Environmental risk perception, motivated cognition, and antecedents of behavior: Field studies of cooperation on Wisconsin's shorelands

by

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Dedication

For my parents, and all of my teachers.

Acknowledgments

It is an honor to be first author on this document, which is a collaborative work that would not have been possible without the effort and support of a great many people.

First and foremost, thank you to each of the individuals who participated in these studies. Many participants not only volunteered their time to complete the relatively lengthy surveys, but also chose to write additional notes about their own insight into challenges and solutions for the lakes they love. I am grateful to all of those participants, particularly those who took the time to fill out the survey even though they had reservations about the studies' goals.

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Finally, thank you to my parents, my sister, and my grandparents. For everything. This is for you.

Table of Contents

Abstract

Many psychological perspectives offer insight regarding antecedents of environmental behavior and cooperation to protect shared environmental resources. This dissertation reviews several perspectives, drawing connections by applying each to an understudied but useful example of environmental behavior: shoreline maintenance decisions by residential shoreline property owners. Property owners can support regional biodiversity by growing native vegetation on their shoreline, providing critical riparian habitat. Habitat pressure is expected to increase with climate change. Shoreline property owners participated in correlational field studies and a randomized field experiment through paper surveys. In chapter 1, motivation to avoid negative conclusions about the impact of past decisions was predicted to cause overly-positive evaluations of environmental risk. Property owners (n=80) rated photos of their own shorelines and shorelines owned by other participants on four dimensions. Linear mixed-effect modeling revealed photos were rated more highly by their owners on all dimensions. Chapter 2 provided property owners (n=405) with feedback about how past shoreline maintenance decisions had impacted the lake, and measured intentions to change. Half of participants performed a values commitment task prior to receiving feedback. Feedback was predicted to increase intentions only when preceded by commitment. The prediction was not supported; little difference in intentions was observed between conditions. The study outcome and participants' written comments are discussed in terms of Reactance Theory. Chapter 3 measured the importance of beliefs and goals for shoreline decision making, drawing from multiple theoretical perspectives (n=566). Exploratory factor analysis revealed that variance was best summarized using 2 goal factors and 2 belief factors. The goal factors were identified as Appearance goals and Lake Health goals; the belief factors

were identified as Stewardship beliefs and Prescriptive Normative beliefs. Strong coherence was observed for all factors. In chapter 4, external validity of the extracted factors was assessed. Shoreline vegetation scores for each participant's property parcel were obtained from a publicly available database and used as an outcome measure. Property owner factor scores, physical environment characteristics, and normative measures were entered as predictors in a linear mixed effect model (n=279). Consistent with prior literature, social norms were the strongest predictors of shoreline behavior.

Chapter 1

The Challenge of Self-Perception Bias

Abstract

Motivation to preserve self-view has been implicated to moderate perceptions of the physical environment and causal reasoning. Few studies have directly examined that motivation's effect on environmental risk perception and conservation behavior. We use an innovative method to measure it in a specific context - lakefront property owners' evaluations of how their past decisions about shoreline maintenance have impacted overall lake health. We predicted motivation to avoid negative conclusions about the impact of past decisions would cause overly-positive evaluations. In a field study, property owners rated photos of their own shorelines and shorelines owned by other participants on four dimensions. Linear mixed-effect modeling revealed photos were rated more highly by their owners than other participants on all dimensions, mean $\beta = 1.13$, $p < 0.05$ for all. These results suggest overly positive evaluations of past behaviors may be a barrier to environmental cooperation.

Chapter 2

Delivering Feedback with Commitment

Abstract

A field experiment provided shoreline property owners (n = 405) with feedback about how their past shoreline maintenance decisions impacted the lake, and measured the effect on intentions to change. Half of the participants performed a values commitment task prior to receiving feedback. Based on findings from chapter 2, it was predicted that feedback would increase intentions to change only when preceded by commitment. The results did not support the prediction; little difference in intentions was observed between conditions. Participants' written comments suggested that many did not accept the feedback as valid. The study outcome is discussed in terms of Reactance Theory (Brehm, 1966; Brehm & Brehm, 1981), and future research directions are suggested.

Chapter 3

Beliefs and Goals

Abstract

Individual differences in shoreline maintenance behavior are likely partially attributable to individual differences in property owner beliefs and goals. Several theoretical perspectives of environmental behavior make predictions about the types of beliefs and goals that determine shoreline behavior. These include basic values, biospheric beliefs, and Goal-Framing Theory, as well as perspectives which emphasize the social norms. The perspectives are discussed within a broad model linking hierarchical beliefs to behavior. A survey mailed to residential lake property owners in Wisconsin, USA (n = 566, response rate = 51%) measured individual differences in the importance of 11 goals and agreement with 20 statements of belief. Exploratory factor analysis revealed that variance in responses was best summarized using 2 goal factors and 2 belief factors. Factors were inspected for cohesion and interpreted as distinct dimensions of belief or goal structure. The resulting goal factors were identified as Personal Benefit Goals and Lake Health goals. The resulting belief factors were identified as Stewardship beliefs and Prescriptive Normative beliefs.

Chapter 4

Beliefs, Goals and Behavior

Abstract

External validity of the belief and goal factors extracted from property owners' survey responses in chapter 4 is assessed. Shoreline vegetation scores for each participant's property parcel were obtained from a publicly available database, and used as an outcome measure of past shoreline decisions. . Intentions to improve shoreline areas were separately analyzed as another outcome measure. Property owner factor scores, characteristics of the parcel physical environment, and two measures of norms based on immediate neighbors' shorelines were entered as predictors in a linear mixed effect model. Consistent with prior literature, the investigation finds that beliefs about social norms are the strongest predictors of shoreline behavior.

Introduction

Being a human is complicated. Seemingly minor decisions can have long lasting consequences not only for our own lives, but countless others as well. The degree to which we are bound together is nowhere more apparent than in the physical environment we share.

Sharing the physical environment can be a challenge, because more often than not environmental resources have the properties of commons dilemmas: individuals accrue direct, personal benefits from using the resource, but the costs are borne by everyone (Hardin, 1968). That disconnect can easily result in usage levels that rapidly deplete or degrade the resource. Catastrophic examples are readily available and widely known. Overfishing beyond the level at which fish populations can sustain themselves has caused the collapse of previously abundant fisheries in the world's oceans (Food and Agricultural Organization of the United Nations, 2012). Fossil fuel combustion for cheap energy has accelerated the amount of carbon in Earth's atmosphere more rapidly than at any point in its past, risking unknown changes in climate and sea levels (Intergovernmental Panel on Climate Change, 2013).

Environmental degradation is not inevitable though. In many cases, formal or informal rules governing the use of shared environmental resources have led to long term, successful management. Humans are highly social animals, and cooperation is one of our strengths.

Just as it is important to lay out assumptions that underlie a theory, it is important to be clear about the land ethic one uses to evaluate environmental alternatives and establish management priorities. In 1936, Clarence Tarzwell addressed the North American Wildlife Conference in Washington D.C. on best practices for restoring lake and stream habitats (Tarzwell, 1936). He drew from years of experience working with Michigan waterways that had

been disturbed in the previous decades by loggers. The loggers cleared trees and debris from the water to prevent log jams during spring and summer drives. Concerned about declining fish populations, Tarzwell and colleagues had systematically studied the effect of habitat restoration actions such as felling trees and creating riffles or mucky areas by constructing devices to deflect the current. Tracking changes in numbers of fish year over year, they experimented with a variety of techniques for creating habitat and controlling erosion. Their goal was to increase fish production.

When Leopold described the ecological land ethic in *A Sand County Almanac* several years later, he sought to distinguish his views from the economic land ethic that was dominant at the time and reflected in the goals of Tarzwell. Leopold promoted an ecological land ethic in which decisions about land use were made on the basis of the intrinsic value of the land and its organisms, rather than their economic value to humans. He argued that conservation and habitat restoration should be pursued not just to improve fishermen's catch, but to improve the health and well being of the ecosystem humans share with other creatures and plants. This dissertation adopts a land ethic similar to Leopold's, and investigates the factors that affect cooperation in the use of a specific environmental resource – the quality of lake ecosystems.

Values are subjective. Stakeholders may disagree with the assumptions of the ecological land ethic. In comments that some participants wrote on their surveys, it is clear that a subset of the surveyed lake property owners believe that the goals of lake management should be to maximize benefit for the humans who live there. For example, individuals whose primary interest in the lake is as a location for jet skiing may be less concerned with ecosystem health. Others may view ecosystem health as a desirable goal, but of less importance than other more anthropocentric goals. This dissertation recognizes that their views are no less legitimate than the

views of the author. However, this research seeks to better understand differences in views and ethics, in the hope that a richer understanding of the diversity of viewpoints individuals hold will facilitate greater cooperation to protect the shared waterways that we all value.

This work makes the subjective assumption that the ultimate benefit of natural shorelines is realized as healthier, more diverse aquatic ecosystems on a regional and continental scale, which benefits humans and other organisms alike. Many secondary benefits which derive from improved ecosystem health, such as improved fishing and wildlife viewing, also hold economic and recreational value for humans, and can be powerful motivators for action. However, this dissertation takes the position that the true value of healthy, ecologically diverse lakes is inherent.

In Wisconsin, as in many other places, lakes and the ecosystems they host are a dominant feature of the landscape that are integral to the identities of many people and communities. The quality of lakes, whether measured in terms of water purity, biodiversity, natural beauty, or ability to provide for human recreation and livelihood, depends on many factors across watersheds. One key factor for many lakes, particularly with regard to biodiversity, is the amount of vegetation in the immediate shoreline area (US EPA, 2009).

Development of lake shorelines across the continent degrades critical riparian habitat that is 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). The pressure on populations of regionally distinct plants and animals due to loss of habitat and competition from invasives is expected to be compounded

by climate change (Heino, Virkkala, Toivonen, 2009; Intergovernmental Panel on Climate Change, 2014).

In states like Wisconsin, lakes and streams belong to the public. Yet their quality depends to a large extent on the shoreline management decisions of tens of thousands of individual property owners. Property owners therefore have a responsibility to balance their own wants and needs with their role as stewards. They can help reduce the impact of development on lake health by maintaining a rich mix of native vegetation along their shore. When space is limited though, growing a vegetated buffer may require foregoing other land uses that would provide more direct personal benefits, such as a patio, beach, or manicured lawn.

Although laws and zoning regulations governing shoreline development are sometimes lax and unenforced, many individuals nonetheless voluntarily choose to manage their shoreline in a way that supports a healthy lake ecosystem. Some, however, exercise their right not to for any number of reasons. Conservationists, advocates and lake managers who are dedicated to protecting lake quality and the essential habitat services lakes provide face a challenge in communicating the importance of shoreline vegetation to owners of impaired shorelines, while respecting their right to manage their property as they choose.

Psychological understanding of basic processes about how people perceive information and make decisions can help address that challenge. At the same time, applied understanding of how those processes affect behavior within the specific context of shoreline management decisions provides externally valid empirical evidence that can inform and refine theory. The following four chapters attempt to meet both of those goals.

Chapter 1 draws on the theory of motivated cognition, and discusses its role shaping the way individuals perceive information about commons dilemmas. The chapter integrates

environmental behavior with a theory of behavior change from the domain of public health, and argues that systematically inaccurate information about the consequences of one's past behavior may be a barrier to changing that behavior. A field study measures the extent to which motivated cognition may affect property owners' evaluations of their shorelines, and finds evidence of robust self-perception bias.

Building on that finding, chapter 2 presents a field experiment designed to provide property owners with more accurate information about their shoreline's contribution to lake health, and measures the effect on intentions to improve. In addition to providing information, the experiment also compared methods for reducing defensiveness to that information when it was negative. Although the intervention was inconclusive regarding its intended aims, it did succeed in producing a potentially valuable insight into how communication about past property management decisions is perceived.

Chapter 3 presents a correlational study into the dimensions of beliefs and goals that influence property owners' decisions about shoreline management. The study integrates ideas from a diversity of perspectives about the antecedents of environmental behavior. Exploratory factor analysis is used to identify the areas in which the perspectives overlap and diverge.

Chapter 4 follows directly from chapter 3, and investigates which of the dimensions of beliefs and goals revealed by the factor analysis are related to actual past behavior. A parcel level measure of shoreline vegetation is used as an indicator of aggregate past decisions. Consistent with prior literature, the investigation finds that beliefs about social norms are the strongest predictor of behavior.

It is hoped that the results of these studies will be useful to social scientists and conservationists alike. Special gratitude is owed to each of the property owners who participated

in the studies. Without any compensation, they volunteered to share their time and their thoughts. They were truly partners in the research, and none of these studies would have been possible without them.

Chapter 1

The Challenge of Self-Perception Bias

Abstract

Motivation to preserve self-view has been implicated to moderate perceptions of the physical environment and causal reasoning. Few studies have directly examined that motivation's effect on environmental risk perception and conservation behavior. We use an innovative method to measure it in a specific context - lakefront property owners' evaluations of how their past decisions about shoreline maintenance have impacted overall lake health. We predicted motivation to avoid negative conclusions about the impact of past decisions would cause overly-positive evaluations. In a field study, property owners rated photos of their own shorelines and shorelines owned by other participants on four dimensions. Linear mixed-effect modeling revealed photos were rated more highly by their owners than other participants on all dimensions, mean $\beta = 1.13$, $p < 0.05$ for all. These results suggest overly positive evaluations of past behaviors may be a barrier to environmental cooperation.

Self-view and environmental cooperation

Environmental resources are often prone to Tragedy of the Commons type problems (Hardin, 1968). Van Vugt (2009) summarizes recent findings from Social Psychology that investigate the conditions under which individuals are likely to cooperate in the protection of shared resources. Based on the empirical results, Van Vugt suggests that accurate information about the nature of an environmental problem should be a key component of strategies to address the problem.

Motivation to maintain a favorable self-view has been shown to affect perception of physical features of the environment. Participants in Balcetis and Dunning (2007) estimated lower distance and gentler slope on a hilly campus when they believed they had voluntarily chosen to traverse it (high-choice), compared to participants who believed their task had been assigned to them (low-choice). Those results suggest that participants in the high-choice condition were motivated to perceive physical features of the environment as less adverse than they truly were, in order to reduce the threat to self-view generated by having voluntarily chosen something unpleasant.

It is less clear from the literature whether motivation to preserve a favorable self-view also affects causal reasoning about more abstract properties and relationships of the physical environment. While that motivation has been shown to affect causal reasoning about personal attributes (Kunda, 1987) and moral reasoning about environmental issues (Opotow & Weiss, 2000), its effect on causal reasoning about features of the physical environment has not previously been investigated. The question is important because many shared environmental resources, such as climate, air quality, water quality, and biodiversity depend to a large extent on the decisions of individual property owners. Their decisions, in turn, depend at least in part on

their causal beliefs (i.e., information) about how their personal property affects the shared resource in question.

The role of self-perception in behavior change

Efforts by conservation and public health officials to improve the quality of shared resources often include behavior change among individuals as an objective. For example, lake managers across North America have developed a variety of programs to encourage owners of suburbanized lakefront properties to restore their shoreline to a more natural, vegetated state, in order to improve water quality and protect continental biodiversity. Programs include a wide range of policy actions including financial subsidies, educational initiatives, zoning regulations, and others.

The Transtheoretical Model of behavior change, typically applied to health behaviors such as smoking cessation, holds that a prerequisite for change is coming to view a current behavior as undesirable (DiClemente et al., 1991; Shaw, 2010). However, coming to viewing one's own past decisions as unwise can threaten self-view, providing motivation to avoid such a negative conclusion. The theory of Motivated Cognition, developed from Cognitive Dissonance Theory (Festinger, 1957; Aronson, 1968), argues that motivation for a preferred outcome can affect reasoning through biased selection of "strategies for accessing, constructing, and evaluating beliefs" (Kunda, 1990). This general phenomenon has been referred to as self-serving bias, self-perception bias, and the above average effect.

Judgments are particularly sensitive to motivation for a particular outcome when the object being evaluated is ambiguous. Dunning, Meyerowitz, and Holzber (1989) presented undergraduate participants with a list of 14 positive and 14 negative personal traits, and asked

them to estimate their percentile rank on each trait relative to other students. In addition to valence, the traits also varied in the ambiguity of their definitions, for example high ambiguity traits like *sensible* compared to low ambiguity traits like *punctual*. The mean rank estimated by participants did not differ by valence for the low-ambiguity traits, but most participants estimated themselves above the median for the high-ambiguity positive traits and below the median for the high-ambiguity negative traits. The observed interaction between trait valence and ambiguity suggests that evaluations were constrained by what was plausible; participants did not simply apply favorable attributes to themselves across the board, but rather only those for which the ambiguity of their definitions allowed a plausible case to be made.

The current study

Returning to the example of residential lakes, owners of impaired shoreline properties would be expected to hold overly positive beliefs about how their property contributes to the lake as a whole, because the current state of their shoreline is a result of decisions they have made (e.g., landscaping, building) (Clayton & Opotow, 2003; Amato, Shaw, & Haack, 2012). The shoreline area by definition transitions from a built environment (the house) to a natural environment (the lake), so judgments of "naturalness" fall on a continuum and are inherently ambiguous, providing ripe opportunity for positively biased evaluations. Individuals who hold overly positive beliefs about how their property contributes to the lake are unlikely to take action and change their shoreline maintenance behaviors to improve that contribution, even if they support shared resource goals such as lake health.

A repeated-measurements field study was used to test that hypothesis. Lake property owners rated photographs of the shoreline area of their own property, and photographs of other

participants' properties, for their overall impact on lake quality measured in four dimensions. We predicted that participants would rate their own property more positively than its average rating received from other participants, because of the motivation to protect self-view from the threat of a negative evaluation, which would imply that they had made unwise shoreline maintenance decisions in the past.

Method

Participants

Surveys were mailed to 140 individuals who owned residential lakefront property in central Wisconsin. That number of participants was chosen to ensure a sufficient number of respondents to observe an effect if present, assuming an effect size similar to that observed in Balcetis & Dunning (2007), and assuming a conservative 36% response rate.

Contact information was obtained from county records. Potential participants were randomly selected from all eligible shoreline property owners in three counties. Photographs of each property's shoreline, taken from the lake at a distance of approximately 30 feet, were obtained from a publicly available database. Property owners were considered eligible if their property's photograph A) showed a moderate level of shoreline development in order to ensure sufficient ambiguity, and B) clearly depicted a single property parcel. Each photo was independently rated for suitability on both dimensions by two research assistants.

The first 3 pages of the surveys included the belief and goal items discussed in chapter 3. Following those pages, participants in the current study were presented with 8 photographs and were asked to rate each on four dimensions: *shoreline contribution to natural beauty*, *shoreline*

contribution to good water quality, *habitat provided for aquatic wildlife*, and *usefulness for enjoying the lake and recreation*. Likert ratings ranged from 1 ("low") to 7 (“high”). Each participant rated their own property's shoreline (self-ratings), and the shorelines of 7 other participants (other-ratings) drawn from different lakes than the participant. Participants' own shorelines were randomly presented in the 3rd through 8th position. An instruction page immediately preceding the to-be-rated photos presented two invariant example photos without ratings, to provide participants a common contextual anchor for evaluation. A cover letter informed participants that they might see their own property in one of the photos, and instructed them to “rate it just like the others.” An example photo is shown in figure 1.1.

Figure 1.1 – Sample shoreline photograph

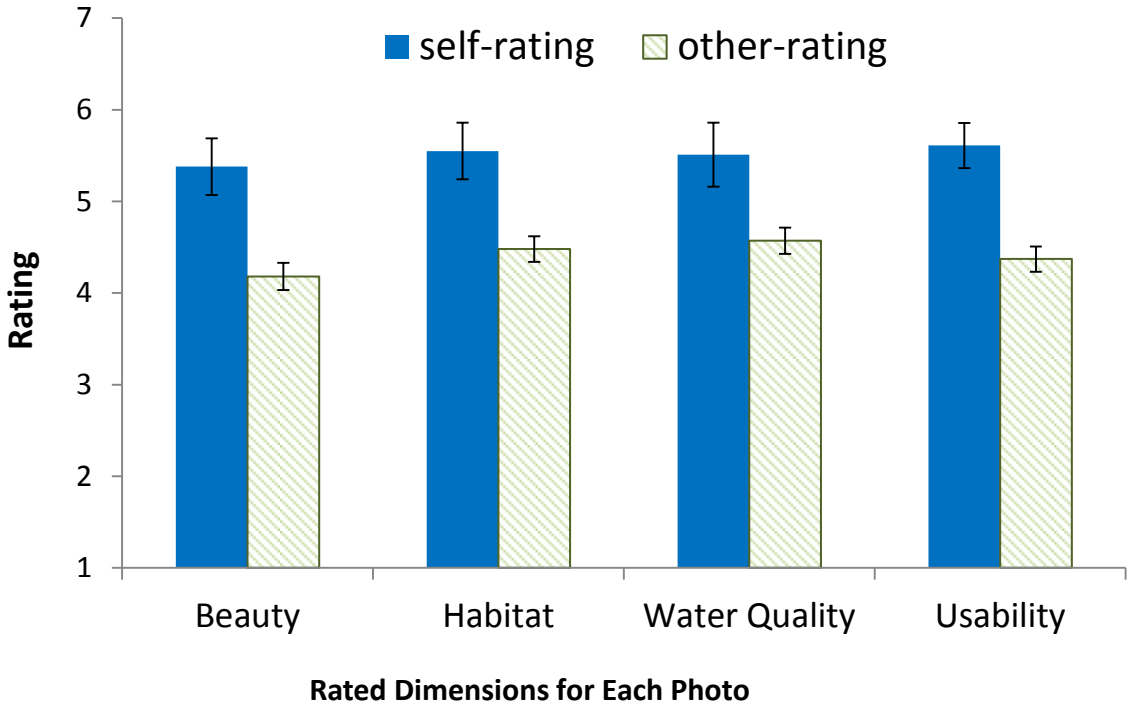
Results

Surveys were returned by 80 participants for a 57% response rate. A 100% response rate would have collected ratings from 7 non-owners for each photo, because photos were perfectly counterbalanced across the full set of mailed surveys. Because some surveys were not returned, the mean actual number of non-owners who rated each photo was 4.09 (sd = 1.27).

Ratings of the four dimensions were separately analyzed with linear mixed effects analyses, to test the hypothesis that participants would exhibit a positive bias when rating their own shoreline. Ownership status (self = 1, other = 0) was included as the sole fixed effect; participant and photo were included as random effects. Mean differences for the effect of ownership are presented as betas with 95% confidence intervals. Analyses were conducted with R version 3.0.3 and the lme4 package.

Robust bias was revealed for all four dimensions. Participants rated photos of their own shoreline higher than they rated photos of others' shorelines on *beauty* (β = 1.21, [0.86, 1.56]), *habitat* (β = 1.03, [0.72, 1.34]), *water quality* (β = 1.25, [0.92, 1.58]), and *usability* (β = 1.01, [0.69, 1.58]). Condition means are presented graphically in figure 2.

Figure 1.2 – Mean photo ratings by ownership status. Error bars show 95% confidence intervals.



Discussion

The field study provides strong evidence that shoreline property owners tend to hold overly positive evaluations of how their personal shoreline contributes to the lake as a whole. The effect was found for all four rated dimensions of lake quality.

While it is possible that the higher *beauty* and *usability* ratings owners gave to their own shorelines were due to personal preferences (i.e., people maintain their shoreline in a state they aesthetically enjoy, and that serves their usage interests), that interpretation cannot explain the differences observed in the *habitat* and *water quality* ratings, because an empirical truth exists for those two dimensions. The similarly sized coefficients for ownership on the preference and empirical dimensions suggests a single mechanism, specifically motivation to avoid negative conclusions about one's own past behaviors and decisions, drove all four effects.

Further research is needed to more conclusively establish the relationship between beliefs about how one's property contributes to shared resources and behavior change to improve that contribution. The relationship is predicted by the Transtheoretical model (also called the Stages of Change model), but experimentally manipulating the magnitude of self-perception bias and then measuring the resulting effect on behavior would provide empirical evidence.

One possible strategy for manipulating the magnitude of self-perception bias could be to provide individuals with objective information about their property's contribution, thereby reducing the ambiguity of the evaluation. However, in many cases that information about past behavior would be negative, creating the potential that they could resolve the dissonance between their beliefs (lake health is good) and their behavior (not supportive of lake health) by

changing their beliefs about lake health. Previous research by Aronson and colleagues on the relationship of cognitive dissonance to environmental behavior has avoided that outcome by reinforcing participants' relevant beliefs immediately before the delivery of feedback about their behavior (e.g., Dickerson, Thibodeau, Aronson, & Miller, 1992). The following chapter investigates the effects of providing property owners with objective information about shoreline health.

The current research expands our understanding of the ways in which motivation can affect perception and reasoning. Whereas motivation to preserve positive self-view moderated estimation of physical environmental features by participants in Balcetis and Dunning (2007), in the current study that motivation moderated estimation about the relationship between environmental features and abstract concepts such habitat and beauty.

Other forms of motivation have also been shown to moderate beliefs and reasoning about the environment. Participants in Balcetis and Dunning (2006) were motivated to interpret an ambiguous visual figure in a way that avoided a physiologically aversive outcome. Thirsty participants in Balcetis and Dunning (2010), who had recently eaten a bowl of salty pretzels, estimated the distance between themselves and a bottle of water to be less than the distance estimated by participants who had recently quenched their thirst. American participants in Jang (2013) attributed less responsibility for climate change to anthropogenic causes (versus natural causes) after reading a news article critical of U.S. energy consumption, compared to participants who read an article critical of Chinese consumption, providing evidence that participants were motivated to select a causal theory that did not threaten their in-group.

Taken together, these studies suggest that effects of motivation are pervasive in judgments about the environment. Biased perceptions of environmental risk and how one’s past

decisions contribute to shared resource quality appear to be the order of the day. The implications are important not only for psychologists, but also for conservation and public health practitioners. Motivation to preserve self-view likely presents a challenge to interventions that encourage behavior change. More generally, a better understanding of the processes by which motivation affects reasoning and behavior in the context of shared resources could offer valuable insight towards solutions to a range of environmental problems, problems which are only expected to intensify with population growth and urbanization.

Chapter 2

Delivering Feedback with Commitment

Abstract

A field experiment provided shoreline property owners (n = 405) with feedback about how their past shoreline maintenance decisions impacted the lake, and measured the effect on intentions to change. Half of the participants performed a values commitment task prior to receiving feedback. Based on findings from chapter 1, it was predicted that feedback would increase intentions to change only when preceded by commitment. The results did not support the prediction; little difference in intentions was observed between conditions. Participants' written comments suggested that many did not accept the feedback as valid. The study outcome is discussed in terms of Reactance Theory (Brehm, 1966; Brehm & Brehm, 1981), and future research directions are suggested.

The challenge of self-perception bias

The previous chapter discussed the importance of coming to view one's own past behavior as undesirable, as a prerequisite to behavior change. That idea is a central component of the Transtheoretical Model of behavior change (DiClemente et al., 1991), which is typically applied to health behaviors but has implications for a wide range of behavioral domains (Shaw, Radler, & Haack, 2012).

The previous chapter also discussed a process by which motivation to preserve self-view could result in overly-positive evaluations of past behavior. The phenomenon resulting from this process was termed self-perception bias, and was predicted to present a barrier to behavior change. In the context of lake shorelines, self-perception bias was predicted to affect evaluations of shoreline quality because the current state of a shoreline reflects past decisions by the owner regarding land use and maintenance activities. A field study found evidence that shoreline evaluations were indeed sensitive to self-perception bias: estimates of shoreline quality were considerably higher when rated by the property owner, compared to ratings from others.

Based on the Transtheoretical Model (see chapter 1), overly-positive evaluations may be a barrier to behavior change, because they prevent an individual from recognizing their past behavior as undesirable. If overly positive evaluations of one's own shoreline prevent action to improve it, then providing owners of impaired properties with a more objectively accurate evaluation may increase the likelihood of behavior change, by highlighting the ways in which their past shoreline maintenance decisions have harmed lake health.

Leveraging dissonance to promote behavior change

Although motivated cognition and cognitive dissonance can sometimes be a barrier to behavior change, previous studies have successfully used those principles to encourage positive behavior change. Aronson and colleagues developed the "hypocrisy paradigm," which seeks to arouse dissonance in individuals by making them aware of inconsistency between their beliefs and behavior. The paradigm was created in response to the observation that persuasive messages from institutions or others often fail to change behavior. Aronson and colleagues reasoned that participants who resolved dissonance by changing their behavior to match their beliefs underwent a form of "self-persuasion," which should be more effective and longer lasting than other-generated persuasion. The superiority of dissonance-generated persuasion owes to a greater degree of engagement for the individual, because it "…entails a challenge to a person's self-concept," (Dickerson, Thibodeau, Aronson & Miller, 1992). More generally, internally generated motivation is often more strongly related to behavior than externally generated motivation (Ryan & Deci, 1985).

For example, undergraduate participants in an experiment by Aronson, Fried, & Stone (1991) received an intervention designed to promote condom use. Participants in the hypocrisy condition reflected on both "mindfulness" (i.e., times in the past when they had failed to use condoms) and "commitment" (i.e., the reasons why safe sex is important). Those participants reported higher rates of condom use 3 months afterwards, compared to participants in control conditions who reflected on only mindfulness, only commitment, or neither.

The hypocrisy paradigm has also been successfully applied to environmental behavior. Dickerson et al. (1992) encouraged southern California undergraduates to conserve water by taking shorter showers after using a campus pool. A 2x2 design similar to Aronson et al. (1991)

manipulated participants' mindfulness about times in the past when they had wasted water, and also manipulated their commitment to water conservation as an important goal. Participants in the hypocrisy condition, who were experimentally manipulated to be both high-mindful and high-commitment, took shorter showers compared to other participants.

Nearly all lake residents in Wisconsin believe that their lakes are important and special (Floress, Simoni, Pai, & Sharp, 2012). Increasing mindfulness about how their past behaviors have harmed the lake would therefore be expected to arouse dissonance, by highlighting the incompatibility of their behaviors with their beliefs. Property owners would then be motivated to reduce the dissonance in one of two ways: either change their behavior to match their beliefs (i.e., improve their shoreline), or change their beliefs to match their behavior (i.e., reduce the importance they ascribe to lake health).

Reinforcing beliefs and affirming values

While the goal of the mindfulness manipulation in the hypocrisy paradigm is to arouse dissonance, the goal of the commitment manipulation is to direct the resolution of that dissonance and increase the likelihood it is reduced via a change in behavior, rather than solely a change in awareness, knowledge or beliefs.

Several strategies have been successfully used to elicit commitment as a means to reinforce beliefs. Participants in Aronson et al. (1991) composed speeches on the importance of condom use. Participants in Dickerson et al. (1992) printed their name on a sign, publicly declaring their support for water conservation.

The values affirmation technique was originally developed be Claude Steele and colleagues, as a paradigm to test whether belief changes induced through cognitive dissonance

tasks (e.g. counter-attitudinal essay) were driven by motivation to protect self-view or to eliminate inconsistencies in belief (Steele & Liu, 1983). More recently, values affirmation has been used in academic settings to reinforce minority students' beliefs in their own abilities and self-concepts, in the face of challenges to those beliefs from stereotype threat.

Miyake, Kost-Smith, Finkelstein, Pollock, Cohen, and Ito (2010) tested a classroom intervention designed to reduce the gender gap in a college physics course, a discipline in which men receive more degrees and higher average exam scores than women do (Pollock, Finkelstein & Kost, 2008; Brewe et al, 2007). The authors hypothesized that the stereotype of men being "better" at physics may itself contribute to the persistence of the gender gap, by causing women to question whether the stereotype is valid, thereby creating psychological stress from identity threat which depletes cognitive and emotional resources. Miyake et al. (2010) found that a values affirmation task at the beginning of the semester, in which students wrote about the values most personally important to them, greatly reduced the gender gap in exam scores relative to students in a control condition. Cohen, Garcia, Apfel, and Master (2006) used a similar values affirmation paradigm to reduce threat experienced by African American students, reducing the achievement gap for students in the affirmation condition relative to students in the control condition. In both studies, the results were interpreted to suggest that the values affirmation task reinforced beliefs about identity, reducing threat by reducing the extent to which students internalized harmful stereotype beliefs.

Critcher, Dunning, and Armor (2010) investigated the effectiveness of values affirmation to reduce defensiveness to threats that are more personal than general stereotypes. They observed that humans use *"…an eclectic array of defensive strategies …to dampen the impact of unfavorable information on their self-integrity, thereby allowing people to maintain*

unrealistically positive illusions about themselves and their place in the world," (Critcher, Dunning, & Armor, 2010). Undergraduate participants received feedback on a laboratory test of creativity and problem solving that was either easy (high threat) or difficult (low threat). Two measures of defensiveness were collected after participants received the feedback: an estimate of the average score received by other students at the university, and an estimate of their own creativity on a Likert scale. Participants who received the high-threat feedback estimated a lower average score among others and a greater amount of personal creativity, compared to participants in the low-threat condition. However, the size of the effect was considerably reduced among participants who had performed a values affirmation task before taking the test. The results suggest that threat generated by the negative feedback caused participants in the no-affirmation condition to construct a set of beliefs that allowed them to maintain a positive self-view, such as "the test was a poor indicator of creativity" and "other people would also perform poorly on the test." Participants in the affirmation condition experienced less threat because self-affirming beliefs were already salient, and therefore those participants had little motivation to construct self-serving beliefs. Crucially, the values affirmation task was only effective at reducing defensiveness when performed before the threat, not after.

Threat to self-view or identity is a powerful motivating force that can cause changes in beliefs and behavior. That motivation can be attenuated, by using values affirmation to reduce threat. It can also be directed, by using commitment to reinforce beliefs, thus increasing the likelihood of behavior change relative to belief change.

For the population of interest- owners of impaired shoreline properties- an objective evaluation of their shoreline's contribution to lake health may be a negative evaluation. Presenting them with that information could be expected to produce dissonance, because it

provides evidence that their behavior has been inconsistent with an important belief ("the lake is valuable"). It would also be expected to threaten self-view, because a negative evaluation of their shoreline implies negative feedback about the wisdom of their own past decisions.

The current study

The current experiment sought to encourage owners of impaired shoreline properties to improve their shoreline, by providing them with information about how its current state impacts overall lake health. The main dependent variable was intention to change.

The results of the self-perception bias field study (chapter 5) suggest that many shoreline property owners hold overly positive beliefs about their property's impact. Based on the results of chapter 1, overly positive beliefs about past shoreline decisions were hypothesized to be a barrier to behavior change for improved shoreline health. Providing participants with more accurate evaluations could help overcome that barrier, and increase the likelihood that an individual would take steps to improve their shoreline. However, conveying to owners of impaired properties the negative consequences of their actions would not only have informational implications for decision making, but also motivational.

In terms of cognitive dissonance, making individuals aware of the disparity between their beliefs (e.g. "the lake is valuable") and their actions (e.g. "my actions have harmed the lake") would be expected to cause them to change either their beliefs or their actions in order to make the two compatible. In terms of identity, the implication that they had made unwise decisions in the past would be expected to threaten self-view, causing defensiveness and motivating participants to construct a self-serving set of beliefs that restores self-view. Although the perspectives differ in mechanism, both offer the same warning for the proposed intervention.

Specifically, the motivational pressure aroused in individuals following negative feedback about their past shoreline maintenance decisions could cause those individuals to diminish their beliefs in the importance of shoreline vegetation, rather than changing their behavior.

One possible method for avoiding that possibility, and instead promoting the possibility that property owners will respond by changing their behavior, is to precede the delivery of feedback with a commitment task that will strengthens the recipient's beliefs about the importance of lake health and shoreline vegetation. The commitment task used was more similar to the hypocrisy paradigm (e.g., Dickerson et al., 1992) than to values affirmation studies (e.g., Cohen et al., 2006), because the targeted beliefs were about the world as opposed to the self. Although the paradigms share a common theoretical history, the goal of the commitment task differed from the goal of typical values affirmation tasks. Values affirmation in studies of academic achievement seeks to *reduce* identity threat by strengthening positive beliefs about the self and weakening stereotype beliefs. In contrast, the goal of the commitment task was to *direct* the motivation caused by threat at behavior change rather than belief change.

A paper survey was mailed to shoreline property owners, which contained biologically objective information about how the state of their shoreline impacts the lake. That information was delivered in the form of report from a shoreline assessment previously conducted by conservation professionals, or a score-it-yourself worksheet. A subset of participants did not receive that information; these participants served as a control condition. Half of the participants completed a commitment exercise before receiving the objective information. Following the treatments, participants responded to questions measuring A) their intentions to improve their shoreline, and B) belief in the importance of shoreline vegetation and its impact on lake health.

An interaction was predicted for intentions, such that participants who received objective information about their shoreline in conjunction with the commitment task were predicted to show an increase in intention to change their behavior, because the commitment task would prevent belief change as a strategy for resolving the dissonance aroused by the objective information. The intentions of participants who only received information were not predicted to differ from controls, because they could resolve the dissonance aroused by changing belief. The intentions of participants who only completed the commitment task were not predicted to differ from controls', because in the absence of objective information about their shoreline's contribution to the lake, self-perception bias was predicted to prevent them from recognizing their past behavior as potentially undesirable.

Interactions were also predicted for the items measuring beliefs in the importance of shoreline vegetation, and property owners' agency for affecting lake health. Reducing either or both of those beliefs would be one strategy participants could use to resolve dissonance aroused by the objective information about how their past shoreline maintenance decisions had adversely affected the lake. In the absence of commitment, providing negative feedback was predicted to decrease those two beliefs.

Method

Participants

Surveys were mailed to 1,000 individuals who owned residential lakefront property in Central Wisconsin. Participants in the current study were a subset of those reported on in chapters 2 and 3. 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. The protocol for this study was approved by the University of Wisconsin Education and Social/Behavioral Science Institutional Review Board.

Surveys were returned by 487 respondents, with an additional 26 surveys returned by the post office as undeliverable, yielding an effective response rate of 50.00%. Of those who returned surveys, 21 were unable to be matched to participant numbers, in some cases due to experimenter error and in others due to steps the participant had taken to protect their anonymity. As it was impossible to determine condition and/or lake for those participants, their data was excluded from analysis.

Respondents owned property on 25 different lakes; there was a median number of 14 participants per lake. Respondents reported a median length of property ownership of 21 years (sd = 18 years). Shoreline health scores, based on publicly available data from a county assessment (see chapter 3), were available for a subset of 353 participants.

Materials

A cover letter informing potential participants that they had been randomly selected for invitation to participate was included with the survey. The cover letter explained that the study had two goals: to better understand the opinions of lake property owners in Wisconsin, and to get feedback on different formats for printed communication about lake shoreline health.

The first 3 pages of the surveys included the belief and goal items discussed in chapter 2. They were immediately followed by an instruction page that was identical for all participants. It explained that the next section of the survey contained information about how their shoreline

contributes to overall lake health, and asked participants to please review it carefully in the order it appeared. Surveys were stapled to encourage participants to complete pages in order. The experimental materials, which varied by condition, followed the instruction page. Finally, two pages of dependent variables and manipulation checks followed the experimental materials. Experimental materials were inserted in the order listed below.

Commitment

The commitment task was implemented with a set of 5 survey items that addressed different reasons individuals might value the lake, shown in table 2.1. The items were chosen based on pilot testing, which suggested that most property owners would strongly agree with their propositions. An additional filler item was added to obscure the purpose of the manipulation. Items were presented in the order shown in the table, or a reversed order.

Table 2.1 – Commitment items
The beauty of the lake is what makes it great.
I enjoy bringing my friends and family to the lake.
The way I maintain my shoreline has an effect on the lake.
Plants and animals have a right to live at the lake.
Because I'm a property owner, I share responsibility for taking care of the lake.
Sometimes the lake is too full of algae. (FILLER)

Unlike other items on the survey, which collected responses on 7-point Likert scales, participants responded to the commitment questions by circling “Yes”, “No”, or “Don’t Know.” Like “push surveys” used by political groups and other donation-soliciting organizations, commitment items and their response set were not intended as a measurement instrument.

Rather, the commitment items were designed to (1) prompt participants to think about specific beliefs about the value of the lake and shoreline vegetation in a way that would make an affirmative response most likely, and (2) strengthen commitment to those beliefs through the act of circling "Yes."

The commitment items appeared on an informational flyer extolling the virtues of shoreline vegetation. Order of the items was reversed for half of the participants. An identical informational flyer, from which the commitment items had been removed, was also created for participants in the non-commitment conditions. Both flyers are available in appendix B.

Feedback

Information about how the state of each participant's shoreline contributed to overall lake health was provided with two instruments: a worksheet and a map. Both included a short paragraph at their top regarding the importance of shoreline vegetation, and contact information at their bottom with a phone number and website for participants interested in more information.

Worksheet. The worksheet invited property owners to evaluate their own shoreline. It guided attention through a list of features that positively and negatively affect shoreline health (e.g., shoreline vegetation, presence of coarse woody debris in the water, canopy cover). By encouraging attention to specific shoreline features, the worksheet aimed to reduce ambiguity in overall shoreline evaluations, and thus constrain opportunity for self-perception bias.

Features were chosen based on common limnological knowledge, and extensively reviewed by biologists and conservation professionals. Above all, the worksheet was designed to contain accurate information about the relationship of shoreline vegetation with lake health, but a

necessary balance was struck with simplicity in order to ensure it was accessible to all participants. The worksheet is shown in appendix B.

Participants were asked to assess each feature's prevalence on their own property, then circle a score for the feature. When finished a total score was summed, and then compared to ranges of scores that demarcated categories of shoreline quality. The categories were "very poor," "poor," "ok," and "great." The labeling of categories was deliberately chosen to encourage participants to strive to reach a higher category. For example, had the third category been labeled "good," participants scoring in that range may have felt little motivation to improve.

Map. Separate maps were created for each lake from which participants were recruited. Over a Google Earth base map, color-coded line segments were drawn around the perimeter of the lake to indicate shoreline health at each segment based on the previously conducted County Lake Assessments. The same four health categories that were used on the worksheet were also used on the maps. Property lines were drawn around all properties that bordered the lake, so that participants could easily locate their own property and that of their neighbors, to facilitate social comparison.

Although norms can be a powerful force for increasing conservation behavior, they also have the potential to decrease conservation behavior among individuals who are already above the mean (Cialdini, 2003). Environmental interventions can protect against such a "boomerang effect" by providing support for the desired behavior along both *descriptive norms* about what people typically do, and *injunctive norms* about what people ought to do (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Support for descriptive norms was provided by the primary map, which was large and centered on the page. Support for injunctive norms was provided by the labelling of the shoreline health categories, and also by a smaller map located in

the bottom right corner of the page. The small map appeared under the text "Goal: A healthier lake," and showed a map identical to the larger one but with each colored line segment shifted one category towards the "healthy" end of the spectrum. The small map was intended to provide injunctive normative information, in the form of an achievable goal. A sample map is included in appendix B.

Assumption check and materials assessments

The penultimate page of the survey contained nine items that measured differences in the effects of the experimental materials on participants. Participants rated their agreement with each item using a 7-point scale, where 1 indicated "strongly disagree" and 7 indicated "strongly agree."

The first item at the top of the page measured agreement with the statement "*I feel that it's important to take good care of the lake.*" The hypotheses tested in this experiment rest on the fundamental assumption that lake property owners agree with that statement. The position of this item was fixed for all participants.

The items shown in table 2.2 tested for differences in participants' reactions to the materials. If any by-condition differences were observed in the primary dependent variables, these items could provide insight into the supporting mechanism by which that effect was achieved. They were presented to half of the participants in the order listed, and reversed for the other half.

Table 2.2 – Materials Assessment Items
I can picture my lake with a healthier shoreline in the future.
The information highlighted the harm that poorly vegetated shorelines can do.
The information highlighted the value of shoreline vegetation.
Compared to other lakes, my lake is in pretty good health.
While reading the information, I thought about specific features of my personal shoreline.
I learned something I didn't know about how my shoreline contributes to lake health.
The information was presented in a way that made it interesting.
The information was easy to understand.

Dependent variables

The four primary dependent variables were located at the top of the final survey page. Dependent variables were always presented in the order listed below. Participants responded to all four items by indicating agreement on a 7-point Likert scale, where 1 indicated "strongly disagree" and 7 indicated "strongly agree."

Two items measured respondents' intentions to improve their shoreline area. The first item read *"I will consider increasing my shoreline buffer by planting new shrubs, grasses, or trees."* The second read *"I will consider increasing my shoreline buffer by extending the un-mowed or un-cut area further up onto the land."* A box was placed directly beneath the scale for each question, which participants could check to indicate *"Not applicable; my shoreline is already heavily vegetated."*

Two items measured beliefs predicted to be strongly related to support for shoreline vegetation. The first measured personal agency: *"How I maintain my shoreline affects the health*

of the lake." The second measured overall importance of shoreline vegetation: *"It is important that I grow a vegetated buffer along my shoreline."*

Demographics and miscellany

The final survey page collected demographic information on variables identified as potential moderators of the dependent measures, based on theory and the personal experiences of conservation professionals. Participants were asked to report the number of years they had owned their property as an open-ended response. The number of months per year that participants lived at their lake property was recorded as a multiple choice measure: (A) Year round; (B) 6-11 months; (C) 2-5 months; (D) less than 2 months. Participants were asked whether they have any children or grandchildren who swim or play at their property, and responded as multiple choice: (A) Yes, often; (B) Yes, occasionally; (C) No. The last question asked participants whether they or their spouse were the sole owners of the property; participants circled "Yes" or "No." A line was provided directly beneath the question, with a prompt asking participants who had circled "no" to describe their relationship to the owner.

Following the demographic items, lines were provided for participants to offer open-ended feedback in response to the prompt *"Do you have any other comments for us?"* Finally, the bottom of the page informed participants that based on their responses the study team may wish to contact them again for a short follow-up survey, or to provide them with information about programs or other opportunities. Two check-boxes allowed participants to opt out from future contact for either or both purposes.

Design

A 2 (commitment: performed/not-performed) x 2 (worksheet: present, absent) x 2 (map: present/absent) experimental design was used, as shown in table 2.3.

Table 2.3 – Experimental Design

	worksheet map	**worksheet ~~no map~~**	**~~no worksheet~~ map**	**~~no worksheet~~ ~~no map~~**
Commitment	commitment + worksheet + map	commitment + worksheet	commitment + map	commitment
~~No Commitment~~	worksheet + map	worksheet	map	-

Analysis

Responses to the assumption check were inspected. Participants who disagreed with the statement "*I feel that it's important to take good care of the lake"* were excluded from further analysis (rating < 4). Responses to the materials checks were plotted, and visually inspected for differences by condition.

T-tests assessed whether participants who checked the "does not apply, my shoreline is already heavily vegetated" box for the two intention questions had higher shoreline health scores than participants who did not.

Descriptive and bivariate statistics for the four dependent variables (intentions to plant, intentions to expand buffer, agency, and importance) were calculated, plotted, and inspected for normality.

The effect of condition on each DV was then separately analyzed twice: first by ANOVA, then by LME. The two analyses were somewhat redundant, but conducting both served

as a methodological exercise into differences between the approaches. The key difference between the analysis strategies involved the treatment of variance explained by participants' lake. For all analyses, the nominal level for significance was $\alpha = 0.05$ for planned comparisons, and $\alpha = 0.01$ for post hoc tests.

First, between-participant ANOVAs were conducted. ANOVAs included the three treatment factors and their interactions, as well as a factor for the main effect of lake which was not crossed with any others. Type III sums of squares were used because n was unbalanced. Marginal means and standard deviations are reported. Cohen's d is reported as a measure of effect size based on the marginal means. The corresponding model-adjusted mean differences are presented in text as β, with 95% confidence intervals.

Second, LME modeling was used. Each factor (commitment, worksheet, map) was entered as binary coded fixed effect, along with all two- and three-way interactions. Lake was entered in the model as a random intercept. Following the recommendation of Barr, Levy, Scheepers & Tily (2013), an initial model included the maximal random effect structure, crossing Lake with each fixed effect term in the model. Nonconverging models were progressively simplified by dropping correlations from higher-order random terms until convergence was reached[1]. Barr et al. (2013) found that procedure produced the fewest type I errors among alternative strategies tested with their simulations. Comparing general patterns and sizes of effects from the two complementary analyses (ANOVA and LME), across the set of four dependent variables, will further help protect against spurious inferences.

The effect of each treatment is presented as β, the mean difference between groups that received the treatment and those that did not. All means are adjusted for random effects, which in

[1] I.e., telling the model to not attempt estimating correlations between specific random intercepts and random slopes.

the current study are associated with idiosyncratic properties of particular lakes. Although questions of how norms vary from lake to lake are an important research topic, they are not the focus of this experimental investigation.

Confidence intervals at the $\alpha = 0.05$ level were constructed using the individual standard error for each effect. As of this writing, I am unaware of standardized measures of effect size for LME models, however within the current analysis betas may be compared as a relative measure of effect size because all DVs are on the same 7-point scale, and all predictors are treatment coded {0, 1}. Significance tests were conducted as model comparison using chi squared tests.

Results

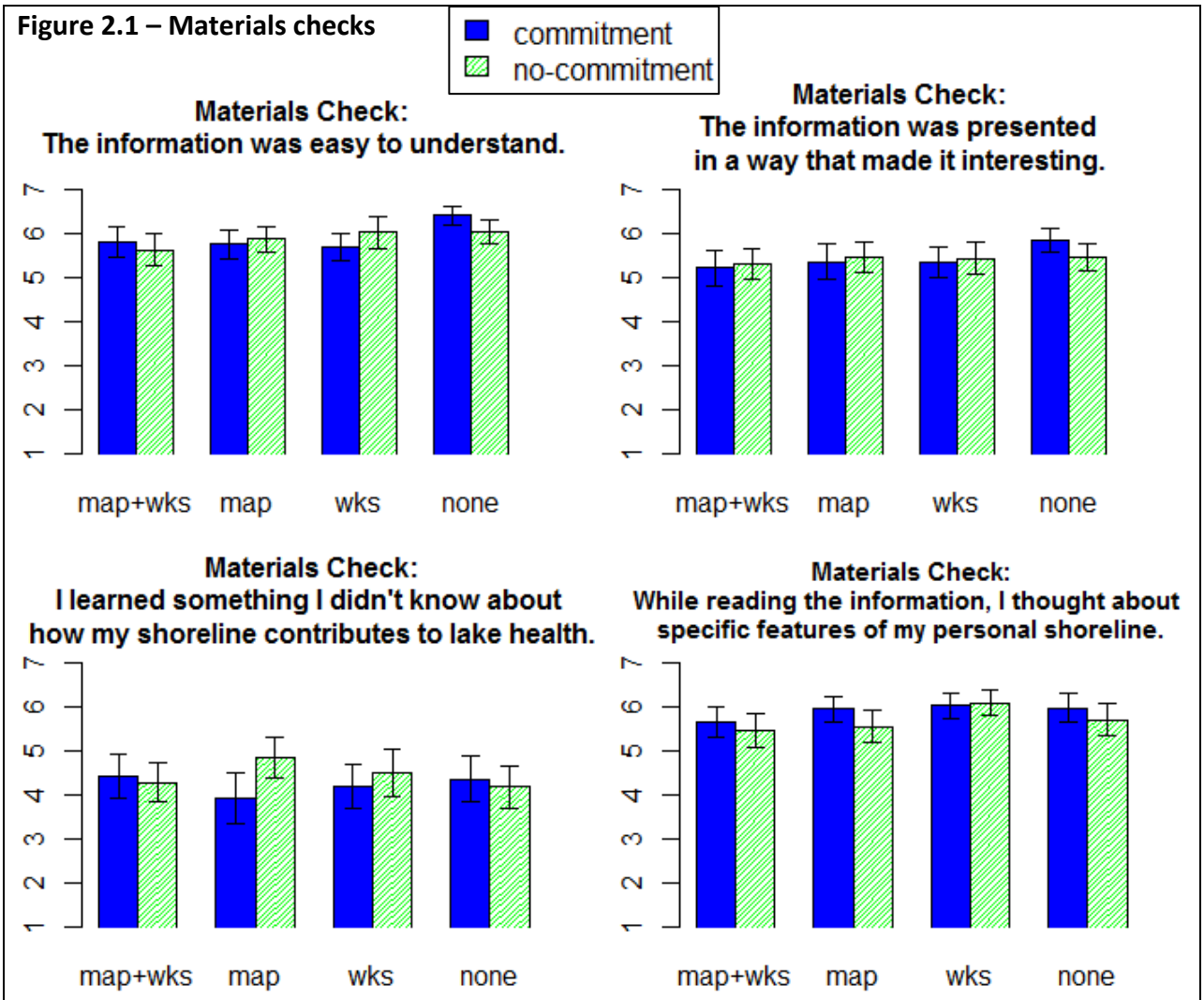
Assumption check

Nearly all participants agreed with the statement "*I feel that it's important to take good care of the lake.*" Only four participants entered a response of 4 or lower. Three participants skipped the item. Those 7 participants were removed from further analyses.

Materials checks

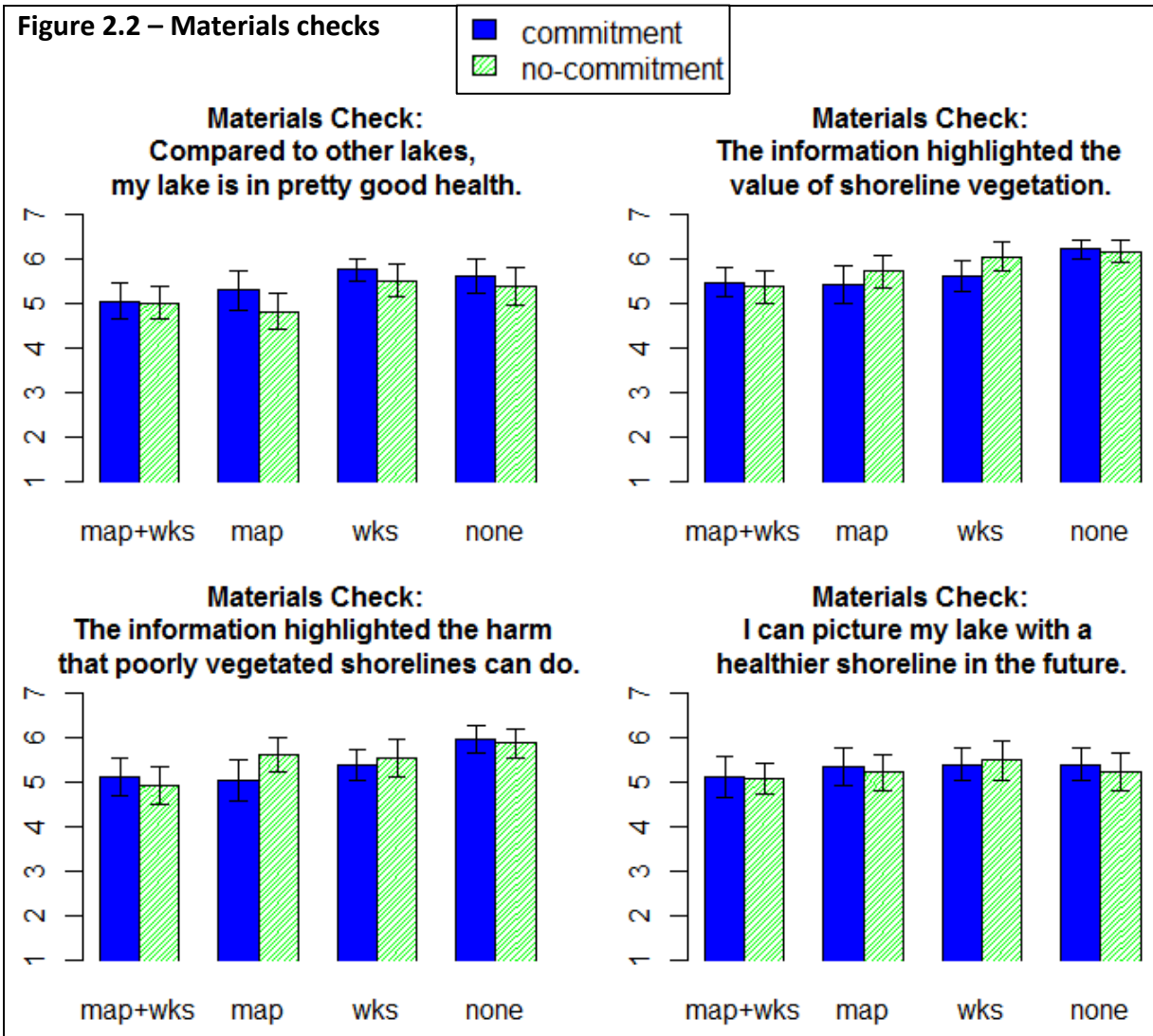
Participants' responses showed little substantial difference to the materials checks based on condition. Means and 95% confident intervals are plotted in figure 2.1 and 2.2.

Figure 2.1 – Materials checks



Errors bars show 95% confidence intervals, using individual standard errors.

Figure 2.2 – Materials checks



Errors bars show 95% confidence intervals, using individual standard errors.

Properties of the dependent variables

Histograms of responses to the four primary dependent variables are shown in figure 2.3. Ratings for the *intention-plant* variable (*"I will consider increasing my shoreline buffer by* ***planting*** *new shrubs, grasses, or trees"*) were provided by 319 participants passing the assumption check, with 110 participants checking "not applicable," and 52 participants leaving it blank. On average, participants who checked "not applicable" had better vegetated shorelines (M = 4.96, SD = 2.94) than participants who provided numeric ratings (M = 3.43, SD = 2.93), t(147) = 4.02.

For the *intention-extend* variable (*"I will consider increasing my shoreline buffer by* ***extending*** *the un-mowed or un-cut area further up onto the land"*), 270 participants provided responses, 128 checked "not applicable", and 61 left it blank. Similarly, participants who checked "not applicable" had better vegetated shorelines (M = 5.17, SD = 3.15) than participants who provided numeric ratings (M = 3.19, SD = 2.74), t(164) = 5.25.

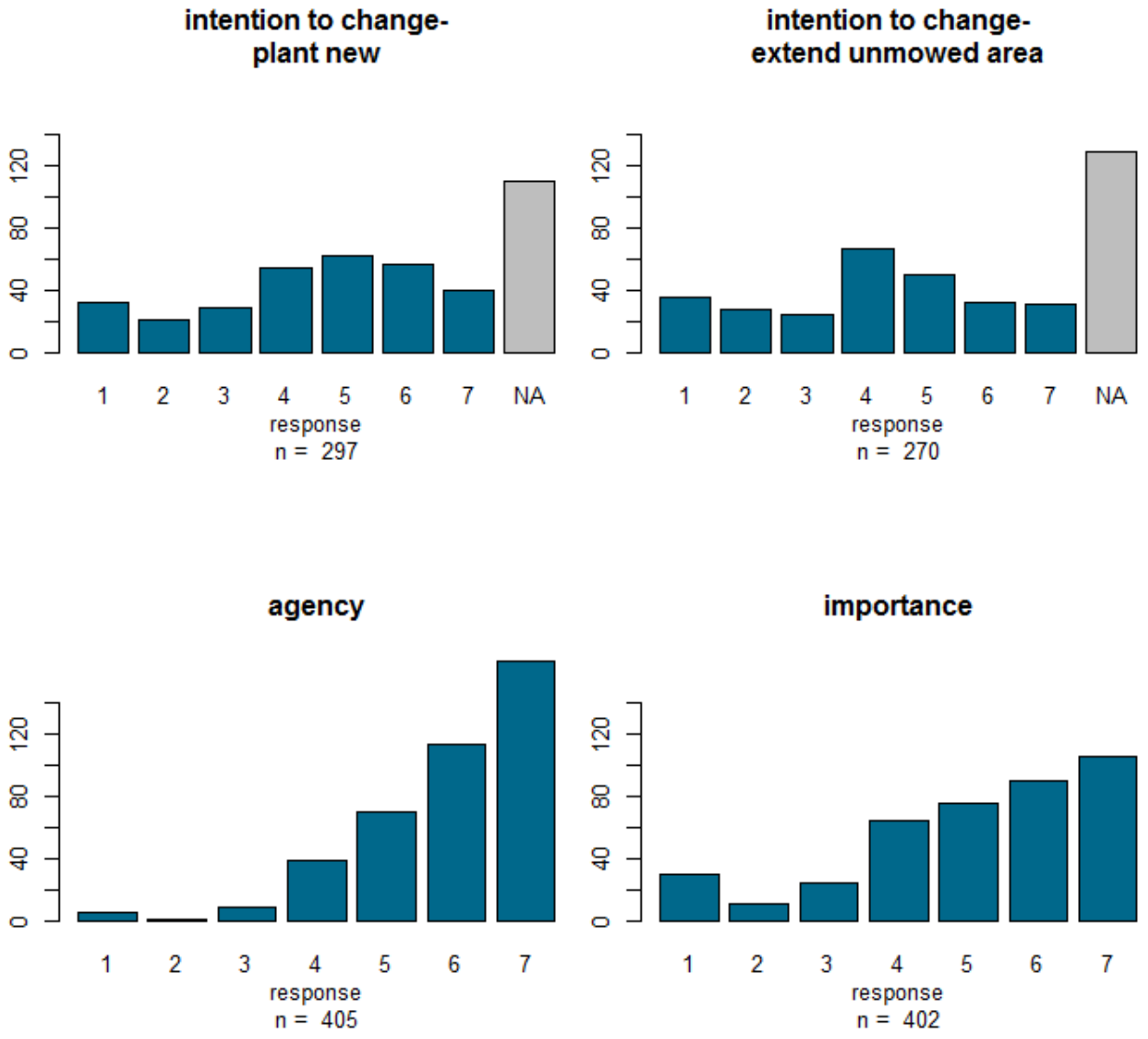
The intention variables were strongly correlated, Spearman's rho = 0.74. The supportive belief variables were similarly correlated, rho = 0.71[2].

Both intention-to-change variables had bimodal distributions: the majority of responses were distributed roughly symmetrically around the middle of the scale, with a small secondary peak at 1. The distributions of the *agency* and *importance* variables were both highly skewed to the left. Skew was most severe in the agency variable. Although both ANOVA and LME are robust to moderate violations of normality when sample sizes are large (Zuur, Ieno, Walker, Saveliev & Smith, 2009), the amount of skew present in these variables suggests that inferential

[2] An alternative analysis was conducted on a composite variable formed by averaging the intention items. The results of that analysis did not differ from the results of the analyses presented here.

findings from the parametric tests should be interpreted with caution, and complemented with additional tests that do not assume normality in the response variable (Hanlon & Larget, 2011).

Figure 2.3 – Histograms of dependent variables.



Intention to change: plant new shrubs, grasses or trees

ANOVA. Reported intentions to change varied marginally by lake, $F(30, 259) = 1.49$, $p = 0.05$. There was a main effect of map, $F(1,259) = 4.33$, $p = 0.04$, such that participants who received a map indicated greater intentions to change ($M = 4.59$, $SD = 1.81$) than participants who did not ($M = 4.24$, $SD = 1.87$), $d = 0.19$, $\beta = 0.88$, 95% CI = [0.05, 1.70]. That effect did not depend on the map X commitment interaction, $F(1, 259) = 1.66$, $p = 0.20$, $\beta = -0.79$, 95% CI = [-1.99, 0.41].

Contrary to predictions, none of the other main effects or interactions approached significance. Results of the ANOVA are presented in table 2.4. Condition means, standard deviations, and cell counts are presented in table 2.5. Means are plotted in figure 2.4.

Inspection of the group means suggested that participants who received none of the three treatments ($M = 3.78$, $SD = 1.77$) indicated the lowest intention to change, and participants who received all three treatments ($M = 4.82$, $SD = 1.75$) indicated the strongest. That post hoc hypothesis was significant, $t(77) = 2.66$, $p = 0.01$.

LME Analysis. The analysis revealed considerable variability in intentions by lake, but less in the effect of the experimental treatments by lake (table 2.6). That result is not surprising, given the very small number of participants in each condition on each lake (0 - 2). The initial model included a random intercept for lake, random slopes for the main effects of map, worksheet, and commitment within each lake, and random slopes for the interactions of all random terms within each lake (map X commitment, worksheet X commitment, map X worksheet, and map X worksheet X commitment). Suppressing correlations from all random slopes was required in order for the model to converge.

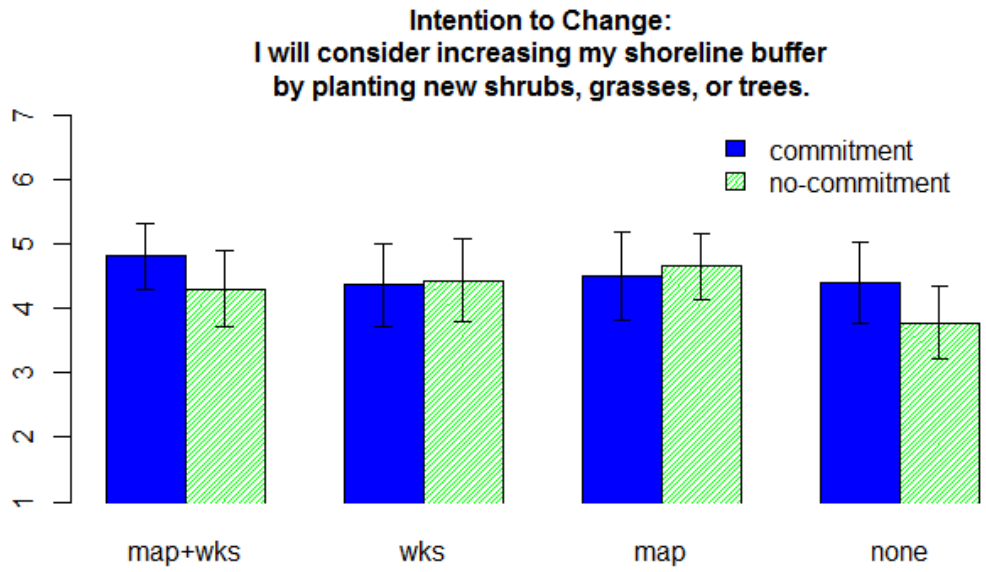
Participants who received a map indicated marginally greater intentions to improve their shoreline through planting new shrubs, grasses or trees, compared to participants who did not receive a map, $\beta = 0.87$, 95% CI = [0.06, 1.68], $t = 2.11$. Removing the fixed effect for map and its fixed effect interactions did not affect model fit, χ^2 (4, N=303) = 5.73, $p = 0.22$. No other fixed effects in the model approached significance.

Table 2.4 – ANOVA for *Intention-Plant New*

	Sum Sq	Df	F value	Pr(>F)
(Intercept) * *	43.98	1	13.62	0.0003
Map *	13.98	1	4.33	0.0385
Worksheet	6.28	1	1.94	0.1644
Commitment	7.00	1	2.17	0.1421
Lake	144.4	30	1.49	0.0538
Map X Worksheet	8.36	1	2.59	0.1088
Map X Commit	5.37	1	1.66	0.1985
Worksheet X Commit	3.05	1	0.95	0.3319
Map X Worksheet X Commit	7.70	1	2.39	0.1237
Residuals	836.6	259		

* indicates $p < 0.05$; ** indicates $p < 0.01$

Figure 2.4 – Condition means, *Intention-Plant New*



Error bars show 95% confidence intervals, calculated from individual standard errors.

Table 2.5 – Condition means, cell counts and standard deviations for *Intention – Plant New*. Means are not adjusted for the effect of lake.

MEAN	worksheet map	worksheet ~~no map~~	~~no worksheet~~ map	~~no worksheet~~ ~~no map~~
Commitment	4.82	4.37	4.52	4.39
~~No Commitment~~	4.31	4.44	4.66	3.78

STD. DEVIATION	worksheet map	worksheet ~~no map~~	~~worksheet~~ map	~~worksheet~~ ~~no map~~
Commitment	1.75	1.79	1.99	1.99
~~No Commitment~~	1.91	1.89	1.67	1.77

CELL N	worksheet map	worksheet ~~no map~~	~~worksheet~~ map	~~worksheet~~ ~~no map~~
Commitment	45	30	33	38
~~No Commitment~~	39	34	41	37

Table 2.6 – LME results for *Intention – Plant New*

	β	95% CI	SE	t
(Intercept) * *	3.79	[3.20, 4.38]	0.30	12.52
Map *	0.87	[0.06, 1.68]	0.41	2.11
Worksheet	0.65	[-0.20, 1.50]	0.43	1.50
Commitment	0.62	[-0.20, 1.44]	0.42	1.48
Map X Worksheet	-1.01	[-2.16, 0.15]	0.59	-1.71
Map X Commit	-0.75	[-1.91, 0.42]	0.59	-1.26
Worksheet X Commit	-0.68	[-1.89, 0.53]	0.62	-1.10
Map X Worksheet X Commit	1.36	[-0.31, 3.02]	0.85	1.60

* indicates $p < 0.05$; ** indicates $p < 0.01$

Intention to change: increase the unmowed area

ANOVA. Participants who received a map reported stronger intentions to extend the unmowed area of their property (M = 4.18, SD = 1.88), compared to participants who did not receive a map (M = 3.96, SD = 1.82), $F(1, 231) = 5.68$, $p = 0.02$, $d = 0.11$, $\beta = 1.10$, 95% CI = [0.19, 2.00]. Participants receiving the worksheet (M = 4.16, SD = 1.94) also reported marginally stronger intentions than other participants (M = 3.99, SD = 1.76), $F(1, 231) = 3.44$, $p = 0.07$, $\beta = 0.91$, 95% CI = [-0.05, 1.86].

The main effects of the map and the worksheet were qualified by a marginally significant interaction, $F(1, 231) = 3.45$, $p = 0.07$, $\beta = -1.23$, 95% CI = [-2.52, 0.07]. Intentions were moderately increased by the map or the worksheet, but receiving both offered little advantage over receiving either by itself. Results of the ANOVA are presented in tables 2.7 and 2.8, and plotted in figure 2.5.

No other factors or interactions were related to intention to extend participants' unmowed shoreline areas. As with the other intention variable, intentions were particularly low among participants who received none of the treatments (M = 3.43. SD = 1.72), compared to all other participants, (M = 4.15, SD = 1.86), $t(38) = 2.15$, $p = 0.04$, $d=0.39$.

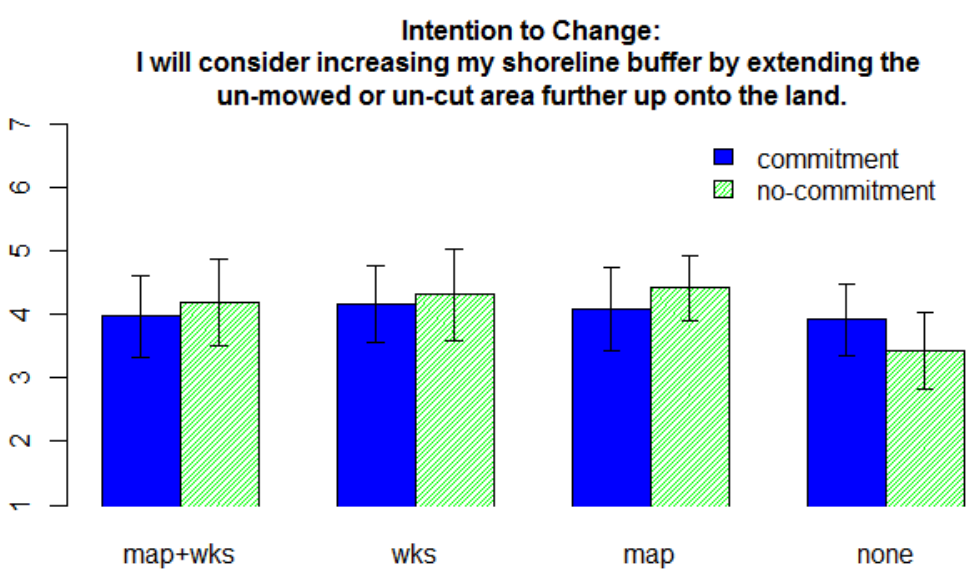
LME Analysis. The model was identical to that used for the other intention variable. Participants who received a map indicated stronger intentions to improve their shoreline by extending the unmowed area ($\beta = 1.00$, 95% CI = [0.13, 1.87], $t = 2.25$). Removing the fixed effect for map and its fixed effect interactions did not significantly reduce model fit, χ^2 (4, N=277) = 5.67, $p = 0.26$. The trends of effects for the worksheet and the map X worksheet interaction observed in the ANOVA were also apparent in the LME model. No other fixed effects in the model approached significance. Results are presented in table 2.9.

Table 2.7 – ANOVA for *Intention – Increase Area*

	Sum Sq	Df	F value	Pr(>F)
(Intercept) * *	46.92	1	14.15	0.0002
Map *	18.85	1	5.68	0.0179
Worksheet	11.40	1	3.44	0.0651
Commitment	2.81	1	0.85	0.3582
Lake	133.54	31	1.30	0.1434
Map X Worksheet	11.45	1	3.45	0.0644
Map X Commit	6.72	1	2.03	0.1561
Worksheet X Commit	3.31	1	1.00	0.3187
Map X Worksheet X Commit	2.72	1	0.82	0.3661
Residuals	766.08	231		

* indicates p < 0.05 ; ** indicates p < 0.01

Figure 2.5– Condition means, *Intention – Extend Area*



Error bars show 95% confidence intervals, calculated from individual standard errors.

Table 2.8 – Condition means, cell counts and standard deviations for *Intention – Extend Area*. Means are not adjusted for the effect of lake.

MEAN	worksheet map	worksheet ~~no map~~	~~no worksheet~~ map	~~no worksheet~~ ~~no map~~
Commitment	3.97	4.17	4.09	3.92
~~No Commitment~~	4.20	4.32	4.42	3.43

STD. DEVIATION	worksheet map	worksheet ~~no map~~	~~worksheet~~ map	~~worksheet~~ ~~no map~~
Commitment	2.01	1.66	1.89	1.79
~~No Commitment~~	2.04	2.06	1.60	1.72

CELL N	worksheet map	worksheet ~~no map~~	~~worksheet~~ map	~~worksheet~~ ~~no map~~
Commitment	37	30	32	37
~~No Commitment~~	35	31	38	30

Table 2.9 – LME results for *Intention – Increase Area*

	β	95% CI	SE	t
(Intercept) * *	3.44	[2.79, 4.10]	0.34	10.28
Map *	1.00	[0.13, 1.87]	0.44	2.25
Worksheet	0.92	[-0.02, 1.85]	0.48	1.93
Commitment	0.49	[-0.39, 1.37]	0.45	1.09
Map X Worksheet	-1.13	[-2.38, 0.11]	0.63	-1.78
Map X Commit	-0.83	[-2.05, 0.40]	0.63	-1.33
Worksheet X Commit	-0.69	[-1.98, 0.59]	0.65	-1.06
Map X Worksheet X Commit	0.78	[-0.98, 2.54]	0.90	0.87

* indicates $p < 0.05$; ** indicates $p < 0.01$

Agency to affect lake health

ANOVA. Neither the main effect of the map ($F(1, 366) = 2.37$, $p = 0.12$, $\beta = 0.26$, 95% CI = [-0.11, 0.90]) nor the main effect of the worksheet ($F(1, 366) = 2.74$, $p = 0.10$, $\beta = 0.43$, 95% CI = [-0.08, 0.95]) were significantly related to perceived personal agency for affecting lake health through their shoreline decisions. There was a significant main effect of commitment, $F(1,366) = 4.22$, $p = 0.04$, $\beta = 0.53$, 95% CI = [0.02, 1.03], such that participants who performed the commitment task reported higher agency ($M = 5.96$, $SD = 1.18$) than participants who did not ($M = 5.81$, $SD = 1.35$), $d = 0.12$.

In contrast to the intention measures, substantial variance was explained by the two- and three-way interactions (tables 2.10 and 2.11). Contrary to predictions however, actual differences between conditions were quite small. No overall pattern emerges from the data; instead the interaction terms seem to be capitalizing on random error to cancel each other out, $\beta_{\text{Map X Worksheet}} = -0.95$, 95% CI = [-1.66, -0.23]; $\beta_{\text{Map X Commit}} = -0.67$, 95% CI = [-1.38, 0.04] ; $\beta_{\text{Worksheet X Commit}} = -0.72$, 95% CI = [-1.43, -0.01] ; $\beta_{\text{Map X Worksheet X Commit}} = 1.15$, 95% CI = [0.15, 2.15]). The most parsimonious interpretation of the results is that the relatively high number of participants in each marginal cell may have led to an overly sensitive analysis. Means are shown in figure 2.6.

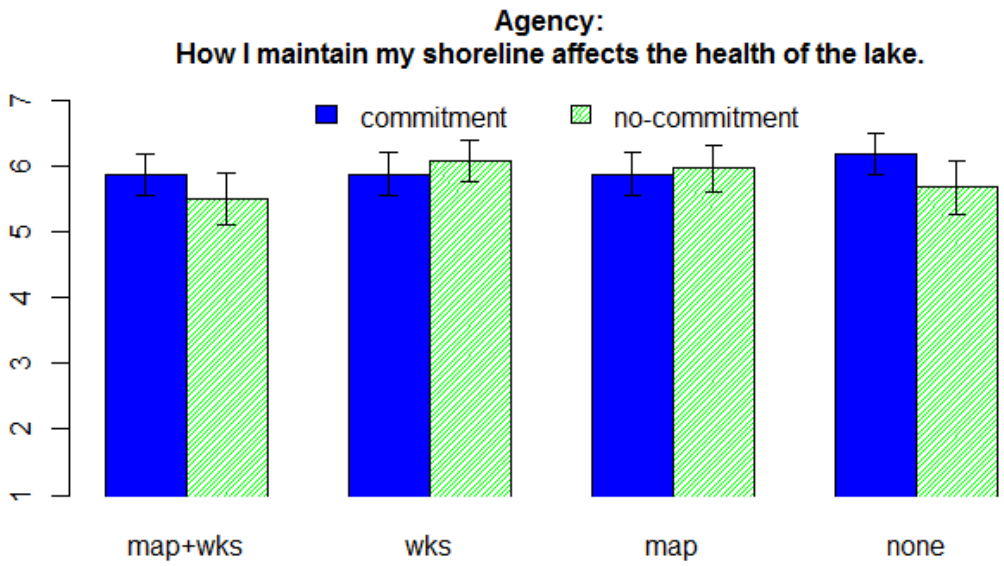
LME. The model was identical to that used for the intention variables. Results were qualitatively similar to the ANOVA, and presented in table 2.12. The main effects of map and worksheet were associated with positive, but non-significant, increases in reported perceived efficacy. The main effect of commitment was associated with a more reliable increase ($\beta = 0.50$, 95% CI = [0.01, 0.99]). Negative betas for the two-way interaction terms and a positive beta for the three-way interaction indicated that receiving two or more treatments offered no additional benefit beyond the first.

Table 2.10 – ANOVA for *Agency*

	Sum Sq	Df	F value	Pr(>F)
(Intercept) * *	276.48	1	174.80	< 0.0001
Map	3.74	1	2.37	0.1248
Worksheet	4.33	1	2.74	0.0990
Commitment *	6.68	1	4.22	0.0405
Lake	55.02	31	1.12	0.3029
Map X Worksheet * *	10.63	1	6.72	0.0099
Map X Commit	5.42	1	3.43	0.0650
Worksheet X Commit *	6.32	1	4.00	0.0463
Map X Worksheet X Commit *	8.10	1	5.12	0.0242
Residuals	578.89	366		

* indicates p < 0.05 ; ** indicates p < 0.01

Figure 2.6 - Condition means for *Agency*



Error bars show 95% confidence intervals, calculated from individual standard errors.

Table 2.11 – Condition means, cell counts and standard deviations for *Agency*. Means are not adjusted for the effect of lake.

MEAN	worksheet map	worksheet ~~no map~~	~~no worksheet~~ map	~~no worksheet~~ ~~no map~~
Commitment	5.88	5.89	5.88	6.18
~~No Commitment~~	5.52	6.09	5.98	5.69

STD. DEVIATION	worksheet map	worksheet ~~no map~~	~~worksheet~~ map	~~worksheet~~ ~~no map~~
Commitment	1.17	1.24	1.19	1.14
~~No Commitment~~	1.45	1.07	1.27	1.50

CELL N	worksheet map	worksheet ~~no map~~	~~worksheet~~ map	~~worksheet~~ ~~no map~~
Commitment	52	54	51	50
~~No Commitment~~	52	46	49	51

Table 2.12 – LME results for *Perceived Agency*

	β	95% CI	SE	t
(Intercept) * *	5.69	[5.34, 6.03]	0.18	32.26
Map	0.30	[-0.19, 0.79]	0.25	1.20
Worksheet	0.40	[-0.10, 0.91]	0.26	1.56
Commitment *	0.50	[0.01, 0.99]	0.25	2.00
Map X Worksheet *	-0.86	[-1.56, -0.16]	0.36	-2.42
Map X Commit	-0.59	[-1.29, 0.10]	0.35	-1.68
Worksheet X Commit	-0.69	[-1.38, 0.00]	0.35	-1.95
Map X Worksheet X Commit *	1.13	[0.15, 2.11]	0.50	2.27

* indicates $p < 0.05$; ** indicates $p < 0.01$

Importance of shoreline vegetation

ANOVA. There was an overall effect of lake on participants' ratings of the importance of shoreline vegetation, $F(31, 363) = 1.96$, $p < 0.01$. Means for individual lakes ranged from 3.58 to 6.31, and are presented in table 2.16.

Participants who received a worksheet ($M = 5.13$, $SD = 1.69$) indicated that they felt it marginally more important to grow shoreline vegetation than participants who did not receive a worksheet ($M = 5.02$, $SD = 1.86$), $F(1, 363) = 4.12$, $p = 0.04$, $d = 0.06$, $\beta = 0.72$, 95% CI = [0.02, 1.42]. That main effect was qualified by a map X worksheet interaction, $F(1, 363) = 4.14$, $p = 0.04$, $\beta = -1.01$, 95% CI = [-1.99, -0.04], providing further evidence that receiving more than one form of feedback offered little advantage over receiving only one .

As with the agency and intention variables, any effect that receiving a worksheet may have had on perceived importance was non-additive with the effect of the map. No other terms approached significance. Results of the ANOVA are presented in tables 2.13 and 2.14. Means are presented in figure 2.7.

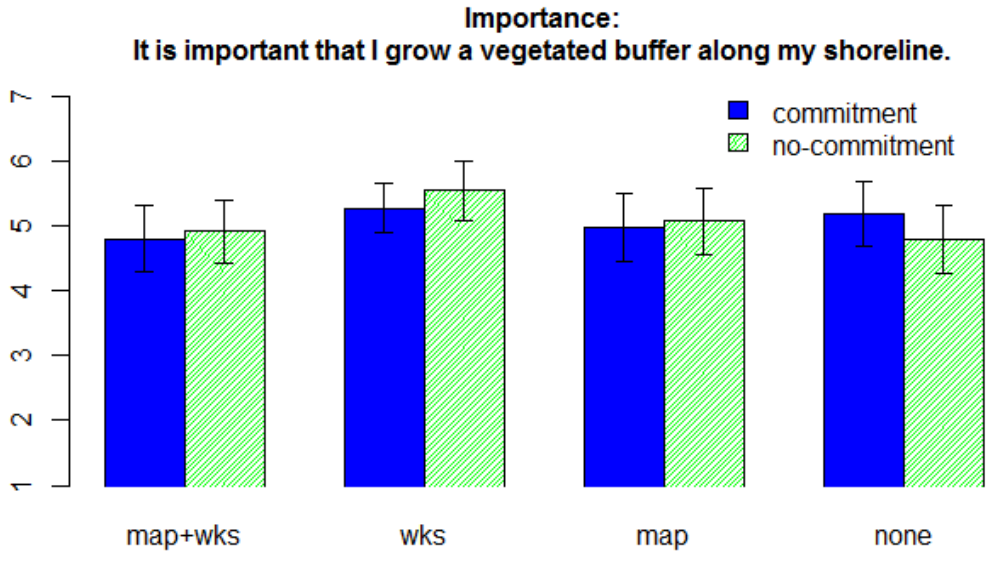
LME. The model was identical to that used for the intention variables. The overall effect of the manipulations on perceived importance of growing shoreline vegetation was characterized by a marginal positive effect of the worksheet ($\beta = 0.64$, 95% CI = [-0.05, 1.33]), and a marginal negative effect of receiving both the worksheet and the map ($\beta = -0.88$, 95% CI = [-1.84, 0.08]). Although none of the other main effects or interactions approached significance, the direction of their effect was consistent with the conclusion that any single treatment moderately increased perceived importance, but additional treatments yielded little additional increase. Results of the LME analysis are presented in table 2.15.

Table 2.13 – ANOVA for *Importance*

	Sum Sq	Df	F value	Pr(>F)
(Intercept) **	159.04	1	54.48	0.0000
Map	3.91	1	1.34	0.2481
Worksheet *	12.01	1	4.12	0.0432
Commitment	4.49	1	1.54	0.2158
Lake **	177.21	31	1.96	0.0021
Map X Worksheet *	12.09	1	4.14	0.0425
Map X Commit	3.07	1	1.05	0.3059
Worksheet X Commit	4.76	1	1.63	0.2022
Map X Worksheet X Commit	2.39	1	0.82	0.3664
Residuals	1059.58	363		

* indicates p < 0.05 ; ** indicates p < 0.01

Figure 2.7 – Condition means for *Importance*



Error bars show 95% confidence intervals, calculated from individual standard errors.

Table 2.14 – Condition means, cell counts and standard deviations for *Importance*. Means are not adjusted for the effect of lake.

MEAN	worksheet map	worksheet ~~no map~~	~~no worksheet~~ map	~~no worksheet~~ ~~no map~~
Commitment	5.88	5.89	5.88	6.18
~~No Commitment~~	5.52	6.09	5.98	5.69

STD. DEVIATION	worksheet map	worksheet ~~no map~~	~~worksheet~~ map	~~worksheet~~ ~~no map~~
Commitment	1.17	1.24	1.19	1.14
~~No Commitment~~	1.45	1.07	1.27	1.50

CELL N	worksheet map	worksheet ~~no map~~	~~worksheet~~ map	~~worksheet~~ ~~no map~~
Commitment	52	54	51	50
~~No Commitment~~	52	46	49	51

Table 2.15 – LME results for *Perceived Importance*

	β	95% CI	SE	t
(Intercept) * *	4.80	[4.29, 5.31]	0.26	18.48
Map	0.34	[-0.34, 1.02]	0.35	0.99
Worksheet	0.74	[0.05, 1.42]	0.35	2.10
Commitment *	0.43	[-0.25, 1.10]	0.35	1.23
Map X Worksheet *	-0.96	[-1.93, 0.00]	0.49	-1.96
Map X Commit	-0.51	[-1.46, 0.45]	0.49	-1.04
Worksheet X Commit	-0.66	[-1.61, 0.29]	0.49	-1.35
Map X Worksheet X Commit *	0.65	[-0.7, 2.00]	0.69	0.94

* indicates $p < 0.05$; ** indicates $p < 0.01$

Table 2.16 – Perceived importance of shoreline vegetation, by lake					
	mean	**sd**		**mean**	**sd**
White River Flowage	6.31	0.75	Fish	5.00	2.22
West Branch White River	6.18	0.98	Napowan	5.00	2.24
Round	6.08	1.16	Witters	4.94	1.92
Tree	6.08	1.08	Pearl	4.94	1.81
Porters	6.00	1.04	Morris	4.92	1.62
Wadley	6.00	1.41	Bughs	4.90	1.66
Wilson	5.79	1.12	Long-Saxville	4.89	2.05
Big Bass	5.63	1.30	Pine	4.82	1.47
Spring	5.46	1.61	Pine - Hancock	4.73	2.19
Gilbert	5.42	1.31	Kusel	4.73	1.56
Emily	5.33	1.61	Alpine	4.50	2.02
Huron	5.31	1.84	Johns	4.40	2.07
Hills	5.23	1.48	Silver	4.33	2.26
Helen	5.12	2.03	Twin	3.90	2.08
Pike	5.10	1.70	Irogami	3.71	1.54
Little Hills	5.08	1.68	Big Silver	3.58	1.95

Summary of Results

The results suggest that providing shoreline property owners with information about how their current shoreline state affects lake health can produce a small-to-moderate increase in intentions to change. For both intention variables there were significant, positive effects of the map and similar, but slightly less reliable, effects of the worksheet.

Overall, however, the experimental predictions were not supported by the preceding analyses. Participants' intentions to improve their shoreline were not defined by the map X commitment interaction, nor by the worksheet X commitment interaction. Both intention variables were higher among participants who received feedback information, but the effects did not depend on whether or not commitment had been performed.

Contrary to the predictions that the map and the worksheet would increase intentions only when commitment was performed, and decrease beliefs in importance and efficacy only when it was not, the overall pattern of results suggests that receiving any treatment (map, worksheet, or commitment) moderately increased intentions and supportive beliefs, with little effect of additional treatments beyond the first.

Many terms in the ANOVAs and LME analyses had substantial mean differences, but low reliability estimates due to considerable variability around cell means. That result suggests large individual differences between participants, in terms of their overall intentions as well as any potential responses treatments, may have obscured effects. Large individual differences are not surprising, given the variability in shoreline management practices found by the lake assessments used to generate the maps (and the shoreline impact scores in chapter 3).

Additionally, all four of the dependent variables were characterized by non-normality (figure 2.1). While non-normality was low among the intention variables, both of their distributions included an unexpectedly large proportion of participants at the very low end of the scale, suggesting the true distribution was bimodal. Non-normality was far worse in the supportive belief variables; the majority of participants responded at the top of the scale, with only a small proportion responding below the midpoint. An alternative analysis strategy to cope with those distributional assumption violations is to dichotomize each outcome variable, and re-analyze it using logistic regression. Such an analysis was performed, but is not reported here because results did not qualitatively differ from those already reported.

Discussion

Several potential explanations exist for the lack of meaningful differences in intentions or intention-supporting beliefs across the experimental conditions.

One possibility is that the commitment task was ineffective as a manipulation. Successful applications of commitment in previous research (e.g., Dickerson et al., 1992; Aronson, Fried, & Stone, 1991) as well as values affirmation (e.g., Steele & Liu, 1983; Miyake et al., 2010) have all used more overt methods to elicit commitment from participants. Participants in Dickerson et al. (1992) printed their name on a sign, publicly declaring their commitment. Participants in other experiments have written essays on the to-be-reinforced beliefs.

In contrast, participants in the current experiment simply circled the word "yes." The mailed survey methodology precluded a time-consuming essay task, and substantial confidentiality concerns and logistical limitations precluded eliciting a public commitment. The "push-survey" task was intended to serve the same purpose as those more established tasks, but the results suggest no evidence that it was effective. Although a very weak main effect of commitment was observed on the agency measure, the key hypothesis was that commitment would enhance the effect of feedback. That pattern of results was not observed.

It is impossible to know from these data whether the push-survey commitment task is inherently ineffective, or whether the presence of so many other survey items measuring similar constructs served the same purpose (i.e., belief and goal questions for the correlational analysis in chapter 3). It may be the case that by simply completing the survey, all participants had recently performed commitment whether they were nominally in a commitment condition or not.

If so, any ability to detect an effect due to the five additional "commitment" questions would have been extremely slim.

While it is possible that the push-survey was insufficient to achieve the desired manipulation, it may also be the case that the feedback materials failed to successfully deliver information to participants about the impact of their past shoreline decisions. Participants may have disregarded the map and the worksheet. Some participants wrote comments suggesting that they thought the materials were inaccurate, or "biased." While it was often not clear what precisely they found to be biased, it was quite clear that a small but substantial number of participants did not believe the feedback materials were a valid source of information.

Participants' comments also suggested another, more fundamental problem for the experiment. Although many comments expressed support for the study and its goals, a substantial number of participants and potential participants were very displeased by the survey. They were so sufficiently displeased that they communicated their concern to the study team, to the Dean of the College, to the University Chancellor's office, and to their state legislators. Common themes of these communications included perceived duplicity by the study team about the true goals of the research, and language about the rights of property owners to manage their property without interference from the government.

Those types of comments suggest that the type of threat the commitment task was intended to address – threat to self-view from negative feedback about the merit of one's own past actions – was misguided. To the extent that it was aroused at all, the magnitude of effect on behavior of that threat paled in comparison to a much greater threat, identified by Brehm (1966) as reactance.

Reactance Theory (Brehm, 1966) postulates that "reactance" is a motivational force which arises in response to threats to freedom. Such threats can be aroused when a person feels pressured to think or act in a particular way. Individuals in a reactant state feel motivated to act in a way that is counter to the way they are being pressured to act. The theory is similar to Self-Determination Theory (Ryan & Deci, 1985; 2000), in that both theories recognize autonomy as a basic human need. However, divergent empirical evidence supports differences in the two theories' definitions and conceptualizations of "autonomy" (Koestner & Losier, 1996; Pavey & Sparks, 2009). The ability to competently act is the major component of autonomy in the Self-Determination conceptualization, while the Reactance Theory conceptualization focuses primarily on freedom to choose.

Any persuasive communication has the potential to threaten autonomy. The magnitude of reactance aroused is moderated by several factors. One is the extent to which the message recipient believes the message producer is attempting to persuade them. Another is the degree to which recipients believe the producer is being honest about their intentions, or attempting to covertly influence their behavior. Third, reactance is greatest in response to persuasive communication from authoritative individuals and institutions, as opposed to communications lacking in formal authority (Brehm & Brehm, 1981; Frankel & Morris, 1976; Pennebaker & Sanders, 1976).

For a substantial subset of participants, this experiment hit all three of those buttons. They believed the study was a dishonest attempt by government agents to tell them how to manage their property, under the guise of a sham research study, with potential penalties of legal enforcement against individuals who did not comply.

Informing a property owner that they have managed their shoreline unwisely may threaten self-view, but it is likely much more strongly to threaten autonomy. Freedom to make decisions about one's own property is a deeply held cultural value in the United States. Perceived infringements on that threat to their freedom may be seen not only as offensive, but potentially even taboo, making reactance even higher than it otherwise would be (Tetlock, Kristel, Elson, Green, & Lerner, 2000; Tetlock, 2003). Future research should explore strategies for reducing threats to autonomy in communications with private property owners about how their decisions affect shared resources, as well as factors that may moderate the threat such as ideology and other individual differences.

One of the strongest predictors of future behavior is often past behavior (Ajzen, 1991). Yet, the influence of past behavior is not fully mediated by attitudes nor by intentions (Ouellette & Wood, 1998). This tendency has been referred to as "resistance to change" in applied and organizational psychology. The term is credited to psychologist Kurt Lewin, who understood human behavior as a dynamic interaction of personal and contextual factors. Integrating those factors in a systems approach known as field theory, Lewin recognized that forces for homeostasis could arise from many different sources within the system, resulting in apparent resistance to change (Lewin, 1951). Lewin viewed resistance to change as a tendency of social systems, a tendency often supported by forces outside the individual. Dent & Goldberg (1999) argue that despite Lewin's original conceptualization, popularization of the term and its adoption by managers have led to a meaning shift in which "resistance to change" is often accepted as a received truth about human decision making, without consideration of mechanism. In fact, however, multiple mechanisms have been proposed to explain our past's influence over our future.

As the human population continues to grow and develop new areas, and the effects of climate change become more pronounced, the pressure for responsible management of shared environmental resources will also increase. Communication between experts and critical lay stakeholders is and will continue to be necessary. A theoretically informed and empirically validated understanding of how individuals perceive and act on information about their own past behaviors, in the context of a publicly desired change in future behavior, will contribute to successful resource management.

Chapter 3

Beliefs and Goals

Abstract

Individual differences in shoreline maintenance behavior are likely partially attributable to individual differences in property owner beliefs and goals. Several theoretical perspectives of environmental behavior make predictions about the types of beliefs and goals that determine shoreline behavior. These include basic values, biospheric beliefs, and Goal-Framing Theory, as well as perspectives which emphasize the social norms. The perspectives are discussed within a broad model linking hierarchical beliefs to behavior. A survey mailed to residential lake property owners in Wisconsin, USA (n = 566, response rate = 51%) measured individual differences in the importance of 11 goals and agreement with 20 statements of belief. Exploratory factor analysis revealed that variance in responses was best summarized using 2 goal factors and 2 belief factors. Factors were inspected for cohesion and interpreted as distinct dimensions of belief or goal structure. The resulting goal factors were identified as Personal Benefit Goals and Lake Health goals. The resulting belief factors were identified as Stewardship beliefs and Prescriptive Normative beliefs.

Antecedents of Shoreline Behavior

While many lakefront property owners choose to contribute to lake health by maintaining a vegetated shoreline, others choose to maintain their shoreline in a state that does not support lake health, such as a mowed lawn or created beach. One potential cause of those differences in behavior may be differences in beliefs.

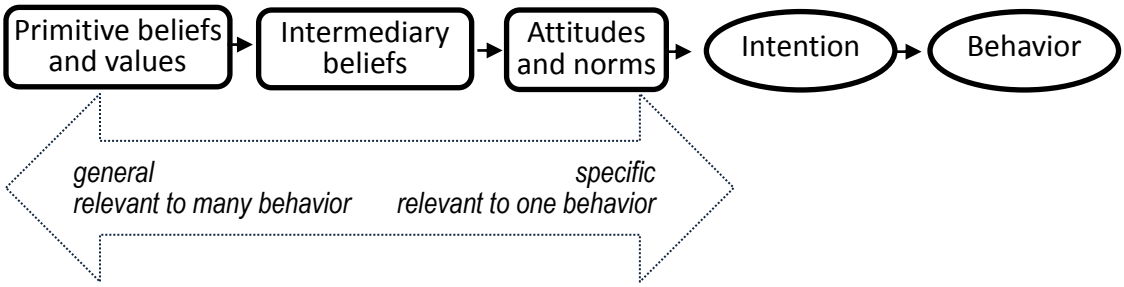
Researchers choose the level of specificity at which they measure the antecedents of behavior, from primitive beliefs to attitudes. The potential set of beliefs that determine shoreline maintenance decisions could range from broadly general beliefs that influence many types of behaviors, such as belief in the virtue of protecting nature, to highly specific beliefs that are only relevant to decisions about one's personal shoreline, such as a belief that one's children enjoy playing on their own personal sandy beach. Given the applied goal of making recommendations to lake mangers and environmental educators about discrete beliefs that both A) are causally related to shoreline maintenance behavior and B) have a realistic likelihood of being changed, an intermediary level of analysis is most appropriate.

Many theories of intentional behavior posit that beliefs have a causal role in determining behavior. For example, Fishbein (1963) argued that the relationships of beliefs to a particular behavior were mediated by an individual's attitude towards that behavior, with attitudes conceptualized as composite beliefs made from sets of simpler beliefs. For example, the belief "it is important that I grow a vegetated buffer" can be considered a composite belief because it is causally dependent on other beliefs, such as beliefs about the ecological consequences of growing a vegetated buffer, and beliefs about the valence of those consequences. Fishbein's ideas on beliefs and attitudes were eventually developed into the Theory of Planned Behavior

(TPB) (Ajzen, 1985), which posits that the relationship of attitude and behavior is itself mediated by intention.

Attitudes have greater predictive validity for explaining a particular behavior than the simpler beliefs from which they are composed, because by definition attitudes take into account multiple simple beliefs that are relevant to the specific behavior in question. Alternatively, however, predicting how an individual will behave across a variety of behaviors is more accurately predicted by primitive beliefs. Bem (1970) described primitive beliefs as foundational "axioms upon which other beliefs are built," and Rokeach (1968a) posited that "a person's primitive beliefs represent his basic truths about physical reality, social reality, and the nature of the self..." Primitive beliefs are general, transcending particular situations and contributing to many specific attitudes. Rokeach (1968b) further argued that studying values, defined as a type of primitive belief that includes preference for a particular mode of conduct or end state, would provide a more parsimonious tool for explaining differences in behavior than studying attitudes, because values are more causally central as well as fewer in number. The moral norm-activation theory of altruism (Schwartz, 1973; 1977) and the value-belief-norm theory (VBN) (Stern et al., 1999; Stern, 2000) are both examples of models that exploit the hierarchical nature of beliefs in order to explain variance in behavior. Figure 3.1 provides a rough schematic of the hierarchical relationship among beliefs, attitudes and behavior.

Figure 3.1 – Hierarchy of beliefs, from general to specific. Basic values and biospheric beliefs are located at the far left of the figure. Goals operate perpendicularly to the figure, affecting the relevance of beliefs for a particular behavior.



Theoretical and applied research aims

An applied aim of the current research was to improve understanding of which beliefs and goals are most strongly related to individual differences in lake property owners' shoreline management decisions. Providing a better understanding of that decision making process will allow lake mangers and environmental educators to communicate more effectively about the importance of shoreline vegetation.

Beyond that applied aim, the topic is also important as an understudied exemplar of the category of contextually situated environmental behavior. Psychologists from a diversity of perspectives have proposed theoretical frameworks for the broad category of environmental behaviors. Although the range of possible environmental behaviors is vast, many empirical studies investigate behavior from a narrow set of possibilities. Recycling behavior, transportation choices, energy/water conservation, and concern among climate change are among the most commonly studied (see appendix A). In contrast, very few controlled studies have investigated the psychological and social factors that determine shoreline maintenance decisions. While focusing on a restricted set of behaviors has the advantage of promoting comparison across

studies on the same topic, a disadvantage is that conclusions may not generalize to other types of environmental behavior. By enhancing the diversity of empirically studied environmental behaviors, the current research aims to contribute to the literature by improving confidence in the generalizability of theoretical claims.

This study draws on five distinct but overlapping theoretical perspectives to measure hypothesized antecedents of shoreline maintenance behaviors, among a population of critical stakeholders. These theories are summarized below, and discussed in detail in appendix A[1]. These theoretical approaches are viewed as complementary rather than competing in the current research, which seeks to capitalize on the distinct dimensions and processes proposed as important by each theory in the context of the generally accepted model of how beliefs are related to behavior outlined in Figure 3.1. In addition to the theoretical constructs predicted by psychologists to be related to environmental behavior, the study also measures beliefs that local conservation officials felt were important, based on their experiences.

Basic Values

Values, which Rokeach considered a type of primitive belief, are highly abstract and vary little across situations for an individual, causally affecting behavior by influencing a hierarchy of increasingly specific beliefs (Stern, Dietz, Abel, Guagnano, & Kalof, 1999; Stern, 2000; Nordlund & Garvill, 2002). The Theory of Basic Values (Schwartz, 2010) proposes a set of ten basic values that are common across all humans and can be summarized along two primary dimensions: 1) openness-to-change with willingness for independent self-direction, and 2) emphasis on the greater good over self-interest. In Schwartz's framework, individual differences

[1] Committee members will recognize much of the text in Appendix A from the author's preliminary exam.

in behavior arise from differences in values. Schwartz's second dimension is frequently found to be more strongly related to pro-environmental behaviors than the first (e.g., Stern, Dietz, Kalof, & Guagnano, 1995). The second dimension can be characterized as a continuum from self-transcendence to self-enhancement.

Biospheric Beliefs and Environmental Attitudes

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 only to the extent that they are aware of benefits it provides to them and needs that it satisfies. Clayton and Opotow (Eds.) (2003) present a range of empirical evidence showing that differences in how individuals perceive their relationships with the natural world are correlated with moral and social environmental judgments.

The New Environmental Paradigm scale (Dunlap & Van Liere, 1978) and its successor, the New Ecological Paradigm scale (Dunlap, Van Liere, Mertig, & Jones, 2000) (both called the NEP), were created to assess individuals' worldviews on the relationship of humans to nature. Factor analysis frequently, but not always, suggests three distinct subcomponents: A) belief in the rights of humans versus animals and plants, B) belief in the resilience of earth's natural systems, and C) whether the earth can support limitless human growth and development. Evidence suggests that belief in a biospheric worldview, in which nature is valued for its own sake, is a distinct value from altruism (De Groot & Steg, 2008). The first dimension of the NEP is often used as a measure of important aspects of the biospheric worldview.

The Environmental Attitudes Scale (EAS) (Ebenbach, Moore, & Parsil, 1998; Ebenbach, 1999; Kortenkamp & Moore, 2001; Kortenkamp & Moore, 2006) uses two subscales to measure the extent to which individuals are motivated to act pro-environmentally. The EAS separately measures internal and external motivation, and has been found to be a better predictor of environmental attitudes and pro-environmental behaviors than scales that do not take motivation into account (Ebenbach, 1999). This scale differs from the others by not including specific environmental issues.

Goals

A property owner's goals may be a key determiner of which beliefs are most relevant for shoreline decisions. Goals are motivational forces to approach a particular end state or manner of conduct, often based on values. Individuals often have more than one goal active simultaneously. Lindenberg and Steg (2007) argue that when a particular goal is focal, it selectively activates a knowledge structure and guides attention, creating a "goal-frame" that is used to evaluate behavioral options. Criteria for evaluating options depend on three broad categories of goals: A) *gain goals* that support behavioral options likely to protect or increase personal resources, B) *hedonic goals* that support behaviors offering immediate personal satisfaction, and C) *normative goals* that support socially expected behavioral options.

Lindenberg and Steg (2007) argue that in general, normative goals are more likely than hedonic or gain goals to result in pro-environmental behaviors. While it seems unlikely that many property owners are actively hostile to the end-state of a healthy lake ecosystem, for some individuals other goals such as a creating a fun play area, presenting a neatly manicured lawn, or enjoying the physical labor of clearing brush (Rein, 2005) may be of greater importance than

contributing to lake health. Steg, Bolderjijk, Keizer & Perlaviciute (2014) argue that situationally strengthening normative goals and weakening gain or hedonic goals are distinct strategies that may be used to increase pro-environmental behavior.

Other predictors of pro-environmental behavior

The literature suggests several other factors that may also be related to shoreline maintenance decisions.

Many empirical studies from the psychology and communications literatures have found that awareness and perceived personal efficacy are necessary prerequisites to environmental behavior. The extent to which individuals feel individually or collectively responsible for a problem or its solution also affects behavior. In the TPB as well the VBN, beliefs about responsibility and efficacy are mediators of the relationship between values and action.

Normative beliefs about others' views and behavior are a prominent factor in many psychological theories. Two main mechanisms explain their effect on behavior- they can be a source of information, and they can be a source of social pressure (Deutsch & Gerard, 1955). More recently, Cialdini and colleagues have used a similar dichotomy in field experiments examining energy conservation behavior. Schultz, Nolan, Cialdini, Goldstein, and Griskevicius (2007) demonstrated separate effects for *descriptive norms* (beliefs about what others do) and *injunctive norms* (beliefs about what one ought to do), and argued that environmental interventions need to consider both in order to be successful.

Finally, the centrality of environmental beliefs for one's identity is a powerful predictor of environmental attitudes and behaviors (Clayton & Opotow, 2003). Similarly, place attachments can moderate the meanings of environmental problems and issues for individuals,

and in so doing affect behavior (Low & Altman, 1992; Spartz & Shaw, 2011; Seifert & Shaw, 2013).

The current study

General constructs from the perspectives and approaches described above were adapted to the specific domain of lake ecology and shoreline management. Those constructs were used to generate statements of belief that participants rated for agreement, and shoreline maintenance goals that participants rated for importance. The set of items was designed to cast a broad net of measurement over the space of beliefs, values and goals predicted to be relevant to shoreline decisions. Each item was created to measure a distinct belief hypothesized to be related to shoreline decisions, based on theory or anecdotal experience of local conservation officials. Several items had conceptual overlap with more than one theory, resulting in an uneven number of items per theory. Although this prevented clean between-theory comparisons, the goal of the research was an externally valid understanding of factors affecting shoreline decisions, not a comparison of theories, and so the methodological decision was made to prioritize the former over the latter.

Exploratory Factor Analysis (EFA) was conducted to summarize respondents' measured beliefs. The resulting factors were interpreted, and then evaluated in terms of their predictive validity for explaining variance in past shoreline decisions. It was predicted that a model which includes property owners' beliefs, values, and goals would fit past decisions more parsimoniously than a model that does not include any of those measures.

Method

Participants

Surveys were mailed to 1,140 individuals who owned residential lakefront property in Central Wisconsin. 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. The protocol for this study was approved by the University of Wisconsin Education and Social/Behavioral Science Institutional Review Board.

Surveys were returned by 566 respondents, with an additional 27 surveys returned by the post office as undeliverable, yielding an effective response rate of 50.85%. Respondents reported a median length of property ownership of 21 years (sd = 19 years).

Measures of belief

Eleven survey items were created to measure the importance of various goals for property owners when making decisions about shoreline maintenance. Twenty survey items were created to measure the strength of beliefs and values predicted to be related to shoreline decisions. Item text is shown in tables 3.1 and 3.2 below. An item measuring normative beliefs about the respondent's lake association allowed them to check a box to indicate "does not apply; my lake does not have an association."

In order to satisfy the theoretical and applied goals of the research, item creation proceeded in two steps. First, one or more items were created to measure each theoretical construct. When applicable, multiple items were created to measure specific dimensions. Second, conservation professionals were invited to suggest additional items or contextual nuance that

they believed might be important. They drew from their many decades of individual and collective experiences working directly with the study population on shoreline maintenance issues. Conservation professionals contributing to item creation were employed by local County Conservation Offices and/or the University of Wisconsin Extension. Additional items suggested through this process were edited for clarity and classified according to the most relevant theoretical perspective, in some cases resulting in an unequal number of survey items per construct, and in others resulting in survey items that did not fit neatly into a single construct. This atypical approach to survey item creation was taken in order to prioritize the external validity of findings from this exploratory study, by attempting to comprehensively measure the space of beliefs, goals, and values that might influence shoreline decisions. In addition, including County Conservation officers and UW—Extension agents facilitated the cooperative goals of the project, which included working with them as active partners in the research process.

Table 3.1 - Goal Items

How important are each of the following considerations for you personally, when making decisions about how you maintain your yard and shoreline? Please circle a number on each scale, where 1 is "not at all important" and 7 is "extremely important."

variable	item text
gain.cost	Cost of the different options, in time and money.
gain.resale	Impact of the decision on the resale value of my property.
gain.enforcement	Fear of enforcement related to zoning regulations for shoreland properties.
hedonic.property	How the decision will affect my ability to enjoy my property and the activities I like.
hedonic.lake	How the decision will impact my ability to enjoy the lake.
hedonic.visual	How much I will like the visual look of an option I am considering.
normative.fit	How well my property will fit in with surrounding properties.
normative.neat	Presenting a neatly groomed landscape that does not look messy.
normative.health	How my decision will affect the overall health of the lake.
normative.wildlife	How the decision will affect fish and wildlife habitat.
normative.follow	Following county zoning regulations for shoreland properties.

Table 3.2 – Belief and Value Items

How much do you agree or disagree with each of the following statements? Please circle a number on each scale, using 1 for "strongly disagree" and 7 for "strongly agree". Circle 4 if you neither agree nor disagree.

variable	item text
resilience.harm	Human development should only be allowed if it does not harm the lake.
resilience.cope	Nature is adaptable enough to cope with development around the lake.
resilience.types	The types of plants and animals in the lake depends on the amount of vegetation along the shore.
rights.wildlife	Plants and animals have as much right to the lake as humans do.
rights.owners	Property owners have the right to modify their shoreline the way they see fit.
responsibility.humans	Property owners have a responsibility to protect lake health for future generations.
responsibility.wildlife	Property owners have a responsibility to protect the plants and animals that live in the lake.
attachment.mylake	I am more concerned about the lake my property is on than I am about other lakes.
attachment.special	I feel a special attachment to my lake.
identity.care	Taking good care of my shoreline is important to me.
identity.reflects	The way someone manages their property reflects what sort of person they are.
self.enhancement	Lake management decisions should prioritize the needs of property owners and their families.
self.transcendence	Our lakes should be available to everyone.
efficacy.know	If I decided to improve my shoreline's buffer, I would know what to do.
efficacy.control	The amount of vegetation on my shoreline is not something I have a lot of control over.
norms.discuss	My neighbors and I discuss the importance of protecting our lake.
norms.neighbors	My neighbors think it is important that I maintain a vegetated buffer on my shoreline.
norms.DNR	The Department of Natural Resources (DNR) thinks it is important that I maintain a vegetated buffer on my shoreline.
norms.lakeassoc	The lake association thinks it is important that I maintain a vegetated buffer on my shoreline.
awareness.plan	I'm aware of the resource concerns and recommendations in the management plan for my lake.

Analysis

Survey items were subjected to exploratory factor analysis, in order to summarize the variance in participants' responses and identify coherent dimensions of belief related to shoreline maintenance decisions.

Descriptive statistics and correlations

Means and standard deviations were calculated for each survey item, and distributions were visually examined. Bivariate pearson correlations were calculated for all goal items. Belief items were separated into two groups for the correlation matrices. The first (group A) contained those items measuring beliefs related to biospheric beliefs and basic values. The second (group B) contained the remainder of the belief items.

The dimensions of variance in shoreline beliefs

Two exploratory factor analyses (EFA) were conducted to summarize survey responses, using the Pearson correlation matrix and unweighted least squares. One EFA included the 21 belief items; the other EFA included the 11 goal items. The scree test was used to determine the number of factors to retain. Retained factors were then obliquely rotated using oblimin, and interpreted based on items loading at or above 0.3. Items were only interpreted for the single factor they loaded on most heavily. Chronbach's alpha and visual inspection of items were used to asses factor cohesion, adopting the conventional alpha level of 0.70 for good coherence. EFA was conducted in R v3.0.2, using the psych package v1.4.2.3.

Results

Descriptive statistics

Means and standard deviations are presented in table 3.3. On average, most respondents indicated that all of the shoreline management goals were moderately to highly important for them. Responses to the belief items contained more variability.

Bivariate correlations are shown in figures 3.2, 3.3, and 3.4. Overall, correlations between items were low to moderate, suggesting that many items measured distinct constructs. The largest correlations were found among the hedonic goal items, the normative goal items, and the normative belief items. Although Spearman correlations would have been more appropriate, given non-normality in several items, Pearson correlations were used to preserve consistency with the EFA. Correlations did not substantially differ between the two methods.

Table 3.3 – Means and Standard Deviations

Goal Items			Belief Items		
item name	***mean***	***sd***	***item name***	***mean***	***sd***
hedonic.property	6.02	1.18	responsibility.humans	6.31	1.04
hedonic.lake	5.94	1.25	attachment.special	6.15	1.28
normative.wildlife	5.91	1.27	identity.care	6.03	1.20
normative.health	5.78	1.28	responsibility.wildlife	5.88	1.30
hedonic.visual	5.73	1.32	resilience.harm	5.55	1.60
normative.follow	5.61	1.44	rights.wildlife	5.53	1.57
gain.resale	5.55	1.61	identity.reflects	5.27	1.69
gain.cost	5.20	1.46	norms.discuss	5.27	1.70
gain.enforcement	5.19	1.70	norms.DNR	5.16	1.68
normative.neat	5.01	1.81	resilience.types	5.06	1.53
normative.fit	4.79	1.78	norms.lakeassoc	4.99	1.71
			attachment.mylake	4.91	1.87
			self.enhancement	4.89	1.74
			efficacy.know	4.84	1.80
			self.transcendence	4.80	1.75
			awareness.plan	4.51	1.68
			norms.neighbors	3.88	1.73
			rights.owners	3.76	2.03
			efficacy.control	3.74	1.94
			resilience.cope	3.72	1.86

Figures 3.2 - 3.4 – Correlation matrices of goal and belief items. Histograms of responses and variable names are on the diagonal. Spearman correlations are in the upper corner, with higher correlations indicated by larger type size. Sunflower plots are in the lower corner. The x-axis of each sunflower plot shows the variable in that row of the larger matrix; the y-axis shows the variable in that column of the larger matrix.

Figure 3.2

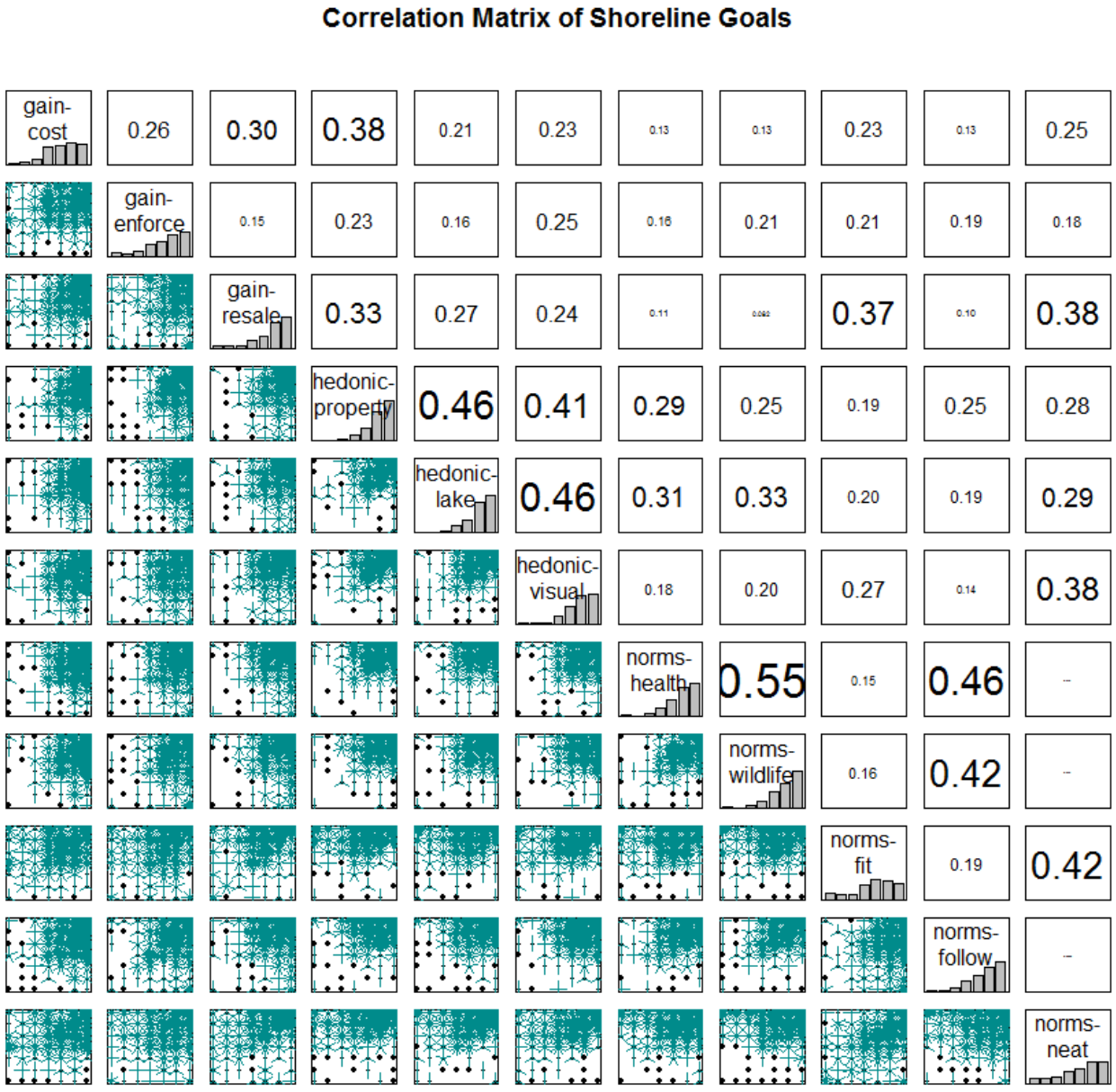


Figure 3.3

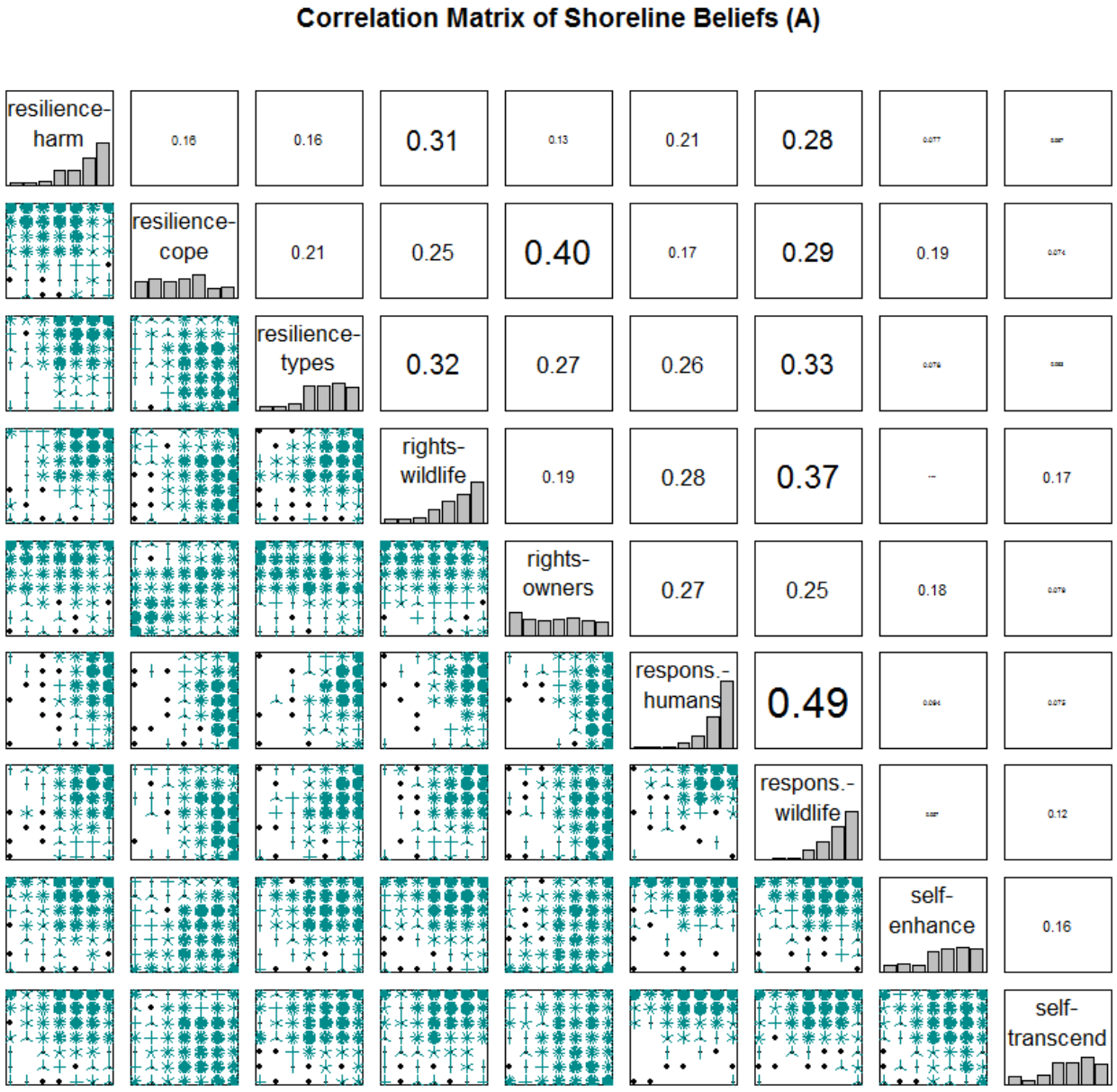
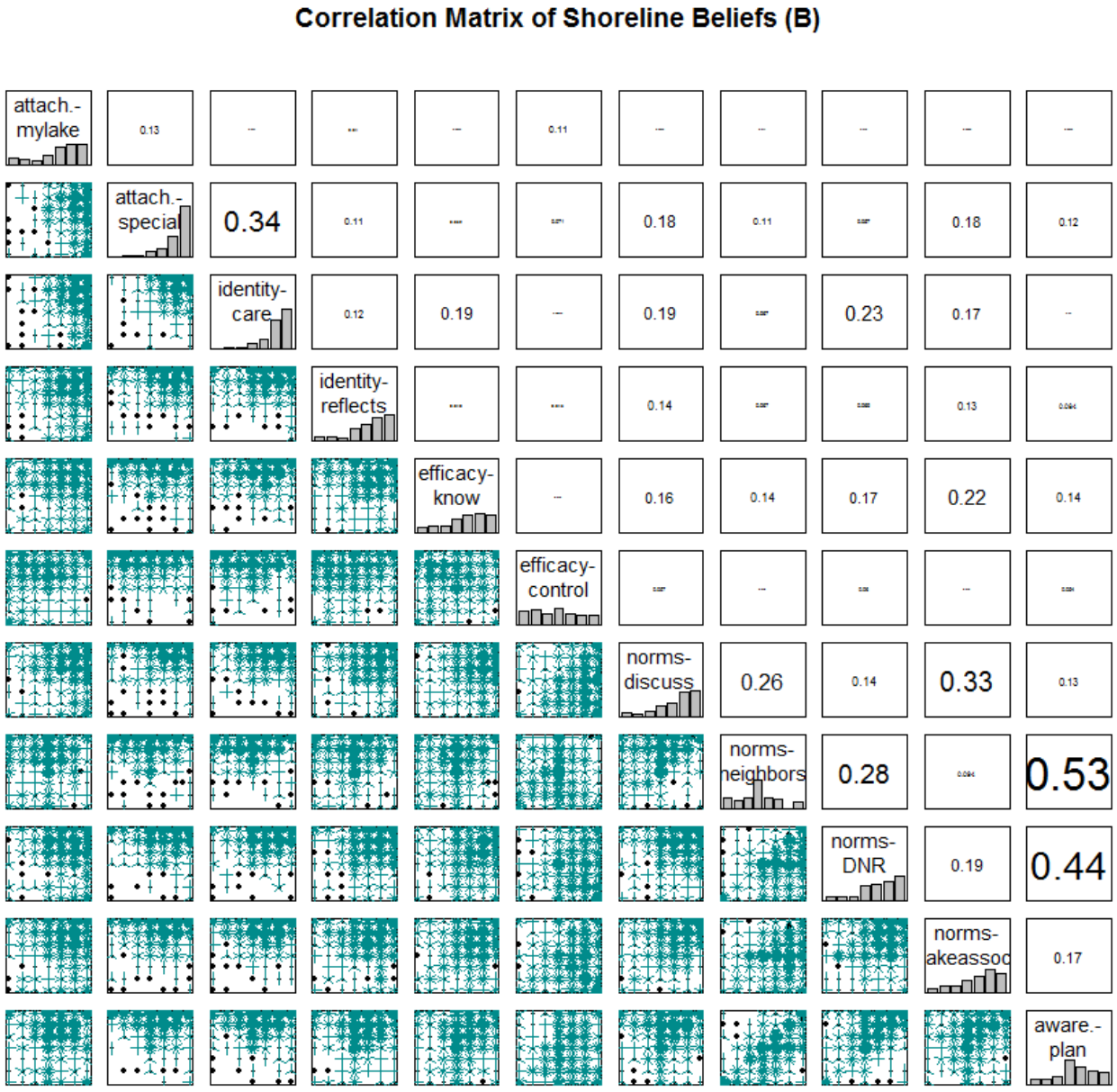

Correlation Matrix of Shoreline Beliefs (A)
resilience-harm
0.16
0.16
0.31
0.13
0.21
0.28
resilience-cope
0.21
0.25
0.40
0.17
0.29
0.19
resilience-types
0.32
0.27
0.26
0.33
rights-wildlife
0.19
0.28
0.37
0.17
rights-owners
0.27
0.25
0.18
respons.-humans
0.49
respons.-wildlife
0.12
self-enhance
0.16
self-transcend

Figure 3.4


Correlation Matrix of Shoreline Beliefs (B)
attach.-mylake
attach.-special
identity-care
identity-reflects
efficacy-know
efficacy-control
norms-discuss
norms-neighbors
norms-DNR
norms-akeassoc
aware.-plan
0.13
0.34
0.11
0.18
0.11
0.18
0.12
0.12
0.19
0.19
0.23
0.17
0.14
0.13
0.16
0.14
0.17
0.22
0.14
0.26
0.14
0.33
0.13
0.28
0.53
0.19
0.44
0.17

Exploratory Factor Analysis

The EFAs were conducted on responses for 475 respondents who provided answers to all belief and goal items, and did not indicate that their lake does not have a lake association. Ten respondents who indicated that their lake does not have an association were excluded from this analysis because the conservation partners believed the item measuring normative beliefs about lake association priorities was an important measure.

The scree plots (figure 3.5) suggested a three factor solution for the belief items, and a 2 factor solution for the goal items. However, the three factor solution for the belief items was rejected because the third factor A) had low thematic coherence among the items that loaded onto it, and B) had low statistical coherence as measured by Cronbach's alpha ($\alpha = 0.53$). For that reason a two factor solution for the belief items (22% total variance explained), and a 2 factor solution for the goal items (36% total variance explained) were chosen. The amount of variance explained by each factor is presented in table 3.4.

Item loadings for the two exploratory factor analyses are presented in tables 3.5 and 3.6. Each factor was interpreted based on items with $|\text{loading}| > 0.30$. For the convenience of readers, tables 3.7 – 3.10 present subsets of the items that contributed to the interpretation of each factor.

Figure 3.5 –Scree plots. Components left of the vertical lines were retained.

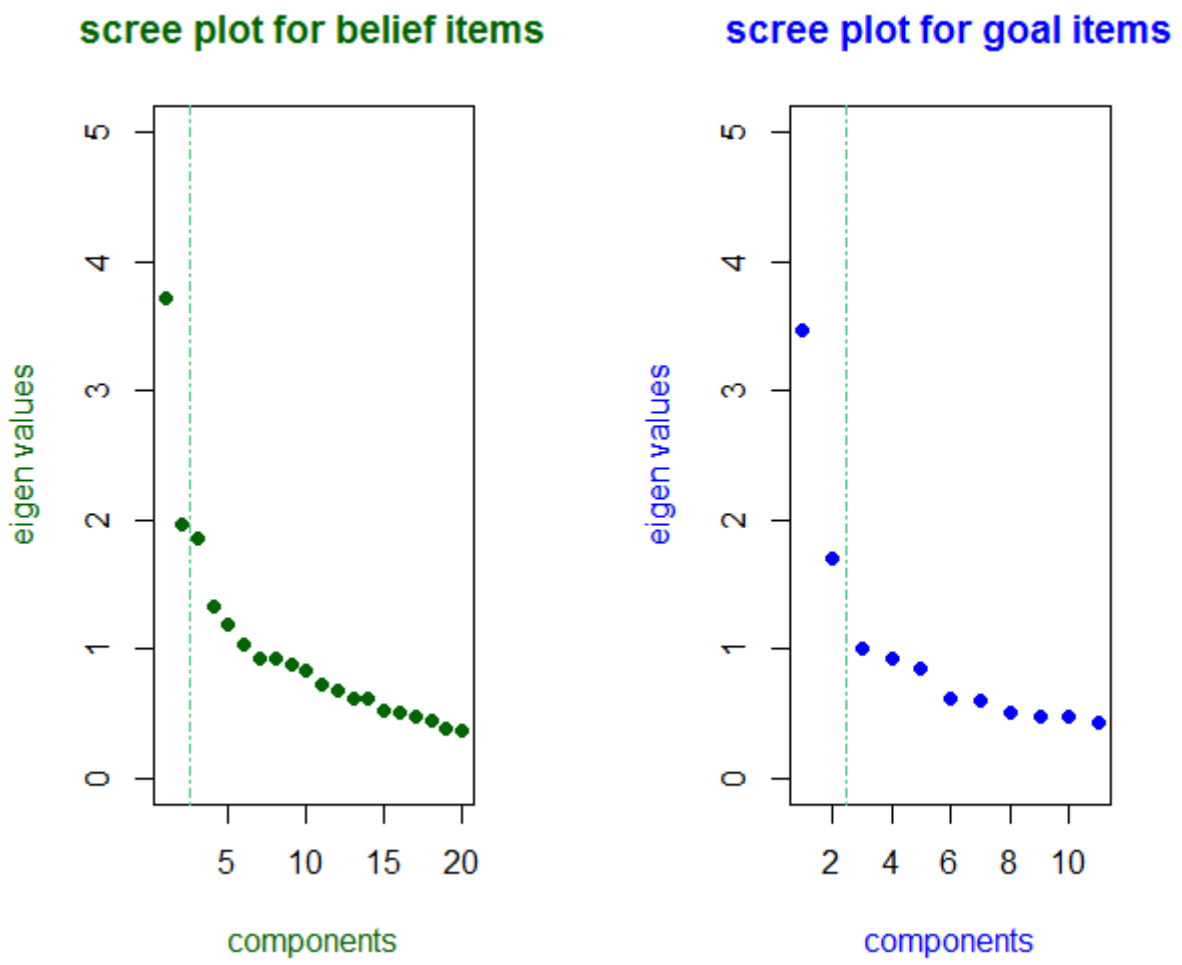


Table 3.4 – Item variance explained by rotated factors in the two EFAs.

	20 Belief Items		11 Goal Items	
	Factor 1	Factor 2	Factor 1	Factor 2
Eigen Values (SS)	2.71	1.71	2.23	1.75
Proportion of Total Variance	0.14	0.09	0.20	0.16
Cumulative Proportion of Total Variance	0.14	0.22	0.20	0.36
Proportion of Explained Variance	0.61	0.39	0.56	0.44
Cumulative Proportion of Explained Variance	0.61	1.00	0.56	1.00

Table 3.5 - EFA Results for Belief Items

item	text	factor 1 loading	factor 2 loading
responsibility.humans	Property owners have a responsibility to protect lake health for future generations.	0.74	-0.10
identity.care	Taking good care of my shoreline is important to me.	0.67	-0.11
responsibility.wildlife	Property owners have a responsibility to protect the plants and animals that live in the lake.	0.64	0.11
attachment.special	I feel a special attachment to my lake.	0.44	-0.19
resilience.types	The types of plants and animals in the lake depends on the amount of vegetation along the shore.	0.43	0.30
rights.wildlife	Plants and animals have as much right to the lake as humans do.	0.41	0.23
resilience.harm	Human development should only be allowed if it does not harm the lake.	0.33	0.12
norms.DNR	The Department of Natural Resources (DNR) thinks it is important that I maintain a vegetated buffer on my shoreline.	0.32	0.47
norms.discuss	My neighbors and I discuss the importance of protecting our lake.	0.25	0.20
identity.reflects	The way someone manages their property reflects what sort of person they are.	0.22	0.08
norms.lakeassoc	The lake association thinks it is important that I maintain a vegetated buffer on my shoreline.	0.21	0.17
efficacy.know	If I decided to improve my shoreline's buffer, I would know what to do.	0.14	0.17
self.transcendence	Our lakes should be available to everyone.	0.10	0.07
self.enhancement	Lake management decisions should prioritize the needs of property owners and their families.	0.07	0.02
awareness.plan	I'm aware of the resource concerns and recommendations in the management plan for my lake.	-0.02	0.79
efficacy.control	The amount of vegetation on my shoreline is not something I have a lot of control over.	-0.08	0.04
norms.neighbors	My neighbors think it is important that I maintain a vegetated buffer on my shoreline.	-0.09	0.69
attachment.mylake	I am more concerned about the lake my property is on than I am about other lakes.	-0.12	0.01
resilience.cope	Nature is adaptable enough to cope with development around the lake.	-0.32	-0.04
rights.owners	Property owners have the right to modify their shoreline the way they see fit.	-0.40	-0.04

Table 3.6 - EFA Results for Goal Items

item	text	factor 1 loading	factor 2 loading
normative.neat	Presenting a neatly groomed landscape that does not look messy.	0.72	-0.21
hedonic.visual	How much I will like the visual look of an option I am considering.	0.57	0.11
gain.resale	Impact of the decision on the resale value of my property.	0.56	-0.02
hedonic.property	How the decision will affect my ability to enjoy my property and the activities I like.	0.51	0.25
normative.fit	How well my property will fit in with surrounding properties.	0.50	0.04
hedonic.lake	How the decision will impact my ability to enjoy the lake.	0.46	0.29
gain.cost	Cost of the different options, in time and money.	0.44	0.08
gain.enforcement	Fear of enforcement related to zoning regulations for shoreland properties.	0.29	0.18
normative.wildlife	How the decision will affect fish and wildlife habitat.	0.02	0.71
normative.follow	Following county zoning regulations for shoreland properties.	0.01	0.59
normative.health	How my decision will affect the overall health of the lake.	-0.02	0.76

Belief factor 1: Stewardship Beliefs. This factor primarily measured respondents' feelings of responsibility for protecting the lake and its ecosystem. Several items with loadings between 0 and 0.5 were less directly related to that construct, but in general all included some element of benevolence or concern for nature and the lake. Two items loaded negatively; in general higher responses to those survey items were associated with lower concern for nature. Statistical coherence was good for this factor (0.74).

Belief factor 1: *Stewardship* **α = 0.74**		
item	**text**	**loading**
responsibility.humans	Property owners have a responsibility to protect lake health for future generations.	0.74
identity.care	Taking good care of my shoreline is important to me.	0.67
responsibility.wildlife	Property owners have a responsibility to protect the plants and animals that live in the lake.	0.64
attachment.special	I feel a special attachment to my lake.	0.44
resilience.types	The types of plants and animals in the lake depends on the amount of vegetation along the shore.	0.43
rights.wildlife	Plants and animals have as much right to the lake as humans do.	0.41
resilience.harm	Human development should only be allowed if it does not harm the lake.	0.33
norms.DNR	The Department of Natural Resources (DNR) thinks it is important that I maintain a vegetated buffer on my shoreline.	0.32
resilience.cope	Nature is adaptable enough to cope with development around the lake.	-0.32
rights.owners	Property owners have the right to modify their shoreline the way they see fit.	-0.40

Belief factor 2: Prescriptive Norm Beliefs. This factor primarily measured the strength of respondents' beliefs that others think they ought to grow a vegetated shoreline. The highest loading item appears to measure that construct indirectly, based on the assumption that property owners aware of the resource concerns in their lake management plan would know that shoreline development is a concern of the local conservation workers who facilitated creation of the plan. Awareness of the plan is similar to awareness of prescriptive normative pressure. The second and third items both have fairly robust loadings, and measure the construct more directly. The fourth and final item had lower thematic coherence, but also loaded onto the factor with the minimum loading for interpretation as a contributor to the factor (0.30). Despite having only moderate overall thematic coherence, the factor exhibited good statistical coherence ($\alpha = 0.69$).

Belief factor 2: *Prescriptive Norms* **$\alpha = 0.69$**		
item	**text**	**loading**
awareness.plan	I'm aware of the resource concerns and recommendations in the management plan for my lake.	0.79
norms.neighbors	My neighbors think it is important that I maintain a vegetated buffer on my shoreline.	0.69
norms.DNR	The Department of Natural Resources (DNR) thinks it is important that I maintain a vegetated buffer on my shoreline.	0.47
resilience.types	The types of plants and animals in the lake depends on the amount of vegetation along the shore.	0.30

Belief items that did not load on either factor. Eight of the belief items did not substantially load on either factor. Unsurprisingly, bivariate correlations of those items tended to be fairly low. One possibility is that those items measured distinct dimensions of belief, which were not measured by any of the other items. Alternatively, the items that did not load on either factor may have been poorly worded and simply measured noise. Additional data would be required to differentiate the two possibilities.

Belief items that did not load on either factor

item	text	factor 1 loading	factor 2 loading
norms.discuss	My neighbors and I discuss the importance of protecting our lake.	0.25	0.20
identity.reflects	The way someone manages their property reflects what sort of person they are.	0.22	0.08
norms.lakeassoc	The lake association thinks it is important that I maintain a vegetated buffer on my shoreline.	0.21	0.17
efficacy.know	If I decided to improve my shoreline's buffer, I would know what to do.	0.14	0.17
self.transcendence	Our lakes should be available to everyone.	0.10	0.07
self.enhancement	Lake management decisions should prioritize the needs of property owners and their families.	0.07	0.02
efficacy.control	The amount of vegetation on my shoreline is not something I have a lot of control over.	-0.08	0.04
attachment.mylake	I am more concerned about the lake my property is on than I am about other lakes.	-0.12	0.01

Goal factor 1: Personal Benefit Goals. This factor primarily measured the importance that respondents placed on presenting their shoreline in a way that meets social approval. Interpretation of the factor was based on the three highest loading items, which had strong thematic coherence. The four items with the lowest loadings had less strong thematic coherence, although Cronbach's alpha (0.72) indicated high covariation among the responses to all items. In a general sense, all items that loaded onto this factor measured the importance of goals that offer personal benefit to the property owner.

Goal factor 1: *Personal Benefit Goals* **α = 0.75**		
item	**text**	**loading**
normative.neat	Presenting a neatly groomed landscape that does not look messy.	0.72
hedonic.visual	How much I will like the visual look of an option I am considering.	0.57
gain.resale	Impact of the decision on the resale value of my property.	0.56
hedonic.property	How the decision will affect my ability to enjoy my property and the activities I like.	0.51
normative.fit	How well my property will fit in with surrounding properties.	0.50
hedonic.lake	How the decision will impact my ability to enjoy the lake.	0.46
gain.cost	Cost of the different options, in time and money.	0.44

Goal factor 2: Shared Benefit Goals. This factor was distinguished from the other goal factor by its emphasis on achieving shoreline management goals with shared benefit for the lake and its ecosystem. The three items that contributed to the factor had good statistical (0.73) as well as thematic coherence. In the goal classification described in Lindenberg & Steg (2007), all three items that contributed to this factor would be considered normative goals.

Goal factor 2: *Shared Benefit Goals* **α = 0.73**		
item	**text**	**loading**
normative.health	How my decision will affect the overall health of the lake.	0.76
normative.wildlife	How the decision will affect fish and wildlife habitat.	0.71
normative.follow	Following county zoning regulations for shoreland properties.	0.59

Goal items that did not load on either factor. One goal item did not substantially load on either factor. The same limitations described above for interpretation the belief items that did not contribute to a factor also apply to this goal item.

Goal items that did not load on either factor			
item	**text**	**factor 1 loading**	**factor 2 loading**
gain.enforcement	Fear of enforcement related to zoning regulations for shoreland properties.	0.29	0.18

Discussion

Property owners' responses to the 21 belief items and 11 goal items were summarized by a total of 4 rotated factors. Each factor represents a dimension of property owners' beliefs or goals that is conceptually distinct from the others. Nine survey items did not cohere with any of the factors, suggesting either that they measure unique constructs, or primarily contain random variance.

Survey items were created based on multiple theoretical models of pro-environmental behavior, as well as the applied observations of conservation professionals. The emphasis of this study was on broad coverage of relevant constructs, rather than theory comparison. Factors which cohered were identified with a data driven method.

Two factor solutions were found for both sets of items. For the belief items, the two factors were identified as Stewardship beliefs and Prescriptive Norm beliefs. That dichotomy may also be thought of as internal versus external motivations for protecting lake health.

A different dichotomy was observed in the goal factors, which were labeled Personal Benefit Goals and Shared Benefit goals. The results of the goals EFA were in some ways similar to, and in some ways different from, the goal categorization proposed in Goal-Framing Theory (Lindendberg & Steg, 2007). Here, items designed to measure both gain and hedonic goals were put together in the first factor of the EFA, despite being categorized separately by Goal-Framing Theory. In contrast, the second factor included exclusively items that had been designed to measure normative goals, suggesting that the normative goals measured were more distinct from the gain and hedonic goals than the gain and hedonic goals were from each other. However, that finding needs to be interpreted within the context of the specific goals measured by this survey.

Items were generated to attempt to comprehensively measure the various goals that were hypothesized to be related to shoreline maintenance decisions. The apparent similarity of gain and hedonic goals observed in this domain may not generalize to other domains.

The factor analyses provide useful insight into property owners' goals for shoreline maintenance decisions, and the dimensions of related beliefs. However, on their own the factor analyses are uninformative regarding the extent to which those goals and beliefs influence behavior. It remains necessary to establish a link between individual differences in beliefs and individual differences in behavior, in order to address the theoretical and applied goals of the research. The following chapter establishes such a link.

Chapter 4

Beliefs, Goals and Behavior

Abstract

External validity of the belief and goal factors extracted from property owners' survey responses in chapter 3 is assessed. Shoreline vegetation scores for each participant's property parcel were obtained from a publicly available database, and used as an outcome measure of past shoreline decisions. Intentions to improve shoreline areas were separately analyzed as another outcome measure. Property owner factor scores, characteristics of the parcel physical environment, and two measures of norms based on immediate neighbors' shorelines were entered as predictors in a linear mixed effect model. Consistent with prior literature investigating other domains of environmental behavior, the investigation finds social norms are the strongest predictors of shoreline behavior.

The relationship of beliefs to behavior

In chapter 3, EFA was used to summarize the structure and dimensions of the two sets of beliefs and goals that were predicted to be related to property owners' shoreline maintenance decisions. Survey items were created based on theoretical models of pro-environmental behavior, as well as the applied observations of conservation professionals. The EFAs summarized the variance in property owner responses to the 30 survey items with 4 conceptually cohesive factors. The current chapter evaluates the ability of those belief and goal factors to explain differences in actual behavior.

The current state of a property owner's shoreline is partially a consequence of physical properties of the local environment such as slope and parcel size, and partially a consequence of decisions that the owner has made. It is therefore reasonable to treat shoreline state as a behavioral outcome, moderated by non-behavioral factors. This chapter investigates the extent to which individual differences in beliefs and goals are associated with differences in the way people choose to manage their shoreline, within the constraints of local conditions.

Shoreline impact scores were obtained for each respondent. Scores were calculated from publicly available county lake assessment data, previously collected by biologists. Linear mixed effect (LME) models were used to measure the strength of relationship between the dimensions of belief and shoreline quality.

In addition to the behavioral measure of shoreline impact score, participants' intentions to improve their shoreline by growing more vegetation were also modeled as an outcome measure. Based on previous research, the relationship between beliefs and intention was predicted to be stronger than the relationship of beliefs and behavior (Ajzen, 1985).

Method

Participants

Shoreline impact scores were obtained for 320 of the participants who had completed surveys. Most of the participants for whom scores were not obtained lived in counties where biologists had used differing assessment methodologies, which would have prevented direct comparison and were therefore excluded.

Shoreline impact scores

The current state of each respondent's shoreline vegetation was used as a behavioral outcome measure, because shoreline state is in large part the result of past decisions and behaviors. The environmental impact of the shoreline part of each respondents' property was assessed by boat during the summer of 2010. All survey respondents indicated that they had owned their property at that time. From boats, biologists and research assistants measured shoreline vegetation, erosion, and built influence using a standardized assessment methodology developed by the Waushara County Conservation office.

The assessments, collected independently from this study, generated a multivariate data set with several dimensions of shoreline buffer quality. For the current research, a single, overall impact score was calculated to approximately measure "shoreline contribution to lake health" for each respondent's property parcel. Impact scores were based on types and abundance of vegetation, built improvements, and erosion. Possible scores ranged from 0 – 11, with higher scores indicating more heavily vegetated shorelines.

In addition to its shoreline assessment score, county records and United States Geological Survey (USGS) data were also matched to each property. Parcel level data included total acreage, land value, improved value, length of shoreline frontage, and average slope.

Objective norms – participants' neighbors' actual shoreline behavior – were measured in two ways, and calculated separately for each participant. A measure of "vegetation norms" was obtained by averaging the shoreline vegetation scores of each participants' two immediately adjacent neighbors (one on either side). A measure of "development norms" was similarly calculated as the mean of each participants' immediate neighbors, but was based on a different metric from the shoreland assessment which measured the impact of buildings and other forms of development on lake health. The two normative measures were highly correlated, Pearson's $r = 0.84$.

Intentions to change

Intention to change was calculated for all participants as the mean of the two intention items described in chapter 3.

Factor scores

Factor scores were calculated for all participants as the mean of items with loadings $\geq |0.3|$. Items meeting that criterion with negative loadings were reverse scored before averaging.

Analysis

Shoreline vegetation scores were modeled as a function of respondents' beliefs and goals. Participants who indicated that they had owned their property fewer than 4 years or who declined to provide a response to the length of ownership item were excluded from the analysis of shoreline vegetation scores, to ensure that all participants owned their property at the time of the assessment (total excluded = 57).

Linear mixed effect modeling treated vegetation scores as a dependent variable in two steps. An initial model included respondents' four factor scores from the EFAs as fixed effect predictors. Parcel level data from county records and the USGS, the objective norm measures, and self-reported length of ownership were also included. A random intercept for Lake was included, to account for baseline differences in shoreline health across lakes. Betas and their standard errors were used to construct 95% confidence intervals.

A second model was used to test the relationship with behavior of the belief and goal items that did not load on any factors. Participant responses to those nine items were included as the only fixed effects in the second model. Residuals from the initial model were used as the outcome measure. Betas and their standard errors were used to construct 99% confidence intervals. The stricter confidence intervals were chosen to help protect against spurious inferences from the single-item measures, which likely provided less stable estimates of the constructs they measured than were available with the multi-item factor scores.

Following the two-step analysis that modeled past behavior, a separate two-step analysis was conducted to model intention for future change as the dependent measure. That analysis was identical to the analysis of shoreline vegetation scores, except that it included shoreline vegetation scores and shoreline development scores as fixed effect covariates. The Pearson

correlation between past behavior (shoreline vegetation score) and intention to change was calculated.

In order to facilitate direct comparison of model betas as a measure of effect size, all predictor variables were centered and converted to z-scores (divided by their standard deviation). The parcel level variables for land value, improved value, parcel area, frontage distance, frontage/area, and length of ownership were characterized by a small number of extremely large observations. To address this violation of linear model assumptions and allow standard deviations to be reliably calculated, these variables were winsorized by replacing the top and bottom 5% of observations with the 95^{th} and 5^{th} percentile. Winsorization was performed prior to centering, calculation of z-scores, and calculation of frontage:area ratios.

Restricted Maximum Likelihood (REML) deviance was used to calculate percentage change in model fit for nested models. Values of the REML criterion are arbitrary, but may be used to compare nested models. Higher values indicate a poorer fit to the data. All analyses were conducted in R v3.0.3, with LME models implemented with using LME4 package v1.0-5.

Results

Past Behavior

Tests of the relationship between dimensions of belief and shoreline scores proceeded as described above for all 320 participants. Results from the initial model are presented in table 4.1; results from the second model are presented in table 4.2. The predictors in the initial model improved fit to the data by 17%, relative to an empty model containing only an intercept

($REML_{Null}$ = 1598, $REML_{Initial\ Model}$ = 1334, χ^2 (12, N = 320) = 2934.94, p < 0.001). Results from the second model are presented in table 4.2.

Table 4.1 – Relationship of EFA factors and parcel variables with past behavior. Table shows predictor coefficients sorted by reliability (absolute value of t). All predictors were z-scored, so betas may be directly compared as measures of effect size.

	β	95% CI	SE	t
(Intercept)	3.87	[3.62, 4.12]	0.13	30.71
Objective norm, vegetation * *	1.11	[0.68, 1.53]	0.22	5.10
Objective norm, development * *	0.95	[0.50, 1.40]	0.23	4.16
Parcel slope *	0.29	[0.05, 0.53]	0.12	2.35
Personal Benefit Goals *	-0.26	[-0.47, -0.04]	0.11	-2.31
Shared Benefit Goals *	-0.27	[-0.52, -0.01]	0.13	-2.02
Parcel land value *	0.24	[0.00, 0.49]	0.13	1.94
Parcel frontage length	0.24	[-0.02, 0.50]	0.13	1.81
Parcel improved value	-0.21	[-0.44, 0.01]	0.12	-1.84
Stewardship Beliefs	0.22	[-0.06, 0.51]	0.15	1.53
Prescriptive Norm Beliefs	0.19	[-0.08, 0.45]	0.13	1.38
Parcel area	0.16	[-0.12, 0.43]	0.14	1.11
Duration of ownership	-0.08	[-0.31, 0.14]	0.12	-0.71

* p < 0.05 ; ** p < 0.01

Table 4.2 – Relationship of items that did not load onto any factors with past behavior.

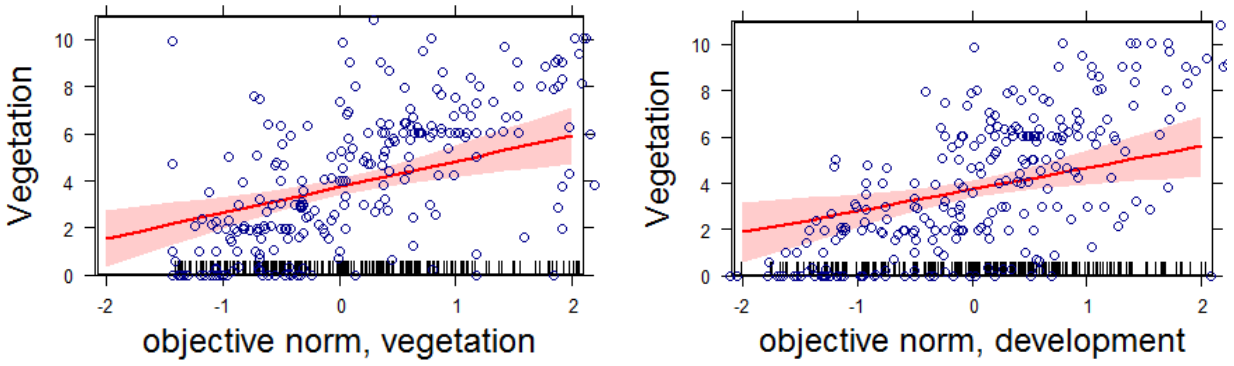
	β	99% CI	SE	t
(Intercept)	0.00	[-0.27, 0.27]	0.10	0.01
norms.lakeassoc.z	-0.28	[-0.58, 0.02]	0.12	-2.42
self.transcendence.z	-0.14	[-0.43, 0.15]	0.11	-1.26
attachment.mylake.z	0.13	[-0.16, 0.43]	0.11	1.14
identity.reflects.z	0.09	[-0.19, 0.38]	0.11	0.82
self.enhancement.z	0.08	[-0.2, 0.36]	0.11	0.77
gain.enforcement.z	0.03	[-0.24, 0.31]	0.11	0.31
norms.discuss.z	-0.03	[-0.32, 0.27]	0.11	-0.23
efficacy.control.z	0.02	[-0.27, 0.3]	0.11	0.15
efficacy.know.z	0.01	[-0.26, 0.29]	0.11	0.12

* p < 0.05 ; ** p < 0.01

Objective norms. Shoreline vegetation scores were most strongly predicted by the norms of one's immediate neighbors, $\beta_{\text{Norm-Vegetation}} = 1.11$, 95% CI = [0.68, 1.53], and $\beta_{\text{Norm-Development}} = 0.95$, 95% CI = [0.50, 1.40]. The explanatory power of norms exceeded all other factors in the model. A model that included only the two objective norm variables was nearly as good a fit to the data as the full model ($\text{REML}_{\text{Norms Only}} = 1379$).

Although a strong influence of norms is consistent with the literature, the absolute size of the effects in the current study should be interpreted with caution, because it likely also includes the influence of similar constraints in the proximal physical landscape. Plots of the effects of the two norm variables are shown in figure 3.1. Note that the fit lines are based on the full model, rather than bivariate fit, and so the high correlation of the two objective norm variables (r = 0.86) results in fit lines that appear less steep than they should be, based only on visual inspection of the scatterplots.

Figure 3.1 - Main effect of *Objective Norms.* Fit line and confidence bands calculated from the final LME model, using mean values of all other predictors.



Parcel slope had a positive association with shoreline vegetation, β = 0.29, 95% CI = [0.05, 0.53]. That result may owe to the fact that steeply sloped shorelines offer fewer options for development, such as patios, lawns or beaches.

The importance of ***Personal Benefit goals*** when considering shoreline maintenance changes was negatively associated with shoreline vegetation, β = -0.26, 95% CI = [-0.47, -0.04]. Property owners who reported that presenting a neat, visually attractive and functionally useful shoreline was highly important to them tended to have less shoreline vegetation than did property owners who reported lower concern about those goals.

Puzzlingly, the importance of ***Shared Benefit goals*** was also negative associated with shoreline vegetation, β = -0.27, 95% CI = [-0.52, -0.01]. Participants who reported placing high importance on how their shoreline management decisions might affect habitat and overall lake health tended to have less shoreline vegetation, compared to participants who reported that those concerns were less important to them.

Parcel land value had a marginally positive relationship with shoreline vegetation, β = 0.24, 95% CI = [0.00, 0.49]. It is unclear why individuals with higher assessed land values tended to have more shoreline vegetation. Participants with long ***parcel frontage length*** also tended to have more shoreline vegetation, β = 0.24, 95% CI = [-0.02, 0.50].

There was a marginally negative relationship of ***parcel improved value*** with shoreline vegetation, β = -0.21, 95% CI = [-0.44, 0.01], suggesting a negative impact of development on the amount of vegetation.

None of the survey items that did not contribute to any of the factors had a significant relationship with the amount of vegetation on property owners' shorelines. There was a marginal trend for the item "*The lake association thinks it is important that I maintain a vegetated buffer*

on my shoreline", $\beta = -0.28$, 95% CI = [-0.58, 0.02]. Participants who agreed most strongly with the item tended to have less shoreline vegetation than other participants. One possible interpretation is that participants with little shoreline vegetation may perceive their lake association as aggressively pushing a pro-vegetation agenda, while participants with robust shoreline vegetation perceive their lake association as passively allowing others to overly groom their shorelines.

Intentions to Change

The relationship of property owners' beliefs and goals with intention to improve their shoreline was tested with two subsequent linear mixed effect models, as described above, for a subset of 243 participants who had responded to one of the intention items. The results of the initial model that included factor scores, parcel variables including vegetation and development scores, and objective norm measures as predictors are presented in table 4.3. The results of the second model testing items that did not load on any factors are presented in table 4.4.

The initial model improved fit to the intention responses by 5%, relative to an empty model ($REML_{Null} = 973$, $REML_{Initial\ Model} = 921$, χ^2 (14, N = 243) = 84.76, $p < 0.001$).

The relationship between past behavior and intention to change future behavior was low, $r = 0.14$, $p = 0.02$. Consistent with that observation, the two measures were significantly associated with very different sets of variables. Whereas the amount of actual vegetation on participants' shorelines was predicted by the goal factors but not the belief factors, the opposite was true for intentions to change.

Table 4.3 – Relationship of EFA factors and parcel variables with intention to change.

	β	95% CI	SE	t
(Intercept)	4.20	[4.00, 4.41]	0.10	40.07
Stewardship Beliefs * *	0.57	[0.27, 0.87]	0.15	3.75
Prescriptive Norm Beliefs * *	0.37	[0.13, 0.61]	0.12	2.98
Duration of ownership *	-0.27	[-0.49, -0.06]	0.11	-2.48
Personal Benefit Goals	-0.18	[-0.40, 0.04]	0.11	-1.62
Parcel improved value	-0.14	[-0.36, 0.07]	0.11	-1.31
Shared Benefit Goals	0.09	[-0.17, 0.34]	0.13	0.67
Parcel slope	-0.06	[-0.27, 0.15]	0.11	-0.58
Parcel land value	0.06	[-0.15, 0.28]	0.11	0.57
scale(TotalScore)	0.12	[-0.58, 0.82]	0.36	0.34
Parcel area	-0.05	[-0.33, 0.24]	0.14	-0.33
Parcel frontage length	-0.04	[-0.31, 0.22]	0.13	-0.32
Objective norm, vegetation	0.07	[-0.40, 0.55]	0.24	0.30
Objective norm, development	0.07	[-0.50, 0.64]	0.29	0.24
scale(BufferScore)	-0.05	[-0.66, 0.56]	0.31	-0.16

* p < 0.05 ; ** p < 0.01

Table 4.4 – Relationship of items that did not load onto any factors with intention to change.

	β	99% CI	SE	t
(Intercept)	0.05	[-0.23, 0.33]	0.11	0.44
gain.enforcement.z *	-0.26	[-0.52, 0.00]	0.10	-2.54
self.transcendence.z	0.24	[-0.03, 0.51]	0.11	2.31
efficacy.control.z	0.22	[-0.04, 0.49]	0.10	2.15
efficacy.know.z	0.11	[-0.14, 0.37]	0.10	1.12
self.enhancement.z	-0.10	[-0.37, 0.17]	0.10	-0.96
norms.discuss.z	-0.05	[-0.32, 0.23]	0.11	-0.46
attachment.mylake.z	-0.04	[-0.32, 0.23]	0.11	-0.38
norms.lakeassoc.z	-0.04	[-0.32, 0.24]	0.11	-0.38
identity.reflects.z	0.02	[-0.25, 0.28]	0.10	0.17

* p < 0.05 ; ** p < 0.01

Intentions were positively associated with Stewardship beliefs and with Prescriptive Norm beliefs. Property owners who felt a strong sense of responsibility to help protect the lake indicated greater willingness increase the vegetation on their shoreline, $\beta = 0.57$, 95% CI = [0.27, 0.87]. Similarly, property owners who believed that their neighbors and authoritative institutions supported shoreline vegetation also indicated greater willingness to increase the vegetation on their shoreline, $\beta = 0.37$, 95% CI = [0.13, 0.61]. In contrast, neither of the goal factors was significantly related to intentions at $\alpha = 0.05$, although the estimate for both of the goal factors was a negative relationship with intention.

The only other term to reach significance in the initial model was duration of property ownership. Intention to change was negatively related to duration of ownership, suggesting that the long-time owners were indicated lower intentions, while more recent owners indicated higher intentions, $\beta = -0.27$, 95% CI = [-0.49, -0.06].

None of the parcel variables were related to intention to change. The strongest relationship was observed for parcel improved value, $\beta = -0.14$, 95% CI = [-0.36, 0.07].

Of the survey items that did not contribute to any factors, a significant negative relationship with intention was observed for the goal item "*Fear of enforcement related to zoning regulations for shoreland properties,"* $\beta = -0.26$, 99% CI = [-0.52, 0.00]. Property owners who reported that fear of enforcement was an important consideration for shoreline maintenance decisions indicated lower intentions to increase their shoreline vegetation, compared to property owners who reported that enforcement was less of a personal concern. The items designed to measure self-transcendent values and efficacy beliefs all had trends towards a positive relationship with intention, but none reached significance using the $\alpha = 0.01$ cutoff established for those single-item measures.

Discussion

Far and away, the strongest predictor of the health of property owners' shorelines was their nearby neighbors' shoreland management practices. That result is consistent with many other findings in the literature. Research on the various reasons for social conformity is foundational to modern psychological thought (e.g., Asch, 1951).

However, the interpretation of the large observed effect for norms on behavior in the current study is not straightforward. To some extent, it measures the combined influences of social pressure and social information (Deutsch & Gerard, 1955), as well as descriptive and injunctive norms (Cialdini, 2003; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007), on property owners' shoreline maintenance decisions. In the current analysis however, the variable for norms also measures the influence of shared local environmental constraints: influence that is outside the scope of human control, operationalized in the TPB as "Actual Behavioral Control." The two types of influence measured by the objective norm variables in the current analysis, social and physical, are confounded. That limitation requires cautious interpretation of the observed effect sizes, but nonetheless it is clear from these results that local norms exert a strong degree of influence on property owners' shoreline maintenance decisions. One likely mechanism of that influence is that property owners look to the behavior of their peers as a source of information on which to base their own shoreline decisions (Deutsch & Gerard, 1955).

In addition to the descriptive norm measures, participants' self-reported goals for shoreline decisions were also significantly related to their past behavior. Property owners who reported high importance of Personal Benefit goals, and also property owners who reported high

importance of Shared Benefit goals, tended to have less shoreline vegetation than property owners who indicated those goals were less important to them.

Differences in shoreline maintenance behavior were also related to physical characteristics of the local environment. Aside from physical characteristics included in the objective norm variables, the amount of vegetation on a property owner's shoreline was directly related to the slope of their shoreline frontage. Owners of steep properties tended to have more shoreline vegetation, likely because they have few opportunities for development than owners of shorter properties. Owners of properties with high assessed land values also tended to have more shoreline vegetation. Although the cause of that apparent relationship is unclear, one possible reason may be that having more shoreline frontage reduces space constraints, and allows property owners to groom part of their shoreline while leaving other parts to grow naturally.

Interpreting the negative relationship of Personal Benefit goals with shoreline vegetation is intuitive. Individuals who prioritize personal benefits in their shoreline maintenance decisions manage their property in a way that prioritizes those benefits, such as an expansive lawn for recreation or a visually impressive, neatly manicured garden. However, interpreting the observed negative relationship of Shared Benefits with shoreline vegetation is less intuitive. One possible explanation is that some participants may have felt pressure to respond with what they thought was the "correct" answer, rather than truthfully reporting their opinion. Alternatively, it may be the case that many participants who truly feel that lake health goals are important believe shoreline vegetation is actually harmful. Some anecdotal evidence supports the latter possibility. On more than one occasion the author has heard from conservation professionals that some property owners believe raking out "weeds" from the lake helps keep it clean, even though those "weeds" sometimes turn out to be important members of the local ecosystem.

It is clear that participants' responses to the survey items designed to measure goals were significantly related to past behavior, while responses to the survey items designed to measure beliefs were not. That result lends support to the importance of studying the role of goals in pro-environmental behavior (Lindenberg & Steg, 2007). It is interesting that the EFA combined gain and hedonic goals into a single factor. While that result may be partially an artifact of the wording of the specific items used, it is also consistent with their classification in Goal-Framing Theory as the two goal-frames that generally do not support environmental behavior (Lindenberg & Steg, 2007). Items designed to measure the importance of normative goals, identified in Goal-Framing Theory as goals most likely to support pro-environmental behavior, cohered as a single factor in the EFA.

The precise meanings of the relationships observed in this study of property owner goals and shoreline maintenance decisions are open to multiple interpretations, an unfortunate limitation due to the fact that goals were only one of several constructs measured. The observed negative relationship of personal benefit goals and behavior has greater face validity than the observed relationship of shared benefit goals and behavior. However, developing better instruments that contain more numerous and varied goal-specific items would provide greater resolution and reduce ambiguity in interpretation. Alternatively, asking property owners to rank a set of goals for shoreline maintenance decisions could potentially be a more useful measure than the ratings used in the current study. The methodological superiority of ratings versus rankings has been a long-running topic of debate among social scientists (Rokeach, 1973). While both methods appear to have advantages and disadvantages, rankings might be particularly useful for measuring the importance of different goals property owners consider when making shoreline maintenance decisions because space constraints on the shoreline can force trade-offs to be made

when goals conflict. More generally, Lindenberg and Steg (2007) argue that multiple goals may be relevant for a particular decision, but only one goal-frame can be dominant at a particular time.

While past behavior was related to descriptive norms, characteristics of the physical environment, and goals, intentions to change were better predicted by the two belief factors identified by the EFA. Stewardship beliefs were the most strongly related to intentions, followed by beliefs about prescriptive norms. Intentions were also related to duration of property ownership. Of those three predictors that were significantly related to intentions, however, none were significantly related to behavior. That pattern of results suggests that in the domain of shoreline maintenance decisions, the correlation between intention to act pro-environmentally and actual behavior change is likely to be low.

Future research should investigate why that is the case. One possibility, given the finding that the overwhelming majority of explained variance in shoreline vegetation was controlled by the objective norm measures, is that intention may simply be a poorly suited construct for understanding this particular example of pro-environmental behavior. Alternatively, important but unmeasured moderators of the intention-behavior relationship may exist. In the TPB framework the pathway from intention to behavior is moderated by actual behavioral control, a catch-all construct that includes all factors external to the individual. One possible direction for future research could be to investigate the identity of those external factors. If a set of such barriers could be identified, then practitioners and conservation professionals could design interventions to reduce their impact and strength the intention-behavior correlation. The moderately high mean intention response provided by participants suggests that many lake property owners in the area are at the very least open to the idea of increasing the vegetation on

their shoreline. Interventions that reduce the influence of external barriers, combined with messaging that reinforces stewardship beliefs and highlights prescriptive norms, could be effective at turning those intentions into action.

The amount of time that elapsed between the shoreland assessments (summer 1010) and the collection of survey data (fall 2013) is a considerable limitation of the current study. Although all participants reported owning their lake property at the time of the assessments, it is possible that some participants may have taken steps to improve their shoreline since that time. It is also possible, although somewhat less likely, that some participants' beliefs may have changed since that time. The methodology of the current study did not measure any such changes, and as a consequence any changes that did occur contributed to error variance in the analyses.

The shoreline assessment scores themselves also likely contributed considerable error variance. The assessments were not conducted with a future psychological study of decisions making in mind; rather they were conducted to provide an accurate biological indicator of lake health. With the help of specialists at the Center for Land Use Education at the University of Wisconsin – Stevens Point[1], the data was adapted to this specific purpose. However the scores were at best an approximate measure of behavior, because they were also influenced by environmental factors outside the control of property owners.

Despite those two sources of measurement error, the current study was able to explain 17% of the variance in property owners' shoreline vegetation. The overwhelming majority of that variance was explained by norms, as measured by the actual state of an individual's immediate neighbors' shorelines. Responses to the goal survey items also explained a smaller, but still reliable, amount of variance in shoreline maintenance behavior.

[1] The author is particularly grateful for the generous help of Dan McFarlane with this task.

The results of this study suggest that water resource managers and environmental educators should focus on descriptive norms when designing interventions to improve shoreline vegetation. For lakes that already have strong norms of shoreline vegetation, strategies could focus on highlighting those norms and raising the profile of well-vegetated properties. For lakes where impaired shorelines are the norm, identifying individuals most likely to change and then supporting them to do so may be a key to long term success and should be tested in future research beyond the scope of this paper. Norms should also be taken into account when prioritizing areas for restoration or preservation. Such efforts are likely to be successful where supportive norms already exist on nearby properties, and likely to fail where supportive norms do not exist.

The results suggest that messaging about shoreline vegetation should address the personal benefits associated with shoreline maintenance. Messages should emphasize ways in which property owners can manage their shoreline in a vegetated state that provides habitat without compromising personal benefits. For example, access corridors can provide space for recreation in the lake. Messaging could also reference studies such as Papenfus and Provencher (2005), which found a positive association between shoreline vegetation and property resale value, or Radmoski and Goeman (2001), which found a direct relationship between the amount of emergent vegetation and the size of sport fish. Messages could also emphasize the cost savings of vegetated shorelines, compared to more expensive or maintenance-intensive options.

Messaging about stewardship beliefs and prescriptive norms may be effective at momentarily increasing intentions to change. However, interventions that rely on such messaging are unlikely to have any effect on behavior unless they also address barriers that prevent intentions from being realized as action. More research is needed to empirically establish

what those barriers are. If they can be identified, and if strategies for overcoming them can also be identified, then based on these results individuals who have recently acquired shoreline property may be good candidates for restoration.

Taken together, the results of these analyses suggest that individual differences in property owners' goals, and to a lesser extent their beliefs, are significantly related to decisions about the way they manage the shoreline part of their property. While the previous statement feels intuitively true, to the best of the author's knowledge the current study is the first to provide empirical evidence that it is indeed the case. Furthermore, the approach to cast a "wide net" over the space of potentially relevant beliefs and goals was able to not only test whether beliefs and goals are related to shoreline maintenance behavior, but rather was able to specify which types were related, and which were not.

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 (e.g., Moran & Woods, 2008; Horton, 2003; Sharma & Wagley, 1996). It is hoped that better understanding of how individuals make decisions about managing their shoreline properties will lead to better communication and greater cooperation between private landowners and the agencies and organizations working to protect our shared water resources.

Conclusion

This research investigated factors that influence shoreline management decisions by private property owners on residential lakes. Shoreline maintenance was chosen as a behavioral context for investigation because it can be environmentally important, and because it has features that will likely generalize to other types of behavior as well. As a shared environmental resource, lake quality depends to a large extent on the actions and decisions of many individuals. The results taken together yield two key findings.

First, individuals are likely to hold overly positive evaluations of how their own actions contribute to environmental degradation. Where that occurs, it may prevent behavior change. Information about the consequences of one's past behavior for a shared environmental resource is likely to be particularly inaccurate when evaluations are ambiguous, as is the case with evaluations of shoreline impact on lake health. An intervention designed to provide property owners with accurate information about the impact of their decisions was inconclusive with regards to motivating intentions to improve; however the intervention experiment suggested that taking steps to minimize threats to autonomy should be an important component of any future efforts.

Second, real and perceived social norms were by far the strongest predictors of shoreline maintenance decisions, compared to other measured types of beliefs and goals. That result is somewhat ironic given the importance of autonomy on reactions to communications about shoreline maintenance. It is also somewhat unsatisfying in terms of suggesting messaging strategies to promote shoreline vegetation. At the same time though it is encouraging, because it suggests that success will beget more success in terms of restoring impaired shorelines. Future

research should test methods for highlighting positive norms, and methods for including local norms when prioritizing locations for restoration projects.

Third, the results of these studies need be interpreted and generalized in the context of the sample from which they were obtained. Considering Waushara County, from which 82% of participants were recruited, 400 out of 800 shoreline property owners randomly selected to receive the survey returned it. It is striking that the survey, which elicited unexpectedly strong emotional reactions both in support of and against the aims of the research, so precisely bisected the population in terms of response selection.

Important differences may exist between those who returned surveys, and those who did not. It is difficult to know the full nature of those differences, but comparing parcel data for the two groups provides some insight into the extent of their homogeneity, and therefore the generalizability of the findings. Across the full set of parcel variables, property owners who returned surveys differed only from property owners who declined in terms of the land value of their property. Individuals who returned surveys tended to have higher property values ($M = \$162,238$, $SD = \$87,253$) than those who did not return surveys ($M = \$133,460$, $SD = \$80,649$), $t(44) = 2.11$, $p = 0.04$. Those who returned surveys did not differ from those who declined to return surveys in terms of parcel area ($p = 0.34$); value of parcel improvements ($p = 0.74$); permanent resident status ($p = 0.91$); parcel frontage ($p = 0.81$); parcel slope ($p = 0.89$); or dominant soil type ($p = 0.20$). Perhaps most importantly, the two groups did not differ in terms of shoreline vegetation score, $p = 0.90$, or the average of their neighbors' shoreline vegetation scores, $p = 0.74$.

Based on those comparisons, it appears that the sample for these studies tends to own property with higher land values than does the general population of lakefront property owners.

However, the physical and biological characteristics of the lakes that respondents own property on appear otherwise similar to the general population of lakefront property owners in the study area. Since the analysis in chapter 4 did not find a significant relationship between land value and amount of shoreline vegetation, the sample bias in property value appears unlikely to have affected the results. It is therefore reasonable to conclude that the correlational and experimental effects observed in the study sample would likely also be observed in the general population.

Even if the sample does differ from the population in relevant, systematic ways that were not measured, the results of the studies still hold for the 50% of property owners who returned their surveys, and similar members of the general population. From an applied conservation perspective, knowing about individuals who are inclined to return surveys may be more valuable than knowing about others who declined to return surveys, because partnerships are more likely to be formed with those willing to engage.

Understanding the bases on which those individuals have made past decisions about shared environmental resources is likely to offer insight into their future decisions, and allow resource managers an opportunity to plan accordingly. One of the strongest predictors of future behavior is often past behavior (Ajzen, 1991). Yet, the influence of past behavior is not fully mediated by attitudes nor by intentions (Ouellette & Wood, 1998). This tendency has been referred to as “resistance to change” in applied and organizational psychology. The term was used by psychologist Kurt Lewin, who understood human behavior as a dynamic interaction of personal and contextual factors. Integrating those factors in a systems approach known as field theory, Lewin recognized that forces for homeostasis could arise from many different sources within the system, resulting in apparent resistance to change (Lewin, 1951). Lewin viewed resistance to change as a tendency of social systems, a tendency often supported by forces

outside the individual. Dent and Goldberg (1999) argue that despite Lewin's original conceptualization, popularization of the term and its adoption by managers have led to a meaning shift in which "resistance to change" is often accepted as a received truth about human decision making, without consideration of mechanism. In fact however, multiple mechanisms have been proposed to explain our past's influence over our future.

As the human population continues to grow, and the effects of climate change become more pronounced, the pressure for responsible management of shared environmental resources will also increase. Communication between experts and critical lay stakeholders is and will continue to be necessary. A theoretically informed and empirically validated understanding of how individuals perceive and act on information about their own past behavior, in the context of a publicly desired change in future behavior, will contribute to successful resource management and a better planet for us all.

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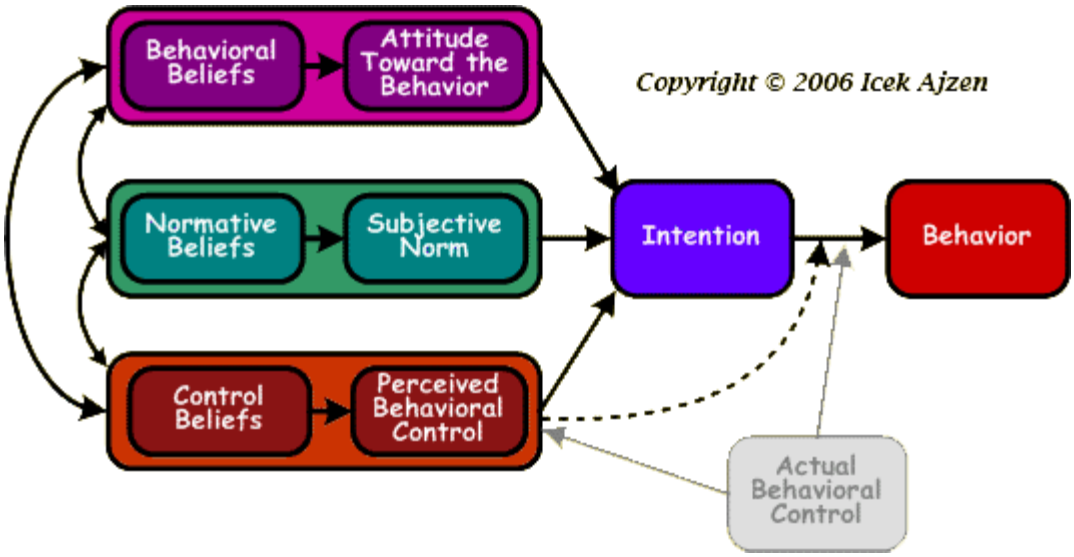
Appendix A

1. The Theory of Planned Behavior

The Theory of Planned Behavior (TPB) (Ajzen, 1985) is one of the most widely used models of decision making (along with its predecessor, the Theory of Reasoned Action). It was created in part as a response to the very low correlation often observed between individuals' attitudes and their behaviors. A major innovation of the model was formalizing *intention* as mediator between attitudes and behavior, where an individual's intention to perform a target behavior is determined by three sets of beliefs: 1) beliefs about the consequences of the behavior, 2) beliefs about social normative pressure regarding the behavior, and 3) beliefs about the individual's ability to successfully perform the behavior. A schematic of the model is shown below.



Beliefs about the behavior and its consequences are affectively evaluated to produce an attitude toward the behavior. In our example, some of the relevant beliefs a shoreline property owner may hold include the belief that a vegetated shoreline increases fish abundance, that it reduces erosion, that it prevents access to the lake, and that it increases mosquito abundance. These beliefs and others are combined to produce a positively or negatively valenced attitude towards the behavior. A major focus of the current document is to explore that combination process.

Early work on attitudes in Psychology focused on attitude as a learned response. The concept of attitude was viewed by Doob (1947) as an "implicit, drive producing response" to a stimulus that is anticipatory to behavior. That definition was narrowed by Osgood, Suci, and Tanenbaum (1957) to include only the affective portion of the implicit response. Attitudes surely must be learned, presumably by mechanisms similar to those which govern other areas of learning. Doob (1947) describes the learning process over two examples: formation of an attitude against a type of fruit, and against a noxious person. However, while the classical and operant conditioning frameworks are well suited for those examples of concrete entities, they are less helpful for understanding attitude formation towards a complex, abstract idea such as "growing a natural shoreline". The question of which experiences an individual generalizes over to form such an attitude becomes central.

One approach to dealing with this problem is to consider an attitude towards a complex object such as "growing a natural shoreline" to be comprised of multiple simpler attitudes: an attitude towards the lake association who carried the message, an attitude towards fish, an attitude towards swimming, an attitude towards mosquitos, etc. This

approach was outlined in Fishbein (1963), and was later adopted into the original formulation of the Theory of Reasoned Action (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980) with the explicit assumption that the valences of simple attitudes combine additively, and the valence of the complex attitude is the net sum. Although the approach has the theoretically undesirable characteristic that a complex attitude may be a combination of a potentially unknowable number of simpler attitudes, methodologically it is not a major concern because psychologists are able to measure attitudes towards the object they are interested in, without needing to exhaustively measure all of the simpler attitudes that support it. However, Heberlein (1981) points out that an unfortunate consequence of this approach is that "anyone with access to a mimeograph machine and a population of willing respondents can (and probably will) conduct an 'attitude survey'"; even in the absence of theoretical grounding and often to the detriment of cross study comparison.

Nonetheless, Ajzen (1985) provides a review of nine studies that demonstrate the considerable predictive power of the Theory of Reasoned Action. The behaviors measured included: cooperation in the prisoner's dilemma, having another child, choice of career orientation, use of birth control pills, voting choice, having an abortion, infant feeding, smoking marijuana, and reenlisting in the military. Across the nine studies, multiple regressions using attitudes and subjective norms were able to predict intentions with a mean R^2 of 0.82, providing strong support for the Theory of Reasoned Action. Furthermore, behaviors were strongly predicted by intentions across the nine studies, with a mean bivariate correlation of 0.80. All but one of the studies had an individual

intention-behavior correlation greater than 0.70; the only study that did not measured the behavior of having another child ($r = 0.55$).

Following presentation of the evidence in support of the theory, Ajzen (1985) then devotes the remainder of the chapter to discussion of a major limitation: the intention-behavior relationship. He notes that all nine of the behaviors in the reviewed studies were highly volitional, meaning that there were few barriers preventing successful execution of the behavior once the participant made up their mind. The one exception- deciding to have another child- was also the behavior most weakly correlated with intention. Clearly, many factors can play a large role in determining whether or not we successfully carry out our intentions. Some of those factors may be external, such as a loss of opportunity due to an unforeseen event, or physical constraints like gravity preventing us from realizing an intention to pole vault. Others may be internal. Intentions may change following new information, or we may tire of trying and decide to do something else. The likelihood of external or internal factors causing a change of intentions increases with the amount of time that elapses between the initial formation of an intention and its execution as behavior, suggesting that the intention-behavior correlation will be strongest when the behavior occurs close in time to the initial decision. Awareness of this negative relationship between time and certainty may be the reason that humans discount future values (see section below, "Discounting and Subjective Future Value").

Based on these observations, Ajzen (1985) modified the Theory of Reasoned Action to include "Actual Behavior Control", a construct that includes internal and external factors that affect an individual's ability to perform the behavior. In the model,

the construct affects intention through beliefs about perceived behavior control, and also affects the intention-behavior relationship via a probability that a behavioral attempt will be successful. The new, resulting model came to be referred to as the Theory of Planned Behavior (TPB). Azjen argues that with the inclusion of actual behavior control as a direct moderator of behavior, it is more appropriate to think of intentions predicted by the model as "intentions to try" than "intentions to perform," because individuals are often aware that success is not guaranteed (but more likely if they try).

The TPB has been demonstrated to reliably predict a variety of pro-environmental behaviors. A particularly well studied example is recycling. Recycling has been an issue of public concern for several decades. Since that time many studies have been published on personal and situational factors related to it, as well as many more interventions to increase recycling that have been implemented in cities, neighborhoods, and workplaces which have not been reported in the literature. A collection of unpublished recycling interventions and evaluations of their behavioral impact has been compiled by users on the website of Doug MacKenzie-Mohr (MacKenzie-Mohr & Smith, 1999), using a variety of Community Based Social Marketing techniques. Broadly, the list shows that a diversity of intervention strategies have been successful at increasing recycling behaviors. A review of published studies on recycling interventions, behaviors, and predictors (Schultz, Oskamp, & Mainieri, 1995) reached a similarly vague conclusion, and argued that comparisons among intervention strategies were difficult given large differences in measurements used and variables included. One criticism that *was* universally applicable to the studies reviewed by Schultz, Oskamp, and Mainieri (1995) was that they all measured behavioral change shortly or immediately following the

intervention; evidence regarding the duration of effected changes in recycling behavior was unavailable. The current review unfortunately does not resolve that time-scale issue, however several empirical studies do allow comparisons that help us untangle the relative contribution of underlying psychological factors to recycling behavior.

The veracity of the TPB for predicting intentions and behavior was tested in a study of residential newspaper recycling in Melbourne, Australia (Boldero, 1995). The statistical models included not only measures of beliefs, attitudes, and norms, but also perceived control and actual behavioral control. Perceived control included several factors including perceived inconvenience of the recycling program in each household's city borough. Actual behavioral control included the frequency of curbside pickup in each borough: weekly, monthly, or none. Higher frequency of pickup makes recycling more convenient for residents, often (but not always) at the cost of increased expense for the municipality. This operationalization of behavioral control as a barrier to carrying out the behavior illustrates similarity between the TPB and McKenzie-Mohr's (1999) Community Based Social Marketing approach, which focuses on the balance of perceived benefits to perceived barriers relevant to performance of a behavior.

The TPB holds that beliefs about perceived behavioral control predict attitudes and intentions, while in the final stage of the model actual behavioral control and intention combine to predict behavior. Separate regression models, one predicting intentions and another predicting behavior, supported the TPB. The overall percent of variance explained in intentions increased from 11% to 36% when beliefs, norms, and perceived control were added to a baseline model that included demographic factors and past behavior. The models for behavior used logistic regression to predict whether or not

each household recycled newspapers during the two week period following survey completion. The baseline model accurately classified 70% of participants, relying on past recycling behavior as the only significant predictor; adding the TPB factors improved accuracy to 85%.

A study of household recycling behaviors among Italian city residents investigated whether the normative pressure from an individual's important relationships was greater than normative pressure from neighbors. Fornara, Carrus, Passafaro and Bonnes (2011) referred to the latter type of pressure as "local norms", which were tied to a particular place. They referred to social pressure from one's close or important relationships as "subjective norms", which is arguably a more restrictive use of the term than the way it has often been used by other authors working within the TPB.

Using self-reported survey data from a convenience sample of 452 participants, confirmatory factor analysis as well as model comparison of structural equation models both supported a distinction between "local" and "subjective" norms for predicting recycling intentions. Furthermore, within each type of norm it was found that descriptive norms were stronger predictors of recycling intentions than injunctive norms (Fornara et al., 2011).

Tests of the TPB that include "past behavior" as a predictor consistently find that it accounts for a large portion of explained variance in behaviors, and a smaller but still reliable portion of explained variance in intentions. In many cases, past behavior may serve as a proxy variable for other personal or situational factors that are causally related to the behavior but not measured by the researchers. In a study of recycling among undergraduates in Hong Kong, Cheung, Chan, and Wong (1999) found that adding a

variable for "past behavior" to their models improved overall model fit for behavior by 34% (R^2 change) for recycling behaviors, but improved model fit by less than 2% for recycling intentions. Overall fit of the full model for intentions was substantially better (R^2 = .59) for Cheung et al. (1999) than in Boldero (1995) (R^2 = 36%). The fact that "past behavior" was more strongly related to intentions in the poorer fitting Boldero model may have been that there was more variance to be explained, consistent with the interpretation of past behavior as a proxy for related but unmeasured variables.

The strength of the correlation between intention and behavior depends on many factors, among them individual differences in the extent to which decisions are made based upon external cues versus inner principles. There is an inverse relationship between an individual's sensitivity to external cues and the strength of their intention-behavior correlation; individuals who are more sensitive to external cues are likely to be more heavily influenced by changing situational factors, and so are expected to exhibit a weaker correlation between their intentions and behavior compared to less sensitive individuals.

This dimension of individual difference can be measured with the "self-monitoring scale" (Snyder & Kendzierski, 1982), on which a high score indicates high sensitivity to external cues. The predictive power of the scale was tested by Azjen, Timko, and White (1982) in a study on college students' intentions to vote a few weeks before the 1980 presidential election. Researchers called participants, assessed them with the self-monitoring scale, and asked questions about their intention to vote as well as their intention to smoke marijuana in the coming weeks. Following the election, study participants were recontacted and asked to report their actual voting and smoking

behavior; the behavior of participants below the median on the self-monitoring scale more closely matched their previously stated intentions (r = .82 versus .59 for voting, and r = .70 versus .42 for smoking).

2. The Eccles et al. Model and Subjective Task Value

The broad class of theories known as expectancy X value (EXV) theories hold that individuals' choices are a function of two beliefs: their expectation that they will be successful in a chosen action, and the value they assign to the outcome of that action. Although the TPB is arguably an exemplar of an EXV model, it is interesting to note than its original authors considered the TPB to be an improvement over the EXV framework because most EXV theories failed to include the important construct of intention, and consequently had low reliability for predicting behavior (Ajzen, 1985).

A similar but alternative model has been developed by Jacquelynne Eccles and colleagues (Eccles-Parson, 1983). Although it has primarily been applied to achievement related behaviors, it is also well suited as a framework for investigating the decision making process of choosing one shoreline state over another from a finite set of alternatives. Of particular use is the part of the theory dealing with an individual's subjective value of each alternative, referred to as Subjective Task Value (STV) and described in detail in Eccles (2005). STV describes an analogous concept to that of "attitude towards the behavior" in the TRA, but instead of emphasizing the distinction between personal attitudes and perceived attitudes of others, the Eccles et al. theory emphasizes four components that contribute to the likelihood of choosing the target behavior. Those four components, which together make up STV in the Eccles et al.

theory, are reviewed briefly below. For the remainder of this document, the terms "subjective value" and "attitude towards the behavior" are used interchangeably.

Attainment. This component describes the personal importance an individual places on participating in a task or performing it well. It is closely related to aspects of an individual's identity (Eccles, 2009). Tasks that are high in attainment value for an individual provide an opportunity for them to demonstrate what sort of person they are to themselves and others. There are many ways in which shoreline management decisions could have attainment value for an individual. For some people, their shoreline is an opportunity to contribute to stewardship of the lake by helping native species to flourish and removing invasives. For others, it may be an opportunity to demonstrate a meticulous and careful approach to managing their property's appearance through frequent mowing and clearing of water plants. Property owners who value financial success may use their shoreline to display wealth by constructing a large boathouse, while others may want to create a fun and safe play area for their family by maintaining an expansive beach. The personal values and attitudes of each individual contribute to determining what attainment value may be held by decisions about their shoreline, and how much. The matter is complicated by the fact that a single individual typically holds multiple competing values simultaneously. For example a property owner could value both stewardship of the lake *and* meticulous property appearance. How that individual makes decisions in the face of competing possibilities for attainment value is not a major concern in most applications of the Eccles et al. model, however it is a central issue for the problem of shoreline management.

Intrinsic Value and Interest. This component describes the value a task holds for an individual based on being inherently interesting or enjoyable to them. In the context of shorelines, intrinsic value of particular maintenance behaviors could contribute to the overall state of the shoreline. For example an individual could particularly enjoying mowing, or clearing brush. In either case the intrinsic interest of the maintenance activity would have the effect of reducing the overall naturalness of the shoreline, because one of the requirements for a natural shoreline is that the property owner allow it to grow naturally. An alternative way in which intrinsic interest could affect shoreline decisions is through aesthetic preferences of the property owner, although such preferences are likely to be highly confounded with the personal values that determine attainment value.

Utility Value. The utility value of a task is based on its usefulness for fulfilling a future goal. Most maintenance actions that do not have high intrinsic value are performed for their utility value of bringing the shoreline into its desired state. This would include both actions that decrease the naturalness of the shoreline, such as mowing or removing brush, as well as actions that increase its naturalness, such as planting native species or building a rain garden up the slope.

Cost. This component contains two related factors that negatively affect subjective task value- risks associated with the choice, and the opportunity cost of other choices not taken. There are desirable features of natural shorelines, but there are also desirable features of more groomed shorelines. Opportunity costs may be in the form of attainment value, intrinsic value, or utility value; property owners must make tradeoffs. For example an owner may be aware that a natural shoreline will contribute to a healthier lake which will increase her property value, but she may also be concerned that tall

grasses along the shoreline will prevent her from keeping an eye on her grandchildren when they play in the lake, and so she may ultimately decide to mow.

Although the overall success of a shoreline outreach program can be assessed in terms of outcomes such as the resulting change to shoreline states around a lake, more local and fine-grained assessments would measure the rate of specific actions undertaken by individuals, such as redeeming vouchers for native plants or cultivating a vegetative buffer. Given a wealth of behavior change research suggesting that specific requests are more effective than ambiguous goals, the four components of STV are useful for thinking about the promotion of specific shoreline maintenance behaviors.

3. Goal Framing Theory

It has been observed that nearly all models of behavior including the TPB are more accurate at predicting proximal future behaviors than distal ones (Ajzen, 1985). Part of the explanation lies in the fact that beliefs can change between the time an intention is first formed and the time when the behavior is to be carried out, potentially causing the intention to be abandoned. For example, a property owner returning home from a lake association meeting that featured an Extension specialist speaking about the importance of natural shorelines may form an intention to plant native shrubs along her shore. However as time goes by and memories of the presentation become foggier, her commitment to that intention may decrease, and if it drops below the threshold necessary for action she may never get around to planting those shrubs. A widely-cited example of this phenomenon can be found in a study of Virginia home owners who attended workshops on energy efficiency (Geller, 1981). The researchers found that although

attendees at the workshops overwhelming stated intentions to take steps to improve the energy efficiency of their home, follow-up visits 18-24 weeks later revealed that very few homeowners had actually implemented any of the recommendations.

The wide discrepancy between intention and behavior can be understood in part as the result of a change in the structure of beliefs underpinning participants' attitudes towards the behavior "replacing bulbs with CFLs". While attitudes may change following the adoption of new beliefs or the abandonment of old ones, changes in the relative salience with which existing beliefs contribute to an overall attitude can have just as great an effect. Returning to the example of the shoreland property owner whose commitment to plant native shrubs wanes as weeks pass following the lake association meeting: her beliefs about the ecological benefits of a natural shoreline may remain unchanged. Yet the saliency of those beliefs may decrease with time, especially relative to beliefs about the difficulty, expense, and time commitment required for the behavior. If so we should not be surprised if her commitment to the intention of planting shrubs diminishes over time.

The passage of time is only one factor that can affect the relative salience of beliefs. An important additional factor is articulated as Goal Framing Theory (Lindenberg & Steg, 2007). Goal Framing Theory is concerned with the criteria an individual uses to evaluate behavioral alternatives, where criteria are selected according to which of three broad categories of goal are focal for an individual. Decision makers may operate with a *gain goal* focal, in which case they would evaluate alternatives according to which would be most likely to protect or increase their resources. Alternatively, they may attempt to satisfy a *hedonic goal*, and choose a behavior based on personal satisfaction and intrinsic

interest. Lastly, individuals may perceive their options with a focus on *normative goals,* in which case they would behave according to what they thought was expected (either descriptively or prescriptively).

Within the TPB, the goal-frame an individual uses to evaluate their behavioral options alters the relative salience of different beliefs, which would affect the weights with which each belief contributed to the overall attitude towards each behavior. In terms of the Eccles et al. model, goal-frame moderates the contribution to subjective task value from each of its four components. Lindenberg and Steg (2007) observe that decisions made when a normative goal-frame is focal are often more likely to result in pro-environmental behavior than decisions made when a hedonic or gain goal-frame is focal, because a normative goal-frame focuses attention on behaviors that are "the right thing to do", with less concern on personal cost. Amato and Moore (2010) found evidence to support that assertion. Undergraduate participants completed a task that was designed to induce them to think about energy decisions using either a gain or normative goal-frame, and then read information about proposed policies for reducing the threat of climate change, as well as the potential economic costs of those policies. Participants in the normative goal-frame condition indicated greater support for climate change legislation, and were more likely to forego their extra credit points in exchange for a donation to a climate advocacy organization, than were participants in the gain condition.

Interventions aimed at changing environmental behaviors should pay careful attention to the goal-frames that support participants' current, undesirable behavior. For example, Steg (2005) used a survey to investigate the motivational factors that determined whether Dutch commuters drove their own cars or rode public transportation.

The study found few differences between frequent and infrequent drivers in their perceptions of the instrumental value or convenience of cars. However, frequent drivers felt stronger positive affect towards cars and considered them to have greater symbolic value than did infrequent drivers. Furthermore, principal components analysis revealed that 25.8% of the variance in judgments about the attractiveness of car use was accounted for by affective items, compared to 10.3% accounted for by instrumental items. The results suggest that transportation campaigns which rely exclusively on messaging about the convenience or cost savings of public transit are unlikely to be successful, because those considerations appear to play a lesser role in commuters' decisions than affective considerations. From a goal-framing perspective, the commuters in Steg (2005) seem to make transportation decisions with a hedonic goal-frame focal; therefore a more effective strategy could be to promote affective benefits that could be gained from using public transit. One example is a faded 1970's era sign hanging in Boston's State Street subway station, which prominently lists "entertainment" as one of the benefits passengers can enjoy while riding the T. Promoting affective benefits of public transit would be expected to increase the subjective value of that option more than promoting convenience or financial benefits would, because they are more relevant when a hedonic goal-frame is focal.

In the context of residential shorelines, appeals to property owners based on protection of lake health are unlikely to have much of an impact if individuals primarily view the decision of shoreline state as a matter of recreation and enjoyment (hedonic goal-frame), or a matter of property value (gain goal-frame). Even if the appeals are successful in convincing the property own that there is indeed a strong link between the

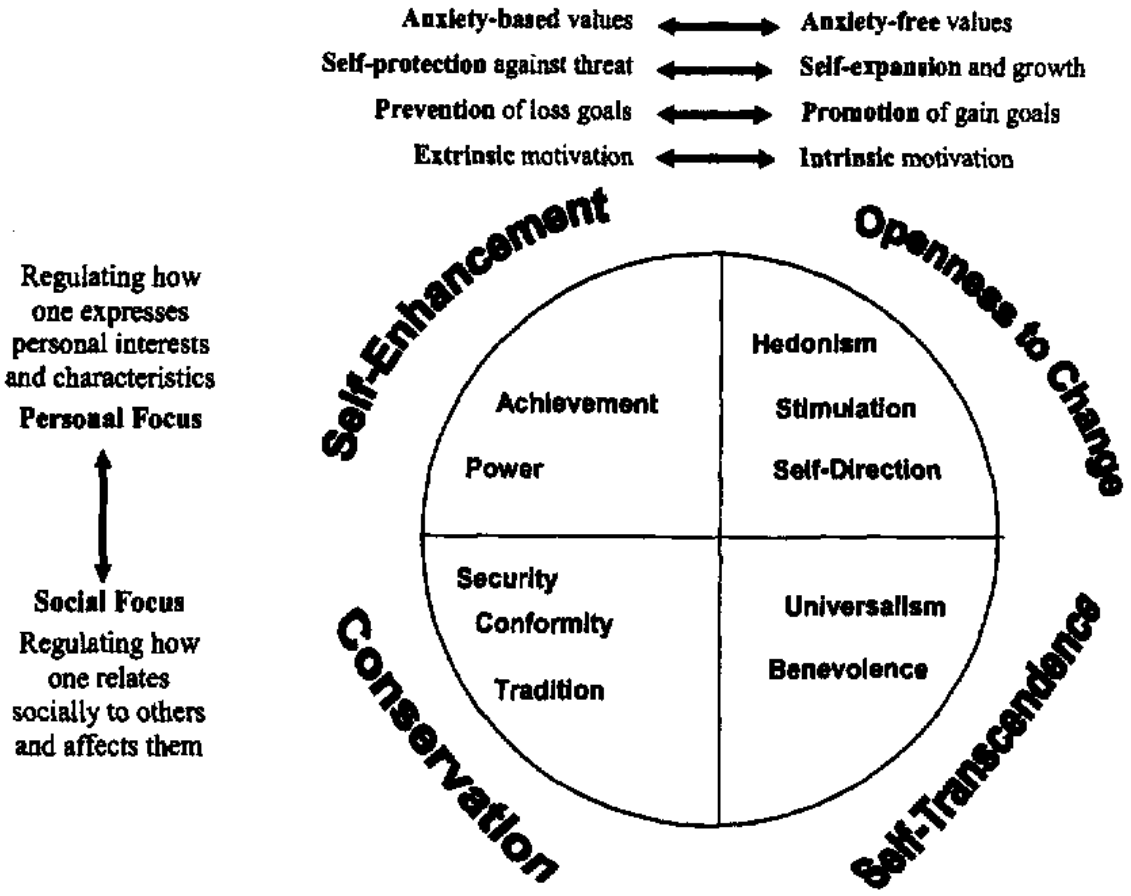
state of their shoreline and lake health, that belief will have little import if it is not considered relevant to the larger goal of the decision. Interventions designed to promote natural shorelines have two options for overcoming that obstacle: they could attempt to shift the goal-frame that property owners use for shoreline decisions to a normative goal-frame, or they could promote benefits of natural shorelines along dimensions that fit within a property owner's existing goal-frame.

4. Theory of Basic Values

Basic Value Theory holds that there are ten basic values which underlie human actions: conformity, tradition, benevolence, universalism, self-direction, stimulation, hedonism, achievement, power, and security. Every individual's personal value system can be characterized as a set of relative weights for each of the 10 basic values. The theory further specifies a circular structure of relationships among the ten basic values, such that values close together around the circle are related to each other, and values on opposite sides of the circle compete with each other (see figure below). Support for the values and structure of their relations has been obtained from correlational studies in many countries, including 81 countries that participated in the European Social Survey (Schwartz, 2007).

Although factor analysis of individuals' value priorities supports the distinction of the ten basic values, it also reveals that they can be summarized along two primary dimensions that cut diagonally across the figure. One concerns response to change; either *openness-to-change* accompanied by a willingness for independent self-direction, or

resistance-to-change ("conservation" in Schwartz's terminology). The other concerns the relationship between the self and others, with values on one end promoting the interests of *self-enhancement* and values on the other promoting the greater good and *self-transcendence*. The relevance of each basic value for an individual when making a decision is a function both of the chronic strength of that basic value, and of its temporary activation.



The basic values of lakeshore property owners are likely to affect their shoreline management decisions in several ways. Basic values directly influence which beliefs are considered most relevant for decisions about shoreline state, and which outcomes most salient, thereby indirectly influencing attitude towards restoration behaviors. For a property owner high on self-transcendence values, the improved ecosystem that is

obtained from natural shorelines may be the most salient outcome, but for a property owner high on self-enhancement values, the loss of a sandy beach may be the most salient outcome.

5. Normative Pressure

The normative pressure that an individual feels to perform a behavior is operationalized in the TPB as a function of the perceived attitudes of important others regarding the behavior, scaled by the perceived probability that they think the individual will be successful if they try to perform it. A lakeshore property owner who (1) values the opinions of his neighbors, (2) believes that those neighbors think natural shorelines are important, and (3) further believes that those neighbors think it is relatively easy to grow a natural shoreline, will feel substantial normative pressure to replace his beach with native shrubs and emergent plants.

The power of social norms for communicating about environmental behaviors has been extensively studied by Robert Cialdini and colleagues. A major emphasis of their work is placed on the distinction between *descriptive norms* (about what people typically do), and *injunctive norms* (about what people ought to do). Cialdini (2003) argued that to be effective, pro-environmental messages should provide support for the desired behavior along both types of norm. Pro-environmental messages that attempt to spur people to action by presenting examples of widespread environmental degradation contain two messages: an *injunctive* message about the importance of protecting environmental quality, but also a *descriptive* message that environmental indifference is the order of the

day. Such an anti-environmental descriptive norm could have the perverse effect of decreasing motivation for pro-environmental behaviors, a result referred to as a “boomerang effect”.

The iconic Iron Eyes Cody commercial from the 1970s is described as a tragic example. In the commercial, a noble American Indian is seen paddling a canoe through a river brimming with litter and industrial pollution. A bag of garbage is hurled from the window of a passing car and breaks open along the road. The camera pans from the resulting mess up to Iron Eyes Cody's face, and we see a solitary tear run down his cheek. Although the public service announcement won many awards, and is highly memorable even to those who were extremely young while it was broadcast, Cialdini (2003) argues that it was not only ineffective but likely counterproductive, because the injunctive message "pollution is wrong" was likely overwhelmed by the descriptive message "pollution is inevitable and everyone does it".

Empirical support for the destructive power of unintended descriptive norms comes from a study in Arizona's Petrified Forest National Park (Cialdini, 2003). Theft of pieces of petrified wood from the park by visitors was a serious problem. Park officials sought to discourage the behavior with a prominent sign near the entrance that read "Your heritage is being vandalized every day by theft losses of petrified wood of 14 tons a year, mostly a small piece at a time." Although the author of the sign likely sought to inspire responsible behavior by communicating the magnitude of the problem, and providing an implicit message that individuals should refrain from stealing petrified wood; the explicit, more salient message was that hundreds of people were stealing wood all the time every day. Following the failure of the sign to stop the theft, Cialdini and

colleagues worked with park officials to test the impact of an alternative injunctive message. Over 5 weekends, researchers placed secretly marked pieces of petrified wood along several trails in the park, and placed one of two signs at the trailheads. Signs either contained a primarily descriptive message ("Many past visitors have removed petrified wood from the Park, changing the natural state of the Petrified Forest"), or a primarily injunctive message ("Please don't remove the petrified wood from the Park, in order to preserve the natural state of the Petrified Forest"). The rate at which planted pieces of petrified wood were stolen was assessed. The injunctive message was far more effective at deterring theft than the descriptive message (1.67% versus 7.92%), providing evidence that different types of normative pressure can have profoundly different impacts on behavior.

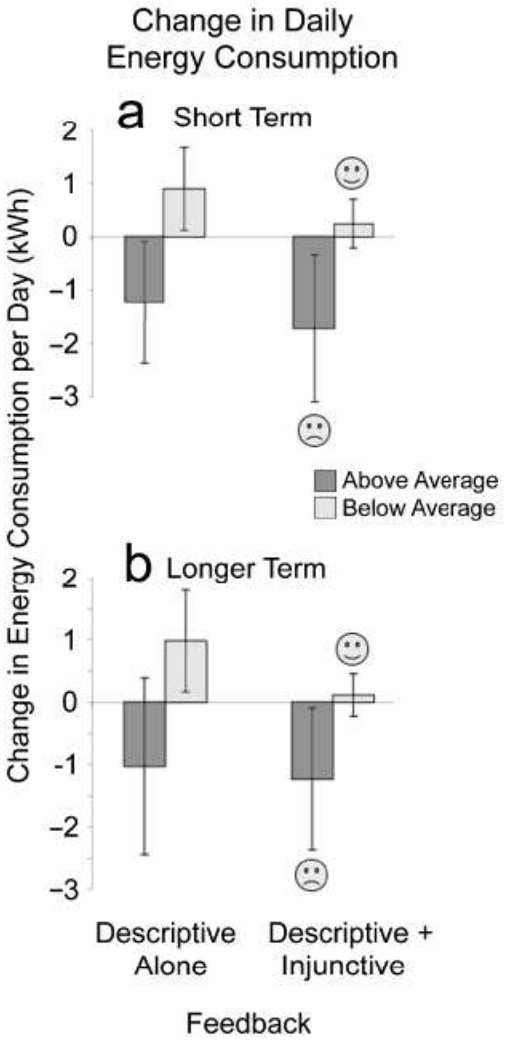
Indeed, Psychology has long acknowledged that the phrase "normative pressure" does not always refer to the same thing. An early classification scheme of motivations to conform in modifications of the Asch (1951) line task separated *informational* social influence from *normative* social influence; where informational social influence referred to participants' use of others' judgments as a source of evidence about the state of the world, and normative social influence referred to pressure to act in a particular (socially expected) way. In a series of five conditions, Deutsch and Gerard (1955) varied the extent to which participants in the line task felt group membership with confederates, as well as participants' confidence in their own judgments and their degree of commitment to their initial answer. Deutsch and Gerard (1955) found that participant error rates were most sensitive to social influences when group affiliation was high, when confidence was low, and when they had not previously committed to an answer. Furthermore, a significant

interaction between affiliation and confidence such that affiliation had the largest influence when confidence was low was interpreted as evidence for the informational/normative distinction. Arguably, Deutsch and Gerard's (1955) informational/normative distinction can be considered orthogonal to Cialdini's descriptive/injunctive description. Both descriptive and injunctive norms provide information about what behaviors are appropriate, and most individuals feel some pressure to conform to both.

Half a century later, an influential field study on residential energy conservation in California conducted by Robert Cialdini further demonstrated the importance of considering both descriptive and injunctive norms (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Partnering with a local electric utility, the researchers tested the effect of providing households with normative information about their electricity consumption. Baseline rates of consumption were measured for a sample of 290 households. Each household then received information about their consumption during the previous week, information about the neighborhood average during the same period, and a list of suggestions on how to conserve energy. Information was provided via a note left on their door during a meter reading. For half of the participants, the note also contained a small picture indicating whether their consumption was above or below the mean for their neighborhood. The picture was either a smiley face for those households using less energy than their neighbors, or a frowny face for households using more. Schultz et al. (2007) predicted that although the emoticon carried no additional descriptive information about a household's relative usage, it would provide important

injunctive information. Follow-up meter readings were taken 1 and 5 weeks after the initial note was left, with a second note left during the first follow-up reading.

Households in the descriptive norm only group whose initial consumption was above average reduced their consumption by about 1 kilowatt-hour (kWh) per day. However, households in the descriptive norm only group whose initial consumption was below average *increased* their electricity consumption by the same amount, an example of the boomerang effect. In contrast, households in the descriptive + injunctive group reduced their daily usage by a mean of 1 kWh if their initial consumption was above average, similarly to the descriptive only group, but unlikely the descriptive only group those households whose initial consumption was below average exhibited only a very slight increase. The pattern of results was similar at weeks 1 and 5, and is shown in the figure at right. Schultz et al.'s (2007) results suggest that injunctive norms are an effective tool for protecting against the boomerang effect when employing interventions that make use of the power of descriptive norms.



The next section of the survey contains information about how your shoreline contributes to overall lake health. Please review all the information carefully, in the order it appears. The final pages of the survey ask questions about whether the information was useful, how well you think it was presented, and how you think it can be improved.

If the next section contains a worksheet, please complete all parts of it.

If the next section contains a report, please read it carefully and think about how your shoreline contributes to lake health.

When you are done, please return all pages with your survey. Feel free to write comments on any of the pages. All of your responses are completely confidential. They will never be shared with anyone other than study personnel. Thank you once again for your time and valuable feedback.

Lake health and your personal shoreline

Wisconsin's lakes define our landscape and our identity. It's important that we keep them healthy and clean. The shoreline vegetation around a lake has two critical functions for helping achieve overall lake health.

A filter for the lake

- Runoff from rain and snowmelt carry pollution into the lake
- Pollution harms water quality
- Pollution can cause excessive growth of aquatic plants and algae
- Shrubs, tall grasses, fallen leaves and pine needles act as a filter
- Roots hold soil in place and help prevent erosion

Well vegetated shorelines clean the water that enters the lake.

Photo by John Hiebert

Critical Habitat

- Many species need shoreline vegetation for habitat
- Frogs lay their eggs in warm water by the shore
- Bald eagles use high limbs over the water to hunt
- Smallmouth bass need low-sediment water to spawn
- Songbirds find food and nest in shoreline vegetation
- Good habitat can help stop the spread of invasive species

Well vegetated shorelines give these animals what they need to survive and thrive.

QUESTIONS

Please take a minute to answer these questions, and think about why the lake is important to you.

• The beauty of the lake is what makes it great.	NO	UNSURE	YES
• I enjoy bringing my friends and family to the lake.	NO	UNSURE	YES
• The way I maintain my shoreline has an effect on the lake.	NO	UNSURE	YES
• Plants and animals have a right to live at the lake.	NO	UNSURE	YES
• Because I'm a property owner, I share responsibility for taking care of the lake.	NO	UNSURE	YES
• Sometimes the lake is too full of algae.	NO	UNSURE	YES

Lake health and your personal shoreline

Wisconsin's lakes define our landscape and our identity. It's important that we keep them healthy and clean. The shoreline vegetation around a lake has two critical functions for helping achieve overall lake health.

A filter for the lake

- Runoff from rain and snowmelt carry pollution into the lake
- Pollution harms water quality
- Pollution can cause excessive growth of aquatic plants and algae
- Shrubs, tall grasses, fallen leaves and pine needles act as a filter
- Roots hold soil in place and help prevent erosion

Well vegetated shorelines clean the water that enters the lake.

Photo by John Hiebert

Critical Habitat

- Many species need shoreline vegetation for habitat
- Frogs lay their eggs in warm water by the shore
- Bald eagles use high limbs over the water to hunt
- Smallmouth bass need low-sediment water to spawn
- Songbirds find food and nest in shoreline vegetation
- Good habitat can help stop the spread of invasive species

Well vegetated shorelines give these animals what they need to survive and thrive.

Your Shoreline's Contribution to Lake Health

Shoreland vegetation is critical to a healthy lake. It provides habitat for birds, frogs, turtles, mammals and plants. It also cleans the water that flows over the landscape into the lake. This worksheet estimates how features of your personal shoreline contribute to lake health.

For each feature, estimate the amount on **your shoreline**, and circle the number in the best-fitting column. *For example, if about half the land on your shore has high tree branches overhead, you would circle "2".*

Land within 35 feet of the shore	almost none	under half	about half	over half	nearly all	your score
How much of the land has high tree branches overhead?	0	1	2	3	4	
How much of the land has shrubs, flowers, prairie grasses or small trees growing on it?	0	2	4	6	8	
How much of the land is mowed lawn?	0	-1	-2	-3	-4	
How much of the land is covered by bare dirt, created beach, stones, or pavement?	0	-2	-4	-6	-8	

Water in the lake, next to your property	almost none	under half	about half	over half	nearly all	your score
How much of the water has aquatic plants growing in it?	0	1	2	3	4	
How much of the water has fallen branches or dead trees in it?	0	1	2	3	4	
How much of the lake bottom is covered by gravel, imported sand, rock or concrete?	0	-2	-4	-6	-8	

Your Total Score: ____

Once you're done, write each number you circled in the column at right labeled "your score". Then add up all of your scores to get your total score. Note that the red numbers are negative, so they subtract from your total score. Compare your total score to the levels below.

0 or less	1 - 9	10 - 14	15 or more
very poor *Lots of room to improve!*	**poor** *Some changes could have a big impact.*	**ok** *Small changes could make it even better.*	**great** *Keep it up!*

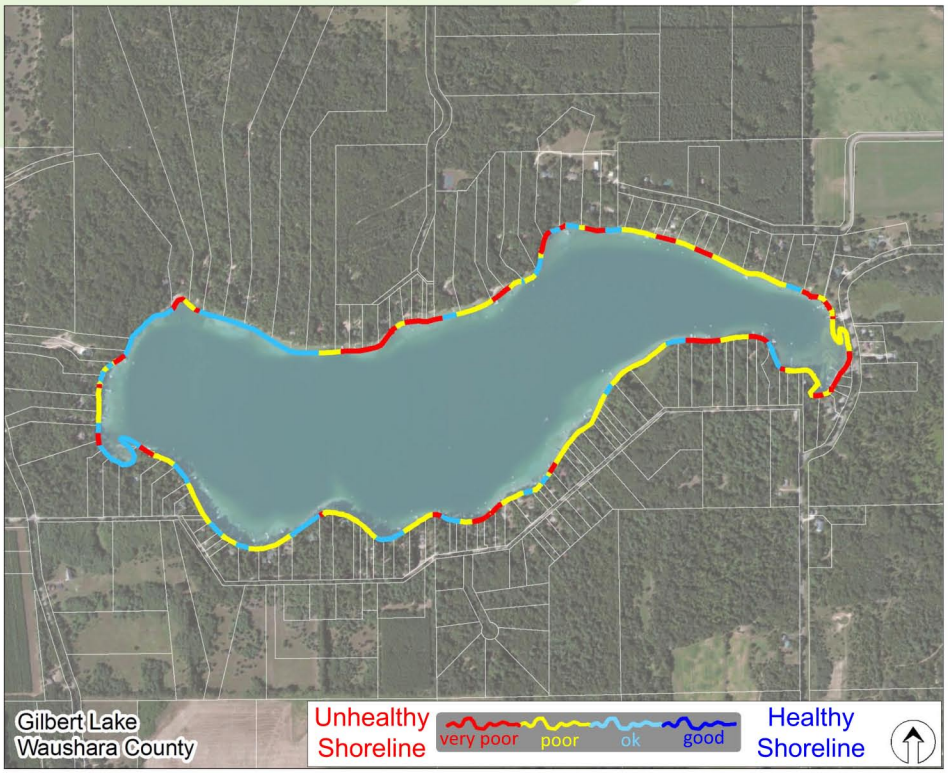
Use your score to think about ways to improve your shoreline's contribution to lake health.
Call a professional from your County Conservation Office for a free consultation today! 920-787-0443

For more information visit: www4.uwsp.edu/cnr/uwexlakes/

Lake Assessment for Gilbert Lake
Waushara County

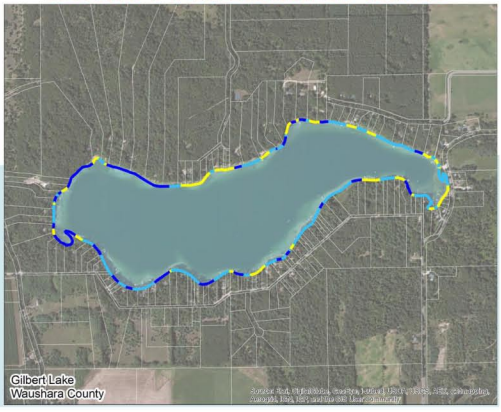
Shoreland vegetation is critical to a healthy lake. It provides habitat for birds, frogs, turtles, mammals and plants. It also cleans the water that flows over the landscape into the lake.

This large map shows an assesment of your lake. Colored lines show how well each area contributes to overall lake health. Mixes of native flowers, shrubs and trees help a healthy lake, but paved areas and large mowed lawns or raked beaches can hurt it. The data for the map was collected as part of a county-wide lake assessment project.



Goal: A healthier lake

The small map at right shows what a healthier lake could look like, if each property owner made small changes to their personal shoreline in the coming year. A truly healthy lake should have a dark blue buffer all the way around, but every improvement makes a difference.



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After seeing the printed information about your shoreline, how much do you agree or disagree with each of the following statements?

I feel that it's important to take good care of the lake.
(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

I can picture my lake with a healthier shoreline in the future.
(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

The information highlighted the harm that poorly vegetated shorelines can do.
(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

The information highlighted the value of shoreline vegetation.
(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

Compared to other lakes, my lake is in pretty good health.
(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

While reading the information, I thought about specific features of my personal shoreline.
(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

I learned something I didn't know about how my shoreline contributes to lake health.
(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

The information was presented in a way that made it interesting.
(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

The information was easy to understand.
(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

Do you have any other comments about the printed information, or how it was presented?

_____

_____

_____

_____

How much do you agree or disagree with each of the following statements?

I will consider increasing my shoreline buffer by planting new shrubs, grasses, or trees.

(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

☐ Not applicable; my shoreline is already heavily vegetated.

I will consider increasing my shoreline buffer by extending the un-mowed or un-cut area further up onto the land.

(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

☐ Not applicable; my shoreline is already heavily vegetated.

How I maintain my shoreline affects the health of the lake.

(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

It is important that I grow a vegetated buffer along my shoreline.

(strongly disagree) 1 2 3 4 5 6 7 (strongly agree)

Finally, please tell us a little about yourself and your shoreline property:

How many years have you owned your lake property? _____

How many months per year do you live at that property? Please circle one.

A. Year round B. 6-11 months C. 2-5 months D. less than 2 months

Do you have children or grandchildren who play or swim at your property?

A. Yes, often B. Yes, occasionally C. No

Are you and/or your spouse the sole owner(s) of this property? Please circle: Yes No

If no, what is your relationship to the owner? _____

Do you have any other comments for us?

_____

_____

Lastly, based on your responses we may want to contact in the future with information about programs or opportunities that you might find useful. In addition, some participants may be randomly selected for a short follow-up survey. We appreciate the time you already took to complete this survey, so if you prefer not to be contacted again, please check the box below.

☐ *Please do not contact me with information about programs or opportunities.*

☐ *Please do not contact me for a follow-up survey.*

Thank you very much for completing this survey! Please return all of the pages within one week of receiving this survey, using the pre-addressed envelope you received.

FIN!