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Creating opportunities for improving lake-focused stakeholder engagement: knowledge–action systems, pro-environment behavior and sustainable lake management

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Abstract

Managers, policymakers, non-government organizations and community group are increasingly relying on stakeholder participation to bolster lake management efforts. The growing portfolio of lake-focused stakeholder engagement cases offers valuable information about the efficacy of alternative stakeholder engagement strategies. While attention has been devoted to inventorying these instances, lesser emphasis has been given to evaluating the effectiveness of different participation and engagement approaches. There is arguably no panacea for involving stakeholders in lake and basin management. Lake management challenges in distinct natural and human systems necessitate diverse approaches for interacting with stakeholders. As calls for stakeholder participation increase and management budget constraints tighten, the urgency of exploring and documenting the effectiveness of alternative approach rises. This paper examines lake-focused stakeholder participation activities targeting individuals and households, summarizes and shares recent findings from research of knowledge–action processes and pro-environment behaviours, and offers encouragement and guidance for lake managers to create opportunities for improving lake-focused stakeholder engagement.

INTRODUCTION

Managers, policymakers, non-government organizations and community groups are increasingly relying on stakeholder participation to bolster lake management efforts (ILEC 2005). The growing, global portfolio of cases of stakeholder engagement around lake and basin management issues offers valuable information about the efficacy of alternative stakeholder engagement strategies (ILEC 2005; RCSE & ILEC 2011). For example, there is much to learn from regional comparisons, such as contrasts of the experiences of Maine and Wisconsin lake associations (Snell *et al*. 2013; Thornton 2013), and global comparisons, such as contrasts between recent stakeholder involvement across 28 lake basins worldwide (ILEC 2005). While attention has been devoted to inventorying these instances and identifying gaps or areas for improvement, lesser emphasis has been given to assessing formally the effectiveness of different approaches. This paper stresses the importance of documenting and evaluating stakeholder participation activities. Learning from successes and failures may prove essential to fully harnessing the capacity for stakeholder participation to bolster lake management.

Lake-focused stakeholder participation activities take many different forms. This paper uses the terms participation, involvement and engagement somewhat interchangeably when discussing lake-focused stakeholder activities. Also acknowledged is the range of disparate activities that fall under the general heading of stakeholder participation. Moreover, the variation of these activities and the human and natural mechanisms that drive these differences are appreciated. Advancing guidelines for the development of the International Lake Basin Management (ILBM) platform process, ILEC (2005) describes four levels of stakeholder participation: information-

sharing, consultation, collaboration and empowerment, and constructs an ordering of influence contingent on the nature of communication (one versus two-way communication) and allocation of resources (independent versus shared versus transferable) among researchers, government and non-government organizational staff, and stakeholders. This ordering is generally supported by other research into water resource management and stakeholder participation (e.g. Sabatier *et al*. 2005; van Kerkhoff & Lebel 2006). Scholars and practitioners also recognize that the ultimate endpoint of the participatory effort matters. For example, forms of participation that support executive decisions and processes are often distinguished from broader classifications of participation, such as citizen science and education programmes (National Research Council 2008). These prior works offer useful guidance on how to classify and inventory participation efforts. Moreover, they suggest there is no simple definition of stakeholder participation. Furthermore, they hint at the absence of a stakeholder participation panacea for lake and basin managers. This paper concentrates on stakeholder engagement focused on individuals and households. By summarizing findings from research into knowledge–action processes and pro-environmental behaviours, useful information from disparate research literatures is integrated and suggestions for creating opportunities to improve documentation and evaluation of stakeholder engagement activities are presented.

LAKE-FOCUSED STAKEHOLDER ENGAGEMENT

Lake-focused stakeholder engagement typically responds reactively to challenges on the ground, reaching out to diverse audiences and encompassing varied activities. While some activities focus on improving public decision-making capacity, other efforts target behavioural change at

the individual, household and community scales. For many challenging lake management problems, individuals and households are at the front lines of understanding problems and developing solutions. For example, in reflecting on summaries of stakeholder involvement in management across numerous International Lake Environment Committee Foundation (ILEC) lake basins, the ILEC committee stresses the importance of a participatory and engaged citizenry: 'the briefs are replete with examples of engineering solutions, some of which have led to major improvements in the environmental status of lake basins. However, even when engineering solutions are successful, behavioural change at the individual, household, and community levels is essential for sustainability, and involving people is the only means to an end (ILEC 2005, p. 47)'.

The challenge of reducing stormwater pollution is a representative lake management problem that illustrates the complexities of changing household behaviour. Diffuse pollutants derived from everyday household activities contribute to stormwater pollution. While stormwater pollution is a by-product of most residential development, simple household conservation practices offer great potential to reduce and mitigate these effects. For example, buffers of shoreline vegetation filter and slow run-off, reducing the erosion of phosphorus-rich soils into nearby lakes (Woodard & Rock 1995; Witherill 1999). There are many engineering solutions available to households. Yet, adoption rates of these solutions are far from widespread. Cumulative adoption of conservation practices can elicit significant benefits for the health of many water bodies. For example, a decade of polluted run-off control projects that focused on changing household-level behaviour in the Mousam Lake watershed (York County, Maine, USA) reversed a 30-year-long trend in declining water quality (U.S. Environmental Protection

Agency 2008). Successes like these inspire a high demand for watershed education and outreach, but resources for restoration, education and outreach programmes are in limited supply (Welch & Smith 2008). Moreover, recent research demonstrates the value of targeting households enrolled in education and conservation practice programmes (e.g. Ribaudo 1989; Tim *et al*. 1992; Khanna *et al*. 2003). In their effort to encourage successfully the adoption of household conservation practices, lake managers are interested in developing cost-effective programmes, which can be expected to meet behavioural change goals at least cost. Hence, economic interests further increase the added value from better understanding of what types of stakeholder engagement actions work in different types of settings. Interacting with households to potentially encourage changes in household behaviour is a significant challenge for lake and basin managers. Coordinated research of stakeholder participation and human behaviour holds great promise for responding successfully to this challenge.

USING RESEARCH TO IMPROVE STAKEHOLDER ENGAGEMENT

Behavioural and social science research can create opportunities for improved stakeholder engagement by encouraging documentation and evaluation of stakeholder engagement efforts. This paper highlights findings from two of many relevant research literatures. These two literatures were opportunistically selected because of ongoing sustainable lake management and sustainability science research at the University of Maine (Maine's Sustainability Solutions Initiative). A growing body of literature is integrating insights and experiences from numerous disciplines to examine knowledge–action processes (see van Kerkhoff & Lebel 2006 for an excellent review). Fundamental to this literature is questions about how best to share and create

knowledge about complicated and coupled natural/human systems (Cash *et al*. 2003; Clark & Dickson 2003; National Research Council 2008; Ostrom 2009). Concurrently, studies of pro-environmental behaviour are advancing knowledge of household decision-making. Combining insights from economics and psychology (Clark *et al*. 2003), this line of research offers useful information about how best to interact with households to encourage behaviour change. Together, emerging insights from these two literatures offer promising guidance on how to link knowledge and action to improve lake and basin management.

KNOWLEDGE–ACTION SYSTEMS

Research into knowledge–action systems is advancing understanding of the dynamic interactions between knowledge and action. Research themes within the knowledge–action systems literature include how knowledge is created and distributed; if and how actions of many different agents are influenced by knowledge; and, in turn, how such actions influence the subsequent generation and sharing of knowledge (McNie 2007; Cash *et al*. 2003; van Kerkhoff & Lebel 2006). Knowledge–action processes are mechanisms by which knowledge interacts with societal, institutional, community and individual actions. Scientific, local and practical experiences form the bases for knowledge; actions are understood as having physical or behavioural implications (van Kerkhoff & Lebel 2006). Responses to historical and emerging lake management challenges can be viewed productively through the lens of dynamic interactions between knowledge and action.

In their review of knowledge–action systems research, van Kerkhoff and Lebel (2006) summarize the evolution of conventional models for linking research-based knowledge and action. Under the trickle-down model, researchers completed studies and summarized their results in journals whose primary audience was peers; knowledge trickled down, arguably inefficiently in some cases, to action. In response to the poor performance of the trickle-down model, an alternative approach surfaced in the 1970s that stressed the importance of research use and argued for investment in processes that facilitated transfer and translation of research-based knowledge. Under the transfer and translate model, researchers completed studies, summarized results in journals and coordinated with other researchers, practitioners and experts to transfer their knowledge to influence action (e.g. USDA Extension Staff; evidence-based health care). Both models are still adopted by researchers today; arguably, both are appropriate for some management and policy challenges. Yet, acknowledgement of failures of both the trickle-down and transfer and translate models for particular management and policy challenges have subsequently resulted in persistent calls for greater experimentation with alternative models.

Themes emergent in alternative models include power, equity, voice, trust and collaboration. For example, knowledge–action systems research within the field of environmental communication research calls attention to the important issues of power, equity and voice (Walker & Daniels 2001; Senecah 2004; Walker *et al*. 2006; Walker 2007). Senecah's (2004) Trinity of Voice framework conceptualizes more effective engagement processes through access, standing and influence. Building and maintaining trust is central to community cohesiveness and improved decision-making that results from sense of community (Senecah 2004). Daniels and Walker (2001) outline key attributes of collaboration, carefully differentiating this concept from other

forms of participation. Collaboration is less competitive, is based on mutual learning and fact-finding, allows for exploration of differences, focuses on interests rather than positions and allocates responsibility across multiple parties. Collaborative engagement is ongoing and draws conclusions through interactive, reflective practices (Daniels & Walker 2001). At the heart of these alternative approaches is the idea that sustainability problems arise and persist within particular social contexts and that the people's perceptions of danger mobilize them to action rather than the sheer reality of these problems (Cantrill 1996). Focusing on culture, social networks and communication practices at finer scales that are specific, locally based and often highly resilient enables nuanced, rich knowledge–action systems analysis (Lindenfeld *et al*. 2012).

Knowledge coproduction defines other alternative models of stakeholder participation and knowledge–action systems. Knowledge–action systems research often conceptualizes knowledge production as co-construction, a contrast to the trickle-down model that conceptualizes universities as experts and stakeholders as having a knowledge deficit (Jasanoff 2004; Hordijk & Baud 2006; Aeberhard & Rist 2009; Anadón *et al*. 2009; Hage *et al*. 2010; Hart & Calhoun 2010). This approach fundamentally rethinks how we produce knowledge (Leach 2007; Kahan 2010) and emphasizes the need for the 'context-dependency of participatory knowledge production [and] the importance of reflection and transparency regarding the role of scientific advisors in the science policy process' (Hage *et al*. 2010).

Examples from the lake management literature illustrate differences across these alternative knowledge–action systems. The trickle-down model applies to situations where scientists publish

results about lake ecosystem health and bear no responsibility for ensuring these results are linked with the action of stakeholders. Instead, this model empowers individuals and organizations outside of the research community to develop and facilitate the transfer as boundary agents (Guston 2001). While some lake management problems may have been well-served by this model, household-based issues are unlikely to be addressed efficiently by this type of knowledge–action system. The transfer and translate model applies to situations, such as stormwater run-off, where researchers coordinate with other experts at research universities, government agencies and/or non-government organizations to distribute their research results in a 'useable' form to lakefront and inland households. The Integrated Lake Basin Management Platform's (ILEC 2005) emphasis on stakeholder participation and associated global experiments are an example of recent, alternative models. Collectively, this evolutionary viewpoint of knowledge–action systems affords managers with a useful, reflective perspective.

In addition to bringing together disparate strands of literature and informing practitioners and researchers of state-of-the-art approaches, knowledge–action systems research is also providing leadership in terms of encouraging documentation and evaluation of knowledge–action systems. Numerous studies conducted over the last decade go beyond documentation and consider evaluation and assessment (Chess & Purcell 1999; Carr & Halvorsen 2001; Cash *et al*. 2003; Layzer 2005; van Wyk *et al*. 2008; Barrateau *et al*. 2010; Sutherland *et al*. 2011). Knowledge–action systems research frequently involves processes of building and studying partnerships (Wills-Toker 2004). Given the complex nature of lake and basin problems, such partnerships are likely to involve multiple stakeholders and diverse communities. Thus, knowledge–action research frequently involves engaged research design to assess local languages and practices,

power structures and cultural practices. This calls for problem-based (Tracy 2007), praxis-oriented (Chouliaraki 2006) and engaged scholarship (Deetz 2008). Knowledge–action research provides a framework for understanding how stakeholder and engagement systems function, while delivering feedback to improve these processes.

Overall, the knowledge–action systems literature has much to contribute to household-focused, lake education, awareness and participation activities. By mapping out the range of participation options for stakeholders and delineating the historical context for current stakeholder activities, this literature offers general guidance to lake managers. Moreover, the increasing emphasis placed on systematic documentation and evaluation introduces a catalyst for seizing opportunities to learn more about the effectiveness of different stakeholder activities. Qualitative and quantitative approaches can be used by lake managers and researchers to examine the relative effectiveness of different types of activities and engagement processes.

PRO-ENVIRONMENT BEHAVIOUR

Research into pro-environment behaviour is advancing knowledge of household decision-making. Notably, practitioners, policymakers and researchers are recognizing important differences across households that complicate the design of stakeholder engagement activities. A subset of recent advances emerges from hybrid models that combine insights from economics and psychology. Researchers have shown that a variety of social psychology models are consistent with classical economic frameworks based on private costs and private benefits and in fact enhance these models' ability to explain household decisions (Clark *et al*. 2003; Carpenter &

Myers 2010). Social norms and positional status are two social–psychological constructs consistent with a long-standing understanding of economic decision-making in the realm of public goods and club goods (Cornes & Sandler 1986; Solnick & Hemenway 2005). Subjective social norms are perceived social pressures to behave in certain ways (Fishbein & Ajzen 2010). Status-seeking behaviour emerges from preferences for higher relative position. Focused studies of specific voluntary pro-environment behaviours, including making green purchases (Ek & Söderholm 2008; Griskevicius *et al*. 2010) and participating in environmental programmes (Goldstein *et al*. 2008), have supported empirical relationships between social norms, positional status and decision-making based on private costs and benefits.

Thinking about pro-environment behaviour in a lake context, household adoption of conservation practices in their yards is generally believed to be motivated by some combination of self-interest and prosocial motivations (Bamberg & Moser 2007). Many economic studies of pro-environment behaviour focus on private utility-maximizing tradeoffs given preferences, tastes, knowledge, income and other constraints (e.g. Helfand *et al*. 2006; Hurd 2006, 2007). In contrast, social psychologists have long addressed the role of social influence on individual pro-environment behaviour and some have provided insight into how individuals cognitively process economic influences (Lynne *et al*. 1995; Vining & Ebreo 2002; Biel & Thogersen 2007; Teisl *et al*. 2009). While many insights from psychology are now recognized as being compatible with the economic framework based on tastes and preferences, studies that merge these insights remain relatively rare in the case of household conservation practice adoption.

To formally address the roles of beliefs, attitudes and preferences in voluntary pro-environment behaviour (e.g. Armitage & Conner 2001), researchers can supplement conventional models of household utility maximization with cognitive and social insights from the Theory of Reasoned Action (Fishbein & Ajzen 2010; Speers 2011). The Theory of Reasoned Action construct describes the relative importance of beliefs, attitudes, social norms and perceived ability in determining behavioural intention, or one's intent to act in a certain way. This construct has been used to explain intentions to adopt a range of personal behaviours, including recycling (e.g. Chu & Chu 2003), water saving (Lam 2006) and adoption of agricultural conservation practices (Lynne et al. 1995; Wauters *et al*. 2010). Research suggests that simply having knowledge about the impact of one's behaviour on water quality is not a sufficient condition for adopting new behaviours that reduce or mitigate such impacts. In parallel, others found that households which adopted conservation practices did not necessarily choose them for their beneficial environmental properties (Fitch 2009).

Empirical work offers guidance on relevant factors to consider when thinking about targeting households for lake-focused conservation practices. Micro-economic theory emphasizes the importance of cost on household decisions about their yards (Helfand *et al*. 2006; Hurd 2007). Although simple in design, many household conservation practices are installed by hand. Therefore, the relevant costs of polluted run-off conservation practices include labour as well as capital (Ghazalian *et al*. 2009). Real and perceived skills and abilities are also important: at extreme levels, a perceived lack of behavioural control inhibits action whether or not true barriers exist (Corbett 2002). Another important attribute of conservation practices may be visibility to others. Research about relative social status suggests people who care about status,

and the opinions of others are more likely to undertake pro-environment behaviours that are both socially desirable and visible to others (Griskevicius *et al*. 2010). Finally, some people care about their behaviour's environmental impact; in this case, documenting variation in conservation practices' environmental effectiveness may also enhance our models (Lam 2006; Noblet *et al*. 2006).

Past research identifies specific parcel characteristics that reveal information about various conservation decisions. For example, a study of residential water use found that the volume of water that a household used was related to lot size and lawn activities, such as the presence of gardens, pools and mechanized watering systems (Syme *et al*. 2004). A similar study found households living in apartments and condominia consumed less energy than those living in houses, but that there was no significant difference between house- and mobile home–dwellers' consumption (Kotchen & Moore 2008). In agricultural applications, farm size, crop types and livestock species are known to influence the scale, type and frequency of conservation practice adoption (Ghazalian *et al*. 2009). Less evidence is available about the relationship between yard attributes and practices specifically related to polluted run-off reduction. One exception is Templeton *et al*.'s (1999) finding that households with a large garden area are more likely to use organic versus inorganic garden chemicals.

Studies have found that residential yard and property maintenance decisions are influenced by neighbourhood norms and aesthetic standards (Dutcher *et al*. 2004; Nielson & Smith 2005). Although conflicting evidence from the agricultural realm suggests social norms have a minimal role in farmers' decisions about adopting conservation practices (Wauters *et al*. 2010),

landscaping-related household conservation practice adoption may be more similar to the case of residential yard care (e.g. using buffers of native shoreline vegetation, maintaining wooded lots and minimizing lawn areas to infiltrate and filter polluted run-off). In addition to understanding which decisions are shaped by norms, it is also important to understand whose behaviour and expectations a household thinks about when forming normative beliefs. Individuals are more likely to perform a given behaviour when they believe more strongly that important people in their lives expect them to perform it (injunctive norms) or when they believe that many people like themselves complete the behaviour (descriptive norms). Normative beliefs about friends, family, neighbours and peers are known to influence many kinds of pro-environment behaviour (Hopper & Nielson 1991; Corbett 2002; Chu & Chu 2003; Ek & Söderholm 2008; Goldstein *et al.* 2008). Less is known about the normative context of household decisions to adopt conservation practices, but the success of norm-based social marketing for lawn care and lake-friendly property management (Welch & Smith 2008; Wilkerson & Wilson 2009) suggests neighbours may be important reference groups.

A growing literature addresses the symbolic nature of pro-environment behaviour. Pro-environment behaviours, particularly consumer products, attract a price premium, yet are sometimes of inferior quality. Thus, pro-environment behaviours may be appealing for a number of reasons, such as signaling prosocial sacrifice, wealth or both. Some behavioural studies suggest positional concerns influence environmentally friendly intentions and behaviours (Grolleau *et al*. 2012), to the point where introducing monetary rewards for good behaviour reduces image-motivated volunteerism (Carpenter & Myers 2010). At this extreme, the presence of rewards reduces the social status conferred from donating one’s time or resources; however,

behavioural change programmes often use visible rewards for ‘good’ behaviours (Welch & Smith 2008). For environmental behaviours that have become status symbols, status influences choices made in public about them (Griskevicius *et al*. 2010). These symbolic concerns suggest variations in practice adoption may be explained by levels of public visibility of the actions.

Standard socio-demographics like age, gender and income are usually accounted for in studies of human behaviour because they relate to preferences about, and ability to afford, choice alternatives. For example, households with higher income are more able to afford and thus choose expensive yard care alternatives (Templeton et al. 1999; Syme *et al*. 2004). Assuming yard amenities like aesthetics are normal goods, it also is expected that preferences for yard aesthetics will increase with income (Helfand *et al*. 2006). While the effect of age on conservation practice adoption is usually significant, it is inconsistent across a variety of conservation practice studies (reviewed in Ghazalian *et al*. 2009). Frequently, levels of environmental education and awareness can predict conservation behaviour. Conservation practice adoption rates tend to be higher among more educated groups, such as college graduates (Ghazalian *et al*. 2009). Environmental education participants tend to have more environmental knowledge (Jemison *et al*. 2004) and often engage in more environmentally friendly behaviours than non-participants (Swann 1999; Dietz *et al*. 2004; Abraham 2010). Yet, environmental knowledge and attitudes in and of themselves are not consistently related to making more environmentally friendly choices (e.g. Templeton *et al*. 1999; Syme *et al*. 2004; Helfand *et al*. 2006). The risk assessment literature suggests risk perceptions can be powerful cues to household action. For example, evidence suggests households use objective and subjective measures of baseline lake water clarity and perceived risks of its loss when weighing the costs

and benefits of engaging in water quality restoration programmes (Poor *et al*. 2001). Several other variables may also be relevant for the lakefront household context. Foremost, the forestry literature suggests absentee owners manage and relate to their land differently than do resident owners (Huntsinger & Fortmann 1990); however, studies of residential lands suggest tenure does not impact stewardship attitudes (Syme *et al*. 2002).

Overall, the pro-environment behaviour literature has much to contribute to household-focused, lake education, awareness and participation activities. By bringing attention to the complexities and regularities of household decision-making, this literature offers specific guidance to lake managers. Studies informed by such research (e.g. Speers 2011) offer excellent opportunities to learn more about the impacts of different stakeholder activities. Households in certain lake basins receive multiple forms of lake education, awareness and participation opportunities. Accordingly, their exposure to different forms of lake-related knowledge varies considerably. Empirical hybrid economic and psychological statistical models are one example of many quantitative and qualitative research approaches that can be used by lake managers and researchers to examine the relative impact of different types of stakeholder activities and interventions.

CONCLUSIONS

While lake communities throughout the world share commonalities, they also exhibit tremendous economic, social and cultural diversity (Carpenter *et al*. 2007; Stedman *et al*. 2007). Distinct coupling of natural and human systems in these regions and communities necessitates diverse

stakeholder engagement approaches. Yet, as more resources are allocated to these diverse stakeholder participation activities, the urgency of exploring and documenting the effectiveness of alternative approaches rises. Globally, scientific agencies invest tremendous resources in monitoring biophysical aspects of ecosystems. By focusing more heavily on the natural components of systems and overlooking the need to monitor the dynamics of coupled natural and human systems, society has less capacity to respond to certain sustainability challenges. Greater systematic documentation, monitoring and analysis of stakeholder participation activities are one of many potential improvements that will create meaningful opportunities to improve stakeholder engagement and inform our understanding of societal capacities to address sustainability challenges.

This paper shares recent findings from research into knowledge–action processes and pro-environment behaviours to encourage lake managers to create and seize opportunities for improving lake-focused stakeholder engagement. The experiences in ILEC's lake basins are well-documented (ILEC 2005; RCSE & ILEC 2011) and represent a starting point for future analysis and evaluation of stakeholder engagement approaches. Greater coordination of documentation across sites will ultimately facilitate more networking and sharing of insights across regions (Ostrom 2009). The tools exist to research natural and human components of lake and basin systems. Creating opportunities to apply these tools to assess engagement with stakeholders concurrently generates meaningful opportunities to advance sustainable lake and basin management.

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