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Research Paper

Community attachment, beliefs and residents' civic engagement in stormwater management

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ABSTRACT

This study examines the drivers of civic engagement in water resource planning and management in diverse watersheds in the Minneapolis-St. Paul (Twin Cities) metropolitan area. Specifically, it investigates the direct and indirect influence of community attachment on perceived collective efficacy and environmental concern, and on civic engagement. Data were collected through a self-administered mail survey of 1000 residents from selected census tracts within three watersheds. Data were analyzed using structural equation modeling. Findings suggest that residents' attachment to their neighborhood through social ties and ties to the natural environment drives their engagement in water resource protection. Residents who are attached to their neighborhood through social ties are likely to be civically engaged in water resource protection. Further, residents' perceived collective efficacy and their concern about stormwater are significant predictors of civic engagement in water. This study offers strategies for resource professionals and other local actors to best design programs aimed at increasing resident engagement in water resource conservation.

1. Introduction

Despite advances in biophysical science and technology, stormwater management continues to be a major challenge for urban planners, water managers, residents and business owners. For example, an estimated 40–60% of the lakes and 60–100% of streams and rivers in the Minneapolis-St. Paul (Twin Cities) metropolitan area are considered unsuitable for (i.e., do not fully support) swimming or recreation (Minnesota Pollution Control Agency, 2015). Many of the pollutants plaguing the Twin Cities' surface water, including nutrients, fecal coliform, chloride, and polychlorinated biphenyl (Capitol Region Watershed District (CRWD), 2010; Mississippi Watershed Management Organization (MWMO), 2016; Ramsey-Washington Metro Watershed District (RWMWD), 2017), are delivered to water bodies via stormwater runoff. Stormwater management, a central concern to water managers in the Twin Cities, will require not only technical solutions such as improved stormwater infrastructure, but also the commitment and action of diverse stakeholders. Private-sphere (e.g., adoption of rain gardens) and public-sphere (e.g., civic engagement in water resource planning) pro-environmental behaviors (Stern, 2000) are needed.

Urban community members should be considered key stakeholders in stormwater management not only because they are primary plan implementers (Morton & Brown, 2011) and beneficiaries, but also because they tend to bear many of the plan's associated costs. Community members also offer local knowledge about social and ecological conditions (Sabatier et al., 2005). Resolution of collective problems such as water pollution requires the commitment and actions of citizens. Without adequate levels of public participation, water resource programs may fail to attract participants and meet people's needs (Prokopy and Floress, 2005).

Water resource programs that engage community members in planning and decision making have multiple benefits. They increase social capital (Prokopy & Floress, 2011), build trust and perceived legitimacy of planning processes (Trachtenberg & Focht, 2005), build support for funding and regulations (Larson & Lach, 2008) and improve plan implementation (Lubell et al., 2005). While direct evidence linking increased levels of civic engagement to water quality improvements is scarce, a recent study linked collaborative watershed management to progress on total maximum daily load implementation in Ohio and West Virginia (Hoornbeek, Hansen, Ringquist, & Carlson, 2013). A study of Portland's Community Watershed Stewardship Program demonstrates that collaborative approaches that engage citizens in the planning process have the potential to increase citizen trust and improve the biophysical environment (i.e., improving riparian areas) (Shandas and Messer, 2008).

While the benefits of citizen engagement in water resource

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programming are clear, getting and keeping such engagement is often challenging. Studies on citizen-based watershed groups demonstrate the difficulty in sustaining member involvement and interest (e.g., Floress, Mangun, Davenport, & Williard, 2009; Koehler & Koontz, 2008). To be effective, civic engagement policies and programs must be based on an understanding of the drivers of and constraints to civic engagement in water resource planning and management. This paper examines the drivers of civic engagement in water resource planning and management in diverse watersheds in the Twin Cities. Specifically, it investigates the direct and indirect influence of community attachment on resident beliefs and on civic engagement.

1.1. Determinants of civic engagement

An extensive literature exists documenting the relationships between sociodemographic variables and civic engagement (e.g., Koehler & Koontz, 2008; Smith, 1994). Studies have linked income, formal education, age and gender with increased levels of civic engagement. Homeownership and length and location of residence have also been related to civic engagement (Koehler & Koontz, 2008; Larson & Lach, 2010; Manzo & Weinstein, 1987; Smith, 1994). For example, Koehler and Koontz (2008) reported that males with environmentally related occupations and higher levels of political activity were more likely to actively participate in collaborative watershed groups. Further, urban residents and those living closer to streams were more likely to be active participants than those from rural locations and living farther from streams (Larson & Lach, 2010).

These studies provide important information about *who* engages or does not engage in environmental decision making. However, they do little to explain stakeholder motivations for engagement. A smaller subset of studies (e.g., Story and Forsyth, 2008; Pradhananga et al., 2015b) focuses on the social-psychological motivations for civic engagement. Feelings of personal responsibility (Story & Forsyth, 2008), stronger pro-ecological worldviews, higher levels of social capital and trust (Larson & Lach, 2010), self-efficacy (Martinez & McMullin, 2004) and personal norms (Pradhananga, Davenport, & Olson, 2015) have been associated with higher levels of civic engagement. A study of landowners in Minnesota demonstrated that landowner engagement in water protection is driven by feelings of personal obligation or personal norms, and perceived ability to protect water resources (Pradhananga, Davenport, & Olson, 2015). Although not in the context of water resource management, higher levels of community attachment has also been associated with increased levels of community action (e.g., attending a public meeting on town or school affairs in the community) (Theodori, 2004). Researchers have also found links between community attachment and increased levels of civic engagement in the context of parks and protected area management (Buta, Holland, & Kaplanidou, 2014). This study expands on this line of research by examining the role of community attachment, perceived collective efficacy, and environmental concern in civic engagement.

1.2. Community attachment, environmental concern and pro-environmental behaviors

Community attachment is defined as emotional connection that people have to a particular community, diversely defined. This emotional connection has been described as a feeling of "rootedness" (Hummon, 1992) or belonging. Community attachment is strongly associated with interpersonal connections and social networks that develop at a local scale. However, some research has shown that perceptions of attachment may be influenced by the geographic scale of the place that people are asked to consider (see Brehm, Eisenhauer, & Krannich, 2006). This concept is similar to place attachment, or affective connections people have with a place. However, community attachment places a stronger emphasis on social interactions (Theodori, 2000). A growing body of literature has investigated the links between various attachment constructs and environmental attitudes and behaviors. For example, in a general population study conducted in Texas, Theodori (2004) reported a statistically significant positive influence of community attachment on community action (e.g., attending a public meeting on school or town affairs). In another study of residents in Southern California, community attachment was a significant positive predictor of community-based activities related to fire protection (e.g., attending meeting, volunteering) (Kyle, Theodori, Absher, & Jun, 2010).

Studies on community attachment have typically focused on emotional attachment based on social ties (i.e., social attachment) (e.g., Kyle et al., 2010; Theodori, 2004). A smaller subset of studies (e.g., Brehm, Eisenhauer, & Krannich, 2004, 2006) has expanded on this body of work by examining people's social ties as well as ties to the natural environment. Two distinct dimensions of community attachment have emerged: social attachment and natural environment attachment (hereafter "environmental attachment") (Brehm et al., 2004, 2006). Brehm et al. (2006) examined the influence of the two dimensions of community attachment on environmental concern. The researchers found that both social attachment and environmental attachment were significant predictors of local environmental concern. Specifically, social attachment was significantly related to attitudes about environmental issues that are "social" in nature (e.g., importance of preserving opportunities for traditional multiple uses of public lands). Environmental attachment on the other hand was predictive of environmental concern related to resource protection. This study's findings suggest that people are invested in and connected to their community for multiple reasons. Further, the distinct bases of community attachment have implications for how attitudes are generated. However, Brehm et al. (2006) did not examine the relationships among community attachment, environmental concern, and pro-environmental behavior. Studies have generally linked higher levels of environmental concern with pro-environmental behavior (e.g., Pradhananga, Davenport, Seekamp, & Bundy, 2015; Schultz, 2001). Yet it should be noted that the relationship between environmental concern and pro-environmental behavior is generally weak (Bamberg, 2003). In the present study, we expand on this line of research by examining the influence of various dimensions of community attachment on concern about stormwater, perceived collective efficacy, and civic engagement in water resource protection.

1.3. Collective efficacy and collective action

In the social cognitive theory, Bandura (2000) argues that humans exercise agency through multiple mechanisms. Perceived self-efficacy, or beliefs about one's ability to produce desired results (Bandura, 1977) is a mechanism through which people exercise personal agency. However, in many situations people rely upon one another to find solutions to problems that affect their lives. Bandura (2000) argues that collective efficacy, or beliefs about the ability of one's group to perform a behavior is a form of socially mediated human agency. Collective efficacy influences people's motivations and actions (Bandura, 2000). People are more likely to take action if they believe that their group (e.g., community, neighborhood) is capable of addressing a problem. While self-efficacy has received much attention in the pro-environmental behavior literature (e.g., Meinhold & Malkus, 2005; Tabernero & Hernández,2011), only a few studies have examined collective efficacy in the context of pro-environmental behavior. Papa et al. (2000) demonstrated how an entertainment-education program inspired collective efficacy and collective action. The authors examined the effect of a radio program on collective efficacy and behavior change among villagers in rural India. They found that social interactions among villagers about the media program led to a higher sense of collective efficacy and community action. However, the authors did not explore the relationship between collective efficacy and collective action. Using a focus group method, Bonniface & Henley (2008) reported an association between collective *outcome* efficacy (i.e., perceptions about the effectiveness of one's group) and waste-minimizing behavior. They compared activists with non-activists and attributed the difference in their pro-environmental behavior to higher levels of collective *outcome* efficacy among activists. Another notable study by Homburg & Stolberg (2006) reported a significant positive influence of collective efficacy on students' private-sphere (e.g., buying recyclable products) and public-sphere (e.g., campaigning for environmental protection) behaviors.

We examine water resource pollution as a collective problem. Nonpoint source (NPS) pollution originates in broad, community-level land use planning policies and actions (e.g., urban growth, stormwater management infrastructure). Solving collective problems such as NPS pollution requires civic engagement and collaboration in water resource discourse, deliberation and decision making. We argue that in the context of a collective problem such as water pollution (Pradhananga, Davenport, & Olson, 2015), residents' perceptions about their group's ability to address local issues (i.e., collective efficacy) rather than beliefs about one's own ability (i.e., self-efficacy) is a more important determinant of collective action.

1.4. Study conceptual model

The study's conceptual model builds on previous studies of community attachment (e.g., Brehm et al., 2006) and predicts a relationship between social neighborhood attachment and environmental attachment (the two dimensions of community attachment) and environmental concern, neighborhood efficacy, and intentions for future civic engagement. Neighborhood efficacy is conceptualized similar to perceived collective efficacy. We hypothesize that social and environmental attachment have a positive influence on neighborhood efficacy and environmental concern, which in turn positively predict civic engagement.

2. Methods

2.1. Study site

The study was conducted in three watersheds within the Twin Cities (Minneapolis-St. Paul) metropolitan area in Minnesota: Mississippi Watershed Management Organization (MWMO), Ramsey-Washington Metro Watershed District (RWMWD), and Capitol Region Watershed District (CRWD). All three watersheds drain into the Mississippi River. The three watersheds spread across Ramsey (all three), Hennepin (MWMO), Anoka (MWMO) and Washington (RWMWD) Counties, and include all or part of the cities of Minneapolis, St. Paul, and other adjacent cities (e.g., Roseville, Shoreview, Maplewood). All three watersheds are highly urbanized and include primarily residential, commercial, and industrial land uses (CRWD, 2010; MWMO, 2016; RWMWD, 2017). Nonpoint source pollution and stormwater runoff are issues of concern in all three watersheds (Davenport, Perry, Pradhananga, & Shepard, 2016). Stretches of the Mississippi River and other water bodies within the three watersheds are listed as impaired due to pollutants such as nutrients, mercury, fecal coliform, chloride, and polychlorinated biphenyl (PCB) (CRWD, 2010; MWMO, 2016; RWMWD, 2017).

The existing management structure in the Twin Cities metropolitan area includes multiple government entities at the state, local, and regional levels. While the Minnesota Board of Soil and Water Resources (BWSR) is responsible for ensuring that local water management plans are coordinated with state water protection efforts, special purpose local government units such as CRWD, MWMO, and RWMWD manage and protect water resources including parts of the Mississippi River within their jurisdictional boundaries. Watershed management plans for all three study watersheds highlight community engagement and outreach as a key strategic goal (CRWD, 2010; MWMO, 2016; RWMWD, 2017).

2.2. Procedures and sample

Data were collected using a self-administered mail survey of a stratified, proportional sample of 1000 residents from selected census tracts within the three study watersheds. The surveys were administered from August 2015 through January 2016. The sample was purchased from Survey Sampling International (SSI). SSI drew a stratified sample from a sampling frame that included all residents within the study's census tracts and did not use any recruitment criteria (e.g., age, race, length of stay) other than census tract for stratification. Census tracts were selected in areas of highest interest for project partners. Resource managers in the three watersheds identified the selected census tracts as areas targeted for future water programming. Further, all three watersheds have implemented several stormwater-related projects in the study areas.

An adapted version of Dillman, Smyth, and Christian et al.'s (2014) tailored design method was employed and included three waves of mailing. Each mailing included a cover letter, survey questionnaire, and a postage-paid envelope. In addition, the first wave of mailing included a $2 cash incentive. The survey questionnaire was designed based on literature review and feedback from project partners. The survey instrument included a variety of fixed-choice and scale questions that asked about residents' attachment with their neighborhood, perspectives on water resources and their neighborhood, current and future conservation and civic actions, and sociodemographic information. This study was approved by the University's Institutional Review Board.

2.3. Measures

2.3.1. Community attachment

The two dimensions of community attachment: social neighborhood attachment and environmental attachment, were measured using a scale adapted from Brehm et al. (2006). The question stem was framed as "How important are the following qualities of a neighborhood to you?" The response format was in a five-point scale from "very unimportant" (−2) to "very important" (+2). Social neighborhood attachment was measured using three items including "opportunities to be involved in community projects." Natural environment neighborhood attachment was measured using three items including "clean streams, rivers and lakes."

2.3.2. Environmental concern

Environmental concern about stormwater issues was measured using three items including "stormwater runoff." The response was in a five-point scale from "very unconcerned" (−2) to "very concerned" (+2).

2.3.3. Perceived neighborhood efficacy

Perceived neighborhood efficacy was measured using three items including "Residents in my neighborhood work together to solve local issues" adapted from Brinkman, Seekamp, Davenport, and Brehm (2012). Respondents rated each statement on a five-point scale from "strongly disagree" (−2) to "strongly agree" (+2).

2.3.4. Civic engagement in water

Items measuring civic engagement are adapted from Pradhananga, Davenport, and Olson (2015). Respondents' intentions to engage in three civic engagement behaviors in the next 12 months were measured on a five-point scale from "very unlikely" (−2) to very likely (+2). Behaviors included "volunteer for clean water projects" and "attend a community discussion, meeting or public hearing about water" (Table 2).

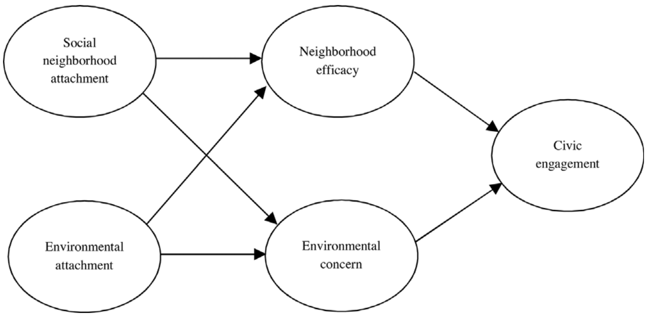

Fig. 1. Study conceptual model.

2.4. Analysis

Cronbach's alpha was used to assess internal consistency of each latent variable. Convergent and discriminant validity of each latent variable was evaluated based on factor loadings of each item on the latent variable and an assessment of average variance extracted (AVE). Based on the formula provided by (Fornell & Larcker, 1981), AVE was calculated manually in Excel 2010. To establish discriminant validity of latent constructs, two criteria have to be met: (1) correlations between pairs of latent variables should be less than 0.85 (Kenny, 2012), and (2) AVE square root scores should be larger than factor correlation values (Fornell & Larcker, 1981). The three study areas were also compared for differences in community attachment, perceived neighborhood efficacy, and environmental concern. Analysis of variance was conducted on each survey item to test for differences among the three study areas. There were no significant differences among the watersheds in any measures of community attachment, perceived neighborhood efficacy, and environmental concern (analysis not shown).

The hypothesized relationships in the conceptual model (Fig. 1) were analyzed using Structural Equation Modeling (SEM). SEM allows for the use of multiple items to measure each latent variable. In addition, unlike regression methods, relationships between a chain of variables can be analyzed simultaneously with SEM (Maruyama, 1998). The latent variables (i.e., social neighborhood attachment, neighborhood efficacy, etc.) were constructed and tested using confirmatory factor analysis simultaneously with the SEM analysis of the full structural model. The correlation matrix of observed variables (i.e., survey items) was used as the input matrix for this analysis. SEM analysis was conducted using the maximum likelihood method in LISREL.

We assessed model fit using maximum likelihood χ^2, relative χ^2 (χ^2/df), root mean-square error of approximation (RMSEA), comparative fit index (CFI), incremental fit index (IFI) and standardized root mean square residual (SRMR). A relative χ^2 of five or less indicates adequate model fit (Schumacker & Lomax, 2004). RMSEA values below 0.07 (Steiger, 2007), CFI and IFI values above 0.95 and SRMR values below 0.08 also indicate adequate model fit (Hu & Bentler, 1999). In addition, mediation analysis was conducted following Hayes' (2013) recommendations. The direct and indirect effects of community attachment (i.e., social and environmental attachment) on residents' intentions for future civic engagement behaviors were examined. The indirect effect of community attachment on residents' intention was calculated as the product of the predictor's (i.e., community attachment) effect on the mediator (i.e., neighborhood efficacy, environmental concern) and the mediator's effect on the criterion variable (i.e., civic engagement). A significant indirect effect indicates that the effect of the predictor on the criterion variable is mediated through the mediator variable (Hayes, 2013). Sobel test (Sobel, 1986) was used to determine if the indirect effects were statistically significant. To compute the Z-statistic for test of significance, the product of coefficients was divided by the pooled standard error. Unstandardized coefficients and standard errors obtained from SEM were used for these calculations.

3. Results

Of the 1000 surveys mailed, 292 completed surveys and 186 undeliverables were returned for a response rate of 36%. More than half the respondents were female (52%). This is comparable to the study area census statistics, which indicates that between 51% (CRWD) and 54% (RWMWD) of the population within the study's census tracts are female. Most respondents were white (97%) and not of Hispanic or Latino origin (99%). According to U.S. Census Bureau (2010) data, between 70% (Ramsey County) and 88% (Washington County) of residents in the study watersheds are white and more than 93% are not of Hispanic or Latino origin. However, there is greater racial and ethnic diversity within the study census tracts. Between 17% (RWMWD) to 52% (CRWD) of the population in the study census tracts are not white (Table 1). These differences indicate that our findings may under-represent the perspectives of racially and ethnically diverse community

Table 1
Study area resident demographic characteristics.

	Mississippi Watershed Management Organization[a]	Ramsey Washington Metro Watershed District[a]	Capitol Region Watershed District[a]	County[b]			
				Ramsey	Hennepin	Anoka	Washington
Total population	53996	10242	41001	508640	1152425	330844	238136
Gender							
Male	48.4%	46.4%	49.3%	48.5%	49.1%	50.0%	49.5%
Female	51.6%	53.6%	50.7%	51.5%	50.9%	50.0%	50.5%
Hispanic or Latino origin							
Hispanic or Latino	9.1%	3.7%	6.7%	7.2%	6.7%	3.6%	3.4%
Not Hispanic or Latino	90.9%	96.3%	93.3%	92.8%	93.3%	96.4%	96.6%
Race							
White	48.7%	83.4%	48.5%	70.1%	74.4%	87.0%	87.8%
Others	51.3%	16.6%	51.5%	29.9%	25.6%	13.0%	12.2%
Age							
15–24	19.2%	14.8%	28.4%	19.9%	16.8%	16.2%	15.4%
25–34	20.5%	15.4%	21.2%	18.8%	20.1%	16.8%	15.5%
35–44	16.8%	11.5%	15.3%	14.8%	16.5%	18.5%	18.4%
45–54	16.7%	16.0%	14.8%	17.2%	18.3%	21.5%	21.7%
55–64	12.6%	15.5%	11.1%	14.4%	14.3%	14.6%	15.6%
65 and over	14.2%	26.8%	9.2%	14.9%	14.0%	12.4%	13.4%

[a] Data from 2010 Census Statistics (US Census Bureau) for study census tracts within each watershed.
[b] Data from 2010 Census Statistics (US Census Bureau) for counties within the study watersheds.

Table 2
Descriptive statistics, reliability analysis and factor loadings of items measuring constructs in the structural model.

Latent Variable	Survey item	Mean*	SD	Factor loadings (λ)	Coefficient alpha (α)
Social neighborhood attachment[a]	Opportunities to express my culture and traditions	0.60	1.11	0.54	0.74
	Opportunities to be involved in community projects	0.57	0.93	0.92	
	Opportunities to serve in leadership roles	0.05	1.11	0.69	
Environmental attachment[a]	Clean streams, rivers and lakes	1.79	0.56	0.73	0.86
	Access to natural areas/views	1.59	0.75	0.92	
	Opportunities for outdoor recreation	1.51	0.81	0.86	
Environmental Concern[b]	Sanitary sewer issues	0.82	1.13	0.81	0.86
	Storm drain issues	0.79	1.09	0.99	
	Stormwater runoff	0.72	1.05	0.69	
Neighborhood efficacy[c]	Residents in my neighborhood work together to solve local issues	0.26	1.13	0.88	0.82
	My neighborhood has strong leadership	0.06	1.14	0.81	
	My neighborhood has residents who are committed to local issues	0.64	0.97	0.64	
Civic engagement[d]	Work with other neighborhood residents to protect water	0.12	1.14	0.80	0.87
	Attend a community discussion, meeting or public hearing about water	0.02	1.21	0.84	
	Volunteer for clean water projects	−0.06	1.14	0.84	

SD = Standard Deviation.
[a] Variables measured on a 5-point scale from *very unimportant* (-2) to *very important* (2).
[b] Variables measured on a 5-point scale from *very unconcerned* (-2) to *very concerned* (2).
[c] Variables measured on a 5-point scale from *strongly disagree* (-2) to *strongly agree* (2).
[d] Variables measured on a 5-point scale from *very unlikely* (-2) to *very likely* (2).
* $n = 261$.

members in the area.

A majority of respondents reported that neighborhood qualities such as opportunities to be involved in community projects (58%) and clean streams, rivers and lakes (97%) were somewhat to very important to them. Almost two-thirds of respondents (63%) reported that they were somewhat to very concerned about stormwater runoff. More than half the respondents somewhat to strongly agreed with items measuring perceived neighborhood efficacy such as “my neighborhood has residents who are committed to local issues.” However, levels of intended civic engagement in water were low. Less than one-third of respondents (30%) reported that they intend to engage in activities such as “attend a community discussion, meeting or hearing about water.”

3.1. Reliability and validity

After employing listwise deletion, an effective sample size of 261 was obtained. The reduced dataset (N = 261) was used for all analyses including SEM analysis. Listwise deletion is appropriate because SEM requires a correlation/covariance matrix based on the same number of cases (Kline, 2011). All latent constructs exhibited acceptable internal consistency (α ≥ 0.74). Factor loadings of each item on their respective latent constructs ranged from 0.54 to 0.99 (Table 2), thus meeting adequate factor loading threshold of ≥0.50 (Fornell & Larcker, 1981). Factor correlations between pairs of latent constructs ranged between 0.05–0.38 (Table 3), below the threshold of 0.85 for discriminant validity (Kenny, 2012). AVE square root values of all latent constructs were larger than factor correlations (Table 3). These findings show that the latent variables included in the model are distinct theoretical constructs.

Table 3
Discriminant validity matrix.

Constructs[a]	SA	NA	EC	NE	CE
SA	**0.75**				
EA	0.38	**0.83**			
EC	0.17	0.21	**0.90**		
NE	0.22	0.14	0.05	**0.64**	
CE	0.37	0.19	0.20	0.22	**0.84**

Off-diagonal elements are correlations between constructs. Diagonal elements (bold) are the square root of average variance extracted (AVE) between the constructs and their indicators. To meet the criteria for discriminant validity, off-diagonal elements should be less than 0.85 and AVE square root scores should be larger than correlations in the same row and column.
[a] SA = social neighborhood attachment, EA = environmental attachment, EC = environmental concern, NE = neighborhood efficacy, CE = civic engagement.

3.2. Structural model

We tested the direct and indirect effects of community attachment on civic engagement in water. Since the model analyzed consisted of two predictors (i.e., social neighborhood attachment and environmental attachment) and two mediators (i.e., perceived neighborhood efficacy and environmental concern), we assessed four indirect effects for statistical significance using the Sobel test.

While the direct effect of social neighborhood attachment on civic engagement was statistically significant (β = 0.30, p ≤ 0.05), the direct effect of environmental attachment on civic engagement was not (β = 0.03, p ≥ 0.05). An assessment of indirect effects revealed that none of the indirect effects were significant (Table 4), indicating that the relationship between community attachment and civic engagement was not mediated by neighborhood efficacy or environmental concern. However, the paths from social neighborhood attachment to neighborhood efficacy (β = 0.19, p ≤ 0.05) and environmental attachment to environmental concern (β = 0.17, p ≤ 0.05) were statistically significant. Neighborhood efficacy (β = 0.15, p ≤ 0.05) and environmental concern (β = 0.14, p ≤ 0.05), in turn, were significant positive predictors of civic engagement. The paths from social neighborhood attachment to environmental concern (β = 0.10, p ≥ 0.05) and environmental attachment to neighborhood efficacy (β = 0.06, p ≥ 0.05) were not statistically significant (Fig. 2).

The structural model consisting of social neighborhood attachment, environmental neighborhood attachment, neighborhood efficacy,

Table 4
Indirect effects of social and natural environment neighborhood attachment on residents' civic engagement.

Indirect effect[a]	Product of unstandardized coefficients	Z- statistic	*p*-value
SA → NE → CE	0.04	1.626	0.104
SA → EC → CE	0.02	1.234	0.217
EA → EC → CE	0.03	1.664	0.090
EA → NE → CE	0.01	0.822	0.411

[a] SA = social neighborhood attachment, EA = environmental attachment, EC = environmental concern, NE = neighborhood efficacy, CE = civic engagement.

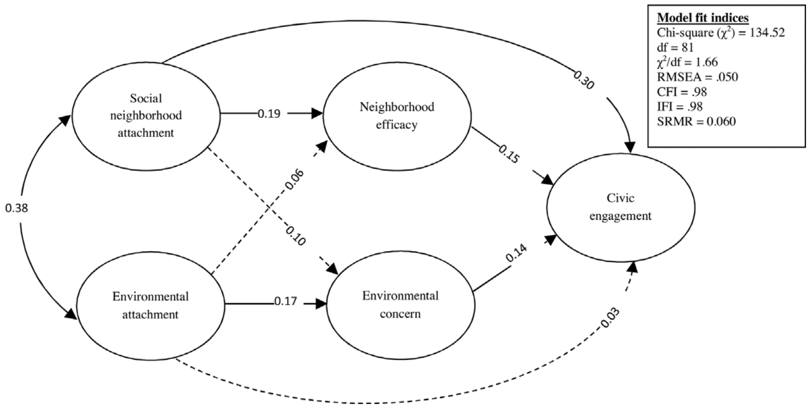

Fig. 2. Standardized solution for structural model of community attachment, beliefs and civic engagement in stormwater management.
Note: RMSEA, root mean square error of approximation; CFI, comparative fit index; IFI, incremental fit index; SRMR, standardized root mean square residual.
Significant paths ($p \leq 0.05$).
Non-significant paths ($p \geq 0.05$).

environmental concern and civic engagement exhibited an acceptable model fit (Fig. 2). Although the chi-square ($\chi^2 = 134.52$) was statistically significant, the relative chi-square of the model was less than 5 ($\chi^2/\text{df} = 1.66$). CFI (0.98) and IFI (0.98) were also over the cutoff value of 0.95. RMSEA of the model was below the threshold of 0.07 (RMSEA = 0.050). SRMR was below the threshold of 0.08 (SRMR = 0.060). In summary, these results suggest that social neighborhood attachment has a direct influence on civic engagement, and the community attachment-civic engagement relationship is not mediated by neighborhood efficacy or environmental concern.

4. Discussion

Study findings enhance current understanding of the relationships among community attachment, perceived collective efficacy and civic engagement in the context of water resource conservation. Findings suggest that residents' attachment to their neighborhood through social ties and ties to the natural environment drives their engagement in water resource protection. This study shows that more attention should be focused on the connections between community level variables, and an individual's beliefs and behaviors.

Analysis of discriminant validity and SEM analysis indicate that social neighborhood attachment and environmental attachment are distinct dimensions of the community attachment concept. Further, the two dimensions of community attachment had distinct and differential effects on perceived neighborhood efficacy and civic engagement. These findings are consistent with previous studies on varying dimensions of community attachment (Brehm et al., 2004, 2006). For example, past studies have found that beyond social attachment, attachment to the natural environment is predictive of attitudes about environmental issues (Brehm et al., 2004, 2006). The inclusion of these dimensions of community attachment provides a more complete picture of how residents are attached to their settings and what motivates them to take civic action. These findings have significance for community outreach and participation efforts that attempt to enhance attachment to local settings. Programs that aim to increase civic participation in water resource issues will benefit from understanding the role of the natural environment in enhancing people's attachment to their community.

The statistically significant direct effect of social neighborhood attachment on civic engagement indicates that residents who are attached to their neighborhood through social ties are likely to be civically engaged in water resource protection. This is consistent with past research that shows a significant influence of community attachment on community action (e.g., Theodori, 2004; Kyle et al., 2010). Residents with social attachment may perceive involvement in water resource issues as a way to build social ties with others in their neighborhood. Environmental attachment, in contrast, did not have a significant direct effect on civic engagement. Individuals that are emotionally connected to their neighborhood primarily through their ties to local natural resources may not necessarily engage in civic actions around water.

From a management standpoint, the two-factor structure of community attachment suggests that civic engagement strategies need to appeal to residents with differing attachments to their neighborhood. Studies have found that people with social attachment to their community are more likely to be concerned about issues that are inherently social in nature (Brehm et al., 2006). Thus, if residents perceive water resource issues as a social matter, they may be more likely to consider being involved in water resource protection. For residents with social attachment, communication campaigns should frame water issues as "social" by drawing connections between water quality and issues of public health, community well-being, and quality of life. For example, community-building events that feature water may help tie water resource issues to local social issues. Further, opportunities to be involved in their community is important for residents with social attachment. Communication campaigns should emphasize engagement in water resource protection as a way to be involved in their community and build social ties. For residents with environmental attachment, campaigns should highlight the impacts of stormwater runoff on local natural resources including lakes and rivers.

Residents who are attached to their neighborhood through social ties are more likely to believe that others in their neighborhood are committed to local issues and that they can work together to solve local issues (i.e., high collective efficacy). Further, residents with an increased sense of collective efficacy at the neighborhood scale were more likely to consider engaging in civic actions. These findings provide further support for past studies that show a positive association between collective efficacy and civic action (e.g., Bonniface and Henley, 2008; Homburg and Stolberg, 2006). Water pollution is a collective problem. Residents with greater confidence in each other's ability to address local issues (i.e., high collective efficacy) are more likely to take collective action. As Bandura (2000) argues, collective efficacy is a form of human agency, and it influences people's motivations and actions. In the context of water pollution, residents may be more committed to taking civic actions to protect water resources if they believe that other residents in their neighborhood are capable of addressing water problems. These findings suggest that civic engagement programs that build collective efficacy are more likely to be successful. Bandura's (2012) work shows that various forms of feedback can maintain or enhance perceptions of self-efficacy. Similarly, strategies that provide feedback about collective efforts to address local water problems may build and enhance a sense of collective efficacy. Mass media campaigns to reinforce a sense of collective efficacy have shown promise. For example, in a study of villagers in India, Papa et al. (2000) found that an environmental education program inspired collective action and collective efficacy. Campaigns to highlight success stories around water resource protection can demonstrate to local residents that local community members are committed to and capable of addressing local issues, thus building a sense of collective efficacy.

However, the relationship between social attachment and civic engagement was not mediated by neighborhood efficacy. This indicates that residents who are attached to their neighborhood through social ties are likely to take civic action regardless of their perceived neighborhood efficacy.

Residents who are attached to their neighborhood through ties to the natural environment were more concerned about stormwater. The positive relationship between environmental attachment and environmental concern found in the present study supports past research on the relationships between environmental attachment and environmental concern. Brehm et al. (2006) found that environmental attachment predicts concern about issues related to resource protection. We also found that residents with a heightened sense of concern were more likely to consider being engaged in water resource protection. While the relationship between environmental concern and environmental behavior is generally weak (Bamberg, 2003), as this study shows environmental concern is still a reliable predictor of public-sphere environmental behavior (i.e., civic engagement in water resource conservation). Communication campaigns that emphasize *local* stormwater problems and impacts are likely to be successful in engaging residents in water protection. However, the lack of a statistically significant direct or indirect effect of natural environment neighborhood attachment on civic engagement indicates that residents' emotional ties to the natural environment do not become salient when making decisions about civic engagement behaviors unless they are also concerned about stormwater.

The spatial scale of strategies that aim to strengthen community attachment and engage community members in stormwater management is an important consideration for resource managers. Further descriptive analysis of study data revealed that a majority of respondents identified with their neighborhood or city as their community. Thus planning and management on a large scale (e.g., watershed) may prove difficult (O'Neill, 2005). Water resource-focused civic engagement strategies should consider a smaller geographic scale such as neighborhood or city. Programs targeted to smaller geographic areas may be more effective at building social networks and encouraging civic engagement than watershed-wide programs (O'Neill, 2005).

Future research should expand on this study's behavioral model by including other determinants of civic engagement. We examined the influence of collective efficacy on a specific public sphere behavior: civic engagement in water resource protection. Past studies have demonstrated the predictive ability of perceived self-efficacy on pro-environmental behavior (Tabernero & Hernández, 2011). Future studies should explicate the differential impacts of collective and self-efficacy on civic engagement. Further, we focused on behavioral intentions, not behaviors. While intentions and behaviors are related, this relationship depends on the decision-making situation. The availability of resources (i.e., behavioral control) and perceptions of behavioral control (i.e., perceived behavioral control) influences the intention-behavior relationship (Ajzen, 1991). Future research should measure self-reported or actual performance of civic engagement behaviors. Research is also needed in understanding ways to build and strengthen collective efficacy. A general caveat in the interpretation of study findings is that the relationships among variables in the model should not be interpreted as causal due to the correlational nature of the study. Although the sample size in this study was adequate for SEM analyses, the survey response rate of 36% could have resulted in a selective sample. Comparisons of survey respondents with census data indicate that racial and ethnic minority community members were underrepresented in this study. These methodological factors potentially limit the generalizability of study findings, particularly to racial and ethnic minority community members. Future research should consider using alternative survey modes such as face-to-face interviews or drop-off/pick-up method (Jackson-Smith et al., 2016) to improve response rates from diverse community members.

5. Conclusion

Study findings show that residents' engagement in water protection is rooted in two distinct dimensions of community attachment: social attachment and environmental attachment. Residents who are attached to their neighborhood through social ties are more likely to believe that others in their neighborhood are capable of addressing local water problems and are more likely to be civically engaged in water resource conservation. Residents who are attached to their neighborhood through ties to local natural resources are more likely to be concerned about local stormwater issues. Further, residents with a heightened sense of concern about stormwater are more likely to be civically engaged in water protection. Importantly, this study highlights the importance of understanding different ways people become attached to their community when developing civic engagement programs.

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