

Quality Connections:

Recreation, Property Ownership, Place Attachment, and Conservation of Minnesota

Lakes

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Dedication

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Abstract

Recently, people have expressed concerns about how declining outdoor recreation participation and increasing housing development in high-amenity areas may affect conservation attitudes and behaviors as well as environmental quality. Recreation participation and property ownership have been identified as antecedents to place attachment. However, limited research has examined how people develop attachments to specific places and how these attachments relate to management preferences and support for conservation of specific areas.

This study used data from two 2004 surveys addressing the management of lakes and aquatic plants in Minnesota. One study was conducted with a sample of Minnesota residents and the other with a sample of lakeshore landowners on “fisheries lakes” in the state. Data were analyzed to examine relationships among recreation participation, lakeshore property ownership, place attachment, and intentions to conserve lakes. Four clusters of recreationists were identified: all-around, appreciative, consumptive, and less-involved. Respondents were also segmented based on their ownership of lakeshore property, and whether property was used as a primary or second home.

This study contributed to research on how participation in outdoor recreation relates to environmental attitudes and behavioral intentions. Results suggested that recreation participation relates to attitudes and behavioral intentions for lake protection. Among members of the general public, less-involved participants in lake-based recreation reported significantly lower intentions to take political or philanthropic action to protect lakes. Appreciative recreationists from the general public sample were more likely to take political action, while all-around and consumptive recreationists were somewhat more likely to donate time and money to protect lakes. Among lakeshore property owners, less-involved recreation participants reported lower personal responsibility for protecting their lake generally and a lower rating of personal norms for protecting native aquatic plants. However, all-around recreationists from the lakeshore property owner sample reported significantly higher behavioral intentions to

remove native aquatic plants compared to appreciative, consumptive, and less-involved recreationists.

The study advanced research on place attachment by: (a) examining visitors' and residents' attachment to Minnesota lakes and (b) how place attachment relates to conservation attitudes and behavioral intentions. Stronger place attachment was associated with property ownership and frequency of recreation participation. The study developed a scale to measure family connections to a lake, which was introduced in this dissertation as normative place attachment.

Results supported previous research that has suggested: (a) a positive relationship between outdoor recreation and environmental attitudes, and (b) differences based on the type of recreation participation. Study findings suggested the importance of recreation participation to protection of Minnesota lakes. Participation in lake-based outdoor recreation was related to place attachment, personal responsibility, and behavioral intentions related to lakes. In particular, less-involved recreation participants reported lower levels of attitudinal and normative place attachment to lakes, expressed less personal responsibility for protecting lakes, and had the lowest intentions of taking philanthropic or political action to protect lakes. However, a substantial amount of unexplained variance remained in models of attitudes and behavioral intentions related to the protection of lakes and aquatic plants. Future studies of recreation, property ownership, place attachment, and conservation, could incorporate more comprehensive measures of recreation participation, place attachment, "insidedness" to a place, and environmental attitudes, and behavioral intentions. In addition, future research could examine the influence of place meanings, environmental values, social capital, sense of community, political ideology, educational background, and length of association with a place on environmental attitudes, behavioral intentions, and actual behaviors.

Key words: conservation, lakeshore property, norm activation theory, place attachment, recreation participation, structural equation modeling

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CHAPTER 1

Introduction and Overview

Introduction

Over 30 years ago, Dunlap and Heffernan (1975) explored the relationship between outdoor recreation participation and environmental concern. Researchers have continued to examine how outdoor recreation participation and attachment to special places relate to environmental concern and environmentally responsible behavior (Bright & Porter, 2001; Hvenegaard, 2002; Theodori, Luloff, & Willits, 1998; Vaske & Kobrin, 2001; Wells & Lekies, 2006). Recently, authors in both the research and popular literature have expressed concern about declining participation in outdoor recreation activities in the United States, and how this decline could have negative implications for natural resource protection (Cordell, Betz, & Green, 2002; Kelly, 2004; Louv, 2006).

Research needs to clarify the relationships among recreation, place attachment, and environmental attitudes and behaviors. Research has explored: (a) how outdoor recreation involvement relates to place attachment (Bricker & Kerstetter, 2000; Kyle, Bricker, Graefe, & Wickham, 2004; Kyle, Graefe, Manning, & Bacon, 2003; Moore & Graefe, 1994), (b) perception of the land and place attachment among property owners (Gobster & Rickenbach, 2004; Jorgensen & Stedman, 2001; Kluender & Walkingstick, 2000; Stedman, 2006), and (c) the relationship between outdoor recreation and environmental concern (Bright & Porter, 2001; Dunlap & Heffernan, 1975; Hvenegaard, 2002; Theodori et al., 1998; Wells & Lekies, 2006). Researchers, however, have identified substantial methodological problems with how recreation participation and environmental concern have been measured (Bright & Porter, 2001; Teisl & O'Brien, 2003).

Study Purpose and Methodology

The purpose of this research was to further analyze the relationships among: (a) outdoor recreation, (b) property ownership, (c) place attachment, and (d) environmental attitudes, personal norms, and behavioral intentions related to Minnesota lakes. The specific goals of this study were to:

- investigate how Minnesota residents connect to lakes through outdoor recreation and how place attachment may lead people to conserve a special lake,
- examine how lakeshore property owners connect to the lakes where they own property and how place attachment, recreation participation, and primary- versus second-home ownership affects their attitudes about protecting the lake,
- model place attachment as an affective precursor to ascribed responsibility and awareness of consequences in Schwartz' (1977) norm activation theory of altruistic behavior as applied to protection of aquatic plants, and examine differences in models based on property ownership and recreation participation.

Data were collected through two mail surveys, one conducted with a sample of Minnesota residents and another conducted with a sample of lakeshore landowners on “fisheries lakes” in the state (Appendices A and B).

Literature Review

How Outdoor Recreation Relates to Environmental Concern and Environmentally Responsible Behavior

Outdoor recreation was considered an important factor in the rise of environmentalism in the United States (Dunlap & Heffernan, 1975). Early waves of the environmental movement were driven by outdoor recreationists—particularly hunters, anglers, bird watchers, hikers, campers, and mountaineers (Taylor, 2000). Indeed, mainstream environmental issues were framed by emphasizing wildlife and wilderness protection, and outdoor recreation (Taylor, 2000). Outdoor recreation was thought to: (a) create awareness of environmental problems by exposing people to environmental degradation, (b) create commitment to protection of valued recreation sites, and (c) cultivate an aesthetic appreciation for “natural” places (Cottrell, 2003; Dunlap & Heffernan, 1975). In addition, because social networks and identity salience facilitate environmental activities and organization memberships (Taylor, 2000), social networks and identification with outdoor recreation likely influenced peoples’ concern for the environment and subsequent environmental behavior.

During the 1970s, “participation in outdoor recreation, particularly appreciative activities, was expected to increase greatly” (Dunlap & Heffernan, 1975, p. 26). So, Dunlap and Heffernan (1975) examined: (a) the relationship between outdoor recreation participation and environmental concern, (b) whether the relationship was stronger for appreciative recreation activities (e.g. hiking) than for consumptive activities (e.g. hunting), and (c) whether the association between recreation and environmental concern

was stronger when concern was for an environment necessary for pursuing the activity as opposed to general environmental concerns like air pollution.

After Dunlap and Heffernan (1975) found limited to moderate support for a positive relationship between outdoor recreation and environmental concern, researchers continued to explore the relationship with less than consistent findings (Bright & Porter, 2001; Theodori et al., 1998). Theodori et al. (1998) found support for a relationship between recreation participation and environmentally responsible behavior, but—in contrast to previous research—did not find differences in environmental behavior among different types of outdoor activities. They suggested that researchers find a new way to classify outdoor recreation participation beyond consumptive and appreciative (Theodori et al., 1998). Others (Bright & Porter, 1994; Teisl & O'Brien, 2003) shared this concern and used other methods to differentiate recreation participation.

Bright and Porter (2001) developed a wildlife-related recreation participation scale based on: (a) participation in an activity within the past 3 years, (b) importance of the activity, (c) number of years participating in important activities, and (d) frequency of participation. Bright and Porter (2001) also used meanings underlying recreation participation to predict environmental concern. They found that researchers could derive more information about peoples' environmental concerns by looking at what recreation activities meant to participants. For some activities, the meaning behind the activity fully mediated the relationship between recreation participation and environmental concern. The data, however, “did not fit the theoretical models well” (p.

274). In addition, this research was limited to involvement in “wildlife-related” recreation based on a sample drawn from hunting and fishing license records.

Tiesl and O’Brien (2003) used regression analysis to examine the influence of recreation participation on various measures of environmental concern. They found that outdoor recreation participation, relative to no participation, was positively associated with environmental concern and behavior. They also found that the level of concern depended on the type of outdoor recreation activity. This research made the important comparison between recreationists and nonrecreationists, but it did not account for level of involvement or motivations for participation.

Research has examined pathways to environmentalism, emphasizing the influence of childhood outdoor experiences and recreation activities on adult environmental attitudes and behavior (Chawla, 1999; Ewert, Place, & Sibthorp, 2005; Tanner, 1980; Wells & Lekies, 2006). This research, which for the most part has been small-scale and qualitative, has documented a relationship between outdoor recreation experiences and environmental attitudes. Tanner (1980) documented significant life experiences, including outdoor experiences like hunting, fishing, hiking, and bird watching during childhood, as formative influences leading people into careers in conservation. Other studies have reinforced the importance of informal outdoor experiences and time spent in natural areas on environmental interests and actions, although most studies have focused on committed, White, middle-class environmental activists and lacked comparison to other groups (Chawla, 1999). Ewert and colleagues (2005) found a positive relationship between appreciative outdoor activities and ecocentric attitudes and a negative relationship between consumptive activities and

ecocentric attitudes. Wells and Lekies (2006) found that experiences with both “wild” and “domestic” nature as a child were predictive of environmental attitudes and behaviors. Wells and Lekies’ (2006) measures of wild and domestic nature included both appreciative and consumptive activities. In addition to experiences in the natural world, childhood connections to animals and role models who taught respect for the natural world have been found to relate to care for the natural world (Chawla, 1999; Tanner, 1980; Vining, 2003).

Additional research is needed to clarify the relationship between recreation participation and environmental concern. Most of the extant research has simply examined differences in environmental concern between participants in consumptive and appreciative recreation activities. Researchers need to study peoples’ outdoor experiences to examine the effects of peak aesthetic or transcendent outdoor experiences (Vining, 2003). Although recent work (Bright & Porter, 2001; Teisl & O’Brien, 2003) has brought important methodological improvements, researchers need to test other methods for classifying recreation participation and the motivations and meanings that drive it. In addition, most of the research has focused on the relationship between recreation participation and general environmental attitudes or behaviors. The research has not examined how recreation at a specific location relates to environmental attitudes and behaviors directed at that place.

Outdoor Recreation and Place Attachment

Research has suggested that involvement in leisure activities is an antecedent to attachment to particular settings (Kyle et al., 2004). Some research has indicated that recreationists with the highest attachment to a place have the highest frequency of use

and live in close proximity to that place (Moore & Graefe, 1994). Other research has suggested that social ties to a recreation activity relate to attachment to a particular setting (Kyle et al., 2004). The type of recreation activity has also been found to affect place attachment (Kyle et al., 2004).

Researchers have described place attachment as an affective construct—an emotional bond between people and places (Bott, Cantrill, & Myers, 2003; Davenport & Anderson, 2005). Brooks, Wallace, and Williams (2006) described place in terms of a relationship metaphor, with similar feelings including intimacy, love, attachment, commitment, interdependence, and knowledge. Activities and emotional experiences make spaces become places (Davenport & Anderson, 2005; Tuan, 1974). Emotionally laden memories can determine place attachment; “affective dimensions of a visit to an area includ[e] reminiscing, remembrances, and a sense of ownership for [an] area” (Bott et al., 2003, p. 106).

Leisure researchers have described the meanings associated with place as place dependence and place identity (Bott et al., 2003; Davenport & Anderson, 2005; Kyle et al, 2003; Moore & Graefe, 1994). Place dependence reflects the functional utility of a setting in facilitating a recreation activity, while place identity reflects an emotional connection (Kyle et al, 2003; Kyle et al., 2004; Moore & Graefe, 1994). Important places also reflect peoples’ evolving identities (Brooks et al., 2006). Place dependence may develop quickly if a setting is convenient and good for a particular activity, whereas place identity may take longer to emerge (Moore & Graefe, 1994). Place identity relates to more symbolic meanings, such as profound first experiences or being from a place (Bott et al., 2003; Davenport & Anderson, 2005). Surprisingly, recreation

involvement has been found to be a better predictor of place identity than place dependence, even among activities that rely on specific recreation settings with limited substitutes (Kyle et al., 2004). Self expression and attraction to an activity have been found to predict place identity, while only self expression has been found to predict place dependence (Kyle et al, 2003).

There has been considerable dialogue in the literature about the nature and measurement of place attachment (Patterson & Williams, 2005; Stedman, 2003a, 2008; Stokowski, 2002, 2008; Van Patten & Williams, 2008; Williams, 2008). Much of the discussion has contrasted end-state, attitudinal measures of place attachment to process-oriented measures of place meanings (Patterson & Williams, 2005; Stedman, 2008; Van Patten & Williams; Williams, 2008). Attitude measures of place connect place attachment to established social psychology methods (Williams, 2008), specifically enabling researchers to examine cognitive (i.e. identity), affective (i.e. attachment), and conative (i.e. dependence) aspects of the construct (Jorgensen & Stedman, 2001). Attitudinal measures of place attachment are also useful for directly measuring and comparing the strength of connections between people and places (Williams, 2008). Process-oriented measures of place meaning complement attitudinal measures of place attachment by more deeply examining the relationships between people and places (Williams, 2008). Examining place meaning ensures that researchers and managers understand the broader range of meanings associated with places rather than simply using superficial measures of place attachment (Patterson & Williams, 2005; Stedman, 2008; Williams, 2008). Further debate has compared the traditional social psychological notion of individually held attitudes to a social construction of place (Stokowski, 2002,

2008; Van Patten & Williams, 2008; Williams, 2008). The emerging study of sense of place as a social construction underscores how interactions with other individuals, groups, and the media affect people's feelings about place (Stokowski, 2002, 2008). The social constructionist approach calls attention to the dynamic and complex nature of place attachment and place meaning (Stokowski, 2002, 2008). Different theories and measures of place offer varying perspectives to examine people's diverse relationships with places.

Although the research has explored how recreation participation relates to place attachment, little research has explored how recreationists' attachment to favorite places relates to environmental concern or conservation behavior for a specific place. Wellman and colleagues (1982) found that recreationists who are more attached to recreation settings may be more likely to act as stewards and less likely to engage in depreciative behavior. Place attachment, and particularly place identity, are "potentially robust predictors of behavior because they may represent enduring mental and emotional configurations" (Bott et al., 2003).

Property Ownership and Place Attachment

Research has examined how the characteristics of the environment, peoples' use of a place, and associated meanings relate to sense of place (Stedman, 2003b). Place attachment has been associated with a sense of ownership (Bott et al., 2003), but research has not specifically examined how place attachment differs among visitors, seasonal residents, and permanent residents of special places. The meanings that people associate with a place translate into emotional bonds (Davenport & Anderson, 2005), and different individuals and groups associate different meanings to places (Bott et al.,

2003). It is likely that meanings differ between visitors, seasonal residents, and permanent residents of a place.

The leisure research has emphasized a connection between recreation use and place attachment, while other research has emphasized attachment to residential places. Moore and Graefe (1994) noted that the place of greatest personal significance is often the home. Home, however, can be associated with “rootedness” rather than place attachment. Tuan (1980) felt that rootedness was simply long habitation at one place, while sense of place implied a distance between self and place that allowed for appreciation.

Stedman (2003a) suggested the need to study place attachment in settings that are more diverse in “mode of interaction” (p. 682) in order to better understand the relationship between place, experience, and attachment. Similarly, Davenport and Anderson (2005) noted the need to use “more holistic and integrative models of the human-environment relationship” (p. 638). They noted that the place attachment research has emphasized visitors’ attachments to recreation areas, which may be “fundamentally different from those of local residents” (Davenport & Anderson, 2005, p. 638). In their study of place attachment among local community members, Davenport and Anderson (2005) found sustenance and nature dimensions to place attachment, in addition to identity and recreation-related meanings. Therefore, research needs to examine how attachment to special places differs between property owners and visitors, and between residential property owners and vacation/seasonal property owners.

Place Attachment and Conservation

Limited research has examined how people develop attachments to specific places and how these attachments relate to management preferences and support for conservation of specific areas. Vorkinn and Riese (2001) found that place attachment, which included a measure of recreation involvement, was related to environmental concern about a proposed hydropower development in Norway. Similarly, Payton, Fulton, and Anderson (2005) found that emotional place attachment (but not functional attachment) was a significant positive predictor of civic action taken to protect a wildlife refuge. Vaske and Kobrin (2001) found a positive relationship between place attachment and environmentally responsible behavior among youth involved in natural-resource-based work programs. Their research suggested that functional attachment to a place can lead to emotional attachment, which can in turn lead to pro-environmental behavior (Vaske & Kobrin, 2001). Vaske and Kobrin's (2001) research has not been extended to older individuals.

Environmental Concern/Environmentally Responsible Behavior

A complex web of internal factors (e.g. environmental knowledge, values, attitudes, emotions, motivations, identity, locus of control, personal norms, habits) and external (e.g. institutional, economic, cultural, social) factors influence pro-environmental behavior (Dietz, Fitzgerald, & Shwom, 2005; Kollmuss & Agyeman, 2002; Stern 2000a). Research related to environmental behavior has typically surveyed self-reported behaviors, behavioral intentions, attitudes, or norms, rather than using costly direct observation of behavior (Dietz et al., 2005).

Stern (2000a) suggested that a causal chain of personal and contextual factors ultimately lead to environmentally responsible behavior. Although research does support a link between values, environmental attitudes, and environmental behaviors (Schultz, 2001; Schultz et al., 2005; Schultz & Zelezny, 1999), much research has documented a gap in the causal chain between possessing environmental knowledge and/or attitudes, and implementing environmental behaviors (Cottrell, 2003; Kollmuss & Agyeman, 2002; Lee & Holden, 1999). One reason for this is that environmentally consequential behavior is strongly influenced by factors outside individual people's control, particularly the convenience of the activity (Cottrell, 2003; Dietz et al., 2005; Kollmuss & Agyeman, 2002; Vining & Saunders, 2004). Attitude strength, awareness of harmful consequences, and ascription of responsibility could also moderate the relationship between values, attitudes, and behavior related to environmental protection (Franc, 1999; Schultz et al., 2005). The gap between environmental attitudes and behaviors often derives from flaws in research methodology, particularly violation of the principle of compatibility between attitude and behavior measures (Eagly & Chaiken, 1993; Kollmuss & Agyeman, 2002).

Much research has focused on environmental concern rather than intended or actual pro-environmental behavior (Theodori et al., 1998). Stern (2000a) describes environmental concern as "a predisposition toward proenvironmental behavior," and suggests that it lies at an intermediate point in the chain leading to behavior (Stern, 2000a, p. 525). Concern derives from the sense that something is important and the belief that it may be at risk (Dietz et al., 2005). The value clusters (or motivations) of altruism and self-interest have been found to be key correlates of environmental concern

(Dietz et al., 2005; Dietz, Kalof, & Stern, 2002; Lee & Holden, 1999). Strong support has been found for a “tripartite classification of environmental concerns organized around concern for self, other people, or the biosphere” (Schultz, 2001; Schultz et al., 2005; Schultz & Zelezny, 1999).

Recent research has emphasized the cognitive hierarchy to examine environmental values, attitudes, intentions, and actions (Bruskotter & Fulton, 2008; Hines, Hungerford, & Tomera, 1987; McFarlane, Craig, Stumpf-Allen, & Watson, 2007; Theodori et al., 1998; Vaske & Donnelly, 1999; Whittaker, Vaske, & Manfreda, 2006). Emotions are vital to our understanding of environmentally responsible behavior, but the affective component—caring for nature and the environment—has been largely ignored in the literature (Vining, 2003; Vining & Saunders, 2004). The influence of identity (Stets & Biga, 2003) and culture (Laroche, Toffoli, Kim, & Muller, 1996) on environmental behavior have also been largely ignored.

Through a meta-analysis, Hines et al. (1987) examined cognitive, psychosocial, demographic, and experimental factors that might influence environmentally responsible behavior. They found that “knowledge of issues, knowledge of action strategies, locus of control, attitudes, verbal commitment, and an individual’s sense of responsibility” most strongly influenced environmentally responsible behavior (Hines et al., 1987, p. 1). Along a similar line, Stern (2000b) categorized the causal variables for environmentally significant behavior as: (a) attitudinal (e.g. general environmental predisposition, behavior-specific norms and beliefs, nonenvironmental attitudes, perceived costs and benefits of an action), (b) personal capabilities (e.g. literacy, social status, financial resources, behavior-specific knowledge, and skills), (c) contextual

factors (e.g. material costs and rewards, laws and regulations, available technology, social norms and expectations, supportive policies, advertising), and (d) habit and routine. Kollmuss and Agyeman (2002) presented an untested model of pro-environmental behavior predicted by external factors, internal factors, and barriers. Their model presented the concept of environmental consciousness, which incorporates knowledge, values, attitudes, and emotional involvement related to an environmental behavior (Kollmuss & Agyeman, 2002).

Researchers have begun to categorize and examine specific types of environmental behaviors. Stern (2000b) categorized behaviors into four groups: (a) environmental activism (e.g. organization membership, demonstrations), (b) nonactivist public-sphere behaviors (e.g. petitioning, joining groups, supporting policy), (c) private sphere environmentalism (e.g. consumer behavior, changes in lifestyle), and (d) other. Smith-Sebasto and D'Acosta (1995) divided environmental actions into six categories: (a) civic action, (b) educational action, (c) financial action, (d) legal action, (e) physical action, and (f) persuasive action. These breakdowns parallel classifications made in political psychology differentiating civic and political participation into: (a) active monitoring (e.g. following an issue in the media), (b) conventional participation (e.g. voting and petitions), (c) making one's voice heard (e.g. protests), (d) joining organizations, and (e) community involvement (e.g. volunteering) (Haste, 2006). Developing valid and reliable measures of different types of environmental behaviors is important because, as in other civic and political behavior, there are likely different correlates for different types of behavior (Haste, 2004; Smith-Sebasto & D'Acosta, 1995).

Premise for the Following Studies

Despite the volume of research examining recreation, place attachment, and environmental concern, research needs to further clarify how participation in outdoor recreation shapes peoples' attachment to special places and subsequent environmental attitudes and behavioral intentions. The following three chapters address each of the three study objectives as a stand-alone paper, together contributing to the study purpose of analyzing the relationships among recreation participation, property ownership, place attachment, and conservation.

CHAPTER 2

Political Action and Philanthropy for Lake Protection: Do Outdoor Recreation Participation and Place Attachment Predict Intention to Conserve Minnesota Lakes?

Introduction

Over 30 years ago, Dunlap and Heffernan (1975) explored the relationship between outdoor recreation participation and environmental concern. More recently, researchers have examined the relationship between recreation participation and place attachment (Anderson & Fulton, 2008; Kyle, Bricker, Graefe, & Wickham, 2004; Moore & Graefe, 1994). Researchers have also studied how place attachment relates to environmental concern and environmentally responsible behavior (Payton, Fulton, & Anderson, 2005; Vaske & Kobrin, 2001; Vorkinn, & Riese, 2001). No research that we are aware of, however, has collectively modeled recreation participation, place attachment, and intentions to take environmentally responsible behavior. Research needs to clarify the relationships among recreation participation, place attachment, and conservation. This study examines the relationships among lake-based recreation participation, attachment to a lake used most often, and intention to take action to protect that lake.

Literature Review

Outdoor Recreation and Environmental Concern

Outdoor recreation was considered an important factor in the rise of environmentalism in the United States (Dunlap & Heffernan, 1975). The early environmental movement was driven by outdoor recreationists—particularly hunters, anglers, bird watchers, hikers, campers, and mountaineers (Taylor, 2000). Indeed, mainstream environmental issues were framed by emphasizing wildlife and wilderness protection, and outdoor recreation (Taylor, 2000). Outdoor recreation was thought to: (a) create awareness of environmental problems by exposing people to environmental

degradation, (b) create commitment to protection of valued recreation sites, and (c) cultivate an aesthetic appreciation for “natural” places (Cottrell, 2003; Dunlap & Heffernan, 1975). In addition, because social networks and identity salience facilitate environmental activities and organization memberships (Taylor, 2000), social networks and identification with outdoor recreation likely influenced peoples’ environmental concern and behavior.

In one of the first studies to explore the relationship between outdoor recreation and environmental concern, Dunlap and Heffernan (1975) examined: (a) the relationship between outdoor recreation participation and environmental concern, (b) whether the relationship was stronger for appreciative recreation activities (e.g. hiking) than for consumptive activities (e.g. hunting), and (c) whether the association between recreation and environmental concern was stronger when concern was for an environment necessary for pursuing the activity as opposed to general environmental concerns like air pollution. After Dunlap and Heffernan (1975) found limited support for a positive relationship between outdoor recreation and environmental concern, researchers continued to explore the relationship with less-than-consistent findings (Bright & Porter, 2001; Theodori, Lulogg, & Willits, 1998). Theodori et al. (1998) found support for a relationship between recreation participation and environmentally responsible behavior, but—in contrast to previous research—did not find differences in environmental behavior among different types of outdoor activities. Bright and Porter (2001) found that researchers could derive more information about peoples’ environmental concerns by looking at what recreation activities meant to participants. Teisl and O’Brien (2003) found that recreation participation, relative to no participation,

was positively associated with environmental concern and behavior. They also found that the level of concern depended on the type of outdoor recreation activity. Teisl and O'Brien's (2003) research made the important comparison between recreationists and nonrecreationists but did not account for level of involvement or motivations for participation.

During the 1970s, "participation in outdoor recreation, particularly appreciative activities, was expected to increase greatly" (Dunlap & Heffernan, 1975, p. 26). Recently, however, authors in the academic and popular literature have expressed concern about declining participation in outdoor recreation, and how this decline could negatively impact natural resource protection (Cordell, Betz, & Green, 2002; Kelley, 2004; Louv, 2006). Pergams and Zaradic (2008a) described a "fundamental and pervasive shift away from nature-based recreation" (p. 2295), and they detailed declines in (a) visitation to public lands in the U.S. and national parks in Japan and Spain, (b) U.S. game licenses issued, (c) time spent camping, and (d) time spent backpacking or hiking. Outdoor recreation participation per capita in Minnesota is estimated to be declining for a wide variety of activities (Kelly, 2005), and absolute participation numbers are stable or declining for fishing, hunting, and wildlife watching (Kelly, 2004). However, Jacobs and Manfredi (2008) noted that declines in outdoor recreation are not being observed across all activities, and that declining participation in outdoor recreation may not correspond strongly to reduced support for conservation.

Outdoor Recreation and Place Attachment

Researchers have described place attachment as an affective construct—an emotional bond between people and places (Bott, Cantrill, & Myers, 2003; Davenport

& Anderson, 2005). The concept of place attachment applies “sentiment and symbolism” (p. 935) to human relationships with places (Williams & Patterson, 2007). Activities and experiences make spaces become places (Davenport & Anderson, 2005; Tuan, 1974).

Research has demonstrated that involvement in leisure activities is an antecedent to attachment to particular settings (Anderson & Fulton, 2008; Kyle et al., 2004; Williams & Vaske, 2003). Research has also indicated that recreationists with the strongest attachment to a place have the longest history or highest frequency of use and may live in close proximity to a place (Anderson & Fulton, 2008; Moore & Graefe, 1994; Williams, Patterson, Roggenbuck, & Watson, 1992; Williams & Vaske, 2003). The type of recreation activity and social ties associated with the activity relate to attachment to a particular setting (Kyle et al., 2004). Anderson and Fulton (2008) found that recreation experience preferences mediate the relationship between recreation participation and place attachment.

Leisure researchers have described meanings associated with place as place dependence and place identity (Bott et al., 2003; Davenport & Anderson, 2005; Kyle, Graefe, Manning, & Bacon, 2003; Moore & Graefe, 1994). Place dependence reflects the functional utility of a setting in facilitating a recreation activity, while place identity reflects an emotional connection (Kyle et al., 2003; Kyle et al., 2004; Moore & Graefe, 1994). Place dependence may develop quickly if a setting is convenient and good for a particular activity, whereas place identity may take longer to emerge (Moore & Graefe, 1994). Place identity relates to more symbolic meanings, such as profound first experiences or being from a place (Bott et al., 2003; Davenport & Anderson, 2005).

Surprisingly, recreation involvement has been found to be a better predictor of place identity than place dependence, even among activities that rely on specific recreation settings with limited substitutes (Kyle et al., 2004).

Researchers have debated the nature and measurement of place attachment (Patterson & Williams, 2005; Stedman, 2003a, 2008; Stokowski, 2002, 2008; Van Patten & Williams, 2008; Williams, 2008). Discussion has contrasted end-state, attitudinal measures of place attachment to process-oriented measures of place meanings (Patterson & Williams, 2005; Stedman, 2008; Van Patten & Williams; Williams, 2008). Attitude measures of place connect place attachment to established social psychology methods (Williams, 2008), and enable researchers to examine cognitive (i.e. identity), affective (i.e. attachment), and conative (i.e. dependence) aspects of the construct (Jorgensen & Stedman, 2001). Attitudinal measures of place attachment are also useful for directly measuring and comparing the strength of connections between people and places (Williams, 2008). Process-oriented measures of place meaning complement attitudinal measures of place attachment by more deeply examining the relationships between people and places (Williams, 2008). Examining place meaning ensures that researchers and managers understand the broader range of meanings associated with places rather than simply using superficial measures of place attachment (Patterson & Williams, 2005; Stedman, 2008; Williams, 2008). Further debate has compared the traditional social psychological notion of individually held attitudes to a social construction of place (Stokowski, 2002, 2008; Van Patten & Williams, 2008; Williams, 2008). Studying sense of place as a social construction underscores how interactions with other individuals and groups affect feelings about

place (Stokowski, 2002, 2008). The social constructionist approach calls attention to the dynamic and complex nature of place attachment and place meaning (Stokowski, 2002, 2008). Although the research described in this study employs attitudinal measures, we recognize and appreciate the value of diverse approaches to measuring people's relationships with places.

Place Attachment and Conservation

Little research has explored how recreationists' attachment to favorite places relates to environmental concern or conservation behavior for a specific place. However, place attachment, and particularly place identity, are "potentially robust predictors of behavior because they may represent enduring mental and emotional configurations" (Bott et al., 2003, p. 106).

A variety of studies have associated stronger place attachment to greater inclination to protect the special place. Wellman and colleagues (1982) found that people who are more attached to recreation settings may be more likely to act as stewards and less likely to engage in depreciative behavior. Vorkinn and Riese (2001) found that place attachment, which included a measure of recreation involvement, was related to environmental concern about a proposed hydropower development in Norway. Similarly, Payton, Fulton, and Anderson (2005) found that emotional place attachment (but not functional attachment) was a significant positive predictor of civic action taken to protect a wildlife refuge. Vaske and Kobrin (2001) found a positive relationship between place attachment and environmentally responsible behavior among youth involved in natural-resource-based work programs. Their research suggested that functional attachment to a place can lead to emotional attachment and pro-

environmental behavior (Vaske & Kobrin, 2001). Finally, Stedman (2000) found that place attachment among lakeshore property owners was associated with willingness to engage in lake-protective behavior.

The Association of Lakes to Place Attachment and Environmental Concern

Lakes and other bodies of water have been identified as important focal points for place attachment and stewardship (Jorgensen & Stedman, 2001; Larson & Santelman, 2007; Stedman, 2006). Stedman (2006) noted that lakes of northern Wisconsin were “loci of attachment,” which embodied “potential for collective action” (p. 201). Stedman (2000) and Jorgensen and Stedman (2001) reported strong sense of place among lakeshore property owners in Northern Wisconsin. Lakeshore property owners in Wisconsin who expressed stronger attachment to their lake reported more willingness to engage in lake-protective behavior, while those who expressed greater place satisfaction expressed less willingness (Stedman, 2000). Larson and Santelman (2007) found that people who lived near water resources in Portland, Oregon were more strongly attached, had more positive attitudes about economic support for resource protection, but more negative attitudes about regulations to protect the resource.

The research goals were to (a) clarify how people connect to Minnesota lakes through outdoor recreation and (b) examine how place attachment may lead people to conserve a special lake. Based on findings from previous research, this research was guided by four hypotheses:

- H1: Increased participation in outdoor recreation would be related to stronger attachment to the lake used most often.

- H2: Increased participation in outdoor recreation would be related to stronger intentions to take action to protect the lake used most often.
- H3: Stronger place attachment to a lake used most often would be related to stronger intentions to take action to protect the lake.
- H4: Lakeshore property owners would report stronger intentions to take action to protect the lake used most often.

Methods

The study population included residents from the State of Minnesota (US). A random sample of 2,300 state residents was purchased from a commercial vendor.

We administered a mail-back survey following accepted research methodology (Dillman, 2000). We implemented five mailings between May and October of 2004. Mailings included: (a) a pre-notice mailing (Appendix C), to inform recipients that they would soon receive a survey mailing, (b) an initial survey mailing, including a personalized cover letter (Appendix D), survey (Appendix A), and postage-paid reply envelope, (c) a second survey mailing, again including a personalized cover letter (Appendix E), survey, and postage-paid reply envelope, (d) a follow-up reminder postcard (Appendix F), and (e) a shortened, one-page survey used to gauge non-response bias (Appendix G) with a cover letter (Appendix H).

The survey included questions about: (a) lake-based recreation participation, (b) attitudes about Minnesota lakes, (c) familiarity with and knowledge about issues and regulations related to aquatic plants and lake ecology, (d) attitudes about aquatic plants, (e) trust of groups to make recommendations about lake management, (f) lake use and

ownership of lake property, (g) place attachment to lake used most often, (h) intention to take action to protect lake used most often, and (g) demographic information.

Recreation Participation

Respondents were asked how many days they spent visiting Minnesota lakes and if they engaged in certain recreational activities. Specifically, respondents were asked to indicate the number of times they participated in six lake-oriented recreation activities (fishing, pleasure boating, swimming/wading, hunting waterfowl, nature viewing, and enjoying lake scenery) during 2003. Response was on the scale 0 (not at all), 1 (1 or 2 times), 2 (3 to 5 times), 3 (6 to 10 times), 4 (11 to 20 times), or 5 (21 or more times).

Place Attachment

Respondents who had a Minnesota lake they used most often were asked to rate 13 items to measure their attachment to that lake. Response was on the scale 1 (strongly disagree) to 5 (strongly agree). Ten of the items were derived from a study of lakeshore property owners in Wisconsin conducted by Jorgensen and Stedman (2001). Based on discussions about the importance of family memories to Minnesotans' attachment to lakes, three new items were added to examine family-related place attachment.

Intention to Protect the Minnesota Lake Used Most Often

We asked respondents to indicate the likelihood that they would take five actions if the environmental quality of the lake they used most often declined. Response was on the scale 1 (extremely unlikely) to 5 (extremely likely).

Data Analysis

Descriptive statistics, along with cluster, factor, reliability, and regression analyses were conducted in the Statistical Package for Social Sciences (SPSS 15.0). Confirmatory factor analysis and structural equation modeling was run using LISREL (8.80).

Using the full data set ($n = 1,057$), we conducted two-step cluster analysis to segment respondents based on their recreation participation. Cluster analysis is a tool used for classification in the social and biological sciences (Mezzich & Solomon, 1980). Academic and marketing researchers employ cluster analysis to classify groups of people with similar characteristics (Punj & Stewart, 1983).

We used principal component analysis with varimax rotation and reliability analyses to identify constructs underlying intended conservation action. We extracted two conservation factors with eigenvalues greater than 1.0. Per the recommendations of Nunnally and Bernstein (1994), variables that loaded heavily (i.e., correlations of greater than 0.5) on one factor without loading heavily on other factors were included in the analysis.

After identifying recreation clusters and conservation constructs, we isolated respondents who had a lake they used most often ($n = 646$) for further analysis of recreation participation, place attachment, and intended conservation actions. We used structural equation modeling (SEM) with maximum likelihood estimation (MLE) and multiple regression analysis to test the relationships between place attachment and intention to take conservation action. Confirmatory factor analyses were conducted on the place attachment and conservation constructs prior to modeling. Attitudinal place

attachment items were modeled based on the correlated-uniquenesses model of sense of place presented in Jorgensen and Stedman (2001). The three new items that we added to examine family-related place attachment were modeled as a factor we describe as normative place attachment. We employed multiple-sample SEM to see whether recreation cluster moderated the relationships among model parameters. SEM builds on regression and factor analysis. It uses the analysis of covariances to explore relationships among a set of variables (McCoach, Black, & O'Connell, 2007). SEM provides a comprehensive and flexible method for examining relationships among observed variables and unmeasured latent constructs (Knoke, Bohrnstedt, & Mee, 2002; McCoach et al., 2007). As opposed to multiple regression, SEM explicitly accounts for measurement error (McCoach et al., 2007). SEM also allows researchers to assess the overall fit of a model to data and to determine the equivalences of model parameters across several samples (Knoke et al., 2002; McCoach et al., 2007). Interpretation of path models produced through SEM is fairly straightforward—the standardized coefficients produced through MLE are interpreted as regression coefficients, and unexplained variance of an endogenous (i.e. dependent) variable equals $1 - R^2$ in recursive models (where causal loops are unidirectional) (Kline, 2005). After conducting multiple-sample SEM on the four recreation clusters, we dummy coded respondents by recreation cluster and used multiple regression analysis to examine the relative effects of place attachment, recreation type, property ownership, age, income, and gender on conservation intentions.

Results

Survey Response Rate

Of the 2,300 surveys mailed, 109 were undeliverable, 2 were sent to deceased persons, and 90 were sent to individuals who had moved out of state or refused to complete the questionnaire. We received 1,057 completed surveys for a minimum response rate (including undeliverable and refused surveys and deceased persons among eligible potential respondents) of 46.0%, and a maximum response rate (excluding undeliverable surveys from eligible respondents) of 48.2%. We received 167 one-page surveys used to gauge non-response bias. The response rate for the non-response test was 16.2%.

Respondent Characteristics

Over half of the respondents (60%) were male, and nearly all (98%) were White. The average respondent age was 53 years. The mean household income before taxes was \$72,932. On average, respondents had lived in Minnesota for 44 years. Forty-one percent of respondents had completed a 4-year college degree or more. Nearly two-thirds (61%) of respondents ($n = 646$) reported that they had a Minnesota lake or lakes that they used most often. Of those respondents, nearly one-third (31%, $n = 197$) reported that they owned property on the lake.

Lake Use and Recreation Participation

On average, respondents visited Minnesota lakes on 45 days during 2003, with a range of 0 to 365 days. Approximately 7% of respondents spent no days at Minnesota lakes, and about 3% spent every day of 2003 at a Minnesota lake. The distribution of

lake-visit days was skewed to the lower end of the 365-day distribution, with a majority (60%) of respondents spending less than 25 days at Minnesota lakes.

Participation in listed recreational activities ranged from 91% for enjoying lake scenery to 16% for hunting waterfowl. About two-thirds of respondents participated in boating, swimming, or “bird watching, viewing wildlife, or studying nature” during the year. About 60% of respondents participated in fishing. Enjoying lake scenery was by far the most popular activity listed; 40% of respondents reported that they enjoyed lake scenery 21 or more times during 2003. In contrast, only 1% of respondents hunted waterfowl 21 or more times during the year. Using cluster analysis, we identified four recreation clusters, including (a) all-around (23%), (b) appreciative (28%), (c) consumptive (6%), and (d) less-involved (44%).

Respondents who had a lake that they used most frequently included 32% ($n = 191$) all-around recreationists, 31% ($n = 183$) appreciative recreationists, 8% ($n = 45$) consumptive recreationists, and 29% ($n = 172$) less-involved recreationists. The number of days these respondents visited Minnesota lakes in 2003 differed by recreation cluster, ranging from high to low as follows: all-around ($M = 96$ days, $SD = 111.3$), appreciative ($M = 69$ days, $SD = 97.6$), consumptive ($M = 61$ days, $SD = 70.3$), and less-involved ($M = 22$ days, $SD = 48.1$) ($F = 18.79$, 3 *df*, $n = 523$, $p < 0.001$, $\eta = 0.31$). Age differed significantly by recreation cluster, with appreciative ($M = 54$ years, $SD = 15.1$) and less-involved ($M = 51$ years, $SD = 15.6$) recreationists older than all-around ($M = 48$ years, $SD = 14.6$) and consumptive ($M = 44$ years, $SD = 13.6$) recreationists ($F = 6.98$, 3 *df*, $n = 580$, $p < 0.001$, $\eta = 0.19$). Respondent gender differed by recreation group with the greatest proportion of females in the appreciative recreation cluster (45%), followed by

the less-involved cluster (44%), the all-around cluster (33%), and the consumptive cluster (16%) ($\chi^2 = 18.34, 3 df, n = 589, p < 0.001, V = 0.18$). Mean household income also differed by recreation cluster, which ranged from high to low as follows: (a) consumptive ($M = \$103,306, SD = 116763.2$), (b) all-around ($M = \$84,228, SD = 65086.1$), (c) less-involved ($M = \$74,559, SD = 75078.1$), and (d) appreciative ($M = \$66,254, SD = 44784.2$) ($F = 3.63, 3 df, n = 478, p < 0.05, \eta = 0.15$). Finally, ownership of lake property varied among the recreation clusters, with 54% of all-around, 38% of consumptive, 21% of appreciative, and 13% of less-involved recreationists reporting ownership of lake property ($\chi^2 = 79.95, 3 df, n = 585, p < 0.001, V = 0.37$).

Place Attachment

Confirmatory factor analysis verified the attitudinal and normative place attachment constructs, with attitudinal place attachment modeled based on Jorgensen and Stedman's (2001) correlated-uniquenesses model. The model, including correlated error terms, had "reasonable" fit ($\chi^2 = 389.30^{***} (52 df), RMSEA = 0.073, CFI = 0.99$). Place attachment constructs had composite reliability values greater than 0.60 and average variance extracted values greater than 0.50, which suggests acceptable content and discriminant validity (Diamantopoulos & Siguaw, 2000). Results of confirmatory factor analysis of place attachment are presented in Table 2.1 and Figure 2.1.

On average, respondents reported similar levels of attitudinal and normative place attachment (Table 2.1). Attitudinal place attachment differed significantly by recreation cluster, with consumptive ($M = 4.0, SD = 0.7$) and all-around ($M = 4.0, SD = 0.7$) recreationists reporting stronger attachment than appreciative ($M = 3.7, SD = 0.7$) and less-involved ($M = 3.3, SD = 0.8$) recreationists ($F = 34.745, 3 df, n = 586, p <$

0.001, $\eta = 0.39$). Similarly, respondents in the all-around ($M = 4.1$, $SD = 0.9$) and consumptive ($M = 4.1$, $SD = 0.8$) recreation clusters reported stronger normative place attachment than those in the appreciative ($M = 3.8$, $SD = 0.9$) and less-involved ($M = 3.3$, $SD = 1.1$) clusters ($F = 21.41$, 3 *df*, $n = 580$, $p < 0.001$, $\eta = 0.32$). Number of days visiting Minnesota lakes in 2003 correlated with both attitudinal ($r = 0.221$, $p < 0.001$) and normative ($r = 0.181$, $p < 0.001$) place attachment. Respondents who owned property on a Minnesota lake reported stronger attitudinal (4.1 vs. 3.5, $t = 8.59$, 629 *df*, $p < 0.001$) and normative (4.3 vs. 3.6, $t = 8.39$, 629 *df*, $p < 0.001$) place attachment.

Intention to Take Conservation Action to Protect the Lake Used Most Often

Based on the five items measuring intended conservation action to protect the lake used most often, we identified two factors underlying intended conservation action: (a) philanthropic and (b) political (Table 2.2). Three items loaded on the philanthropy factor ($\alpha = 0.846$), and two items loaded on the political factor ($\alpha = 0.764$). Confirmatory factor analysis supported the intended philanthropic and political action constructs. The model had “mediocre” fit based on the RMSEA goodness-of-fit measure, but it had good fit based on the NFI, CFI, and GFI measures ($\chi^2 = 43.68^{***}$ (4 *df*), RMSEA = 0.097, CFI = 0.99). Conservation constructs had composite reliability values greater than 0.60 and average variance extracted values greater than 0.50, which suggests acceptable content and discriminant validity (Diamantopoulos & Sigauw, 2000). Results of confirmatory factor analysis of intended conservation actions are presented in Table 2.2 and Figure 2.2.

Intended philanthropic action differed significantly by recreation cluster, with consumptive ($M = 3.8$, $SD = 1.0$) and all-around ($M = 3.8$, $SD = 1.0$) recreationists

reporting stronger intentions to contribute time or money to protect lakes than appreciative ($M = 3.4$, $SD = 1.0$) and less-involved ($M = 2.7$, $SD = 1.1$) recreationists ($F = 35.38$, $3 df$, $n = 568$, $p < 0.001$, $\eta = 0.40$). However, respondents in the appreciative ($M = 4.2$, $SD = 0.9$) cluster reported the strongest intention to take political action to protect lakes, compared to the consumptive ($M = 3.9$, $SD = 1.1$), all-around ($M = 3.8$, $SD = 1.1$), and less-involved ($M = 3.6$, $SD = 1.1$) clusters ($F = 12.08$, $3 df$, $n = 576$, $p < 0.001$, $\eta = 0.24$). Number of days visiting Minnesota lakes in 2003 was positively correlated with intention to take philanthropic action ($r = 0.175$, $p < 0.001$). However, the relationship between number of days at Minnesota lakes and intended political action was not significant. Respondents who owned property on a Minnesota lake reported significantly stronger intentions to take philanthropic action to protect their lake (3.9 vs. 3.2, $t = 8.54$, $613 df$, $p < 0.001$). However, there was no significant difference in intention to take political action based on property ownership (3.8 lakeshore property owner vs. 3.9 non-owners).

Modeling Recreation, Place Attachment, and Conservation

The results from structural equation modeling conducted with all respondents suggest a positive relationship between attitudinal place attachment and intentions for both philanthropic and political action (Figure 2.3). Next, we compared the structural equation models relating place attachment to intended conservation action for the three recreation clusters with adequate sample sizes¹ (Figures 2.4-2.6). In the all-around (Figure 2.4) and low-involvement (Figure 2.6) recreation clusters, attitudinal place attachment was positively related to greater intention to take both political and philanthropic action to protect the lake used most often. For appreciative (Figure 2.5)

recreationists, there were no significant relationships between place attachment and intended conservation action. Results from multiple-sample structural equation modeling suggested a better fit when factor loadings and structural parameters varied across recreation segments ($\Delta\chi^2 = 496.32$, 60 *df*, $p < 0.001$; $\Delta\text{AIC} = 121.20$). Fit improved further when error terms for observed conservation variables were allowed to vary freely across groups ($\Delta\chi^2 = 74.58$, 9 *df*, $p < 0.001$; $\Delta\text{AIC} = 6.04$).

Structural equation modeling indicated that recreation cluster was related to intention to conserve a favorite lake. However, because there were significant differences in gender, age, income, and ownership of lakeshore property among the recreation clusters, we used multiple regression analyses to predict intended conservation action. We used the four recreation clusters, two place attachment factors, ownership of lakeshore property, age, gender, and income as independent variables, and intended political and philanthropic action as dependent variables. Attitudinal place attachment and being in the appreciative recreation cluster were positively related to intention to take political action to protect the lake used most often (Adj. $R^2 = 0.12$) (Table 2.3). Attitudinal place attachment and ownership of lakeshore property were positively related to intention to take philanthropic action, while being in the less-involved recreation cluster was negatively related (Adj. $R^2 = 0.31$) (Table 2.4).

Discussion

The data provided support for each of the stated hypotheses. Hypothesis 1 suggested that increased participation in outdoor recreation would be related to stronger attachment to the lake used most often. In support of the hypothesis, we found a positive correlation between the number of days spent at Minnesota lakes and both

attitudinal and normative place attachment. In addition, respondents in the less-involved recreation cluster reported significantly lower levels of both attitudinal and normative place attachment to the lake used most often. Place attachment differed by recreation type. Consumptive and all-around recreationists reported the highest levels of attitudinal and normative place attachment, followed by appreciative recreationists, then less-involved recreationists. Our results parallel other research, which found place attachment to be associated with frequency of use (Anderson & Fulton, 2008; Bricker & Kerstetter, 2000; Moore & Graefe, 1994; Williams et al., 1992, Williams & Vaske, 2003) and the type of recreation activity (Kyle et al., 2004).

Similar to the previous hypothesis, results suggest some support for Hypothesis 2 that increased participation in outdoor recreation would be related to stronger intentions to take action to protect the lake used most often. The number of days visiting Minnesota lakes was positively correlated to intended philanthropic action. In addition, respondents in the less-involved recreation cluster reported significantly lower intentions to take either philanthropic or political action to protect the lake they used most often. However, there was no significant relationship between days at lakes and intended political action.

All-around and consumptive recreationists reported stronger intentions to take philanthropic action to protect a lake, while appreciative recreationists reported significantly stronger intentions to take political action. The observed differences in intended conservation action may relate to ownership of lakeshore property. Appreciative recreationists had a lower rate of lakeshore property ownership than consumptive and all-around recreationists. People who don't own property may have

less concern about regulatory restrictions to their property and may be more inclined to support government regulations to protect lakes, while those with lakeshore property might prefer nongovernmental actions taken by local community organizations. Another possible reason for appreciative recreationists' stronger reported support for political action might be their participation in bird watching, wildlife viewing, and studying nature. Perhaps appreciative recreation participants view political actions and regulations as more effective means of protecting the flora and fauna that are the focus of their activities.

Our results correspond to earlier findings relating recreation participation to conservation attitudes and behaviors. Like Dunlap and Heffernan (1975), Theodori et al. (1998), and Teisl and O'Brien (2003), we found a positive relationship between recreation participation and intention to take conservation action. Like Dunlap and Heffernan (1975) and Teisl and O'Brien (2003), but unlike Theodori et al. (1998), we found differences in intended action based on the type of recreation.

Hypothesis 3 suggested that stronger place attachment to a lake used most often would be related to stronger intentions to take action to protect the lake. The results suggest that attitudinal place attachment was indeed positively related to intentions for philanthropic and political action. However, normative place attachment had no significant relationship to either type of intended conservation action. Previous research, using a different measurement scale, found positive relationships between place attachment and environmental concern (Payton et al., 2005; Vaske & Kobrin, 2001; Vorkinn & Riese, 2001). Payton and colleagues (2005) found that emotional, but not functional, place attachment was a significant positive predictor of civic action taken to

protect a wildlife refuge. Vaske and Kobrin's (2001) research suggested that functional attachment to a place can lead to emotional attachment, which can in turn lead to pro-environmental behavior. Normative place attachment, which had not been previously examined, did not predict intended conservation action in our models.

Finally, Hypothesis 4 indicated that lakeshore property owners would report stronger intentions to take action to protect the lake used most often. Ownership of property on the lake used most often was significantly related to both types of place attachment, and intended philanthropic, but not political, action. In a study relating place attachment and environmental attitudes to residential proximity to water, Larson and Santelman (2007) found that individuals who lived close to water had a strong sense of stewardship and attachment. However, these individuals also wanted decreased regulation (Larson & Santelman, 2007). Our results parallel those of Larson and Santelman (2007). Lakeshore property owners may be willing to contribute money to those lake-based conservation actions that they support, but they may not be willing to take political action, which might mean additional regulation of their personal property.

Management Implications, Study Limitations, Future Research, and Conclusions

Management Implications

The results of this study indicate that lake-based recreation participation, attitudinal place attachment to the lake used most often, and ownership of lake property relate to intended conservation action. Therefore, they need the attention of resource managers.

Given the observed relationship of outdoor recreation participation to place attachment and intended conservation action, projected declines in outdoor recreation

participation may have implications for conservation efforts. Declines in lake-based outdoor recreation may decrease attachment to lakes and reduce the value placed on aquatic resources. Managers need to better understand the factors that motivate and constrain current and potential recreation users. This information could be used to develop programs that to maintain and enhance lake-based recreation participation.

Based on the positive correlation of attitudinal place attachment and intended conservation action, it is important for land managers to better understand the meaning of public spaces to visitors and residents. Managers might also work to build attachment to special places to enhance support for future conservation efforts and management activities. Stedman (2008), however, notes that it may be a mistake to manage for attachment because (a) place attachment is not necessarily associated with environmental quality and (b) managing for place attachment is difficult. Therefore, management efforts to increase attachment to lakes and other special places might emphasize the experiences, activities, and meanings associated with environmental protection. Managers influence meanings associated with public spaces through activities that affect the material landscape (i.e. timber harvest, building a fishing pier, putting in a parking lot) and through provisions for and prohibitions of certain activities (i.e. motorized versus nonmotorized recreation) (Stedman, 2008). Direct and indirect management communications also influence the meanings that visitors associate with public spaces.

In order to encourage lake protection, managers need to pay attention to the signals they send that may influence place meanings. For example, if managers want to emphasize protection of native plants along lakeshore, they may be sending the wrong

message by removing native vegetation for boat launches, beaches, fishing piers, and parking lots. Managers could communicate with the public through innovative designs for these facilities that retain native aquatic plants while providing needed access. Interpretive signage could draw attention to the benefits of the design for flora and fauna, and for visitors who enjoy bird watching, wildlife viewing, fishing, and waterfowl hunting. Our study suggests that appreciative recreationists may be more supportive of political actions for lake protection, which managers might prefer to activities funded through philanthropy and conducted by non-governmental organizations. Because place meanings are derived from lived experiences (Stewart, 2008), managers could encourage appreciative activities like bird watching, wildlife viewing, and nature study through interpretive exhibits, programming, and volunteer activities that emphasize the natural history of special places.

Study Limitations

This study included 2,300 individuals from the general public in Minnesota. The sample of names and addresses for this survey was drawn from listed phone numbers in the state. Although nearly 98.9% of Minnesotans have phones, approximately 30% of state residents have unlisted phone numbers and were not included in the sampling frame. A higher proportion of our respondents were male and older compared to census data for Minnesota. Other research has found age bias in mail surveys (Filion, 1975; Schroeder, Fulton, Currie, & Goeman, 2006). Our results also appear to over represent lakeshore property owners. Nearly one-fifth (18.6%) of all survey respondents and 31% of individuals who had a lake they used most often reported owning lakeshore property, which compares to approximately 5.6% of Minnesota households overall (Lanegran,

2007).

Researchers can never be certain about the characteristics of people who do not respond. Based on our non-response test, the respondents and nonrespondents were similar in age and number of years lived in Minnesota. Respondents to the main survey included a greater proportion of women and a smaller proportion of people who owned property on a Minnesota lake. The survey subject matter and framing effects may have influenced response. Responses may have been framed by the question order; questions early in the survey addressed participation in lake-based outdoor recreation. Because this survey dealt with Minnesota lakes and lake-based activities, respondents (compared to nonrespondents) likely over-represent people who are concerned about the state's lakes.

The SEM results for each recreation type were based on medium (100 – 200 subjects) sample sizes (Kline, 2005). Researchers have suggested a lower bound for total sample size of approximately 100 to 200 (Violato & Hecker, 2007). Our results by recreation type included sample sizes of 137 to 155 individuals.

This survey did not ask for respondents' history of lake use nor their motivations for participation in lake-based recreation. These factors have been found to relate to both place attachment and environmental concern (Anderson & Fulton, 2008; Bright & Porter, 2001; Moore & Graefe, 1994). In a study focused on participation in hunting and wildlife watching at Minnesota Waterfowl Production Areas, Anderson and Fulton (2008) found recreation experience preferences to partially mediate the relationship between recreation participation and place attachment. Bright and Porter (2001) found

that, for some recreation activities, the meaning behind the activity full mediated the relationship between recreation participation and environmental concern.

Future Research

This research adds to existing knowledge on the relationships among outdoor recreation participation, place attachment, and intended conservation action, but it is largely a base for further study. We used cluster analysis to categorize respondents' lake-based recreation participation and found differences in place attachment and intended conservation action by recreation type. Future research could employ similar methods for non-lake-based recreation. Analysis of recreation participation must be multidimensional and include: (a) participation versus nonparticipation, (b) involvement and commitment, (c) motivations/benefits, (d) exposure, avidity, recency, activity level, (e) years of participation, and (f) overlap or clustering in activity participation. Research might also consider the resource-dependence of activities and the influence of transcendent experiences on place attachment and conservation attitudes and behaviors.

This study adapted new items for scales to measure place attachment and introduced the concept of normative place attachment. As in previous studies, we found place attachment to be an important correlate of conservation attitudes. Previous research has emphasized the importance of social bonds to place attachment (Bott et al., 2003), and additional research could flesh out the concept of normative place attachment. Future studies could expand our measures, which specifically addressed family connections, to incorporate normative influences from friends, neighbors, and other recreation participants. Stokowski (2002, 2008) emphasized the importance of studying sense of place as a social construction to better understand how human

connections relate to sense of place. Our method of quantifying normative place attachment using end-state, individual measures could complement more process-oriented, qualitative measures of the social construction of place. Additional research could also examine how place meanings relate to recreation participation, place attachment, and conservation attitudes.

This study employed items to measure intended philanthropic and political action to protect a favorite lake. Researchers have begun to categorize and examine specific types of environmental behaviors (Smith-Sebasto & D'Acosta, 1995; Stern, 2000b). Future research needs to develop valid and reliable measures of different types of pro-environmental behavior.

Conclusions

Our results suggest that recreation participation relates to both place attachment and intended conservation action. Individuals who participate in different types of lake-based recreation activities develop different levels of attachment to and different degrees of intention to protect the lakes. In this study, all-around and consumptive recreationists had stronger attachments than appreciative and less-involved recreationists. All-around and consumptive recreationists were more likely to report intentions to take philanthropic action to protect a lake, while appreciative recreationists were more likely to report intentions to take political action.

Footnotes

¹We did not conduct structural equation modeling with consumptive recreationists because of the small ($n = 45$) sample size for this group.

Table 2.1 Mean scores and scale reliability for place attachment to the Minnesota lake used most often.

Factor (Cronbach's α ; composite reliability, average variance extracted) - items	\bar{x}	SE	All ^a \bar{x}	App ^b \bar{x}	Con ^c \bar{x}	Less ^d \bar{x}
Attitudinal ($\alpha = .93$; CR = .96; AVE = .69)	3.7	.032	4.0 _a	3.7 _b	4.0 _a	3.3 _c
A1. It is my favorite place to be.	4.1	.034	4.5 _a	4.1 _b	4.3 _{ab}	3.7 _c
A2. I feel that I can really be myself there.	4.1	.035	4.4 _a	4.2 _a	4.3 _a	3.7 _b
A3. I really miss it when I am away from it too long.	3.9	.041	4.3 _a	3.9 _b	4.0 _{ab}	3.4 _c
A4. I feel happiest when I am there.	3.8	.040	4.1 _a	3.7 _b	4.1 _{ab}	3.3 _c
A5. It is the best place to do the things I enjoy.	3.9	.039	4.2 _a	3.7 _b	4.3 _a	3.4 _b
A6. It reflects the type of person that I am.	3.8	.041	4.1 _a	3.6 _b	4.3 _a	3.3 _b
A7. For the things I enjoy doing most, no other place can compare to it.	3.4	.046	3.8 _a	3.3 _b	3.9 _a	3.0 _b
A8. Everything about it is a reflection of me.	3.2	.045	3.5 _{ab}	3.1 _{bc}	3.6 _a	2.8 _c
A9. As far as I am concerned there are better places to be ^f .	3.4	.045	3.6 _a	3.5 _a	3.6 _a	2.9 _b
A10. My lake property says very little about who I am ^f .	3.5	.045	3.9 _a	3.6 _a	3.9 _a	3.0 _b
Normative ($\alpha = .84$; CR = .90; AVE = .76)	3.8	.041	4.1 _a	3.8 _a	4.1 _a	3.3 _b
N1. It is a special place for my family.	4.0	.039	4.4 _a	4.0 _b	4.1 _{ab}	3.6 _c
N2. Many important family memories are tied to it.	3.9	.048	4.2 _a	3.9 _a	4.2 _a	3.3 _b
N3. It ties the generations of my family together.	3.5	.053	3.9 _a	3.4 _{ab}	3.9 _a	3.1 _b

Notes. ^a All = all-around recreationists, ^b App = appreciative recreationists, ^c Con = consumptive recreationists, ^d Less = less-involved recreationists. ^f Items reverse coded for scale development and reliability analysis. Means in the same row that do not share subscripts differ at $p < 0.05$ in the Tukey honestly significant difference comparison.

Table 2.2 Mean scores and scale reliability for intended conservation action for the Minnesota lake used most often.

Factor (Cronbach's α ; composite reliability, average variance extracted) - items	\bar{x}	SE	All ^a \bar{x}	App ^b \bar{x}	Con ^c \bar{x}	Less ^d \bar{x}
Philanthropic Action ($\alpha = .86$; CR = .90; AVE = .75)	3.4	.044	3.8 _{ab}	3.4 _b	3.8 _a	2.7 _c
PH1. Contribute money to protect the lake(s).	3.4	.051	3.8 _{ab}	3.4 _b	3.9 _a	2.8 _c
PH2. Contribute personal time to protect the lake(s).	3.5	.048	3.9 _a	3.5 _a	3.9 _a	2.8 _b
PH3. Join an organization working to protect the lake(s).	3.3	.052	3.6 _a	3.4 _a	3.8 _a	2.7 _b
Political Action ($r = .65$; CR = .87; AVE = .77)	3.8	.043	3.8 _b	4.2 _a	3.9 _{ab}	3.6 _c
PO1. Support legislation or regulations that limit human use to protect the lake(s).	3.6	.054	3.4 _b	4.0 _a	3.6 _{ab}	3.3 _b
PO2. Vote for people who support lake protection.	4.1	.042	4.1 _b	4.5 _a	4.1 _{ab}	3.8 _b

Notes. ^a All = all-around recreationists, ^b App = appreciative recreationists, ^c Con = consumptive recreationists, ^d Less = less-involved recreationists. Means in the same row that do not share subscripts differ at $p < 0.05$ in the Tukey honestly significant difference comparison.

Table 2.3 Regression analysis of intended political action

Independent Variables	β	Adj. R²
Attitudinal place attachment	.291***	.120
Normative place attachment	-.061	
Own lake property?	-.053	
All-around recreationist	.119	
Appreciative recreationist	.391***	
Consumptive recreationist	.115	
Less-involved recreationist	.136	
Age	-.002	
Income	.009	
Gender	.078	

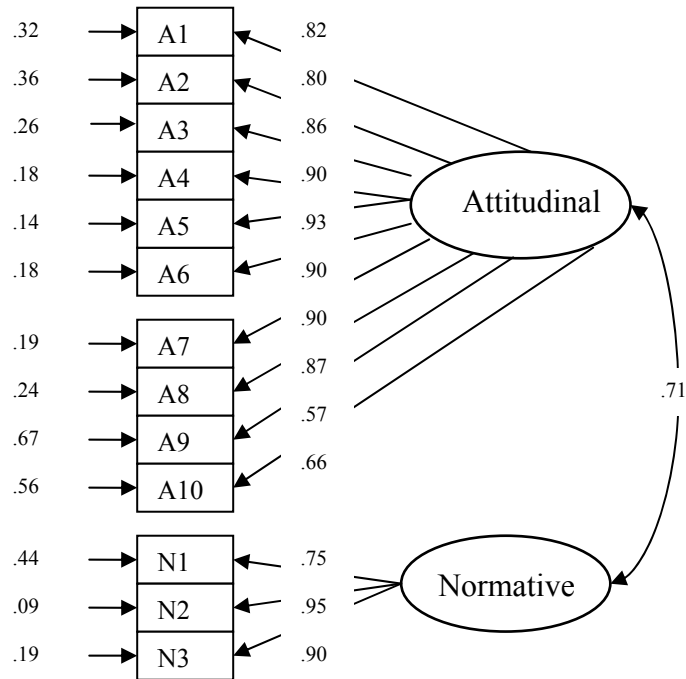
Notes. *p < 0.05, ** p < 0.01, *** p < 0.001

Table 2.4 Regression analysis of intended philanthropic action

Independent Variables	β	Adj. R²
Attitudinal place attachment	.343***	.307
Normative place attachment	-.054	
Own lake property?	.172***	
All-around recreationist	.088	
Appreciative recreationist	.077	
Consumptive recreationist	.069	
Less-involved recreationist	-.187*	
Age	-.011	
Income	.038	
Gender	-.035	

Notes. *p < 0.05, ** p < 0.01, *** p < 0.001

Figure 2.1 Results of confirmatory factor analysis of place attachment.

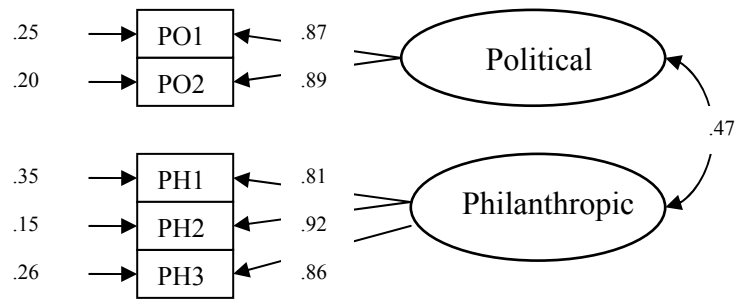


Notes: Minimum fit $\chi^2 = 389.30^{***}$ (52 df), RMSEA = 0.073, NFI = 0.99, CFI = 0.99, GFI = 0.87

Model includes the following correlated errors (based on Jorgensen & Stedman's (2001) correlated-uniquenesses model):

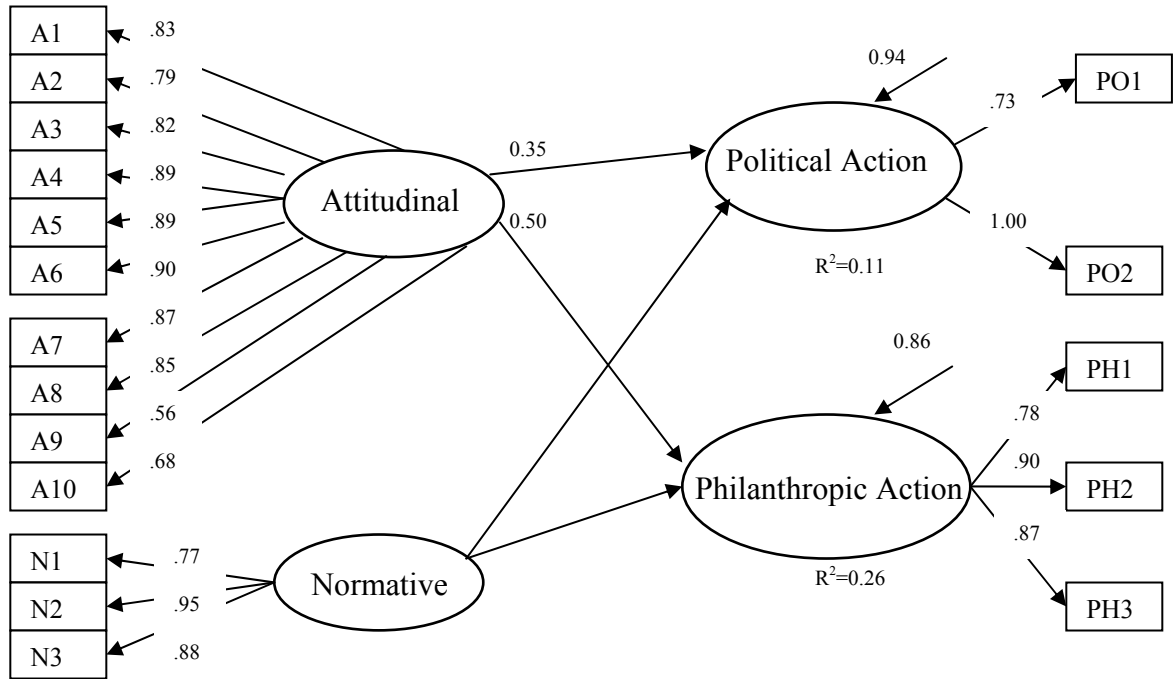
- A1 – A3: .05
- A1 – A4: .03
- A3 – A4: .08
- A2 – A6: .00
- A2 – A8: -.04
- A2 – A10: .01
- A6 – A8: .02
- A6 – A10: .05
- A8 – A10: .06
- A5 – A7: .01
- A5 – A9: .00
- A7 – A9: .01

Figure 2.2 Results of confirmatory factor analysis of intended conservation action.



Notes: Minimum fit $\chi^2 = 43.68^{***}$ (4 df), RMSEA = 0.097, NFI = 0.98, CFI = 0.99, GFI = 0.96

Figure 2.3 Significant ($p < 0.05$) standardized coefficients and error terms ($\sqrt{\zeta}$) for latent endogenous variables in path model for full data set ($n = 502$).

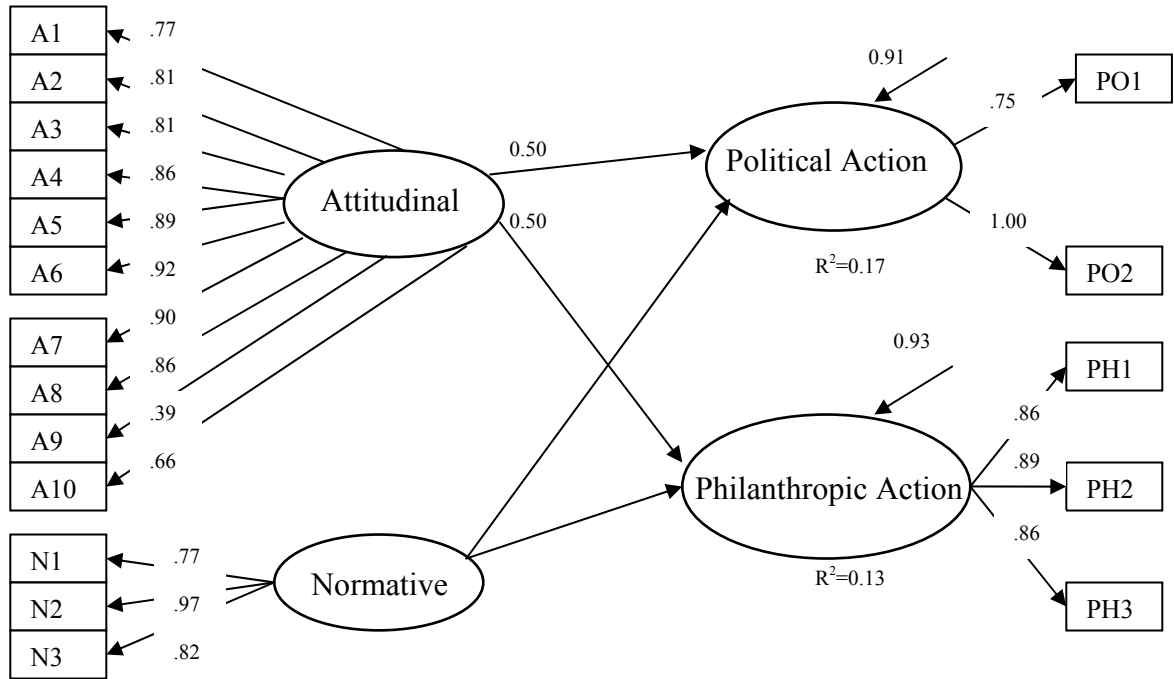


Notes: Minimum fit $\chi^2 = 700.15^{***}$ (119 df), RMSEA = 0.056, NFI = 0.98, CFI = 0.99, GFI = 0.87

Model includes the following correlated errors (based on Jorgensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .09
- A1 – A4: .08
- A3 – A4: .09
- A2 – A6: -.01
- A2 – A8: -.07
- A2 – A10: .05
- A6 – A8: .02
- A6 – A10: .04
- A8 – A10: .08
- A5 – A7: .04
- A5 – A9: .00
- A7 – A9: .03

Figure 2.4 Significant ($p < 0.05$) standardized coefficients and error terms ($\sqrt{\zeta}$) for latent endogenous variables in path model for all-around recreationists ($n = 152$).

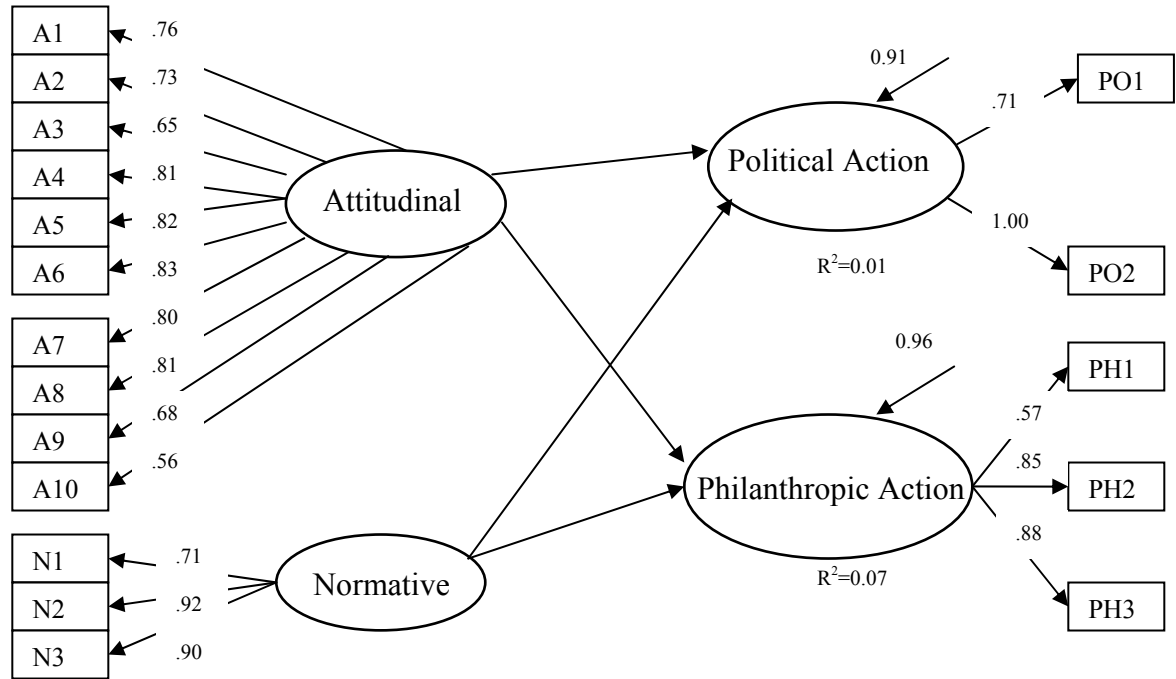


Notes: Minimum fit $\chi^2 = 563.03^{***}$ (119 df), RMSEA = 0.052, NFI = 0.97, CFI = 0.99, GFI = 0.77

Model includes the following correlated errors (based on Jorgensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .10
- A1 – A4: .11
- A3 – A4: .14
- A2 – A6: .01
- A2 – A8: -.08
- A2 – A10: .09
- A6 – A8: .03
- A6 – A10: .07
- A8 – A10: .11
- A5 – A7: .03
- A5 – A9: -.03
- A7 – A9: -.03

Figure 2.5 Significant ($p < 0.05$) standardized coefficients and error terms ($\sqrt{\zeta}$) for latent endogenous variables in path model for appreciative recreationists ($n = 138$).

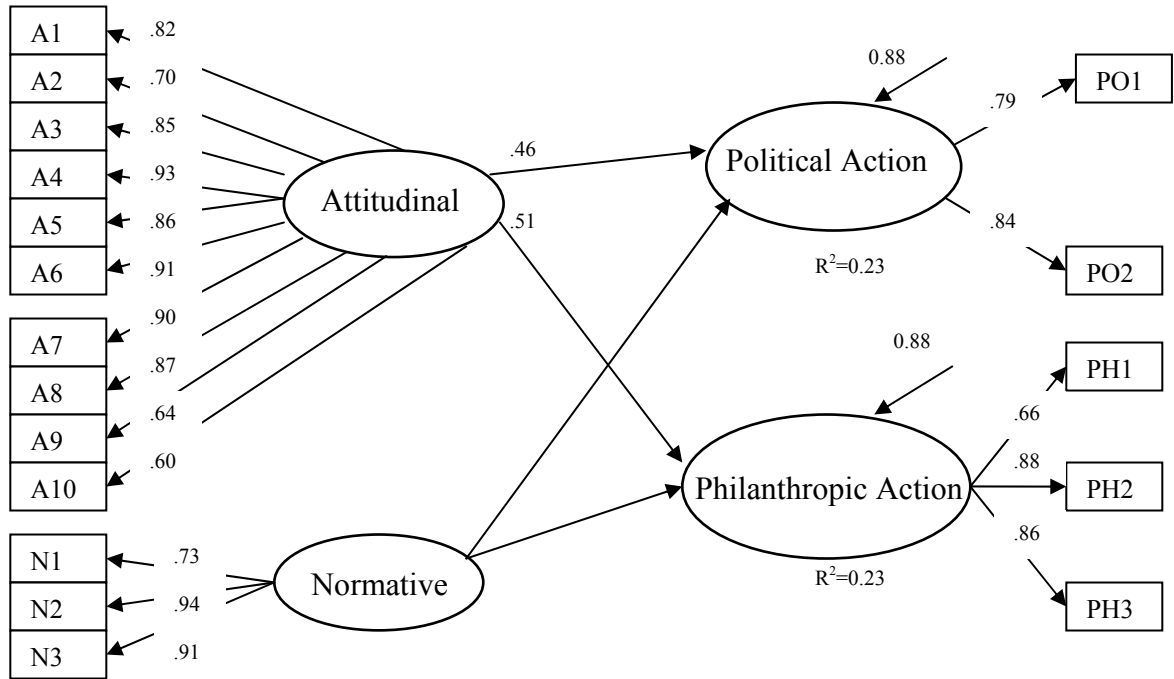


Notes: Minimum fit $\chi^2 = 394.91^{***}$ (119 df), RMSEA = 0.055, NFI = 0.95, CFI = 0.98, GFI = 0.79

Model includes the following correlated errors (based on Jorgensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .04
- A1 – A4: .09
- A3 – A4: .11
- A2 – A6: .02
- A2 – A8: -.02
- A2 – A10: .14
- A6 – A8: .04
- A6 – A10: .15
- A8 – A10: .07
- A5 – A7: .06
- A5 – A9: -.01
- A7 – A9: .05

Figure 2.6 Significant ($p < 0.05$) standardized coefficients and error terms ($\sqrt{\zeta}$) for latent endogenous variables in path model for less-involved recreationists ($n = 134$).



Notes: Minimum fit $\chi^2 = 380.79^{***}$ (119 df), RMSEA = 0.054, NFI = 0.97, CFI = 0.99, GFI = 0.79

Model includes the following correlated errors (based on Jorgensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .13
- A1 – A4: .06
- A3 – A4: .10
- A2 – A6: .00
- A2 – A8: -.11
- A2 – A10: .01
- A6 – A8: -.03
- A6 – A10: -.02
- A8 – A10: .05
- A5 – A7: .01
- A5 – A9: .02
- A7 – A9: .00

CHAPTER 3

Do Outdoor Recreation Participation and Place Attachment Relate to Minnesota Lake Home Owners' Attitudes About Protecting Their Lake?

Introduction

Researchers have documented declining participation in outdoor recreation (Pergams & Zaradic, 2008a) and increasing housing development in rural and amenity areas (Stedman, 2000, 2006; Wilson, 2006). These trends have been observed in Minnesota, and specifically for Minnesota lakes (Kelly, 2005; Myers, 2007).

Limited research has examined how property ownership, the characteristics of the environment, peoples' use of a place, and associated meanings relate to sense of place (Stedman, 2003a; Stedman 2006). Research has examined the relationship between outdoor recreation participation and environmental concern (Bright & Porter, 2001; Dunlap & Heffernan, 1975; Theodori, Lulogg, & Willits, 1998), how recreation participation relates to place attachment (Anderson & Fulton, 2008; Kyle, Bricker, Graefe, & Wickham, 2004; Moore & Graefe, 1994), and how place attachment may relate to environmental concern and environmentally responsible behavior (Payton, Fulton, & Anderson, 2005; Vaske & Kobrin, 2001; Vorkinn, & Riese, 2001).

In Chapter 2, we found that recreation participation, place attachment, and property ownership may be important predictors of Minnesotans' intention to protect lakes. Research needs to clarify the relationships among recreation participation, place attachment, and conservation, and better understand how recreational and year-round property ownership affects these relationships. This study extends research from the general public to Minnesota lakeshore property owners to further examine how recreation and place attachment relate to peoples' feelings of personal responsibility for protecting lakes.

Literature Review

Property Ownership, Recreation Participation, and Place Attachment

Place attachment research has emphasized visitors' attachments to recreation areas. Visitors' attachment to a place, however, may be "fundamentally different from those of local residents" (Davenport & Anderson, 2005, p. 638). Stedman (2003a) suggested the need to study place attachment in settings that are more diverse in "mode of interaction" (p. 682) in order to better understand the relationship between place, experience, and attachment. Similarly, Davenport and Anderson noted the need to use "more holistic and integrative models of the human-environment relationship" (p. 638). Despite calls to extend research on place attachment to examine the various relationships people have to places, little research has compared the views of visitors and residents (Kaltenborn & Williams, 2002).

Recent research has begun to examine how place attachment by visitors differs from seasonal and permanent residents of special places (Kaltenborn & Williams, 2002; Stedman 2000, 2006). Kaltenborn and Williams (2002) compared visitors and local residents of a Norwegian national park and found that residents reported stronger place attachment than visitors. Likewise, in Chapter 2 we found that property owners reported stronger place attachment to Minnesota lakes than visitors. However, seasonal homeowners in northern Wisconsin reported higher place attachment than permanent residents (Stedman, 2006).

Research has examined how the characteristics of the environment, peoples' use of a place, and associated meanings relate to sense of place (Stedman, 2003a). Larson and Santelman (2007) found that people who lived near water resources in Portland,

Oregon were more strongly attached than those who did not live near water. The meanings that people associate with a place translate into emotional bonds (Davenport & Anderson, 2005), and different individuals and groups associate different meanings to places (Bott, Cantrill, & Myers, 2003). Stedman (2006) found that attachment among seasonal residents in northern Wisconsin was related to the environmental quality of the area while attachment among permanent residents was related to social networks. Kaltenborn and Williams (2002) found that the nature of place attachment for residents was associated more with social networks and local history than it was for visitors.

Research has recognized involvement in recreation activities as an antecedent to attachment to particular settings (Anderson & Fulton, 2008; Kyle et al., 2004; Williams & Vaske, 2003). Recreationists with the strongest attachment to a place often have the longest history or highest frequency of use and may live in close proximity (Anderson & Fulton, 2008; Moore & Graefe, 1994; Williams, Patterson, Roggenbuck, & Watson, 1992; Williams & Vaske, 2003). The type of recreation activity and social ties associated with it can predict attachment to a particular setting (Kyle et al., 2004). In the research reported in Chapter 2, we found that all-around and consumptive recreationists generally reported stronger attachment to Minnesota lakes compared to appreciative and less-involved recreationists. Recreation experience preferences can also affect place attachment (Anderson & Fulton, 2008).

Property Ownership, Outdoor Recreation, and Environmental Concern

Researchers have examined conservation attitudes and behaviors among property owners, particularly farmers (Brook, Zint, & De Young, 2003; McCann, Sullivan, Erickson, & De Young, 1997; Messmer, Lively, MacDonald & Schroeder,

1996; Napier, Thraen, & Camboni, 1988), but specific research addressing riparian property owners is sparse (Fish, 2001; Shandas, 2007; Stedman, 2000). Research has identified factors that may affect landowners' conservation attitudes and behaviors, including: (a) aesthetic preferences, (b) desired benefits, (c) economic considerations, (d) information (e.g. sources, amount), (e) parcel size, (f) personal attitudes and values related to conservation, (g) recreation activities, (h) residence on the property, (i) social norms, and (j) demographics (e.g. length of residence, farm versus residence) (Brook et al., 2003; Fish, 2001; Napier et al., 1988; Ryan, 1998; Shandas, 2007). Increased valuation of nature, concern for environmental problems, and information about conservation are key predictors for private property owners adopting conservation practices and improving habitat for wildlife (Brook et al., 2003; McCann et al., 1997). In general, research suggests that property owners are wary of government regulation to increase conservation (Larson & Santelman, 2007; Shandas, 2007).

In one of few studies of conservation among riparian property owners, Shandas (2007) examined four challenges to conservation, including: (a) aesthetics (i.e. beliefs and preferences about landscapes), (b) trust in information sources, (c) barriers to making changes on property (e.g. costs, time, labor, regulations), and (d) personal attitudes about conservation. Shandas found an inconsistency in property owners' preference for scenes with abundant riparian vegetation and the current condition of their personal property. Riparian owners wanted changes to their property that would improve fish and wildlife habitat, conditions for future generations, and water quality. However, property owners faced (a) limited access to and trust in information about managing their property, (b) fears about the economic and aesthetic consequences of

making changes on their property, and (c) cost and time constraints. Shandas recommended partnerships with university extension services and neighborhood organizations to increase trust in agency informational materials and financial incentives to reduce constraints related to cost.

In Chapter 2, we found that property owners reported a greater intention to take philanthropic action to protect a Minnesota lake than visitors did. However, there was no significant difference between property owners and non-owners in intention to take political action.

Research has examined the relationship between outdoor recreation and environmental concern, with inconsistent findings. Outdoor recreation, particularly hunting, fishing, bird watching, hiking, camping, and mountaineering, was important to the rise of environmentalism in the United States (Dunlap & Heffernan, 1975; Taylor, 2000). Outdoor recreation was thought to increase: (a) awareness of environmental problems by exposing people to environmental degradation, (b) commitment to protection of valued recreation sites, and (c) aesthetic appreciation for “natural” places (Cottrell, 2003; Dunlap & Heffernan, 1975).

After Dunlap and Heffernan (1975) found limited support for a positive relationship between outdoor recreation and environmental concern, researchers continued to explore the relationship (Bright & Porter, 2001; Theodori et al., 1998). Theodori et al. (1998) found support for a relationship between recreation participation and environmentally responsible behavior, but—in contrast to previous research—did not find differences in environmental behavior among different types of outdoor activities. Bright and Porter (2001) looked at how the meaning behind recreation

participation affected peoples' environmental concerns. Teisl and O'Brien (2003) found increased environmental concern and behavior among recreation participants, relative to non-participants. Teisl and O'Brien also found that the level of concern was related to the type of outdoor recreation activity. Similarly, in Chapter 2, we found that recreation type was related to intended conservation action—consumptive and all-around recreationists reported the greatest intention to take philanthropic action to protect a lake, while appreciative recreationists reported the strongest intention of taking political action.

Little research has explored the relationship between recreation participation and environmental attitudes and behaviors among property owners. Brook et al. (2003) examined the influence of various factors, including recreation participation, on landowners' stewardship behaviors related to habitat protection for an endangered mouse in Colorado and Wyoming. Their results did not “support the notion that engaging in nonconsumptive or consumptive recreation leads landowners to engage in stewardship behavior” (p. 1647).

Place Attachment and Conservation

Research has associated stronger place attachment to greater inclination to protect a special place. The research has consistently found a positive relationship between place attachment and conservation among recreational users. In Chapter 2, we found that attitudinal place attachment predicted intended philanthropy and political action among all-around and less-engaged recreationists. Payton, Fulton, and Anderson (2005) found that emotional place attachment was a significant positive predictor of civic action taken to protect a wildlife refuge. Wellman, Roggenbuck, and Smith (1982)

found that people who are more attached to recreation settings may be more likely to act as stewards and less likely to engage in depreciative behavior. Vorkinn and Riese (2001) found that place attachment, which included a measure of recreation involvement, was related to environmental concern about a proposed hydropower development in Norway.

Studies have found relationships between place attachment and conservation among property owners. Stedman (2000) found place attachment among lakeshore property owners was associated with willingness to engage in lake-protective behavior. Larson and Santelman (2007) found that people who lived near water resources in Portland, Oregon were more attached, and had more positive attitudes about economic support for resource protection, but more negative attitudes about regulations to protect the resource. Place attachment was associated with environmental attitudes among both visitors and residents to a Norwegian national park, but there were no significant differences between visitors and residents in the importance of protection of nature, wilderness, and cultural landscape (Kaltenborn & Williams, 2002).

Research Goals and Hypotheses

The goals for this study were to (a) clarify how Minnesota lakeshore property owners connect to lakes through outdoor recreation and (b) examine how place attachment may relate to lakeshore property owners' attitudes about and management of aquatic plants on their lakeshore property. Based on previous research, this research was guided by six hypotheses:

H1: Increased participation in lake-based outdoor recreation by respondents will be related to stronger attachment the lake where they own property.

- H2: Increased participation in lake-based outdoor recreation by respondents will be related to greater personal responsibility for protecting the lake where they own property.
- H3: Compared to respondents who own year-round/primary residences on lakes, respondents who own recreational property/second homes will report stronger place attachment to the lake where they own property.
- H4: There will be no relationship between type of residence and personal responsibility for protecting the lake where they own property.
- H5: The relationships between place attachment and personal responsibility for protecting lakes will vary by recreation types.
- H6: The relationships between place attachment and personal responsibility for protecting lakes will not vary by type of property.

Methods

The study population included lakeshore landowners on “fisheries lakes” in the State of Minnesota (US). There are an estimated 180,000 property owners on 3,029 “fisheries lakes” in Minnesota (Payton & Fulton, 2004; Schupp, 1992). A stratified, random sample of 5,550 lakeshore property-owner households was selected based on lake ecotype, development classification, and number of developed properties. Stratification information was derived from a lake database provided by the Minnesota Department of Natural Resources (MDNR). Landowner contact information was obtained from county property ownership records.

We administered a mail survey following accepted research methodology (Dillman, 2000). We implemented five mailings between May and July of 2004.

Mailings included: (a) an initial survey mailing including a personalized cover letter (Appendix I), survey (Appendix B), and postage-paid reply envelope, (b) a reminder postcard (Appendix J), (c) a second survey mailing again including a personalized cover letter (Appendix K), survey, and postage-paid reply envelope, (d) a second reminder postcard (Appendix L), and (e) a shortened survey used to gauge non-response bias (Appendix M) with a cover letter (Appendix N).

The main survey included questions about: (a) landowner demographics, (b) property characteristics, (c) aquatic plant removal, (d) lake activities, (e) opinions on the value of aquatic plants, (f) perceptions of lake conditions, (g) subjective norms, (h) behavior evaluations, and removal behaviors, (i) awareness of consequences of plant removal, (j) opinions regarding responsibility for managing aquatic plants, and (k) value and importance of lakeshore property.

Recreation Participation

Respondents indicated the number of times they participated in 14 lake-based recreation activities during 2003. Response was on the scale 0 (not at all), 1 (1 or 2 times), 2 (3 to 5 times), 3 (6 to 10 times), 4 (11 to 20 times), or 5 (21 or more times).

Place Attachment

Respondents rated 13 items addressing attachment to their lake property (Table 3.1). Items were identical to those used in the study reported in Chapter 2. Response was on the scale 1 (strongly disagree) to 7 (strongly agree). Ten items were derived from a study of Wisconsin lakeshore property owners conducted by Jorgensen and Stedman (2001). Based on discussions about the importance of family memories to Minnesotans' attachment to lakes, three items examined family-related place

attachment.

Responsibility for Managing Lakes

Respondents rated 11 items to measure respondents' perceptions of responsibility for managing aquatic plants. Response was on the scale 1 (strongly disagree) to 7 (strongly agree). Items were derived from Schwartz (1977).

Data Analysis

Descriptive statistics, along with cluster, reliability, and regression analyses were conducted in the Statistical Package for Social Sciences (SPSS 15.0).

Confirmatory factor analysis and structural equation modeling were run using LISREL (8.80).

Using the full data set ($n = 3,103$), we conducted two-step cluster analysis to segment respondents based on their recreation participation. Prior to analysis, we calculated the average response to four fishing items (fishing from shore or dock/pier, fishing from motorized boat, fishing from non-motorized boat, ice fishing) and two boating items (motorized pleasure boating, canoeing/kayaking/paddleboating) to provide measures similar to those used in Chapter 2. Cluster analysis is a tool used for classification in the social and biological sciences (Mezzich & Solomon, 1980). Academic and marketing researchers employ cluster analysis to classify groups of people with similar characteristics (Punj & Stewart, 1983).

We used structural equation modeling (SEM) with robust maximum likelihood estimation (MLE) to test the relationships between place attachment and reported personal/property-owner responsibility for protecting lakes. Confirmatory factor analysis was conducted on the place attachment constructs prior to modeling. We

modeled attitudinal place attachment based on the correlated-uniquenesses model of sense of place presented in Jorgensen and Stedman (2001). The three new items that we used to examine family-related place attachment were modeled as a factor we describe as normative place attachment. We employed multiple-sample SEM to test whether the type of property (i.e. year-round residence versus recreational property) and recreation cluster (i.e. less-involved, consumptive, appreciative, all-around) moderated the relationships among model parameters. SEM builds on regression and factor analysis. It uses the analysis of covariances to explore relationships among a set of variables (McCoach, Black, & O'Connell, 2007). SEM provides a comprehensive and flexible method for examining relationships among observed variables and unmeasured latent constructs (Knoke, Bohrnstedt, & Mee, 2002; McCoach et al., 2007). As opposed to multiple regression, SEM explicitly accounts for measurement error (McCoach et al., 2007). SEM also allows researchers to assess the overall fit of a model to data and to determine the equivalences of model parameters across several samples (Knoke et al., 2002; McCoach et al., 2007). Interpretation of path models produced through SEM is fairly straightforward—the standardized coefficients produced through MLE are interpreted as regression coefficients, and unexplained variance of an endogenous (i.e. dependent) variable equal to $1 - R^2$ in recursive models (where causal loops are unidirectional) (Kline, 2005).

Results

Survey Response Rate

Of the 5,500 surveys mailed, 353 were invalid because the survey was undeliverable or because the landowner no longer owned lakeshore property or was

deceased. Of the remaining 5,197 surveys, 3,115 were returned for a response rate of 59.9%. We received 548 shortened surveys to gauge non-response bias. The response rate for the non-response test was 26.3%.

Respondent Characteristics

Nearly three-fourths of the respondents (72%) were male, and nearly all (98%) were White. The mean respondent age was 58 years. The average household income before taxes in 2003 was \$183,850, with a median of \$75,000. Seventy-three percent of respondents had completed a 4-year college degree or more. Over half (55%) of respondents ($n = 1,662$) reported that they were members of lake associations.

Lakeshore Property Types

Lakeshore property was fairly evenly split between year-round/primary residences (49.1%, $n = 1,457$) and recreational properties/second homes (50.1%, $n = 1,488$), with less than 1% rental ($n = 12$) and business ($n = 11$) property. Second-home owners reported having owned their lake property longer ($M = 20.4$ years, $SD = 16.3$) than those with a year-round residence ($M = 19.0$ years, $SD = 14.2$) ($t = 2.47$, 2888 df , $p < 0.05$). The mean number of feet of lake shore owned also varied by property type with 418 feet for recreational property owners and 484 feet for primary property owners ($t = 2.28$, 2835 df , $p < 0.05$). Age and income did not differ significantly between respondents who owned a year-round residence versus recreational property on a lake. Compared to respondents who owned a year-round residence, a greater proportion of recreational property owners reported having completed college (25.1% vs. 22.9%), postgraduate education (9.7% vs. 8.0%), or a postgraduate degree (20.8% vs. 16.0%) ($\chi^2 = 27.47$, 7 df , $n = 2833$, $p < 0.001$, $V = 0.098$). A slightly larger proportion of second-

home owners were male (74.0% vs. 70.3%) ($\chi^2 = 4.76$, 1 *df*, $n = 2851$, $p < 0.05$, $V = 0.041$) and reported being members of lake associations (59.1% vs. 52.8%) (74.0% vs. 70.3%) ($\chi^2 = 11.56$, 1 *df*, $n = 2861$, $p < 0.01$, $V = 0.064$), compared to primary-home owners. Respondents who owned year-round residences were more likely to participate in ice fishing and birding than recreational property owners. Second-home owners were more likely to fish from a boat, ride motorized and non-motorized boats (not fishing), waterski, and swim.

Lake Use and Recreation Participation

Respondents were active in lake-based recreation. Participation in listed recreational activities ranged from 98% for enjoying lake scenery to 8% for hunting waterfowl. Over three-fourths of the participants participated in fishing (81%), swimming/wading (82%), boating (85%), and bird or wildlife watching (88%). Enjoying lake scenery was the most popular activity listed; 80% of respondents reported that they enjoyed lake scenery 21 or more times during 2003. Only 1% of respondents hunted waterfowl 21 or more times during the year. Using cluster analysis, we identified four recreation clusters, including (a) all-around (38%), (b) appreciative (36%), (c) consumptive (6%), and (d) less-involved (21%).

Age differed by recreation cluster, with appreciative ($M = 62$ years, $SD = 11.7$) and less-involved ($M = 58$ years, $SD = 13.0$) recreationists older than all-around ($M = 55$ years, $SD = 11.7$) and consumptive ($M = 53$ years, $SD = 11.9$) recreationists ($F = 60.42$, 3 *df*, $n = 2835$, $p < 0.001$, $\eta = 0.25$). Respondent gender differed by recreation group with the greatest proportion of females in the appreciative recreation cluster (32%), followed by the all-around cluster (28%), the less-involved cluster (21%), and

the consumptive cluster (15%) ($\chi^2 = 37.36$, 3 *df*, $n = 2872$, $p < 0.001$, $V = 0.11$). Mean household income did not differ significantly by recreation cluster. The type of property owned, year-round residence versus second home, differed by recreation type. The proportion of respondents who owned their lake property as a year-round residence ranged from 34% for less-involved, to 49% for all-around, 52% for consumptive, and 59% for appreciative recreationists ($\chi^2 = 94.97$, 3 *df*, $n = 2830$, $p < 0.001$, $V = 0.18$). The mean number of years of ownership of the current lake property differed by recreation cluster, ranging from 22 years for appreciative recreationists, 20 years for consumptive and less-involved recreationists, and 17 years for all-around recreationists ($F = 15.02$, 3 *df*, $n = 2908$, $p < 0.001$, $\eta = 0.12$). The mean number of feet of lake shore owned also varied by recreation type from 522 feet for consumptive to 262 for appreciative, 227 for less-involved, and 214 for all-around ($F = 21.05$, 3 *df*, $n = 2846$, $p < 0.001$, $\eta = 0.15$).

Place Attachment

Confirmatory factor analysis verified the attitudinal and normative place attachment constructs, with attitudinal place attachments modeled based on Jorgensen and Stedman's (2001) correlated-uniquenesses model. The model had "reasonable" fit ($\chi^2 = 1912.23^{***}$ (52 *df*), RMSEA = 0.071, CFI = 0.99). Place attachment constructs had composite reliability values greater than 0.60 and average variance extracted values greater than 0.50, which suggests acceptable content and discriminant validity (Diamantopoulos & Siguaw, 2000). Results of confirmatory factor analysis of place attachment are presented in Table 3.1 and Figure 3.1.

Place attachment differed by home type and recreation segment (Table 3.1). Year-round residents reported stronger attitudinal place attachment (6.0 vs. 5.7) ($t =$

6.79, 2922 *df*, $p < 0.001$), and second-home owners reported greater normative place attachment (6.1 vs. 5.8) ($t = 5.62$, $n = 2911$ *df*, $p < 0.001$). Attitudinal place attachment differed significantly by recreation cluster, with all-around ($M = 6.1$, $SD = 0.8$), consumptive ($M = 6.0$, $SD = 0.9$), and appreciative ($M = 5.9$, $SD = 1.0$) recreationists reporting stronger attachment than less involved ($M = 5.2$, $SD = 1.2$) recreationists ($F = 105.05$, 3 *df*, $n = 2942$, $p < 0.001$, $\eta = 0.30$). Similarly, respondents in the all-around ($M = 6.2$, $SD = 1.1$), consumptive ($M = 6.0$, $SD = 1.1$), and appreciative ($M = 5.9$, $SD = 1.3$) recreation clusters reported stronger normative place attachment than those in the less-involved ($M = 5.6$, $SD = 1.4$) clusters ($F = 35.72$, 3 *df*, $n = 2930$, $p < 0.001$, $\eta = 0.19$). We also observed positive correlations between most measures of recreation frequency and attitudinal and normative place attachment.

Responsibility for Managing Lakes

Based on the 11 items used to measure responsibility for lake management, we identified three factors: (a) personal/property owner responsibility ($M = 6.3$, $SD = 0.9$, $\alpha = 0.72$), (b) agency responsibility ($M = 4.0$, $SD = 1.6$, $\alpha = 0.62$) and (c) fatalistic/hopeless views ($M = 3.3$, $SD = 1.5$, $\alpha = 0.64$) (Table 3.2). There was only one significant difference by home type among the 11 items used to measure management responsibility—year-round property owners agreed slightly more than recreational property owners that “regardless of whether I remove aquatic plants or not, the quality of my lake will decline” (4.5 vs. 4.2, $t = 2.94$, 2801 *df*, $p < 0.01$). Results, however, suggest differences by recreation cluster in ascribed responsibility for managing lakes. Less-involved recreationists reported lower levels of personal responsibility for protecting the health of their lake ($F = 25.41$, 3 *df*, $n = 2856$, $p < 0.001$, $\eta = 0.161$) and

higher fatalistic/hopeless views ($F = 16.47, 3 \text{ df}, n = 2849, p < 0.001, \eta = 0.131$).

Respondents from the appreciative recreation cluster reported more support for agency management ($F = 8.62, 3 \text{ df}, n = 2847, p < 0.001, \eta = 0.095$).

Modeling Recreation, Place Attachment, and Conservation

Structural equation modeling conducted with all respondents suggested positive relationships between both attitudinal and normative place attachment with personal responsibility for protecting lakes ($R^2 = 0.12$) (Figure 3.2). The model had a reasonable fit to the data (Minimum fit $\chi^2 = 2101.87^{***} 89 \text{ df}$, RMSEA = 0.055).

We compared structural equation models for respondents who owned year-round residences to those who owned recreational property (Figures 3.3 - 3.4). For both home types, attitudinal place attachment was positively related to personal responsibility for protecting a lake. For respondents with recreational property, normative place attachment was also positively related to personal responsibility for protecting a lake. Results from multiple-sample structural equation modeling suggested better fit when factor loadings and structural parameters varied across home types ($\Delta\chi^2 = 1334.25, 27 \text{ df}, p < 0.001$; $\Delta\text{AIC} = 799.32$). Fit improved further when error terms (along with factor loadings and structural parameters) were varied freely across the groups ($\Delta\chi^2 = 3498.12, 16 \text{ df}, p < 0.001$; $\Delta\text{AIC} = 499.06$).

Next, we compared structural equation models for the four recreation clusters relating place attachment to personal responsibility for protecting lakes (Figures 3.5 – 3.8). In all four recreation clusters, attitudinal place attachment positively predicted greater personal responsibility for protecting lakes. Among appreciative and less-involved recreationists (Figures 3.6 – 3.7), normative place attachment also positively

predicted personal responsibility. Results from multiple-sample SEM suggested a better fit when factor loadings and structural parameters varied across recreation segments ($\Delta\chi^2 = 27813.29$, 81 *df*, $p < 0.001$; $\Delta\text{AIC} = 6340.81$). Fit improved further when error terms, factor loadings, and structural parameters varied freely across groups ($\Delta\chi^2 = 6579.30$, 48 *df*, $p < 0.001$; $\Delta\text{AIC} = 1030.52$).

We used multiple regression analysis to examine the combined effects of place attachment, recreation participation, and property ownership on personal responsibility for protecting lakes. The recreation clusters, place attachment factors, and type of lakeshore property served as independent variables, and personal responsibility for protecting lakes was the dependent variable. Recreational property ownership ($\beta = 0.065$) along with attitudinal ($\beta = 0.205$) and normative ($\beta = 0.048$) place attachment were positively related to personal responsibility for protect lakes. Being in the less-involved recreation cluster was negatively related ($\beta = -0.075$) to personal responsibility. The variables, however, explained only a small portion of the variance in personal responsibility for protecting lakes ($\text{Adj. } R^2 = 0.075$).

Discussion

Although development on Minnesota's lakeshores has grown rapidly in recent years (Myers, 2007), research suggests declining participation in lake-based outdoor recreation activities like boating and fishing in the state (Kelly, 2005). Resource managers and researchers need to better understand how lakeshore property ownership and recreation participation relate to place attachment to and personal responsibility for protection of lakes.

We found support for Hypothesis 1 that increased participation in lake-based recreation would relate to stronger attachment a lake. Less-involved recreationists reported the lowest levels of attitudinal and normative place attachment. Where differences existed among the other recreation clusters, all-around and consumptive recreationists reported stronger attachment than appreciative recreationists. These results parallel results from our study of attachment to Minnesota lakes with the general public (reported in Chapter 2), which found that less-involved recreationists had the lowest levels of place attachment, while all-around and consumptive recreationists had the highest place attachment. We also observed positive correlations between frequency of participation in outdoor recreation activities to attitudinal and normative place attachment. These results parallel correlations between lake-based recreation and place attachment observed by Stedman (2006). Others have associated place attachment with frequency of use (Anderson & Fulton, 2008; Bricker & Kerstetter, 2000; Moore & Graefe, 1994; Williams et al., 1992, Williams & Vaske, 2003) and type of recreation activity (Kyle et al., 2004).

Hypothesis 2 suggested that increased participation in lake-based outdoor recreation would relate to greater personal responsibility for protecting a lake. We found support for this hypothesis. Less-involved recreationists rated personal responsibility for protecting their lake lower than respondents in the other clusters did. Unlike place attachment, however, there was no significant difference among the other three clusters in personal responsibility for protecting lakes. Similar to the results here, in Chapter 2 we found that less-involved recreationists were less likely to intend to take either philanthropic or political action to protect a lake they used most often. Our results

correspond to findings by Dunlap and Heffernan (1975), Theodori et al. (1998), and Teisl and O'Brien (2003), who found a positive relationship between recreation participation and intention to take conservation action.

The data provided both support for and opposition to Hypothesis 3, which suggested that respondents who owned recreational property/second homes would report stronger attachment to the lake where they owned property than respondents who owned year-round residences. In support of our hypothesis, second-home owners reported greater normative place attachment. Year-round residence owners, however, reported stronger attitudinal place attachment. Stedman (2006) found that seasonal homeowners in a lake-filled region of northern Wisconsin exhibited higher levels of attachment. However, Stedman (2006) also found that attachment among seasonal residents was related to the environmental quality of the area and the opportunity to escape from day-to-day cares, while attachment among year-round residents was related to social networks with people in the community. Our results related to attitudinal place attachment may differ from those of Stedman (2006) due to sampling differences. We sampled lakeshore property owners from around the state of Minnesota, while Stedman sampled from one high-amenity county in northern Wisconsin. On average, seasonal residents in Stedman's (2006) study had been coming to the county for 44 years, compared to 30 years for year-round residents, which compares to about 20 years of property ownership among both seasonal and year-round residents in our survey. Our results related to normative place attachment suggest that family connections influence peoples' connection to place. Interestingly, attachment associated with family memories was stronger among recreational property owners than year-round residents. This may

suggest the importance of second homes on Minnesota lakes for family recreation and escape from day-to-day life to place attachment among recreational property owners.

We found some support for the fourth hypothesis that type of residence would not be related to personal responsibility for protecting the lake where they own property. Both year-round and recreational property owners agreed with items addressing personal responsibility for protecting lakes. However, results from our regression analysis indicated that recreational property ownership was related to personal responsibility for protecting lakes when considered with recreation participation and place attachment. Interestingly, Stedman (2000) also found that seasonal, rather than year-round, residents in northern Wisconsin reported stronger intentions to take action to protect their lake. He surmised that seasonal residents might be more willing to fight to protect a lake because, compared to year-round residents, they derived place attachment more from the environmental quality of the area (Stedman, 2000). Likewise, our results may suggest that recreational property owners may be somewhat more likely to take personal responsibility to protect a lake, because their attachment may be connected to the environmental quality of the place.

Hypothesis 5 suggested that the relationships between place attachment and personal responsibility for protecting lakes would vary by recreation type. We found support for this hypothesis. As in Chapter 2, our results here underscore the importance of attitudinal place attachment on conservation attitudes among all types of recreationists. In contrast with our results in Chapter 2, our results here suggest that normative place attachment positively predicts lakeshore property owners' personal responsibility for protecting their lake among individuals in the appreciative and less-

involved recreation clusters. The positive relationship between normative place attachment and personal responsibility may result from population differences or different measures of conservation. Our sample of lakeshore property owners reported stronger attitudinal and normative place attachment than the sample from the general public. In addition, we modeled reported personal responsibility for protecting the lake, rather than behavioral intention to protect a lake, which was modeled in the previous study.

The results refuted Hypothesis 6, which suggested that the relationships between place attachment and personal responsibility for protecting lakes would not vary by type of property. Attitudinal place attachment positively predicted personal responsibility for protecting lakes among both primary- and second-home owners, but normative place attachment was related to personal responsibility only for second-home owners.

The results demonstrate a positive relationship between place attachment and personal responsibility for protecting lakes. Both attitudinal and normative place attachment predicted personal responsibility, at least in some groups. Previous research has demonstrated positive relationships between place attachment and environmental concern (Payton et al., 2005; Vaske & Kobrin, 2001; Vorkinn & Riese, 2001). Our results suggest that attitudinal, more than normative, place attachment predicts peoples' attitudes about protecting a lake. This result parallels our finding in Chapter 2 that attitudinal, but not normative, place attachment influenced intention to take conservation action.

Our results emphasize the need to better understand how family connections relate to place attachment. Research has demonstrated the importance of social

connections to place attachment (Kyle et al., 2004; Stedman, 2000, 2006), but it has not differentiated connections associated with family, friends, neighbors, and new acquaintances. Because of the observed relationships between normative place attachment and personal responsibility for protecting lakes, the concept of normative place attachment deserves further study.

Management Implications, Study Limitations, Future Research, and Conclusions

Management Implications

We found that lake-based recreation participation, attitudinal and normative place attachment, and type of lake property related to lakeshore property owners' sense of personal responsibility for lake protection. Survey respondents reported strong attachment to and personal responsibility for the lake where they owned property. These findings have implications for managers.

Attachment among these property owners was significantly stronger than reported in our study of Minnesota residents' attachment to lakes reported in Chapter 2. Therefore, growing lakeshore residential development may increase attachment to Minnesota lakes and provide opportunities for engaging residents in lake protection. However, it is important to note that attachment by lakeshore property owners will not necessarily lead to more sustainable management of riparian areas, because (a) place attachment is not necessarily associated with environmental quality (Stedman, 2008), and (b) property owners' perceptions of their impacts on riparian systems may be inconsistent with impacts as measured by experts (Fish, 2001). People remain attached to degraded settings through memories of past events and selective attention to detail (Stedman, 2008). Therefore management may need to help property owners better

understand the impacts of people and housing development on riparian areas. Beyond this, managers may need to emphasize incentives, partnerships with local lake associations and community organizations, and investments in the resource—rather than regulations—to build trust with property owners.

Given the observed relationship of outdoor recreation participation to place attachment and personal responsibility for lake protection, declines in outdoor recreation participation may have implications for conservation efforts. The type of recreation participation was related to responsibility for managing lakes and aquatic plants, with appreciative recreationists agreeing more with agency responsibility and less-involved recreationists agreeing less with personal responsibility. Declining lake-based outdoor recreation may decrease attachment to lakes and reduce personal responsibility for aquatic resources. Managers need to understand what motivates and constrains current and potential recreation users. This information could be used to develop programs to maintain or enhance recreation participation in general or in specific activities.

To enhance support for conservation and management activities, land managers need to better understand the meaning of and benefits derived from public and private spaces for property owners. Place meanings are derived from peoples' experiences as property owners and recreation participants. Place meanings are also intentionally and unintentionally communicated by managers. Therefore, managers need to recognize that their actions influence the meanings that people associate with places. If managers remove native aquatic plants to put in a boat launch, this might communicate place meanings associated with recreational access. Property owners who associate their lake

property with recreation may take actions that reflect the management message that removing aquatic plants is necessary for access. Therefore, it may be important for managers to create meanings by modeling sustainable land management practices, providing for certain experiences, and communicating through interpretation, visitor programming, and volunteer activities.

Study Limitations

Although our models relating place attachment to personal responsibility for protecting lakes had reasonable to good fit for the data, they did not explain much of the variance in personal responsibility ($R^2 = 0.02 - 0.12$). Obviously, there are other important determinants of lakeshore property owners' feelings of personal responsibility for protecting their lakes. The personal responsibility for protecting the lake reported in the survey may have been influenced by the nature of the survey, which specifically addressed aquatic plant management. The study suggested the value of native aquatic plants for ecological reasons. As property owners, these respondents may be concerned about additional regulation of shoreline property and may be less likely to report that property owners should take responsibility for managing aquatic plants.

This study sampled 5,500 lakeshore property owners in Minnesota. Names and addresses were drawn from property tax records. A higher proportion of our respondents were male and older compared to census data for Minnesota. This skewed proportion may reflect lakeshore property ownership or bias for male response on the topic of aquatic plant management. However, the nonresponse check suggested that reluctant respondents were younger and included a greater proportion of women. Other research has found age bias in mail surveys (Filion, 1975; Schroeder, Fulton, Currie, &

Goeman, 2006), and the older age of our respondents may reflect this bias.

In addition to being younger and including a greater proportion of females, reluctant respondents were less likely to participate in lake-based outdoor recreation activities. Survey subject matter and framing effects may have influenced response. Responses may have been framed by the question order; questions early in the survey addressed participation in outdoor recreation. Because this survey dealt with aquatic plant management at Minnesota lakes, respondents likely over-represent people who are concerned about this topic. A smaller proportion of reluctant respondents (36%) compared to respondents (44%), who had aquatic plants on their property, reported that they try to keep an area free of aquatic plants each year.

We did not query meanings behind respondents' attachment to their lake, recreation motivations, nor benefits associated with lakeshore property ownership. Place meanings are derived from experiences in a space, like recreation activities, interactions with family, friends, and neighbors, and caretaking of a property. Stedman's (2000, 2006) work demonstrated how year-round and seasonal property owners' place attachment was rooted in social and environmental meanings. Researchers have also described how underlying motivations for outdoor recreation participation may relate to place attachment and environmental concern (Anderson & Fulton, 2008; Bright & Porter, 2001; Moore & Graefe, 1994). Anderson and Fulton (2008) found recreation experience preferences to partially mediate the relationship between recreation participation and place attachment. Bright and Porter (2001) found that, for certain recreation activities, the meaning behind activities fully mediated the relationship between recreation participation and environmental concern. In his study of

landowners in riparian landscapes, Fish (2001) suggested that desired benefits from property ownership drive human activities and behaviors, which in turn drive impacts on the landscape. These findings underscore the need to better understand how experiences drive place meanings, and how place meanings relate to attachment and environmental attitudes and behavioral intentions.

Future Research

This research contributes to knowledge of the relationships among property ownership, outdoor recreation participation, place attachment, and conservation attitudes, but additional research is needed. Normative place attachment predicted conservation attitudes among recreational property owners and appreciative and less-involved recreationists. In what might appear to be conflicting results, Stedman (2006) found that place attachment among year-round residents was derived from social networks, while our results emphasize the importance of normative (i.e. family-related) place attachment for seasonal residents. Future research could further examine the importance of social bonds with family, friends, neighbors, and others to place attachment among year-round residents and second-home owners. Interactions with others affect individuals' feelings about place, and research needs to better understand social/normative influences on place attachment (Stokowski, 2002, 2008).

Future research could incorporate social capital and “sense of community” into studies that examine the relationship between place attachment and conservation. Manzo and Perkins (2006) suggest that place attachment, sense of community, and social capital “can motivate community members to participate in neighborhood improvement” (p. 339). Like neighborhoods, lakes and public lands are shared

resources, subject to the “tragedy of the commons” (Hardin, 1968). Peoples’ conservation attitudes and behaviors toward public resources may reflect a shared “sense of community” more than a personal “sense of place.” Social capital—which refers to the extent and effectiveness of social networks and includes the components of collective efficacy (empowerment), neighboring, and citizen participation—relates closely to sense of community (Long & Perkins, 2007; Manzo & Perkins, 2006). Kaltenborn and Williams (2002) describe how community studies focus on “social networks and interactions whereas tourist-visitor studies focus on natural and cultural landscape features” (p. 189). Future research on property owners’ conservation attitudes toward lakes or other resources could incorporate measures of sense of community, social capital, along with place attachment.

We used cluster analysis to categorize respondents’ lake-based recreation participation. Future research could employ similar methods for non-lake-based recreation. Researchers could employ multidimensional measures including: (a) participation versus nonparticipation, (b) involvement and commitment, (c) motivations/benefits, (d) exposure, avidity, recency, activity level, (e) years of participation, (f) overlap or clustering in activity participation, (g) resource dependence, and (h) transcendent experiences. More robust measurement of recreation participation may help clarify its relationship to place attachment and conservation attitudes.

Research needs to include non-residential visitors and property owners in studies of recreation participation, place attachment, and conservation attitudes and behavioral intentions. Few studies have compared residents and visitors (Kaltenborn & Williams, 2002). Hay (1998), however, differentiated degrees of place “insidedness” from

transients and tourists, to long-term visitors and recreational property owners, to residential property owners, to intergenerational residents. Research needs to better understand how peoples' "insidedness" to a place relates to attachment and commitment to protecting that place.

Conclusions

Our results suggest property type relates to place attachment. Year-round home owners reported stronger attitudinal place attachment, while second-home owners reported stronger normative place attachment. Recreation participation was related to both place attachment and personal responsibility for lake protection. Individuals who participated in different types of lake-based recreation developed different levels of attachment to and different degrees of responsibility for protecting lakes. All-around recreationists had stronger attachments than consumptive, appreciative, and less-involved recreationists. Less-involved recreationists reported significantly lower personal responsibility for protecting lakes. Attitudinal and normative place attachment were related to personal responsibility for lakes.

Table 3.1 Mean scores and reliability for place attachment to lake, overall and by recreation cluster and home type.

Factor (Cronbach's α ; composite reliability; average variance extracted) - items	Recreation Type						Home Type	
	\bar{x}	SE	All ^a \bar{x}	App ^b \bar{x}	Con ^c \bar{x}	Less ^d \bar{x}	Prim ^e \bar{x}	Rec ^f \bar{x}
Attitudinal/General ($\alpha = .91$; CR = .95; AVE = .65)	6.0	0.019	6.2 _a	6.0 _b	6.2 _{ab}	5.4 _c	6.2	5.9***
A1. It is my favorite place to be.	6.5	0.018	6.7 _a	6.5 _b	6.7 _{ab}	5.9 _c	6.6	6.4***
A2. I feel that I can really be myself there.	6.3	0.020	6.6 _a	6.4 _a	6.5 _a	5.8 _b	6.5	6.3***
A3. I really miss it when I am away from it too long.	6.2	0.021	6.5 _a	6.2 _b	6.3 _{ab}	5.6 _c	6.3	6.2***
A4. I feel happiest when I am there.	6.1	0.021	6.3 _a	6.2 _a	6.2 _a	5.5 _b	6.4	5.9***
A5. It is the best place to do the things I enjoy.	6.0	0.022	6.3 _a	6.1 _b	6.3 _{ab}	5.4 _c	6.2	5.9***
A6. It reflects the type of person that I am.	5.9	0.024	6.2 _a	5.9 _b	6.1 _{ab}	5.2 _c	6.1	5.7***
A7. For the things I enjoy doing most, no other place can compare to it.	5.6	0.027	5.9 _a	5.6 _a	5.9 _a	5.0 _b	5.8	5.5***
A8. Everything about it is a reflection of me.	5.3	0.028	5.5 _a	5.3 _a	5.5 _a	4.7 _b	5.5	5.1***
A9. As far as I am concerned there are better places to be ^r .	4.9	0.036	5.2 _a	4.9 _{ab}	4.8 _b	4.4 _c	4.9	4.9
A10. My lake property says very little about who I am ^r .	5.4	0.032	5.8 _a	5.4 _b	5.7 _{ab}	4.7 _c	5.5	5.4
Normative/Family-Related ($\alpha = .78$; CR = .88; AVE = .70)	5.9	0.022	6.2 _a	5.9 _b	6.0 _b	5.6 _c	5.8	6.1***
N1. It is a special place for my family.	6.3	0.021	6.5 _a	6.3 _b	6.4 _{ab}	5.9 _c	6.3	6.4
N2. Many important family memories are tied to it.	6.1	0.025	6.3 _a	6.0 _b	6.0 _b	5.7 _c	6.0	6.2***
N3. It ties the generations of my family together.	5.5	0.033	5.8 _a	5.4 _{bc}	5.6 _{ab}	5.2 _c	5.3	5.8***

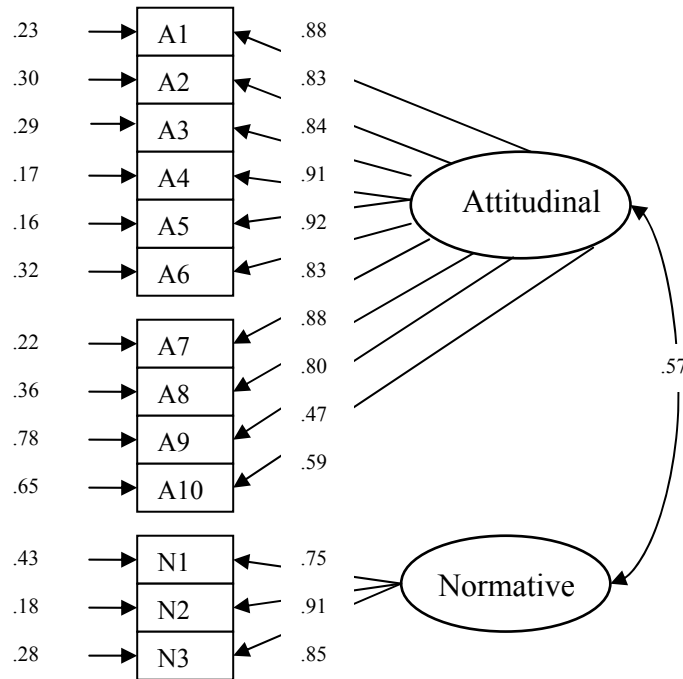
Notes. ^aAll = all-around recreationists, ^bApp = appreciative recreationists, ^cCon = consumptive recreationists, ^dLess = less-involved recreationists, ^ePrim = primary home owners, ^fRec = recreational home owners. ^rItems reverse coded for scale development and reliability analysis. For recreation type, means in the same row that do not share subscripts differ at $p < 0.05$ in the Tukey honestly significant difference comparison. For home type, means in the same row differ at * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 3.2 Mean scores and reliability for responsibility for managing lakes, overall and by recreation cluster and home type.

Factor (Cronbach's α) - items	Recreation Type						Home Type	
	\bar{x}	SE	All ^a \bar{x}	App ^b \bar{x}	Con ^c \bar{x}	Less ^d \bar{x}	Prim ^e \bar{x}	Rec ^f \bar{x}
Personal/Property Owner Responsibility ($\alpha = 0.72$)	6.3	0.016	6.5 _a	6.3 _a	6.5 _a	6.1 _b	6.3	6.4
PR1. I feel a strong personal obligation to protect the health of the lake I live on.	6.4	0.018	6.6 _a	6.4 _a	6.5 _a	6.2 _b	6.4	6.5
PR2. I feel a strong personal obligation to protect the wildlife populations on the lake.	6.3	0.019	6.4 _a	6.3 _a	6.5 _a	6.1 _b	6.3	6.4
PR3. Lakeshore owners have a responsibility to maintain the environmental quality of a lake.	6.3	0.022	6.4 _a	6.2 _{ab}	6.4 _a	6.1 _b	6.3	6.3
Fatalistic/Hopeless/Property Rights Views ($\alpha = 0.64$)	3.3	0.027	3.1 _b	3.3 _b	3.4 _{ab}	3.6 _a	3.3	3.3
F1. Regardless of whether I remove aquatic plants or not, the quality of my lake will decline.	4.4	0.040	4.1 _b	4.6 _a	4.4 _{ab}	4.3 _{ab}	4.5	4.2**
F2. There are so many other people removing aquatic Vegetation from the lake that it really doesn't matter what I do.	3.3	0.042	3.0 _b	3.4 _{ab}	3.3 _{ab}	3.7 _a	3.4	3.2
F3. If everyone else is removing aquatic vegetation form the lake for swimming and boating, I'm harming myself if I do not.	2.8	0.036	2.7 _b	2.8 _b	2.8 _b	3.3 _a	2.8	2.8
F4. Lakeshore owners should have the right to alter the shoreline any way they want.	2.7	0.036	2.6 _b	2.6 _b	3.0 _a	3.2 _a	2.7	2.8
Agency Responsibility ($\alpha = 0.62$)	4.0	0.031	3.9 _b	4.2 _a	3.9 _{ab}	4.0 _{ab}	4.0	4.1
AR1. Regulations for removing aquatic plants should be more restrictive	4.3	0.041	4.1 _b	4.5 _a	4.2 _{ab}	4.3 _{ab}	4.3	4.4
AR2. State agencies should be responsible for managing aquatic plants (not shoreline property owners).	4.0	0.041	3.7 _b	4.2 _a	3.9 _{ab}	4.0 _{ab}	3.9	4.0
AR3. Lake associations should be responsible for managing aquatic plants (not shoreline property owners).	3.9	0.040	3.7 _a	3.9 _a	3.7 _a	3.9 _a	3.8	3.9

Notes. ^aAll = all-around recreationists, ^bApp = appreciative recreationists, ^cCon = consumptive recreationists, ^dLess = less-involved recreationists, ^ePrim = primary home owners, ^fRec = recreational home owners. For recreation type, means in the same row that do not share subscripts differ at $p < 0.05$ in the Tukey honestly significant difference comparison. For home type, means in the same row differ at * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. For home type, means in the same row differ at * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Figure 3.1 Results of confirmatory factor analysis of place attachment.

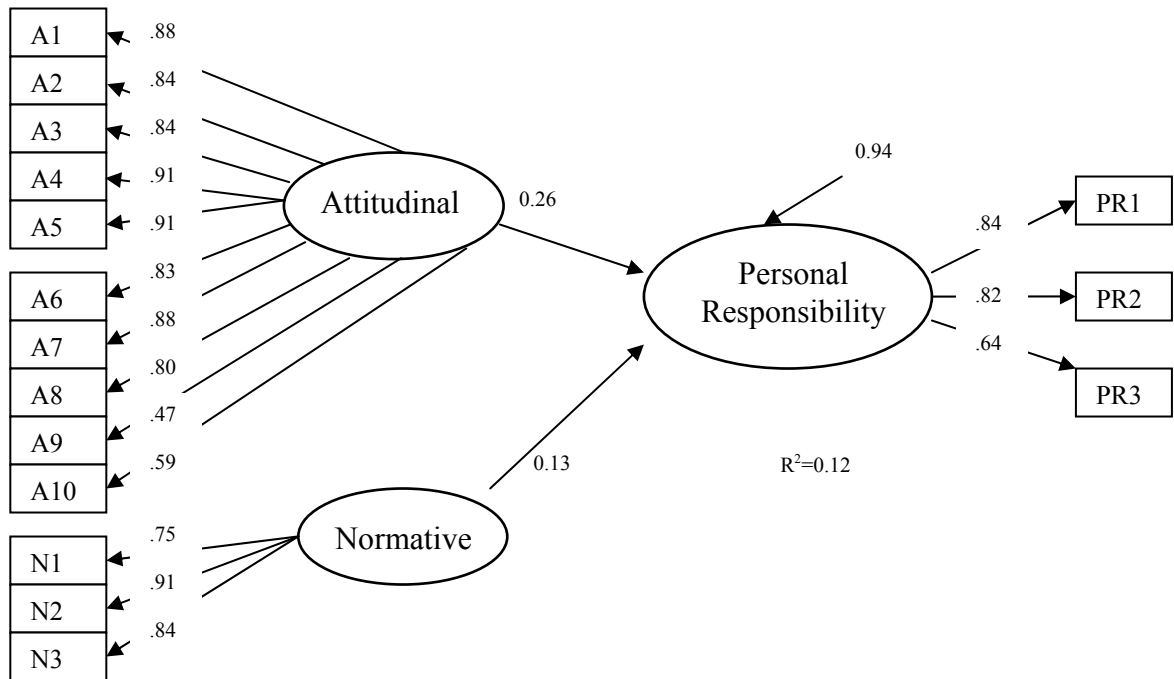


Notes: Minimum fit $\chi^2 = 1912.23^{***}$ (52 df), RMSEA = 0.071, NFI = 0.99, CFI = 0.99, GFI = 0.90

Model includes the following correlated errors (based on Joregensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .05
- A1 – A4: .05
- A3 – A4: .06
- A2 – A6: -.01
- A2 – A8: -.04
- A2 – A10: .04
- A6 – A8: .17
- A6 – A10: .18
- A8 – A10: .19
- A5 – A7: .01
- A5 – A9: -.02
- A7 – A9: .04

Figure 3.2 Significant ($p < 0.05$) standardized coefficients and error term ($\sqrt{\zeta}$) for latent endogenous variable in path model for all lakeshore property owners ($n = 2660$).

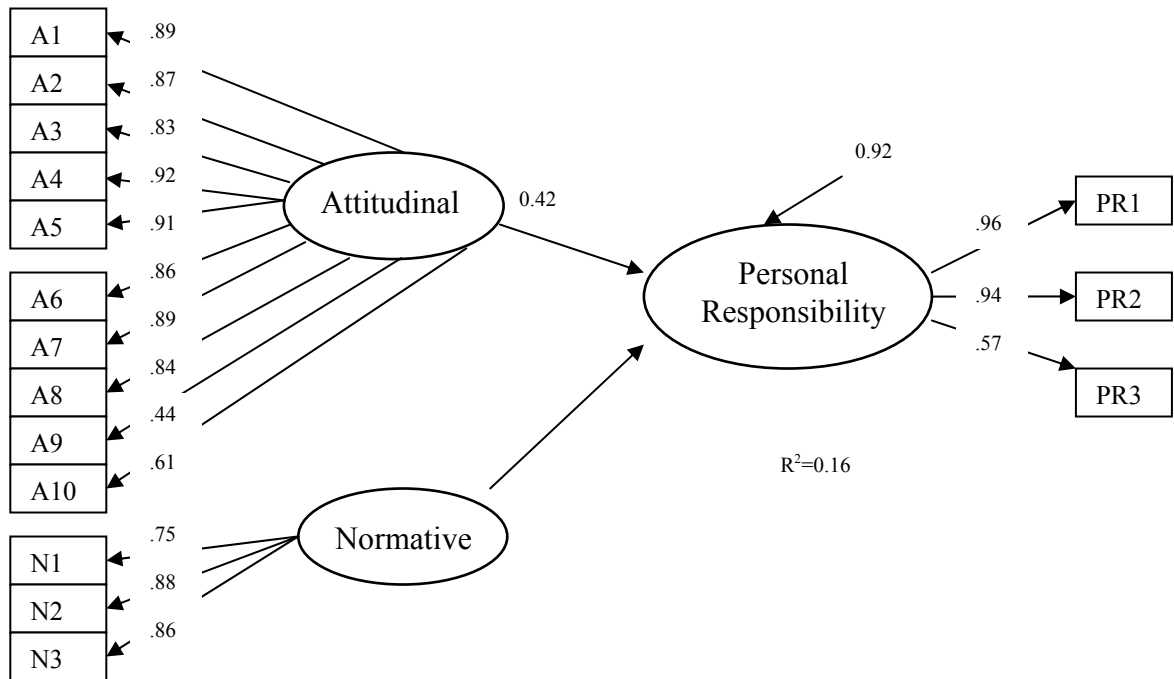


Notes: Minimum fit $\chi^2 = 2101.87^{***}$ (89 df), RMSEA = 0.055, NFI = 0.99, CFI = 0.99, GFI = 0.91

Model includes the following correlated errors (based on Jorengsen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .05
- A1 – A4: .05
- A3 – A4: .05
- A2 – A6: -.01
- A2 – A8: -.04
- A2 – A10: .04
- A6 – A8: .17
- A6 – A10: .19
- A8 – A10: .19
- A5 – A7: .02
- A5 – A9: -.01
- A7 – A9: .04

Figure 3.3 Significant ($p < 0.05$) standardized coefficients and error term ($\sqrt{\zeta}$) for latent endogenous variable in path model for primary residence owners ($n = 1247$).

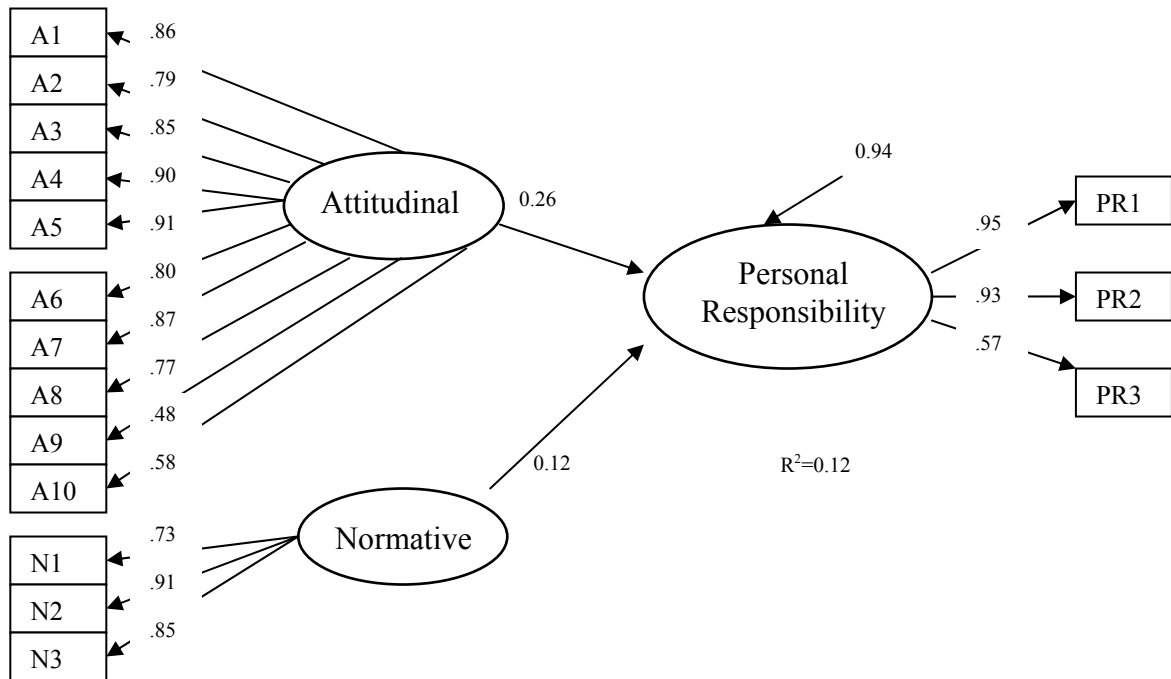


Notes: Minimum fit $\chi^2 = 1432.91^{***}$ (89 df), RMSEA = 0.056, NFI = 0.99, CFI = 0.99, GFI = 0.88

Model includes the following correlated errors (based on Jorengsen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .03
- A1 – A4: .07
- A3 – A4: .08
- A2 – A6: -.01
- A2 – A8: -.07
- A2 – A10: .01
- A6 – A8: .12
- A6 – A10: .15
- A8 – A10: .15
- A5 – A7: .06
- A5 – A9: .02
- A7 – A9: .02

Figure 3.4 Significant ($p < 0.05$) standardized coefficients and error term ($\sqrt{\zeta}$) for latent endogenous variable in path model for recreational property owners ($n = 1306$).

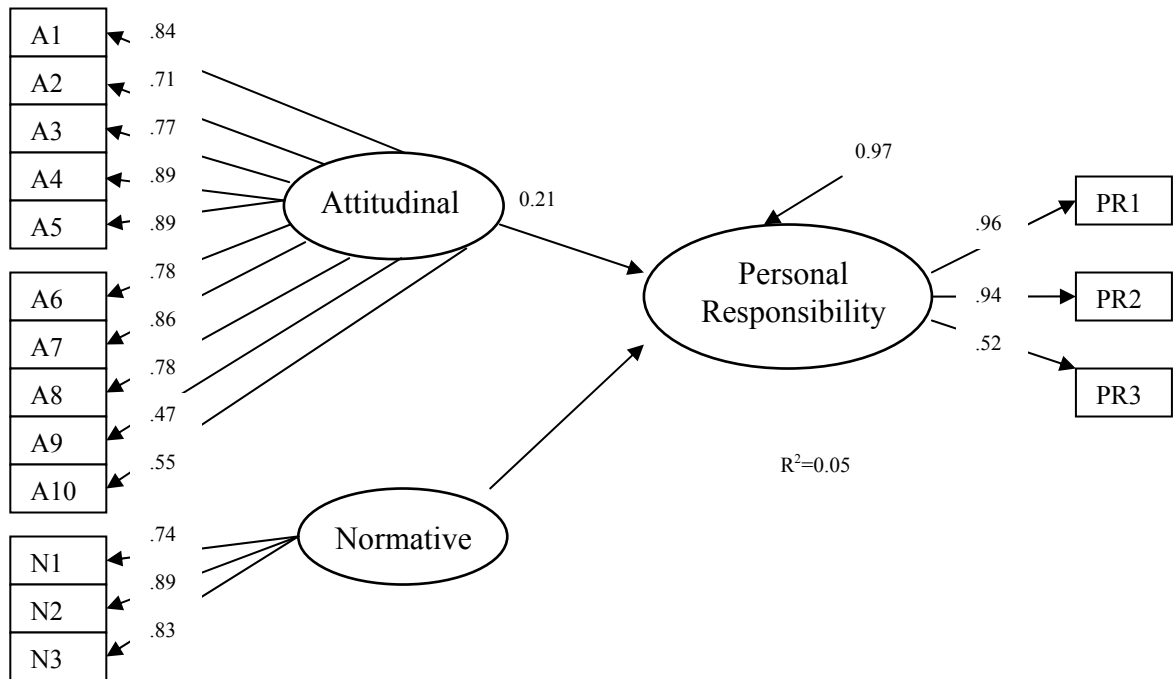


Notes: Minimum fit $\chi^2 = 1069.72^{***}$ (89 df), RMSEA = 0.052, NFI = 0.99, CFI = 0.99, GFI = 0.91

Model includes the following correlated errors (based on Jorengsen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .07
- A1 – A4: .04
- A3 – A4: .04
- A2 – A6: .00
- A2 – A8: -.02
- A2 – A10: .07
- A6 – A8: .21
- A6 – A10: .22
- A8 – A10: .23
- A5 – A7: .00
- A5 – A9: -.04
- A7 – A9: .05

Figure 3.5 Significant ($p < 0.05$) standardized coefficients and error term ($\sqrt{\zeta}$) for latent endogenous variable in path model for all-around recreationists ($n = 1004$).

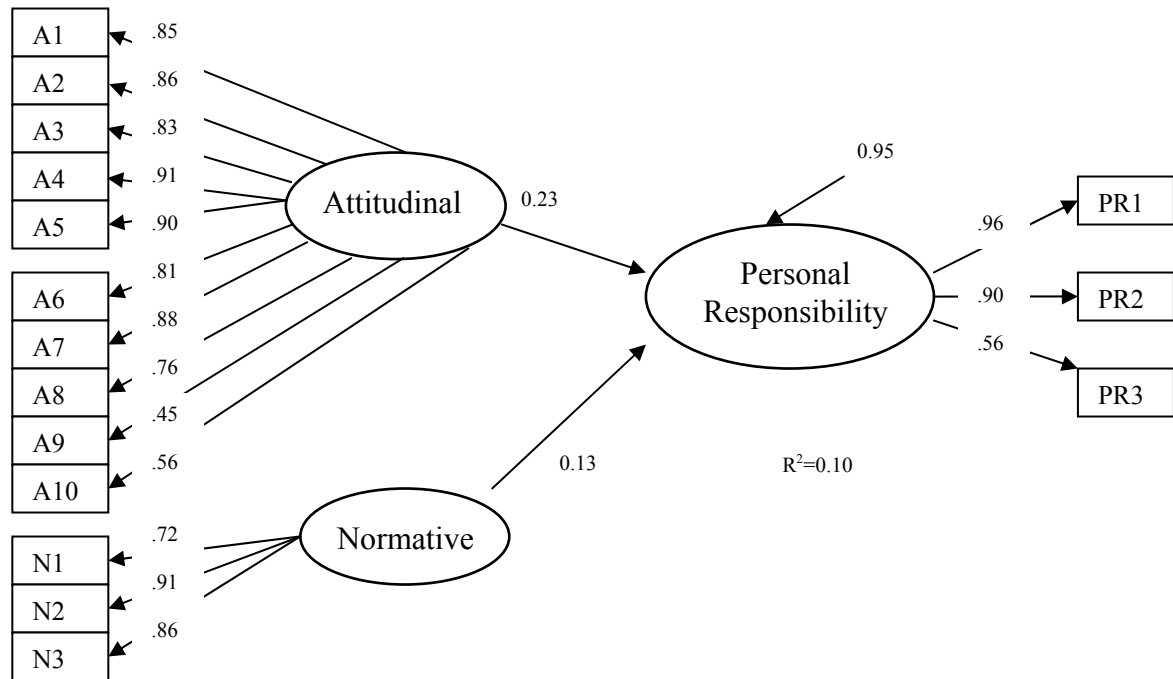


Notes: Minimum fit $\chi^2 = 980.39^{***}$ (89 df), RMSEA = 0.049, NFI = 0.99, CFI = 0.99, GFI = 0.89

Model includes the following correlated errors (based on Jorengsen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .04
- A1 – A4: .06
- A3 – A4: .05
- A2 – A6: .01
- A2 – A8: -.02
- A2 – A10: .06
- A6 – A8: .20
- A6 – A10: .22
- A8 – A10: .24
- A5 – A7: .02
- A5 – A9: -.03
- A7 – A9: .04

Figure 3.6 Significant ($p < 0.05$) standardized coefficients and error term ($\sqrt{\zeta}$) for latent endogenous variable in path model for appreciative recreationists ($n = 903$).

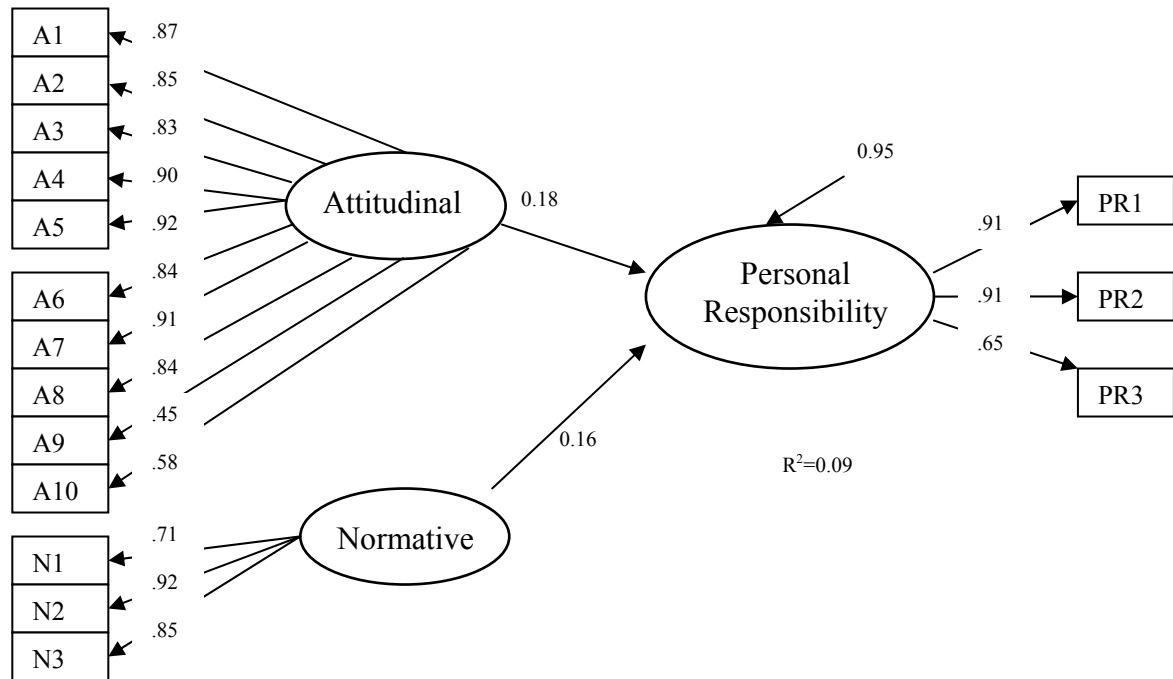


Notes: Minimum fit $\chi^2 = 932.98^{***}$ (89 df), RMSEA = 0.059, NFI = 0.99, CFI = 0.99, GFI = 0.88

Model includes the following correlated errors (based on Joregensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .07
- A1 – A4: .07
- A3 – A4: .07
- A2 – A6: -.04
- A2 – A8: -.04
- A2 – A10: .03
- A6 – A8: .21
- A6 – A10: .23
- A8 – A10: .23
- A5 – A7: .02
- A5 – A9: -.01
- A7 – A9: .02

Figure 3.7 Significant ($p < 0.05$) standardized coefficients and error term ($\sqrt{\zeta}$) for latent endogenous variable in path model for less-involved recreationists ($n = 511$).

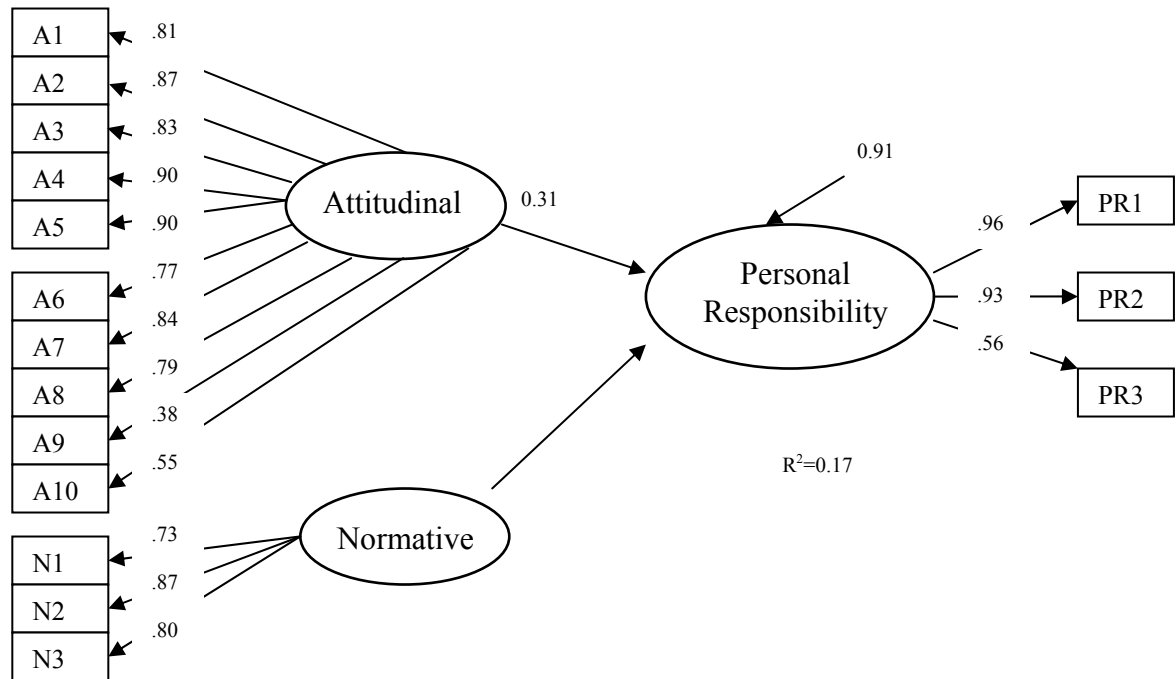


Notes: Minimum fit $\chi^2 = 537.02^{***}$ (89 df), RMSEA = 0.059, NFI = 0.98, CFI = 0.99, GFI = 0.89

Model includes the following correlated errors (based on Jorengsen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .05
- A1 – A4: .07
- A3 – A4: .08
- A2 – A6: .00
- A2 – A8: -.07
- A2 – A10: .03
- A6 – A8: .11
- A6 – A10: .15
- A8 – A10: .13
- A5 – A7: .00
- A5 – A9: -.02
- A7 – A9: .04

Figure 3.8 Significant ($p < 0.05$) standardized coefficients and error term ($\sqrt{\zeta}$) for latent endogenous variable in path model for consumptive recreationists ($n = 148$).



Notes: Minimum fit $\chi^2 = 431.46^{***}$ (89 df), RMSEA = 0.048, NFI = 0.97, CFI = 0.99, GFI = 0.79

Model includes the following correlated errors (based on Jorengsen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .11
- A1 – A4: .07
- A3 – A4: .11
- A2 – A6: -.01
- A2 – A8: -.02
- A2 – A10: .08
- A6 – A8: .23
- A6 – A10: .21
- A8 – A10: .17
- A5 – A7: .06
- A5 – A9: .05
- A7 – A9: .13

CHAPTER 4

**Place Attachment as an Affective Precursor in Norm Activation Theory:
Predicting Personal Norms and Behavioral Intentions for Protection and Removal
of Native Aquatic Plants by Minnesota Lakeshore Property Owners**

Introduction

This paper examines how place attachment relates to the intention to protect native aquatic plants among Minnesota lakeshore property owners. We examine place attachment as an emotional precursor of awareness of consequences and ascribed responsibility in Schwartz' (1977) norm activation theory (Figures 4.1 – 4.2). Then, we compare relationships among place attachment, awareness of consequences, ascribed responsibility, personal norms, and behavioral intentions related to aquatic plant management by home owner type and recreation participation.

Literature Review

Minnesota, Land of 10,000 Lakes and 150 Species of Aquatic Plants

Estimates suggest that over 180,000 individuals own lakeshore property on Minnesota fisheries lakes, and that development on Minnesota lakeshore is increasing (Krysel, Marsh Boyer, Parson, & Welle, 2003; Payton & Fulton, 2004). In response to growing public concern about increasing development and the condition of Minnesota's lakes, the 2002 state legislature mandated (Minnesota Session Laws 2002, Chapter 351, Section 31) the Minnesota Department of Natural Resources (MNDNR) to review its aquatic plant management program (Minnesota Department of Natural Resources [MNDNR], 2002).

Aquatic plants are a critical component of healthy lakeshore communities (MNDNR, 2002). They “provide habitat for fish and wildlife, dampen wave action protecting shorelines from erosion, prevent the re-suspension of bottom sediments, tie up nutrients that might otherwise cause excessive algal growth, and add beauty and character to lakeshores” (MNDNR, 2002, p. 3). The presence of aquatic plants ensures

the recreational activities, economic benefits, and appreciative attributes that people enjoy from lakes (MNDNR, 2002).

Aquatic plants growing in public waters in Minnesota are owned by the state (MNDNR, 2008). The MNDNR aquatic plant management program protects native vegetation from unnecessary harm but allows lakeshore property owners to control some aquatic vegetation for water access (MNDNR, 2008). Specifically, the MNDNR requires permits for the destruction of emergent vegetation or to use herbicides in lakes to control submerged vegetation (MNDNR, 2008). Many lakeshore homeowners remove aquatic plants for aesthetic reasons or recreational access (MNDNR, 2002). In addition, commercial firms provide aquatic plant removal services, and—more recently—have become involved in the restoration of natural shoreland vegetation (MNDNR, 2002).

Theoretical Explanations for Pro-environmental Behavior

A variety of internal (e.g. environmental knowledge, values, attitudes, emotions, motivations, identity, locus of control, personal norms, habits) and external (e.g. institutional, economic, cultural, social) factors influence pro-environmental behavior (PEB) (Dietz, Fitzgerald, & Shwom, 2005; Kollmuss & Agyeman, 2002; Stern 2000a). Several key theories have been used to explain PEB, including (a) the theory of planned behavior (TPB) (Ajzen, 1985), (b) norm activation theory (NAT) (Schwartz, 1977), and (c) value-belief-norm theory (VBN) (Stern, Dietz, Abel, Guagnano, & Kalof, 1999). TPB emphasizes personal self-interest, external social norms, and perceived control of an activity in explaining pro-environmental intentions and behaviors (Ajzen, 1985; Kaiser, Hubner, & Bogner, 2005; Wall, Devine-Wright, & Mill, 2007). NAT focuses on

altruism and internal personal values and norms (Kaiser et al., 2005; Schwartz, 1977; Wall et al., 2007). Stern and colleagues incorporated ecological worldview measured by the Dunlap's (1978) New Environmental Paradigm with NAT to establish VBN (Stern et al., 1999).

Researchers have applied NAT, VBN, and TPB to help understand a variety of individual pro-environmental behaviors including transit choice, recycling, energy conservation, contributions to environmental causes, and various household behaviors (Bratt, 1999; Guagnano, Dietz, & Stern, 1994; Harland, Staats, & Wilke, 2007; Hopper & Nielsen, 1991; Tyler, Orwin, & Schurer, 1982; Van Liere & Dunlap, 1978; Wall et al., 2007). Research has compared the effectiveness of these theories in explaining PEB, with conflicting results (Kaiser et al., 2005; Wall et al., 2007). For example, Kaiser and colleagues (2005) found that the TPB provided a stronger model than VBN for predicting a collection of personal conservation behaviors, while Wall and colleagues (2007) found that the TPB explained less variance in car-use intentions than NAT.

TPB, VBN, and NAT address different levels of the cognitive hierarchy, which ranges from values as central, transcendent psychological drivers to individual behaviors which are numerous and specific to situations (Fulton, Manfreda, & Lipscomb, 1996). TPB emphasizes behavior and its proximal determinants, while VBN and NAT incorporate values on the top of the cognitive hierarchy (Kaiser et al., 2005). Oreg and Katz-Gerro (2006) emphasized the need for a more comprehensive model of environmental behavior that incorporated culture and values along with the more proximal determinants of behavior.

NAT “remains one of the most widely applied models of moral behavior” (Jackson, 2004, p. 47), including PEB. Schwartz (1977) emphasized personal norms in NAT, because he believed that truly altruistic behavior would not reflect social influences. Moral obligation, also referred to as personal norms, is the immediate antecedent of altruistic acts in NAT (Schwartz, 1977; Wall et al., 2007). Personal norms are activated by awareness of a behavior’s consequences and beliefs about personal responsibility (Jackson, 2004; Schwartz, 1977; Wall et al., 2007). Applications of NAT to PEB have found significant relationships between awareness of consequences and ascribed responsibility to personal norms, and personal norms to behavior (Bamberg & Schmidt, 2003; Hunecke, Blöbaum, Matthies, & Höger, 2001; Wall et al., 2007). However, studies applying NAT often fail to measure actual behaviors or behavioral intentions, and rely on personal norms to reflect behavior (Jackson, 2004). Many situational and contextual factors, particularly habits, institutional constraints, and social expectations, may affect the strength of the relationship between personal norms and behaviors in NAT (Jackson, 2004).

Although research has emphasized the importance of moral values to pro-environmental behavior (Harland, Staats, & Wilke, 1999, 2007; Wall et al., 2007), others have raised doubts about the need to include moral concepts to predict conservation behavior (Kaiser et al., 2005; Kaiser & Scheuthle, 2003). Recent studies have incorporated measures of personal values and morals from NAT and VBN with self-interest components of TPB along with efficacy and ability to improve prediction of PEB (Harland, Staats, & Wilke, 2007; Wall et al., 2007). However, research has largely overlooked the influences of affect, habit, physical context, status, and

sociodemographics on PEB (Wall et al., 2007). We incorporate components of affect, context, and demographic characteristics by examining the effects of place attachment, home type, and recreation participation on the PEB of protecting native aquatic plants among Minnesota lakeshore property owners.

The Influence of Place Attachment, Recreation Participation, and Property Ownership, on Pro-environmental Behavior

Researchers have described place attachment as an affective, or emotional, bond between people and places (Bott, Cantrill, & Meyers, 2003; Davenport & Anderson, 2005). Strong, positive feelings for a place could predict altruistic behavior to protect resources at that place. Therefore, we wanted to examine place attachment as a precursor in NAT.

Research has associated stronger place attachment to greater inclination to protect special places (Payton, Fulton, & Anderson, 2005; Vaske & Kobrin, 2001; Vorkinn & Riese, 2001; Wellman, Roggenbuck, & Smith, 1982). This positive relationship has been consistently observed among recreationists (Payton, Fulton, & Anderson, 2005; Vorkinn & Riese, 2001; Wellman, Roggenbuck, & Smith, 1982). It has also been observed among property owners, although property owners may resist regulations to protect resources on their land (Larson & Santelmann, 2007; Stedman, 2000).

Related to protection of lakes and other water resources, in Chapters 2 and 3, we found that attitudinal place attachment predicted intended conservation action in four clusters of recreationists. In the study of the general public reported in Chapter 2, attitudinal place attachment predicted intentions for philanthropy in all recreation

groups, and it predicted intended political action among all-around and less-engaged recreationists. Studies have found relationships between place attachment and conservation among lakeshore and riparian property owners (Larson & Santelmann, 2007; Stedman, 2000). In Chapter 3, we found that attitudinal place attachment positively predicted personal responsibility for protecting lakes among primary and recreational property owners, and that normative place attachment predicted personal responsibility for lake protection among recreational property owners. Stedman (2000) also found place attachment among lakeshore property owners was associated with willingness to engage in lake-protective behavior. Larson and Santelman (2007) found that people who lived near water resources in Portland, Oregon were more attached, and had more positive attitudes about economic support for resource protection, but more negative attitudes about regulations to protect the resource.

Research Goals and Hypotheses

The goals of this study were to: (a) model place attachment as an affective precursor of altruistic behavioral intentions related to aquatic plants among lakeshore property owners in Minnesota, and (b) examine differences in models of aquatic plant management based on type of property ownership and recreation participation. Based on these goals and previous research findings, we established six hypotheses:

- H1: Awareness of consequences will be positively related to personal norms related to aquatic plant management,
- H2: Ascribed personal responsibility will be positively related to personal norms related to aquatic plant management,

- H3: Place attachment will not be related to awareness of consequences of aquatic plant protection and removal,
- H4: Place attachment will be positively related to ascribed responsibility for aquatic plant management,
- H5: Relationships among place attachment, awareness of consequences, ascribed responsibility, personal norms, and behavioral intentions will differ by property owner type, and
- H6: Relationships among place attachment, awareness of consequences, ascribed responsibility, personal norms, and behavioral intentions will differ by recreation cluster.

Methods

The study population included lakeshore landowners on “fisheries lakes” in the State of Minnesota (US). An estimated 180,000 individuals own property on 3,029 “fisheries lakes” in Minnesota (Payton & Fulton, 2004; Schupp, 1992). We selected a stratified, random sample of 5,550 lakeshore property-owner households based on lake ecotype, development classification, and number of developed properties. Stratification information was derived from a lake database provided by the Minnesota Department of Natural Resources (MDNR). We obtained landowner contact information from county property ownership records.

We administered a mail survey following accepted research methodology (Dillman, 2000). We implemented five mailings between May and July of 2004. Mailings included: (a) an initial survey mailing including a personalized cover letter (Appendix I), survey (Appendix B), and postage-paid reply envelope, (b) a reminder

postcard (Appendix J), (c) a second survey mailing again including a personalized cover letter (Appendix K), survey, and postage-paid reply envelope, (d) a second reminder postcard (Appendix L), and (e) a shortened survey used to gauge non-response bias (Appendix M) with a cover letter (Appendix N).

Survey Items

The survey included questions about: (a) landowner demographics, (b) property characteristics, (c) aquatic plant removal, (d) lake activities, (e) opinions on the value of aquatic plants, (f) perceptions of lake conditions, (g) subjective norms, (h) behavioral intentions, and removal behaviors, (i) awareness of consequences of plant removal, (j) opinions regarding responsibility for managing aquatic plants, and (k) value and importance of lakeshore property.

Based on previous research on NAT, respondents rated 8 statements about awareness of consequences of aquatic plants using the scale 1 (definitely false) to 5 (definitely true). Respondents rated 11 items to measure respondents' perceptions of responsibility for lakes and aquatic plants, including 3 measuring ascribed personal responsibility. Response was on the scale 1 (strongly disagree) to 7 (strongly agree). We asked respondents to rate items addressing personal norms related to protection and removal of aquatic plants. Response was on the scale 1 (strongly disagree) to 7 (strongly agree). In order to measure behavioral intentions, respondents indicated yes or no as to whether they kept an area next to their property free of aquatic plants on a year-to-year basis. They also rated the likelihood that they would keep an area free of aquatic plants about the same size as they did in the previous year using the scale 1 (extremely unlikely) to 7 (extremely likely). These two items were multiplied to create an index of

behavioral intentions related to aquatic plant removal.

Respondents rated 13 items measuring attachment to their lake property. Response was on the scale 1 (strongly disagree) to 7 (strongly agree). Ten of the items were derived from a study of lakeshore property owners in Wisconsin conducted by Jorgensen and Stedman (2001). Based on discussions about the importance of family memories to Minnesotans' attachment to lakes, three new items were added to examine family-related place attachment.

Finally, we measured recreation participation and property ownership. Respondents were asked to indicate the number of times they participated in 14 lake-based recreation activities during 2003. Response was on the scale 0 (not at all), 1 (1 or 2 times), 2 (3 to 5 times), 3 (6 to 10 times), 4 (11 to 20 times), or 5 (21 or more times). They also selected the type of lakeshore property they owned, including options for primary/year-round residence and recreational property/second home.

Data Analysis

Descriptive statistics, and cluster and regression analyses were conducted in the Statistical Package for Social Sciences (SPSS 15.0). Confirmatory factor analyses and structural equation modeling was run using LISREL (8.80).

We conducted two-step cluster analysis ($n = 3,103$) to segment respondents based on their recreation participation. Academic and marketing researchers employ cluster analysis to classify groups of people with similar characteristics (Punj & Stewart, 1983). Prior to analysis, we calculated the average response to four fishing items (fishing from shore or dock/pier fishing from motorized boat, fishing from non-motorized boat, ice fishing) and two boating items (motorized pleasure boating,

canoeing/kayaking/ paddleboating) to provide measures similar to those used in the studies reported in Chapters 2 and 3.

We used structural equation modeling (SEM) with robust maximum likelihood estimation to model place attachment as a precursor of awareness of consequences and ascribed responsibility in NAT (Figure 4.2). Prior to structural equation modeling, we conducted confirmatory factor analyses on the place attachment and norm activation theory constructs of ascribed responsibility and awareness of consequences. We modeled attitudinal place attachment based on the correlated-uniquenesses model of sense of place presented in Jorgensen and Stedman (2001). The three new items that we used to examine family-related place attachment were modeled as a factor we describe as normative place attachment. We employed multiple-sample SEM to test whether the type of property (i.e. primary residence versus recreational property) and recreation cluster (i.e. less-involved, consumptive, appreciative, all-around) moderated the relationships among model parameters. SEM builds on regression and factor analysis. It uses the analysis of covariances to explore relationships among a set of variables (McCoach, Black, & O'Connell, 2007). SEM provides a comprehensive and flexible method for examining relationships among observed variables and unmeasured latent constructs (Knoke, Bohrnstedt, & Mee, 2002; McCoach et al., 2007). SEM explicitly accounts for measurement error, and it allows researchers to assess overall fit of a model to data and to determine the equivalences of model parameters across several samples (Knoke et al., 2002; McCoach et al., 2007). Standardized coefficients are interpreted as regression coefficients, and unexplained variance of an endogenous (i.e.

dependent) variable equals $1 - R^2$ in recursive models (where causal loops are unidirectional) (Kline, 2005).

Results

Survey Response Rate

Of 5,500 surveys mailed, 353 were undeliverable or sent to a deceased landowner or someone who no longer owned lakeshore property. Of the remaining 5,197 surveys, 3,115 were returned for a response rate of 59.9%. We received 548 shortened surveys to measure non-response bias. The response rate for the non-response survey was 26.3%. Compared to respondents from the main survey, reluctant respondents included a greater proportion of females, were younger, were less active in lake-based recreation, and included a smaller proportion of individuals who tried to keep an area of their property free of aquatic plants.

Respondent Characteristics

Almost all respondents (98%) were White, and nearly three-fourths (72%) were male. Average household income before taxes in 2003 was \$183,850, with a median of \$75,000. Mean age was 58 years. Seventy-three percent of respondents had completed a 4-year college degree or more. Over half (55%) of respondents were members of lake associations.

Lakeshore property was nearly evenly split between primary residences (49.1%, $n = 1,457$) and recreational properties (50.1%, $n = 1,488$), with less than 1% rental ($n = 12$) and business ($n = 11$) property. Second-home owners reported having owned their lake property longer ($M = 20.4$ years, $SD = 16.3$) than those with a primary residence ($M = 19.0$ years, $SD = 14.2$) ($t = 2.47$, 2888 df , $p < 0.05$). Age and income did not differ

significantly by type of residence, but, compared to respondents who owned a primary residence, a greater proportion of second-home owners reported having completed college (25.1% vs. 22.9%), postgraduate education (9.7% vs. 8.0%), or a postgraduate degree (20.8% vs. 16.0%) ($\chi^2 = 27.47, 7 df, n = 2833, p < 0.001, V = 0.098$).

Respondents who owned primary residences were more likely to participate in ice fishing and birding than second-home owners. Recreational property owners were more likely to fish from a boat, use motorized and non-motorized boats (not fishing), waterski, and swim.

Respondents were active in lake-based recreation. Using cluster analysis, we identified four recreation clusters, including (a) all-around (38%), (b) appreciative (36%), (c) consumptive (6%), and (d) less-involved (21%). Appreciative ($M = 62$ years, $SD = 12.0$) and less-involved ($M = 58$ years, $SD = 13.0$) recreationists were older than all-around ($M = 55$ years, $SD = 11.7$) and consumptive ($M = 53$ years, $SD = 11.9$) recreationists ($F = 60.42, 3 df, n = 2835, p < 0.001, \eta = 0.25$). The greatest proportion of females were in the appreciative recreation cluster (32%), followed by the all-around cluster (28%), the less-involved cluster (21%), and the consumptive cluster (15%) ($\chi^2 = 37.36, 3 df, n = 2872, p < 0.001, V = 0.11$). Mean household income did not differ significantly by recreation cluster. The type of property owned, primary residence versus vacation property, differed by recreation type. The proportion of respondents who owned their lake property as a primary residence ranged from 34% for less-involved, to 49% for all-around, 52% for consumptive, and 59% for appreciative recreationists ($\chi^2 = 94.97, 3 df, n = 2830, p < 0.001, V = 0.18$).

Place Attachment

Confirmatory factor analysis verified the attitudinal and normative place attachment constructs, with attitudinal place attachments modeled based on Jorgensen and Stedman's (2001) correlated-uniquenesses model. The model had "reasonable" fit ($\chi^2 = 1912.23^{***}$ (52 *df*), RMSEA = 0.071, CFI = 0.99). Place attachment constructs had composite reliability values greater than 0.60 and average variance extracted values greater than 0.50, which suggests acceptable content and discriminant validity (Diamantopoulos & Siguaaw, 2000). Results of confirmatory factor analysis of place attachment are presented in Table 4.1 and Figure 4.3.

Place attachment differed by home type (Table 4.1). Primary residents reported stronger attitudinal place attachment (6.0 vs. 5.7) ($t = 7.89$, 2922 *df*, $p < 0.001$), and second-home owners reported greater normative place attachment (6.1 vs. 5.8) ($t = 5.62$, 2911 *df*, $p < 0.001$). All-around ($M = 6.1$, $SD = 0.8$), consumptive ($M = 6.0$, $SD = 0.9$), and appreciative ($M = 5.9$, $SD = 1.0$) recreationists reporting stronger attitudinal attachment than less involved ($M = 5.2$, $SD = 1.2$) recreationists ($F = 105.05$, 3 *df*, $n = 2942$, $p < 0.001$, $\eta = 0.30$). Similarly, respondents in the all-around ($M = 6.2$, $SD = 1.1$), consumptive ($M = 6.0$, $SD = 1.1$), and appreciative ($M = 5.9$, $SD = 1.3$) recreation clusters reported stronger normative place attachment than those in the less-involved ($M = 5.6$, $SD = 1.4$) cluster ($F = 35.72$, 3 *df*, $n = 2930$, $p < 0.001$, $\eta = 0.19$).

Awareness of Consequences of and Responsibility for Aquatic Plants

Confirmatory factor analysis provided some support for the awareness of consequences and ascribed responsibility constructs. The model had "reasonable" fit ($\chi^2 = 605.09^{***}$ (39 *df*), RMSEA = 0.053, CFI = 0.98). Both constructs had composite

reliability values greater than 0.60, which suggests acceptable content validity and construct reliability (Diamantopoulos & Siguaw, 2000). However, the average variance extracted value for awareness of consequences was 0.33. This raises some concern about the soundness of the indicators measuring this construct, which was measured with both positively and negatively worded beliefs about the consequences of removing aquatic plants, (Diamantopoulos & Siguaw, 2000). Results of confirmatory factor analysis of place attachment are presented in Tables 4.2 and 4.3 along with Figure 4.4.

On average, respondents were somewhat aware of the consequences of aquatic plant removal (Table 4.2). For the full scale and four individual items, respondents from the less-involved recreation cluster reported lower awareness of consequences about the role of aquatic plants for lake ecology. Overall, recreational property owners were slightly more aware of the consequences of removing aquatic plants (3.7 vs. 3.6, $t = 2.02$, 2728 *df*, $p < 0.05$). They rated two items slightly more false than primary property owners rated them: (a) “native aquatic plants decrease the aesthetic beauty of the lake” (2.5 vs. 2.6, $t = 2.32$, 2654 *df*, $p < 0.05$), and (b) “native aquatic plants reduce the economic value of the lake in the long term” (2.5 vs. 2.6, 2566 *df*, $t = 1.99$, $p < 0.05$).

Respondents moderately to strongly agreed on personal/lakeshore property owners’ responsibility for protecting the health of lakes (Table 4.3). They were neutral about agency responsibility and disagreed slightly with fatalistic/property owner rights attitudes. Results suggest differences by recreation cluster in ascribed responsibility for managing aquatic plants. Less-involved recreationists reported lower levels of personal responsibility for protecting the health of the lake that they own property on.

Respondents from the appreciative recreation cluster reported more support for agency

management and more restrictive regulations. Consumptive and less-involved recreationists agreed slightly more strongly with fatalistic/property owners' rights items. There was no significant difference between primary and recreational property owners in the 3 scales, nor in 10 of the 11 items, used to measure responsibility for managing aquatic plants. Primary property owners agreed slightly more than recreational property owners that "regardless of whether I remove aquatic plants or not, the quality of my lake will decline" (4.5 vs. 4.2, $t = 2.94$, 2801 df , $p < 0.01$).

Personal Norms Related to Aquatic Plant Management

Overall, respondents agreed slightly with the items used to measure personal norms related to protecting aquatic plants (Table 4.4). Personal norms associated with aquatic plants differed significantly by recreation cluster with less-involved recreationists reporting a lower overall norm for protecting aquatic plants. There was no significant difference in personal norms between respondents who owned a primary residence versus a recreational property.

Behavioral Intentions Related to Aquatic Plants

Over 40% of respondents indicated that they kept an area in the lake next to their property free of aquatic plants on a year-to-year basis, and, on average, respondents reported that they would be slightly likely to maintain an area free of aquatic plants on their property in the coming year (Table 4.5). A greater proportion of all-around recreationists reported that they had an area that they kept free of aquatic plants on a year-to-year basis, and this group reported the strongest likelihood of keeping an area of their property free of aquatic plants in the coming year. There were no significant differences between the property owner types for: (a) keeping an area free

of aquatic plants on a year-to-year basis, or (b) intentions to remove aquatic plants in the coming year.

Modeling Protection of Aquatic Plants

Structural equation modeling conducted with all respondents suggested positive relationships between both attitudinal and normative place attachment and ascribed responsibility for protecting lakes ($R^2 = 0.12$) (Figure 4.5). Attitudinal, but not normative, place attachment was also positively related to awareness of consequences of removing native aquatic plants ($R^2 = 0.01$). Both ascribed responsibility and awareness of consequences were positively related to personal norms about the protection and removal of aquatic plants. The model explained 71% of the variance in personal norms, with only 4% explained by the exogenous place attachment constructs and the remainder explained by the endogenous NAT constructs. The relationship between personal norms for protecting aquatic plants and behavioral intentions about removing aquatic plants on personal property was negative. The model explained only 6% of the variance in behavioral intentions, with 0% explained by the exogenous place attachment constructs. The model had a reasonable fit to the data (Minimum fit $\chi^2 = 3679.08^{***}$ (386 *df*), RMSEA = 0.052, NFI = 0.97).

We compared structural equation models for respondents who owned primary residences to those who owned recreational property (Figures 4.6 – 4.7). For both home types, attitudinal place attachment was positively related to both awareness of consequences for removing aquatic plants and ascribed responsibility for protecting a lake. For respondents with second homes, normative place attachment was also positively related to ascribed responsibility for protecting a lake. For both groups,

ascribed responsibility and awareness of consequences were positively related to personal norms about the protection of aquatic plants, which in turn were negatively related to behavioral intentions about removing aquatic plants on personal property. Results from multiple-sample structural equation modeling suggested better fit when factor loadings and structural parameters varied across home types ($\Delta\chi^2 = 1149.65$, 43 *df*, $p < 0.001$, $\Delta\text{AIC} = 515.98$). Fit improved further when error terms (along with factor loadings and structural parameters) were varied freely across the groups ($\Delta\chi^2 = 1189.94$, 29 *df*, $p < 0.001$, $\Delta\text{AIC} = 319.19$).

Next, we compared structural equation models for the four recreation clusters (Figures 4.8 – 4.11). For all recreation groups, attitudinal place attachment positively predicted greater ascribed responsibility for protecting lakes. Among appreciative and less-involved recreationists (Figures 4.9 and 4.11), normative place attachment also positively predicted ascribed responsibility. Normative place attachment was negatively related to awareness of consequences in the all-around recreationist segment. In all four groups, both awareness of consequences and ascribed responsibility predicted personal norms related to protection of aquatic plants. In all groups, except the consumptive recreation group, personal norms were negatively related to behavioral intentions. Results from multiple-sample SEM suggested a better fit when factor loadings and structural parameters varied across recreation segments ($\Delta\chi^2 = 15951.74$, 129 *df*, $p < 0.001$, $\Delta\text{AIC} = 7576.05$). Fit improved further when error terms, factor loadings, and structural parameters varied freely across groups ($\Delta\chi^2 = 16285.01$, 87 *df*, $p < 0.001$, $\Delta\text{AIC} = 8091.94$).

Discussion

Consistent with previous studies of norm activation theory and our first two hypotheses, awareness of consequences and ascribed responsibility were positively related to personal norms related to the protection and removal of native aquatic plants. These two constructs were important in explaining variance in personal norms related to the protection of native aquatic plants. Wall and colleagues (2007) described awareness of consequences as “the least influential of the NAT variables” (p. 745). In this study, awareness of consequences more strongly predicted personal norms related to the protection and removal of aquatic plants. However, our measures of ascribed responsibility addressed obligations for protecting a lake rather than specifically protecting aquatic plants at the lake.

Looking at the relationships between place attachment and awareness of consequences and ascribed responsibility, we found mixed support for Hypothesis 3 and Hypothesis 4. Hypothesis 3 suggested that place attachment would not be related to awareness of consequences of aquatic plant protection and removal. Normative place attachment was not significantly related to awareness of consequences, but attitudinal place attachment was positively related to awareness of consequences. Place attachment explained a very small amount of the variance in respondents’ awareness of consequences of removing native aquatic plants. We found support for Hypothesis 4, which suggested that place attachment would be positively related to ascribed responsibility. This was true for both attitudinal and normative place attachment. Place attachment explained a moderate amount of the variance in ascribed responsibility for protection of lakes.

We found support for Hypothesis 5 that models would differ for primary- and second-home owners. Among both types of home owners, attitudinal place attachment was positively related to both ascribed responsibility and awareness of consequences. Among second-home owners, normative place attachment was also related to ascribed responsibility. Second-home owners reported slightly greater awareness of consequences about removal of native aquatic plants, and somewhat greater normative but somewhat lower attitudinal place attachment. Although primary- and second-home owners differ on awareness of, responsibility for, and personal norms related to protecting native aquatic plants, these differences are subtle.

Differences in knowledge, attitudes, and norms about aquatic plants appear to be greater among different recreation segments. We found support for Hypothesis 6 that models would differ among different recreation segments. Attitudinal place attachment was related to ascribed responsibility for protecting lakes among all groups, but normative place attachment was positively related to ascribed responsibility among only appreciative and less-involved recreationists. Normative place attachment was negatively related to awareness of consequences of removal aquatic plants among all-around recreationists. Less-involved recreation participants had significantly lower awareness of consequences, ascribed responsibility, and personal norms related to aquatic plants. All-around recreationists reported that they would be significantly more likely to remove native aquatic plants in the next year.

Place attachment may lead individuals to feel somewhat more responsible for the protection of lakes, but it may not necessarily lead to greater awareness of the consequences of removing native aquatic plants—which was more strongly predictive

of personal norms for protecting these plants. Attitudinal place attachment, related to identity or dependence on the lake, may be more predictive of increased responsibility than normative attachment. However, normative place attachment, derived from family connections to a lake home, may also lead to greater responsibility for protecting lakes among second-home owners and appreciative and less-involved recreationists.

Normative place attachment was related to lower awareness of consequences of removing aquatic plants among all-around recreationists. This finding may reflect motivated social cognition (Jost & Kruglanski, 2003). These individuals may minimize or avoid information about the negative consequences of aquatic plant removal because of positive family connections associated with swimming, boating, and other recreation activities that they perceive to benefit from the removal of aquatic plants.

Place attachment had a minimal to moderate influence as a precursor of NAT. The influence of place attachment on norms and behavioral intentions related to protection and removal of native aquatic plants by lakeshore property owners was less than relationships between place attachment and pro-environmental attitudes and behaviors observed by others (Vaske & Kobrin, 2001; Vorkinn & Riese, 2001). Previous research, however, has examined attachment to public, rather than personal, property and general environmental attitudes and behaviors rather than specific personal behavioral intentions (Payton, Fulton, & Anderson, 2005; Vaske & Kobrin, 2001; Vorkinn & Riese, 2001; Wellman, Roggenbuck, & Smith, 1982). People may be less likely to change how they manage personal property than to take general pro-environmental actions that affect public land.

In support of norm activation theory, personal norms for protection of native aquatic plants were negatively related to behavioral intentions to remove native aquatic plants. These results parallel many studies that have found personal norms to be good predictors of altruistic behavior (Harland et al., 1999; 2007; Nordlund & Garvill, 2002; Thøgersen & Ölander, 2006). However, the model explained a minimal amount of the variance in behavioral intentions. There are likely numerous factors that influence property owners' decisions to remove native aquatic plants. Lewin (1951) conceived of human behavior as a force field of opposing forces. Indeed, attitudes, individual factors, social factors, habits, and context all drive behavior (Corbett, 2005). Social pressures from family, neighbors, or lake associations may influence personal norms on management of aquatic plants by lakeshore property owners. Individuals may face family pressures to provide recreational access, or neighborhood and lake association expectations to maintain tidy lakeshores. There could also be a disparity between peoples' personal norms about what they feel they should do to manage their property sustainably and what habits they have for regular maintenance and management of their property. In addition, property owners may feel that removal of aquatic plants from their piece of lakeshore would have little impact on the health of the lake in as a whole. Even if they hold a moral standard or ideal goal for pristine natural lakeshores, property owners' behavior may be driven by standards derived from prior expectations, past actions, and social norms for accessible, carefully managed lakeshore (Schultz, 1998).

Study Limitations, Future Research, Management Implications, and Conclusions

The study provided support for norm activation theory by demonstrating the influence of awareness of consequences and ascribed responsibility on personal norms

related to protection of native aquatic plants. It also documented the expected relationship between personal norms and behavioral intentions about removing native aquatic plant on private lakeshore property. However, given the large amount of unexplained variance in behavioral intentions, managers and researchers need to conduct additional research and analysis to better understand the factors that influence property owners' decision to remove native aquatic plants.

Management efforts could work to strengthen the relationship between lakeshore property owners' (a) personal norms for protection of aquatic plants and lake ecosystems and (b) their aquatic plant removal behavior. Information campaigns to increase pro-environmental behaviors usually produce weak effects, so efforts might emphasize activation of personal norms through incentive programs and feedback (Schultz, 1998). Feedback interventions are actions taken by external agents to provide information about individuals' task performance, and they have proved effective for encouraging other pro-environmental behaviors (Schultz, 1998). Feedback may be particularly important in the case of aquatic plant management where property owners and managers may have inconsistent perceptions about sustainable management of lakeshore property (Fish, 2001). Feedback to property owners about discrepancies between their behavior and personal norms could motivate personal change in management of native aquatic plants (Schultz, 1998). Programs to provide feedback to property owners might be more well-received if they were administered by a non-regulatory, service organization like university extension. As discussed in the previous two chapters, managers need to better understand the meanings that visitors and residents associate with Minnesota lakes. Management actions and communications can

model and express desired meanings, which may encourage sustainable management of private lakeshore property. With growing lakeshore development, changes to management of aquatic plants by private property owners could be vital to the health of Minnesota's lake ecosystems.

This study faced many limitations common to mail surveys. Specifically, respondents may not accurately represent the population of lakeshore property owners in Minnesota. Our respondents included a greater proportion of older and male respondents. The higher male response may reflect actual differences in property ownership, property records, or bias for male response on the topic of aquatic plant management. The older age of respondents may simply reflect age bias that has been found in mail surveys (Filion, 1975; Schroeder, Fulton, Currie, & Goeman, 2006). Based on differences between the main group of survey respondents and reluctant respondents, the main survey respondents likely also over-represent individuals who are concerned about aquatic plant management regulations.

The SEM results for the consumptive recreationist group were subject to small (*i.e.* < 100 subjects) sample size (Kline, 2005). Researchers have suggested a lower bound for total sample size of approximately 100 to 200 (Violato & Hecker, 2007). Our sample size for the consumptive recreation model was 90, so this model must be viewed with caution.

Place attachment was related to awareness of consequences and ascribed responsibility for protection of native aquatic plants, but the strength of the relationships was minimal to moderate. In addition, place attachment explained a minimal amount of variance in personal norms related to aquatic plant management. Consistent with NAT,

awareness of consequences and ascribed responsibility were strongly predictive of personal norms related to aquatic plant management. The question is what factors, other than place attachment, might better predict awareness of consequences and ascribed responsibility. Future research might examine place meanings, recreational motivations, environmental values, educational background, length of residence, and other factors that might relate to awareness and responsibility for aquatic plant protection. Future research could apply other theories of pro-environmental behavior to examine the role of self interest and social pressures on the protection and removal of aquatic plants. Studies might also examine barriers that individuals face in protecting or restoring native aquatic plants. Finally, research might examine the motivations for and the perceived benefits of aquatic plant protection and removal, and test incentives for restoration of native aquatic plants on private property.

Table 4.1 Mean scores and reliability for place attachment to lake, overall and by recreation cluster and home type.

Factor (Cronbach's α ; composite reliability; average variance extracted) - items	\bar{x}	SE	Recreation Type				Home Type	
			All ^a \bar{x}	App ^b \bar{x}	Con ^c \bar{x}	Less ^d \bar{x}	Prim ^e \bar{x}	Rec ^f \bar{x}
Attitudinal/General ($\alpha = .91$; CR = .95; AVE = .65)	5.8	0.019	6.1 _a	5.9 _b	6.0 _{ab}	5.3 _c	6.0	5.7***
A1. It is my favorite place to be.	6.5	0.018	6.7 _a	6.5 _b	6.7 _{ab}	5.9 _c	6.6	6.4***
A2. I feel that I can really be myself there.	6.3	0.020	6.6 _a	6.4 _a	6.5 _a	5.8 _b	6.5	6.3***
A3. I really miss it when I am away from it too long.	6.2	0.021	6.5 _a	6.2 _b	6.3 _{ab}	5.6 _c	6.3	6.2***
A4. I feel happiest when I am there.	6.1	0.021	6.3 _a	6.2 _a	6.2 _a	5.5 _b	6.4	5.9***
A5. It is the best place to do the things I enjoy.	6.0	0.022	6.3 _a	6.1 _b	6.3 _{ab}	5.4 _c	6.2	5.9***
A6. It reflects the type of person that I am.	5.9	0.024	6.2 _a	5.9 _b	6.1 _{ab}	5.2 _c	6.1	5.7***
A7. For the things I enjoy doing most, no other place can compare to it.	5.6	0.027	5.9 _a	5.6 _a	5.9 _a	5.0 _b	5.8	5.5***
A8. Everything about it is a reflection of me.	5.3	0.028	5.5 _a	5.3 _a	5.5 _a	4.7 _b	5.5	5.1***
A9. As far as I am concerned there are better places to be ^f .	4.9	0.036	5.2 _a	4.9 _{ab}	4.8 _b	4.4 _c	4.9	4.9
A10. My lake property says very little about who I am ^f .	5.4	0.032	5.8 _a	5.4 _b	5.7 _{ab}	4.7 _c	5.5	5.4
Normative/Family-Related ($\alpha = .78$; CR = .88; AVE = .70)	5.9	0.022	6.2 _a	5.9 _b	6.0 _b	5.6 _c	5.8	6.1***
N1. It is a special place for my family.	6.3	0.021	6.5 _a	6.3 _b	6.4 _{ab}	5.9 _c	6.3	6.4
N2. Many important family memories are tied to it.	6.1	0.025	6.3 _a	6.0 _b	6.0 _b	5.7 _c	6.0	6.2***
N3. It ties the generations of my family together.	5.5	0.033	5.8 _a	5.4 _{bc}	5.6 _{ab}	5.2 _c	5.3	5.8***

Notes. ^aAll = all-around recreationists, ^bApp = appreciative recreationists, ^cCon = consumptive recreationists, ^dLess = less-involved recreationists, ^ePrim = primary home owners, ^fRec = recreational home owners. ^fItems reverse coded for scale development and reliability analysis. For recreation type, means in the same row that do not share subscripts differ at $p < 0.05$ in the Tukey honestly significant difference comparison. For home type, means in the same row differ at * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4.2 Mean scores and reliability for awareness of consequences of retaining versus removing aquatic plants, overall and by recreation cluster.

Scale (Cronbach's α ; composite reliability; average variance extracted) - items	\bar{x}	SE	All ^a \bar{x}	App ^b \bar{x}	Con ^c \bar{x}	Less ^d \bar{x}
Awareness of consequences of removing aquatic plants ($\alpha = .72$; CR = .79; AVE = .33)	3.6	0.013	3.7 _a	3.7 _a	3.7 _a	3.5 _b
- Removal of native aquatic plants is harmful to lake health (water quality, biotic balance, etc.).	4.0	0.021	3.9 _a	4.0 _a	4.0 _a	3.9 _a
- Removal of native aquatic plants increases shoreline erosion.	3.9	0.022	3.9 _a	4.0 _a	3.9 _a	3.8 _a
- Removal of native aquatic plants is harmful to fish populations.	3.7	0.025	3.7 _a	3.7 _a	3.8 _a	3.6 _a
- Removal of native aquatic plants increases the role of the lake as a recreational area. ^f	3.3	0.023	3.2 _b	3.2 _b	3.1 _b	3.5 _a
- Native aquatic plants decrease the aesthetic beauty of the lake. ^f	2.6	0.024	2.6 _a	2.5 _a	2.6 _a	2.7 _a
- Native aquatic plants reduce the economic value of the lake in the long-term. ^f	2.6	0.024	2.5 _b	2.6 _{ab}	2.7 _{ab}	2.7 _a
- Native aquatic plants reduce water clarity and quality. ^f	2.4	0.024	2.3 _b	2.4 _{ab}	2.2 _b	2.7 _a
- Native aquatic plants are harmful to wildlife populations (waterfowl, wading birds, amphibians, etc.). ^f	1.7	0.019	1.6 _b	1.7 _b	1.6 _b	1.9 _a

Notes. ^a All = all-around recreationists, ^b App = appreciative recreationists, ^c Con = consumptive recreationists, ^d Less = less-involved recreationists. ^f Items reverse coded for scale development and reliability analysis. Means in the same row that do not share subscripts differ at $p < 0.05$ in the Tukey honestly significant difference comparison.

Table 4.3 Mean scores and reliability for responsibility for managing aquatic plants, overall and by recreation cluster.

Responsibility factors (Cronbach's α ; composite reliability; average variance extracted)	\bar{x}	SE	All ^a \bar{x}	App ^b \bar{x}	Con ^c \bar{x}	Less ^d \bar{x}
- Items						
Personal responsibility ($\alpha = .72$; CR = .87; AVE = .69)	6.3	0.016	6.5 _a	6.3 _a	6.5 _a	6.1 _b
- I feel a strong personal obligation to protect the health of the lake I live on.	6.4	0.018	6.6 _a	6.4 _a	6.5 _a	6.2 _b
- I feel a strong personal obligation to protect the wildlife populations on the lake.	6.3	0.019	6.4 _a	6.3 _a	6.5 _a	6.1 _b
- Lakeshore owners have a responsibility to maintain the environmental quality of a lake.	6.3	0.022	6.4 _a	6.2 _{ab}	6.4 _a	6.1 _b
Agency responsibility ($\alpha = .62$)	4.0	0.031	3.9 _b	4.2 _a	3.9 _{ab}	4.0 _{ab}
- Regulations for removing aquatic plants should be more restrictive.	4.3	0.041	4.1 _b	4.5 _a	4.2 _{ab}	4.3 _{ab}
- State agencies should be responsible for managing aquatic plants (not shoreline property owners).	4.0	0.041	3.7 _b	4.2 _a	3.9 _{ab}	4.0 _{ab}
- Lake associations should be responsible for managing aquatic plants (not shoreline property owners).	3.9	0.040	3.7 _a	3.9 _a	3.7 _a	3.9 _a
Fatalistic/property owner rights attitude about responsibility ($\alpha = .64$)	3.3	0.027	3.1 _b	3.3 _b	3.4 _{ab}	3.6 _a
- Regardless of whether I remove aquatic plants or not, the quality of my lake will decline.	4.4	0.040	4.1 _b	4.6 _a	4.4 _{ab}	4.3 _{ab}
- There are so many other people removing aquatic vegetation from the lake that it really doesn't matter what I do.	3.3	0.042	3.0 _b	3.4 _{ab}	3.3 _{ab}	3.7 _a
- Lakeshore owners should have the right to alter the shoreline any way they want.	2.7	0.036	2.6 _b	2.6 _b	3.0 _a	3.2 _a
- If everyone else is removing aquatic vegetation form the lake for swimming and boating, I'm harming myself if I do not.	2.8	0.036	2.7 _b	2.8 _b	2.8 _b	3.3 _a
Items that did not load on factors						
- Development of lakeshore property is a greater threat to my lake than my removing aquatic plants.	5.2	0.035	5.1 _a	5.3 _a	5.3 _a	5.1 _a

Notes. ^a All = all-around recreationists, ^b App = appreciative recreationists, ^c Con = consumptive recreationists, ^d Less = less-involved recreationists. Means in the same row that do not share subscripts differ at $p < 0.05$ in the Tukey honestly significant difference comparison.

Table 4.4 Mean scores and reliability for personal norms associated with aquatic plants, overall and by recreation cluster.

Factor (Cronbach's $\alpha =$) - items	\bar{x}	SE	All ^a \bar{x}	App ^b \bar{x}	Con ^c \bar{x}	Less ^d \bar{x}
Protection/Removal Norms ($\alpha = 0.70$)	4.8	0.024	4.9 _a	5.0 _a	4.9 _a	4.4 _b
- Removal of native aquatic plants should be closely regulated.	4.6	0.036	4.5 _{ab}	4.8 _a	4.6 _a	4.2 _b
- Native aquatic plants are so important they should be completely left alone.	4.0	0.037	4.0 _{bc}	4.2 _{ab}	4.4 _a	3.7 _c
- Shoreline property owners should be allowed to control native aquatic plants as much as they wish to improve their use of the lake. ^r	3.5	0.038	3.4 _b	3.4 _b	3.4 _b	4.0 _a
- Native aquatic plants are weeds and should be removed. ^r	2.4	0.031	2.3 _b	2.3 _b	2.4 _b	2.8 _a
- Native aquatic plants have no importance to me. ^r	2.4	0.031	2.2 _b	2.3 _b	2.5 _{ab}	2.8 _a

Notes. ^aAll = all-around recreationists, ^bApp = appreciative recreationists, ^cCon = consumptive recreationists, ^dLess = less-involved recreationists. ^rItems reverse coded for scale development and reliability analysis. Means in the same row that do not share subscripts differ at $p < 0.05$ in the Tukey honestly significant difference comparison.

Table 4.5 Mean scores and proportions for items used to measure behaviors and behavioral intentions related to aquatic plants, overall and by recreation cluster.

Items	\bar{x} / %	SE	All ^a \bar{x} / %	App ^b \bar{x} / %	Con ^c \bar{x} / %	Less ^d \bar{x} / %
Behavior/behavioral intentions about removing aquatic plants ^e	2.4	0.067	3.2 _a	2.0 _b	1.9 _b	1.9 _b
Do you try to keep an area in the lake next to your property free of aquatic plants on a year-to-year basis? (% yes) ^f	43.2%		54.9%	35.6%	33.3%	36.1%
Respondents who reported keeping an area free of aquatic plants indicated if they would clear an area of aquatic plants in 2004 about the same size as they did in 2003... unlikely/likely ^g	5.0	0.045	5.3 _a	4.9 _{ab}	4.7 _b	4.7 _b

Notes. ^a All = all-around recreationists. ^b App = appreciative recreationists. ^c Con = consumptive recreationists. ^d Less = less-involved recreationists. ^e Means based on the scale calculated as the product of two items below. ^f Proportions = % yes, 0 = no, 1 = yes. ^g Means based on the scale: 1 = extremely unlikely, 2 = quite unlikely, 3 = slightly unlikely, 4 = neither, 5 = slightly likely, 6 = quite likely, 7 = extremely likely. Means in the same row that do not share subscripts differ at $p < 0.05$ in the Tukey honestly significant difference comparison.

Figure 4.1 Schwartz's (1977) Norm-Activation Theory

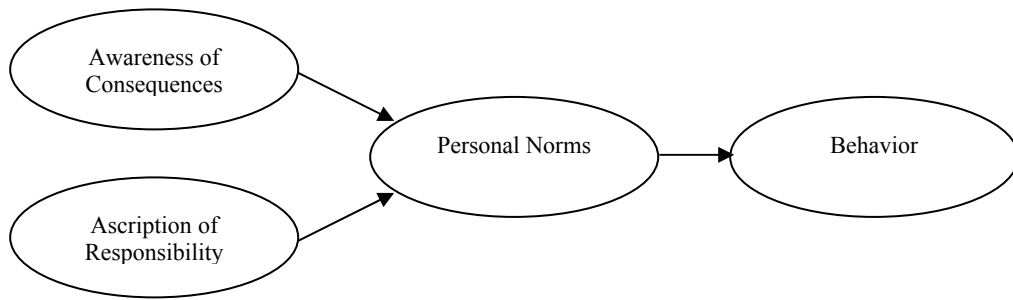


Figure 4.2 Hypothesized Structural Equation Model, With Place Attachment as Precursor of Schwartz's (1977) Norm-Activation Theory

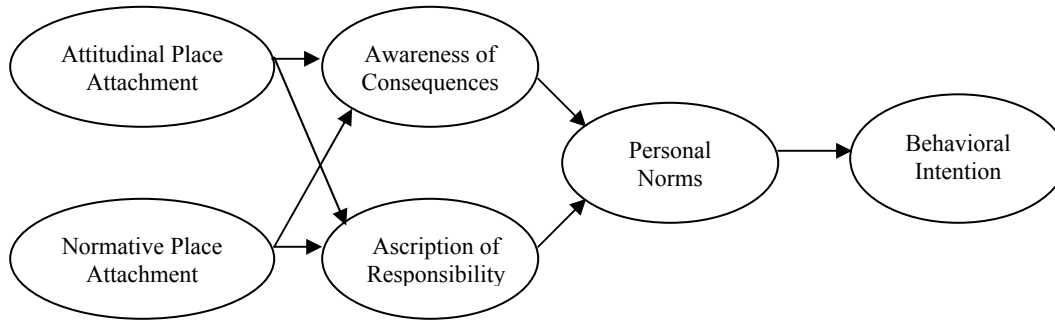
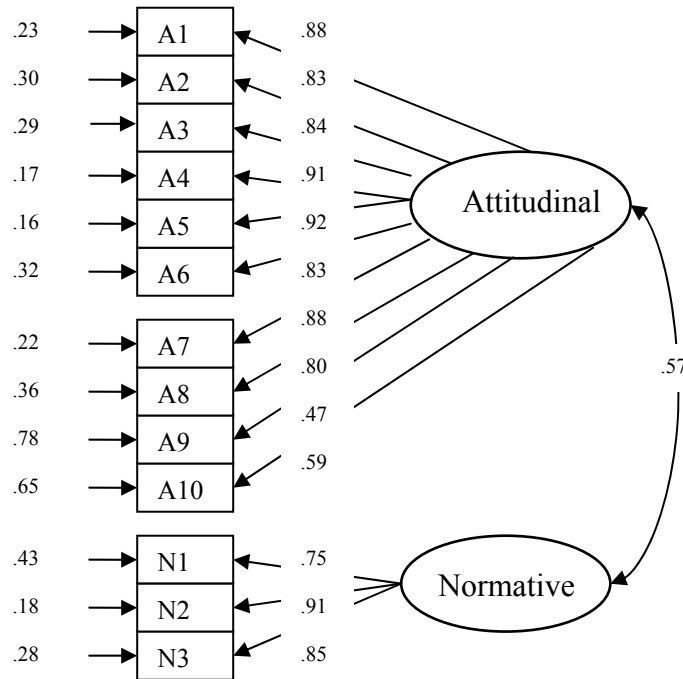


Figure 4.3 Results of confirmatory factor analysis of place attachment.

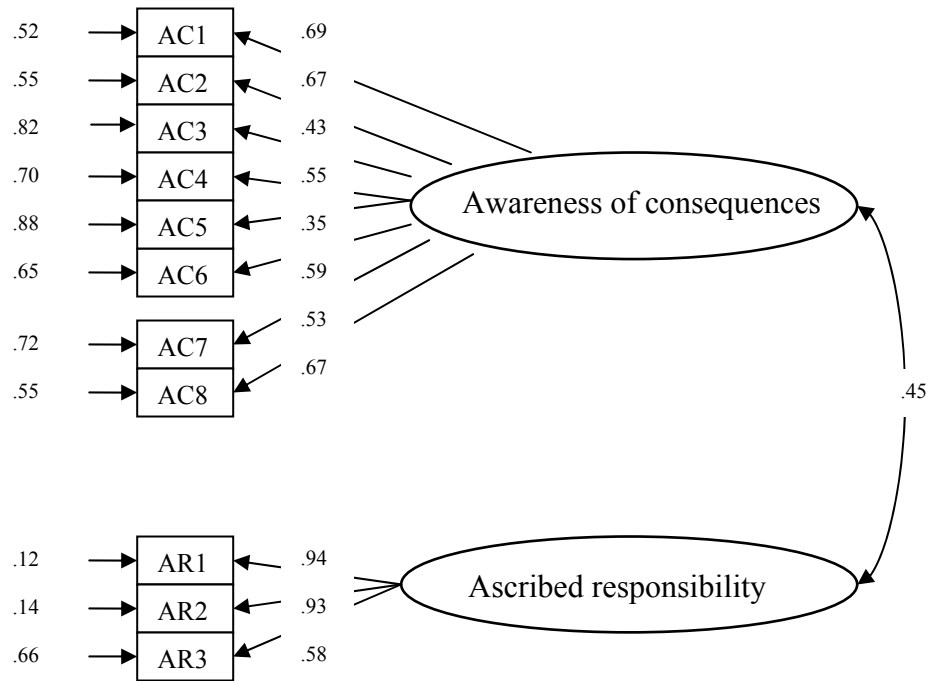


Notes: Minimum fit $\chi^2 = 1912.23^{***}$ (52 df), RMSEA = 0.071, NFI = 0.99, CFI = 0.99, GFI = 0.90

Model includes the following correlated errors (based on Joregensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .05
- A1 – A4: .05
- A3 – A4: .06
- A2 – A6: -.01
- A2 – A8: -.04
- A2 – A10: .04
- A6 – A8: .17
- A6 – A10: .18
- A8 – A10: .19
- A5 – A7: .01
- A5 – A9: -.02
- A7 – A9: .04

Figure 4.4 Results of confirmatory factor analysis of awareness of consequences and ascribed responsibility.

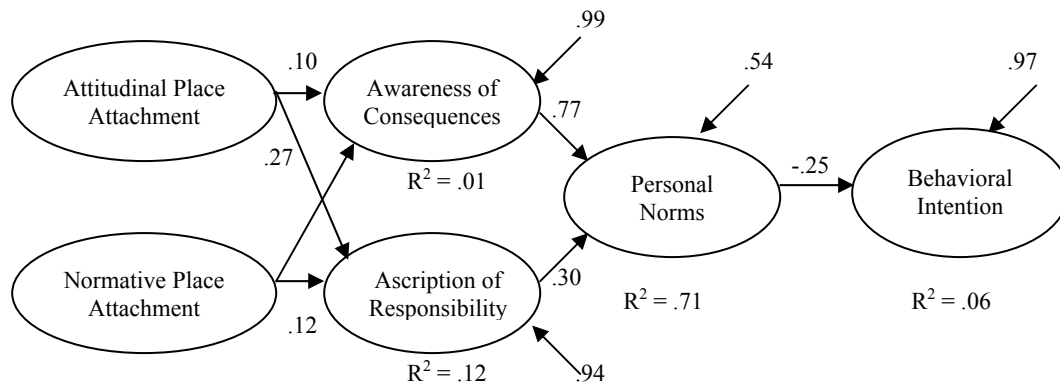


Notes: Minimum fit $\chi^2 = 605.09^{***}$ (39 df), RMSEA = 0.053, NFI = 0.98, CFI = 0.98, GFI = 0.96

Model includes the following correlated:

- AC1 – AC3: .30
- AC5 – AC6: .27
- AC4 – AC5: .23
- AC4 – AC6: .19

Figure 4.5 Significant ($p < 0.05$) standardized coefficients and error terms ($\sqrt{\zeta}$) for latent endogenous variables in path model with place attachment as an affective precursor of NAT ($n = 1,455$).

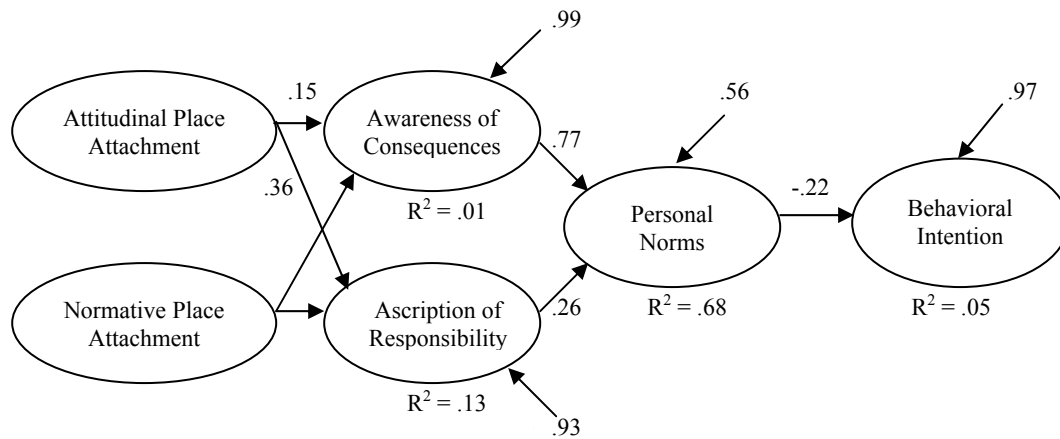


Notes: Minimum fit $\chi^2 = 3679.08^{***}$ (386 df), RMSEA = 0.052, NFI = 0.97, CFI = 0.98, GFI = 0.84

Model includes the following correlated errors (based on Joregensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .05
- A1 – A4: .06
- A3 – A4: .06
- A2 – A6: .02
- A2 – A8: -.02
- A2 – A10: .06
- A6 – A8: .19
- A6 – A10: .23
- A8 – A10: .20
- A5 – A7: .01
- A5 – A9: -.02
- A7 – A9: .04

Figure 4.6 Significant ($p < 0.05$) standardized coefficients and error terms ($\sqrt{\zeta}$) for latent endogenous variables in path model with place attachment as an affective precursor of NAT for primary lakeshore property owners ($n = 682$).

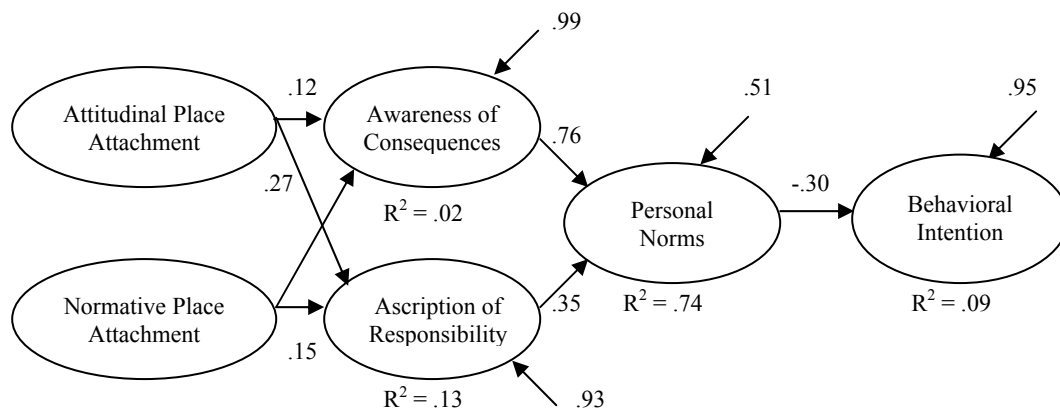


Notes: Minimum fit $\chi^2 = 2141.60^{***}$ (386 df), RMSEA = 0.049, NFI = 0.97, CFI = 0.98, GFI = 0.82

Model includes the following correlated errors (based on Joregensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .03
- A1 – A4: .07
- A3 – A4: .07
- A2 – A6: .00
- A2 – A8: -.06
- A2 – A10: .02
- A6 – A8: .15
- A6 – A10: .19
- A8 – A10: .16
- A5 – A7: .05
- A5 – A9: .00
- A7 – A9: .03

Figure 4.7 Significant ($p < 0.05$) standardized coefficients for path model and error terms ($\sqrt{\zeta}$) for latent endogenous variables in path model with place attachment as an affective precursor of NAT for recreational lakeshore property owners ($n = 718$).

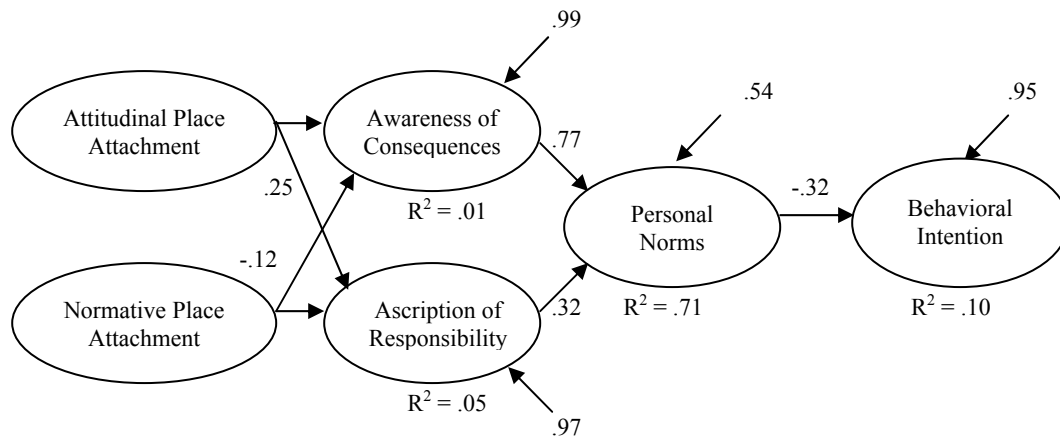


Notes: Minimum fit $\chi^2 = 2196.49^{***}$ (386 df), RMSEA = 0.051, NFI = 0.97, CFI = 0.98, GFI = 0.83

Model includes the following correlated errors (based on Joregensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .07
- A1 – A4: .06
- A3 – A4: .05
- A2 – A6: .03
- A2 – A8: .00
- A2 – A10: .10
- A6 – A8: .25
- A6 – A10: .27
- A8 – A10: .23
- A5 – A7: -.03
- A5 – A9: -.05
- A7 – A9: .03

Figure 4.8 Significant ($p < 0.05$) standardized coefficients for path model and error terms ($\sqrt{\zeta}$) for latent endogenous variables in path model with place attachment as an affective precursor of NAT for all-around recreationists ($n = 584$).

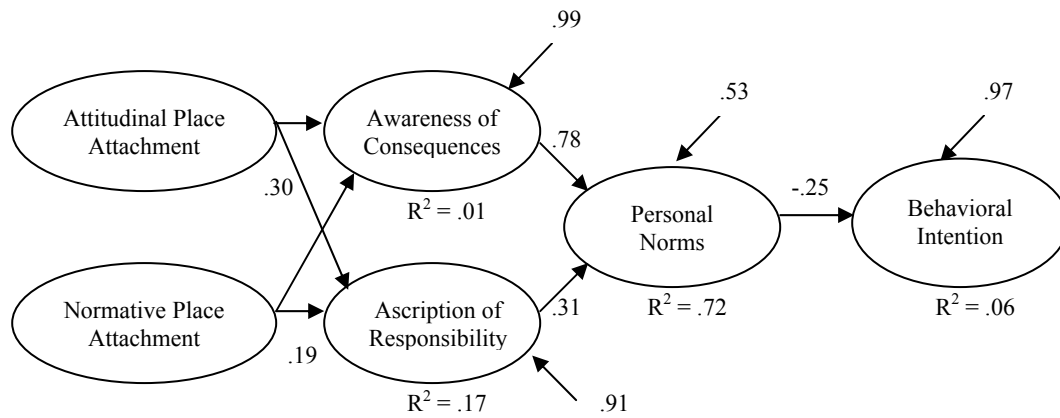


Notes: Minimum fit $\chi^2 = 2015.12^{***}$ (386 df), RMSEA = 0.048, NFI = 0.96, CFI = 0.98, GFI = 0.81

Model includes the following correlated errors (based on Joregensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .01
- A1 – A4: .07
- A3 – A4: .05
- A2 – A6: .06
- A2 – A8: .01
- A2 – A10: .10
- A6 – A8: .23
- A6 – A10: .31
- A8 – A10: .29
- A5 – A7: .00
- A5 – A9: -.04
- A7 – A9: .06

Figure 4.9 Significant ($p < 0.05$) standardized coefficients for path model and error terms ($\sqrt{\zeta}$) for latent endogenous variables in path model with place attachment as an affective precursor of NAT for appreciative recreationists ($n = 482$).

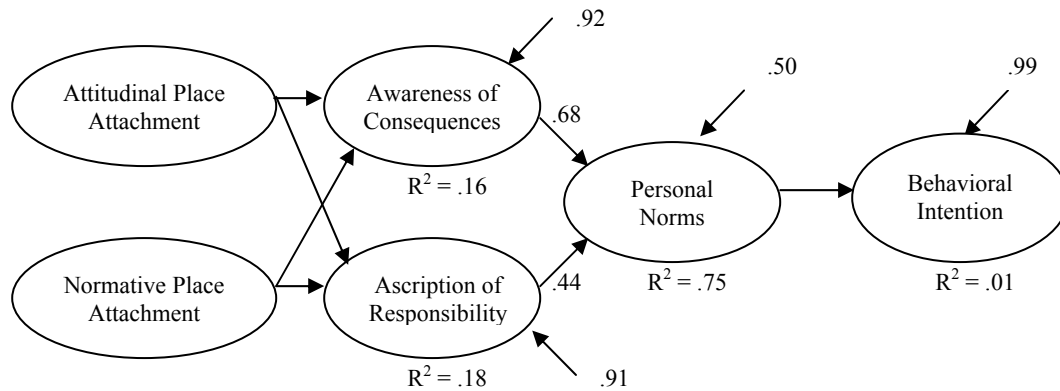


Notes: Minimum fit $\chi^2 = 1838.77^{***}$ (386 df), RMSEA = 0.053, NFI = 0.96, CFI = 0.97, GFI = 0.80

Model includes the following correlated errors (based on Joregensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .07
- A1 – A4: .08
- A3 – A4: .08
- A2 – A6: -.03
- A2 – A8: -.03
- A2 – A10: .01
- A6 – A8: .22
- A6 – A10: .24
- A8 – A10: .20
- A5 – A7: .04
- A5 – A9: -.01
- A7 – A9: .03

Figure 4.10 Significant ($p < 0.05$) standardized coefficients for path model and error terms ($\sqrt{\zeta}$) for latent endogenous variables in path model with place attachment as an affective precursor of NAT for consumptive recreationists ($n = 90$).

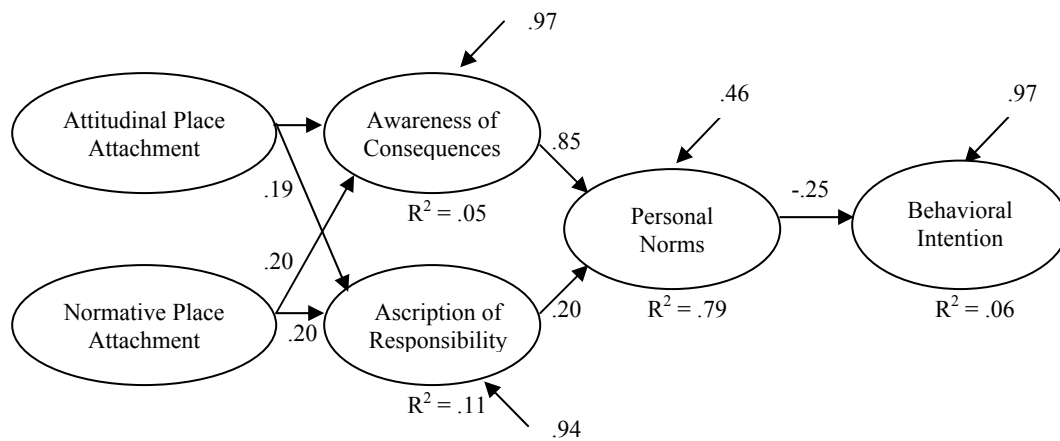


Notes: Minimum fit $\chi^2 = 137.24$ (386 df), RMSEA = 0.070, NFI = 0.56, CFI = 0.80, GFI = 0.90

Model includes the following correlated errors (based on Joregensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .08
- A1 – A4: .05
- A3 – A4: .06
- A2 – A6: -.03
- A2 – A8: -.05
- A2 – A10: -.01
- A6 – A8: .14
- A6 – A10: .11
- A8 – A10: .09
- A5 – A7: .06
- A5 – A9: .02
- A7 – A9: .08

Figure 4.11 Significant ($p < 0.05$) standardized coefficients for path model and error terms ($\sqrt{\zeta}$) for latent endogenous variables in path model with place attachment as an affective precursor of NAT for less-involved recreationists ($n = 253$).



Notes: Minimum fit $\chi^2 = 1228.29$ (386 df), RMSEA = 0.051, NFI = 0.95, CFI = 0.98, GFI = 0.77

Model includes the following correlated errors (based on Joregensen & Stedman's (2001) correlated-uniquenesses model):

- A1 – A3: .06
- A1 – A4: .07
- A3 – A4: .09
- A2 – A6: .04
- A2 – A8: -.05
- A2 – A10: .09
- A6 – A8: .11
- A6 – A10: .15
- A8 – A10: .10
- A5 – A7: -.03
- A5 – A9: -.03
- A7 – A9: .02

CHAPTER 5

Conclusions, Implications, and Future Research

This dissertation examined relationships among recreation participation, property ownership, place attachment, and attitudes and intended behavior related to the protection of Minnesota lakes. Chapter 1 provided background and a review of pertinent literature. Chapter 2 described how Minnesota residents connect to lakes through outdoor recreation and how place attachment relates to people's intentions to take political or philanthropic action to conserve a special lake. Chapter 3 examined how Minnesota lakeshore property owners connect to the lakes where they own property and how place attachment relates to their reported personal responsibility for protecting lakes. Chapter 4 modeled place attachment as a precursor to ascribed responsibility and awareness of consequences in Schwartz' (1977) norm activation theory of altruistic behavior, by applying the model to protection of aquatic plants by lakeshore property owners. Chapter 4 also described differences in models based on property ownership and recreation participation. The cumulative findings of this dissertation have implications for management and future research, which are described in this chapter.

Management and Policy Implications

Recreation Participation

The findings suggest the importance of recreation participation to protection of Minnesota lakes. Participation in lake-based outdoor recreation was related to place attachment, personal responsibility, and behavioral intentions related to lakes. In particular, less-involved recreation participants reported lower levels of attitudinal and normative place attachment to lakes, expressed less personal responsibility for protecting lakes, and had the lowest intentions of taking philanthropic or political action to protect lakes.

Given the relationship of outdoor recreation participation to place attachment and intended conservation action, projected declines in outdoor recreation participation in Minnesota and across the country (Kelly, 2005; Pergams & Zaradic, 2008a) may have implications for conservation efforts on public lands and waters. Researchers debate the veracity of reports of declining participation in outdoor recreation, and whether such declines would lead to less support for nature conservation (Cordell, 2008; Jacobs & Manfredi, 2008; Kareiva, 2008; Pergams & Zaradic, 2008b). Declines in total participant numbers may not be apparent in pooled measures of nature-based recreation or for all individual activities (Cordell, 2008; Jacobs & Manfredi, 2008), but research shows reduced *per capita* participation in a wide variety of key indicator activities in Minnesota and the United States (Kelly, 2005; Pergams & Zaradic, 2008a). Although correlation does not infer causation, these *per capita* declines in participation are correlated with (a) a drop in proenvironmental attitudes (Pergams & Zaradic, 2008b) and (b) increased use of electronic media (Pergams & Zaradic, 2006). In addition, previously described positive relationships between proenvironmental attitudes with (a) childhood nature experiences (Chawla, 1999; Tanner, 1980; Vining, 2003; Wells & Lekies, 2006), (b) significant life events (Tanner, 1980), and (c) outdoor recreation participation (Bright & Porter, 2001; Dunlap & Heffernan, 1975; Theodori et al., 1998; Tiesl & O'Brien, 2003) suggest the need for natural resource managers to consider projected declines in outdoor recreation at lakes and elsewhere. Although research needs to continue to clarify the relationship between outdoor recreation and proenvironmental attitudes, the research here and elsewhere suggests that declines in

lake-based recreation may lead to reduced attachment to lakes and less public value placed on aquatic resources.

Managers need to better understand what motivates and constrains current and potential visitors to Minnesota lakes. They also need to better understand personal identities and cultural connections that visitors, seasonal and recreational property owners, year-round residents, and intergenerational residents associate with lakes. This information could be used to develop programs that maintain and enhance lake-based recreation participation and meaningful connections to lakes. The research in this dissertation and in other studies suggests that people care about what they know. Therefore, people may express greater environmental concern and intentions for proenvironmental behavior if they experience nature and develop meanings associated with special places. Because of increasing urbanization and the observed connection of environmental concern to childhood nature experiences, management efforts may be most successful if they focus on opportunities for children and urban residents, including improved access, interpretation, and in-depth field experiences and natural history programs.

Property Ownership

Results suggest that property ownership relates to place attachment and to attitudes and behavioral intentions related to lake management. Lakeshore property owners reported greater place attachment to lakes and stronger intentions to take conservation action compared to visitors. Although primary home owners reported slightly stronger attitudinal place attachment while second home owners reported

slightly stronger normative attachment, there was no significant difference between the two groups in personal responsibility for lake protection.

In contrast with decreasing participation in outdoor recreation, there is increasing housing development in rural and amenity areas (Wilson, 2006) and specifically along lakeshores in Minnesota and Wisconsin (Jakes, Schlichting, & Anderson, 2003; Stedman, 2000; Walljasper & Newburg, 2009; Wilson, 2006). Although published estimates and projections of lakeshore development are difficult to come by, it appears that increases in lakeshore development in the upper Midwest have been and will continue to be dramatic. Jakes, Schlichting, and Anderson (2003) described shoreline development in northern Wisconsin increasing an average of 216% between 1960 and 1995, and Walljasper and Newburg (2009) described a projected population increase of 60% for Lake County, Minnesota. Although people value riparian areas for seasonal and permanent residences, Walljasper and Newburg (2009) describe “intense planning issues related to land use, water quality, shoreline protection, and sprawl” (p. 35) in Minnesota’s lake country. This increasing development suggests the need for managers to engage residents in lake protection. Management efforts may need to begin with efforts to address inconsistencies between managers and property owners in perceptions of the sustainable management of aquatic plants. In addition, management efforts may need to emphasize incentives, partnerships, and investments in resource protection—rather than regulations—to build trust with property owners. It will be important for managers to better understand the meanings and benefits property owners associate with their lake homes.

Place Attachment and Place Meanings

Managers need to better understand the place meanings associated with specific lakes, and how management actions and communications may intentionally or unintentionally perpetuate place meanings. The studies in this dissertation described connections between place attachment and proenvironmental attitudes, and identified differences in relationships based on recreation participation and lakeshore property ownership. Because place meanings are derived from experiences at a place (Stedman, 2008), managers need to better understand how recreation activities and property ownership may influence place meanings. This knowledge could be used to provide infrastructure and programs to support activities that reflect desired meanings for a space. Management actions—including land management activities, regulations, and interpretive signage—influence the meanings the public associates with a space (Stedman, 2008). For example, when managers remove native aquatic plants for boat launches, beaches, fishing piers, and parking lots, they may be communicating place meanings associated with outdoor recreation over an undisturbed environment. Managers could communicate place meanings associated with conservation and habitat protection by using innovative designs for these facilities that retain and emphasize the importance of native aquatic plants while providing access. Managers need to pay attention to messages that they deliberately or inadvertently send about place meanings for a space.

Theoretical and Methodological Implications

This study contributes to ongoing research on how participation in outdoor recreation relates to environmental concern and behavioral intentions. Most previous

research has simply examined participation (versus nonparticipation) in consumptive versus appreciative outdoor activities (Dunlap & Heffernan, 1975; Teisl & O'Brien, 2003; Theodori et al., 1998). This study used cluster analysis to segment recreation participation by type and recent avidity, differentiating lake-based recreation into all-around, appreciative, consumptive, and less-involved participation. Results suggest that recreation participation relates to attitudes and behavioral intentions related to lake protection. Among members of the general public, less-involved participants in lake-based recreation reported significantly lower intentions to take political or philanthropic action to protect lakes. Appreciative recreationists were more likely to take political action, while all-around and consumptive recreationists were somewhat more likely to donate time and money to protect lakes. Similar to stronger support for political action reported by appreciative recreationists from the general public, appreciative recreationists from the property owner sample were more supportive of agency responsibility for protecting a lake. Again paralleling results from the general public sample, less-involved recreationists from the lakeshore property owner sample reported lower personal responsibility for protecting their lake generally and a lower rating of personal norms for protecting native aquatic plants. Although all-around, appreciative, and consumptive recreationists reported similar levels of personal responsibility for protecting their lake and personal norms for protecting native aquatic plants, all-around recreationists reported significantly higher behavioral intentions to remove native aquatic plants. Results generally support previous research that has suggested (a) a positive relationship between outdoor recreation and pro-environmental attitudes, and

(b) differences based on the type of recreation participation. There are needs for additional research in this area, which will be addressed in a subsequent section.

This study advanced research on place attachment by (a) examining visitors' and residents' attachment to Minnesota lakes and (b) how place attachment relates to conservation attitudes and behavioral intentions. Greater place attachment was associated with property ownership and frequency of recreation participation. This study developed a scale to measure family connections to a lake home, which was introduced in this dissertation as the normative place attachment construct. In analyses, normative place attachment was contrasted to attitudinal place attachment, which parallels place dependence and place identity studied in previous research (Bott et al., 2003; Davenport & Anderson, 2005; Kyle et al, 2003; Moore & Graefe, 1994). Attitudinal place attachment was generally more strongly predictive of attitudes and behavioral intentions related to lake protection compared to normative place attachment, but the concept of normative place attachment deserves additional study, which will be discussed later.

This study demonstrated the value of norm activation theory for predicting the personal norms and behavioral intentions related to protection and removal of native aquatic plants by Minnesota lakeshore property owners. Results show: (a) the strong positive influence of awareness of consequences and ascribed responsibility on personal norms related to the protection of aquatic plants, and (b) the relationship between personal norms for protection of aquatic plants and behavioral intentions for removing plants on personal property. These results parallel other applications of norm activation

theory to pro-environmental behavior (Bamberg & Schmidt, 2003; Hunecke, Blöbaum, Matthies, & Höger, 2001; Wall et al., 2007).

Research Limitations and Future Research Needs

This study adds to existing knowledge on the relationships among outdoor recreation participation, place attachment, and intended conservation action, but it is largely a base for further study. Results demonstrated differences in place attachment and lake conservation measures related to recreation participation. Future studies could employ similar methods applied to non-lake-based recreation and conservation attitudes and behavioral intentions. Analysis of recreation participation must be multidimensional and include: (a) participation versus nonparticipation, (b) involvement and commitment, (c) motivations/ benefits, (d) exposure, avidity, recency, activity level, (e) years of participation, and (f) overlap or clustering in activity participation. Research also needs to consider the resource-dependence of activities and the influence of transcendent experiences on place attachment and conservation attitudes, behavioral intentions, and behaviors.

This study examined attachment to lakes among recreational visitors, year-round residents, and seasonal residents, and it tested new items to measure normative place attachment. As in previous studies, we found that place attachment correlated with conservation attitudes and behavioral intentions. Previous research has emphasized the importance of (a) social bonds in the development of place attachment (Bott et al., 2003), and (b) studying sense of place as a social construction (Stokowski, 2002, 2008). Additional research could expand our measures of normative place attachment by studying attachment related to friends, neighbors, and other recreation participants. Our

method of quantifying normative place attachment using end-state, individual measures differed from the process-oriented, qualitative measures that have been used to measure the social construction of place. We suggest that quantitative measures like those used in this study can complement valuable qualitative measures. Future research also needs to better measure place attachment associated with “insidedness” to a place by conducting studies of transients, tourists, repeat visitors, recreational property owners, residential property owners, and intergenerational residents.

This study measured environmental attitudes and behavioral intentions related to Minnesota lakes, specifically examining: (a) intention to take philanthropic and political action to protect a favorite lake, (b) personal responsibility for protecting lakes, and (c) personal norms and behavioral intentions for protection and removal of aquatic plants. Our models explained differing amounts of variance depending on the dependent variable used to measure environmental attitudes and behavioral intentions. For example, the models for the general public sample explained over 25% of the variance in intended philanthropic action compared to only about 10% of the variance in intended political action. The models for lakeshore property owners explained about 10% of the variance in personal responsibility for protecting lakes and between 1% and 10% of variance in behavioral intentions for removing native aquatic plants. This underscores the need to better differentiate conservation attitudes, intentions, and behaviors. Researchers have begun to categorize and examine specific types of environmental behaviors (Smith-Sebasto & D’Acosta, 1995; Stern, 2000b). Future research needs to develop valid and reliable measures of different types of pro-environmental behavior including civic, educational, financial, legal, physical, and

persuasive actions, which could be applied to issues like lake and aquatic plant conservation.

Study results show substantial unexplained variance in attitudes and behavioral intentions related to the protection of lakes and aquatic plants. In addition to incorporating better measures of recreation participation, place attachment, “insidedness” to a place, and pro-environmental behavior, future research could examine the influence of place meanings, environmental values, social capital, sense of community, political ideology, educational background, and length of association with a place on pro-environmental attitudes, intentions, and behaviors.

This study faced some limitations related to question wording, sampling, and other issues related to survey research in general and mail surveys in particular. Although the same items were used to measure place attachment for the general public and the lakeshore property owner surveys, these surveys used different measures of pro-environmental attitudes and behavioral intentions. Therefore, this study could not compare the general public to lakeshore property owners on measures of lake and aquatic plant protection. In addition, the structural equation models for some recreation segments were subject to small sample sizes.

Future research could apply other theories of pro-environmental behavior, such as the theory of reasoned action and the theory of planned behavior, to the protection of lakes and aquatic plants. These theories might demonstrate how self interest and social pressures influence the protection and removal of aquatic plants. Future research also needs to examine actual behavior related to lake and aquatic plant protection in addition to self-reported attitudes and behavioral intentions. Studies might also examine barriers

that individuals face in protecting or restoring native aquatic plants. Finally, research might examine motivations and test incentives for restoration of native aquatic plants on private property.

Conclusions

In summary, by examining recreation participation, property ownership, place attachment, and pro-environmental attitudes and behavioral intentions related to Minnesota lakes, this study has suggested several important theoretical and management implications. Future research, however, is needed to clarify how recreation participation, place attachment, and residents' and visitors' "insidedness" to special places relates to environmental attitudes and behavioral intentions. This study and future research may help resource managers build support for conservation of lakes and other special places.

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APPENDICES

Minnesota Lakes Survey



Spring 2004

**Please complete this survey and return it in
the postage-paid return envelope.**

Minnesota Cooperative Fish and Wildlife Research Unit
University of Minnesota
1980 Folwell Avenue
St. Paul, Minnesota 55108

A. Recreating on Minnesota lakes and waterways

Q1. Please indicate how often you personally did each of the following activities in 2003 on lakes in Minnesota. (Please circle one response for each.)

Activities on Lakes in 2003	Not at all	1 or 2 times	3 to 5 times	6 to 10 times	11 to 20 times	21 or more times
Fishing of all types (boat, shore, dock, ice)	0	1	2	3	4	5
Pleasure boating (motorized or unmotorized) excluding fishing from a boat	0	1	2	3	4	5
Swimming/wading	0	1	2	3	4	5
Hunting waterfowl (ducks, geese)	0	1	2	3	4	5
Bird watching, viewing wildlife, studying nature	0	1	2	3	4	5
Enjoying lake scenery	0	1	2	3	4	5

Q2. In total how many days would you say you visited lakes in Minnesota in 2003?

_____ days

B. Importance of Minnesota lakes

Q3. Please indicate how much you agree or disagree with the following statements using the scale 1=strongly disagree to 5=strongly agree. (Please circle one response for each.)

	Strongly disagree	Mildly disagree	Neutral	Mildly agree	Strongly agree	Don't know
Minnesota lakes have no particular importance to me.	1	2	3	4	5	9
Minnesota lakes are important to me, whether or not I use them.	1	2	3	4	5	9
Minnesota lakes are important to me because of their fish, wildlife, and other natural features.	1	2	3	4	5	9
Minnesota lakes are important to me because they offer many types of recreation.	1	2	3	4	5	9
Minnesota lakes are inviting to me.	1	2	3	4	5	9
Minnesota lakes are important to me because of their beauty and atmosphere.	1	2	3	4	5	9
Minnesota lakes must be taken care of, so that we can pass them along to future generations for their enjoyment.	1	2	3	4	5	9
Minnesota lakes are important to me because of their economic value to surrounding communities.	1	2	3	4	5	9
Minnesota lakes are important to me because they are sources of clean water.	1	2	3	4	5	9
Minnesota lakes are important to me because they provide habitat and protection for wildlife and fish.	1	2	3	4	5	9
Minnesota lakes are important to me because they are a source of childhood memories.	1	2	3	4	5	9
Minnesota lakes are important to me because they are quiet, natural places for personal renewal.	1	2	3	4	5	9
Minnesota lakes are important to me because they offer protection for rare, unique, or endangered plants and animals.	1	2	3	4	5	9

C. Lake health and aquatic plants

Aquatic Plants: Minnesota is home to about 150 types of aquatic plants, including a few types that are exotic species not native to the state. The questions below address *native* aquatic plants like water lilies, wild rice, and cattails, NOT non-native exotic species like Eurasian water milfoil and curly-leaf pondweed.

Q4. Please rate your level of familiarity with issues related to native aquatic plants and lake ecology.

- Not at all familiar
- Slightly familiar
- Moderately familiar
- Very familiar
- Extremely familiar

Q5. For each of the word pairs below, please place an “X” in the space that best expresses how you feel.

Removing native aquatic plants from lakes is:

Bad _____ : _____ : _____ : _____ : _____ : _____ : _____ **Good**
 extremely quite slightly neither slightly quite extremely

Harmful _____ : _____ : _____ : _____ : _____ : _____ : _____ **Beneficial**
 extremely quite slightly neither slightly quite extremely

Q6. Please rate the following items on the scale of 1=definitely false to 5=definitely true. (Please circle one response for each.)

	Definitely false	Probably false	Unsure	Probably true	Definitely true	Don't know
Removal of native aquatic plants is harmful to lake health (water quality, biotic balance, etc.)	1	2	3	4	5	9
Native aquatic plants are harmful to wildlife populations (waterfowl, wading birds, amphibians, etc.)	1	2	3	4	5	9
Removal of native aquatic plants is harmful to fish populations	1	2	3	4	5	9
Native aquatic plants decrease the scenic beauty of the lake	1	2	3	4	5	9
Removal of native aquatic plants increases the value of the lake as a recreational area	1	2	3	4	5	9
Native aquatic plants reduce the economic value of the lake in the long-term	1	2	3	4	5	9
Removal of native aquatic plants increases shoreline erosion	1	2	3	4	5	9
Native aquatic plants reduce water clarity and quality	1	2	3	4	5	9

Q7. For the following statements regarding native aquatic plants, please indicate the degree to which you agree or disagree with each statement by circling the appropriate number. (Please circle one response for each.)

	Strongly disagree	Mildly disagree	Neither	Mildly agree	Strongly agree	Don't know
Native aquatic plants have no importance to me.	1	2	3	4	5	9
Native aquatic plants are weeds and should be removed.	1	2	3	4	5	9
Native aquatic plants are so important they should be completely left alone.	1	2	3	4	5	9
Lakeshore property owners should be allowed to control native aquatic plants as much as they wish to improve their use of the lake.	1	2	3	4	5	9
Removal of native aquatic plants should be closely regulated.	1	2	3	4	5	9
Native aquatic plants add to the scenic beauty of lakes.	1	2	3	4	5	9
Native aquatic plants make the shoreline look messy.	1	2	3	4	5	9
Lake shorelines are more beautiful when lawns are turf grass and mowed to the edge.	1	2	3	4	5	9
Lake shorelines are more attractive when they have an abundance of native aquatic plants.	1	2	3	4	5	9
Removal of native aquatic plants is essential to maintaining the water quality and water clarity of lakes.	1	2	3	4	5	9
To improve the overall health of lakes, native aquatic plants should be removed.	1	2	3	4	5	9
Native aquatic plants serve important functions that maintain the health of lakes.	1	2	3	4	5	9
Abundant floating and emergent native aquatic plants are signs of an unhealthy lake.	1	2	3	4	5	9
Life in lakes depends on native aquatic plants.	1	2	3	4	5	9
Native aquatic plants support the economic value of lakes for tourism and recreation.	1	2	3	4	5	9
Native aquatic plants improve the quality of fishing.	1	2	3	4	5	9
Native aquatic plants improve the quality of hunting for waterfowl and other wildlife.	1	2	3	4	5	9

Q8. How much do you trust each of the following groups to make sound recommendations concerning the management of lakes and aquatic plants? (Please circle one response for each.)

	Do not trust at all	Trust slightly	Trust moderately	Trust greatly	Don't know
Individual lakeshore landowners	1	2	3	4	9
The State of Minnesota	1	2	3	4	9
The county government for the lake	1	2	3	4	9
Lakeshore property owner groups	1	2	3	4	9
The Minnesota Department of Natural Resources (DNR)	1	2	3	4	9
The general public	1	2	3	4	9
Lake users (recreationists, etc.)	1	2	3	4	9

Q9. How knowledgeable are you about regulations concerning aquatic plant management in Minnesota? (Please check one.)

- Not at all knowledgeable
- Slightly knowledgeable
- Moderately knowledgeable
- Very knowledgeable
- Extremely knowledgeable

Q10. How would you describe current management regulations concerning native aquatic plants in Minnesota?

- Too restrictive
- About right
- Not restrictive enough
- Don't know

D. Lake property and use

Q11. Is there a lake or lakes in Minnesota that you use most often?

- No. (If no, please skip to Part E, Q14.)
- Yes. (If yes, please answer Q11a.)



Q11a. If yes, do you own property on the lake?

- No. (If no, please skip to Q12.)
- Yes. (If yes, please answer Q11b.)



Q11b. How would you describe your use of the property?

- Primary residence
- Seasonal or recreational property
- Business property
- Rental property
- Other (Please describe: _____.)

Q12. How do you feel about the Minnesota lake you use most often. (Circle one response for each.)

	Strongly disagree	Mildly disagree	Neither	Mildly agree	Strongly agree	Don't know
It is my favorite place to be.	1	2	3	4	5	9
I feel that I can really be myself there.	1	2	3	4	5	9
I really miss it when I am away from it too long.	1	2	3	4	5	9
I feel happiest when I am there.	1	2	3	4	5	9
It is the best place to do the things I enjoy.	1	2	3	4	5	9
It reflects the type of person that I am.	1	2	3	4	5	9
For the things I enjoy doing most, no other place can compare it.	1	2	3	4	5	9
Everything about it is a reflection of me.	1	2	3	4	5	9
As far as I am concerned there are better places to be.	1	2	3	4	5	9
It is a special place for my family.	1	2	3	4	5	9
It says very little about who I am.	1	2	3	4	5	9
Many important family memories are tied to it.	1	2	3	4	5	9
It ties the generations of my family together.	1	2	3	4	5	9

Q13. If the environmental quality of the lake(s) you use most often declines, how likely would you be to take the following actions? (Please circle one response for each.)

	Extremely unlikely	Moderately unlikely	Neither	Moderately likely	Extremely likely	Don't know
Contribute money to protect the lake(s).	1	2	3	4	5	9
Contribute personal time to protect the lake(s).	1	2	3	4	5	9
Join an organization working to protect the lake(s).	1	2	3	4	5	9
Support legislation or regulations that limit human use to protect the lake(s).	1	2	3	4	5	9
Vote for people who support lake protection.	1	2	3	4	5	9

E. Demographics

Q14. In what year were you born?

_____ year

Q15. How many years have you lived in Minnesota?

_____ years

Q16. How many years have you lived in your current residence?

_____ years

Q17. What is the highest level of education you have completed? (Check one.)

- | | |
|--|---|
| <input type="checkbox"/> Grade school | <input type="checkbox"/> Some college |
| <input type="checkbox"/> Some high school | <input type="checkbox"/> Four-year college (bachelor's) degree |
| <input type="checkbox"/> High school diploma or GED | <input type="checkbox"/> Some graduate school |
| <input type="checkbox"/> Some vocational or technical school | <input type="checkbox"/> Graduate (master's or doctoral) degree |
| <input type="checkbox"/> Vocational or technical school (associate's) degree | |

Q18. What is your gender?

- Male
- Female

Q19. What was your approximate total household income before taxes last year?

\$ _____

Q20. Which of the following best describes your race? (Check all that apply.)

- Caucasian/White
- African American/Black
- Asian
- Pacific Islander
- American Indian or Alaskan Native

Q21. Do you consider yourself Hispanic/Latino/Spanish? (Check one.)

- No
- Yes

Appendix B: Lakeshore Property Owner Survey

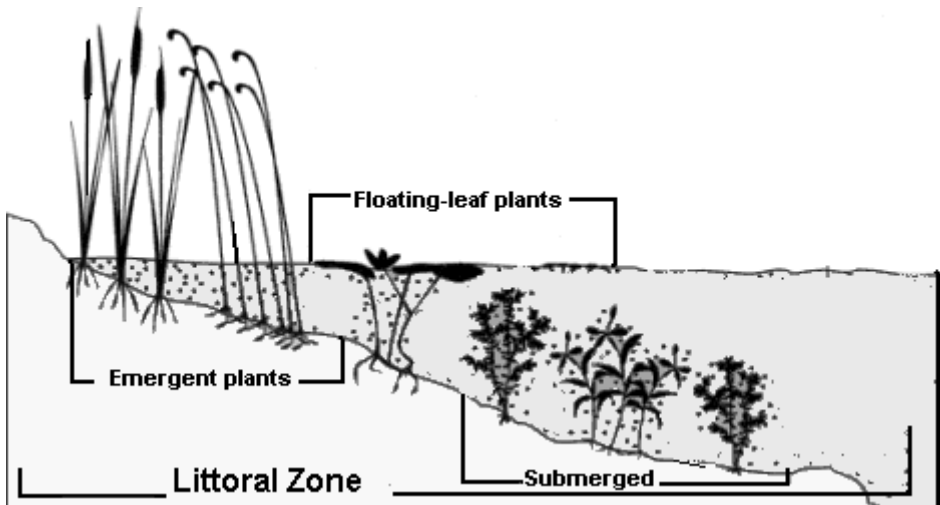
**Aquatic Plants:
Minnesota Lakeshore Landowner Survey**



Spring 2004

**Please complete this survey and return it in
the postage-paid return envelope.**

Minnesota Cooperative Fish and Wildlife Research Unit
University of Minnesota
1980 Folwell Avenue
St. Paul, Minnesota 55108



Within a lake, aquatic plants grow in the shallow area between dry land and the deep-water area of a lake. In Minnesota lakes, this area typically extends from the shore to a depth of about 15 feet.

Types of aquatic plants:

Submerged plants have stems and leaves that grow entirely underwater, although some may also have floating leaves. Flowers and seeds on short stems that extend above the water may also be present. Submerged plants grow in many areas of the lake, from near shore areas into deep water, and display a wide range of plant shapes. Depending on the species, they may form a low-growing "meadow" near the lake bottom, grow with lots of open space between plant stems, or form dense stands or surface mats. Examples include wild celery, broad-leaf and narrow-leaf pondweeds, and coontail.

Floating-leaf plants are often rooted in the lake bottom, but their leaves and flowers float on the water surface. Water lilies are a well-known example. Floating leaf plants typically grow in protected areas where there is little wave action.

Emergent plants are rooted in the lake bottom, but their leaves and stems extend out of the water. Cattails, bulrushes, and other emergent plants typically grow in wetlands and along the shore, where the water is less than 4 feet deep.

SECTION 1: Questions about Your Lakeshore Property & Your Lake

Q1. How would you describe your use of your lakeshore property? (Please check one response.)

- PRIMARY RESIDENCE
- SEASONAL OR RECREATIONAL PROPERTY
- RENTAL PROPERTY
- BUSINESS PROPERTY
- OTHER (PLEASE DESCRIBE _____)

Q2. Please indicate how often you personally did each of the following activities in 2003 on the lake where you own property. (For each statement below circle one response.)

	Not at all	1 or 2 times	3 to 5 times	6 to 10 times	11 to 20 times	21 or more times
FISHING FROM SHORE OR DOCK/PIER	0	1	2	3	4	5
FISHING FROM MOTORIZED BOAT	0	1	2	3	4	5
FISHING FROM NON-MOTORIZED BOAT	0	1	2	3	4	5
ICE FISHING	0	1	2	3	4	5
PLEASURE BOATING (MOTORIZED)	0	1	2	3	4	5
CANOEING/KAYAKING/PADDLEBOATING	0	1	2	3	4	5
WATER SKIING/KNEEBOARDING/TUBING	0	1	2	3	4	5
PERSONAL WATERCRAFT USE (JET SKIING)	0	1	2	3	4	5
SAILING	0	1	2	3	4	5
WINDSURFING	0	1	2	3	4	5
SWIMMING/WADING	0	1	2	3	4	5
HUNTING WATERFOWL (DUCKS, GEESE)	0	1	2	3	4	5
BIRD WATCHING, VIEWING WILDLIFE, STUDYING NATURE	0	1	2	3	4	5
ENJOYING LAKE SCENERY	0	1	2	3	4	5

Q3. How long have you owned your current lakeshore property?

Years

Q4. How many feet of lake shoreline do you own?

Feet

Q5. How do you feel about your lake property? (For each statement please circle one response.)

	Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neither	Slightly Agree	Somewhat Agree	Strongly Agree	Don't know
It is my favorite place to be.	1	2	3	4	5	6	7	dk
I feel that I can really be myself there.	1	2	3	4	5	6	7	dk
I really miss it when I am away from it too long.	1	2	3	4	5	6	7	dk
I feel happiest when I am there.	1	2	3	4	5	6	7	dk
It is the best place to do the things I enjoy.	1	2	3	4	5	6	7	dk
My lake property reflects the type of person that I am.	1	2	3	4	5	6	7	dk
For the things I enjoy doing most, no other place can compare to my lake property.	1	2	3	4	5	6	7	dk
Everything about my lake property is a reflection of me.	1	2	3	4	5	6	7	dk
As far as I am concerned there are better places to be.	1	2	3	4	5	6	7	dk
It is a special place for my family.	1	2	3	4	5	6	7	dk
My lake property says very little about who I am.	1	2	3	4	5	6	7	dk
Many important family memories are tied to it.	1	2	3	4	5	6	7	dk
It ties the generations of my family together.	1	2	3	4	5	6	7	dk

Q6. Please rate the characteristics of the lake on which you own property. (Please circle one response for each.)

	Poor	Fair	Good	Excellent	Don't know
Overall condition of lake and shoreland areas	1	2	3	4	dk
Water clarity	1	2	3	4	dk
Water quality	1	2	3	4	dk
Scenic quality of lake and shoreland areas	1	2	3	4	dk
Fishing	1	2	3	4	dk
Condition of land area close to shoreline (0-100ft from shore)	1	2	3	4	dk
Condition of land area away from shoreline (100-1000ft)	1	2	3	4	dk

Q7. To what extent do you believe the following are a problem at the lake on which you own property? (For each statement below circle one response.)

	Not a problem	Minimal problem	Moderate problem	Major problem	Don't know
Level of fish contamination (e.g., mercury)	1	2	3	4	dk
Presence of exotic species (such as Eurasian milfoil, purple loosestrife, etc.)	1	2	3	4	dk

Q8. How would you describe the level of each of the following at the lake on which you own property? (For each statement below circle one response.)

	Way too little	Too little	About right	Too much	Way too much	Don't know
Fish habitat	1	2	3	4	5	dk
Motorized watercraft	1	2	3	4	5	dk
Diversity of birds and wildlife	1	2	3	4	5	dk
Keeper-size pan and game fish	1	2	3	4	5	dk
Emergent vegetation like bulrush near the shore	1	2	3	4	5	dk
Submerged vegetation near the shore	1	2	3	4	5	dk
Floating algae on the surface	1	2	3	4	5	dk
Waterfowl	1	2	3	4	5	dk
Natural shoreline vegetation (trees and shrubs)	1	2	3	4	5	dk
Shoreland housing	1	2	3	4	5	dk

Q9. Since you have owned your lakeshore property would you say...(Please circle one response for each).

	Greatly Declined	Declined	Stayed about the Same	Increased	Greatly Increased	Don't know
Overall condition of lake and shoreland areas	1	2	3	4	5	dk
Water clarity	1	2	3	4	5	dk
Water quality	1	2	3	4	5	dk
Scenic quality of lake and shoreland areas	1	2	3	4	5	dk
Fishing	1	2	3	4	5	dk
Condition of land area close to shoreline (0-100ft. from shore)	1	2	3	4	5	dk
Condition of land area away from shoreline (100-1000ft)	1	2	3	4	5	dk
Level of fish contamination	1	2	3	4	5	dk
Presence of exotic species (such as Eurasian milfoil, purple loosestrife, etc.)	1	2	3	4	5	dk
Keeper-size pan and game fish	1	2	3	4	5	dk
Motorized watercraft	1	2	3	4	5	dk
Diversity of birds and wildlife	1	2	3	4	5	dk
Fish habitat	1	2	3	4	5	dk
Emergent vegetation like cattails and bulrush near the shore	1	2	3	4	5	dk
Submerged vegetation near the shore	1	2	3	4	5	dk
Floating algae/scum on the surface	1	2	3	4	5	dk
Waterfowl	1	2	3	4	5	dk
Natural shoreline vegetation (trees and shrubs)	1	2	3	4	5	dk
Shoreland housing	1	2	3	4	5	dk

Q10. Please indicate what percentage (%) of the shoreline along your property falls into each category. (Please circle one response for each.)

Rip rap	<5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95+%
Sea wall	<5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95+%
Mowed turf grass	<5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95+%
Sandy beach	<5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95+%
Natural vegetation	<5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95+%
Other	<5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95+%

Q11. Do you have aquatic plants in the lake next to your property?

- YES
 NO (SKIP TO QUESTION 28)

Q12. Approximately what percentage of your shoreline has aquatic plants? (Circle one.)

0% ≤5% 10% 20% 30% 40% 50% 60% 70% 80% 90% 95+%

Q13. Do you try to keep an area in the lake next to your property free of aquatic plants on a year-to-year basis? (Please check one response.)

- YES
 NO → **Q14. Please indicate why you do not remove aquatic plants from your lake/shoreline (Check all that apply):**

- Plants are few in number and removal is not necessary
 I do not want to remove plants
 There are laws and regulations that prevent me from removing the aquatic plants
 Other(please describe): _____

(If you do not remove aquatic plants, PLEASE SKIP TO QUESTION 21.)

Q15. What types of aquatic plants do you remove? (Check all that apply. See description on inside cover.)

- SUBMERGED PLANTS
 FLOATING-LEAF PLANTS
 EMERGENT PLANTS

Q16. Please indicate your reason for removing aquatic plants on your property. (Check all that apply.)

- APPEARANCE/ TO MAKE SHORELINE LOOK BETTER
- SWIMMING
- BOATING
- FISHING
- OTHER (PLEASE DESCRIBE) _____

Q17. Please indicate whether you took any of the following actions on your lakeshore property in 2003. (Please check YES or NO.)

	Yes	No
Placed a plastic mat on the lake bottom	<input type="checkbox"/>	<input type="checkbox"/>
Cut or pulled submerged aquatic vegetation by hand	<input type="checkbox"/>	<input type="checkbox"/>
Applied herbicides (plant-killing chemicals) to the water	<input type="checkbox"/>	<input type="checkbox"/>
Used power cutters, rakes, trimmers, or other equipment	<input type="checkbox"/>	<input type="checkbox"/>
Planted or transplanted aquatic plants in front of my property	<input type="checkbox"/>	<input type="checkbox"/>
Used a floating, motorized harvesting machine	<input type="checkbox"/>	<input type="checkbox"/>
Used a Crary WeedRoller, Beach Groomer, or similar device	<input type="checkbox"/>	<input type="checkbox"/>
Removed floating-leafed plants for a boat channel	<input type="checkbox"/>	<input type="checkbox"/>
Removed floating-leafed plants for another reason	<input type="checkbox"/>	<input type="checkbox"/>
Removed emergent plants for a dock or boat channel	<input type="checkbox"/>	<input type="checkbox"/>

Q18. Approximately what percentage of your shoreline did you remove aquatic plants from in 2003? (Circle one.)

0% ≤5% 10% 20% 30% 40% 50% 60% 70% 80% 90% 95+%

Q19. In 2003, how large an area did you keep free of aquatic plants or remove aquatic plants from?

Please write the dimensions of the area.

Example:

<i>30 feet of shoreline</i>	<i>out to</i>	<i>40 feet from shore</i>
-----------------------------	---------------	---------------------------

feet of shoreline

out to

Feet from shore

Q20. Was someone hired to remove aquatic plants on your property in 2003?
(Please check one.)

- YES
- NO

→ **19a.If yes, how did they remove aquatic plants?** _____

Q21. In your household, who makes the decisions about removing aquatic plants? (Please check one.)

- SELF ONLY
- SPOUSE/PARTNER ONLY
- SELF AND SPOUSE/PARTNER TOGETHER
- SOMEONE ELSE

(Please describe: _____)

Q22. During 2004, I will keep an area free of aquatic plants about the same size as I did in 2003.

(Place an "X" in the space that best expresses what you believe).

Unlikely _____:_____ :_____ :_____ :_____ :_____ :_____ Likely
extremely quite slightly neither slightly quite extremely

Q23. Removing aquatic plants from the lake in front of your property each year is: (For each of the word pairs below, please place an "X" in the space that best expresses how you feel).

Bad _____:_____ :_____ :_____ :_____ :_____ :_____ Good
extremely quite slightly neither slightly quite extremely

Harmful _____:_____ :_____ :_____ :_____ :_____ :_____ Beneficial
extremely quite slightly neither slightly quite extremely

Q24. If everyone on your lake removed as many aquatic plants as you do, it would be: (For each of the word pairs below, please place an "X" in the space that best expresses how you feel).

Bad _____:_____ :_____ :_____ :_____ :_____ :_____ Good
extremely quite slightly neither slightly quite extremely

Harmful _____:_____ :_____ :_____ :_____ :_____ :_____ Beneficial
extremely quite slightly neither slightly quite extremely

Q25. Part 1: Listed below are some possible results of removing aquatic plants. Please read each result and indicate whether you think the result is likely or unlikely. (For each result below circle one response.)

My removing aquatic plants will...	Extremely Unlikely	Quite Unlikely	Slightly Unlikely	Neither	Slightly Likely	Quite Likely	Extremely Likely	Don't Know
Improve swimming conditions in my lake	1	2	3	4	5	6	7	dk
Get rid of exotic plants in my lake	1	2	3	4	5	6	7	dk
Improve the appearance of my lake's shoreline	1	2	3	4	5	6	7	dk
Cause no problems or negative effects in my lake	1	2	3	4	5	6	7	dk
Remove fish and wildlife habitat from my lake	1	2	3	4	5	6	7	dk
Decrease the natural appearance of my lake	1	2	3	4	5	6	7	dk
Improve fishing conditions in my lake	1	2	3	4	5	6	7	dk
Improve boating conditions on my lake	1	2	3	4	5	6	7	dk
Harm my lake's ecosystem	1	2	3	4	5	6	7	dk
Decrease my lake's water quality	1	2	3	4	5	6	7	dk
Cause erosion in my lake	1	2	3	4	5	6	7	dk
Remove native plants from my lake	1	2	3	4	5	6	7	dk

Q25. Part 2: Now we would like you to look over the same list of results and indicate whether you think the result is good or bad. (Circle one response for each).

Result	Extremely Bad	Quite Bad	Slightly Bad	Neither	Slightly Good	Quite Good	Extremely Good	Don't Know
Improve swimming conditions in my lake	1	2	3	4	5	6	7	dk
Get rid of exotic plants in my lake	1	2	3	4	5	6	7	dk
Cause no problems or negative effects in my lake	1	2	3	4	5	6	7	dk
Improve the appearance of my lake's shoreline	1	2	3	4	5	6	7	dk
Remove fish and wildlife habitat from my lake	1	2	3	4	5	6	7	dk
Decrease the natural appearance of my lake	1	2	3	4	5	6	7	dk
Improve fishing conditions in my lake	1	2	3	4	5	6	7	dk
Improve boating conditions on my lake	1	2	3	4	5	6	7	dk
Harm my lake's ecosystem	1	2	3	4	5	6	7	dk
Decrease water quality in my lake	1	2	3	4	5	6	7	dk
Cause erosion in my lake	1	2	3	4	5	6	7	dk
Remove native plants from my lake	1	2	3	4	5	6	7	dk

Q26. Most people who are important to me think I should remove aquatic plants from my lake. (Place an X in space that best expresses what you believe).

False _____ : _____ : _____ : _____ : _____ : _____ : _____ **True**
 extremely quite slightly neither slightly quite extremely

Q27. Part 1: Please indicate whether it is likely or unlikely that each group of people listed below would like you to remove aquatic plants from your lakeshore property. (Circle one for each).

Group	Extremely Unlikely	Quite Unlikely	Slightly Unlikely	Neither	Slightly Likely	Quite Likely	Extremely Likely	Don't Know
Neighbors/ Other lakeshore landowners	1	2	3	4	5	6	7	dk
Department of Natural Resources (DNR)	1	2	3	4	5	6	7	dk
Lake association	1	2	3	4	5	6	7	dk
Environmentalists	1	2	3	4	5	6	7	dk
Most anglers & hunters	1	2	3	4	5	6	7	dk
Most members of my family	1	2	3	4	5	6	7	dk
My close friends	1	2	3	4	5	6	7	dk

Q27. Part 2: Now we would like you to look over the same list of groups and indicate how likely or unlikely it is that you would do what the group thinks you should do. (Circle one response for each).

Generally speaking, I want to do what _____ think I should do	Extremely Unlikely	Quite Unlikely	Slightly Unlikely	Neither	Slightly Likely	Quite Likely	Extremely Likely	Don't Know
Neighbors/ Other lakeshore landowners	1	2	3	4	5	6	7	dk
Department of Natural Resources (DNR)	1	2	3	4	5	6	7	dk
Lake association	1	2	3	4	5	6	7	dk
Environmentalists	1	2	3	4	5	6	7	dk
Most anglers & hunters	1	2	3	4	5	6	7	dk
Most members of my family	1	2	3	4	5	6	7	dk
My close friends	1	2	3	4	5	6	7	dk

SECTION 2: General Lake Questions

Q28. Minnesota is home to about 150 types of aquatic plants, including a few types that are exotic species (not native to the state). The questions below address native aquatic plants (i.e. cattails, bulrushes, and water lilies) NOT non-native exotic species like Eurasian milfoil. Please indicate the degree to which you agree or disagree with each statement. (Please circle one response for each.)

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree	Don't Know
Native aquatic plants have no importance to me.	1	2	3	4	5	6	7	dk
Native aquatic plants are weeds and should be removed.	1	2	3	4	5	6	7	dk
Native aquatic plants are so important they should be completely left alone.	1	2	3	4	5	6	7	dk
Shoreline property owners should be allowed to control native aquatic plants as much as they wish to improve their use of the lake.	1	2	3	4	5	6	7	dk
Removal of native aquatic plants should be closely regulated.	1	2	3	4	5	6	7	dk
Native aquatic plants add to the scenic beauty of lakes.	1	2	3	4	5	6	7	dk
Native aquatic plants make the shoreline look messy.	1	2	3	4	5	6	7	dk
Lake shorelines are more beautiful when lawns are turf grass and mowed to the edge.	1	2	3	4	5	6	7	dk
Lake shorelines are more attractive when they have an abundance of native aquatic plants.	1	2	3	4	5	6	7	dk
Removal of native aquatic plants is essential to maintaining the water quality and water clarity of lakes.	1	2	3	4	5	6	7	dk
To improve the overall health of lakes, native aquatic plants should be removed.	1	2	3	4	5	6	7	dk
Native aquatic plants serve important functions that maintain the health of lakes.	1	2	3	4	5	6	7	dk
Abundant floating and emergent native aquatic plants are signs of an unhealthy lake.	1	2	3	4	5	6	7	dk

Q28. Continued.

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree	Don't Know
Conserving native aquatic plants increases the value of lakeshore property.	1	2	3	4	5	6	7	dk
Life in lakes depends on native aquatic plants.	1	2	3	4	5	6	7	dk
Native aquatic plants support the economic value of lakes for tourism and recreation.	1	2	3	4	5	6	7	dk
Removing native aquatic plants increases the value of lakeshore property.	1	2	3	4	5	6	7	dk
Native aquatic plants improve the quality of fishing.	1	2	3	4	5	6	7	dk
Native aquatic plants improve the quality of hunting for waterfowl and other wildlife.	1	2	3	4	5	6	7	dk

Q29. We are interested in your beliefs about native aquatic vegetation. Please rate the following items on the scale of definitely false to definitely true: (Please circle one response for each.)

	Definitely false	Probably false	Unsure	Probably true	Definitely true	Don't Know
Removal of native aquatic plants is harmful to lake health (water quality, biotic balance, etc.)	1	2	3	4	5	dk
Native aquatic plants are harmful to wildlife populations (waterfowl, wading birds, amphibians, etc.)	1	2	3	4	5	dk
Removal of native aquatic plants is harmful to fish populations	1	2	3	4	5	dk
Native aquatic plants decrease the aesthetic beauty of the lake	1	2	3	4	5	dk
Removal of native aquatic plants increases the role of the lake as a recreational area	1	2	3	4	5	dk
Native aquatic plants reduce the economic value of the lake in the long-term	1	2	3	4	5	dk
Removal of native aquatic plants increases shoreline erosion	1	2	3	4	5	dk
Native aquatic plants reduce water clarity and quality	1	2	3	4	5	dk

Q30. We are interested in your beliefs about responsibility for managing aquatic plants in your lake. For the following statements, please indicate the degree to which you agree or disagree with each statement. (Please circle one response for each).

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree	Don't Know
I feel a strong personal obligation to protect the health of the lake I live on.	1	2	3	4	5	6	7	dk
I feel a strong personal obligation to protect wildlife populations on the lake.	1	2	3	4	5	6	7	dk
Regardless of whether I remove aquatic plants or not, the quality of my lake will decline.	1	2	3	4	5	6	7	dk
There are so many other people removing aquatic vegetation from the lake that it really doesn't matter what I do.	1	2	3	4	5	6	7	dk
If everyone else is removing aquatic vegetation from the lake for swimming and boating, I'm harming myself if I do not.	1	2	3	4	5	6	7	dk
State agencies should be responsible for managing aquatic plants (not shoreline property owners).	1	2	3	4	5	6	7	dk
Lakeshore owners should have the right to alter the shoreline any way they want.	1	2	3	4	5	6	7	dk
Regulations for removing aquatic plants should be more restrictive.	1	2	3	4	5	6	7	dk
Development of lakeshore property is a greater threat to my lake than my removing aquatic plants.	1	2	3	4	5	6	7	dk
Lake associations should be responsible for managing aquatic plants (not shoreline property owners).	1	2	3	4	5	6	7	dk
Lakeshore owners have a responsibility to maintain the environmental quality of a lake.	1	2	3	4	5	6	7	dk

Q31. How knowledgeable are you about regulations concerning aquatic plant management in Minnesota? (Please check one.)

- Not at all knowledgeable
 Slightly knowledgeable
 Moderately knowledgeable
 Very knowledgeable
 Extremely knowledgeable

Q32. How would you describe current management regulations concerning native aquatic plants in Minnesota?

- Too restrictive About right Not restrictive enough Don't know

Q33. Are you a member of a lake association? (Please check one.)

- YES
 NO

Q34. Are you: (Please check one.)

- Male
 Female

Q35. What is your current age? _____

Q36. Which of the following best describes your race? (Check all that apply.)

- African American/black Asian Pacific Islander
 American Indian or Alaskan Native Caucasian/white Other

Q37. Do you consider yourself Hispanic/Latino/Spanish? (Check one.)

- Yes No

Q38. What is the highest level of education you have completed? (Check one.)

- Some high school Graduated from Vo-Tech school Some postgraduate study
 Graduated from high school or GED Some college Postgraduate degree(s)
 Some vocational or technical school Graduated from college

Q39. Including you, how many people belong to your household?

_____ Adults (18 or older)? _____ Children (0-12 yrs)? _____ Teenagers (13-17 yrs)?

Q40. How many grandchildren do you have (if any)? _____

Q41. What was your approximate total household income before taxes last year (2003)?

\$ _____

THANKS YOU FOR YOUR TIME AND EFFORT!

Please write any comments or questions you may have in the space below:

**Please return the completed survey in
the postage-paid return envelope.**

If you have any questions or concerns about this study please contact Dr. David
Fulton at 612-625-5256, dcfulton@umn.edu.

Appendix C: Prenotice Letter General Public Survey

May, 2004

«ID»

«LNAME» HOUSEHOLD
«ADDRESS»
«CITY», «ST» «ZIP»-«ZIPFOUR»

Dear «LNAME» household,

In a few days, your household will receive a questionnaire in the mail. The questionnaire is for an important research project being completed by the University of Minnesota and the Minnesota Department of Natural Resources.

The project concerns peoples' feelings about and use of Minnesota lakes and waterways.

I am writing to you in advance because we have found that many people like to know ahead of time that they will be contacted. The study is important because it will help the Minnesota Department of Natural Resources better understand how citizens feel about the lakes in the state.

In order for the results of this survey to accurately represent all adults in the state, **it is important that the questionnaire sent to your household be completed by the adult (18 years or older) who now lives there and has had the most recent birthday.**

Thank you for your time and consideration. It's only with the generous help of people like you that our research can be successful.

Sincerely,

David C. Fulton
Assistant Professor

Appendix D: First Mailing Cover Letter General Public Survey

June, 2004

«ID»

«LNAME» HOUSEHOLD
«ADDRESS»
«CITY», «ST» «ZIP»-«ZIPFOUR»

Dear «LNAME» household,

I am writing to ask for your help in a study about Minnesota lakes and waterways. This study is part of an effort to learn how Minnesotans feel about their lakes.

You are one of a small sample of Minnesota residents who were randomly selected to participate in this study. The quality of our results depends on responses from you and other survey recipients. In order for the results of this survey to accurately represent all adults in the state, **it is important that the questionnaire be completed by the adult (18 years or older) who now lives in your household and has had the most recent birthday.**

The results of this study will be used to help the Minnesota Department of Natural Resources (DNR) manage lakes and waterways. The DNR relies on public input to manage lands, waterways, plants, and wildlife. The DNR has contracted the University of Minnesota to conduct this survey.

Your answers on this survey are completely confidential and will be released only as summaries in which no individual's answers can be identified. When you return your completed questionnaire, your name will be deleted from the mailing list and never connected to your answers in any way. This survey is voluntary. However, you can help us by taking a few minutes to share your feelings and opinions about Minnesota lakes. If for some reason you prefer not to respond, please let us know by returning the blank questionnaire in the enclosed stamped envelope.

We hope you will take the time to fill out and return the enclosed questionnaire. Your answers will provide insight into public feelings about Minnesota lakes.

We would be happy to answer any questions you might have. Please call or e-mail Sue Schroeder, the project manager for the study at (612) 624-3479 or sas@umn.edu. Thank you in advance for taking the time to help the DNR manage our lakes. Your input is greatly appreciated!

Sincerely,

David C. Fulton, Ph.D.
Assistant Professor

Appendix E: Second Mailing Cover Letter General Public Survey

June, 2004

«ID»

«FNAME» «LNAME»

«ADDRESS»

«CITY», «ST» «ZIP»-«ZIPFOUR»

Dear «FNAME» «LNAME»,

About three weeks ago we sent your household a survey about Minnesota lakes. As of today, we have not received your completed questionnaire. We realize that you may not have had time to complete it. However, we would appreciate hearing from you. If you have recently returned your survey, please disregard this letter and accept our thanks for your input.

Your response to this survey will help direct future policies related to lakes in Minnesota. We are writing to you again because the study's usefulness depends on our receiving a questionnaire from each household.

Your name was drawn through a scientific sampling process in which every household with a listed Minnesota phone number had an equal chance of being selected. Your participation in the survey is voluntary. However, in order that the results of this survey accurately represent all adults in the state, it is important that the questionnaire be completed by the adult (18 years or older) who now lives in your household and has had the most recent birthday.

In the event that your questionnaire has been misplaced, a replacement is enclosed. We would be happy to answer any questions you have about the study. Please call or e-mail call the project manager for the study, Sue Schroeder, at (612) 624-3479 or sas@fw.umn.edu.

Sincerely,

David C. Fulton, Ph.D.
Assistant Professor

Appendix F: Postcard Reminder for General Public Survey

Dear Minnesotan,

You have received several mailings about a lake survey.

If you have already completed and returned the questionnaire, please accept our thanks! If you have not completed your survey, we hope you will complete it and mail it back.

Your participation is completely voluntary. If you do not wish to complete the survey, please return your blank survey in its business-reply envelope. Then we can remove your name from our mailing list.

If you have any questions about the survey please contact the project manager for the study, Sue Schroeder, at (612) 624-3479 or sas@umn.edu.

Sincerely,

David Fulton
Assistant Professor
Department of Fisheries, Wildlife and Conservation Biology

Appendix G: Nonresponse Questionnaire for General Public Survey

Minnesota Lakes Study—Follow-up Questionnaire

A. Recreating on Minnesota lakes

Q1. Please indicate how often you personally did each of the following activities in 2003 on lakes in Minnesota. (Please circle one response for each.)

	Not at all	1 or 2 times	3 to 5 times	6 to 10 times	11 to 20 times	21 or more times
Fishing of all types (boat, shore, dock, ice)	0	1	2	3	4	5
Pleasure boating, do not include fishing from a boat	0	1	2	3	4	5
Swimming/wading	0	1	2	3	4	5
Hunting waterfowl (ducks, geese)	0	1	2	3	4	5
Bird watching, viewing wildlife, studying nature	0	1	2	3	4	5
Enjoying lake scenery	0	1	2	3	4	5

B. Importance of Minnesota lakes

Q2. Please indicate how much you agree or disagree with the following statements. (Please circle one response for each.)

	Strongly disagree	Mildly disagree	Neutral	Mildly agree	Strongly agree	Don't know
Minnesota lakes are important to me because they offer many types of recreation.	1	2	3	4	5	9
Minnesota lakes are important to me because of their beauty and atmosphere.	1	2	3	4	5	9
Minnesota lakes are important to me because of their economic value to surrounding communities.	1	2	3	4	5	9
Minnesota lakes are important to me because they provide habitat and protection for wildlife and fish.	1	2	3	4	5	9

C. Lake health and aquatic plants.

Aquatic Plants: Minnesota is home to about 150 types of aquatic plants, including a few types that are exotic species not native to the state. Questions below address *native* aquatic plants like water lilies, wild rice, and cattails. NOT non-native exotic species like Eurasian water milfoil and curly-leaf pondweed.

Q3. Please rate your familiarity with issues related to native aquatic plants and lake ecology.

- Not at all familiar
- Slightly familiar
- Moderately familiar
- Very familiar
- Extremely familiar

Q4. For each word pair below, please place an “X” in the space that best expresses how you feel.

Removing native aquatic plants from lakes is:

Bad _____ : _____ : _____ : _____ : _____ : _____ : _____ **Good**
extremely quite slightly neither slightly quite extremely

Harmful _____ : _____ : _____ : _____ : _____ : _____ : _____ **Beneficial**
extremely quite slightly neither slightly quite extremely

Q5. How knowledgeable are you about regulations concerning aquatic plant management in Minnesota? (Please check one.)

- Not at all knowledgeable
- Slightly knowledgeable
- Moderately knowledgeable
- Very knowledgeable
- Extremely knowledgeable

Q6. How would you describe current management regulations concerning native aquatic plants in Minnesota? (Please check one.)

- Too restrictive
- About right
- Not restrictive enough
- Don't know

Q7. Is there a lake or lakes in Minnesota that you use most often?

- No. (If no, please skip to Part D, Q8.)
- Yes. (If yes, please answer Q7a.)



Q7a. If yes, do you own property on the lake?

- No.
- Yes.

D. Demographic information

Q8. In what year were you born?

_____ year

Q9. How many years have you lived in Minnesota?

_____ years

Q10. What is the highest level of education you have completed? (Check one.)

- Grade school
- Some high school
- High school diploma or GED
- Some vocational or technical school
- Vocational or technical school (associate's) degree
- Some college
- Four-year college (bachelor's) degree
- Some graduate school
- Graduate (master's or doctoral) degree

Q11. What is your gender?

- Male
- Female

Appendix H: Cover Letter for Nonresponse Questionnaire General Public Survey

October, 2004

«ID»

«FNAME» «LNAME»
«ADDRESS»
«CITY», «ST» «ZIP»-«ZIPFOUR»

Dear «FNAME» «LNAME»,

In June and July, we sent your household several mailings about a Minnesota lakes survey we are conducting for the Minnesota Department of Natural Resources.

We are sending you this final contact because we are concerned that people who did not respond to the survey may differ from those who responded. So, we have enclosed a one-page follow up survey that includes a few questions from our original survey, and a few demographic questions. Your response to this short questionnaire will assure that our survey results are as accurate as possible.

In order that the results of this survey accurately represent all adults in the state, we ask that the questionnaire be completed by the adult (18 years or older) who now lives in your household and has had the most recent birthday.

We appreciate your willingness to consider our request as we conclude this effort to better understand how Minnesota residents feel about the state's lakes. We would be happy to answer any questions you have about the study. Please call or e-mail the project manager for the study, Sue Schroeder, at (612) 624-3479 or sas@umn.edu.

Thank you very much.

Sincerely,

David C. Fulton, Ph.D.
Assistant Professor

Appendix I: First Mailing Cover Letter for Lakeshore Property Owner Survey

ID

DATE

FIRST LAST

STREET

CITY, STATE ZIP

Dear FIRST LAST,

Recently many Minnesotans have expressed concern about the condition of lakes throughout the state. In response to this concern, the Minnesota Department of Natural Resources (DNR) is reviewing its lake management strategies and exploring options for improvement. In particular, the DNR is interested in better understanding the opinions and perspectives of lakeshore landowners regarding management of native aquatic plants (such as cattails, bulrushes, and water lilies).

You have been identified as an individual who owns lakeshore property in Minnesota, and we need your help. Only a small number of landowners are being sent this survey, and it is important that each questionnaire is completed and returned for the results of the study to truly represent the thinking of lakeshore landowners. By completing your questionnaire you are contributing to the improvement of lake management in Minnesota. More importantly, your input will help the DNR focus on issues that affect landowners.

The survey should be completed by the adult in your household who makes the aquatic plant management decisions. If decisions are jointly made, the adult with the most recent birthday should complete the survey. Please be assured that the process is confidential and your participation is voluntary. The questionnaire has an identification number for mailing purposes only—this will allow us to check your name off the mailing list when your survey is returned. Your name will never be associated with this study and will not be distributed to anyone.

If you have any questions, please contact my research assistant, Michelle Payton. Please send letters to the address on the letterhead or call (612) 624-2228. Michelle can also be reached by e-mail at payt0008@umn.edu. I would like to say “thank you” in advance for taking the time to help the DNR manage our lakes. Your thoughts are greatly appreciated!

Sincerely,

David C. Fulton, Ph.D.

Assistant Unit Leader

Minnesota Cooperative Fish and Wildlife Research Unit

Appendix J: First Postcard for Lakeshore Property Owner Survey

May 17, 2004

You recently received a questionnaire from the University of Minnesota about aquatic plant management in Minnesota. **If you have already completed and returned the questionnaire, please accept our thanks!** If you have not, please complete and return it today. Your opinions are very important to us.

If you have any questions about the study or if you need to request a replacement survey, please call Michelle Payton at the University of Minnesota: (612) 624-2228 or email (payt0008@umn.edu).

Sincerely,

David Fulton, Assistant Unit Leader
Minnesota Cooperative Fish and Wildlife Research Unit
Aquatic Plant Management Study

Appendix K: Second Mailing Cover Letter for Lakeshore Property Owner Survey

Dear ,

In early May we sent a questionnaire to you concerning your opinions on aquatic plant management issues. At this time, we have not yet received a completed questionnaire from you. For this reason, we've sent you a replacement questionnaire and ask that you complete and return in to us if at all possible.

The DNR is interested in better understanding the opinions and perspectives of lakeshore landowners regarding management of native aquatic plants (such as cattails, bulrushes, and water lilies). You have been identified as an individual who owns lakeshore property in Minnesota, and we need your help. Only a small number of landowners are being sent this survey, and it is important that each questionnaire is completed and returned for the results of the study to truly represent the thinking of lakeshore landowners. By completing your questionnaire you are contributing to the improvement of lake management in Minnesota.

The survey should be completed by the adult in your household who makes the aquatic plant management decisions. If decisions are jointly made, the adult with the most recent birthday should complete the survey. Please be assured that the process is confidential and your participation is voluntary. The questionnaire has an identification number for mailing purposes only—this will allow us to check your name off the mailing list when your survey is returned. Your name will never be associated with this study and will not be distributed to anyone.

If you have any questions, please contact my research assistant, Michelle Payton. Please send letters to the address on the letterhead or call (612) 624-2228. Michelle can also be reached by e-mail at payt0008@umn.edu. I would like to say “thank you” in advance for taking the time to help the DNR manage our lakes. Your thoughts are greatly appreciated!

Sincerely,

David C. Fulton, Ph.D. Assistant Unit Leader Minnesota Cooperative Fish and Wildlife
Research Unit

Appendix L: Second Postcard for Lakeshore Property Owner Survey

June, 2004

You recently received a questionnaire from the University of Minnesota about aquatic plant management in Minnesota.

If you have already completed and returned the questionnaire, please accept our thanks!

If you have not, please complete and return it today. By completing your questionnaire you are contributing to the improvement of lake management in Minnesota. We greatly appreciate your help!

If you have any questions about the study or if you need to request a replacement survey, please call Michelle Payton at the University of Minnesota: (612) 624-2228 or email (payt0008@umn.edu).

Sincerely,

David Fulton, Assistant Unit Leader Minnesota Cooperative Fish and Wildlife Research Unit
Aquatic Plant Management Study

Appendix M: Nonresponse Questionnaire for Lakeshore Property Owner Survey

Q1. Do you own lakeshore property in Minnesota? (Please check one response.)

- YES
 NO (YOU DO NOT NEED TO FILL OUT THE REST OF THE SURVEY. PLEASE RETURN THE SURVEY IN THE POSTAGE PAID ENVELOPE. THANK YOU.)

Q2. How would you describe your use of your lakeshore property? (Please check one response.)

- Primary residence
 Seasonal or recreational property
 Rental property
 Business property
 Other _____

Q3. About how many days did you spend at your lakeshore property last year (2003)?

- 0 days 1 – 10 days 11 – 20 days 21 – 30 days 31+ days

Q4. Please indicate how often you personally did each of the following activities in 2003 on the lake where you own property. (For each statement below circle one response.)

	Not at all	1 or 2 times	3 to 5 times	6 to 10 times	11 to 20 times	21 or more times
Fishing of all types (boat, shore, dock, ice)	0	1	2	3	4	5
Pleasure boating (motorized or unmotorized) excluding fishing from a boat	0	1	2	3	4	5
Swimming/wading	0	1	2	3	4	5
Hunting waterfowl (ducks, geese)	0	1	2	3	4	5
Bird watching, viewing wildlife, studying nature	0	1	2	3	4	5
Enjoying lake scenery	0	1	2	3	4	5

Q5. Do you have aquatic plants in the lake next to your property?

- YES
 NO (SKIP TO QUESTION #10)

Q6. Do you try to keep an area in the lake next to your property free of aquatic plants on a year-to-year basis? (Please check one response.)

- YES
 NO → **Q6a. Please indicate why you do not remove aquatic plants from your lake/shoreline (Check all that apply):**
- Plants are few in number and removal is not necessary
 I do not want to remove plants
 There are laws and regulations that prevent me from removing the aquatic plants
 Other _____

(IF YOU DO NOT REMOVE AQUATIC PLANTS, SKIP TO QUESTION #10.)

Q7. What types of aquatic plants do you remove? (Check all that apply.)

- SUBMERGED PLANTS (such as wild celery and coontail)
- FLOATING-LEAF PLANTS (such as water lilies)
- EMERGENT PLANTS (such as bulrushes and cattails)

Q8. Please indicate your reason for removing aquatic plants on your property. (Check all that apply.)

- APPEARANCE/ TO MAKE SHORELINE LOOK BETTER
- SWIMMING
- BOATING
- FISHING
- OTHER _____

Q9. Approximately what percentage of your shoreline did you remove aquatic plants from in 2003? (Circle one.)

0% ≤5% 10% 20% 30% 40% 50% 60% 70% 80% 90% 95+%

Q10. Are you: (Please check one.)

- Male
- Female

Q11. What is your current age? _____

Q12. What is the highest level of education you have completed? (Check one.)

- | | | |
|--|--|--|
| <input type="checkbox"/> Some high school | <input type="checkbox"/> Graduated from Vo-Tech school | <input type="checkbox"/> Some postgraduate study |
| <input type="checkbox"/> Graduated from high school or GED | <input type="checkbox"/> Some college | <input type="checkbox"/> Postgraduate degree(s) |
| <input type="checkbox"/> Some vocational or technical school | <input type="checkbox"/> Graduated from college | |

Please complete this survey and return it in the postage-paid return envelope by AUGUST 10th.

**Minnesota Cooperative Fish and Wildlife Research Unit
University of Minnesota
1980 Folwell Avenue
St. Paul, Minnesota 55108**

Appendix N: Cover Letter for Nonresponse Questionnaire Lakeshore Property Owner Survey

July 2004

FIRST LAST
STREET
CITY, STATE ZIP

Dear FIRST LAST,

During the past few weeks we have sent you several mailings concerning your opinions on aquatic plant management issues. At this time, we have not yet received a completed questionnaire from you. For this reason, we ask that you complete this shortened questionnaire and return it by August 10th.

If you have already returned the original survey, thank you for your help! There is no need to respond to this letter.

The DNR is interested in better understanding the opinions and perspectives of lakeshore landowners regarding management of native aquatic plants (such as cattails, bulrushes, and water lilies). Only a small number of landowners are being sent this survey, and it is important that each questionnaire is completed and returned for the results of the study to truly represent the thinking of lakeshore landowners. By completing your questionnaire you are contributing to the improvement of lake management in Minnesota.

The survey should be completed by the adult in your household who makes the aquatic plant management decisions. If decisions are jointly made, the adult with the most recent birthday should complete the survey. Please be assured that the process is confidential and your participation is voluntary. The questionnaire has an identification number for mailing purposes only—this will allow us to check your name off the mailing list when your survey is returned. Your name will never be associated with this study and will not be distributed to anyone.

If you have any questions, please contact the project manager, Michelle Payton. Please send letters to the address on the letterhead or call (612) 624-2228. Michelle can also be reached by e-mail at payt0008@umn.edu. I would like to say “thank you” in advance for taking the time to help the DNR manage our lakes. Your thoughts are greatly appreciated!

Sincerely,

David C. Fulton, Ph.D.
Assistant Unit Leader
Minnesota Cooperative Fish and Wildlife Research Unit