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The Role of Public Space in Building the Resilience of Cities: Analysis of Representative Projects from IFLA Europe Exhibitions

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Abstract: Climate change exerts a notable influence on the formation of public spaces, necessitating design solutions that address not only aesthetic and functional aspects but also adaptability to local environmental challenges. Public spaces in the form of streets, squares and parks constitute significant parts of cities, creating an opportunity to adapt to climate change through the proper use of ecosystem services. Through the examination of 114 projects from 29 countries showcased in two IFLA Europe exhibitions, this study assesses the extent to which contemporary public spaces integrate responses to prevailing environmental issues and locally contribute to climate change mitigation efforts. The results reveal a discernible rise in the incorporation of environmentally sustainable strategies within projects, particularly those focused on mitigation, protection, reuse, recovery, and education. Additionally, the identification of projects demonstrating the spectrum of responses to local threats is outlined. This research underscores the pivotal role of public spaces in ameliorating the local impacts of climate change within urban environments, emphasizing the increasing prevalence of such solutions in recent years and advocating for their formal recognition in contemporary principles guiding public space design.

Keywords: climate change adaptation; resilient landscapes; climate-responsive design; landscape architecture; sustainable cities

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1. Introduction

Climate change is one of the most painful environmental problems [1], exerting an escalating impact on both human societies and natural ecosystems [2]. Notably, over the last decade, a discernible intensification has been observed [3], marked by conspicuous alterations such as rising air temperatures, varying precipitation patterns, proliferation of extreme weather events, sea level elevation, floods, droughts, and wildfires. The factors mentioned above are progressively reshaping the landscape and everyday life of European citizens [4]. They constitute one of the most important design challenges today. The problem affects both the Mediterranean region and the Arctic areas in the northern part of the Old Continent [5], it affects both urbanized areas and rural areas. Cities, owing to their intricate physical and socio-economic characteristics, emerge as particularly susceptible to the vagaries of climate and weather phenomena. The extent of threats depends on topography, location, and the efficiency of urban resilience strategies [4].

In this context, the essential inquiry arises regarding the potential role of newly developed and transformed public spaces amidst the challenges posed by climate change. Public spaces understood as inclusive and accessible areas include squares and streets, as well as green spaces in the form of parks and public gardens. Can their design effectively mitigate adverse environmental impacts while enhancing urban quality of life? The executed projects in both architecture and landscape architecture, as well as urban planning, present compelling subjects for investigation. They afford insights into prevailing design trends within specific locales over recent years. Such an investigation was undertaken, leveraging projects nominated for The European Union Prize for Contemporary Architecture—the Mies van der Rohe Award—revealing distinct morphological characteristics of public spaces concerning their proximity to water [6]. Similar investigations were undertaken in Hunan Province, China, a region prone to recurrent calamities. The resultant insights proffer applicability to urban contexts globally, underscoring the universality of urban resilience as a research purview transcending European confines. The study evinces a robust correlation between urban resilience and urbanization, signaling burgeoning polarizing tendencies. Spatial distribution analyses reveal a progressive attenuation in interconnectivity between central urban hubs and outlying regions [7]. Public spaces, notably parks, transcend mere recreational and social functions, serving as natural climatic refuges, offering respite amid extreme thermal conditions. Barcelona, Spain, serves as a case in point, wherein deliberate interventions have been enacted to ameliorate escalating temperatures. These spaces afford shelter from heat, enhancing both resident and visitor senses of security and comfort [8]. Urban frameworks must also contend with disruptions stemming from human activities—an expanded inquiry was conducted in Genoa, wherein researchers grappled not solely with threats such as the 2011 deluge, but also with the collapse of the Morandi Bridge in 2018. These instances serve as exemplars of the "learning by doing" paradigm, elucidating how urban centers adeptly navigate crises through the concerted engagement of diverse stakeholders [9].

Cities persistently refine their climate policies, with discernible emphasis on instituting stringent adaptive strategies concerning water resource governance, complemented by a burgeoning emphasis on nature-derived solutions. Notably, the environmental dimension emerges as paramount, with endeavors concentrating on land-use metamorphosis, flood alleviation, and reinforcement of adaptive capacities [10]. Such inquiries can furnish succor to municipal authorities, policymakers, and academic institutions in evidence-driven decision making pertinent to the management and augmentation of public spaces [11]. They prove salutary in safeguarding broadly construed cultural landscapes, underpinned by political, social, and economic backing to secure their resilience [12]. Promisingly, they constitute interlinked systems capable of proffering remedies to climate-related conundrums [13]. Scrutinizing the interplay between landscape design and assorted climatic exigencies, along with delving into foundational interrelations between landscape design and climate, engenders the orientation of decision-making processes and the issuance of prescriptions for prospective paradigms [14]. These revelations foster comprehension of the dynamics of urban susceptibility to threats and the formulation of management strategies predicated on delineated benchmarks [15]. Urban Climate Action Planning assumes precedence for cities endeavoring to curtail greenhouse gas emissions and fortify climate resilience, aligning with imperatives articulated in the New Urban Agenda and the Paris Agreement [16]. This necessitates large-scale actions such as building green and blue infrastructure systems [17]. Moreover, attention to micro-level interventions, including the revitalization or modernization of existing public spaces, remains imperative [18].

The research was conducted on the basis of representative examples of European projects submitted to two editions of the IFLA Europe Exhibition (2018 Landscape architecture as a common ground and 2022 Reconsidering Nature). The exhibition presents the best implementations of public spaces in the field of contemporary landscape architecture. These projects were selected by the member associations of IFLA Europe, which currently (March 2024) brings together teams from 34 countries [19]. Notably, the selection process does not adopt a competitive framework for identifying the best European works; rather, it provides an overview of achievements across individual countries. Through examination of these, the contemporary approach to spatial design was scrutinized and characterized in terms of prevalence and efficacy. Additionally, an analysis was conducted to ascertain the extent to which these actions answer climate change threats, employing the delineation of the EU into NUTS 3 areas (French Nomenclature des unités territoriales statistiques) [20].

Moreover, based on representative projects within the domain of landscape architecture, a paradigmatic approach for this still nascent profession was revisited.

The study aims to scrutinize the influence exerted by the design of public spaces and innovative urban approaches in adapting to the new climate reality and endeavors to assess the capacity of public spaces to serve as crucial domains for environmental services, bolstering urban resilience against climate change. It is noteworthy that since 2007, adaptation to climate change has become integrated into the urban legislative plans of the member states of the European Union [21]. One outcome of the study entails a comprehensive analysis of design interventions that bolster urban resilience against the effects of climate change. It is acknowledged that over time, architects and landscape architects have increasingly recognized the significance of their roles in enhancing urban resilience. They emphasize such interventions as fundamental strategies within their designs. These findings offer valuable insights for potential adoption by future designers seeking to enhance the resilience of urban environments. Additionally, the research provides an assessment of the specific challenges that certain regions of Europe confront, elucidating potential hazards. This heightened awareness informs decision-making processes, particularly in urban revitalization initiatives, by highlighting factors that necessitate consideration for enhancing resilience to climate change. Specifically, the article explores the significance of public space design in shaping sustainable, multifunctional places in the context of the threats posed by climate change in European urban areas and evaluates the degree to which implemented projects effectively address local climate threats [22].

2. Materials and Methods

The analysis seeks to delineate design interventions targeting the alleviation of climate change impacts within urban settings. It endeavors to juxtapose these interventions with the predominant threats prevalent in distinct regions of Europe, aiming to generate an illustrative synthesis of strategies employed by designers within these locales to mitigate climate change effects. The subject of the research is projects submitted to two editions of the IFLA Europe Exhibition, which present examples of contemporary landscape architecture and representative implementations in the area of public spaces in most European countries over the last decade. The set of implementations chosen on a selection basis at the level of each country constitutes interesting research material in terms of the location, quality and quantity of pro-climate solutions contained therein. The required participation of landscape architects in the author's team means that these projects are multidisciplinary and initially focused on pro-ecological solutions.

A total of 114 projects from two editions of exhibitions were analyzed, including 61 projects from 23 countries submitted in 2018 and 53 projects from 20 countries submitted in 2022. These projects offer a panorama of diverse approaches, with the descriptions provided by their authors elucidating the fundamental design principles [23]. It is noteworthy that not all countries reported projects located on their territory. For instance, in the 1st edition, the project submitted by Ukraine was located in Azerbaijan. France has submitted a project located on La Réunion island. All 114 projects were taken into account in the first part of the research, which summarized actions aimed at improving the resilience of cities to climate change.

The initial phase of the study involved categorizing solutions into five main categories: mitigate, protect, recover, reuse, and educate. This endeavor aims to compile a comprehensive catalog of design interventions implemented by practitioners over the preceding decade. Such a compilation serves as a blueprint and benchmark for the development of future public spaces. Grouping these interventions into five categories facilitates the understanding of their goals and outcomes, thereby enhancing the ease of identifying suitable strategies to address impending climate shifts and enabling their amalgamation to forge more resilient public realms. The action areas were selected from the general classification of nature-based solutions (NBSs) [24] combined with four capacities outlined in the vulnerability framework—threshold capacity, coping capacity, recovery capacity, and adaptive capacity [25]—and implemented to the specific requirements of the analyzed projects. For each group, a list of design implementations was prepared, aiming to diminish the local impact of climate change on public spaces. A comparative analysis of both editions of the exhibition was carried out in terms of the above groups of activities, identifying the differences and similarities between them.

The data obtained from the first part of the study were verified in the context of local threats related to climate change. To this end, the geographic distribution of projects was juxtaposed with the delineation of Europe into NUTS 3 regions [20]. During the comparative analysis with data sourced from the Climate Risk Typology Map, only countries encompassed within its scope were taken into account. Leveraging information extracted from the exhibition [26,27], the projects were scrutinized for their incorporation of pro-environmental solutions, with particular emphasis placed on the adaptation of public spaces to climate change. Subsequently, an analysis of whether projects from specific regions took action to prevent particular threats faced by these urbanized areas was conducted. The results of the analysis are presented in the context of current challenges related to climate change in Europe. The scheme presenting the research methodology is shown below (Figure 1).

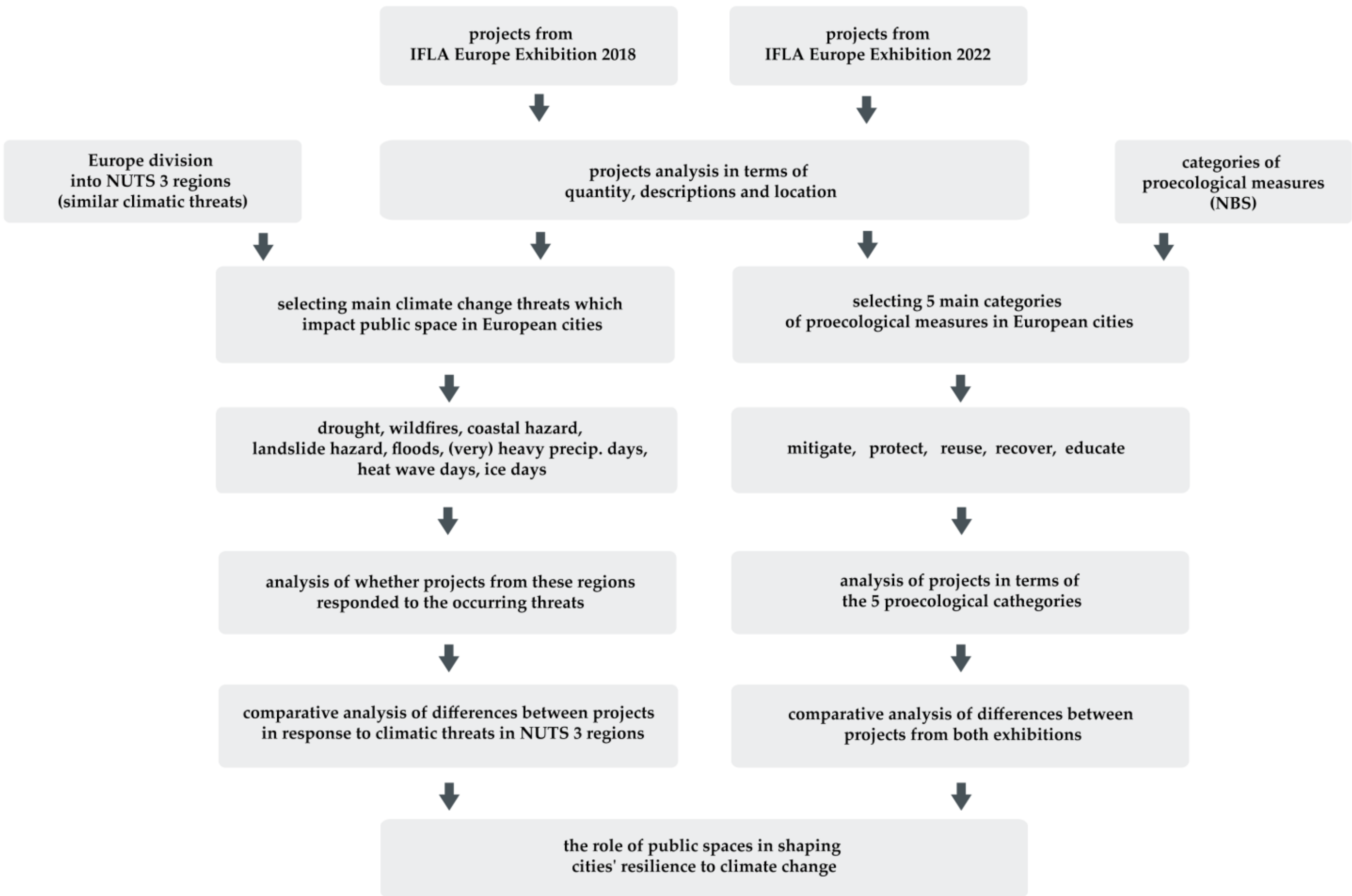

Figure 1. Graphical representation illustrating the research methodology and its objectives.

The study approach took into account the characteristics of representative projects based on the classification of pro-ecological activities, verification of compliance with local threats, and a comparative analysis of the two editions of the exhibition.

3. Climate Threats in Europe

Based on information published by the European Environment Agency (EEA) in Report No. 12/2020—Urban Adaptation in Europe: How Cities and Towns Respond to Climate Change, we can note that the elements most affected by climate change are and will be the following: the environment, biodiversity, and land forested [4]. The main expected and current impacts of climate change depend on the region of Europe [5]. Threats that directly affect urbanized areas in the European Union are described in the European Climate Risk Typology [20]. The segmentation into areas in this list was developed according to the hierarchical system of dividing the economic territory of the European Union—NUTS. In this particular case, districts belonging to NUTS 3 were distinguished as areas with 150,000–800,000 inhabitants [28]. These regions are visible in the illustration below (Figure 2).

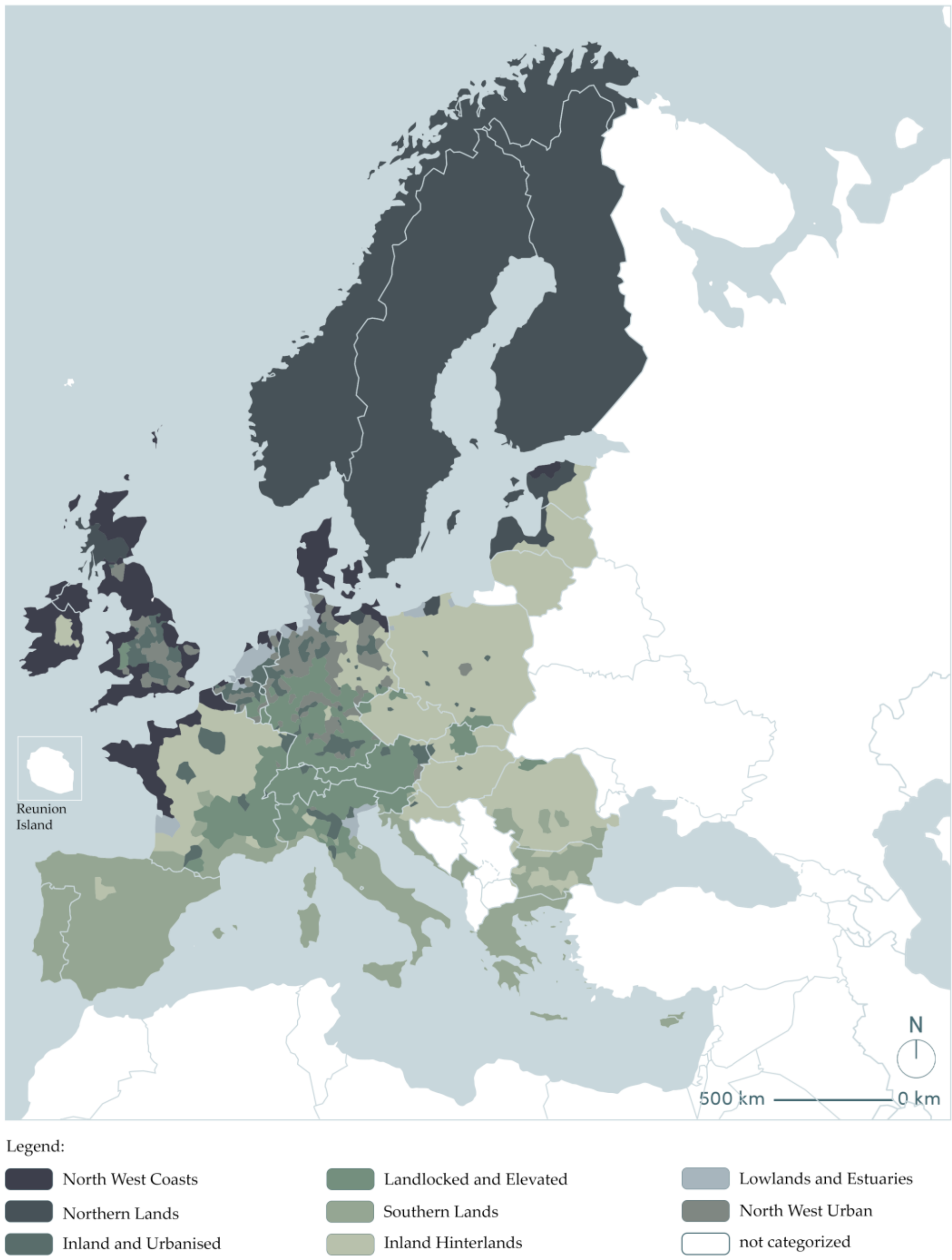

Figure 2. Division of the EU into NUTS 3 areas. Prepared by authors based on European Climate Risk Typology.

The table below presents the categories of threats related to climate change that should be particularly taken into account when designing urban spaces, divided into the above-mentioned NUTS 3 regions and information on whether the severity of a given problem in them is higher or lower than the European average (Table 1).

Table 1. Categories of threats related to climate change—division into NUTS 3 regions. Prepared by authors based on European Climate Risk Typology.

Region NUTS 3	Drought Hazard (D)	Wildfire Hazard (W)	Coastal Hazard (C)	Landslide Hazard (L)	Fluvial Hazard (F)	Heavy Precip. Days—p.c. (HP)	Very Heavy Precip. Days—p.c. (VP)	Heat Wave Days—p.c. (H)	Ice Days—p.c. (I)
Inland and Urbanized	0.14	−0.46	−0.51	−0.67	1.03	0.36	0.13	−0.06	−0.06
Inland Hinterlands	−0.46	0.66	−0.52	−0.39	0.58	0.19	0.04	0.44	0.51
Northern Lands	0.85	0.28	0.72	−0.06	−0.2	1.04	0.69	−1.15	1.85
Southern Lands	−0.48	1.04	0.37	0.9	−0.49	−1.49	−1.4	1.36	−1.14
North West Coasts	0.44	−0.31	1.89	−0.53	−0.76	0.02	0.22	−1.03	−0.63
Landlocked and Elevated	−0.03	−0.45	−0.56	1.03	0.01	0.39	0.65	−0.23	0.58
North West Urban	0.26	−0.79	−0.48	−0.57	−0.84	0.23	0.24	−0.54	−0.04
Lowlands and Estuaries	0.69	−0.24	1.45	−1.08	1.57	0.51	0.16	−0.56	−0.33

The following threats were taken into account (based on the European Climate Risk Typology [20]):

- Drought hazard—referring to data published by the EEA (EEA 2009: 11), drought is defined as the persistent and widespread occurrence of water availability below average. The index provides a measure of meteorological drought using the Standard Precipitation and Evapotranspiration Index (SPEI) on nine-month time scales. A location with rainfall below the European average over a nine-month period is indicated by an SPEI value of less than zero. A location that receives rainfall above the European average over a nine-month period is marked with a value above zero. The above data shows that the Southern Lands and Inland Hinterlands are most vulnerable to drought.
- Wildfire hazard—this statistic shows the percentage of NUTS 3 regions that Corine's 2012 categorization refers to as "burned areas". These data show how dangerous forest fires were in the past in particular locations. Positive values characterize areas where fires occurred more often than the European average, and negative values indicate areas where fires are less frequent than the European average. The Southern Lands and Northern Lands, along with the Inland Hinterlands, are most vulnerable to fires.
- Coastal hazard—this indicator shows the percentage of the NUTS 3 coastline (measured in kilometers) exposed to a coastal storm wave occurring once every 100 years, and the percentage of the coastline exposed to flooding in the event of a one meter sea level rise. The areas most sensitive to this type of phenomena are North West Coasts, Lowlands and Estuaries, Northern Lands, and Southern Lands.
- Landslide hazard—this indicator is based on the global landslide susceptibility map developed by NASA, which assesses the probability of landslides occurring over the entire surface of the planet on a scale from minor to severe. The Landlocked and Elevated and Southern Lands areas are most vulnerable to landslides.
- Fluvial hazard—this indicator shows what percentage of the NUTS 3 area is susceptible to flooding in the event of a river flood occurring once every 100 years. The

areas most at risk are Lowlands and Estuaries, Inland and Urbanized areas, and Inland Hinterlands.

- Heavy precip. days—p.c.—an indicator determining the difference in the number of days with precipitation of at least 10 mm between the period 1981–2010 (base value) and the period 2036–2065 (future forecast). The forecast was developed for a representative concentration path (RCP 8.5 scenario) of the Intergovernmental Panel on Climate Change (IPCC), which is a scenario characterized by high greenhouse gas emissions. All areas except the Southern Lands are exposed to heavy rainfall above the European average. However, the Northern Lands and Lowlands and Estuaries will suffer the most.
- Very heavy precip. days—p.c.—an indicator determining the difference in the number of days with precipitation of at least 20 mm between the period 1981–2010 (base value) and the period 2036–2065 (future forecast). The forecast was developed for a representative concentration path (RCP 8.5 scenario) of the Intergovernmental Panel on Climate Change (IPCC). All areas except the Southern Lands are also exposed to very heavy rainfall above the European average. The Northern Lands and Landlocked and Elevated areas will be hardest hit.
- heat wave days—p.c.—an indicator showing the difference in the number of days with a maximum temperature higher than 35 °C between the period 1981–2010 (base value) and the period 2036–2065 (future forecast). The forecast was developed for a representative concentration path (RCP 8.5 scenario) of the Intergovernmental Panel on Climate Change (IPCC). The Southern Lands and Inland and Urbanized regions are most vulnerable to heatwaves.
- ice days—p.c.—an indicator showing the difference in the number of days with a maximum temperature lower than 0 °C between the period 1981–2010 (base value) and the period 2036–2065 (future forecast). The forecast was developed for a representative concentration path (RCP 8.5 scenario) of the Intergovernmental Panel on Climate Change (IPCC). The Northern Lands, Landlocked and Elevated, and Inland and Urbanized are most susceptible to significant temperature drops.

Through the systematic categorization of design interventions and the subsequent analysis of their deployment in urban contexts, a deeper understanding of their efficacy in addressing challenges posed by climate change can be achieved. Furthermore, it is postulated that by evaluating the responses of projects from various regions to specific threats delineated in the Climate Risk Typology, valuable insights can be gleaned regarding the adaptability and resilience of urban planning and design strategies across heterogeneous environments.

4. Results

The analysis of the projects examined covered 114 implementations from 29 European countries. A detailed list of the representations of the countries participating in the exhibition, divided into editions, is presented in the table (Table 2).

Table 2. List of countries participating in the IFLA Europe exhibition divided into editions (2018 and 2022). Prepared by the authors based on project descriptions included in the catalogues from the IFLA Europe Exhibition.

Participation	Countries Presenting the Projects
in both editions	Austria, Bulgaria, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Norway, Poland, Romania, Slovenia, Spain, Sweden, Switzerland
only in 2018	Croatia, France, Israel, Latvia, The Netherlands, Slovakia, Turkey, Ukraine, United Kingdom
only in 2022	Belgium, Germany, Ireland, Italy, Lithuania

In the majority of instances, countries presented three examples of projects that had been created over the last 4 years preceding a given edition. This is the maximum amount that an association representing a given country in the IFLA EU can submit to the exhibition. In both editions, three projects were presented by, among others, the Czech Republic, Norway, Poland, and Spain. However, in some cases, fewer projects were presented. For instance, during the first edition, entitled "Landscape Architecture as a common ground 2018", two projects were submitted by Israel, and one by Austria, Bulgaria, Croatia, Greece, and Ukraine. The second edition, entitled "Reconsidering Nature 2022", presented two projects each from Austria and Greece, and only one from Ireland. A comprehensive overview is depicted in the bar chart below (Figure 3).

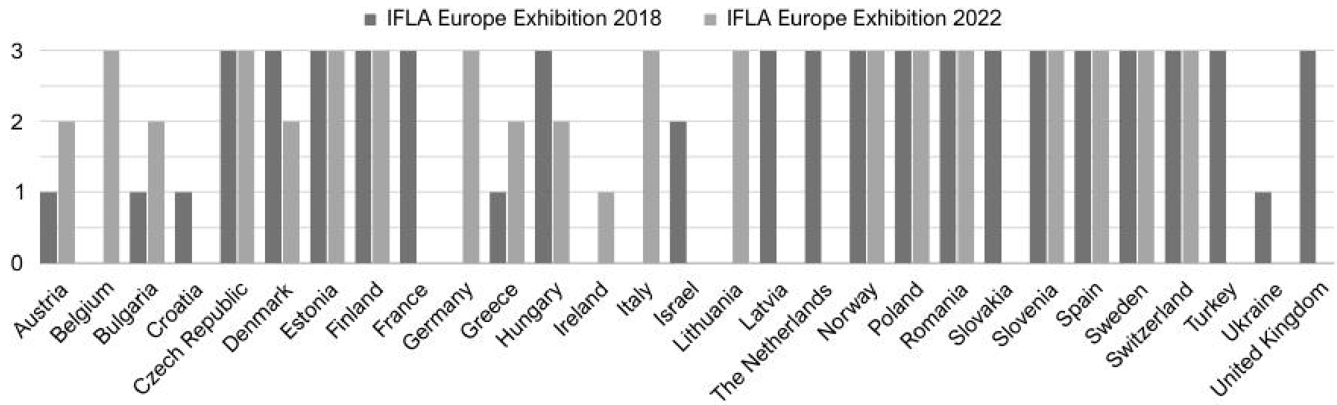

Figure 3. Number of projects from a given country participating in the IFLA Europe exhibition divided into editions (2018 and 2022). Prepared by authors based on project descriptions included in the catalogues from the IFLA Europe Exhibition.

The projects under scrutiny span diverse regions across Europe, extending from northern Scandinavia to the southern shores of the Mediterranean Sea. This geographic spread exposes them to a spectrum of climatic conditions, a pivotal consideration within the research framework. The importance of the location in the context of climatic diversity was highlighted by analyzing geographical aspects and comparing them with regional NUTS 3 data [20]. The approximate location of the projects is presented on the maps below (Figure 4).

Initially, the pro-ecological solutions of individual projects were characterized. For this purpose, the presence of activities in the fields of mitigate, protect, reuse, recover, and educate was analyzed. The 'mitigate' category encompasses measures aimed at locally curtailing or mitigating the impact of climate change. The project descriptions highlighted interventions such as efficient rainwater management, mitigating the heat island effect, preventing soil erosion, and generally understanding climate resilience. The subsequent category consists of actions aimed at protecting the existing environment and representing the 'protect' category. These include maintaining the natural character of space, projects creating special protection areas, steps aimed at limiting the impact of pollution, including noise, and eliminating harmful factors negatively affecting the well-being of the ecosystem. An important facet is reducing the carbon footprint of this type of investment. Such activities were subsumed under the category of 'reuse'. This encompasses practices like repurposing materials from demolition, using rainwater or condensate from air conditioners for irrigation, or using existing watercourses for this purpose. Additionally, the deployment of clean technologies aligns with this category. Operations aimed at restoring the state of the environment lost due to human activity were separately categorized and assigned to the 'recovery' group. This involves employing directed succession, strengthening broken and weakened ecological corridors and changing the surface to permeable substrates. Some projects aspire to recreate ecosystems that previously existed in a given area and had a positive impact on improving biodiversity in urban spaces. Lastly, activities aimed at community education on topics concerning the significance of green spaces in cities were categorized under 'educate'. The results of the above analysis are presented below (Table 3). The table contains the project ID. Further details regarding project names and authors can be found in the Supplemental Materials and are provided in list format.

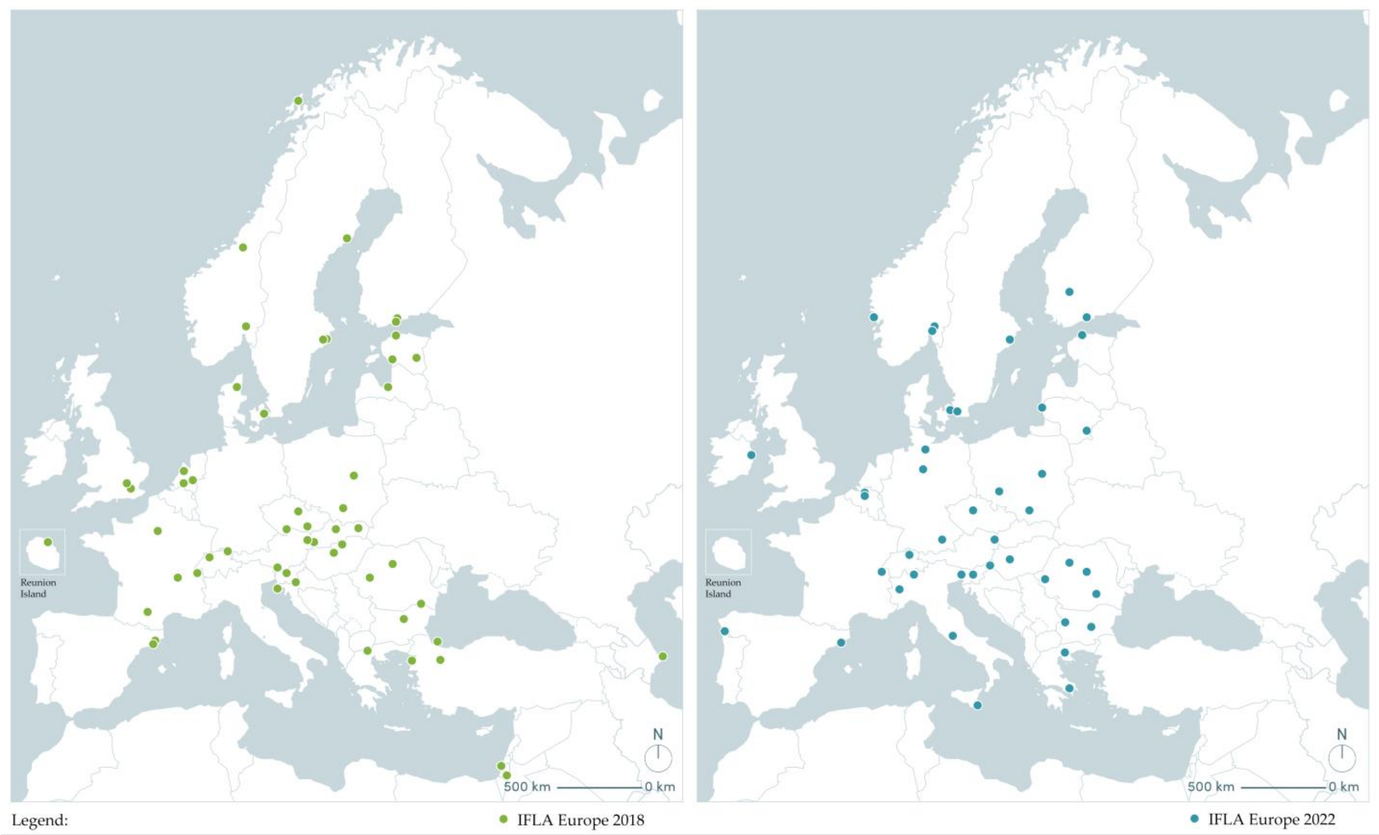

Figure 4. Location of projects from IFLA Europe exhibitions divided into editions (2018 and 2022). Prepared by the authors based on information contained in the IFLA Europe 2018 and 2022 Exhibition catalogues.

Table 3. Results of the analysis of project descriptions from the 2018 and 2022 exhibitions—assignment of activities from specific projects to selected categories: mitigate (MI), protect (PR), reuse (RU), recover (RC), and educate (ED). The mark ✔ indicates that a particular project meets the criteria for a specific category.

Project ID	Category of Undertaken Climate Action					Project ID	Category of Undertaken Climate Action				
	MI	PR	RU	RC	ED		MI	PR	RU	RC	ED
18_AT_01						22_LT_02		✔			✔
22_AT_01	✔		✔			22_LT_03				✔	
22_AT_02						18_NL_01			✔	✔	
22_BE_01						18_NL_02	✔			✔	
22_BE_02	✔					18_NL_03	✔			✔	
22_BE_03				✔		18_NO_01					
18_BG_01		✔				18_NO_02				✔	
22_BG_01	✔					18_NO_03				✔	
22_BG_02		✔				22_NO_01					✔

Table 3. *Cont.*

Project ID	Category of Undertaken Climate Action					Project ID	Category of Undertaken Climate Action				
	MI	PR	RU	RC	ED		MI	PR	RU	RC	ED
18_HR_01		✔				22_NO_02	✔		✔	✔	
18_CZ_01		✔		✔		22_NO_03	✔			✔	
18_CZ_02			✔			18_PL_01	✔				✔
18_CZ_03		✔				18_PL_02	✔				
22_CZ_01		✔		✔		18_PL_03				✔	
22_CZ_02	✔	✔		✔		22_PL_01		✔		✔	✔
22_CZ_03	✔			✔		22_PL_02		✔		✔	
18_DK_01	✔	✔				22_PL_03	✔	✔		✔	
18_DK_02		✔				18_RO_01					
18_DK_03	✔		✔			18_RO_02					
22_DK_01	✔	✔		✔		18_RO_03		✔			
22_DK_02						22_RO_01		✔		✔	✔
18_EE_01		✔		✔	✔	22_RO_02		✔		✔	✔
18_EE_02		✔				22_RO_03		✔		✔	✔
18_EE_03						18_SK_01					
22_EE_01		✔		✔	✔	18_SK_02					
22_EE_02	✔	✔		✔		18_SK_03					
22_EE_03	✔	✔				18_SI_01					
18_FI_01	✔					18_SI_02				✔	
18_FI_02	✔					18_SI_03		✔			
18_FI_03	✔					22_SI_01	✔	✔	✔	✔	
22_FI_01		✔			✔	22_SI_02	✔				✔
22_FI_02	✔	✔		✔		22_SI_03					
22_FI_03			✔	✔		22_ES_01				✔	
18_FR_01				✔		22_ES_02				✔	
18_FR_02	✔		✔	✔		22_ES_03					
18_FR_03		✔				22_ES_01		✔	✔		
22_DE_01				✔		22_ES_02	✔	✔			✔
22_DE_02		✔				22_ES_03				✔	
22_DE_03	✔			✔		18_SE_01				✔	
18_GR_01		✔		✔	✔	18_SE_02					
22_GR_01	✔	✔			✔	18_SE_03		✔			✔
22_GR_02	✔	✔		✔	✔	22_SE_01					
18_HU_01						22_SE_02		✔		✔	✔
18_HU_02						22_SE_03					✔
18_HU_03						18_CH_01	✔			✔	
22_HU_01		✔				18_CH_02					
22_HU_02					✔	18_CH_03	✔	✔			
22_IE_01			✔	✔		22_CH_01					
18_IL_01						22_CH_02	✔	✔		✔	

Table 3. *Cont.*

Project ID	Category of Undertaken Climate Action					Project ID	Category of Undertaken Climate Action				
	MI	PR	RU	RC	ED		MI	PR	RU	RC	ED
18_IL_02	✔		✔			22_CH_03	✔			✔	
22_IT_01		✔		✔		18_TR_01					
22_IT_02	✔		✔	✔		18_TR_02		✔		✔	✔
22_IT_03		✔		✔		18_TR_03		✔			
18_LV_01				✔		18_UA_01					
18_LV_02			✔	✔	✔	18_GB_01					
18_LV_03			✔	✔	✔	18_GB_02	✔				
22_LT_01			✔	✔		18_GB_03					

The number of topics covered, divided into editions of IFLA Europe exhibitions, is as follows (Table 4):

Table 4. Number of projects in which activities assigned to a given category were described, divided into two editions of the IFLA Europe exhibition (2018 and 2022). Prepared by the authors based on project descriptions included in the catalogs from the IFLA Europe Exhibition.

Edition of the IFLA Europe Exhibition	Mitigate (MI)	Protect (PR)	Reuse (RU)	Recover (RC)	Educate (ED)
2018	14	16	7	20	7
2022	21	27	8	31	15
2018 + 2022	35	43	15	51	22

In each category, there is a clear increase in interest in the topic of climate change. Most designers addressed topics assigned to the categories of 'recover' (51 projects), 'protect' (43 projects), and 'mitigate' (35 projects).

The examination of diverse architectural and landscape architecture implementations enables the identification of pivotal and efficacious elements for fortifying public spaces, thereby facilitating the adaptation of cities to the escalating challenges posed by global warming. Examples of implementations and design solutions assigned to a specific category are described below.

4.1. Mitigate

Interventions assigned to this category aim to mitigate or reduce the local impact of climate change (Figure 5). The largest number of projects focused on problems that arise in public spaces during very intense rainfall. They mainly used elements that stopped or slowed down the flow of water and then slowly drained it into the ground. An example of such an intervention is the project 22_PL_03, entitled 'Oława River Waterfront' by Vertigo Margareta Jarczewska and Angelika Kuśmierczyk-Jędrzak, a + f space design, located in Poland, in which rainwater from impervious surfaces is drained into green areas and rain gardens [27]. Similar objectives are achieved in other projects through the implementation of retention reservoirs or water basins. Another important aspect is the prevention of local floods. This problem is solved by developing spaces that may be seasonally underwater, creating landscape embankments to block excess water, or appropriately designed engineering structures. The area can also be adapted to periodic flooding by introducing a large number of new watercourses and eliminating flood embankments. Such an unusual approach was presented in the project 18_NL_03, titled 'De-poldering Noordwaard, Biesbosch' by

Robbert de Koning, landscape architect, BNT, Rijkswaterstaat, and Dienst Landelijk Gebied. This project was carried out in the Netherlands and was part of the Room for the River program. During the implementation, approximately 40 km of new, winding freshwater streams were created with direct access to the freshwater tidal region called Biesbosch, and the main flood embankments of the Noordwaard polder were lowered [26]. Urban heat island mitigation strategies predominantly focus on enhancing local microclimates through greenery. The methods of mitigating its effects presented during the exhibitions are mainly the use of greenery to improve the local microclimate. This method was presented in the project 22_EE_03, titled 'Pae Promenade', by H. Kalberg, T. Breede, and M. Karro-Kalberg, located in Estonia. A significant number of trees, bushes and grasses have been planted along impervious surfaces to provide shade and shelter for walkers during periods of high temperatures [27]. The presented projects also touched on topics related to counteracting erosion (22_FI_02; The Tikkurila River Park—M. Hakari, Loci Landscape Architects Ltd., Finland), the use of plants with requirements adapted to forecasted climate changes (22_CH_02; Schütze-Areal—planikum AG, Switzerland), and even the use of bioactive boards on walls, which can improve the local microclimate.

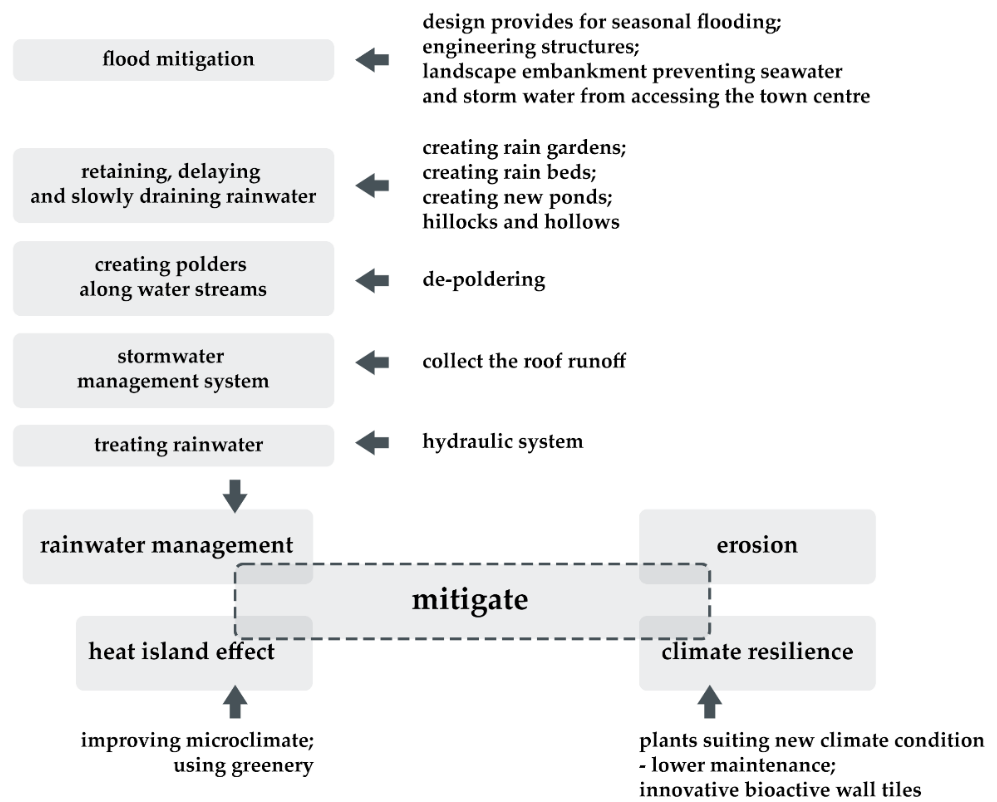

Figure 5. A graphical diagram of activities undertaken in projects presented during two editions (2018 and 2022) of the IFLA Europe Exhibition assigned to the 'mitigate' category.

To summarize, activities in the "mitigate" category related to 14 projects from the 1st edition of the IFLA Europe Exhibition and 21 activities from the 2nd edition, showing an upward trend (an increase of 50%).

4.2. Protect

In contemporary nature conservation, protected areas are increasingly used as a tool for preserving biodiversity through an ecosystem approach (Figure 6). These areas hold significance not only for specialists in the field of ecology but also for broader societal groups [29]. For instance, the German project 22_DE_02, titled 'Baumkirchen Mitte', by mahl gebhard konzepte, exemplifies this approach by establishing a new ecological reserve within the designated area [27]. However, legal protection was not applied in every case. Consequently, the predominant action in this category involves safeguarding the existing natural features of green spaces. Another important factor is the inclusion of plant species already existing in a given place into the design concept. This was done, among others, in the project 18_EE_02, entitled 'Reconstruction of Roosi Street', by Landscape architects Mirko Traks et al. Protection of existing ecosystems can also be achieved through measures to combat erosion (18_FR_03; Parc Agricole de vernand—FABRIQUES Architectures Paysages et al., France) by making the area available using only delicate design interventions (18_TR_02; Terkos old water pumping station museum—DS Landscape & Trafo Architects, Turkey) and paying particular attention to maintaining the continuity of existing ecological corridors (18_DK_02; Vestre Fjordpark—GHB Landskabsarkitekter et al., Denmark) [26]. Finally, it is also worth emphasizing the importance of activities that eliminate factors negatively affecting the proper development of ecosystems and vegetation. This situation occurred in the 18_FI_03 project from Finland titled 'The Tikkurila River Park' by M. Hakari and Loci Landscape Architects Ltd., where a dam blocking the free migration of fish in the river was removed [27].

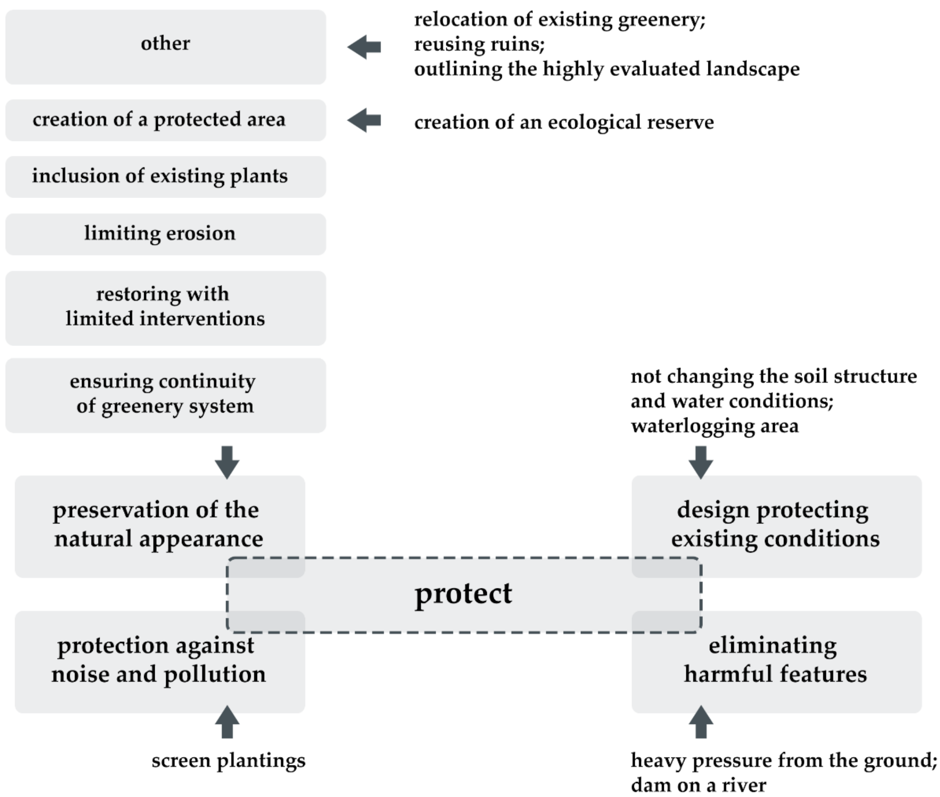

Figure 6. A graphical diagram of the activities undertaken in projects presented during two editions (2018 and 2022) of the IFLA Europe Exhibition assigned to the 'protect' category.

It can therefore be noted that activities assigned to the "protect" category were undertaken by 16 projects from the 2018 edition of the IFLA Europe Exhibition and 27 authors from the 2022 edition, which shows a rising tendency (an increase of 68.75%).

4.3. Reuse

In alignment with the objectives outlined in the Paris Agreement of 2015, which aims to achieve climate neutrality in Europe by 2050, it is imperative to reduce greenhouse gas emissions to zero compared to 1990 levels [30]. Reducing the carbon footprint of architectural and urban investments is an important element of this strategy. The construction sector is responsible for approximately 38% of global carbon dioxide emissions [31]. To diminish emissions originating from construction materials, one approach involves utilizing recycled materials sourced from demolition activities (Figure 7). This measure was used in the Irish project 22_IE_01, entitled 'Bridgefoot Street Park', by Dermot Foley Landscape Architects [27]. An important aspect is also the reuse of rainwater, among other uses, for watering plants (22_IT_02; City Water Circle—OPEN 011—Alessandra Aires Landscape Architect et al.), or condensation from air conditioners (18_IL_02; A resilient and bio-enhanced urban oasis—Studio Urbanof Landscape architects, Israel). Furthermore, irrigation of green spaces can be augmented by leveraging existing watercourses, as illustrated in the project (18_CZ_02; Chateau City Park Pardubice—Tyršovy Sady—Studio: New Visit, Czech Republic) [26]. Contributing to the ethos of a circular economy, the Spanish project 22_ES_01, titled 'Forest Path in the Cemetery of Roques Blanques, El Papiol', by Batlleiroig Arquitectura, endeavors to minimize waste generation [27]. Additionally, the adoption of clean technologies, such as energy generated by photovoltaic panels, plays a pivotal role, as evidenced in project 18_LV_03; Jauna Teika (New Teika)—Multifunctional Complex—Landscape: ALPS Ltd.; Architecture: Tectum Ltd., Latvia [26].

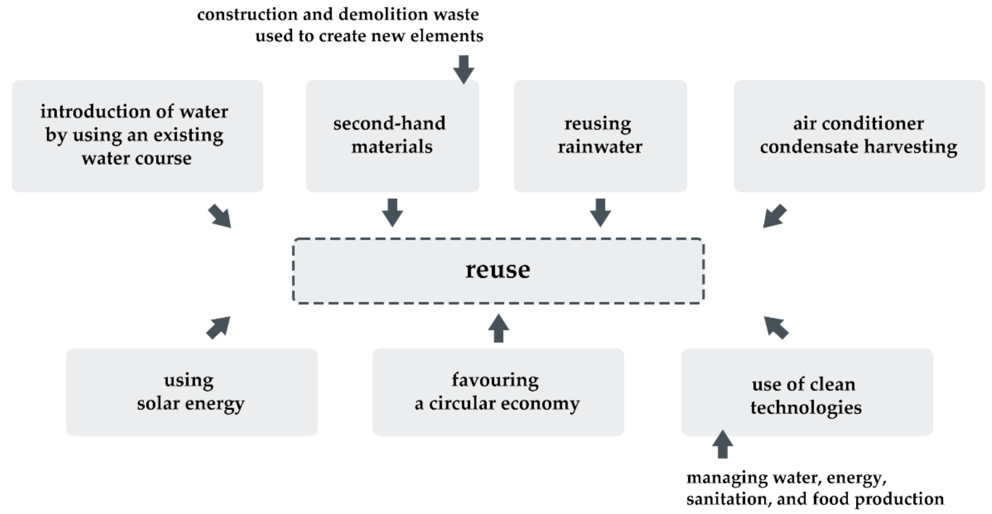

Figure 7. A graphical diagram of activities undertaken in projects presented during two editions (2018 and 2022) of the IFLA Europe Exhibition assigned to the 'reuse' category.

Consequently, it is evident that initiatives categorized under "reuse" were carried out by seven projects featured in the 2018 iteration of the IFLA Europe Exhibition and by eight contributors in the 2022 edition, indicating a positive trend (reflecting a rise of 14.29%).

4.4. Recover

One of the trends visible in the projects analyzed was the restoration of previously lost ecosystems (Figure 8). A great example of this type of intervention is the Swiss river restoration project titled 'Renaturation of the river Aire', by Superpositions. These activities were described by the authors as follows: *The project consists in a real "restoration" of the territory, since it reconstructs landscape features—ditches, hedges, groves, marshes — almost entirely disappeared, but clearly legible on the historical documents. In the area reserved for natural environments (approximately 80-metre strip along the canal), the intensively cultivated open lands are replaced by diversified environments that allow the creation of a true ecological corridor that encourages the networking of biotopes and the movement of small fauna* [26]. However, it is worth remembering that these types of investments are long-term and it is not possible to fully restore their naturalness [32]. Notable examples of ecosystem restoration in representative projects also include river revitalization efforts (22_NO_03; Grorud Park—LINK Arkitektur—Landskap, Norway) [27]. Additionally, endeavors aimed at enhancing biodiversity within urban areas fall under this category, as exemplified by project 22_GR_02; 'Biodiversity green roof in Athens', by Katerina Gkoltsiou et al., located in Greece. Moreover this category includes strengthening, supplementing and rebuilding ecological corridors

(18_GR_01; Blue and green corridors in Edessa—Dr.I.A.Tsalikidis et al., Greece), the phenomenon of directed succession (18_CZ_01; 4Courts Park—Studio: M&P architekti, Czech Republic), cleansing contaminated soil using phytoremediation techniques (18_NL_01; De Ceuvel—DELVA Landscape Architects et al., Netherlands) use of permeable surfaces (18_ES_01; Niel garden—miCHELE&mIQUEL, Spain) [26], or the currently quite frequently mentioned restoration of spaces which can also help in restoring the naturalness of highly urbanized environments.

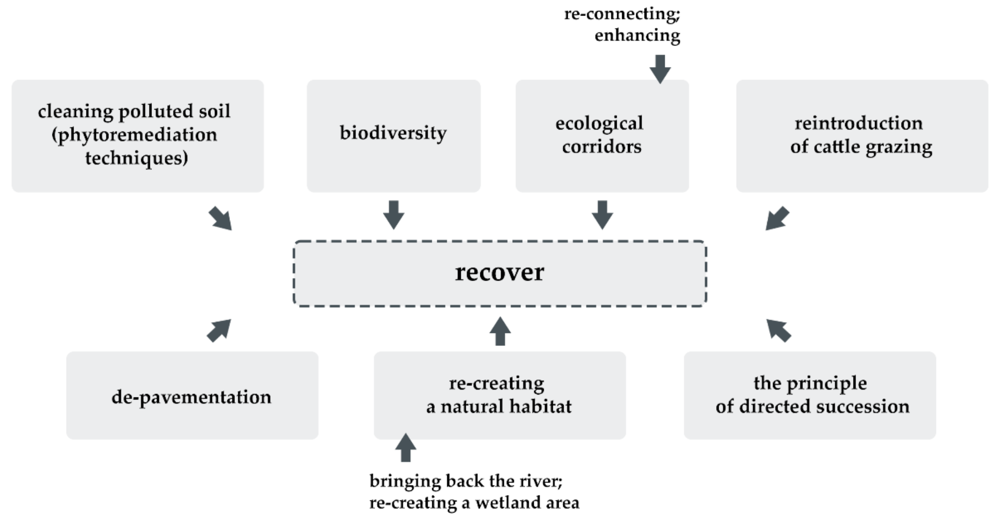

Figure 8. Graphical diagram of activities undertaken in projects presented during two editions (2018 and 2022) of the IFLA Europe Exhibition assigned to the 'recover' category.

In summary, endeavors categorized under "recover" involved 20 projects showcased in the inaugural IFLA Europe Exhibition, and 31 initiatives from the subsequent edition, indicating a positive trajectory (with a 55% increase).

4.5. Educate

Research suggests that the greater people's awareness of climate, the more informed decisions they make about behaviors that impact the environment [33]. Analyses conducted on citizens of various countries show that the knowledge and awareness of residents have a significant impact on their pro-ecological attitudes [34,35]. When we encounter a lack of information or education regarding climate change, there is a noticeable obstacle to citizens' opportunities to change their lifestyles [36].

Many designers emphasize the educational aspect of their projects (Figure 9). This is achieved, among other ways, by raising users' awareness of the values of natural areas in cities (22_PL_01; Educational pavilion with a recreational clearing on the banks of the Vistula River—eM4 Pracownia Architektury Brataniec, Poland) [27], or of biological processes occurring in the environment (18_LV_03; Jauna Teika (New Teika)—Multifunctional Complex—Landscape: ALPS Ltd. and Architecture: Tectum Ltd., Latvia) [26]. These efforts also include providing designated areas for nature observation (22_EE_01; Tondiraba Nature Park—H. Kalbergi et al., Estonia) [11], designing educational paths (22_LT_02; Melnragė Dunes Park—V. Pilkauskas et al., Lithuania) or education through play (22_RO_01; Forest Kindergarten—Poteca Studio, Romania). Furthermore, it is essential to monitor ecological indicators within specific areas and derive insights from such research to facilitate more effective adaptation to climate change (22_SE_03; Alnarp Landscape Laboratory—Department of Landscape Architecture, Planning and Management, Sweden) [27].

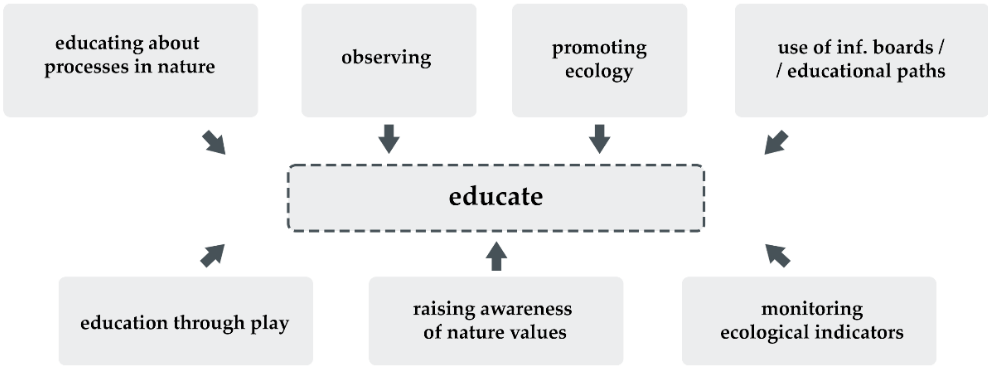

Figure 9. A graphical diagram of activities undertaken in projects presented during two editions (2018 and 2022) of the IFLA Europe Exhibition assigned to the 'educate' category.

Thus, it is evident that initiatives categorized under "educate" were conducted by seven projects featured in the 2018 edition of the IFLA Europe Exhibition and by 15 contributors in the 2022 edition, indicating an ascending pattern (reflecting an increase of 114.29%).

The subsequent phase of the study involved categorizing projects showcased in both editions of the IFLA Europe exhibition (2018 and 2022) based on their geographic location with respect to NUTS 3 regions. This facilitated a comparison of the initiatives undertaken within these projects with the climate challenges specific to their respective regions (Table 5). Upon consolidating the projects from both catalogues, it becomes evident that the majority were executed in the 'Inland and Urbanized' zones, totaling 27 projects (14 from 2018 and 13 from 2022). Following this, projects were also prominent in the 'Inland Hinterlands' zone, with a combined total of 20 projects (10 from each edition), and in the 'Northern Lands', totaling 20 projects (11 from 2018 and nine from 2022). Conversely, the 'North West Urban' area saw the fewest submissions, with only three projects in total (one from the 2018 edition and two from the 2022 edition). Additionally, an 'other' category was included in the analysis, comprising projects from countries not delineated in the typology of climate-threatened regions resilient to climate change [20]. These are countries such as Israel, Turkey, and Ukraine presenting a project located in Azerbaijan, and France with its implementation on Reunion Island. There is a total of seven designs and they all come from the 2018 edition.

Table 5. Location of projects from both editions of the IFLA Europe exhibition in relation to the division of the EU into NUTS 3 areas. Prepared by the authors based on the European Climate Risk Typology and information contained in the IFLA Europe Exhibition 2018 and 2022 catalogues.

Edition of the IFLA Europe Exhibition	Inland and Urbanized	Inland Hinterlands	Northern Lands	Southern Lands	North West Coasts	Landlocked and Elevated	North West Urban	Lowlands and Estuaries	Other
2018	14	10	11	5	4	5	1	4	7
2022	13	10	9	7	6	4	2	2	0
2018 + 2022	27	20	20	12	10	9	3	6	7

However, notable variations emerge in the rankings when considering only projects that explicitly included activities aimed at enhancing urban resilience to climate change, as delineated in the descriptions provided in the exhibition catalogues (Table 6). In this case, most projects are located in the areas of Inland and Urbanized' (a total of 19 projects, with nine from 2018 and 10 from 2022), 'Northern Lands' (a total of 18 projects, including nine from each edition), and 'Inland Hinterlands' (15 projects in total, with five from 2018 and 10 from 2022). Conversely, the 'North West Urban' region witnessed the implementation of only two projects from the 2022 edition.

Table 6. Location of projects from both editions of the IFLA Europe exhibitions, which described activities aimed at making public spaces more resistant to climate change about the division of the EU into NUTS 3 areas. Prepared by the authors based on the European Climate Risk Typology and information contained in the IFLA Europe 2018 and 2022 Exhibition catalogues.

Edition of the IFLA Europe Exhibition	Inland and Urbanized	Inland Hinterlands	Northern Lands	Southern Lands	North West Coasts	Landlocked and Elevated	North West Urban	Lowlands and Estuaries	Other
2018	9	5	9	4	3	4	0	4	4
2022	10	10	9	7	5	3	2	2	0
2018 + 2022	19	15	18	11	8	7	2	6	4

An overview of the location of projects presented at the IFLA Europe exhibition, divided into the 2018 and 2022 editions of the exhibition, located in NUTS 3 areas, and information on whether a given implementation described activities aimed at making urban spaces more resistant to changes brought about by global warming is presented on the maps below (Figure 10).

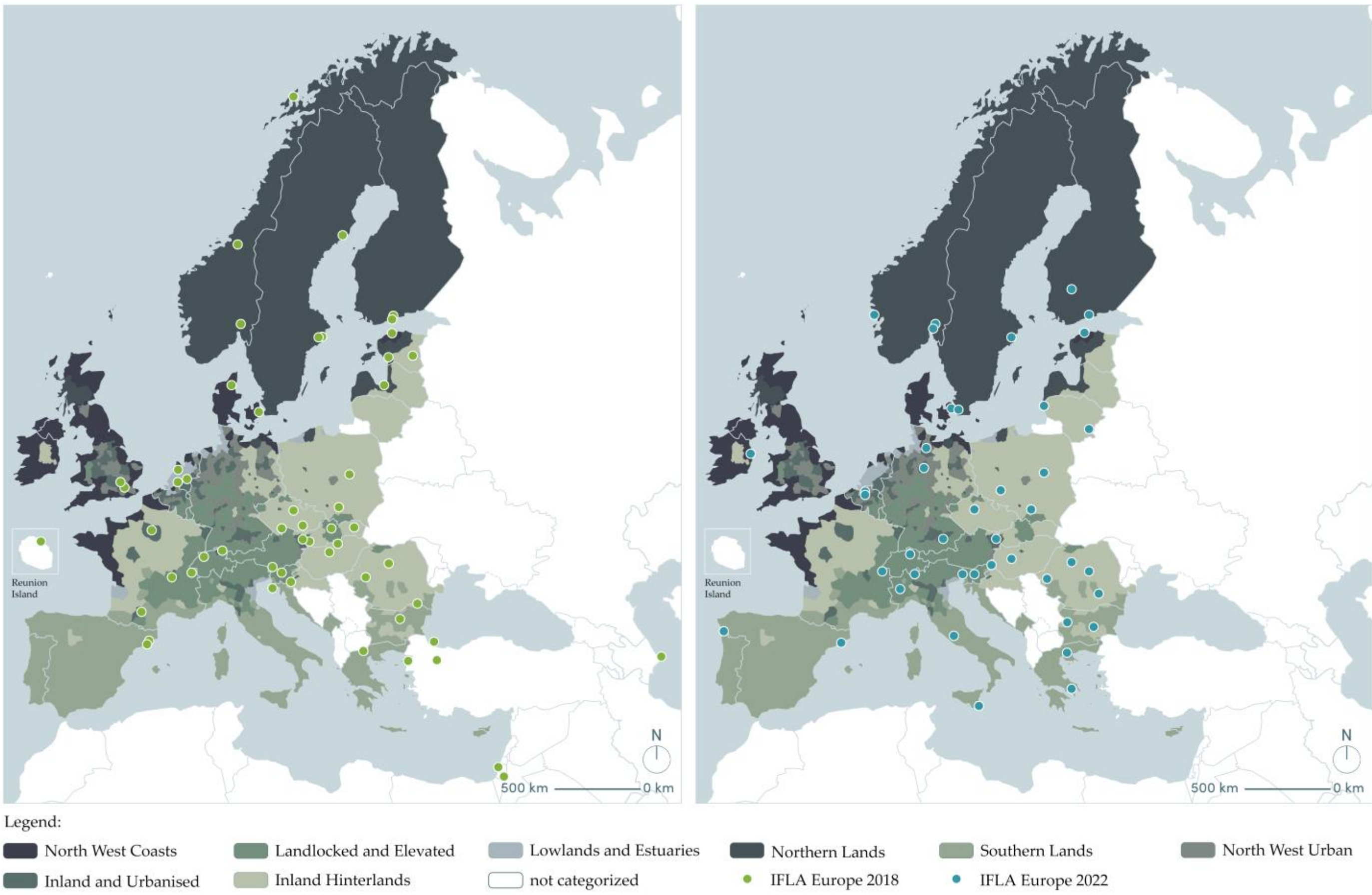

Figure 10. Location of projects from both editions of the IFLA Europe exhibitions about the division of the EU into NUTS 3 areas. Prepared by the authors based on the European Climate Risk Typology and information contained in the IFLA Europe 2018 and 2022 Exhibition catalogues.

Individual projects were assigned to the appropriate NUTS 3 regions (Table 6). This categorization enabled the identification of specific climate challenges to which each project should be particularly responsive. Subsequently, an analysis was conducted to ascertain whether the project descriptions included activities aimed at mitigating the effects of the climate crisis specific to each respective area. The findings of this analysis are outlined in the table provided below (Table 7).

Table 7. Results of the analysis of the response of projects located in a given NUTS 3 region to the threats related to climate change that occur there. Grey fields mean that a given threat occurs in a given NUTS 3 region. Prepared by the authors based on the typology of climate threats resistant to climate change and information contained in project descriptions from the IFLA Europe Exhibition 2018 and 2022 exhibition catalogues. The mark ✔ indicates that a particular project meets the criteria for a specific category.

Region NUTS 3	Project ID	D	W	C	L	F	P	H	I	Project ID	D	W	C	L	F	P	H	I
Inland and Urbanized	18_AT_01									22_AT_01					✔	✔		
	18_FR_02					✔	✔			22_AT_02								
	18_HU_01									22_BE_01								
	18_HU_02									22_CZ_01								
	18_NL_02					✔	✔			22_CZ_03					✔	✔		
	18_PL_01					✔	✔			22_DE_01								
	18_PL_02					✔	✔			22_DE_02								
	18_PL_03									22_DE_03					✔	✔		
	18_SK_03									22_PL_01					✔	✔		
	18_ES_01					✔	✔			22_PL_02					✔	✔		
	18_CH_01					✔	✔			22_PL_03					✔	✔		
	18_CH_02					✔	✔			22_CH_01								
	18_GB_01									22_CH_02					✔	✔		
	18_GB_02					✔	✔											
Inland Hinterlands	18_CZ_01	✔				✔	✔			22_BG_01						✔	✔	
	18_CZ_02	✔				✔	✔			22_CZ_02	✔				✔	✔		
	18_CZ_03	✔				✔	✔			22_HU_01								
	18_EE_02									22_HU_02								
	18_HU_03									22_LT_01						✔		
	18_RO_01									22_LT_02								
	18_RO_02									22_LT_03								
	18_RO_03									22_RO_02								
	18_SK_01									22_RO_03	✔				✔	✔		
	18_SK_02									22_SI_01	✔				✔	✔	✔	
Northern Lands	18_EE_01									18_SE_03								
	18_FI_01			✔						22_FI_01								
	18_FI_02						✔			22_FI_02						✔		
	18_FI_03						✔			22_FI_03								
	18_LV_02						✔			22_NO_01								
	18_NO_01									22_NO_02						✔		
	18_NO_02									22_NO_03						✔		
	18_NO_03						✔			22_SE_01								
	18_SE_01									22_SE_02								
	18_SE_02									22_SE_03								
Southern Lands	18_BG_01									22_GR_01	✔							
	18_HR_01									22_IT_01								
	18_GR_01							✔		22_IT_03	✔						✔	
	18_ES_02									22_ES_01								
	18_ES_03									22_ES_02	✔							
	22_BG_02									22_ES_03			✔					
North West Coasts	18_DK_01						✔			22_DK_02								
	18_DK_02									22_EE_01						✔		
	18_DK_03						✔			22_EE_02						✔		
	18_EE_03									22_EE_03								
	22_DK_01						✔			22_IE_01								
Landlocked and Elevated	18_FR_03									22_IT_02	✔				✔	✔		
	18_SI_01									22_SI_02	✔				✔	✔		
	18_SI_02									22_SI_03								
	18_SI_03									22_CH_03	✔				✔	✔		
	18_CH_03					✔												

Table 7. *Cont.*

Region NUTS 3	Project ID	D	W	C	L	F	P	H	I	Project ID	D	W	C	L	F	P	H	I
North West Urban	18_GB_03									22_RO_01								
	22_GR_02						✔											
Lowlands and Estuaries	18_LV_01									18_NL_03			✔		✔	✔		
	18_LV_03									22_BE_02								
	18_NL_01					✔	✔			22_BE_03								
other	18_FR_01									18_TR_02								
	18_IL_01									18_TR_03								
	18_IL_02									18_UA_01								
	18_TR_01																	

After an in-depth analysis of the descriptions contained in the catalogues from the IFLA Europe exhibitions "Landscape Architecture as a common ground 2018" and "Reconsidering Nature 2022", we can determine the number of projects from a given region that included in the descriptions of their concepts solutions aimed at mitigating climate threats occurring in it (Table 8).

Table 8. A summary of analyses regarding the reactions of projects situated within a designated NUTS 3 region to the climate change-related hazards prevalent in that area. Gray cells signify the occurrence of a specific threat within the designated NUTS 3 region. The designation "a/b" denotes 'a'—the number of projects addressing a particular threat, and 'b'—the total count of projects categorized within a specific group. Prepared by authors based on the typology of climate threats resistant to climate change and information contained in project descriptions from the IFLA Europe Exhibition 2018 and 2022 catalogues.

Region NUTS 3	Project ID	Drought Hazard (D)	Wildfire Hazard (W)	Coastal Hazard (C)	Landslide Hazard (L)	Fluvial Hazard (F)	(Very) Heavy Precip. Days—p.c. (P)	Heat Wave Days—p.c. (H)	Ice Days—p.c. (I)
Inland and Urbanized	2018					8/14	8/14		
	2022					7/13	7/13		
	2018 + 2022					15/27	15/27		
Inland Hinterlands	2018	3/10	0/10			3/10	3/10	0/10	0/10
	2022	3/10	0/10			3/10	5/10	2/10	0/10
	2018 + 2022	6/20	0/20			6/20	8/20	2/20	0/20
Northern Lands	2018		0/11	1/11			4/11		0/11
	2022		0/9	0/9			3/9		0/9
	2018 + 2022		0/20	1/20			7/20		0/20
Southern Lands	2018	0/5	0/5	0/5	0/5			1/5	
	2022	3/7	0/7	1/7	0/7			1/7	
	2018 + 2022	3/12	0/12	1/12	0/12			2/12	
North West Coasts	2018			0/4			2/4		
	2022			0/6			3/6		
	2018 + 2022			0/10			5/10		
Landlocked and Elevated	2018	0/5			0/5	1/5	0/5		0/5
	2022	3/4			0/4	3/4	3/4		0/4
	2018 + 2022	3/9			0/9	4/9	3/9		0/9
North West Urban	2018						0/1		
	2022						1/2		
	2018 + 2022						1/3		
Lowlands and Estuaries	2018			1/4		2/4	2/4		
	2022			0/2		0/2	0/2		
	2018 + 2022			1/6		2/6	2/6		
total	2018	3/20	0/26	2/24	0/10	14/33	19/49	1/15	0/26
	2022	9/21	0/26	1/24	0/11	13/29	22/46	3/17	0/23
	2018 + 2022	12/41	0/52	3/48	0/21	27/62	41/95	4/32	0/49

In the 'Inland and Urbanized' area, which is mainly exposed to heavy and very heavy rains [20], 15 out of 27 authors (55.56%) took action to prevent the negative consequences of heavy rainfall. One of the answers to this problem is the implementation from project 22_AT_01, entitled: 'Johann Nepomuk Vogl Platz' by Karl Grimm Landschaftsarchitekten. This is a city square design located in Vienna, Austria. Employing a sponge principle, this design fosters conditions conducive to tree growth despite substantial impervious surfaces. Rainwater is efficiently harvested from rooftops and paved areas, with the discharge into storm sewage systems entirely eliminated. This achievement was realized through augmenting storage capacities within surface layers and substituting them with fine and coarse-grained aggregates, facilitating water and nutrient accumulation. The authors underscored the efficacy and adaptability of these methods in response to climate change [27].

In areas categorized by NUTS 3 as "Inland Hinterlands', there is a risk of heavy rainfall (eight out of 20 projects—40% responded to this problem), droughts and floods (in both cases, six out of 20 projects—30% responded to this problem), heat waves (two out of 20–10% of projects tried to mitigate their effects) fires and erosion of coastal areas (no project mentions preventive actions in its description).

Also in the 'Northern Lands' regions, the main threats are fires (none of the 20 projects mentioned preventive measures in their descriptions) and heavy or very heavy rains (seven out of 20 projects—35% tried to mitigate their effects). There is also a danger related to periodically very low temperatures (no response in the projects), shoreline erosion and sea level rise [20] (one out of 20 projects took this into account). The architects face the last factor in the project 18_FI_01, titled: 'Leimuniitty', by Byman & Ruokonen Landscape Architects et al., located in Espoo, Finland, in which a landscaped embankment was placed in the middle of the park. Its task is to block seawater and rainwater from entering the city center. Underground infrastructure was hidden behind it, including pumping stations [26].

In areas defined as 'Southern Lands', particularly dangerous are fires, landslides (both omitted in design considerations), droughts (three out of 12–25% of projects try to counteract this), coastal erosion (one project—8.33% took this into account) and recurring and intensifying heatwaves [20] (two projects from 12–16.66% emphasized the purpose of their mitigation in the description). Green public spaces can help shelter residents on hot days. The project 18_GR_01, located in Edessa, Greece, titled 'Blue and Green Corridors in Edessa', in which the project leader was Dr. I.A. Tsalikidis, is part of the city's green strategy, which aims to redesign and connect the blue and green ecological corridor networks. They are to be made available to the local community using walking paths and meeting points. They create a new urban linear park [26].

In the 'North West Coasts' regions, the threat is posed by heavy and very heavy rains (the desire to mitigate their effects was emphasized in five out of 10 projects—50%) and rising sea water levels [20] (there was no information on how to prevent them in the analyzed projects in this area). In the project 18_DK_03, titled 'Lindevangs Park', by Marianne Levinsen, Landskab ApS, located in Frederiksberg, Denmark, one of the main goals of the designers was to retain rainwater in the park. This is to help protect the more vulnerable lower areas from flooding. The collected rainwater is used to irrigate the greenery. This also allowed fruit trees, reeds, and bushes to be planted here. Play spaces also have an additional function. Due to their depressions, they act as retention basins. Rainwater collected in this place is then purified in an underground pipe system. The entire project is intended to show how adaptation to climate change can modernize the traditional vision of the park [26].

'Landlocked and Elevated' areas are particularly exposed to floods (four out of nine projects—44.45% responded to this threat) droughts and heavy or very heavy rainfall [20] (in both cases three out of nine projects—33.33% tried to prevent this). These regions are also at risk of landslides and very low air temperatures. However, elements to prevent them were not mentioned in the descriptions of any of the projects located in this area. In the 'North West Urban' region there is a risk of heavy and very heavy rainfall, which was responded to by one of the three projects (33.33%) assigned to this category. 'Lowlands and Estuaries' areas are exposed to coastal erosion (one out of six–16.67% of projects took this into account), floods, and heavy or very heavy rainfall (two out of six–33.33% of projects took into account mitigating measures).

The analysis shows that most projects tried to mitigate the effects of floods (27 out of 62 projects particularly exposed to them—43.55%), strong and very heavy rainfall (41 out of 95 projects—43.16%), and drought (12 out of 41 projects—29.27%). Some of the implementations also addressed the problem of heat waves (four out of 32 projects—12.5%) and shoreline erosion (three out of 48 projects—6.25%). However, none of the projects situated in regions susceptible to wildfires, landslides, and extremely low air temperatures included descriptions of measures aimed at mitigating these effects induced by the climate crisis.

5. Discussion

The results of the conducted research provide information on the use of pro-environmental solutions in the context of climate change. The study focused on a specific cohort comprising landscape architecture projects in public spaces presented during the IFLA Europe Exhibition selected by national associations. A total of 114 projects submitted by 29 countries were scrutinized, constituting a substantial reference pool. Furthermore, these projects are emblematic of individual countries, as they were curated through local competitions, thus making them an interesting research sample. The use of pro-ecological solutions was examined using five categories of applied actions—mitigate, protect, reuse, recover, and educate. These categories were used to systematize all activities supporting the resilience of urban public spaces to the effects of climate change. This analysis aimed to extract project actions positively influencing urban resilience to climate change, facilitating their application in future projects and considering new adaptation methods.

The research shows that 'recover' activities were used in the largest number of cases—51 projects (44.74%). In second place are 'protect' activities—43 projects (37.72%), followed by 'mitigate'—35 projects (30.70%). The smallest number was assigned to the 'educate' category—22 projects (19.30%), and 'reuse'—15 projects (13.16%).

The characteristics of the projects in terms of the adopted criteria indicate the widespread use of pro-ecological activities. An upward trend in the topics covered in the second edition compared to the first one can also be observed in each category—'educate' at 36.37 pp., 'protect' at 25.58 pp., 'recover' at 21.56 pp., 'mitigate' at 20 pp., and 'reuse' by 6.66 pp.

As the analyzed projects concern public spaces, it can be stated that the potential associated with these spaces is important. They can be tailored to address the resilience of cities to climate change. As discrete entities, they exert influence on the local microclimate, rainwater management, and mitigation of heat islands [37]. Additionally, by integrating into a cohesive green infrastructure network, they contribute to its overall functionality.

The multitude of these types of solutions in a representative sample indicates the evolution of design tools and the increase in designers' awareness in this area. European programs such as the Green Deal [38] or the assumptions of the New European Bauhaus [39] are undoubtedly influential in this regard. Furthermore, a notable uptick in the adoption of such solutions is evident upon comparing the 2018 and 2022 editions, underscoring ongoing progress in this sphere. This also allows for the extraction of actions that are most commonly applied and highlights climate change-related issues of which contemporary designers may not yet be fully aware.

A comparative assessment of the utilization of pro-environmental solutions in tandem with contemporary climate hazards yields insightful findings. The division into NUTS regions made it possible to compare project locations with the areas distinguished on the European Climate Risk Typology Map [20]. An analysis of responses to local hazards showed that of 62 projects focusing on extremely flood-prone areas, 27 (43.55%) described actions to mitigate their effects. In comparison, 41 of 95 projects (43.16%) focused on reducing the undesirable effects of heavy and very heavy rainfall. Additionally, 12 out of

41 projects (29.27%) focused on counteracting drought. To a lesser extent, some projects also dealt with problems related to heat waves (four out of 32 projects—12.5%) and shoreline erosion (three out of 48 projects—6.25%). However, none of the projects implemented in areas exposed to fires, landslides, and very low air temperatures took into account preventive measures. Comparing the 2018 and 2022 editions, over time, an increasing trend can be seen in four of eight categories ('drought hazard' by 27.86 pp., 'heatwave days—p.c.' by 10.98 pp., '(very) heavy precip. days—p.c.' by 9.05 pp., and 'fluvial hazard' by 2.41 pp.). A downward trend of 4.16 percentage points can be seen in 'coastal hazard'. In this instance, it is essential to regard the findings with a degree of approximation, particularly concerning specific hazards like landslide susceptibility, low air temperatures, or shoreline erosion. To elucidate these nuanced concerns, a meticulous examination of local conditions is imperative, akin to the thorough investigation conducted in the scrutiny of low-lying coastal areas [6]. However, this study is of a general nature and takes into account a selected set of issues related to design in the field of sustainable development. The research showed that about half of the analyzed projects address the problem of excess amounts of water or its lack and try to mitigate the impact of the extreme phenomena by locally managing water resources. This indicates the important role that public spaces can play in taking into account the issue of broadly understood water resources and properly integrating them into the design process. An example of this type of action may be projects that can significantly reduce the risk of flooding in cities [40]. Solutions such as rain gardens [41], retention basins [42], or green roofs [43] prove highly effective in this regard, augmenting the capacity of green areas to absorb atmospheric precipitation [44]. Due to rapidly changing climate and urban conditions [45], planting additional trees can help significantly [46] but it will not be enough. Future-proof strategies and implementations are imperative to address the challenges anticipated in the coming decades [47]. Cultural landscapes must withstand increasingly frequent and intense rainfall events and prolonged drought periods [48].

Based on the selected reference group comprising landscape architecture designs crafted by multidisciplinary teams, it becomes evident that this approach to design aligns with contemporary challenges. Attention is directed to the field of landscape architecture, a profession that was established to "repair" the space and create beauty around human settlements [49]. In this context, the essence of landscape architecture represents a modernized approach to crafting public spaces, coined as "the new art of urban order" [50]. Evolving into interdisciplinary strategies that intertwine aesthetic considerations with environmental imperatives, landscape architecture emerges as a solution to the contemporary urban dilemmas. The task of landscape architects is not only to create a visually pleasant environment but also to design and plan areas that will support sustainable development and take into account the threats resulting from global warming [48]. This field plays a key role in strengthening the resilience of cities through thoughtful planning of urban greenery, preserving existing ecosystems and developing creative solutions [51].

A multidisciplinary approach is also key to the contemporary design of public spaces. The cooperation of landscape architects with experts, such as urban planners or environmental and communication engineers, enables the creation of comprehensive city plans that can meet adaptation challenges [52]. Creating microclimatic urban zones [53], designing environmentally friendly transport networks [54], or building green ecological corridors [55] are just some of the elements of an effective system that is a condition for ensuring cities' resilience to the difficult challenges of the future.

Another important element of contemporary design is sensitivity to the public environment in the context of its resilience. Close cooperation with residents, engaging them in social participation [56] and education are an important part of projects at all scales [57]. Participation is strongly embedded in landscape architecture as a field.

In today's rapidly changing urban environment, the response to one of the greatest threats to biodiversity also plays a key role [4]. The IFLA Europe publication—The role of Landscape Architects in promoting Biodiversity—draws attention to the importance of this phenomenon in shaping contemporary cities and the role of the landscape architecture profession in promoting an appropriate approach. *The profession is inherently connected to the implementation of Blue-Green Infrastructure and the use of Nature-based solutions that offer unique opportunities to include biodiversity principles and enhance the ecological value for nature's benefit but also a vital component of our planet. Humanity evolved in a diverse landscape and our vision is to restore and maintain our natural and anthropogenic habitats* [57].

One of the key elements of the harmonious development of cities is undoubtedly the function that landscape architecture plays in strengthening their resistance to the climate crisis [58]. This article serves as the basis for discussion of the role of public space in building urban resilience to climate change and demonstrates the actions through which landscape architects can contribute to its construction. Through appropriate design proposals adapted to local climatic conditions, landscape architects can positively influence the attractiveness of public spaces [22]. In the future, landscape architecture is expected to bring innovations that will not only beautify urban areas but also improve the quality of life of their inhabitants [59].

6. Conclusions

The design of public spaces currently faces difficult problems related to climate change in cities. Urban areas must become increasingly resilient to factors such as rising sea levels, severe weather, and changing atmospheric conditions. The conducted research underscores the pivotal role of public space design in bolstering urban resilience. This applies not only to designing new places on new principles but also to redesigning existing ones and adjusting them to, for example, the newly adopted spatial policy [6]. The contribution of this study involves the identification of sample project actions mitigating the effects of climate change and their categorization, facilitating their application in future projects, as well as initiating discussions on new interventions supporting urban resilience. These interventions will not only help to prevent, protect, and restore lost ecosystems and biodiversity at the microscale, but also reduce carbon footprints, increase reuse, and enhance awareness among local communities. The effectiveness of such actions is corroborated by the theory and implementation results of "micro-interventions" and "urban acupuncture" [60], indicating the significant impact of even small remedial actions in small areas [61].

In this context, these spaces should be designed in a multi-threaded and multi-functional manner. The task of designers, or rather multidisciplinary teams, is to develop creative and practical solutions to these challenges. The problems include not only adapting to current threats but also anticipating upcoming changes. Therefore, our study compares actions taken in projects on Climate Risk Typology threats to elucidate which regions are most susceptible to which effects of climate change and to verify whether these topics have been addressed by specific designers. This initiates a discussion on the design of public spaces considering local conditions, not only those currently existing but also forthcoming changes in the coming decades. Such an approach will contribute to the design of cities more resilient to climate change. To build environments that are both sustainable and resilient to climate change, designers must take into account diverse cultural contexts, the dynamic structures of urban communities, and emerging technologies. Involving numerous specialists in the development of local land-use plans or planning studies is crucial.

Adhering to the principles of landscape architecture appears to be the most suitable approach, integrated into local regulations and the requirements outlined in tender and competition documentation for public spaces. Understanding and emulating strategies from successful projects are increasingly vital for informing future solutions, essential for constructing resilient, livable, and sustainable cities.

This study serves as a model for comprehensive project analysis, encompassing the general application of measures to mitigate the effects of climate change and evaluating the extent to which implemented projects address local threats. Moreover, this article serves as the foundation for future research endeavors aimed at verifying the implementation of climate-resilient project actions in public spaces, as well as continuously expanding the list of such implementations with increasingly newer technologies, thereby facilitating their application in the future. Integrating these actions into a greater number of public space projects will create a network within cities, better preparing them for continually changing atmospheric conditions. The demonstrated upward trend in pro-environmental activities in the analyzed projects proves the increase in awareness in this respect both among designers and among the investor communities undertaking these activities. While the projects are selectively chosen, their representation among the 29 IFLA European member countries underscores the widespread prevalence of this trend across Europe.

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