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Property owner beliefs and goals related to shoreline maintenance behaviors

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Abstract

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Individual differences in shoreline maintenance behaviors are likely partially attributable to individual differences in relevant beliefs and goals. Lake property owners can help reduce the impact of development by maintaining a vegetated buffer on their shoreline, as opposed to grooming an expansive manicured lawn. A survey mailed to residential lake property owners in Wisconsin (n returned = 155, response rate = 64%) measured lake-specific beliefs and goals and self-reported frequency of engaging in 4 behaviors counterproductive to shoreline health. Analysis revealed those counterproductive behaviors were negatively associated with endorsement of biospheric beliefs and positively associated with stated relevance of human usage goals ($p < 0.01$ for all). Recommendations for lake managers and environmental educators, particularly the importance of aesthetic preferences, are discussed.

Key words: behavior, lake, property owners, shoreline, survey

Shoreline development on residential properties is a major threat to lake health and biodiversity (USEPA 2010). Development of lake shorelines across the continent often degrades habitat necessary for native species, while at the same time improving habitat for invasive species that are well-adapted to thrive in human-altered environments (Rahel 2002). The resulting process of continental homogenization is particularly insidious because it is only observable over large scales of time and area (Burns 1991). Shoreline development is frequently associated with habitat alteration such as decreased amounts of coarse woody debris (Christensen et al. 1996), reduced abundance of macrophytes (Radomski and Goeman 2001), and reduced canopy cover (Elias and Meyer 2003). Shoreline habitat alteration can have a deleterious effect on many species (Engel and Pederson 1998), from green frogs (Woodford and Meyer 2003) to bald eagles (Chandler et al. 1995). Shoreline development has also been shown to negatively affect the size of game fish such

as trout (Francis and Schindler 2009), bluegill (Schindler et al. 2000), largemouth bass (Gaeta et al. 2011), and northern pike and pumpkinseed fishes (Radomski and Goeman 2001).

Shoreline property owners in many areas of North America can help reduce the impact of development on habitat and lake health by maintaining a vegetated buffer along their shoreline, which can provide critical habitat for native and game species. One simple act that can improve buffer quality is to refrain from excessive mowing or cutting. For many properties around residential lakes, the state of shoreline vegetation is a direct result of actions or decisions by the property owner (Amato et al. 2012). Many other factors also have an impact, such as region, lake type, parcel size, soil characteristics, and state at initial time of purchase, to name just a few. Yet within those physical constraints, the decisions and maintenance behaviors of the owner (or other caretaker) determine the amount and extent of vegetation between the house and the lake. State departments of natural resources, county land conservation offices,

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nongovernmental conservation organizations, and lake associations actively encourage property owners to maintain a buffer on their shoreline through a diversity of programs and initiatives. For example, lake property owners in Burnett County, Wisconsin, can receive an annual tax credit for enrolling in a stewardship program, and lake property owners in Vilas County, Wisconsin, can receive financial assistance for shoreland restoration. Most programs include an educational component to strengthen beliefs in the importance or desirability of buffers and increase property owners' motivation to maintain more vegetation along their shoreline. Currently, however, few empirical studies have examined which beliefs or goals are most strongly related to behavioral differences such as maintenance activities.

Knowing the identity and relative influence of those beliefs and goals on habitat modification behaviors would allow educational efforts to communicate along dimensions most likely to be effective at influencing behavior to promote shoreline buffers (Heberlein 2012, Steg et al. 2014). Communication and education alone are unlikely to be sufficient to change behavior; however, public behavior change programs that employ other strategies, such as focusing on normative information or regulatory compliance, typically also include communication or educational components. This research aims to provide evidence to support effective design of those components.

We draw on 2 distinct conceptual perspectives, one concerned with human beliefs and the other human goals, to measure constructs hypothesized to be associated with shoreline maintenance behaviors. We see these theoretical approaches as complementary rather than competing, and so we sought to capitalize on the distinct processes proposed as important by each in the context of the generally accepted view of how beliefs and goals are related to behavior.

Biospheric beliefs

Leopold (1949) proposed that the health of human communities is inextricably linked to the health of the environmental systems in which they live. Individuals who view themselves as part of a larger ecological system have an inherent concern for the health of that system, while individuals who view humans as separate from the natural environment are more likely to value its health to the extent that they are aware of benefits it provides to them. Previous research suggests 3 distinct dimensions to biospheric beliefs: (A) belief in the resilience of Earth's natural systems; (B) belief as to whether the earth can support unbridled human growth and development; and (C) belief in the rights of humans relative to animals and plants (Dunlap et al. 2000, Clayton and Opo-

tow 2003). Biospheric beliefs may influence how property owners view themselves and their property within the larger ecosystem of the lake.

Goals

A property owner's goals may be key determinants of shoreline management decisions. Goals are motivational forces to approach a particular end state or manner of conduct; a property owner's goals for their property describe the types of outcomes that are important to them. Individuals often have more than one goal active simultaneously. Lindenberg and Steg (2007) argue that 3 broad categories of goals exist: (A) *hedonic goals* that support behaviors offering immediate personal satisfaction; (B) *gain goals* that support behavioral options likely to protect or increase personal resources; and (C) *normative goals* that support socially expected behavioral options. The decisions lake property owners make about shoreline maintenance may be influenced by their individual goals.

The current study

The current research aimed to identify a set of specific beliefs and goals related to individual differences in lake property owners' management of their shorelines. Our intention was to identify a useful set of beliefs and goals that lake managers and environmental educators could use to inform their outreach efforts with shoreline property owners.

We created survey items to measure beliefs and goals hypothesized to be relevant to shoreline management decisions, and another set of items to measure shoreline maintenance behavior. Paper surveys were mailed to a sample of lake property owners. The extent to which each measured belief or goal predicted shoreline maintenance behavior was compared to identify those most strongly associated with self-reported behavior.

Study site

Surveys were mailed to 243 individuals who owned residential property along 1 of 2 seepage lakes in rural north-west Wisconsin. Both lakes are characterized by moderately high development with relatively small homes and primarily nonresidents who use their property as a vacation home. All lakes in Wisconsin are public, although shoreland property may be public or private. Lakes were 251 and 229 acres in size. All property owners on both lakes received surveys.

Materials and methods

Participants and procedure

All individuals had received communications over the previous 4 years as part of a social marketing campaign promoting natural shorelines (Haack and Shaw 2013). The majority of survey items were about specific communications that participants had received as part of that campaign and are not reported here. Following recommendations of the Total Design Method (Dillman 1978) for increasing mailed survey response rates, participants who did not initially return the survey were mailed a reminder postcard, followed by a second copy of the survey, followed by a final reminder postcard. This method achieved a response rate of 64% (155 respondents). Respondents had a mean age of 62 years ($SD = 11$), had owned their lake property a mean of 26 years ($SD = 17$), and were 39% female. Most (83%) were seasonal residents.

Measures

General constructs from the theoretical perspectives described in the procedures were adapted to create 9 survey items specific to the domain of lake ecology and shoreline management. Additional survey items asked participants about their past shoreline maintenance behaviors. Measures are described in greater detail in the following sections (Table 1). The survey instrument was pretested by a convenience sample of lake managers and extension specialists.

Beliefs

Each of the 3 dimensions of biospheric belief were drawn upon to create a corresponding survey item specific to the domain of shoreline management. The dimension “nature’s resilience” was used to create the item “The lake can withstand human modifications of the shoreline.” The dimension “human ingenuity” was used to create the item “The health of the lakes is dependent on human intervention and ingenuity.” The dimension “rights of nature” was used to create the item “It is important to protect the lake for the plants and animals that live there.” Respondents indicated agreement using a 5-point scale, where 1 indicated “strongly disagree” and 5 indicated “strongly agree.”

Goals

The 3 categories of goals described by Lindenberg and Steg (2007) are considerably broader categories than the dimensions of biospheric belief. To capture that variability, we created 2 survey items for each of the 3 goal types. Respondents indicated the importance of each goal for their

shoreline maintenance decisions, where 1 indicated “not at all important” and 5 indicated “extremely important.”

Two items were created to measure hedonic goals: “My ability to enjoy my property” (hedonic-enjoy) and “How much I will like the look of it” (hedonic-aesthetic). Two items were created to measure gain goals: “Cost of the different options” (gain-cost) and “Resale value of my property” (gain-resale). Two items were created to measure normative goals: “How the look of my shoreline fits in with others nearby” (normative-fit) and “Effects on the overall health of the lake” (normative-health).

Shoreline maintenance behavior

Finally, 4 items asked participants to report the frequency with which they typically engaged in specific shoreline maintenance behaviors. Items were presented in a 4-row table, with responses entered using a 5-point scale where 1 indicated “not at all” and 5 indicated “a lot.” The full text of the table items included “Cut trees and shrubs,” “Mow,” “Rake,” and “Maintain a beach.”

Statistical analysis

Responses were analyzed to determine which beliefs and goals were most strongly related to differences in self-reported behavior.

A composite variable “yardscaping” was created from the mean response to the 4 shoreline behavior questions. Internal consistency was assessed with Cronbach’s alpha, a variable representing how often a respondent engaged in 4 activities that can reduce shoreline vegetation and degrade buffers, as described earlier. Individuals with high yardscaping scores reported performing those behaviors frequently.

We predicted that each of the belief and goal statements would be related to yardscaping frequency. To test that prediction, we calculated the bivariate correlation of each survey item with the composite yardscaping score. We used Spearman’s rho rather than Pearson’s r because several of our measures had nonnormal distributions. The interpretation of rho is similar to r . To control family-wise type I error in the presence of so many tests, we adopted an alpha level of 0.01 rather than the conventional 0.05.

Results

Response rate

Surveys were returned by 155 property owners, as described earlier. Nine surveys were excluded from analysis because the respondents declined to provide ratings for more than

Table 1. Belief and goal item text and relationships with behavior.

Beliefs	Item text	Descriptive statistics		Correlation with “yardscaping”	
		Mean	SD	rho	p-value
nature’s resilience*	The lake can withstand human modifications of the shoreline.	2.76	1.05	0.34	$p < 0.0001$
human ingenuity	The health of the lakes is dependent on human intervention and ingenuity.	3.88	0.95	-0.12	$p = 0.17$
rights of nature*	It is important to protect the lake for the plants and animals that live there.	4.32	0.65	-0.24	$p < 0.01$
Goals	Item text	Mean	SD	rho	p-value
hedonic-enjoy*	My ability to enjoy my property.	4.14	0.77	0.35	$p < 0.0001$
hedonic-aesthetic*	How much I will like the look of it.	3.92	0.77	0.35	$p < 0.0001$
gain-cost	Cost of the different options.	3.33	0.99	0.13	$p = 0.89$
gain-resale	Resale value of my property.	3.91	0.89	0.14	$p = 0.10$
normative-fit	How the look of my shoreline fits in with others nearby.	3.29	1.05	0.18	$p = 0.04$
normative-health	Effects on the overall health of the lake.	4.31	0.68	-0.10	$p = 0.25$

*indicates $p < 0.01$
Means and standard deviations are in units of the 7-point Likert scale.

50% of the survey items. The remaining 146 respondents provided responses to a mean of 90% of items.

Shoreline behaviors

The 4 items contributing to the yardscaping composite variable had a Cronbach’s alpha of 0.78, suggesting substantial internal consistency among the 4 behaviors. On average, respondents reported seldom engaging in yardscaping activities on their shoreline (M = 1.97, SD = 0.77).

Relationships of beliefs and goals with behavior

Individual differences in 2 of the measured beliefs were associated with frequency of yardscaping (Table 1). The more resilient that property owners believed nature to be, the more frequently they engaged in harmful shoreline behaviors ($\rho = 0.34, p < 0.0001$). Conversely, the more strongly they agreed that nature has rights, the less frequently they engaged in harmful shoreline behaviors ($\rho = -0.24, p < 0.01$).

Individual differences in both of the hedonic goal items were associated with frequency of yardscaping. Participants who ascribed relatively high importance to being able to personally enjoy their property reported more yardscaping behaviors than participants who ascribed lower importance to that goal ($\rho = 0.35, p < 0.0001$). There was a similar positive relationship between yardscaping behaviors and importance of visual aesthetic ($\rho = 0.35, p < 0.0001$).

The importance of aesthetic was reinforced by a marginally significant effect observed between behavior and the normative goal item most closely related to aesthetic ($\rho = 0.18, p = 0.04$).

None of the other items’ correlations with yardscaping were significant (Table 1).

Discussion

Recommendations

Individual differences in biospheric beliefs were predictive of self-reported shoreline maintenance behaviors. Specifically, participants who believed nature is highly resilient to pressures from development reported engaging in behaviors that could potentially decrease buffer quality more frequently than did participants who believed nature was fragile. In addition, participants who believed in the rights of nature reported less frequently engaging in behaviors that could degrade buffers compared to participants who believed less strongly in those rights.

The association between belief in the resilience of lake ecosystems and shoreline maintenance decisions suggests that emphasizing the relationship between shoreline state and ecological health may be an effective strategy for environmental educators in this domain. Communication could focus on the delicate balance of aquatic ecosystems, or alternatively on actions property owners can take to increase

the resilience of nature. Future research could explore methods for communicating concepts of resilience from ecology (e.g., Gunderson et al. 2010) to the general public. Another possible strategy suggested by our results is strengthening belief in the rights of the animals and plants to coexist in and around the lake, although designing an effective program to accomplish such an objective is complicated.

The priority placed on hedonic goals was also significantly related to shoreline behavior. The data suggest that enjoyment and aesthetic goals may prevent some property owners from increasing their shoreline buffers. One potential strategy for overcoming that barrier could be finding ways to make shoreline buffers more compatible with the satisfaction of those goals by demonstrating that shorelines can be managed attractively and functionally while also providing habitat and other ecosystem services. The bases of aesthetic preferences, and how they do or do not change over time, are good candidates for future research because of their potential applicability to a wide variety of resource management problems.

Individual differences in the relevance of the gain goals were not found to be related to differences in behavior, suggesting that among respondents, neither cost nor resale value were a limiting factor in their decision to maintain (or not maintain) a buffer on their shoreline. Those null results should be interpreted with caution because the wording of our items possibly failed to tap important gain goal considerations. The same caution is warranted for interpreting the minimal relationship found between behavior and the normative goal items. While that result could suggest that the priority an individual places on the satisfaction of normative goals is unrelated to behavior, research in other domains suggests that respondents' ability to accurately report the influence of normative concerns on their behavior is fairly poor (e.g., Nolan et al. 2008).

Limitations

While the null findings in this exploratory study have multiple interpretations, the positive findings of the biospheric beliefs and hedonic goals allow greater confidence in those results. Property owners' responses to those items exhibited a robust relationship with reported shoreline maintenance behavior and therefore provide a valuable data point for environmental educators and lake managers.

It is also possible that our self-report behavioral measures failed to capture important variance in actual differences in shoreline maintenance behaviors. Future work should include questions about a wider range of behaviors, or dispense with self-report entirely and directly measure changes in shoreline vegetation.

Conclusion

The current study examined the individual differences that may influence some shoreline property owners to engage in activities that can undermine shoreline buffer quality. Maintaining a buffer is an effective way for individuals to positively contribute to the health of the aquatic ecosystems in which they live. As is the case with many public resources, successful management of aquatic ecosystems in the face of human development depends on cooperation and behavior change among a range of stakeholders with a diversity of interests. The need for broad-based popular support has been noted in watershed planning case studies from both developed and developing countries (Sharma and Wagley 1996, Horton 2003, Moran and Woods 2008). Insights from social science can provide valuable recommendations for increasing that support and participation in outreach programs to protect lakes (Shaw et al. 2011, 2012, Amato et al. 2012). Better understanding of how individuals make decisions about their shoreline property could lead to better communication and greater cooperation between private land owners and the agencies and organizations working to protect our shared water resources.

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