

The Possibility of Including Habitat Types as Nature-Based Solutions in Spatial Planning Documents: the Case of Slovenia

Manca Dremel, Igor Zelnik, Barbara Goličnik Marušić

(Manca Dremel, Urban Planning Institute of the Republic of Slovenia, Trnovski pristan 2, 1000 Ljubljana, manca.dremel@uir.si)

(PhD Igor Zelnik, University of Ljubljana, Biotechnical faculty, Department of Biology, Jamnikarjeva 101, 1000 Ljubljana, igor.zelnik@bf.uni-lj.si)

(PhD Barbara Goličnik Marušić, Urban Planning Institute of the Republic of Slovenia, Trnovski pristan 2, 1000 Ljubljana, barbara.golicnik-marusic@uir.si)

1 ABSTRACT

There are many forms of NBS for contemporary urban challenges that reflect individual elements or facilities in urban space, but a systematic and comprehensive implementation of NBS in urban planning documents has not yet been observed. In this paper, we use unaltered native habitat types (HTs) as innovative forms of NBS that originate from the natural or semi-natural environments of the same region as the targeted urban environment, which is the subject of urban planning. We draw on a planning approach that attributes added value (a function in addressing urban challenges such as air pollution, noise, stormwater management, and urban heat island) to HT, thus linking the concepts of NBS and HT in an innovative way to integrate them into urban planning. Based on a qualitative content analysis of spatial planning documents in the case of Slovenia, the paper presents a proposal for the inclusion of HTs as NBS in spatial planning documents at national, regional, and local levels. It was found that strategic spatial planning documents are suitable for defining the concept of NBS as a way of addressing urban challenges, while key to integrating HT as NBS into existing spatial planning practice are the spatial implementing document at national and municipal levels, as well as the Urban Development Concept as a mandatory technical basic document for these acts.

Keywords: spatial planning documents, habitat types, nature-based solutions, urban challenges, environment

2 INTRODUCTION

The concept of nature-based solutions (NBS) is firmly established in European urban policy, but its systematic and integral implementation in urban planning documents is yet to be observed. NBS are based on natural or nature-mimicking processes with the aim of solving social challenges (Cohen-Shacham et al., 2016; European & Directorate-General for Research and, 2015; Goličnik Marušić et al., 2023). We focus on NBS in urban areas. The most typical urban challenges to which NBS can respond are mainly particulate and gaseous air pollution, noise, stormwater runoff, and urban heat island (Ferrini et al., 2020; Raymond et al., 2017).

There are many forms of solutions to urban challenges in the literature, referred to as nature-based solutions, that reflect individual elements or facilities in urban spaces (e.g., green roofs, urban gardens, rain gardens, permeable paving, urban woodland, vertical greening systems, open green systems, constructed wetlands, river floodplains). In this paper, we used unmodified natural terrestrial and freshwater habitat types (HTs) found in Europe as forms of NBS for urban challenges. HTs as NBSs originate from the natural or semi-natural environments from the same region as the targeted urban environment that is the subject of urban planning. HTs are notable spatial units for conservation practice and their spatial definition can be directly represented graphically in spatial planning documents. Recognizing their ability to effectively solve urban challenges such as temperature reduction, stormwater management, noise reduction, air quality improvement, and CO₂ concentration reduction through their ecosystem processes (such as evapotranspiration, shading, water purification, water retention, noise attenuation, particle deposition, carbon sinks) gives us the opportunity to treat them as NBSs represented directly in spatial planning documents. The following characteristics, defined by Dremel et al. (2023), represent a basic starting point for understanding natural HTs as NBS:

- (a) They do not require (extensive) maintenance (e. g. supplemental watering) and are self-sustaining, unlike agricultural and urban Hats'
- (b) They are more resilient to pests, weather and climate conditions, and other disturbances than HTs of non-native species.
- (c) They contribute to the biodiversity of native species.

This paper focuses on the pilot attempt to integrate HTs as NBS in spatial planning documents, from the strategic and national level to the implementation level and the local level. The aim of the paper is to present a proposal for the inclusion of HTs as NBS in spatial planning documents using the example of spatial planning in Slovenia. The result of the pilot test is a conceptual proposal that shows how HTs can be included in binding spatial components that are NBS and not only as spatial units for nature conservation in mandatory spatial planning documents relevant for nature conservation.

In Slovenia, the urban environment faces the following urban challenges that could be addressed by the implementation of HTs and on which our research focuses:

(a) urban heat island (Cerar, 2020; Darko & Krevs, 2015; Komac et al., 2016) and thus the need to reduce surface temperature, especially during hot summer weather.

(b) urban pluvial flooding (Klemen et al., 2020; Krajnc, 2019) and thus the need for efficient stormwater management to regulate urban surface runoff.

(c) noise pollution from road and rail traffic (Cegnar et al., 2022; Prisljan & Kvasič, 2021) and therefore the need for noise reduction.

(d) particulate matter (PM₁₀) air pollution, mainly from traffic and small wood-fired biomass combustion plants (Cegnar et al., 2022; Koleša, 2021), and therefore need for air quality improvement.

2.1 Spatial documents in the planning system in Slovenia

The overarching law for spatial planning in Slovenia is the Spatial Management Act (“Zakon o urejanju prostora (ZUreP-3)”, 2021). It defines in detail the objectives, principles and rules of spatial planning, actors, spatial planning documents and procedures for site selection, detailed planning and approval of spatial developments of national importance, as well as other spatial measures, instruments, monitoring, operation of the spatial information system and issuance of certificates in the field of spatial planning. Spatial planning is implemented through the preparation and drafting of spatial planning documents and national spatial planning procedures. A Spatial Management Act defines the spatial development of the country, regions and municipalities (strategic spatial planning documents), and determines the implementation of spatial regulation (spatial implementation documents). In addition to main spatial planning documents, all the mandatory documents under the ZUreP-3, which directly affect their preparation, are also important and are therefore also the focus of the study.

Spatial planning documents are both strategic and implementing. Strategic documents take precedence over the implementing documents and are coordinated so that the implementing documents do not conflict with strategic documents. In Figure 1, the strategic spatial planning documents are shown in the left column in the middle box and the spatial implementing documents in the right column in the same box. The central frame in Figure 1 also shows the relationships between them and the level of responsibility for their preparation (State, Region, Municipality).

In addition to the hierarchy and typology of spatial planning documents, Figure 1 shows that the overarching framework for spatial planning, which includes the approval and implementation of spatial planning interventions and the implementation of other spatial planning tasks, is the National spatial order (DPR) (represented by the outer frame surrounding the central framework of spatial planning documents), and the documents that are mandatory for certain spatial planning documents, which influence their preparation and approval (the list of documents is shown outside of the frame).

3 METHODOLOGY

To assess the potential of including HT as NBS in spatial planning documents that influence spatial planning in Slovenia, or in spatial planning instruments at the national, regional, and municipal levels, we developed a set of criteria for qualitative content analysis. Each document was evaluated according to the following three criteria:

(1) Determination of the status of HTs and NBS participation in the document: in order to determine the situation, we analysed documents whose orientations are defined for the entire country of Slovenia, and which were therefore analysed in terms of their content objectives, recommendations, orientations, etc. When analysing each document, we asked whether it in any way involves HT and the NBS, or, if the NBS is not explicitly mentioned/referred to, whether the document’s guidelines are consistent with the NBS concept.

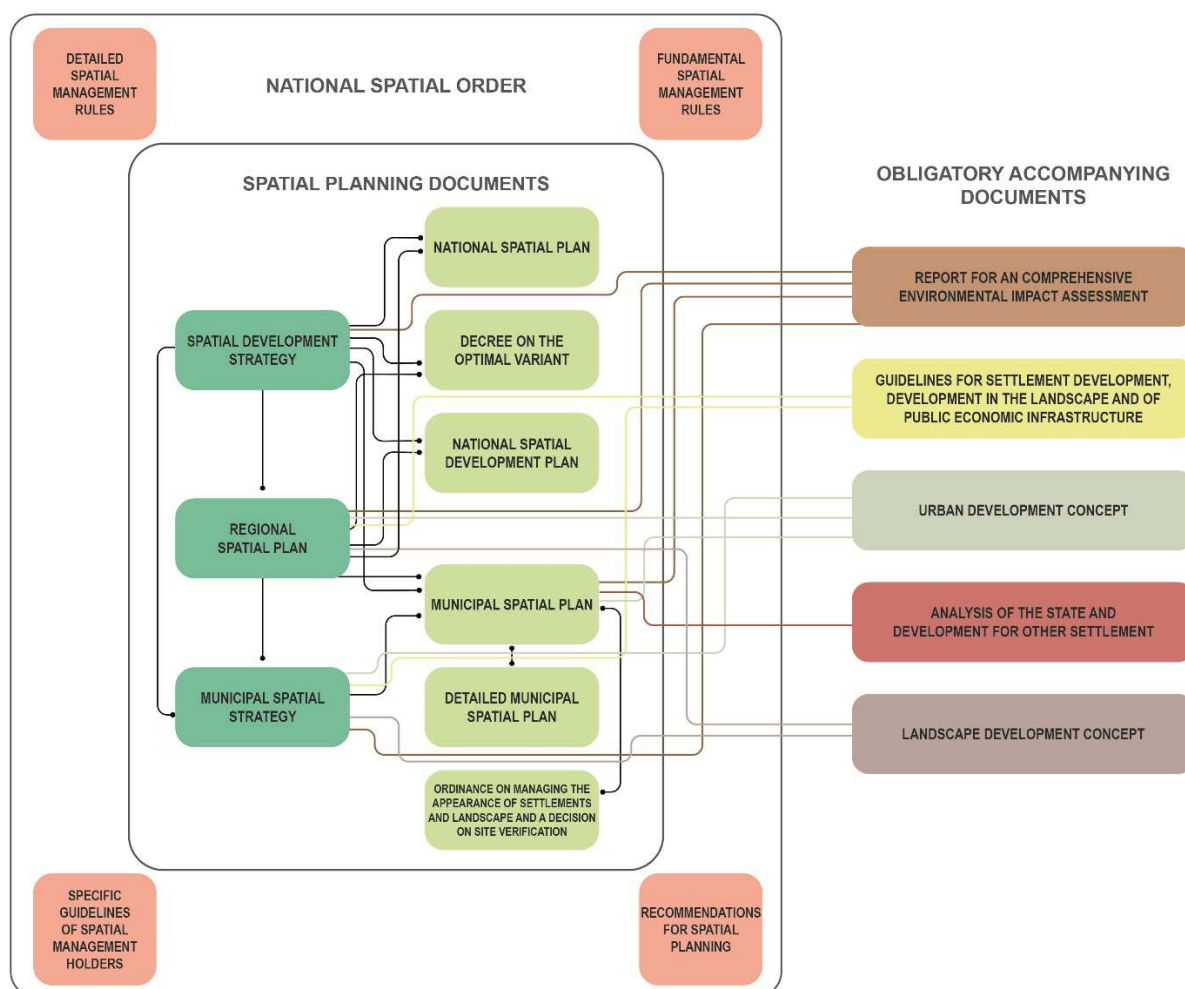


Figure 1: Spatial documents and their links under the Spatial Management Act (ZUreP-3)

The following documents were analysed for content: Draft Spatial Planning Strategy; Specific guidelines of spatial management holders of National spatial order, National spatial order (DPR) and DPR recommendations for spatial planning. For the spatial planning documents prepared for individual areas (Regional Spatial Plan (RPP), National Spatial Plan (DPN), Municipal Spatial Strategy (OPP), Municipal spatial plan (OPN), Detailed Municipal Spatial Planning Plan (OPPN), and mandatory background documents, we examined their drafting instructions, which are mainly contained in the Spatial Management Act (ZUreP-3) or in specific publications.

(2) Rationale for including NBS and HT as NBS in the documents: This was justified based on our knowledge of the concept of NBS, the content included in spatial planning documents, their scale, and their impact on lower-level spatial planning documents. In some documents, we acknowledged the reasonableness for including NBS as a concept, while in others, primarily the implementing documents, we fleshed out NBS as HT.

(3) Possibilities and opportunities to include NBS and HT as NBS in the planning document: These were identified primarily in the way each document is created to integrate with established spatial planning practices, rather than adding new procedures or documents.

Based on Criteria 2 and 3, if we have determined that it is appropriate to include HTs as NBSs or there are possibilities and/or opportunities for their inclusion in the graphic and descriptive parts of the relevant spatial planning document, we have proposed for each document how HTs can be included as NBSs.

4 RESULTS

4.1 Status of the inclusion of HTs and NBS in spatial planning documents

The results show that there is no analysed spatial document that explicitly refers to the NBS concept, but in terms of knowledge about NBS and urban planning, we were able to identify different paraphrases and terms in the documents that lead to the same goals as the implementation of NBS. HT as a spatial unit is mentioned only where the analysed document refers to nature conservation and thus understands and considers it in terms of limiting interventions in space.

4.1.1 Strategic spatial planning documents

The Draft Spatial Planning Strategy and Regional Spatial Plan (RPP) and the Guidelines for the preparation of Strategic Spatial Documents at the regional and municipal levels do not directly address the NBS concept. They focus only on green spaces, green infrastructure, and the region's green system. This is likely due to the fact that green infrastructure is a very strategic approach to planning and NBS can also be seen as a tool to implement green infrastructure principles and are therefore more applicable at other planning levels.

The Draft Spatial Planning Strategy identifies green areas as effective means of addressing urban challenges, as the goals and implementation of the Spatial Development Strategy of Slovenia (SPRS) concept includes efforts to address urban challenges through vegetation (e.g. preservation and creation of floodplains, and a greater proportion of well-managed and maintained green areas to mitigate extreme events and heat islands) or recognizing the value of vegetation and water bodies in general, which are the beginnings of the introduction of the NBS concept. The Regional Spatial Plan (RPP) emphasises the importance of the region's green system for ecological connectivity of ecosystems and creating conditions for their conservation, but does not recognise the importance of these areas for addressing urban challenges. Strategic spatial plans do not address HT, but efforts to conserve habitats in general can be recognised. The spatial scale of the maps in the strategic spatial planning documents is not detailed enough to show individual HTs for urban challenges.

4.1.2 Spatial implementing documents

The analysis shows that spatial implementing documents for individual areas are prepared according to guidelines that do not include the NBS concept. As for the HTs, only those that are relevant for nature conservation are addressed. For example, the National Spatial Plan (DPN) addresses HT in the planning of nature conservation areas established by the state and in the environmental reports for each plan if there are HT of nature conservation importance in the area of the proposed development. The Decree on the optimal variant (UNV) and National Spatial Development Plan (DPUN) also address the nature conservation importance of HT as a constraint to development. The spatial scale of implementation planning at municipal level (Municipal Spatial Plan and Detailed Municipal Spatial Plan) is suitable for highlighting HTs and addressing specific urban challenges, while the Municipal Spatial Plan (OPN) and Detailed Municipal Spatial Plan (OPPN), together with the Ordinance on Management of the Appearance of Settlements and Landscape (UONK), are key documents for permitting, promoting, or preventing certain interventions in the urban environment.

4.1.3 National Spatial Order (DPR) documents

Based on the content analysis of the National Spatial Order (DPR) documents, we note that the concept of NBS is implicit or potential in the guidelines documents from the field of settlement space, protection from natural and other disasters, energy, water management, and nature conservation, while HT as a spatial unit of nature conservation importance is included only in the Guidelines for Nature Conservation. The recommendations for spatial planning, as presented by Šuklje Erjavec et al. (2020), and Čufer and Ribič (2021), indirectly refer to the concept of NBS, but do not mention it explicitly and do not address HT or define green areas in relation to HT.

4.1.4 Obligatory accompanying documents

All obligatory accompanying documents to spatial planning documents or their drafting instructions address nature conservation-related HTs as constraints on spatial interventions, but the NBS concept is not found in them. We identify the Urban Development Concept (UZ) and Landscape Development Concept (KZ) as relevant for the NBS and HT, which provide an interdisciplinary and comprehensive expert basis and have

the status of obligatory accompanying documents, and therefore focused only on these two documents in the further analysis of the accompanying documents for strategic and implementing spatial planning documents. For the urban challenges considered here, the Urban Development Concept, which targets urban areas, is more relevant than the Landscape Development Concept, which targets areas outside the built-up area.

4.2 Rationale and possibility to include NBS and HT as NBS in the documents

		Explanation of reasonableness and possibility	
Docu- ment		NBS	HT as NBS
Strategic Spatial Planning Documents	Spatial Development Strategy of Slovenia (SPRS)	Development documents by area and sector must not contradict the strategy. Therefore, it is essential for the introduction of the NBS concept at the local level that these documents recognise it as an appropriate and effective way to address the challenges.	As we look for ways to use HTs to create a better quality of urban living environment, the scale of spatial planning at national level is too high for them and therefore it does not make sense to include HTs in the graphic representations of the SPRS. In the descriptive part of the SPRS, individual HTs in urban areas should be understood as smaller spatial units than green spaces and blue spaces or their individual elements that also occur in other areas, such as residential areas. The conservation or restoration of HTs in urban and periurban environments should be argued not only in terms of biodiversity, but also in terms of their direct contribution to solving urban challenges. The SPRS provides an opportunity to include this understanding of HT into the orientations for achieving the SPRS objectives, while also including it in the indicators for monitoring the implementation of the SPRS.
	Regional Spatial Plan (RPP)	Areas identified in the RPP as important for nature conservation should also be identified based on their functions in addressing societal challenges, making them part of the environmental infrastructure (and not just nature conservation). The NBS concept provides an opportunity to develop this kind of understanding of the region's green system. NBSs as means of addressing urban challenges should be identified and presented a guiding principle in the report. Prior to developing the RPP, urban challenges need to be well defined, especially those whose impact extends beyond municipal boundaries or need to be addressed on an inter-municipal level. In addition to the defined challenges, the RPP expert base can use the NBS concept to propose appropriate solutions. This can provide space for appropriate solutions already at the regional level and be can be directly transferred to the OPN.	The planning scale is too small to show in the graphic part the positioning of specific HTs to address urban challenges, which requires a scale of 1:5000.
	Municipal Spatial Strategy (OPP)	The OPP should follow other national development documents and EU development objectives, including the NBS concept. As the OPP is prepared for urban communities, consideration of urban challenges (already in the expert bases) is even more important than in the regional plan. The OPP spatial scale may already be relevant for NBS planning for specific urban challenges.	The OPP shows the layout of the planned networks (e.g., municipal infrastructure, green system), so it is not yet a suitable spatial document for locating specific HTs as NBS. As it defines the areas for which the UZ or KZ is to be elaborated, HT as NBS can be considered as NBS within these two expert bases.
Spatial Implementing Documents	National Spatial Plan (DPN)	In the context of national spatial planning, NBS can serve primarily to mitigate the negative impacts that new planned elements cause in space (e.g., noise reduction, particulate matter deposition and thus air quality improvement, stormwater retention, etc.).	These spatial planning laws define the spatial implementation laws of the municipalities, so it is important that HT is provided as NBS in these documents. It is important that HT be more specifically defined as a form of NBS in the UNV, as this draft provides space for planned spatial development. A detailed graphic representation of the planned/warned HTs as NBS at a scale of 1:5000 is reasonable in the DPUN.
	Decree on the optimal variant (UNV)		
	National Spatial Development Plan (DPUN)		
	Municipal Spatial Plan (OPN)	The OPN is referred to as an important spatial planning tool for the introduction of the NBS concept in urban areas (especially for the settlements for which no UZ is prepared). However, it is important that the urban challenges and their management are defined in the development programmes and do not contradict the orientations in strategic documents.	HT can be mapped in the graphic part and presented in the descriptive part, while the content is transferred in more detail to the subordinate documents (OPPN and OUNK).
	Detailed	As a municipality can change the land use or spatial	HTs may be presented in the OPPN as NBS in

	Municipal Spatial Plan (OPPN)	implementation conditions through an OPPN without first changing the OPN, this spatial planning tool is particularly suitable for urban areas with an already defined OPN.	appropriate detail.
	Ordinance on managing the appearance of settlements and landscape (OUNK)		How HTs implemented in the urban environment to act as NBS are managed can be written into the OUNK.
Order	National Spatial (DPR) documents	As spatial planning documents are prepared based on and in accordance with the various recommendations, the NBS concept should be properly identified, interpreted and recommended within the DPR, in particular in the recommendations in the areas of settlement development, water management, nature conservation, energy, protection and safety, sustainable mobility, road and rail transport and motorways. There is also an opportunity to develop specific spatial planning recommendations for the NBS concept.	An important improvement would be to start to identify existing HTs that are important for the quality of the living environment, in addition to HTs that are important to conservation, and to protect them accordingly.
Obligatory documents	Urban Development Concept (UZ)	The development of UZ is based, among other things, on spatial solutions that arise from the challenges of the settlements. It therefore makes sense to incorporate NBS in UZ to address urban challenges by addressing challenges and solutions in a holistic and systemic manner at the whole settlement level. NBS as a mean to address challenges should be defined in the development vision and professional backgrounds of the UZ. In this way, UZ can provide an important professional basis for the implementation of NBS in the preparation of RPP, OPP and OPN.	In IP/UZ, as an expert base, the NBS can be concretized by placing appropriate HTs.

Table 1: Spatial documents in which it makes sense to involve NBS and/or HT as NBS to address the urban challenges

The spatial documents that have proven to be suitable for the integration of HT as NBS for the urban challenges in their graphic and descriptive parts and in their elaboration procedures are the spatial implementing documents:

- at the level of national spatial planning, the National Spatial Plan (DPN), the Decree on the optimal variant (UNV) and the National Spatial Development Plan (DPUN),
- at the level of municipal spatial planning, the Municipal Spatial Plan (OPN) and its subordinate Detailed Municipal Spatial Plan (OPPN) and Ordinance on managing the appearance of settlements and landscape (OUNK),
- and Urban Development Concept (UZ) as an expert study for the OPP, OPN and/or RPP.

4.3 Proposal for how to include HTs as NBS into spatial planning documents

In the following, we make suggestions for the inclusion of HT as NBS in the existing components of the implementing spatial planning documents of national and municipal spatial planning, as well as UZ as expert studies that have proven to be relevant spatial planning documents for the inclusion of HT as an NBS.

4.3.1 Inclusion of HT as NBS in spatial implementation acts of national spatial planning

In developing the DPN, we suggest that expert studies identify and map HTs (especially bypasses, forest, wetlands) that already function as NBS and protect them in the same way as HTs of nature conservation importance (e.g., by prohibiting construction or creating alternative HTs). At the same time, the placement of appropriate HTs should be required to avoid negative impacts from development. This could be the subject of a separate expert study from the environmental report, as it is important to include the concept of NBS and HT in the initial stages of the developing potentially viable options, rather than in the evaluation of the selected option. HTs would be shown on maps at 1:5000 scale or smaller, depending on the size of the planned or protected area, or they would be shown in the descriptive part of maps at a larger scale, e.g., a specific (named) HT is established in a specific dry reservoir.

4.3.2 Inclusion of HT as NBS in spatial implementation documents of municipal spatial planning

We suggest that in the development of the OPN, the assessment of the situation and future needs of the area identifies the urban challenges that can be solved by the NBS and proposes solutions to them in the expert studies by locating or protecting the corresponding HT at a scale of 1:5,000 or more detailed. This is crucial in the initial phase, in particular for dividing the area into the corresponding spatial planning units, determining the corresponding land use designations, and the spatial implementation conditions. As the division of the OPN area into spatial units should be based on the specificity of the urban space and may also be determined by specific protection regimes (e.g., water resources, Natura 2000) and not necessarily by infrastructure corridors, the space could be subdivided according to urban challenges and designated or protected HTs. Currently, the most characteristic spatial morphological units of unified spatial planning are land use zones such as single-family houses, dense (closed) housing, historic settlement core, production areas, green areas, economic zones, etc., which means that they are mainly defined by activities and facilities. For the areas where NBS interventions are foreseen, the OPN must provide for the preparation of an OPPN, since the OPPN, among other things, presents in more detail the technically justified spatial arrangements for the implementation of environmental and nature protection measures. Planners of the OPPN can either preserve the HT or create a new one through provisions on a specific parcel. It is important that, in addition to the existing HTs that are important for nature conservation, HTs that are important for maintaining a high quality living environment are identified and mapped, appropriately protected, and the possibility to use these areas is established.

In the already adopted OPNs, it is useful to identify urban challenges within specific spatial planning units, as these allow for different types of actions in the area. A single HT as NBS should not be equated with a land use designation when drafting or updating new spatial planning legislation, as they can occur in small areas within different land uses, e.g., within residential areas, economic zones, transport infrastructure areas. However, where larger contiguous areas of HT are envisioned to address challenges (flat ground occurrence of HT), it makes sense to provide for a separate, more detailed land use designation. Considering the existing types of basic and detailed land use designations, we suggest that the larger areas of HT be placed in one of the following detailed land use designations:

- other maintained green areas which, according to the regulations, are green belts with a protective or other function;
- wooded areas in the case of forest HT;
- water areas on land in the case of inland or marine water HT or water infrastructures, so that their ecological function can be specified, e.g., for water purification or water retention;
- areas related to protection against natural and other disasters for HTs that contribute to protection against natural disasters such as floods, landslides and fires;
- areas of environmental infrastructure if HT, which has an identified important function e.g., wastewater treatment, water retention for later use, etc., were defined as public economic infrastructure, which would require modifications in legislation to recognise the broader, not just nature conservation, importance of HT.

To address the challenges posed by HTs, it is important that their location or protection is adequately defined in the spatial implementation conditions, as these directly determine the design of spatial interventions. In a specific spatial planning unit, specific HTs, their uses (accessibility, types of recreation, etc.) protection regimes, specific restrictions and requirements should be defined. Within these provisions, there is an opportunity to understand and predict the occurrence of HT also on green roofs and vertical greening types, and not only on flat and paved surfaces. This will require further interdisciplinary research. HTs to be provided or protected should be shown in detail on the site.

For HTs that allow other land uses for residents in addition to their primary function as NBS (e.g. recreation), it is important that the established allowable land use of the particular spatial planning unit is appropriate for their placement in the spatial planning unit (allow for sufficiently large areas). In our opinion, HTs that do not serve recreational use for the population cannot be counted towards the absolute area of open green or other areas that serve the common use of the population. However, in addition to the so-called

required absolute area of open green spaces, it would also be useful to define the absolute area of specific HTs to address a specific urban challenge within a given spatial planning unit.

The OUNK provides the opportunity to define the appearance of HTs, their allowable or minimum size, design requirements, etc., which may vary from settlement to settlement, depending on their distinctive characteristics and identity. Care must be taken to ensure that the design of HT does not take precedence over its NBS function. As the decree aims to improve the quality of the environment and mitigate the effects of climate change, the municipality may include in this spatial planning document (which may be merged with the OPN) a requirement to implement NBS for certain spatial interventions, e.g., construction of rain gardens, green roofs with/or appropriate HTs.

4.3.3 Inclusion of HT as NBS in Urban Development Concept (UZ)

The UZ should identify HTs that are already part of the city's existing green system and have an important NBS function (e.g., flood protection, cooling of the surrounding area). Such areas should be given a conservation value and protected at a scale of 1:5,000 on a unit basis. In addition, their integration with urban functions (accessibility, recreational opportunities, sustainable mobility routes, etc.) should be determined. The determination of what percentage of the urban area should be occupied by HTs should be considered on a unit-by-unit basis and determined based on expert evidence on the effects of HTs.

5 CONCLUSION

In this paper, the concept of NBS and HT as a form of NBS is applied to the case of the Slovenian planning system, with the proposal to integrate it into the existing spatial planning documents and place it in the scope of spatial planning. Based on a systematic review of spatial planning documents, we found that in strategic spatial planning documents and national spatial planning documents, especially in the spatial planning guidelines for sectors and spatial planning recommendations, there is an opportunity to define the concept of NBS as a way to address the upcoming urban challenges, thus defining NBS as a vision and goals for spatial development. The key to the integrating HT as NBS into existing spatial planning practice is spatial implementation documents, both at the national and municipal levels, and UZ as the mandatory expert basis for these documents. Understanding and translating the concept of NBS from EU-level policy documents into national, regional and local strategic documents will be the key to their widespread adoption. However, further research on the performance and environmental requirements of HTs, with an emphasis on interdisciplinary and multi-criteria evaluation, is needed to promote a planning approach that spatially locates appropriate HTs as NBS for urban challenges.

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