Environmental Management (2012) 49:192–206
DOI 10.1007/s00267-011-9756-7

Prognostic Framing of Stakeholders' Subjectivities: A Case of All-Terrain Vehicle Management on State Public Lands

Stanley T. Asah · David N. Bengston · Keith Wendt · Leif DeVaney

Received: 13 January 2011 / Accepted: 13 September 2011 / Published online: 9 October 2011

Abstract Management of all-terrain vehicle (ATV) use on Minnesota state forest lands has a contentious history and land managers are caught between ATV riders, non-motorized recreationists, private landowners, and environmental advocates. In this paper, we demonstrate the usefulness of framing distinct perspectives about ATV management on Minnesota state public forests, understand the structure of these management perspectives, identify areas of consensus and disagreement, specify which stakeholders hold the various perspectives, clarify stakeholder perceptions of other stakeholders, and explore the implications for ATV planning and management. Using Q methodology, three distinct perspectives about how we should or should not manage ATVs resulted from our analysis, labeled Expert Management, Multiple Use, and Enforcement and Balance. A surprising degree of unanimity among the three management perspectives was found. Although some of the areas of agreement would be difficult to implement, others would be relatively simple to put into place. We suggest that land managers focus on widely accepted management actions to ameliorate commonly recognized problems, which may ease tensions between stakeholders and make tackling the tougher issues easier.

Keywords Conflict · ATV · Q methodology · Consensus · Stakeholders · Prognostic framing

S. T. Asah (✉)
College of the Environment, University of Washington,
Box 352100, Seattle, Washington, USA
e-mail: stasah@u.washington.edu

D. N. Bengston
Northern Research Station, USDA Forest Service,
1992 Folwell Avenue, St. Paul, Minnesota 55108, USA

K. Wendt
MN DNR, Policy, Research, and Planning,
St. Paul, Minnesota, USA

L. DeVaney
Conservation Biology, University of Minnesota,
St. Paul, Minnesota, USA

Introduction

The use of all-terrain vehicles (ATVs) in the United States has increased substantially in recent decades, with an estimated 10.2 million 4-wheel ATVs—small, motorized vehicles specifically designed for off-road and trail use—in use in 2008 (Garland 2010). This poses many challenges for land managers who struggle to balance the diverse and competing interests of multiple stakeholders that involve protecting the environment while providing quality recreation experiences for all recreationists. Management of ATVs has become a concern on federal, state, and local lands across the country (Stokowski and LaPointe 2000; Ouren and others 2007; United States Government Accountability Office (US GAO) 2009).

Motorized use of Minnesota state lands has also grown significantly. In some cases, this significant growth results in overuse, resource damage, and increased conflict among stakeholders (Rahn 2009). More than 250,000 ATVs, off-highway motorcycles (OHMs), and off-road vehicles (ORVs) now registered in Minnesota regularly use state forest roads and trails. The challenge facing the Minnesota Department of Natural Resources (MN DNR) is to accommodate motorized recreation on state forest lands safely, responsibly, sustainably, and without displacing

non-motorized forest users (Minnesota Department of Natural Resources (MN DNR) 2007).

ATVs provide a variety of benefits to users. They are a means for physically challenged nature-enthusiasts to access and enjoy nature. ATV recreationists enjoy benefits such as spending time with family and friends, and getting away from the demands of everyday life—benefits that are common to other recreation activities (Davenport and others 2002). Riders also use ATVs for hunting and non-recreational purposes such as snow plowing and hauling heavy objects. The unique presence of two ATV manufacturers in Minnesota provides employment opportunities to thousands in manufacturing, retail, and tourism-related jobs (Schneider and Schoenecker 2006). ATVs also contribute millions of dollars in state and local tax revenue.

But managing ATVs on Minnesota forests is challenged by a variety of social and ecological issues. Common ecological impacts include soil erosion and compaction, decreased water and air quality, reduction in the size and abundance of native plants, spread of invasive and non-native plants, and disruption of wildlife habitat (Ouren and others 2007). ATVs pose human safety problems, with almost half of ATV-related deaths in 2006 involving riders under the age of 16 (Brown 2006). In the same year, there were over 1500 injuries related to ATVs requiring emergency attention and, in 2008, eight of 17 ATV-related deaths involved use of alcohol (MN DNR 2008a). Other social problems include noise pollution (Ouren and others 2007) and the visually offensive sights of eroded tracks and churned wetlands (Meersman 2002).

These social and ecological issues provoke dispute episodes that cumulatively characterize the conflict about how we should or should not manage ATVs on state public lands. Land managers are caught between ATV riders, non-motorized recreationists, private landowners, and environmental advocates. The history of efforts to manage both ATV use and the ensuing conflict began with the 1985 requirement by the state legislature to register ATVs and the first designation of trails on state lands (Minnesota Department of Natural Resources (MN DNR) 2009). Other management efforts have followed, including the classification of state forests as either open or closed to ATV recreation. In 2002, a two-part article on environmental damage caused by ATVs in the Minneapolis *Star Tribune* newspaper (Meersman 2002) was a catalyst for increased controversy and efforts to address it. These efforts included the establishment of a Motorized Trails Task Force (MTTF) by the state legislature in 2002. The MTTF consisted of 21 individuals representing most stakeholders and was charged with addressing motorized vehicle issues on public lands. Few important recommendations achieved the 100% consensus required for approval. Motorized interests rejected the report from the MTTF immediately after it was finalized, and almost none of its recommendations were adopted by the legislature or the Minnesota Department of Natural Resources.

State legislative efforts to manage ATVs continued in 2003 with legislation calling for a "forest-by-forest" review of Minnesota state forests with regard to motor vehicle use (MN DNR 2008b). In response, the Minnesota Department of Natural Resources completed a comprehensive statewide forest road and trail inventory in 2004. Based on this newly available forest access inventory and an extensive public participation process, the Minnesota Department of Natural Resources began to officially classify state forests regarding motorized recreation and to issue designation orders for forest roads and trails. This process designated or decommissioned specific roads and trails for motorized and non-motorized use. Forest reclassification and route designation was completed on December 31, 2008 for all 58 state forests. Route designations resulting from this process included over 2,300 miles of roads, 831 miles of ATV/OHM trails, 143 miles of single-track OHM trails, 27 miles of ORV trails (i.e., jeep or truck), and 837 miles of non-motorized trails (MN DNR 2008b). The resulting managed trail infrastructure was considered an important step towards addressing and reducing ATV-related conflict.

Despite these efforts, the contentious nature of ATV management within Minnesota state forests remains. Different stakeholders hold different views about how we should or should not manage ATVs in state lands. Stakeholders variously describe the ATV-associated conflict within state forests as complex, irresolvable, difficult to manage, and stubborn. These attributes make the ATV conflict appear intractable (Lewicki and others 2003). Environmental conflicts, such as that with ATV use on Minnesota state lands, are said to be intractable or resist resolution in part because they lack structure or frame (Bardwell 1991). That is, the views of stakeholders are not well organized and articulated, and hence not well understood. Thus, there is a need for approaches that help organize and give structure to stakeholders' viewpoints in environmental disputes and conflicts. One way in which such structure and organization is achieved is by way of framing. This study illustrates how Q methodology—a semi-quantitative approach to structuring stakeholder viewpoints—is used to frame conflicting parties' perspectives about how we should or should not manage ATVs in Minnesota state public lands.

Framing Stakeholders' Subjectivities

Framing, as a concept and process, originated in the field of cognitive psychology (Bartlett 1932) where it is defined as cognitive structures in human memory that are retrieved to

help organize and interpret new experiences. Since Bartlett, the concept of frames and the process of framing have been adopted by several disciplines (Van Gorp 2007; Lewicki and others 2003). Framing is prevalent in the research endeavors of communication sciences (e.g., Van Gorp 2007; Bryant and Miron 2004), social movement research (e.g., Benford and Snow 2000), sociolinguistics (e.g., Goffman 1974; Tannen 1979), and intractable environmental policy research (e.g., Schön and Rein 1994). In each of these disciplines, the concept of frames and the process of framing have different meanings and applications. Framing in sociolinguistics and communication research, for example, focuses on three major processes: frame construction, how journalists cast the elements of news stories (e.g., Putnam and Shoemaker 2007); framing effects which focuses on the outcomes of news stories and the interaction between the media and audiences (e.g., Scheufele 2004); and frame definition that emphasizes the word choices and contents of frames (e.g., Snow and Benford 1988). The widespread use of frames and framing in these disciplines points to its importance as a research concept.

In environmental dispute resolution, frames have been defined as social constructions that portray how stakeholders make sense of a conflict (Gray 2003). Framing is the process by which conflicting parties shape, focus, organize, and represent their views about a conflict. Framing involves sorting and categorizing issues and taking stances with respect to issues involved in a conflict (Gray 2003). Because framing in environmental disputes and conflicts involves sorting and categorization of issues, it is also cognitive (e.g., Pinkley 1990) because personal experiences are brought to bear on the categorization. Such experiences are often retrieved via cognitive processes (Bartlett 1932). In environmental conflicts, frames therefore structure stakeholder views which enhance understanding and the consequent chances of resolution. The terms 'diagnostic and prognostic' have been used to describe conflict frames. Diagnostic frames are primarily about how the conflict is defined, while prognostic frames, the approach used in this study, are those preoccupied with structuring how the conflict should be dealt with (Snow and Benford 1988; Benford 1993; Gray 2004).

Several studies have used the concept of frames, in various ways, to understand different aspects of conflicts. Schweitzer and DeChurch (2001) showed that conflict outcomes differ with the type of frame adopted by negotiators. But their study did not determine, and was not about, areas of consensus and disagreement among conflicting parties. In examining the effects of framing on bargaining behaviors and outcomes, Neale and Bazerman (1985) found that positive frames led to more concessionary behaviors and successful performances than negative frames. However, Neale and Bezerman's study focused on the effects of framing and not the clear articulation of frames and the delineation of areas of consensus and disagreement. In an effort to understand how disputants' interpret conflict, Pinkley (1990) used multidimensional scaling to identify three types of conflict frames. But, the study focused on deriving the dimensions necessary to elucidate people's cognitive representation of conflict and did not lead to established areas of consensus and disagreement regarding the prioritization of issues within these areas and ensuing frames.

Pellow (1999) examined framing and consensus-based tactics used by the environmental movement and demonstrated that conflicting parties sometimes engage in collaborative framing. However, the study was focused more on the environmental movement than on natural resource management conflicts. Moreover, the aim was to show how tactical framing is used to demobilize conflict rather than to outline clear and well-articulated frames of the conflict. Brummans and others (2008) elaborately employed the concept of frames and the process of framing in efforts to make sense of intractable multiparty environmental conflicts. They used a combination of qualitative (interviews and content analysis) and quantitative (cluster and chi-square analyses) methods to identify frames, group disputants into clusters representing different frames, and showed how these different frames fueled intractability in four different environmental disputes. Still, the frames in question were defined using content and qualitative analysis rather than emerged from the construction of the disputants themselves. Additionally, the qualitative construction of frames made it difficult to quantitatively prioritize the contents of frames, and outline prioritized issues within areas of consensus and disagreement among frames. Furthermore, the grouping of disputants using cluster analysis makes it practically impossible to place disputants in more than one cluster and thence to identify disputants who hold multiple frames. Determining which disputants hold multiple, especially contradictory, frames is particularly useful in understanding and resolving conflicts (Benford 1997; Gray 2003).

Using a discourse analytic approach to examine transcripts of stakeholder interviews in several intractable environmental conflicts, Lewicki and others (2003) identified several types of conflict management (prognostic) frames. These included frame types such as avoidance or passivity frames that were defined by statements expressing proclivities towards inaction. Other management frames from those studies included, among many others, joint problem solving, fact finding, and adjudication frames. These frames respectively called for joint action, collecting more information, and the need for a third party, such as an arbitrator, to decide. Despite the enormous success with

identifying various frames, the methods used in these studies do not allow disputants to quantitatively construct and prioritize issues within frames—the frames are interpretations of the researchers guided by the stories and perspectives of the disputants. The qualitative nature of the studies did not allow for determination of the extent to which various stakeholders agree or disagree with the frames they appear to hold or despise. Additionally, the studies do not quantitatively articulate clearer/finer distinctions that reflect the extent to which issues within each frame, and areas of consensus and disagreement, are more or less important than others. In resource-scarce situations that typify environmental management, trade-offs are necessary and are often made in on-the-ground management and collective decision-making processes. It is therefore important not only to frame conflicts but to do so such that it helps prioritize the issues contained in frames, and those contained in areas of consensus and disagreement. These prioritizations would help managers not only understand which issues should and can be tackled, given the resources available, but also the degree to which issues within areas of disagreement are likely to resist resolution (Rubinstein 1998).

In this study, we contribute to efforts to better understand and manage ATV use on Minnesota state forests, and demonstrate the utility of Q methodology as a tool for facilitating the framing of management options in contentious environmental problems. We facilitated framing such that disputants clarified and prioritized issues within frames, outlined areas of consensus and disagreement while prioritizing constitutive elements within these areas, and revealed the multiple frames they hold. We examine the views of multiple stakeholders simultaneously and provide a framework for stakeholders to better understand each other.

Several previous studies in the US have examined land manager views or rider perspectives on ATV/OHV (Off-Highway Vehicle) management. For example, Chavez and Knap (2006) and Thompson (2007) surveyed land managers on national forests for their views on OHV management issues and management actions. Other studies have focused on ATV or OHV rider perspectives, including their motivations, preferences, support for management actions, and demographic characteristics (e.g., Schuett 1998; Crimmins 1999; Fisher and others 2001; Flood 2006; Baker and others 2008; Mann and Leahy 2009). There have also been efforts to explore the usefulness of collaborative approaches to ATV and OHV planning and management. For example, the US Forest Service held a National OHV Collaboration Summit in 2005 which included eleven case studies and lessons learned from collaborative efforts around the country (United States Institute for Environmental Conflict Resolution 2005). These studies have provided useful insights on land manager perspectives, rider perspectives, and collaboration, but none have examined simultaneously the views of the full range of stakeholders.

Q methodology—a social science technique that originated in the 1930 s (Stephenson 1953)—was used to structure stakeholders' views of ATV management on Minnesota state forests. Q methodology is well suited for analyzing contentious issues (Eden and others 2005) such as ATV use and management because it helps managers and policy makers understand the belief structures of other stakeholders (Stephenson 1953). Q is viewed by some as more democratic and open than other means of analyzing public perspectives (Dryzek 1990). This is especially the case when the statements used in a Q study are derived directly from stakeholders and their verbatim statements are taken back to them for sorting (Brown 2002), as in this study. This approach allows stakeholders to "speak for themselves," making Q methodology an interactive, stakeholder-driven process (Dryzek and Berejikian 1993). Another advantage of Q is its ability to facilitate the emergence of latent belief structures, rather than imposing a framework or taxonomy by the researcher.

In the next section, we describe Q methodology and the data used in this study. This is followed by a description and comparison of the stakeholder perspectives which emerged from the analysis, including areas of consensus and disagreement on ATV management. Finally, a discussion of the usefulness of Q methodology in the context of our findings and concluding comments are presented.

Approach

The typical approach to framing stakeholder perspectives, using Q methodology, used in this study involved five main steps. First, we identified a concourse—a set of statements of opinions and beliefs—about ATV management on Minnesota state forests. The goal of constructing the concourse was to include all major stakeholder views on the issue. Most of the statements came directly from comments submitted by stakeholders to ATV planners and managers as part of an ongoing participatory planning process carried out by the Minnesota Department of Natural Resources. In the planning process, proposed ATV management plans are submitted for public review and comment. Stakeholder comments on these plans expressed in public meetings, open houses, and emails were obtained from Minnesota Department of Natural Resources staff. We supplemented these statements with views expressed by stakeholders in newspaper articles and other literature, including the Motorized Trail Task Force report (Motorized Trail Task Force (MTTF) 2003). We stopped collecting statements

when further statements did not add new perspectives. In total, the concourse consisted of about 400 statements regarding how ATVs should or should not be managed.

Second, we qualitatively analyzed and sampled the concourse to obtain a representative subset of statements. The open coding method was used to identify and categorize ideas expressed by stakeholders in the concourse, an approach that is well suited to capture diverse themes and uncover unanticipated ideas (Strauss and Corbin 1998). Briefly, this method involves a process of multiple coders carefully reading and re-reading the textual data, developing draft outlines of recurring themes and subthemes, reconciling differences between the outlines of the different analysts, coding the entire database of text, and cross-referencing each theme back to the original text. Details of the open coding method are provided in Strauss and Corbin (1998).

The main themes about how we should or should not manage ATVs that emerged from analyzing the concourse included: environmental sustainability; ATV fees; trail signage, connectivity, and maintenance; organizational structure of management; education, regulation and enforcement; economic and political influences on ATV planning and management; ATVs versus other forms of forest recreation; and balanced or multiple use of trails on state forest lands. We drew a sample of statements such that the main themes and sub-themes were represented and replicated at least once. Five volunteers participated in a pre-test of the sorting exercise and provided feedback to ensure that the selected statements were comprehensive and the meaning of each was clear. After revision, we ended up with 55 statements that were numbered and printed on individual business-sized cards.

Third, we identified stakeholders and requested their participation in the study. Individuals who met at least one of the following criteria were selected for participation: (i) currently or recently active in ATV planning and management in Minnesota, (ii) active users of Minnesota state forest lands (both ATV riders and non-motorized recreationists), (iii) represent interest groups involved in ATV use or management in state forests, (iv) own private property adjacent to or near ATV-active state forests, or (v) university or government researchers who have studied ATV use in Minnesota. A list of potential participants was obtained from the Minnesota Department of Natural Resources, Division of Parks and Trails (Trails Section) and supplemented with other sources, including a list of private land owners neighboring state forests with ATV activity.

Fourth, stakeholders participated in a framing exercise or "Q-sort" in the Minneapolis-St. Paul metropolitan area and in six communities in outlying ATV hot spots around the state. Each participant received a deck of the 55 cards, with each card containing a statement about ATV management. Participants were asked to read through the cards and sort them into three piles: a pile for statements they agreed with, disagreed with, or were neutral towards. The neutral pile also included statements that respondents were unsure about or did not have enough information about to make an informed placement. We then asked participants to make finer distinctions by sorting the cards into a forced-choice, roughly normal-shaped, distribution grid (Stephenson 1989). Participants placed statements they agreed with most strongly at the far right side of this grid and statements they most strongly disagreed with at the far left.

Participants were encouraged to move cards around the grid as they saw fit and their sorts were not collected until they affirmed their satisfaction with their sorting choices. After the sort, participants completed a Likert scale-like instrument assessing the intensity and frequency of their ATV use for both recreational and non-recreational purposes. This information was used to distinguish riders according to ATV-use intensities. Following Brown's (1980) recommendation, we conducted brief interviews to capture participants' views of the sorting process and additional comments they had about ATV management. We asked stakeholders to tell us what they thought about the framing exercise and ATV management in Minnesota state forests. Participants also wrote responses to two questions: Why did you place the three statements to the far right of the distribution grid (most strongly agree), and why did you place the other three statements to the far left (most strongly disagree)? These questions were intended to help clarify and subsequently interpret stakeholder views. A total of 97 individuals (21 females and 76 males) participated in the study.

Fifth, data were analyzed using the PQMethod software, version 2.11 (PQMethod 2002). A correlation matrix of all 97 sorts was generated. The matrix was subjected to principal component factor analysis resulting in eight un-rotated factors (i.e., perspectives on ATV management), all of which had Eigen values ≥ 1.0. These initial management perspectives were rotated using the varimax orthogonal method (Stephenson 1953, 1964; Brown 1980). Typical of factor analysis procedures in Q methodology, some level of judgment was used in retaining relevant perspectives (Brown 1980). Accordingly, retained management perspectives had explanatory values greater than or equal to seven percent, were markedly different from other perspectives, positive inter-perspective associations were less than 0.5, and at least one participant loaded highest on that perspective. Based on these criteria, three of the eight management perspectives were retained. Each of the three retained management perspectives is represented by a unique Q-sort, relative to which an individual's loading scores for each perspective can be computed. A loading

score is a measure of the strength of association of each participant's Q-sort to a management perspective. Loading scores range from +1.00 (when an individual's sort exactly matches the management perspective) to −1.00 (when an individual's sort is the exact opposite of a management perspective). Individuals whose sorts most closely match a perspective are said to exhibit a "defining sort" for that management perspective. The PQMethod automatically flags defining sorts based on a comparison of an individual's sort to the characterizing statements for that perspective. Characterizing statements are derived from a PQMethod output table of distinguishing statements for each perspective. A statement is considered distinguishing when its score on two factors exceeds the difference score, which is the extent of distinction between a statement's score on any two factors required for statistical significance (van Exel and de Graaf 2005).

Table 1 shows the 55 Q statements and their Z-scores (number of standard deviations from the mean). The mean of the Q-sort distribution is zero, the neutral point in the distribution of issues. We report Z-scores because they provide a finer distinction between stakeholders' preferences which would be concealed in raw factor scores. In the Results section, each management perspective is described using characterizing statements for that perspective. All statements used to describe each perspective are significant at $P < 0.05$.

Summary statistics from the Likert-like scale of items assessing the frequency of ATV use for recreational and non-recreational purposes suggested a further categorization of ATV riders who are non-ATV club members. We labeled those who used ATVs with the same intensity for both recreational and non-recreational purposes "balanced riders." Those who used ATVs more frequently for non-recreational purposes were labeled "practical riders," and the label "high recreational use" was ascribed to those who use ATVs frequently ($\geq$3 on a scale from 1 = never to 5 = very often) for such purposes. This categorization led to the 17 major stakeholder groups and subgroups shown in the first column of Table 2.

Results

Analysis of the stakeholder Q-sorts revealed three distinct management perspectives, explaining 56 percent of the variance, which we labeled *Expert Management*, *Multiple Use*, and *Enforcement and Balance*. In the description of the perspectives that follows, the numbers in parentheses refer to the statements listed in Table 1. After describing the management perspectives, we compare them to each other, focusing on areas of consensus (statements that all perspectives either agree with or disagree with) and disagreement (statements that perspectives had opposing views about).

Expert Management Perspective

The *Expert Management* perspective maintains that ATV trail planning and management should be informed by ecological expertise and ought to include setting aside large ATV-free areas (statements 10 and 12 in Table 1). According to this perspective, effective management and minimization of ecological damage require avoiding political influences on management, sufficiently enforcing rules, and adequately funding, including ATV user fees for, trail maintenance and enforcement (1, 5, 36, 44). Increased ATV trails and activity, and multiple use management in its various forms, are inappropriate, ineffective, or unreasonable ATV management strategies according to the *Expert Management* perspective (11, 16, 17, 18, 23, 29, 38, 51). To avoid the spread of illegal trails, this perspective deems it better to post signs on trails that are open for ATV use rather than relying on posting those that are closed (26).

The *Expert Management* perspective opposes a variety of ATV management tools and approaches, including ATV use of logging roads and creating more trail loops to minimize environmental damage (13, 19). Those who hold this perspective do not believe that stringent restrictions on ATV activity will have negative economic consequences (37), and they disagree with the view that ATV signs should be kept to a minimum because area boundaries are typically well defined and easily recognizable by ATV riders (25). The *Expert Management* perspective is also critical of the "managed designation" of state lands (i.e., forest roads and trails are designated as open to recreational motor vehicle use unless posted closed) and the associated signage of ATV trails (26, 41). Finally, this perspective is in favor of a management process that recommends environmental protection (47) and opposes claims that time will fix the management problems (43).

Fifty of the 97 stakeholders significantly agreed with the *Expert Management* perspective and six significantly disagreed (Table 2). A wide range of stakeholders significantly agreed with this perspective, but a preponderance of Minnesota Department of Natural Resources professionals hold this view. There were 29 "defining sorts" for *Expert Management*—participants whose sorts most closely match this perspective. More than half (15) of the defining sorts were Minnesota Department of Natural Resources or county natural resource professionals. All four participants who identified themselves as environmental advocates significantly agree with this, and only this, perspective (Table 2).

Table 1 Q-Sort statements and their Z-Scores for each management perspective

	Q-sort statements	Management perspectives		
		Z-scores		
		Expert managment	Multiple use	Enforcement & balance
1	Fees should be charged to all ATV users for trail upkeep and enforcement	1.0	−0.3	0.2
2	Additional fees on all ATV users would be unfair to those who ride responsibly; instead, stringent fees and penalties should apply to renegade riders	−0.8	0.4	−0.01
3	Thrill seeking ATV users should pay a thrill fee to support enforcement and trail repairs	−0.2	−1.3	−1.3
4	Snowmobilers took great pains to address their problems—ATV riders should do the same	−0.2	0.6	0.4
5	Sufficient enforcement is needed to prohibit unauthorized ATV use	1.5	0.9	1.8
6	ATV management should be stringent, with no grey areas	0.8	−0.8	1.2
7	The forest is quieter than the cities so forest ATV use should have tougher noise regulation than elsewhere	0.7	−0.8	−0.5
8	The DNR should increase its commitment to ATV education	0.1	−0.1	0.6
9	There should be ATV speed limits where people feel it is dangerous or unsafe	0.6	0.6	0.5
10	It is wisest to allow ATV traffic only in areas that professional foresters and ecologists designate as suitable	1.9	−1.1	0.9
11	The DNR should develop a system that spreads ridership throughout the state as a means to protect natural resources and meet appropriate recreational expectations	−0.9	1.0	0.6
12	We need to set aside large ATV-free areas, as has been done in some federal parks	1.8	0.2	−1.0
13	Low-maintenance roads connecting to sections of higher standard roads to create loops and destination points will help reduce ATV damage and off-trail violations	−1.0	0.6	−0.1
14	If trails were maintained properly and frequently the damage from ATVs would be less visually distasteful and provocative to non-motorized recreationists	−0.7	0.04	0.1
15	Trails should include access to local businesses so that ATV riders can readily contribute to the local economy (gas, lodging, dining, etc.)	−0.8	0.8	1.6
16	Enough trails would help keep ATV use out of ditches, wetlands and other sensitive areas	−1.6	−0.5	−0.3
17	Opening more areas to ATV traffic will only increase violations and cause more environmental destruction	1.5	−1.4	−1.9
18	If creating more ATV trails meant it would keep them off other public roadways, town roads, and county roads, I would be supportive	−1.1	−0.2	−0.3
19	Recreational use of abandoned logging roads should be allowed; it will reduce ATV traffic and impacts as legal trails are becoming fewer and fewer	−1.6	0.8	−1.3
20	Trails should be designated for either non-motorized use or any motorized vehicle with a width of so many inches, rather than having separate trails for each type of motorized vehicle	−0.4	−0.7	0.4
21	Make provisions to accommodate big game hunting using ATVs	−0.9	0.3	−0.9
22	Challenging riding areas should be located in all corners of the state, not just in north-central Minnesota, to disperse rather than concentrate severe impacts	−0.9	1.3	0.5
23	I support multiple uses of trails by snowmobiles and ATVs; in the summer ATV use trails to help keep brush down and in winter snowmobiles use them	−1.2	0.5	1.3
24	The current maps of ATV trails are a good start but they will need to be improved to make them as accurate as possible	0.04	0.7	1.1
25	Signs should be posted only where necessary because area boundaries are typically well defined and easily recognizable to ATV riders	−1.2	−1.7	−2.0
26	When an ATV goes off-trail it creates a new trail and if that new trail is unmarked, other ATVs will follow, so it is better to post trails that are open for ATV use rather than those which are not	1.5	0.5	−0.6
27	I would like a balance of uses for all peoples' enjoyment and in a respectful manner. The Minnesota forest is a beautiful area and should be enjoyed by all	0.1	2.0	1.7
28	Develop ATV trails in the urban areas	−0.1	−0.2	1.3
29	Other forest users need to get the message that these forests are multi-use and that certain areas are going to have some noise and erosion from ATV use	−1.5	0.3	0.5
30	Compromises can be found with enough ATV trails and solitude areas while protecting natural resources for future generations	−0.5	1.5	1.3

Table 1 continued

	Q-sort statements	Management perspectives		
		Z-scores		
		Expert managment	Multiple use	Enforcement & balance
31	In areas where the forest transcends federal, state and county boundaries, a committee of officials from the respective governments should be formed to harmonize the confusing rules that state, federal, and county governments make	0.3	0.7	1.3
32	A permanent, balanced citizen committee made up of people willing to set aside suspicion and mistrust, which reports regularly to the legislature and the DNR about ATV issues, will help	−0.2	0.3	−1.3
33	A thorough environmental assessment of all state forest trails is essential to get those opposed to ATVs to be comfortable with trails development	0.8	0.4	−1.6
34	A trail ambassador type program to assist in safety, environmental education, and monitoring trails on public lands would be one good way to limit ATV destruction of public lands	−0.7	0.7	0.6
35	Enforcement of ATVs is difficult, so education is our best bet	−0.5	0.1	−0.1
36	To find a good statewide solution to the ATV problem, we need to be bold enough to make the decisions without being politically swayed	1.8	0.9	0.8
37	In times of economic hardship like now, the economic impact would be huge if overly stringent restrictions are placed on ATV riding	−1.7	−0.8	−1.2
38	If ATV use is further encouraged in forests, other types of recreation and the revenue generated from them could suffer	1.0	−1.5	−1.5
39	In the spirit of free enterprise and entrepreneurship, we should limit ATV use to private lands; it will create jobs and confine ATVs to areas controlled by private interests	0.2	−2.2	−1.0
40	Restricting ATV use is no different than that of fishing "seasons", "bag limits" or nonuse of motors in some lakes	0.7	−0.4	0.3
41	The "managed designation" is the best for all parties involved because this way if the DNR feels the trails are too wet or have been used too much they can close them down	−1.2	−0.5	−0.1
42	Opening and closing dates for ATV riding season are better dictated by seasonal on the ground conditions, rather than the fixed Memorial Day to Labor Day datelines	0.6	0.8	0.1
43	The ATV issue will self-correct in future years	−2.1	−2.2	−0.9
44	Without adequate funding, the DNR will not be able to implement any of the badly needed improvements in trail maintenance, repair and enforcement	1.0	0.8	1.1
45	Signs to call DNR enforcement in case of an ATV violation would help reduce misbehavior of ATV riders	−0.02	−0.03	−0.5
46	The DNR should provide a system of environmentally sustainable trails that accommodates multiple skill levels and provides access to suitable riding opportunities	−0.5	1.6	1.2
47	An ATV management process that recommends protection of natural resources is more likely to evade criticisms from environmental groups, lawsuits, delays and frustrations over the best way to get trails on the ground	0.9	−0.3	−0.5
48	A balanced citizens committee that meets regularly to consider ATV issues would help instill respect for different opinions and reduce mistrust of others' motives	0.03	0.3	−1.1
49	Without continued dialogue about the issues facing the ATV program, there is great concern about an environmentally acceptable ATV program existing in Minnesota	0.7	0.5	−0.3
50	Rut-causing tire types should be regulated to reduce the severity of ruts	0.6	−0.8	−0.4
51	The notion of 'multiple uses', or sharing public lands, is not a reasonable way to manage ATV riders and other forest users	1.0	−2.0	−1.6
52	User fees to help manage the ATV problem would be great	0.5	0.2	0.01
53	Only normal ATV riding should be allowed in state forests; thrill riders should be restricted to private property	0.8	−1.4	−0.3
54	The most important goal should be sustainable resource management while being fair to all public forest users	0.9	1.9	1.7
55	The statewide plan is too large; plans should be implemented on a local level by thinking globally and acting locally	−0.5	−1.0	−0.3

Table 2 Stakeholder groups and the number of stakeholders in each group who loaded on each of the three management perspectives, and those who loaded on multiple perspectives

Stakeholder groups (total participants in parentheses)[a]	Management perspectives[b]			
	Expert management	Multiple use	Enforcement & balance	Multiple perspectives
MN DNR internal stakeholders				
Office of Management & Budget Services (4)	3	1	0	1AB
Fish & Wildlife (10)	8	1	1	1AC
Enforcement (7)	6	1	3	3AC
Forestry (10)	2	1 [1]	4	1AC
Parks & Trails (Trails section) (4)	0 [1]	2	4	1BC
Parks & Trails (Parks section) (3)	2	0	1	0
Ecological Resources (4)	3	0	0	0
External Stakeholders				
County Recreation Planner/Manager (4)	1	1	2	0
ATV Club Members (8)	0 [3]	6	2	2BC
Non-motorized recreationists (8)	6	2	1	1BC
Private land owners (6)	5	1	0	0
Practical Riders, Low Recreational Use (10)	5 [1]	3	1	0
Practical Riders, High Recreational Use (4)	1	2	0	0
Balanced Riders, High Recreational Use (5)	0 [1]	5	2	2BC
Balanced Riders, Low Recreational Use (2)	2	0	0	0
Environmental Advocates (4)	4	0	0	0
ATV Researchers, University and Federal (4)	2	3	1	1AB, 1BC
Total (97)	50 [6]	29 [1]	22 [0]	2AB, 5AC, 7BC

[a] Some stakeholders did not significantly agree or disagree with any management perspective, which is why the number of stakeholders who loaded on each of the three management perspectives plus those who loaded on multiple perspectives may not equal the total for a group

[b] Numbers in [ ] indicate the number of stakeholders who significantly disagree (significant negative loadings) with that management perspective

Multiple Use Perspective

The *Multiple Use* perspective emphasizes fairness, balanced multiple use, and sustainable management (statements 27, 46, 51 and 54 in Table 1). According to this management perspective, ATV riding is a legitimate use of public lands that can be balanced with other uses through compromise, adequate enforcement, and the avoidance of political influences (5, 30, 36). The *Multiple Use* management perspective suggests that ATV riding on public lands should be spread across the state and affirms that all types of ATV riding (e.g., multiple skill levels, including challenging riding areas) should be accommodated on state forests (3, 11, 22, 46, 53).

The *Multiple Use* perspective opposes a number of ATV management statements, including the idea that ATV management problems will fix themselves with time (43). This perspective also disagrees with the statement that signs should be posted only where necessary because area boundaries are easily recognizable to ATV riders (25), and opposes the view that forest and ecological expertise should determine ATV trail designations (10). The *Multiple Use* perspective believes that more ATV activity will not increase ecological damage or have negative impacts on other forms of forest recreation, and opposes the idea of restricting ATV activity to private lands (17, 38, 39).

Twenty-nine individuals significantly agreed with this perspective while one significantly disagreed (Table 2). The sorts of 15 participants defined the *Multiple Use* perspective: three ATV club members, four high recreational ATV riders, three ATV researchers, one county recreation planner/manager, and one member each from the DNR divisions of Enforcement, Parks and Trails (Trails Section), Fish and Wildlife, and Office of Management and Budget Services.

Enforcement and Balance Perspective

According to the *Enforcement and Balance* management perspective, sufficient enforcement, a balance of forest uses, and fairness to all forest land users are ideal

management conditions (statements 5, 27 and 54 in Table 1). This management perspective emphasizes the economic contributions of ATVs by supporting the connection of trails to local businesses to facilitate such contributions (15). The *Enforcement and Balance* perspective believes in compromise between motorized and non-motorized uses and users of public forests (30). Development of ATV trails in urban areas, multiple uses of trails by ATVs and snowmobiles, and harmonization of confusing rules where trails transcend federal, state and county forests and management jurisdictions (23, 28, 31) are supported.

The *Enforcement and Balance* perspective rejects the beliefs that increased ATV trails will negatively affect the environment or other forms of forest recreation, and that trail signs should be posted only where necessary since area boundaries facilitate ATV trail recognition (17, 25, 38). This perspective disagrees that environmental assessment of all trails would minimize opposition to ATVs (33). The *Enforcement and Balance* perspective also opposes the idea of charging fees to thrill seeking ATV riders for trail maintenance and enforcement, and dismisses claims that multiple use management is an unreasonable approach (3, 51). The perspective does not see the utility of a permanent, balanced citizen committee to report regularly to the legislature and the Minnesota Department of Natural Resources about ATV issues (32). Reinforcing its view that more ATV trails pose little threat to the environment and other forms of recreation, this perspective rejects suggestions that riders use abandoned logging roads to offset decreasing availability of ATV trails, thereby reducing ATV traffic and consequent damage (19).

Twenty two individuals significantly agreed with this perspective and no participants significantly disagreed with it (Table 2). The Q-sorts of six participants define the *Enforcement and Balance* perspective: one ATV club member, one high recreational ATV rider, two members of DNR Forestry, one member of DNR Parks and Trails (Trails Section), and one county recreation planner/manager.

Comparing Perspectives

Areas of Consensus

Despite holding three distinct viewpoints among them, stakeholders share many common views. Some level of consensus was found across all three management perspectives on 19 of the 55 statements about ATV management in Minnesota state forests. First, there were four Q-defined consensus statements for which there was no significant difference in a statement's Z-scores across all management perspectives. All three management perspectives agreed without significant differences that: (i) "there should be ATV speed limits where people feel it is dangerous or unsafe" (9); (ii) "without adequate funding, the DNR will not be able to implement any of the badly needed improvements in trail maintenance, repair and enforcement" (44); and (iii) "user fees to help manage the ATV problem would be great" (52). The fourth Q-defined consensus statement was a disagreement. All three perspectives disagreed with claims that "signs to call DNR enforcement in case of an ATV violation would help reduce misbehavior of ATV riders" (45).

In addition to the Q-defined consensus statements, all three perspectives unanimously, though at varying levels, agreed with the views that effective ATV management requires: (i) determining the opening and closing dates for ATV activity on the basis of on-the-ground conditions (42); (ii) sufficient enforcement (5); (iii) harmonizing confusing rules in areas where trails transcend federal, state, and county boundaries (31); (iv) avoidance of political influences on ATV planning and management (36); (v) accurate ATV trail maps (24); (vi) sustainable resource management that is also fair to all forest users (54); and (vii) a balance of uses for the enjoyment of all (27).

Issues about ATV management for which all three perspectives unanimously disagree are also areas of potential common ground for stakeholders. All three perspectives unanimously disagreed, though at varying levels, with claims that: (i) ATV issues will self-correct with time (43); (ii) enough trails will eliminate damage caused by ATVs (16); (iii) "thrill seeking" ATV riders should pay a fee to support enforcement and trail maintenance (3); (iv) the "managed designation" of forest lands (i.e., forest roads and trails are designated as open to recreational motor vehicle use unless posted closed) is the best approach (41); (v) creating more ATV trails would be a solution to keeping ATVs off roadways (18); (vi) "overly stringent" restrictions on ATV activity will have significant economic impacts (37); (vii) the statewide plan is too large and ATV management plans should be local (55); and (viii) signs should be posted only where necessary because area boundaries are typically well defined (25).

Areas of Disagreement

There were also areas of major contention and disagreement among the management perspectives. The *Expert Management* perspective strongly supports the view that increased ATV activity will increase violations and negatively impact the environment (17), while *Multiple Use* and *Enforcement and Balance* strongly oppose this viewpoint. The notion of multiple use, or whether ATVs should be integrated with or separated from other uses of public land, was another contentious issue (23, 51). The *Multiple Use,* and *Enforcement*

and Balance perspectives strongly support multiple use in its varied forms, while the *Expert Management* perspective is against it. The *Expert Management* and *Enforcement and Balance* perspectives support the idea that ATV traffic should be allowed only in areas judged as suitable by professional foresters and ecologists, while *Multiple Use* disagreed with this belief (10).

The *Expert Management* and *Enforcement and Balance* perspectives strongly oppose ATV use of abandoned logging roads to help minimize ATV damage, while the *Multiple Use* management perspective supports this management action (19). Those who hold the *Multiple Use* and *Enforcement and Balance* perspectives would like ATV trails to include access to local businesses to facilitate riders' contribution to local economies, while the *Expert Management* perspective is opposed to such an approach (15). The *Expert Management* and *Multiple Use* management perspectives both suggest that it is better to post signs on trails that are open rather than closed because when an ATV goes off-trail it creates an unmarked new trail, but the *Enforcement and Balance* perspective opposes this management strategy (26). The *Expert Management* and *Enforcement and Balance* perspectives support stringent ATV management with no "grey areas," while the *Multiple Use* perspective opposes this approach (6). The *Multiple Use* and *Enforcement and Balance* perspectives suggest an ATV program to assist with safety, education, and monitoring (34), and both perspectives also support the development of a trail system that would spread ridership throughout the state, rather than concentrating riding in certain areas, as a means to protect resources and meet recreational demands (11). The *Expert Management* perspective opposes these two approaches.

Although the *Expert Management* perspective is the most popular among conflicting parties (50 of 97 participants significantly agreed with this perspective), it is also the most contentious perspective with six stakeholders significantly disagreeing with it. Stakeholders who significantly disagreed with the *Expert Management* perspective include one member of the MN DNR, Division of Parks and Trails (Trails Section), three ATV club members, and two ATV recreational riders.

Multiple Perspectives

There were 14 double positive loaders for the three management perspectives, i.e., stakeholders who significantly agreed with two management perspectives as shown by their positive, significant loading scores on those perspectives (see the far right column in Table 2). Of these double positive loaders, two significantly agreed with the *Expert Management* and *Multiple Use* perspectives, five agreed with the *Expert Management* and *Enforcement and Balance* perspectives, and seven agreed with *Multiple Use* and *Enforcement and Balance* perspectives. Of the 14 double positive loaders, seven are from the Minnesota Department of Natural Resources. Of these seven, five agreed with the *Expert Management* and *Enforcement and Balance* perspectives, one agreed with the *Multiple Use* and *Enforcement and Balance* perspectives, and one agreed with both *Expert Management* and *Multiple Use*. There was one triple loader who significantly disagreed with the *Expert Management* perspective and significantly agreed with the other two.

Discussion

We found that the controversy about ATV management is framed into three distinct perspectives that prioritize issues within each frame, delineated areas of consensus and disagreement and outlined the extent to which stakeholders agree or disagree with each frame. This approach to framing stakeholder attitudes and beliefs enhances managers' understanding of complex and contentious environmental management issues (Addams and Proops 2000). Frames of stakeholder perspectives provide managers and policy makers with another lens to observe and approach negotiations in multi-stakeholder settings. For example, in light of their strong belief in the value of ecological and forestry expertise, it is possible that those who hold the *Expert Management* perspective will agree to multiple use practices if prescribed by such expertise. Agreeing to multiple use perspectives will help reduce the level of contention between holders of the *Expert Management* and the other perspectives thereby enabling opportunities for negotiations about more contentious issues.

Bringing organization and consequent interpretability to bear on such a contentious and complex issue could enhance collaborative planning and management efforts. For example, some levels of consensus exist among all three perspectives on 19 of the 55 statements representing the varied viewpoints about ATV management. These levels of consensus in the midst of such apparent contention demonstrate Q methodology's efficacy in bridging the gap among contending parties' perspectives on contentious natural resource management issues (Maxwell 2000). Identification of consensus areas could serve as a gauge of the relative degree of "contentiousness" of a particular management issue, and provide a starting point for collaboration among stakeholders.

Unlike other approaches to framing environmental disputes, Q methodology outputs include numerical values that illustrate the relative importance of issues within each frame. This issue prioritization may enable stakeholders to more accurately compare their understanding of an issue

with those of other stakeholders and to validate their perceptions of the relative importance of issues to other stakeholders (Stephenson 1953). For example, the consensual acceptance across all management perspectives of ATV user fees for trail repairs and maintenance contradicts the commonly held perception of pro-ATV stakeholders as those who are opposed to ATV user fees. When asked as a standalone issue, pro-ATV stakeholders are likely to reject the notion of user fees. However, because Q methodology enables disputants to numerically prioritize issues through the forced-choice distribution technique, stakeholders respond to the issue of user fees in relation to other management issues that they consider more pressing and therefore make trade-offs. The undesirability of issues such as restricting ATV use, pre-requisite environmental assessments related to ATV activity, facilitating the reporting of ATV violations, etc., become relatively more pressing than the idea of ATV user fees. This highlights Q methodology's strengths in revealing important latent preferences about an issue (Addams and Proops 2000) by enabling issue prioritization. When stakeholders are enabled to express themselves and organize their perspectives in tandem with other perspectives, using Q methodology's forced-choice distribution technique, the undesirable may become relatively and surprisingly acceptable (Stephenson 1982).

The quantitative determination of the extent to which stakeholders hold or despise a frame—the magnitude and statistical significance of stakeholder associations with frames—could help clarify previously held viewpoints about the conflict and challenge conventional wisdom. For example, prior to and during this study, we encountered the widely held view that environmental advocates are highly skeptical of and uncompromising towards pro-ATV perspectives. Although two individuals who identified themselves as environmental advocates loaded negatively on the *Multiple Use* and *Enforcement and Balance* management perspectives, those loadings were not statistically significant. On the other hand, six stakeholders who were not environmental advocates disagreed significantly with the *Expert Management* perspective. These six stakeholders, mostly ATV riders, significantly disagreed with the perspectives held by environmental advocates, more so than the environmental advocates disagreed with the perspectives of these other stakeholders. But, the fact that all participating environmental advocates significantly load only on the *Expert Management* perspective suggests single-mindedness and/or inflexibility that may help explain why they are sometimes perceived as uncompromising towards pro-ATV perspectives. These insights on stakeholder flexibility and relative agreement or disagreement with the viewpoints of other stakeholders could help planners and managers better understand which issues, and why, may be more or less likely to resist resolution (Rubinstein 1998). Such knowledge could help planners and managers successfully design multi-stakeholder collaboration.

We found a surprising degree of unanimity among the three management perspectives. For example, all perspectives disagreed with the claim that "Signs should be posted only where necessary because area boundaries are typically well defined and easily recognizable to ATV riders" (25). Efforts to increase and improve signage and clarify permitted uses will be welcomed by all stakeholders and may help diffuse tensions. Similarly, all stakeholders agree that on-the-ground conditions, rather than some predetermined dates, should determine opening and closing dates for ATV activity (42); sufficient enforcement is required (5); ATV rules are confusing in areas where trails transcend federal, state, and county boundaries (31); political influences on ATV planning and management efforts must be avoided (36); the accuracy of ATV trail maps should be improved (24); sustainable resource management, while at the same time being fair to all forest users, should be the most important goal (54); and a balance of uses for the enjoyment of all is desirable (27). Although some of these areas of agreement would be difficult to define or implement (e.g., avoiding political influences, and determination of what exactly constitutes fairness), others are clear cut and would be relatively simple to put in place (e.g., improving the accuracy of trail maps, and clarifying confusing rules across jurisdictional boundaries). Management solutions tend to get hung up on disagreements over potentially irresolvable differences, rather than focusing on practical management steps that most stakeholders support. Our results suggest that the conflict is less intense at the stage of deliberating specific management actions. Land managers should therefore focus on widely accepted management actions that will ameliorate commonly recognized problems, which may ease tensions between stakeholders and make tackling the tougher issues easier.

Q methodology is a powerful tool for systematically examining the subjective views of stakeholders. But, like any research method, it also has limitations. Perhaps most important, results cannot be generalized to the rest of the population. The aim is to determine the range, diversity, and structure of views expressed about an issue, not to make claims about the percentage of people expressing them. Q methodology also has practical limitations. For example, because it is an unfamiliar method to most, understanding a Q sort may be difficult and time-consuming for respondents. The potential for poor completion and high error rates exists if the method is not carefully explained. Finally, participant's responses are restricted to the pre-determined statements, which could limit the views that can be expressed if researchers are not thorough in identifying the concourse and the Q statements subsequently selected for sorting.

Conclusions

This study aimed to identify distinct perspectives about ATV management on Minnesota state public forests, understand the structure of these management perspectives and what issues disputants prioritize within each perspective, identify areas of consensus and disagreement, specify which stakeholders hold the various perspectives and to what degree, and explore the implications for ATV planning and management. Our findings also enabled us to verify stakeholder perceptions of other stakeholders, with important planning and management insights.

Dryzek (1990) points to the advantages of Q methodology in comprehensively and deliberatively exploring social discourses about public policy issues. We learned from this study that such comprehensive deliberative processes may uncover a surprising degree of consensus about management practices previously perceived as contentious and therefore unacceptable. We found four Q-defined consensus statements and 15 other statements for which all three perspectives agreed with or disagreed with to some degree. Additionally, only seven of the 97 participants significantly disagreed with one management perspective or the other. This is a surprising degree of consensus and agreement about an issue that has proven to be so intractable.

The fact that there were so many multiple positive loaders—individuals who were able to see more than one side of the issue—is another strong indicator of the level of contention that exist among conflicting parties. It suggests that the perspectives of some ATV management stakeholders are not "carved in stone," which may be helpful in promoting collaboration among stakeholders. Many of these multiple loaders are from the Minnesota Department of Natural Resources, evidence of the existence of flexibility among DNR ATV-related staff which may be playing an important role in buffering the intensity of the controversy. But, it is equally interesting to notice that one member of the DNR's trails section of the Division of Parks and Trails, in alignment with some ATV Club members and riders, disagree with the *Expert Management* perspective. Stakeholder flexibility may have been promoted by the Q methodology itself. Participants were asked to comment on the study immediately following the completion of the sorting exercise. Some reported that the exercise was a thoughtful experience, enabling them to reflect on the fact that there are multiple ways to view ATV management.

Acknowledgments The authors are thankful to all those who participated in the study through interviews and Q-sorting. We extend our gratitude to Grant Wilson and Andy Holdsworth for pre-testing the initial sort and providing constructive feedback on the design of the final sort. We are grateful to Seth Tuler and Kimberly Byrd for their insightful reviews of an earlier draft of this manuscript. We also thank the anonymous reviewers for their many constructive comments and suggestions. The authors extend their gratitude to the Division of Parks and Trails of the Minnesota Department of Natural Resources for funding this study.

References

Addams H, Proops J (eds) (2000) Social discourses and environmental policy: an application of Q methodology. Edward Elgar, Northampton

Baker J, Schuster RM, Cordell HK (2008) An exploratory study of OHV riders in New York State: Findings and implications for management. In: LeBlanc C, Vogt C (comps.) Proceedings of the 2007 northeastern recreation research symposium. General Technical Report NRS-P-23. Northern Research Station, USDA Forest Service, Newtown Square, PA, pp 216–222. http://treesearch.fs.fed.us/pubs/13829. Accessed 19 Oct 2009

Bardwell LV (1991) Problem-framing: a perspective on environmental problem solving. Environmental Management 15(5):603–612

Bartlett FC (1932) Remembering: a study in experimental and social psychology. Cambridge University Press, Cambridge

Benford R (1993) Frame disputes within the nuclear disarmament movement. Social Forces 71:677–701

Benford R (1997) An insider's critique of the social movements framing process. Sociological Quarterly 67:409–430

Benford RD, Snow D (2000) Framing processes and social movements: an overview and assessment. Annual Review of Sociology 26:611–639

Brown SR (1980) Political subjectivity: applications of Q methodology in political science. Yale University Press, New Haven

Brown SR (2002) Structural and functional information. Policy Sciences 35:285–304

Brown H (2006) Minnesota's ATV safety record sub-par. http://wcco.com/local/ATV.safety.Minnesota.2.361801.html. Accessed 10 May 2009

Brummans BHJM, Putnam LL, Gray B, Hanke R, Lewicki RJ, Wiethoff C (2008) Making sense of intractable multiparty conflict: a study of framing in four environmental disputes. Communication Monographs 75(1):25–51

Bryant J, Miron D (2004) Theory and research in mass communication. Journal of Communication 54:662–704

Chavez DJ, Knap NE (2006) Manager perceptions of issues and actions for off-highway vehicle management on national forests in California. Res. Paper PSW-RP-250, Pacific Southwest Research Station, USDA Forest Service, Albany

Crimmins T (1999) Colorado off-highway vehicle user survey: summary of results. Report to the State of Colorado, Colorado State Parks OHV program. http://nohvcclibrary.forestry.uga.edu/SCANNED%20FILES/M-0042.pdf. Accessed 16 Aug 2010

Davenport MA, Borrie WT, Freimund WA, Manning RE (2002) Assessing the relationship between desired experiences and support for management actions at Yellowstone National Park using multiple methods. Journal of Park and Recreation Administration 20:51–64

Dryzek J (1990) Discursive democracy. Cambridge University Press, Cambridge, UK

Dryzek J, Berejikian J (1993) Reconstructive democratic theory. American Political Science Review 87:48–60

Eden S, Donaldson A, Walker G (2005) Structuring subjectivity? Using Q methodology in human geography. Area 37:413–422

Fisher AL, Blahna DJ, Rosalind B (2001) Off highway vehicle uses and owner preferences in Utah. Professional report IORT PR2001-02, Prepared for the Utah Department of Natural

Resources, Division of Parks and Recreation. Institute for Outdoor Recreation and Tourism, Department of Forest Resources, Utah State University, Logan, UT. http://nohvcclibrary.forestry.uga.edu/SCANNED%20FILES/M-118.pdf. Accessed 16 Aug 2010

Flood JP (2006) Just don't tell me no: managing OHV recreational use on national forests. In: Peden JG, Schuster RM (eds) Proceedings of the 2005 Northeastern Recreation Research Symposium. General Technical Report NE-341. Northeastern Research Station, USDA Forest Service, Newtown Square, PA, pp 130–134. http://treesearch.fs.fed.us/pubs/22260. Accessed 16 Aug 2010

Garland S (2010) 2008 Annual report of ATV-related deaths and injuries. U.S. Consumer Product Safety Commission, Bethesda, MD. http://www.cpsc.gov/library/foia/foia10/os/atv2008.pdf. Accessed 16 Aug 2010

Goffman E (1974) Frame analysis: an essay on the organization of experience. Northeastern University Press, Boston

Gray B (2003) Framing of environmental disputes. In: Lewicki RJ, Gray B, Elliott M (eds) Making sense of intractable environmental conflicts: frames and cases. Island Press, Washington, DC, pp 11–34

Gray B (2004) Strong opposition: frame-based resistance to collaboration. Journal of Community and Applied Social Psychology 14:166–176

Lewicki RJ, Gray B, Elliot M (eds) (2003) Making sense of intractable environmental conflicts: concepts and cases. Island Press, Washington, DC

Mann MJ, Leahy JE (2009) Connections: integrated meanings of ATV riding among club members in Maine. Leisure Sciences 31:384–396

Maxwell JP (2000) Managing conflict at the county level: the use of Q methodology in dispute resolution and strategic planning. Public Administration Quarterly 24:338–354

Meersman T (2002) Tracks on the land: nature pays the prices as ATVs hit Minnesota woods. Star Tribune (Minneapolis-St. Paul, MN). February 23. http://www.startribune.com/sports/outdoors/11593471.html?elr=KArksUUUoDEy3LGDiO7aiU. Accessed 17 May 2009

Minnesota Department of Natural Resources (MN DNR) (2007) A strategic conservation agenda 2003–2007: 2007 update, outdoor recreation. http://files.dnr.state.mn.us/aboutdnr/reports/conservationagenda/recreation.pdf. Accessed 17 Feb 2009

Minnesota Department of Natural Resources (MN DNR) (2008a) 2008 summary of fatal ATV/OHM/OHV accidents: updated January 30, 2009. http://files.dnr.state.mn.us/enforcement/incident_reports/atvfatal_accidents08.pdf. Accessed 10 May 2009

Minnesota Department of Natural Resources (MN DNR) (2008b) MN DNR 2008 Fact sheet "State forest classification and road/trail designation: motor vehicle access to Minnesota's public lands". http://www.dnr.state.mn.us/input/mgmtplans/ohv/designation/index.html. Accessed 17 Feb 2009

Minnesota Department of Natural Resources (MN DNR) (2009) Off-highway vehicle management program, Minnesota Department of Natural Resources, chronology 1984–2009. http://files.dnr.state.mn.us/trails_waterways/ohvplanning/mgmtprogramchronology.pdf. Accessed 10 May 2009

Motorized Trail Task Force (MTTF) (2003) Motorized trail task force report to the Minnesota state legislature and the Minnesota Department of Natural Resources, January 14, 2003. http://files.dnr.state.mn.us/input/issues/ohv/finalreport_draft.pdf. Accessed 10 May 2009

Neale MA, Bazerman MH (1985) The effects of framing and negotiator overconfidence on bargaining behaviors and outcomes. Academy of Management Journal 28(3):34–49

Ouren DS, Haas CH, Melcher CP, Steward SC, Ponds PD, Sexton NR, Burris L, Fancher T, Bowen ZH (2007) Environmental effects of off-highway vehicles on Bureau of Land Management Lands: a literature synthesis, annotated bibliographies, extensive bibliographies, and Internet resources. Open-File Report 2007-1353. US Geological Survey, Reston, VA. http://www.fort.usgs.gov/products/publications/22021/22021.pdf. Accessed 16 Aug 2010

Pellow DN (1999) Framing emerging environmental movement tactics: mobilizing consensus, demobilizing conflict. Sociological Forum 14(4):659–683

Pinkley RL (1990) Dimensions of conflict frames: disputant interpretation of conflict. Journal of Applied Psychology 75(2):117–126

PQMethod (2002) Version 2.11. http://www.lrz.de/~schmolck/qmethod/downpqx.htm. Accessed Feb 11 2006

Putnam LL, Shoemaker M (2007) Changes in conflict framing in the news coverage of an environmental conflict. Journal of Dispute Resolution 2007(1):167–175

Rahn M (2009) ATV: striking a balance between use and abuse. Lake Country Journal Magazine 13(2):47–50

Rubinstein RA (1998) Intractable conflicts and possibilities for resolution: Conference framing essay. Paper presented at a meeting of the Hewett-funded Centers for the Study of Conflict Resolution and Negotiation, January 9–11, Palo Alto, CA

Scheufele B (2004) Framing-effects approach: a theoretical and methodological critique. Communications 29:401–428

Schneider IE, Schoenecker T (2006) All-terrain vehicles in Minnesota: economic impacts and consumer profiles. Executive Summary. University of Minnesota Tourism Center. http://www.tourism.umn.edu/prod/groups/cfans/@pub/@cfans/@tourism/documents/article/cfans_article_122726.pdf. Accessed 19 Oct 2009

Schön DA, Rein M (1994) Frame reflection: towards the resolution of intractable policy controversies. Basic Books, New York

Schuett MA (1998) Draft report of off-highway vehicle users study. Report submitted to the National Off-Highway Vehicle Conservation Council, Inc. (NOHVCC). Division of Forestry, West Virginia University, Morgantown, WV. http://nohvcclibrary.forestry.uga.edu/SCANNED%20FILES/M-0041.pdf. Accessed 16 Aug 2010

Schweitzer ME, DeChurch LA (2001) Linking frames in negotiations: gains, losses and conflict. The International Journal of Conflict Management 12(2):100–113

Snow D, Benford R (1988) Ideology, frame resonance, and participant mobilization. International Social Movement Research 1:197–217

Stephenson W (1953) The study of behavior: Q-technique and its methodology. University of Chicago Press, Chicago

Stephenson W (1964) Application of Q method to the measurement of public opinion. Psychological Record 14:265–273

Stephenson W (1982) Q methodology, interbehavioral psychology, and quantum theory. Psychological Record 32:235–248

Stephenson W (1989) Quantum theory of subjectivity. Integrative Psychiatry 6:180–195

Stokowski PA, LaPointe CB (2000) Environmental and social effects of ATVs and ORVs: an annotated bibliography and research assessment. School of Natural Resources, University of Vermont, Burlington, VT. http://vtcite.info/~snrvtdc/trails/ohvbibliogVT00.pdf. Accessed 3 May 2011

Strauss AL, Corbin JM (1998) Basics of qualitative research: techniques and procedures for developing grounded theory, 2nd edn. Sage Publications, Newbury Park

Tannen D (1979) What's in a frame? Surface evidence for underlying expectations. In: Freedle RO (ed) New directions in discourse processing. Ablex, Norwood, pp 137–181

Thompson KA (2007) Management perceptions of off-highway vehicle use on national forest system lands in Appalachia. MS Thesis, Recreation, Parks, and Tourism Resources, West Virginia University, Morgantown, WV

United States Government Accountability Office (US GAO) (2009) Enhanced planning could assist agencies in managing increased use of off-highway vehicles. GAO-09-509, Report to the Subcommittee on National Parks, Forests and Public Lands, Committee on Natural Resources, US House of Representatives. June. http://www.gao.gov/new.items/d09509.pdf. Accessed 16 Aug 2010

United States Institute for Environmental Conflict Resolution (2005) Off-highway vehicle use and collaboration: lessons learned from project implementation. Prepared for the National OHV Implementation Team, USDA Forest Service. http://www.fs.fed.us/recreation/programs/ohv/CaseStudyReport.pdf. Accessed 16 Aug 2010

van Exel, J, de Graaf, G (2005) Q methodology: a sneak preview. Q-methodology.Net. http://www.qmethodology.net/index.php?page=1&year=2005. Accessed 26 Jan 2011

Van Gorp B (2007) The constructionist approach to framing: bringing culture back. Journal of Communication 57:60–78