Compatibility as a conceptual basis for outdoor recreation planning

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Abstract:

In this paper, we propose a comprehensive model of recreational compatibility and report results from a series of expert panels that examined recreational use interactions and pro-active management strategies. Recreational use interactions take place along a compatibility spectrum that ranges from complementarity and supplementarity to competition and antagonism. Results suggest that motorized forms of recreation tend to interact asymmetrically with non-motorized uses and that complementarity and supplementarity characterize closely related recreation types. We forward an approach to recreation planning and management that focuses on relative compatibilities and involves maximizing complementary and supplementary uses while segregating and regulating competitive and antagonistic uses.

Keywords:

Compatibility, conflict, outdoor recreation planning, leisure, management, user groups, complementary, supplementary, competitive, antagonistic, additivity.

Introduction

Supplying outdoor recreation is taking on an increasing sense of urgency as open and publicly accessible lands experience increased demand pressures (Gunn, 1994; Hall, 2000). As rural landscapes become fragmented by private residential and commercial developments, the extent and quality of accessible public recreation lands becomes increasingly scarce. With a simultaneous growth in demand for opportunities to partake in outdoor recreation, conflict among uses will become an increasingly important issue of public policy. Alternative conflict arenas bear continued, and increasingly creative, management input for those charged with prioritizing scarce public resources. The most obvious arena is among alternative recreational uses of a finite land base (Carothers, Vaske & Donnelly, 2001). This conflict grows due to both increased aggregate demand for outdoor recreation (Manning & Valliere, 2001) and technological change that allows new forms of outdoor recreation such as geo-caching, all-terrain-vehicles, and jet skis (Roe & Benson, 2001; Wang & Dawson, 2005).[1]

Recreational use interaction

The primary focus of recreation management practices is on managing site level interactions between individual recreationists with a wide variety of strategies that include restricting the use of certain areas, restricting the timing or type visitor in problem areas, encouraging and educating visitors on proper etiquette and modifying visitor expectations (Manning, 1999 see also Cole, Peterson & Lucas, 1987; Manning et al., 1996). However, much planning for recreation occurs at a larger scale, with a

proliferation of outdoor recreation or parks and open space plans being produced at the city, county or state level. At this planning scale, the interaction of recreational user *groups* provides a key challenge to recreation planners. Recreation activities interact with different degrees of compatibility resulting in various levels of recreational use conflict. One logical approach to managing for recreational compatibility at this scale involves maximizing those uses thought to be complementary and supplementary while segregating those uses that are competitive and antagonistic (Clawson, 1974; vanKooten, 1993; Marcouiller & Clendenning, 2005). Although the compatibility of alternative recreation types is conceptually distinct, there is scant empirical evidence upon which to base management decisions through recreation planning.

Current understanding of recreation conflict is informed by a significant literature that seeks to understand individual perceptions, motivations, behaviors, and even psychological state. The most commonly used definition of outdoor recreation conflict is the one proposed by Jacob and Schreyer (1980, p369) where "conflict is defined as goal interference attributed to another's behavior". This definition emphasizes that conflict arises when one or more of an individual's goals for their recreation experience is interfered with by the activities of other individuals. Jacob and Schreyer (1980) posited four goal interference factors related to individual recreation activity. These included activity style, resource specificity, mode of experience, and lifestyle tolerance.[2] The need for some kind of interaction to occur between individuals as led to this type of conflict to also be called "interpersonal" conflict (Vaske, Donnelly, Wittmann & Laidlaw, 1995; Carothers et al., 2001). Interpersonal conflict may occur

between any combination of recreation participants, recreation managers and local community members (Hammitt, 1998). Studies have consistently shown that this interpersonal conflict may be asymmetrical (Adelman, Heberlein & Bonnicksen, 1982; Jackson & Wong 1982; Ivy, Stewart & Lue, 1992; Gibbons & Ruddell, 1995), with those users reliant on technology for their recreation experience, such as snowmobilers or helicopter skiers, perceiving less conflict than recreation users engaged in more silent pursuits, such as cross-country skiers or canoeists.[3]

Other research has shown that some types of recreation conflict are based solely on differences in individual social values (Adelman et al. 1982; Saremba & Gill, 1991; Carothers et al. 2001). For example, the different values people have about the treatment of animals may lead to a conflict between hunters and other recreationists even though they never interact in person (Vaske et al., 1995; Whittaker et al., 2001).

An equally important dimension of recreation conflict is how individuals cope with conflict. Research has consistently shown that visitor satisfaction remains high despite high visitor use levels (Heberlein & Vaske 1977; Manning & Ciali 1980; Becker, 1981; Robertson & Regula, 1994; Stewart and Cole, 2001) and other recreation conflicts (Schuster & Hammitt, 2000). Coping behaviors, the different mechanisms that an individual has for avoiding or minimizing the negative experiences of crowding or conflict, are well documented in the literature (e.g. Gramann 1982, Anderson & Brown 1984; Hammitt & Patterson 1991, Kuentzel & Heberlein 1992; Hall & Shelby, 2000; Shindler & Shelby, 1995; Manning & Valliere 2001; Johnson & Dawson 2004).

Manning (1999) provides a synthesis of the recreation conflict literature and proposes an expanded goal interference model of recreation conflict. In this model, the four factors, interpreted broadly, postulated by Jacob and Schreyer (1980) remain, but these are seen as simply setting the preconditions for conflict. These four variables simply determine the sensitivity to conflict and other catalyzing factors or stimuli are needed to actually create conflict. These catalyzing factors may be of the interpersonal nature or the result of different social values. Whether conflict leads to diminished satisfaction is largely dependent on whether the recreation users engage in coping behaviors.

This conflict model, while contributing greatly to our understanding of potentially negative recreation interactions, has two principle shortcomings when it comes to its applicability to recreation planning. Firstly, this one-way explanatory model focuses solely on that type of interaction that is represented by conflict while omitting broader types of interaction. Thus, the only types of outcomes well-represented by this model are diminished satisfaction and/or a coping with a conflict outcome. Positive interactions between different types of outdoor recreationists do, however, exist. Recreation planning, as a forward looking practice, should be informed by a conceptual model that explains all types of interactions. The problem with the current model, we believe, is its potential to inform a planning practice that seeks simply to avoid conflict rather than attain compatibility.

Secondly, this model does not explicitly recognize the fact that management interventions can have an important impact on recreation interactions. A variety of

recreation management strategies have been proposed over time including managing recreation areas based on social and environmental carrying capacity (Heberlein & Shelby, 1977; Stankey & McCool, 1984; Shelby & Heberlein, 1986; Manning 1999), separating uses in either time or space (Watson, Niccolucci & Williams , 1993; Roe and Benson, 2001), educating users and managers about the issues (Peterson, 1974; Blahna et al., 1995; Whittaker et al. 2001), being clear about the goals of management (Clark, Hendee & Campbell, 1971; Shelby, 1980) providing a spectrum of different recreation opportunities (Hammitt, 1988; Manning 1999), and, more recently, using visitor norms to set standards of quality or management targets (Shelby & Vaske 1991; Shelby, Vaske and Donnelly, 1996; Manning, 1999). Some studies have investigated the usefulness of different management interventions (Lime & Lucas, 1977; Bright, Manfredo, Fishbein & Baht, 1993; Kernan & Drogin, 1995), and within the recreation conflict literature authors have speculated on the usefulness of certain management interventions to reduce conflict (e.g. Chambers & Price, 1986, Blahna et al., 1995, Whittaker et al., 1993). However, these concepts have not been integrated into conflict model itself. Clearly, this begs for a more comprehensive model that informs the planning for recreation conflict. The lack of up-front resource management input limits its applicability to resource planning and management. In essence, this literature focuses on conflict from the perspective of the user … not the recreation manager, and even less so, the recreation planner.

A Compatibility Framework

Despite its introduction into the literature over thirty year ago (Clawson, 1974) the concept of planning for and managing a wide range of outdoor recreation activities at different scales based on an understanding of their relative compatibility has not been widely explored. Our research builds on Clawson's (1974) concept of relative land-use compatibilities and incorporates the multiple-use trade-off concepts of Van Kooten (1993), which have been formalized as multi-product "additivity" in the environmental economics literature (Bailey and Friedlaender 1982; Weitzman 1992).

Broadly speaking, this framework forwards the notion that conflict between recreational user groups can be understood as representing relative levels of incompatibility between alternative recreation uses. While clearly dependent on many factors, a specific recreation user group will be more able to interact without conflict with some recreational user groups than they can with others. Positive outcomes result when the interaction between recreation groups is complementary (increasing rate of return with increased use) or supplementary (neutral interaction with increased use). Negative outcomes result when the interaction between recreation groups is competitive (decreasing rates of return with increased use) or antagonistic (when the presence of one activity does not allow the other to occur). Characteristics, outcomes, and examples for each interaction type are shown in Table 1. Quite simply, the challenge for recreation planners involves managing group interaction with an eye toward maximizing complementary and supplemental uses while minimizing those which result in competition or antagonism. To be sure, this is easier said, than done.

[insert Table 1 about here]

Some attempts have been made to analyze the compatibility of outdoor recreation activities. For example, Hay and McConnel (1984) found some evidence of complementarity between wildlife watching and hunting, while Fesenmaier and Lieber (1988) found many examples of compatibility between different recreation types based on household recreation choices.

Thus, our review of the literature on recreation conflict and compatibility delivered us to several interesting conclusions. First, the literature on recreation conflict has a set of predefined outcomes that provide an incomplete picture of recreational interaction. A broader set of outcomes is necessary for the application of conflict and compatibility models to the usefulness of planners and recreation managers. Indeed, if our conflict outcomes are predetermined as either coping or diminished satisfaction, this overlooks the significant amount of recreational alternatives that, by and large, work well together. We offer the notion that recreation planning and management necessarily must work within a glass that is half-full, not half-empty.

Further, it is apparent that if we are interested in management-specific options for improving the manner in which planning is applied to outdoor recreation activities, there is a strong need to account for the role of management specific activities in determining the sensitivity to conflict, resulting types of recreational interaction, and their respective outcomes.

Given this conceptual approach, the research reported in this paper attempts to answer several questions related to recreational use compatibility. First, how do

recreation professionals view recreational use interactions along a spectrum from antagonistic to complementary? Second, given the array of uses, how could we develop management priorities to begin dealing with the comprehensive array of interactions taking place? Finally, given this broader, more comprehensive approach to recreation interaction, what management strategies would seem most appropriate for varying levels of use compatibility?

This paper is organized into four distinct sections. Following this introduction and literature review, we outline a modified Delphi process used to collect information from expert panels. We then outline qualitative results and provide discussion of the salient features relevant to management planning. Finally, we conclude with a section on caveats, further research needs, and relevant policy implications.

Methods

For the research reported in this paper we used a modified Delphi process to develop an understanding of the relative compatibility of different land-based recreation activities in Wisconsin. The Delphi method has been widely applied in a number of different fields and was first used as a forecasting method (Archer, 1976; Ziglio 1996). The Delphi method has now been applied to a wide variety of problems (e.g. Green, Hunter & Moore, 1990; Bertin, 1996; Miller, 2001) and is most commonly defined as "a method of structuring a group communication process so that the process is effective in allowing a group of individuals as a whole to deal with a complex problem." (Linstone & Turoff, 1975, p.3). The communication is typically "structured"

so that Delphi process provides feedback to expert participants on their individual contributions, some assessment of the group view, some opportunity for individuals to revise views and some degree of anonymity for the individual responses (Linstone & Turoff, 1975). The Delphi technique is sometimes described as method that allows a group of individuals to reach consensus (e.g. Green et al., 1990), but consensus is simply a desired outcome of some Delphi processes rather than a defining characteristic of the method (Turoff & Hiltz, 1996).

This study was trying to simultaneously accomplish two specific objectives during the modified Delphi process. Firstly, to introduce the compatibility-based recreation model to recreation management experts, and solicit input on the model's validity and its applicability to outdoor recreation planning and management. Secondly, the study was attempting to gather information on the relative compatibility of different outdoor recreation activities in Wisconsin. A Delphi method is an appropriate technique in a number of circumstances that are applicable when (1) the problem does not lend itself to precise analytical techniques but can benefit from subjective judgments, (2) more individuals are needed than can effectively interact in a face-to-face exchange, (3) time and cost make frequent group meetings infeasible, and (4) the efficiency of face-to-face meetings can be increased by supplemental group communication processes (Linstone & Turoff, 1975).

In this modified Delphi process [4], a total of 30 professional recreation managers and recreation advisory volunteers were assembled in six different face-to-face expert-panels. Participants included professionals with the Wisconsin Department of Natural

Resources, the USDA Forest Service, the University of Wisconsin–Extension, volunteer members of the Wisconsin State Trails Council and representatives from the Wisconsin Statewide Forest Plan's Leadership Team on Minimizing Recreational Use Conflicts. Panel participants were sent a background document explaining the methodological approach of the study. The meetings were used to discuss and clarify the methodological approach as well to clarify and develop shared understanding of the proposed compatibility spectrum.

Following the expert-panel sessions, participants were asked to independently complete a recreation activity compatibility matrix. Using the recreation compatibility spectrum (see Figure 1), respondents rated the interaction between different recreation activities. The interaction between activities was rated, both in term of how activity A interacted with activity B, but also how activity B interacted with activity A. For example, what is the compatibility of hiking with snowmobiling? And, what is the compatibility of snowmobiling with hiking? Respondents were asked to use their knowledge as recreation experts, but complete the matrix from the perspective of activity participants. Respondents were encouraged to rank the interaction with a single number, but were told a compatibility range was also acceptable[3].

[insert Figure 1 about here]

Results

All the participants in the expert-panel sessions were asked to complete both the land-based and water-based compatibility matrices. It is illustrative to review briefly the pooled results to see how different participants interpreted the compatibility spectrum. Most respondents rated the compatibility interaction with a single number on the scale between 1 and 10, while a few respondents provided a range of up to 6 points. A few respondents provided a comment along with their rating, such as "on groomed trails" for the interaction between cross country skiers and snowmobilers, or "due to incompatible trails" for a low score between mountain biking and cross country skiing.

The averaged scores for the land-based recreational activities are summarized in Table 2. The scores range from the complementary end of the spectrum, with a high of 9.2 for the compatibility of hiking with camping, to the antagonistic end of the spectrum, with a low of 1.8 for the compatibility of cross-country skiing with ATV use. For most activity pairs there was a wide range of scores reported by the Delphi participants and compatibility ranges of a least eight points – from the antagonistic all the way to complementary end of the spectrum - in 72% percent of the activity pairs (e.g. 1-8, 2-9, 3-10, 1-9, etc.) Indeed for 17% of the activity pairs the interaction is rated from completely antagonistic (1) to fully complementary (10). This range of response can also be seen in the averaged responses for individual respondents, with the average score by respondent ranging from competitive (3.8) to supplementary (7.4). Clearly, some Delphi participants perceive more conflict in outdoor recreation in Wisconsin than do

others and there is a need for further research to clarify why different management experts have such differences of opinion. Despite this range of response the standard deviation for the activity pairs only range from 0.9 to 2.9.

[insert Table 2 about here]

A similar pattern of responses emerged for water-based recreational activities which are summarized in Table 3. The scores ranged from a supplementary interaction (7.9) for canoeing/kayaking with fishing to a strongly competitive interaction (2.5) for fishing with jet-skiing. The range of responses was not as great for water-based recreational activities with only 60% percent of activity pairs with a range of at least eight points, and standard deviations that were slightly more consistent (ranging from 1.3 to 2.7). Nevertheless, 27% of the activity pairs had a range from 1 to 10 and average respondent scores ranged from 4.1 to 8.0.

[insert Table 3 about here]

In this study, Delphi participants were given the opportunity to rate the interaction between two activities differently, depending on which activity's perspective the interaction was rated from. Only one of the twenty-three participants thought that there was no asymmetry between activity interactions. Some interesting patterns of response are revealed by comparing the average compatibility scores for

interaction with a particular activity versus how that activity *interacts with other* activities. While the average compatibility score for interacting with ATV riding is relatively low (2.9), the score for ATV riding interacting with other activities is relatively high (6.0). Similarly the interaction with jet-skiing has an average score of 3.6 while the interaction of jet-skiing with other activities has an average score of 6.2. So while the interaction with motorized and consumptive activities (ATV riding, jet-skiing, hunting, snowmobiling, motorboating/waterskiing) were scored the lowest (fishing being the lone consumptive exception), some of the non-motorized activities can be characterized by these results as fairly demanding activities. For example, cross-country skiing (4.7) and horse back riding (4.9) had the lowest average scores for how these two activities interacted with other activities and may be illustrative of recreation uses that have activity styles, certain resource specificities, as well as typical modes of experience and participants' lifestyle tolerance that contribute to relatively competitive interactions with other activities.

In many respects, the most important findings from this study relate to more qualitative and contextual elements. One issue frequently addressed by expert-panel participants was the challenge in generalizing responses and providing responses that accurately rate the compatibility and interaction between two recreation activities. A number of respondents identified that some of the categories included in the matrix, particularly hunting, wildlife watching and camping, can include significant variability in activity style or attitude of the participant. For example, there are many different types of hunting practiced in Wisconsin – bow-hunting for deer, different types of gun-

hunting for deer, turkey hunting, grouse hunting, duck hunting, dog-assisted hunting, etc. – and factors that relate to the hunting activity – such as the season in which it is conducted, whether it is perch-based or trail-based, and whether an ATV or other motorized vehicle is used. This variability can have a significant influence on the degree of conflict that may be generated with other recreation users. Furthermore, other participants emphasized that a majority of recreation users tend to be quite responsible, but is the "bad apples" that are usually responsible for generating conflict. There was not full agreement on how to account for the conflict created by this type of user as recreation conflict management is often forced to respond to the actions of these "bad apples". Some of the variability in responses may be related to some respondents' perspective of considering the actions of "bad apples" compared to others taking the perspective of the responsible (or average) user. Indeed, for the interaction between ATV use and hunting or camping, one respondent provided two responses, one based on the "reasonable and responsible" user and one based on interaction with "bad apples".

Another source of significant discussion focused on how to deal with activities that tend not to interact very frequently, primarily the snow-based activities of cross-country skiing and snowmobiling with activities such as hiking, mountain biking, horseback riding and linear trail biking. Some respondents took the perspective that these interactions should not be included on the matrix and left the matrix blank. In one instance, the respondent commented that from their perspective there was "no conflict", but included a score of 7 (supplementary). Other participants felt that infrastructure

needs are an important component of recreation conflict management and recreation activities need not occur at the same time of year to generate competing or complementary interactions.

The compatibility spectrum used in this research ranges from very conflicting interactions ("antagonistic") to non-conflicting interactions, which include both neutral ("supplementary") and positive-sum ("complementary") interactions. A number of expert-panel participants commented that they thought this added an "interesting" perspective to consider in recreation management. While much of their time is spent on managing negative, conflict-ridden situations, the compatibility spectrum emphasizes the possibility of maximizing what is working well. Some of respondents commented that they would welcome this shift in emphasis at the institutional level.

The expert-panel discussion revealed that there are already a number of examples from across Wisconsin on how recreation managers are trying to create and maintain positive interactions amongst outdoor recreation users and groups. A few of the respondents felt that some of the most positive outcomes come from getting different user groups to sit down face to face and take active roles in the management process. This allows user groups to develop common understandings and devise creative management strategies. In some cases, these groups are actively involved in the implementation of the management strategies and are involved in such programs as education-orientated volunteer trail patrols. One expert-panel participant discussed the positive outcomes that can come from Community Wardening programs. In Community Wardening programs recreation users themselves become involved in

education and monitoring of recreation activities, conflicts can be reduced and illegal activities prevented. Both increased face-to-face interaction and Community Wardening were cited as more effective ways of increasing levels of understanding about appropriate and responsible behaviors than signage or other education strategies. However, for some recreation activities, the participants identified that the recreation user groups are not terribly well-organized and it can be challenging to get them involved in these types of management actions.

While the expert-panel participants emphasized the value of strategies that help to create positive interactions amongst recreation users, they also cited the usefulness of management strategies that segregate recreation activities in time and space when antagonistic or competitive interactions are likely. Some of the management activities that were cited included restricting the location, style or timing of hunting activities, and actively monitoring weather temperatures to facilitate the restriction of ATV trail use during the spring thaw. Without segregating-orientated management actions, participants felt more antagonistic recreation conflict would be likely to occur in Wisconsin. A few participants also emphasized the importance of planning processes that provide the foundation for devising appropriate management actions.

Discussion

The typical approach to outdoor recreation management is a problem-based one: "Many writers have suggested a variety of management practices that might be applied to outdoor recreation management *problems* such as crowding, conflict and

environmental impacts" (Manning, 1999, p.238, emphasis added). In contrast, we have introduced a recreation interaction model based on relative compatibilities that recognizes a full spectrum of recreation user interaction from the negative to the positive. The model also recognizes the manner in which recreation management can have an important influence on the eventual outcomes of recreation user interaction.

The results of a modified Delphi process suggest that for recreation managers and experts in Wisconsin this approach has some validity, but it is not without some important caveats. Delphi participants expressed general agreement with the conceptual framework and some even suggested this would be an interesting alternative to the typical problem-based approach. Recent reviews of the recreation conflict management field have highlighted the importance of adopting approaches that recognize the impossibility of avoiding conflict, but seek instead to understand and mitigate it (Watson, 1995; Hammitt & Schneider, 2000). We believe our conceptual model is consistent with that perspective, but takes the approach one step further towards accentuating the positive. Similarly, the benefits-based approach to management also has a strong focus on the positive elements of recreation (e.g. Driver 1990, 1996). However, unlike both the goal interference conflict model or our compatibility-based approached, benefits-based management focuses little on the interaction between users or user groups, and instead focuses on the beneficial outcomes that accrue to individuals or groups. Moreover, benefits-based management does not account for the full spectrum of recreation interactions.

In recreation conflict research, most investigations to date have focused on the interaction between two activity types and particularly as conflict it is perceived and occurs at the individual level (Jacob & Schreyer, 1980; Manning, 1999; Vaske et al., 2000). Much recreation planning, however, occurs at a regional or state scale. At these broader scales, the task is to satisfy the recreation demands of growing numbers of people participating in a wider array of recreation activities. Complicating matters is that in many regions recreation is an important, if not the principle driver, of tourism and economic development. Ultimately, the success of recreation planning and management strategies may be most appropriately measured at a larger, recreation group scale, and this has been the normative management approach (Shelby & Vaske, 1991; Shelby et al., 1996). As Owens (1985) suggested, recreation conflict should perhaps not be seen as the result of a single event, but rather a social process with conflict being a negative experience occurring when competition for shared resources prevents expected benefits of participation from accruing to an individual or group.

To illustrate but one example, how is conflict minimized or the interactions improved between ATV riders and hikers? Conflict between these user groups may be the result of individual interaction on specific trails, or it may relate to evidence of use by the other group (trail damage for example), or it may be caused by perceptions, accurate or not, of the usual habits of the other user groups, or it may be because of a dispute (or perceived dispute) between the user groups on appropriate management action. For recreation planners and managers, it is not simply the individual

interactions that are important, but the more complex and difficult to determine result of the entire interaction process.

In this study, Delphi participants' attempts to categorize intra-recreational compatibilities appeared beset by this individual to group challenge. The range of responses that were submitted by the Delphi participants for different recreation activity interaction pairings suggests that it is difficult for experts to agree on how different recreation uses generally interact. This may be a problem of using overly broad recreation categories for this study, but it may also represent how different participants in this study accounted for the recognized recreation management challenge of individuals who do not follow group norms or respect management efforts (Manning, 1999; Dustin & McAvoy, 1984). Alternatively, the varied experiences and management responsibilities of Delphi participants may have led to different interpretations of what scale is most appropriate for considering group level recreation interactions.

Another area of discussion during the expert-panel sessions was how to characterize the interaction between activities where users did not interact in time or space. The dominant view in recreation management, has characterized recreation conflict from a goal interference model which requires individual interactions (Jacob & Schreyer, 1980). However, when recreation interaction is seen either as a process (Owens, 1985), and includes other aspects such as social values (Carothers et al., 2001), coping behaviors (Manning, 1999) and management interventions, then limiting

interactions to those that occur between active recreation users may not adequately capture the full range of interactions..

Our study results are consistent with past research that has found that motorized recreation activities generate higher levels of conflict than do non-motorized activities (Adelman et al., 1982; Ivy et al., 1992; Gibbons & Ruddell, 1995). The compatibility of activities interacting with ATV riding and snowmobiling was generally rated as the lowest for land-based recreation activities while the compatibility of interacting with jet-skiing and motorboating/water skiing was rated the lowest for water-based activities. At the other end of the scale, camping and wildlife watching and fishing, sailing and canoeing/kayaking were rated as the most compatible activities. Interestingly, non-motorized activities that require trails (horseback riding, mountain biking, cross-country skiing, linear trail biking and hiking) generated more positive compatibility ratings than motorized and consumptive uses, but interaction with these activities was rarely rated above supplementary (neutral). However, the present research also highlights that for non-motorized activities that require trail infrastructure a simple dichotomy being motorized and non-motorized activities is not always applicable.

The current research framework highlights the positive benefit of having the interaction between recreation activities fall towards the supplementary and complementary end of the compatibility spectrum. It may be possible with management action, to shift where on the compatibility spectrum an activity falls and improve the overall compatibility of the interaction between two activities. Land-based

recreation activities pairs and their two compatibility scores are summarized graphically in Figure 2. It may be that the activity pairs that fall in the middle of graph, approximately four and above for both scores, have the greatest potential for increasing their compatibility. Activities that score above a seven work well together, these activities can be planned to occur together in the same management unit or at the same time. While those activity pairs that fall below a certain compatibility score, a threshold score of four has been chosen in this example, are likely incompatible and the most appropriate management action likely involves segregating uses.

[insert Figure 2 about here]

Thus we believe there is room to incorporate an expanded and realistic view of the spectrum of recreation user interactions as well as recreation planning and management into the current the model of recreation conflict. Figure 3 presents our interpretation of a compatibility-based recreation interaction model. Note from Figure 3 that the original Manning model contains the generic causal elements of interaction and a single diminished satisfaction outcome resulting from a single aggregate interaction type (conflict). In this compatibility-based recreation interaction model, we have incorporated both the ability of interpretation, adaptive site planning and the interaction of user groups during recreation planning as key elements that determine recreational interaction outcomes. We no longer present a model constrained by interactions limited to competition and antagonism (conflict). Indeed, much

recreational interaction can be considered supplementary and/or complementary. These types of interactions would logically be addressed through planning and recreation management as warranting close scrutiny and encouragement. In this manner, we can correctly view planning as a key element of maximizing the positive-sum outcomes while actively addressing those uses in conflict through the minimization of antagonistic and competitive outcomes.

[insert Figure 3. about here]

Conclusion

This paper has presented a novel conceptual approach to understanding recreational interactions and recreation conflict. Starting from the premise that more planning relevant conceptual models are needed for sound recreation planning and management, we sought to bridge the gap between the rich literature that exists on understanding and characterizing recreation conflicts, and the management strategies and tools that are applied to achieve a whole host of recreation planning and management goals.

Research into recreation conflict has a relatively brief history, and the most widely used goal interference model of recreation conflict was first introduced by Jacob and Schreyer in 1980. Subsequent research has refined this model and incorporated other elements such as social values conflict and coping mechanisms. However, we find this model lacks management relevancy because it fails to recognize and include

different planning and management modes such as adaptive site planning, user group participation and education or interpretation. Moreover, the goal interference conflict model presupposes the result of recreation interaction to be either diminished satisfaction or individual coping. As demands for outdoor recreation continue to grow and multiple demands are put on a finite land and water base, planning relevancy requires models that account for the full range of possible interactions. We submit that conceptual models that recognize both positive and negative interactions will inevitably lead to management strategies that focus on both types of interactions. It may be more efficient for planners and recreation managers to invest time into supporting and encouraging positive interactions rather than solely focusing on the problematic interactions.

An important contribution of this work is the extension relative use compatibilities first introduced by Clawson (1974) into the realm of recreation management planning. The concept of relative land use compatibilities has been developed further by environmental economists and can be described graphically by production transformation functions (Van Kooten, 1993) or mathematically through the concepts of additivity (Bailey and Friedlaender 1982; Weitzman 1992). We have relied on these foundations to describe a recreation compatibility spectrum that ranges from antagonistic and competitive interactions (conflict) to positive interaction types of supplementary and complementary. Moreover, we have also introduced a compatibility-based recreation interaction model that integrates these concepts into past work on outdoor recreation conflict.

A modified Delphi process was used to field test the recreation compatibility spectrum with recreation management experts as well as to make some first attempts to measure the compatibility of different recreation activities. Results suggest that a comprehensive recreation interaction model has both validity and applicability. Delphi participants were able to identify interactions between recreation activities that ranged from antagonistic to complementary. As in past research, motorized and consumptive activities were seen as the source of more conflict than non-motorized activities and Delphi participants identified strong asymmetrical interactions between different activities.

Through discussion, Delphi participants also used the compatibility spectrum to identify relevant management strategies. Just as there is a spectrum of possible compatibility interactions between creation activities, there may also be a spectrum of possible management interventions. Expert-panel participants discussed a variety of strategies that they use to manage conflict between recreation activity groups within their jurisdiction. Expert-panel participants describe a range of overlapping and complementary management strategies. For activities that fall towards antagonistic end of the compatibility spectrum, much of the focus will be on segregating uses, such as developing separate facilities and infrastructure for different activities. Law enforcement will be the predominant implementation strategy, with Wardens and other law enforcement officials taking the lead. In the competitive range of compatibility spectrum, regulation is likely the dominant management strategy with such actions as defining at what time of year an activity can take place or with what type of equipment

can be used. As an implementation strategy the expert-panel participants described a strong need for more face to face interaction amongst the different activity groups, so that they may take the lead in coming up with creative solutions for how the groups could interact without causing conflict. In the supplementary range of the compatibility spectrum participants described such activities as Community Wardening that can serve both education and monitoring objectives and help ensure that competitive interactions do not come to dominate. Just as there is a need to refine and further develop the compatibility matrices, our future research work includes plans to further elaborate and collect examples of how management tools and interventions can be appropriately coupled with the appropriate interaction category or categories.

A growing population, new technologies and increased diversity of recreation activities will continue to put pressure on a finite land and water base. Planners and recreation managers need appropriate conceptual models to inform their critical efforts in meeting this increased demand. The compatibility-based interaction model, and associated recreation compatibility spectrum, has management relevancy and can help inform sound and rational management decisions. Moreover this approach recognizes a full-spectrum of recreation interactions and helps to switch the emphasize from a glass half empty, problem-base approach to a glass half full, more positive approach.

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Footnotes

1. Another arena of conflict is that which arises between outdoor recreation and other forms of land use (Clawson 1974). This type of conflict has affected how open space develops and is represented by the struggles over such disparate issues as residential development, agriculture, and forest management. This form of recreational use compatibility is beyond the scope of the research reported here.
2. Subsequent research has explored whether the four different factors hypothesized by Jacob and Schreyer are the principle variables behind recreation conflict (e.g. Gramann & Burdge, 1981; Ivy et al., 1992; Watson, Niccolucci & Williams,1993; Ruddell & Gramann, 1994; Gibbons & Ruddell, 1995; Vaske, Dyar & Timmons, 2004; Wang & Dawson, 2005). While the published research suggests mixed support for these conflict antecedents, further research has identified other variables that might be added to the model including safety (Vaske, Carothers, Donnelly & Baird, 2000), philosophical appropriateness (Blahna, Smith & Anderson, 1995), or attitudes towards encountering other types of recreation groups (Watson, Niccolucci & Williams, 1994)
3. These are consistent with common recreational conflict themes as reported in the popular press as confirmed by a recent search of the Nexus/Lexus database for popular media articles for recreational use conflict from the State of the Lake States of Minnesota, Wisconsin, and Illinois. Activities dependent on noisy

technology or extractive uses, such as ATV use or hunting, were more frequently mentioned than those activities that use the land and water resources in a more quiet and non-extractive manner such as camping, cross-country skiing and kayaking. When "silent sports" were involved in recreation conflict, it was most often related to interaction with motorized uses and trail-based activities.

4. To date the results of this structured process are most appropriately labeled a modified Delphi method, as there has been only one round of compatibility ratings completed by the participants. Most Delphi processes are typified by iterative process (Ziglio, 1996) and this remains the plan for this research project.

Table 1. Spectrum of interaction types and their recreational outcomes

Interaction Type	Key Characteristic	Outcome	Example
Complementary	Increasing rates of return with increased use	Positive sum & growing – No conflict	Canoeing and Fishing
Supplementary	Neutral interaction	Positive sum – linear Minor conflict	Snowmobiling and ATV use
Competitive	Decreasing rates of return with increased use	Trending toward zero sum - Conflict	Fishing and Jet-skiing
Antagonistic	Any activity of one drives the other to zero	Negative sum Strong Conflict	Wilderness camping and ATV use

Table 2. Average land-based recreation activity compatibility ratings[a].

	ATV Riding	Hunting	Snow-mobiling	Horseback Riding	Mountain Biking	X-Country Skiing	Linear Trail Biking	Hiking	Wildlife Watching	Camping	**Average Compatibility**
ATV Riding	X	5.3	6.5	5.1	5.5	4.9	5.5	6.1	6.9	7.5	**6.0**
Hunting	3.3	X	3.7	4.7	4.3	5.3	5.7	5.4	6.0	6.3	**5.0**
Snowmobiling	4.3	4.0	X	4.0	4.8	4.3	5.8	5.3	6.3	7.2	**5.1**
Horseback Riding	2.2	3.5	3.0	X	3.8	4.9	4.5	6.3	7.3	7.7	**4.8**
Mountain Biking	3.1	3.6	4.7	4.8	X	5.7	8.1	6.1	7.4	8.0	**5.7**
X-Country Skiing	1.8	3.6	2.6	3.3	4.2	X	5.6	4.9	8.1	8.5	**4.7**
Linear Trial Biking	2.6	3.9	5.5	5.3	8.2	7.1	X	7.4	8.0	8.7	**6.3**
Hiking	2.4	3.5	3.5	5.7	4.7	6.1	6.5	X	8.9	9.2	**5.6**
Wildlife Watching	2.2	3.2	2.9	6.4	5.2	7.6	6.8	8.6	X	8.3	**5.7**
Camping	3.9	4.1	5.0	7.5	7.8	8.2	8.2	8.9	8.5	X	**6.9**
Average Compatibility	**2.9**	**3.9**	**4.2**	**5.2**	**5.4**	**6**	**6.3**	**6.6**	**7.5**	**7.9**	

a. Compatibility ratings are for how column activity *interacts with* the row activity.

Table 3. Average water-based recreation activity compatibility ratings [a].

	Jet-Skiing	Motorboating Water Skiing	Swimming	Fishing	Sailing	Canoeing/ Kayaking	**Average Compatibility**
Jet-Skiing	X	7.1	5.4	5.9	6.5	6.2	**6.2**
Motorboating Water Skiing	6.5	X	4.9	5.6	5.8	5.9	**5.7**
Swimming	2.9	3.5	X	6.1	6.2	7.4	**5.2**
Fishing	2.5	3.0	5.4	X	6.5	7.7	**5.0**
Sailing	3.4	4.3	6.4	7.0	X	7.6	**5.7**
Canoeing / Kayaking	2.6	3.2	7.6	7.9	7.4	X	**5.7**
Average Compatibility	**3.6**	**4.2**	**5.9**	**6.5**	**6.5**	**7.0**	

a. Compatibility ratings are for how column activity *interacts with* the row activity.

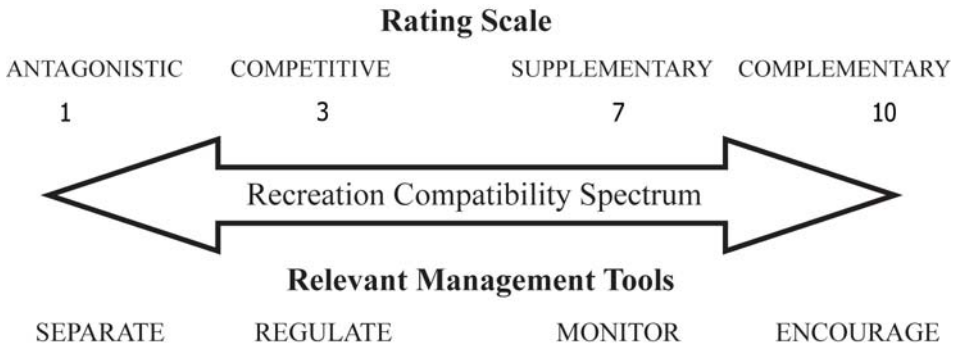

Figure 1. The Recreation Compatibility Spectrum used in the study.

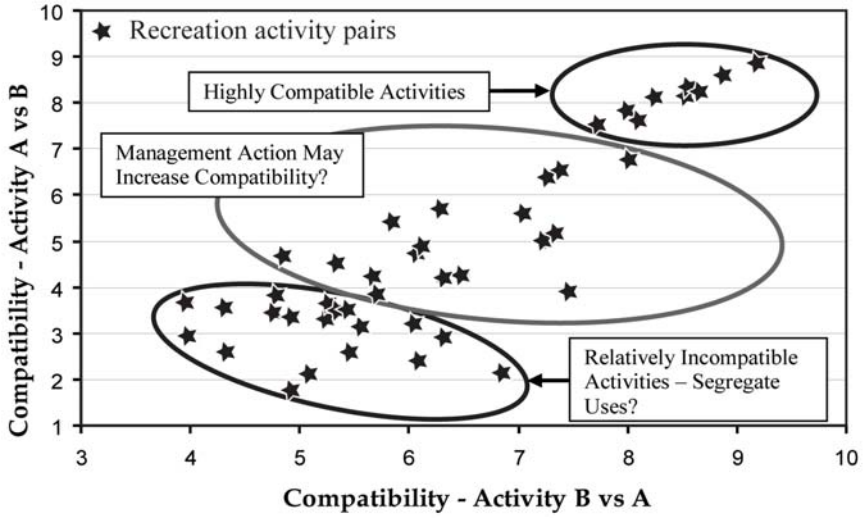

Figure 2. Scatter plot of the compatibility scores for land-based recreation activities.

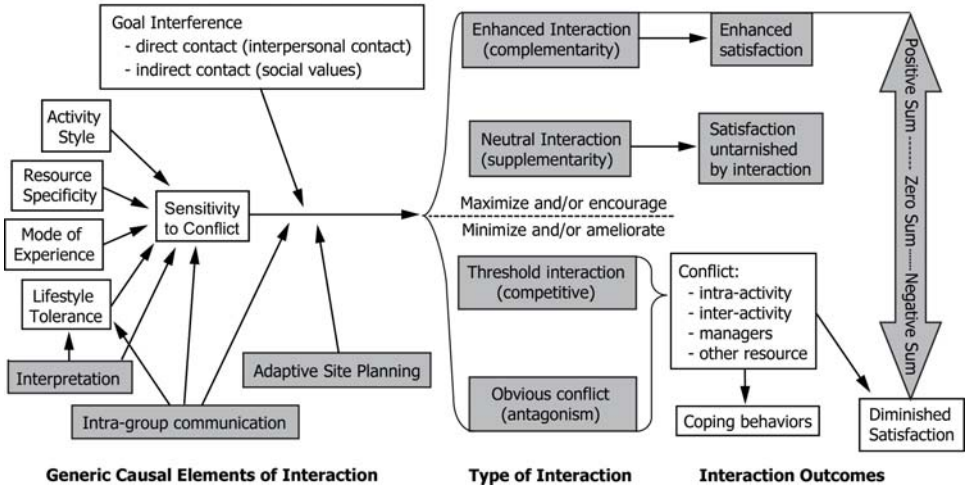

Figure 3. A compatibility-based recreation interaction model adapted from Manning's (1999) expanded goal interference conflict model. Original elements of Manning's model are in white.