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A model for measuring natural area values and park preferences

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SUMMARY

Theory suggests that values are important in determining an individual's behaviour and preferences related to environmental issues; however robust models that attempt to describe empirical relationships have proven elusive. This paper describes a model that clarified some relationships between values and preferences for the future management of natural areas. The key element in the model was the use of a new scale, the Natural Area Value Scale (NAVS) for measuring the relative strengths of individuals' intrinsic, non-use, use and recreation values for natural areas. Also of importance was a variable that grouped people according to their common values. The data were obtained from samples of the general public, environmentalists and farmers in Australia and were analysed in a structural equation model. The model indicated the relative importance of particular value components in determining nature conservation preferences, as well as individuals' willingness to make personal sacrifices to secure these preferences for protecting natural areas. The model fit differed for the three samples: it provided a good fit for the general public sample, for which it was designed, and weaker fit for environmentalists and farmers. The work contributes to understanding of the values that underlie conservation decisions and provides a basis for further research to develop the model's explanatory power.

Keywords: conservation preferences, intrinsic value, instrumental value, natural areas, structural equation modelling

INTRODUCTION

Human interactions with and behaviours towards natural environments have led to the well-documented problems of biodiversity loss, breakdown of ecosystem function and decline in productive capacity (Ehrlich & Ehrlich 1981; Myers 1994; Rolston 1995). One approach to finding solutions for these problems has been through examining human values towards natural areas, based on the theory that behaviours are influenced by values (Rokeach 1979).

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The involvement of the general community in the management of, and decisions made about, the future of natural areas is becoming increasingly important. Among other things, this is because some decisions are not easily resolved on scientific or economic grounds alone (Harrison & Burgess 2000). Neither is it appropriate or effective to simply present scientific evidence about a situation to the public and expect that suggested management strategies will be supported; the decisions made by governments must be able to withstand public scrutiny (Bright & Manfredo 1997). There are also many practical reasons for community involvement in decisions about the environment. Many decisions can only be made by the community, the cooperation of which is essential if the programmes of scientists and government are to succeed. For problems like climate change, the way ordinary people make decisions will have a substantial impact on management (Halford 1990). In other cases, support may be needed in the form of on-ground works, such as revegetation, fencing and monitoring (Halford 1990; Moore *et al*. 2001; Bright *et al*. 2002). Often, interests and values of the various stakeholders are in competition with each other, and conservation is only one possible alternative for a site that can be overridden by other human interests (Spash & Simpson 1993; Seligman *et al*. 1994). It is therefore important to understand the way in which individuals and different stakeholders may trade-off their values with respect to a natural area.

Social psychologists have been particularly active in developing an understanding of the factors that determine individuals' behaviour in relation to environmental preservation and conservation (Kaiser *et al*. 1999). Various determinants of behaviour have been proposed and empirically explored, including attitudes, volition, knowledge, beliefs, ascribed responsibility, personal norms, behavioural intention and values (Stern *et al*. 1993, 1995; Stern & Dietz 1994; Grendstad & Wollebaek 1998; Fransson & Gärling 1999; Kaiser *et al*. 1999; Schultz 2001; Bamberg 2003; Gärling *et al*. 2003). Such determinants have been integrated into theoretical models that attempt to explain individuals' environmental behaviour. Many of these models have drawn upon behavioural theories such as Ajzen's (1985) theory of planned behaviour and Schwartz's (1992, 1994) theory of norm activation. Previous psychometric research on this topic has commonly identified broad orientations, or collections of values, from the data. Anthropocentric (human centred), biocentric (ecosystem centred) and egocentric (self centred) orientations have been identified (Stern *et al*. 1993; Axelrod

1994; Steel *et al.* 1994; Kempton *et al.* 1995; Bjerke & Kalternborn 1999). Although orientations have proven to be useful, they have been unable to explain why groups such as farmers and wildlife managers possess similar orientations but widely divergent behaviours (Kempton *et al.* 1995; Bjerke & Kalternborn 1999).

The research reported here used intrinsic and instrumental (use and non-use) values to represent the broad range of human perspectives towards natural areas. Intrinsic value of natural areas, or parts thereof, signals that such areas are an end in themselves, independent of any benefit to humans (O'Neill 1992; Vilkka 1997). Various classifications have been developed for instrumental values. We adopted a system used by environmental economists that has just two categories: use and non-use. This categorization is relatively simple and encompasses values types that are most likely to be used and understood by members of the general public. Use values encompass the values humans extract from natural areas (timber, water, grazing and so on) as well as on-site activities such as recreation and aesthetic appreciation (Adamowicz 1995). Non-use value has two aspects, namely existence value related to satisfaction from knowing that a site is preserved in a certain condition irrespective of use or potential use, and bequest value that foregoes use to preserve the heritage of future generations (Krutilla 1967; Brookshire *et al.* 1983; Cicchetti & Wilde 1992).

The primary aim of this research was to develop a model that incorporated measures for a range of values for an individual, and assess the influence of these on preferences for the future of a natural area. The model also aimed to provide for decisions that reflected the way in which personal issues intervene in individuals' preferences, and their willingness to make personal sacrifices to uphold their preference. The model was developed for a general public sample, but given the importance of other stakeholders in environmental decision-making, this research tested the transferability of the model by including samples of environmentalists and farmers.

We hypothesized the relationships between values and preferences for protecting natural areas (Fig. 1) based on theoretical and empirical work including that of Stern and Dietz (1994) and Lockwood (1999). The basis of the model is the four latent variables that represent intrinsic, non-use, use (non-recreation) and recreation values. In modelling linkages between values and preferences, it is important to allow for the simultaneous influence of multiple values on preferences and behaviour. Values are not mutually exclusive in that individuals may simultaneously hold several values, even in circumstances where such values are in opposition (Callicott 1994; Gebhardt & Lindsey 1995). The model (Fig. 1) hypothesized that the influence of values on preferences is best represented through a variable that reflects the way in which individuals hold the values with varying strengths and signs (positive or negative).

Specific questions that we explored in this research are as follows. Does the model depicted in Figure 1 provide an acceptable description of the relationships between values, preferences and willingness to make sacrifices for environmental protection? What is the relative importance of different values for explaining management preferences? Does the model provide acceptable descriptions of value/preference relationships for different populations, specifically the general public, environmentalists and farmers? The last question addresses the robustness of the model across different populations. These questions were addressed using a survey of individuals' values and preferences.

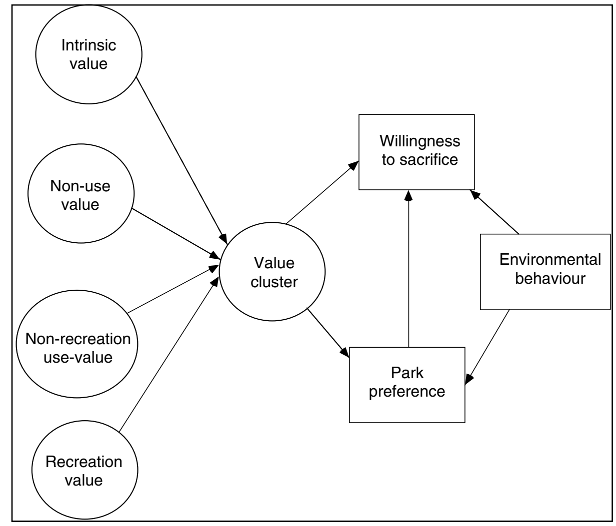

Figure 1 Hypothesized relationships between values and preferences.

METHODS

The instrument used to generate data for developing the model was a mail questionnaire that comprised:

- a set of 34 items to measure individuals' values for natural areas;
- a scenario describing various management options for a pristine natural area;
- a question to elicit respondents' management preferences for this area (PP);
- a question to determine the sacrifice people would be willing to make to secure their preferences (WTS); and
- demographic and behavioural questions.

Three different samples were used for this study: the general public, environmentalists and farmers. These groups provide a range of the values related to the use/non-use of natural areas. In particular, environmentalists and farmers are often in conflict about the future uses of natural areas suggesting they hold opposing values. This variation in the samples also provided a basis for validity tests at various stages of the project and an indication of the model's general applicability.

The survey instrument was administered in May 2001 to three independent samples:

- 3000 members of the general public, selected at random from the electoral rolls from two Australian States, Victoria and New South Wales;
- 1000 selected randomly from the membership list of a major environmental group; and
- 1000 selected randomly from the membership list of a major farmer group.

The full data set comprised 1482 general public responses (56% return rate), 797 environmentalist responses (82% return rate), and 385 farmer responses (40% return rate). As some of the variables used in the structural model had non-responses, 273 records were cut from the data set: 200 general public, 39 environmentalists and 34 farmers. The combined sample of general public, environmentalists and farmers was thus reduced to 2391: 1282 members of the general public, 758 environmentalists and 351 farmers.

Components of the model

The model (Fig. 1) was developed using several components, namely observed variables (a 20 item psychometric scale, park preference, willingness to sacrifice and behavioural questions) that were measured by the instrument, and five latent variables (four value types and value clusters) derived from the observed variables. We report on the simultaneous analysis of the components; the development and results for the natural area value scale (NAVS) were described in Winter and Lockwood (2004), the analysis of the value clusters was described in Winter *et al*. (2003), and a full description of the scenarios and results for the preference variables were provided in Winter (2005).

Value types

Exploratory factor analysis of the 34 items, using the alpha extraction method reduced them to a 20-item psychometric scale comprising four subscales of six intrinsic (IN) value items, six non-use (NU) items, six use (US) items and two recreation (RC) value items (Table 1). An oblique rotation method was used which allowed correlations between the factors. The resulting NAVS can measure, distinguish between and gauge the relative strengths of individuals' intrinsic, non-use and use values for nature. Use values had distinct recreation and non-recreation components. For the general population sample, the four value subscales have good reliability, as indicated by Cronbach's alpha: intrinsic (0.79), non-use (0.67), use (0.73) and recreation (0.68) (Winter & Lockwood 2004). Evidence for construct validity was given by the presence of expected correlations between the subscales; the verification of expected relationships between the relative subscale values for different population samples, and the verification of expected relationships between subscale values and management preferences (Winter & Lockwood 2004). Similar results were obtained for environmentalists and farmers, except that the farmers did not distinguish non-use value from intrinsic value.

Value clusters

Initial work indicated the relationship between values and preferences was more accurately represented when respondents were grouped using cluster analysis according to their common values. This clustering was based on the factor scores for each of the four values (intrinsic, non-use, use and recreation) generated from the NAVS (Winter *et al*. 2003). Thus the latent (unobserved exogenous) variables for the four values subsequently became the input variables for the value cluster (observed endogenous) variable. Rather than being a mediating variable, the value cluster represents five clusters each having a unique combination of signs and magnitudes for all four values. Table 2 can be interpreted by comparing the magnitude and the signs of the values. There were two 'green' clusters, (pro-intrinsics and the green recreationists), whose members valued natural areas for their own sake (indicated by high positive intrinsic values) and not for extractive use (indicated by negative use values). There were two clusters with the opposite values, that is, high negative intrinsic values and positive use values (pro-use and traditionalists) with one moderate group. The pro-intrinsic cluster members valued nature only for its own sake and for indirect (non-use) by humans, whereas the green recreationists also valued nature for its recreational value. The values of the pro-use cluster members were opposed to those of the pro-intrinsics, and they valued nature only for its direct and extractive use. The traditionals were similar to the pro-use cluster members, but they also valued nature for recreation. The moderates held a negligible intrinsic value and moderate instrumental values showing that they valued nature for all of the direct and indirect uses to humans, but not for its own sake.

Park preference and willingness to sacrifice

Two variables were used to test whether respondents' values influenced their decisions about protection of the natural area. Data for these variables were derived from scenarios which were developed about a pristine old-growth forest area and a wetland. Protection of old-growth forests and wetlands are two major environmental issues in Australia. Respondents were given either the forest or the wetland scenario and told that they were hypothetical, but they were asked to treat the situation as one that was actually occurring. The scenarios concerned the issue of whether the areas should be used for extractive purposes or conserved as national park. The economic, social and environmental benefits and costs of these two broad options were described. Respondents to the forest version were then told that the government was considering four possible options for future management:

- all park with no timber harvesting or tourism;
- all park with no harvesting and some tourism;

Table 1 Standardized regression weights (direct effects) for variables in the model: development and test samples. *Indicates a reverse coded item. A = general public development sample, B = general public test sample.

Natural area value scale items (from Winter & Lockwood 2004)	*Indicator variables observed endogenous*	*Direction of effect*	*Latent Variables unobserved exogenous*	*General Public A*	*General Public B*	*Environmentalists*	*Farmers*
Only humans have intrinsic value – that is, value for their own sake*	IN6	←	intrinsic	0.56	0.52	0.52	0.61
The value of an ecosystem only depends on what it does for humans*	IN5	←	intrinsic	0.65	0.79	0.58	0.74
Ugliness in nature indicates that an area has no value*	IN4	←	intrinsic	0.56	0.67	0.47	0.59
Places like swamps have no value value and should be cleaned up*	IN3	←	intrinsic	0.57	0.63	0.44	0.59
The only value that a natural place has, is what humans can make from it*	IN2	←	intrinsic	0.71	0.67	0.40	0.72
The value of nature exists only in the human mind. Without people nature has no value*	IN1	←	intrinsic	0.51	0.54	0.51	0.58
There are plenty of natural places that are not very nice to visit but I'm glad they exist	NU6	←	non-use	0.38	0.44	0.33	0.37
Even if I don't go to natural areas, I can enjoy them by looking at books or seeing films	NU5	←	non-use	0.35	0.33	0.30	0.46
We have to protect the environment for humans in the future, even if it means reducing our standard of living today	NU4	←	non-use	0.60	0.53	0.53	0.65
I'm seeing natural areas the next generation of children may not see, and that concerns me	NU3	←	non-use	0.72	0.68	0.62	0.70
I need to know that untouched, natural places exist	NU2	←	non-use	0.46	0.60	0.35	0.51
Natural areas are valuable to keep for future generations of humans	NU1	←	non-use	0.53	0.42	0.38	0.72
Natural areas must be protected because I might want to use them for recreation in the future	RC2	←	recreation	0.76	0.74	0.64	0.73
Natural areas are important to me because I use them for recreation	RC1	←	recreation	0.67	0.74	0.71	0.71
I don't like industries such as mining destroying parts of nature, but it is necessary for human survival	US6	←	use	0.42	0.47	0.42	0.32
It is better to test new drugs on animals than on humans	US5	←	use	0.49	0.48	0.42	0.52
Our children will be better off if we spend money on industry rather than on the natural environment	US4	←	use	0.51	0.58	0.46	0.68
All plant's and animal's lives are precious and worth preserving but human needs are more important than all other beings	US3	←	use	0.67	0.61	0.56	0.58
To say that natural areas have value just for themselves is a nice idea but we just cannot afford to think that way: the welfare of people has to come first	US2	←	use	0.64	0.65	0.54	0.68
Forests are valuable because they produce wood products, jobs and income for people	US1	←	use	0.45	0.56	0.39	0.54

Table 2 Frequency of cluster membership and mean factor scores for values: general public. From Winter *et al*. (2003).

Clusters	*Frequency*	*Per cent of total*	*Intrinsic value*	*Non-use value*	*Use value*	*Recreation value*
1 Traditional	80	6.2	−1.93	−0.01	1.01	0.72
2 Pro-use	349	27.2	−0.58	−0.97	0.50	−0.35
3 Moderate	241	18.8	−0.07	0.39	0.53	0.55
4 Green recreationist	292	22.8	0.57	0.46	−0.54	0.70
5 Pro-intrinsic	320	25.0	0.65	0.34	−0.70	−0.85
Total	1282	100.0				

- some park with some harvesting and some tourism; and
- no park with the whole area available for timber and little associated tourism.

A similar series of options was given to respondents of the wetland version. A brief description of the implications of each option was given. Respondents were first asked to choose their preferred option (park preference, PP). In a second question respondents were asked to indicate the level of personal sacrifice in jobs, home and income they would be willing to make to secure their preferred scenario (willingness to make sacrifices, WTS). A choice of four options was given, varying from 'no sacrifice' up to a very significant level of personal sacrifice. It was hypothesized that this willingness to sacrifice interacted with the formation of preferences, as well as being directly influenced by values (Fig. 1).

Environmental behaviour

The survey included a number of questions concerning pro-environmental and pro-business behaviours to help predict respondents' preferences. These questions aimed to provide a potentially more powerful alternative to commonly used socio-demographic variables. The indicator variables selected for inclusion in the model were membership of an environment group, donations of money to an environment group and volunteer work for an environment group. These three items performed better than other available behavioural and demographic items in regression and reliability, as well as in the final model.

Analysis of the model

To test the relationships between values and preferences we used structural equation modelling (SEM), with AMOS Version 4.1 (Arbuckle 1994–1999). With SEM, we had the capacity for simultaneous analysis of the variables, thus more accurately reflecting the way in which people considered multiple issues and values in their decisions. The SEM method could also measure the direct and indirect effects of the variables. The SEM combined the techniques of factor analysis and regression and it was used to statistically test a hypothesized structure (Fig. 1) against one based on the sample data, and determine the fit between the two (Byrne 2001). The analysis provided a statistical test of the extent to which the data fitted the model and, although it did not prove relationships, it indicated the plausibility of the model (Holmes-Smith & Coote 2001).

The basic measure of model fit was the discrepancy between the matrix of implied variances and covariances (the hypothesized model, Fig. 1) with the empirical matrix of variances and covariances (the sample data). If the model is a good representation of the data, then the estimated parameters will have a small discrepancy. A χ^2 statistic was used to indicate the similarity between the two matrices. Unlike most statistical testing, in SEM we aimed to accept the null hypotheses, of no significant difference between the sample data and the hypothesized model. Thus the probability statistic value referred to the likelihood of the null hypothesis being true, and in these analyses, values less than 0.05 meant the model should be rejected. However, the χ^2 statistic is sensitive to sample size. With a larger sample, the χ^2 value is also likely to be bigger and the model more likely to be rejected (Byrne 1994). Complex models with more parameters will also increase the χ^2 value (Byrne 1994). Because of this, χ^2 divided by degrees of freedom (*df*) was also used as a test statistic. Even so, in most empirical research, the attainment of a good χ^2 value has proven unrealistic (Byrne 2001). For this reason, we used a selection of absolute, incremental and parsimony indicators that have been developed to assess the fit between the sample and original models (Holmes-Smith & Coote 2001). Following Schultz (2001) we assessed the model using three widely-adopted indices, namely the goodness of fit index (GFI), the root mean square error of approximation (RMSEA), and the Tucker-Lewis index (TLI). The GFI and RMSEA are absolute indicators, while the TLI is an incremental measure. We also used a parsimony index, Hoelter's critical N (HONE), to determine the adequacy of the sample size in relation to the number of parameters to be estimated. This indicator, for a significance level of 0.01, measured the adequacy of the sample size for the hypothesis that the model is correct.

Standardized regression weights between latent variables and squared multiple correlations between groups of observed variables also provide an indication of the strength of the model. Regression weights are interpreted in the same way as coefficients from ordinary least squares regression (Kline 1998). It is desirable that the coefficients be 0.30 or more, indicating at least a moderately strong relationship between the predictor variable and the latent construct. Squared multiple correlations indicate the proportion of variance explained by the variable's predictors (Kline 1998; Byrne

Table 3 Overall fit measures for the model: development and test sample results (desired range compiled from Arbuckle 1994; Kline 1998; Byrne 2001; Holmes-Smith & Coote 2001). A = general public development sample, B = general public test sample. GFI = goodness of fit index, RMSEA = the root mean square error of approximation, TLI = Tucker-Lewis index and HONE = Hoelter's critical N.

Fit measure	*General public A* $n = 641$	*General public B* $n = 641$	*Environmentalists* $n = 751$	*Farmers* $n = 351$	*Desired range*
χ^2	635.47	684.15	833.49	625.67	
Degrees of freedom (*df*)	287	287	287	287	
p	<0.01	<0.01	<0.01	<0.01	>0.05
χ^2/df	2.21	2.38	2.90	2.18	1.0–3.0
GFI	0.93	0.93	0.92	0.88	>0.90
RMSEA	0.04	0.05	0.05	0.06	<0.08
TLI	0.90	0.89	0.78	0.86	>0.90
HONE	349	324	314	194	>200

Table 4 Correlations between exogenous latent variables. A = general public development sample, B = general public test sample.

Latent variables (values)	*Direction of effect*	*Latent variables (values)*	*General public A*	*General public B*	*Environmentalist*	*Farmer*
intrinsic	↔	non-use	0.51	0.46	0.59	0.64
non-use	↔	use	−0.41	−0.49	−0.39	−0.54
recreation	↔	use	0.24	0.14	0.31	−0.07
non-use	↔	recreation	0.28	0.27	0.11	0.54
intrinsic	↔	use	−0.73	−0.69	−0.74	−0.79
intrinsic	↔	recreation	−0.12	−0.18	−0.10	0.11

2001) with 0.30 (30% of the variance) being an acceptable level. The model (Fig. 1) was developed using half of the general public sample ($n = 641$) selected at random. The model was then tested using the other half of the general public sample ($n = 641$), the environmentalists ($n = 758$) and farmers ($n = 351$).

RESULTS

Development of the model

The model fit for half of the general public sample is described in relation to the overall fit indicators (Table 3), the standardized regression weights (Table 1), correlations between the latent variables (Table 4) and squared multiple correlations. No significant difference was found between responses to the forests and wetlands scenarios (Winter 2005), so the two survey versions were combined for this analysis.

The indicators for the overall fit (Table 3), with the exception of the χ^2 statistic, were within the acceptable range and showed that the model was a plausible fit for the data. The relationships between the latent variables (unobserved exogenous and observed endogenous) which formed the basis of the structural model are shown in Table 5. Three of the values have weights above 0.29 with the strongest being non-use (0.37) and the weakest being intrinsic (0.29). The relationships between the clusters and the PP (0.23) and WTS (0.16) variables were modest. The link between behaviour and WTS was weak and with PP it was not significant. All other regression weights were significant. Table 1 shows that in all cases, the observed variables were good indicators of their respective latent variables with most weights being above 0.40. Some of the fit indicators could be improved by the removal of the poorly performing items (in particular US5, US6, NU5, NU6) but were retained to ensure an acceptable measure of reliability. The squared multiple correlations showed that the greatest proportion of the variance was explained for intrinsic value, with five of the six items over 0.30. Both of the recreation items explained over 40% of the variance. Only two of the non-use (NU3, NU4) and two of the use items (US2, US3) explained more than 30% of the variance. In total, eleven of the twenty NAVS items explained more than the required 30% of the variance, and nine items explained less than 30%. Again, only a modest percentage of the variance was explained for PP (0.06) and WTS (0.25). The correlations between the four value types conformed to theoretical expectations (Table 4). A negative correlation was shown between non-use and use (−0.41), intrinsic and use (−0.73), and intrinsic and recreation (−0.12). A positive correlation was shown between intrinsic and non-use (0.51), recreation and use (0.24) and recreation and non-use (0.28).

Testing the model

The picture provided by the various overall indicators (Table 3) showed that the model was an acceptable fit for the data from the second half of the general public sample and the environmentalist sample, but was a weak fit for the farmers with the GFI, TLI and HONE indicators being below the acceptable limits.

The standardized regression weights for the test half of the general public sample were similar to those for the development half (Table 5) and all relationships

Table 5 Standardized regression weights (direct effects) for variables in the model: development and test samples. Regression weights are significant except as indicated probabilities: a = 0.07, b = 0.11, c = 0.06, d = 0.44, e = 0.11, f = 0.89, g = 0.03, h = 0.25, i = 0.28. A = general public development sample, B = general public test sample.

Latent variables observed endogenous	*Direction of effect*	*Variables unobserved exogenous*	*General public A*	*General public B*	*Environmentalists*	*Farmers*
Cluster	←	intrinsic	0.29	0.27	0.42	0.52
Cluster	←	use	−0.34	−0.37	−0.14[b]	−0.01[f]
Cluster	←	recreation	−0.34	−0.35	−0.27	−0.18[g]
Cluster	←	non-use	0.37	0.36	0.11[c]	0.30
PP	←	cluster	0.23	0.24	0.11	0.33
WTS	←	cluster	0.16	0.15	0.03[d]	0.24
WTS	←	preference	0.41	0.35	0.43	0.50
PP	←	behaviour	0.09[a]	0.17	0.24	0.07[h]
WTS	←	behaviour	0.14	0.16	0.08[e]	−0.05[i]
Membership	←	behaviour	0.65	0.69	0.63	0.87
Donate cash	←	behaviour	0.52	0.56	0.35	0.46
Volunteer	←	behaviour	0.58	0.50	0.44	0.67

between the latent variables were significant. For both the environmentalists and farmers, the regression weights between the clusters and intrinsic value were good, but use value was not significant. In addition, non-use value was not significant for the environmentalists and recreation value was not significant for the farmers. Values had a relatively modest influence on PP (weights between 0.11 and 0.33 for the three samples) and a weak influence on WTS (weights of 0.03 to 0.24 for the three samples). The behavioural variables contributed little to the PP and WTS and in most cases were below 0.20, but their inclusion improved the model's overall fit. Table 1 shows the relationships between the observed indicator variables and their respective latent variables. The weights were above 0.30 for all samples, with most being above 0.40, meaning that the observed variables were satisfactory indicators of the variables representing the values.

Approximately half of the items for the general public sample explained greater than 30% of the observed variance, and the farmer sample had 14 of the 20 items with over 30% explained. The model held least relevance for the environmentalists with only five of the 20 NAVS items over 0.30. The squared multiple correlations for NU5, NU6, US5 and US6 did not achieve the minimum 0.30 index for any of the samples, reproducing the result of the development sample. The model explained 38% of the variance for farmers' WTS, 22% for the general public and 21% for the environmentalists. The model accounted for less than 15% of the PP variance for all samples.

The correlations for the values (Table 4) for each sample were generally in line with theoretical expectations. Intrinsic value was positively correlated with non-use value only, and non-use value was also positively correlated with recreation value. Recreation value was positively correlated with use value and non-use value. The farmers showed exceptions to these results and the correlation between intrinsic and recreation was positive, with a negative result between recreation and use. The strongest relationships in all three samples were negative correlations between intrinsic and use values.

DISCUSSION

Overall, the model provides a plausible fit for the data, and establishes the relevance of the various components (values, value clusters, pro-environmental behaviour) in influencing PP and WTS. The inclusion of all the components in the model provided a better overall fit even though the performance of some individual components was weak.

The model supports theoretical expectations that stronger intrinsic values have a positive effect on conservation preferences and the level of personal sacrifices people are prepared to make for those preferences, while stronger use values have the opposite effect. The model shows that two other instrumental values were also important; recreation value had an overall negative influence on PP and WTS, and non-use value had a positive influence.

The model helps us to understand the way in which individuals hold multiple values of different magnitudes, and that these in turn have differential influences on their decisions and preferences (Callicott 1994; Gebhardt & Lindsey 1995). For example, intrinsic value had greater influence for some respondents, while for others, recreation value was most important. It also appears that strong negative values may influence decisions in addition to positive values.

Including a variable representing the unique ways in which groups of people hold multiple values significantly contributed to the explanatory power of the model. Each cluster's PP and WTS was influenced differently by particular combinations of the four values. Education and community engagement programmes concerning natural places are likely to have greater effect if they address those values on which respondents place the greatest importance.

The varying effects of the four values provides a possible explanation for research results showing similar orientations for groups that display divergent behaviours (see Bjerke & Kalternborn 1999 for example). That is, samples may need to be further defined on the basis of specific values in addition to their orientation or to their initial sample membership, in order to reveal the underlying influences on behaviour. As has been argued, a person with either an anthropocentric or a biocentric orientation may support conservation (Katz 1999; Vilkka 1997). The measurement of their intrinsic and instrumental values can distinguish those respondents who are more likely to uphold values for nature over humans.

This study provides quantified empirical support for the concepts of intrinsic value described by environmental philosophers (Callicott 1989; Rolston 1989; Vilkka 1997) and for the conservation arguments put forward by environmental groups. The model shows that intrinsic value is also held by members of the general public and farmers, and that it plays a role in their decision-making. It was the only value that showed significant regression weights for all the samples.

The model was designed and tested for a general public sample and consequently the fit with the data was better than for the environmentalists and the farmers. The weaker fit for the farmers and environmentalists may be explained by their more specialized knowledge about natural areas, which may in turn demand more detailed questions and value items. In addition, farmers and environmentalists are located at the opposite ends of a value continuum and it seems this reduces the capacity of the model to explain their preferences. Both these groups' values and preferences are more homogenous than those of the general public, and this reduced variation also means that other within-group characteristics were likely to be more important determinants of preference variation. Given the sensitivity of the SEM method to sample size, the weaker result for the farmers may also be partly due to the relatively small sample from this group.

Testing of the individual model components such as the NAVS, clusters, and PP and WTS (Winter *et al.* 2003; Winter & Lockwood 2004) showed that groups of respondents could be clearly distinguished on the basis of their values, which correlated with their PP and WTS. When combined in the structural model, however, the components explained relatively low variances for PP and WTS. While the components are clearly relevant, the model requires the addition of other factors to improve the explanation of the variance.

The model contributes to our understanding of the values that underlie conservation decisions. Specifically, it shows that intrinsic, non-use and use values, and the particular combinations of these values held by individuals, are important influences on the direction and intensity of conservation preferences.

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