An Analysis of Willingness to Participate in Wilderness or other Primitive Areas

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A logit model was used to determine the major factors explaining willingness to participate of an individual in the wilderness or other primitive area visits. The results of the study showed that education and environmental awareness were in wilderness participation decision. Demographic variables like age, race, and sex also were statistically significant and emerged as important policy variables in defining wilderness participation behavior. Characteristics of wilderness areas like crowdness, pollution, and poor management failed to produce any significant impacts in the decision making process of wilderness area visit.

Wilderness or other primitive area visits are increasing in the United States. The report of outdoor recreation in American life shows that visits to wilderness areas have increased significantly in the last few decades, especially after the passage of wilderness act in 1964 (Cordell *et. al.*, 1999). The USDA reports the increasing trend of national forest visitors from 560 million in 1980 to 860 million in 1996, and the role of outdoor recreation activities including wilderness or other primitive area visits in U.S. national forests. This trend of visiting wilderness areas will likely to increase in the coming years. The dramatic changes in the diverse spectrum of wilderness or other primitive area visits create challenges and demand more responsibility on the part of environmental policy makers. Most wilderness values arise from the use of wilderness as do many of the threats to wilderness resources (Lucas, 1989). Answering any policy question related to wilderness management requires in-depth analysis and understanding of shifting economic and social variables as well as impacts of growing demand for wilderness or other primitive area visits.

The rapid rise of people's participation in wilderness or other primitive areas and the growing developmental and construction pressures near wilderness sites raise a serious policy issue of economic trade-offs between development and wilderness protection. In spite of ecological, cultural, and moral justifications, wilderness preservation remains controversial on economic grounds (Power, 1996). Growing wilderness demand, expanding development pressures, rising scarcity of wilderness areas, growing incidences of extinction of wildlife, bird, and other forest species make wilderness protection a serious policy issue. This issue is further

exaggerated by the finite, non-renewable, irreversible, and public goods nature of wilderness resources. Solving any wilderness issue requires a clear economic justification on the part of wilderness preservation.

Analysis of factors that affect general public participation in wilderness or primitive area visits and importance that people place on wilderness areas would help to answer many policy questions. Understanding of wilderness uses and users supports policy makers in the decision-making process related to wilderness management. Recreation, in the form of wilderness and primitive area visits, is one of the several important services provided by wilderness areas. In this study, we analyze the determinants of willingness to participate in wilderness or primitive area visits.

Our analysis, first analyzes the determinants of participation behavior of wilderness visitors in a narrowly defined wilderness or primitive areas visits irrespective of outdoor recreations, which cover a broad areas. This allows more precise definitions of supply variables such as wilderness or primitive areas making information useful for wilderness resource mangers. Contrary to other outdoor recreational visit studies, which use the linear probability model, our analysis uses a logit model to pursue the objectives of the study.

Theoretical Model

Economic theory states that the yes-no decisions or responses regarding participating or not participating in any program depend on the level of utility that participant gains from the choice. A utility index represents a set of characteristics that an individual uses implicitly or explicitly to rank decision alternatives. The index represents trade-offs among the different attributes of the choice for decision makers. In the case of wilderness and primitive area visits, the trade-off represents the expected benefits of wilderness visits and associated costs. In the decision making process, an individual weighs the utility of two alternatives and selects the alternative with the highest high level of utility.

A random utility model was used to analyze the dichotomous choice between participating or not participating in wilderness or other primitive area visits. The utility function of a participant is not directly observable, so utility is treated as a random variable in the participation model. From this perspective, the random utility

model evaluates the probability that a person will visit wilderness or other primitive area based on the information that describes the decision makers. In our study, the difference between two individuals' utility from visiting and not visiting the wilderness or other primitive areas was specified as:

$$Z_i = \beta_0 + \beta_1 X + \beta_2 EDU + \beta_3 ENV + \beta_4 EDU + + B_6 INFO + e$$

Here, Zi represents the indirect utility gained by participating (i = 1) or not participating (i = 0) in wilderness or other primitive areas; X is the vector of demographic characteristics which include age and sex. The potential relationship of ethnicity and wilderness or other primitive area visits was modeled by dividing the race in to white, black or African American, and others (Asian, American Indian, Native Hawaiian or other pacific Islanders); EDU and ENV represent the level of education and environmental awareness of wilderness and other primitive area visitors respectively; FAMINC is the total family income from all sources; Information about wilderness and primitive area to potential participant is represented by INFO. In the participation function, B_j and e represent the parameter coefficients and random errors respectively.

Our study records 5013 valid responses. However majority of respondents were actually not participating in the wilderness and primitive area visits. Attempts to analyze the determinants of wilderness or primitive area visits from such a broadly based sample of individuals where major proportion of respondent are not participating in wilderness or primitive area visits will result in a large concentration of values of the dependent variable at zero. And this concentration of the dependent variable at a lower bound underestimates the people participation. The classical regression analysis might not be useful when most of the dependent variables are zero. Using ordinary least square when dependent variable is zero might result some problems:(a) the error terms are heteroskedastic resulting in inefficient estimators; (b) the predicted probabilities could exceed 0-1 probability interval; (c) Because of violation of normality assumption of error terms, t-tests of significance do not apply (Green, 1995).

In order to assuage the problem, a binary logit model estimated with the maximum likelihood method was used to empirically implement the random utility model (Ben-Akiva and Lerman, 1985). The logistic model, which follows a logit distribution, models the probability within the 0 and 1 interval. The dependent variable is the yes-no answer made by a person regarding his/her willingness to visit wilderness and other primitive areas. Equations below represent the binary logit model used to analyze the participation decision of respondent.

(1) Pi = 1/1 + e $^{-(\alpha + X'_i\beta)}$

The specification would be more apparent if equation 1 is rearranged, i.e.

(2) Log $(P_i / 1 - P_i)$ = $(\alpha + X'_i\beta)$

Unlike the standard linear probability model where the probability of the occurrence is assumed to be a linear function of the explanatory variables, the logit formulation assumes the log of the odds, or logit, is a linear function of the explanatory variables. Here P_i shows the respondent's probability of participating in wilderness or other primitive area visits and base e represents the numerical value of the natural logarithm function. In logit model, maximum likelihood coefficients are asymptotically consistent, efficient, and normally distributed, and the t-test is a valid test of significance (Miller and Hay, 1981).

Data and Methods

The data for this study was obtained from National Survey of Recreation and Environment (2000). A total of 5,013 valid responses were recorded in the study. However, due to missing values of different variables mostly the income, majorities of observation were removed from the model. The final study sample was limited to 1,352 respondents. The final sample size represents the total number of respondents who participated or did not participate in the wilderness or other primitive area visits. Out of the 1,352 respondents, only 492 respondents participated in wilderness or other primitive area visits.

Logit Model Estimation

Dependent Variable

The dependent variable (WPART) represents an indirect utility measure depending on the observable choice of a person to visit wilderness or other primitive areas. A value of 1 indicates that a person is a wilderness visitor, and a value of 0 indicates that a person is not interested in a wilderness or other primitive area visits.

Independent Variables

Table 1 presents the summary of explanatory variables. In this study, explanatory variables, which either cover the main demographic characteristics of participants or seriously affect the wilderness area visits, were included. The demographic variables include age and sex. Many studies show the influential role of demographic variables in an individual's participation decision-making process (Nagubadi *et. al.,* 1996). The demographic composition of the US population is getting diverse because of growing   population of many ethnic and racial groups, especially the Hispanic community and ethnic minority groups. Environmental policies might be influenced by the environmental ethics and orientation of rapidly growing populations of Hispanics and Asia/Pacific Islanders (Murdock *et. al.,* 1990). In this study, Therefore, the relationship between ethnicity and wilderness or other primitive area visits was captured by dividing the race in to white, black or African American, and other minorities (Asian, American Indian, Native Hawaiian or other pacific Islanders); a positive relationship was expected between white and other minorities and wilderness or other primitive area visits.   Watson and Cole (1999) report the increasing trend of participation of women in wilderness or other primitive areas. The sign of gender is expected to be positive.

The sign of age was expected to be negative. The assumption is based on the research finding of Cordell *et. al.* (1996) which reports the inverse relationship between the age and participation in many outdoor recreation activities. It is hypothesized that age, which measures the activeness of people, negatively influences the decision to participate in outdoor recreation activities including wilderness visits. Some knowledge about the value of nature may promote the visits to wilderness areas. And education is likely to have positive impacts on people's understanding of nature and its value. Based on the above assumptions, education is expected to have positive relationship with wilderness or other primitive area visits participation. Generally, increases in income increase the participation of people in recreation activities. The question of how increased income distributes among the different recreation activities is an empirical question. Even though the majority of respondents have not responded to income questions, we expected a positive relationship between income

and wilderness area visits for those who answered the income questions. This expectation is based on the income effect of people where Increase in income promotes the demand of goods.

Membership in an environmental organization is used as a proxy variable for the environmental awareness of a person. Membership in an environmental organization reflects enthusiasm for environmental issues. And environmental awareness likely increases the probability of participating in any nature related recreation activities. In this study, a positive relationship was hypothesized between environmental awareness and wilderness or other primitive area visits participation. Assuming negative impacts of lack of proper information about importance, location, and cost of wilderness or other primitive area visits in the decision to participate in wilderness or other primitive area visits, a negative sign was hypothesized for lack of information.

Result and Discussion

Means value of independent variables

Table 2 presents the mean, standard deviations, minimum and maximum values for explanatory variables. In this study, the average age of participants was 43.7 years with the age of respondents ranging from 16 years to 99 years. The majority of respondents seem to have more than high school education. The average family income of the respondents of this study ranges from $35,000 to $49,999 per year.   Most of the participants of survey are white Americans and most of them are not members of any environmental organization. Except age and income, interpretation of the mean and standard deviations of remaining categorical variables do not represent statistical inference. But it does help to understand the general pattern of categorical variables.

Estimated Parameters of the Logit Model

The results of maximum likelihood ratio testing change in probability, and pseudo R-square is presented in table 3. The psuedo-R^2 statistic is the McFadden's-R^2 statistic: McFadden's-R^2 = 1 - [LL (α,β)/LL (α)] {= 1 - [-2LL(α,β)/-2LL(α)]}. Where the R^2 is a scalar measure, which varies between 0 and (somewhat close to) 1 much like the R^2 in a linear probability model. The parameter estimate of the logistic model directly does not explain the change in probability of participating in the wilderness or other primitive area visits

because of a one-unit change in an explanatory variable. In order to get a meaningful interpretation of the result, we need to find out the change in probability by multiplying the parameter estimate by its mean for the corresponding explanatory variable. A density function can be find out by using,

Here the exponent $\beta_j X_j$ represents the summation value of multiplication between parameter estimates β_j and sample means X_j and e represents the numerical value of the natural logarithm function respectively. The value of change in probability of each explanatory variable comes after multiplication between the parameter estimate and density function. The change in probability represents a function of probability itself. Multiplication of change in probability by 100 shows a percentage change in the probability of willingness to participate in the wilderness program given a one unit change in the variable. For example a one level increase in education results in a 3.092 percent increase in the probability of participating in wilderness or other primitive area visits.

Analysis of parameter estimates of the econometric model show that age, sex, race, education, and environmental awareness have significant impacts on decision making related to participation in wilderness or other primitive area visits. All of these variables are statistically significant at the 95 percent probability level. Explanatory variables like family income, and lack of information did not show significant impacts on the decision to participate in wilderness area visits. Family income, poor management of wilderness area, pollution problems,   and   lack   of   information   were   statistically   insignificant.

The age variable negatively influences wilderness recreation participation. The sign of age was as expected and consistent with the finding of Cordell *et. al.*, (1999) . The negative sign on the age variable shows that willingness of people to participate in outdoor recreation decreases with time or age. The change in probability shows that increases of one year of age decreases the probability of participation in wilderness or other primitive area visits by 0.47 percentage. The sex variable, which shows the gender impact on participation decision, has an expected sign showing the positive relationship between males and wilderness or other

primitive area visits participation.   It is somewhat contrary to our hypothesis, where we assumed the positive impact of the rising women population on wilderness or other primitive area visits. Further analysis shows that an increase of male population by one percent increases the probability of participating in wilderness or other primitive area visits by 20.1 percent. The race shows the positive relation between white and other groups and wilderness or other primitive area visits participation.   The race variable is statistically significant and has the expected sign. The result shows that increases in the white population by one percent increase the probability of wilderness or other primitive area visits participation by 21.3 percent. The result may arise because of high economic prosperity and education among white Americans in comparison to African American. However, this result is inconsistent with the other findings where researchers portrayed the Hispanic community as more lovers of nature and outdoor recreation activities (Murdock *et. al*., 1990).

The income variable yields an unexpected result. The parameter estimate of family income, even though statistically not significant, produced the expected sign showing a positive relationship between family income and wilderness or other primitive area visits participation. The result of change in probability shows that increase of family income by $1000 increases the probability of visiting wilderness areas by 0.58 percent. Education shows a statistically significant positive relationship with the wilderness or other primitive area visits promotion.   Increases in the level of education not only increases environmental awareness, but also increases knowledge regarding benefits of outdoor recreation activities including wilderness activities. Both of these awarenesses are positively related to participation in environmental recreation programs. The result of change in probability shows that a one level increase education enhances the probability of engaging in wilderness or other primitive area visits by 24.639 percent.

Policy Implications

The results failed to provide much insight into how the lack of information affects participation in wilderness or other primitive area visits. The parameter estimate and change in probability of lack of information yield results contrary to our expectation. In the opposite argument, we can assume that most of the people are well informed , and so far wilderness or other primitive area visits participation is not severely affected by lack of information because of substantial efforts of federal agencies like US Forest Service, Bureau of Land

Management, US Fish and Wildlife Service, National Park Service and the private sector. As most of these variables have significant policy implications in defining the supply and demand of wilderness or other primitive area visits, we suggest further analysis of the issue.

The statistically insignificant but positive relation between family income and wilderness or other primitive area visits participation raises the policy issue of distribution of family income. Increase of family income may promote people to develop private landscaping or private Wilderness or other primitive area visits areas. Alternatively, this result suggests the possibility of using money to fund recreation activities other than wilderness visits. Demographic factors like sex and age seem to have major influences on the decision making process for wilderness or other primitive area visits. Even though results of some of these variables do not support the findings of previous research, it clearly shows why consideration of demographic variables are important in defining key environmental policy issues related to wilderness or other primitive area visits. In our study, education and environmental awareness are the most influential policy variables in predicting the probability of participating in wilderness or other primitive area visits. Education and environmental awareness seem interrelated in promoting outdoor recreation participation including wilderness or other primitive area visits. So a major policy focus is necessary to increase the both level of environmental awareness and education in order to promote the wilderness or other primitive area visits in the future

Conclusion

Analysis of major demographic characteristics of wilderness or other primitive area visits participants and non-participants and the role of race and information in defining the participation decision of individual in wilderness or other primitive area visits yield an interesting and dominating role of demographic characteristics in determining wilderness visit behavior. The results of this study indicate the importance of focusing on demographic features while making environmental policy decisions. In our analysis, education and environmental awareness emerged as important policy variables in determining people's willingness to participate in the wilderness or other primitive area visits.

Table 1. Independent Variable and Definitions

Independent Variables	Definitions
AGE	Age of respondent in years
SEX	Gender: 1 if male; 0 otherwise
RACE	Race of respondent: white American 1; otherwise 0
FAMINC	Combined household income
	1= <$4,999 or less; 2= $5,000 - $9,999;
	3= $10,000 - $14,999; 4= $15,000 - $19,999
	5 = $20,000 - $24,999; 6 = $25,000 B $34,999
	7 = $35,000 B $49,999; 8 = $50,000 B $74,999
	9 = $75,000 B $99,999;10 = $100,000 B $149,999
	11 = > $150,000
EDUC	Respondent=s education:
	1= 8th grade or less;2 = 9th-11th grade
	3 = high school graduate; 4 = some collect but not graduate
	5 = Associate degree; 6 = Bachelor degree
	7 =Master degree; 8 = Professional degree
	9 = Doctoral; 10 = other
ENV	Member of environmental organization: 1 if member; 0 otherwise
CROWD	Crowd in wilderness areas: 1 if crowd; otherwise 0
PMA	Poor management of wilderness areas: 1 if poorly managed; otherwise 0
POLLUT	Pollution in wilderness areas: 1 if polluted areas; otherwise 0
INFO	Lack of information about wilderness areas: 1 if lack of information; 0 otherwise
WPART	Willingness to participate in wilderness program: 1 if interested t o join wilderness program; 0 otherwise

Table 2. Summary Statistics of Explanatory Variables

Variables	Mean	SD	Minimum	Maximum
AGE	43.7454	16.832	16	99
SEX	0.438	0.4962	0	1
RACE	0.885	0.319	0	1
FAMINC	7.394	2.1411	1	11
EDU	4.38	1.7351	1	9
ENV	0.2599	0.4386	0	1
CROWD	0.2548	0.4357	0	1
PMA	0.1442	0.35133	0	1
POLLUT	0.1658	0.3719	0	1
INFO	0.2507	0.4334	0	1

Table 3. Parameter Estimates and Statistical Inference of the Logit Model

Variable	Estimate	SE	Mean	t-Value	P vale	Change in Probability
CONSTANT	-1.7653	0.3797	1	-4.65	<.0001	-0.59274
AGE	-0.014	0.00437	43.7454	-3.21	0.0013	-0.0047
SEX	0.6008	0.1195	0.438	5.03	<.0001	0.201732
RACE	0.6497	0.2388	0.885	2.72	0.0065	0.218151
FAMINC	0.0173	0.0304	7.394	0.57	0.5698	0.005809
EDU	0.0921	0.0383	4.38	2.41	0.0161	0.030925
ENV	0.7338	0.1292	0.2599	5.68	<.0001	0.24639
CROWD	0.3345	0.1375	0.2548	2.43	0.015	0.112316
PMA	-0.2037	0.2095	0.1442	-0.97	0.3308	-0.0684
POLLUT	0.1898	0.1812	0.1658	1.05	0.2948	0.06373
INFO	0.1914	0.1437	0.2507	1.33	0.1827	0.064267
log-likelihood	ration test					110.05
Mc Fadden=s	LRI (Psudo	R^2)				0.06

References

Alan. W. and D. N. Cole, Wilderness Users and Use: Recent Additions to Understanding.
  Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends,@
  Sagamore Publication, 378-380:1999.

Ben-Akiva, M. and S. R. Lerman, Discrete Choice Analysis. Cambridge: The MIT Press, 1985.

Bishop, R.C and T. A. Herberlein., AMeasuring Values of Extra-Market Goods: Are Indirect Measures
  Biased?, American Journal of Agricultural Economics. Vol 61, 1979

Cordell, H.K., L.B. McDonald, R.F. Teasley, J.C. Bergstrom, J. Martin, J. Bason, and V.R. Leeworthy,
  AOutdoor Recreation in American Life: A National Assessment of Demand and Supply Trends,@
  Sagamore Publication, 1999.

Lucas Robert C.,@ A Look at Wilderness Use and Users in Transition,@ *Natural Resources Journal,* Vol 29:
  Winter 1989.

Murdock, S.H., K.E. Backman, E. Colberg, M.N. Hoque, and R.R. Hamm, AModeling Demographic Change
  and Characteristics in the Analysis of Future Demand for Leisure Service,@ *Leisure Science*, Vol 12:
  79-102: 1990.

Nagubadi, V., K. T. McNamara, W.L. Hoover, and W.L. Mills, Jr., AProgram Participation Behavior of
  Nonindustrial Forest Landowners: A Probit Analysis,@ *Journal of Agricultural and Applied Economics,*
  Vol 28: 1996

Power Thomas, M., ASoul of the Wilderness: Wilderness Economics Must Look Through the Windshield, Not
  the Rearview Mirror, @ *Journal Of Wilderness*, Vol 2, Number 1: May 1996.