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Perspective Swap from Central Europe to East Asia: How Relevant Is Urban Environmental Acupuncture in Small-Scale Green Space Development in the Context of the Republic of Korea?

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Abstract: A lack of green space, driven by intense urbanization, has resulted in adverse effects on human life and ecosystems. These adverse effects include, but are not limited to, urban heat islands, disruption to ecological networks, and fragmentation of human and animal habitats. Despite the critical need to improve climate resilience through green infrastructure expansion, not enough is being done to improve conditions globally. This study investigates the Urban Environmental Acupuncture (UEA) concept, exploring its potential application in Korea to implement green infrastructure in dense urban areas. Korea was selected as a case study due to its high population density and the urgent long-term need to safeguard urban green spaces. Semi-structured interviews with experts working in park and green space policy among Korean local governments were conducted. The interviews were analyzed using content analysis based on research questions. The results point to challenges in applying the UEA concept related to Korea's urban green space policies, including land acquisition difficulties, insufficient information and research, and difficulties in continuous management with micro green spaces. Moreover, we provide strategies to overcome the challenges of UEA implementation within Korea. The findings and proposed strategies offer insight to those facing similar conditions such as high population density and limited delegated land for green space expansion.

Keywords: urban environmental acupuncture; green space; small-scale green space; green infrastructure; small-scale green infrastructure; dense cities; Korea; Central Europe; planning concepts; nature-based solution implementation

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1. Introduction and Literature Review

The consequences of climate change on urban areas are enormous and serious [1]. In countries with densely populated urban areas, such as Korea[1], many populations, economic activities, and resources can be seriously affected by climate-related events [2]. For example, Seoul, the most populous city in Korea, faces susceptibility to heatwaves because of its dense population and low permeability. Seventy-seven percent of urbanized zones, including residential, commercial, and industrial areas, are impervious [3]. The prevalence of impervious surfaces, such as paved asphalt and concrete roads, contributes to the absorption of substantial heat, exacerbating the severity of heatwaves and the heat island effect [4]. In addition, urban areas with high population densities cause destruction of urban ecosystem services due to expanding urbanization. Therefore, densely populated urban areas are important spaces for increasing climate resilience and promoting urban ecosystem services. Urban green infrastructures focused on buildings and public areas play a crucial role in enhancing the ecosystem service capabilities within densely populated urban areas [5]. To solve these problems, Korea is attempting to introduce various measures to secure green infrastructure and green spaces in urban areas (We understand green

infrastructure as a network of various types of green spaces throughout an urban area. We consider green space to be vegetated areas of land or water connected to an urban area [6]). For example, urban regeneration policies are set as primary policies across the country, and in some exemplary cases, climate response measures (e.g., rainwater collectors and rooftop gardens) are adopted in urban regeneration projects with public funding of urban regeneration [7]. Nevertheless, half of all areas in Korea still only possess a per capita green space area of less than 9 m^2 according to the World Health Organization (WHO) international standard. What is more, urban green space is decreasing by an average of 3.5% every year in Korea [8,9].

Green space availability varies across the European Union. Access to urban green space tends to be above average among Northern European cities when compared with other parts of Europe. That is, two thirds of urban residents can reach urban green spaces within 500 m. Cities in Eastern EU countries, specifically, Poland, Slovakia, and the Czech Republic, tend to be somewhere in the middle, whereas Southern EU cities tend to have the least access to green space. The population density is highest in the Southern EU (26.01 (h./ha) and lowest in the Eastern EU (16.61 (h./ha) [10]. Even in cities possessing a good amount of urban green space, highly dense city centers still offer little to no green space access [10]. Roughly 42,968 premature deaths occur each year in Europe related to a deficiency of green space. To reduce mortality, equitable increases in access to green space is needed. This would not only extend the lives of thousands, it would also contribute to more sustainable, livable, and healthy cities [11]. Green space density is often unevenly distributed throughout the urban fabric, that is, wealthier individuals may live near more green space than low income individuals, for example [12]. Many European postindustrial cities are looking for ways to rejuvenate and maintain a high quality of life in their cities [13]. Nature-based solutions have been identified as one method of improving the conditions and minimizing the impacts of climate change, such as extreme heat and flooding, within urban areas [14]. In the literature, various barriers exist regarding green infrastructure implementation. The prevention of green infrastructure loss has been challenging due to institutional constraints, especially within the context of existing planning and regulations [15]. Postindustrial European cities often lack urban green spaces and find it a challenge to maintain biodiversity related to urbanization such as transportation and housing expansion [16]. The implementation of urban green infrastructure is often difficult due to a lack of political leadership, responsible parties, interagency cooperation, and procedural guidance and knowledge regarding the nuances of grey versus green infrastructure [17,18]. Planners, architects, and others responsible for green infrastructure initiatives have struggled with navigating design standards, regulatory pathways, budgets, and implementation of new types of green infrastructure [19]. To deal with the many challenges of urban transformation and green infrastructure implementation, new concepts and tools are sought [20].

Urban environmental acupuncture (UEA) is one potential tool to overcome barriers toward green infrastructure implementation. The concept was developed and implemented within the Interreg Central Europe project called SALUTE4CE (i.e., Integrated Environmental Management of Small Green Spots in Functional Urban Areas). The goal of the project was to develop natural resources by increasing the capacities of the public sector and related entities to improve an integrated environmental management of green and blue infrastructure in Functional Urban Areas (FUAs). The idea was to address the issue of urban areas where no large sites are available for green space development and instead utilize small sites, which tend not to be lucrative for other types of development. The project funding included 2.2 million Euros, of which 439,000 Euros were invested in developing UEA pilot projects.

The projects implemented utilized micro-spaces—such as inner courtyards, roofs, and small plots of land—and transformed them into urban green space (UGS) (see Figure 1). Due to the small project size (0.2 hectares or less) and local embeddedness of the pilot projects, they were especially suitable for the public to participate in their implementation. The projects

are meant to be low-budget and rapidly implementable due to their small size [21]. UEA based on urban acupuncture emphasizes that urban regeneration can take place at the local level via many small and inexpensive urban adjustments [22,23]. UEA stemming from urban acupuncture is unique because it is a planning concept defined as both a metaphor and socioenvironmental theory pushing for both physical and social change [24,25]. UEA is complementary to other forms of planning; it does not replace it [26]. UEA is a planning tool, metaphor, or heuristic, used to guide implementation, for example, of blue and green infrastructure, nature-based solutions, and green infrastructure. It is different from other urban greening concepts because it bridges both the act of implementing green infrastructure and social change (e.g., public participation, large impacts via small interventions). UEA, when presented as a metaphor, may help to form a community vision of urban green space. UEA pilot projects may also be used to garner more support for urban greening initiatives and develop urban green space further, thus expanding access to green space [26].



Figure 1. Illustration of UEA (Source: conceptualization: Hemingway, Jessica, Mathey, Juliane, and Wirth, Peter; illustration: Strangfeld, Franka).

The following pilot projects were implemented in four countries, resulting in 16 sites altogether utilizing UEA as the underlying planning concept [27]. What is more, the projects possess the following characteristics: they are low-budget, quickly implementable, utilize micro or abandoned spaces, and involve public participation. In Liptovský Mikuláš, Slovakia, for example, a project called "Grandma's Garden" was created at an elementary school. A 600 m^2 site was planned to be incorporated into educational activities and open to the public (see Figure 2). Children were involved in the process, but, due to legalities, could not implement the project without a professional contractor. The project cost was approximately 12,939 Euros. Additional, pocket parks were also constructed in Liptovský Mikuláš near a shopping center to revitalize a frequented pedestrian zone; this site included greenery, water elements, and even trampolines [26,27].

Further UEA projects were implemented in Alessandria, Italy. This included an urban orchard, a 1600 m^2 site embedded within a residential neighborhood, as well as native fruit trees and wildflowers to support local wildlife with a cost of 25,300 Euros. Additional projects included an urban forest of native trees, a newly constructed pedestrian pathway, outdoor sport equipment, and 300 green planters scattered throughout the city of Alessandria. The planters were unique in that they served two purposes. One purpose was to infiltrate the city with greenery and the second purpose was to use the plants as bioindicators of air pollutants [26,27]. In the impulse region of Germany, an urban green

space located near residential buildings was altered to improve socialization among the neighborhood and offer a place to grow food. A pocket park was constructed near a school between two structures and an insect meadow constructed near a daycare designed to promote outdoor play and educational areas. Finally, in Chorzow, Poland, a dilapidated 300 m^2 residential courtyard was renovated and converted into a green space [26,27].



Figure 2. Pilot project example of UEA called "Grandma's Garden" located in Liptovský Mikuláš, Slovakia (Source: Petran, Matej).

Project partners identified specific barriers of UEA implementation. In the initial stages of UEA implementation, convincing decision-makers that green infrastructure is important was the first challenge [26]. Project partners approached mayors and city council members to gain support for the pilot project measures, often linking the projects to challenges their urban city centers were facing (i.e., extreme heat, lack of biodiversity, quality of life issues). There was such a high-level support for green infrastructure implementation from voters that the mayors, in some cases, announced their intention to support further UEA sites after the project concluded, thus, highlighting the importance of not only convincing decision-makers but also local citizens [26].

Another potential barrier toward UEA implementation are land use conflicts [28]. Therefore, before UEA sites are implemented, current and future planning projects should be identified which could be in conflict with the selected site [29]. The technicalities of the sites can be demanding, for example, the wall design needs to be created in conjunction with the lighting, water collection, and irrigation features. Finding knowledgeable contractors familiar with green walls and other types of infrastructure may also take some time. The public procurement process can also be a challenge. Some project partners indicated that the public tender took more than one round as the projects were small (i.e., low budget) and required particular expertise in green infrastructure [26]. Future challenges will be to develop strategies that integrate UEA into municipal activities after the temporary funding and project activities end. Citizen participation in the UEA planning process is key in successfully designing, implementing, and managing UEA sites [30]. At the same time, public participation is time-intensive, and this must be considered during the planning process and when determining project deadlines. The involvement of a variety of experts can increase the quality and success of UEA implementation [27]. Despite the challenges incurred during UEA implementation, the projects and concept offer a pathway toward overcoming barriers of urban green space implementation, at least within dense European urban areas. It has been shown to be easily integrated into the existing planning processes within the four pilot project countries; see [16] for an example.

2. Gaps and Research Questions

Implementation of UEA took place in Central European cities. Insights into more dense urban configurations is needed to determine whether UEA could also be a viable option in those contexts. Furthermore, research is needed examining the applicability of UEA to contexts outside of Europe, considering differing governmental structures and the barriers that may occur there. A major research gap among transformation projects exists regarding the specifics of urban contexts and their practical operationalization [31]. By examining the applicability of UEA in the Korean context, we elaborate the concept outside of Europe, increasing its robustness for further application in more dense urban settings. The main research questions are as follows:

- How applicable is UEA in the Korean context?
- How is this different from Central Europe?
- How can UEA be improved for better application in the Korea context?
- What lessons can we learn for future application?

3. Research Methods

The purpose of this study is to identify barriers toward expanding small-scale green space in order to examine the applicability of UEA in the Korean context. This research was conducted with a case study approach to examine the applicability of the UEA concept in solving wide-scale environmental problems through many small spatial interventions outside Europe. Korea is used as a case study for the following reasons: (1) Korea's urban areas are, on average, the densest among OECD countries in the world [32], and (2) the country has actively prepared green space and park policies by enacting the Park and Green Space Act to expand urban green space within residential neighborhood since 2005 [33].

Korea is highly urbanized and lacks green space, resulting in a high level of negative climate change impacts such as heatwaves. Therefore, it is important to establish policies to increase climate resilience and promote urban ecosystem services in Korea. We assume the concept of UEA, which can promote climate resilience and urban ecosystem services through small interventions within dense urban fabrics, is a potentially effective tool in governing implementation of urban green infrastructure.

The reason for setting the case at the national level, Korea holistically, rather than at the city level is as follows. Korea has a top-down approach to policy formulation and implementation, which means local governments are charged with establishing park and green space policies tailored to their respective conditions but rely on national policies and budgets, so the situation is similar in urban areas of local governments. What is more, since UEA has been applied in four countries in Central Europe, it is more appropriate to look at a country with a different context to study the applicability of UEA.

Korea faces challenges of high population density and limited park and green space; this trend is expected to continue. The decrease in park areas in Korea is linked to the Urban Park Sunset Rule[2], which, as of 2020, allows undeveloped parks to be developed. By examining the number and size of parks in Korea over the past decade, a noticeable decline in park areas post-2020 becomes evident (904 km^2 in 2019 and 698.6 km^2 in 2020) [34]. While the Urban Park Sunset Rule has been established by the central government, it falls upon local governments to procure and develop parks.

We conducted 17 semi-structured interviews with experts from public research institutes affiliated with local governments in Korea. These interviewees are responsible for establishing plans for urban parks and green spaces or providing advice and research related to planning and policy establishment for urban parks and green spaces. The interviewees were selected as they are the most experienced in the creation of parks and green spaces within their respective local government. Interviews were conducted either face-to-face or via video conference from July 2020 to November 2023. All interviews were recorded and scripted with the consent of the interviewees. The semi-structured interviews consisted of an introduction of the interviewer and the interviewee, status of policies, plans, and programs to expand small green spaces and green infrastructures in

Korea, descriptions of UEA, and opinions of small-scale urban green infrastructure/space. The main interview questions are as follows:

- (Q1) What kinds of policies/plans/programs do you have to increase green space?
- (Q2) Are there policies/plans/programs for the expansion of small-scale urban green infrastructure and green spaces?
- (Q3) In terms of cost and time, do you think that small-scale urban green infrastructure/green space expansion is an effective strategy for reducing heat, improving ecosystem services, and improving social and cultural aspects?
- (Q4) What are the difficulties in promoting small-scale urban green infrastructure and park/green space expansion projects (e.g., converting abandoned land into green space and using vacant land as urban agricultural space and green recreation space, etc.)?
- (Q5) What needs to be improved to promote small-scale urban green infrastructure and park/green space expansion projects?

The interview data was imported into MAXQDA software (Version 22.8.0) and content analysis was performed. For content analysis, the interview data was coded twice after constructing a list of barriers and strategies to expand small green spaces and infrastructures obtained through the literature review (see Tables 1 and 2).

Table 1. List of barriers and strategies for small-scale green space development.

Category	List of Barriers and Strategies for Small-Scale Green Space Development
Barriers	Procurement of property/land, a lack of space Not prioritized in policy A lack of finances/budget A lack of information/research/knowledge Management difficulties Interagency cooperation Institutional constraints Residents' awareness
Strategies	Policy improvement Available information and research Residents' participation and education Resources and budget Cooperation between ministries/departments Awareness of civil servants Awareness of residents

(Source: authors' own compilation).

Table 2. Example of content analysis and the number of coded segments.

	Identified Segments	Coding	Category of Factors
Content analysis	(1) In the end, securing land is the most difficult. That's right. It is impossible to secure green space, because there is no open space where green space can be created. And the street roads and the sidewalks are narrow. (2) And there are green walls and green roofs but after seeing the construction sites of them (green walls and green roofs), I think maintenance is a bit lacking in our country. So, the green roof of our research institute building is currently being constructed poorly.	(1) Procurement of properties/land, a lack of space; (2) Management difficulties	Barriers

Note: Number of coded segments is 110 as barriers and strategies (58 barriers and 52 strategies). (Source: authors' own compilation).

In sum, Figure 3 presents the entire research process.

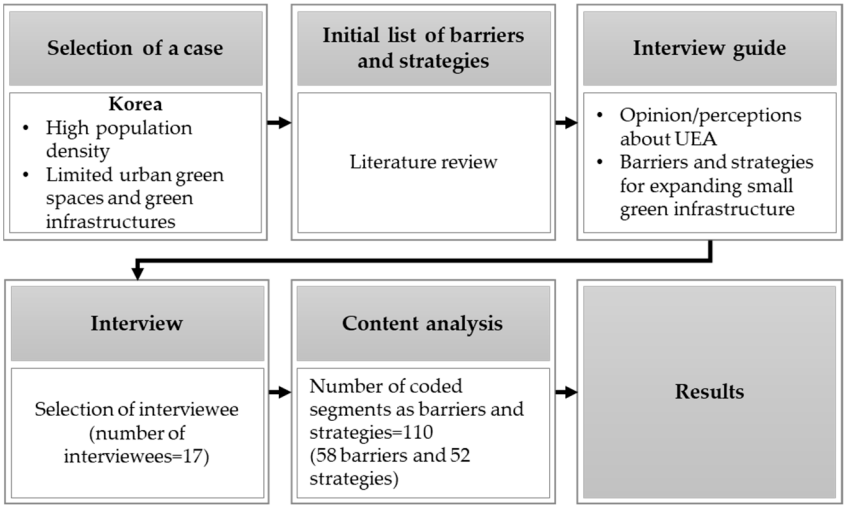


Figure 3. Process of research (Source: authors' own compilation).

4. Results

In Korea, local governments endeavor to create green spaces in small areas. This is essential because of the high population density and the inadequate green space available per person. In this aspect, the concept of UEA is regarded as an efficient solution for expanding urban green space and infrastructure for achieving the effects of urban green space and infrastructure in terms of biodiversity (INT9[3]), micro-climate adaptation to heatwaves (INT7, INT13), recreational space (INT6, INT7, INT9, INT11), educational benefits (INT6), social-cohesion benefits (INT6, INT7, INT11, INT13), and economic benefits (INT11).

There are three ways for local governments to create small-scale green spaces and green infrastructure in urban areas in Korea: (1) creating small-scale green spaces using urban regeneration, (2) incentivizing private landowners to lease land for green spaces, and (3) creating a budget for local governments to promote parks and green spaces.

The first is to create small-scale green spaces using urban regeneration. Urban regeneration is a project in which the central government selects declining communities with characteristics such as a declining population, a decrease in the number of industrial companies, and aging urban infrastructure, and provides public funds to regenerate the city for five years. One of the urban regeneration projects is to create a green space in an existing space that can be utilized. This requires the willingness of urban regeneration's stakeholders (e.g., residents, civil servants in local governments, urban regeneration support center, heads of local governments) to include green space creation projects, but currently, in most local governments, securing green space is not included as a major project in urban regeneration. The main priorities of urban regeneration projects are securing car parking and garbage disposal (See Figure 4).

Secondly, it is a form of leasing underutilized lands by providing incentives to private landowners. The incentive is to provide demolition costs of the deteriorated buildings or reduce property taxes for a certain time. There are many vacant houses that are currently not being utilized, and local governments can convince landowners to lend the local government their land by offering demolition costs to demolish vacant houses and reducing property taxes. By doing so, the government may improve the urban environment by creating small green spaces. Many local governments in Korea, such as Seoul, Daegu, and Gangwon Province, are creating green spaces in this way [35,36].

Third, local governments can prepare their own budgets to create small parks and green spaces. Suwon City is promoting a project to create "palm gardens", which are empty spaces transformed into small gardens. In addition, the Seoul Metropolitan Government's "Bloom with Flowers" project plants flowers and trees in urban areas, teaches the need to create green spaces through landscape education for residents, and educates residents to become environmental activists in these communities.

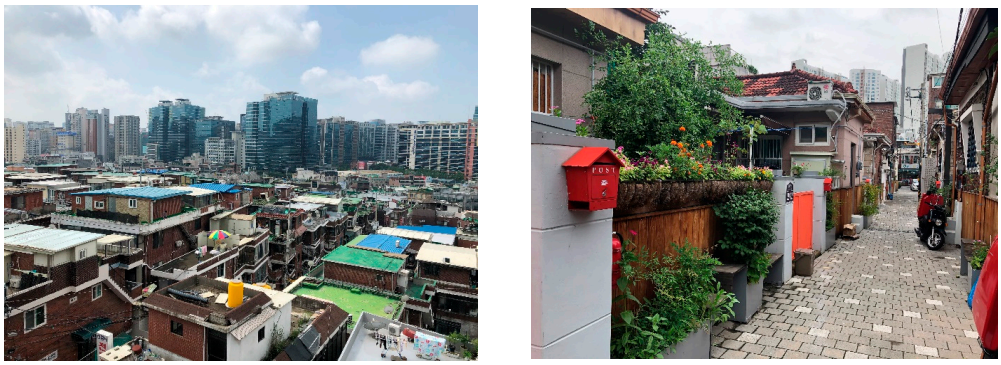


Figure 4. Ordinary urban regeneration area (**left**) and urban regeneration project with urban greening project (**right**) (Photos taken by Jiyoon Song in August 2020).

Through interviews with experts in Korean municipal parks and green spaces, we identified factors hindering the integration of UEA into park and green policies and suggest strategies to address them. In this section, we initially present three inhibiting factors in reflecting UEA in park and green policies in the Korean context: (1) challenges in acquiring properties for green spaces due to limited budgets and a lack of prioritization in local government policies, (2) a lack of information, knowledge, and research, and (3) difficulties in managing small green spaces and green infrastructures (Section 4.1). The research further investigates strategies that cope with barriers for expanding small green spaces and green infrastructure in Korea: (1) policy improvement, (2) available information and research, and (3) residents' participation and education (see Table 3 and Section 4.2).

Table 3. Summary of barriers to expanding small green spaces and strategies that cope with barriers (Source: authors' own compilation).

Current Ways to Secure Small Green Spaces for Local Governments	
• By using urban regeneration projects	
• Leasing underutilized lands by providing incentives to private landowners	
• Preparing their own budgets to create small parks and green spaces	
List of barriers	**List of strategies**
• Procurement of properties, a lack of space - Not prioritized in policy - A lack of finances/budget	• Policy improvement
• A lack of information/research/knowledge	• Available information and research
• Management difficulties	• Residents' participation and education

4.1. Inhibiting Factors

4.1.1. Challenges in Acquiring Properties for Green Spaces due to Limited Budgets and Lack of Prioritization in Local Government Policies

In Korea, the authority to create small-scale green spaces lies with local governments. Nevertheless, it is challenging for local governments to secure ownership of land to implement small-scale green spaces. This difficulty stems from the scarcity of available land within urban areas, where most land is privately owned. Furthermore, in cases where land is owned by local governments, interdepartmental competition within the local government for land utilization further complicates the process. Additionally, in cases where land is owned by the central government, local governments must put efforts into a complex process of negotiation for the use of vacant land, presenting an additional challenge. To create small-scale green spaces under these circumstances, local governments are securing

small-scale green spaces through (1) delegation of urban regeneration funding to create small-scale green spaces, (2) leasing underutilized lands by providing incentives to private landowners, and (3) adjusting their own budgets to create small-scale green spaces. These projects can only be implemented if local governments have a policy priority to create small-scale green spaces. However, most local governments in Korea do not prioritize the creation of parks and green spaces, and the main obstacle to this is the difficulty in securing land for green spaces.

Most empty houses and vacant lots in Korea are privately owned. Thus, it is challenging for local governments to secure land for an empty house to create small green spaces due to ownership challenges. To utilize the land, local governments may offer to pay for the demolition of empty houses or reduce property taxes, but the process of convincing landowners is not easy (INT11; INT13). In addition, even if vacant land is secured, it is more likely that the facilities desired by the department in charge of urban regeneration (such as public building and buildings for urban regeneration centers, etc.) will be installed first when urban regeneration is promoted (INT3). An interviewee, an expert in park and green space policy, emphasizes the competition within local governments regarding the use of vacant land when it is created as follows:

> "*A vacant lot has appeared. So, if we suggest, "let's go to that vacant land now and plant trees", do you think people will say, "Plant trees there."? No. Why? Because civil servants who are working on urban regeneration projects had a purpose in creating that vacant land... When vacant land appears in the city, there are numerous options for how to use it. Among them, planting trees is just one option. Ironically, there is a high possibility that it is a non-mainstream option, not the mainstream one. Moreover, if you go to the city center, the parking problem is extremely serious. Then there are more people suggesting to build a parking lot than a green space. So, on the site, we are now facing considerable difficulties*." (INT3).

Urban areas in Korea are densely populated, and especially in urban areas, there is only a small amount of land available to create green spaces through urban regeneration. This is because the density of buildings is very high in residential areas designated for urban regeneration (INT16). Therefore, it is very difficult to find new spaces for greenery, even in urban regeneration (INT16). For example, in Garibong-dong, the head of the resident council of urban regeneration reported,

> "*(In urban regeneration areas) there is no green space, no place to plant a tree. There is no leftover land*" (INT17).

In the situation that local governments rely on central governments' policies to be implemented in the local government due to their limited budget, expanding small green space is not a prioritized policy for most local governments (INT1). Regarding the expansion of small green spaces, it is difficult to expect policy programs that can be funded by the central government in the form of public projects. From the Ministry of Land, Infrastructure and Transport's point of view, the authority to secure parks and green spaces has been transferred to local governments, making it difficult for the Ministry of Economy and Finance to budget for them (INT2). An interviewee who is an expert on the local government's park and green space policy said that it is difficult for the local government to independently secure small-scale park and green space:

> "*Most of the government ministries, such as the Ministry of Environment, the Ministry of Land, Infrastructure and Transport, and Korea Forest Service, agree that we should do greening and allocate money for it, but the important thing is that it is local governments that have to secure the land to plant it...but the most important thing is that if there is a lot of such land, we can just do it, but in fact, it is not easy to find such land for small-scale urban green spaces*." (INT9).

In the case of small-scale green space developments, the most fundamental thing is to secure the budget for securing the land, which requires the willingness of the head of local

governments to secure the budget, but in the case of small-scale green space developments, the effects of small green spaces are not visible, so it is not a priority for the local government head's policy (INT11).

4.1.2. Lack of Information, Knowledge and Research

One of the challenges for local governments to create green spaces is the lack of information on how to create small-scale green spaces. The information needed to create small-scale green spaces is (1) information on the current state of green spaces, (2) information on where additional green spaces can be created, and (3) information on the effectiveness of small-scale green spaces.

The map that is typically used to identify the current status of green spaces is the land cover map provided by the Ministry of Environment, which does not show the detailed attributes of green spaces and is entered together with land use areas, so it is not possible to clearly identify whether there are actually small-scale green spaces (INT2). In addition, while it is relatively easy to analyze the effects of large-scale green spaces (through thermal images, satellite images, etc.), it is not easy to identify the effects of small-scale green spaces, and there is a lack of information on where and how to create green spaces (INT8; INT12). Local authorities also need information on where and how to create green spaces, but the lack of research makes it difficult to do so (INT12). An expert who established a local government's environmental plan points out the difficulty in securing space for green space due to a lack of information on the effectiveness of the local government's small-scale green space as follows:

> "*In the end, we need to evaluate how effective it (small green space) was with the same budget, considering various indicators, including local resident satisfaction. Now, in the local government, there is a strong desire for clear results in these aspects*." (INT12).

4.1.3. Difficulties to Manage Small Green Spaces and Green Infrastructures

Small-scale green spaces are more difficult to manage than large-scale green spaces, needing a person in charge and maintenance on an ongoing basis. Many local governments report that it is difficult to create small-scale green spaces, including rooftop greening, due to the lack of continuous budget and the difficulty in assigning a person in charge and maintaining them on an ongoing basis (INT5; INT6; INT9; INT11; INT13). The central government and local governments are increasingly creating small-scale infrastructure facilities such as rooftop greening, but once they are created, they are often not utilized, which leads to poor management and poor construction, which makes them even more difficult to use (INT11). One interviewee states the situation in which roof greening is not maintained well as follows:

> "*The important thing for small-scale green spaces is that they should be properly maintained, so once they are built, the most difficult thing is rooftop greening, and rooftop greening is actually now in vogue, so when it was in full swing, the municipality built all of them on the rooftops, but because the rooftops are inaccessible, it has become a situation where there is no point in locking the doors and doing this*." (INT11).

Smaller green spaces and parks are also more difficult to manage than larger ones. Once a park has been established for a long time, it needs to be managed, but management is concentrated on large-scale parks, making it increasingly difficult to create smaller parks (INT6). A local government park policy expert explains the difficulty in securing a continuous budget for the maintenance of these small-scale parks as follows:

> "*In the case of small green spaces, even after development, maintenance and securing the budget are necessary. In reality, the development is often successful, but it is challenging to secure funding for maintenance. Unlike larger urban parks that receive continuous investment, small green spaces are often neglected, leading citizens to submit complaints. If you have experienced such situations as a public official, you might even think that small green spaces may not be necessary*." (INT5)

Another interviewee also points out,

"*Due to their small size, after setting up these small parks, there seem to be some areas where maintenance is lacking. Probably because the focus of maintenance is more on larger, more extensive parks... Since they are not very large in scale, there are many parks or green spaces with features typical of small-scale areas, but there is a widespread feeling that they are not well-maintained. Especially in cities like Gwangju, where the city was established some time ago, the overall parks are said to be aging*." (INT6).

4.2. Strategies That Cope with Barriers

In this study, park and green space policy experts representing each local government present the small green spaces and green inhibiting factors presented above, as well as strategies to solve them. In Korea, local governments still rely on the central government's policies of expanding park and green spaces. This is because local governments are unable to secure parks and green spaces independently due to a lack of capacity, financial resources, and information. Therefore, interviewees emphasized the importance of policy improvement in various ways. Nevertheless, policy support from the central government may be difficult to sustain, considering the UEA concept of creating long-term environmental effects through small interventions. This is because policy support can be influenced by the political environment. Therefore, it is crucial to promote the participation of residents in using and managing small green spaces, education for this purpose, and dissemination of information for the long-term sustainability of environmental effects. The strategies proposed in this section are (1) policy improvement, (2) development and dissemination of relevant research and information, and (3) residents' participation and education.

4.2.1. Policy Improvement

Korea has transferred the authority to create parks and green spaces to local governments, and local governments should implement various policies to create small-scale green spaces. However, the policy formulation and implementation process in Korea operates in a top-down manner, so policy improvement by the central and local governments is necessary to activate UEA. The following policy suggestions were provided through interviews with park and green space experts from local governments across the country. They were divided into (1) policy suggestions for securing land for small-scale parks and green spaces (a, b, and c) and (2) policy strategies for convincing residents and civil servants (d) (Table 4).

Table 4. Suggestions for policy improvements of small-scale green spaces and infrastructures expansion.

Category	Policy Suggestions
Policy suggestions for securing land for small parks and green spaces	(a) Regulation or incentives for new urban development or redevelopment to provide green space (INT4, INT6, INT13, INT14, INT15) (b) Financial support from the central government to obtain available land or to support local governments' policy (INT1, INT3, INT9) (c) Planning small green space in the process of urban planning from the beginning (INT3, INT6)
Policy strategies to persuade residents and civil servants	(d) Development of projects and programs to attract residents and civil servants to have interest in small green space (INT3, INT9)

(Source: authors' own compilation).

4.2.2. Development and Dissemination of Relevant Research and Information

To promote UEA in the Republic of Korea, it is important to research and disseminate the lack of information mentioned in the Barriers section to policy stakeholders and citizens:

(1) information on the current status of green spaces, (2) information on where additional green spaces can be acquired, and (3) information on the effectiveness of small green spaces.

Through interviews with experts nationwide, it is emphasized that to activate UEA in Korea, the highlighted information presented earlier is necessary to enhance the understanding of green policy stakeholders and residents. Particularly, the prioritized information for this purpose is related to presenting the effectiveness of small green spaces (See Table 5).

Table 5. Required information for expanding small-scale green spaces and infrastructures.

Category	Policy Suggestions
Presenting the effectiveness of small green spaces	• Verifying the effectiveness of green infrastructure and green spaces, such as rooftop greening, and how to manage them (INT1; INT9; INT11) • Raising awareness of local governments by publishing research on per capita parkland area for each local government (INT8) • Research on the benefits of parks and green spaces (INT4; INT12)

(Source: authors' own compilation).

The information suggested by interviewees is related to empowering and persuading civil servants of local governments and residents to raise awareness of the importance of small-scale green spaces in the communities. In Korea, where the importance of securing parks and green spaces is being suppressed by real estate development pressure, the information and research and development presented above are significant. What is more, as competition in performance between local governments is severe in Korea, presenting the per capita park and green space area by local government, especially in research, can serve as a driving force for local governments to further expand parks and green space (INT8).

4.2.3. Residents' Participation and Education

To activate UEA in Korea, it is important to ensure that residents who use small green spaces are actively involved from the beginning of the planning process in order to create and manage small green spaces (INT3; INT6; INT11). The first step is to develop programs to maintain residents' activities in small-scale green spaces through education and engagement. In Seoul's "Bloom with Flowers" program, members of the Citizen Landscape Academy are selected to give lectures, and at the end of the course, they are trained to become citizen landscape architects, and after that, they are trained to become citizen park and green space coordinators. Through this process, citizens develop knowledge about green space creation and become active agents for green space creation in their communities (INT9). In addition, programs that involve citizens in the early stages of green space creation, such as the "palm garden" program currently being promoted by Suwon City, can be further developed and made into models that can be used nationwide.

5. Discussion and Conclusions

By analyzing the interviews, we see there is a need for and demand for UEA-type projects in the Korean context. First, we already see implementation of similar projects; therefore, policymakers themselves have already identified the usefulness of such projects. Efforts are being made to regenerate cities by installing small green spaces and green infrastructure through policy projects such as urban regeneration. And through the "palm garden" project in Suwon, citizens and local governments are working together to create small green spaces and continuously manage green spaces, expanding small-scale green space creation into social activities and climate response efforts. These are policy implementations that realize the implementation of small-scale green spaces, which aim to address the problems of the entire city by utilizing small spaces to improve the climate resilience

and improve urban ecosystem services, as well as increase social cohesion. This study identified three factors that hinder the introduction of UEA into Korea's park and green space policy.

First, in the case of Korea, it is difficult to secure small properties to introduce the UEA concept due to the high urbanization rate, population density, and fierce competition for land use. For these reasons, abandoned spaces are not as easy to come by in the Korean context in comparison to Central Europe. Often the planning authorities themselves have already allocated the vacant land for uses other than green space and have experienced backlash from the public when parking, for example, is not created. Therefore, convincing city residents of the importance of urban greenspace is of high importance. What is more, private landowners control much of the potential land which could be converted to greenspace. This is contrary to our experience in Central Europe, where many of the UEA projects were constructed on land owned by the cities themselves.

Second, the Korean case emphasizes the importance of research on the effectiveness of securing small-scale green spaces to persuade local government officials, policy makers, and residents. Within the SALUTE4CE context, the project partners from cities (e.g., urban planners) and research institutes (e.g., research scientists) made the case for small-scale green space implementation and were able to convince city leadership to adopt such measures. However, more information regarding the effectiveness of microgreen spaces is also lacking in the European context (e.g., potential overall impact of many small interventions, knowledge regarding precise availability of sites ideal for UEA).

Third, in Korea's local governments, the importance of small-scale green spaces and green infrastructure is not high due to limited budget situations, so it is difficult to maintain and manage them on a continuous basis compared to large-scale green spaces. Regarding previously implemented UEA projects, we postulated that the small-scale nature the projects makes them ideal for public engagement in planning, maintenance, and monitoring of sites in comparison to large urban green spaces. Some evidence from the interviews in Korea suggest that this is not the case, as small-scale green infrastructure projects appeared to fall quickly into disrepair compared to larger green areas in Korea.

In this study, various inhibiting factors for securing small green spaces were identified in Korea. This has some similarities to the barriers found in Central Europe. The complexity of the sites can be challenging, highlighting the need for experts for these types of projects. Furthermore, urban green infrastructure such as green roofs need to be maintained to be accessible to the public. In the Korean context, the coordination of the different levels of government is not yet optimal to support wide-spread urban green space implementation. The local government struggles to find vacant land for micro-greenspace development and the upper levels of government are failing to provide the budgetary spending for such measures. Similar challenges exist within the European context, even if the scarcity of urban green space is not as pronounced as the Korean case. Dire consequences for not meeting equitable access to urban green space among citizens still exists (e.g., premature deaths in Europe). A lack of continuous budget and responsible individuals for the sites once they are created have been identified as barriers within the Korean context. Similar concerns existed during the implementation of UEA during the SALUTE4CE project. That is why the action planning concept including identifying responsible individuals and organizations to maintain the sites after project implementation during the planning process. Despite this, we cannot confirm if this recommendation was taken up or successful.

To overcome the barriers toward UEA implementation, this study proposed several points that need to be improved in terms of (1) policy improvement, (2) development of available information and research, and (3) residents' participation and education. These will be important lessons for establishing green space policies applying UEA in urban areas such as Korea, where per capita green space is insufficient and population density is severely high.

We addressed research gaps by examining the applicability of UEA outside the Central European context. We also identified methods of moving forward to improve conditions

for improved implementation of small-scale green space. What is more, specifics regarding both European and the Korean context have been identified; if our suggestions toward overcoming barriers are addressed, the practical operationalization of UEA should be improved. The robustness of the UEA concept has also been increased by identifying the potential weaknesses of the concept within the East Asian context (i.e., obstacles in procuring properties for green spaces, insufficient information and research, and challenges in ongoing management for small green spaces and green infrastructure), thus allowing for improvements in its application globally. Further research should examine best cases where UEA has been implemented after policy improvements, provision of information regarding the benefits of small-scale green infrastructure projects, and inclusion and education of residents involved in planning such sites.

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Appendix A

Table A1. List of interview participants.

Level	Government	Organization	In-Text Reference	Interview Date
National	National	Korea Environment Institute	INT1	19 September 2023
National	National	Korea Research Institute for Human Settlements	INT2	16 November 2023
Metropolitan city	Incheon	Incheon Institute	INT3	25 September 2023
Metropolitan city	Seoul	Seoul Institute	INT4	4 October 2023
Metropolitan city	Busan	Busan Development Institute	INT5	3 November 2023
Metropolitan city	Gwangju	GwangJu Institute	INT6	20 October 2023
Metropolitan city	Daejeon	Daejeon Sejong Research Institute	INT7	12 October 2023

Table A1. *Cont.*

Level	Government	Organization	In-Text Reference	Interview Date
Province	Gyeonggi	Gyeonggi Research Institute	INT8	5 October 2023
Province	Gangwon	Gangwon Institute	INT9	10 October 2023
Province	North Jeolla	Jeonbuk Institute	INT10	27 October 2023
Province	North Chungcheong	Chungbuk Research Institute	INT11	27 October 2023
Province	South Chungcheong	Chungnam Institute	INT12	19 October 2023
Province	North Gyeongsang	Gyeongbuk Development Institute	INT13	22 September 2023
Province	South Gyeongsang	Gyeongnam Institute	INT14	8 November 2023
Special Autonomous Province	Jeju	Jeju Research Institute	INT15	8 November 2023
Metropolitan city	Seoul	Seoul Institute	INT16	9 July 2020
Metropolitan city	Seoul	Garibong-dong resident's council of urban regeneration	INT17	1 August 2020

(Source: authors' own compilation).

Notes

[1] In this study, Korea refers to only to the Republic of Korea (South Korea).

[2] The 'Urban Park Sunset Rule' refers to the release of privately owned land that has been designated as an urban park according to urban planning facilities from the status of an urban park in order to protect the property rights of land residents if a park is not developed for 20 years. According to the decision of the Constitutional Court, the park designation statute of limitations was lifted (sunset) for the site from 1 July 2020.

[3] Interviewee's number. See Table A1 in Appendix A.

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