The threat of inappropriate directions of urban green space development calls for investigating all of the processes linked to urban greening mentioned above.

The preservation of residential green space is most susceptible to urbanisation processes (Grimm, et al., 2008). Each new residential development has a separate landscaping design, while in terms of the modernisation of existing housing estates, the quality of their green areas is enhanced both at the design and functional level. Both types of urban greening changes are aimed at improving the structure of urban green space. On the other hand, greening areas of housing development from the second half of the 20th century suffers from stagnation and degradation because their use intensity increased while no structural changes were made.

The functional densification of multi-family developments in the previous century successfully adapted the areas to the contemporary needs of their residents (Mochocka, 2019; Kychko, 2021). However, urban densification, more often than not, is spontaneous and episodic and fails to improve the urban greening situation. It may be referred to as 'fake urbanisation'.

Regarding constructing houses in open spaces, we should note the tendency to transform natural landscapes and disregard their characteristic biological features (Colding, 2011). This process is generally far from beneficial to any comprehensive and long-term policy of introducing or renewing green space. On the contrary, the new normal is projects that destroy urban green space in addition to being controversial in terms of construction standards. One embodiment of this approach is a residential development in Borek Fałęcki, Kraków, in a forest and marsh area. People living there complain about damp on their properties, while the

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unique fluvial system of this part of the city was meaningfully reduced.

In this paper, we present an in-depth investigation of a type of urban green space, namely residential green space. We characterise processes of residential greening and changes in this regard caused by urbanisation in Poland and Ukraine, with Kraków and Lviv as examples. The cities were chosen for the detailed study because they are relatively extensive and demonstrate very dense developments,[1] which exacerbate the pressure of anthropogenic impact on landscape sites. The impact assessment on greening processes presented will be a methodological foundation for future research on other cities.

Methods The overview of spatial and landscape characteristics of the city is highly relevant to any investigation of urban green space. Therefore, the research process was divided into the following stages:

1) determination of green space types in the cities;
2) identification of the structure and type of greening in existing residential areas;
3) determination of trends in the greening of new residential developments.

As a method, we employed satellite data to assess the green surface of the cities.

Outline of the problem and preliminary conclusions

Green spaces in contemporary Kraków and Lviv

In the case of **Kraków**, it is estimated that 20% of its area is covered by grassy surfaces, 36% is covered in trees. Research shows that there is over 200 m^2 of green space per capita in Kraków (Biuletyn informacji publicznej, m. Kraków, 2003). It is worth noting that many districts of Kraków (like Zwierzyniec or Dębniki) are covered by vegetation in a substantial proportion due to topography (Niechaj, 2000).

Still, quantitative assessment is not sufficient to objectively evaluate urban green space. Its functional value and condition have to be considered as well. The literature enumerates the key functions of urban green space that should be included in any evaluation. These functions include health and biological (Uruszczak, 2017), social and mental – green space is perfect for relaxing or communing with nature – food production and economic, such as agricultural land, orchards, forests, or allotment gardens, aesthetic, or contributing to 'cold islands' (Torowska, 2002).

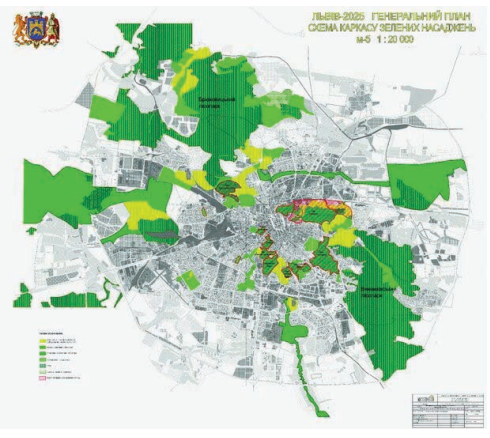
The green space use split involves dividing individual spaces by their roles in the city (Giedych, 2003).

Kraków's typology of green spaces is defined in 'Directions of Development and Management of Green Spaces in Kraków 2019–2030'. This document lists 25 types[2] of green spaces by function and considers their development potential, accessibility, and management framework. The document divides the city's green spaces into public and auxiliary green spaces. Public spaces are owned by the City, property of the State Treasury, maintained by the City, or managed by the City. The owners or managers of the spaces differ, but the areas have to be made available to the public. Auxiliary spaces are vegetated areas not classified under any public category in the definition and are not available to the public. Kraków also has green urban spaces called 'areas of agricultural cultivation and grassland'. It occupies the largest area of all.

By 2030, Kraków will have increased its area of urban green space by 2,538 ha or 7.77% of its territory (Biuletyn informacji publicznej m. Kraków, 2003).

This official list precisely reflects the types of green spaces found in Kraków. Still, how the spaces are perceived in terms of quality, quantity, or accessibility 'on the ground' is also important. Beyond any doubt, recent years saw a great need to revitalise the existing green spaces and establish new ones. Various surveys among the public proved to be an effective tool for influencing decision-makers who now understand that it is not enough to merely adhere to the standards (Pawłowska, 2001). Business circles have started to appreciate that green space can drive property prices up, which, in a way, is in line with the concept of A. Zachariasz, who many years ago characterised in detail the benefits of apt combination of green spaces and urban planning (Zachariasz A, 2006). Grassroots pressure by residents on authorities, real-estate developers, and designers was necessary. The urban fabric's 'upwards' growth rate, namely the number of new multi-storey residential buildings and the growth rate of new green spaces, are different issues.

Ill. 1. Green space types in Lviv ('General Spatial Development Plan of Lviv', 2008)



Ill. 2. Green space types in Kraków ('Directions of Development and Management of Green Spaces in Kraków 2019–2030')

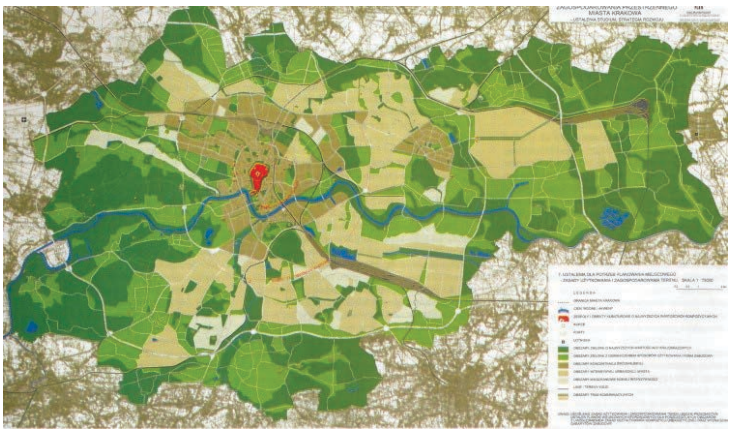


Table 1. Housing projects completed in Ukraine from 2010 to 2022 (millions of UAH)

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
6,876.5	8,137.1	8,523.0	9,953.1	11,292.4	13,908.8	18,012.8	23,730.0	29,344.8	33,208.8	29,083.6	39,147.9	20,072.2

Source: State Statistics Service of Ukraine, https://www.ukrstat.gov.ua › bud_20

Lviv's typology of green spaces was defined in the 'Landscape Map of the City of Lviv' from 2008. Considering the city as a system of how its area functions, Lviv has the following green space categories: (I) public green space: city parks, historical promenades, greens (green squares), regional parks and landscape parks, forest parks, and meadows; (II) restricted green spaces: villa gardens, gardens of educational and health institutions, gardens of religious buildings, and greens near multi-family buildings; and (III) special green spaces: arboreta, memorial parks, belts of isolation green, and protection zones. According to the 'General Spatial Development Plan of Lviv', public green space takes up about 831.90 ha (Poiasniuiucha zapyska koryguvannia heneralnoho planu m. Lvova/An informative note, 2008).

The main development trends in Ukrainian cities, including Lviv, involve increasing development compactness, embodied in the building up of vacant land, development densification in existing districts, diversifying the functional mix per unit area, and a growing number of means of transport (Sosnowa, Herman, 2014). According to official statistics for Ukraine, the number of new flats increased in the years 2014–2022 (until the full-scale Russian invasion of Ukraine, Table 1).

The intensity of urbanisation processes, including the growth of the multi-family housing and the third (services) sector, called for a search for new solutions regarding the siting of a growing number of buildings and uses in the city. As empirical research shows, most new developments take up green space as it is the only conditionally available area.

For example, the General Plan (Poiasniuiucha zapyska koryguvannia heneralnoho planu m. Lvova/An informative note, 2008) provides for construction of multi-storey residential buildings on the northern slopes of the Poltva (Полтва) valley on hills that form the eastern-most part of Roztochia (Roztocze in Polish)[3] towards north-east into a unique landscape and hydrological formation of the Bilohorshcha Peatland (Торфовище Білогорща). Therefore, the problem concerns the development of valuable landscape areas that may become the city's green corridors.

Green spaces as part of multi-family residential developments

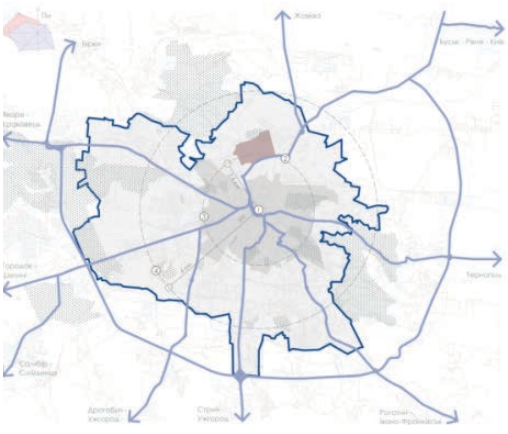
Changes in the structure and character of the greenery in Kraków and Lviv, along with problems and their causes, are considered with a focus on districts with multi-family residential buildings from the second half of the 20th century and new residential developments.

Based on data on the location of multi-family residential buildings built in the second half of the 20th century in Lviv (Mysak, 2014; Rubchenko, 2021), we selected the area of Hetmana Mazepy Street, Ivana Mykolaichuka Street, and Mykoly Khvyl'ovoho Street in the northern part of the city as the Lviv study area as it is currently undergoing intensive urbanisation (Ill. 3).

The area was dynamically developed in the 1970s and 1980s. The core developments are five- and nine-storey residential buildings designed by J. Nazarkiewicz, W. Leochnowski, and R. Fedotowska. It is a typical 'dormitory district' with soft infrastructure (Ill. 4). Its ratio of built-up to total area is 64.6%. Green space takes up 25% of the area (Ill. 5).

A morphological analysis of the development revealed that most of the multi-family residential buildings form

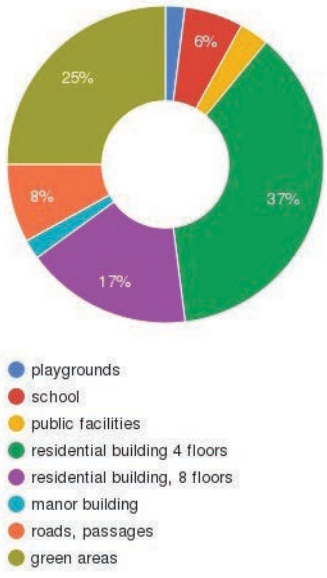
Ill. 3. The investigated residential area in Lviv; a) the investigated residential district of Lviv; b) a typical courtyard in the study area. Author: B. Cherkes







III. 4. Functional diagram of the area. Author: N. Sosnowa



III. 5. Use mix of the area. Author: N. Sosnowa

clusters around an open-space courtyard with a group of trees and small lawns (51%) and terraced housing on a modular grid with pedestrian routes along building lines and adjacent areas form open spaces (49%) with extensive lawns, lines of trees, and shrubs which frame the buildings (III. 6). The multi-family area is dotted with single-family houses with private green spaces.

Larger landscape features are situated outside the investigated area. The recreational load from nearby residential districts gravitates towards them. These are three parks. In the west, there is the park around St. Josaphat Church; in the east, there is the 700th Anniversary of Lviv Park and the Zamarstynivskyi Park, the largest and most frequented park in the area. The Zamarstynivskyi Park is north of Zamarstyniv (Замарстинів). There is a cemetery of German soldiers and prisoners nearby. The district has many green and recreation spaces, with a pond between Avraama Linkol'na Street and Lypynskoho Street. Functional disparities between the expectations of the residents and the initially planned model of spaces adjacent to the multi-family buildings concern fundamentally different socioeconomic models in place at the time of construction of the buildings and today. Massive residential buildings constructed by the state between the 1960s and 1980s, when the market economy and private property were yet to come, did not focus on providing high-quality curtilage in planning and functional terms. It was a time of unsophisticated solutions. Curtilage offered parking spaces, leisure and recreation spots, lawns, and groups of trees. The growth of motorisation has led to problems with using such adjoining areas. More and more of them are transformed into



III. 6. Diagram of green spaces in the investigated area. Author: N. Sosnowa

local car parks. Lawns are also used as parking spaces. Simultaneously, some green spaces with no clearly defined functions became transit zones and decayed. After nearly fifty years, large trees planted in lines or groups grew excessively; their crowns have become deformed, and the ground below them is partially shaded so that grass grows poorly and unevenly.

New urban green spaces established mainly alongside new residential buildings in Kraków and Lviv determine the special character of nearby areas, improve their aesthetics, and drive up property value. They are usually small and barely noticeable against the aggregate urban green space. The types of green spaces introduced into the urban fabric today are consistent with global trends. The ratio of green spaces to adjacent spaces is rather small (about 3%) (III. 7–9).

Another trend in urban horticulture is the replacement of plant silhouettes and species that require special



Ill. 7. Tiffany housing development, 80a Pasichna Street (Lviv), completed in 2022
Photograph by: B. Cherkes





Ill. 8. Pasichne housing development, 169–171 Pasichna Street (Lviv), completed in 2020
Photograph by: B. Cherkes



Ill. 9. A modern green space in front of a ten-storey residential building from 2015 in the Krowodrza district of Kraków. Ubiquitous concrete and lack of irrigation cause the lawns to wither. Photograph by M. Uruszczak, 2023





Ill. 10. Garden Residence residential development in Kraków. The enclosed leisure area with a substantial amount of vegetation shows that buyers of new urban flats today expect and 'force' developers to include 'real' gardens in their designs. Photograph M. Uruszczak, 2023

care, such as lawns with belts of low shrubs (spindle trees are popular in Lviv, while Kraków prefers hydrangeas), meadow species, or tall vegetation that require only occasional attention.

New developments are dominated by decorative trees that grow neither tall nor large. Another popular type of green space is gardens near ground-floor flats. Still, such plants fail to provide shade on hot days (Ill. 10).

SUMMARY

The research can be summarised with the following primary conclusions:

1. Urban planning documentation of Kraków covers cityscape protection and future expansion of green space. Parks, river parks, and forests in Kraków are planned to grow substantially by 2030. The latest green spaces in Kraków include mainly pocket parks, which make use of small areas of unused land. On the other hand, the comprehensive plan for green space expansion and maintenance for Lviv for 2024–2028 aims to improve the condition of existing city parks. Greens (green squares) in the central part of the city are remodelled, and components of green cityscape accompany new commercial buildings. Qualitative changes are evident in Ukraine in that urban green spaces are being rearranged, and global landscape design trends are taken into account.

2. Ukraine and Poland alike have areas of dense residential developments, employ similar greening solutions, and face similar challenges of preserving green spaces among violent urban processes. Regrettably, due to its scale, urban planning documentation today focuses on strategic tasks and blurs 'lesser' points related to preserving green space and greening processes in districts and areas with dense residential developments.

3. Improvement of such 'untouched' biologically vital areas as overgrown abandoned farmland, groves, or meadows so numerous in the cities under study, through the construction of leisure infrastructure, could meaningfully improve the quality of life and public identification with their city. Conversely, leaving certain such areas unattended drives the wasteful 'concreting' of green space by real estate developers, who justify it with the need to arrange the space and allegedly improve safety.

PRZYPISY / ENDNOTES

[1] In Lviv, Ukraine, the built-up area ration varies between over 50% to 80% in the city centre (Kyrhyzbaieva, 2018).

[2] 1. Park (ZP); 2. Green square (ZPS); 3. Błonia Meadow (ZPB); 4. Fluvial park (ZPR); 5. Kraków mounds (ZK); 6. Greens, street-side greenery (ZZ); 7. Meadow (ZŁ); 8. Park in a former fort area (ZPF); 9. Sports greenery (ZS); 10. Green spaces in former forts other than parks (ZF); 11. Forest (ZL); 12. Cemetery (ZC); 13. Forest park (ZLP); 14. Green space at public facilities (ZUP); 15. Monastery/church green space (ZOK); 16. Green spaces adjacent to residential developments (ZOM); 17. Areas of agricultural cultivation and grassland (ZR); 18. Eco park (ZPE); 19. Ecological buffer around water bodies (ZW); 20. Existing communities to be preserved (Z); 21. Greenery of public spaces (ZPP); 22. Allotment garden (ZD); 23. Non-landscaped green space (ZN); 24. Isolation green (ZI); 25.Geopark (ZPG), a kind of eco park.

[3] Roztochia (Розточчя) is a range of clear-cut hills situated from western Ukraine to south-eastern Poland. Some parts of the Ukrainian portion of Roztochia are protected.

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