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Insight

Using meaningful places as an indicator for sense of place in the management of social-ecological systems

*Falco Knaps*¹, *Sarah Gottwald*², *Christian Albert*³ and *Sylvia Herrmann*⁴

ABSTRACT. Sense of place is increasingly advocated to support the management of social-ecological systems. Given the concept's complexity, we suggest that an indicator for sense of place is needed to facilitate its application in practical planning. We propose such an indicator called "meaningful places," defined as geographic locations to which (i) immediately perceived as well as socially constructed meanings are ascribed and (ii) evaluative attachments are tied. We applied the indicator in two independent case studies, Lübeck and Lahn, both of which aimed to integrate sense of place in an actual planning process. The case studies differed in the spatial scale of the meaningful places, the indicator's operationalization, and the specific assessment methods. In the Lübeck case, semi-structured interviews and a simple mapping method were used to analyze participants' "home-regions." The results revealed diverse but overlapping locations characterized as aesthetic, different from others, close to nature, and quiet (place meanings). In the Lahn case, a public participation GIS (public participation geographic information system [PPGIS]) survey was conducted and yielded insights into the spatial distribution of meaningful places. The results reflect a wide range of place meanings linked to, for example, activities, aesthetic qualities, or well-being. Furthermore, participants expressed different intensities of place attachments. Although the indicator is still in an exploratory stage, it allows for reflection on potential benefits for planning practitioners. The resulting data can be combined with spatial information usually used in planning processes, e.g., about the state of the underlying physical environment and/or foreseeable drivers of change. This offers new opportunities for managers regarding the determination of priorities to conserve meaningful places, the anticipation of conflicts, and the utilization of the communicative power of meaningful places. We argue that the benefits for planning justify a new direction of research devoted to the development and further advancement of the indicator.

Key Words: *management; meaningful places; public participation GIS; semi-structured interviews; sense of place; social-ecological systems*

INTRODUCTION

The academic concept "sense of place" refers to people's interpretative perspectives on and emotional reactions to their environments (Hummon 1992), or as Stokowski (2008) puts it: It refers to a place relation that is felt to be deeply important and is thus interpreted to be meaningful. Consequently, sense of place offers a framework for analyzing subjective place-related meanings and sentiments (Stedman 2016) and contributes to better understanding the wholeness of human-place relationships (Nelson et al. 2020). Given these potentials, current research highlights sense of place as a promising factor for the management of social-ecological systems (Verbrugge et al. 2019). Specifically, sense of place entails normative expectations regarding the kind of activities, management regimes, and appropriate land uses (Ingalls et al. 2019). Knowing stakeholders' sense of place helps to better understand supportive, indifferent, or hostile behavior (Gottwald and Stedman 2020) as well as place-related conflicts (Clermont et al. 2019). In this respect, it is recommended to integrate sense of place in practical spatial management and planning (Marshall et al. 2019).

However, sense of place is also a highly complex concept that scholars have operationalized in various ways in the past decades leading to a "braided stream" of literature (Williams and Miller 2020), a characteristic that seems to impede applications outside of the scientific community. As a result, there is a myriad of assessment approaches for sense of place and its related concepts (Williams 2014). Yet, few studies have applied a spatially explicit assessment of sense of place aiming for its integration into an actual planning process, and simultaneously accounting for the

complexity of the concept, including its emotional and cognitive dimensions (for exceptions see Gottwald et al. 2021, Hawthorne et al. 2022). We hypothesize that this deficiency has contributed to the lack of uptake of sense of place in planning practice (Ryan 2011) despite its potential (Verbrugge et al. 2019, Gottwald et al. 2021). Therefore, we suggest that an indicator for sense of place is needed to facilitate its application in practical contexts.

In the fields of planning and resource management, the use of indicators is a widely accepted approach for simplified measurements of complex social-ecological phenomena (van Oudenhoven et al. 2011). Early research on indicators in social-ecological systems was primarily concerned with environmental conditions, causes of change, and change impacts (Heink and Kowarik 2010). Recently, a growing body of literature has investigated holistic indicators that also consider social, economic, and cultural values (Jørgensen et al. 2013). Extending this line of research, we propose that sense of place can be assessed in the context of social-ecological systems using an indicator. This would allow a simplification of this rather complex concept (Turnhout et al. 2007), making it compatible with existing planning indicators and applicable to spatial planning. To our knowledge, there is no indicator for assessing sense of place for its integration into management processes of social-ecological systems.

Therefore, the aim of this paper is to propose such an indicator and to explore two alternative approaches for its application. Our objectives are guided by established benchmarks for the development and evaluation of indicators (Table 1) and include

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(i) proposing an indicator for sense of place based on scientific evidence (validity) and optimized for application in social-ecological systems management (intended purpose), (ii) presenting methods for its assessment (measurability) at different spatial scales (transferability), and (iii) critically reflecting on the indicator's relevance for social-ecological systems management.

Table 1. Benchmarks of environmental indicators as discussed in academic literature.

Category	Description
Validity	The indicator exhibits a strong scientific basis. ^{1,2}
Purpose	An indicator must be optimized for an intended purpose. ³
Measurability	The indicator is straightforward to measure using standard methods while novel methods need evidence of effective performance. ^{4,5}
Transferability	The indicator is applicable at different spatial scales. ²
Relevance	The indicator addresses information needs of decision makers, policy actors, and affected stakeholders. ^{2,5}

¹ Niemeijer and Groot (2008).

² van Oudenhoven et al. (2018).

³ Dizdaroglu (2017).

⁴ Gudmundsson et al. (2016).

⁵ Jackson et al. (2000).

MEANINGFUL PLACES: AN INDICATOR FOR SENSE OF PLACE IN SOCIAL-ECOLOGICAL SYSTEMS

Conceptual foundations

Guided by the aim to integrate the sense of place indicator into planning practice, we draw on theoretical foundations from sense of place scholarship related to social-ecological systems research. Multidisciplinary research on people-place relationships in general, and sense of place in particular, has led to a body of literature that Williams and Miller (2020) illustrate as a “braided stream” rather than a coherent body (see also Trentelman 2009). Not only disciplines, but also time has shown to provide different focal points. The perception of place evolved from being understood as a mere container in the 1960s, to a locus of attachment, to the perspective of critical constructivism and further acknowledging a system's perspective, up to recent advances in combining sense of place and assemblage theory (Williams and Miller 2020). To position our paper within this “braided stream,” three core assumptions about sense of place are important.

First, we acknowledge sense of place as a complex phenomenon that encompasses the emotional and cognitive subdimensions of place attachments and place meanings. Place attachments are evaluative ties to a location that reflect the intensity of an emotional connection to a place and can be distinguished further into two subdimensions (Stedman 2008):

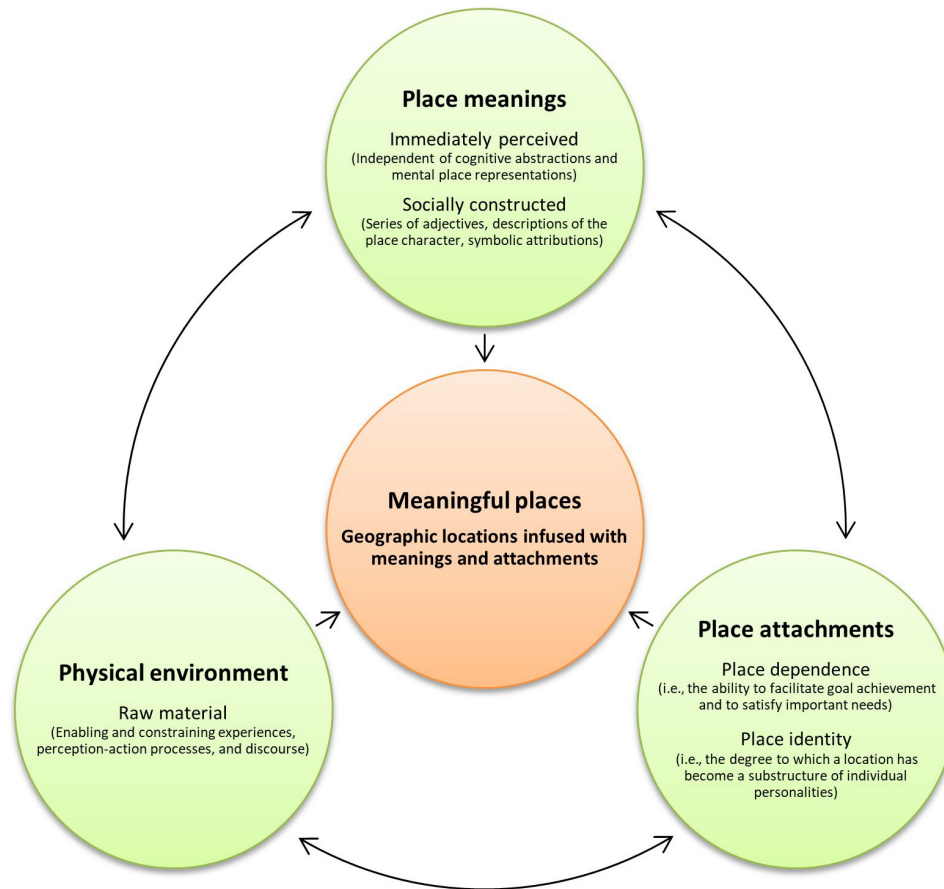
1. Place identity refers to a place-related substructure of individual personalities. To identify with a place means to distinguish oneself from others by (amongst other things) references to a location (Peng et al. 2020),
2. Place dependence reflects the perceived ability of a setting to facilitate goal achievement and to satisfy important needs.

In addition, place meanings are descriptive reasons for attachment (Stedman 2008), which can range from simple series of adjectives (e.g., polluted, warm) to complex descriptions of the place character and symbolic attributions (e.g., place as home or escape; Masterson et al. 2017). It should be emphasized that the separation into place meanings and attachments is entirely analytical. Ascribing meanings to a place and becoming attached are mutually influencing, interwoven, and parallel processes.

Second, especially in the field of spatial planning, we need to appreciate the physical environment. Adopting a social-ecological systems perspective means acknowledging that place is impacted by environmental processes and people, both of which are embedded in institutional settings (Williams and Miller 2020). Although social-ecological systems research dates back to the 1980s, a systemic perspective within sense of place research has developed more recently (Masterson et al. 2017). Drawing on relational understandings of place (Di Masso et al. 2019), it accounts for social-ecological systems dynamics (Masterson et al. 2017). A review of nature's contribution to people highlighted that social science and environmental studies have a much more relational understanding of people and place. Social science tends to use a subjectivist perspective and qualitative methods. Environmental studies show a constructivist understanding using quantitative methods and tend to provide policy guidance (Ives et al. 2017). Both have in common that they consider relational interaction with and perception of places. Given a relational perspective, material structures can be assumed to provide the raw material for forming a sense of place and both enable and constrain experiences (Stedman 2003).

Third, we assume that place can be both a center of meaning developed over time and through perception-action processes (Raymond et al. 2017). Within the “braided stream” of sense of place literature among different disciplines and temporal developments, the authors of this work acknowledge a subjective and a constructivist perspective. Sense of place is subjective as people perceive and interpret place subjectively (Davidson 2010), but variations of place attachments and meanings are patterned, according to type of people, experiences, and environments (Masterson et al. 2017). In line with constructivist perspectives, place is seen to be a center of socially constructed meanings, which are formed and conveyed through discourse and interaction (Di Masso et al. 2014), shaped by wider cultural meanings (Horlings 2015), and act as an interpretation template for personal place representations (Stokowski 2008). Because of the complex interplay between social influences and personal interpretations, the same physical environment can carry multiple meanings (Cervený et al. 2017). However, in addition to “socially constructed place meanings,” “immediately perceived place meanings” offers a lens to understand perception-action processes that are shaped by the individual's personal knowledge, abilities, intentions, and perceptions of possibilities for action in a given physical environment. Based in the assumption that the environment provides sufficient contextual information for human visual systems to perceive opportunities for action, perception-action processes function independently of cognitive abstractions and mental place representations. Immediately perceived as well as long-standing place meanings have shown to positively impact affective relationships to a spatial environment,

Fig. 1. Mutually influencing core dimensions (green) of meaningful places (orange), an indicator for sense of place.



as well as environmental concern or stewardship (Brehm et al. 2013, Barthel et al. 2018). This underlines the importance for environmental planning and management practice to increase our understanding of both perspectives, perception-action processes, and place as a center of meaning.

Toward an indicator for sense of place

Regarding place attachment, Brown et al. (2015:51) argued that until it “can be meaningfully rendered on a map, it will not be influential for land use planning and decision support.” Cartographic representations allow to aggregate these data and to identify meaningful places of intersubjective relevance, using diverse analytical methods, such as overlay or spatial pattern analysis (Fagerholm et al. 2021). Therefore, an indicator measuring sense of place must be spatially explicit, i.e., it must (geographically) represent (at least approximately) the positions and demarcations of spatial environments that are infused with meanings and attachments. Consequently, we define an indicator for sense of place called “meaningful places” as follows: meaningful places are geographic locations—in the physical world as well as in abstracted representation on maps—to which immediately perceived as well as socially constructed meanings (e.g., series of adjectives, descriptions of the place character, symbolic attributions) are ascribed and evaluative attachments (place dependence, place identity) are tied (Fig.1).

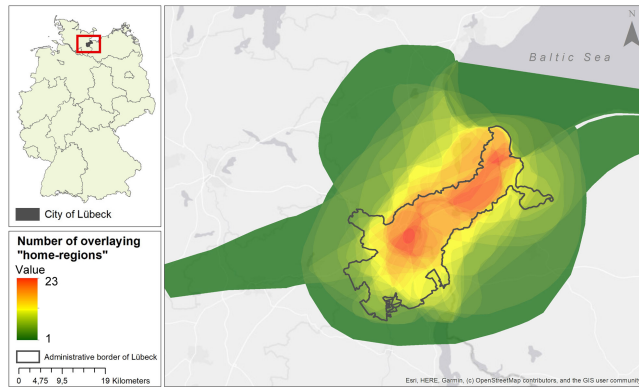
MEASURING MEANINGFUL PLACES: EVIDENCE FROM TWO CASE STUDIES

Case study regions and methods

Our cases were embedded in two independent transdisciplinary research projects. In both projects, sense of place was assessed to be communicated with practice partners to plan for sustainable landscape development at a comparable spatial scale and within the same administrative planning context (i.e., German spatial planning regulations). Therefore, both projects faced the challenge to assess and analyze sense of place accounting for its complexity and simultaneously translating it to be integrated in a planning process. However, both study regions differ in their geographic location, extent, shape, and settlement structure. Lübeck is a major northern German city of 214 km² close to the Baltic Sea (Fig. 2). The Lahn river valley is located in central Germany and is characterized by several small- and medium-sized settlements (Figs. 3 and 4). The Lahn study focused on a 140 km long river stretch, including a 5 km buffer on each side.

In the Lübeck case study, the indicator approach was used to identify spatial environments at a regional scale to which residents ascribe the symbolic meaning to be their personal “home” and that are relevant to their place identities (place attachment). Further attention was devoted to the perceived character of these locations (socially constructed place meanings). Because of the

Fig. 2. Location of the study area (left) and overlay analysis of participants' "home-regions" (right; N=23)



super-local perspective, immediately perceived place meanings played a minor role in revealing deeply rooted symbolic attributions. Meaningful places were assessed using semi-structured face-to-face interviews, lasting approximately 45 minutes. We involved 23 respondents of different ages, origins, and backgrounds. These included experts (interpreted here as respondents representing the business community, interest groups, politics, and public administrations with a special perspective on the region because of training or current activities) but also laypersons (further participant characteristics are shown in Appendix 1, Table A1.1). During the interviews, participants were asked to sketch on a prepared, georeferenced map what they have in mind when they think of their "home-region." Further interview questions explored the character of these places and ascribed meanings (for the interview guide see Appendix 1, Table A1.2). For the analysis, participants' "home-regions" were digitized and overlaid using ArcGIS. The recorded interviews were transcribed verbatim and analyzed by conducting a qualitative content analysis using the professional qualitative-data-analysis software (MAXQDA).

In the Lahn case study, the core interest was on meaningful places on a local (assessed points) and regional (analyzed spatial patterns) scale. For this purpose, an online PPGIS survey was developed. A total of 3000 people were invited via mail (including one reminder), of which 244 participated (response rate = 9.2%). Older age groups and male respondents dominated the sample (further participant characteristics are shown in Appendix 1, Table A1.3). In the online PPGIS survey, participants marked their meaningful places on a map. After each location, they were asked (i) to describe why the located place is meaningful to them (immediately perceived and socially constructed place meanings), and (ii) to value nine place attachment items (based on Williams and Vaske 2003, Jorgensen and Stedman 2006) on a 5-point Likert scale. To further account for the highly variable spatial extent of meaningful places, respondents were (iii) able to specify the geometric shape of their meaningful place, which could be either a point (such as a barbecue spot or small beach), an elongated course (such as a stretch of the river), or a larger area (such as a forest or part of the city). Data analysis was conducted by

qualitative content analysis using OpenCode, descriptive statistics in IBM SPSS Statistics, and GIS visualization using QuantumGIS. GIS analysis assumed the located meanings as points. Meaning categories were formed deductively following the cultural value model by Stephenson (2008). The cultural value model presents a framework that helps understand the range of potential values present in a landscape, including its dynamic interactions. It distinguishes between forms (i.e., the physical and tangible components), relationships (i.e., values based on people-people or people-landscape interaction), and practices, including human practices and ecological processes.

Both approaches differ in the scale of the meaningful places assessed and in the perspective of place in terms of operationalization and assessment methods. Although the Lübeck approach is rather narrow, the Lahn approach is inclusive and integrates the whole range of possible meanings and attachments (Table 2).

RESULTS

Meaningful places in the Lübeck study

Participants interpreted diverse areas as their personal "home-regions." The spectrum ranges from small-scale places, such as sub-parts of Lübeck to areas going far beyond the city borders. Most "home-regions" included Lübeck's urban center, less urbanized areas adjacent to the administrative boundaries, and coastal areas (Fig. 2). The interviews confirmed that these spatial environments were components of participants' place identity and personality. They were described as "my home" (I19), and others claimed they "couldn't live anywhere else" (I9). Furthermore, participants expressed emotional connections: making the point to be "proud (...) of Lübeck as a whole" (I14) and (in times of absence) to "miss this piece of home, where you are rooted" (I20).

Participants' diverse description of their "home-region's" character can be structured into four categories: aesthetic, different from others, close to nature, and quiet (Table 3). They often highlighted certain features to underline this character (e.g., the Baltic Sea, peasant structures, the river Wakenitz, and the former inner-German border). The importance of certain place characteristics to contribute to respondents' sense of place is indicated in Table 4, presenting all features found in the interviews along inductively developed categories. Our cross-case analysis also revealed inconsistent patterns of perception. Although some highlighted the impressive canola blooming as characteristic for the region, others perceived it as also typical for other regions and as less important for their "home-region" (e.g., I24). Likewise, the fishery was seen by some respondents as a still preserved feature (e.g., I24), although others emphasized it as an already lost one (accompanied by feelings of regret; I16, I13).

Meaningful places in the Lahn study

In the Lahn study, participants marked 561 meaningful places within the study area, mainly located near the Lahn River and concentrating in and near urban areas (Fig. 3). For over half of the points (N = 309; 55%) respondents indicated at least one descriptive meaning. They were structured along 13 categories formed deductively (Table 5). The most frequently revealed place meanings related to practices carried out at that place, specifically activities such as fishing or hiking. Relationship meanings (e.g., aesthetics

Fig. 3. Location of the study area (top left) and distribution of meaningful places in the Lahn-study (right).

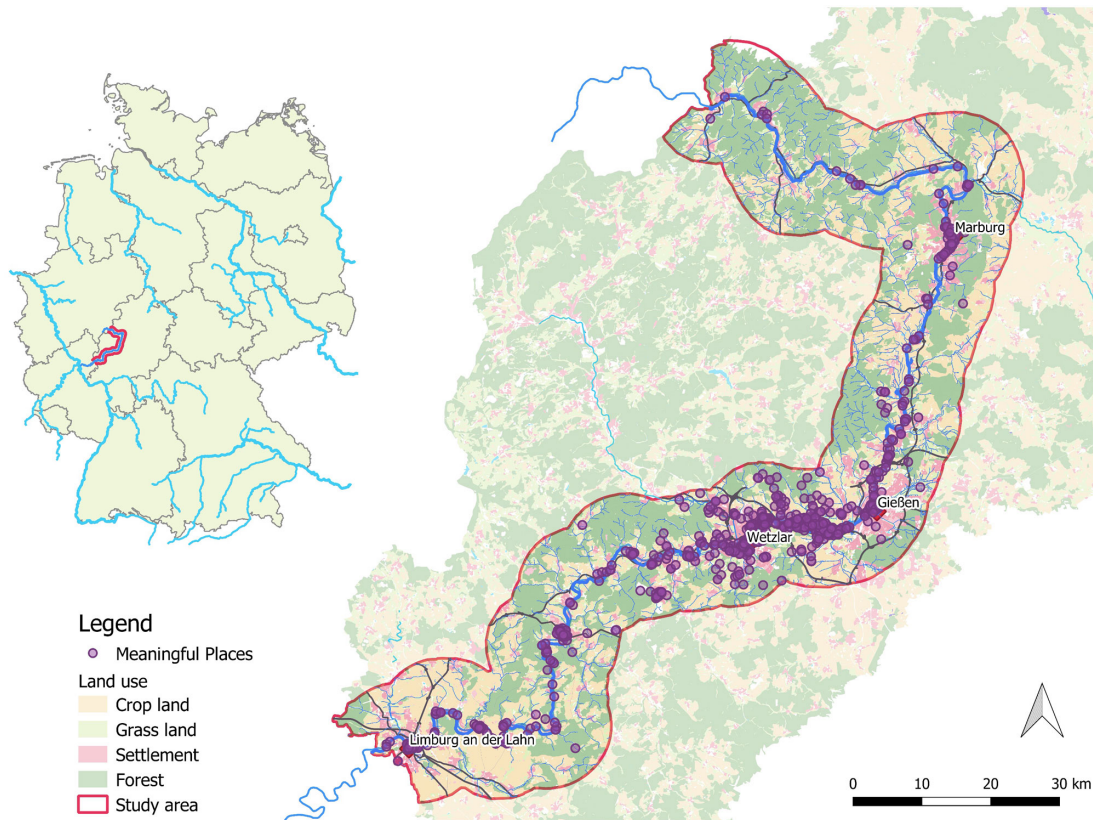
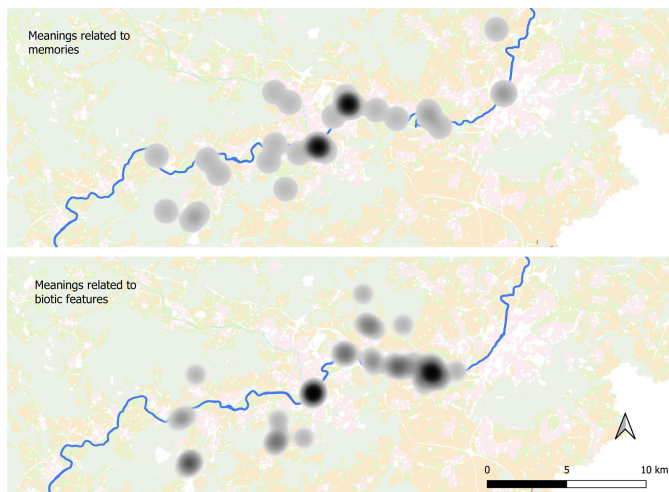


Fig. 4. Heatmap of places that are meaningful because of “biotic features” and “memories,” radius = 1000 m.



and well-being) were also mentioned frequently. Forms, such as biotic features, rivers, and human settlements turned out to be less important. Attachments could be measured for 444 meaningful places (mean = 3.64, SD = 0.72). The strength of attachment varied

between the meaning categories. Origin, home, everyday life, and continuity yielded the strongest mean values, whereas activities, river, and accessibility yielded the weakest attachment mean values.

Respondents specified the spatial extent of 30% of their meaningful places as an elongated course (e.g., a river stretch), 19% as a larger area (e.g., a forest), and 19% as a point. For 32% of the meaningful places, the geometry was not further specified by the participants.

Based on this, it was possible to create visualizations for each category. As an example, two maps are shown for the categories “memories” and “biotic features” (Fig. 4), both of which show an equally strong place attachment ($M = 3.7$). This allows researchers to visualize hotspots of meaningful places in these categories and to analyze their distribution. Meaningful places related to memories (e.g., referring to specific events or whole parts of life) are located inside or close to urbanized areas. The western hotspot is located in the city center of Wetzlar; the eastern hotspot is located around a river meander surrounded by a settlement and characterized by a variety of sport facilities. They show a stronger spatially clustered pattern than places that were located for their meanings related to biotic features, such as parks or specific animals. One of the hotspots is also located within the city center of Wetzlar, the most eastern hotspot is characterized by lakes and wetland.

Table 2. Comparison of both case studies.

Case Study	Lübeck	Lahn
Scale of meaningful places	Regional	Local to regional
Operationalization of meaningful places	Geographic locations perceived as “home-regions” and their character (socially constructed meanings)	Geographic locations related to the Lahn River and its surrounding landscape to which various meanings are ascribed and attachments are tied (socially constructed and immediately perceived meanings)
Assessment methods	Analog mapping technique and GIS-overlay-analysis Semi-structured interviews and qualitative content analysis	Public participation GIS (PPGIS), GIS visualization, and hot-spot analysis Open and closed follow-up questions, qualitative content-analysis, and descriptive statistics
No. of participants	23	244

Table 3. Main categories of participants “home-region” characterizations.

Category	Representative quotations
Aesthetic	“That’s very pretty there, too. Yes, there are quite a lot places, around and near Lübeck.” (I2)
Different from others	“When I think of Lübeck, immediately I think of the Baltic Sea (...). This is decisive for me.” (I9) “Everywhere in Mecklenburg [German Federal State adjacent to Lübeck] are only big structures due to the land consolidation. There are no more peasant structures. But this is something typical for Lübeck, what you can see here (...).” (I3)
Close to nature	“The [river] Wakenitz was untouched for a long time, because there was the inner-German border. Here, we also speak of the ‘Amazon of the north’.” (I23)
Quiet	“I love this quietness, which the nature emanates.” (I19)

DISCUSSION

Meaningful places: a spatially explicit indicator for sense of place

In this paper we presented the indicator “meaningful places” to assess sense of place. Consistent with benchmarks of environmental indicators (Table 1), the indicator is rooted in relevant strands of sense of place literature and optimized for its intended purpose, which is its application in the context of social-ecological systems management. This is to be achieved through the indicator’s spatial explicitness, i.e., its focus on specific geographic locations infused with place meanings and attachments. In two case studies, we applied the indicator and found evidence of its potential to visualize meaningful places on maps as distinct features or aggregated areas that contain details on place meanings and attachment.

Transferability and measurability of meaningful places

Our case studies demonstrated that analyzing sense of place through meaningful places is a transferable approach. First, it is applicable at different spatial scales. Although the spatial extent of both study areas was at a regional level, the scale of the meaningful places itself varied. Although the Lübeck study assessed large-scale meaningful places (regional level) with participants drawing areas on maps, the Lahn study enabled participants to draw points, indicating the specific geometry, which resulted in smaller spatial scales (local to regional level).

However, in the Lübeck study, some participants referred to more local areas as their “home-region,” and in the Lahn case, half of the respondents indicated that their meaningful places extended over an elongated course or a larger area. These results correspond with previous research highlighting that subjective place bonds often do not fit with predefined spatial scales (Knaps and Herrmann 2018). Thus, users of our indicator should be careful in determining narrow and fixed scales of interest, such as specific administrative entities. Second, our indicator is transferable in the sense that it can be used in urban, sub-urban, as well as in rural areas. Third, the indicator is transferable to various planning contexts. Depending on place specific planning requirements, it can be narrowed to one specific aspect (as shown in the Lübeck study with the emphasis on “home-regions”) or used in an open way to cover the whole range of meanings and attachments (as shown in the inclusive approach of the Lahn study).

A limitation of the study is caused by the inclusion of only two spatial scales. To further validate the transferability of the indicator, future studies should be more rigorous in the selection of case studies. Based on a most-different design for case study selection (Seawright and Gerring 2008), the indicator could be applied to explore meaningful places at a neighborhood scale compared to an (inter-)national or global scale. Likewise, future studies should consider applications in non-Western countries exhibiting contrasting socio-cultural conditions. Although knowledge of human-nature connections and mapping methods are predominantly produced in Western contexts (Brown and Fagerholm 2015, Ives et al. 2017), we hypothesize that transferring this indicator to landscapes with cultural diversity has potential. First, mapping methods, including PPGIS, have already been employed in different cultural contexts and in regions of high cultural diversity, such as Tanzania (Fagerholm et al. 2019), the Faroe Islands (Plieninger et al. 2018), or Malaysia (Lechner et al. 2020). Second, our indicator accounts for all types of meanings and attachments and their spatial configuration. Because of its openness and inclusiveness, it does not impose any directionality between people and nature, which may be conflicting with non-Western perspectives. Finally, this indicator could make cultural diversity visible so that it can be acknowledged and included in planning processes. Furthermore, experiences from transfer cases that differ from those presented here would deliver important insight to further develop and adjust the indicator.

No completely novel measurement methods were used in either case study. Although quantitative surveys and the use of maps is

Table 4. Categorized core features of meaningful places.

Category	Subcategory	Features
Landscape	Coastal landscape	Baltic Sea, Lübeck Bay (and side bays), beaches, steep coasts, near-natural coastal areas, maritime climate
	Rivers and lakes	Various running waters and lakes, partly in a near-natural condition
	Topography and soils	Hilly topography, glacial character, outwash planes, dunes, sandy soils, partly extremely fertile soils
	Woods	High forest content, diverse forest areas, near-natural forest management
	Small-scale features	Heath-lands, hedgerows
Land and water use	Shipping and fishery	Ferry traffic to Scandinavia, sailing vessels, fishery, historical ships
	Agriculture	High proportion of canola fields, mixture of small-scale (partly organic) and large-scale agriculture, mixture of arable and grassland farming
Settlement structures	Rural settlement structures	Historic farmhouses (partly with thatched roofs), village character, peasant structures, manor houses (mainly in the eastern parts)
	Historic city center	Brick-built historic houses, churches, and other monuments of historical importance, UNESCO World Heritage
	Coastal settlement structures	Seaside resorts, former fishing villages, harbors
History	Lübeck as Hanseatic city	Hanseatic history and culture, European Hansemuseum

well established in environmental indication, the novelty of the Lahn case study is the combination of a mapping survey with established place attachment scales and free listing exercises (to reveal the specific place meanings). There are few PPGIS studies that explicitly assess and engage with sense of place. Although the mapping of “positive and negative places” (Kyttä et al. 2013, Samuelsson et al. 2018), of “place values,” or of “landscape values” can certainly be argued to be connected to sense of place or even be employed as proxies (Brown et al. 2020, Raymond and Gottwald 2020), an engagement with the respective literature and the complexity of the theory itself is missing. Furthermore, most studies using PPGIS methods to spatially assess sense of place omit the complexity of sense of place, including place attachment and place meanings (Pérez-Ramírez et al. 2019). Exceptions being recent studies on sense of place in coastal areas assessing place attachment intensity and reasons for attachment (Hawthorne et al. 2022), as well as the Lahn study presented in this paper (e.g., Gottwald et al. 2022). One important challenge to be addressed in future studies relates to the exact spatial and geometric extent. In the presented PPGIS study, one-third of the respondents did not specify the exact geometry and the other could only indicate very simplistic forms (point, area, route). Further research needs to find ways to capture these geometries more accurately while maintaining a user-friendly survey design. Qualitative research methods (as used in the Lübeck-study) are still rarely used in environmental indication (for the prioritization of quantitative approaches see Müller et al. 2012). However, the Lübeck case provided insights into the range of features contributing to peoples’ “home-regions” and the spatial extent of these regions. Furthermore, the results demonstrate the indicator’s ability to tap into inconsistent patterns of perception. Although they were a side issue in our analysis, they shed light on what Sebastien (2020) called “polarizing entities” and highlighted as an underdeveloped research phenomenon. In line with the general logic of qualitative methodologies (providing a deep understanding of a given problem instead of numerical generalization) qualitative data on meaningful places can enrich planner’s sensitivity for residents’ sense of place. Future studies should take greater methodological care in selecting interviewees, which are low in number and may create bias, e.g., when stakeholders with a low degree of professionalism and communicative power are excluded.

The two case studies used different methods (quantitative and qualitative) and were embedded in independent research projects, which limits a direct comparison (e.g., in terms of scale-specific performance and effectiveness). Nevertheless, both methods used have strengths that could be combined in a tiered approach and tested at various scales in future studies. The first step could be a digital PPGIS survey that includes a large and representative sample of the population. The analysis would elucidate spatial distributions and hotspots of meaningful places with detailed information on the intensity of attachments and types of meaning. In a second step, qualitative approaches could be applied around the identified hotspots to better understand the underlying diversity of perspectives (including polarizing entities) and the most significant place characteristics.

Relevance of meaningful places in the management of social-ecological systems

The studies presented have shown how by applying the meaningful places indicator, sense of place can be explored and visualized in a reduced complexity. Despite the methodical limitations discussed, our analysis provided insights into (i) the locations and demarcations of (aggregated) meaningful places, (ii) the place meanings, and (iii) the intensity of attachment.

Given the spatial character of the indicator, GIS can be used to further characterize the meaningful places e.g., regarding the state of physical environment, foreseeable drivers of change (new infrastructures or climate change adaptations), and their potential impacts. A starting point and focus for further GIS-analysis may be, (i) areas in which many meaningful places overlap or accumulate, (ii) areas with a high density of material features interpreted to be a constituting feature of meaningful places, (iii) polarizing entities, (iv) areas to which people ascribe high degrees of attachments, or (v) that relate to a specific meaning (e.g., “home” or “memories”).

Although the indicator is in the development stage, the potential to be combined with other spatial data usually used in spatial planning allows to reflect on potential benefits for practitioners:

1. Determine development priorities to sustain or enhance ascribed meanings and respective attachments, for example

Table 5. Results of the question “Why is this place meaningful for you?”

Category	Frequency	Examples of codes	Attachment (M)	Standard deviation	Number of points with attachment response
Activities	102	Fishing, hiking, shopping	3.3	0.74	90
Aesthetics	79	Beauty, fantastic, cozy, neat, pristine, wide, idyllic	3.5	0.64	73
Well-being	66	Happiness, quality of life, tranquility	3.5	0.68	60
Social	53	Club/association, friends, family, gastronomy	3.7	0.75	47
Biotic features (land)	53	Forest, parks, plants, animals	3.7	0.75	43
Everyday life	48	Center of life, living, way to work	4	0.75	42
River	46	Lahn, floodplain, creek	3.2	0.74	41
Memories	44	Childhood, school	3.7	0.7	41
Human settlement structures	41	Castle, church, urban structures	3.5	0.69	40
Home	25	“Heimat,” home, my own	4	0.6	24
Continuity	20	Everyday, regularly	3.9	0.55	19
Accessibility	15	Accessible, central, close, proximity	3.4	0.51	13
Origin	12	Birth place, identity	4.2	0.51	13

where meaningful places are in a degraded (physical) state or threatened by land-use changes. Planner and landscape managers are shaping the physical environment with which people interact and which enables and restricts the creation of potential meaning (Stedman 2008). This could include conservation and restoration of their core features, and planning for multi-functional land uses.

2. Anticipate controversy and potentially minimize possible conflicts related to foreseen land-use changes. For example, meaningful places in a degraded state provide challenging situations because people feel attached to a state that needs restoration (Kibler et al. 2018). Furthermore, questions of legitimacy and equity can emerge where local-level implementations of (inter-)national sustainability goals evoke assumptions of being disproportionately exposed to environmental burdens. Because place-protective attitudes and actions are often rooted in feelings of threatened sense of place (Devine-Wright and Howes 2010), knowledge of meaningful places could deepen planners' sensitivity to local concerns and help them better balance problems caused by multi-level governance. Using the presented indicator, practitioners could engage with the local population at an early stage. Data on the location and characteristics of meaningful places can frame dialogue and avoid superficial discussions based on pejorative (pre-)categorizations into supporters vs. opponents of change.
3. Using the communicative power of the meaningful places indicator to engage citizens in the planning process. The communicative power relates to (i) its proximity to citizens' everyday life (compared to rather abstract planning topics, such as species diversity), (ii) co-produced results by the participants, and (iii) the tangibility of the result in the form of maps. Applying the indicator provides visual evidence to stakeholders on how their perspectives are considered, which may motivate and incentivize active participation and cooperation efforts in planning processes.

The presented potentials illustrate how the outputs from meaningful place assessments can effectively be implemented in the management of social-ecological systems and complement

existing planning tools (Gottwald et al. 2021). This broadens the perspective of planners, decision makers, policy actors, and stakeholders making invisible people-nature connections visible and thus supporting sustainable development approaches.

CONCLUSION

To integrate sense of place into social-ecological systems management, it needs to be easy to assess and complement existing planning information, such as biophysical indicators. This paper developed an indicator for sense of place that is (i) conceptualized in line with benchmarks of environmental indicators, (ii) rooted in relevant strands of sense of place research and takes into account the complexity of the concept (i.e., the emotional and cognitive dimension as well as the inclusion of socially constructed and immediately perceived place meanings), and (iii) applicable in practice because of its spatial approach, resulting in the ability to aggregate data, and graphic representations. The proposed indicator extends existing research and provides valuable insights for spatial planners seeking sustainable development in social-ecological systems. In line with the suggestions from van Oudenhoven et al. (2018) and based on our insights, further advancements should include the following:

- Setting up expert panels with decision makers and practitioners to verify the indicator's usefulness from a practical point of view,
- Involving professional communication experts to enhance the comprehensibility of indicators for planners and civil society,
- Enhancing understanding of the financial and time resources required to assess meaningful places,
- Applying the indicator in different cultural and planning contexts and at different scales,
- Improving the methods to account for specific spatial extents (geometries).

We argue that the benefits for planning, such as anticipating potential conflict, targeting specific local needs, and enhancing an integrative planning approach justify a new direction for sense of place research dedicated to developing and further advancing the indicator.

Responses to this article can be read online at:
<https://www.ecologyandsociety.org/issues/responses.php/13340>

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Data Availability:

The data/code that supports the findings of this study are available on request from the corresponding author. None of the data/codes are publicly available because they contain information that could compromise the privacy of research participants. An ethics approval was not required because this study was deemed low risk, i.e., that all participants in the study were above 18 years old, data assessment was anonymous, and informed consent was obtained. According to our Institute's standard practice, no ethics approval is necessary in those circumstances.

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APPENDIX 1.

Table A1.1 Characteristics and number of participants in the Lübeck case study (N=23)

Characteristic		Participants
Age	<30	4
	31-60	13
	>61	6
Gender	Female	7
	male	16
Origin	Native	12
	Newcomer	11

Table A1.2 Guiding questions for the semi-structured interviews

Questions
Could you tell me something about your region?
Are there features which you consider typical for your region?
Do you know features, of which people from another region would envy?
What would you show a friend from Southern Germany on a one-day visit?
What would you miss from your region in times of absence?

Table A1.3 Characteristics and number of participants in the Lahn case study (N=244)

Characteristic		Participants
Age	<20	0
	21-40	18
	41-60	137
	>61	82
Gender	female	79
	male	162
Length of residency	<10	9
	11-20	25
	21-30	30
	>30	178