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# THE PRESENCE OF BLUE INFRASTRUCTURE IN THE INTERACTION BETWEEN GREEN INFRASTRUCTURE AND URBAN AND REGIONAL PLANNING

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**ABSTRACT**: The notion of Green Infrastructure (GI) is linked to topics such as sustainability, social justice, governance, and climate resilience, among others. This concept includes Blue Infrastructure (BI), which is associated with water management as well as Low Impact Development (LID), Water Sensitive Urban Design Systems (WSUDs) and Best Management Practices (BMP). However, the relationship between GI and BI in urban and regional planning may not be obvious, even when examining important databases in the academic field, limiting its application. This paper tries to illustrate, using three samples of 77 publications, that BI is frequently overlooked in academic production connected to the implementation of GI in urban and regional planning (URP). Its aim is to expose the various perspectives, or variations, on BI in GI and URP research. Articles on the integration of GI in URP were collected from the Web of Science and Scopus and grouped based on analyses performed using database filters, and analyzed with Bibliometric, and VOSviewer. The results show that there is a significant

difference in the presence of BI between the three groups, implying different approaches to urban hydrology within GI and its integration into urban and regional planning, and also a disconnect between authors and their areas when observing thematic maps that represent the development of this field in scientific research.
**Keywords**: Blue Green Infrastructure. Trame verte et bleue. Urban and Regional Planning. Sustainable Development. Water management.

## A PRESENÇA DA INFRAESTRUTURA AZUL NA INTERAÇÃO ENTRE A INFRAESTRUTURA VERDE E O PLANEJAMENTO URBANO E REGIONAL

**RESUMO**: A noção de Infraestrutura Verde (GI, na sigla em inglês) está ligada a temas como sustentabilidade, justiça social, governança e resiliência climática, entre outros. Esse conceito inclui a Infraestrutura Azul (BI, na sigla em inglês), que está associada à gestão da água, bem como ao Desenvolvimento de Baixo Impacto (LID, na sigla em inglês), Sistemas de Design Urbano Sensível à Água (WSUDs, na sigla em inglês) e Melhores Práticas de Gestão (BMP, na sigla em inglês). No entanto, a relação entre GI e BI no planejamento urbano e regional pode não ser óbvia, mesmo ao examinar bases de dados importantes no campo acadêmico, o que limita sua aplicação. Este artigo busca ilustrar, por meio de três amostras de 77 publicações, que a BI é frequentemente negligenciada na produção acadêmica relacionada à implementação da GI no planejamento urbano e regional (URP, na sigla em inglês). Seu objetivo é expor as diversas perspectivas, ou variações, sobre a BI em pesquisas relacionadas à GI e ao URP. Artigos sobre a integração da GI no URP foram coletados da Web of Science e Scopus e agrupados com base em análises realizadas usando filtros de banco de dados, e analisados com ferramentas de Bibliometria e VOSviewer. Os resultados mostram que há uma diferença significativa na presença da BI entre os três grupos, sugerindo abordagens distintas sobre hidrologia urbana dentro da GI e sua integração no planejamento urbano e regional, além de uma desconexão entre autores e suas áreas ao observar mapas temáticos que representam o desenvolvimento desse campo na pesquisa científica.
**Palavras-chave:** Infraestrutura Verde e Azul. Trame Verte et Bleue. Planejamento Urbano e Regional. Desenvolvimento Sustentável. Gestão de Águas.

## 1 INTRODUCTION

Green Infrastructure (GI) is a concept deeply rooted in sustainability, connectivity, and social justice. While its value in enhancing urban resilience is widely recognized, the widespread adoption of GI remains constrained by financial, institutional, social, and technological barriers (Elderbrock *et al*., 2020; Matsler *et al.*, 2021; Reu Junqueira; Serrao-Neumann; White, 2023; Wilfong *et al*., 2023). Furthermore, the multifunctional and multiscale nature of GI extends to Blue Infrastructure (BI), incorporating water management strategies that complement the broader goals of urban sustainability (Yonegura; Laurent; da Silveira, 2025). In 2009, GI was conceptualized by Natural England and Lanusse Consultants (in Mell, 2019) as:

> Green infrastructure is a strategically planned and delivered network comprising the broadest range of high quality green spaces and other environmental features. It should be designed and managed as a multifunctional resource capable of delivering those ecological services and quality of life benefits required by the communities it serves and needed to underpin sustainability. Its design and management should also respect and enhance the character and distinctiveness of an area with regard to habitats and landscape types. Green infrastructure includes established green spaces and new sites and should thread through and surround the built environment and connect the urban area to its wider rural hinterland. Consequently, it needs to be delivered at all spatial scales from sub-regional to local neighborhood levels, accommodating both accessible natural green spaces within local communities and often much larger sites in the urban fringe and wider countryside. Natural England and Landuse Consultants (2009) in Mell (2019).

Even in a very complete concept, which is at the beginning of the twenty-first century, such as the concepts of writers analyzed in this research between 2018 and 2024, we can see that BI is not always stated when conceptualizing GI.

The constitution of Green Infrastructure (GI) is determined by who you are and where you come from, and the notion varies depending on who asks (Mell, 2019). The perception of Green Infrastructure (GI) can vary according to geographic location, local characteristics, usage objectives, or cultural factors. GI for an American visiting the Emerald Necklace may differ from the view of an Anglican accustomed to the tradition of Garden Cities, and both may be even more distinct from the perspective of users in Chinese Sponge Cities.

Lack of consistency in nomenclature, goals, and meanings of GI may hinder planning, implementation, and maintenance, reducing benefits (Afionis; Mkwambisi; Dallimer, 2020; Mastler *et al*., 2021; Mell, 2010; Sunding, 2025). Some concepts expressly include blue infrastructure, such as the concept of TEP (2005 in Mell, 2019) when evoking waterways:

> Green infrastructure: the physical environment within and between cities, towns and villages. The network of open spaces, waterways, gardens, woodlands, green corridors, street trees and open countryside that brings many social, economic and environmental benefits to local people and communities.

In different instances, the water is only related to water management issues, like in McFarland *et al*. (2019): "Green infrastructure (...) promotes urban livability. It reduces stormwater quantity and improves surface water quality while simultaneously providing a multitude of other environmental, economic, and social benefits." Other concepts, such as those created by Natural England and Landuse Consultants in 2009, make no mention of it. As a result, hydrological resources may be "forgotten", or their significance is reduced in the development of urban and regional landscapes. In France, where GI is known as *Trame verte et bleue* (TVB), both *trames*, or infrastructures, are visible and considered equally in URP procedures. For example, we may query how the BI appears in scientific research in databases extensively utilized by academia. Since this area has the potential to influence policymaker training and the practical implementation of GI.

This essay is part of a PhD research project on the presence, visibility, and significance of BI in the complex junction of GI and URP and the creation of a sustainable urban and regional landscape. Its goal is to use bibliometric analysis to highlight the invisibility of BI and its various perspectives in scientific databases such as Web of Science and Scopus. Based on an analysis of scientific articles related to water management and urban and regional planning, the goal is to identify knowledge gaps and fragmentation, highlighting the absence of the concept of BI and its implications for sustainable urban planning and city resilience. Its methodology is based on a search for BI, "water management" and "water resources" in scientific papers published between 2018 and 2024 that discuss the relationship between Green Infrastructure and urban and regional planning and are deposited in Web of Science and Scopus. It was analyzed using Bibliometrix[1] e VOSviewer[2] software.

The bibliometric evaluation was conducted at the start of the thesis's theoretical framework searches, to aid in understanding the core content of the selected works. It was resumed after studying the papers and authoring the essay "The insertion of Green <Blue> Infrastructure in urban and regional planning barriers and invisibility" (Yonegura; Laurent; da Silveira, 2025). This resulted in a new analysis, allowing for a more in-depth comprehension of the graphs, thematic maps, and schemes created by VOSviewer and Bibliometrix. The authors of the samples themselves may contribute to the discussion of the subject.

As a result, it became apparent that BI is linked to social, technological, and governance issues as well as environmental ones. However, it may be implicit or hardly evident within the GI idea, preventing proper handling of this valuable resource when building or regenerating the

[1] In RStudio version 2024.04.2+764, R version 4.4.1.
[2] Version 1.6.20

urban and regional landscape, decreasing its potential as a driving force for sustainable urban projects.

## 2 GI AND OTHER NAMES FOR *TRAME VERTE ET BLEUE*, WITH OR WITHOUT B.

Green infrastructure (GI) dates to the late nineteenth century, when planners like Ebenezer Howard and Frederick Law Olmsted pioneered the incorporation of green spaces into urban settings. Howard's Garden City plan offered polycentric urban networks that combined urban and rural benefits with wide green spaces to reduce industrial pollution and regulate urban expansion, as demonstrated by Letchworth (Howard, 1985, 1988 in Mell, 2010). Meanwhile, Olmsted's[3] vision of connecting natural spaces via parkways and boulevards set the groundwork for the development of Greenways in North America. According to Fábos (1995) and Gobster and Westphal (2004) in Mell (2010), Greenway development occurred in three stages: the first emphasized scenic parkways, the second recreational trail networks connecting cities to nature, and the third multifunctional Greenway systems integrating ecological, recreational, and cultural functions. GI also has historical origins in the writings of Patrick Geddes, Ian McHarg, Michael Hough, and Anne W. Spirn, who emphasized ecological planning principles (Pauleit *et al*., 2017).

Because of its multipotentiality, the term GI is commonly used generically, and when discussing its scope, the term BI can be discarded in favor of the term GI. Several terminologies are used to solve water resource and GI issues, including Nature-based Solutions (NbS)[4], Best Management Practices (BMPs)[5], Blue Green Systems (BGS)[6], Low Impact Development (LID)[7],

[3]Several biographers of Olmsted discuss his contribution to the development of GI. According to Eisenman (2013), Olmsted, despite being influenced by current thinking, developed notions that foreshadowed GI, such as networks of parks and vegetative corridors that connected various metropolitan regions. His work remained a great effect on succeeding planners and landscape architects.

[4] According to Pauleit *et al*. (2017, p.31-32), the concept of NbS evolved by adding to the concerns regarding climate change and its consequences in the first concept, "as a way to mitigate and adapt to climate change, secure water food and energy supplies, reduce poverty and drive economic growth." (IUCN 2014 in Pauleit *et al*., 2017), a greater emphasis on the protection of biodiversity, when The European Commission defines it as "actions which are inspired by, supported by or copied from nature" (EC 2015 in Pauleit *et al*., 2017). Later, in the research program Horizon 2020, the same commission gave a greater focus to urban areas, when Maes and Jacobs (2015, in Pauleit *et al*., 2017) defined NbS "as any transition to a use of ecosystem services with decreased input of non-renewable natural capital and increased investment in renewable natural processes".

[5] Best Management Practices (BMPs) are structural measures used to store or treat urban stormwater runoff with the aim of reducing flooding, removing pollution, among other benefits. Non-structural methods can be implemented singly or in tandem and link in stormwater management, including detention or retention devices, infiltration facilities, wetlands, vegetative strips, filters, water quality inlets, among others (Fletcher *et al*., 2014, p.529-530, 538).

Sustainable Urban Drainage System (SUDS)[8] e Water Sensitive Urban Design Systems (WSUDs)[9]. According to Silveira (2018), *Trame Verte et Bleue* (TVB) has a broad spatial scale and is multidisciplinary, but on a smaller scale, it uses specific concepts and solutions from different disciplines that, in the case of sustainable urban drainage, naturally integrate with the previously mentioned solutions. This could help to explain why these terminologies (Figure 1) are used instead of GI.

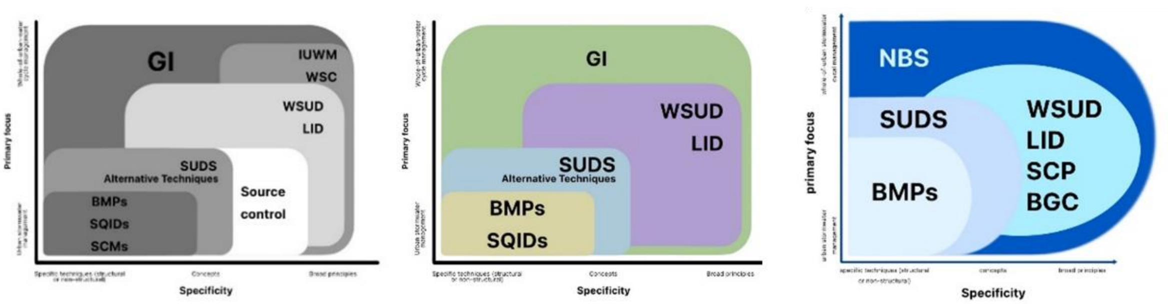


**Figure 1: Classification of urban drainage terminology, according to specificity and focus**
**Source: Fletcher et al. (2015), Jacob (n.d.), Qi et al. (2020), modified by the authors**

The three graphs in Figure 1, published in three different documents, illustrate modifications or disagreements on a term that encompasses GI and BI. In this one, we can see GI embracing numerous techniques to water management before being supplanted by NbS in the last one. The terminology for green infrastructure in water management has expanded since the 1980s, reflecting the subject's expanding interdisciplinarity (Everett; Lawson; Lamond, 2015; Fletcher *et al.*, 2014). The discussion, which was initially limited to civil engineers, eventually expanded to include landscape architects, planners, ecologists, and social scientists. Blue-

[6] In Blue-Green Systems (BGS), green and blue elements, such as vegetation and water, are integrated to enhance ecosystem services, improve connectivity between natural spaces, mitigate urban heat, and offer a range of environmental benefits (Probst *et al.*, 2022).
[7] Low Impact Development (LID) is an approach that aims to minimize stormwater management costs through “natural” hydrology, taking advantage of the site layout and the use of integrated control measures. This approach favors smaller-scale stormwater treatment devices, such as bioretention systems and green roofs, which are located close to the source of runoff, in addition to seeking to maintain natural areas and reduce impervious urban areas (Fletcher *et al.*, 2014, p.526-7).
[8] Sustainable Urban Drainage System (SUDS). Systems formed by a set of drainage technologies and techniques, working together and in sequence, which seek to replicate the natural pre-development drainage of a site and be more efficient and sustainable than conventional solutions (Fletcher *et al.*, 2014, p.529).
[9] Water Sensitive Urban Design (WSUDs) is an urban planning and design approach that seeks to minimize the hydrological impacts of urban development by promoting sustainable management of the water cycle. Aiming for water balance, it aims at conservation, environmental and recreational use of water resources, and maintenance of water quality. Although it emerged with an emphasis on stormwater management, it has evolved to encompass the entire urban water cycle, aligning with the broader concept of "water-sensitive cities" (Fletcher *et al.*, 2014, p.527-8).

Green Infrastructure (BGI)[10], a term borrowed from WSUD (Brown *et al*., 2009 in Everett; Lawson; Lamond, 2015), depicts green systems that temporarily turn "blue" during rains and floods. The Urban Blue-Green Infrastructure (UBGI)[11] is another approach that focuses on urban space.

UGBI plays an important role in biodiversity conservation by facilitating ecosystems functions as pollination and nutrient cycling (Andreucci; Russo; Olszewska-Guizzo, 2019). Pauleit *et al*., (2017) identify four fundamental principles for tackling urban difficulties through Urban Green Infrastructure (UGI) planning: green-gray integration, multifunctionality, connectivity, and social inclusion. Among these, integrating blue features such as rivers, wetlands, and stormwater systems is essential for improving ecological resilience and urban sustainability; even though the letter B does not appear in this concept.

Williamson (2003, in Mell, 2019) defines green infrastructure as "our nation's natural life support system," emphasizing an interconnected network of protected land and water that sustains biodiversity, regulates air and water quality, and improves human well-being. While providing support benefits, the use of GI in URP mitigates floods, regulates the hydrological cycle and incorporates recreational spaces (Schubert *et al*., 2018). The equitable distribution of green (GI) and blue infrastructure (BI) is closely tied to the integration of green spaces into urban projects, which helps mitigate structural disparities (Hasala; Supak; Rivers, 2020; Staddon *et al*., 2018). In this context, clear regulations and well-designed public policies are needed for facilitating and scaling GI-based solutions (Staddon *et al*., 2018).

Effective policy integration ensures that GI initiatives reach their full potential, while inconsistencies in terminology and regulatory frameworks can create misalignment between sectors, ultimately undermining their effectiveness (Afionis; Mkwambisi; Dallimer, 2020). However, the importance of water in these networks is frequently neglected in planning frameworks and policies, perpetuating long-standing distinctions between green and blue

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10 BGI is “an interconnected network of natural and designed landscape components, including water bodies and green and open spaces, which provide multiple functions such as: (i) flood control, (ii) water storage for irrigation and industry use, (iii) wetland areas for wildlife habitat or water purification, among many others.” (Ghofrani; Sposito; Faggian, 2016, p.499).

11 Urban blue-green infrastructure (UBGI) to De Macedo *et al*., 2021, or Urban green-blue infrastructure (UGBI) to Andreucci, Russo and Olszewska-Guizzo (2019), is an interconnected network of natural and semi-natural areas, including vegetation, water elements, and other environmental features integrated into the built environment. As a hybrid infrastructure, it is strategically planned, designed, and managed across multiple scales to regulate surface runoff, filter pollutants, enhance water quality and quantity, and provide cooling benefits, increasing urban resilience (Andreucci; Russo; Olszewska-Guizzo, 2019; De Macedo *et al*., 2021).

infrastructure. Water is not simply a resource; it also serves as a structural element in landscape connectivity, increasing natural corridors and supporting multifunctional networks that increase climate adaptation and environmental quality.

Mell (2010) suggests that segregating blue infrastructure from broader green infrastructure discussion restricts interdisciplinary collaboration and impedes holistic environmental management. Integrating water systems into green infrastructure frameworks improves landscape planning, while also acknowledging water's multifunctional benefits in urban resilience measures. Furthermore, this viewpoint is consistent with the larger principles of connection and access to nature, emphasizing the significance of blue-green synergies in developing more sustainable urban and regional ecosystems (Mell, 2019).

## 3 MATERIALS AND METHODS

Data collecting began in February 2023 using the Web of Science database (WOS) to obtain a better understanding of the issue, identify gaps, and formulate research objectives. The second phase began in April 2024 and ended in June of the same year, with the inclusion of a sample from the same research conducted in the Scopus database (Figures 2, 3 and 4).

In both databases, the investigation began with the umbrella term Green Infrastructure; Topic (5889 records) and Article title, Abstract, Keywords (7564 records) encompassing production from 1995 to 2024. The time span 2018-2024 was added, and only peer-reviewed papers were considered, with early access excluded, yielding 4.712 articles in WOS and 4.353 in Scopus.

The filters used in the WOS study provided 725 articles, with only the following categories retained: Environmental Studies, Urban Studies, Ecology, Water Resources, Regional Urban Planning, Biodiversity Conservation, Development Studies, and Environmental Engineering. There were 116 articles in the Water Resources category, and 64 items in the Regional Urban Planning category were chosen as a sample. This sample was analyzed in Excel, and a duplicate was removed, resulting in the selection of 22 articles based on keywords, keywords plus, titles, and abstracts (Figure 2). In this selection, the selected works are considered to emphasize the interaction between GI, water resources, and regional and urban planning.

<table>
<tr><th>Time</th><th>WOS</th><th>Parameters (WR-UP)</th><th>Tools</th></tr>
<tr><td>1995-2024</td><td>5.889</td><td>Term: Green infrasctruture;</td><td>WOS filters and analysis</td></tr>
<tr><td rowspan="7">2018-2024</td><td>4.712</td><td>Term: Green infrasctruture;</td><td>WOS filters and analysis</td></tr>
<tr><td>725</td><td>Categories: Environmental Studies, Urban Studies, Ecology, Water Resources, Regional Urban Planning, Biodiversity Conservation, Development Studies, Engineering Environmental;</td><td>WOS filters and analysis</td></tr>
<tr><td>116</td><td>Category: Water Resources ;</td><td>Bibliometrix and VOSviewer</td></tr>
<tr><td>64</td><td>Category: Regional and Urban Planning;</td><td>WOS filters and analysis</td></tr>
<tr><td>63</td><td>Analysis by Title, abstract and Key-words. One duplicate eliminated;</td><td>Zotero</td></tr>
<tr><td>22</td><td>Articles chosen for this study.</td><td>Bibliometrix and VOSviewer, Excel, Zotero</td></tr>
</table>

**Figure 2 – Water Resources – Urban Planning (WR-UP), Articles about urban and regional planning were found in the WOS database under the category Water Resources**
**Source: Prepared by the authors**

Using Scopus research filters (Figure 3), articles and reviews in English from the Environmental Science area (921) were selected. Limiting this category to: Urban Planning, Urban Development, Urban Design, and City Planning resulted in a new sample of 219 articles relating to urban planning, 148 of which were transferred to Excel. To continue the research, 32 articles relating to GI, urban planning, and water resources were identified by an analysis of their titles, abstracts, and keywords.

<table>
<tr><th>Time</th><th>Scopus</th><th>Parameters (UP-WR)</th><th>Tools</th></tr>
<tr><td>1995-2024</td><td>7.564</td><td>Term: Green infrasctruture;</td><td>Scopus filters and analysis</td></tr>
<tr><td rowspan="6">2018-2024</td><td>4.353</td><td>Term: Green infrasctruture;</td><td>Scopus filters and analysis</td></tr>
<tr><td>921</td><td>Subject area: Environmental science; Limited to: Urban Planning, Urban Development, Urban Design, City Planning;</td><td>Scopus filters and analysis</td></tr>
<tr><td>219</td><td>Reports requested for collection</td><td>Scopus filters and analysis</td></tr>
<tr><td>148</td><td rowspan="2">Category: Urban Planning; Analysis by Title, abstract and Key-words. One duplicate eliminated;</td><td rowspan="2">Bibliometrix and VOSviewer, Zotero</td></tr>
<tr><td>147</td></tr>
<tr><td>32</td><td>Articles with focus in water resources chosen for this study.</td><td>Bibliometrix and VOSviewer, Excel, Zotero</td></tr>
</table>

**Figure 3 – Urban Planning - Water Resources (UP-WR), in the Urban planning category, articles focusing on Water Resources were searched for in the Scopus database**
**Source: Prepared by the authors**

A new cycle was carried out in the Scopus database (Figure 4); from the previous sample of 921 manuscripts, we confined the search to the domain of water management (150), looking for papers with an emphasis on urban planning. For this study, 82 papers were chosen using the keywords urban area, land use, sustainable development, urban planning, urbanization, city, and urban development, and 23 were separated.

| Time | Scopus | Parameters (WM-UP) | Tools |
|---|---|---|---|
| 1995-2024 | 7.564 | Term: Green infrasctruture; | Scopus filters and analysis |
| 2018-2024 | 4.353 | Term: Green infrasctruture; | Scopus filters and analysis |
| | 921 | Subject area: Environmental science; Limited to: Urban Planning, Urban Development, Urban Design, City Planning; | Scopus filters and analysis |
| | 150 | Subjetct area: Water management; Reports requested for collection; | Bibliometrix and Vosviewer, Zotero |
| | 149 | One duplicate eliminated; | |
| | 82 | Category: Water management; Analysis by Title, abstract and Key-words with focus in urban planning; | Zotero |
| | 81 | One duplicate eliminated; | |
| | 23 | Articles with focus in urban planning chosen for this study. | Bibliometrix and VOSviewer, Excel, Zotero |

**Figure 4 – Water management – Urban Planning (WM-UP), In the Water management category, papers on urban planning were searched in the Scopus database.**
**Source: Prepared by the authors**

The samples were analyzed and compared using the programs Vosviewer and Bibliometrix. According to Callon, Courtial and Laville (1991), Cobo *et al*. (2011), and Aria and Cuccurullo (2017), these software programs can discover their differences by analyzing their keywords and clustering. The information was then loaded into Zotero and Excel to organize (refine) the choices based on the explored subjects and eliminate duplicates.

With defined manuscripts, a new analysis of clusters and keywords was performed through VOSviewer and Bibliometrix, to complement the study and classify thematic groups. With the application of mapping techniques, internal structures and the development of critical research points in the analyzed areas are revealed (Yu; Xu; Antuchevičienė, 2019 in Mcallister; Lennertz; Atencio Mojica, 2022, p. 320). At this stage, only publications belonging to these three cycles were considered for bibliometric analysis, totaling 77 articles.

The blocks have been renamed to W22 (WOS WR-UP 22), S32 (SCOPUS UP-WR) and S23 (WM-UP 23) to simplify and speed up the analysis process.

## 4 RESULTS

### 4.1 MOST GLOBAL CITED DOCUMENTS AND MAIN SOURCES

By comparing the three samples and examining the most cited documents globally as well as the main sources, we can gain a more thorough understanding of the importance and effect of GI research in science. This allows researchers to discover which papers garnered the most academic attention during the research period, as well as assess emerging patterns and potential gaps in literature. Table 1 shows that sample S23 stands out from the rest based on the number of citations. At the same time, we identify which publications are most important in disseminating information about the GI-URP link.

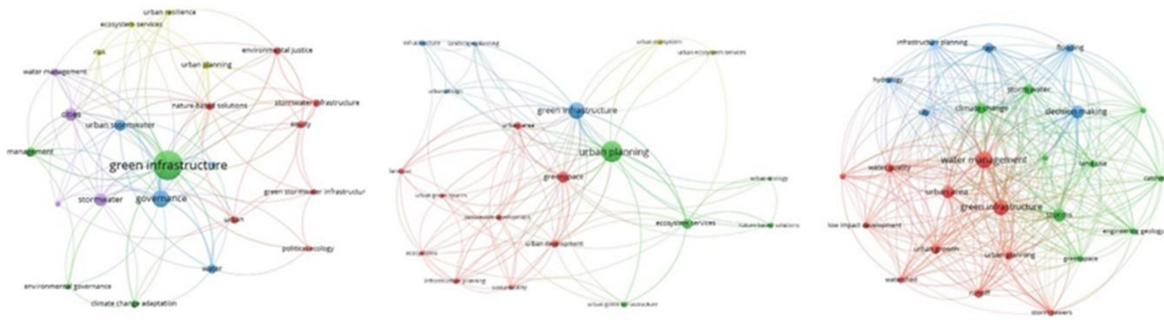
| Most Global Cited Documents (W22) | | | Most Global Cited Documents (S32) | | | Most Global Cited Documents (S23) | | |
|---|---|---|---|---|---|---|---|---|
| Zuniga-Teran AA, 2020 | J. Environ Plan Manag | 84 | Matsler AM, 2021 | Landsc. Urban Plan. | 101 | Nguyen TT, 2019 | Sci. Total Environ. | 279 |
| Carter JG, 2018 | J. Environ Plan Manag | 53 | Staddon C, 2018 | Environ. Syst. Decis. | 92 | Mei C, 2018 | Sci. Total Environ. | 207 |
| Hoover FA, 2021 | J. Environ Pol Manag | 46 | Hersperger AM, 2020 | Landsc. Urban Plan. | 66 | Leng L, 2020 | Sci. Total Environ. | 72 |
| Johns CM, 2019 | J. Environ Plan Manag | 43 | Cortinovis C, 2018 | Land | 58 | McFarland AR, 2019 | Environ. Sci. Water Res. Technol. | 58 |
| Cousins JJ, 2021 | J. Environ Pol Manag | 25 | Hoover FA, 2021 | Environ. Policy Plan. | 53 | Chen J, 2019 | Sci. Total Environ. | 54 |
| Heck S, 2021 | J. Environ Pol Manag | 22 | Badiu DL, 2019 | Landsc. Urban Plan. | 53 | Hamel P, 2022 | Environ. Manag. | 52 |
| Rojas O, 2022 | Habitat Int | 21 | Brzoska P, 2020 | Land | 48 | Woznicki SA, 2018 | Hydrol. Process | 38 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Walker RH, 2021 | J. Environ Pol Manag | 15 | Liu L, 2022 | Landsc. Urban Plan. | 27 | Gao Z, 2022 | Sci. Total Environ. | 32 |
| Kooy M, 2020 | Int Dev Plan Ver | 12 | Schubert P, 2018 | J. Environ. Policy Plan. | 22 | Bixler TS, 2019 | Sci. Total Environ. | 32 |
| Willems JJ, 2021 | J. Environ Pol Manag | 11 | Feltynowski M, 2020 | Land | 19 | Bauer S, 2020 | Water Environ. Res. | 18 |

**Table 1 – Most global cited documents and publication sources**
**Source: Prepared by the authors**

Bibliometrix revealed that the two predominant publication sources for each sample were: Journal of Environmental Planning and Management and Journal of Environmental Policy & Planning for sample W22; Land and Landscape and Urban Planning for sample S32; and Science of the Total Environment for sample S23. Analyzing the most widely cited papers, it was discovered that during data collection, the number of citations of articles in sample S23 suggested a larger interest in the issues addressed by this sample, followed by samples S32 and W22.

The three samples, or blocks, present distinct approaches to incorporating green infrastructure (GI) into urban planning, reflecting the diversity of contexts and concerns in discussions on rainwater management and climate change adaptation, as shown in clustering keywords based on VOSviewer graphs (Figure 5). For its use and analysis, its manual by Van Eck and Waltman (2013) was used.



| | Grapho 1: WOS WR-UP (22) | Grapho 2 : SCOPUS UP-WR (32) | Grapho 3: SCOPUS WM-UP (23) |
|---|---|---|---|
| Green cluster | Green infrastructure, Environmental governance, Management, Climate change adaptation | Urban planning, Ecosystem services, Urban ecology, Nature-based solutions | Storms, Climate change, Storm water, Land use, Engineering geology, Greenspace, Catchment area (hydrology), Catchments, Water supply |
| Blue cluster | Governance, Urban stormwater, Water, policy | Green infrastructure, Land planning, Infrastructure, Urban design | Decision making, Rain, Flooding, City, Infrastructure planning, Hydrology |
| Red cluster | Nature-based solutions, Urban, Environmental justice, Equity, Stormwater infrastructure, Green stormwater infrastructure, Politcal ecology | Green space, Urban area, Urban development, Infrastructure planning, Land use, Sustainable development, Urban green spaces, Sustaintability, Ecosystems | Water management, Green infrastructure, Urban area, Water quality, Urban growth, Runoff, Urban planning, LID, Storm sewers, Watershed, Water conservation |
| Yellow cluster | Ecosystem services, Urban planning, Urban resilience, Risk | Urban ecosystem, Urban ecosystem services | |
| Purple cluster | Cities, Stormwater, Water management, Sustainability | | |

**Figure 5: Graphs produced by vosviewer and their clustering keywords**
**Source: Prepared by the authors**

The first block (W22) focuses on keywords relating to the social consequences and equity of GI practices in the URP, emphasizing the significance of incorporating environmental justice standards into urban planning and water management decisions. This point of view emphasizes the importance of planning that supports environmental sustainability, social fairness, and equitable distribution of GI benefits.

The second block (S32) shows the integration of GI into urban plans in a comprehensive manner, considering above all urban planning, green spaces, infrastructure planning and ecosystem services. Indicating a greater synergy between natural systems and administrative structures and the search for sustainable management is suggested by the terms related to land use, land planning and urban development.

The terms in the third block (S23) indicate a higher emphasis on technical water management issues in GI practices, specifically infrastructure planning, flood management, and climate change adaptation. A stronger connection between the concepts emphasizes the links between GI, stormwater management, and urban development.

The word cloud (Figure 6) generated by Bibliometrix can summarize the graphs in Figure 5 and its key-words table. It is also possible to visualize the difference in occurrences between the keywords of the three samples in the graph presented in Figure 7.


**Figure 6: World Cloud**
**Source: Prepared by the authors**

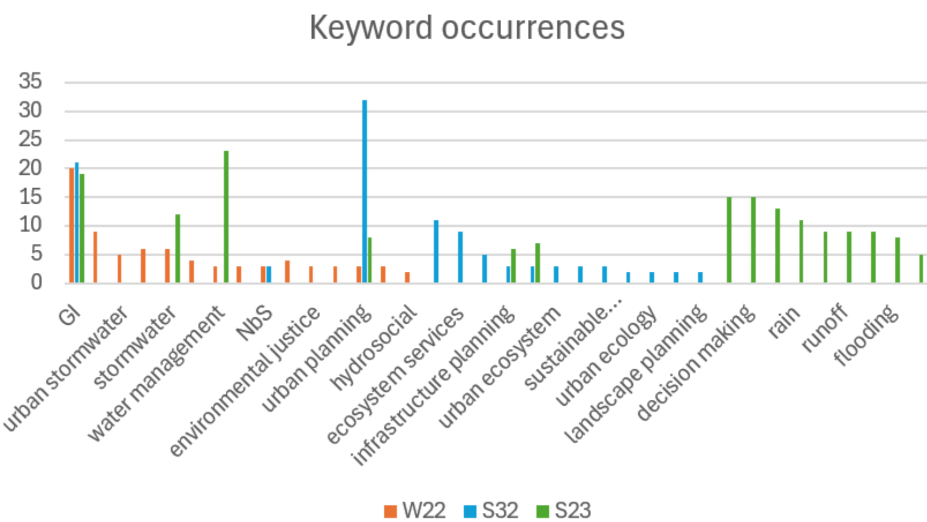



**Figure 7: Keyword occurrences**
**Source: Prepared by the authors**

The keyword occurrences (Figure 7) confirm (attest) to a greater emphasis on governance issues in relation to GI in W22, whereas in S32 urban planning stands out with a much greater weight in relation to GI, which is also more important in the S23 sample, but with a lower significance compared to water management, decision making, and climate change.

## 4.2 THE DIFFERENT RELATIONSHIPS BETWEEN HYDROLOGICAL RESOURCES, GI AND URP IN SCIENTIFIC LITERATURE

The analysis of blue infrastructure, as outlined in the three blocks, reveals significant nuances in the theoretical and practical approaches to urban water management. Looking at the three samples, with a focus on the presence and visibility of BI, we notice varied approaches of urban water resources in the URP. In the W22 sample, water management, including sustainable urban drainage, climate adaptation, and water governance, BI is treated as a component of GI, but does not occupy a central role in the discussions. The main focus is on the environmental benefits of NbS, highlighting environmental justice and ecosystem services. BI is present, but its approach occurs mainly as a subset of GI strategies in the URP. This structure implies that, despite understanding of the importance of BI in urban resilience, its inclusion remains secondary to larger GI initiatives. This reveals a gap in the integration of the two concepts, emphasizing the need to widen the scope of discussions to include a model that recognizes the interconnectedness of green and blue infrastructure.

In sample S32, the association between GI and UP becomes more pronounced, even though water management plays no significant role in this setting. "Urban planning" appears as a key node in the techniques examined, with ideas like ecosystem services and UGI being more clearly linked to it. This configuration suggests that the methods' focus changes away from water management and toward the integration of GI into UP. In this instance, the BI approach is applied secondarily, with water management handled as a supplementary component within the larger scope of GI. The mapping demonstrates an emphasis on the relationship between GI and UP, indicating the necessity for integrated planning, but without giving water the attention it deserves in urban sustainability initiatives, as evidenced by the loss of important keywords from the purple cluster of sample W22 to S32.

In sample S23, water management becomes a central node alongside GI. This arrangement, as seen by the numerous linkages between them on the map, shows a more integrated strategy, with water management at the core of conversations about sustainable urban planning. The growth in the number of linkages related to the water theme suggests a more detailed and interdisciplinary approach, revealing the complexities of the interconnections between urban systems and water resources. The presence or lack of terms in the samples, such as "low impact development" (LID) from sample S23 and "hydrosocial" (the interplay of water and social systems) from sample W22, suggests a more in-depth examination of the relationship between urban planning and water management. These principles refer to a more comprehensive study, emphasizing the need to take social and environmental factors into account when developing water management solutions. Simultaneously, a narrowing of the key-words figure is noted, reflecting a shrinking of techniques, which are more technical.

Table 2 was created using this information to highlight the differences across samples in terms of vision, role, and integration into the UP and URP.

| **BI approaches difference in samples W22, S32 and S23** | | | |
|---|---|---|---|
| **Aspect** | **W22** | **S32** | **S23** |
| Role of BI in the GI | BI is one of the components of GI but is not the main focus. | BI loses space, with the focus shifted to urban planning. | Water management becomes a central theme, with GI being seen as a mechanism to solve water challenges. |
| Integration with URP | The GI is seen as a broad concept within urban planning. | UP gains more prominence and BI has a smaller role. | Urbanism integrates strongly with water management, addressing specific solutions such as sustainable drainage and LID. |
| Vision of BI in the urban context | BI is presented as part of a larger set of environmental strategies. | BI is minimized, there is greater integration between GI and urban planning. | BI is seen as a structuring element, but not as a driving force for planning, connecting it directly to different GI and urban planning approaches. |

**Table 2 – Comparative table of the samples difference in BI approaches**
**Source: Prepared by the authors**

The evolution of the BI and URP relationship, as shown in the graphs (summarized in Table 2), shows a shift from a perception of a more conceptual and generic relationship, where water is just one of the elements of GI, to a more technical and integrated relationship, where water becomes central but not yet a driving force in urban planning. In sample S23, where BI is stronger and more prominent, an interdisciplinary approach is perceived, recognizing the importance of integrating GI-URP and water management to address climate change, resilience, and urban sustainability concerns.

## 4.3 ANALYSIS OF THEMATIC MAPS GENERATED WITH BIBLIOMETRIX

Thematic mapping eases the understanding of the dynamics of scientific networks and the transition of clusters between well-established and emerging areas.

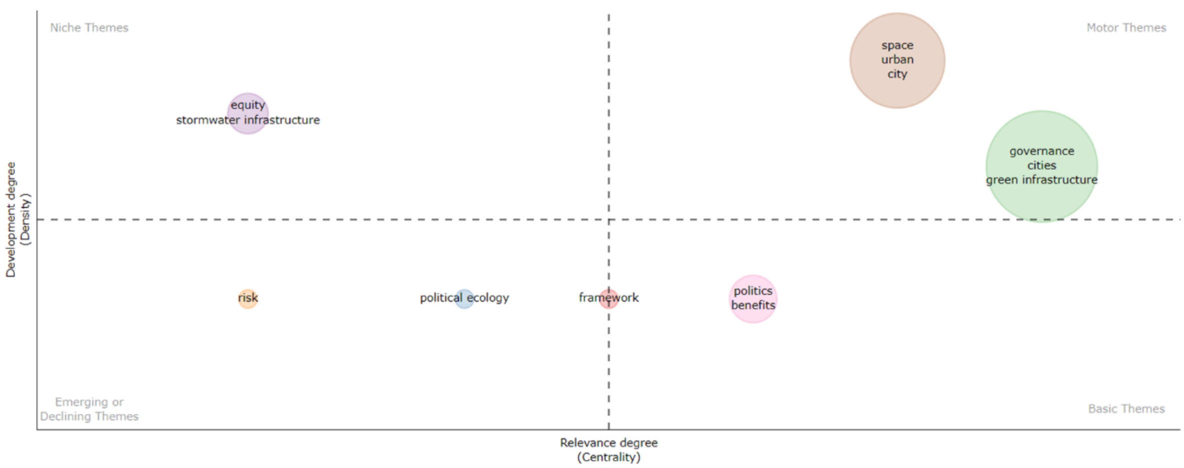



**Figure 8: Sample W22 Thematic map**
**Source: Prepared by the authors**

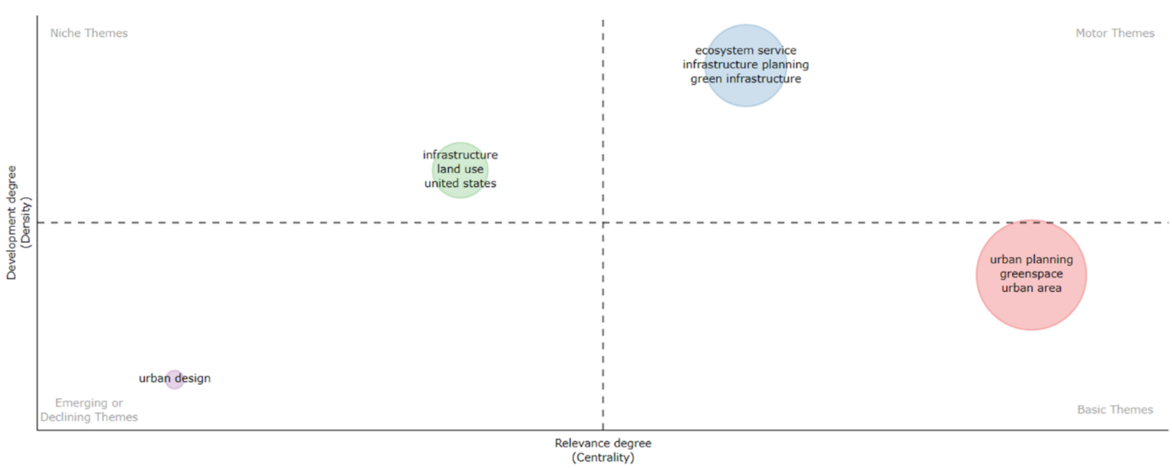



**Figure 9: Sample S32 Thematic map**
**Source: Prepared by the authors**

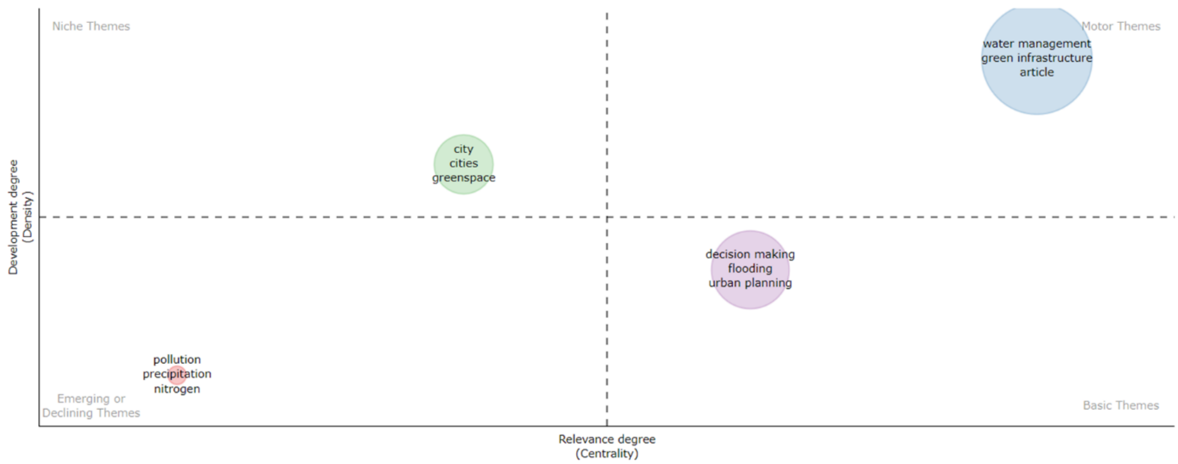



**Figure 10: Sample S23 thematic map**
**Source: Prepared by the authors**

The analysis of the three thematic[12] maps obtained from Bibliometrix, according to Callon, Courtial and Laville (1991, p.163-167) and Cobo *et al*. (2011, p.154-156) reveals several nuances and methods at the intersection between green infrastructure, blue infrastructure, water resource management and urban planning. These subjects, while linked, are treated in diverse ways, reflecting the variations in the interests and techniques of the studies that make up the bibliography analyzed.

| Thematic fields | W22 (WOS-WR-UP) | S32 (SCOPUS UP-WR) | S23 (SCOPUS WM-UP) |
|---|---|---|---|
| Niche Themes | equity, stormwater infrastructure | ecosystem services, infrastructure, United States | city, cities, greenspace |
| Motor Themes | city, GI, governance, space, urban | ecosystem services, GI, infrastructure planning | GI, water management |
| Basic Themes | benefits, framework, politics | greenspaces, urban area, urban planning | decision making, flooding, urban planning |
| Emerging Themes | framework, political ecology, risk | urban design | nitrogen, pollution, precipitation |

**Table 3 – Thematic Fields and Themes in Green Infrastructure and Urban Planning Research.**
**Source: Prepared by the authors**

[12] With its methodology inspired by Cobo *et al*. (2011), Bibliometrix creates thematic maps based on co-word network analysis and clustering (Aria; Cuccurullo, 2024, p.68).

The analysis of Table 3, resulting from the thematic maps (Figure 8, Figure 9, Figure 10, from the perspective of Callon, Courtial and Laville (1991, p.163-167) and Cobo *et al*. (2011, p.154-160)[13], classifies the thematic clusters within the field of green infrastructure and urban planning. “Centrality” measures the intensity of connections between a cluster and others in other research areas and shows strategic themes. In this research, themes such as “city” and “governance” (W22) or “ecosystem services” (S32 and S23) have high centrality. This indicates that they occupy a central position in the research network and are considered essential as if they were “mandatory passage points” when researching GI and urban planning.

According to Callon, Courtial and Laville (1991, p.163-167), “density” assesses the internal cohesion of a cluster, that is, how strongly the themes that compose it are interconnected. Clusters with high density, such as “greenspaces” and “urban planning” (S32), prove that these topics are well-developed in the scientific field. However, the low density in some central clusters, such as “political ecology” (W22), suggests that, despite being strategic themes and interconnected with others, they are still in the internal development stage. According to Callon, Courtial and Laville (1991), the intermediate position of themes like “political ecology” and “risk” on the W22 map indicates their role as a bridge between consolidated networks (Basic themes and Emerging or declining themes), implying an evolving area with the potential to become more robust as research advances.

Regarding the position in the quadrants, niche themes, such as "equity" and "stormwater infrastructure" (W22), "ecosystem services" (S32) and "city" and "greenspace" (S23), can be considered highly specialized and have relevance restricted to very specific areas. This suggests fragmentation because they are central topics in specific contexts of research and practice. The driving themes, in turn, are those that direct the advancement of the field, such as "city, GI, governance" in W22 and "ecosystem services, infrastructure planning and GI" in S32 and "green infrastructure" and "water management" in S23, which reveal the continued importance of integrating ecosystem services and governance in urban planning.

The basic themes, such as "benefits, politics" in W22 and "urban planning," "green spaces" in S32, and "decision making, flooding, and urban planning" in S23, serve as a conceptual and methodological foundation for field investigations, as well as widely discussed

[13] In the analysis of thematic maps, the notions of “centrality” and “density” are explored in the study of scientific networks by locating the spheres in the four quadrants or niches (Motor themes, Basic themes, Emerging or Declining Themes and Niche themes), at the same time that their dimensions indicate a greater quantity of documents; also demonstrating interest in the theme (Cobo *et al*., 2011, p.160).

and consolidated themes. Emerging themes include "political ecology" and "risk" (W22), "urban design" (S32), and "pollution, nitrogen, and precipitation" (S23), which are less established but increasing relevance.

The hierarchical structure of this framework (Table 3) reveals the complexity of thematic interconnections in the study of GI and urban planning, with emerging and niche themes pointing to future innovation foci and driving and core themes providing the theoretical and practical foundation for the field's continued development (Callon; Courtial; Laville, 1991; Cobo *et al*., 2011). The examination of the thematic maps shows the minimal participation of water resources in the intersection of urban (or regional) planning and GI, as seen in the three sample articles. The third thematic map (S23) identifies "water management" and "green infrastructure" as driving topics, implying a substantial convergence of sustainable water management methods in GI. Although this appears to be a well-established link in the literature, this study found that the method is more technical (e.g., LID, SUDs) and does not fit into a larger, more participatory way of directing urban and regional planning processes.

## *5* DISCUSSION

The results from the analyses of WOS22, Scopus S32, and Scopus S23 samples support the initial hypothesis that the integration of the concepts of GI and BI in the context of urban and regional planning is still marked by significant knowledge fragmentation. This fragmentation, as observed by Mastler *et al*. (2021) and Mell (2010), makes it difficult to develop a cohesive understanding of the relationship between GI, particularly BI and urbanization, affecting practical application and professional training in the field. Additionally, a persistent gap exists between academic research and practical application, complicating the process of translating this knowledge into actionable strategies for GI implementation (Sinnett *et al*., 2018).

In the findings, we can observe that the lack of a common concept that encompasses BI has contributed to the disconnection between the different fields of knowledge. In line with what was suggested by Fletcher *et al*. (2014) and Matsler *et al*. (2021), the lack of a conceptual consensus on the terms hinders both the planning and implementation of solutions and the articulation between the agents involved, such as planners, stakeholders, policy makers and communities. Unexpectedly, we discovered that, despite the existence of good practical experiences in industrialized nations, as pointed out by Silveira (2018), nomenclature and conceptual paradigms have yet to be consolidated globally. The term blue infrastructure, which is critical for understanding the relationship between green infrastructure and water management, is missing from the analysis's keywords, highlighting the ongoing nomenclature crisis and fragmentation.

The examination of the thematic maps reveals the organization and evolution of GI and URP research using the criteria of Callon, Courtial and Laville (1991), Cobo *et al*. (2011), and Aria and Cuccurullo (2017). The centrality of themes, such as "city", "governance" and "ecosystem services", indicates their strategic relevance as fundamental interconnection points. However, although clusters such as "greenspaces" and "urban planning" have high density, indicating conceptual maturity, others, such as "political ecology", have less internal cohesiveness, suggesting areas under development. The placement of the themes in the quadrants reveals a fragmentation into highly specialized niches, while driving themes, such as "GI" and "water management", drive conceptual and applied advances.

A closer look at these maps also reveals a limited participation of water resources in the interface between URP and GI, which is more clear in the third map (S23), where "water management" and "green infrastructure" emerge as central themes. Despite the consolidation of this relationship, the approach identified in the analyzed articles tends to be predominantly technical, focused on practices such as LID and SUDs, without a broader and more participatory integration in the urban and regional planning process.

Keyword analysis found a prevalence of terms relating to green infrastructure (GI) and water management. We also looked for related bibliometric research. Shao *et al*. (2021) used CiteSpace to conduct a bibliometric analysis on GI and identified keywords such as green infrastructure, ecosystem services, climate change, sustainability, biodiversity, and others, indicating a concern with the impacts of GI on the urban ecosystem, but no keyword related to BI was addressed.

The research by Shao *et al*. (2021) reiterates the invisibility of BI. In our findings, we found keywords such as GI (20 occurrences), governance (9), urban stormwater (5), cities (6), stormwater (6), water (4), water management (3), politics (3), NbS (3), management (4), environmental justice (3), stormwater infrastructure (3), urban planning (3), climate change adaptation (3) and hydrosocial (2), among others. These keywords indicate an emphasis on urban water management, adaptation to climate change and integration between the various green and blue infrastructure approaches, but this only occurred through targeting databases. In the WOS22 sample, we searched for articles on urban and regional planning within the Water

Resources area in the WOS database. In S32, we searched for articles focusing on Water Resources in the Urban Planning area of the Scopus database. In the Scopus database, papers concentrating on urban planning were searched for in the S23 sample under the Water management category. Although BI was the focus of many investigations, it was often referenced only briefly or not at all.

This difference in focus is significant because it suggests that this research proposes a more integrated and holistic view of urban planning, where water management and GI complement each other more explicitly. However, it also demonstrates that, despite this emphasis on BI, the importance of the topic can vary greatly. The fragmentation of the concept of GI, which could be stipulated to be replaced by BGI or *Trame verte et bleue*, giving cohesion to GI and BI, makes it difficult to implement more resilient and sustainable urban solutions, as pointed out by several experts in the field. The integration of GI and BI is challenged by the intricate dynamics of ecosystem interactions, competing stakeholder interests, financial constraints, and fragmented policy frameworks (Hansen *et al.*, 2023). The construction of a more solid conceptual basis and the integration of these concepts in urban planning and water management would be the first and most important step among the fundamental steps to face contemporary urban challenges, especially in view of the growing threats of climate change and accelerated urbanization.

## CONCLUSIONS

By comparatively analyzing all the material from Bibliometrix and VOSviewer of the three samples, it is possible to observe a transition in the way BI is managed in the articles. Starting as a more conceptual and generic object (WOS22), just a part of GI and not always visible. Then, more integrated with urban planning and other issues of resilience and urban sustainability (S32), to be found as a more technical element (S23). This finding suggests the perception of BI as on an increasing scale of importance and visibility, culminating in a more accurate perception of technical and specific issues, where it is seen in its fullness, although it distances itself from social issues and the urban and regional planning process as a whole.

In essence, there is a significant difference between the focuses and topics addressed in the samples. The WOS22 sample addresses water resource management and urban stormwater challenges, as well as governance, climate change, environmental justice, and ecosystem services. In the S32 sample, water management in urban planning is not the primary concern. This is mostly about urban planning and development, but it also addresses sustainability issues like urban ecosystem services and NbS. In S32, BI is rarely directly mentioned, while it is implied in the idea of GI in numerous articles. The third sample (S23) focuses on water management, both quantity and quality, as well as urban planning, though in a more technical manner. This block prioritizes the planning of water infrastructures, their costs, and efficiency, without addressing ecosystem services or social issues, but still mentioning climate change.

The findings of this study suggest that the scientific field, which produces significant actors and policymakers, may contribute to the current disarticulation of fields and agents taking part in the construction of the regional and urban landscape employing BGI. The lack of a common concept may perpetuate this disarticulation, preventing BI from being recognized for its true value and potential. BI can guide urban and regional planning because of its significant impact on connectivity between basins, ecosystems, and systems, establishing flows, enriching and preserving biodiversity, and regulating processes critical to life maintenance. With actual's severe climate challenges, academics, practitioners, public officials, and ordinary individuals must work together to find solutions.

As pointed out by Matsler *et al*. (2021), Mell (2010) and Pauleit *et al*. (2017) among other leading authors on the subject, the lack of formulation and consolidation of a GI concept hinders its application, maintenance and long-term success. Despite sociocultural, geographic and economic differences, there is a need for a concept that can be used when thinking about the regeneration or creation of new spaces, especially considering BI, bringing back the appreciation of waterscapes. This study aims to contribute to the international scientific debate by finding out questions related to the intersection of GI and URP, mainly the issue of the visibility and perception of BI in this relationship, that planners, policymakers and other agents involved are facing when creating or retrofitting urban and regional areas, searching to mitigate environmental problems or resolve them. The role of blue infrastructure, its potential and its visibility is still a vast field for research. Although the study of hydrological resources and GI are very present in academic databases, a first move towards finding a conciliatory and holistic concept is necessary.

## ACKNOWLEDGEMENTS

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001. Thanks to the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) for the financial support, Le Mans Université and the Federal University of Rio Grande do Sul (UFRGS).

## REFERENCE

AFIONIS, Stavros; MKWAMBISI, David D.; DALLIMER, Martin. Lack of cross-sector and cross-level policy coherence and consistency limits urban green infrastructure implementation in Malawi. **Frontiers in Environmental Science**, v. 8, p. 558619, 2020.

ANDREUCCI, Maria Beatrice; RUSSO, Alessio; OLSZEWSKA-GUIZZO, Agnieszka. Designing urban green blue infrastructure for mental health and elderly wellbeing. **Sustainability**, v. 11, n. 22, p. 6425, 2019.

ARIA, Massimo; CUCCURULLO, Corrado. Bibliometrix: Comprehensive Science Mapping Analysis. Available at: https://cran.r-project.org/web/packages/bibliometrix/bibliometrix.pdf. Accessed on: 25 Mar. 2024.

ARIA, Massimo; CUCCURULLO, Corrado. bibliometrix: An R-tool for comprehensive science mapping analysis. **Journal of informetrics**, v. 11, n. 4, p. 959-975, 2017.

CALLON, Michel; COURTIAL, Jean Pierre; LAVILLE, Francoise. Co-word analysis as a tool for describing the network of interactions between basic and technological research: The case of polymer chemsitry. **Scientometrics**, v. 22, p. 155-205, 1991.

COBO, Manuel J. et al. An approach for detecting, quantifying, and visualizing the evolution of a research field: A practical application to the Fuzzy Sets Theory field. **Journal of informetrics**, v. 5, n. 1, p. 146-166, 2011.

DE MACEDO, Laura Silvia Valente et al. Urban green and blue infrastructure: A critical analysis of research on developing countries. **Journal of Cleaner Production**, v. 313, p. 127898, 2021.

EISENMAN, Theodore S. Frederick Law Olmsted, green infrastructure, and the evolving city. **Journal of planning history**, v. 12, n. 4, p. 287-311, 2013.

ELDERBROCK, Evan et al. A guide to public green space planning for urban ecosystem services. **Land**, v. 9, n. 10, p. 391, 2020.

EVERETT, Glyn; LAWSON, Emily; LAMOND, Jessica. Green infrastructure and urban water management. **Handbook on green infrastructure: Planning, design and implementation**, v. 50, 2015.

FLETCHER, Tim D. et al. SUDS, LID, BMPs, WSUD and more–The evolution and application of terminology surrounding urban drainage. **Urban water journal**, v. 12, n. 7, p. 525-542, 2014.

GHOFRANI, Zahra; SPOSITO, Victor; FAGGIAN, Robert. Designing resilient regions by applying blue-green infrastructure concepts. **WIT Transactions on Ecology and the Environment**, v. 204, p. 493-505, 2016.

HANSEN, Rieke et al. Reorienting urban green infrastructure planning towards biodiversity–Perspectives and ongoing debates from Germany. **Urban Forestry & Urban Greening**, v. 90, p. 128155, 2023.

HASALA, Dresden; SUPAK, Stacy; RIVERS, Louie. Green infrastructure site selection in the Walnut Creek wetland community: A case study from southeast Raleigh, North Carolina. **Landscape and Urban Planning**, v. 196, p. 103743, 2020.

JACOB, A.C.P. **BMP, LID, SUDS, WSUD E INFRAESTRUTURA VERDE – PRÁTICAS QUE REVOLUCIONAM A DRENAGEM URBANA**. Available at: https://swmm5.org/2015/11/20/bmp-lid-suds-wsud-e-infraestrutura-verde-praticas-que-revolucionam-a-drenagem-urbana/. Accessed: 20 Oct. 2021.

MATSLER, A. Marissa et al. A ‘green’chameleon: Exploring the many disciplinary definitions, goals, and forms of “green infrastructure”. **Landscape and Urban Planning**, v. 214, p. 104145, 2021.

MCALLISTER, James T.; LENNERTZ, Lora; ATENCIO MOJICA, Zayuris. Mapping a discipline: a guide to using VOSviewer for bibliometric and visual analysis. **Science & Technology Libraries**, v. 41, n. 3, p. 319-348, 2022.

MCFARLAND, Andrea R. et al. Guide for using green infrastructure in urban environments for stormwater management. **Environmental science: Water research & technology**, v. 5, n. 4, p. 643-659, 2019.

MELL, Ian Caleb. **Green infrastructure: concepts, perceptions and its use in spatial planning**. 2010. Tesis Doctoral. Newcastle University.

MELL, Ian. **Green infrastructure planning: Reintegrating landscape in urban planning**. Lund Humphries, 2019.

PAULEIT, Stephan et al. **Nature-based solutions and climate change–four shades of green. Nature-based solutions to climate change adaptation in urban areas: Linkages between science, policy and practice**, p. 29-49, 2017.

PROBST, Noëmie et al. Blue Green Systems for urban heat mitigation: mechanisms, effectiveness and research directions. **Blue-Green Systems**, v. 4, n. 2, p. 348-376, 2022.

QI, Yunfei et al. Addressing challenges of urban water management in Chinese sponge cities via nature-based solutions. **Water**, v. 12, n. 10, p. 2788, 2020.

REU JUNQUEIRA, Juliana; SERRAO-NEUMANN, Silvia; WHITE, Iain. Developing and testing a cost-effectiveness analysis to prioritize green infrastructure alternatives for climate change adaptation. **Water and Environment Journal**, v. 37, n. 2, p. 242-255, 2023.

SCHUBERT, Per et al. Implementation of the ecosystem services approach in Swedish municipal planning. **Journal of environmental policy & planning**, v. 20, n. 3, p. 298-312, 2018.

SHAO, Huamei et al. Web of science-based green infrastructure: a bibliometric analysis in CiteSpace. **Land**, v. 10, n. 7, p. 711, 2021.

SILVEIRA, André Luiz Lopes da. Trama verde-azul e drenagem urbana sustentável**. Planejamento e gestão territorial: a sustentabilidade dos ecossistemas urbanos [recurso eletrônico]**. Criciúma, SC: EDIUNESC, 2018. cap. 3, p. 69-91, 2018.

SINNETT, Danielle et al. The translation and use of green infrastructure evidence. In: **Proceedings of the Institution of Civil Engineers-Water Management**. Thomas Telford Ltd, 2018. p. 99-109.

STADDON, Chad et al. Contributions of green infrastructure to enhancing urban resilience. **Environment Systems and Decisions**, v. 38, p. 330-338, 2018.

SUNDING, Anna. Management of green infrastructure in public organizations**. Acta Universitatis Agriculturae Sueciae**, n. 2025: 9, 2025.

VAN ECK, Nees Jan; WALTMAN, Ludo. VOSviewer manual. **Leiden: Univeristeit Leiden**, v. 1, n. 1, p. 1-53, 2013.

WILFONG, Matthew et al. Shifting paradigms in stormwater management–hydrosocial relations and stormwater hydrocitizenship. **Journal of Environmental Policy & Planning**, v. 25, n. 4, p. 429-442, 2023.

YONEGURA, Valéria Borges; LAURENT, François; DA SILVEIRA, André Luiz Lopes. THE INSERTION OF GREEN <BLUE> INFRASTRUCTURE IN URBAN AND REGIONAL PLANNING: BARRIERS AND INVISIBILITY. **ARACÊ** , [S. l.], v. 7, n. 3, p. 10243–10273, 2025. Available at: https://periodicos.newsciencepubl.com/arace/article/view/3636. Accessed on: 6 Mar. 2025.

**Enviado em 11/12/2024**
**Aprovado em 23/06/2025**