



The uptake of new concepts in urban greening: Insights from Poland

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ABSTRACT

The idea of nature having multiple benefits for urban management and planning is gaining prominence alongside the rise of climate change awareness. It is expressed through concepts such as nature-based solutions (NbS), ecosystem-based adaptation (EbA), and blue-green infrastructure (BGI). Despite their popularity in the international arena, relatively little is known about how these concepts are used and interpreted at the local level, which has implications for policy formulation and actions. This paper examined both direct and indirect references to these concepts, as well as the reasons for their potential omission. By analysing policy documents and interviews with practitioners and activists from four Polish cities (Gdansk, Krakow, Warsaw, Wroclaw), it discussed the uneven and ambivalent uptake of concepts in the urban green and blue space (UGBS) governance. While the reluctance to use new terminology was often explained by accessibility and efficiency concerns, it also revealed some conceptual confusion. The contribution of this study is twofold: 1) providing a more nuanced understanding of the conceptual ambiguity surrounding the NbS, EbA and BGI concepts and the gap between international policy rhetorics and local interpretation; 2) expanding the geography of research on urban climate adaptation and urban green spaces which tends to overlook the countries of Central and Eastern Europe.

1. Introduction

The idea of nature's benefits for climate adaptation is becoming increasingly widespread in both academic and policy circles (Frantzeskaki et al., 2019; McPhearson et al., 2014). While nature as a planning-based response to the growing pollution and congestion in cities emerged already in the 19th century (Duvall et al., 2018), new approaches that emphasise its multi-functionality, multiple benefits and cost-effectiveness comparing to conventional engineering solutions have recently been packaged into distinctive concepts. This study focuses on some of the most prominent of these new "green concepts" (as was put by Hanson et al., 2019): nature-based solutions (NbS), ecosystem-based adaptation (EbA) and blue-green infrastructure (BGI). EbA and NbS build on the concept of ecosystem services (ES), generally defined as the benefits people obtain from ecosystems (MEA, 2005), with key adaptation-related benefits including protection of communities from climate extremes and variability (Wamsler et al., 2016).

Globally, these concepts are promoted by international organisations and agreements, such as the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2014), Sendai Framework for Disaster Risk Reduction 2015–2030 (UNISDR), UN Convention on Biological Diversity (CBD, 2016), the UN New Urban Agenda (Article 157) and the Paris Agreement (Article 7). In the European Union (EU), which positions itself as a global leader in

climate adaptation, they feature in the key policy agendas, examples include Green Infrastructure Strategy report (2013), EU Biodiversity Strategy (2013), the EU Adaptation Strategy (2013), Urban Water Agenda 2030 and EU action plan for disaster-risk reduction EC (2016). Additionally, NbS is a priority area for investment under the Horizon 2020 research program, and an interdisciplinary Expert Group was commissioned to define and operationalize the concept and identify its research priorities (Faivre et al., 2017; Raymond et al., 2016).

Despite the rise and active promotion of "green concepts" in the international rhetorics, relatively little is known about what activities and practices constitute these concepts on the ground (Hansen et al., 2019; Milman and Jagannathan, 2017). Practitioners' interpretations and framings affect the choice of policy solutions (O'Brien et al., 2007; Oulahen et al., 2019) but also play an important role in the institutionalisation of new policy concepts (Lennon, 2015); the impact of conceptualisations used in documents is even more straightforward as they determine what policy steps are taken. Although some research has been carried out on structural obstacles for mainstreaming the policies associated with these concepts, e.g. lack of institutional and financial capacity (Brink et al., 2016; Kabisch et al., 2016), less has been published on how these concepts are "being interpreted, assessed, acted upon and integrated in actual decision making" at different governance levels in the EU Member States (Blicharska and Hilding-Rydevik, 2018, p.181).

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This lack of knowledge is problematic both theoretically and practically. The few existing studies comparing practitioners' and academics' perspectives on new concepts in urban greening (e.g. [di Marino and Lapintie, 2018d](#)) as well as related research on concepts' uptake in climate adaptation ([Meerow and Stults, 2016](#); [Vogel et al., 2007](#)) indicate a frequent mismatch in conceptualisations between these two groups. Thus, theoretical inquiry in concepts' operationalisation may be moving even further away from the on-the-ground reality.

Being conceptually vague from a theoretical perspective, the concepts acquire a further degree of confusion when they move from academic discussion to policy documents and then to implementation. Some argue conceptual vagueness is an integral part of the EU policy-making and is necessary for collective action ([Kovacic and Di Felice, 2019](#)). Still, because concepts are often used inconsistently and loosely in policy documents, it is difficult to identify, assess and monitor the performance enacted by them ([Milman and Jagannathan, 2017](#); [Albert et al., 2019](#)). Unclear articulation precludes them from appearing at the operating level in executive regulations which therefore impedes their employment ([Stepniowska et al., 2018b](#)). All-encompassing vision and different understandings among different actors risk undermining the possibility of meaningful implementation and might instead discredit the concepts, legitimising business as usual approach and contributing to path-dependency ([Matthews et al., 2015](#); [Reid, 2016](#)).

This qualitative exploratory ([Creswell, 2007](#)) study sets out to explore how the new "green concepts" (BGI, EbA, NbS) have been used in policy documents and interpreted by practitioners in the field of urban green space planning and management in four major Polish cities: Gdansk, Krakow, Warsaw and Wroclaw. The analysis was organized around two main topics: (i) direct and indirect references to the concepts, and (ii) reasons for their potential omission. The study aimed not only to assess the extent of uptake but also to provide a more in-depth understanding of the variety of concepts' interpretations and use.

Several factors influenced the choice of Poland. First, addressing a geographical research gap: much of the literature on urban greening and climate adaptation overlooks Central and Eastern Europe (CEE) countries ([Kronenberg et al., 2017a,b](#)). Second, whereas the impact of the EU on policy uptake on its Member States is considered to be high ([Massey et al., 2014](#)), especially in the New Member States ([Börzel and Buzogány, 2010](#)), Poland is one of the most vocal climate sceptics, boycotting many EU climate and environmental policies and strategies ([Marcinkiewicz and Tosun, 2015](#)). It is simultaneously the largest coal producer and the largest beneficiary of the EU structural funds, a substantial part of which is dedicated to climate-related goals ([Benzie et al., 2019](#)). Previous research has emphasised the crucial impact of the EU on climate adaptation policies development in Poland ([Swianewicz et al., 2018](#); [Szmigiel-Rawska, 2017](#)). Still, some commentators are wary ([Kuchler and Bridge, 2018](#); [Skjærseth, 2018](#)) or even sceptical ([Bankwatch, 2016](#); [Szulecka and Szulecki, 2017](#)) about country's progress in climate adaptation and the positive impact of these investments. This conjunction of climate scepticism and generous EU funding makes Poland a compelling setting for examining the dissemination and operationalisation of new concepts pertaining to the EU-wide environmental policies and climate change agenda.

In the following section, I present the analytical and theoretical framework guiding this study. Section 3 introduces case cities and describes how data was gathered and analysed. After presenting the key results (Section 4), I move on to compare them with observations from other contexts (Section 5) and then discuss their implications for further studies of concepts' uptake (Section 6).

2. Analytical and theoretical framework

The examination of "green concepts" uptake in the practice of decision-making regarding urban green and blue space (UGBS) governance is guided by two questions: a) how these concepts are used explicitly and implicitly and b) if the concepts are not used, what are the

Question	Method of analysis
direct references	deductive coding: <ul style="list-style-type: none"> • (blue)-green infrastructure (GI/BGI) • nature-based solutions (NBS) • ecosystem-based adaptation (EBA)
indirect references	deductive coding: benefits (moderating temperatures, water retention) inductive coding: relations between UGS & climate change
reasons for not using	inductive coding

Fig. 1. The analytical framework for the study.

reasons for their omission? To address these questions, the following analytical framework (Fig. 1) was developed based on the previous scholarship on concepts' uptake.

Crucially, this paper departs from similar studies by focusing on more than one concept simultaneously: nature-based solutions, ecosystem-based adaptation, blue-green infrastructure as well as ecosystem services in the context of climate adaptation. This decision was based on two considerations. First, while recent publications have contributed to delineating the boundaries between these concepts ([Dorst et al., 2019](#)), they are still closely interrelated and share such central characteristics as multifunctionality and multiple co-benefits — not only climate adaptation and mitigation but also broader environmental, social, environmental and economic; thus, they tend to overlap and complement each other ([Pauleit et al., 2017](#)), as old and new paradigms often do ([Raum and Potter, 2015](#)). For instance, NbS are considered either as an umbrella term ([Derksen et al., 2017](#); [Nesshöver et al., 2017](#)) or may be used interchangeably with BGI or EbA ([Fink, 2016](#); [Wamsler and Pauleit, 2016](#)). Second, I assumed the differences between these concepts were even less straightforward in practice than in academic debates, and conceptual differences were probably not the most urgent issue for practitioners. Indeed, in practice similar interventions – urban gardens, waterways, or green roofs – are referred to as either NbS, EbA or BGI ([Dorst et al., 2019](#)). Considering these concepts simultaneously might better account for these peculiarities.

Analysing both direct and indirect (explicit and implicit) references offers an opportunity to get a more comprehensive insight about concepts' integration into practice ([Zölch et al., 2018](#)). Direct references are "an obvious but nonetheless relevant indicator" for the entry of concepts in the policy discourses, whereas indirect references, even though not always signify a conscious uptake of concepts, may nevertheless indicate the presence of ideas associated with them ([Hansen et al., 2015](#)). Previous studies illustrated that even though local policy documents and practitioners seldom use novel concepts *explicitly*, their underlying principles may be included indirectly: see [Zölch et al. \(2018\)](#) and [Albert and Von Haaren \(2017\)](#) on Germany; [Beery et al. \(2016\)](#); [Blicharska and Hilding-Rydevik \(2018\)](#); [Wamsler et al. \(2016\)](#); [Nordin et al. \(2017\)](#) on Sweden; [Pasquini and Cowling \(2015\)](#) on South Africa; [La Rosa \(2019\)](#) for Italy; [Mascarenhas et al. \(2015\)](#) on Portugal; [Hansen et al. \(2015\)](#) and [Rall et al. \(2015\)](#) for the comparison between US and European cities.

Unlike a relatively straightforward analysis of explicit and implicit references to a single concept (e.g. [Hauck et al., 2013](#); [Zölch et al., 2018](#)), the principles for examining implicit references to several concepts simultaneously require clarification. I adopt a broader perspective by discussing not only the benefits of UGBS to climate adaptation (e.g. moderating temperatures and increasing water infiltration – [Derksen et al., 2017](#)) but elucidating other potential framings of their relation, such as vulnerability of ecosystems themselves ([Bush and Doyon, 2019](#); [Green et al., 2016](#); [McPhearson et al., 2014](#)). And since climate change is a novel theme in Polish policymaking, it is worth examining how its relations with UGBS are conceptualised, and whether discussing them correlates with using the 'green concepts' elsewhere in the documents or interviews.

Exploring the reasons for not using the concepts (hereinafter 'potential omission') is a less common strategy which can, nevertheless,

illuminate important concerns. For instance, about the limited heuristic or operational value of a new concept (Mascarenhas et al., 2015; Stępniewska et al., 2018a), its inadequacy to describe the reality (De Vreese et al., 2019), or a general confusion around the content of a new approach (Raum and Potter, 2015). Concepts' dissemination is also influenced by incentives to adopt them (Sitas et al., 2014) and linguistic preferences of practitioners from non-English speaking countries (Cortinovis and Geneletti, 2018; Niemelä et al., 2010). More generally, competing interests and political agendas determine the success of ideas and knowledge claims in policymaking (Saarikoski et al., 2018).

Noticing implicit use and reasons for the potential omission is particularly relevant for the case of Poland, where the uptake of new concepts in urban greening was described as limited and slow (Kronenberg et al., 2017a,b; Swianewicz et al., 2018). Main reasons include political disregard to urban green space and lack of awareness about its needs and benefits, its narrow and rigid classification (Feltynowski et al., 2018) and poor institutional collaboration (Kronenberg, 2015). When the concepts are used, then mostly indirectly (Maczka et al., 2016; Piwowarczyk et al., 2013; Stępniewska et al., 2018a,b; Zwierzchowska et al., 2019). Local authorities generally demonstrate low awareness about climate change and perceive environmental hazards as a traditional effect of humans' activity (Szmigiel-Rawska, 2017).

3. Methods

3.1. Case studies introduction

This paper focuses on four major cities in Poland: Gdansk, Krakow, Warsaw and Wroclaw (Fig. 2). The main selection criterion was the presence of innovations in the UGBS field: I assumed, based on the previous observations (Pauleit et al., 2019), the concepts were more

likely to be used in these cases. These innovations were identified through desk research (Table 1 in Appendix A contains some prominent examples.) As other large cities in Poland are similar to these cases in terms of urban greening innovations and exposure to new concepts (see e.g. Raszeja and Gałęcka-Drozda, 2015; Zwierzchowska et al., 2019 on Poznan, Kronenberg et al., 2017a,b; Wagner et al., 2013 on Lodz), the findings from this study may be relevant for other cities.

Even though this was not intended as a comparison study, I remained sensitive to the potentially emerging differences in the concepts' use across the four case study cities. To be able to draw some general conclusions, I selected cities that represent a wider variety of contexts in terms of climate risks, built form, organisation of UGBS management and focus of their activities (see Appendix A for more details).

3.2. Data sources

Data sources consisted of two types: strategic policy documents related to urban greening and climate adaptation at the local and national level ($n = 21$) and in-depth semi-structured interviews with practitioners and activists ($n = 19$). The documents were selected based on the reports by governmental and non-governmental institutions (Bergier and Kronenberg, 2018; Biejat, 2017; NIK, 2017). There were four documents per city (exception is Krakow, $n = 5$) and four documents representing the national level, see Appendix C for a full list.

At the city level, I considered the following types of documents (adapted from Zwierzchowska et al., 2019):

- 1 municipal development strategy (*Strategia rozwoju miasta*);
- 2 Study of conditions and directions of spatial development (*Studium uwarunkowań i kierunków zagospodarowania miasta*) – a planning document defining the spatial policy of a city;

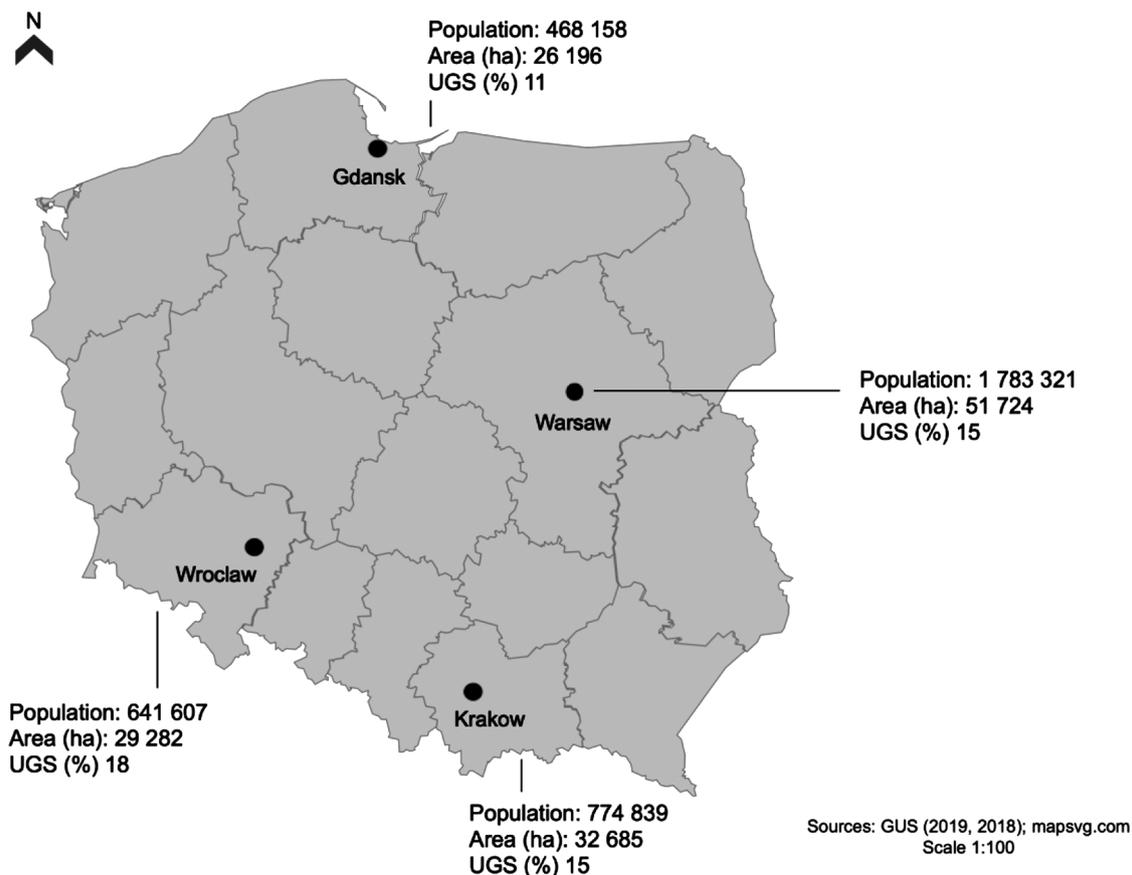


Fig. 2. Map of Poland showing the case study cities.

- 3 Environmental Protection Program (*Program ochrony środowiska*) – an executive document for implementing the environmental policy (hereafter 'EPP');
- 4 climate adaptation plans created within the Urban Adaptation Plan project (*Miejskie Plany Adaptacji*, hereinafter 'MPA44') initiated by the Ministry of the Environment for the 44 biggest cities in Poland.

Additionally, I included the Urban greening strategy for Krakow, the only document of this kind in the country, and the separate strategy for climate adaptation of Warsaw. The core set of data consisted of the documents referring to the policies currently in place, but their previous versions were also screened to get familiar with earlier references to climate change adaptation.

Key relevant national documents were incorporated as well given the importance of high-level policies for concepts' operationalisation and implementation (Rall et al., 2015; Gorgoń, 2018). These include the summary publication of the above-mentioned MPA44 project (2019), National Urban Strategy (2015); Strategy for Energy Security and Environment (2014); and Strategic Adaptation Plan for Sectors and Areas Sensitive to Climate Change in Poland (2013).

The respondents were selected by purposive and snowball sampling (see the full list and the questionnaire in Appendix D). They represented key official institutions in planning and managing urban greenery, such as the Municipal Greenery Authority (Zarząd Zieleni Miejskiej, hereinafter 'ZZM'), Municipal Road Authority (Zarząd Dróg Miejskich) responsible for greenery along the streets, Environmental Protection Office and others. I also interviewed some activists and representatives of non-governmental organizations to learn about a bottom-up perspective on UGBS. The interviews were conducted from January to May 2019, mostly face-to-face, with length ranging from 30–70 min, and in several cases by email. The questions revolved around respondents' attitude to the concepts and the relations between climate change and UGBS.

Participant observation at workshops and conferences (n = 4) helped to triangulate preliminary observations, obtain additional contacts, learn about prevailing discourses and key legislation and documents (see a list in Appendix E.)

3.3. Data analysis

To analyse the documents and interview transcripts, a combination of quantitative and qualitative coding was conducted in the NVivo 12 software package. When assessing the *direct* references to concepts, I looked for the keywords related to NbS, EbA, BGI (see Appendix C). I also included the ecosystem services concept, which is relatively more established in the Polish context (Stepniewska et al., 2018a), focusing on its usage in relation to climate adaptation. While it is not fully equivalent to EbA or other concepts under analysis, ES is often used in similar ways and contexts.

First, I counted the instances of explicit use, noting whether the concepts were defined. Second, to assess the extent of elaboration, I developed a scoring protocol, giving 0 for no reference, 1 for a brief mentioning, 2 for a more elaborated reference. Third, to test the overall consistency of concepts' use within a document, I noted their location following the protocol suggested by Cortinovis and Geneletti (2018) who identify three main components: information base (background knowledge supporting planning decisions); vision and objectives (longterm vision and targets) and actions (strategies, policies and other actions envisioned to achieve the objectives). The summary of the analysis is presented in Table 1, Appendix C.

To assess the *indirect reference* to concepts, I applied a combination of inductive (data-driven) and deductive (theory-driven) coding. The key way to identify indirect references was to see whether UGBS was mentioned in the context of climate change adaptation. The preliminary list of codes was informed by the literature and contained the benefits of UGBS to climate adaptation; simultaneously, new themes describing

the relations between UGBS and climate emerged through the process of inductive coding. A similar open coding strategy was used in the analysis of transcripts to understand the reasons for the *potential omission* of concepts. To mitigate an interpretative bias associated with coding by a single researcher and to enhance the reliability of the study, I provide a detailed description of the process and the coding scheme in Appendix B.

4. Results

4.1. Direct references

4.1.1. Documents

No big difference between cities, city and national level and types of documents was identified (see Table 1, Appendix C). The only pattern that became apparent was time: the concepts are likely to occur in the more recent documents. The most frequent and elaborated concept was BGI, appearing in 13 out of 21 documents at both national and city levels. It was generally associated with such adaptation-related benefits as water retention and risk reduction from storms. However, several documents (Warsaw and Wroclaw development strategies, Study of the conditions... for Warsaw) deliberated instead on biodiversity conservation, community cohesion and increase in property prices. In about a third of documents (8 out of 21), BGI was mentioned repeatedly but was seldom (5 out of 21) defined. In the descriptions of BGI, an emphasis was put on connectivity and integration of green, blue and non-natural areas, as well as using water elements (e.g. 'turning cities to rivers' – National Urban Strategy; drainage channels – Warsaw Adaptation Strategy) and vertical greening (e.g. EPP for Wroclaw used the examples of green walls and roofs to explain what green infrastructure is).

The concept of NbS was only briefly mentioned in relation to the Horizon2020 project "Grown Green" funded under the call "Demonstrating innovative nature-based solutions in cities" ('activities' section of the EPP for Wroclaw). ES were four times, albeit briefly mentioned in the context of climate adaptation and natural hazards protection, whereas no references to EbA were identified.

Both BGI and climate-related examples of ES mostly appeared in the 'Visions and objectives' part of the documents but were usually presented in quite abstract terms, such as the need to promote green infrastructure. Slightly less popular was the 'Information base' part where the concepts were defined and explained. As Fig. 3 illustrates, few specific actions were mentioned in relation to BGI and none about ES, while EbA was never used.

4.1.2. Interviews

Direct references in the interviews were more rare and sporadic than in the documents: only 8 out of 19 respondents mentioned the concepts explicitly. Apart from this, similar patterns of use were revealed, again with no substantial differences across cities. Similarly to the documents, the most popular term was BGI (mentioned 5 times). Connectivity, integration, water elements and vertical greening

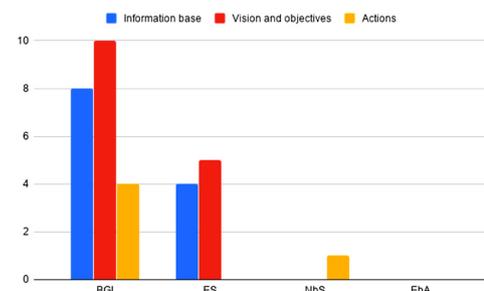


Fig. 3. The number of references to concepts in different parts of the documents.

("introducing greenery wherever possible" – city official, Gdansk) were brought up as its key characteristics.

No direct references to EbA were identified, and ES were not explicitly linked to climate adaptation. Curiously, NbS was mentioned four times, which is more often than in the documents. Two city officials (from Wroclaw and Krakow) saw NbS as an alternative to costly grey infrastructure and a way to deal with floods, alleviate heat and as a source of co-benefits such as recreation. In contrast, two other respondents (from Gdansk and Warsaw) were rather sceptical about NbS, even though their attitude to BGI was positive (see Section 4.3).

4.2. Indirect references

4.2.1. Documents

Most strategic documents contained references to climate change adaptation. At the *city level*, all environmental protection and strategic development documents (also Studies of the conditions... apart from those for Warsaw and Krakow, which were adopted earlier) at least briefly mention adaptation among their key goals. At the *national level*, the National Urban Strategy puts responsibility for climate adaptation on local governments, emphasising that climate risks should be considered in spatial and investment planning (p. 82). Nevertheless, it does not necessarily imply the recognition of UGBS in this respect: instead, the need for risk assessments and improvement of urban infrastructure were usually mentioned.

Explicit use of the concepts generally correlated with UGBS and climate change being discussed elsewhere in the document (see Table 1, Appendix C). But there were exceptions: BGI was not always explicitly linked to climate, and several documents (EPP for Warsaw and Krakow, Study of the conditions... for Wroclaw) discussed water retention and heat alleviation potential of UGBS without mentioning the concepts.

Two key framings of the relations between UGBS and climate were identified. The most popular one described the benefits of UGBS in addressing the negative impacts of climate change through heat alleviation and water retention. It was particularly elaborated in the Urban Adaptation Plans (UAP) but could also be found in other national and city-level documents:

"... [green spaces] help to improve hydrological conditions of soil in a city by water retention [...] and prevent the lowering of water table." (Urban greening strategy for Krakow)

The second framing described UGBS as a victim of climate-induced heat waves in summer: "...[droughts] cause the soil to dry out and result in a deterioration of vegetation and poor quality of urban green areas." (EPP for Warsaw)

4.2.2. Interviews

A common view amongst interviewees was that climate change awareness had increased and become mainstream over recent years. They linked it with a higher occurrence of extreme weather events and perceived weather changes.

Even though the respondents couldn't come up with the examples of activities primarily motivated by climate adaptation, they often felt climate change concerns justified investing in urban greening and protected UGBS from being built upon. According to them, climate change adaptation was one of the key ideas behind spatial planning, even if it was not stated directly. Interestingly, the lack of specificity as to what climate adaptation actions should be taken received mixed perceptions among activists and city officials. The former saw it as a factor undermining the efficacy of the Urban Adaptation Plans, the latter didn't think it was a problem: "[in our activity] we don't follow these guidelines but know for sure that even one planted tree or a rain garden do make a change" (official, Warsaw).

Similarly to the documents, the benefits of UGBS to climate adaptation constituted the most popular framing. The respondents from all four cities often mentioned the role of green space in water retention, which might be attributed to the changes in responsibility of water

management envisaged by the water regulation, modified in 2018 in accordance with the EU Water Directive Framework. Water retention was particularly relevant for Gdansk due to its prior experience of severe flooding in 2001. As a local official said, "for us, urban greening is first and foremost about water retention."

The framing of UGBS as a victim of climate-related heatwaves received particular elaboration from the activists who described the challenges of watering trees in summer. Two additional framings mentioned by several interviewees include UGBS as a threat (e.g. falling trees during storms) and the adjustments in greening management associated with longer vegetation periods (e.g. selection of species and prolonged working season.)

4.3. Reasons for potential omission

To better understand why the concepts might be used implicitly but not explicitly, I examined the overall attitude to them and the reasons for their potential omission. Generally speaking, three types of attitude towards the "green concepts" could be identified, but attributing them to individual respondents is not clear-cut: a person may express different views throughout the interview (see more on that below).

Type 1: attitude is positive, the concepts are actively used (however, only in one interview the respondent indeed mentioned them frequently). *Type 2:* attitude is positive but the concepts guide the activities implicitly. For example, city officials from Krakow and Warsaw said they used the concepts explicitly only in the context of conferences and projects but not in their everyday practice. *Type 3:* attitude is suspicious. Both officials and activists reported to consider the concepts as gobbledegook: "I have never heard anyone using these terms in their everyday practice. It sounds nice for marketing, but when it comes down to practice the main thing is to have trees, shrubs, ponds and so on" (activist, Warsaw). In terms of proportions, only 5 instances were coded to Type 1, whereas Type 2 and 3 had 9 and 7 codes respectively.

While the concept of BGI was widely used (Section 4.1) and had positive connotations, the attitude to NbS was more ambivalent. Despite its potential benefit of "harmonizing the way of thinking about a given solution and therefore facilitating its introduction" (official, Warsaw), the added value of NbS was often perceived as low due to its vagueness and little novelty: similar solutions have already been used in the past, and the ideas behind NbS "come as no surprise" (official, Wroclaw).

Other reasons explaining a wary attitude towards NbS (and new concepts more generally) included concerns about maintenance costs of green roofs and walls (e.g. watering them and providing electricity), which made them less attractive than traditional forms of greening, and also concerns about their accessibility. Participants from all cities, especially Krakow and Gdansk, emphasized that while green roofs are beneficial for water retention and temperature regulation, they can only be used by inhabitants of a given building. Thus, they have no social value, unlike the greening around housing planted in the previous decades. Another drawback stems from the fact that green roofs can be counted as a half of the minimum green area required for new developments: "we should not allow for a situation when all greening is at the top floor, and all we have on the ground is a single tree pushing through a pavement" (official, Krakow).

NbS was sometimes seen as less effective comparing to engineering solutions ("When you get 120 ml of rain in one hour, no forest, moss and fern can absorb this" – official, Gdansk). However, according to a city official from Krakow (NbS supporter himself), the problem was not only in the engineers' preference for hard solutions. The adoption of NbS faces some practical obstacles, such as lack of data (necessary e.g. to launch a project exploring the benefits of NbS) and inability of current legislation to enforce these solutions: "There is no guarantee that at a certain point someone will not decide to build a terrace on this place, and the system will stop functioning." A similar concern about inadequate legislation was voiced by a city official from Warsaw: if a

sewage system is available, water should be treated there and cannot be retained in a rain garden, which indicates a mismatch between the scale of BGI promotion and the legal realities.

5. Discussion

Before discussing the results, several limitations should be acknowledged. The number of interviews was unequal across the cities (varying from 3 to 7 respondents), and the depth of the interviews varied depending on the form in which they were conducted (while most were face-to-face, some were done via email). While these limitations should be kept in mind, I believe the data collected nevertheless provides a valuable resource to explore the uptake of "green concepts" in four Polish cities.

5.1. On direct references

Prior research has established that the concepts are seldom used directly but often referred to implicitly (Section 2). This study only partly corroborated this tendency to limited direct use. Indeed, the interview respondents (both city officials and activists, who overall expressed similar views) were generally reluctant to use the concepts even if they welcomed the ideas associated with them. In the documents, however, direct references appeared to be relatively common: almost two-thirds of publications explicitly mentioned one of the concepts at least once. This is more than could be assumed based on previous investigations (Section 2). Still, these references tended to be of little elaboration and without definitions. Similar to previous studies (Beery et al., 2016; Cortinovis and Geneletti, 2018; Geneletti and Zardo, 2016), the concepts were mostly absent from strategic parts of the documents, describing a general vision rather than specific goals, tasks and objectives. Despite the increased occurrence, the concepts were still used rather vaguely and inconsistently. And while it is difficult at this stage to deliberate on their meanings, discussing the reasons for potential omission (below) offers some thought-provoking insights in this respect.

A different degree of concepts' popularity (many occurrences of BGI, few of NbS and none of EbA) may be partly explained by the impact of the EU-wide policies on their dissemination. BGI has featured in the key regulations at least since 2013 (Section 1). NbS were mentioned by the respondents whose cities participated in the recently launched NbS-related projects funded by the EU, while the term was absent from the documents that were generally published several years ago. EbA, even though mentioned in the EU Biodiversity and in Green Infrastructure Strategies, has been arguably less promoted than NbS or BGI. In terms of future work, it would be interesting to investigate more closely the process of concepts' dissemination and the role of the EU in it, using e.g. the lenses of urban policy mobility studies (McCann, 2017).

5.2. Making sense of indirect references

Similar to prior research (Honey-Rosés and Pendleton, 2013; Hauck et al., 2013; Wilkinson et al., 2013), even though the practitioners seldom used the concepts, they still showed interest in the information related to them and were aware of the complex relations between UGBS and climate. This propensity to use the concepts implicitly has been explained by the fact that practitioners felt the concepts were underpinning their policies for a long time (Beery et al., 2016; Rall et al., 2015), that the concepts are too easy to grasp and have little novelty (Piwowarczyk et al., 2013), but also that it is hard for practitioners to link familiar issues (e.g. recreation) to the newly introduced concepts (Mascarenhas et al., 2014).

Climate change adaptation, however, is a relatively recent policy agenda, especially in CEE countries, which might suggest the novelty of 'green concepts' and therefore the absence of above-mentioned barriers to their explicit use. Importantly, though, the notion of climate change

adaptation is vague in itself. While climate adaptation was clearly an important issue both in the documents and interviews, it was not always clear what activities constitute it and how they differ from previous actions. Based on their analysis of the projects in the UNFCCC database, Milman and Jagannathan (2017) noted that "some projects not initially labelled as EbA have been reclassified as EbA and some projects labelled as EbA are primarily aimed at conservation, rather than climate change"; furthermore, the projects identified as climate change adaptation not always articulate their contribution to responding to climate change (ibid.) Szmigiel-Rawska (2017) observed a similar tendency in her study of local climate change adaptation in Poland, where both adaptation and mitigation activities were often re-labelled in terms of their benefits in other domains (e.g. efficiency and attracting more funding) and portrayed as not directly motivated by climate concerns but as traditional activities of local governments.

The results gained from this study present a similar picture: it is indeed difficult to point out the activities in UGBS field that have been specifically designed and aimed at climate adaptation. Both documents and respondents often acknowledged the role of UGBS in reducing flood risks and heatwaves, but these concerns were usually about the current issues and not explicitly linked to climate change. Uncertainty, which is intrinsic to the discussion on climate change (Matthews et al., 2015), was not mentioned, except for the section outlining general climate risks for cities (similarly to Milman and Jagannathan, 2017). The potential implications of this vagueness around climate change adaptation for the concepts' use are discussed further below.

5.3. Reasons for potential omission

Practitioners' reluctance to use the concepts explicitly may be driven by accessibility, efficiency and maintenance concerns, but also by the confusion around what constitutes climate change adaptation. Efficiency considerations mirror the arguments about preference for hard infrastructure over UGBS, voiced in the literature on Poland (Kronenberg et al., 2017a,b) and elsewhere (O'Donnell et al., 2017), whereas concerns about everyday maintenance and management, as well as public accessibility of green roofs were seldom articulated in previous studies on concepts' uptake (see, however, the literature on climate gentrification, e.g. Anguelovski et al., 2016).

Curiously, efficiency and equity concerns partially stem from associating the "green concepts" with predominantly vertical forms of greening (e.g. green roofs and walls) which were often opposed to more traditional greening (e.g. trees). This association was found in both documents and interviews. Although these concerns undoubtedly deserve further investigation, they also reveal a certain confusion over the meanings of these concepts: NbS and other "green concepts" are not limited to vertical greening but instead "encompass existing ideas and require the inclusion of lessons from the past... local and traditional knowledge" (Eggermont et al., 2015, p. 245). Meanwhile, if the novelty of a new approach is not clear, practitioners may be sceptical about the added heuristic and operational value of new concepts: the results of this study corroborated the observation by Kronenberg et al. (2017a,b) that NbS in Poland were not seen as an innovation and were therefore not attractive for mainstreaming.

In line with previous literature (Mascarenhas et al., 2015; Matthews et al., 2015), this study suggests ambiguity around the "green concepts", coupled with the vagueness of climate adaptation, are among the main reasons behind practitioners' reluctance to use the new terminology. There is an underlying assumption that "if a project builds or restores ecosystems services, it also contributes to climate change adaptation" (Milman and Jagannathan, 2017, p. 125). In practice, though, climate adaptation measures are often framed in terms of infrastructural solutions and not UGBS, while UGBS planning is not always driven primarily by climate adaptation concerns. While approaches associated with "green concepts" are grounded in both ecosystem service and climate change adaptation research, these activities are mainly

implemented independently, which in turn has not only theoretical but also practical implications (Wamsler et al., 2014; 2016). This problematic assumption about inextricable links between two different domains might be another source of confusion for practitioners, adding up to the reasons for the potential concepts' omission.

6. Implications and conclusion

The concepts of blue-green infrastructure, nature-based solutions and ecosystem-based adaptation have penetrated the practice of decision-making in UGBS governance in Poland, but their uptake has so far been uneven and ambivalent. It can, on the one hand, be described as selective (the aspects embraced are usually the ones that are in line with broader policy priorities, e.g. requirements of the new water law) and somewhat superficial (when mentioned, the concepts often lack specificity and elaboration, and take a relatively marginal place in the documents). On the other hand, direct references to the concepts played a noticeable role in introducing the agenda on UGBS in climate adaptation to the policy documents. Even though the impact of climate awareness on UGBS management and planning was often unclear, its rise seemed to support the importance of urban greening.

To interpret a situation when the concepts were mostly used implicitly and considered as gobbledegook with negative impacts to efficiency and accessibility of green spaces, it is useful to recognise that knowledge can have multiple pathways in policy processes and can be used at different stages (Saarikoski et al., 2018). The examination of new "green concepts" uptake illustrated "both visible, short term responses as well as more subtle and diffuse changes in policy frames that are time-lagged but traceable—and in some case also untraceable but nevertheless existing" (Saarikoski et al., 2018, p. 581). It also showed how new concepts do not simply displace the old ones but interact with them in various ways, competing and overlapping with them, as practitioners tend to load the new agendas into existing planning frameworks (Matthews et al., 2015; Albert and Von Haaren, 2017). One possible implication for further research is thus investigating the apparent paradoxes and inconsistencies in concepts' use, which may reveal hidden drivers and obstacles to their dissemination and uptake.

The second implication for future analysis stems from acknowledging that cities are embedded in and dependent on higher levels of governance (Hughes et al., 2018). Furthermore, within cities the application of concepts is determined by wider systems — not only practitioners' perceptions but also infrastructure and institutions (Andersson et al., 2019). This study elaborated on how discrepancies might exist not only between the EU and Member States' policies but also between national and city levels. Despite Poland's climate scepticism (Section 1), in big cities new approaches associated with "green concepts" are often embraced. Their implementation, however, might be hampered by the lack of precise guidelines and requirements, poor environmental legislation and spatial planning. All these barriers need to be dealt with predominantly at the national level, and therefore a higher level of governance may affect concepts' uptake locally in various, not immediately evident ways.

Despite these limitations, learning about the peculiarities of practitioners' perceptions and the actual use of concepts in policy documents provides a more nuanced understanding of the relations between the international policy rhetoric, academic discussions and local decision-making. While some scholars questioned transferability of the internationally-grounded policies and concepts (Mell et al., 2017), this study demonstrated that patterns of and obstacles in their use can be relatively similar across various contexts. These findings can therefore be relevant for practitioners in other cities in Poland and elsewhere, facilitating further discussion and development of a joint understanding of the concepts. Finally, while a certain degree of conceptual vagueness helps to accommodate for different interests, the evidence from this study suggests too much ambiguity and vagueness can lead to reluctance to use the concepts. Clarifying how greening and climate

adaptation activities are linked in practice, accentuating the core principles of the concepts and including them into the operational elements of policy documents are among the key steps that might not only enrich theoretical discussion but also help to avoid path dependency in concepts' integration.

Author-statement

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Declaration of Competing Interest

None.

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Appendix A. Supplementary data

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