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Sense of Place and Water Quality: Applying Sense of Place Metrics to Better Understand Community Impacts of Changes in Water Quality

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Abstract

Understanding people's values for coastal and freshwater areas is critical for identifying concerns and motivating people to protect water resources and for informing management decisions. Sense of place is a social indicator that captures the relative value that different people hold for specific places. Its use in water quality assessments remains extremely limited but based on lessons from other environmental fields, sense of place offers promise as a tool for measuring an important aspect of the social value of water quality. In this chapter, we propose a quantitative sense-of-place scale and additional qualitative questions which can be used in conjunction with biophysical water quality data and water quality perceptions data to better understand how people's values change with improvements or degradations in water quality.

Keywords: sense of place, water quality, social science, cultural ecosystem services

1. Introduction

Coastal and freshwater areas are important (or not) to people for a number of reasons ranging from the provision of the right resources for recreational activities to ease of accessibility for a family's use. Decisions about actions and policies that affect water quality can be better informed by understanding what makes people value various locations and how improvements or degradations in water quality can affect that value. While biophysical data are being increasingly collected, analyzed, and applied to critical environmental decisions, complementary social data remain relatively scarce. This presents a significant problem, as water quality impairments are inherently social problems in specific locations and effective solutions require public support and community willingness to make decisions and changes. Even the most readily available social data related to water quality—water quality perceptions and travel cost studies—are limited in scope and quantity and often do not consider the extent of environmental attributes of those places [1].

Sense of place has significant potential as an indicator of the social value of different locations and their environmental attributes. In this chapter, we focus on using sense of place to capture values related to water quality and connecting this sense of place value with biophysical water quality metrics and other social indicators. To date, sense of place assessments have focused on water quality have been conducted in only a few places and most do not link to specific biophysical metrics. We highlight the utility of sense of place as an indicator of the relative importance of different sites and its potential for assessing water quality in conjunction with other social and biophysical data. First, we review the literature on sense of place and its historical application and findings. We then describe the few existing applications of sense of place in the context of environmental attributes, including water quality. This chapter ends with a call for researchers to use sense of place as a cultural ecosystem service indicator and we present a proposed sense of place scale for use in water quality social assessments.

2. Sense of place

Sense of place analyses are mechanisms for articulating the social value of a geographical area. Specifically, “sense of place” is a social theory that connects an individual’s meaning and attachment for a specific geographical place with the attributes of that place such as amenities, site characteristics, and environmental quality [2]. Sense of place can be a useful tool for quantifying and characterizing the social value of water quality as coastal and freshwater places are more than just their environmental attributes. These places provide important meaning and value to the people who inhabit and visit them.

In the application of sense of place, “place” is generally a specific geography that is defined based on political or natural boundaries or other special features [3]. Place is, importantly, identified in this context as not just a stage for social interactions but as a critical component of those interactions [4]. For example, one coastal place may be a neighborhood access point to a small estuary that is primarily used for launching kayaks or exploring tidepools. Another coastal place might be a larger beach visited by residents from multiple states that is operated by a state as a park and offers full amenities such parking, restrooms, and lifeguards.

Sense of place provides a useful indicator of social value, as the components of sense of place have been connected to increased community involvement as well as environmental protection responses, concern, intentions, and behavior (e.g., [5–11]). For example, Lukacs and Ardoin [12] connected sense of place with participation and motivation for engagement with local watershed management groups in Appalachia. Similarly, sense of place attitudes have been connected with behaviors such as opposition to new renewable energy development and natural protected areas, which were seen as threats to the autonomy and opportunities of the local residents [1, 13]. As the concept of sense of place inherently recognizes humans as a component of the ecosystem, it helps bridge the gap between scientific research and environmental decision making by elucidating some of the social value of environmental protection [14]. For example, in a Nebraska river watershed effort, Davenport and Anderson [15] developed a place-meanings framework that can be used by managers to better understand the complexities behind contentious issues.

The bulk of sense of place research has focused on individual-level attitudes toward a particular geographical area, but there is also a body of work connecting broader sociocultural values and perspectives to more general geographical constructs. Put more simply, an individual’s interaction with a specific place does not exist in a vacuum separate from the broader geography or society. Larger

socio-cultural constraints and interactions influence individual's or communities' emotional relationships to a place [16–18]. For example, Campbell [19] studied the shared sense of place values in Ontario's eastern Georgian Bay and found sub-communities (i.e., artists/writers and residents) developed a specific language and identity that was different from that of people in other areas within the region, revealing a unique reference to their home communities. Poe et al. [17] found that sense of place for residents of Puget Sound was multidimensional with the availability of access to the Sound, knowledge about use, access and conditions, and perceived ecological integrity influencing place attachment. The environmental characteristics of a location also matter, as sense of place is not just a social construct [20], and some research has supported the idea that people's sense of place can be for both a specific geography as well as for general places that share similar characteristics, including environmental attributes [21]. One example of this research [22] found some differences between site specific attachment to a wilderness location and more general attachment to wilderness areas.

3. The components of sense of place

Sense of place can be considered broadly as an overall measure and can be investigated through several subcomponents—most commonly place dependence, place identity, and place attachment (see **Figure 1**). Relationships with a site because of its functional provision of particular resources that support activities (e.g., waves for surfing, clarity for diving, bacteria-free access for swimming, or scenic vistas for viewing) are described as *place dependence* [22]. A person with high place dependence would ascribe high importance on the availability of a specific condition at a site relative to other sites [23]. Place dependence has been investigated in several

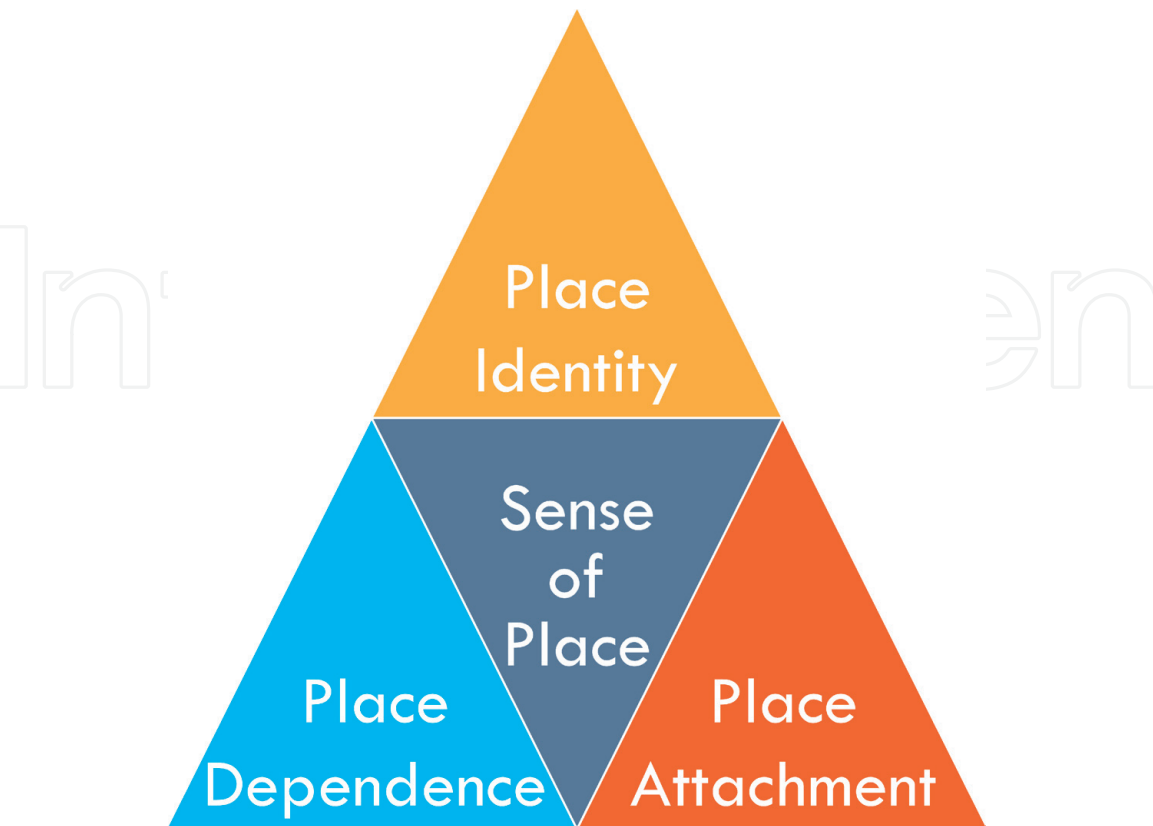


Figure 1.
Sense of place. Sense of place is often discussed in terms of three subcomponents: place dependence, place identity, and place attachment.

studies of various types of recreation areas and was found to increase with perceived familiarity with a park [23], and with length of residence and education [24].

Several studies have investigated hypotheses that sense of place (e.g., often place dependence, specifically) is different for various types of users but have not always found consistent differences [2]. For example, Bricker and Kerstetter [25] found that, for whitewater recreationists, how particularly specialized recreational users were described in terms of equipment, skills, and activity frequency did not affect place dependence, although it did influence place identity. When applying sense of place metrics to water quality assessments, degree of specialization is important because the acceptable type of recreation may vary considerably for different water quality conditions. For example, someone may still be willing to go for a walk on a beach that is closed to swimming because of bacterial contamination but would not be willing to go diving or swimming. Specialization also matters when connecting the social value of a place to economic values, as people tend to have different values depending on the type of recreational use, and users' individual attributes (e.g., more or less avid, residents or visitors) affect their values for attributes of a place.

Place identity can be described as the emotional counterpart to place dependence. Instead of measuring the dependence on a place for its resources to support an activity or livelihood, place identity captures the dependence on the place for constructing one's self-identity [2, 16]. The specific place builds symbolic importance for an individual's emotions and self-identification [26]. For example, people with high place identity for water areas might express sentiments like "I'm an ocean person," or "Water is a part of who I am." Higher place identity has been identified in those who are more familiar with a recreational site [23]; in those who have a higher degree of recreational specialization [25]; or in those who live in rural areas, have a longer time of residence, and own their homes [24].

The most studied of the main sub-components of sense of place is *place attachment*. In part this is because, out of the components, it has the broadest breadth of meanings [2, 27]. In some fields and research efforts, place attachment and sense of place are virtually synonymous [23]. In other applications, particularly in recreation-based work, place attachment is a subcomponent of sense of place that captures the emotional bond with a place or how important a place is to someone beyond the resource or identity dependences. Place attachment is rooted in Tuan's [28] seminal work on topophilia which focuses on the connection of an individual to a place.

Past studies have shown that local environmental perceptions, as well as the number of local social relationships, increase place attachment [8]. Someone with high attachment may have a lot of fond memories of visiting a place or consider themselves bonded with a location. There is a range of findings associated with place attachment to natural areas. Some researchers have found that place attachment to lands or sites is higher for locals (e.g., [1]). Others (e.g., [29]) have found that place attachment is higher for more repetitive users of the area.

A number of researchers (e.g., [5, 15, 20, 30]) have argued the importance of in sense of place is not just the strength of these three sub-components, but also the overall meanings an individual ascribes to a location. These place meanings are often captured through complementary quantitative/qualitative studies or stand-alone qualitative investigations into people's values, significance, and descriptions of the place [30]. A place may hold diverse meanings for different individuals, such as a recreationist at a site versus an adjacent property owner. For example, in the Midwest, Mullendore et al. [31] argue that farmers' sense of place values have not been captured in most sense of place studies. They explain that most sense of place studies have targeted recreational use in parks, wilderness, or other natural areas

rather than exploring place values for working landscapes, which have different meanings associated with them. Place meanings can also have management implications. Jacobs and Buijs [32] found that attitudes toward water-level and restoration management interventions depended on the stakeholders' place meanings for the area.

While these three components are often talked about in terms of contributing to overall sense of place attitudes, there are not always clear-cut boundaries among them, and a number of researchers have identified varying relationships and interactions among them. For example, Kyle et al. [33] found conflicting effects between place identity and dependence for social and environmental conditions on the Appalachian Trail despite a moderate positive correlation of place identity and dependence. They found that respondents with higher place identity were more likely to see social and environmental conditions as problematic while the opposite was true for those with high place dependence. For Indiana farmers, Mullendore et al. [31] looked at the relationship between sense of place and willingness to adopt specific conservation behaviors in a working landscape (related to nutrient pollution in waters). They found the magnitude of the overall sense of place scale did not affect conservation adoption, but place attachment and place identity individually did.

4. Policy application of sense of place

Application of sense of place to policy questions is relatively new and there have been mixed findings about its utility for informing environmental management [2]. This may have resulted from sense of place studies not being conducted using consistent metrics or methods and the findings have also not always been consistent across places and studies. Researchers are increasingly applying similar quantitative scale questions, most particularly the scales developed by Jorgensen and Stedman [26] and Williams and Vaske [23]. Qualitative investigations of sense of place follow consistent themes investigating place attachment, dependence, identity, and meanings; however, because of the inherent nature of place-based work, these quantitative and qualitative questions often need to be tweaked to be site- or use-appropriate. This can make broader interpretation and application of the findings more difficult.

One example is the connection between recreationists and sense of place. A number of studies have found positive relationships between recreation and sense of place values. In several recreation studies (e.g. [25, 33–35]), recreationists did not have particularly high attachment to a place. Further, research that applies mixed qualitative and quantitative methods may help to tease out the reasons for these differences. A high sense of place also does not necessarily translate to actions. Rudestam [36] found a strong sense of place for waters in the Willamette River Basin among water users in their professional capacity (agriculture-related, fisheries-related, recreational outfitters), as well as those involved in agencies and watershed councils. However, that attachment did not motivate intentions for personal sacrifices. For example, interview participants still talked about clearcutting their lands for high timber prices or anglers being unhappy with management actions that would limit their catch. These results point to the importance of using sense of place values along with other social measures, as well as biophysical measures. Although social attitudes and values are complex and subjective, a better understanding of these attitudes and values, including sense of place, could enable better connections between communities and management and conservation of resources.

Applications of sense of place findings are primarily at a localized level but provide insights about the relative social value of different places. To increase the application of sense of place in environmental management, social data will need to be collected on a broader scale with more consistent means of data collection such as the use of standardized sense of place scales for use across locations. One promising advancement has been an increase in applying spatial techniques in place-based research (e.g., [37–39]). These techniques connect survey or interview data to places and landscapes which allows for the incorporation of spatially defined ecological data to analyze relationships with sense of place.

Beckley [4] calls for research that identifies the environmental attributes for which people develop place attachment; however, a big limitation in the use of sense of place, or many other place-based social indicators, for water quality assessment is the lack of localized biophysical water quality data. Place-based values are site specific and are not always generalizable past that location as testing and monitoring methods are not always consistent. Without corresponding localized water quality data—either perceptions or biophysical measurements—we may be able to capture the social value for that place as a whole but not for its environmental attributes. In the case of water quality valuation, this means that we are limited in our ability to explain changes in the social value for sense of place resulting from changes in water quality due to gaps in our biophysical monitoring and understanding.

5. Sense of place and environmental change

Sense of place is a social construction of place identity, dependence, and attachment that is mediated by physical attributes and conditions [4, 40]. For example, while many studies have found that long-term residents have higher place attachment, in Montana, McCool and Martin [41] surprisingly found that newer residents had higher place attachment. They explained this unusual finding as possibly reflecting the fact that many newer residents had moved to the area specifically because of the mountain access and environmental attributes of the area. Kibler et al. [42] highlighted the value of connecting human attachment to the condition of an ecosystem for evaluating the success of restoration projects. Specifically, they hypothesized that it is likely for ecosystem improvement in restoration projects to depend on the interaction between ecosystem function and sense of place. These interactions project that a restoration site where stakeholders have a high sense of place and where there is a highly functioning ecosystem will lead to emotionally invested stakeholders and iterative monitoring of the ecosystem. On the other end of the spectrum, they hypothesized that low sense of place and low ecosystem function would require enhancing stakeholder attachment for a restoration effort to be successful.

Minimal work has been conducted that moves beyond general attachment to the environment to directly connect sense of place to environmental attribute data. The connection of biophysical data with social data is often limited by the availability of the two types of data at the same meaningful scale. Many social scientists focus on survey respondents' or interview participants' environmental perceptions or landscape values for a location when biophysical data are unavailable [43]. For example, in Norway, Kaltenborn [44] found the most important contributing attribute to place attachment to be the perception of the quality of the natural environment. Brown and Raymond [37] investigated the relationships between landscape values which incorporate both ecological and social values, and sense of place in Australia. They found esthetic, spiritual, future generation, and wilderness values to be the best predictors of place attachment. Matarrita-Cascante et al. [45] found that

natural amenities increased place attachment for both seasonal and permanent residents. Larson et al. [46] applied nine natural environmental wellbeing factors to explain sense of place values, including general “environmental quality,” “water quality,” “fishing,” “soil,” and others. They found that coastal residents valued beauty and conditions of the environment.

To date, very little work has connected sense of place with water quality assessments (see **Table 1**). In the only work that directly connects biophysical water quality data with sense-of-place meanings, Stedman [20] connected water quality to place attachment and satisfaction for property-owners in a lake-rich region of Wisconsin. He found that the construction of sense of place meanings was mediated by the level of shoreline development as well as the social influences of whether or not the lake felt like a wilderness escape place or a neighborhood of friends. In terms of place attachment, the two social influences (wilderness escape and sociability) that depend upon what the property owners were seeking essentially cancel one another out when considering shoreline development. More shoreline development leads to a more social environment, but also less wilderness, thereby differently affecting the experiences of each property owner. Jorgenson and Stedman [26] investigated the same dataset and found that perceptions of environmental features were the best predictors of place identity, dependence, and attachment.

There has been some work connecting various water quality metrics to sense of place without using biophysical data. Brehm et al. [5] measured predictors of water quality concern and found place meanings to be linked to local environmental concern. They found that the level of water quality concern was predicted by the environmental values, gender (female > male), and assigned place meanings (how impacted they perceived the watershed was by environmental threats and how they perceived the watershed as a getaway). Smith et al. [10] connected perceived ecological integrity (along with a set of other place attachment indicators) with a set of desired social and ecological outcomes for lakes in Illinois. They found that the more people believed the lakes contributed to the ecological integrity of the area, the more they desired improved environmental outcomes and the less they

Author	Water quality metric(s) used
Stedman [20] [*]	Level of lake shoreline development (number of structures within a 100 m buffer of the lake), water clarity, algal biomass, chlorophyll, color, alkalinity, and conductivity
Brehm et al. [5]	Water quality concern
Smith et al. [10]	Perceived ecological integrity Likert-scale questions: 1. This lake is important in protecting the landscape from development 2. This lake is important in providing habitat for wildlife 3. This lake is important in protecting water quality
Cox et al. [47]	Perceived waterway condition Likert-scale questions: 1. Considering everything, how would you rate the overall condition of the following waterways? 2. How would you rate the waterways in terms of the quality of the water? 3. How would you rate the waterways in terms of the vegetation along the shores? 4. How would you rate the waterways in terms of the number and variety of animals?
Larson et al. [46]	Environmental wellbeing factors for fishing, swimming, air quality, water quality, soil quality, beauty of the landscape, condition of the landscape, access to the natural areas, biodiversity, overall-natural environment

^{*}This is the only study that applied specific water quality data. The other studies applied perceived ecological integrity or water quality value.

Table 1.
Past research connecting water quality metrics and sense of place.

desired competing economic outcomes. Cox et al. [47] also investigated water quality perceptions and found a weak connection with the number of visits, which then indirectly affected other quality of life indicators, including sense of place. In a qualitative investigation of sense of place, Lukacs and Ardoin [12] found that the perception of the environmental attributes and biophysical resources influenced sense of place and watershed group participation in Appalachia.

6. Sense of place as a cultural ecosystem service indicator for water quality

Sense of place is sometimes identified as a cultural ecosystem service [48, 49]. The term “cultural ecosystem services” is used to represent a range of non-material benefits that humans receive from their interactions with the environment, including esthetic appreciation, spiritual services, cultural identity, recreation experiences and more [49, 50]. These types of benefits provide some convincing reasons for environmental protection that may be compelling to different audiences than those who prefer other ecosystem service benefits [51]. Because of the importance of cultural ecosystem service benefits to humans, their assessment is critical for understanding the impact of environmental change, including water quality degradation or improvement.

Although cultural ecosystem services are one of the core components of most ecosystem services frameworks, their assessment and use remains relatively limited [48, 51]. This is due, in part, to the challenge of calculating the economic value of the benefits, resulting in the frequent omission of the value of non-material cultural services [51]. Over the past few decades, a number of survey scales to capture sense of place attitudes for various geographies have been developed. As discussed throughout this chapter, very little of this work has been conducted in freshwater places and even less has been done in saltwater places.

Here, we propose a set of scaled sense of place questions (**Figure 2**) with the purpose of understanding the social impacts of water quality changes through recreation. These questions were compiled and modified from past work on sense of place in both water recreation areas as well as in other contexts. The questions are derived most directly from the work of Jorgensen and Stedman [26], Williams and Vaske [23], and Mullendore et al. [31]. In addition to the nine quantitative, Likert-scale questions, we also include open-ended, qualitative questions that can be used to further explain sense of place responses. We developed the scale questions and the qualitative follow-up questions to attempt to address some of the issues mentioned above. The scale is intended for increased consistency in data collection and an increased ability to compare sense of place across different geographic places. The qualitative questions are intended to capture some of the nuance associated with the complexity of sense of place and to better capture place meanings. In future work, we will explore the use of our sense of place scale to further elucidate variations in economic values for changes in water quality, an area that has not been explored by researchers to date.

To develop the quantitative and qualitative questions, we began with a set of open-ended qualitative questions gleaned from the past sense of place research. We then modified a number of these questions and, through further focus group testing, reduced the set to nine questions capturing the three subcomponents of sense of place. The two qualitative questions were also refined through focus group testing.

As discussed earlier in this chapter, scaled sense of place questions have been used in a range of different research efforts. These include connecting sense of place

Thinking about the place you visited most recently for water recreation, please indicate how much you agree or disagree with the following statements. (Fill in one circle for each statement)								
		Strongly Disagree						Strongly Agree
Place Dependence	That place provides value to me that I can't obtain elsewhere.	☐	☐	☐	☐	☐	☐	☐
	I get more satisfaction out of visiting that place than any other recreation place.	☐	☐	☐	☐	☐	☐	☐
Place Identity	The recreational activities that I pursue at that place say a lot about who I am.	☐	☐	☐	☐	☐	☐	☐
	I identify with the physical landscape of that place.	☐	☐	☐	☐	☐	☐	☐
Place Attachment	That place means a lot to me.	☐	☐	☐	☐	☐	☐	☐
	I have no particular love for that place compared to other areas.	☐	☐	☐	☐	☐	☐	☐
	I am very attached to that place.	☐	☐	☐	☐	☐	☐	☐
	I feel happiest when I'm at that place.	☐	☐	☐	☐	☐	☐	☐
	Many important memories are tied to that place.	☐	☐	☐	☐	☐	☐	☐

Why did you choose that place? (Please describe)

What is important to you about that place, if anything?

Figure 2.
Sense of place scale and qualitative questions developed for use in water quality social assessments in the context of coastal recreation.

with support for environmental actions, recreation behaviors, and perceived environmental quality. Our scaled questions provide specific metrics for quantifying place dependence, identity, and attachment with the ability to use the data to better understand the impacts of changes in water quality at recreational sites. By coupling the sense of place data with biophysical data, we will be able to conduct analyses of how sense of place is affected by water quality. These analyses will connect site-level water quality data such as water clarity via Secchi depth measurements, bacteria counts from beach monitoring, or chlorophyll *a* to the sense of place measurements, like in the work of Stedman [20] in Wisconsin lakes.

In the past, a great deal of the sense of place research has focused on qualitative exploration of the concepts of place attachment, identity, and dependence

(e.g., [15, 32, 40]). The symbolic and complex meaning of sense of place and its components makes agreement/disagreement with simplified statements, like those required to develop a scale, difficult to capture in their entirety [5]. Qualitative questioning, including the two qualitative questions proposed in **Figure 2** (“Why did you choose that place? (Please describe)” and “What is important to you about that place, if anything?”) allows for deeper exploration of the meaning behind the responses given in the quantitative scale and an extension of sense of place meanings.

7. Conclusion

This work expands on the research investigating the relationships between biophysical data and social data, specifically in the context of evaluating the relationships between sense of place and water quality. Davenport and Anderson [15] wrote “A holistic and integrated understanding is needed, though, of place meanings and the setting to which these meanings are ascribed. What happens to sense of place when places change? What happens when landscape change threatens place meanings and emotions? (p. 630)” Although a number of researchers have contributed to the sense of place literature since then, direct investigations of the impacts on sense of place from changes to the environment remain relatively non-existent.

We have presented a set of sense of place scales that capture the three main components of sense of place – place dependence, identity, and attachment. We combine these scales with qualitative questions in order to further understand the nuance of people’s sense of place. Through our work, we are attempting to advance the research on sense of place, as well as contribute to better understanding social values for water quality. Used in conjunction with environmental economic valuation methods for recreation and water quality, sense of place may provide additional nuance and explanatory power in describing people’s preferences for the quality of natural resources. We suggest that this approach may be useful in other places and contexts.

Sense of place is a promising metric in the assessment of water quality for capturing the social value of various locations. Moving forward, in order to identify the impacts of changes in water quality and better inform the process of managing resources, increased social and biophysical data are needed at place-based scales. If researchers collect and report these data in more consistent ways across places, it will be possible to make comparisons across places and contexts. Increased collection and application of place-based social data can contribute to understanding community priorities for conservation or restoration, which is crucial for informing targeted management aimed at water quality improvements. Identifying areas of particular value may also help to identify potential sources of conflict or areas of special value. By informing water quality management to better target waters, community priorities may be better accounted for in interventions and decisions. Finally, sense of place research can also be used to improve connections between humans and natural systems by understanding the social and environmental attributes that make a place important.

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