The Efficacy of Visitor Education Programs

By Scott Reid and Jeff Marion

Introduction

Sustaining outstanding recreational opportunities and natural resource conditions are primary goals for public land managers. Research has shown that even at low visitation levels, resource degradation is an inevitable consequence of recreational use (Leung and Marion 2000). A principal challenge for land managers is to eliminate avoidable impacts and minimize unavoidable impacts while providing for high quality recreation experiences.

Visitor education has often been cited as a preferred and more appropriate response to reduce resource impacts or improve visitor experiences on protected public lands (Manning 1999; Roggenbuck 1992). Visitor education is considered a light-handed management response, while regulations more directly curtail visitor freedoms and site management alters the natural setting (Stankey and Schreyer 1987). The national Leave No Trace (LNT) program targets visitors engaging in human-powered recreational activities on public lands with educational information on low impact outdoor skills and ethics. It's mission is to promote and inspire responsible outdoor recreation through education, research and partnerships. The program has experienced substantial growth over the past two decades through the support of the four national land management agencies, Leave No Trace, Inc., recreation equipment and clothing manufacturers and retailers, and hundreds of volunteers.

Through a diverse array of literature, training opportunities, and public outreach messages, the LNT program is reaching millions of outdoor recreationists annually. But how effective is this program in conveying low impact practices and ethics and do visitors who receive such messages modify their behavior to reduce resource impacts or improve the experiences of other visitors? Which visitor education approaches are most effective? This paper seeks to provide some answers to these questions by reviewing what we've learned from research on the efficacy of visitor education efforts on protected public lands. Unfortunately, very few studies have specifically targeted LNT educational efforts, though findings from similar educational efforts are generally applicable.

Visitor Education: What's Possible?

The potential effectiveness of visitor education is determined in part by the nature of the visitor's actions. Five general categories of undesirable visitor actions on public lands have been identified: careless, unskilled, uninformed, unavoidable, and illegal (Hendee et al. 1990). Careless actions are nuisance or thoughtless behaviors, such as littering or picking wildflowers, that are done without full consideration for their effect on other visitors or the resource. Unskilled actions are inappropriate behaviors that occur when visitors know what they should do, but lack the skills to do so. Examples include the inability to build a low-impact campfire or hang a bear bag. Uninformed actions result from visitors simply not having the adequate information to select a particular behavior. Visitors that feed wildlife or cut a dead tree for firewood without knowing that these practices violate regulations or recommended practices are examples.

Unavoidable actions are inherent behaviors that occur to some degree regardless of a visitor's knowledge or experience, such as vegetation trampling and soil compaction along a designated trail. Illegal actions are deliberate violations of laws or regulations, such as the theft of archeological artifacts.

Visitor education can only be expected to effectively address unskilled and uniformed actions, and to a lesser extent, careless actions, as these are more highly related to visitor knowledge and skill level (Hendee et al. 1990; Roggenbuck 1992). There is a lower potential for effectively targeting unavoidable impacts, though one could argue that this is possible by shifting hiking and camping activities to durable surfaces such as bare sand or bedrock where trampling has little effect. Illegal actions are generally

addressed through increased enforcement, however, communicating the rationale for laws and regulations can encourage higher compliance.

Theoretical Basis for Visitor Education

Scientists seek to understand the mechanism by which visitor education alters an individual's behavior. Three theories have been advanced and tested through studies: persuasion, moral development and planned behavior.

Theories of Persuasion: Two models of persuasion are pertinent to visitor education efforts: the central route to persuasion and the peripheral route to persuasion (Roggenbuck 1992; Vande Kamp et al. 1994). The central route to persuasion relies on visitor attention, consideration and internalization of the message. An interpretive presentation on LNT that includes the rationales for adopting the practices provides an example. This is cited as the most effective method of communication because complex concepts are conveyed to interested visitors and long-term behavioral change results following careful consideration and internalization. The peripheral route to persuasion relies on the source of the message rather than the message itself. This approach is characterized by a well-known spokesperson or authority figure conveying a simple message to an audience with a short attention span in need of consistent reinforcement (Roggenbuck 1992; Roggenbuck and Manfredo 1990).

Theories of Moral Development: Theories of moral development formulated by Kohlberg (1976) and furthered by Gilligan (1982) have also been applied to educating public land visitors. These theories suggest that people evolve through several stages of moral development that range from preconventional (characterized by fear of punishment), conventional (characterized by attention to the opinions of significant others and societal norms) and postconventional (characterized by consideration for justice, fairness and self-respect) (Kohlberg 1976).

Christensen and Dustin (1989) suggested that managers need to communicate different messages to target visitors at these different levels of moral development. For example, visitors at preconventional moral levels would likely respond best to law enforcement actions or behavioral incentives while visitors at postconventional levels would likely respond to rationales appealing to a sense of altruism and justice (e.g., what's best for society at large) (Manning 1999). In contrast, visitors at conventional levels of morality need to be convinced that land managers, their family, peers and society as a whole condone certain actions in contrast to others.

Theory of Planned Behavior: This theory suggests that behavioral intentions and behavior are related, and that social norms and knowledge affect behavioral intent (Fishbein and Azjen 1975). In short, knowledge affects behavioral intent, which is a strong indicator and antecedent of actual behavior, i.e., behaviors can be modified by increasing knowledge.

The Efficacy of Visitor Education: Study Results

In this section we highlight the results of studies that have assessed the effectiveness of low impact visitor education. We have grouped these in four categories based on the intent of the education: redistributing visitors, knowledge gain, behavioral change, and change in resource conditions. Within these we also highlight studies that have assessed the effectiveness of different media in achieving education goals. Each study provides some additional insight into the effectiveness of visitor education programs and methods.

Education to Redistribute Visitors: Lucas (1981) evaluated the effect of a brochure in redistributing visitor use to more lightly used wilderness campsites. The brochure was ineffective, which Lucas attributed to its limited distribution, narrow focus, and presentation late in the decision process. He also

speculated that visitors familiar with the area were less receptive to the information.

In contrast, Roggenbuck and Berrier (1981, 1982) distributed brochures intended to direct visitors away from a congested wilderness camping area to more lightly used sites. A comparison between the behavior of visitors exposed to the brochure versus those exposed to the brochure and a ranger contact revealed that both communication techniques were equally effective in altering visitor behavior.

In Rocky Mountain National Park, Huffman and Williams (1987) compared the effectiveness of a brochure and a computer in redistributing visitor use to more lightly used backcountry sites. Both methods effectively redistributed visitors but the computer was more effective in altering visitor travel and camping patterns. In Yellowstone National Park, Krumpe and Brown (1982) conducted a similar study using a trail selector information chart that described routes and destinations with different qualities. They found that descriptive information about the most heavily used sites helped redistribute visitors to lesser-used sites.

With the exception of Lucas (1981), these studies found that visitor use could be effectively redistributed through information and that some information distribution methods were more effective than others. Based on later recreation ecology findings, managers concluded that the redistribution of visitors to more lightly used areas was not an appropriate management strategy for reducing resource impacts (Cole and Fichtler 1983). In areas of heavy use a containment strategy has become the preferred method to minimize the areal extent of visitor impacts (Leung and Marion 2000).

Knowledge Gain Following Education: Fazio (1979) developed some of the first tests of the effectiveness of education methods in improving visitor knowledge of low-impact camping techniques. His studies in Rocky Mountain National Park and the Selway-Bitterroot Wilderness evaluated the effectiveness of brochures, trailhead signs, slide shows, television programs and newspaper coverage in conveying low-impact messages to visitors. This work found that personal contact from an agency employee was the most effective method. Also effective were trailhead signs and a visitor-activated slide show presentation with sound. Informational brochures were shown to be minimally effective while communication through the mass media (e.g., newspapers and television) was ineffective.

McAvoy and Hamborg (1984) assessed the effectiveness of a brochure on visitors' knowledge of regulations within the Boundary Waters Canoe Area Wilderness. The researchers found that sampled visitors had a high degree of knowledge of area regulations, suggesting that the brochure and the distribution method employed by the Forest Service were highly successful in raising visitors' knowledge of area regulations.

Utilizing the central route to persuasion, Dowell and McCool (1986) developed three methods (slide show, booklet and both together) to teach Boy Scouts about wilderness ecology and Leave No Trace practices. Knowledge tests following the education program and one month later demonstrated significant knowledge gains when compared to the control group. However, the treatments did not vary significantly in their effectiveness in increasing knowledge. Behavioral intent was also measured and shown to have changed to greater support for applying low-impact behaviors with no significant variation between educational treatment. However, decreases in behavioral intent scores for the later test suggest the need for continued LNT education over time. These results provide support for the knowledge and behavioral intent relationship proffered under the theory of planned behavior.

Stubbs (1991) examined the effectiveness of a wilderness trailhead sign on visitor knowledge, behavioral intent and actual behavior. Baseline knowledge of low-impact practices for wilderness visitors was found to be fairly low. In addition, campsite selection and the campfire management were found to be difficult topics for visitors, perhaps due to inconsistent messages generated by managing agencies over time and in different places. The trailhead sign was found to be only slightly effective in increasing visitor knowledge levels, behavioral intent and behavior. This was attributed to the complexity of the message (dispersed camping in low use pristine areas vs. established site camping in moderate to high use areas) and the difficulty of conveying that complexity through a trailhead sign.

Thorn (1995) evaluated the effect of trailhead signs and personal contact on visitor knowledge in the

Pecos Wilderness of New Mexico. Educational messages effectively increased knowledge on campsite selection, campfire impacts and camping behaviors - areas identified as skill areas least understood by visitors in Stubbs' study. Thorn also found that more experienced backpackers were not significantly more knowledgeable about low-impact camping skills than less experienced visitors, suggesting that experience plays a minimal role in the understanding and practicing of low-impact camping skills. The majority of backpackers utilized some low-impact practices much of the time, such as using cookstoves and proper disposal methods for human waste, litter and dishwater. However, decisions regarding toilet paper disposal and campsite selection were based less on low-impact principles. This study provided further evidence that knowledge of low-impact skills did affect visitor behavior in the intended direction.

Behavioral Change Following Education: Gramann and Vander Stoep (1986) evaluated the effectiveness of three types of messages intended to reduce depreciative behavior at Shiloh National Military Park. The messages varied in their utilization of rationales including awareness of consequences, resource protection and incentives. Observation of subsequent depreciative behaviors found that all treatments were effective and that a simple message based on awareness of consequences (e.g., deterioration of artifacts) was the most effective. The majority of depreciative behavior was attributed to uninformed behavior.

Johnson and Swearingen (1988) assessed the effectiveness of different trailside signs in deterring off-trail hiking in Mt. Rainier National Park. Observers counted the number of visitors exposed to each sign that hiked off-trail contrary to the signs' messages. The signs did deter off-trail hiking and different sign texts varied in their effectiveness. The most effective sign threatened sanctions for non-compliance. Signs with an ethical appeal to stay on the trail to preserve the meadow, humorous appeals, and symbolic signs were equally effective. These findings suggest that the preconventional moral appeal was the most effective technique for altering visitor behavior. Other messages representing higher moral appeal levels changed visitor behavior to a lesser degree.

Martin (1992) compared the effects of three signs and a brochure in discouraging visitors from removing pumice from Mount St. Helens National Park. As with Johnson and Swearingen's study, all four approaches effectively reduced pumice theft and the sign that threatened sanctions for theft was the most effective.

Utilizing the theory of moral reasoning and normative theories, Widner and Roggenbuck (1999) assessed the effectiveness of three educational interventions on the theft of petrified wood in Petrified Forest National Park. The interventions included an interpretive sign with multiple moral approaches discouraging the theft of petrified wood, a signed pledge by visitors to not take petrified wood, and a uniformed volunteer patrolling the site. Each of the three educational treatments significantly reduced wood theft. There were no significant differences between approaches, indicating that a good interpretive sign can be as effective as an on-site uniformed volunteer in reducing depreciative behavior.

Hockett (2000) evaluated the effectiveness of two different picnic table signs in reducing wildlife feeding by visitors in Shenandoah National Park. Both appeals were effective in reducing feeding behavior. A moral appeal was more effective than a fear appeal, likely because visitors discounted the threat of being hurt by deer. Use of signs on picnic tables also acted as a timely primer to remind visitors of appropriate behavior while eating.

Christensen and Cole (2000) used information from visitor surveys in eight wilderness areas to assess the effect of LNT information on the behaviors of wilderness visitors. Analyses of visitor's reported behavior revealed that campfire use had decreased appreciably since the LNT program began active promotion of campstove use, and lakeshore camping had also decreased in response to educational messages promoting camping away from water. Notably, visitor preferences and behaviors have changed substantially in regards to campfire use. Visitors prefer cooking on campstoves, as opposed to fires, when compared to visitor surveys from the 1970's. In contrast, visitors still prefer camping next to water, but are willing to be persuaded to camp away from water for ecological reasons. The study concluded that LNT efforts have succeeded in altering visitor behavior, and to some extent preferences.

Change in Resource Conditions Following Education: Interestingly, despite a thorough search, only one study was found that measured site conditions following educational efforts. A study by Oliver et al. (1985) gauged the efficacy of three educational methods in reducing tree damage and litter in a campground. The first approach was a brochure on low impact camping practices, the second employed the brochure plus a ranger contact, and the third used the brochure and ranger plus a request to report any destructive acts observed by campers. All three educational treatments significantly reduced litter and tree damage with the personal contact treatments more effective than the brochure alone. The personal contact with the request to report observed depreciative behavior was less effective than the simple ranger request to reduce littering and tree damage.

Discussion

What conclusions can be drawn from these varied research efforts for visitor education on public lands? There are some clear trends in spite of the wide variation in study design and theoretical basis. First, there is adequate evidence that visitor education does affect visitor behavior in an intended direction. Some efforts did not achieve their stated goals for various reasons, but the majority of educational efforts succeeded in altering visitor behavior. Regulatory messages that threaten sanctions are more effective than purely educational messages.

Most of the studies concluded that the effectiveness of education is related to: message content, message delivery, audience characteristics, and theoretical grounding. These four topics frame the following discussion.

Message Content: Message content is critical to message effectiveness. Oliver et al.(1985) found that simple, interesting and useful information was the most effective in reaching visitors. Douchette and Cole (1993) also concluded that messages should be clear and concise. Lucas (1981) concluded that educational information must be detailed, but not too detailed, so as to detract from a visitor's sense of exploration and discovery. Clearly identifiable desirable and undesirable behaviors should be evident in the educational message (Gramann and Vander Stoepp 1986). To assist in this goal, specific objectives need to guide education, suggesting that before any educational efforts are undertaken, land managers must agree on the message goals (Douchette and Cole 1993).

Stubbs' (1991) findings showed that consistency is critical to the message's effectiveness. The evolving nature of low-impact information was considered the primary reason for low knowledge levels among visitors. Respondents scored the lowest on questions pertaining to practices that have evolved the most over the years - campsite selection and campfires. Thorn (1995) reached similar conclusions in his study. Therefore, message consistency should be a goal for all public land education efforts.

Christensen and Cole (2000) found that visitors were more likely to be persuaded to alter their behavior for ecological than social reasons. This finding suggests that credible, convincing ecological rationales may be more effective than social rationales in convincing visitors to alter their behavior away from their preferences. The educational message's content should also be specific to a defined audience. Christensen and Cole (2000) found that some user groups were less likely to practice low impact behavior. The researchers concluded that information targeting these groups would help address specific resource and behavioral concerns.

Message Delivery: The delivery of educational messages was also shown to play a key role in the messages' effectiveness. Consistently, these studies showed that messages should be well timed for maximum effectiveness. For example, information regarding planning a trip and campsite selection should be provided early in the planning process or prior to the visitor's arrival at the site (Lucas 1981; Roggenbuck and Berrier 1981; Douchette and Cole 1993). When addressing issues such as feeding wildlife, education must occur near the moment of feeding, based on Hockett's (2000) findings. Visitors were less likely to feed deer if they received reminders and reinforcement at or as close as possible to the moment of potential feeding. The timing of message delivery therefore appears to play an important role

in the effectiveness of visitor education.

Source credibility is another fundamental key to the success of any educational effort. Oliver et al. (1985) and Roggenbuck and Berrier (1981) suggest that source reliability and validity should be considered for every message. Manfredo and Bright (1991) found that the degree of source credibility was strongly related to effectiveness of persuasion. Message consistency, critical to the effectiveness of a low-impact education program, is also important to the credibility of the source. Fazio (1979) found examples where inconsistent messages were provided from the same source - the US Forest Service. Sending mixed messages can undermine source credibility. This finding implies that consistent messages based on defined objectives can help establish source credibility.

A common question is whether personal contacts, signs, brochures or computers should be used to deliver messages to visitors. The answer remains unclear. Widner and Roggenbuck (1999) concluded that well-designed trailhead signs are as effective as a uniformed person in reducing depreciative behavior, while Stubbs (1991) found that trailhead signs could not communicate complex LNT information. Brochures proved ineffective for some efforts (Lucas 1981) but effective for others (Huffman and Williams 1985; Roggenbuck and Berrier 1981; McAvoy and Hamborg 1984). Some studies found that personal contacts were the most effective method of reaching visitors (Fazio 1979; Oliver et al.1995) while others found personal contacts no more effective than brochures (Roggenbuck and Berrier 1981). Computers offer promise in providing self-directed information (Huffman and Williams 1985), but have not been extensively tested. Clearly, large proportions of visitors must be exposed to the message for it to be effective (Lucas 1981) and the use of the computers and the Internet is one way to achieve this goal.

Another potential consideration is the redundancy and repetition of educational messages. McAvoy and Hamborg (1985) found that long-term wilderness visitors had significantly higher knowledge levels of area regulations when compared to newcomers. Repetition of messages and area experience increases visitor knowledge, although this finding contrasts with those from two other studies (Manfredo and Bright 1991; Fazio 1979). Thorn (1995) also concluded that redundant messages are more effective, suggesting that managers should repeat their educational efforts to reach more visitors more often. Similarly, Hockett's (2000) findings that information should act as a primer to initiate action requires that messages be available, widespread and repetitious to maximize effectiveness.

Audience Characteristics: Audience awareness is another key element to effective public education (Fazio 1979; Gramann and Vander Stoepp 1986). Awareness of the audience's knowledge level and perspective allows an educator to target efforts to a specific group, regardless of the media used. Understanding an audience's needs allows for the prioritization of specific content, thus ensuring that the areas and audiences of concern can be addressed.

For example, study findings suggest that an individual's experience is not always the best teacher. In fact, those participants that attributed their low-impact knowledge to experience scored significantly lower on knowledge assessments (Fazio 1979). Visitors who had higher experience levels were also less likely to be persuaded by new information (Manfredo and Bright 1991). Similarly, informal, word-of-mouth sources of information were found to be unreliable and potentially detrimental to low-impact knowledge (Manfredo and Bright 1991). Messages targeting experienced visitors should therefore provide more convincing rationales and should try to logically refute common misconceptions. Christensen and Cole (2000) found that visitor characteristics are important considerations for a low-impact educational message. User groups vary in their receptivity to low-impact messages. Awareness of audience receptivity allows educators to better target less receptive audiences through creative messages and delivery methods, such as peers or respected sources.

Theoretically Grounded Messages and Delivery: An important consideration for both message content and delivery is the theoretical approaches to persuasion, moral development and planned behavior. Regardless of whether or not they are aware of it, land management education efforts utilize these theoretical frameworks. Better understanding of the theoretical paradigms could help message content and delivery reach their full potential. Widner and Roggenbuck (1999) suggest that signs using multiple

persuasive and moral techniques are more effective than those developed with no theoretical grounding. Vande Kamp et al. (1994) recommend that a multifaceted approach be used to reduce noncompliant behavior, a concept easily extended to low-impact education efforts (Douchette and Cole 1993). Of course, inadequate resources will often limit the number of approaches applied.

Conclusion

This paper assessed the efficacy of low impact visitor education based on a review of existing research in backcountry and wilderness settings. Most studies found that educational interventions were effective in increasing visitor knowledge and altering visitor behaviors. Some general conclusions were also suggested regarding the content and delivery of educational messages. Educators can apply these findings to improve the effectiveness of their educational efforts. Few conclusions were reached regarding whether education ultimately improves resource conditions or visitor experiences. This topic has received very little research, yet it is a significant need for the Leave No Trace program.

Literature Cited

Ajzen, I. and Fishbein, M. 1980. Understanding Attitudes and Predicting Social Behavior: An Illustration of Applied Social Research. Prentice-Hall Publishing. Englewood Cliffs, NJ.

Christensen, H. and Cole, D.N. 2000. Leave No Trace practices: Behaviors and preferences of wilderness visitors regarding use of cookstoves and camping away from lakes. In: Wilderness Science in a Time of Change Conference Proceedings. S.F. McCool, W.T. Borrie, J. O'Loughlin (eds.). May 23-27, 1999, Missoula, MT. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Ogden, UT. RMRS-P-15-VOL-4, pp. 77-85.

Christensen, H. and Dustin, D. 1989. Reaching Recreationists at Different Levels of Moral Development. Journal of Park and Recreation Administration, 7:72-80.

Cole, D.N. and Fichtler R.K. 1983. Campsite Impacts on Three Western Wilderness Areas. Environmental Management, 7:275-288.

Douchette, J.E. and Cole, D.N. 1993. Wilderness Visitor Education: Information About Alternatives Techniques. US Department of Agriculture Forest Service, Intermountain Research Station, General Technical Report-INT-295.

Dowell, D.L. and McCool, S.F. 1986. Evaluation of a Wilderness Information Dissemination Program. In: Proceedings, National Wilderness Research Conference: Current Research; Lucas, R.C. (ed.). July 23-26, 1985. Ft Collins, CO. General Technical Report- INT 212. Ogden, UT. USDA Forest Service, Intermountain Research Center. pp. 494-500.

Fazio, J.R. 1979. Communicating with the Wilderness User. University of Idaho College of Forestry, Wildlife and Range Experiment Station, Bulletin Number 28.

Fishbein, M. and Ajzen, I. 1975. Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research. Addison-Wesley Publishing Company: Reading, MA. 578 pp.

Gilligan, C. 1982. In a Different Voice. Harvard University Press, Cambridge, MA.

Gramann, J.H. and Vander Stoep, G.A. 1986. Reducing Depreciative Behavior at Shiloh National Military Park, U.S. Department of Interior, National Park Service. Shiloh National Military Park.

Hendee, J.C., Stankey, G.H., and Lucas, R.C. 1990. Wilderness Management. North American Press, Golden, CO. 546 pp.

Hockett, K.S. 2000. The Effectiveness of Two Interpretations on Reducing Deer Feeding Behavior by Park Visitors. Unpublished Master's of Science Thesis. Virginia Polytechnic Institute and State University.

Huffman, M.G. and Williams, D.R. 1987. Computer Versus Brochure Information Dissemination as a Backcountry Management Tool. In: Proceedings, National Wilderness Research Conference: Current Research; Lucas, R.C. (Ed.). July 23-26, 1985. Ft Collins, CO. General Technical Report- INT 212. Ogden, UT. USDA Forest Service, Intermountain Research Center. pp. 501-508.

Johnson, D.R. and Swearingen, T.C. 1988. The Effectiveness of Selected Trailside Sign Texts in Deterring Off-Trail Hiking, Paradise Meadows, Mount Rainier National Park. In: Vandalism: Research, Prevention and Social Policy; H.H. Christensen, D.R Johnson and M.M. Brookes (eds.). US Department of Agriculture, Forest Service, General Technical Report PNW-GTR-293. pp. 103-119.

Kohlberg, L. 1976. Moral Development and Behavior: Theory, Research and Social Issues. Holt, Rinehart and Winston Publishing, New York, NY.

Krumpe, E.E. and Brown, P.J. 1982. Redistributing Backcountry Use Through Information Related to Recreation Experiences. Journal of Forestry, 80:360-362.

Leung, Y. and Marion, J. 2000. Recreation Impacts and Management in Wilderness: A State-of-Knowledge Review. In: Wilderness Science in a Time of Change Conference Proceedings. S.F. McCool, W.T. Borrie, J. O'Loughlin (eds.). May 23-27, 1999, Missoula, MT. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Ogden, UT. RMRS-P-15-VOL-5, pp. 23-48.

Lucas, R. 1981. Redistributing Wilderness Use Through Information Supplied to Visitors. US Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. Research Paper-INT-277.

Lucas, R. 1982. Recreation Regulations- When Are They Needed? Journal of Forestry, 80:148-151.

Manfredo, M.J. and Bright, A.D. 1991. A Model for Assessing the Effects of Communication on Recreationists. Journal of Leisure Research, 23(1):1-20.
Manning, Robert E. 1999. Studies in Outdoor Recreation: Search and Research for Satisfaction. Oregon State University Press: Corvallis, OR. 374 pp.

Martin, D.C. 1992. The Effect of Three Signs and a Brochure on Visitors' Removal of Pumice at Mount St. Helens. In: Vandalism: Research, Prevention and Social Policy. H.H. Christensen, D.R Johnson and M.M. Brookes (eds.). US Department of Agriculture, Forest Service, General Technical Report PNW-GTR-293. 121-131.

McAvoy, L.H. and Hamborg, R. 1984. Wilderness Visitor Knowledge of Regulations: A Comparison of Visitor Contact Methods. Journal of Interpretation, 9(1):1-10.

Oliver, S.S., Roggenbuck, J.W. and Watson, A.E. 1985. Education to Reduce Impacts in Forest Campgrounds. Journal of Forestry, 83(4):234-236.

Roggenbuck, Joseph W. 1992. Use of Persuasion to Reduce Resource Impacts and Visitor Conflicts. In:

Influencing Human Behavior: Theory and Applications on Recreation, Tourism, and Natural Resources Management, Michael J. Manfredo, (ed,). Sagamore Publishing Inc., Champaign, IL. pp. 149-208

Roggenbuck, J.W. and Berrier, D.L. 1981. Communications to Disperse Wilderness Campers. Journal of Forestry, 79:295-297.

Roggenbuck, J.W. and Berrier, D.L. 1982. A Comparison of the Effectiveness of Two Communication Strategies in Dispersing Wilderness Campers. Journal of Leisure Research, 14(1):77-89.

Roggenbuck, J.W. and Manfredo, M. 1990. Choosing the Right Route to Wilderness Education. In: Managing America's Enduring Wilderness Resource: Proceedings if the Conference: St. Paul, MN, Tourism Center Minnesota Extension Service and Minnesota Agricultural Experiment Station. pp. 103-112.

Stankey, G. H., Schreyer, R. 1987. Attitudes Towards Wilderness And Factors Affecting Visitor Behavior: A State of Knowledge Review. In: Proceedings- National Wilderness Research Conference. Issues, State of Knowledge, Future Directions. Lucas, Robert C. (ed.). July 23-26, 1985. Fort Collins, CO. General Technical Report. INT-220. Ogden, UT: US Department of Agriculture Forest Service, Intermountain Research Station. 246-293.

Stubbs, C.J. 1991. Low-Impact Recreational Practices: Assessing and Improving Wilderness User Knowledge, Behavioral Intentions and Behavior. Unpublished Master's of Science Thesis. Virginia Polytechnic Institute and State University.

Thorn, T.F. 1995. Teaching Low-Impact Camping Practices to Wilderness Backpackers: An Evaluation of Trailhead Information Signing and Personal Contact. Unpublished Masters of Science Thesis. Utah State University.

Widner, C.J. and Roggenbuck, J.W. 1999. Reducing Theft of Petrified Wood at Petrified Forest National Park. Journal of Interpretation Research, 5(1):1-18.

Vande Kamp, M., Johnson, D. and Swearingen, T. 1994. Deterring Minor Acts of Noncompliance: A Literature Review. Cooperative Parks Studies Unit College of Forest Resources, University of Washington, Seattle, WA. Technical Report NPS/PNRUN/NRTR-92/08.