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A REGENERATIVE APPROACH TO URBAN HEAT-ISLAND RESILIENCE PLANNING

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Abstract: This research addresses the growing impact of urban heat islands on city dwellers' quality of life, exacerbated by increasing urbanization and global warming. A regenerative approach is proposed, exploring the potential of integrating revitalized functionally degraded areas (FDAs) with strategically implemented green-blue infrastructure (GBI). This integration aims to mitigate urban heat island effects while ensuring all residents have access to public green spaces within a 300m radius. A decision-making framework, pairing FDA characteristics with GBI types to maximize benefits, guides this process. Analysis of the FDA inventory revealed that 68% of larger FDAs are already undergoing development, exacerbating urban heat island effects. However, this analysis also identified nine smaller FDAs (minimum size 0.2 ha) within 300m of four densely populated areas lacking adequate green space access. These smaller FDAs offer strategic opportunities for implementing multifunctional GBI to mitigate urban heat. Results indicate that by revitalizing four selected FDAs, representing only 0.04% of the study area, can effectively provide necessary green space access. The study also identifies a conceptual gap in current planning frameworks, which prioritize conventional development over multifunctional GBI for addressing environmental challenges. This highlights the need for actionable guidelines and criteria for regenerative spatial planning,

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providing a clear "how-to" framework for utilizing nature-based solutions to enhance climate mitigation and develop more resilient cities.

Keywords: regenerative spatial planning, urban heat islands, green-blue infrastructure, functionaly degraded areas.

1. Introduction

The urban heat island (UHI) effect is driven by both urbanization and climate change. Urbanization's replacement of natural surfaces with heat-absorbing materials, reduced vegetation, and altered urban geometry creates the UHI (Urban…, 2024, Sixth…, 2023). Climate change then intensifies this effect by increasing baseline temperatures and the frequency of heat waves, leading to more extreme urban heat events. (Urban…, 2024).

The escalating UHI effect poses a threat to the health and well-being of urban residents, particularly those without access to private green space or air-conditioned living or working spaces. Consequently, the role of urban green spaces—including parks, recreational green areas, and green corridors—in mitigating UHI effects has gained considerable attention. Researches focuses (Urban, 2024) on two approaches: (1) utilizing green infrastructure for strategic cooling of the built environment and (2) establishing green "shelters" where urban residents can find respite from the heat. This study focuses on the latter, investigating the design and implementation of accessible and effective green spaces that provide effective relief from urban heat for residents of UHI-impacted areas who lack private green spaces.

Regenerative design offers a valuable framework for enhancing these green spaces (Davidson, 2022). This approach, which aims to restore and revitalize natural systems rather than simply sustain them (Plessis and Brendon, 2015), fosters multi-functional solutions that benefit both people and the environment. It extends beyond temperature regulation to encompass climate change adaptation strategies like water management. This facilitates a transition towards integrating carbon-reducing green infrastructure with existing grey infrastructure (e.g., water pipes, air conditioning), which can contribute to issues like increased runoff, reduced groundwater recharge, and the urban heat island effect. This integrated approach seeks to enhance the functionality of grey infrastructure while mitigating its environmental impact.

This research investigates how green-blue infrastructure (GBI), implemented through a regenerative design lens, can create effective and resilient "cooling shelters" able of withstanding and adapting to the challenges posed by a warmer climate. (Radinja et al., 2021, Severin and Michalikova, 2024) A particular emphasis is placed on the revitalization of underutilized urban spaces, transforming them into critical climate adaptation infrastructure.

Implementing GBI is simpler in new spatial designs where the need for green and water spaces can be considered from the initial planning stages. In existing urban environments, however, GBI planning is more challenging due to limited space and pre-existing infrastructure. (Radinja et al., 2021) Therefore, our proposed solution is particularly relevant for spatial planning in urban areas facing the negative impacts of climate change and possessing limited spatial resources

The aim of our research is to develop a framework for decision-making regarding the use of the regenerative potential of FDAs with implemented GBI to address the challenges of climate change. Specifically, we investigate the following research question: To what extent can the strategic revitalization of functionally degraded urban areas, using GBI, enhance urban resilience to heat zones?

2. Methods

2.1. Selecting a Study Area for Validating a Regenerative Spatial Planning Framework

The Municipality of Ljubljana (MOL) was selected as the study area for model testing because it represents an urban environment with a high proportion of green spaces (46% of MOL's area) (ICLEI, 2024), yet still experiences UHIs (Komac et al., 2016). To assess the accessibility of public green spaces for residents within UHI-affected areas, we applied the 3-30-300 rule proposed by Konijnendijk (2021). This rule establishes minimum standards for urban nature access, stipulating that every dwelling should be within 300 meters of a public green space with a minimum size of 1 hectare. Our analysis encompassed a variety of public green spaces within MOL, including parks, green corridors, riverbanks etc. Areas within MOL that fell both within identified heat zones and beyond a 300-meter radius of accessible public green spaces were identified through spatial analysis using ArcGIS Pro software. This analysis employed an overlay method integrating three key datasets:

- Delineation of densely built-up areas: Land use data (Raba…, 2024) was used to identify built-up areas within the urban environment. These areas were further refined using orthophotos and field observations to pinpoint densely built-up zones where residents of multi-story buildings typically lack access to private green spaces.
- Inventory of public green spaces: A comprehensive data layer encompassing all public green spaces managed by the Municipality of Ljubljana was acquired. (Public…, 2024)
- Heat zone data: Due to the unavailability of specific UHI data for the MOL, we utilized accessible data on heat zones as a proxy (Oštir et al., 2014). These data provide insights into spatial temperature variations within the urban area.

By overlaying these datasets, we identified critical areas within the designated heat zones where residents lack the required access to public green spaces, as defined by the 300-meter criterion of the 3-30-300 rule.

2.2. Developing a Blue-Green Infrastructure (GBI) Typology

GBI typology, specifically tailored for urban heat mitigation and climate resilience, was developed through a two-stage literature review of 11 scientific articles.

Stage 1: The initial stage focused on identifying and refining GBI types relevant to the research context. GBI types that did not align with established definitions or were deemed unsuitable for this study's scope (e.g., urban beekeeping, green spaces at elderly care homes, archaeological parks, and green traffic islands) were systematically excluded. Synonymous terms, such as "green roofs," "eco-roofs," and "vegetated roofs," were consolidated to ensure clarity and consistency within the typology.

Stage 2: In the second stage, we assigned potential benefits[2] to the refined list of GBI types based on the reviewed literature. This process resulted in a curated GBI typology, where each type is accompanied by a description of its potential benefits, such as heat reduction, stormwater management, and biodiversity enhancement. We used a multi-criteria analysis (MCA) for assessing each GBI type's suitability for this research. The MCA evaluated GBI types based on their potential to deliver key benefits and meet study objectives. Values reflected performance against predetermined criteria. We assigned values to the legend descriptions based on their relevance to the proposed criteria, ordering them from most to least relevant. Unassessed criteria received a default value of 1.

- **P:** Primary function - assigned a value of 5
- **S:** Secondary function - assigned a value of 4
- **x:** Incidental function - assigned a value of 3
- **!:** Added benefit - assigned a value of 2

This evaluation enabled us to prioritize criteria based on their relative importance, assigning higher values to those deemed most critical for achieving the study's objectives. The developed typology, in conjunction with the MCA, served two primary purposes: (1) it provided a catalog of potential GBI solutions for addressing urban heat and enhancing climate resilience, and (2) it established criteria for selecting suitable FDAs for GBI implementation.

2.3. Inventory of FDAs

To identify, categorize, and map areas that have lost their original function and could potentially benefit from GBI implementation, an inventory of FDAs was conducted within the study area. The existing dataset (Lampič, 2024) only included areas with a minimum size of 2 hectares. To ensure a comprehensive inventory, smaller areas meeting the size criteria for local pocket parks - up to 0.2 ha (Jones et al., 2022) were also included.

- Initial inventory development: potential FDAs were identified by combining the existing FDAs dataset for the MOL (Lampič, 2024) with an analysis of current orthophotos.
- Field validation and refinement: a targeted field survey was conducted to validate the initial inventory, refine FDA boundaries, and gather detailed site-specific

[2] Benefits considered in this paper are closely related to ecosystem services, however as GBIs are not ecosystems we avoided to use the term ecosystem services.

data. This step ensured the accuracy and completeness of the FDA inventory. A structured survey form, incorporating criteria from the existing MOL FDA dataset (Lampič, 2020) was used for data collection during the field survey.

The survey form was based on the methodology developed by Lampič (2024) and included the following criteria:

- Type of FDAs: (e.g., agricultural, service, industrial, craft, tourism, defense, mineral extraction, infrastructure, transitional land use, residential)
- Degree of dereliction: partial (10–50%), substantial (50–90%), complete
- Environmental degradation: water, air, soil, vegetation, surface
- Potential contamination: yes/no
- Current ownership: private, state, municipal, public-private, unknown
- Size and form of FDAs
- Protection regimes: cultural, nature conservation, water protection
- Accessibility of stormwater runoff: estimation of the contributing area from built structures (excluding runoff coefficient considerations). This criterion assesses the potential for capturing and utilizing stormwater runoff from impermeable surface (e.g. roofs, parking lots…).

2.4. Framework for developing spatial guidelines based on regenerative potential assessment

Using the collected data, we evaluated the potential for revitalizing FDAs through GBI implementation, specifically focusing on mitigating urban heat island effects. This assessment was based on pairing on GBI benefits and FDA characteristics:

1. GBI Benefits:

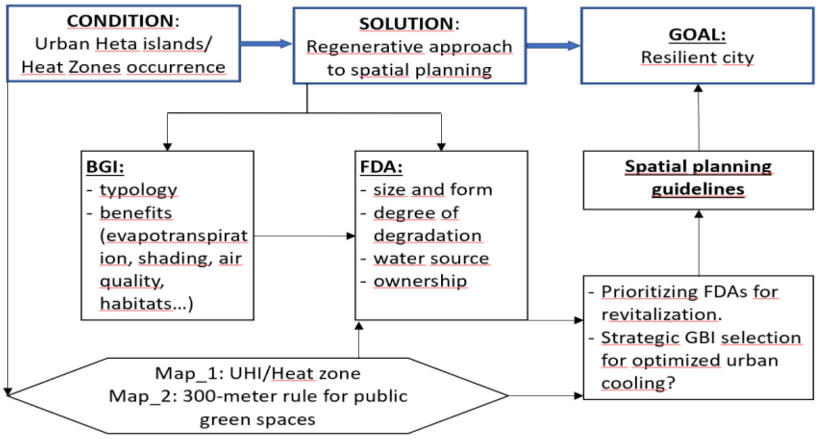
- Temperature reduction: the capacity of GBI to reduce air and surface temperatures through mechanisms such as evapotranspiration and shading was assessed.
- Biodiversity enhancement (habitat factor): the potential for GBI to increase local biodiversity was considered.

2. FDA characteristics influencing GBI feasibility and effectiveness:

- Municipal ownership: preference was given to municipally-owned land to facilitate project implementation.
- Size and shape: the size and shape of the FDA were assessed to determine suitability for different GBI types and their spatial requirements.
- Proximity to water source for runoff capture: the potential to capture and utilize stormwater runoff from surrounding impervious surfaces was evaluated, prioritizing FDAs with good accessibility to this source.

This two-pronged assessment framework, combining FDA characteristics with the potential benefits of GBI, allowed for a systematic evaluation of the revitalization potential of each FDA. The results informed the prioritization of FDAs for GBI implementation aimed at mitigating urban heat island effects and enhancing urban resilience.

Figure 1: A Framework for Assessing FDA Suitability for GBI implementation

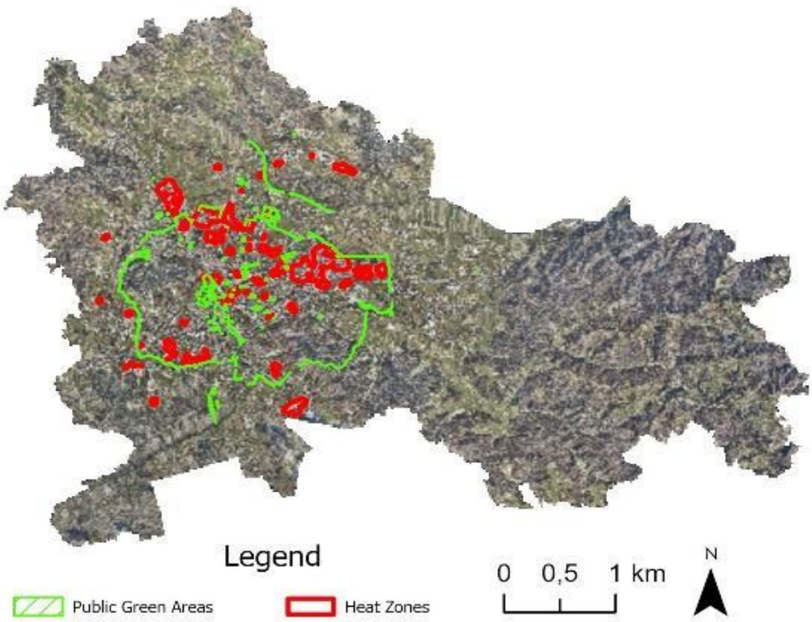


3. Results

3.1. Study Area for Validating a Regenerative Spatial Planning Framework

Built-up areas, characterized by various land cover types such as roads and buildings (LANDUSE_ID attribute code: 3000; description: Built-up and related land), constitute 28.83% (79.28 km^2) of the total area of the MOL. This area encompasses all zones relevant to this study, including green spaces, densely populated areas, and UHIs.

Figure 2: MOL with designated heat zones and public green spaces.



Heat zones within the study area encompass 4.51 km², representing 5.7% of the study area. Public green spaces comprise 1.38 km², a 1.7% of the study area. This analysis excludes significant green spaces managed by public companies, such as Castle Hill, and Rožnik and Šiška hill, despite their public accessibility. Of particular concern is the concentration of dense urban development within or adjacent to urban heat zones, encompassing 28,600 m² across four distinct zones. These densely populated areas lack adequate access to public green spaces, falling outside the recommended 300-meter radius. This deficiency highlights a need for improved green space provision in these vulnerable areas to mitigate the urban heat island effect and enhance residents' well-being.

Table 1: Identified threatened areas in MOL.

	Location	Size
Threatened Area_1	Cerkova street	11699m²
Threatened Area_2	Milcinskega street	5532m²
Threatened Area_3	Devova street	7452m²
Threatened Area_4	Ramovseva street	3916m²

3.2 GBI Typology Catalog

The first part of the analysis resulted in a set of 45 GBI types, predominantly consisting of structural solutions (green roofs, green walls, reservoirs, permeable surfaces), green infrastructure (parks, gardens, green corridors), and blue infrastructure (permeable surfaces, bioretention units, infiltration basins). We excluded GBI types that could not be used as solutions within the context of our research because they do not provide evapotranspiration and shading functions and are therefore unsuitable as heat island mitigation measures. These exclusions were made because the GBI types:

- Are not applicable (e.g., cemeteries, urban farms, theme parks, green railway corridors, green parking lots).
- Do not achieve the desired effects (e.g., balcony plants, green art, art installations, flower meadows).
- Represent overly broad categories (e.g., general green spaces, forest, lake, canal, buffer zones, public open spaces).
- Are unsuitable due to the geographic characteristics of the study area (e.g., mangroves, estuaries, coastal zones, floodplains).
- Represent private property (gardens).
- Are structural solutions and cannot be used as public spaces (e.g., green roofs, green walls).
- Are entirely intended for water management (e.g., bioretention units, infiltration basins).
- The final selection consisted of 7 GBI types.

Table 2: Identified GBIs that can potentially contribute to Heat zones mitigation in cities.

Benefits / GBI types	Min. size	Long-term water detention	Evapotranspiration	Shade	Habitat	Air quality improvement
City park[1]	from 20.000m²*	x	S	P	P	P
Pocket park[1]	to 20.000m²*	x	S	P	S	S
Tree-lined Park[2]	-	S	P	P	S	S
Rain garden[2]	10-20% of the impervious drainage area	S	S	!		
Wetland[2]	approx. 100m²	x	P	x	!	!
Water square[2]	-	P	S	x	!	!
Pond[2]	-	P	!		!	

Legend: P = Primary function, S = Secondary function, x = Random, ! = Added benefit

[1]The evaluation of the selected benefits was based on assessment (Jones et al., 2022)

[2]The evaluation of the selected benefits on assessment (Coletti et al., 2013) adapted by Radinja et al. (2021)

Assigned values were subsequently utilized in the Multi-Criteria Analysis (MCA) to rank the GBI types according to their overall benefits, from highest to lowest.

Table 3: Weighted assessment of GBIs performance.

GBI types / Benefits	Weight (%)	Weight (value)	Park	Pocket park	Tree-lined park	Rain garden	Water square	Pond	Wet-land
Evapotranspiration	30%	0,3	4	4	3	4	4	2	5
Shade	30%	0,3	5	5	5	2	3	1	3
Long-term water detention	20%	0,2	2	3	2	4	5	5	3
Improving air quality	10%	0,1	5	4	2	1	2	1	2
Habitat	10%	0,1	5	4	4	1	2	1	2
Total weighted score			4,1	4,1	3,4	2,8	3,5	2,1	3,4

Among the top five most suitable solutions, three are classified as green infrastructure (park, pocket park, and treelined park) and two as a blue infrastructure (water square and wetland). Notably, rain gardens and ponds received lower scores than initially anticipated due to the unavailability of certain data points. However, combining different infrastructure types yields enhanced solutions.

Table 4: Weighted assessment of combined GBIs performance.

Benefits \ Comb. of GBI types	Weight (%)	Weight (value)	Combination: Pocket Park & Rain Garden	Combination: Pocket Park & Water Square
Evapotranspiration	30%	0,3	4	4
Shade	30%	0,3	5	5
Long-term water detention	20%	0,2	4	5
Improving air quality	10%	0,1	4	4
Habitat	10%	0,1	4	4
Total weighted score			4,3	4,5

These findings suggest that integrating specific types of GBI, particularly those that combine blue and green elements, offers the most substantial benefits within the context of this study's objectives. A ranking of GBI types, based on their assessed potential to deliver these benefits, is presented below in descending order of overall value:

1. The combination of a Water square and a Pocket park
2. The combination of a Rain garden and a Pocket park
3. Park
4. Pocket park
5. Water square
6. Tree-lined park
7. Wetland
8. Rain garden
9. Pond

3.2. Mapped FDAs in Threatened areas

We reviewed the existing inventory of functionally degraded areas (FDAs) within our study area, cross-referencing their current status with records from Lampič (2020). Of the FDAs initially identified (minimum size of 2 hectares), approximately 68% of them are already in the construction phase. A field survey identified nine more suitable areas.

Table 5: Green Space Enhancement Potential of FDAs in 4 Critical zones.

Critical zones and their FDAs	Type of functional degradation	Degree of degradation	Size	Shape	Environmental degradation	Potential contamination	Access to a water source (estimated size of the contributing area)
Critical zone 1							
FDA 1-1	Agricultural activities	Substantial	4601 m²	Square	Soil	Use of herbicides and biocides	No
FDA 1_2	Agricultural activities	Substantial	2173 m²	Non-uniform shape	Soil	Use of herbicides and biocides	Yes (19462m²)
FDA 1_3	Agricultural activities	Complete	7015 m²	Non-uniform shape	Vegetation	No	Yes (6738 m²)
FDA 1_4	Transitional land use	Partial	1420 m²	Square	Surface	No	No
Critical zone 2							
FDA 2_1	Transitional land use	Substantial	3550 m²	Non-uniform shape	Soil, Surface	No	No
Critical zone 3							
FDA 3_1	Agricultural activities	Partial	14514 m²	Non-uniform shape	Soil	Use of herbicides and biocides	Yes (5788 m²)
Critical zone 4							
FDA 4_1	Transitional land use	Complete	2091 m²	Elongated rectangle	Soil	No	No
FDA 4_2	Agricultural activities	Partial	3437 m²	Elongated rectangle	Vegetation	No	Yes (2275 m²)
FDA 4_3	Transitional land use	Partial	6688 m²	Non-uniform shape	Vegetation	No	Yes (13044m²)

Figure 2: A map of FDAs and heat zone on densely populated area on Critical zone 1.

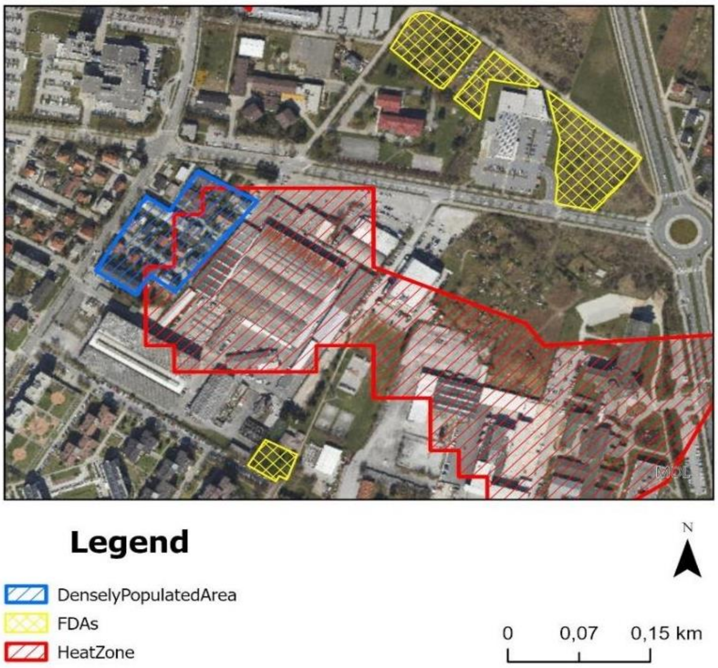


Figure 3: A map of FDA and heat zone on densely populated area on Critical zone 2.

Figure 4: A map of FDA and heat zone on densely populated area on Critical zone 3.

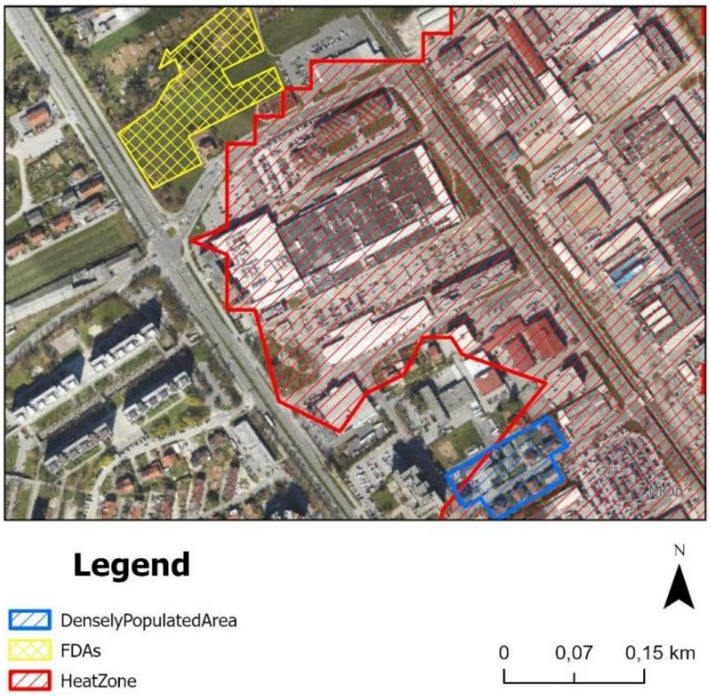


Figure 5: A map of FDA and heat zone on densely populated area on Critical zone 4.

3.3. Optimizing Functionally Degraded Areas with Green-Blue Infrastructure for enhanced urban resilience

Using a decision-making framework, we compared the characteristics of each FDA with the requirements for implementing selected types of GBI.

Table 9: Comparison matrix of identified FDAs with selected GBI.

	FDAs 1-1	**FDAs 1-2**	**FDAs 1-3**	**FDAs 1-4**	**FDAs 2-1**	**FDAs 3-1**	**FDAs 4-1**	**FDAs 4-2**	**FDAs 4-3**
Water source (est. size of contr. area)	-	Yes (19462 m²)	Yes (6738m²)	-	-	Yes (5788m²)	-	Yes (2275m²)	Yes (13044 m²)
Shape	Square	Non-uniform shape	Non-uniform shape	Square	Non-uniform shape	Non-uniform shape	Elongated rectangle	Elongated rectangle	Non-uniform shape
Size	4601m²	2173m²	7015m²	1420m²	3550m²	14514m²	2091m²	3437m²	6688m²
Comb.: Pocket park& WaterSquare	No	No	No	No	No	No	No	No	No
Comb.: Pocket park&Rain garden	No	No	**Yes**	No	No	**Yes**	No	Yes	**Yes**
Pocket park	Yes	Yes	Yes	Yes	**Yes**	Yes	Yes	Yes	Yes
Water square	Yes	No	No	No	No	No	No	No	No
Tree-lined Park	No	No	No	No	No	Yes	Yes	Yes	Yes
Rain garden	No	Yes	Yes	No	No	Yes	No	Yes	Yes

4. Discussion

Investigating the primary research question—to what extent can the strategic revitalization of FDAs using GBI contribute to greater urban resilience against climate change impacts—has yielded both key insights but also raised further questions.

Analysis of the FDA inventory data layer (Lampič, 2024) reveals that approx. 68% of the mapped FDAs with a minimum size of 2 ha within the built-up area of the MOL are already undergoing development or redevelopment. This trend of urbanisation, coupled with rising average temperatures, will further intensify the thermal pressure on the urban environment. Therefore, the importance of high-quality public green spaces will be further amplified in the coming years. The reduction of larger FDAs as revealed in this study will further limit the city's opportunities to create larger parks. Additional field research of FDAs revealed that within 300m of each threatened area, smaller degraded sites (0.2 ha) exist, offering opportunities for developing smaller-scale GBI (e.g. local park…). With the use of proposed framework we deduced that with minimal spatial interventions within the four selected FDAs, totaling a combined area of 0.03 km² (representing 0.04% of the study area), MOL can provide the necessary access to green space for all residents living in densely populated areas within or adjacent to heat zones who lack access to private green spaces. Three of the four selected FDAs can be upgraded from green infrastructure to GBI (for example by adding water element to pocket park) to enhance their benefits for climate change adaptation and urban resilience. The current strategic planning framework, as reflected in the Municipal Spatial Plan (MSP) (OPN…, 2010), presents a critical barrier to GBI implementation, which confirms the observations of Radinja et al. (2021). While the MSP acknowledges FDAs as priority areas for urban renewal, it focuses primarily on land-use changes for residential densification, habitat revitalization, and green space restoration within green wedges. This approach neglects the potential of GBI to address environmental challenges. The MOL Environmental Report (Okoljsko…, 2022) further underscores this limitation, indicating an expansion of green infrastructure within degraded areas that does not prioritize areas with high population density. The article focuses on pairing GBI with FDAs but it does not address the influence of the size and density of urban heat islands and population concentration on the effectiveness of the proposed solutions. Future research should develop models that simulate the impact of these factors on temperature and optimize the placement of green spaces for maximum heat island reduction. Furthermore, to gain a more precise understanding of the benefits provided by different GBI types, more refined and elaborate assessment methods are needed. This would enable a more accurate evaluation of their effectiveness in mitigating urban heat island effects and inform decision-making for optimal GBI implementation.

Developing a typology of GBI has shown inconsistencies across various studies (Blue…, 2019, Niedzwiecka-Filipiak, 2022). For example, some proposed types, such as green spaces at elderly care facilities (Niedzwiecka-Filipiak, 2022), do not clearly align with the GBI concept. The highest level of consistency was found in catalogs that list GBI types within the context of hydrological solutions (e.g. USEPA, 2024, Blue…, 2019). This suggests that the GBI concept remains largely confined to its original focus on water management (Radinja et al., 2021). The MCA analysis supports enhancing green areas with multifunctional GBI, demonstrating the benefits of combining different types, such as local parks and rain gardens, to maximize their positive impacts in the face of climate change. Further research is needed to assess the specific benefits of individual GBI types and explore additional typologies for a more comprehensive understanding.

Our study also highlight a significant conceptual gap in regenerative spatial planning of public green spaces for climate change mitigation. The initial concept lacks clear guidelines and criteria for regenerative design and implementation in this context. The literature on regenerative design and development emphasizes a fundamental shift from merely mitigating environmental harm to actively restoring and enhancing the health and resilience of both natural and human systems. This involves a new design paradigm that promotes a co-evolutionary relationship between human activities and natural processes (Reed, 2007). The concept champions a holistic approach, aiming for a net-positive impact by integrating human habitats with nature (Plessis & Brandon, 2015), and striving for the continuous renewal and improvement of ecosystem functions (Morselleto, 2020; Unter et al., 2024), even suggesting its potential to enhance adaptive capacity in the face of climate change (Plessis, 2012). Future research should prioritize developing tangible, measurable guidelines for the regenerative spatial planning of green areas. This includes creating a composite index to quantify the multifaceted benefits of diverse nature-based solutions, enabling informed decision-making and maximizing the potential for resilient cities. Advanced simulation tools are needed to analyze the complex interactions between heat island characteristics (size, proximity) and nature-based solutions (size, type, proximity). This will facilitate the development of more effective strategies for implementing GBI and fostering truly regenerative urban environments.

5. Conclusions

This research demonstrated the potential of pairing FDAs with GBI to mitigate the urban heat island effect in three out of four threatened zones. As urbanization rapidly diminishes larger FDAs within cities, it is crucial to utilize smaller FDAs (up to 0.2 ha) to create vital green spaces.

Upgrading green spaces with blue infrastructure to create GBI not only provides multifunctional benefits—including improved air quality, enhanced biodiversity support, and increased evapotranspiration—but also amplifies these benefits, contributing to a more resilient urban environment.

Further research is needed to develop clear guidelines and measurable criteria for regenerative spatial planning, including the creation of composite indices that enable a comprehensive assessment of the benefits of various nature-based solutions, including GBI.

Better simulation tools are needed to compute interactions between the size and vicinity of the heat islands to the size, type and vicinity of the FDA/GBI. This will facilitate the development of more effective strategies for implementing GBI and creating regenerative urban environments.

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REGENERATIVNI PRISTUP PLANIRANJU OTPORNOSTI NA FENOMEN URBANIH TOPLOTNIH OSTRVA

Apstrakt: Ovo istraživanje se bavi rastućim uticajem urbanih toplotnih ostrva na kvalitet života stanovnika gradova, koji je dodatno pogoršan povećanom urbanizacijom i globalnim zagrevanjem. Predložen je regenerativni pristup koji istražuje potencijal integracije revitalizovanih funkcionalno degradiranih područja (FDAs) sa strateški implementiranom zeleno-plavom infrastrukturom (GBI). Cilj ove integracije je ublažavanje efekata urbanih toplotnih ostrva, uz obezbeđivanje pristupa javnim zelenim površinama svim stanovnicima u radijusu od 300 metara. Proces je vođen okvirom za donošenje odluka, koji povezuje karakteristike FDAs sa tipovima GBI kako bi se maksimizirale koristi. Analiza inventara FDAs pokazala je da se 68% većih FDAs već nalazi u fazi razvoja, čime se dodatno pogoršavaju efekti urbanih toplotnih ostrva. Međutim, identifikovano je devet manjih FDAs (minimalne veličine 0,2 ha) unutar 300 metara od četiri gusto naseljena područja koja nemaju adekvatan pristup zelenim površinama. Ova manja FDAs pružaju strateške prilike za implementaciju multifunkcionalne GBI kako bi se ublažila urbana toplota. Rezultati pokazuju da revitalizacijom četiri odabrana FDAs, koja predstavljaju samo 0,04% istraživanog područja, može efikasno da se obezbedi potreban pristup zelenim površinama. Studija takođe identifikuje konceptualni jaz u postojećim planerskim okvirima, koji daju prioritet konvencionalnom razvoju u odnosu na multifunkcionalnu GBI u rešavanju ekoloških izazova. Ovo naglašava potrebu za praktičnim smernicama i kriterijumima za regenerativno prostorno planiranje, pružajući jasan *how-to* okvir za korišćenje rešenja zasnovanih na prirodi radi unapređenja klimatskih mera i razvoja otpornijih gradova.

Ključne reči: regenerativno prostorno planiranje, urbana toplotna ostrva, zeleno-plava infrastruktura, funkcionalno degradirana područja.

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