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Experiencing the Restorative Components of Wilderness Environments: Does Congestion Interfere and Does Length of Exposure Matter?

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Abstract

Wilderness should provide opportunities for stress reduction and restoration of mental fatigue. Visitors, surveyed as they exited wilderness trailheads, were asked for self-assessments of stress reduction and mental rejuvenation and the extent to which they experienced various restorative components of the environment—attributes deemed by attention restorative theory to be conducive to restoration. Day and overnight hikers on both very high use and moderate use trails were studied. Most respondents reported substantial stress reduction and mental rejuvenation and most experienced the environment in ways considered conducive to restoration. At the moderate to high use levels we studied, psychological restoration did not vary significantly with level of congestion, suggesting that concern about restorative experiences is not a valid rationale for limiting use on wilderness trails. Day trips reduced stress and allowed for mental rejuvenation to the same degree that overnight trips did. However, several of the restorative

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components of environment were experienced to a significantly greater degree as length of trip increased.

Keywords

congestion, crowding, outdoor recreation, restorative environments, wilderness

Psychological restoration is an important benefit of recreation (Hammitt, 2005). In fact, the word recreation, which stems from the Latin *recreatio*, refers to restoration or recovery (Kelly, 1996). Outdoor recreation can provide a relief from the pressures of work and day-to-day activities, an opportunity for stress reduction and the rejuvenation of fatigued mental function (Driver, Brown, & Peterson, 1991). In the past few decades, a substantial body of work has developed on the restorative qualities of different environments. Studies have consistently demonstrated that natural environments are more restorative than urban or built environments (e.g., Berto, 2005; Kaplan, 2001; Ulrich et al., 1991). Theories have been advanced to explain these findings, one concerned with stress reduction (Ulrich, 1983) and the other emphasizing restoration of the capacity for focused attention (Kaplan & Kaplan, 1989).

It has been posited that wilderness environments have particularly high restorative capacities (Chang, Hammitt, Chen, Machnik, & Su, 2008). Although work on the psychological benefits of wilderness outings (Kaplan, 1984) contributed to development of attention restoration theory (ART), there has been little empirical work on restorative experiences conducted in wilderness. The legislation that designated wilderness areas in the United States, The Wilderness Act of 1964, uses the descriptors, solitude, primitive and unconfined, to define the type of recreational experience wilderness is supposed to provide. Although psychological restoration is not mentioned in the Act, a societal need for places conducive to restoration was a major motivation for the preservation of wilderness. In an early statement of the need for wilderness, for example, Marshall (1930) asserted that "convalescing in the wilderness" was a "psychic necessity," given the "terrible neural tension of modern existence." Howard Zahniser, the primary author of the Wilderness Act, wrote in 1949 that wilderness visits can help in "healing the mental disorders resulting from too much continuous crowding with other people and from the tensions in abstracting mental activity from physical exertion, which is so characteristic of modern living" (as cited in Harvey, 2005). This suggests that it is important to manage wilderness environments in such a way that their restorative potential can be realized.

Most research on restorative environments has been based on responses of participants to images of a few broad classes of natural and built

environments. There has been some work on how more subtle variations in environmental attributes influence restorative capacity. For example, Ivarsson and Hagerhall (2008) compared two different gardens; a more spacious garden with more natural and wild areas was perceived to be more restorative than a smaller garden with no natural areas and no views that did not include buildings. But more work is needed on how restorative experiences are affected by environmental attributes and social context, both to advance basic understanding and for the more applied purpose of ensuring optimal design and management of such environments.

One aspect of social context that is particularly important in wilderness is degree of congestion and crowding. Particularly close to large cities, wilderness trails get congested. Under such conditions, visitors seeking solitude often have their tranquil moments disrupted (Cole & Hall, 2008), which can contribute to stress and conflict (Schuster, Hammitt, & Moore, 2006). Consequently, there is widespread concern that congestion is diminishing experiential quality, perhaps to such a degree that the amount of visitor use should be limited. Despite a substantial literature on the adverse effects of human density, congestion and crowding on human behavior and psychological outcomes generally (e.g., Regoeczi, 2003) and in recreational contexts specifically (Manning, 1999), there has been virtually no research on the effects of density, congestion and crowding on restorative experiences. One limited exception is the work of Staats and Hartig (2004) who found that being alone was more beneficial to restoration of the capacity for directed attention than being with one other person.

Based on this finding and the generally adverse effects of congestion on human well-being, our hypothesis was that the restorative capacity of wilderness environments should decrease as the degree of congestion within wilderness increases. In contrast to Staats and Hartig (2004), who compared no congestion with some congestion, we compared modest congestion, by wilderness standards, with high levels of congestion. This is the choice faced by wilderness managers considering use limits.

Another issue that needs more research is the effect of length of exposure on restoration. How much time must be spent exposed to certain environments for restoration to occur? This issue has practical application in wilderness, where visitation trends suggest that an increasingly large proportion of visits are of short duration. Forest Service visitor use monitoring data suggest that day visits constitute more than 80% of all wilderness visits, leading to concern that fewer people are exposed to wilderness environments long enough to obtain optimal restorative benefits. Most previous work suggests that wilderness trips are typically of sufficient duration (a few hours at least)

for restoration to occur. Ulrich et al. (1991) found significant restoration with exposure lengths as short as 4 min and Berto (2005) reported restoration occurred within 10 minutes. But Berto (2005) also noted that the time it takes for complete restoration is probably a function of task difficulty and length, as well as the inherent restorativeness of the environment and other studies have attributed nonsignificant results to the 50 min exposure period being insufficient (Hartig, Book, Garvill, Olsson, & Gärling, 1996). Since this work implies that restoration may require a minimum exposure length, our hypothesis was that the restorative capacity of wilderness environments should increase as the length of time spent in the wilderness increases.

The primary purpose of this study was to assess, in a wilderness environment, the influence of congestion and length of time spent in wilderness on two aspects of restorative experiences: (a) self-assessments of how much restoration was experienced and (b) the extent to which components of the environment considered to be conducive to restoration were experienced. This work was couched in the theoretical framework of ART, which postulates that human capacity for directed attention, so critical to work and day-to-day life, is subject to fatigue (Kaplan, 1995). This capacity can be restored by exposure to environments that promote involuntary attention. Such environments must have four components: Being Away, Extent, Fascination and Compatibility. As is described in more detail elsewhere (e.g., Herzog, Maguire, & Nebel, 2003; Ivarsson & Hagerhall, 2008; Kaplan, 1995; Laumann, Gärling, & Stormark, 2001), Being Away refers to an environment that facilitates psychological and/or geographical distancing from one's routine situation. Extent implies the need for an environment that is rich and coherent enough to invite exploration and captivate the mind. For Fascination, the environment must hold one's attention effortlessly. Compatibility refers to the match between one's personal inclinations and desires and the types of actions required or supported by the environment. Some authors have suggested expanding the number of components, subdividing Being Away into Novelty and Escape (Laumann et al., 2001) and subdividing Extent into Scope and Coherence (Purcell, Peron, & Berto, 2001). However, this study was confined to the original four components that remain most commonly used.

Methods

Study Areas and Sampling Procedures

The cross-sectional study design involved questioning day and overnight visitors about what they had just experienced, as they exited wilderness trails

that varied in amount of use. Visitors were surveyed at 10 trailheads in two wilderness areas in the northwestern United States—the Alpine Lakes Wilderness in Washington and the Three Sisters Wilderness in Oregon. These wilderness areas are adjacent to the sprawling metropolis of Seattle, Washington, and the rapidly-growing city of Bend, Oregon. They are mountainous, with vegetation of mixed forest and meadow, and with lakes that can be reached by walking a few miles along trails.

In each wilderness, visitors were sampled at two very heavily used trailheads and three moderately used trailheads. Based on trailhead counts on sample days, visitation levels at the very high use trailheads, which are among the most popular wilderness trails in Oregon and Washington, were typically at least 100 people per day. Use on sunny weekend days sometimes exceeded 300 people. This contrasts with typical use levels of 15-20 people per day at moderate use trailheads. At these trailheads, there were summer weekdays when nobody visited. Even on peak days on summer weekends, use levels seldom exceeded 50 people.

Typically, each group of trailheads was sampled twice during the July-August summer season, each time over a 9-day block of time. Researchers were present for at least 6 hours per day (usually 8 hours), with sampling times adjusted to match the times of day that people were likely to be present. Researchers attempted to contact all adult (16 years and older) members of all groups as they exited the wilderness and asked them to participate. Approximately 72% agreed. A total of 531 completed questionnaires were obtained, 381 at the very high use trailheads and 150 at the moderate use trailheads. In total, 100 completed questionnaires were obtained from overnight visitors (52 from very high use trails and 48 from moderate use trails) and 431 were obtained from day users (329 from very high use trails and 102 from moderate use trails).

The Survey Instrument

Respondents were given a 4-page questionnaire about what they had experienced on their trip. For the purposes of this article, experiences relevant to restoration were included in a question that read: "The following are experiences that people sometimes seek in wilderness. For each item, please indicate the extent to which it was experienced on this trip."

Response options ranged from 0 (*not at all*) to 6 (*very much*). Visitors were asked about two aspects of restorative experiences. First, they were asked directly about the extent to which restoration occurred. They were asked about the extent to which they experienced "release of stress and

tension," reflecting the stress reduction theory of Ulrich (1983) and "mental rejuvenation," an outcome expected from restoration of attention (Kaplan, 1995). Second, they were asked about the extent to which they experienced components of the environment considered to be conducive to restoration (e.g., being "absorbed in my immediate surroundings" or "sensing that the elements around me fit together"). Individual descriptors were drawn from the scale items developed by Hartig, Korpela, Evans, & Gärling (1997) and Laumann et al. (2001) and adapted to be meaningful in the context of a wilderness visit. Three descriptors were selected from each of the four restorative components: Being Away, Extent, Fascination and Compatibility. Three of these descriptors were written in inverse format (i.e., restorativeness should decrease as experience of that attribute increased). Visitors were asked about the length of their trip and, to measure congestion, about how many other groups of people they had seen that day.

Data Analysis

To assess the restorativeness of wilderness environments, means and standard errors are reported for each environmental descriptor, as well as correlations between these descriptors and the extent to which respondents experienced release of stress and tension and mental rejuvenation. To assess the distinctiveness of the four theorized components of restorative environments, the dimensionality of the restorative components of environment was assessed using principal components factor analysis with Varimax rotation. Factor loadings had to be ≥0.40 for descriptors to be included in a factor and only factors with eigenvalues ≥1.0 were extracted.

Regarding congestion, our hypotheses were that experience of restoration and restorative components of the environment (a) would be higher on the moderate use trails than on the very high use trails and (b) would increase as the number of encounters with other groups decreased. Regarding length of exposure, our hypotheses were that experience of restoration and restorative components of the environment (a) would be higher for visitors who stayed out overnight than for those on day hikes and (b) would increase as length of day trip increased.

To test these hypotheses, three-factor analysis of variance tests were conducted. There were two levels of each of the main factors of interest: use level (very high and moderate) and length of exposure (day and overnight). Wilderness was included as a random factor in the model to account for the possibility of a systematic difference between the two wildernesses. Dependent variables were each of the 12 descriptors of the restorative components of environment, as well as the two direct measures of restoration. Since there

was no interaction between use level and length of exposure, results for each main factor are presented in separate tables. Linear regression was used to assess the extent to which the descriptors of the environment and two direct measures of restoration varied with the self-reported number of groups seen and with the length of day trips (in hours).

In all, 24 separate multifactorial analysis of variance tests and 48 separate regression analyses were conducted. With this large number of tests, opportunities for Type I errors increase. Consequently, a very conservative alpha level of 0.001 was used to assess the statistical significance of differences.

Results

Most respondents came in small groups (median group size of 2) and stays were not lengthy. The median stay for day users was 4 hours while the median stay for overnight visitors was 1 night. Men were somewhat more common (57%) than women and the median age was 40. Approximately 50% of respondents lived within 50 miles of the trailhead where they were contacted and 60% were repeat users on that trail.

Restorativeness of Wilderness Environments

After their wilderness trip, most respondents reported substantial reduction in stress and tension, as well as mental rejuvenation (Table 1). More stress reduction was reported than mental rejuvenation. However, differences in magnitude were small and the levels of stress reduction and mental rejuvenation were highly correlated ($r = .66$). Respondents also typically experienced the wilderness environment in ways theorized to be conducive to restoration from mental fatigue brought on by prolonged directed attention (Table 1). Means were above the midpoint (3) of the 7-point scale, suggesting at least moderate achievement experience, except for the three descriptors that were inversely formatted, which were all well below the midpoint. Descriptors of the Fascination component were experienced most strongly, although variation among individual descriptors was not large.

Both stress reduction and mental rejuvenation were positively correlated with most of the descriptors of restorative environments that were asked about (Table 2). Effect sizes were mostly moderate to large ($r = .3$-$.5$; Cohen, 1992). For most individual descriptors, correlations were slightly larger for mental rejuvenation than for stress reduction. Correlations varied more within the theorized restorative components than among them. Correlation coefficients were smallest for the three descriptors that were inversely

Table 1. Extent to Which Wilderness Visitors Experienced Restoration and Environmental Attributes Conducive to Restoration[a]

	0-1 (%)	2-4 (%)	5-6 (%)	*M*	*SE*
Direct assessment of restoration					
Release of stress and tension	7	44	49	4.19	0.07
Mental rejuvenation	10	50	41	3.84	0.07
Fascination					
I felt bored by the environment	82	15	3	0.76	0.06
There was much to attract and hold my attention	7	42	51	4.30	0.07
I was absorbed in my immediate surroundings	5	45	50	4.25	0.07
Being away					
I felt removed from my daily routines	10	39	51	4.15	0.08
I was away from other people's demands and expectations	16	43	41	3.70	0.09
I was focused on things I had to get done after the trip	50	42	8	1.79	0.08
Compatibility					
I felt I could easily handle the problems that arise here	11	47	42	3.85	0.08
I sensed that I belong here	13	46	42	3.82	0.08
What I wanted to do was what needed to be done here	24	45	31	3.19	0.10
Extent					
I sensed that the elements around me fit together	13	51	36	3.67	0.08
I felt my immediate surroundings were part of a larger whole	17	47	36	3.58	0.09
A feeling that there was too much going on	59	36	5	1.44	0.07

a. Responses to a question about how much each item was experienced on a scale from 0 (*not at all*) to 6 (*very much*)—percent of respondents, mean and standard error.

formatted. Contrary to expectations, two of these ("I was focused on things I had to get done after the trip" and I experienced "a feeling that there was too much going on") were positively correlated with stress reduction and mental rejuvenation.

Although the psychometric properties of the scales were not a focus of this study, a factor analysis was conducted to assess the distinctiveness of the four theorized components of restorative environments. As has been found in some (Hartig et al., 1997; Purcell et al., 2001), but not all previous studies (Laumann

Table 2. Correlation (Pearson's *r*) Between Restoration Experienced and Restorative Components of Environments

	Stress Reduction	Mental Rejuvenation
Fascination		
I felt bored by the environment	–0.09	–0.08
There was much to attract and hold my attention	0.34	0.48
I was absorbed in my immediate surroundings	0.37	0.48
Being away		
I felt removed from my daily routines	0.50	0.52
I was away from other people's demands and expectations	0.46	0.49
I was focused on things I had to get done after the trip	0.12	0.17
Compatibility		
I felt I could easily handle the problems that arise here	0.22	0.14
I sensed that I belong here	0.40	0.49
What I wanted to do was what needed to be done here	0.36	0.39
Extent		
I sensed that the elements around me fit together	0.30	0.39
I felt my immediate surroundings were part of a larger whole	0.35	0.51
A feeling that there was too much going on	0.11	0.20

et al., 2001), one dominant factor (40% variance explained) and one secondary factor (15% variance explained) were extracted (Table 3). The three descriptors that loaded on the secondary factor, from three different restorative components, were the ones that were inversely formatted, a result consistent with Hartig et al. (1997). Redundancies among the four theorized components were high, suggesting that wilderness visitors experience these components more as a unified whole than as distinct elements. Given the lack of distinction among theorized components, further analyses were based on individual items.

Effects of Congestion and Length of Exposure

Interactions between level of congestion (very high or moderate use) and length of exposure (day or overnight) were not statistically significant, simplifying interpretation of results. The hypothesis that congestion on very high use trails would interfere with the restorativeness of wilderness environments

Table 3. Varimax Rotated Loadings From Factor Analysis of Visitor Experience of Restorative Components of the Environment

	Factor		
	1	2	Communalities
Fascination			
I felt bored by the environment	–0.16	0.77	0.62
There was much to attract and hold my attention	0.81	–0.12	0.67
I was absorbed in my immediate surroundings	0.79	–0.06	0.63
Being away			
I felt removed from my daily routines	0.67	0.12	0.46
Away from other people's demands and expectations	0.68	0.18	0.49
I was focused on things I had to get done after the trip	0.20	0.70	0.53
Compatibility			
I felt I could easily handle the problems that arise here	0.48	0.13	0.23
I sensed that I belong here	0.81	0.07	0.66
What I wanted to do was what needed to be done here	0.64	0.28	0.49
Extent			
I sensed that the elements around me fit together	0.74	0.02	0.55
Felt immediate surroundings were part of larger whole	0.77	0.14	0.62
A feeling that there was too much going on	0.18	0.80	0.67

was not supported. Self-assessments of degree of stress reduction and mental rejuvenation did not vary significantly between very high use and moderate use trails (Table 4). None of the descriptors of restorative environments varied significantly with level of congestion ($\alpha = .001$). If an alpha of 0.05 had been used, results would not have been substantively different. One descriptor varied significantly ($p = .01$), but for this descriptor the direction of difference was opposite the hypothesis. The descriptor, "there was much to attract and hold my attention" was experienced more on very high use trails than on moderate use trails.

Regression analyses (data not shown) confirmed that there was little effect of congestion on restorative experiences. Neither stress reduction nor mental rejuvenation varied significantly with number of groups seen; nor did any of the descriptors of restorative environments ($\alpha = .001$). If an alpha of .05 had

Table 4. Effect of Congestion on the Extent to Which Wilderness Visitors Experienced Restoration and Environmental Attributes Conducive to Restoration[a]

	Very High Use (n = 335)		Moderate Use (n = 140)		ANOVA	
	M	*SE*	*M*	*SE*	*F*	*p*
Direct assessment of restoration						
Release of stress and tension	4.16	0.08	4.26	0.13	0.0	.45
Mental rejuvenation	3.81	0.09	3.89	0.14	0.1	.37
Restorative components—Positive						
There was much to attract and hold my attention	4.37	0.09	4.12	0.13	9.2	.01
I was absorbed in my immediate surroundings	4.28	0.08	4.20	0.12	1.6	.21
I felt removed from my daily routines	4.05	0.10	4.39	0.14	0.5	.25
I felt I could easily handle the problems that arise here	3.74	0.10	4.10	0.14	0.6	.21
I sensed that I belong here	3.84	0.10	3.76	0.15	3.4	.07
Away from other people's demands and expectations	3.57	0.11	4.00	0.15	0.3	.30
I sensed that the elements around me fit together	3.66	0.09	3.71	0.15	0.1	.35
Felt immediate surroundings were part of larger whole	3.55	0.10	3.65	0.16	0.6	.22
What I wanted to do was what needed to be done here	3.17	0.11	3.23	0.17	0.9	.17
Restorative components—Negative						
I felt bored by the environment	0.74	0.07	0.81	0.12	0.2	.68
A feeling that there was too much going on	1.50	0.09	1.32	0.14	0.9	.18
I was focused on things I had to get done after the trip	1.84	0.09	1.67	0.15	0.7	.20

a. Means and standard errors for responses to a question about how much each item was experienced on a scale from 0 (*not at all*) to 6 (*very much*).

been used, we would have concluded that two of the descriptors ("I felt removed from my daily routines" and "I felt away from other people's demands and expectations") declined significantly as number of groups seen increased ($F = 5.3$, $p = .02$ and $F = 5.0$, $p = .03$, respectively). However, the percent of variance explained was negligible ($R^2 = .01$ in each case), as was the slope of the regression line ($b = .02$).

The hypothesis regarding length of exposure effects was only partially supported. Based on an alpha level of .001, none of the descriptors of restorative environments varied significantly with length of stay (Table 5). With an alpha level of 0.05, five of the descriptors that were not inversely formatted were experienced more by overnight users than by people on day trips and two of the descriptors that were inversely formatted were also experienced more by overnight users. These were the same inversely formatted descriptors that loaded positively, in the factor analysis, with the other descriptors and that were positively correlated with stress reduction and mental rejuvenation. Neither stress reduction nor mental rejuvenation varied significantly with length of exposure.

Differences in the experience of day and overnight users result from both differences in length of exposure and differences in activity. Overnight campers engage in a wider range of activities, such as cooking meals, sleeping outdoors, and so on. To more effectively isolate length of exposure effects, the effects of length of day trip (in hours) on restoration were explored. Variation in length of overnight trip was insufficient to permit analysis. Length of day trip had no effect on extent of stress reduction or mental rejuvenation (Table 6). However, two of the descriptors associated with the theorized Fascination component of restorative environments were experienced to a greater extent as length of trip increased ($\alpha = .001$).

Discussion

Although limited in scope, this study represents an initial exploration of psychologically restorative experiences in wilderness by typical visitors under field conditions. As expected, most people on wilderness trips reported that they experienced both stress reduction and mental rejuvenation to a substantial degree. They also reported experiencing the environment in a number of ways posited to be conducive to restoration of the capacity for focused or directed attention. Positive correlations between these descriptors of restorative environments and self-assessments of restoration, of a moderate-to-high effect size, were consistent with the predictions of ART (Kaplan, 1995).

Table 5. Effect of Exposure Length on the Extent to Which Wilderness Visitors Experienced Restoration and Environmental Attributes Conducive to Restoration[a]

	Day Use (n = 380)		Overnight (n = 95)		ANOVA	
	M	*SE*	*M*	*SE*	*F*	*p*
Direct assessment of restoration						
Release of stress and tension	4.19	0.08	4.21	0.17	0.0	.50
Mental rejuvenation	3.80	0.08	3.98	0.17	0.4	.26
Restorative components—Positive						
There was much to attract and hold my attention	4.25	0.08	4.48	0.14	1.1	.14
I was absorbed in my immediate surroundings	4.19	0.08	4.52	0.14	3.3	.03
I felt removed from my daily routines	4.04	0.09	4.59	0.16	4.6	.02
I felt I could easily handle the problems that arise here	3.71	0.09	4.39	0.13	8.6	.01
I sensed that I belong here	3.78	0.09	3.97	0.18	0.2	.33
Away from other people's demands and expectations	3.59	0.10	4.12	0.17	2.6	.05
I sensed that the elements around me fit together	3.65	0.09	3.77	0.17	0.1	.40
Felt immediate surroundings were part of larger whole	3.50	0.10	3.87	0.18	1.5	0.11
What I wanted to do was what needed to be done here	3.09	0.11	3.60	0.19	3.3	.03
Restorative components—Negative						
I felt bored by the environment	0.71	0.07	0.98	0.15	3.2	.08
A feeling that there was too much going on	1.37	0.08	1.72	0.18	4.9	.03
I was focused on things I had to get done after the trip	1.72	0.09	2.05	0.19	4.1	.02

a. Means and standard errors for responses to a question about how much each item was experienced on a scale from 0 (*not at all*) to 6 (*very much*).

These results are consistent with assertions some have made that the restorative capacity of wilderness environments is particularly large (Purcell et al., 2001). However, since the focus of this study was on effects of social context on restoration rather than the restorativeness of wilderness environments per se, nonwilderness users were not included in the study. Consequently, it is not possible to draw conclusions about how the restorativeness of

Table 6. Relationship Between Length of Day Trip (in hours) and Extent to Which Wilderness Visitors Experienced Restoration and Environmental Attributes Conducive to Restoration[a]

	Regression Results				
	F	*p*	R^2	Constant	Slope
Direct assessment of restoration					
Release of stress and tension	0.9	.35	—	—	—
Mental rejuvenation	0.0	.91	—	—	—
Restorative components—Positive					
There was much to attract and hold my attention	10.9	<.001	0.03	3.54	0.16
I was absorbed in my immediate surroundings	14.9	<.001	0.04	3.41	0.18
I felt removed from my daily routines	1.5	.23	—	—	—
I felt I could easily handle the problems that arise here	2.1	.15	—	—	—
I sensed that I belong here	5.6	.02	—	—	—
Away from other people's demands and expectations	0.1	.74	—	—	—
I sensed that the elements around me fit together	2.8	.10	—	—	—
Felt immediate surroundings were part of larger whole	4.0	.05	—	—	—
What I wanted to do was what needed to be done here	2.1	.15	—	—	—
Restorative components—Negative					
I felt bored by the environment	0.3	.57	—	—	—
A feeling that there was too much going on	1.5	.22	—	—	—
I was focused on things I had to get done after the trip	3.6	.06	—	—	—

a. Responses to a question about how much each item was experienced on a scale from 0 (*not at all*) to 6 (*very much*).

wilderness compares to other environments. It is noteworthy that, in studies that used similar scales, urban environments evoked lower ratings than those found in this study (Korpela & Hartig, 1996; Laumann et al., 2001).

Results suggest that, within the range of use levels we examined, level of visitor use does not affect the restorativeness of wilderness environments. Congestion did not interfere with the ability of people to experience stress reduction

and mental rejuvenation when traveling in wilderness. The levels of congestion examined ranged from moderate to the highest levels found in legislatively designated wilderness. Given the finding of Staats and Hartig (2004) that being totally alone is more restorative than being with just one other person, provided one feels safe, it is possible that results would have been different had very lightly used wilderness locations been studied as well. However, those participants in our survey who encountered few or no other people on their trip did not experience particularly high levels of restoration. It is also possible that there is a level of congestion, much higher than currently occurs in wilderness, at which restorative experiences would be inhibited to a substantial degree.

Regarding the effect of length of exposure, results are more equivocal. A few of the environmental attributes conducive to restoration were experienced to a greater extent by people on longer trips. However, differences were not large. Moreover, there were no differences related to exposure length in self-reported stress reduction and mental rejuvenation. This is consistent with findings that substantial restoration can occur in short periods of time—generally measured in minutes rather than hours or days (Berto, 2005). This does not preclude the possibility that further research might identify different levels and types of restoration that occur in phases and over vastly different lengths of exposure (Kaplan, Kaplan, & Ryan, 1998).

Although adequate for the limited purposes of this study, from a psychometric perspective the restorativeness scales were problematic. The four different components were highly redundant—not very distinct. Herzog et al. (2003), in discussing similar results, point out the challenge of maintaining "user friendliness" in definitions while working to develop more distinctive definitions. Further work is needed to develop scale items that make sense in field situations and also function to emphasize the distinctiveness of different constructs. Alternatively, perhaps in wilderness these dimensions are not as distinct as they are in other contexts. Finally, additional research is needed using approaches that avoid some of the limitations of this work, most notably reliance on self-assessments and perceptions of experiences.

Practical Applications

A major motivation for this study was to gain insight into the validity of concerns about deteriorating experience quality as a result of increasingly heavy visitation on some wilderness trails and a trend toward shorter visits to wilderness (Cole and Hall, 2008). The centrality of a place for mental restoration, as a reason for establishing wilderness, led us to apply concepts derived from ART. Despite the limited nature of this study, it appears that wilderness experiences are

restorative, even under the highest levels of visitor use currently occurring in wilderness. Managers of some very popular wilderness areas have already limited access, using permit systems, to ensure that trails are moderately congested rather than heavily congested. Managers of other popular wilderness areas question whether they should reduce use to improve the quality of visitor experiences. Our results suggest that while there may be good reasons to limit use on wilderness trails (e.g., to minimize ecological impacts or to provide opportunities to get away from crowds of people), ensuring opportunities for stress reduction, mental rejuvenation and restoration of attentional capacity does not appear to be a valid reason. Further research comparing, for example, being completely alone in wilderness with low to modest levels of congestion would further advance knowledge regarding the relationship between congestion and restorative experiences. Our results, when viewed along with those of Staats and Hartig (2004) suggest an asymptotic relationship between use level and restorative experience, in which restorativeness varies substantially with use level, where use levels are low, but not where use levels are modest to high. Such an asymptotic relationship has been demonstrated for the relationship between amount of use and certain environmental impacts (Cole, 1995).

There is more reason for concern about the trend toward shorter trips into the wilderness. Several of the restorative components of wilderness environments were experienced less by wilderness visitors on short trips. Nevertheless, even a few hours in wilderness were sufficient for substantial stress reduction and mental rejuvenation. Further research might identify restorative experiences, other than recovery from directed attention fatigue, that require lengthier periods of exposure to wilderness environments.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the authorship and/or publication of this article.

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