The role of place attachment in public perceptions of a re-landscaping intervention in the river Waal (The Netherlands).

Abstract

Rivers are among the most heavily managed landscapes worldwide. The meanings people ascribe to river landscapes and their preferences for management have implications for public support for management decisions. This paper reports on a postal survey (N = 1,102) on perceived landscape qualities (place attachment, scenic beauty and safety perception) and public perceptions of a re-landscaping river intervention in four residential areas along the river Waal (The Netherlands). The objectives of this study were to (1) examine the relationship between place attachment and socio-demographic and geographic variables, and (2) explore the role of perceived landscape qualities in public perceptions of a planned river intervention. Multiple regression analyses showed that socio-demographic and geographic variables explain 21-41% of variation in place attachment dimensions (including place identity, place dependence, social bonding, and narrative bonding). We found that local residents have intermediate to strong bonds with the area and that village residents were more attached than city residents. Based on our findings, we note some conceptual differences between place identity, which received the highest score of the four dimensions, and narrative bonding, which focused on cultural-historical and learning aspects. Overall, the planned intervention was positively evaluated, especially in terms of improving flood safety. Social bonding, scenic beauty, and recreational value correlated positively with the evaluation scores. Our findings emphasize the importance of place as a social environment in residents' responses to re-landscaping river interventions and discuss opportunities to engage local communities and sustain social processes in river management.

1. Introduction

People perceive, value and interact with landscapes in multiple ways, making them complex social-ecological systems. Rivers are among the most heavily managed landscapes worldwide (Nilsson, Reidy, Dynesius, & Revenga, 2005; Tockner & Stanford, 2002). Landscape interventions in rivers include large-scale, regulating engineering works, such as the construction of dams, as well as river restoration or rehabilitation measures aimed at decreasing human influence and increasing natural values. Climate change and urbanization put increasing pressures on river landscapes in terms of flood resilience and flood protection (Palmer, Lettenmaier, Poff, Postel, Richter, & Warner, 2009). For example, the Netherlands has many low-lying, flood-prone urban areas and a long tradition in flood protection and river management (Baan & Klijn, 2004). After the near-floods in 1993 and 1995 new measures were implemented to maintain safety standards in the face of the projected increase in river discharges resulting from climate change (van Stokkom, Smits, & Leuven, 2005). River landscapes were transformed to create more space for the river, for example by constructing side channels or excavating floodplains, and enable sustainable use of its resources for economic, ecological and human well-being benefits (Rijke, van Herk, Zevenbergen, & Ashley, 2012). Incorporating local values, knowledge and perspectives to account for these benefits is one of the major challenges of river management (e.g. Fliervoet, van den Born, Smits, & Knippenberg, 2013; Gundersen, Kaltenborn, & Williams, 2016; Smith, Clifford, & Mant, 2014).

Local residents' livelihoods are among the ones greatest affected by both floods and flood prevention measures, however, their particular interests are often not represented in decision-making processes (Burley, Jenkins, Laska, & Davis, 2007; Junker, Buchecker, & Müller-Böker, 2007; Michels, 2016). As Manzo and Perkins (2006) already noted, practitioners often regard research on public perceptions as a luxury, however, the costs of

overlooking social and contextual factors may be great. Several studies highlight the importance of considering emotional connections to place (or place attachment) in planning processes for river management (Agyeman, Devine-Wright, & Prange, 2009; Davenport & Anderson, 2005; Jacobs & Buijs, 2011). These bonds may take a long time to develop (Åberg & Tapsell, 2013) and relate to different values, such as recreational values, naturalness, and connectedness to landscape (Junker et al., 2007; Seidl & Stauffacher, 2013). The relationships between the meanings individuals ascribe to landscapes and their preferences for management outcomes have become an increasingly important area of research, as they may explain conflicting views on landscape management (Gundersen et al., 2016; Smith, Davenport, Anderson, & Leahy, 2011) or community opposition to new developments (Vorkinn & Riese, 2001).

We present a case study of the construction of longitudinal training dams in the river Waal (The Netherlands) with the aim to improve our understanding of the role of people's attachment to rivers in shaping their perceptions of re-landscaping management interventions. To inform this study, we first reviewed existing literature on place meanings of and attachment to river landscapes in a management or restoration context. The intervention under consideration in our study aims for an integral solution to river issues (i.e. to improve flood safety, ecological conditions and navigability) and is not a river restoration project per se. However, we do believe that this literature is relevant as it also concerns landscape change. Using a sample of local residents of four communities living along the river Waal, we then examine (1) the influence of socio-demographic and geographic variables on four dimensions of place attachment (i.e. place identity, place dependence, social bonding, and narrative bonding) and (2) the role of perceived landscape qualities (including place attachment, scenic beauty and safety perception) in public perceptions of this planned river intervention.

1.1 Interpreting place meanings in changing landscapes

People's responses to place changes are complex and result from the process of (1) becoming aware, (2) interpreting, (3) evaluating, and (4) coping, leading (possibly) to (5) resistance or support (Devine-Wright, 2009). This complex relationship becomes apparent when reviewing qualitative studies on place meanings in a river setting. A qualitative study carried out in rural Nebraska by Davenport and Anderson (2005) found four interlinked river meanings; depicting the river as (1) part of people's or communities' *identity*, (2) a place for recreation that is beneficial for the body and mind (as a *tonic)*, (3) a resource (or *sustenance*), and (4) a place for *nature*. They conclude that it "is not simply a matter of being for or against development", but that, depending on the nature of the intervention, meanings attributed to the river could be enhanced or interfered (Davenport & Anderson, 2005, p. 639). Using semi-structured interviews with Dutch floodplain residents, farmers and water professionals, Jacobs and Buijs (2011) identified beauty, functionality, attachment, biodiversity, and risk as important place meaning categories. For local residents, their appreciation of the beauty of the riverine landscape (determined by nature, agricultural use and historical elements) shaped positive attitudes toward stream restorations (Jacobs and Buijs, 2011). A public perception study based on semi-structured interviews which were held 14 years after a restoration project in England found similar categories but also noted the importance of connections between the river and the landscapes, changes in the landscape after restoration, and the role of history, memories and traditional practices (Westling, Surridge, Sharp, & Lerner, 2014).

Places can also become meaningful through spiritual or mythological relationships, participation in cultural events, and storytelling and place naming (Low, 1992). Thus, the understanding that places give meaning to one's identity inherently includes a historical

dimension which should not be overlooked (O'Neill, Holland, & Light, 2008). This sense of identity is rooted in what Drenthen (2013, 17) refers to as a "narrative understanding of place", in which landmarks construct a narrative that reflects the history of the place and its relation to people (Drenthen, 2009a). For example, the traditional groynes in the river Waal (i.e. small dams placed perpendicular to the river; Figure 1) continue to tell the story of the Dutch that 'tamed' the river in the 18th and 19th century to keep people protected from floods and to make it suitable for shipping (Lenders, 2003). Moreover, people often have memories that are specifically linked to these landmarks, either during their childhood or as part of recreational activities. Through re-landscaping interventions (such as the replacement of groynes by longitudinal training dams), these cultural and historical meanings of a landscape may be lost, creating non-places without any historical identity or narrative value (Drenthen, 2009b; Westling et al., 2014). While this may be true, it is also important to note that places may regain meaning as people familiarize themselves with or learn more about their new environment (Davenport & Anderson, 2005). For example, a large-scale survey among school pupils living in small Polish communities found that educating young people about local history yielded an increased interest in history and greater place attachment (Stefaniak, Bilewicz, & Lewicka, 2017).

Place attachment broadly refers to affective bonds between people and places and has been studied extensively in the past decades (Altman & Low, 1992), in particular in the field of environmental psychology. As a concept, it originated independently in different disciplines and therefore a broad spectrum of terms and concepts is employed (Hernández, Hidalgo, & Ruiz, 2014). For example, Trentelman (2009) notes that 'place attachment' and 'sense of place' are both used as overarching concepts while subcomponents such as place dependency and place identity are used as constituent parts of both. Recently, Raymond et al. (2010) developed and tested a framework with four dimensions of place attachment,

including place identity, place dependence, social bonding and bonding with nature. Place identity (referring to personal affective bonds) and place dependence (referring to an instrumental value) are two of the most well studied dimensions of place attachment. Social bonding refers to meaningful social relationships and shared experiences, for example in the neighborhood where you live or when engaging in social outdoor activities (Hidalgo & Hernández, 2001; Kyle, Graefe, & Manning, 2005). The fourth dimension refers to bonding with the natural environment (Raymond, Brown, & Weber, 2010).

In a theoretical discussion of place identity and risk perception, Wester-Herber (2004) argues that artificial landscape changes may stigmatize places by negatively affecting an individual's sense of self-esteem and self-efficacy, a loss of distinctive landscape features, or through disruption of continuity. Therefore, attachment to place should be given importance in itself, and not be "disguised as health or environmental concern" (Wester-Herber, 2004, p. 114), as it may influence whether people support decisions for land (use) change. It is not easy to detect a direct relation between people's attachment to place and their support for river management, because this is highly depending on contextual factors, such as the kind of intervention and the location. Previous quantitative research on this topic mainly addressed personal attachment to and recreational value of an area using a composite variable such as 'importance of the river' (de Groot and de Groot, 2009) or 'sense of place' (de Groot, 2012) in the analyses. For example, de Groot and de Groot (2009) found both positive and negative relationships between the perceived importance of the river and public support for different management interventions (i.e. negative for cutting down trees and dike relocation, while positive for the construction of side channels). In a follow up study in France, Germany and The Netherlands, sense of place did not emerge as a significant predictor (de Groot, 2012). The mixed-method study of Buijs (2009) sheds some light on the plurality of views among residents by identifying different frames used to inform their arguments to oppose or support

river restoration. While people adhering to an attractive nature frame supported river restoration, those using an attachment or rurality frame opposed it, reflecting their fears of losing cultural heritage and agricultural land respectively. Other place attachment literature suggests that people with higher place attachment report greater social and political involvement in communities and are more likely to work together to achieve mutual goals such as protecting social and physical features that characterize their places (Mesch & Manor, 1998). Especially in countries where residents have a high level of trust in water authorities and flood protection, as is the case in the Netherlands (Terpstra & Gutteling, 2008), higher levels of place attachment may then become a positive factor in public support for flood risk interventions.

In this study, we build upon the perceived landscape qualities framework of Buijs (2009), including scenic beauty, place attachment and risk perception, but broaden place attachment by including social and cultural-historical dimensions. Recognizing the lack of emphasis on social bonding in previous studies, we combined items from Buijs (2009) with the framework from Raymond et al. (2010) in order to provide a more comprehensive and inclusive approach to place attachment. Moreover, narrative bonding is introduced as a new dimension in the place attachment scale to account for cultural and historical meanings of river landscapes.

2. Methods

2.1 Study area

The river Waal is the main branch of the river Rhine in the Netherlands and intensively used for inland shipping. The river landscape is characterized by small dams placed perpendicular to the river at regular intervals to prevent bank erosion and maintain sufficient depth for shipping (Figure 1). In 2014, the Dutch national water authority initiated

a pilot engineering project on a ten kilometer stretch of the river (Figure 2A-B), which entails the replacement of traditional groynes by three dams that are situated parallel to the riverbank (Figure 2C). This intervention results in the formation of a main and secondary channel in the river and consequently changes the appearance of the Dutch river landscape drastically. The main rationale for the construction of the longitudinal training dams is that they will benefit the discharge capacity of the river by reducing hydraulic resistance at high water levels. In addition, they are expected to reduce maintenance costs for dredging (van Vuren, Paarlberg, & Havinga, 2015) and to create more optimal ecological conditions at the river banks (Collas, Buijse, van den Heuvel, van Kessel, Schoor, Eerden, & Leuven, 2018). As this is the first construction of longitudinal training dams in the Netherlands, with possibilities for extending this to other parts of the river, it is important to study public perceptions of the intended measure and affected landscape qualities.

2.2 Data collection

Postal questionnaires were distributed in two villages situated on the south bank and one city and one village on the north bank of the river Waal (km 911.5 to 922) (Figure 2). Addresses were retrieved via the GIS-department of the Directorate-General for Public Works and Water Management. We selected all addresses in the villages Dreumel (1,472 addresses; a 24% response rate resulted in $N = 347$), Ophemert (679 addresses; 23% response rate; $N = 155$), and Wamel (1,043 addresses; 22% response rate; $N = 225$). For the city of Tiel, a random selection of 2,000 addresses was made from the 16,754 available (17% response rate; $N = 343$). Data were collected in the period December 2013 until February 2014, which was before the planned reconstruction of the area. Household members aged 18 years or older had two options to complete the survey: a hardcopy could be returned in the enclosed pre-paid envelope, or an identical questionnaire could be filled in online. Forty

questionnaires were returned to sender because of incorrect addresses (i.e. houses under construction). The total number of returned questionnaires was 1,136. Thirty-four respondents failed to complete substantial parts of the questionnaire and were omitted from the sample. Thus, the total number of questionnaires available for analysis was 1,102 (of which 138 were online versions). This number includes thirty-two respondents who did not wish to report their place of residence.

There may be several reasons for the low response rate in this study, such as the length of the questionnaire or a lack of interest in the topic. No reminder was sent after the first mailing. Compared to the population of the residential areas in 2015 (from Statistics Netherlands, CBS), middle aged people of 45 and older, higher educated people and men were overrepresented among the respondents (Supplementary Material). Similar studies carried out in the Netherlands with higher response rates also reported age and gender biases in their sample (Buijs, 2009). In our case, it may have led to a slight overrepresentation of those in favor of the intervention because age was related to more positive evaluations of the proposed intervention.

2.3 Questionnaire

The questionnaire consisted of three main parts: perceived landscape qualities, evaluation of the intervention and socio-demographic and geographic variables. Perceived landscape qualities were measured as three separate elements, including scenic beauty (i.e. attractiveness of the river landscape), place attachment, and safety perception (Table 1). All items were measured on a five-point Likert scale. *Scenic beauty* was measured using nine items depicting different aspects of the river landscape from Buijs (2009). For each item, respondents indicated to what degree they considered this to be a characteristic element of the river landscape ranging from 1 (not applicable to the river landscape) to 5 (highly applicable

to the river landscape). The scores for these items were aggregated in a composite measure for scenic beauty (Cronbach's α = 0.8). *Place attachment* was measured with sixteen items that were evenly divided over four dimensions: place identity, place dependence, social bonding, and narrative bonding. Selection of the scale items was based on the previous review of the literature on place attachment. We measured social bonding and place dependence using scale items previously developed and tested by Kyle et al. (2004, 2005), Raymond et al. (2010) and Williams et al. (1992). Scale items for place identity were based on the work of Buijs (2009) but two additional items (i.e. on being proud of the area and feeling at home) were included in the place identity dimension based on results from exploratory semi-structured interviews with local residents (unpublished results). The scale items for measuring narrative bonding were adapted from an earlier study on place attachment of Dutch floodplain inhabitants (Buijs, 2009; Buijs, de Boer, Gerritsen, Langers, & de Vries, 2004). One item in this concept has been newly developed (i.e. *I have learned more about the historical features of this area*). *Safety perception* was measured using one item on whether people feel (un)safe with regard to floods and could be answered using categories ranging from 1 (unsafe) to 5 (very safe).

In the second part of the survey, we measured respondents' *evaluation of the placement of longitudinal training dams* by allowing respondents to give ratings for the expected impact on the landscape in terms of beauty, naturalness, accessibility, and flood safety (e.g. *"In my opinion, the placement of longitudinal training dams will make the landscape more natural"*). In addition, we asked for an overall rating of the intervention. All items were measured on a five-point Likert scale. From these five items evaluating the longitudinal training dams, a composite variable was devised (Cronbach's α = 0.8), where a high score indicates a more positive evaluation of the planned intervention.

Socio-demographic and geographic variables included gender, age, education, place of residence, duration of residence, distance of home to the river (calculated using GIS analyses based on reported postal codes), rental or owned property, and family situation. In addition, we asked whether the respondent was evacuated during the floods in 1995 (yes/no), and asked for the attractiveness of the area for recreational activities (on a five-point Likert scale ranging from not at all to very attractive) and the frequency of recreational visits (including the answering categories: daily, weekly, monthly, about once a year and never). The questionnaire included two visual elements: (1) a map indicating the area boundaries and (2) an impression of the new landscape including longitudinal training dams with a short description (Supplementary Material).

2.4 Data Analyses

The sixteen items on place attachment were grouped using factor analysis with oblique rotation (promax) to account for correlations between factors. The following criteria were used to form the factors (based on Hammitt, Backlund, & Bixler, 2006): (1) eigen values ≥ 1.0, (2) factor loadings ≥ .450, (3) items loadings on more than one factor had to differ by ≥ .10 to be retained, and (4) reliability values had to be .70 or higher. Factor analysis distinguished between four dimensions of place attachment with good reliability: place identity (.87), place dependence (.82), social bonding (.81), and narrative bonding (.79). The factors describing place identity and narrative bonding each consist of four items that were initially grouped in these categories (Table 2). Social bonding has three items, excluding one item about family bonding (Table 2). This item (i.e. "*I live in this area because my family lives here*") can also be regarded as a form of dependency and was allocated to the place dependence scale instead. However, the factor loading was too low to be included in this factor (.354). The factor describing place dependence consists of three items, including one item about place identity

(i.e. "*Living in this area says a lot about who I am*") (Table 2). Previous studies found that this item loaded less strongly than others in the place identity dimension (e.g. Raymond et al., 2010). Finally, one item scored low on all factors (< .190) and therefore was excluded from further analyses (i.e. "*This area provides enough services (e.g. stores, schools, public transport) that are important to me"*). For the emerging factors, we calculated the average scores for each respondent.

We used analyses of variance (ANOVA) to examine the mean differences in scores for the variables in perceived landscape qualities among the four residential areas. Next, multiple linear regression analyses were performed to examine (1) the relations between socio-demographic and geographic characteristics of our sample and the four dimensions of place attachment, and (2) the relations between place attachment and perceptions of the planned management intervention. All statistical analyses were performed with IBM SPSS Statistics 21.

3. Results

3.1 Respondents' background

Respondents (N = 1,102) were on average 57 years old and included slightly more men than women (59%). There was a fairly even distribution of respondents between the education levels including lower secondary school, higher secondary school, and college / university (31%, 35%, and 34% respectively. Eight out of ten respondents (81%) own their property and a similar number (75%) has lived there for over 20 years. The average distance between the respondents' homes and the river was found to be 1099 m; half of the respondents (49%) live between 500 and 1000 m from the river, while for a small number (6%) this was 500 meter or less. The majority of the respondents (82%) had been evacuated

299 in 1995. Almost two-thirds of the respondents considered the area (very) attractive for
300 recreational activities (64%).
301
302 3.2 Descriptive results
303 'Tranquility and quietness' and 'well maintained' were regarded as most
304 characteristic elements of the river landscape, while 'many rare plants and animals' was
305 ranked lowest (Table 3). People living in the three villages gave higher scores to 'tranquility
306 and quietness' compared to residents of the city of Tiel. The average scores for each place
307 attachment dimension show that local residents have intermediate to strong bonds with the
308 area (Table 4). Respondents' feelings of place identity are strongest when compared to the
309 other three dimensions, especially regarding sense of familiarity, being at home, and being
310 proud of the area (Table 2). Village residents were more attached to place overall compared
311 to residents from the city of Tiel, with the exception of Wamel on place identity and
312 Ophemert on social bonding (Table 4). Average scores for safety perception showed that
313 most respondents feel protected against floods (Table 4). Finally, average scores for items
314 evaluating the expected impacts of the longitudinal training dams on the landscape ranged
315 between 2.94 (regarding beauty and naturalness) and 3.62 (regarding flood safety).
316
317 3.3 Relationship between demographics and place attachment dimensions
318 The relationships between socio-demographic and geographic characteristics of our
319 sample and the dimensions of place attachment were examined in the first round of regression
320 analyses (Table 5). Of the four dimensions, place identity had the highest explained variance
321 (41.2%), followed by place dependence (25.6%), narrative bonding (24.9%), and social
322 bonding (21.3%). Being born in the area and the appreciation of scenic beauty positively
323 influenced all four measured dimensions of place attachment. Regarding place of residence,

the results confirm the previously reported findings in Table 4. In addition, length of residence, frequency of river visits, and recreational value were found to positively influence three dimensions of place attachment, excluding only narrative bonding.

A positive correlation was found between narrative bonding and age of the respondent, and between narrative bonding and gender (with males being more attached through narratives than were females). Education was a negative predictor for social bonding and place dependence, indicating that higher educated respondents have fewer social ties to the area and are less place-dependent than are respondents with less education. The results also point to a higher place dependence of singles compared to couples without children, however no significant results were found for the other category (i.e. families), leading to inconclusive results on this point. Respondents who had experienced flooding reported stronger place identity and narrative bonding. Finally, residents who live closer to the river (< 500 m) reported higher levels of place identity.

3.4 Perceptions of the planned river intervention

The second regression analysis examined the relations between perceived landscape qualities and respondents' evaluation of the longitudinal training dams. Despite the low predictive value, the results show some interesting correlations (Table 6). Inhabitants of two villages showed a more negative attitude towards the construction of the longitudinal training dams compared to city residents. Scenic beauty and recreational value had a positive correlation with evaluations of the planned intervention, indicating that people who find the area attractive (for recreation) are also more in favor of the planned intervention. Older people had a more positive attitude toward the longitudinal training dams than people below the age of 45, while people who were born in the area were less positive than people who moved there later in life. Of the variables measuring place attachment, only social bonding

had a minor positive effect, indicating that stronger feelings of social cohesiveness lead to a more positive evaluation of the intended measure.

4. Discussion and conclusions

This study examined perceived landscape qualities among floodplain residents living along the river Waal (The Netherlands) and how these may inform their perceptions of a planned river intervention. Our case study contributes to the existing body of research in two ways. First, our findings emphasize the importance of place as a social environment in residents' responses to re-landscaping river intervention. Second, we developed and tested a narrative bonding dimension to account for the role of narratives and local history in residents' attachment to the river landscape.

4.1 Place as a social environment

Landscape evaluation studies often refer to people's general 'resistance to change' as proposed changes may be perceived as a threat to the status quo (van den Berg & Vlek, 1998). Previous studies in fluvial landscapes have reported negative relationships between attachment to place and public support for river management (e.g. de Groot & de Groot, 2009). Our results, however, indicate that a stronger attachment in the form of social bonding leads to a more positive evaluation of the planned landscape change by residents. Aside from different approaches to measuring place attachment, an alternative explanation may be given in terms of the type of measure that is proposed. Compared to dike relocations and cutting down trees, longitudinal training dams may be perceived as a less imposing intervention, as it only changes the river and its embankments and not the adjacent floodplains. Moreover, the respondents in our study mainly framed the intervention in a water safety context. Protection against floods is an important landscape value in river communities in the Netherlands. Our

374 results are thus more in line with studies that have shown how place change can be viewed
375 positively if it is considered place-enhancing (Devine-Wright, 2011) and when a certain level
376 of familiarity with the landscape is maintained (von Wirth, Grêt-Regamey, Moser, &
377 Stauffacher, 2016). In this respect, our concept of social bonding may also resemble beliefs
378 about the extent to which the managed landscape contributes to a 'community identity'
379 (Smith et al., 2011) or a 'community of neighbours' (Stedman, 2002).
380 Flood protection is an important goal in river interventions, and therefore we need to
381 take into account how people living in flood prone areas perceive flood risks and how this
382 affects public engagement in and support for river management. Using a one-measure
383 construct, we have to interpret the results for flood risk perception with care. We can say that
384 our findings are in line with other studies in the Netherlands, which found that local residents
385 feel protected against floods (Baan & Klijn, 2004; Terpstra & Gutteling, 2008). An
386 explanation for this can be found in the low number of flooding events and the perceived high
387 safety standards of the Dutch dike systems. Room for the River measures are often framed in
388 the context of flood protection and therefore receive high public support. However, high
389 levels of trust in institutions responsible for flood risk measures may also have undesirable
390 consequences for river management. New strategies for coping with uncertainties are
391 expected to promote the concept of shared responsibilities in flood mitigation among
392 governments and citizens (Warmink, Brugnach, Vinke-de Kruijf, Schielen, & Augustijn,
393 2017). A lack of flood awareness and preparedness among local residents may impede the
394 implementation of this management strategy.
395
396 4.2 A place for local history and narratives
397 We tested narrative bonding as a separate dimension of place attachment, which
398 resulted in a coherent set of statements with good reliability (Table 2). Correlation

coefficients show the dependencies between the four dimensions and can be used as an indicator for their uniqueness. As expected, all constructs correlate to some degree (between .450 and .655), with stronger correlations between narrative bonding with place identity (.587) compared to narrative bonding with place dependence (.469) or social bonding (.450). Conceptually narrative bonding may be closely linked to place identity, as narratives and stories reflect personal memories and feelings of identity (Burley et al., 2007). Our regression analysis shows that these two dimensions have similar predictors, but with age and gender as additional ones for narrative bonding, while excluding recreational value (Table 5). A recent study linking place attachment to experienced psychological benefits found that the most often cited benefit among respondents was that their favorite place enable them "to connect them to the past, or evoke memories" (Scannell & Gifford, 2017, p. 259). While some studies show that river restoration may disrupt landscape identity (e.g. Buijs, 2009), others note the opportunity that landscape transformation creates for renegotiating, transforming or newly developing identities (Butler, Sarlöv-Herlin, Knez, Ångman, Ode Sang, & Åkerskog, 2017). Further research is needed to address this temporal aspect.

Previous research shows that the degree in which settlements near large rivers take up a 'river identity' varies greatly from place to place (Rice & Urban, 2010). By including four residential areas (i.e. three villages and a city), this study allowed us to compare the nature and strength of attachments between communities on a spatial scale. Villages are relatively stable and self-contained communities, in contrast to the city of Tiel with more in and out flux of residents. We consistently found higher average scores on place attachment from the three villages compared to the urban area of Tiel (Tables 4 and 5) which confirms results from Lewicka (2005). The actual distance to the river is less important, as this was only linked to the dimension of place identity (Table 5).

4.3 Methodological reflections

We choose a survey approach to quantitatively examine the role of different dimensions of place attachment in people's perceptions of a planned river intervention, however, this method is not without limitations. This study was conducted with a purposive sample in a case study area characterized by a relatively wealthy and highly educated population. Further work with different populations in The Netherlands, especially in urban areas, and in other countries is required to explore the broader validity and cross-cultural relevance of our findings. Future studies need to take into account cultural heterogeneity as this may play a role in societal preferences for river and floodplain management (Chen, Liekens, & Broekx, 2017). Quantitative methods are also limited in revealing the complexities of the relation between people and places that are subject to change. To capture a broader variety of and gain a deeper insight in place meanings and other potential factors influencing perceptions of planned interventions, a qualitative follow-up study in which interviews are held with inhabitants would be suitable.

Previous studies on public perceptions of river management were conducted after an intervention took place and measured respondents' changes in perception (e.g. Buijs, 2009; Seidl & Stauffacher, 2013; Westling et al., 2014). For planned landscape interventions, such as the one presented in this paper, the changes in the landscape are not visible yet. Asking respondents about their views on the impact of a planned intervention is not straightforward and resulted in relatively high numbers of respondents opting for a 'neutral' answer. However, during the time between planning and actual development, people do become aware and try to make sense of possible changes and how it will affect them, often through or mediated by communicating with others or the media (Devine-Wright, 2009). The use of augmented or virtual reality technologies to visualize the intervention in the landscape (instead of photographs) may overcome some of these problems (Bishop, 2011). Longitudinal

studies will provide more insights in how people's evaluations of this specific intervention and their use of an area may change over time (e.g. Åberg & Tapsell, 2012).

In our case, the construction of longitudinal dams is a pilot project and the results from our survey fed directly into a governance partnership that is responsible for designing the monitoring program to evaluate the effects of this measure, including the national water authority, research institutes and representative organizations of the recreational angling and shipping sector (*Reference removed to ensure blind reviewing process*). Our findings have implications for scholars and practitioners beyond the direct context of our case study. River management is often focused on improving natural conditions and associated benefits for residents (e.g. recreation, health). While these aspects are important, our study points out that local communities and relations between *people* also need to be considered. An opportunity lies in engaging local communities in managing the area, for example cutting down vegetation to reduce hydraulic resistance, or maintaining walking trails. Finally, documenting landscape changes as well as the stories that people tell about the past, present and future of the area may be a fruitful approach to capture and preserve their narratives and incorporate them in landscape design.

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Fig. 1 The river Waal landscape with traditional groyne structures and the formation of beaches in the low-lying floodplains. (Source: https://beeldbank.rws.nl, Rijkswaterstaat).

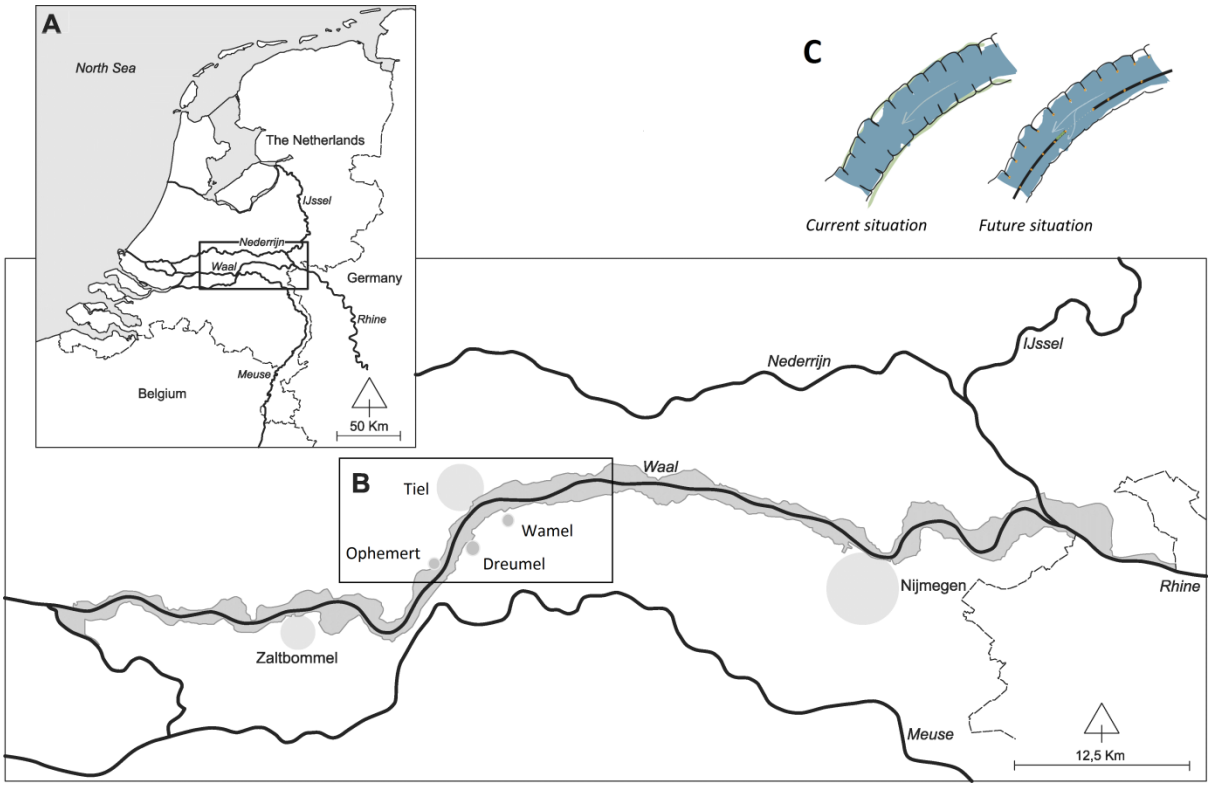

Fig. 2 Map of the Netherlands (A) and study area (B) comprising a ten kilometer stretch of the river Waal (river km 911.5 to 922), including a schematic illustration of the planned intervention (C) (*Note: reference has been removed to ensure blind reviewing process*).

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Table 1 Description of indicators to measure perceived river landscape qualities (including the number of items within parentheses)

Scenic beauty (9)	**Place attachment (4 x 4)**	**Safety perception (1)**
Vegetation	Dimension 1: place identity	Perceived risk of flooding
Unity	Dimension 2: place dependence	
Spaciousness	Dimension 3: social bonding	
Well maintained	Dimension 4: narrative bonding	
Dynamic area		
Undisturbed		
Tranquility and quietness		
Many rare plants and animals		
Many different plants and animals		

Table 2 Factor analysis of the place attachment statements, including factor loadings and level of adherences with standard deviation.

Place attachment items	Factor loading	Level of adherence[a]	Standard deviation
Place identity [b]			
I feel at home in this area [c]	**0.882**	4.39	.708
I feel a sense of familiarity when I am in this area	**0.881**	4.36	.695
I am proud of this area [c]	**0.719**	4.12	.823
I have personal memories that link me to this area	**0.574**	3.92	1.111
Narrative bonding [b]			
I know folk tales about this area	**0.871**	3.23	1.112
I have heard personal stories that took place in this area	**0.868**	3.46	1.091
I think the landscape genesis is visible in this area	**0.505**	3.16	.864
I have learned more about the historical features of this area [c]	**0.491**	2.86	1.114
Social bonding [d]			
Belonging to volunteer groups in this area is very important to me	**0.907**	3.36	1.043
I feel connected to the neighborhood / street where I live	**0.739**	3.47	1.038
The friendships developed in this area strongly connect me to it	**0.587**	3.24	1.123
Place dependence [e]			
This area is the best place for the activities I like to do	**0.954**	3.44	1.049
Living in this area says a lot about who I am[f]	**0.625**	3.31	1.086
For the activities I like to do most, no other place can compare to this area	**0.547**	2.89	1.016

[a] Item scale ranged from 1 = 'strongly disagree' to 5 = 'strongly agree'.
[b] scale items in this dimension are adapted from Buijs (2009) and Buijs et al. (2004), unless otherwise indicated.
[c] newly developed scale item.
[d] all scale items in this dimension were developed and tested in previous studies (e.g. Raymond et al. 2010).
[e] all scale items in this dimension were developed and tested in previous studies (e.g. Kyle et al. 2004, 2005; Raymond et al. 2010; Williams et al. 1992).
[f] this item, originally from the place identity dimension, loaded higher on place dependence.
Note: Requirements for factor analysis were assured with the KMO statistic (0.886) and Bartlett's test ($\chi^2 = 7567$, $p < 0.001$). Items with low factor loadings (≤ .450) were excluded from a factor.

Table 3 Comparison of average scores for items on scenic beauty (Cronbach's $\alpha = 0.8$) across the four residential areas. Items were measured on a scale from 1 (not applicable to the river landscape) to 5 (highly applicable to the river landscape)

	Overall	Tiel ($N = 343$)	Ophemert ($N = 155$)	Wamel ($N = 225$)	Dreumel ($N = 347$)	F	
Tranquility and quietness	3.91	3.66 [†]	4.02	4.06	4.00	16.86	***
Well maintained	3.76	3.79	3.75	3.79	3.73	0.46	n.s.
Appealing vegetation	3.64	3.61	3.75	3.52	3.70	2.71	*
Many different plants and animals	3.58	3.51	3.67	3.51	3.67	2.83	*
Unity	3.56	3.54	3.68	3.50	3.60	1.68	n.s.
Spaciousness	3.51	3.51	3.73 [a]	3.31 [a,b]	3.54 [b]	5.48	**
Undisturbed	3.37	3.25 [a]	3.38	3.30 [b]	3.51 [a,b]	4.85	**
Dynamic	3.34	3.42 [a]	3.42	3.19 [a]	3.34	3.42	*
Many rare plants and animals	3.23	3.19	3.39 [a]	3.08 [a,b]	3.30 [b]	5.00	**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Similar letters indicate significant differences between residential areas for a particular item based on Games-Howell post-hoc testing ($p < 0.05$). [†]Significantly different from all other residential areas ($p < 0.01$).

Table 4 Comparison of average scores for composite variables across the four residential areas (scores range between 1 and 5)

	Overall	Tiel (N = 343)	Ophemert (N = 155)	Wamel (N = 225)	Dreumel (N = 347)	F	
Place identity	4.21	3.97 †	4.24	4.31	4.36	20.12	***
Place dependence	3.23	2.92 †	3.34	3.34	3.40	19.90	***
Social bonding	3.39	3.18 [a]	3.27 [b]	3.48 [a]	3.58 [a,b]	13.09	***
Narrative bonding	3.19	2.96 †	3.28	3.33	3.28	14.01	***
Scenic beauty	3.57	3.53 [a]	3.69 [a,b]	3.49 [b]	3.61	4.62	**
Recreational value	3.73	3.57 [a,b]	3.83 [a]	3.71	3.86 [b]	6.63	***
Safety perception	4.01	3.95 [a]	4.22 [a]	3.99	4.00	3.44	*

*p < 0.05; **p < 0.01; ***p < 0.001. Similar letters indicate significant differences between residential areas for a particular item based on Games-Howell post-hoc testing (p < 0.05). †Significantly different from all other residential areas (p < 0.001).

Table 5 Regression analyses with place attachment dimensions as dependent variables and demographics as independent variables

		Place identity	**Place dependence**	**Social bonding**	**Narrative bonding**
Independent variables		*Beta*	*Beta*	*Beta*	*Beta*
Age (compared to < 45 years)	45 - 64 years				.104**
	65 and older				.119**
Education (compared to lower secondary education)	Higher secondary education				
	College or university		-.189***	-.137**	
Family situation (compared to singles)	Couple (no children)		-.088*		
	Family with children				
Gender (f / m)					.084**
Owned property (n / y)					
Distance to river (compared to < 500 m.)	500m - 1km	-.129*			
	1 - 1.5km	-.129*			
	>1.5km				
Residential area (compared to Tiel)	Ophemert	.060*	.117**		.083*
	Dreumel	.090**	.128**	-.087*	.095*
	Wamel		.146***	.091*	.129**
Born in the area		.329***	.158***	.168***	.253***
Duration of residence (> 20 years)		.125**	.107*	.104*	
Experienced flooding (n / y)		.094**			.093*
Frequency river visits (compared to daily)	Weekly		-.097*		
	Monthly	-.185***	-.097*		-.075*
	Once or twice a year	-.219***	-.121**		-.121**
	None	-.116***	-.095**		-.084*
Scenic beauty		.220***	.236***	.165***	.228***
Recreational value		.179***	.144***	.153***	
Explained variance (%)		**41.2**	**25.6**	**21.3**	**24.9**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 6 Regression analyses with evaluation of the planned construction of longitudinal training dams (LTDs) as dependent variable and demographics, place attachment and safety perception as independent variables

		Evaluation of LTDs
Independent variables		*Beta*
Age (compared to < 45 years)	Age (45 - 64 years)	.104*
	Age (65 and older)	.175***
Education (compared to lower secondary education)	Higher secondary education	-.005
	College or university	-.031
Family situation (compared to singles)	Family situation (living together, no children)	.007
	Family situation (family with children)	.036
Gender (f / m)		-.016
Owned property (n / y)		.044
Distance to river (compared to < 500 m.)	Distance to river (500m - 1km)	.046
	Distance to river (1 - 1.5km)	.051
	Distance to river (>1.5km)	-.030
Residential area (compared to Tiel)	Residential area (Ophemert)	-.098*
	Residential area (Dreumel)	-.149**
	Residential area (Wamel)	-.053
Born in the area		-.097*
Duration of residence (> 20 years)		-.003
Experienced flooding (n / y)		.024
Frequency river visits (compared to daily)	Frequency river visits (weekly)	.001
	Frequency river visits (monthly)	.029
	Frequency river visits (two times a year)	.062
	Frequency river visits (no visits)	.044
Scenic beauty		.198***
Recreational value		.103**
Place identity		-.036
Narrative bonding		.011
Social bonding		.118**
Place dependence		.037
Safety perception		-.056
Explained variance (%)		**14.0**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$