

Recreational/Spiritual/Cultural Technical Work Team Report

Minnesota Water Sustainability Framework January 2011

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A. Key Findings

- Incorporating public values into water resource management, planning and policy formulation promotes ethical land use decisions, enables appropriate goal setting, helps managers assess public reaction to management activities, informs conflict resolution and allows managers to respond to the evolving social environment.
- Values related to water resource management decisions include sacredness, quality of experience, access, sustenance, and economic value.
- Information gaps related to values include insufficient information on Minnesotans' values associated with water, lack of mechanism for focusing on common values, impact of noises, data on desired access, information on boat size and impacts on waterways, data on wild rice trends, information on aquatic habitat protection and restoration, and data on economic costs and benefits of water-based recreation.
- Factors influencing values related to water resource management include pollution, climate change, multiple/competing uses, and invasive species.
- Information gaps related to factors influencing values include details on public involvement in decision making, full cost-benefit analysis of resource decisions, understanding of how to best disseminate science, knowledge of public awareness related to invasive species, and understanding of how to best deal with invasive species.
- Collateral factors relate to water-linked values include treaty rights, education/communication/advocacy, and policy.
- Information gaps related to collateral factors include insufficient understanding of the level of awareness and education and insufficient understanding related to conflict resolution in developing sustainable water policy.

B. Introduction

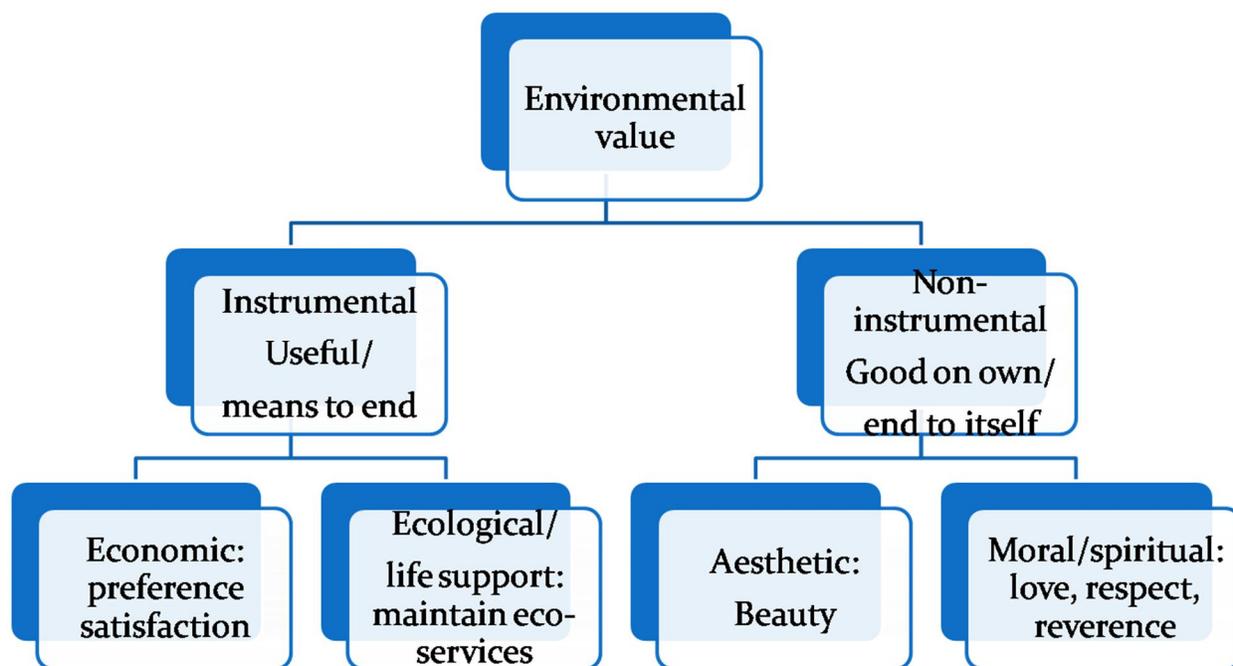
Water is a part of Minnesota's identity, roots, and spirit. A fundamental human desire is to be near water—clean water—and the natural resources it supports. This desire to connect with water drives tourism, community involvement and activism, and, to a great extent, our state pride or identity. Minnesota's businesses and enterprises also rely on clean water, but global economic forces place additional external pressure on Minnesota's resources, while not necessarily reflecting the environmental policies, priorities and values that have historically been supported.

One way to understand water is to consider how it is valued, for that will influence how it's used, managed and planned for. Objects themselves have no value unless an importance is attached to them. For example, a river is an ecosystem that affords opportunities to fish, swim, boat, canoe or kayak, grow wild rice, and shelter spawning fish, as well as has value just as it is. Our modern patterns of resource use, whether to simply put food on the table or for more recreational purposes, still fundamentally connect us to the water and remind us of the abundance water can provide. However, the values associated with any of these opportunities are socially constructed and may differ among stakeholders, geographic regions, places of residence, and socio-demographic characteristics (Bengston 1994; Steel, List, and Shindler 1994; Williams and Patterson 1999). Values are statement of a relationship, an estimation of worth of some object

to an individual or in particular situation (Andrews and Waits 1980, 71). The systematic incorporation of public values in natural resource management, planning and policy formulation is critical (Bengston 2000; Hetherington, Daniel and Brown 1994). Enhanced value comprehension is beneficial in that it promotes ethical land use decisions, enables appropriate goal establishment, assists managers in assessing public reaction to management practices, informs natural resource conflict resolution and allows managers to be responsive to the evolving social environment (Bengston 1994; Bengston, Fan, and Celarier 1999).

A variety of value frameworks exist. Bengston (2000) presented a framework (figure 1) that considers values as instrumental or non-instrumental: valued for what its use toward something else or valued for itself. Instrumental is further divided into economic and environmental areas while non-instrumental is further divided into spiritual as well as aesthetics. Non-instrumental values may also be identified as intangible values or those that which enrich the intellectual, psychological, emotional, spiritual, cultural and/or creative aspects of human existence and well being (World Conservation Union 2000). While other frameworks exist, we found this framework useful as a basis to understand how recreational/cultural/spiritual values relate to other areas important for water sustainability.

Figure 1. Value framework (Bengston, 2004)



C. Team Charge, Members, and Process

The recreational/spiritual/cultural technical work team was charged to develop a short white paper on issues of water use for recreational, spiritual, and cultural purposes in Minnesota for presentation to the Headwaters Council. The paper was directed to include: 1) knowledge about

recreational, spiritual, and cultural uses of water, 2) gaps in what we know, 3) and a statement of issues to address in the Minnesota Water Sustainability Framework.

Team members were selected to represent different areas of the recreation, spiritual, and cultural knowledge bases (Appendix A). Each member was expected to understand specific needs to water, correspond to different government and nonprofit agencies, connect to a diversity of people, as well as provide expertise and analysis in recreational, cultural, and/or spiritual aspects of water use.

The team met three times to discuss related issues, gaps, and needs. The meetings consisted of presentations from experts; research on water resources as applied to recreation, spiritual, and cultural use (Appendix B, Appendix C, Table 1); brainstorming and establishment of primary issues (Appendix D), and continual refining of issues through collaborative worksheets and discussion sessions. The team framed each issue to address additional protection, preservation, and enhancement of the quality and quantity of Minnesota's waters.

D. Issues, Needs, and Gaps

With more than 11,000 lakes larger than 10 acres in Minnesota, lakes are the hallmark public resource of the state (Anderson et al. 1999). In addition to lakes, Minnesota's 69,200 miles of water resources include nearly 600 miles of state or nationally designated wild and scenic rivers. Also, nearly 4,400 miles of water trails are managed for canoeing and kayaking. Wetlands also contribute to Minnesota's abundant water resources with approximately 870,000 wetlands covering 10 million acres (MNDNR 2009a). Minnesota's water resources are unique in that we are home to the headwaters of the Mississippi, the Minnesota River, Lake Superior and the Boundary Waters Canoe Area Wilderness.

These resources provide a wealth of water-based recreation opportunities and are significant sources of cultural and spiritual values (Appendix C, Table 1). The following pages highlight important elements of 13 issues identified by the recreational/cultural/spiritual team. We grouped these issues in three categories: values, factors influencing values and collateral factors. Values include sacredness, quality of experience, access, sustenance and economics. Factors influencing the values include pollution, climate change, multiple/competing uses, and invasive species. Finally, the collateral factors include treaty rights, education/communication/advocacy and policy.

1. Values

The team discussions resulted in five primary water-based values: sacredness, quality of experience, access, sustenance and economics. Each of these is briefly discussed, given the page constraints for the paper (about 10 pages). Following the discussion, we identify several information gaps within each area with respect to recreational, cultural and spiritual values for water in Minnesota.

- a. Sacredness.** Water is an essential part of every Minnesotan's cultural identity, in our modern uses and connections to water resources, and for cultures with an

ancient reliance on water for survival. When viewed through the lens of sacredness, it becomes intuitive that any alteration or destruction of aquatic habitat or fouling of waters by polluted runoff or discharges, is a desecration of this very essence of life. Across cultures and religions worldwide, water is central to stories of creation and healing, and can be a symbol of grace (for example, its use in Christian baptism) or purification (the sacred Hindu River Ganges purifies bathers of their sin). In other cultures, water is reflection or image of the soul. The identification of sources of rivers, streams, springs, or wells as sacred is an ancient paradigm; the sacred waters could ensure life, health and abundance (Witcombe).

Water has played a fundamental role in the history of human presence in this place. The Ojibwe migration story is linked to a series of visions which led the Ojibwe people westward through the St. Lawrence seaway and the Great Lakes to a number of stopping places, the last of which was revealed as the place where food grows on the water (Warren 2005). Manoomin, or wild rice, is considered a gift from the Creator; as much medicine as it is food for subsistence, and even today is a defining element of tribal culture. Traditional cultural and ceremonial practices such as sweat lodges require clean, pure water, and in turn the water provides healing. European settlement was initially linked to the abundance of furbearing mammals, and today's diverse immigrant cultures (Hmong, Somali, Hispanic) are also integrally linked to the resources that water provides, especially fish for consumption.

Water has also represented mobility, providing a highway for ancestral tribal cultures who moved from fishing camps to ricing camps to hunting grounds, following a seasonal pattern of resource use that took advantage of abundant resources while they were most readily available. Living near rivers, they developed an efficient means of transportation, building birch bark canoes constructed with the resources at hand. Today, canoes and kayaks are widely used as recreational transportation, and serve to connect people with water in a way that is largely unchanged from ancient times.

Our experiences on and near the water can shape a renewed reverence for all that it offers: physical and spiritual nourishment as well as aesthetic sustenance. Failure to honor the cultural and spiritual values of water will lead to the failure of political leaders and decision-makers to provide for a sustainable water future.

Information gaps: survey on Minnesotans' values associated with water; mechanism for focusing on the commonalities of values for water across demographic sectors

- b. Quality of experience.** Minnesotans value their water-based experiences and the quality of these experiences is subsequently important. A 2005 study revealed four-fifths of all Minnesotans claim outdoor recreation is at least "moderately important" in their life (MNDNR 2005). A 2007 survey of state park users

indicates this importance is higher among visitors, rising to 99 percent among more frequent visitors (MNDNR 2008).

Quality water-based recreation experiences are available in Minnesota across a range of settings, from wilderness to urban areas. These settings are combinations of desired physical environments, levels of management presence and social factors (USDA FS 1979; Auckerman, Haas, Lovejoy, et. al. 2004). Providing quality experience opportunities across these settings is an ongoing challenge as both population and natural resource-based recreation activities continue to develop and diversify (Manning 2000). Physical environments are challenged by visitor-induced impacts, development pressures and pollution. The management environment must continually evolve as new activities and technologies emerge. Similarly, the social environment gradually evolves as the population diversifies and ages and, as such, the management environment must respond. Retaining the range and quality of settings is essential.

Primary reasons for water-based recreation include: to experience nature, to escape the pressures of daily life, to experience quiet, to get or stay physically active, and to be with friends and family (Driver 1977; MNDNR 2008). The importance of recreation motivations differs by a variety of factors, including age and ethnicity. For example, a 2007 Minnesota state park visitor study revealed that older adults place greater emphasis on learning-related experiences (experience a sense of history, learn about nature), while young adults want more to achieve and be stimulated (taking risks, being active, feeling exhilarated, being adventurous; MNDNR 2007). National research indicates that outdoor recreation participation among 6- to 17 year-olds dropped 16.7 percent between 2006 and 2008 (The Outdoor Foundation 2009). In Minnesota, the Minnesota Department of Natural Resources (2008) reported that the steepest declines in outdoor recreation are for young adults (under 45) and their children. With regards to experiences by non-dominant cultures, limited data exist. Focus groups with Hmong in Minnesota revealed that harassment and racism were a problem in both Minnesota and Wisconsin outdoor recreation areas (Bengston, Schermann, Moua, et al. 2008). Similarly, Wilhelm Stanis, Schneider, Chavez, et al. (2009) found that non-dominant cultural groups in Minnesota and elsewhere felt significantly more unwelcome and fearful in the outdoors than the non-Hispanic whites.

Constraints to such recreation experiences must be recognized so that interest and participation in water-based recreation experience can continue. As reported elsewhere (Schneider, Davenport, and Oftedal 2010), Minnesota-based research documents that time and family obligations are among the most constraining factors across the Recreation Opportunity Spectrum (MNDNR 2008; Wilhelm Stanis, Schneider, Shinew et al. 2009; Schneider, Schroeder, and Schwaller 2010). Important to consider given Minnesota's changing demographics, constraints change through time, depending on an individual's life stage (Schneider, Schroeder and Schwaller, 2010; Green, Bowker, Johnson, et al. 2007). Although data on non-

white Minnesotans is wanting, focus groups with a variety of racial/ethnic groups in Oregon revealed a lack of information and transportation particularly problematic for Asians and Hispanics (Burns, Covelli, and Graefe 2008).

Of particular relevance to quality of water-based experiences are the viewscapes and soundscapes. Given the importance of being in nature and a natural environment for recreation experiences, scenic quality is essential. Scenic quality includes the appearance of both the land and air. Though visual resource management guidelines exist (e.g., USDA Forest Service and Minnesota Department of Natural Resources), they are unevenly applied on the ground. While quiet environments have long been appealing for recreation and essential for various cultural/spiritual ceremonies, systematic research into natural sounds is only in its initial phases (e.g. Manning, Newman, Fristrup, et al. 2009). When recreationists are unable or prevented from attaining the recreation experiences they seek, the quality of that experience is compromised. Similarly, unwanted (or unnatural?) noise can impact cultural/spiritual ceremonies.

- (1) **Information gaps identified.** Value of quality experiences, differences in perceived recreation quality among racially/ethnically diverse groups, longitudinal understanding of quality of recreation experiences, impact of various noises to experiences (recreation and cultural/spiritual).
- c. **Access.** Minnesota may be the Land of 10,000 Lakes, but it is a state in which not all residents have desired access to water resources to meet their recreational, spiritual and cultural needs. We are a state with laws granting rights of access to public waters for its citizens, but are increasingly finding those public waters blocked by expanding private shoreline development. Certain ethnic communities describe unwelcoming experiences in places with public waters, thereby depriving them of equitable access. Older citizens and people with disabilities may be restricted in their chances to experience Minnesota's land of water. And our aquatic-dependent wildlife is increasingly experiencing degradation of water quality that they require for survival. Further, recreation management suggests that a range of water-recreation experience opportunities be provided to address the breadth of desires and potential benefits (Driver, Brown and Peterson 1991; Driver 2009). As public water access increases, an area moves closer to the urban end of the recreation opportunity spectrum. Beyond human access, a number of species are water-dependent and need access to high quality water bodies for their survival.

Under Minnesota's statutes, landowners can exclude anyone from their land. However, Minnesota statutes also state that everyone has riparian rights when it comes to using public waters. It is possible for a body of water to be entirely closed to public use because the shoreline is entirely owned by private individuals. Minnesota's public water access program was founded in the early 1940s in order to acquire, develop and maintain public water access sites to preserve opportunities for water recreation activities (N. Stewart, pers. comm. 2010). Human-related

access issues encompass not only actual physical access, but also the perception of access. Some public perception is that access to Minnesota water bodies, lakes in particular, is decreasing. The perception is driven by increasing development along lake and river fronts. Notably, additional access points are being developed at the state level (E. Wrede, pers. comm. 2010).

Further, there may be a perception that access is reserved for the dominant population (in 2010, non-Hispanic White). The limited data available indicate non-dominant groups feel more unwelcome than the dominant groups (Bengston, Schermann, Moua, et al. 2008; Wilhelm Stanis, Schneider, Chavez, et al. 2009). Alienation of non-dominant groups from recreation and conservation areas poses a problem in that all non-dominant populations are expected to see growth across Minnesota through 2035 (Minnesota Department of Administration (MDOA) 2009). Specifically, the Latino population is projected to increase almost 200 percent, growing from an estimated 196,300 residents in 2005 to 551,600 in 2035. Similarly, the African American and Asian/Pacific Islander communities will double in size by 2035. Therefore, as the non-dominant population is expected to increase and because non-dominant segments describe feeling unwelcome a concern is that problems with access to water resources may increase over time rather than the problem improving.

Accessibility typically changes as we age and, according to the 2007 Minnesota state demographer (MDOA 2007), Minnesota's population older than 65 will increase 125 percent through 2035. As such, attention to consideration for universal design or minimally access following the Americans with Disabilities Act (1990) will be necessary, balanced with the challenge of infrastructure and maintenance costs. According to the Department of Natural Resources' *2004 Outdoor Recreation Participation Survey of Minnesotan*, rural residents, people older than 65, and non-dominant populations tend to spend less time recreating outdoors than others. On a related note, economic imbalance among citizens translates into inequity in access: to political leaders, to clean water, to recreational, spiritual and cultural resources. Managers should consider both real and perceived accessibility of water resources for diverse populations.

Importantly, costs are incurred to provide physical access (e.g., the estimated infrastructure costs for an accessible fishing pier). Similarly, a full benefits-cost analysis of water-based projects would include the impact of access to the terrestrial and aquatic life. Complicating public access are the individual private landowners rights who may view providing public access as both a legal liability and nuisance. Similarly, access to sacred sites can be viewed as a commercialization and a conflict among those who find them sacred (Salk and Schneider 2010).

- (1) **Information gaps.** Data on access by desired recreation experience across water bodies (swimming, boating by type, etc.); status of accessible facilities

for water bodies per Americans with Disabilities Act; state and regional data on boat size (motor size; horsepower) and impacts of various horsepower on shoreline vegetation, as well as fuel, GAO and National Boat Manufacturing; boat size use on lakes; regulations for water/management/habitat.

- d. Sustenance: wild rice, wildlife, and waterfowl.** This issue is intended to encompass the range of what waters provide to sustain life and health (nutrition or nourishment), as well as that which sustains the mind or spirit (our recreational, cultural, and spiritual reliance upon waters).

Wild rice was historically abundant throughout the Upper Midwest, especially in Minnesota, Wisconsin and Michigan's Upper Peninsula. Today, the range of natural stands of wild rice is diminishing, due to multiple and cumulative effects of altered hydrology, pollution, invasive species, and now global climate change. The significance of wild rice (ōmanoominō in Ojibwe) to the Ojibwe cannot be overstated; it is considered a gift from the Creator, and is essential to their traditional, spiritual, cultural, medicinal, social, educational, recreational, and economic well-being. It can provide seasonal income to tribal and state harvesters, in addition to its nutritional subsistence value.

Declining stands of natural wild rice have been linked to altered hydrology, such as extensive ditching that drains a rice bed, or inundation from dams or industrial discharges that overwhelms the shallow-rooted plants. The effects of global climate change are predicted to include changes to natural hydrology, and will likely aggravate existing impacts of development and land use changes on the unique and very specific hydrologic conditions that wild rice requires. Aquatic invasive species, both plant and animal, can reduce vigor, stand density and rice production, and outcompete this annual grass for available habitat. Declining wild rice has also been linked to industrial discharges high in sulfate concentrations, such as from mine pit dewatering or seepage from tailings basins. Tribal harvesters and state harvesters of natural wild rice have grave concerns about impacts from genetically modified wild rice, and have worked with the legislature to reach agreement on how best to protect natural wild rice while enabling the cultivated wild rice industry to improve production.

While the significance of protecting and restoring our state grain is clear, natural wild rice beds also represent important, complex aquatic ecosystems, and support an abundance of wildlife and waterfowl. Where healthy stands of wild rice persist, so do diverse animal and plant communities; the presence or absence of natural wild rice can be an indicator of broader ecosystem health.

Although wild rice remains a significant cultural, subsistence, and economic resource for Minnesota, there are few regulatory protections in place, and little application or enforcement of the single existing state water quality criterion for sulfate that is intended to protect waters used for the production of wild rice. Ensuring the sustainability of this invaluable aquatic resource will require research

and funding for effective restoration and habitat protection, and may also suggest the need for broader regulatory protections.

Every spring, Minnesota celebrates its shared cultural heritage with the Minnesota fishing opener. A smaller segment of our community feels just as passionate about opening day of the duck season. Our modern patterns of resource use, whether to simply put food on the table or for more recreational purposes, still fundamentally connect us to the water and remind us of the abundance it can provide.

Widespread fish consumption advisories throughout the state are a grim reminder that legacy and ongoing pollution sources prevent us from fully enjoying the demonstrated health benefits of eating fish. There are over 1800 waterbodies (lakes and streams) in Minnesota with listed water quality impairments, and nearly 1300 of those impairments are for mercury in fish tissue, or mercury concentrations in the water column. Mercury is the most widespread fish contaminant, and mercury emission reductions defined in the statewide mercury Total Maximum Daily Load (the state's plan for reducing this impairment) if achieved, are not sufficient to result in lifting these consumption advisories on many of the state's waters. Restrictions on the amount of fish that can be safely eaten also represent a degradation of treaty-protected rights to harvest and consume fish from usual and customary places.

Management of these resources is, by definition, a complex process that must address sometimes conflicting goals (i.e., managing fisheries for certain species or size classes, or managing for healthy ecosystems while facing pressure from interest groups to favor certain resources over others). But sustaining recreational and traditional fishing and hunting in Minnesota undoubtedly depends upon maintaining or improving water quality and aquatic habitat.

- (1) **Information gaps.** data on trends in wild rice presence and productivity, information on implementation of the statewide mercury TMDL, information on aquatic habitat protection and restoration.
- e. **Economic value.** Water has multiple economic values for recreation and cultural areas. Water-based outdoor recreation experiences are part of Minnesota's \$11 billion tourism industry (Explore Minnesota Tourism 2009) and significant outdoor recreation industry. Estimates for fishing suggest that fishing in Minnesota (residents and nonresidents) accounted for \$2,725,366 in expenditures whereas wildlife viewing accounted for \$698,889 of total expenditures in 2006 (U.S. Department of the Interior and U.S. Census Bureau 2007).

Communities and regions benefit economically from water-based outdoor recreation as visitors eat, shop, and stay in gateway communities. Entire communities and regions have transitioned into tourism destinations based on water-recreation, such as Ely and Brainerd. Property values are enhanced by the

presence of water, especially when good water quality is preserved (Krysel et al 2003). Further, the contribution water makes to the overall quality of life likely influences personal and organizational decisions to relocate. Sustaining Minnesota's reputation as a premier recreation destination fundamentally depends upon maintaining and improving water quality.

Among the indirect economic benefits derived from water-based outdoor experiences, health-related economic benefits are important. Obese individuals spend around 36% more on health services than the general population (Strum 2002). In Minnesota, estimates based on historical spending estimates indicates a 7.5% increase in health care costs between 2008 and 2018 with the public share about 42% of the \$78.5 billion projected costs (Gillespie 2010). As of 2007, only 48.8% of the U.S. population met the recommended levels of physical activity, defined as at least 30 minutes of moderate intensity physical activity five or more days of the week or 20 minutes of vigorous intensity physical activity three or more days per week (Centers for Disease Control and Prevention [CDC] 2008b). In the U.S., 63.0% of adults are either overweight or obese (CDC 2008a), and poor diet and physical inactivity may be responsible for as many as 365,000 U.S. deaths annually (Mokdad, Marks, Stroup, et al. 2004). In Minnesota, about 60% are overweight and 17% obese (Minnesota Department of Health 2010). As recreation is an important vehicle for physical activity, which, in turn, reduces obesity, attention to increasing participation is essential.

- (1) **Information gaps.** Local water-based recreation and tourism expenditure estimates; cost-benefit analyses of water-development decisions; health care cost reduction from participation in water-based recreation.

2. Factors Influencing Recreational/Cultural/Spiritual Values

The team identified at least three factors that influence the values related to water: pollution, climate change, multiple/competing uses, and invasive species.

- a. **Pollution.** Pollution is contrary to any common definition of sustainability. Protection and enhancement of water quality is a cross-cultural value, important to all. Water quality directly affects wildlife and other resources (moose, fish, waterfowl, wild rice, etc.), and plays a key role in public health, both directly (drinking water supply, recreational contact, spread of disease), and indirectly (food/dietary sources, safety).

The environmental manifestations of water pollution are enormous and wide-ranging: degraded fisheries (due to mercury and other bioaccumulative contaminants), degraded waterfowl and wildlife habitat, increased human health risks and exposures, harmful and ecologically disruptive algal blooms, sedimentation, thermal pollution (affecting coldwater-dependent species). Sources can be as diverse as air deposition of global pollutants, or as direct as

contamination from latrines along lakeshores. Pollution not only adversely impacts the aesthetics of a water body (e.g., for swimming), but also human health and safety through contact or ingestion.

Funding required to fully address impaired waters in Minnesota greatly exceeds available resources, and our best available technologies for monitoring new or emerging contaminants of concern are not yet sufficient to accurately define the risks to the public or lead to specific regulatory controls. But beyond monitoring and treatment technology needs, Minnesota must also cultivate a stronger sense of public stewardship of water resources. New, improved tools for economic valuation, such as a cost-benefit analysis that clarifies the public's cost liabilities related to pollution vs. the value of providing for full recreational, cultural and spiritual uses, may help guide future decisions.

- b. Climate change.** Global climate change will overlay additional, unpredictable and cumulative impacts to Minnesota's water resources, beyond those impacts we can currently observe and measure: pollution, sedimentation, eutrophication, land use changes, habitat loss and degradation. Some of our most precious and unique resources, such as Lake Superior and the BWCAW, are likely to experience the earliest and most devastating impacts of climate change, according to current predictive models (Kling et al 2003).

Climate change will likely impact both water quality and water quantity, in turn affecting our spatial and temporal recreational uses of water resources and creating adverse implications for tourism-dependent communities. Recreational impacts may include shortened seasons (i.e., less ice cover, earlier ice-out), flashier precipitation events and/or prolonged dry periods that translate into greater uncertainty for recreation service providers. There may be a general human population migration northward in pursuit of a more favorable climate, leading to added pressures on water resources and recreational infrastructure. The impacts to traditional recreational opportunities (fishing, boating, canoeing/kayaking, swimming) may include increasing constraints on timing/seasons, access, and quality of experience.

Impacts to water quality and quantity will also affect cultural water uses, such as wild rice harvest and subsistence fish consumption. Altered hydrology and warmer mean water temperatures will shift biological assemblages, both plant and animal species, and may profoundly change the resources available to future generations. For instance, Minnesota's moose population is already exhibiting high mortality rates that can be linked to stress from a warming climate: greater susceptibility to parasites and disease, greater energy expense to keep cool (Lange 2007). The warmer temperatures may exacerbate mercury contamination in fish tissue, and accelerate introductions of invasive species that are now temperature-limited.

Climate change is a global problem, yet there are few, if any, global solutions at hand. Our waters and associated natural resources are finite, but there are limited approaches for mitigation and adaptation. There is still uncertainty, whether real or

perceived, about the science of climate change, and that uncertainty restrains socially and politically acceptable strategies and actions.

- c. **Multiple use/competing use.** Like any valued resource, abundant competition for the use exists. The general public, industry, various stakeholders and government have water use priorities that do not always coincide. To illustrate this, one framework identifies several sources of conflict: visitors, managers, community officials and residents, and government (Little and Noe 1984). These sources interact in multi-dimensional ways, leading to an interactive framework with nine levels of conflict and opportunities for conflict management (Figure 2).

Of particular concern for recreational and cultural/spiritual areas are the challenges of multi-jurisdictional areas where authority is not always clear, decisions where full cost-benefit analysis is not readily available or accessible, and when decisions are not informed by the best available science. Decisions of particular interest include those related to water flows, development, and cultural/spiritual issues.

- (1) **Information gaps.** Details on public involvement and actual public ideas integration into decision-making process, full cost-benefit analysis of resource decisions, and ways to more effectively and quickly disseminate the best available science.

- d. **Invasive species.** Invasive species cause ecological or economic problems to a local area and beyond. Specific to water, invasive species impact the perceived quality of water, its accessibility for recreational activities, the health and productivity of native species, and the accessibility for cultural practices.

Given the sacredness of water environments and the reliance of indigenous cultures on wild rice, invasive species pose an imminent and ominous challenge. Invasive species are spread unintentionally by boats, animals, vehicles, produce, footwear, and clothing (Minnesota Department of Natural Resources 2009b). Similarly, given the extent of outdoor recreation dependent on water, the interaction between recreationists and water-based invasive species is significant.

Many educational and regulatory approaches to invasive species have been taken or are in process. However, a 2009 literature review revealed that educational campaigns related to invasive species appear very limited and evaluation of these educational campaigns is non-existent in the published literature (Schuweiler and Schneider).

- (1) **Information gaps.** Level of education/awareness about invasive species and helpful/harmful actions across individuals and organizations, appropriateness of funding levels to problem magnitude, treatment effectiveness, full cost-benefit analysis of impact and treatments, specific vectors, regulation effectiveness.

3. *Collateral Factors*

The team identified three factors related to water-based values that involve action with the capacity to influence water's recreation/cultural/spiritual aspects. In some cases these are actions to take; in other instances, they represent existing actions and influences upon the other issues we present. These three factors are treaty rights, education/communication/advocacy and policy.

- a. **Treaty rights.** The rights to hunt, fish and gather within lands that were ceded by Native American tribes to the U.S. government are retained in perpetuity for the physical, cultural and spiritual well-being of tribal members, but these federally protected usufructuary rights are not fully recognized by state government, nor widely understood or respected by the general public. Yet, fundamentally, the ability to exercise those treaty rights is completely dependent upon clean water and healthy ecosystems: the very basis of sustainable resource use.

The lack of consideration for treaty rights leads to potential conflicts between policies and regulations, and the ability to continue traditional spiritual and cultural practices. When treaty rights are not honored or exercised, it limits a traditional, cultural way of life and results in a loss of traditional practices; as traditions are erased, assimilation is imposed. Subsistence living and maintaining cultural practices are how modern tribal members preserve links to their ancestral generations, and still engage in contemporary society; for example, harvesting, finishing and marketing wild rice is a source of seasonal income to many tribal members today.

Traditional oral teaching is to "take only what you need and leave the rest." This ideology is essentially a sociocultural control for protecting the resource for future use; modern harvest limits and management activities are more of a political construct. Traditional harvests represented much more than simply the acquisition of food; they were seasonal gatherings that also included socializing and visiting. The Native American view of the world may be described as continuous stewardship of the resources provided by the Creator, rather than an ownership perspective that precludes others' ability to use the resource. This model or perspective would serve us well to emulate, if we are committed to a sustainable water future for Minnesota.

- b. **Education/communication/advocacy.** Education about water is essential for a variety of reasons, as detailed by the education technical work team (Education Technical Team 2010). Unique and important aspects related to recreation and cultural/spiritual areas include: environmental education curriculums, the relationship between awareness and action, and recreational education campaigns for low impact use.

While Minnesota provides a formal environmental education curriculum for fifth graders, having just one required point of environmental education contact poses a

serious concern and impediment to life-long appreciation for and understanding of the environment as a whole and water, specifically. As such, the lack of awareness about water and its multiple values impedes desired behaviors toward water conservation and quality retention.

Specific to outdoor recreation education, a longstanding program of low-impact behavior exists and is used for state and federal agencies: leave no trace. This program of seven principles encourages low-impact behaviors to maintain or improve resources (Leave No Trace 2010). Curricula such as these focus specifically on target groups and can be considered for further expansion.

- (1) **Information needs.** Level of awareness and education among a variety of individual and organization entities, educational program effectiveness and impact on specific behaviors.
- c. **Policy.** Revising Minnesota's water resources policies to provide for sustainability will be challenging. Existing policies and regulations are not consistently enforced, and critical sectors or industries are not always subject to regulations or source controls. In fact, there often appears to be a disconnect between water policy and standards and their implementation (e.g., lack of effluent limits or monitoring requirements established in permits; ongoing variances issued for noncompliant facilities; transfer of waters between watersheds and aquifers).

Regulatory agencies are faced with considering multicultural priorities, and there are multiple jurisdictions (local, state, federal, tribal) with varying regulatory authorities and capacities. Current economic and cost-benefit analyses do not accurately or adequately account for the benefits of clean water or related natural resource values, or even attempt to quantify the spiritual or cultural values of water.

Economic imbalance among citizens translates into inequity in access: to political leaders, to clean water, to recreational, spiritual and cultural resources. Those with financial wealth and political influence tend not to represent the full spectrum of perspectives, but are often able to advance their individual, not statewide interests.

Policy provides the necessary framework for the regulations that minimize and/or mitigate impacts to water resources. Citizen input to the creation of legislation is critical for ensuring that comprehensive and inclusive values and perspectives are recognized. If there is not sufficient, effective policy in place to protect Minnesota's internationally important water resources, global pressure may drive the development paradigm of a "resource colony". Again, the future sustainability of Minnesota's waters requires that we acknowledge and respect the fact that our precious waters are a limited resource.

Water resources policies are challenging because existing policies aren't always enforced, important sectors/issues are not regulated in the first place; they present the need to accomplish difficult multi-cultural and jurisdictional management, and

accurate cost-benefit analysis is not traditionally inclusive of clean water/natural resource values. As a policy issue, it is the responsibility of legislature to protect our resources for the future ó we received this Legacy from our forebears and are called on to preserve them for those who will follow.

- (1) **Information needs.** Process or mechanism for conflict resolution in developing sustainable water policy.

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Appendix A. Recreational/Cultural/Spiritual Technical Work Team Members

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Lark Weller, National Park Service, Mississippi National River Recreation Area
Erik Wrede, Minnesota Department of Natural Resources

Appendix B. Annotated Bibliography

<p>Anderson, K. A., T. J. Kelly, R. M. Sushak, C. A. Hagley, D. A. Jensen, and G. M. Kreag. 1999. <i>Summary report on public perceptions of the impacts, use, and future of Minnesota lakes: Results of the 1998 Minnesota lakes survey</i>. A joint publication by the University of Minnesota Sea Grant Program (SH 1) and Minnesota Department of Natural Resources. Office of Management and Budget Services. St. Paul, MN.</p>			
<p>Best Addresses: Recreation</p>			
What/Why	How	Results/Findings	Implications
<p>Lakes are a hallmark resource in MN, they are a public resources owned by all Minnesotans. Management programs of lake resources require public support to be successful. This survey allowed public input to affect design and implementation of management programs</p>	<p>Survey designed by MN DNR and the MN Sea Grant Program to assess public perceptions of the conditions of MN lakes.</p>	<p>Lakes are valued in a variety of ways including: recreation, aesthetics, ecological, economic, future use, and simple existence (intrinsic). 77% reported engaging an activity enhanced by presence of a lake in the last year. The majority of lake users rate lake conditions as "pretty good" with the condition staying about the same. Those who reported changes in condition indicated conditions were getting worse. Riparian landowners were most likely to report worsening conditions. Worsening conditions were attributed to runoff from lawns, fields and urban surfaces.</p>	<p>More than 50% support and fewer than 10% oppose the following solutions to lake problems: Education, management, regulation/enforcement, and incentives.</p>

Bengston, D. N. 2000. Environmental values related to fish and wildlife lands. <i>Human Dimensions of Natural Resource Management: Emerging issues and practical application</i> . A Cooperative Park Studies Program. University of Minnesota, Department of Forest Resources. St. Paul, MN.			
Best Addresses: recreational/spiritual/cultural			
What/Why	How	Results/Findings	Implications
The purpose of this paper is to provide an overview of key concepts related to environmental values and their importance for public land managers. The paper defines environmental values and discusses their relationship to environmental attitudes and beliefs; this includes presentation of a broad system for classifying environmental values and understanding distinct ways in which people value nature. The conclusion discusses some recommendations for future research related to environmental values.	<p>Overview of key concepts related to environmental values and their importance for public land managers.</p> <p>Classification and framework models</p>	<p>Managing public lands in ways that are responsive to the changing social environment is one of the biggest challenges facing public land managers today.</p> <p>Most people value the environment and public lands both instrumentally (economic/utilitarian; life support/ecological) and non-instrumentally (aesthetic; moral/spiritual).</p> <p>Classification systems of environmental values could be expanded to include much more detail and specific types of values that fall under the main categories.</p> <p>The communities served by public natural resource management agencies are becoming</p>	<p>Need research that is place-specific (research is general and not assigned to a particular area). Creative/cost-effective ways to gather information are needed; more research on differences in environmental values, preferences for recreation activities, acceptability of management actions among different ethnic and minority communities. Research is needed to understand</p> <p>the value differences between long-time residents and new residents in communities that have experienced significant change to minimize conflict, facilitate communication between these groups, and build bridges of understanding; research needed on collaborative planning</p>

		more racially and ethnically diverse.	and decision-making processes.
Bengston, D. N. 2004. Listening to neglected voices: American Indian Perspectives on Natural Resource Management. <i>Journal of Forestry</i> 102, no.1: 48-52.			
Best Addresses: historical/cultural			
What/Why	How	Results/Findings	Implications
This study provides an example of an alternative approach to traditional social science research methods (focus groups, surveys, interviews) that are often ineffective when used in the context of racial/ethnic minority populations. The study analyzed news articles about resource management issues written by American Indians and published in Indian newspapers (as expressed in their own words) and finds ways in which their attitudes differ from those of many other Americans ó particularly the importance of spiritual values and the validity of traditional knowledge as a first step to bridge understanding and communication	Document review ðOpen codingð method of qualitative content analysis	Several themes emerged from database of American Indian news stories: Major themes: traditional knowledge, spiritual values, environmental justice and racism, ecosystem management. Additional themes: The link between tribal sovereignty and management of natural resources, the importance of subsistence uses, and economic benefits and values. Central themes and perspectives discussed in American Indian news stories about natural resource management are ignored or rarely mentioned in the mainstream public discourse. The news stories indicate a deep lack of trust in	The approach of analyzing perspectives on natural resource management in a community's own words can be used to further understanding and knowledge about the attitudes of other minority populations; approach and data described in this article offer a useful tool for building understanding between forest managers and stakeholders that can be applied to other underserved or underrepresented communities. This study may give forest policymakers and managers a new perspective into the attitudes, beliefs, and values of a particular

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across diverse worldviews.		land management agencies. Cooperative approaches that involve development of trusting relationships between forestry professionals and stakeholder communities are a step toward improving communication and building understanding.	minority group.
Bengston, D. N., M. Schermann, M. Moua, and T. T. Lee. 2008. Listening to neglected voices: Hmong and public lands in Minnesota and Wisconsin. <i>Society and Natural Resources</i> 21, no. 10: 876-890.			
Best Addresses: historical/cultural			
What/Why	How	Results/Findings	Implications
Much research has grouped cultural groups into large categories such as "Asian." This study specifically examined Hmong American community and its members' experiences, needs, perspectives and concerns related to "public lands." The goal of this research is to make managers more responsive to Hmong American needs and to better	Focus groups and literature reviews	A distinctive aspect of Hmong culture is a deep connection with the natural world. However, there is paucity of literature document Hmong relationships with the natural environment and resources. In focus groups, participants revealed deep and personal connections with nature and public lands. Hunting, fishing and gathering were highly valued by many. Public lands provide a way to preserve Hmong culture, participating in traditional activities on public lands honors cultural traditions and preserves time-honored traditions. Problems and concerns	This paper contributes to deeper understanding of Hmong Americans in relations to public lands. Hmong cannot be grouped with all other Asians, because their culture and relationships with natural resources and the environment are unique. Intercultural and interracial tensions exist on public lands, and managers need ongoing efforts to address these complex concerns and

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serve the needs of that community.		also exist, and harassment is major issue, and evidence of environmental racism also emerged.	conflicts.
Burmil, S., T. C. Daniel, and J. D. Hetherington. 1999. Human values and perceptions of water in arid landscapes. <i>Landscape and Urban Planning</i> , 44, no. 2/3: 99-109.			
Best Addresses: Spiritual			
What/Why	How	Results/Findings	Implications
Human perceptions, meanings, and values associated with water on the landscape are diverse; at the foundation, water is essential for life. This review explored human perceptions, meanings, values associated with water ó esp focused on biophysical, spiritual, cognitive, artistic/design, perceptual, and legal/technical views of water in arid landscapes.	Document review	<p>Biophysical perspectives- Water is colorless, but it can reflect many colors different landscapes. Water shapes and is shaped by the landscape. Shape and movement of water take many forms.</p> <p>Philosophical and spiritual perspectives ó water makes the difference between life and death. Water symbols- reflective mirror, cleanliness and purity, healing, youth, holy water, renewal.</p> <p>Water and environmental meanings ó water influences sense of place and shapes the environment (esp in arid landscapes). Water areas are refuges; land/water juxtaposition has aesthetic value.</p> <p>Water in landscape design - water is used to influence landscape aesthetics and garden design. Different colors of water have different impacts.</p> <p>Human perceptions and preferences ó water is consistently preferred for aesthetics and for recreation. Water has beneficial</p>	A more holistic management approach to water and water resources is warranted. Human environmental experiences with water affect individual wellbeing and social welfare. Management decisions should not be based on technical standards alone, but must acknowledge the emotional, aesthetic, and spiritual values associated with water.

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		<p>psychophysiological effects and can be restorative to health. Water contributes to scenic beauty perceptions. Water is of great importance to outdoor recreation.</p> <p>Legal and technical perspectives ó most definitions and regulations focus on direct use and consumption of water, failing to take into account the rich and diverse role water plays in the landscape and the special meanings water has for people</p>	
<p>Chhabra, Deepak. 2010. Back to the past: a sub-segment of Generation Y's perceptions of authenticity. <i>Journal of Sustainable Tourism</i> 18, no. 6: 793-809.</p>			
<p>Best Addresses: Recreation/Cultural</p>			
<p>What/Why</p>	<p>How</p>	<p>Results/Findings</p>	<p>Implications</p>

<p>This study challenges the issue of previous authenticity examinations on heritage tourism and cultural heritage management by focusing on a distinct market segment based on age and life experience. The paper looks at the perceptions of authenticity of a sub-segment of Generation Y (university students in the United States) and investigates if preferred authenticity ideologies have an influence on their decisions to become a heritage tourist. It aims to study how university students conceptualize the meaning of authenticity in heritage tourism and what are the predictors that inspire this unique study population to be heritage tourists.</p>	<p>Literature review Survey</p>	<p>In respect to age, 55.1% were 20 years or less and 32% were between 21 and 25 years of age. Approximately 47.3% were males and 60% were Whites. As expected, the majority of this generation was single and 69% were employed.</p> <p>Also, most of the respondents were undergraduates. Average party size during heritage trips was 5.6 and average number of days visited was 10.3. Approximately 37% had been a heritage tourist before at some point in their life and heritage interest was the main reason for visiting the heritage site.</p>	<p>The desire for object authenticity can translate into a powerful force for the advocacy of conservation causes and offer opportunities to cultural heritage management to reinforce or reintroduce cultural roots, thereby reviving pride in discontinued or forgotten traditions.</p> <p>Managerial knowledge gained can be employed to enhance the sustainable development of regions offering heritage products and to the conservation and interpretation of heritage sites.</p>
<p>Groenfeldt, D. 2006. Multifunctionality of agricultural water: Looking beyond food production and ecosystem services. <i>Irrigation and Drainage</i> 55, no. 1: 73-83.</p>			
<p>Best Addresses: Historical</p>			
<p>What/Why</p>	<p>How</p>	<p>Results/Findings</p>	<p>Implications</p>

<p>Assessment of the multi-functional features of agriculture and specifically the multi-functional features of ag water. Seeks to illustrate the full assemblage of ag water potential benefits when viewed from the multi-functional perspective.</p>	<p>Narrative report focused on case study of paddy cultivation in Monsoon Asia</p>	<p>Agricultural water provides multiple impacts and benefits; food production is the biggest one. Other functions include (environmental, social, cultural) plus the multifunctional uses of the water itself: drinking, bathing, washing, recreation, aesthetic, spiritual, cultural, etc.</p>	<p>• Making wise decisions about water allocations to agriculture depends upon a full accounting of the multiple functions of agricultural water. • Market economics is not sufficient to make decisions; externalities and the multiple functions of water must be considered.</p>
<p>Matzarakis, Andreas, et al. 2010. Bioclimatic maps for tourism purposes. <i>Physics & Chemistry of the Earth - Parts A/B/C</i> 35, no. 1/2: 57-62.</p>			
<p>Best Addresses: Recreation</p>			
<p>What/Why</p>	<p>How</p>	<p>Results/Findings</p>	<p>Implications</p>
<p>This paper is part of the research project ACTIVE (Austria Climate Tourism Initiative) and aims to develop basic bioclimatological material for the Austrian spa and wellness resorts. The current study addresses the thermal complex of human bioclimate using a method that represents our current state of knowledge on thermophysiology of humans. The developed bioclimatic diagrams, (based on standard climatic parameters ó air</p>	<p>Evaluation Methods: Human Energy Balance equation Predicted Mean Vote (PMV)</p>	<p>Humans are influenced by radiant fluxes, air temperature, water vapor pressure, and wind velocity, (all part of human energy balance equation) as are physiological parameters (weight, size, activity, sex, age) and clothing. Humans react to their environment by adjusting skin temperature and sweat rate to keep the core temperature constant (stationary condition). Transferring the human adaption from outdoor to indoor conditions (with a clothing insulation of 0.9 clo, metabolic rate of 80 W, water vapor pressure of 12 hPa, wind velocity of 0.1 m/s, and provided that the indoor air temperature</p>	<p>The mapping of modern bioclimatic indices, based on the human energy balance, presents an adequate method for the quantification of the human thermal bioclimate and can be applied to different situations and requirements. The need of bioclimatic information for wellness tourism and also for tourism and recreation in general is very high. The climate and its effects on recreation and tourism are economic factors, which have to</p>

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<p>temperature, air humidity, wind speed and cloud cover) are a valuable tool for managers and tourist of wellness resorts and other tourism attractions.</p>	<p>Physiologically Equivalent Temperature (PET) Mode</p> <p>GIS mapping and bioclimatic diagrams</p>	<p>corresponds to the mean radiant temperature) results in a PET value that is equivalent to the respective air temperature (°C); fulfils the energy balance equation under outdoor conditions.</p> <p>The importance for human well-being and health depends on the close linkage between thermal regulation and circulation.</p>	<p>be taken into account when planning and forecasting the tourism development of a region. Extreme events like heat waves and other negative effects that climate can have on tourists must be quantified in a human-biometeorological manner to accomplish a better protection of human health and an improved quality of domestic and international tourism.</p>
<p>McAvoy, L. 2002. American Indians, place meanings and the Old/New west. <i>Journal of Leisure Research</i> 34, no. 4: 383-397.</p>			
<p>Best Addresses: Recreation</p>			
<p>What/Why</p>	<p>How</p>	<p>Results/Findings</p>	<p>Implications</p>

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<p>The American west, with its many national parks and protected lands, is associated with a sense of place and place meaning for people who live there and people who visit for recreation and tourism. However, the meaning and sense of place is often very different for American Indians than it is for White Americans. The purpose of this paper is to examine sense of place and place meaning for American Indians in the West.</p>	<p>Document review</p>	<p>Landscapes represent socially constructed systems of meaning (Patterson & Williams, 1999) and differences in culture have impacts on that construction. Contrasts in place meaning can result in controversy and conflict in recreation and tourism.</p>	<p>Scholars in recreation, parks, and tourism have a role to play as translators to identify and translate the different place meanings that different people and different cultural groups hold about the American West.</p>
<p>McAvoy, L., D. McDonald, and M. Carlson. 2003. American Indian/First nation place attachment to park lands: The case of the Nuu-Chah-Nulth of British Columbia. <i>Journal of Park and Recreation Administration</i> 21, no. 2: 84-104.</p>			
<p>Best addresses: Spiritual</p>			
<p>What/Why</p>	<p>How</p>	<p>Results/Findings</p>	<p>Implications</p>

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<p>Case study to describe the Nuu-Chah-Nulth relationships with parks and protected areas surrounding their communities and with the government agencies that control these lands. This case study addresses the need to better understand place meaning and place attachment from the perspective of multiple cultures and indigenous people.</p>	<p>Case study approach. Document review and key informant interviews.</p>	<p>Place creates a sense of historical, spiritual and cultural significance for the group. Cultural practices are connected to the land ó example, initiating children to the cold water of the sea. Sense of place provides culturally symbolic meanings that are culturally relevant. Cultural traditions informed the management and use of natural resources ó but government management of land and resources has changed this today. Traditional resource management connects spiritual and cultural meanings.</p>	<p>First Nation people hold deep emotional, cultural, and symbolic place attachment and place meaning with areas that were their traditional lands, but now are public lands. The cultural/symbolic meaning had the highest priority in describing sense of place. Park managers need insights into the place meanings held by First Nations people and other cultures. Greater understanding of diverse place attachment will lead to policies that are acceptable to more people and cultures, and can minimize costly contested terrain conflicts.</p>
<p>Minnesota Department of Health. Environmental Health Division. Environmental Surveillance and Assessment Section. 2009. <i>Building on Existing Knowledge: Updating Minnesota's Fish Consumption Educational Outreach for the Hmong Community</i>. By Eshenaur, T., P. McCann, and Berglund in cooperation with U.S. Environmental Protection Agency (EPA) and the U.S. Agency for Toxic Substances and Disease Registry (ATSDR). M. E Great Lakes Consortium Fish Guidelines Outreach Project. Department of Public Health, Environmental Health. St. Paul-Ramsey County, MN.</p>			
<p>Best Addresses: Cultural</p>			
<p>What/Why</p>	<p>How</p>	<p>Results/Findings</p>	<p>Implications</p>
<p>The discovery of perfluorochemicals in metro area</p>	<p>Survey</p>	<p>The goal was to learn about fish and health in Hmong culture, the kinds and amounts of fish</p>	<p>This paper contributes to deeper understanding of Hmong population</p>

<p>lakes in 2006 and 2007 raised citizen concern about the potential for disproportionate exposure to minority populations that fish the metro area lakes. Hmong are subsistence fishers and would be a vulnerable population that is not reached by normal outreach efforts. This concern prompted the Minnesota Department of Health to reconsider fish consumption advisory outreach and education for limited English proficiency populations, particularly the Hmong. The goal of this project was to gain information about fish eating practices and communication preferences of the Hmong community living in Ramsey County. This research is expected to establish consistent fish consumption advisories and risk communication efforts.</p>	<p>Focus Groups/Listening Sessions</p> <p>Mental Models Mapping</p> <p>Needs Assessment and Field Testing</p> <p>Participatory Rural Appraisal</p> <p>Pre/Post Tests for Fish and Mercury Video</p> <p>DVD Script Talk</p>	<p>consumed, and preferred ways of receiving information about fish.</p> <p>Existing Concepts Fishing is a fun family activity. Fish is good for your heart and health. In America, we are experiencing different diseases than our elders did in Thailand and Laos.</p> <p>We need to make changes in lifestyle and habits to prevent disease and maintain health. Children and pregnant women are a special population that requires special care.</p> <p>Misconceptions Lakes and rivers that are rural or look clean have fish that are healthy to eat. Lakes and rivers that are urban or look dirty have fish that are not healthy to eat. Removing fat while cleaning/cooking will remove contaminants including mercury.</p>	<p>in relation to cultural traditions in water use. These outreach efforts may help subpopulations understand the benefits and costs of fishing lakes in the metropolitan areas, and to be aware of contaminants like mercury as much as possible. Eating fish plays an important role in preventing diseases here in America and good for babies and young children. Eat a variety of locally caught fish. (not just white bass)</p>
<p>Minnesota Department of Natural Resources (MNDNR). 2001. <i>Survey of sea kayak owners in Minnesota: Kayaking the North Shore of Lake Superior study</i>. Prepared by the Office of Management and Budget Resources. St. Paul, MN.</p>			

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Best Addresses: Recreational			
What/Why	How	Results/Findings	Implications
Purpose of this study was to understand how much the Lake Superior Water Trail and associated kayaking facilities are being used, what sea kayakers are looking for in terms of facilities/ services and experiences on the Trail, and what barriers exist to the further use of Lake Superior by sea kayakers.	Mail survey to MN registered sea kayak owners and field counts of sea kayak campgrounds and access facilities along the Lake Superior Water Trail.	MN has 3238 registered sea kayaks, and the typical sea kayak is used 20 times per year. The North Shore of Lake Superior is the destination for 14 % of all sea kayaking outings, and the Water Trail is the destination for 5% of all outings. The typical water trail outing is 10 miles in length. Experience of getting away to natural peaceful setting, enjoying nature, physical fitness, connect to nature, challenge and risk, spiritual renewal in undeveloped area.	Sea Kayakers are sensitive to increased development along the north shore of they seek a more primitive experience and want kayak campgrounds to be more remote. Lack of knowledge about the area was reported as a constraint only by people who did not frequently paddle there. Frequent paddlers felt that crowding and full campsites were constraints or interfering issues.
Minnesota Department of Natural Resources (MNDNR). 2004. <i>Recreational boating study of the Mississippi River, Pools 4 to 9, Summer 2003.</i> Prepared by the Office of Management and Budget Resources. St. Paul, MN.			
Best Addresses: Recreational			
What/Why	How	Results/Findings	Implications

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<p>The broad intent of the study was to collect the information needed to more effectively understand and manage the River for recreational boating. The study was designed to answer a wide variety of questions, from the amount and origin of boating, to the experiences boaters had on the water, to safety concerns of boaters, to facility preferences and future needs of boaters.</p>	<p>Boater use data and survey data from boaters.</p>	<p>Pool 4 to 9 on the River has nearly 130,000 acres of boating water and use exceeds 1 million boat-hours during the summer period. The 2 sides of the river generate equal boating use.</p> <p>Boaters on the MS river have depth of experience, boaters have 25 years median experience on the river and 75% have been boating the river more than 10 years. The primary activity is fishing, followed by boat riding and fishing. Nearly all boaters are very satisfied or satisfied. Less than 4% were dissatisfied. Crowding and behavior of other boaters limits satisfaction.</p>	<p>The results of this study have implications for better understanding of the river and improved management for the MS river as a recreational boating resource.</p>
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<p>Minnesota Department of Natural Resources (MNDNR). 2005. <i>Minnesota canoe and kayak study</i>. Prepared by the Office of Management and Budget Resources. St. Paul, MN.</p>
<p>Best Addresses: Recreational</p>

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What/Why	How	Results/Findings	Implications
<p>Boating is one of the largest recreational activities in MN (second only to walking as outdoor pursuit) and 1 in 5 boats is a non-motorized canoe or kayak. To gain a better understanding of canoeing and kayaking in Minnesota, the DNR conducted this study, which has two major goals. One goal is to provide a general understanding of the nature and direction of canoeing/kayaking in Minnesota, and the second goal is to provide information to help guide Minnesota's Canoe and Boating Route (CBR) Program.</p>	<p>State wide survey to MN canoe and kayak owners asked paddlers about aspects of their paddling activity, including reasons for canoeing/kayaking, barriers to river paddling, opinions on potential paddling-related management actions, evaluations of the importance and performance of river facilities and services for paddlers, and boating-safety issues.</p>	<p>Overall boat registrations have increased 50% since 1980, and canoe and kayaks have relatively increased as well (20% of total boat registration). Majority of canoeing and kayaking occurs on lakes. Results indicate that canoeing/kayaking rates are stable (despite increase in registered craft).</p>	<p>Majority of kayakers and canoe have no awareness of the CBR program, although two thirds of survey respondents used a CBR river sometime in the past. Results from this study have implications for management actions on CBR rivers.</p>

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Minnesota Department of Natural Resources (MNDNR). 2009a. *Boating in North Central Minnesota: Status in 2008 and Trends Since 1985*. Prepared by the Office of Management and Budget Resources. <http://www.dnr.state.mn.us/index.html> (accessed February 24, 2010).

Best Addresses: Recreational

What/Why	How	Results/Findings	Implications
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<p>Study Objectives:</p> <p>Measure the total number of boats on lakes and tracing those boats to their means of access;</p> <p>Describe the boater's experience on the water, including trip satisfaction, on-water problems, and crowding;</p> <p>Describe the boater's perception of public accesses, including quality, use problems, improvements needed, and desire for additional access;</p> <p>Describe the boater's view of boating safety and enforcement concerns;</p> <p>Describe the characteristics of the boating trip, including boating activities, travel distance, and boating equipment; and</p> <p>Describe the characteristics of boaters.</p>	<p>Methods included a combination of aerial observations and boater surveys with public access users, commercial access users and riparian residents.</p> <p>This study is an update of 2 previous studies from 1985 and 1998.</p>	<p>North Central region has 280,000 acres of boating water on 205 lakes. 81% of lakes are accessible through public access. Mille Lacs is the largest and most frequently used lake in this region.</p> <p>Boaters seek experience = relaxing with family/friends in an enjoyable and quiet natural setting that is away from crowds. At least half of boaters are "very satisfied with their experience."</p> <p>Fishing and boat riding are the 2 main activities.</p>	<p>This study provides an assessment of the boater's experience from the boater's perspective. The study also documents the number of boats on lakes and their means of access - this is important information to be publically documented and increases equitable access opportunities. Finally this study provides information to guide public access programs by assessing the use of these facilities and evaluating their quality through boater surveys. Many levels of government - local, county, state and federal - manage free public accesses in the north central region.</p>
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Minnesota Department of Natural Resources (MNDNR). 2010. <i>Invasive Species of Aquatic Plants and Wild Animals in Minnesota: Annual Report for 2009</i> . Invasive Species Program. St. Paul, MN.			
Best Addresses: Recreation / Historical (<i>Economic</i>)			
What/Why	How	Results/Findings	Implications
Invasive species are a threat to MN's natural resources and the local economies that depend on those natural resources.	Invasive Species Program (est 1991) to implement actions to monitor and manage invasive species of aquatic plants and animals. Goals include 1) prevent introduction of new invasive species, 2) prevent spread of invasive species, 3) reduce impacts caused by invasive species.	Regional updates for 2009 report. "MN State Management Plan for Invasive Species" was completed in 2009. It provides a framework for multiple agencies' cooperation and coordination to address invasive species issues.	The completion of the state management plan should lead to new funds to address invasive species concerns.

<p>Pahl-Wostl, C., D. Tabara, R. Bouwen, M. Craps, A. Dewulf, and E. Mostert. 2008. The importance of social learning and culture for sustainable water management. <i>Ecological Economics</i> 64, no. 3: 484-495.</p>			
<p>Best Addresses: Historical</p>			
What/Why	How	Results/Findings	Implications
<p>Water resources management is undergoing a paradigm shift. The new approach is integrated and begins to take into account the importance of cultural and social learning for water resources management. This paper addresses: how do cultural differences influence social learning? And how can social learning lead to a transformation of culture?</p>	<p>Document review, case study (Spain and The Netherlands river basin management)</p>	<p>Radical changes in resource management require social learning. Water resources are transboundary, and the technical/scientific management regime is not sufficient. The water resource must be adaptively managed with a more holistic approach across national boundaries, thus social learning and cultural change come into play.</p>	<p>New participatory and adaptive water resource management techniques will require cultural changes in society in order to be accepted and implemented.</p>

Riddington, G., D. McArthur, T. Harrison, and H. Gibson. 2010. Assessing the Economic Impact of Wind Farms on Tourism in Scotland: GIS, Surveys and Policy Outcomes. <i>International Journal of Tourism Research</i> 12: 2376252.			
Best Addresses: Recreational			
What/Why	How	Results/Findings	Implications
<p>This study was concerned with making a quantitative assessment of the economic impact of wind farms on tourism and the environment in Scotland. The research hoped to help resolve the debate on impact to inform government policy on planning for renewable energy.</p> <p>The paper discusses in detail two methods used to assist decision makers.</p>	<p>GIS assessment</p> <p>Internet Survey: Willingness to Pay</p>	<p>The research found a very small but significant negative economic impact and, on the basis of the survey information, suggests ways of minimizing this impact.</p> <p>At the national level, the estimated impact is so small (<0.1% of employment) that it would suggest little reason for changing either renewable strategy or tourism targets. At the local level the impact is sufficiently large to suggest specific action might be required to ensure that impact is minimized.</p> <p>Both GIS modeling and internet surveying were found to be extremely useful and, it is suggested, both should become standard tools for the tourism researcher.</p>	<p>The paper has shown how GIS can be used to solve problems that would not have been remotely possible 10 years ago, and how a CV survey can be conducted quickly, effectively and cheaply using the internet. The study strongly recommends that those concerned with tourism impact develop skills in both methods.</p>

Riediker, M., and H. S. Koren. 2004. The importance of environmental exposures to physical, mental and social well-being. <i>International Journal of Hygiene and Environmental Health</i> 207, no. 3: 193-201.			
Best Addresses: Spiritual (Health & wellbeing)			
What/Why	How	Results/Findings	Implications
WHO defines health as physical, social, and mental well-being. This paper reviews examples of wellbeing and compares the policies of 2 wealthy countries (US and Switzerland).	Case study comparison among 3 examples of wellbeing ó noise and silence, aesthetics and recreation, and lifestyle. For each example, policies are compared between US and Switzerland.	Noise is a disturbance than can negatively impact wellbeing. The US has few regulations or attention to reduce noise; the Swiss regulations are strict and prohibit trucks and planes from traveling at night. Aesthetics and recreation ó US and Swiss policies to achieve clean water is similar (emphasis on water that is safe for drinking & swimming), while policy for protection of scenic views is quite different. Lifestyle ó in the US the lifestyle preference for individual freedom has lead to suburban sprawl and an auto dependent nation. Land use and development in Switzerland has been more strictly regulate and public transportation and communities have been emphasized.	This paper can provide some benchmarks and guidance as developing countries identify indicators for wellbeing and implement policies for natural resource management. Considering wellbeing when developing management strategies can be beneficial to people and to the environment.

<p>Schroeder, S., and D. C. Fulton. 2006. <i>Fishing in the Neighborhood: A Study of Recreation and Fishing Participation in the Twin Cities Metropolitan Area</i>. University of Minnesota, Minnesota Department of Fisheries, Wildlife, and Conservation Biology. Cooperative Fish and Wildlife Research Unit. St. Paul, MN.</p>			
<p>Best Addresses: Recreation</p>			
What/Why	How	Results/Findings	Implications
<p>The purpose of this study was to explore Twin Cities residents' motivations for, constraints to, and participation in outdoor recreation and fishing. Perceptions of, attitudes about and norms related to fishing were also investigated.</p>	<p>Survey to 2100 Twin Cities residents</p>	<p>63% had participated in fishing at some point, and one fourth indicated fishing was a favorite activity. Appreciation and health benefits of outdoor activities were the most motivational factors. Fishing perceived as good means for social benefits and nature appreciation. Most frequent constraints were work/family commitments and cost. People felt the Twin Cities "has good fishing places" but disagreed that they would eat fish from Twin cities lakes and rivers. 57% indicated they would fish again in MN in the future.</p>	<p>With aging, immigration, and busy modern lifestyles fishing participation in Minnesota in the near future may slightly decrease, although respondents reported they are more likely to continue to participate in the near future.</p>

Stein, T. V., C. B. Denny, and L. A. Pennisi. 2003. Using visitors' motivations to provide learning opportunities at water-based recreation areas. <i>Journal of Sustainable Tourism</i> 11, no. 5: 404-425.			
Best Addresses: Recreation			
What/Why	How	Results/Findings	Implications
<p>Education plays an important role in ecotourism & learning is consistently rated as one of the most important motivations in nature-based tourism. The purpose of this study was to identify the relationship between nature-based recreationists' motivations for learning and their preferences for recreation services and facilities.</p> <p>1) ID experience sought by visitors to fresh-water springs in central Florida 2) describe role of knowledge-based learning in motivations 3) the recreation opportunities (i.e., facilities and services) that provide learning benefit opportunities for</p>	<p>Mail questionnaire and onsite interviews with day and overnight visitors at Ocala National Forest water-based recreation sites in FL.</p>	<p>Description of experiences sought at the water-based recreation sites. 1) Motivations for water-based recreation visits included: being with friends and family, enjoying natural scenery, Escape and relaxation, Learning ranked 4th, and finally improve well-being and new experience.</p> <p>2) Learner groups rate the overall exp more highly, and non learners are more motivated by being with friends & family and relaxing.</p> <p>3) although many visited with families, children's facilities were not highly rated. Many enjoy facilities such as visitor center and museum, but prefer to learn independently w/o a guide or interpretation. Finally the</p>	<p>Giving visitors the chance to explore the natural environment w/o learning facilities can provide valuable independent learning opportunities. People take different approaches to learning.</p> <p>Planning based implications are described for the different learner and non learner groups.</p>

all visitors.		“Learner” did not necessarily rate educational facilities more highly.	
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Taylor, B. 2007. Focus introduction: Aquatic nature religion. *Journal of the American Academy of Religion* 75, no. 4: 863-874.

Best Addresses: Spiritual

What/Why	How	Results/Findings	Implications
Recreation practices express, evoke and reinforce religious perceptions. “Aquatic nature religion” explores the religious aspects of water recreation of surfing, fly fishing, and white water kayaking. It asks the question where does religion end and phenomena that is not religious begin?	Three case studies	<p>“Nature religion” involves these dimensions: 1) belief that nature is sacred and worthy of reverent care 2) feelings of belonging and connection to the earth.</p> <p>Note: need to get the 3 essays, have only the introduction here.</p>	Characteristics commonly associated with religion are present in many outdoor recreation and water adventure sports. “Aquatic Nature Religion” provides a framework to analyze the beliefs and practices of individuals engaging in a “religious” recreation practice.

Toupal, R. S., M. N. Zedeno, R. W. Stoffle, and P. Barabe. 2001. Cultural landscapes and ethnographic cartographies: Scandinavian-American and American Indian knowledge of the land. <i>Environmental Science and Policy</i> 4, no. 4/5: 171-184.			
Best Addresses: Historical (cultural)			
What/Why	How	Results/Findings	Implications
Ethnographic study to provide information to assist federal land managers to identify and protect cultural landscapes.	GIS mapping and ethnography were used to collect, analyze and present data to provide a cultural landscape approach to land management.	Ethnographic landscape research complements other research methods. Cultural landscapes were described for 2 regions, including Scandinavian American fishing culture in Isle Royal National Park.	Seeks to incorporate cultural aspects into natural resource management. Makes explicit the relationships between people and resources. The findings from studies like this that combine ethnography with GIS mapping can be helpful resources to facilitate co-management and partnerships of natural resources.

U.S. Department of Agriculture. Forest Service. 1997. <i>The SOS-A spiritual opportunity spectrum: Theory and implications of spirit of place for ecosystem management</i> . By Crystal, L., and C. Harris. Southern Research Station. Helen, GA.			
Best Addresses: Spiritual			
What/Why	How	Results/Findings	Implications
Ecosystem management is a holistic approach that requires consideration of people's attachment to place and the spiritual and therapeutic values associated with natural environments. The Spiritual Opportunity Spectrum is being proposed as a tool to assess and classify these values.	Document review & Development of the SOS as tool to measure some intangible experiences in recreation and natural environment	Spiritual expression and experiences are often found in nature through engaging in outdoor recreation. The ROS does not do enough to capture and assess the spiritual aspect of the recreation experience; an additional tool is needed.	Natural amenity resources provide a greater good than simply "to have fun or play." These areas have important spiritual values and connect individual to people, environment, and cultural traditions. The SOS can provide a systematic assessment of feelings and values associated with a place.

U.S. Department of Agriculture. Forest Service. 2001. A comparison of recreation conflict factors for different water-based recreation activities. By Wang, C. P., and C. P. Dawson. In Kyle, Gerard, comp., ed., Proceedings of the 2000 Northeastern Recreation Research Symposium. Gen. Tech. Rep. NE-276. Northeastern Research Station. Newton Square, PA.

Best Addresses: Recreation

What/Why	How	Results/Findings	Implications
Personal watercraft are becoming more popular, and also more controversial. User group and activity influence recreation conflict but often there is overlap among groups and activities. "The purpose of this paper is a comparison of conflict factors across groups with different activity combinations."	Mail survey to six study sites representing each user group and combination of user groups.	"Asymmetric conflicts" were observed among motor boaters, landowners and personal watercraft users. Landowners were bothered by both other groups, motor boaters were bothered by PWC but not by landowners, PWC users were not bothered by either. These finding support previous research documenting asymmetrical conflicts.	Place dependence and sensitivity to conflict are also factors that influence conflict. Education is key to reducing conflict.

U.S. Department of Agriculture. Forest Service. 2001. *Factors influencing experience quality: Comparing user groups and place attachment at the St. Croix international waterway*. By Daigle, J. J., J. Hannon, and C. Stacey. Science and stewardship to protect and sustain wilderness values: Seventh World Wilderness Congress. Port Elizabeth, S. Africa. Rocky Mountain Research Station. Ogden, UT.

Best Addresses: Recreation			
What/Why	How	Results/Findings	Implications
<p>Purpose: to examine experience quality domains and the relationship of these domains to different user groups and their place attachment to the St. Croix International Waterway.</p> <p>First ID indicators that define the experience quality for visitors.</p> <p>Second ID users' relationship to resource in terms of place attachment, with a focus on the diversity of visitor to the St Croix Waterway.</p>	<p>Mail survey with random sampling</p>	<p>The four factors most influencing experience were (1) careless or disrespectful resource impacts, (2) management activities, (3) solitude, and (4) resource impact/development.</p> <p>User groups were divided into 5 categories (upper lakes, lower lakes, upper river, full river, and extended trippers) 6 factors influencing experience generally similar among the groups (litter and tree damage). Solitude factor was different among groups.</p> <p>Emotional/symbolic as well as functional attachment were measured for the groups. Levels of attachment were significantly different among the groups. Experiencing solitude and natural conditions are part of what makes this area unique.</p>	<p>A diverse group of visitors comes to the area seeking a variety of experiences. Managers must plan and prepare for the diverse variables including different primary activity, length of stay, mode of travel, group size, experience use history, and many other variables. Despite this diversity, nearly all users have a feeling of place identity and report that no other place can substitute for this one. Managers must involve the diversity of visitors needs and experience factors in planning and management.</p>

U.S. Department of Agriculture. Forest Service. 2002. *Assessing and evaluating recreational uses of water resources: Implications for an*

<i>integrated management framework.</i> By Kakoyannis, C., and G. H. Stankey. Pacific Northwest Research Station			
Best Addresses: Recreation			
What/Why	How	Results/Findings	Implications
<p>To explore the impact of water based recreation on the water regime & in turn the impact of water management practices on water based recreation. Social drivers were also examined because recreation and management occur within social contexts.</p>	<p>Document review including review of available recreation use data, literature, and demographic trends.</p>	<p>Social trends including shifting populations (migration, growth, changes in leisure activities, and more) will impact water recreation demand. As people move from more rural areas to amenity rich areas, there may be increased pressure on the wildland urban interface.</p> <p>As the population ages, there may be a decline in demand for physically challenging water based recreation. The impact of technological advance is not fully predictable, but managers must plan and manage with rapid social and technological changes underway.</p> <p>Compared to other uses (irrigation etc) water recreation has a low impact on the water regime. However, management of the water regime does have an impact on water-based recreation.</p>	<p>Conflicts over competing water uses are likely to grow in the future, and a better understanding of how to integrate recreation with other uses is needed. Because changes to the water regime have an impact on water recreation, a framework of understanding the changing social trends and changing demands is needed to manage water resource and continue to provide recreational opportunities.</p>
U.S. Department of Agriculture. Forest Service. 2003. <i>A comparison of leisure constraints among three outdoor recreation activities:</i>			

<p><i>Whitewater rafting, canoeing and overnight horseback riding.</i> By Nyaupane, G. P., D. B. Morais, and A. Graefe. Bolton Landing, NY. Northeastern Research Station. Newton Square, PA.</p>			
<p>Best Addresses: Recreation</p>			
What/Why	How	Results/Findings	Implications
<p>The purpose of the study was to compare leisure constraints among 3 activities: white water rafting, canoeing, and overnight horseback riding using the Crawford & Godbey leisure constraint model.</p>	<p>Mail survey</p>	<p>Canoeing was the activity with the fewest constraints. Rafting had highest intrapersonal constraints and horseback riding had highest structural constraints. Overall study results partially supported the three-dimensional Crawford & Godbey model.</p> <p>Importantly, the three types of constraints were different for the three activities across the same group of individuals.</p>	<p>The three-dimensional model (Crawford & Godbey) was only partially supported and many constraints (esp structural) did not fit the model. This study suggests that the model could be changed and the structural category broken down into sub-categories.</p> <p>Managers must consider all activities differently because the constraints to participation are unique for each activity.</p>

U.S. Department of the Interior. Bureau of Reclamation. 2004. *Water Recreation Opportunity Spectrum (WROS) Users' Guidebook*. By Aukerman, R., and G. Haas in cooperation with V. Lovejoy, and D. Welch. Office of Program and Policy Services. Denver Federal Center. Lakewood, CO.

Best Addresses: Recreation

What/Why	How	Results/Findings	Implications
<p>The Water Recreation Opportunity Spectrum enables the recreation managers to inventory and map ó by using expert opinion and an inventory protocol ó to assess the opportunities for people to participate in particular recreation activities, in a specific setting, in order to enjoy a particular recreation experience and the benefits this affords. (WROS) is a tool to understand the type and location of six types of water related recreation opportunities; classes range across a spectrum of urban, suburban, rural developed, rural natural, semi primitive, and primitive classes. Each WROS class is defined by a particular õpackageö of activities, setting</p>	<p>WROS inventory and mapping tool; assesses the physical, managerial, and social attributes of the recreation setting.</p>	<p>WROS is an indispensable tool for inventorying, planning, and managing water resources where recreation is an important public use and benefits the local communities:</p> <ul style="list-style-type: none"> · Inventorying and mapping the current available recreation opportunities · Helping tourists and recreationists choose where to recreate · Assessing the effects of proposed land use and water management changes · Improving public input and communication with stakeholders · Improving management efficiency and effectiveness · Improving regional interagency 	<p>WROS can provide planners and managers with a framework and procedure for making better decisions for conserving a spectrum of high quality and diverse water recreation opportunities. WROS improves our understanding of the complexity of outdoor recreation management, strengthens sound professional judgment, and enables a manager to make better and more defensible decisions.</p>

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attributes, experiences, and benefits.		collaboration · Improving the defensibility of management decisions	
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U.S. Department of Agriculture. Forest Service. 2008. *2007 Boundary Waters Canoe Area Wilderness visitor use study: Description of users and use characteristics*. By Dvorak, R. G., W. T. Borrie, and A. E. Watson. Rocky Mountain Research Station Research Work, University of Montana, College of Forestry and Conservation.

Best Addresses: Recreation

What/Why	How	Results/Findings	Implications
<p>The purpose of this report is to provide a comparison data set for determining trends in use and user characteristics at the Boundary Waters Canoe Area Wilderness (BWCAW) and to update knowledge gained through previous visitor use studies.</p>	<p>On-site interview and follow up mail questionnaire.</p>	<p>Visitor characteristics and visitor trends were reported for both day and overnight users. Users also evaluated wilderness conditions, perceived crowding, responses to the blowdown and recent fires, and attitudes towards the management fee program.</p>	<p>This visitor use study provides comparison data to a 1969 visitor use study in the BWCAW and also provides baseline data for comparisons in future studies.</p>

U.S. Department of Agriculture. Forest Service. 2008. <i>Water and people: challenges at the interface of symbolic and utilitarian values</i> . By McCool, S. F., R. N. Clark, G. H. Stankey. Portland, OR: Pacific Northwest Research Station.			
Best Addresses: recreantional/cultural/spiritual			
What/Why	How	Results/Findings	Implications
This book is about the issues associated with the symbolic values and uses of water: the challenges they present language, allocation mechanisms, communication the conflicts raised; and the potential for resolving complex issues concerning the use of water for various purposes. The studies cover a range of topics regarding the social values and uses of water, with an emphasis on recreation in the Western portion of the United States.	Literature review	Many spiritual/cultural traditions and emotions associated with water are not well-served by decisions affecting its management; cultural and symbolic values are often neglected and poorly understood, contemporary approaches to understanding water tend to focus primarily on its functional, utilitarian purposes. Beyond personal uses of water at home and work, the varied settings of leisure and recreation provide most people with their primary encounters with water. Water laws are complex and controversial. Regardless of water form or activity pursuit, much recreation research tends to refer to water as a tangible object, as a resource available for human use and subject to agency or community management and control. All ancient civilizations had spiritual systems based on glorification of natural elements, and because water was so necessary to life, there were many gods with water interests. Most water symbols center around five general meanings: creation and birth, spiritual and	Drivers of change population growth and migration, economic conditions, information have the capacity to affect recreation resources as well as other users, an understanding of these social trends is critical for anticipating and preparing for future recreation demands. Management of water resources will be increasingly influenced by external influences (national and global) largely beyond the control of regional managers. Recreation can serve as an alternative for a host of symbolic values associated with water. Transportation has the potential to dramatically impact the political landscape, as people located outside the region exercise their voting and political influence in ways that have

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		emotional growth, cleansing, journey, and fulfillment.	direct impacts upon the future direction of water management.
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<p>Valkering, P., D. Tabara, P. Wallman, and A. Offermans. 2009. Modelling cultural and behavioural change in water management: An integrated, agent based, gaming approach. <i>Integrated Assessment</i> 9, no. 1: 19-46.</p>			
<p>Best Addresses: Historical</p>			
What/Why	How	Results/Findings	Implications
<p>“The objective of this paper is to explore such a new approach for a better understanding of societal transitions in the water domain, focussing on the interactions between a water system, autonomous behaviours, water policy, and cultural change.”</p>	<p>A modeling “game” approach, incorporating various worldviews (Hierarchist Egalitarian Individualist). Model also incorporates GIS, climate science, hydrology and more. Pressure, State, Impact Response.</p> <p>Study and game are modeled after the River Ebro in Spain</p>	<p>Players actually play the game to model complex societal processes with an analytical modelling approach. The game is played in 4 stages.</p>	<p>The game is a complex modeling system, and also a hands-on learning tool “the combination of modeling and participation is promising for understanding the complex nature of societal change.”</p> <p>Stakeholders actually play hands on.</p>

Wang, C. P., and C. P. Dawson. 2005. Recreation Conflict along New York's Great Lakes Coast. <i>Coastal Management</i> 33, no. 3: 297-314.			
Best Addresses: Recreation			
What/Why	How	Results/Findings	Implications
The use of personal watercraft in the U.S. has contributed to increased complaints about ownership and operator behavioral issues: safety/accidents, competition for resources, noise, and environmental impacts. This study used goal inference theory to examine the recreation conflict among motorboat users, personal watercraft users, and riparian landowners in the New York Great Lake coastal area.	Surveys	Conflicts that were present: Landowners bothered by PWC and motorboat users Motorboat users bothered by PWC but not by landowners PWC users were not affected by landowners or motorboat users Owners who had strong ownership identification and shared fewer values with others are more likely to be interfered with by other users. Owners have strong identification with their unique characteristics and distinguish themselves from others based on specific norms of participant behavior, but interference	This theory can be used as a general model to explain recreational conflict. Recreation managers/planners should identify groups experiencing conflict and those who have limited opportunities, to minimize potential conflict (in this instance, by creating single-use recreation zones) to regulate usage.

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		<p>may occur when other participants violate their norms. Owners sharing fewer values with others may not know how others users see them.</p> <p>Motorboat and PWC owners may not know landowner expectations of what constitutes their experience. Without common values, the potential for conflict increases.</p>	
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Appendix C. Water-Based Recreation Participation Among Minnesotans

Boating

Boating is one of the largest outdoor recreational activities in Minnesota, and ranks second only to walking as an outdoor pursuit. With 600,000 registered watercraft, Minnesota ranks top in the nation for recreational watercraft per capita; there is one registered boat for every six Minnesota residents (MN DNR 2009a). Minnesota offers a variety of boating resources and opportunities with 32 managed Water Trails, more than 3000 public access lakes, Boaters tend to seek both a social experience and escape. Specifically boaters rated the following experiences as most important: relaxing with family/friends in an enjoyable and quiet natural setting that is away from crowds, and enjoying natural scenery (MN DNR 2009a).

Canoeing and Kayaking

One in five registered boats in Minnesota is a non-motorized canoe or kayak with a total of 172,442 registered canoes and kayaks as of 2004 (MN DNR 2009a). Overall boat registration has steadily increased over the past decades, and canoe and kayak registrations have relatively increased at the same rate. Total boat registration increased by 50% from 1980 to 2000, and canoes and kayaks consistently accounted for 20% of all registered watercraft (MN DNR 2005). Kayak registrations have increased by 56% in the last five years (2005-2009). Minnesota's State Water Trail Program, established by the Minnesota Legislature in 1963, is primarily targeted towards canoeists and kayakers. Escape and enjoying nature are rated as the primary motivations for engaging in canoeing and kayaking. Specifically paddlers seek to escape from a hectic lifestyle and get away to experience silence and quiet. In addition to escape, social experiences also motivate canoeists and kayakers and being with friends and family is ranked as an important experience factor (MN DNR 2001). Kayakers specifically rate exercise and feeling healthier as top motivations compared to canoeists who give a medium ranking of importance to these factors (MN DNR 2001).

Sea-Kayaking

In 2000, there were 3298 registered sea kayaks in Minnesota in 2000 and, on average, it is used 20 times per year (MN DNR 2009a). Like other recreational boating, sea kayakers have access throughout the state to 32 managed Water Trails, more than 4,200 miles of canoe and kayak routes, and more than 3000 lakes with public access. Lake Superior is a unique resource for sea kayakers and the North Shore of Lake Superior is the destination for 14 % of all sea kayaking outings. Specifically, the Lake Superior Water Trail is the destination for 5% of all outings. The typical Water Trail outing is 10 miles in length and sea kayak campgrounds are available along the Water Trail, which is 155 miles long (MN DNR 2001). Sea kayakers report that the most important experiences they seek are related to getting away to natural peaceful settings. Like other water-based recreationists, sea kayakers seek

opportunities to enjoy the sounds, sights, and smells of nature and working to attain physical fitness. Experience factors that are unique to sea kayakers include adventure and taking risks (MN DNR 2001).

Fishing

Nationwide, trends in fishing participation have shown a steady decline over the past decade (Cordell 2010). From 1996 to 2006, fishing in the Great Lakes experienced the largest negative shift at 30 percent (Cordell), while other freshwater locations had a lower decline of 13 percent. Approximately 36% of Minnesota residents participate in fishing and Minnesota is first nationally in the sales of fishing licenses per capita (Schroeder and Fulton 2006). The 1,345,000 anglers in Minnesota can fish 158 species in the state. In total, Minnesota contains 3,800,000 acres of fishing waters, with 5,493 fishable lakes and 15,000 miles of fishable streams (MN DNR 2009a). Minnesota anglers rate relaxing with family friends in an enjoyable natural setting the most important aspects of their recreational experience. Anglers rate catching some fish as a more important factor of the boating experience compared to other boaters (MN DNR 2009a).

Swimming

Trends in recreational swimming in Minnesota are difficult to assess because overall swimming opportunities and participation have not been well documented. That said, as of 2005, 41% of Minnesotans 20 years and older participated in swimming. Elevated bacteria levels in rivers, lakes and streams pose potential health hazards to swimmers.

Wild and Scenic Rivers

Six rivers are designated as Wild and Scenic Rivers by the state of Minnesota. These rivers include: the Mississippi River from St. Cloud to Anoka, the Kettle River in Pine County, the Rum River in Mille Lacs, Sherburne, Isanti, and Anoka Counties, the North Fork Crow River in Meeker County, the Minnesota River from Lac Qui Parle dam to Franklin, and the Cannon River from Faribault to the Mississippi River. In total, 589 river miles are state designated Wild and Scenic Rivers (MN DNR 2009a).

The Lower St. Croix National Scenic Riverway and the St. Croix National Scenic Riverway are federally designated Wild and Scenic River stretches in Minnesota. These river stretches a total of 252 miles and is cooperatively managed by the National Park Service, the Minnesota Department of Natural Resources, and the Wisconsin Department of Natural Resources. The St. Croix National Scenic Riverway receives 564,326 visitors annually (MN DNR 2009a).

Boundary Waters Canoe Area Wilderness

The Boundary Waters Canoe Area Wilderness (BWCAW) is one of Minnesota's premier water recreation resources, with over one million acres of protected wilderness. The BWCAW is the largest Wilderness area east of the Mississippi river and with more than 250,000 annual visitors it is one of the most visited Wilderness areas in the country. The BWCAW contains more than 1,500 miles of canoe routes, 190,000 total acres of water, and more than 1000 lakes and streams (USDA Forest Service 2009).

North Shore Scenic Driving

The scenic byway along the North Shore of Lake Superior provides yet another recreational opportunity focused around water. The North Shore scenic drive extends 154 miles along the Shore of Lake Superior from Duluth to the Canadian border.

Mississippi River: Headwaters & National River Recreation Area

The Mississippi River begins its 2,552-mile journey to the Gulf of Mexico at Itasca State Park, 1,475 feet above sea level. Established in 1891, Itasca is the oldest state park in Minnesota. The park contains 32,690 acres and receives 496,651 annual visits (MN DNR 2009). The Mississippi National River and Recreation Area includes 72 miles of the Mississippi River stretching from the cities of Dayton and Ramsey to just south of Hastings, Minnesota.

Appendix D. List of Issues

Values

Sacredness

Quality of Experience

Access

Wild Rice, Wildlife, and Waterfowl

Economic Value

Impacts/Influences on Recreational/Cultural/Spiritual Values

Pollution

Climate Change

Multiple-use/Competing use

Invasive Species

Institutional factors related to Recreational/Cultural/Spiritual Values

Treaty Rights

Education/Communication/Advocacy

Policy

Appendix E. Figures and Tables

Figure 2. Classifying values and use hierarchy model (Bengston 2000)

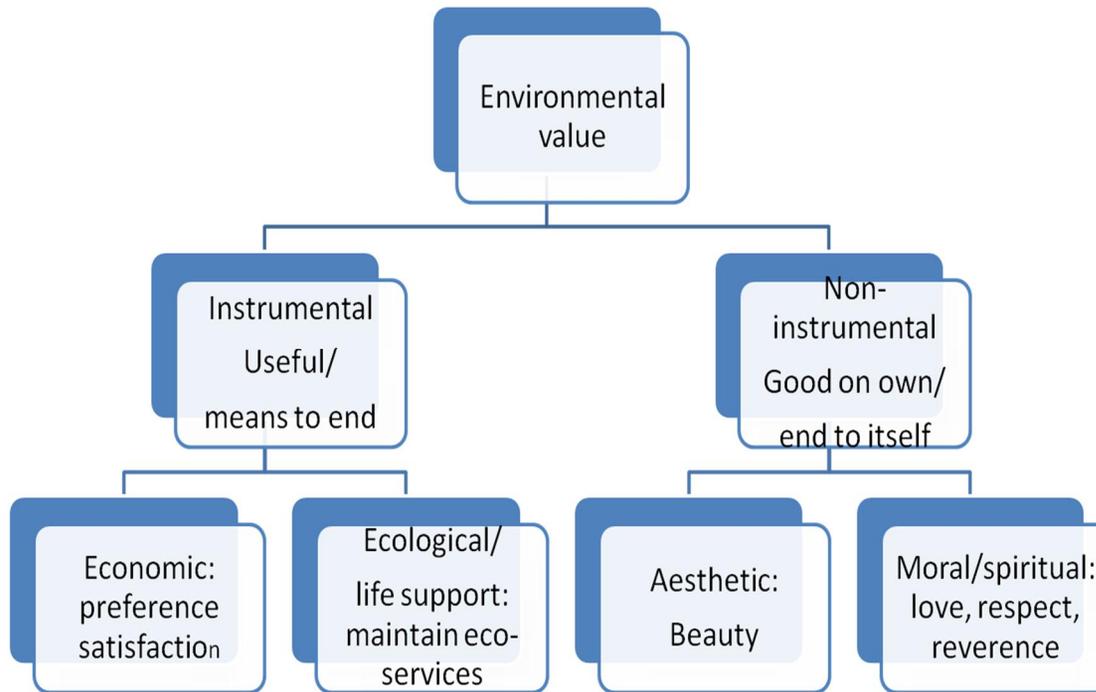


Figure 3. Interaction model for various levels of recreation conflict (Little and Noe 1984)

Source of Conflict	Recipient of Conflict		
	Visitors	Management	Community
Visitors	Visitors ó Visitors	Visitors ó Management	Visitors ó Community
Management	Management ó Visitors	Management-Management	Management ó Community
Community	Community ó Visitors	Community ó Management	Community - Community

Table 1. Recreation activity participation by region and statewide percentages

	Statewide (%)	Northwest (%)	Northeast (%)	Southern (%)	Central (%)
Boating of all types, including fishing from a boat	43	43	42	40	45
Swimming or wading (all places)	41	37	38	38	41
Driving for pleasure on scenic roads or in a park	37	40	37	35	38
Picnicking	36	34	36	35	33
Fishing of all types	30	35	34	30	36
Camping of all types	26	30	32	22	28
Nature observation of all types (e.g., viewing, identifying)	24	20	24	23	26
Visiting historic or archaeological sites	21	17	19	18	19
Ice skating/hockey outdoors	12	5	8	4	8

Minnesota Department of Natural Resources (2005). Data based on population 20 years of age and older