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MAN/ENVIRONMENT RELATIONS: A PRELIMINARY BEHAVIORAL MODEL

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ABSTRACT

Behavior research in the study of man/environment relations has advanced significantly with the advent of computer technology. More and different types of multi-variant analysis was possible and led to the development of many new discoveries and models. The purpose of this study was to investigate the development of a preliminary model for examining the complexity of man/environment relations. A predictive regression model was formulated which accounted for approximately 70 per cent of variance in recreation behavior for a user and general population.

INTRODUCTION

In the study of man/environment relations, the topic area that has received less emphasis and has been a major problem is human behavior. The primary reason for this is the amount of variability associated with it. Where the physical and biological environments tend to be regular and easily observed, those involving human behavior tend to be less regular and more difficult to observe and analyze.

With the advent and development of computer technology, behavior research methodology has become more sophisticated. Data are being analyzed in different ways, especially with the expanded potential for multi-variate analysis. The scrutinizing of data has given rise to many new discoveries and has provided an

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empirical foundation on which to build more sophisticated designs [1, 2]. Multi-variate model building is one of two designs: applied or basic. The objective of applied is prediction and the objective of basic research is causal analysis [2-4]. The objectives of these research positions are not inconsistent because the isolation of predictive relationships is a precursor to causal analysis [4].

There are two types of methodologies used to implement multi-variate model building. The most widely used is the conceptual framework [5]. In this approach the variables used in analysis are the ones isolated from previous research that is consistent with a position within a central theme. The other type is based upon an open variable system [6]. In this approach all potential variables are used regardless of thematic meaning or their previous research record. These two approaches are not mutually exclusive. The approaches that have been the most successful are those that have operationally synthesized these two philosophies [2, 4, 6].

Another potential way of classifying predictive multi-variate models is by their type of analysis: mathematical processes or gaming and simulation [7]. Mathematical processes are based upon an ability to isolate the relationships of a direct and inverse nature and specify a consistency in terms of a constant or a statistical regularity in terms of consistency of patterns in data [4, 8-10]. Gaming and simulation are based upon an ability to isolate response distributions into different situations to suggest possible outcomes [11]. The basic function of both analysis systems is extrapolation from current data to predict future outcomes consistently [12]. These approaches are not mutually exclusive and those that have achieved a synthesis of these two are the ones that have been the most successful.

A basic function of multi-variate analysis is to break down complex relationships into their component parts. Two problems that multi-variant analysis has helped solve are the effect of one variable upon another (interrelationships) and the effect of statistical interactions. These are the factors that confound uni-variant analysis and have given rise to the isolation of spurious relationships in some circumstances. Most research methodology has focused upon removing the effect of interrelationships. For a multi-variate framework to be comprehensive it must incorporate methodology to solve the effect of interactions.

The purpose of this study, therefore, is to utilize multi-variable analysis to start isolating some predictive relationships to begin to model behavior to initiate studying man/environment relations.

ANALYSIS

Since this is an initial investigation, the models that were used are of a predictive rather than a causal nature [13]. The basic unit of analysis was multiple regression, and variables utilized in the equations were from a conceptual framework. A multi-variate linear regression with a vectoral dependent variable was the analysis format used [14]. A series of different equations with different variables were utilized to isolate the equation which accounts for the greatest explanation in variance. An F-test was used to compare two equations to test the statistical significance of the increase in accounted for variance. Interrelationships (Multi-collinarily) were reduced through the use of a step-wise regression analysis to isolate significant variables [15, 16]. Interactions were incorporated into the equations by the use of cross products.

The dependent variable, behavior, was evaluated using a time budget. Independent variables utilized were those isolated and developed from a conceptual framework [17]. Factor analysis with orthogonial (principle component and Varimax methodologies) solutions were used to reduce the number of variables and develop a series of equations for analysis [16, 18-21]. Qualitative data were incorporated through the use of dummy variables [22-24]. Empirical measures were obtained for as many variables as possible in the conceptual framework. A special effort was made to operationalize those variables that had a direct bearing upon behavior or that may serve as an intervening variable. Variables that could not be empirically operationalized were incorporated into equations using simulation techniques [25-28].

STUDY AREA

State College, Pennsylvania, like many other communities, is growing rapidly. This growth in the form of new housing developments has partially encircled a 700-acre section of a recreational area (Dispersed Type) known as Game Lands 176. This land is economically valuable because housing developments are encroaching on this area. Due to the proximity of this land to a high density population center it also has a recreation (Mass Type), commercial, right-of-way, and sewage disposal value. Since this land has multiple uses that are potentially of a conflicting nature, this type of situation will lend itself to the examination of behavior because it permits the examination of a wide range of responses that are related to a specific area.

State College is also a community that has city, county, state, national, and university recreational areas (Dispersed Type) that provide a wide variety of outdoor activities. Because of the diversity in activities that exist in this area it provides a good situation for the study of a general factor about behavior.

SAMPLE POPULATION

The populations sampled were the user and general populations of the State College area (12 minor civil divisions adjacent to State College). Geographic boundaries were established based upon an area where 80 per cent of Game Lands 176 users resided and an area that represented a diverse demographic mix of the general population.

SAMPLING

A proportionate, stratified, random sampling technique was employed to reduce cost and increase the efficiency of the sample design. Stratifications used for sampling were age (age categories: 1. 18-34 years and 2. 35+ years), sex, marital status, occupation, and resident types (resident type categories: 1. resident—5 or more continuous years' residence in county where State College is located and 2. non-resident-residual) [29]. The variable occupation was deleted from the analyses because no consistent categories could be formulated between men's and women's occupational status. Situational variables were used for stratification because they are readily accessible. This is a necessary condition for the characterization of the sample so that if a similar population is sampled the results can be compared with this study. The variables were factor analyzed using principal component and Varimax methodologies to find interrelationships to reduce the effect of double sampling. A dummy variable framework was used to permit the use of factor analysis [15, 24, 30]. The matrix used in the analysis was the one that clarified variable structure in terms of community influences. Random representative variables from each of the factors isolated were used as stratifications. The sample populations were proportionately stratified on the bases of the total local population within each strata.

There were two factors isolated in both the user and general populations. Sex and residential status were the representative variables used as stratifications in the user population. Sex and

age were the variables used in the general population. The user and general populations were characterized as follows:

1. users—55 per cent were male residents; 30 per cent were male non-residents; 8 per cent were female residents; and 7 per cent were female non-residents and
2. general population—37 per cent were males between the ages of eighteen and thirty-four; 17 per cent were males thirty-five years of age or over; 27 per cent were females between the ages of eighteen and thirty-four; and 19 per cent were females thirty-five years of age or over.

Users of Game Lands 176 were identified and proportions isolated using sampling techniques similar to those developed by James and Henley [31]. The sample source included 89 per cent of the total user population. A simple random sample of 180 users of State Game Lands 176 were contacted and asked to participate in the study. Of the 180 individuals, 173 (96%) were personally interviewed. Sixty of these individuals were proportionately, randomly selected to represent the user population.

Proportions for the general population were identified using the 1970 Census data. The sample was selected from the Centre County tax records and The Pennsylvania State University Student Directory. One hundred and seventy individuals were randomly selected and 153 were personally interviewed. The sample source included 96 per cent of the total general population (18% of general population was users of Game Lands 176). Sixty of these were proportionately, randomly selected to represent the population. Due to the large number of respondents in both populations, a non-respondent correction factor was not used to adjust the sample.

MEASUREMENT METHODOLOGY

A semi-structured interview patterned after a tool developed by Harvey was the type of instrument used [32]. This approach was designed to obtain a knowledge (cognitive), feeling (affective), and action (action tendency) commitment to recreation areas and relate to the commitment using "how" and "why" questions to obtain information about the other variables in the analysis. The primary problem in the operational use of the interview was the establishing of reliable and valid items that discriminate the hierarchical levels. Experienced workers were consulted in the

selection of items. These items were pre-tested on the user and general populations to test for semantic understanding. The items were then adjusted, but the conceptual basis obtained from the experts was maintained.

Interviewers and judges were trained in the use of the interview schedule. A tape recorder was used so that the interviewer could concentrate on his interviewing technique and improve his skill through correction by insight. The recorder also allowed a team of three experts as a group to examine the information for classification. The minimum criteria for placement on a level was based upon a two out of three decision by the judges. To aid the judges in the classification procedure, responses from the preliminary interviews that characterized each level was used in the training procedures and were available for reference use. Response distribution, where possible, was also used to help establish critical levels in the measurement process. Response distribution, where possible, was also used to help establish critical levels in the measurement process.

Reliability of the interviews was checked using a test-retest design on every fifth person interviewed. A correlation coefficient was used to determine the significance, direction, and degree of the relationship. A t-test for related samples was used to determine if there was a significant difference between pre- and post-tests. The attitudinal components were used in the reliability check because these are the elements on which the interview commitments were based. There were significant positive relationships at the 0.001 probability level using the correlation coefficient but not a significant difference at the 0.05 probability level on the t-tests between the pre- and post-tests for attitudinal components. As an indicator of the degree of association, the coefficients of determination are as follows: Cognitive r^2: User (U) = 0.857 and General Population (GP) = 0.787; Affective r^2: U = 0.808 and GP = 0.974, and Action Tendency r^2: U = 0.787 and GP = 0.956. The reliability check gives an indication about interviewer and judge consistence because the same respondent was used with different interviewers and judges.

RESULTS

The first step in the analysis was the factor analysis of the dependent and independent variables to isolate underlying dimensions.

Table 1. Rotated Matrix of Factor Loadings: Free Time, Leisure Time, Time Spent on Outdoor Activities, on Forest Recreation, Public Forested Land in the State College Area, and Game Lands 176-Users

	Factor 1	*Factor 2*	h^2	
Free Time	0.290	-0.902	0.897	-S.R.F.
Leisure Time	0.467	-0.806	0.867	
Outdoor Activities	0.752	-0.609	0.935	
Forest Recreation	0.873	-0.422	0.941	
Public Forested Land	0.890	-0.411	0.961	
Game Lands 176	0.911	-0.286	0.912	-S.R.F.
Per cent of Trace	54.19	37.70		

Note: A 0.4 factor loading was used to determine the importance of that variable to a factor. If a variable loaded high on more than one factor, it was deleted from this segment of the analysis.

An orthoginal solution was used to help reduce the effect of interrelationships and conceptually reduce the number of variables for analysis. The variables with the highest positive factor loading was selected as the representative variable of each factor to be used in the next phase of the analysis. (If there were no positive factor loadings, the highest negative factor loading was used.) Two factors were isolated from the analysis of the dependent variable behavior for the users and the two selected representative factors identified were: amount of time spent on Game Lands 176 and amount of free time (Table 1). In the factor analysis of behavior for the general population three factors were isolated and the selected representative factors isolated were: amount of free time, amount of time spent on Game Lands 176, and amount of time spent on forest recreation (Table 2). Examination of dependent variables of the users using factor analysis resulted in the isolation of nine representative factors and the identification of the following selected representative factors: cognitive domain—Public Forested Land; affective domain—Game Lands 176; action tendency domain—Public Forested Land; age, concrete meaning—Public Forested Land; recreational activities participated in during youth; occupation of mother; organizations participated in during youth; and use meaning—Public Forested Land (Table 3). Factor analysis of the dependent variables of the general population resulted in the isolation of eight factors and the identification of the following selected representative factors: need—Public Forested Land;

Table 2. Rotated Matrix of Factor Loadings: Free Time, Leisure Time, Time Spent on Outdoor Activities, Forest Recreation, Public Forested Land in the State College Area, and Game Lands 176-General Population

	Factor 1	*Factor 2*	*Factor 3*	h^2	
Free Time	0.943	0.048	0.222	0.941	-S.R.F.
Leisure Time	0.912	0.094	0.341	0.957	
Outdoor Activities	0.700	0.146	0.664	0.952	
Forest Recreation	0.275	0.271	0.899	0.957	-S.R.F.
Public Forested Land	0.349	0.227	0.892	0.968	
Game Lands 176	0.073	0.961	0.268	1.000	-S.R.F.
Per cent of Trace	40.22	18.01	38.04		

residential status; affective domain—Game Lands 176; emotional meaning—Public Forested Land; use meaning—Game Lands 176; sex; action tendency domain—Public Forested Land; and occupation of mother (Table 4).

The next step in the analysis was the use of step-wise regression on the selected representative factors to isolate factors that significantly contribute to the explanation of variance in the dependent variable behavior. Cross-products were incorporated to the equation as an indicator of interactions [15]. It was further used because it helped reduce the influence of interrelationships. Selected representative factors and associated cross-products were used as independent variables and run against the selected representative factor from the dependent behavioral variables. A 0.01 probability level was used to determine significance. Step-wise regression analysis of the dependent variable free time of the users resulted in the isolation of the following significant variables: cognitive domain—Public Forested Land; interaction concrete meaning—Public Forested Land and Occupation of Mother; and interaction recreational activities participated in during youth and organizations participated in during youth (Table 5). Analysis of the dependent variable Game Lands 176 of the users resulted in the isolation of the following significant variables: affective domain—Game Lands 176; interaction cognitive domain—Public Forested Land and affective domain—Game Lands 176; interaction cognitive domain—Game Lands 176 and Use meaning—Public Forested Land; and interaction recreational activities participated in during youth and occupation of mother (Table 5). Analysis of the

Table 3. Rotated Matrix of Factor Loadings: Independent Variables-Users

	1	2	3	4	5	6	7	8	9	h^2	
Expectations-Public Forested Land	0.515	-0.084	0.016	0.054	-0.077	-0.667	-0.133	-0.046	-0.041	0.748	
Expectations-Game Lands 176	-0.030	-0.135	-0.061	-0.027	-0.132	-0.867	-0.034	0.066	-0.024	0.799	
Cognitive Domain-Public Forested Land	0.868	-0.143	-0.160	-0.021	-0.094	-0.195	-0.145	-0.064	-0.069	0.876	-S.R.F.
Cognitive Domain-Game Lands 176	0.300	0.827	-0.306	0.081	-0.064	-0.114	-0.019	-0.081	-0.009	0.899	
Affective Domain-Public Forested Land	0.769	0.112	0.189	0.064	0.121	0.237	0.165	-0.059	0.090	0.753	
Affective Domain-Game Lands 176	-0.163	0.925	-0.020	-0.008	-0.007	0.105	0.140	0.085	0.000	0.921	-S.R.F.
Action Tendency Domain-Public Forested Land	0.003	-0.131	0.762	0.034	-0.119	-0.001	-0.115	0.254	-0.011	0.691	-S.R.F.
Action Tendency Domain-Game Lands 176	-0.290	0.863	0.216	0.059	-0.051	0.066	0.023	0.131	0.025	0.904	
Concrete Meaning-Public Forested Land	0.131	-0.089	0.065	0.021	-0.918	-0.086	0.104	-0.050	-0.112	0.905	-S.R.F.
Concrete Meaning-Game Lands 176	0.226	0.064	0.371	-0.066	-0.284	0.009	-0.065	-0.011	-0.729	0.814	-S.R.F.
Use Meaning-Public Forested Land	0.419	-0.181	-0.660	0.199	-0.133	-0.021	0.030	0.230	0.209	0.799	
Use Meaning-Game Lands 176	0.084	-0.179	-0.860	0.118	0.081	0.040	-0.154	0.062	0.086	0.836	
Emotional Meaning-Public Forested Land	-0.065	0.266	-0.022	0.111	-0.906	-0.090	0.060	-0.081	-0.054	0.920	
Emotional Meaning-Game Lands 176	-0.102	0.706	0.151	-0.003	-0.217	-0.007	-0.003	-0.003	-0.528	0.858	

Table 3. (Cont'd.)

	1	2	3	4	5	6	7	8	9	h^2	
Symbolic Meaning-Public Forested Land	0.291	0.007	−0.714	0.125	−0.225	0.029	−0.036	0.228	0.212	0.761	
Symbolic Meaning-Game Lands 176	−0.174	0.437	−0.808	0.034	0.042	0.076	−0.100	0.019	0.082	0.901	
Needs-Public Forested Land	0.593	−0.266	−0.564	0.030	0.057	−0.260	0.015	−0.101	−0.117	0.836	
Needs-Game Lands 176	0.386	−0.290	−0.570	−0.014	−0.004	−0.393	0.049	−0.051	−0.155	0.741	
Selection Process Styles	0.626	0.035	−0.153	−0.086	−0.144	−0.252	0.003	0.111	−0.075	0.526	
Habit	−0.718	0.174	0.420	−0.079	−0.050	0.112	0.256	0.091	−0.004	0.817	
Types of Community	−0.157	−0.443	−0.037	0.111	−0.206	0.199	0.421	0.041	0.423	0.683	
Organizational Activities Participated in During Youth	−0.080	0.187	−0.033	−0.030	0.115	−0.002	0.021	0.853	−0.052	0.787	−S.R.F.
Recreational Activities Participated in During Youth	−0.181	−0.315	−0.091	−0.222	−0.020	0.668	−0.177	−0.008	−0.086	0.675	−S.R.F.
Occupation of Father	−0.051	0.296	−0.035	0.142	−0.021	0.160	0.316	−0.509	−0.446	0.695	
Occupation of Mother	0.195	0.028	0.019	−0.082	0.142	−0.045	−0.834	0.113	−0.048	0.779	−S.R.F.
Sex	−0.254	−0.294	−0.174	0.039	−0.026	0.185	−0.537	−0.112	0.147	0.541	
Marital Status	−0.273	−0.272	−0.008	0.511	0.012	−0.042	0.244	0.189	−0.482	0.740	
Age	−0.031	0.028	−0.093	0.965	−0.031	−0.047	0.027	−0.019	−0.057	0.950	−S.R.F.
Residential Status	−0.120	−0.112	0.129	−0.903	0.097	0.065	−0.010	0.094	−0.113	0.894	
Per cent of Trace	16.74	17.24	18.22	9.63	8.89	9.53	6.84	5.72	7.18		

Table 4. Rotated Matrix of Factor Loadings: Independent Variables-General Population

	1	2	3	4	5	6	7	8	h^2	
Expectations-Public Forested Land	0.768	-0.025	-0.201	0.163	0.081	-0.301	0.246	0.176	0.846	
Expectations-Game Lands 176	0.735	0.074	-0.498	-0.157	0.169	0.015	0.187	0.076	0.888	
Cognitive Domain-Public Forested Land	0.712	0.009	-0.214	0.197	0.093	-0.337	0.172	0.314	0.841	
Cognitive Domain Game Lands 176	0.368	-0.008	-0.765	0.135	0.275	-0.186	-0.092	0.124	0.873	
Affective Domain-Public Forested Land	0.513	-0.114	-0.409	0.047	-0.125	-0.160	0.188	0.536	0.809	
Affective Domain-Game Lands 176	0.224	-0.034	-0.870	0.105	0.073	-0.129	0.011	0.223	0.891	-S.R.F.
Action Tendency Domain-Public Forested Land	0.328	-0.253	-0.272	0.039	-0.047	-0.213	0.645	0.329	0.819	-S.R.F.
Action Tendency Domain-Game Lands 176	-0.012	-0.219	-0.853	-0.022	0.185	-0.101	0.219	0.175	0.899	
Concrete Meaning-Public Forested Land	0.500	-0.270	-0.043	-0.585	0.355	-0.091	-0.106	0.069	0.817	
Concrete Meaning-Game Lands 176	0.255	-0.287	-0.447	-0.419	0.387	-0.190	-0.227	-0.065	0.764	
Use Meaning-Public Forested Land	0.286	0.113	-0.023	0.904	0.089	-0.063	0.111	0.036	0.937	-S.R.F.
Use Meaning-Game Lands 176	0.088	-0.052	-0.264	0.859	0.056	-0.212	-0.182	-0.028	0.901	
Emotional Meaning-Public Forested Land	0.319	0.003	0.084	-0.089	0.830	-0.005	0.255	0.059	0.875	
Emotional Meaning-Game Lands 176	0.053	-0.095	-0.333	0.101	0.901	-0.062	0.047	-0.000	0.951	-S.R.F.

Table 4. (Cont'd.)

	1	2	3	4	5	6	7	8	h^2	
Symbolic Meaning-Public Forested Land	0.598	0.026	-0.666	0.080	-0.155	0.112	0.058	-0.153	0.871	
Symbolic Meaning-Game Lands 176	0.375	-0.073	-0.841	0.131	0.061	0.061	-0.153	-0.096	0.908	
Needs-Public Forested Land	0.860	-0.035	-0.055	0.255	0.111	-0.259	-0.023	0.167	0.916	-S.R.F.
Needs-Game Lands 176	0.795	0.036	-0.376	0.000	0.191	0.160	0.056	-0.044	0.841	
Selection Process Styles	0.795	0.105	-0.195	-0.043	0.244	-0.244	0.104	0.133	0.831	
Habit	0.230	-0.096	-0.205	0.266	0.218	-0.672	0.201	0.215	0.761	
Types of Community	-0.304	0.362	0.270	-0.345	-0.027	-0.027	0.028	-0.590	0.779	
Organizational Activities Participated in During Youth	-0.231	-0.110	-0.111	0.011	-0.359	-0.034	-0.712	0.049	0.717	
Recreational Activities Participated in During Youth	-0.174	-0.410	0.199	-0.226	-0.437	0.355	0.042	-0.348	0.728	
Occupation of Father	-0.013	-0.360	-0.024	0.244	0.130	0.555	-0.289	0.171	0.570	
Occupation of Mother	0.094	-0.124	-0.002	-0.067	0.003	0.102	0.042	0.818	0.711	-S.R.F.
Sex	-0.240	0.063	0.042	-0.050	-0.043	0.754	0.158	0.108	0.673	-S.R.F.
Marital Status	-0.124	-0.791	0.019	-0.113	0.085	-0.140	-0.050	-0.106	0.694	
Age	-0.072	-0.749	-0.135	-0.044	-0.012	0.183	0.074	0.152	0.648	
Residential Status	-0.188	0.827	0.086	0.011	0.043	0.043	0.002	-0.358	0.858	-S.R.F.
Per cent of Trace	23.52	11.31	19.32	10.44	11.06	8.99	6.42	8.94		

Table 5. Users

Dependent variables	*Significant independent variables*[a]
Free Time $R^2 = 0.32$	Cognitive Domain-Public Forested Land -0.26 (Standardized Beta Coefficient)
	Interaction Concrete meaning-Public Forested Land and Occupation of Mother 0.29
	Interaction Recreation/Activity Participated in during Youth and Organizations Participated in during Youth -0.26
Game Lands 176 $R^2 = 0.57$	Affective Domain-Game Lands 176 1.2
	Interaction Cognitive Domain-Public Forested Land and Affective Domain-Game Lands 176 -0.88
	Interaction Cognitive Domain-Game Lands 176 and Use Meaning-Public Forested Land -0.29
	Interaction Recreation Activities Participated in during Youth and Occupation of Mother 0.33

[a] A 0.1 Probability Level was used to determine significant variables.

general population's dependent variable Forest Recreation resulted in the isolation of the following significant variables: residential status; interaction need—Public Forested Land and residential status; interaction need—Public Forested Land and affective domain—Public Forested Land; interaction affective domain—Public Forested Land and emotional meaning—Public Forested Land; interaction affective domain—Public Forested Land and action tendency domain—Public Forested Land (Table 6). Analysis of the dependent variable free time resulted in the identification of the following significant variables: action tendency domain—Public Forested Land; interaction need—Public Forested Land and sex; interaction need—Public Forested Land and action tendency domain—Public Forested Land; interaction residential status and occupation of mother; and interaction use meaning—Game Lands 176 and sex (Table 6). When the dependent variable Game Lands 176 was analyzed the

Table 6. General Population

Dependent variable	*Independent variables*
Forest Recreation $R^2 = 0.46$	Residential Status -1.18
	Interaction Need for Public Forested Land and Residential Status 1.29
	Interaction Need for Public Forested Land and Affective Domain-Public Forested Land -0.95
	Interaction Affective Domain-Public Forested Land and Emotional Meaning-Public Forested Land 0.41
	Interaction Affective Domain-Public Forested Land and Action Tendency Domain-Public Forested Land 0.35
Free Time $R^2 = 0.44$	Action Tendency Domain-Public Forested Land 0.17
	Interaction Need-Public Forested Land and Sex 1.26
	Interaction Need-Public Forested Land and Action Tendency Domain-Public Forested Land -0.92
	Interaction Residential Status and Occupation of Mother -0.18
	Interaction Use Meaning-Game Lands 176 and Sex -1.00
Game Lands 176 $R^2 = 0.33$	Action Tendency Domain-Public Forested Land 0.62
	Interaction Need-Public Forested Land and Occupation of Mother -0.25

following significant variables were isolated: action tendency domain—Public Forested Land; interaction need—Public Forested Land and occupation of Mother (Table 6).

The next phase of the analysis was a multi-variate linear regression with vectoral dependent variables made up of the selected representative factors in which various types of hypotheses were tested in relation to each other to isolate the best predictive equation. The variables utilized and the equation types tested are illustrated in Appendices A and B. An F-test was used to isolate the equation that significantly explained the greatest variance in relation to the other equations. The user population equation type 1 was the one that explained the greatest amount of variance and the coefficient of determination (R^2) was 0.78. For the general population, equation type 6 explained the greatest amount of variance and the coefficient of determination (R^2) was 0.71.

IMPLICATIONS

Results suggest that when multi-variate models are used with simulation in a synthesis type of analysis an overall predictive model that account for 75 per cent of the variance in behavior. Predictive models are common types of analysis found in literature. As the measurement process is refined and the conceptual theories become better, greater understanding will be provided about the causes of behavioral problems. As causal techniques such as path analysis becomes more widely used, more of the variance in behavior will be explained.

The primary test of any model is its ability to predict hypotheses accurately in a real world setting [33]. The next step for the use of the proposed model is the prediction and testing of hypotheses in a recreational setting. The better the model, the closer it will come to predicting the occurrence of behavior. After a model is tested, the next phase would be to modify the model based upon the information obtained in terms of a new analysis and a new model [34]. The proposed model is one of variable types and relationships among variables and does not put forth any particular hypothesis or conceptual framework. It tries to analyze the difference and relationships among variables to better predict and understand behavior. The question is one of adding new variables to test their predictability in the real world. Even if predictive measures are found, the question still remains one of causality and understanding behavior to help individuals in application of clinical

information is not based upon prediction but causality, especially in terms of psychology of the dimension [35, 36].

Results of this study are not definitive, but only suggestive of a type of research needed to synthesize mathematical and simulation models.

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APPENDIX A

VARIABLES USED IN THE ANALYSIS

DEPENDENT VARIABLES

Variable	Scales
Free Time	Amount of time spent—hours per week
Leisure Time	Amount of time spent—hours per week
Outdoor Activities	Amount of time spent—hours per week
Forest Recreation	Amount of time spent—hours per week
Public Forested Land	Amount of time spent—hours per week
Game Lands 176	Amount of time spent—hours per week
See references [37-51]	

EMPIRICAL INDEPENDENT VARIABLES

Variables	Scales
Attitudes [52, 53]	
Cognitive	A 6 point hierarchical scale based on knowledge utilization about an object
Affective	A 6 point hierarchical scale based on amount of emotional involvement with an object
Action Tendency	A 6 point hierarchical scale based on extent of action involvement with an object
Functional Perspective [54, 55]	
Selection process styles [56-59]	A 3 point hierarchical scale based on an evaluation of amount of awareness and rationality used in selection of alternatives
Meaning [60]	A 3 point negative, neutral, and positive scale for each meaning component
Concrete	Tangible results (higher taxes, firearm noise, etc.)
Use	Utility value (for hiking, bird watching, etc.)
Emotion	Intangible results (aesthetically pleasing, invigorating, etc.)
Symbolism	Intangible results that represents more than is seen (freedom, bygone years, etc.)

Expectations [61]	A 4 point hierarchical scale based on anticipated encounters with public forested land using a development-wilderness continuum with the following characteristics used in the evaluation process: numbers of people; quantity, quality, and diversity of wildlife and habitat; smell; sound; and development
Needs [62, 63]	A 5 point hierarchical scale based on motivational components
Habits	A subjective percentage scale based on the respondent's estimate of his learned recreational behavior
Situational [43, 64, 65]	Sex (male vs. female), age (18-34, and 35+), residential status (resident vs. non-resident), occupation of father (white collar vs. blue collar), occupation of mother (employed outside home vs. housewife), and marital status (married vs. single)
Adolescent Experiences [66-69]	Organizational activities participated in during youth (outdoor and conservation vs. nonoutdoor and nonconservation), recreational activities participated in during youth (remote vs. non-remote), occupation of father (white collar vs. blue collar), occupation of mother (employed outside home vs. housewife), and type of community (rural vs. urban)

Note: Attitude and meaning variables were measured in terms of both a Game Lands 176 and a Public Forested Land frame of reference.

SIMULATED INDEPENDENT VARIABLES

Variables	Skewness [3, p. 74]
Experience [66, 70, 71[a]]	8.4
Intellectual Skill [72,[a] 73]	-3.2
Psychomotor Skill [74-76]	4.3
Social Skill [77-80]	-1.4
Personality [81[a]-83]	3.1

[a] Indicates location of instrument as well as distribution.

APPENDIX B

Steps in Analysis

Users

Empirical Variable Types

Independent Variables				Dependent Variables
Situational	Attitudinal	Functional Perspective	Adolescent Experience	Behavior
F.A.[a] Table 3	F.A. Table 3	F.A. Table 3	F.A. Table 3 →	F.A. Table 1
SRF[b] Table 3	SRF Table 3	SRF Table 3	SRF Table 3 →	SRF Table 1

Step-wise Regression Equations

Independent Variables	Dependent Variables
Selected representative factors + Cross products for the incorporation of interactions →	One equation per selected representative factor

Equation Types

1. Significant variables → Selected representative factors-vectoral quantity
2. Significant variables + simulated variables → Selected representative factors-vectoral quantity
3. Significant variables + variables related to significant variables → Selected representative factors-vectoral quantity
4. Significant variables + variables related to significant variables + simulated variables → Selected representative factors-vectoral quantity
5. Selected representative factors → Selected representative factors-vectoral quantity
6. Selected representative factors + simulated variables → Selected representative factors-vectoral quantity
7. Selected representative factors + variables related to selected representative factors → Selected representative factors-vectoral quantity
8. Selected representative factors + variables related to selected representative factors + simulated variables → Selected representative factors-vectoral quantity

[a] Factor analysis
[b] Selected Representative Factors

Note: Analysis for General Population is the same-Independent Variable, Table 4 and Dependent Variable, Table 2.

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