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# Urban parks as an important component of environmental infrastructure: Biodiversity conservation and recreational opportunities

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**Abstract**. The ecological development of a modern urbanised territory is grounded in the fundamental concepts of sustainable green development, the concept of which reflects the satisfaction of the city's needs while preserving the environment. The study has the objective

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of formulating recommendations to enhance the institutional structure of urban parks. These recommendations are aimed at aligning park operations with the principles of sustainable green development in cities. Additionally, the study seeks to improve the social and economic efficiency of the environmental infrastructure in urban areas. To achieve these goals, the study employed general scientific methods of cognition. They include analysis, abstraction, synthesis, induction, and deduction. The study also utilized methods of specification and formalisation. Throughout the research, the focus was on investigating the existing state of the management system for urban parks and evaluating the reserves of their recreational capabilities. It is established that the park economy of Ukraine is currently functioning in isolation, so the environmental optimisation of this area requires the formation of a modern approach to the management and organisation system. It has been determined that green areas of the city are a basic prerequisite for preserving the species diversity of local ecosystems. The primary directions for development of urban park systems in the direction of recreation are highlighted. The specifics of their management process with the involvement of modern monitoring and investment opportunities are investigated, and further development prospects are outlined. The study recommends key measures to improve the situation in the examined field. These measures encompass the enhancement of recreational opportunities within parks, the monitoring and control of anthropogenic impact on the environment, the regulation of quality and safety standards, and the preservation of biodiversity in local ecosystems. The practical significance of the research results is evident in their potential application in the development of programs. These programs are designed to enhance the efficiency of urban parks, elevate their recreational value, and establish a resilient ecological park network in Ukraine

**Keywords**: green areas; sustainable urbanisation; climate change; smart cities; optimisation

## Introduction

High urbanisation rates, the rise in urban population, coupled with the escalating influence of transportation and industrial operations on environmental conditions, including the quality of air, soil, and water environments, along with global negative trends in climate change, are causing a significant deterioration in urban living conditions. Theoretically, the formation of the planning structure of urbanised areas should be inextricably linked to the development of green spaces (Ferreira *et al.*, 2022). There is an opposite trend - minimising the area allocated for urban parks and squares results in a reduction in the comfort of the environment, directly affecting the health of the population. Functional zoning of the green zone, allocation of its primary structural components, as well as calculation of areas for various purposes within urban development, is currently often carried out without considering the ecological characteristics of landscape ecosystems, with the priority given to the factor of economic benefit. Simultaneously, it is crucial to acknowledge that urban parks constitute an exceedingly significant element of the city's framework, directly influencing the quality of the urban ecosystem.

Many scientists have extensively explored the organization, utilisation, and rejuvenation of urban parks, with numerous publications delving into these issues. Within the European Union, there exist numerous programs and projects dedicated to optimising the state of green spaces in urban regions (Chen *et al.*, 2020). These initiatives aim to comprehensively tackle

environmental challenges in urban areas and enhance the living environment quality for the urban population.

Analysing the outcomes of scientific research related to the study's subject reveals that a predominant focus among most scientists is directed toward the landscape and architectural aspects in the organisation and planning of urban park areas. As such, P. Polko & K. Kimic (2021) argue that careful planning of urban development is a priority. This means determining the optimal location of parks, their size, and specifications so that they are accessible and convenient for all city residents. N. Guneroglu & M. Bekar (2022) recommend implementing strict measures to control its implementation in practice. According to their data, the establishment of a building code and urban zone planning is imperative, as these constitute the primary instruments for regulating land plot development and usage. These documents play a pivotal role in delineating rules and constraints for development, city zoning, and the allocation of spaces for various types of activities. O. Bondar *et al.* (2022) and V. Emelyanova (2022) focus on examining the biogenic component of parks and its influence on the health and psycho-emotional well-being of the population. Simultaneously, I. Shvydenko & M. Shvydenko (2023) extensively explore the pollution aspects of green spaces in urban parks resulting from substantial anthropogenic pressures. The scientists argue that the system of city parks should acquire optimising alternative variations, and, therefore, develop in the spatial and temporal aspect synergistically with the development of the city itself.

Several scientific publications by Ukrainian researchers examine the criteria used for the development and assessment of preventive and regeneration measures of environmental, socio-economic, and managerial nature aimed at improving existing strategies for the development of park systems in urban areas and developing alternative options for development programmes. In particular, I. Kuraieva *et al.* (2021) emphasised that green park areas play the role of a buffer between natural ecosystems of the urban environment and industrial and urban complexes. At the same time, N.V. Vernihorova (2023), V. Scherba & O. Pylypovych (2023) focused on the complexities of the dualistic uniqueness of landscape complexes of this kind, because, on one hand, they are often places of increased recreational pressure and anthropogenic pressure, and on other hand, they often perform the functions of preserving the species diversity of local and regional biocoenosis.

Despite significant attention from the scientific community, there is a notable gap in the analysis of the algorithm for the successful functioning of urban parks as centres for biodiversity conservation. Additionally, the effective management of these parks utilising the potential of a recreational reserve remains insufficiently explored and warrants further scientific investigation. The study's objective is to devise approaches to optimise the situation and enhance the role of green areas as recreational resources and hubs for biodiversity conservation, aligning with the principles of balanced sustainable development in urban areas.

## Materials and Methods

The research is based on a theoretical and methodological foundation influenced by the dialectical method, the systemic approach, and the prioritised principles of conducting thorough investigations. By employing the systemic approach, the study facilitated the exploration of urban park complexes as an interlinked system. The investigation utilized abstract-logical and dialectical methods of scientific knowledge, in addition to the scientific abstraction method. These methods were

applied to develop theoretical generalisations, enhance the conceptual framework, and draw conclusions.

The abstraction method was utilised to pinpoint essential concepts and categories. This approach facilitated the delineation of the concept of a comprehensive process within the management system of the green urban space domain. This conceptualisation was characterised as an organised and consequential arrangement of interrelationships. In this structure, the management process occupies a prominent position alongside the primary planning and organisational factors. Analytical and synthetic methods were employed to uncover the essence of the organisational and economic mechanism of the subject under scrutiny. These methods were also utilised to determine the strategic directions for the development of effective management in the sector of park systems in urbanised areas. The analysis method played a role in establishing structural relationships among the elements of the phenomenon under investigation. Moreover, the analysis and synthesis methods were integral in identifying the principal aspects of functioning and the key determinants within the studied object.

The concretisation method played a crucial role in the study by documenting the effectiveness and feasibility of a set of management measures in the optimisation of the recreational functionality of urban parks. It was also utilised to uncover ideal circumstances and resolutions for the conservation of biodiversity and the mitigation of environmental risks in the landscape complexes of urban park areas.

The comparative method was used to identify the details of growth and intricacies in the dynamics of both quantitative and qualitative aspects of the ecological condition within urban park systems. In turn, the inductive approach was applied to predict development indicators, while deduction played a crucial role in crafting recommendations to enhance management processes in the examined area.

The formalisation method was implemented in the study, particularly during the derivation of priority vectors for optimising the functional state of urban park systems based on "green" sustainable development. It was also applied during documenting the findings of the study that are intended for practical application in the management of urban parks as centres for recreation and conservation of the regional biocenotic fund. The study was conducted in accordance with all the provisions of the Convention on Biological Diversity (1992) and the Convention on the Trade in Endangered Species of Wild Fauna and Flora (1973).

## Results

Green spaces in contemporary cities fulfill more than just aesthetic functions. Parks and squares play a crucial role in the urban environment, serving as spaces for recreation and rejuvenation. The presence of natural ecosystems within urban areas contributes to creating a favourable environment for the existence and propagation of local biodiversity. Additionally, trees play a significant role in effectively purifying the air by filtering out dust and harmful substances, while also acting as barriers to noise pollution (Santos *et al.*, 2019).

In the present stage of global community development, urban parks are growing in significance and diversity, aligning with the evolving needs and expectations of the population. Consequently, trends in urban park development undergo continuous modernisation and optimisation to address crucial environmental and social issues. Simultaneously, these efforts aim to enhance the role of parks in fostering recreation, tourism, and investment. Green areas of modern cities are often subject to the destructive impact of anthropogenic activities. The problem of preserving parks in urbanised

areas for comfortable living and environmental protection is becoming more acute every year. Guided by the findings of the International Bank for Reconstruction and Development, which conducted a comprehensive analysis of urbanisation processes in Ukraine and the world, it can be asserted that the degree of urbanisation in the twenty-first century is substantial, and the human impact on the environment is poised to intensify in the near future (Scherba & Pylypovych, 2023). In this regard, to achieve harmonious and sustainable development, Ukrainian cities need to strengthen and expand the functionality of environmental infrastructure, as well as optimise and improve its components, with the implementation of successful foreign experience following domestic realities and legal requirements.

City parks, as an important component of environmental infrastructure, perform several important functions to ensure an optimal microclimate in the city, including cooling urbanised space in the heat, regulating humidity and groundwater reserves, assimilating excess carbon dioxide and pollutants, optimising wind conditions, and neutralising noise pollution. The functional zoning of the green zone in Ukraine is implemented by sectoral regulations (Vernihorova, 2023), according to which the greening of the development area should reach 40-50%. In general, the area of urban green spaces for public utilisation is influenced by factors such as the city's size, its natural and climatic conditions, and the specifics of building planning. Overall, the spatial organisation of urban green spaces should cater to the establishment of areas for recreation and leisure, including the designation of zones with special conservation value to maintain the normal functional state of park ecosystems. Concurrently, in accordance with existing legislation, urban parks fall within the category of public green spaces (Kuraieva *et al.*, 2021).

Based on their functional attributes, parks can be categorised into two main groups: multifunctional and specialised. It is noteworthy that in Ukraine, the common practice is to establish multifunctional parks, which may include citywide mass recreation parks. Concurrently, there is a contemporary relevance in the creation of specialized parks, such as sports parks, children's parks, recreational parks, and those with a distinct environmental status aimed at preserving the biodiversity of local landscape ecosystems (Scherba & Pylypovych, 2023). Considering the ongoing urbanisation processes and the increasing urban population, which consequently heightens the demand for recreational spaces, there is a necessity to systematically organise and optimise the natural resource foundation for the recreational utilisation of urban park complexes. Determining the amount of recreational load creates the prerequisites for assessing the degree of recreational use of certain territories and is a defining criterion for the implementation of functional zoning, establishing quantitative and qualitative benchmarks for enhancement and developing systems of optimisation and regeneration measures are essential to ensure the judicious recreational utilisation of urban parks (Fig. 1).

To explore the characteristics and untapped potentials of urban parks as multifunctional entities, a comprehensive approach is necessary. This involves conducting a multifactorial examination of landscapes, identifying key indicators of their functional state, establishing a monitoring and analytical system, and formulating strategies for the optimal utilisation and development of these territories.

One of the primary requirements for optimising the state and fostering innovative development within the park system in urban areas is regular and comprehensive environmental assessment based on monitoring

observation programmes (Chen *et al.*, 2020; Song *et al.*, 2022). Institutional management functions for urban parks in Ukraine are performed by local governments, which narrow their competence to issues of financing and economic regulation in the sector. Simultaneously, the recreational, health and environmental potential of urban parks is usually untapped.

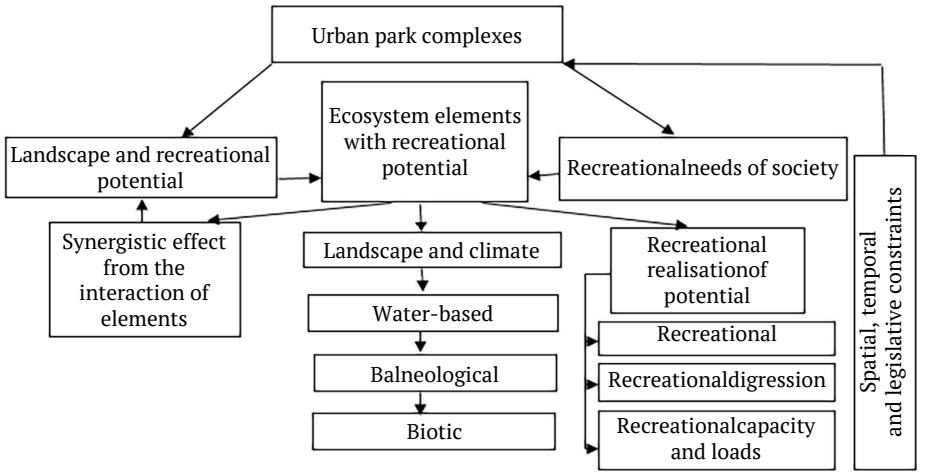


**Figure 2.** Recreational potential of urban park complexes
**Source**: compiled by the authors

The current global trend of developing the concept of "smart" parks, which involves the active use of modern technologies, allows for optimising the park's resource management system and increasing the level of environmental safety. Such prospects open up variations for expanding the multidisciplinary nature of urban parks. In modern green park areas of urbanised areas, considerable attention is paid to ensuring environmental sustainability and biodiversity conservation, eliminating air and noise pollution, and optimising water quality in rivers and lakes within urban parks. To this end, various technological innovation opportunities are being applied, in particular in the areas of water treatment systems, waste management and the introduction of renewable energy sources. The role of urban parks is progressively gaining significance in the realms of tourism and recreation. This shift in focus directs attention to the urbanised areas hosting these parks. These conditions open up new avenues for developing the economic potential of cities and attracting investment opportunities, aligning with global initiatives supporting projects geared towards the practical implementation of sustainable development principles across various spheres of socio-economic activity.

The conceptual basis of "green" sustainable urban development envisages the degree of greening as a crucial metric for assessing the capability of an urban area to provide comfortable living conditions for the population. A commonly accepted indicator in global practice is sufficient greening at the level of 20-30 $m^2$ or more of public green space per city resident (Kulczyk-Dynowska & Stacherzak, 2020). At the same time, urban parks play a substantial role in addressing the challenge of recreational recuperation for the population. Aesthetic possibilities, a comfortable microclimate in the hot season, air filled with phytoncides, reduced

levels of dust, noise and vibration, and increased oxygen content synergistically have a reproductive, strengthening, and regenerative effect on humans (Emelyanova, 2022).

The management of park systems in Ukrainian cities, based on practical experience, underscores the necessity to formulate and implement specific management methods, functions, organisational structures, and systems. These elements are essential prerequisites for ensuring the effective management of green urban areas (Table 1).

**Table 1.** Principles of management of urban park complexes

| No. | Principle | Meaning |
|---|---|---|
| 1 | Eco-friendliness | Any managerial, organisational, and technological decisions should be founded upon the maximum preservation of the natural potential |
| 2 | Transparency | Engaging in successful international experience, participation in programmes and grants |
| 3 | Adaptability | Ability to make dynamic adjustments in the course of implementing the management strategy due to the impact of external and internal factors |
| 4 | Prospectivity | Sustainable development in the future is a priority |
| 5 | Economic effect | Implementation of cost-effective measures to support parks for the economic sustainability of cities |
| 6 | Monitoring | The execution of management measures should constitute a thoroughly monitored process, with accounting, coordination, regular performance review and evaluation |
| 7 | Social Orientation | Priority for decision-making is given to social needs, health improvement and rehabilitation of the population, and "green" development of the city |

**Source:** compiled by the authors

The primary objective of the contemporary approach to managing the functionality of urban parks should be the safeguarding, conservation, and rejuvenation of existing green spaces. This involves fostering synergy with the urban landscape, and creating resilient complexes capable of withstanding adverse environmental conditions and substantial anthropogenic pressures. It is considered necessary to expand the recreational opportunities of urban park areas while ensuring the implementation of biosecurity functions and the ecological balance of the city's ecosystem.

The contemporary urban green park, fulfilling its socio-economic, environmental, and urban planning functions, shapes the "green" system within the city as an integral component of the regional ecological network. This system contributes to establishing a balanced framework for the ecological and economic development of urban areas. Key areas of optimisation for urban park systems include the preservation and restoration of biological and landscape diversity, the minimisation of noise pollution and airborne pollutants, and the promotion of regulated recreation. These efforts aim to enhance the sanitary and hygienic parameters of urbanised areas and ensure optimal living conditions for the city's population. When optimizing the functional state of urban park systems, it is crucial to consider a range of environmental factors, both natural and anthropogenic. Additionally, it's essential to account for the functional state, pace, and direction of the city's ecosystem development. A priority in this optimisation is restructuring the structure of urban green spaces, introducing new greening technologies, and reconstructing existing urban parks based on functional zoning, emphasising recreation and nature conservation. This approach facilitates the creation of ecological hubs within the city's network,

enhancing species diversity, increasing recreational appeal, and promoting environmentally friendly nature management.

Building upon the examination of the theoretical foundations of recreational reserves within contemporary urban park areas and their potential adaptation to real-world conditions, it is deemed prudent to develop a strategic management concept for urban parks. This strategic management approach aims to enhance the recreational functionality of urban parks, with a focus on biodiversity conservation and the sustainability of landscape ecosystems. It also seeks to stimulate increased efficiency in the zonal utilisation of urban parks while achieving optimal outcomes with minimised costs. It's noteworthy that effective management necessitates flexibility, adaptability, and regular reassessment of goals and programs. Moreover, the incorporation of modern innovative monitoring, modelling, and forecasting capabilities is considered a fundamental prerequisite for successfully optimising the environmental functionality of urban parks.

The envisaged outcomes of the proposed concept for optimising the state of urban parks in Ukraine include a comprehensive enhancement of the sanitary and epidemiological well-being of the population. This is coupled with the expansion of the recreational functionality of park complexes in urban areas, a reduction in the impact of detrimental natural and anthropogenic factors on the ecological state of the city, the preservation of biological and landscape diversity through the enlargement of nature protection sites, and the establishment of a rigorous control system to prevent the misuse of park territories. Considering the multifunctionality of management support for the stabilisation of urban park systems, their regeneration and future development, it is necessary to organise a multidisciplinary sectoral structure at the state level, specialising in ensuring an appropriate level of urban parks' improvement, maximising their recreational functionality and opportunities for biodiversity conservation and protection of landscape ecosystems. The combination of urban park improvement, recreation and economic efficiency programmes requires professional coordination and the allocation of individual development priorities for each of the green infrastructure facilities (Vernihorova, 2023).

The sectoral structure of the above-mentioned direction should optimally play an intermediary role between authorities of different levels, communities, and urban parks (Slätmo *et al.*, 2022). Its important function should be practical collaboration with international organisations in the realm of park improvement. The latter will provide an opportunity to fill the gaps in the sector's financing through grants and credit opportunities. In particular, the international organisation World Urban Parks is open to cooperation, which stimulates the optimisation of urban park systems by solving financial and personnel problems of parks to offset the socio-environmental problems of urbanised areas (Vernihorova, 2023). The proposed state structure should cover a wide range of issues related to the development of parks, their recreational and environmental protection functions, and, as a result, public welfare.

Competent recreational planning requires determining the permissible loads on the landscape ecosystem, as the sustainability of natural complexes is a fundamental requirement for safeguarding the recreational potential of the area (Kulczyk-Dynowska & Stacherzak, 2020; Yang *et al.*, 2020). Unregulated recreation causes a decrease in the growth, completeness, and stock of tree composition, increased thinning processes, disruption of natural regeneration processes, and degradation of the indigenous phytocenosis (Ferreira *et al.*, 2022). The development of an adequate concept of recreational

nature management within urban parks should be based on the principle of rational use of natural resources to meet human recreational needs without causing destructive environmental impact. Adherence to the principles of zoning the park territory to reduce the manifestations of digression, the allocation of protected areas, regular sanitary cleaning, elevating the environmental awareness of the population and implementing organised algorithms to streamline recreational usage will enable the complete realisation of the city park's potential. This includes serving as a space for the physical and neuropsychological recovery of the population while simultaneously preserving representative landscapes and species diversity within the ecosystem.

## Discussion

Many contemporary scientists regard urban park systems as foundational elements for developing the ecological network within urbanised areas. This perspective establishes several organisational and economic prerequisites for the effective reproduction and rational utilisation of the resource capabilities inherent in the city's green spaces. Researchers, such as J. Palliwoda *et al.* (2022), have demonstrated that the environmental dimensions of modern city development hinge primarily on optimising the overall ecological state of the natural environment and adhering to the principles of sustainable urban development. The scholars emphasize that the directions for unlocking the ecological potential of urban parks are chiefly shaped by the optimal design of the city's functional and planning structure.

J.Z. Farkas *et al.* (2023) emphasised the need to ensure that the anthropogenic load is proportionate to the adaptive resources of park ecosystems, without violating the morphological and functional parameters of the green zone. Based on the findings of S. Ming & Q. Du (2021), who consider the management support of urban parks as a key prerequisite for the conservation of biodiversity in urban areas, it can be asserted that urban green spaces have considerably broadened their range of functions in contemporary times, becoming a basic element of the system of modern urban ecosystems. Scientists emphasise that urbanisation processes are mostly accompanied by a significant destabilising transformation of the environment. In this regard, the primary task of the urban ecosystem management system is currently to minimise anthropogenic destructive pressure by regulating the balance between the urban and natural environment.

X. Zhao *et al.* (2022) identified the main reasons for the need to maximise the protection and conservation of biodiversity within urban landscapes, including air purification, comfortable thermal conditions in different periods of the year, protection against landslides and erosion of urban cover and soil, formation of a sustainable landscape ecosystem, runoff regulation, conservation of diverse landscapes, and reproduction of human-nature synergy. Examining the practices of foreign management systems in the realm of green urban areas, researchers have observed that their initiatives are tailored to meet local needs and preferences in each country. Consequently, it becomes crucial to emphasise that, in the context of Ukraine, there is a need to formulate a specific strategy for the development of green spaces in urbanized areas. This strategy should align with the restoration of the state, fostering increased sustainability, and enhancing competitiveness.

Researchers F.A. La Sorte *et al.* (2023) emphasised the fact that intensive use of transport causes one of the key environmental problems of the city – air quality, which directly affects the health of city residents. Biodiversity, in particular, meadow crops and herbs, significantly improve air quality, mitigating the situation

with respiratory diseases. The authors argued that urban greenery largely regulates air and surface temperatures in different periods of the year and times of day, and on windy autumn and winter days, the high massifs of city parks create barriers to wind gusts. Plants and their root systems keep the soil loose and aerated, which creates better conditions for insects and worms. This assertion is supported by the research conducted by J. Winkler *et al.* (2022). Degraded areas that have lost their vegetation cover are vulnerable to direct rain and strong winds. The root system of plants significantly strengthens local soil cover and prevents it from shifting in places with steep terrain, or during floods or flooding. In Ukraine, a striking example of such a phenomenon is the emergence of landslides in Carpathian towns due to the massive felling of trees whose roots held the soil cover (Scherba & Pylypovych, 2023).

A. Addas (2023) notes that the primary task of urban landscapes is to form sustainable ecosystems that can mitigate negative climate change and help the city adapt to the dynamics of weather and climate conditions. According to the scientist, biodiversity is a key element of sustainable landscapes. It is thanks to it that ecosystems are formed that can exist on their own without requiring significant investments from the local budget or excessive attention, and simultaneously, benefit the city in the form of a renewable recreational resource. The researcher analyses the spatial structure of the city's green zone, arguing for the need to expand park areas and the need to allocate investments in green spaces. It is hard to disagree with the scientist. X. Zhao *et al.* (2021) focus on the need to identify specific areas of urban park systems that could have a special environmental protection status. Specifically, leveraging local biodiversity, it is deemed advisable to establish accessible open botanical and zoological parks for the public. However, this initiative should be augmented with a recognition of the imperative to provide special protection to habitats hosting rare representatives of local and regional biocoenosis.

The research by S. Štrbac *et al.* (2023) underscores the importance of synergizing the green infrastructure of a modern city with the principles of sustainable development. The scientists argue that the urban green infrastructure within a sustainable urbanised area constitutes a network of human-managed natural ecosystems that optimize public health, promote ecosystem sustainability, and preserve landscape biodiversity. The study also emphasises several challenges in implementing sustainable urban park management principles, including issues related to financing, investment, and the availability of qualified personnel.

In the context of post-war recovery, Ukraine has the potential to engage international cooperation mechanisms and targeted investment opportunities, expanding the horizons for urban environmental solutions. The future entails actively promoting the use of urban greening projects at national, regional, and local levels through sustainable development programs (Chen *et al.*, 2023; Evans & Hardman, 2023). The anticipated long-term outcomes of such a management strategy encompass the enhancement of social and environmental microclimates in cities, increased economic efficiency of projects, and an overall improvement in the living environment (Kruize *et al.*, 2020; Rehman *et al.*, 2022; Grigoletto *et al.*, 2023).

Preserving biodiversity in cities necessitates concerted efforts to develop a sustainable system of management and governance for green spaces in Ukrainian cities. Based on the findings of this study and the conclusions from the analysed works, it can be anticipated that urban park complexes will play an increasingly significant role in the successful management of urban ecosystems in modern Ukraine. This

would enable the deliberate enhancement of productivity, the implementation of innovative solutions, and adherence to the principles of sustainable green development.

Future scientific research in this domain should aim to delineate strategic priorities for establishing a resilient system for developing green space networks in Ukrainian cities. Additionally, the focus should be on creating and integrating an information monitoring system, positioned as a primary resource for optimizing the situation. There is a crucial role assigned to leveraging international practical experience, developing novel methodologies, and refining existing ones within the scope of an integrated multifactorial approach to managing urban park systems. The prospects for further research lie in constructing the institutional framework for the operation of urban parks in the context of European integration and the post-war regeneration of Ukraine.

## Conclusions

The study successfully analysed the multifaceted nature of the management paradigm to enhance the efficiency of urban park complexes based on sustainable development principles. It also assessed the role and significance of greening in the context of socio-economic transformations in urbanized areas.

The findings indicate that the development of urban park systems plays a crucial role in enhancing urban amenities, reinforcing the prioritisation of green living, and optimising the living standards of the population concerning restoration and recreation. The study thoroughly analysed the objective conditions for the functioning of green urban areas in modern Ukraine and asserted that the establishment of park ecological infrastructure should play a central role in the management systems of urbanised areas. Furthermore, the recommended functions of these systems include the development of recreational opportunities in parks, control of anthropogenic pressure on the environment, regulation of quality and safety standards, and preservation of biodiversity in local ecosystems.

The study concluded that achieving these goals requires the optimisation of management policies in the field of research. It emphasized that strategic planning, operational management, and the implementation of effective regeneration and preventive measures should be integral components of the strategic management of urban park complexes. Such an approach allows for a timely response to emerging challenges, such as the increasing importance of environmental safety standarts. The study has identified inter-sectoral gaps that currently require urgent elimination through regulatory and legal regulation, establishment of strict measures of liability for violations, and involvement of international levers to regulate the situation: neglect of the norms of territory development and status of territories, misuse of territories, spontaneous development of recreational and nature protection areas within park areas, and disregard for urban planning norms. Following the study, the author argues for the significance of creating a unified management body dedicated to addressing urban park issues in Ukraine. Additionally, a comprehensive concept for the activities of this management body is proposed.

The foundation of sustainable “green” urban development, as outlined, should rest on principles such as environmental safety, the conservation of landscapes and biodiversity, the integration of green practices in production, and the utilisation of available natural resources for recreation. These initiatives collectively contribute to the establishment of a favourable urban microclimate. The international experience of positioning environmental priorities of urban development as the main tool for

ensuring sustainable development is summarised. The problematic aspects of urban greening that require a change in strategic management approaches towards the targeted preservation and restoration of green spaces in urban areas are analysed.

The proposed measures for the optimisation and development of urban park complexes can be used to form targeted concepts of integrated landscaping, as well as a component of environmental assessment of the urban environment and preventive diagnosis of negative changes in local ecosystems. An effective approach to managing urban parks involves an integrated set of methods and tools that are interconnected to enhance their functionality in terms of recreation and biodiversity conservation. This approach should be grounded in the implementation of a sustainable development strategy, with environmental safety serving as an integral component of the management paradigm. There is a pressing need for further research to explore the potential application of management measures, drawing on international practical experience, to formulate optimal programs for the regeneration and development of green spaces. In combination, these measures will establish the prerequisites for addressing immediate challenges in the functioning of urban parks and identifying opportunities to enhance their operational efficiency, taking into account a range of influencing factors from both the internal and external environments.

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## Conflict of Interest

None.

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# Міські парки як важливий компонент екологічної інфраструктури: збереження біорізноманіття та забезпечення рекреаційних можливостей

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**Анотація**. Екологічний розвиток сучасної урбанізованої території базується на засадах сталого «зеленого» розвитку, концепція якого відображає задоволення потреб міста при збереженні навколишнього середовища. Метою статті є розробка рекомендацій щодо оптимізації інституційного устрою міських парків для організації їхнього функціонування відповідно до засад сталого «зеленого» розвитку міст, а також підвищення соціальної та економічної ефективності екологічної інфраструктури урбанізованих територій. Дослідження проводилось з використанням загальнонаукових методів пізнання: методи аналізу, абстрагування, синтезу, індукції та дедукції, а також методи конкретизації та формалізації. У ході роботи досліджено сучасний стан системи управління міськими парками, резерви їх рекреаційних можливостей. Встановлено, що паркове господарство України наразі функціонує відособлено, тому екологічна оптимізація даної сфери вимагає формування сучасного підходу до системи управління та організації. Визначено, що зелені зони міста є базовою передумовою для збереження видового різноманіття місцевих екосистем. Виділено пріоритетні вектори розвитку міських паркових систем в напрямку рекреації. Досліджено

специфіку процесу управління ними з залученням сучасних можливостей моніторингу та інвестування, окреслено подальші перспективи розвитку. Запропоновані основні заходи з оптимізації ситуації в досліджуваній галузі, серед яких – розвиток рекреаційних можливостей парків, контроль впливу антропогенного навантаження на навколишнє середовище, регулювання стандартів якості та безпеки, а також збереження біорізноманіття місцевих екосистем. Практична значимість результатів дослідження полягає в можливості їх застосування в процесі розробки відповідних програм, що мають на меті підвищення ефективності функціонування міських парків, зростання показників їх рекреаційної значущості, а також формування стабільної екологічної паркової мережі в Україні

**Ключові слова**: зелені зони; стійка урбанізація; зміна клімату; розумні міста; оптимізація