Visitor Perceptions of Technology, Risk, and Rescue in Wilderness

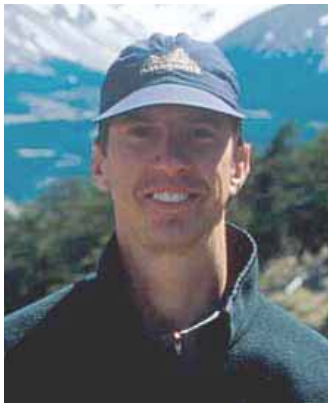
BY KRISTEN POPE and STEVEN R. MARTIN

Abstract: As devices like personal locator beacons become readily available, more visitors may bring them into wilderness and use them to request rescues, and may develop unrealistic expectations of rescue. In 2009, 235 overnight visitors to the King Range Wilderness in California completed a written survey. "Pro-technology" respondents (55% of the sample) felt that technology increased one's safety in wilderness, and would be more likely to use technology to request a wilderness rescue. "Anti-technology" respondents (45%) felt very strongly that technology cannot substitute for skill, experience, and knowledge; were very unlikely to take chances that could increase risk just because they had technology with them; and did not agree that technology reduced dangers and made them feel safer in the wilderness. Those with personal experience of a serious wilderness accident were more likely to believe that technology creates a false sense of safety for wilderness users than were people who have not been involved in a serious wilderness accident.

Introduction

The National Park Service (2008) described the Grand Canyon's Royal Arch Loop as a route "for canyon experts only" that offers "a million ways to get into serious trouble." In September 2009, two men and their teenage sons ventured out on this 35-mile (56 km) loop with, among other items, a personal locator beacon (PLB). During their brief trip, they activated this beacon three separate times. PLBs are equipped to send rescuers only the location of the party requiring rescue. The group activated their beacon for the first time at night when they ran out of water; by the time rescuers arrived in the morning (via a dangerous canyon helicopter ride) the group had already found water and refused help. The same evening, the group signaled another emergency. Rescuers used a night-vision enabled helicopter to make a risky night journey into the canyon arriving to find the same group telling them that the water they found tasted salty. Again, the group refused evacuation, but they accepted water from the rescuers. In the morning, the group activated the beacon for a third time; rescuers required the group to leave with them and cited one man for "creating a hazardous condition" (Cone 2009).

Kristen Pope. Photo by Emily Scholler.



Steven R. Martin. Photo by Peter Keller.

As technological devices such as cellular phones, satellite phones, and personal locator beacons become more readily available, greater numbers of recreation visitors may bring these devices into the wilderness and use them to request res-

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Figure 1—The tranquil scenery of the King Range Wilderness masks many dangers. Photo by Bob Wick.

cues. Although these devices have sometimes alerted rescuers to emergencies early enough to save lives, it remains to be seen whether visitors, particularly those with limited wilderness experience and skills, may develop unrealistic expectations of rescue based on their possession of and reliance on these devices. Visitors may come to rely on these devices in the wilderness instead of developing appropriate knowledge, abilities, experience, and skills. The Royal Arches foursome is an example of an inexperienced group that used their beacon in place of appropriate knowledge, abilities, experience, and skills. When rescuers asked the men what they would have done had they not possessed the device, they said: "We would have never attempted this hike." As a result of this type of incident, some rescuers refer to personal locator beacons as "Yuppie 911" (Cone 2009).

Personal locator beacons were legalized for public use in 2003, and by February 2010, the SPOT brand of personal locator beacon sold for $99.95 plus a $99.99 annual service fee (SPOT 2010). The basic SPOT model offers three signaling options: "OK," which provides preselected friends or family members with the device's location and notifies them everything is "OK"; "help," which notifies friends or family of the device's location and the user's request for assistance (but no other details); and "911," which alerts emergency responders of the user's location and request for assistance. Though people may rely on them, personal locator beacons are by no means foolproof.

The two federal agencies primarily responsible for conducting search and rescue missions in the United States are the National Park Service (NPS) and U.S. Coast Guard (USCG). Counties are typically responsible for search and rescue missions on other public land, including Bureau of Land Management (BLM) and U.S. Forest Service land; interagency efforts are very common. Between 1992 and 2007, the NPS responded to 65,439 search and rescue incidents that involved a total of 78,488 individuals in the NPS system (Heggie and Heggie 2009). During the same period, there were a total of 4.4 million recreational visits to the national parks and a total of 2.2 million nonrecreational visits (National Park Service Public Use Statistics Office 1992–2007). The most common causes for these search and rescue incidents were judgment errors (22.3%); lack of physical preparation/fatigue (16.8%); insufficient equipment, clothing, or experience (15.6%); falls (8.9%); and weather (7.4%). One out of five people rescued (20%) would have died without search and rescue intervention. However, 65.7% of those rescued were not ill or injured (Heggie and Amundson 2009; Heggie and Heggie 2009).

From 2003 to 2006, people used cellular and satellite phones to report 18% of the 12,337 search and rescue incidents in the U.S. national parks. More recent figures are not yet available, but it is likely the percentage has climbed considerably with the proliferation of new technology in recent years. During the same years, 1% of incidents were reported via personal locator beacon devices. However SPOT, the first widely available and reasonably affordable personal locator beacon, was not released until 2007 and is not included in those figures (Heggie and Heggie 2009). It is likely that this number has increased substantially.

One of the major differences between devices (such as SPOT) and equipment (such as a topographical map and compass) is that equipment requires skill and practice as well as incorporating environmental knowledge. Devices may provide instantaneous results, but they fail to involve or engage us with the surrounding environment (Pohl 2006). This lack of engagement with one's environment can contribute to a lack of visitor autonomy, self-sufficiency, and sense of self-responsibility. In turn, these factors may contribute to changes in visitor behavior and use patterns, including increased risk-taking behavior, not understanding the dangers involved

with particular behaviors, and overestimating the availability of rescue assistance. Technology may serve to insulate visitors from the consequences of their actions to the point where they fail to recognize the severity of a situation (Borrie 2000).

Many land managers feel that the average level of experience and skill among users is decreasing as more people venture into the wilderness with technology. This technology allows people with less skill to access areas that were once available only to the highly skilled (Hollenhorst 1995). The subsequent diminishing capacity for self-rescue can lead to a "society of rescuers and rescuees" where rescue (including self-rescue) is a specialized niche instead of an essential skill. Lack of visitor self-reliance has distressed wilderness proponents for decades. This is especially problematic when individuals are "no longer willing to extricate themselves" from trouble (Setnicka 1980). Robert Marshall once wrote, "In a true wilderness if a person is not qualified to satisfy all requirements of existence, then he is bound to perish" (Marshall 1930). Now that many wilderness visitors bring technology on trips and rely on this technology in the event of an emergency situation, they are no longer prepared to "satisfy all requirements of existence" and may rely on professional rescuers to fill in the gaps. San Bernardino County Emergency Coordinator John Amrhein deals with the repercussions of this on a daily basis. "In the past, people who got in trouble self-rescued; they got on their hands and knees and crawled out," Amrhein said. "We saw the increase in non-emergencies with cell phones: people called saying 'I'm cold and damp. Come get me out.' These [devices] take it to another level" (Cone 2009).

This increasing reliance on others also includes reliance on the financial resources of others (particularly public agencies) in order to fund search and rescue missions. From 1992 to 2007, the NPS spent more than $58 million on search and rescue missions, often reallocating resources to fund rescues. Rescues at Alaska's Wrangell-St. Elias and Denali National Parks were the most expensive (averaging $29,310 and $18,345 per search and rescue respectively) due to the need for extensive aerial searches (Heggie and Amundson 2009). Despite the high costs of rescue, the NPS provides search and rescue services "without subsequent cost recovery from the person(s) assisted" as a member of the United States Search and Rescue Plan. There are also concerns that charging for rescue would open the NPS up to legal liability and create a legal mandate for rescue (Heggie and Amundson 2009).

The purpose of this study was to examine wilderness visitors' beliefs and perceptions about safety, risk, and rescue in wilderness, and the extent to which technological devices may influence those beliefs.

Methods

The Lost Coast Trail follows 25 miles (40 km) of remote northern California coastline, nestled between the Pacific Ocean and the mountains of the King Range National Conservation Area. Managed by the BLM, 42,585 out of the 68,000 acres (17,234 out of the 27,519 ha) in the King Range National Conservation Area are designated as wilderness. Visitation is steadily increasing, from 3,302 self-registered visitors in 2007 to 4,646 in 2009, with an estimated registration compliance rate of 80 to 90% (Carr, pers. comm. 2009; Pritchard-Peterson, pers. comm. 2010). The topography is so rugged that engineers had to locate coastal roads farther inland. This rugged isolation makes the area an excellent place to study technology and rescue.

Lost Coast Wilderness dangers include high tides that leave miles of trail underwater, unexpectedly large "sneaker" waves, high winds, precarious cliffs, river crossings, slippery rocks, environmental hazards, and wildlife. Rescues often involve multiple agencies, including the Humboldt County Sheriff's Office, Bureau of Land Management, Cal Fire, U.S. Coast Guard, local volunteer fire

Figure 2—Strong surf is just one on a long list of hazards. Photo by Kristen Pope.

Table 1—Visitor perceptions of factors contributing to the need for rescue in wilderness, King Range Wilderness, California, 2009.

Factor	Visitor perception mean rating[a]
Inexperience	6.0
Poor judgment	5.9
Lack of preparation	5.9
Bad weather	5.0
Equipment failure or wrong equipment	4.0
Bad luck	3.6

[a]Measured on a 7-point scale, where 1 = "not at all" and 7 = "a lot."

Table 2—Self-reported level of experience/training, and perceived importance of same, King Range Wilderness, California, 2009.

Skill	Median self-reported level of experience/ training[a]	Median perceived importance of same[b]	Related samples Wilcoxen Signed Ranks test results
First aid	4	6	$p < .001$
Survival skills	4	6	$p < .001$
Navigation	4	6	$p < .001$
Search and rescue	3	4	$p < .001$
General backcountry skills	6	6	$p < .001$

[a]Measured on a 7-point scale, 1 = no experience/training, 7 = a lot of experience/training.
[b]Measured on a 7-point scale, 1 = not important, 7 = very important.

departments, Southern Humboldt Technical Rescue, and other volunteers. However, no one agency keeps comprehensive records of Lost Coast Trail rescues.

From May through September 2009, 235 overnight visitors to the King Range Wilderness completed a survey along the Lost Coast Trail. Sampling occurred on a stratified sample of weekdays, weekends, and holidays at three points along the trail: the northern trailhead (Mattole Beach), southern trailhead (Black Sands Beach), and a popular resting spot 3 miles (4.8 km) south of the northern trailhead (Punta Gorda Lighthouse). All adult visitors on an overnight backcountry trip were asked to complete the survey.

Respondents answered questions about their wilderness skills, experiences, and beliefs regarding risk, rescue, and technology in the wilderness. Questions consisted of logical items as suggested by the literature and personal experience, and were further refined by way of a focus group of experts. Respondents answered some questions on a 7-point scale (e.g., "not at all" to "a lot" or "not important" to "very important"). Other questions were answered by checking "yes" or "no" or one of several provided responses.

Results

The response rate was 92%. Respondents ranged in age from 18 to 80 (median age was 28). Sixty-five percent of respondents were male. Subjects reported a median of 10 years of experience making overnight wilderness trips, with a median of 2.5 trips (6 nights total) in the previous 12 months. Median group size was 4. Additionally, 32 visitors (13.6%) reported serving in a leadership or guide role on a wilderness trip in the previous 12 months.

King Range Wilderness visitors believed that factors they felt they could personally control (such as inexperience) were greater contributing factors in the need for visitor rescue in the wilderness than factors they could not control (such as "bad luck") (see table 1). Respondents reported that they believed the following factors were responsible for people making unsafe decisions in wilderness (on a 7-point scale where 1 = not at all, 4 = somewhat, and 7 = a lot): overestimating one's abilities (mean=5.3), not realizing the consequences (mean=5.2), proving themselves (mean=4.8), adrenaline or endorphin surge (mean=4.4), fear of looking weak (mean=4.4), and feeling they can call for help (mean=3.8).

Visitors self-reported their own level of experience or training in first aid, navigation, survival skills, general backcountry skills, and search and rescue, then assessed how important they believed it was to possess those same skills. All medians for "perceived importance" were significantly higher than the medians for "self-assessment," indicating that people believe it is important to possess a higher level of wilderness skills than they actually have (see table 2).

Out of 235 respondents, 135 (57.4%) reported having cellular phones with them, six (2.6%) had satellite phones, four (1.7%) had emergency position indicating radio beacons or personal locator beacons, 56 (23.8%) had GPS devices, 62 (26.4%) had no technological devices, and 42 (17.8%) had more than one device. A minority of visitors (17.8%) reported

having previously used a technological device in a self-defined "emergency situation in the wilderness."

Most respondents reported that technology was not a very successful substitute for skills, experience, and knowledge in the wilderness, nor would they be likely to take chances that could increase risks if they had technology with them, nor did they believe that technology reduces many of the dangers people associate with being in the wilderness (see table 3). Respondents were fairly evenly split on whether technology creates a genuine increase in safety or a false sense of safety for wilderness users, whether they would feel safer by having technology with them, and whether or not having technology makes people feel their safety is not their personal responsibility. However, using the scores from the items in table 3, we did a K-means cluster analysis to classify respondents (see table 4). A "pro-technology" group (55% of the sample) felt that technology increased one's safety in wilderness, and were more likely than the "anti-technology" group to use technology to request a rescue, take chances that could increase risk if they had technology with them, and believe that technology can successfully substitute for skill, experience, and knowledge. The "anti-technology" group (45%) felt quite strongly that technology cannot substitute for skill, experience, and knowledge, were very unlikely to take chances that could increase risk just because they had technology with them, and did not agree that technology reduced dangers and made them feel safer in the wilderness. Those respondents in the "pro-technology" cluster also identified themselves (in a different question) as significantly greater risk takers than did the respondents in the "anti-technology" cluster (Mann-Whitney U test, $p < .05$).

An overwhelming majority of King Range Wilderness visitors (80.9%) would choose a traditional map and compass over GPS (14%) if forced to choose only one navigation method. Notably, all 31 respondents (100%) who reported having served in a leadership or guide role in the previous year opted for the map and compass. However, those visitors who would choose technological navigation (GPS) were more likely to say they felt safer by having that technology with them (Mann-Whitney U test, $p < .05$), and would be more likely to take chances that could increase risk if they had that technology with them (Mann-Whitney U test, $p < .01$) than visitors who preferred the traditional map and compass. Not surprisingly, people who actually brought a GPS device to the King Range Wilderness were also more likely to believe that "technology creates a genuine increase in safety for wilderness users" (Mann-Whitney U test, $p < .01$), were more likely to believe that "technology reduces many of the dangers people associate with being in the wilderness" (Mann-Whitney U test, $p < .01$), were more likely to feel safer (Mann-Whitney U test, $p < .01$), and would be more likely to take chances that could increase risk (Mann-Whitney U test, $p < .01$) than those without GPS.

If forced to choose a single method of emergency communication, 61% of respondents preferred technological methods such as a cell/satellite phone or EPIRB device (e.g. SPOT beacon) over

Table 3—Perceptions of technology use in the King Range Wilderness, California, 2009.

To what extent...	Percentage of respondents rating 1–3 on 7-point scale	Percentage of respondents rating 5–7 on 7-point scale
Do you think technology in the wilderness can successfully substitute for skill/experience / knowledge?	82.0	6.8
Would you be more likely to take chances that could increase risk if you had technology with you in the wilderness?	68.9	16.3
Do you feel technology reduces many of the dangers people associate with being in the wilderness?	56.2	17.1
Would you be more likely to use technology to request rescue when you could make it out on your own but the process of self-rescue would be long and uncomfortable?	42.6	37.2
Do you think technology in the wilderness makes people feel that their safety is not their personal responsibility?	39.0	38.6
Do you/would you feel safer by having technology with you on a wilderness trip?	34.3	36.2
Do you think technology creates a genuine increase in safety for wilderness users?	18.7	50.9
Do you think technology creates a false sense of safety for wilderness users?	13.8	56.3

[a]Measured on a 7-point scale, where 1 = "not at all" and 7 = "a lot"; *n* ranges from 218 to 224

a traditional signal mirror and whistle. Visitors who preferred such technological emergency communication were more likely to believe that technology can successfully substitute for skills/experience/knowledge (Mann-Whitney U test, $p < .05$), that technology reduces many of the dangers people associate with being in the wilderness (Mann-Whitney U test, $p < .01$), and reported being more likely to take chances that could increase risk if they had the technology with them (Mann-Whitney U test, $p < .01$) than visitors who preferred traditional methods of emergency communication.

When asked, "Do you see yourself as a risk taker?" the mean response was "somewhat" (mean = 4.1) on a 7-point scale (1 = not at all, 4 = somewhat, 7 = a lot). Not surprisingly, the more likely someone was to self-identify as a risk taker, the more likely they were to report that they would take chances that could increase risk if they had technology with them in the wilderness (Spearman's *rho* = .337, $p < .01$). A majority of visitors (63.1%) reported having done something in the wilderness that they felt at the time was unsafe; 68.2% reported having done something that in retrospect they felt was unsafe. People who have done something in the wilderness that they felt at the time was unsafe were more likely (than those who had not) to believe that technology creates a genuine increase in safety (Mann-Whitney U test, $p < .05$). People who have done something in the wilderness that they felt in retrospect was unsafe were more likely to believe that technology reduces many of the dangers people associate with being in the wilderness (Mann-Whitney U test, $p < .01$), but somewhat paradoxically were also more likely to believe that technology creates a false sense of safety for wilderness users (Mann-Whitney U test, $p < .05$).

Gender was a significant factor in risk taking, with males more likely to see themselves as risk takers (Mann-Whitney U test, $p < .01$). Males were more likely to report having done something in the wilderness that they felt at the time was unsafe (Chi-Square, sig. < .05), and were more likely to report having done something in the wilderness that they felt in retrospect was unsafe (Chi-Square, sig. < .01). This is consistent with Slovic (2000), who reported dozens of studies documenting that men judge risks as smaller than do women. Age is negatively correlated with self-identifying as a risk taker (Spearman's *rho* = -0.186, $p < .01$).

About 11% of King Range Wilderness visitors reported having been personally involved in a serious

Table 4—Contrasting perceptions of technology use in the King Range Wilderness, California, 2009.

To what extent...	Mean score[a] "pro-tech" cluster *N* = 118	Mean score "anti-tech" cluster *N* = 97	Mann-Whitney test results
Do you think technology in the wilderness can successfully substitute for skill/experience / knowledge?	2.8	1.5	*p* < .01
Would you be more likely to take chances that could increase risk if you had technology with you in the wilderness?	3.4	1.9	*p* < .01
Do you feel technology reduces many of the dangers people associate with being in the wilderness?	3.7	2.6	*p* < .01
Would you be more likely to use technology to request rescue when you could make it out on your own but the process of self-rescue would be long and uncomfortable?	4.7	2.6	*p* < .01
Do you think technology in the wilderness makes people feel that their safety is not their personal responsibility?	3.9	3.8	*p* < .05
Do you/would you feel safer by having technology with you on a wilderness trip?	4.9	2.9	*p* < .01
Do you think technology creates a genuine increase in safety for wilderness users?	5.2	3.9	*p* < .01
Do you think technology creates a false sense of safety for wilderness users?	4.8	5.0	*p* < .05

[a]Measured on a 7-point scale, where 1 = "not at all" and 7 = "a lot."

wilderness accident, and 41% knew someone involved in a serious wilderness accident. Half (52%) of the respondents who reported personal involvement in a wilderness accident said they had used a technological device in a wilderness emergency. Tellingly, those with personal experience of a serious wilderness accident are more likely to believe that technology creates a false sense of safety for wilderness users than those who have not been involved in a serious wilderness accident (Mann-Whitney U test, $p < .05$), as do those who know someone who was involved in a serious wilderness accident (Mann-Whitney U test, $p < .05$). This second ("know someone") group is also more likely to believe that technology makes people feel that their safety is not their personal responsibility (Mann-Whitney U test, $p < .05$).

The possible financial repercussions of rescue appear to play a small role in certain types of decisions. Visitors reported that they would be "somewhat likely" (mean=3.2, on a 7-point scale, with 1 = not likely and 7 = very likely) to delay or reconsider requesting a rescue for "yourself or someone in your party" if they thought they would be held financially responsible for the rescue.

Figure 3—Ocean rescues are sometimes required along the King Range Wilderness coastline. Photo by Shelter Cove Fire Department, CA.

Discussion

Visitors who enter the wilderness without adequate knowledge, skill, abilities, and equipment to return from their trip safely endanger themselves and rescuers. Respondents believed they should possess a greater level of wilderness skills and experience than they actually did. Many admitted to venturing into the wilderness with less preparation than they believed was necessary. Professional and volunteer rescuers and others are often left to fill in these gaps in skill and ability. This reliance on technology and rescue may create a false "safety net" when people's expectations of technology and rescue do not correspond with the actual capabilities of technology and rescuers. It may also lead to people taking more risks than they otherwise would take, relying on technology to "take up the slack." Borrie (2000) posits that as reliance on GPS rises, people's confidence in their ability to go anywhere may increase, and their willingness to turn back may decline. Our empirical findings suggest this as well, as our "pro-technology" respondents identified themselves as significantly greater risk takers who would be more likely to take chances that increase risk if they have technology with them, and are more likely to use technology to request a rescue. This represents a combination that many managers have expressed concern over—visitors who believe that their technology makes the wilderness a safer place, who are therefore willing to take more risks and then use the technology to bail themselves out of trouble.

Kruger and Dunning (1999) found that individuals who lacked experience reached inaccurate conclusions, made bad choices, and were unable to realize that their conclusions and choices were poor, falsely believing they were doing everything right. Novices have poorer metacognitive skills than experts, and are less likely to accurately judge the difficulty of the problem at hand (Kruger and Dunning 1999). Media coverage and the recency of an event distort risk perception (Slovic 2000). "Optimism bias" also affects the perception of risk, leading people to believe they are at less risk than others would be in a similar situation. This is particularly prevalent when people believe they can control the risk, that it is unlikely to happen, or if they lack experience with the risk (Powell 2007). Optimism bias can "harness us to a wishful, thereby inaccurate, and therefore dangerous image of the world," with misperceptions leading to accidents (Udall 1987).

Lack of knowledge about device capabilities can create dangerous situations. The Rocky Mountain Rescue Group spent two months searching for the source of a personal locator beacon that was triggered in Colorado nine times between December 2009 and

February 2010. They finally solved the mystery, learning that a backcountry skier thought it was an avalanche beacon, activating it every time he went skiing. He had received it as a gift and never read the instructions (Willoughby 2010).

In recent years, the media has frequently presented stories about people in need of wilderness rescue as well as technology's role in these rescues (from calling on a cellular or satellite phone, activating a personal locator beacon, or even possessing a cell phone on which rescuers could triangulate the approximate location). Although this technology can and does save lives, such media portrayals may lead people to believe that they can expect an easy and technologically aided wilderness rescue should they get into trouble. This can be dangerous and inaccurate. In 2006, three climbers were stranded on Oregon's Mount Hood during a blizzard in 100-mph (161 kmph) winds. They built a snow cave and contacted relatives via cellular phone, but rescuers were unable to locate or reach them. They had enough knowledge to build a snow cave, but their skills, supplies, abilities, and technology were, tragically, not enough to save their lives (Frazier 2006).

As the use of technology expands into wilderness areas, it is important to address people's expectations of technology in a backcountry environment and the dangerous blending of expectations between frontcountry road-accessible areas and backcountry settings (Pohl 2006). Unrealistic expectations can occur when individuals bring technology into the wilderness, falsely believing they can rapidly summon help if needed. Cellular and satellite phone coverage is often unreliable in wilderness areas, and technology is not always reliable and functional in a wilderness environment (Attarian 2002). Bringing technology into the wilderness can create a false sense of security that may compromise a group's self-reliance (Borrie 2000; Holden 2002). Even when used perfectly in ideal conditions, it can still take a considerable amount of time for rescue crews to respond. Without appropriate self-rescue abilities, even the most technologically equipped wilderness visitor can be in considerable danger waiting for help to arrive.

> Visitors who enter the wilderness without adequate knowledge, skill, abilities, and equipment to return from their trip safely endanger themselves and rescuers.

Technology will improve with time, but it remains to be seen if these improvements will create even higher expectations of safety and more unrealistic views of rescue. This topic will require further attention as technology advances and becomes more prevalent among wilderness visitors. Heggie and Heggie (2009) noted a "general feeling among many search and rescue unit managers in the United States that cell phones are being used to request search and rescue assistance in what turns out to be minor situations," or as Lomas notes: "We've confused emergency with convenience" (Lomax 2006, p. 21).

This is an especially serious concern as rescuers often place themselves in danger. Although technology has undeniably been used to save lives in wilderness emergencies, nonemergency use can negatively influence the wilderness environment.

The first Leave No Trace (2010) principle is to plan ahead and prepare. We recommend an educational campaign that would include public service announcements promoting responsible use of technology devices in wilderness, including their limitations, as well as encouraging personal locator beacon owners to register their devices with the National Oceanic and Atmospheric Administration to provide rescuers with information to help facilitate rescue (www.beaconregistration.noaa.gov).

References

Attarian, A. 2002. Rock climbers' self-perceptions of first aid, safety, and rescue skills. *Wilderness and Environmental Medicine* 13(4): 238–44.

Borrie, W. 2000. The impacts of technology on the meaning of wilderness. In *Personal, Societal, and Ecological Values of Wilderness: Sixth World Wilderness Congress Proceedings on Research, Management, and Allocation,* vol. II, comp. A. Watson, G. Aplet, and J. Hendee. (pp. 87-88) October 24–29, 1998, Bangalore, India. Proc. RMRS-P-14. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Cone, T. 2009. Tired from a tough hike? Rescuers fear Yuppie 911. *San Francisco Chronicle,* October 25.

Frazier, J. B. 2006. Mt. Hood body identified as Kelly James. *San Francisco Chronicle,* December 18.

Heggie, T. W., and M. E. Amundson. 2009. Dead men walking: Search and rescue in U.S. national parks. *Wilderness and Environmental Medicine* 20(3): 244–49.

Heggie, T. W., and T. M. Heggie. 2009. Search and rescue trends associated with recreational travel in U.S. national parks. *Journal of Travel Medicine* 16(1): 23–27.

Holden, T. 2002. Making tough calls from the field: Cellular and satellite technology used in the backcountry. In R. Poff, S. Guthrie, J. Kafsky-DeGarmo, T. Stenger, Wayne Taylor (eds.), *Proceedings of the 16th Annual International Conference on Outdoor Recreation and Education* (pp. 97–101). Bloomington, IL: Association of Outdoor Recreation and Education (AORE).

Hollenhorst, S. J. 1995. Risk, technology-driven, and other new activity trends. In *Proceedings of the Fourth International Outdoor Recreation and*

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global environmental change brought some leading conservation and protected area authors together to address the need for more connectivity to conserve biodiversity.

The idea for this book began at a 2004 international workshop called "*Protecting the World's Mountain Corridors and Peace Parks"* in Banff, Canada, and was followed by IUCN WCPA workshops called "*Mountains Connectivity Conservation"* in Ecuador in 2006 and in Nepal in 2008. These workshops provided the dialogue, case studies, feedback on the book concept, and practical insights necessary to write this comprehensive and well-documented overview of the management of connectivity conservation around the world.

The book is divided into three parts. The first part sets the stage for the book with the theory, science, planning, and management of connectivity conservation, with particular emphasis on mountain connectivity conservation. The second part includes 25 case studies of the practice of connectivity conservation from six of the eight biogeographic regions on Earth: Africotropical, Australian, Indomalayan, Nearctic, Neotropical, and Palaearctic. The third part includes an overview of the main themes that emerged from the case studies and workshops and forms the practical and empirical basis for a connectivity conservation management framework that is proposed and discussed with implications for several different spatial scales. Additionally, the planning and management tasks required for successful connectivity conservation are outlined along with the challenges and opportunities.

The book concludes with a poignant warning and a suggestion for the place of connectivity conservation in a better future: "Without intervention, the reality of past and forecast human behaviour identifies the inevitable fragmentation and loss of natural lands and their ecosystem services. The end result would be an unhealthy and less diverse world. For many areas of the earth, however, we still have a choice: a worldwide network of large-scale natural connectivity conservation lands with their associated interconnected and embedded protected areas would constitute an investment in the survival of many species and a better future for the planet and the people who live on it" (p. 346).

This book is a valuable and practical resource for anyone interested in connectivity conservation, from policy makers to planners to managers, and would serve as a text for teachers and students studying the large-scale issues in conservation, biodiversity, protected area management, and landscape level connectivity.

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Tourism Trends Symposium and the 1995 National Recreation Resources Planning Conference (pp. 65–67). St. Paul: University of Minnesota.

Kruger, J., and D. Dunning. 1999. Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology* 77(6): 1121–34.

Leave No Trace. 2010. Programs: Front country. In *Leave No Trace Center for Outdoor Ethics.* Retrieved on March 5, 2010, from www.lnt.org.

Lomax, B. 2006. Leave only footprints, and turn the darn phone off. *High Country News* 38(18): 21.

Marshall, Robert. 1930. The problem of the wilderness. *Scientific Monthly* 30(2): 141–48.

National Park Service. 2008. Royal Arch Loop. Retrieved on April 5, 2010, from www.nps.gov/grca/planyourvisit/upload/Royal_Arch_Loop.pdf.

National Park Service Public Use Statistics Office. 1992–2007. Multi-Year Summary Report: Recreation Visits. Retrieved on April 5, 2010, from www.nature.nps.gov/stats/park.cfm.

Pohl, S. 2006. Technology and the wilderness experience. *Environmental Ethics* 28: 147–63.

Powell, C. 2007. The perception of risk and risk taking behavior: Implications for incident prevention strategies. *Wilderness and Environmental Medicine* 18: 10–15.

Setnicka, T. J. 1980. *Wilderness Search and Rescue.* Boston, MA: Appalachian Mountain Club.

Slovic, P. 2000. Trust, emotion, sex, politics and science: Surveying the risk-assessment battlefield. In *The Perception of Risk*, ed. P. Slovic (pp. 390–412). London: Earthscan.

SPOT. 2010. In *SPOT Satellite Messenger.* Retrieved March 5, 2010, from www.findmespot.com.

Udall, J. R. 1987. Thinking about safety: Let the "accident dynamic" help you take a look at safety awareness. In *High-Adventure in Outdoor Pursuits,* ed. J. Meier, T. Morash, and G. Welton. (pp. 380–87). Columbus, OH: Publishing Horizons.

Willoughby, S. 2010. Rescue group finds ignorant beacon owner who triggered false alarms. *The Denver Post,* March 3.

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