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Mobilizing nature-based solutions through temporary urban interventions: A civic guide to ephemeral landscapes

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Abstract

The potential of permeable urban landscapes has gained increasing attention in contemporary academic scholarship on nature-based solutions (Nbs). The common thread of these solutions is related to pressing issues arising from responses to climate change caused by urban densification, necessitating innovative strategies for enhancing environmental resilience. However, these strategies often require extensive timeframes and large-scale implementation. In contrast, temporary approaches to urbanism have the potential to provide answers to these strategies by focusing on citizen-engaged, small-scale, low-cost and low-tech actions. This study engages these two planning approaches in dialogue by focusing on overlooked urban interstices—small and unnoticed impervious spaces that have significant potential to become permeable. Developing a conceptual framework, the research explores how ephemeral installations can transform these interstices into nature-based, scalable and socially engaged landscapes. Applying this framework, the study adopts prototyping as an experimental research method, structured around three phases: (1) experimentation: incorporating nature-based aggregates, (2) fabrication: forming scalable and modular tiles, and (3) dissemination: creating social value with workshops. Building over the findings of these phases, the paper concludes with a proposal for a civic urban guide that outlines all these practical strategies for activating underutilized spaces through accessible and low-maintenance interventions. The guide aims to inspire civic engagement and environmental awareness, offering a model for small-scale, bottom-up interventions in line with broader Nbs objectives. In doing so, the research proposes a comprehensive approach to urban resilience that bridges planning theories, material experimentation, and public engagement.

Keywords: civic engagement, ephemeral landscapes, nature-based solutions, temporary urbanism, urban permeability

1. Introduction

In late October 2024, the flash floods in Valencia[1] once again rendered visible the vulnerability of cities in the face of climate change. While such urban vulnerabilities are largely associated with impervious surfaces, it is widely accepted that these types of events are not local but global in nature (Seddon et al., 2021; Kabisch et al., 2017). Over the past decade, the fields of design, architecture, and planning with a focus on environmental concerns have become more prominent in response to these threats due to fast-forward and uncontrolled urbanization (Cuff & Sherman, 2011). In this context, nature-based solutions (Nbs) have become an umbrella concept in capturing the ecological and societal challenges foregrounding urban ecosystem-based approaches (Keeler et al., 2019; Bush & Doyon, 2019; Frantzeskaki et al., 2019). Nbs demonstrate the appealing potential of permeable landscapes with varying motivations for the re-naturalization of urban spaces, such as tackling stormwater drainage (Biswal et al., 2022), preserving ecosystems (Dorst et al., 2019) or reducing flood risk (Vojinovic et al., 2021). These motivations on urban resilience have also been

[1]It is important to recognize that the severe flooding in Valencia was not an isolated incident, but part of a wider series of catastrophic floods that also occurred in many other European countries. For further details, *see*. " How Cities Are Using Nature-Based Solutions to Tackle Floods". Retrieved December 20, 2024, from https://time.com/7202917/cities-nature-based-solutions-floods/.

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incorporated into urban design and architectural practices at various scales globally, ranging from responses in the context of revitalizing brownfields or wetlands, to seeking solutions at the building scale by redefining underutilized rooftops.[2] However, the larger scale nature of these projects and the search for long-term re-naturalization of cities makes the widespread application of Nbs in practice questionable in terms of how to scale up their measures to achieve wider benefits for society, biodiversity and the climate (Odongo et al., 2022).

From this end, temporary urbanism has the potential to offer insights with a focus on improving ecological performance (Kay et al., 2019; Mata et al., 2019). Characterized by bottom-up and short-term actions that are small-scale, low-cost, and low-tech in enhancing urban resilience (Lydon & Garcia, 2015), temporary urban design practices range from community gardening in vacant spaces, pop-up green spaces in parking lots to simply planting into small lots that go unnoticed in everyday rush.[3] Despite the fact that the initial objectives of temporary urban practices may diverge from Nbs in terms of revitalizing lands left vacant due to regulations or financial constraints (Oswalt et al., 2013), providing a creative tool for urban branding and foster urban entrepreneurship for global competitiveness of cities (Thorpe et al., 2017; Colomb, 2012), and exploring the potential of democratic production of urban spaces (Andres, 2012; Bradley, 2015; Parker et al., 2019), the design responses concerning these practices coincide with nature-based solutions.

The growing interest in the adoption of Nbs in urban practice and the relevance of temporary urbanism create opportunities for rethinking urban ecosystem approaches. Following this path of possibilities, this article explores how the approach of temporary urbanism complements Nbs by introducing creative ways of imagination through examples of projects realized in urban spaces. Departing from the proposition that citizen-engaged, small-scale and short-term urban interventions can mobilize Nbs in practice, we argue that rather than expanding the scope of Nbs, scaling down its measures through the implementation of temporary urban interventions may facilitate the integration and widespread adoption of Nbs in urban contexts. Recognizing that natural responses in the urban environment cannot be conceptualized in isolation from social resolutions (McGrath et al., 2023), this study examines how communities can play a role in catalyzing Nbs through temporary interventions.

The paper engages with the intersecting literature on nature-based solutions (Dorst et al. 2019; Kabisch et al., 2016) and the practical dimensions of temporary urbanism (Stevens & Dovey, 2022; Lydon & Garcia, 2015; Bialski et al., 2015; Oswalt et al., 2013), bringing them into dialogue to inform a new conceptual approach. Structured as a two-part research study, the first part develops the theoretical groundwork, while the second presents product-oriented research that builds upon the insights derived from the theoretical exploration. Regarding the former, the paper acknowledges the recent trends and traits of temporary interventions in urban space within the context of nature-based urban solutions, with a particular focus on the motivations and processes in creating permeable urban grounds. In terms of the latter, through practice-based research and adopting prototyping as an experimental research method, it further situates these concerns within urban interstices that go unnoticed in everyday life—along roadsides, between cracks in the pavement, unattended urban planters that become dumping grounds—such minuscules that are overlooked by local authorities due to their small scale. Exploring the potential of spontaneous propagation and ephemeral nature of plants in these urban interstices, the study attempts to respond to how such spontaneity can be further cultivated through civic imagination, and how these nature-based temporal interventions in the urban environment strive without human assistance for maintenance.

[2]These Instances include the Grand Canal Linear Park designed by 128 Architecture and Urban Design in Mexico City, Sankt Kjeld's Square & Bryggervangen designed by SLA in Copenhagen, Rachel de Queiroz Park designed by Architectus S/S, in Fortaleza, Brazil, Qunli Stormwater Wetland Park designed by Turenscape, in Haerbin City, Northern China.

[3]These instances include but are not limited to transforming car-oriented landscapes by offering permeable platforms, redefining vacant spaces with gardening practices and community gardens, turning underutilized water basins into learning spaces, and pavement guerilla gardening practices located at various urban spaces. For a detailed catalogue of temporary urban interventions, *see*. Ho and Douglas, (2012). *Spontaneous Interventions: Design Actions for the Common Good*, Washington, DC: Architect/Hanley Wood.

The article unfolds in five sections: Following this introduction, Section 2 sets the ground for Nbs and temporary urbanism as two planning approaches addressing global challenges. It further visits a diverse array of temporary urban interventions tackling permeable urban grounds, and develops a conceptual framework at the intersection of nature-based solutions and temporary urbanism, grounded in the shared concerns and intentions of these fields. Section 3 operationalizes this framework by discussing the phases of a research experimentation covering its objectives, processes and outcomes. This experimentation focuses on the integration of ephemeral landscape installations aiming to explore innovative strategies for permeable surface solutions in urban spaces. The culmination of these research phases constitutes a civic urban guide discussed in section 4, proposing temporary nature-based interventions to enhance urban resilience, aspire people to engage with their environments, to foster a sense of ownership, with the potential for a lasting, albeit temporary, impact. These potentials are tested in practice through a workshop held in Izmir, Türkiye, the points of which we close in the concluding section 5.

2. Nature-Based Solutions and Temporary Urbanism: A Conceptual Framework for Integrating Two Planning Approaches as Solutions to Global Challenges

The dominant urban growth model seen globally in the 21st century has entered a critical period marked by climate change, loss of biodiversity, and other human-induced environmental crises, creating significant challenges (Mahmoud et al., 2022; Dorst et al., 2019; Bush & Doyon, 2019). In contrast to the predominant urban development model, nature-based solutions (Nbs) have emerged as an important planning approach that seeks solutions to these global issues. Introduced by the International Union for Conservation of Nature, Nbs are defined as "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" (IUCN, 2017). This approach seeks to improve urban resilience, looking for ways to replace the reliance on hard and grey infrastructure with green and blue alternatives (McPhearson et al., 2023, p. 2).

Notable projects such as the Grand Canal Park in Mexico City, which reclaims a neglected 70,000 square-meter canal through environmental regeneration and reforestation, or the Stormwater Wetland Park in Harbin, China, which revitalizes a dying wetland by transforming it into a green sponge supporting multiple ecosystems, have become emblematic examples of Nbs. While these examples could be expanded further, they clearly demonstrate the long-term benefits of ecological restoration without ignoring the needs of local communities. However, a common feature and a mentioned discussion among these renowned projects is their larger scale, which requires extensive planning and implementation timelines (EEA, 2023; Odongo et al., 2022; Vojinovic et al., 2021). In connection with these concerns, the literature also emphasizes the lack of a systematic approach (Odongo et al., 2022) and the absence of clearly defined principles (Kabisch et al., 2022; Dorst et al., 2019) in Nbs, thereby highlighting the need for a conceptual framework, which is addressed in this section.

Building on these concerns, this section is grounded in the main premise that Nbs can be mobilized through temporary urbanism, a planning approach that engages with small-scale, low-cost, low-tech and experimental planning approaches. In conjunction with recent international scholarship discussing the field, temporary practices are approached from different perspectives, summoned as tactical (Rossini, 2018; Stevens & Dovey, 2022; Lydon & Garcia, 2015), guerrilla urbanism (Hou, 2010; Hardman et al., 2018; Mikadze, 2015), interim (Colomb, 2017), or indeterminate (Groth & Corijn, 2005). These varying connotations affirm that temporary interventions offer alternative approaches to addressing shortcomings in traditional urban development, including unsanctioned, unexpected, and meanwhile operations. The rationale for integrating temporary urbanism into Nbs lies in the practices' inherently temporality. This temporality becomes both an instrument and an asset in the reimagining of urban space

(Madanipour, 2017), allowing for the rapid implementation of short-term experimental projects. Examples such as guerilla gardening, pop-up parks, and community gardens are both well-established labels and forms of temporary urban interventions, often driven by ecological imperatives in response to climate change adaptation (Stevens & Dovey, 2022, p. 42).

Consequently, although these fields may initially appear distinct, this section identifies their commonalities and argues that their convergence holds significant potential for advancing climate resilience and spatial justice in urban environments. While this study particularly focuses on the contribution of temporary urbanism to Nbs, it should also be acknowledged that bridging these two fields offers mutual benefits: temporary urban interventions can act as catalysts for short-term and small-scale strategies within Nbs, while Nbs can provide ecologically embedded solutions for temporary practices.

The growing body of Nbs literature emphasizes the potential of Nbs (1) to provide sustainable and resilient innovations for incorporating elements of nature into urban areas (McPhearson et al., 2023; Bush & Doyon, 2019); (2) be cost-effective and applicable at multiple scales by replacing hard and grey with soft and green urban infrastructure (Vojinovic et al., 2021); (3) and respond to societal challenges rather than aiming only at technological solutions (Almenar et al., 2021; Kabisch et al., 2022). These three interconnected potentials - natural elements, scalability and social challenges - are also explicitly or loosely relevant to temporary urbanism. Among them, natural elements and scalability are implicitly linked with temporary urban interventions, while addressing social challenges are intrinsic to the bottom-up character of such practices. The following subsections draw on these three common threads, providing information from the literature on temporary urbanism and related urban implementations to discuss how these practices may mobilize Nbs in practice.

2.1. Natural Elements

As with Nbs, incorporating elements of nature into urban areas to increase urban density is among the concerns of temporary urban interventions. Just as urban intensification in temporary interventions refers to harnessing the potential of vacant or underutilized urban spaces by enhancing "both the volume and the variety of users and uses", renaturalization of urban spaces also becomes "a form of intensification because of its focus on improving ecological performance" (Stevens & Dovey, 2022, p. 35). Such renaturalization of urban spaces as a temporary form of urban intensification is evident in the replacement of parking lots with parklets as small parks, the transformation of waste sites into wild landscapes, or the introduction of pop-up parks and guerilla gardening practices. While these practices depart from different concerns and premises, such as the revolts against the car-dependent urbanization in the parklet movement (Lydon & Garcia, 2015, p. 132) or the renegotiation of spatial rules through the appropriation of public spaces in guerrilla gardening (Mikadze, 2015), the environmental concerns that encompass these practices have been further interpreted by temporary urbanism scholarship as "transitional ecology" (Kay et al., 2019) or "civic ecology" (Krasny & Tidball, 2012).

An example relevant to this scholarship is the practices of the Depave,[4] a citizen initiative launched in Portland in 2006. Depave has been removing asphalt and concrete surfaces in order to restore the natural environment, thus reducing the risk of flooding by creating alternative drainage areas for stormwater. To this day, Depave continues to collaborate with local governments, enabling communities to respond to climate change through urban re-greening and address environmental and social inequities. In a similar vein, tile-popping[5] campaign, which started as a playful idea by civil society organizations during the Covid-19 period, has become a rivalry between the two Dutch cities of Rotterdam and Amsterdam. The competition, which involves replacing

[4]To view the practices of Depave organization, visit the link at https://www.depave.org/, Accessed December 15, 2024.

[5]Although there are guidelines organizing the Tile-Popping campaign, residents can remove tiles from their front yards without any consent by the relevant municipalities. See https://www.rotterdam.nl/geveltuinen. https://www.theguardian.com/environment/2024/apr/04/we-need-to-accept-the-weeds-dutch-towns-compete-to-remove-the-most-garden-paving, Accessed January 20, 2025.

pavement tiles with shrubs, grass or other greenery, becomes a way of empowering residents to create more permeable surfaces and to promote natural spaces in the cities (Figure 1).

Similar concerns are addressed at the material scale in the works of Urban Reef,[6] which incorporate bio-based algorithms and 3D printing techniques to prototype reef-like structures. The designs of Urban Reef explore how such forms can generate diverse microclimates and capture rainwater, complementing existing urban drainage networks. These explorations are also spatialized in the public realm through innovative construction approaches, such as the Hi-Fi project,[7] a zero-carbon, compostable cluster of circular towers made from discarded corn stalks and mycelium. Altogether, these instances demonstrate that temporary practices in the urban areas provide environmental benefits that are also recognized for their contribution to reducing the heat island effect, balancing microclimate and stormwater surges (Mata et al., 2019; Stevens et al., 2024).

Figure 1 De-tiling practices in the Netherlands (left column) and practices of depave (right column) (Source: https://www.nlvergroent.nl/ & https://www.depave.org/)

2.2. Scalability

While these instances in the context of environmental restoration might remain limited in providing a thorough perspective on the full scope of temporary urbanism, they do underline the potential of spatial and temporal scale in these practices (Stevens & Dovey, 2022, p. 17-32). Consequently, the question of scalability is implicitly linked to the nature of temporary interventions, as small-scale actions encourage quick and tactical implementations alternative to larger-scale urban strategies that take time, while short-termism allows for the escape of master plans that address global capitalism respectively (Oswalt et al., 2013). Responding to these two dimensions of scale is the practice of guerrilla gardening, a label associated with temporary urbanism that emerges as a direct and unauthorized response to neglected spaces (Douglas, 2014, p. 10). Bringing nature to vacant or abandoned spaces, guerrilla gardening practices are largely small in scale in terms of seed bombs being practiced in sites with limited spatiality, transforming them into spaces of nature with basic tools needed (Mikadze, 2015). These practices of sowing the

[6]Urban Reef is a research and design platform that creates open-ended habitats to encourage the growth and diversity of life in urban settings. For further information, visit https://www.urbanreef.nl, Accessed July 25, 2025.
[7]Hi-Fi project has received an award for sustainable construction https://www.holcimfoundation.org/projects/hy-fi, Accessed July 25, 2025.

seeds of seasonal plants, are also of a temporal scale, dependent on the legal status of the vacant land that is in limbo and the ephemeral landscape they offer.

The state of in-betweenness, both spatially and temporally, also becomes a tactical approach, where modularity is a common design response in temporary practices. An instance of modularity can be traced in the ECObox project, with recycled wooden pallets defining the basic module of a community garden on a derelict site (Petrescu, 2013). The creation of a public space that the community can build with pallets allows the spatial scale to expand over time, but also encourages the dismantling of the design due to the limited temporal scale offered by the space (Figure 2). As well as being linked to the design response to a problem or defined by the material chosen, modularity can also be determined by the imposed architectural and urban standards. In another temporary practice, the Urban Hives project, the scale of the incorporation of urban gardens into the hard surface of public spaces is determined by the size standards of car parks (Figure 3). By offering an elevated modular structure, the project can grow with the occupation of further car parks, as well as being easily assembled and disassembled. In this respect, modularity could hold potential for the further development of nature-based solutions, with innovative and creative responses that are scalable in public spaces.

Figure 2 Ecobox project, realized by aaa, 2001-2006 (Source: www.urbantactics.org)

Figure 3 Urban hives, realized by Natalie Harb, 2018 (Source: www.nathalieharb.com)

2.3. Social Challenges

A third and a final commonality between Nbs and temporary approaches lies in their response to societal challenges. Nevertheless, the manner in which social challenges are addressed is slightly different in the two approaches. In the context of Nbs, climate change and extreme weather events pose major threats to urban systems, necessitating solutions that go beyond ecology to also consider the long-term impacts on urban communities (McPhearson et al., 2023). In this regard, social challenges arise as consequences of global environmental crises and are addressed within nature-based projects as part of a broader response to these issues through the promotion of equity and enhancement of urban liveability. While Nbs treat social challenges as secondary effects of global environmental crises, serving social needs, in contrast, become primary triggers for action through temporary interventions.

By directly shaping and encouraging practical solutions in the city, temporary interventions are known to deliver "less tangible changes and more socially aware practices" (Tardiveau and Mallo, 2014, p. 456). Social awareness can take place through temporary urban interventions that are directly initiated by residents, as well as through participatory processes that are initiated by designers and trigger the engagement of the community. Consequently, the social role of temporary interventions is contingent upon an underlying sense of socio-political agency and involves efforts to revise or reinterpret existing structures (Wortham-Galvin, 2013, p. 23). These efforts to (re)define public spaces for social encounters can be seen in the practice of guerrilla gardening, or in the closing of laneways and the creation of parklets. Similar concerns have recently started to be addressed in the Nbs scholarship as "social-natural solutions", which refers to the consideration of material solutions where socially produced spaces and natural processes intersect (McGrath et al., 2023). In this context, and as seen in the aforementioned instances, temporary approaches that provide unexpected events and social encounters in public spaces foster new social relationships in urban public spaces (Rossini, 2018), thereby strengthening community engagement by providing less hierarchical relationships and welcoming underserved groups.

2.4. Researching the Materiality of the Conceptual Framework

As discussed in the introduction, despite the varying scopes and objectives of Nbs and temporary urban practices, a literature review and an overview of selected works across diverse scales and contexts reveal the emergence of a common trajectory underlying both fields. While the instances illustrated in this section are not exhaustive, they serve as a departing point for identifying the commonalities that give rise to them. These common concerns demonstrate how temporary interventions can potentially mobilize Nbs in practice, thereby playing a critical role in raising awareness and fostering engagement with the global challenges addressed by Nbs. Furthermore, the increasing recognition of Nbs not only at the macro scale, but also at the meso to micro scales (Tozer et al., 2023), from green roofs and walls to planters on apartment balconies, further reinforces the potentials for practical openings that temporary urbanism can offer in the field of Nbs. From this perspective, therefore, it is possible to acknowledge that temporary interventions that address the renaturalization of urban spaces in their concerns can also be considered as Nbs.

With these commonalities forming a conceptual framework, this study outlines the early-stage development of a product solution. The product development process serves as a means of operationalizing the proposed framework, translating theoretical insights into practical strategies that address both ecological concerns and urban adaptability. Emphasis is placed on identifying spatial and material strategies, with the intent to test how such an approach might function at a smaller, replicable scale within the urban fabric. Nonetheless, it is important to mention other areas, such as biomaterials and parametric research, that could trigger nature-based solutions in urban environments. These fields have the potential to provide information for temporary approaches, yet they largely remain context-free. Although acknowledging these fields, this study excludes them from its scope.

While the preceding subsections attempt to construct a conceptual framework that concurrently outlines a corresponding product vision, it is equally important to interrogate how these ideas materialize through practice. Therefore, it should be acknowledged that the components of the framework should be evaluated not only as separate stages in the research process, but also as defining features of the final product, which aims to raise social awareness on ecological issues. This dual role, both analytical and generative, positions the framework as a guide for action-oriented inquiry. In the following section, the focus shifts toward the experimental research phase, where each design move is examined in relation to its conceptual underpinnings and practical implications. By tracing the material development and implementation processes, this phase aims to ground abstract theory in lived, spatial interventions, further reinforcing the civic relevance of the work discussed in Section 4.

3. Ephemeral Landscapes: Prototyping Nature-Based Solutions via Temporary Interventions

Situated within these literature intersections, this section takes a closer look at how temporary urbanism in the context of Nbs may potentially unfold. It introduces Ephemeral Landscapes, a project that is developed as a continuation of research-oriented and product-oriented experimentations, integrating these approaches into practice.

In Ephemeral Landscapes, research-orientation stands for the exploration of how nature emerges in impervious urban landscapes. This approach is parallel to the recognition and understanding of urban wildlife, which has been a subject of interest since the 1970s (Page & Weaver, 1974) and continues in contemporary temporary urban practices (Seiter & Future Green Studio, 2016). Emphasizing the important role of urban weeds in erosion control, stormwater management, and climate mitigation, this orientation extends beyond mere research by exploring the ways to harness the potential of not only wild plants, but also urban plants in general, through their practical application in urban landscapes, leading to product-oriented implementations. In temporary urban practices, product-oriented approaches generally experiment with nature-based interventions, embedding them within urban landscapes in more exploratory ways. While some works question the quality of soil and water in urban spaces and raise awareness of growing food in public spaces, others fall into the exploration of material development, critiquing urban waste at the nexus of industry and ruins, giving new life to industrial by-products through the mixing of nature. Despite the different objectives in product-orientation in temporary interventions, a common goal is to allow nature to take root within built environments, creating dynamic vegetation systems through material experimentation.

The Ephemeral Landscapes project is developed against this backdrop as a continuation of research and product-oriented experimentation. As discussed in the previous section, guerrilla gardening practices were the inspiration for this project (Mikadze, 2015), and an important component of these practices, seed bombing (Marris, 2013), in which seeds are placed in clay and compost to protect them from environmental conditions and promote germination, was adopted. The Ephemeral Landscapes project follows this simple yet effective technique for the introduction of vegetation in impermeable urban environments, with a particular focus on overlooked urban interstices—small and unnoticed spaces with significant potential. To achieve this goal, the aim is to develop a versatile tile that can come in multiple forms and with flexible condiments which can function both on vertical and horizontal surfaces. Facilitating plant growth on impermeable urban materials like concrete without requiring substantial soil depth, seed-embedded tiles offer a bottom-up approach to urban natural restoration, bridging research and product-oriented experimentation while extending the possibilities of Nbs through temporary urbanism.

This section explores the integration of nature-based temporary installations into urban landscapes through the processes and outcomes of the Ephemeral Landscapes project. Adopting small-scale, low-tech and low-cost approach, the project includes innovative alternatives for permeable surface solutions that can be adapted to urban environments. The research and product-oriented studies consist of three stages that correspond to the three key themes derived

from the literature in the previous section: (1) experimentation: incorporating nature-based aggregates, (2) fabrication: forming scalable and modular tiles, and (3) dissemination: creating social value through workshops. The following subsections discuss these stages separately. However, it is important to remember that these stages are interrelated, creating a nonlinear process in which each stage informs the others.

3.1. Experimentation: Incorporating Nature-Based Aggregates

Starting from the concern of unlocking the potential of urban interstices that go unnoticed in everyday life —along roadsides, cracks in the pavement, derelict urban planters that turn into landfills that become dumping grounds— the main objective of the project is to develop a nature-based aggregate that is capable of creating durable yet biodegradable surfaces that support plant growth. Since the literature overview has demonstrated the potential benefits of integrating vegetation into urban infrastructures, highlighting its role in enhancing environmental resilience (Mata et al., 2019; Stevens et al., 2024), the project aimed to identify an optimal solution through design innovation in material experimentation.

To start the research process, initial experimental studies were carried out in a controlled environment. The selection of appropriate materials formed a critical step, with ceramic clay—both in its solid and liquid forms—chosen as the primary binding agent due to its formability, durability, environmental sustainability, and moisture-retention properties. These potentials of the clay made it easier to combine the seeds as the green agent without harming them. Furthermore, feeder agents of soil and peat were added to improve the mix's properties for seed propagation, aerator agents such as straw, sawdust and perlite were added to improve the permeability and texture of the design (Figure 4). The initial seed selection focused on plant species known for their resilience and ability to adapt to different environmental conditions. Various seed combinations, including quinoa and lentil seeds as legumes, were tested to assess their suitability. By systematically measuring variables such as soil and binder composition, frequency of watering and sunlight exposure during a series of controlled trials, the most suitable seed varieties for the ideal clay-to-seed ratio and ideal tile sizes were identified (Table 1).

Figure 4 Initial experiments in Ephemeral Landscapes (Source: Authors)

Table 1 Key Components for a Seed Tile

RATIO	Key Components for a Seed Tile			
	1	2	3	4
	Binder Agent	Feeder Agent	Green Agent	Aerator Agent

	45-50%	25-30%	5-10%		15-20%
	Liquid Clay	Peat	Edible	Microgreens	Mist of Water
	Solid Clay	Soil		Quinoa	Perlite
		Egg Shells		Lentil	Straw
		Coffee Grounds		Wheat grass	Wood chips
			Non-edible	Wildflower seeds	
				Clover seeds	
				Groundcover mix	

The process of achieving an optimal mix is influenced by several key factors, including the choice of plants (e.g. seeds, legumes, edible greens or flowering plants), the type of soil and peat as nutrients, and the aeration agents (e.g. sawdust or wood chips) in appropriate proportions. The following is a discussion of the efficacy of these different blends that have been tested with different ratios and in different contexts.

3.2. Fabrication: Forming Scalable and Modular Tiles

Once the settling of the ideal ratio of materials and the optimization of the conditions for securing seed propagation, product-oriented explorations were initiated. To ensure that the seeds remain viable and the tiles retain their structural strength, the production procedures are based on two standard methods of ceramic production: slab making and slip casting. In the former, the mixture was formed into triangles by hand, while in the latter, the slip-casting technique, liquid clay was poured into triangular plaster molds to form the tiles (Figure 5). The triangular shape of the mold was chosen for its ability to create different patterns when assembled in different ways. Circular shapes were not preferred because of the difficulty in creating interconnected patterns as they do not line up smoothly. However, fragility was evident at the corners of the preferred triangular and polygonal shapes.

Figure 5 Experiments with liquid clay, lentils and mixed seeds (Source: Authors)

As for the thickness and the size of the tiles, liquid mixture was poured into a plaster mold with thickness of approximately 2.5 cm, with an additional half-centimeter drying allowance. In contrast,

handmade slab tiles were shaped into equilateral triangles with sides measuring 10 cm. To assess plant growth, soil stability, and watering frequency requirements, prototype tiles were then placed outdoors over a soil ground, with some covered by a membrane underneath and others left directly on the ground. The process was analyzed through direct observation and taking notes. Within a few weeks, seeds sprouted rapidly, and as rainfall gradually dissolved the tiles, they adapted to their surroundings, forming a uniform green layer (Figure 6). The tiles attracted stray animals, but unlike traditional open-field seed dispersal, which is often disrupted by animals, the tiles provided a protective structure that prevented seeds from being scattered or consumed.

Figure 6 First experiments of vegetated tiles with quinoa seeds (Source: Authors)

Building on these initial insights, the trial extended to the urban landscape in the Bostanlı district of Izmir, specifically targeting the impermeable, unattended concrete grounds. A neglected urban planter that turned into a dumping ground was identified as problematic where vegetation also struggled to thrive due to insufficient soil depth. To overcome these challenges, the project aimed to offer a practical and sustainable solution by placing the fabricated seed tiles in this urban setting and monitor their performance, particularly focusing on how they respond to natural irrigation (Figure 7). In this regard, the field testing provided a comprehensive opportunity to assess the tiles' effectiveness in fostering plant growth while also proving their potential to address urban environmental issues, such as limited vegetation growth, and the enhancement of soil permeability.

Figure 7 Field test in a neglected urban planter in Bostanlı, Izmir (Source: Authors)

3.3. Dissemination: Creating Social Value with Workshops

The research conducted in the previous subsections on nature-integrated, scalable, and modular solutions led to the development of the "seed tile", where sharing it with the public was planned as the next step. To trigger public engagement and the potential for a bottom-up adoption, a workshop was organized as a part of the World Creativity and Innovation Day designated by the United Nations. This special day not only played an important role in sharing the results of the

research as an innovative natural solution in the city, but also provided an opportunity to disseminate a bottom-up approach to the production of seed tiles. The goal was to share the methodology and allow participants to replicate the production process within their own communities and urban environments. Organized in an academic setting, the full-day workshop brought together a diverse group of participants, including students and academic staff. During the workshop, various tile options were explored, including the assessment of different clay types and their compatibility with various soil and seed compositions (Figure 8-9-10-11).

Figure 8 Workshop materials: Various types of clay, seeds and soil (Source: Authors)

Figure 9 Workshop with high school students interested in studying design: Preparation phase at the Faculty of Fine Arts and Design, Izmir University of Economics

Figure 10 Workshop with high school students: Production phase at the Faculty of Fine Arts and Design, Izmir University of Economics

Figure 11 Workshop with administrative and academic staff during the seed selection phase, conducted at the Faculty of Fine Arts and Design, Izmir University of Economics

About 15 participants took part in the morning and afternoon sessions, preparing mixtures of different types of clay and applying them to printed patterns. Afterward, the tiles were placed on the gravel floor of a roof garden (Figure 12-13). It was at this point that the effectiveness and adaptability was tested, particularly in terms of engaging participants via a collaborative working environment and fostering a sense of ownership for the project. However, the lack of rainfall during the extremely hot summer month became a research limitation and the intended goal of promoting a natural environment over the impervious roof garden was not realized. Nevertheless, the active involvement in product fabrication and the positive reception of the activity demonstrated the potential for broader public engagement and interest in the project as some participants took seed tiles to their home environments to test their effectiveness, further extending the experiment beyond the workshop setting.

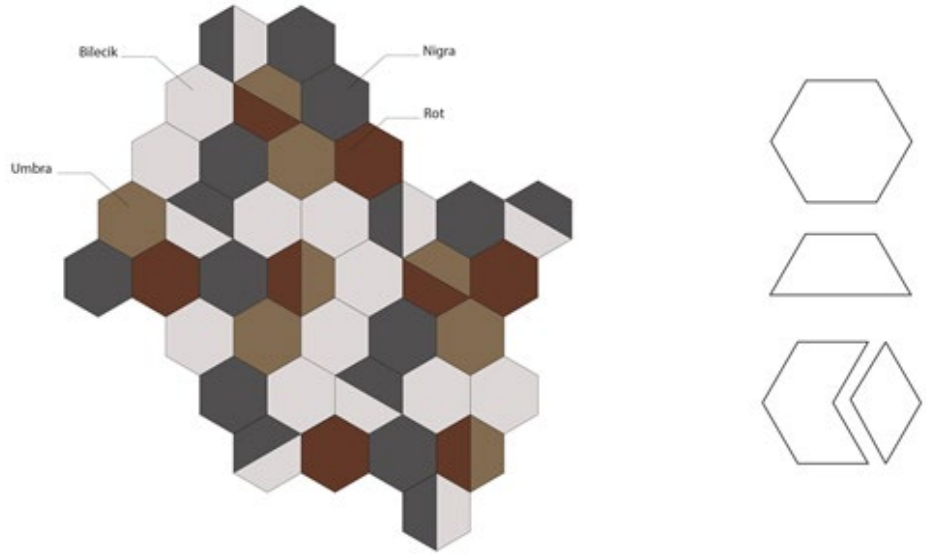

Figure 12 Tile pattern alternative (Source: Authors)

Figure 13 Testing the tiles on the roof garden (Source: Authors)

4. Learning from Ephemeral Landscapes

The research and product-oriented experimentation phases mentioned above revealed several lessons about the limitations and potentials of the project, including the diversity of the seeds and the performance of the seed tiles. Regarding the former, and relevant with the experimentation phase of seeking the optimum aggregate, tiles containing seeds such as lentils exhibited the fastest growth rate. However, larger seed's strong root systems have been the cause of tile cracking. In contrast, smaller seeds, such as chia seeds, produced weaker root systems that spread over the top and bottom surfaces, effectively covering the tiles and demonstrating their permeability while maintaining structural integrity. The larger and smaller seed types thus have distinct advantages and disadvantages: the mix with the larger seeds promotes rapid vegetative growth but damages the tile integrity, while the smaller seed mix maintains the tile's shape and provides a uniform ground cover without causing breakage.

In terms of the latter factor, tiles produced with slip-casting technique demonstrated greater fragility and were more prone to breakage compared to those handmade slab tiles. Although the problem of fragility is a disadvantage in the transportation of tiles, the slab technique remains more

advantageous than slip casting because it requires less equipment and therefore less intensive human labor. Yet, the efficiency of the fabrication processes depends on the surface area desired to be covered, thus the number of people involved in the production, how fast the results are aimed and the desired thickness.

Despite these two limitations, small-scale production still makes the transportation of the tiles viable, while their modular structures make them adaptable to the context. Timing and outdoor conditions also remain critical for optimal results. Along with these advantages, the process of tile making demonstrates the potential for social awareness of the presence of neglected urban spaces and their impervious conditions. A series of further workshops, organized with participants coming from different backgrounds and age groups,[8] aimed for social awareness where participants began to recognize design not only as a formal practice but also as a playful reconnection with social and environmental relevance. These findings, both from the material experimentations and engagement with participants, reveals a pathway to promoting innovation in design through community-driven approaches. Although such urban interventions remain temporary in nature, inspiring public engagement can foster a sense of ownership that can potentially have a lasting impact.

Together, these learnings from the Ephemeral Landscapes project present the possibility of a civic guide that can foster bottom-up, nature-based temporary interventions, where citizens produce tiles by their own means due to material simplicity. The proposed civic guide has the potential to work as a how-to manual, and by following these steps, it bears the potential of becoming a speculative tool for engaging with urban interstices. In Table 2, these steps are presented through actions, descriptions and considerations to simplify the product-oriented process. This civic guide is planned to be disseminated through community workshops, printed distributions in relevant contexts, or digital platforms. Through this dissemination, the project aims to raise public awareness of nature-based solutions, as well as to build collective imagination for the long-term vision of permeable urban landscapes.

Table 2 Step-by-Step Urban Civic Guide for Ephemeral Landscapes

Step		Action	Description	Considerations
1	Spotting Urban Interstices	Identify underutilized urban spaces	Unattended planters, removed tiles, cracked surfaces, etc.	Scale, accessibility, and environmental conditions
2	Taking an X-Ray of the Spot	Estimate the rough volume & scale	Spatial dimensions to determine material needs	Sketches and photos from the site
3	Preparation of Ingredients	Mix materials	*See* Table 1. for details	Seeds selection in line with climatic conditions
4	Deciding the Form	Determine modular & small-scale units	Simple forms for small spots, multi-edged for larger spots	Stacking potential and water retention efficiency
5	Curing & Drying	Solidify tiles	A few days is necessary to ensure durability	Test for brittleness before installation
6	Urban Installation	Deploy intervention	Documenting growth & transformation	Vehicular traffic & human flow

[8]These workshops include a Children's Day event held in the same location and year, specifically organized for earthquake victims.

Civic guides, or as they are called - how-to manuals, handbooks, design guidelines or specifications - are already playing an important role in the implementation of temporary urban approaches.[9] These guidelines are increasingly being adopted by urban institutions and local governments,[10] and the tactical urbanism literature is recognized as a primary reference for presenting intervention models and their implementation (*see.* Lydon & Garcia, 2015; Stevens & Dovey, 2022). However, despite their institutional recognition, many of these guides run the risk of failing to engage directly with urban users, as they primarily inform designers rather than interacting directly with users. In contrast, the civic guide proposed by the Ephemeral Landscapes project seeks to bridge this gap by directly proposing an engagement with city users, empowering them to take action. In this regard, the guide proposed in the Ephemeral Landscapes remains analogous to open-source temporary interventions, such as those prompted by Recetas Urbanas,[11] wherein the project itself can be regarded as a toolkit that can be customized.

5. Conclusion

In the face of increasing threats from climate change and extreme weather events, this study acknowledges the inevitable role of nature-based approaches in increasing the permeability of urban landscapes. However, it emphasizes that this role can be further strengthened through temporary interventions. While we recognize that such temporary measures alone cannot solve the problems, by embracing transitional and civic ecology practices (Kay et al., 2019; Krasny & Tidball, 2012), they may serve a critical function in raising awareness in the long run, as they can be easily replicated and disseminated compared to many nature-based solutions.

As a response to this concern, the paper explored the intersection of literature on nature-based solutions and temporary urbanism approaches in the context of impervious urban landscapes through the Ephemeral Landscapes project. In doing so, it makes two key contributions to these seemingly disparate fields: first, by integrating them through the proposal of a novel conceptual framework; and second, by introducing a design-based method that operationalizes this framework.

Firstly, regarding the conceptual framework developed in this study, impervious urban landscapes can be approached through three key themes: incorporating natural elements into the design process, providing small-scale yet scalable solutions, and addressing social challenges through community-driven processes. While these themes contribute to ongoing discussions in the nature-based solutions literature, the exemplified global temporary urban projects upon which this framework is founded are only the starting point in imagining how temporary strategies can complement long-term nature-based interventions. In this regard, while the conceptual framework is open for contextualization, its themes are likely to be expanded and/or further refined as more practice-based approaches continue to be developed.

From this perspective, the case of Ephemeral Landscapes presented in this study derives its context from overlooked small urban interstices—impervious spaces that often escape the attention of planners and authorities due to their small scale. By exploring the spontaneous propagation of urban flora, particularly within guerrilla gardening practices (Hou, 2010; Hardman et al., 2018; Mikadze, 2015), it questions how temporary green interventions can be fostered through civic imagination.

The conceptual framework holds potential for adaptation across various urban and design studies: as this study has attempted, it can inform the objectives and phases of design research at the product scale; determine the contents of an urban guide that could play a critical role in urban

[9]For the most well-known ones, *see.* A Tactical Urbanism Guidebook, Mohankumar (2020); The Planner's Guide to Tactical Urbanism, Pfeifer, (2013).

[10]This is especially true of the parklet movement, which has been embraced by renowned cities such as San Francisco, Milan, Minneapolis, and Los Angeles.

[11]Recetas Urbanas, translated as *Urban Recipes*, is a collective founded by renowned guerrilla architect Santiago Cirugeda. For more information, *see*. www.recetasurbanas.net, Accessed January 2025.

policymaking; or serve as a pedagogical tool in design education. Covering these areas, the civic guide proposed in this study is a first step toward applying the conceptual framework in practice, and can be adapted to suit different contexts and uses. Since temporary urban guidelines are already integrated as tools in planning practices (Pfeifer, 2013), the informal and not widely adopted approach in the study also holds promise for future integration into policymaking processes as it gains recognition and support from local authorities.

This brings us to the second contribution of the study. Through the conceptual framework, which facilitates the dissemination of nature-based solutions via temporary interventions, this research also explores effective strategies for transforming hard-to-implement surfaces due to their scale. In this regard, operationalizing the conceptual framework via a design-based prototyping method assumes a dual role: it demonstrates how the conceptual framework can lead to practical spatial solutions, and how in turn this practical solution can contribute to environmental awareness via a civic guide.

By directly linking ecological awareness to the materiality of urban spaces, the project demonstrates how research-oriented product experiments can translate into low-cost, modular infrastructures that increase permeability and support the development of green spaces in urban voids. By integrating seed-infused tiles into urban landscapes, the study demonstrates how such innovations can support the natural and aesthetic diversity of cityscapes. Therefore, the environmental role of the seed tiles extends beyond their immediate function as a building material, aligning with the growing concerns of incorporating nature into urban design. The results of the product-oriented research process suggest that the appropriate selection of seed mixtures and their application during optimal seasons plays a crucial role in ensuring favorable plant growth, with plants thriving even in difficult environments such as concrete and low soil depths.

By simultaneously addressing both theoretical and practical approaches to the problem of impermeable urban landscapes, the civic guide that operationalizes the conceptual framework proposed in this study serves as a practical tool, bridging academic discourse and practice. While it is only a small incentive toward a nature-based, modular, bottom-up approach, it provides practical steps that can serve as a valuable entry point into the broader discussions on urban resilience at the intersection of nature-based solutions and temporary urbanism.

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CRediT Authorship Contribution Statement

Tuba Doğu: Writing – review & editing, Writing – original draft, Resources, Methodology, Conceptualization, Data curation. Hande Atmaca: Writing – review & editing, Writing – original draft, Investigation, Methodology, Conceptualization, Data curation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data Availability

Data will be made available upon request.

Ethics Committee Approval

An ethics committee decision is not required.

Resume

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