Expansion of the Wilderness Values Scale With Three Sub-Scales: Personal Maintenance, Expression and Learning, and Societal Maintenance

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Abstract—The purpose of this research was to expand the wilderness value scale administered in the 1994 and 2000 versions of the National Survey on Recreation and the Environment using questions included in the 2003 NSRE. A data set of 1,900 cases was randomly split in half. Validity of the additional questions was tested using principal component analysis, a confirmatory factor analysis cross validation procedure, Cronbach's alpha and weighted omega reliability coefficients, and identification of a simplex pattern among the scales. Results revealed that the three sub-scales, personal maintenance, expression and learning, and societal maintenance have adequate levels of reliability and validity. Concluding sections include recommendations for further testing of the scales and definitions for the specific value measures to aid in understanding the intended theoretical meaning and foster consistent replication.

Introduction

Previous research suggests that a shift may be occurring in how American citizens value the National Wilderness Preservation System (NWPS). Cordell and others (2003) stated that this shift is devaluing a paradigm that emphasizes economic uses and human dominance over nature and placing more value in a paradigm that posits sustainable development and a balance between human and non-human uses of nature. In most paradigm shifts, there is bound to be variation among interest group attitudes and a stage during which interest groups have difficulty articulating opinions. In an on-going effort to identify, understand, and confirm these values, the United States Department of Agriculture Forest Service has included questions concerning social values of wilderness on three iterations (1994, 2000, and 2003) of the National Survey on Recreation and the Environment (NSRE).

The 1994 and 2000 iterations of the NSRE used a 13-item wilderness value scale (WVS) that was founded on the concepts of onsite use and offsite values (table 1). Onsite use values require one's physical presence in a wilderness. Use values have been the main focus of previous research as a result of the perceived link with recreational use of wilderness, profit involving services (for example, guide services), or extraction of raw materials from wilderness. Use values are often tangible, observable, and sometimes marketable (Cordell and others 2003). Offsite, or nonuse, values "include a range of potential benefits that can accrue to people whether or not they ever enter wilderness" (Cordell and others 1998: 28). Nonuse values are more difficult to measure; they tend to be less understood, intangible and not marketable. However, Cordell and others (2003) and Loomis and others (1995) posit that nonuse values are equal to and in some cases surpass use values.

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Table 1—Factors and loadings found using the 1994 and 2000 NSRE wilderness values data.

Wilderness value item	Factor loadings	
	1994	2000
Factor one **Wildland protection**		
Protection of wildlife habitat	0.81	0.75
Protection for endangered species	.79	.76
Preserving ecosystems	.79	.74
For future generations	.77	.68
Protecting air quality	.73	.73
Protecting water quality	.71	.68
Future option to visit	.58	.54
Just knowing it exists	.57	.54
Factor two **Wildland utilization**		
Income for tourism industry	.82	.75
Recreation opportunities[a]	.71	.66
Providing spiritual inspiration	.56	.65
For scientific study[a]	—	.50
Scenic beauty	—	—

[a]Redundant with 2003 question.

Using the previous 13-item WVS, Cordell and others (1998) identified two factors using principal components analysis (PCA) (table 1). The first factor, *wildland protection*, reflected offsite nonuse values such as protection of air and water quality, habitats, ecosystem functioning, existence, option, and bequest values. The second factor, *wildland utilization*, was more a reflection of onsite use values realized through recreation or scientific study, and economic benefits of tourism and business. Two of the questions (*use of wilderness for scientific study and providing scenic beauty*) loaded on both factors and could not be assigned to either. In 2000, a PCA with varimax rotation identified the same two factors as in 1998; thus, the 2000 NSRE data preformed consistently (Cordell and others 2003). Again, the question *providing scenic beauty* loaded on both factors. However, the item *use of wilderness for scientific study* loaded on the *wildland utilization* factor, as one might expect. The authors asserted that the "consistency in structure…over time indicates persistence of the dichotomy between nonuse and use values" (Cordell and others 2003: 30). A necessary step in understanding wilderness values is to expand the WVS to be more inclusive of the variation in the human relationship with wilderness.

The 2003 NSRE included an added module of wilderness questions that increased the breadth of possible values. The purpose of the current research was to expand the wilderness value scale used in the 1994 and 2000 NSRE by validating the additional questions. The new wilderness value questions address less tangible values than the previous WVS items.

The overall intention of the analyses herein was to identify scales that could be combined with the original items to create a WVS that accounts for more variation in attitudes toward the National Wilderness Preservation System. The next section provides brief descriptions of the new value items. For convenience, the items below are organized according to the value class and factors listed in table 2.

New Value Meaning

Personal Maintenance

Therapeutic value is found in the ability of wilderness to isolate an individual from external pressures and provide opportunities for healing and the development of self-concept, personality, locus of control, and self-assertion (Burton 1981). *Personal well-being* is fostered through opportunities for escape from urban and social settings (White and Hendee 2000). Unlike therapeutic value, this value focuses on maintenance of psychological health rather than recovery from traumatic events or using wilderness as a prescription. *Self-enlightenment* is the pursuit of higher levels of consciousness. Wilderness holds this value to the extent that it can remove urban or social stimuli from a self-reflective experience and provides opportunities for self-relevant feedback (Scherl 1989). *Family and social* bonds are strengthened through wilderness-based leisure outings. Such experiences improve family stability, interactions, and relationship satisfaction

Table 2—Factor loadings, means, and standard deviations for the wilderness value variables from the 2003 NSRE.

Wilderness value and factor	Value class	PCA loadings sample 1	CFA loadings sample 1	CFA loadings sample 2	Mean N = 1924	SD[a]
Personal Maintenance		$\alpha =.78$[b]	$\Omega = .82$[c]	$\Omega = .76$		
Helps one recover from tragic life events or illness, such as death of a loved one, divorce, or depression.	Therapeutic	0.826	0.629	0.590	1.90	1.0
Helps people escape the stresses of every-day life.	Well-being	.678	.753	.680	1.36	0.71
Helps people meditate and reflect on how one's life is going.	Self-enlightenment	.671	.767	.622	1.51	0.79
Strengthens family bonds, values, and friendships.	Family/Social	.598	.657	.643	1.58	0.26
Helps people learn skills beneficial in everyday life such as leadership, overcoming challenges, and self-confidence.	Character building	.563	.599	.544	1.76	0.89
Expression and Learning		$\alpha =.77$	$\Omega = .83$	$\Omega = .71$		
Provides an opportunity to study wildlife, plants, rocks, and minerals as they occur in nature.	Educational	0.814	0.787	0.587	1.23	0.55
Allows people to see and experience nature such as wildflowers, wildlife, clear streams, or mountains.	Esthetic	.809	.780	.639	1.19	0.52
Allows people to have fun and enjoy outdoor recreation activities.	Recreational	.676	.678	.644	1.26	0.56
Provides unique and outstanding subjects for art such as painting or photography.	Artistic	.631	.671	.587	1.36	0.65
Societal Maintenance		$\alpha =.70$	$\Omega = .68$	$\Omega = .71$		
Nature and wild lands are important symbols of American culture.	Cultural	0.821	0.627	0.692	1.54	0.87
It reminds us what it was like before European settlement.	Historical	.766	.622	.666	1.96	1.1
It provides scientists an opportunity to study how nature works when not disturbed by humans.	Scientific	.583	.678	.671	1.31	0.70

[a]Standard deviation
[b]Cronbach's alpha reliability coefficient
[c]Weighted omega reliability coefficient

(Mannell and Kleiber 1997). Likewise, the reduction of formality and role barriers in wilderness activities enhance trust and communication among social groups (Cheek 1981). Finally, *character building* occurs as an individual gains self-control by successfully overcoming physical and emotional challenges (Scherl 1989) or is presented with opportunities for self-reflection or concentration. Human character is enriched when the outcomes from such experiences inform daily behavior.

Expression and Learning

The *education* value of wilderness is found in its use as a classroom, as a tool in the classroom, as an object of personal study, or in the general media (Driver and others 1987). The minimization of human influence provides unique subject matter in the physical, biological, and social sciences. *Esthetic* values relate to the sublimity of wilderness. Scenic beauty and the enjoyment of nature consistently rank as strong wilderness values and associations for visitors (Driver and others 1987). Offsite esthetic value is expressed through the frequent use of wilderness themes in advertising, writing, and the media. Wilderness provides esthetic value when it challenges the senses and forces new perceptions (Thompson 1995). *Recreation* provides the vehicle for the realization of most of the other 11 values discussed here. Apart from these values, however, wilderness recreation provides opportunities for physical exercise (Godfrey-Smith 1979), wilderness-dependent activities, stimulation, independence, and risk-taking (Driver and others 1987). Additionally, wilderness has value as the left-hand primitive anchor on the Recreation Opportunity Spectrum (Manning 1989). *Artistic* value describes the use of wilderness as a subject for creative expression. The popularity of wilderness art (for example, Ansel Adams) attests to the fact that artists and consumers value the opportunities for artistic inspiration in wilderness landscapes (Driver and others 1987).

Societal Maintenance

Cultural values reflect the importance of wilderness as a repository of symbols affecting human cultures. For example, wilderness symbols, from mountain men to bald eagles to rugged peaks, serve to form and reinforce American cultural ideals of strength, diversity, and individualism. An appreciation of national origins is important for an individual's sense of self-identity and is aided by wilderness symbols (Hammond 1985). *Historical* value incorporates elements of cultural values, but is broader in scope and refers to the worth of wilderness as a relic of American and earth history. Appreciation of pre-settlement landscapes allows a greater sense of human duration and identity in the natural world (Rolston 1985). The final value, *scientific*, anticipates the use of untrammeled wilderness as a physical, biological (Driver and others 1987), and social (Manning 1989) laboratory.

Methods _____

Data used for the analysis were collected as part of the 2003 NSRE. The 2003 NSRE was a random digit dial telephone survey of more than 19,000 noninstitutionalized persons over the age of 16, in all 50 United States. A sub-sample of approximately 1,900 people was asked a series of questions specifically about wilderness. Data collection and sample weighting procedures were consistent with NSRE data collection conducted in 1994 and 2000 and described in previous studies (Cordell and others 1998; Cordell and others 2003; Cordell and Teasley 1998). This analysis focused on 12 questions that directly addressed the topic of wilderness value. The questions are listed in table 2. As noted in table 1, three of the questions from the original WVS scale are redundant with questions in the 2003 expanded WVS. All variables were measured on a five-point Likert type scale: 1 = strongly agree, 2 = moderately agree, 3 = neither agree nor disagree, 4 = moderately disagree, and 5 = strongly disagree. The complete sub-sample dataset consisted of 1,924 cases.

The analysis procedure was as follows. A single sample of NSRE respondents who answered the wilderness value questions was randomly split in half. PCA and confirmatory factor analysis (CFA) were used to identify and confirm a factor structure for the new wilderness value questions using sample one. The factor structure was cross-validated with sample two. Reliability was assessed using an internal consistency method (Carmines and Zeller 1979). To establish construct validity, correlations among the sub-scales were calculated to test for the presence of the wilderness use-nonuse dichotomy established in the previous research discussed above.

SPSS version 12.0 was used to randomly split the data into two sets. Sample one consisted of 983 cases and sample two consisted of 941 cases. PCA, with a varimax rotation, was performed using sample one. Scree plots and percent variance accounted for were used to identify plausible factor structures. Separate PCA analyses were run for the plausible models to identify the simplest structure. Factor loadings of greater than 0.5 were required for a variable to be included in a factor. Factors accounting for less than 5 percent of the variance were not considered acceptable. The factors identified by the PCA procedure were submitted to a confirmatory factor analysis (CFA) using EQS version 6.1. Based on the factor structure validation method described by Byrne (1994), sample two was submitted to a CFA in which all of the parameter, variance, and covariance estimates for sample two were constrained to be the same as the estimates from the sample one CFA. Factor structure validity is supported when an acceptable fitting model is identified while all estimates match the original factor structure estimates. An unstable factor structure is evidenced by identifying an unacceptable model, the need to freely estimate parameters, or the need to modify the model during the second CFA.

Initial analysis of sample one produced a multivariate kurtosis normalized estimate of 209, which is highly suggestive of nonnormality in the population. An appropriate response to nonnormal data is to use a test statistic that has been corrected to take nonnormality into account when evaluating model goodness of fit (Hu and others 1992). Thus, Robust Maximum Likelihood estimation was used with a covariance matrix developed from raw data. The Satorra-Bentler Scaled Chi-Square (S-Bχ^2) is sensitive to sample size and should not be trusted with large samples. Following recommendations of Hu and Bentler (1998), additional robust fit indices used were the comparative fit index (CFI) and standardized root mean square error of approximation

(RMSEA). A CFI greater than 0.9 was considered acceptable and greater than 0.95 was considered an excellent fit. An RMSEA less than 0.1 was considered acceptable and less than 0.05 was considered an excellent fitting model.

Results

Principal Components Analysis

The exploratory, PCA produced a scree plot indicating that three and five factor structures were statistically plausible. The three and five factor models accounted for 52 percent and 72 percent of the variance respectively. Separate principal components analyses were run for the three and five-factor models. The three-factor model produced the simplest structure and was selected based on interpretability. Sixty-one percent of the variance was accounted for by the three-factor model. Factor loadings are listed in table 2. Factors were labeled based on the general theme that the values in each appeared to represent. The first factor consisted of five variables that appeared to represent wilderness as a means of re-creating the self or recovering from the stress of daily life. The second factor included four value categories and portrayed wilderness as a place for self-expression, individual learning, or having fun. The final factor, consisting of three value categories, was broader in scope. The third factor characterized wilderness as a symbol of American culture, as well as a resource for scientific research.

Confirmatory Factor Analysis

The hypothesized factor structure based on the PCA was tested using CFA and supported for sample one (S-Bχ^2 = 131, df = 51, p <.000, Robust CFI = .910, RMSEA = .040). The factor structure with all parameter, variance, and covariance estimates constrained to match the estimates from sample one was imposed on sample two. The second CFA, with the constrained factor structure, produced acceptable fit indices using sample two (S-Bχ^2 = 117, df = 51, p <.000, Robust CFI = .928, RMSEA = .037). Factor structure validity was supported. An acceptable fitting model was identified without freely estimating parameters or making model modifications while all estimates were constrained to match factor structure estimates of the first CFA model.

Additional Validity and Reliability Tests

Scale reliability, "the extent to which…any measuring procedure yields the same results on repeated trials" (Carmines and Zeller 1979: 11), was assessed through an internal consistency method (Carmines and Zeller 1979) using Cronbach's alpha reliability coefficient (Cronbach 1951) and weighted omega reliability coefficient (Bacon and others 1995; DeShon 1998; Werts and others 1974). Reliability coefficients of the factors ranging from 0.68 to 0.83 indicated acceptable internal consistency (table 2). The lowest reliability estimates were obtained for the social maintenance scale (0.68 to 0.71); considering that this scale consisted of only three items, it is thought to have adequate internal consistency. In addition, reliability coefficient patterns were consistent when repeated between the two samples.

Construct validity, "the extent to which a particular measure relates to other measures consistent with theoretically derived hypotheses concerning the concepts" (Carmines and Zeller 1979: 23), was assessed using correlations of the three scales and the identification of a simplex pattern (Pelletier and others 1995). Correlations among the three factors, in both sample one and two, ranged from 0.65 to 0.86 (table 3). We would expect to find high correlations among the factors since they are measuring related constructs of wilderness value. Correlations of this level indicate shared variance among the factors and suggest that it might be appropriate to create a second order factor. However, a second-order model was not tested because it was theoretically inappropriate at this time. The objective of this research was to evaluate questions to be added to the original WVS. It will be more appropriate to create a second-order factor model after the expanded WVS is confirmed using all items combined.

A simplex pattern exists when sub-scales adjacent on a continuum have higher-positive correlations and sub-scales at opposite ends of a continuum have weaker or negative correlations. Previous research using the original WVS scale identified a dichotomy between nonuse and use values. The questions listed in table 2 indicate that the *personal maintenance* and *expression and learning* factors represented onsite use values and the societal maintenance factor represented nonuse values. Thus, we can hypothesize that the *personal maintenance* and *expression and learning* factors are adjacent on the nonuse-use continuum and the societal maintenance is on the opposite end of the continuum. The correlations in table 3 supported this indicator of construct validity. The correlation between *personal maintenance* and *expression and learning* was stronger than the correlations between *societal maintenance* and both *personal maintenance* and *expression and learning*.

Discussion

The purpose of the analysis reported in this article was to confirm and validate sub-scales to be added to the existing WVS. Results from the analyses revealed that the three sub-scales, *personal maintenance, expression and learning*, and *societal maintenance* have adequate levels of reliability

Table 3—Correlations among factors in both CFA models (sample one/sample two).

	Expression and learning	Social maintenance
Personal Maintenance	0.80/0.86	0.70/0.65
Expression and Learning		0.65/0.77

and validity. Specifically, the PCA of sample one produced a clear and interpretable three-factor structure. The CFA of the three-factor model using sample one was acceptable and did not require post-hoc modifications. In addition, the CFA cross-validation procedure using sample two was successful. Acceptable Cronbach's alpha and weighted omega reliability coefficients established internal consistency. Construct validity was supported through high correlations among the three factors considering their relationship within the overall construct of wilderness values. Construct validity was also supported by identifying a correlation pattern representing *personal maintenance* and *expression and learning* factors being adjacent on the nonuse-use continuum and the *societal maintenance* being on the opposite end of the continuum.

Overall, these results are encouraging. Albeit, additional research will be necessary to establish the psychometric properties of the scales when combining them with the original WVS items and when investigating relations with various constructs used in wilderness research. For instance, previous research has not produced consistent results using the WVS to identify relationships among various American demographic groups (Cordell and others 1998); however, demographic groups have been found to be important indicators in relation to similar constructs such as recreational use and environmental attitudes (Cordell and Tarrant 2002; Cordell and Teasley 1998). The efforts of the research herein were founded on the belief that expanding and reorganizing the WVS should contribute to accounting for more variance in wilderness values.

As part of the WVS reorganization, two of the items (*recreation opportunities* and *scientific study*, see table 1) from the original WVS factor *wildland utilization* were included in the new factors. Additional research is necessary to determine how the original *wildland utilization* factor will perform now that it contains a reduced number of indicators. In previous studies, the item *scenic beauty* thwarted classification by loading on multiple factors. Combining the original and new sub-scales will create a WVS that measures a minimum of four domains of wilderness values. Theoretically, this should allow researchers to account for more variation in wilderness values and provide better discriminant and predictive validity.

Finally, research methods using the WVS should be expanded to include more in-depth analyses of the indicators. Qualitative methods could provide data richness that allows for a more detailed understanding of how questions are interpreted and how wilderness is actually valued. This will also lead to more meaningful interpretations of quantitative analysis. The NSRE uses a telephone survey method targeting the entire American population. Future research should use more specific target populations and methods such as actual wilderness users and face-to-face interviews or surveys. Finally, there must be consistent replication in administration and analysis in order for theoretical development to occur.

Conclusion

The findings of these analyses supported the initial reliability and validity of three scales that can be used to reorganize additional values and expand the original WVS.

While the scales performed well in the current analysis, all of the research using the WVS to this point has been associated with the NSRE. Future research should target additional and specific populations to fortify the psychometric properties of the WVS. In addition, the predictive and discriminant validity of the WVS should be investigated through relationships with variables familiar to wilderness research. Understanding how humans value wilderness can help managers understand visitor needs, help protect and expand the NWPS, and further theoretical, recreation research.

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