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Urban Green Areas in Baku

Crafting a Sustainable and Climate-Resilient City Agenda

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In the face of ongoing global environmental dynamics such as climate change, biodiversity loss, and natural resource depletion, one of the most significant challenges of the twenty-first century is mitigating the negative externalities due to urbanization while adapting to the consequences of urban development. Beyond the increasing, ecological footprint of urban areas and the escalating demands for a diverse array of resources, land-use practices significantly diminish the availability of areas essential for sustaining ecosystem services.

This reduction not only impacts biodiversity but also limits nature's capability to provide crucial services like clean air, water, and climate regulation—paradoxically, precisely in cities where their demand would be greatest. Many of these ecosystem services are directly linked to the natural environment in cities, such as green urban areas. Indeed, urban green areas (UGAs) are of high importance as

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they significantly contribute to vital ecosystem services (e.g., pollination through increased biodiversity), response options and thus resilience to environmental (climate) change (e.g., sponge cities), and human wellbeing, including direct impacts on our physical and mental health (e.g., nearby recreation).

Given these social and environmental advantages, cities have strong incentives and significant potential to actively mitigate and adapt to the loss of urban green spaces. Building urban resilience involves not only mitigating externalities but also adapting to change. Therefore, urban areas serve as crucial entry points for sustainable development, making them essential for tackling pressing environmental challenges.

Taking stock of the workshop organized with diverse stakeholders in Baku, this essay discusses the critical role of UGAs in enhancing ecosystem services, promoting resilience to climate change, and improving human wellbeing in cities. It highlights the complex governance challenges associated

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with managing these areas, emphasizing the need for interdisciplinary and multi-stakeholder approaches to integrate UGAs into urban planning for sustainable development.

UGAs and SEN

UGAs encompass various urban land uses, including highly-managed parks or cemeteries, tree-lined streets, vegetated rooftops, gardens including vertical green walls, unmanaged short-term vacant lots, lakeshores and seashores, and riversides. These diverse UGAs form a dynamic network of urban green in cities.

UGAs can offer numerous environmental benefits (e.g. heat mitigation, water capture, carbon sequestration, biodiversity conservation), social benefits (e.g. physical and mental health, social cohesion), and economic benefits (e.g. nature positive and circular economy) as part of sustainable urban living. Indeed, as urban populations grow, integrating UGAs into urban planning becomes increasingly important.

Prioritizing UGAs allows cities to address environmental challenges effectively while improving inhabitants' quality of life, which means that UGAs are important in the context of long-term urban resilience. They can help mitigate externalities or recover from shocks and crises resulting from environmental change while maintaining essential functions and services for the population. In the long term, UGAs offer the potential to adapt to changing conditions and to improve long-term sustainability and quality of life in cities.

This essay discusses the critical role of UGAs in enhancing ecosystem services, promoting resilience to climate change, and improving human wellbeing in cities.

The management of spatially distributed UGAs is complex and subject to the continuous shifting of urban policies and strategies as well as interacting social, cultural, and economic factors. These include governance challenges, social constraints, individual preferences of a broad set of stakeholders, and financial constraints. The governance of UGAs is challenging due to the complexity of demands and actors across many sectors, often with conflicting interests (e.g., biodiversity conservation, leisure, climate mitigation,

infrastructure, land use planning) and exacerbated by rapid environmental changes and increasing urbanization.

The governance of UGAs varies in processes, institutions, and stakeholder participation, influencing policy outputs, and transformative potential across distinct urban contexts. Integrating different stakeholders (e.g., local administrations, registered environmental groups, neighborhood associations, private firms, and landowners) into governance processes is crucial for producing broadly supported, effective, and sustainable outputs.

Despite these challenges, UGAs present many advantages. These include a range of valuable resources that contribute significantly to the environmental, social, and economic wellbeing of cities. These areas provide essential ecosystem services (e.g., air and water purification, climate regulation, and biodiversity conservation), which help mitigate urban heat island effects and improve overall environmental quality.

Moreover, UGAs serve as important recreational spaces, offering residents opportunities for physical activities, relaxation, and social interaction, which are crucial for mental and physical health. These spaces can also promote community cohesion and social integration by providing common areas for public gatherings, events, and cultural activities. In addition to their ecological and social benefits, UGAs can enhance the aesthetic appeal of a city, making it more attractive to residents and visitors alike.

This aesthetic value can also translate into economic benefits by increasing property values and attracting new businesses and tourism. Furthermore, UGAs can support urban agriculture and local food production, contributing to food security and promoting sustainable urban living practices. The presence of diverse plant and animal species in

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these areas fosters urban biodiversity, creating habitats for various species and promoting ecological balance. In other words, UGAs have considerable resources, access, and flexibility to co-develop

and co-implement environmental and infrastructure-related projects, resulting in areas of high transformative innovation potential.

Urban governance can be effectively analyzed through a network lens to better address the resources and challenges of UGAs. One such approach is the framework of social-ecological networks (SEN), coined to assess the complex interdependencies within social-ecological systems. The framework has been put to the forefront of interdisciplinary environmental and sustainability research. A SEN framework conceptualizes, operationalizes, and analyzes the complex interdependencies between social and ecological systems. Examining the relationships among actors, ecological units, and their interactions not only deepens our understanding of collaborative and synergistic ecosystem governance but also uncovers practical management gaps and barriers. As such, the SEN framework offers potential solutions to complex management challenges.

In a SEN framework, social and ecological networks are calibrated

individually but analyzed as inter-related networks. *Social networks* in SEN include nodes representing human or multi-level organizational actors with links representing relevant social inter-actions, e.g., information sharing and exchange, collaboration, or cooperation. *Ecological networks* describe interrelated UGAs as a functional green infrastructure that supports both ecological habitats and human needs for sustainable cities. The ecological network consists of nodes representing, for example, UGAs as habitats for biodiversity, while links refer to ecological connectivity (movement, dispersal, spatial flow) between the nodes. As such, SENs allow us to conceptualize complex social-ecological systems to assess human-ecosystem relationships in an integrated way.

SEN Stakeholder Engagement in Baku

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to tackle complex management and planning challenges. To achieve this for Baku, a first workshop with 25 international and local participants from agencies and universities, held at ADA University on 5 June 2024, aimed at informing and supplementing a proposal for a global initiative within the context of COP29 related to Sustainable and Climate-Resilient Cities.

In order to include actors relevant for a holistic, integrative, and multi-sectoral governance of UGAs, we relied on actors directly related to UGAs due to their management competencies or their interests related to specific green areas. These included representatives from the State Committee on Urban Planning and Architecture (SCUPA), the Executive Power of Baku City, the Ministry of Ecology and Natural Resources, and the Urban Initiative Focal Unit from the Ministry of Foreign Affairs.

The selection of participants allowed for fruitful feedback loops between science and practice, and the learning and knowledge-transfer process of actors

from different backgrounds and contexts. The workshop showed that effective surveying, planning, and long-term evaluation of UGAs as a resource is essential to unlock their full potential to support effective environmental policies tackling pressing environmental challenges.

How, then, are UGAs to be understood? *First*, UGAs are fine-grained and often exhibit high heterogeneity. Using state-of-the-art baseline geospatial information enhances our understanding of the thematic composition, the spatial configuration, and the 2D and 3D structure of UGAs. To this end, remotely-sensed data as well as local surveys to accurately

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determine ecological and structural diversity may leverage the quantification of UGAs. *Second*, as UGAs are the result of continuously shifting and interacting social, cultural, and economic factors, a spatially dynamic system's framework is key in the context of UGAs. And *third*, UGAs are directly at the interface between human requirements and the environment, requiring a combined ecological and

social approach, i.e., social-ecological systems analyses. An inter- and trans-disciplinary approach allows for identifying fits and misfits of management and responsibility between the ecological, the social, and economic/business components of UGAs.

Integrating the SEN framework into Baku's urban planning strategies for UGAs can significantly contribute to the city's sustainable development goals, aligning with global initiatives like those that will be discussed at COP29. This approach not only maximizes the multifunctional benefits of urban green spaces, but it also ensures that these benefits are equitably distributed across the city's diverse population.

The aforementioned workshop concluded with a set of key outcomes designed to ensure the success of the global initiative known as the Global Pledge, which is part of COP29's Multisectoral Actions Partnership (MAP) for Sustainable, Climate-Resilient, and Healthy Cities.

This initiative aims to enhance multisectoral national actions within cities and encourage stronger partnerships to improve global coherence on climate action, urban development, and resilience. It produced three key outcomes.

One, the mitigation potential of UGAs includes carbon storage, reduced urban warming, and flooding potential, and promotion of biodiversity. *Two*, collaboration between registered NGOs, public and state agencies, and ministries as well as volunteers will allow UGAs to become lively, publicly accessible places for (small-scale) commercial activities and neighborhood actions, which, in turn, increase people's sense of place and their wellbeing (e.g., sports activities) and encourage social mixing. *Three*, educational initiatives are an important channel to increase awareness of the benefits of UGAs—not least because the city's greenness correlates well with high real-estate prices. Underprivileged areas and informal settlements benefit less from UGAs, a social injustice that should be of particular focus when planning green spaces.

The workshop in Baku represented a first step to disentangling the complex social and ecological aspects of its UGA. Several crucial points and related recommendations require consideration for advancing the city's sustainable and climate-resilient agenda within the local context. This essay will examine six of these.

Local Involvement

First, the *role of the population in analysis.* Citizen involvement in urban sustainability efforts is paramount. As a general rule, the more citizens are engaged, the greater the sense of ownership and responsibility toward maintaining and enhancing UGAs. Active participation in planning and decisionmaking processes can lead to more effective and sustainable outcomes.

To foster sustainable urban development, designing and implementing mechanisms that actively engage citizens is crucial. Creating platforms for community input and decisionmaking (e.g., public fora, participatory workshops, and digital engagement tools) can lead to more inclusive and effective initiatives involving UGAs. Empowering local communities with high-resolution data sources, such as NDVI data, Sentinel Hub, and Google Satellite imagery, provides them with the necessary information to participate meaningfully in planning processes. These tools offer detailed insights into vegetation health, coverage, and changes over time, enabling more informed decisionmaking.

However, the data needs to be prepared in a simple and accessible manner to ensure it is truly useful to local communities. This involves translating complex scientific information into clear, actionable insights that can be easily understood and applied by community members. By doing so, residents can more effectively participate in decisionmaking processes, contribute to sustainable practices, and take informed actions to improve their local environment and quality of life.

Increased transparency and access to information help build trust and encourage active involvement in the maintenance and improvement of UGAs. Additionally, there is an ongoing discussion on whether the SEN approach should be prescriptive (i.e., guiding how these interactions should be managed) or whether it should remain descriptive (i.e., mapping existing relationships without suggesting improvements).Regardless, enhancing citizen participation and utilizing high-resolution data are key strategies for achieving sustainable urban development.

Diverse Types of UGAs

We can identify the second way to advance the city's sustainable and climate-resilient agenda with the phrase *promoting diverse types of UGAs for sustainable urban development.* UGAs encompass a variety of spaces, each serving unique functions and providing distinct benefits. Examples include parks, seaside areas, green public and private spaces, boulevards, lakes, and campuses. Public parks, accessible to all, offer recreational opportunities and enhance community wellbeing, while private parks might serve more restricted, albeit equally valuable, roles. Green roofs and community gardens represent innovative uses of urban space, contributing to biodiversity, rainwater management, and food security.

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Promoting diverse types of UGAs is essential for catering to the varied needs of urban populations and enhancing urban biodiversity. Studies have shown that there is a direct correlation between vegetation patterns with real-estate values. This suggests that socio-economic factors significantly influence the distribution and quality of UGAs, and vice versa. Therefore, a more equitable distribution of green spaces across different socio-economic areas is critical to ensuring accessibility for all urban residents. Policies should aim to create green spaces in underserved neighborhoods, thereby addressing disparities in access to natural environments and promoting social equity. This approach ensures that all citizens, regardless of their socio-economic status, can enjoy the benefits of UGAs.

Social and Spatial Justice

The third way to advance the city's sustainable and climate-resilient agenda is through the application of the *concept of social and spatial justice*. UGAs provide a multitude of benefits for both the population and the natural environment. Ecologically, they function as corridors, facilitating species movement, reversing biodiversity loss, and promoting biodiversity conservation. They offer habitats for co-existence and create spots for the promotion of environmental awareness with activities such as birdwatching. Environmentally, UGAs contribute to air quality improvement by filtering pollutants, providing cooling effects through shading and evapotranspiration, and enhancing biodiversity and water infiltration to aquafers while acting as carbon sinks, mitigating and adapting to climate change impacts.

Socially and economically, UGAs serve as recreational spaces, promoting physical and mental health. They encourage social mixing by providing venues for community events and interactions, thus fostering a sense of community. Local businesses can thrive around these green spaces, benefiting from increased foot traffic and the attractive environment they provide. The overall improvement in mental and physical health associated with access to green spaces underscores their importance in urban planning.

Integrating UGAs into urban planning as essential components of ecological and social well-being is vital for maximizing their benefits. Urban planners should prioritize green spaces as key elements in city development plans, ensuring they are designed to meet both environmental and community needs across social strata.

Initiatives to address pollution in green and blue spaces should be implemented, transforming these areas into ecological corridors and habitats that support biodiversity and environmental health bringing the benefits from nature to the whole population—regardless of socio-economic status and localization of the latter.

Stakeholder Engagement

The fourth way to advance the city's sustainable and climate-resilient agenda is to *engage diverse stakeholders related to UGAs*. A diverse array of stakeholders is typically involved in the design, implementation, management, and governance of UGAs. Key players include those in charge of parks, various ministries, NGOs, schools, and volunteers. These stakeholders bring different perspectives and expertise, contributing to the holistic management of UGAs, particularly in the context of rapidly urbanizing areas like Baku.

Educational initiatives and national tree-planting programs play crucial roles in promoting the importance of green spaces and encouraging community participation. Municipalities, industries, citizens, and state versus private funding all have significant roles in creating and maintaining green areas. Collaborative efforts among these stakeholders are essential to ensure the sustainability and effectiveness of urban green spaces.

Government bodies are essential for creating and enforcing policies that reduce pollutants and ensure the sustainable management of urban green spaces. Their regulatory power can drive adherence to environmental standards and emissions laws, crucial for mitigating climate change impacts. For instance, stringent laws and regulations can control industrial emissions, safeguarding the quality of air and water in urban areas.

Citizens' groups and registered NGOs often act as advocates for environmental conservation and sustainability. They can mobilize community support, raise awareness, and drive grassroots initiatives that complement governmental efforts. These can also play a pivotal role in holding public and private sectors accountable for their environmental impact.

Educational institutions are key to fostering a culture of sustainability from a young age. By integrating sustainability practices and environmental education into curricula, schools can encourage creative thinking and problem-solving skills related to environmental challenges. Programs that involve children in hands-on sustainability projects, such as school gardens or local clean-up efforts, can instill a lifelong appreciation for the environment.

The private sector's involvement is crucial for funding and implementing green projects. Businesses and their associated philanthropies must adhere to emission laws and adopt sustainable practices within their operations. Companies can also invest in green infrastructure, such as creating green roofs or sponsoring public parks, as a form of corporate social responsibility.

Supporting initiatives that educate and involve children and the public in sustainability practices is another crucial element. Public awareness campaigns, community workshops, and educational programs can help build a collective understanding of the importance of UGAs. These initiatives can empower individuals to take

active roles in maintaining and advocating for green spaces in their communities.

Interdisciplinary Approach

The fifth way to advance the city's sustainable and climate-resilient agenda consists in *strengthening interdisciplinary approaches.* To effectively manage and enhance UGAs, it is essential to foster collaboration between various disciplines, including ecological sciences, urban planning, and business management and governance. This interdisciplinary approach can help integrate diverse perspectives and expertise, leading to more comprehensive and sustainable solutions.

Promoting a dynamic and process-based framing of ecosystems can enhance resilience and sustainability in urban environments. By understanding and managing the complex interactions between social, ecological, and economic factors, urban planners and stakeholders can develop more adaptive and resilient green spaces. This approach allows for the continuous evolution and improvement of UGAs, ensuring they remain functional and beneficial in the face of changing environmental and social conditions.

Data Leveraging

The sixth and final way to advance the city's sustainable and climate-resilient agenda involves *leveraging data for decisionmaking.* High-resolution data, such as those obtained from NDVI, Sentinel Hub, and Google Satellite, provide detailed insights into vegetation health, coverage, and changes over time. This data can be instrumental in planning, monitoring, and managing urban green spaces.

Utilizing available high-resolution data allows urban planners to make informed decisions about where to develop new green areas, how to maintain existing ones, and how to address environmental challenges effectively. For example, data can reveal areas with the highest levels of pollution or heat islands, indicating where new green spaces could provide the most significant benefits.

Encouraging data-driven approaches enhances the effectiveness and efficiency of green city initiatives. Data can help identify trends and patterns that inform better resource allocation and project prioritization. For instance, data analysis might show that certain areas of a city have lower tree canopy coverage, prompting

targeted tree-planting initiatives in those neighborhoods.

Moreover, data-driven decisionmaking fosters transparency and accountability. By making data publicly available, city planners and government officials can demonstrate the impact of their policies and initiatives, which helps to build trust with the community. This transparency also allows for community input and feedback, ensuring that green space developments align with the needs and preferences of local residents.

Positive Force

UN-Habitat's 2010 annual report was among the first to describe urbanization as a "positive force for transformation" and to highlight the importance of localizing knowledge in cities. This has been our guiding methodological principle in this essay. Utilizing a SEN framework, as noted above, is critical for enhancing Baku's UGA, thus providing significant environmental, social, and economic benefits. Implementing these strategies will help create a sustainable, resilient, and livable urban environment for all the city's inhabitants. Urban areas are a solution to, rather than a source of, environmental challenges.

Moreover, the various outcomes of the June workshop, including this essay, will feed into a process of delivering actionable recommendations to the COP29 Presidency's global initiative on urban sustainability. The collaborative approach we outline in these pages is designed to ensure that initiatives involving UGAs are underpinned by scientific evidence, responsive to community needs, and aligned with global sustainability goals.

We have also sought to underline that addressing urban issues in line with the approach taken in this essay represents

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one of the few potentially synergetic entry points to work towards the successful implementation of the UN 2030 Agenda for Sustainable Development, at the center of which lies the 17 interrelated SDGs. This shift in viewpoint—urban areas as a solution to, rather than as a source of, environmental challenges—requires a critical evaluation in empirical contexts, in Baku and many other cities in the Silk Road region and other parts of the globe. This work will continue at the upcoming World Urban Forum in Cairo and, in two years, at the next one, to be held in Baku. BD

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