Evaluating the usefulness of the Internet as a survey method for testing visual preferences

Thale Dillon

The University of Montana

Follow this and additional works at: https://scholarworks.umt.edu/etd

Let us know how access to this document benefits you.

Recommended Citation
Dillon, Thale, "Evaluating the usefulness of the Internet as a survey method for testing visual preferences" (1999). Graduate Student Theses, Dissertations, & Professional Papers. 4732.
https://scholarworks.umt.edu/etd/4732

This Thesis is brought to you for free and open access by the Graduate School at ScholarWorks at University of Montana. It has been accepted for inclusion in Graduate Student Theses, Dissertations, & Professional Papers by an authorized administrator of ScholarWorks at University of Montana. For more information, please contact scholarworks@mso.umt.edu.
Permission is granted by the author to reproduce this material in its entirety, provided that this material is used for scholarly purposes and is properly cited in published works and reports.

** Please check "Yes" or "No" and provide signature **

Yes, I grant permission
No, I do not grant permission

Author's Signature: [Signature]

Date 7-13-99

Any copying for commercial purposes or financial gain may be undertaken only with the author's explicit consent.
Evaluating the Usefulness of the Internet
as a
Survey Method for Testing Visual Preferences

by

Thale Dillon

B. A. University of Montana, 1996

presented in partial fulfillment of the requirements

for the degree of

Master of Science

The University of Montana

1999

Approved by:

Chairperson

Dean, Graduate School

7-13-99

Date
The 1990s have seen an impressive advance in the field of computer technology. Not only has the personal computer become commonplace—programming has become easier, software more advanced, graphics more sophisticated and the Internet more accessible. With all these advances, new uses for the technology are to be expected, one of them being the use of computer graphics in survey design and using the Internet as a survey method. However, it is unknown how these methods compare to the more traditional ones such as mail or telephone surveys, and thus its use may produce results of unknown value.

This study is an attempt at evaluating this new technology. As an experiment, a contingent valuation survey was designed to solicit people's visual preferences regarding forest landscapes, and their associated willingness-to-pay for a recreational permit. The survey used computer-generated graphics rather than actual photographs, and a questionnaire was posted on the web rather than mailed to a sample of households. The results were compared to the responses from on-site surveys. A descriptive analysis highlights the differences and similarities in the sampled populations, and statistical modeling determines the magnitude and degree of these relationships.

The final discussion pinpoints potential problems with such survey designs and methods, and offers suggestions as to how these problems may be solved. A suggested study design is provided, pertaining to surveys with visual stimulus requirements.
Acknowledgments

It would have been nice to say that I had been able to compile this thesis all by myself. Reality, however, is radically different, and the truth is that there are many people who helped to make this project happen. I would like to thank Dave Jackson for his help and encouragement; Doug Dalenberg for his patience and knowledge, and for large portions of his time; Hayley Hesseln for being on my committee; and Pat Flowers and Will Wood of the DNRC for their ideas and cooperation. My parents' support has been unwavering for three years, and for that I am eternally grateful. Most importantly, I want to thank my husband, Dave, for being patient and for being proud of me.
**TABLE OF CONTENTS**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>ii</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>iii</td>
</tr>
<tr>
<td>List of Tables</td>
<td>vi</td>
</tr>
<tr>
<td><strong>Chapter I</strong></td>
<td></td>
</tr>
<tr>
<td>1. Introduction</td>
<td>1</td>
</tr>
<tr>
<td>2. The Nature of the Problem</td>
<td>3</td>
</tr>
<tr>
<td>3. Objectives and Hypotheses</td>
<td>5</td>
</tr>
<tr>
<td>4. Review of the Contingent Valuation Literature</td>
<td>7</td>
</tr>
<tr>
<td><strong>Chapter II</strong></td>
<td></td>
</tr>
<tr>
<td>1. A Case Study for Potential Use</td>
<td>12</td>
</tr>
<tr>
<td>2. Method</td>
<td>15</td>
</tr>
<tr>
<td>3. The Questionnaire</td>
<td>16</td>
</tr>
<tr>
<td>4. Sampling</td>
<td>21</td>
</tr>
<tr>
<td><strong>Chapter III</strong></td>
<td></td>
</tr>
<tr>
<td>1. Descriptive Analysis</td>
<td>23</td>
</tr>
<tr>
<td>2. Regression Analysis</td>
<td>29</td>
</tr>
<tr>
<td><strong>Chapter IV</strong></td>
<td></td>
</tr>
<tr>
<td>1. Discussion</td>
<td>41</td>
</tr>
<tr>
<td>2. Inferences</td>
<td>46</td>
</tr>
<tr>
<td>3. Conclusion</td>
<td>48</td>
</tr>
<tr>
<td>Literature Cited</td>
<td>49</td>
</tr>
</tbody>
</table>
Appendix A – Trust Lands Permit Sales .................................................. 52
Appendix B – Web Page Cover Letter and Questionnaire ......................... 54
Appendix C – Color Prints of Landscape Images ...................................... 70
Appendix D – On-Site Questionnaire ...................................................... 74
Appendix E – On-Site Comments ......................................................... 77
Appendix F – Definitions of Variables ................................................... 79
Appendix G – Demand Curves ............................................................... 81
Appendix H – Shazam Program .............................................................. 85
LIST OF TABLES

Table 1: General Trends in Sample Populations .............................................................. 24
Table 2: Population Differences—On-Site vs Web-Page Survey ............................... 25
Table 3: Landscape Preference Rankings ........................................................................26
Table 4: Mean WTP based on Cut Type ..........................................................................27
Table 5: Results of Paired-Samples T-test on WTP ........................................................28
Table 6: Regular Ordinary Least Squares Model .............................................................31
Table 7: OLS model with Interactive Variables .............................................................32
Table 8: Differences in Coefficients—Basic vs Interactive Model ...............................33
Table 9: White’s Test for Heteroscedasticity .................................................................34
Table 10: OLS model with Heteroscedasticity Correction ............................................35
Table 11: The Final Model ..............................................................................................39
Table 12: Example A .......................................................................................................40
Table 13: Example B ......................................................................................................40
CHAPTER I

1. INTRODUCTION

In 1978, in his book *Mail and Telephone Surveys*, Don Dillman wrote that perhaps in the future the computer would make the arduous task of surveying an easier enterprise. Later, in 1995, James Kahn alluded to the possibilities of multimedia and the Internet in improving the quality and accessibility of surveys. As the 20th century draws to a close, it is becoming obvious that Dillman’s “future” is now. Not only has the computer made data processing and analysis far simpler, the advent of the World Wide Web is offering possibilities which Dillman could not have predicted.

Using the World Wide Web as a survey tool is promising for several reasons. First, the reach of the Internet is unlimited. A researcher can literally reach the entire world from his or her office, without having to worry about mailing costs or postal schedules.

Secondly, the quality and attractiveness achieved with a properly created web page far exceeds what is possible with a paper survey. This is especially true in cases where responses to visual stimuli are important, in that the images used will not suffer in the reproduction process.

A third facet of the web’s potential is the fact that the Internet is becoming more accessible every day. Most high schools offer Internet access to their students and employees. Virtually all colleges and universities are “on the web”, and public libraries follow suit. Many businesses and government work places are also online. Granted, Internet access relies on the access to a computer, but computer ownership is soaring as
prices continue to plummet. In short, "[t]he Internet looks more like America than it ever has (Simons, 1999)".
2. THE NATURE OF THE PROBLEM

Clearly, there are problems involved in replacing the proven mail survey with an electronic one. For one, it is uncertain how the results of the two compare. It is important to consider the advantages and disadvantages of each method, and then compare the results in a scientific manner.

One advantage of the web page approach to surveying is cost. Conventional mail surveys, and especially those containing color pictures, can be prohibitively expensive. Adhering to the advice of Dillman, a mail survey should be printed on paper which does not allow “bleed-through” when printed on both sides (Dillman, 1978), necessitating the use of expensive, high-quality paper. Together with the cost of color printing and first-class postage (Dillman, 1978), the budget for a mail survey can become preventive, especially for larger surveys.

In contrast, a web page survey requires only a person with knowledge of Hypertext Markup Language (HTML) to create the page itself, a relational database program such as Microsoft Access to store the data, and familiarity with SQL to link the two. In addition, the web page researcher needs a server, which most research institutions already have. In other words, it is more of a time commitment than a money commitment, and a relatively small one at that.

Related to the issue of cost saving is the fact that using a web page and relational database also saves a lot of work. A mail survey involves the tedious task of going through each response and entering all submitted data into a database individually. For even a modest sample of a few hundred respondents, this involves hours of data entry—
work which is completely avoided when using a web based survey because responses are automatically entered into the database when respondents submit their answers.

A last point in favor of a web-based survey is the improved control over quality. It is easy to create an attractive-looking questionnaire which appeals to the respondent and thus increases the chances for a response. Thus, better quality visual imagery can be presented than what is possible with printed reproductions.

While there are many potential advantages of web-based surveys, there are some negative aspects as well. As mentioned above, access to the Internet is improving every day. However, it is still not universal. This goes against one of the basic rules of sampling design, which states that each member of a population must have an equal chance of being selected for the sample (Moore and McCabe, 1993). Thus, the sample obtained through a web-based survey will not be random.

Further bias is introduced among those with Internet access when it comes to actually finding the web page in question. A person can surf the net for years without finding a web-site containing a questionnaire about chewing gum habits, simply because he or she has no interest in the subject, and is thus unlikely to search for related sites. Consequently, a person with a strong passion for chewing gum is more likely to be represented in the sample than one without, thus skewing the results. As Tom Halfhill, senior editor of BYTE magazine put it, “. . .you can’t let the studied population select itself (Udell, 1996)” If the sample is self-selected, the results will not be representative of the population as a whole.
3. OBJECTIVES AND HYPOTHESES

The main objective of this study is to evaluate the advantages and disadvantages of using a web-based survey to identify visual preferences for various landscapes to be used for recreational purposes. A secondary objective is to estimate the associated willingness-to-pay for recreational permits granting access to these landscapes. The objectives will be achieved through a contingent valuation study.

In pursuing the main objective, two separate populations will be examined, and differences between the two are expected. In particular, based on findings by Simons (1999), the web population is expected to have a higher level of education, and by extension, a higher income level. This is expected to result in a higher willingness-to-pay for the web-population than for the on-site population, because people’s propensity to consume increases with their earnings. The two are expected to have the same landscape preferences, but the web population is expected to engage less in recreational activities because their technological experience is earned at the expense of pursuing outdoor recreational activities.

Secondly, the survey is expected to show that some forest landscapes are more attractive to recreationists than others, regardless of survey medium. Attractive forest landscapes will draw more permit buyers and solicit higher permit prices. It is expected that the ideal forest landscape will be thinned, moderately managed stands that allow for easy access and mobility. This expectation is consistent with the findings of prior studies. DeLucio and Mugica found that “[v]isual penetration and openness are widely described in literature, and are an obvious aspect among the motivations for choosing
recreation scenes (DeLucio and Mugica, 1994). Hollenhorst et al., in their 1993 paper, also report findings consistent with this.

It is also expected that the permit price will be somewhat higher than the current $10 (because people are generally generous when it comes to issues which benefit public education). The willingness-to-pay (WTP) varies with certain socioeconomic factors. It is expected that years of post-high school education will be a positive influence because level of education is usually directly related to earnings. In addition, the presence of children in a household will increase the likelihood of the household purchasing a permit. However, as household size increases, the WTP for such a permit will decrease because there will be less money left over to dedicate to leisure activities. These two latter influences will to a certain extent cancel each other out.
4. REVIEW OF THE CONTINGENT VALUATION LITERATURE

The great outdoors presents a tremendous diversity of opportunities for aesthetic and other hard-to-define, nature-based experiences, and the public demands an equally diverse set of experiences. From pristine wilderness to urban settings, people look to the outdoors to satisfy their needs (Bacon, 1996).

In the 1960s, economist Robert K. Davis first employed a method for estimating the value of an intangible commodity such as “the Great Outdoors”. Now known as the Contingent Valuation (CV) method, Davis first used it “. . . to estimate the benefits of outdoor recreation in the Maine backwoods (Mundy and McLean, 1998)” Today, “[c]ontingent valuation is a standardized and widely used survey method for estimating willingness to pay (WTP) for recreation, existence, and bequest values (Loomis, 1996)” of a given environmental good or service.

Contingent Valuation can be defined as a method for establishing the value of a good with a limited or no market at all (Mundy and McLean, 1998). The method is often used in attempts at estimating “. . . the existence values for resources damaged by commercial activity (Blomquist and Whitehead, 1995)” such as the Exxon Valdez catastrophe, in the face of compensation and lawsuits.

The CV approach rests on the rationale that imperfect estimates of the value of a resource is better than no estimate at all. It is based on “. . . the direct elicitation of these values from individuals through the use of carefully designed and administered sample surveys (NOAA, 1993)” The respondents are asked how much they are willing to pay (or accept) to achieve (endure) a hypothetical change in a non-market good such as groundwater quality.
Likened to the process of fitting square pegs into round holes (Kahn, 1995), one of the main criticisms of this method is that “... self-reported willingness to pay is greater than ‘actual’ willingness to pay (NOAA, 1993)”. The Report of the NOAA Panel on Contingent Valuation offers various reasons for respondents to over-state their willingness-to-pay. Most importantly, it is the hypothetical nature of the study—its very essence, which contributes to this problem.

It was found that response rates and expressed willingness to contribute were significantly higher when the contribution was hypothetical than when “expressed willingness” meant an immediate cash contribution (NOAA, 1993).

In the words of Lindsay and Shultz,

...it has been demonstrated that several socioeconomic characteristics that have been shown to influence environmental attitudes and concerns in several previous sociological (attitudinal) studies, do not necessarily influence a person’s WTP for the same environmental good or service. This indicates that people may be quite willing to voice their support for environmental causes, but when it comes time for them to actually pay or to give consideration to financial aspects of environmental planning their support and enthusiasm disappears (Lindsay and Shultz, 1990).

To drive home this point, “...social psychological research has revealed poor relations between verbal attitudes and overt actions (Ajzen and Peterson, 1988)”’. An attempt at mediating this problem consists in paying close attention to survey design.

The concept of the “Warm Glow” effect is also cause for some criticism. Proponents of this idea claim that “... responses to CV questions serve the same function as charitable contributions—not only to support the organization in question, but also to feel the ‘warm glow’ that attends donating to worthy causes (NOAA, 1993)”.
Sometimes, this effect is the result of the respondent being too eager to please the researcher, giving answers what he or she thinks the researcher wants.

Rebecca W. Thompson, in her expert testimony “New Age Numbers: the Use of Contingent Valuation Methodology to Assess Natural Resource Damages”, addresses other criticisms of the CV method. These include a general lack of knowledge when it comes to valuing natural resources, and a lack of information provided, making it all but impossible for a respondent not to rely on his or her preconceptions (Mundy and McLean, 1998). Desvousges et al. raises the problem of wording, stating that “. . . the framing of questions—the process of developing the contingent market without influencing individuals’ responses—can hinder the effectiveness of the contingent valuation method (p249)”.

Additionally, Thompson addresses the fact that CV studies, in order to be reliable and to avoid the above-mentioned criticisms, must be designed according to certain standards established by NOAA (Mundy and McLean, 1998). This involves among other things a response rate approaching 70% (Loomis, 1996), a precision rarely achieved without spending more money and expertise than can be afforded in most instances.

When it comes to the valuation questions themselves, it is important to consider that different formats solicit different responses. For example, estimates based on “. . . the dichotomous-choice format may be sensitive to the number and range of payments in the survey (Fried et al., 1995)”. The alternative is to use open-ended questions, a strategy that poses a different problem because “. . . an open-ended request for willingness to pay or willingness to accept compensation invites strategic overstatement (NOAA, 1993)”.
However, according to Carson, responses to open-ended questions "... are likely to be biased downward relative to those of binary discrete-choice questions (Carson, 1997)" because "[a]n open-ended question, of necessity, invokes cost uncertainty, as it does not state the cost to be paid by the respondent (Carson, 1997)." Purvis et al. found support for this statement in that "... telling respondents outright exactly how much their [. . .] payment would be helped to simplify their decision-making (Purvis et al., 1989)."

Users of the contingent valuation method realize that "[u]ncertainty is inherent in CV and any other approach to estimating values for environmental changes (Blomquist and Whitehead, 1995)." It has been said that "... the current state of the art in economic valuation cannot adequately measure the value of wilderness systems (Kahn, 1995)." However, Cummings and Taylor offer some hope. They have found that there exists a "... connection between the meaningfulness and/or realness of the CV survey and the accuracy of responses to the survey (Cummings and Taylor, 1998)." "In other words, the more realistic the survey, the more closely responses to hypothetical willingness-to-pay (WTP) questions will follow those from WTP questions that involve actual cash payments on the part of the CV respondent (Cummings and Taylor, 1998)." Supposedly, "... unbiased estimates of willingness to pay will result from CV surveys that indicate to respondents that policy will be influenced by their vote (Cummings and Taylor, 1998)."

The scientific community disagrees widely on the issue of contingent valuation surveys. There are avid critics, but also staunch supporters of the method. The literature suggests that CV surveys can be done in ways which make their results unbiased and reliable, but these studies come with a large price tag. Giving the critics their due, CV studies can also be done in ways that make the resulting estimates worthless.
Despite the problems associated with the contingent valuation method, "... a variety of federal and state agencies consider contingent valuation to be an acceptable method for estimating nonmarket values (Fried et al., 1995)". The method "...is recommended for use by Federal agencies for performing benefit-cost analysis and for valuing natural resource damages (Loomis, 1996)" and it has been concluded that it "... can produce estimates reliable enough to be the starting point for administrative and judicial determinations (Loomis, 1996)". 
CHAPTER II

1. A CASE STUDY FOR POTENTIAL USE

The author had previously been in touch with representatives for the Department of Natural Resources and Conservation (DNRC). In Montana, the DNRC is the agency responsible for managing the State's School Trust Lands, an enterprise governed by a mandate of revenue maximization (Souder and Fairfax, 1996). Traditionally, that mandate has been fulfilled through resource extraction such as timber harvesting, mineral leases and royalties from oil wells (Souder and Fairfax, 1996). Recently, in the era of increased economic and environmental awareness, this approach seems increasingly less viable and has been the cause of some conflict.

First, there is the issue of protecting existing old-growth forests. There is also concern with the silvicultural practices in production forests, as well as with the cumulative effects of state, federal and private timber harvest. Lastly, there is pressure to allow public hunting and recreation access on State Trust Lands. The notion that forested trust lands should be managed for general benefits contrasts sharply with the trustee's only obligation, which is to the public school system alone (Souder and Fairfax, 1996).

To partly address this emerging problem, the current State Forest Management Plan, instituted in 1996 states that revenue from other sources than timber management is welcome, but only if this revenue will exceed the revenue potential of long-term timber production. In the Montana Supreme Court decision of Jerke vs. Department of State Lands, it is stated that "it is within the discretion of the DNRC to receive less income
currently, if this action will maintain the long-term productivity of the land and guarantee income to the beneficiaries in the long run (MT DNRC, 1996). The question remains as to what would constitute a viable alternative to timber harvesting as a source of long-term revenue.

Implemented in 1992, a **Recreational Use License** is now required for any person age 12 or older to recreate on State Trust Lands. The license is available from any license agent authorized by the *Department of Fish Wildlife and Parks*, and costs $10 per person per year. Senior/Youth licenses are available for $5, and family licenses covering up to six people cost $20. The revenue is distributed to the public educational trust accounts, although some is used for weed control, damage reimbursement, administration and license vendor commissions (MT DNRC 1998). In 1997, revenue was $325,840, up from $316,100 in 1996 (MT DFWP 1997, see appendix A for full document). Obviously, considered on its own, this is not a viable option to resource extraction.

As mentioned above, it is the purpose of this study to evaluate the differences between two different survey media. To properly evaluate the value of the World Wide Web as a survey medium, a basis of comparison must be established. The results of a web-based survey need to be compared to the results of the same survey conducted by more traditional methods to ensure that the results are valid. Thus, a dual survey was designed, intended to sample both the web-population and the non-web population.

The survey was created with the purpose of determining recreationists’ willingness-to-pay for access to State Trust Lands if the forest landscape is in an ideal condition as defined by them. Learning what constitutes an ideal forest landscape became central, because this would determine if timber management and recreationists
can co-exist. These objectives were arrived at through talks with Pat Flowers and Will Wood of the Forestry Division of the Montana DNRC. Due to financial constraints, an extensive mail survey was out of the question, but they agreed to cooperate on the dual survey, considering it a test of the methodology which may allow them to carry out a survey in the future. As such, the study became an exploratory pre-test for a larger DNRC survey.
2. **METHOD**

A questionnaire was developed in two versions. One version was posted on a web site, while the other shorter version was used in two on-site surveys. The results were then combined in a data set and analyzed. First, a general descriptive analysis was performed, in which trends and differences were noted. Then, a regression analysis was performed, trying to establish quantitative relationships between the variables. Through both analyses, it has been the intention to show differences in populations, as well as weaknesses and strengths of the electronic survey medium as compared to the mail survey approach.
3. THE QUESTIONNAIRE

In designing the questionnaire, the main goal was to collect the type of information that would help address the stated hypotheses. Care was taken in deciding the wording of each question, adhering to Dillman’s principles of using non-technical, non-discipline specific language. While making each question easy to understand for any member of society, it was also important that there were no sources of misunderstanding in any of them (Dillman, 1978).

In deciding on the nature of the valuation portion of the study, care was taken to adhere to established practices which identify three elements: “(1) portrayal of the resource to be valued, (2) description of the particular mechanism to be used to pay for the resource, and (3) the question format used to elicit the respondent’s dollar amount of WTP (Loomis, 1996)”. As for (1), the resource in question (the State of Montana’s School Trust Lands) is described in the cover letter, and is pictured in the images used. The payment mechanism is clearly stated as the General Recreational Use License, issued by the DNRC and sold by the Department of Fish, Wildlife and Parks. When it comes to (3), a dilemma was faced. The most common way to elicit WTP responses is the dichotomous choice option, in which the respondent is faced with a question (“Would you be willing to pay $X per year to protect resource Y?”) to which he or she answers either yes or no. The dollar amount given is varied between all the respondents in set increments to enable the modeling of a demand-like relationship. This variation is hard to accomplish on a web page, especially when the programmer is inexperienced.

A second option is to use open-ended questions, in which the respondent is asked how much money he or she would be willing to pay per year in order to protect resource
Y. Not only does this method introduce uncertainty because it offers no upper or lower limits, it also invites hypothetical and strategic bias (Lindsay and Shultz, 1990).

An approach of multiple-choice was chosen, which lies between these two alternatives. The method eliminates the uncertainty of open-ended questions, and it does away with the problem of using only a single value option in that it offers a range of four to five value alternatives. The results from this approach are also easier to analyze.

The questionnaire itself, which can be viewed in appendix B, consists of 31 questions and six images. The first item requests the respondent’s zip code, which was to be used as a control mechanism. The population of Western Montana was the primary focus. Questions 2 and 3 aim at determining the respondent’s recreational activities and the frequency with which he or she engages in them. Question 4 will establish whether or not the respondent recreates on State Trust Lands, and is followed by question 5, which asks whether the respondent buys a General Recreational Use License. After using question 6 to determine why those who do not buy permits choose not to do so, questions 7 and 8 are used to affirm the response. To further explore this subject, question 9 is used to find out if the respondent is a permit buyer in the first place, and if so, what permit(s) he or she holds.

Items 10 through 15 contain pictures of fictional forest landscapes. The respondent receives no information regarding the nature and degree of possible management intervention in each of the six images. The responses to these questions will help in determining a preference for the given types of landscapes. The second part of each of these questions will determine the respondent’s willingness-to-pay, and this can thus be linked to landscape preference.
Questions 18 through 31 deal exclusively with socioeconomic variables, which serve as a source for comparative studies, relating age, income, educational background and employment sector to opinions on landscapes, permit buying and recreational habits.

When the questions were completed, they were transformed into a web page using HTML and the guidelines for creating a successful site recommended by Dick Oliver in his book *Teach Yourself HTML 3.2 in 24 hours*. The electronic questionnaire was then appended to a cover letter and put on the School of Forestry server, with a link from the School of Forestry home page.

**The Images**

Though there are no guidelines as to the optimal number of images included in a questionnaire, it was decided to use six in this particular study. From an information-gathering point of view, using more images would have been optimal, as more forest types, conditions, and viewpoints could be covered. However, as the questionnaire was converted to a web page format, it was discovered that too many pictures, the differences between some apparent only to a trained eye, would seem tedious and confusing on a computer screen. Again adhering to Dillman’s philosophy, it was decided to reduce the number of pictures in an attempt to keep the respondent’s interest and ensure completion of the questionnaire.

In the end, the number of pictures chosen for the study was lower by far than what has been common in scenic beauty research. For example, both Anderson and Arthur used 90 slides in their landscape studies (Anderson, 1981; Arthur, 1977). This disparity
is justified by the fact that landscape analysis studies are usually carried out with several

group panels and a slide projector, rather than through a mail or on-site survey.

The images that were chosen all represent one area. Three pictures represent "... near-view forest scenes that might be experienced while camping, hiking, or driving

through wooded landscapes (Hollenhorst et al., 1993)”, whereas the other three represent
the forest as “... distant vistas that might be seen at scenic overlooks (Hollenhorst et al.,
1993)”.

Three techniques were chosen, each pictured two ways. The first was the
condition of non-management in a forest stand with a density of 65 trees per acre, a
density supplied by Dr. Carl Fiedler, and representative of an old-growth forest. The
second condition pictured was that of selective thinning to a density of 35 trees per acre,
whereas the last condition pictured was a clear-cut stand with a density of 5 trees per
acre.

The images were computer generated to avoid photographic bias, while also
permitting all three techniques to be shown on the same piece of land, in the same season,
under identical conditions. This approach also avoided the bias faced if some
respondents should recognize the forested area in question.

In generating the images, a visualization software package called World
Construction Set v.3 was used. It employs photographic images with real-life colors to
render scenes of exceptional quality, especially when viewed on a computer screen.
However, even respondents to the on-site survey who viewed laminated color printouts
expressed disbelief when told the images were not actual photographs.
The software package has its own database of forest images, and those were chosen which best represented a moist forest condition in Western Montana, as few options existed for representing the more common dry forest condition. A slightly mountainous landscape was created, over which were draped trees of specified type, density and size. As the trees would be the main focus, no understory other than grass was included. To add realism to the renderings, a sun image was added, and a sky of gradient color with a slight haze was created. Color printouts of these images can be viewed in Appendix C.
4. SAMPLING

Two additional populations were sampled to provide a basis of comparison for the web-based survey. While the web page was left on the Internet for a couple of months to gather responses from the population of web users, two other groups were sampled as well. The first of these was the student population at the University of Montana, the second was the general population of Missoula. To sample these, an on-site survey was designed. The survey consisted of a double-sided questionnaire and a picture display. The questionnaire was a pared-down version of the original 31 questions, the text of which can be viewed in appendix D. The display consisted of the same images used on the web page, enlarged to 6 ⅞ by 4 ⅛ inches, printed on a color laser printer and laminated to simulate the glossy look of an actual photograph. Larger pictures would have been more desirable, as they would be more comparable to the computer version. However, the images became too “pixelized” beyond the 6 ⅞ by 4 ⅛ inch format.

To sample the U of M student population, the picture display was set up in the University Center on the U of M Campus at the beginning of November 1998. To sample the general population of Missoula, the same display was set up outside of Gart Sports Super Store¹ on Reserve Street in Missoula about a week later. In both locations, respondents were a sample of the people walking by. They were informed of the nature of the study, handed a questionnaire on a clipboard, and accompanied to the picture display to answer questions about forest aesthetics preferences.

More on-site surveys would have been desirable, especially to capture variation within the population of Missoula, and every effort was made to accomplish this.

¹ Gart Sports Super Store was chosen because this sporting goods store also sells recreational, fishing and hunting licenses.
However, in most locations, it is "against company policy" to let anybody conduct a survey on company premises. In any case, the on-site surveys encountered reasonable success, with 39 responses in the University Center and 45 at the Gart Sports location. Valuable information about people's knowledge, interests, priorities and opinions was gained through interaction with the various respondents, and by simply listening to the respondents' reasoning while filling out the various items on the question sheet.

With the on-site response rate in mind, a similar if not better result was expected for the web survey. However, for various reasons addressed later in this paper, in the end it yielded only 15 responses. This produced an over-all sample that in itself was of a decent size, but when composed of three different samples of unequal size could not possibly produce the desired results. This is treated in further detail in the "Discussion" section of Chapter IV.

Included on both the paper and electronic questionnaires was a space for comments. Initially intended for remarks pertaining to the permit system and to State Trust Lands in general, it turned into a forum for forest management issues. These comments were dutifully recorded and are available in appendix E.
CHAPTER III

1. DESCRIPTIVE ANALYSIS

Although the goal of this study was to compare two different sample populations — one from the web-page survey and one from the on-site survey, the outcome shows that three distinct sample populations were achieved. This is due to there being two on-site surveys and one web-page survey. As an aside, Pat Flowers encouraged DNRC employees to visit the web page and fill out the survey. To distinguish these observations from the rest of the population sample, they were told to enter “99999” as their zip code. A complete list of the variables used in the analysis can be found in Appendix F.

The most popular activities which respondents participated in were hiking, camping, backpacking, fishing and down-hill skiing. The most frequently purchased permits were Fishing License, Hunting License and State Park Use Permit (SPUP). Mean post-high school education was 3.65 years for the sample as a whole, mean household size was 3.07 people, and the mean number of children in a household was 0.82.
<table>
<thead>
<tr>
<th>Item</th>
<th>Total</th>
<th>Gart Sports</th>
<th>UC</th>
<th>Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of respondents</td>
<td>99</td>
<td>39</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Respondents who recreate on State Trust Lands</td>
<td>66</td>
<td>26</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Respondents who buy General Recreational Use Licenses</td>
<td>11</td>
<td>4</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Hiking</td>
<td>79</td>
<td>26</td>
<td>41</td>
<td>12</td>
</tr>
<tr>
<td>Camping</td>
<td>78</td>
<td>29</td>
<td>36</td>
<td>13</td>
</tr>
<tr>
<td>Backpacking</td>
<td>68</td>
<td>21</td>
<td>37</td>
<td>10</td>
</tr>
<tr>
<td>Fishing</td>
<td>66</td>
<td>28</td>
<td>25</td>
<td>13</td>
</tr>
<tr>
<td>Downhill Skiing</td>
<td>56</td>
<td>25</td>
<td>22</td>
<td>9</td>
</tr>
<tr>
<td>Fishing License</td>
<td>64</td>
<td>29</td>
<td>24</td>
<td>11</td>
</tr>
<tr>
<td>Hunting License</td>
<td>50</td>
<td>25</td>
<td>17</td>
<td>8</td>
</tr>
<tr>
<td>State park Use Permit</td>
<td>34</td>
<td>15</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Average Post-High School Education</td>
<td>3.65</td>
<td>2.87</td>
<td>3.49</td>
<td>4.6</td>
</tr>
<tr>
<td>Average Household Size</td>
<td>3.07</td>
<td>3.41</td>
<td>2.8</td>
<td>3.00</td>
</tr>
<tr>
<td>Average # of Children in Household</td>
<td>0.82</td>
<td>1.21</td>
<td>0.24</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table 1. General Trends in Sample Populations

For those who recreate on State Trust Lands, the most common reason for not buying a General Recreational Use License was not knowing it to be required. Six out of fifteen, or 40% of the web page respondents answered this. One out of fifteen web respondents mentioned "lack of enforcement" as the reason for not buying a permit. Incidentally, this person also reported working for the DNRC. The question had a 33% non-response rate.

Only two respondents had ever been stopped by a Game Warden while recreating on State Trust Lands, and of these, only one was asked to present his GRUL. Both report that they do buy a GRUL. Of the four DNRC employees who responded to the survey, three do recreate on State Trust Lands, but only two of them report buying a GRUL.

Respondents to the web page were mostly male (10 males vs. 5 females). The average over-all age was 38 years: 29 years for women and 43 years for men. The web page sample has a 100% high school completion rate. Maximum post-high school education is 12 years, maximum income is in excess of $54,000 per year and the respondents are employed mostly with the government and in the field of education.
Remembering the hypotheses stated in Chapter I, section 3, they can now be either accepted or rejected. The web population does indeed have a higher level of education than does the on-site population: 4.6 years of post-high school education for the web sample, as opposed to 3.18 years for the on-site sample. The hypothesis regarding frequency of recreation has to be rejected. It was expected that the web population recreated less frequently than the on-site population. However, the web population has a mean frequency value of 1.75, whereas the on-site population has a mean value of 2.07. A value of one represents the highest frequency (once per week or more), and a value of 6 the lowest (twice per year or less).

The hypothesis stating that the web population and the on-site population have the same landscape preferences can also be accepted. The data summarized in Table 3 shows that although minor inconsistencies are present, the over-all rankings are almost identical for the two samples. Making sense of the relationship between mean WTP for the two
groups is more complicated. As seen below, WTP for the on-site population is higher for CUTHIGH, OLDLOW and OLDHIGH, whereas it is higher for the web population for CUTLOW, THINLOW and THINHIGH. Seen in light of the ranking similarities, this is puzzling to say the least, and may be caused by differences in priorities between the two populations, although they engage in roughly the same type of recreational activities (see table 2).

<table>
<thead>
<tr>
<th>LANDSCAPE</th>
<th>ON-SITE MEAN WTP</th>
<th>ON-SITE RANK</th>
<th>WEB MEAN WTP</th>
<th>WEB RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUTFLOW</td>
<td>5.1466</td>
<td>5</td>
<td>6.7333</td>
<td>5</td>
</tr>
<tr>
<td>CUTHIGH</td>
<td>4.4492</td>
<td>6</td>
<td>3.0000</td>
<td>6</td>
</tr>
<tr>
<td>THINLOW</td>
<td>8.8649</td>
<td>1</td>
<td>11.0667</td>
<td>1</td>
</tr>
<tr>
<td>THINHIGH</td>
<td>7.8680</td>
<td>4</td>
<td>8.6000</td>
<td>2</td>
</tr>
<tr>
<td>OLDLOW</td>
<td>8.7122</td>
<td>2</td>
<td>6.9333</td>
<td>3</td>
</tr>
<tr>
<td>OLDHIGH</td>
<td>8.2655</td>
<td>3</td>
<td>6.8571</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 3. Landscape Preference Rankings

Table 3 also shows that for both populations, the thinned landscape in near view (THINLOW) is the most attractive one.

Demand Functions

The willingness-to-pay data collected with both survey methods can be used to generate a cumulative demand curve for each image used. This is done by adding all the permits which could be sold at each given price. For example, if a permit cost $10, all the respondents who reported a WTP=$5 would be included, as well as all those who reported being willing to pay more. This process was repeated for each WTP increment for each of the six scenes, and thus a curve was created for each landscape. The graphs are included in appendix G.

Looking at the cumulative demand curves and the below table, it is evident that THINLOW solicits the highest WTP. Thus the conclusion is that respondents prefer a
thinned landscape in near view. The scene with the lowest WTP is CUTHIGH, i.e. a clear-cut landscape in high view.

<table>
<thead>
<tr>
<th>Landscape Type</th>
<th>CUTLOW</th>
<th>CUTHIGH</th>
<th>THINLOW</th>
<th>THINHIGH</th>
<th>OLDLOW</th>
<th>OLDHIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean WTP</td>
<td>$5.60</td>
<td>$4.30</td>
<td>$9.14</td>
<td>$7.96</td>
<td>$8.44</td>
<td>$7.96</td>
</tr>
</tbody>
</table>

Table 4. Mean WTP, based on cut type

**T-tests on WTP Means: Significant Difference**

When considering a respondent’s WTP for a given forest landscape, it is important to know if this WTP is landscape-specific or person-specific. In other words, does WTP depend entirely on the forest landscape seen, or does a respondent’s WTP for one landscape depend on the WTP for a different one? To find an answer to this question, the mean willingness-to-pay for each scene was compared to the other means to test if they were statistically significantly different. In this case, the null-hypothesis states that the means are pair-wise statistically identical. This hypothesis is tested by comparing the means as seen in table 5, and then using the associated t-value to either accept or reject the null-hypothesis. If the null-hypothesis is rejected, the WTP means are statistically significantly different.
With α=0.05 and n(population size)=99, the t-statistic=1.645 (Gujarati, p809)

<table>
<thead>
<tr>
<th>Null-Hypothesis</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUTLOW$=CUTHIGH$</td>
<td>4.445</td>
</tr>
<tr>
<td>CUTLOW$=THINLOW$</td>
<td>-7.202</td>
</tr>
<tr>
<td>CUTLOW$=THINHIGH$</td>
<td>-5.476</td>
</tr>
<tr>
<td>CUTLOW$=OLDLOW$</td>
<td>-5.148</td>
</tr>
<tr>
<td>CUTLOW$=OLDHIGH$</td>
<td>-4.471</td>
</tr>
<tr>
<td>CUTHIGH$=THINLOW$</td>
<td>-8.864</td>
</tr>
<tr>
<td>CUTHIGH$=THINHIGH$</td>
<td>-7.754</td>
</tr>
<tr>
<td>CUTHIGH$=OLDLOW$</td>
<td>-7.803</td>
</tr>
<tr>
<td>CUTHIGH$=OLDHIGH$</td>
<td>-7.354</td>
</tr>
<tr>
<td>THINLOW$=THINHIGH$</td>
<td>4.164</td>
</tr>
<tr>
<td>THINLOW$=OLDLOW$</td>
<td>2.060</td>
</tr>
<tr>
<td>THINLOW$=OLDHIGH$</td>
<td>3.349</td>
</tr>
<tr>
<td>THINHIGH$=OLDLOW$*</td>
<td>-1.071</td>
</tr>
<tr>
<td>THINHIGH$=OLDHIGH$*</td>
<td>0.043</td>
</tr>
<tr>
<td>OLDDLOW$=OLDHIGH$*</td>
<td>1.243</td>
</tr>
</tbody>
</table>

Table 5. Results of Paired Samples T-test on WTP

Comparing the individual t-values to the t-statistic above (1.645) shows that only three pairs of means are not significantly different. These are marked with asterisks in the table. The lack of significant differences in these three cases is due to the similarities in appearance of the images representing these options, and is reflected in the below regression analysis as well. When it comes to the 12 other pairs, it can be concluded that each reported mean is different from the others.
2. REGRESSION ANALYSIS

Purpose

The purpose of creating a regression model is to express the relationship between the willingness to pay for a permit and various attributes reflecting the value of the permit. In this case, willingness-to-pay (WTP) is the dependent variable. The parameters of the regression model will be estimated by using the method of ordinary least squares (OLS). Introduced in 1886 by Francis Galton (Gujarati, 1995), the term "regression" has in modern times come to be interpreted in the following way:

Regression analysis is concerned with the study of the dependence of one variable, the dependent variable, on one or more other variables, the explanatory variables, with a view to estimating and/or predicting the (population) mean or average value of the former in terms of the known or fixed (in repeated sampling) values of the later (Gujarati, 1995).

It is important to keep in mind that the statistical relationships which result from regression analyses can never establish causal connections. Such connections have to "... come from outside statistics, ultimately from some theory or other (Gujarati, 1995)."

The Model

The data obtained from the three different surveys was consolidated into one data set. Variables from the web survey that were not available for the on-site surveys were deleted from the web page data to make a uniform data set without missing entries. Each of the three surveys asked respondents to estimate their WTP for six different views. As a result, the 99 observations obtained yielded 594 estimates of willingness-to-pay. These values of WTP are the values of the dependent variable.
A dummy variable called LOWVIEW was created to isolate the effect of the different views: high-level view and low-level view. It was given the value of one for the low-level view and zero for the high-level view, making the high view the base case. An additional set of dummy variables was created in order to isolate the effect of the different management techniques: clear-cutting, thinning and old-growth (non-management). CLEAR indicates clear-cut, THIN indicates thinning, and OLD represents old-growth.

The responses are also categorized by the users' input regarding the likelihood of purchasing a recreational use license. The three responses “likely”, “indifferent” and “unlikely” were coded as a set of dummy variables called POS, INDI and NEG to capture the impact which likelihood of purchase may have on WTP.

A base case was chosen for each of the three dummy variables. For LOWVIEW, high view is excluded, and is thus the base case. This was an arbitrary choice. For the likelihood dummy, INDI (indifferent) is chosen to be the base case because it is the most neutral option, and for cut technique, OLD (old-growth) is the base case because it represents the most natural state.

In all the variables there were incidents of item non-response. To easily spot these occurrences, missing values in the data set were replaced by -99999. As each observation with missing values was repeated six times, the item non-response incident compounded itself. When these observations were later skipped, the final number of observations was 534. This amounts to 9.93% of the observations having item non-response.
Item non-response is a common problem in contingent valuation research. To discard the observations with missing values "... results in a biased sample if the discarded cases are a nonrandom subsample of the population (Whitehead, 1994)". One way to remedy this is through the imputation of missing data, where estimates are used to replace the missing data. This approach "... allows analysis of the entire sample which reduces the effects of item non-response (Whitehead, 1994)". However, the result of this regression is not expected to yield a model of good enough fit to warrant these measures, thus the observations with missing values were skipped outright.

The first regression included variables that were thought to influence the dependent variable, WTP. The full program can be viewed in appendix H.

\[
\text{WTP} = \beta_1 + \beta_2 (\text{lowview}) + \beta_3 (\text{clear}) + \beta_4 (\text{thin}) + \beta_5 (\text{pos}) + \beta_6 (\text{neg}) + \beta_7 (\text{uc}) + \beta_8 (\text{web}) + \beta_9 (\text{freq}) + \beta_{10} (\text{phs}) + \beta_{11} (\text{cihh}) + \beta_{12} (\text{hhs}) + \beta_{13} (\text{recks})
\]

<table>
<thead>
<tr>
<th>VARIABLE NAME</th>
<th>ESTIMATED COEFFICIENT</th>
<th>T-RATIO</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOWVIEW</td>
<td>0.99982</td>
<td>2.570</td>
<td>0.010</td>
</tr>
<tr>
<td>CLEAR</td>
<td>-3.1436</td>
<td>-6.577</td>
<td>0.000</td>
</tr>
<tr>
<td>THIN</td>
<td>0.37170</td>
<td>0.7822</td>
<td>0.434</td>
</tr>
<tr>
<td>POS</td>
<td>-0.72349</td>
<td>-1.228</td>
<td>0.220</td>
</tr>
<tr>
<td>NEG</td>
<td>0.29539E-01</td>
<td>0.5132E-01</td>
<td>0.959</td>
</tr>
<tr>
<td>UC</td>
<td>1.4551</td>
<td>3.088</td>
<td>0.002</td>
</tr>
<tr>
<td>WEB</td>
<td>1.0076</td>
<td>1.593</td>
<td>0.112</td>
</tr>
<tr>
<td>FREQ</td>
<td>0.18360E-01</td>
<td>1.401</td>
<td>0.162</td>
</tr>
<tr>
<td>PHS</td>
<td>-0.17554</td>
<td>-1.670</td>
<td>0.095</td>
</tr>
<tr>
<td>CIHH</td>
<td>-0.32986</td>
<td>-1.268</td>
<td>0.205</td>
</tr>
<tr>
<td>HHS</td>
<td>0.52799</td>
<td>2.778</td>
<td>0.006</td>
</tr>
<tr>
<td>RECS</td>
<td>0.10250</td>
<td>1.809</td>
<td>0.071</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>4.5899</td>
<td>4.556</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 6. Regular Ordinary Least Squares Model

Using a 5% error level, the variables with P-values of over 0.05 were concluded to be not significant. However, at this point no decisions should be made regarding significance,
as these values may change as the model is refined. This may also improve the R-square values.

Although this straight-forward model provides much information about the linear relationship under examination, it leaves room for improvement. To examine in further detail the different effects of low versus high view within the model, interactive variables were used to capture these specific variations. Two new variables were created through cross products of LOWVIEW, and CLEAR and THIN. These were called LOWCLEAR and LOWTHIN, and were included in the modified OLS.

\[
WTP = \beta_1 + \beta_2 (lowview) + \beta_3 (clear) + \beta_4 (thin) + \beta_5 (lowclear) + \beta_6 (lowthin) + \beta_7 (pos) + \beta_8 (neg) + \beta_9 (uc) + \beta_{10} (web) + \beta_{11} (freq) + \beta_{12} (phs) + \beta_{13} (cithh) + \beta_{14} (hhs) + \beta_{15} (recs)
\]

\[
\begin{align*}
R^2 & = 0.1747 \\
R^2 \text{ adjusted} & = 0.1525
\end{align*}
\]

<table>
<thead>
<tr>
<th>VARIABLE NAME</th>
<th>ESTIMATED COEFFICIENT</th>
<th>T-RATIO</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOWVIEW</td>
<td>0.48251</td>
<td>0.7152</td>
<td>0.475</td>
</tr>
<tr>
<td>CLEAR</td>
<td>-3.5501</td>
<td>-5.247</td>
<td>0.000</td>
</tr>
<tr>
<td>THIN</td>
<td>0.18271E-02</td>
<td>0.2716E-02</td>
<td>0.998</td>
</tr>
<tr>
<td>LOWCLEAR</td>
<td>0.81294</td>
<td>0.8497</td>
<td>0.396</td>
</tr>
<tr>
<td>LOWTHIN</td>
<td>0.73971</td>
<td>0.7775</td>
<td>0.437</td>
</tr>
<tr>
<td>POS</td>
<td>-0.72308</td>
<td>-1.226</td>
<td>0.221</td>
</tr>
<tr>
<td>NEG</td>
<td>0.30162E-01</td>
<td>0.5234E-01</td>
<td>0.958</td>
</tr>
<tr>
<td>UC</td>
<td>1.4547</td>
<td>3.083</td>
<td>0.002</td>
</tr>
<tr>
<td>WEB</td>
<td>1.0109</td>
<td>1.596</td>
<td>0.111</td>
</tr>
<tr>
<td>FREQ</td>
<td>0.18334E-01</td>
<td>1.397</td>
<td>0.163</td>
</tr>
<tr>
<td>PHS</td>
<td>-0.17558</td>
<td>-1.669</td>
<td>0.096</td>
</tr>
<tr>
<td>CITHH</td>
<td>-0.32969</td>
<td>-1.266</td>
<td>0.206</td>
</tr>
<tr>
<td>HHS</td>
<td>0.52880</td>
<td>2.780</td>
<td>0.006</td>
</tr>
<tr>
<td>RECS</td>
<td>0.10271</td>
<td>1.811</td>
<td>0.071</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>4.8442</td>
<td>4.639</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 7. OLS model with Interactive Variables

Clearly the interactive variables do make the model more sophisticated by enabling a more detailed break-down of the predicted values. From looking at the outputs, some differences can be noticed in the two models, as is summarized in the below table.


<table>
<thead>
<tr>
<th>Cut Technique</th>
<th>View</th>
<th>Basic Model (values included in equation)</th>
<th>Model with Interactive Variables (values included in equation)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old-Growth</td>
<td>High</td>
<td>Base case</td>
<td>Base case</td>
<td>0</td>
</tr>
<tr>
<td>Old-Growth</td>
<td>Low</td>
<td>1.0</td>
<td>0.48</td>
<td>-0.52</td>
</tr>
<tr>
<td>Thinning</td>
<td>High</td>
<td>0+0.372=0.372</td>
<td>0+0.0018+0=0.0018</td>
<td>-0.37</td>
</tr>
<tr>
<td>Thinning</td>
<td>Low</td>
<td>1.0+0.372=1.372</td>
<td>0.483+0.0018+0.740=1.225</td>
<td>-0.147</td>
</tr>
<tr>
<td>Clear-Cut</td>
<td>High</td>
<td>0-3.144=-3.144</td>
<td>0-3.550+0=-3.550</td>
<td>-0.406</td>
</tr>
<tr>
<td>Clear-Cut</td>
<td>Low</td>
<td>1.0-3.144=-2.144</td>
<td>0.483-3.550+0.813=-2.254</td>
<td>-0.11</td>
</tr>
</tbody>
</table>

Table 8. Differences in Coefficients—Basic vs Interactive Model

However, the two interactive variables that were added are not statistically significant, showing no interactive effects. Additionally, the Adjusted-$R^2$ is now 0.1425—lower than it was in the first regression.

At this point it makes sense to consider the problems which may occur within the model. Through the above manipulations, the coefficients on the different variables have changed very little, indicating that they are robust. This is evidence that the model is correctly specified. However, there are other problems that need to be examined.

**Heteroscedasticity**

Heteroscedasticity has never been a reason to throw out an otherwise good model (Mankiw, p1648)

One of the assumptions of the classical linear regression model is that of homoscedasticity, or equal variance of the error terms (Gujarati, 1995). When this assumption is violated, the regression model is no longer “best” (as in Best Linear Unbiased Estimator, or BLUE), although it is still both “unbiased” and “linear” (Gujarati, 1995). The OLS estimators and the forecasts based on them will be inefficient, and most importantly, hypothesis testing will be invalid because the estimated variance and covariance will be biased and inconsistent (Ramanathan, 1998).
The data resulting from this survey is called panel-data because it contains six observations per respondent. Heteroscedasticity can occur when using panel data rather than individual data because the errors of people's behavior diminishes over time (Ramanathan, 1998). To test for its presence, the easy way is to plot the squares of the residuals to look for a heteroscedastic pattern. However, while this can serve as a clue, it is not a sure indicator of any problems because the computer plot must be of high quality for anything to show up. The best thing to do is to perform a formal test which can give a definite answer as to whether or not heteroscedasticity is present. If it is found to be present, corrections can be made so that the regression model again will be BLUE.

One popular test for heteroscedasticity is White's Test. This is a good test because it does not assume any prior knowledge of the heteroscedasticity pattern, and because it is a large-sample Lagrange Multiplier test which does not depend on any assumptions of normality (Ramanathan, p390). The outcome of White's Test indicates that there is indeed heteroscedasticity present in the model.

```
WHITE'S TEST FOR HETEROSCEDASTICITY
H0: No Heteroscedasticity Present
H1: Heteroscedasticity Present
N=534, α=0.05, DF=12, chi-square=21.0261,
adjusted R^2=0.1034
(N)x (adjusted R^2)=55.2156
Since 55.2156 > 21.0261, it is concluded that there is heteroscedasticity present in the model.
```

Table 9. White's Test for Heteroscedasticity

The most common correction for heteroscedasticity is White's Heteroscedasticity Consistent Covariance Approach, the formula for which is provided in Shazam. In this approach, the standard errors are adjusted directly.
\[ WTP = \beta_1 + \beta_2 \text{(view)} + \beta_3 \text{(cut1)} + \beta_4 \text{(cut2)} + \beta_5 \text{(intcut1)} + \beta_6 \text{(intcut2)} + \beta_7 \text{(pos)} + \beta_8 \text{(neg)} + \beta_9 \text{(uc)} + \beta_{10} \text{(web)} + \beta_{11} \text{(freq)} + \beta_{12} \text{(phs)} + \beta_{13} \text{(cihh)} + \beta_{14} \text{(hhs)} + \beta_{15} \text{(recs)} / \text{het} \]

Using heteroskedasticity-consistent covariance matrix

\[ R^2 = 0.1747 \quad R^2 \text{ adjusted} = 0.1525 \]

<table>
<thead>
<tr>
<th>VARIABLE NAME</th>
<th>ESTIMATED COEFFICIENT</th>
<th>T-RATIO</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOWVIEW</td>
<td>0.48251</td>
<td>0.6852</td>
<td>0.494</td>
</tr>
<tr>
<td>CLEAR</td>
<td>-3.5501</td>
<td>-5.772</td>
<td>0.000</td>
</tr>
<tr>
<td>THIN</td>
<td>0.18271E-02</td>
<td>0.2691E-02</td>
<td>0.998</td>
</tr>
<tr>
<td>LOWCLEAR</td>
<td>0.81294</td>
<td>0.8916</td>
<td>0.373</td>
</tr>
<tr>
<td>LOWTHIN</td>
<td>0.73971</td>
<td>0.7440</td>
<td>0.457</td>
</tr>
<tr>
<td>POS</td>
<td>-0.72308</td>
<td>-1.338</td>
<td>0.181</td>
</tr>
<tr>
<td>NEG</td>
<td>0.30162E-01</td>
<td>0.5925E-01</td>
<td>0.953</td>
</tr>
<tr>
<td>UC</td>
<td>1.4547</td>
<td>3.128</td>
<td>0.002</td>
</tr>
<tr>
<td>WEB</td>
<td>1.0109</td>
<td>1.802</td>
<td>0.072</td>
</tr>
<tr>
<td>FREQ</td>
<td>0.18334E-01</td>
<td>1.536</td>
<td>0.125</td>
</tr>
<tr>
<td>PHS</td>
<td>-0.17558</td>
<td>-1.691</td>
<td>0.092</td>
</tr>
<tr>
<td>CIHH</td>
<td>-0.32969</td>
<td>-1.329</td>
<td>0.184</td>
</tr>
<tr>
<td>HHS</td>
<td>0.52880</td>
<td>2.832</td>
<td>0.005</td>
</tr>
<tr>
<td>RECS</td>
<td>0.10271</td>
<td>1.887</td>
<td>0.060</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>4.8442</td>
<td>4.873</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 10. OLS with heteroscedasticity correction

**Interpretation**

After the model has been corrected for heteroscedasticity, some conclusions can be reached as to the statistical significance of the variables, and with regards to the magnitude of their coefficients. As mentioned above, the variables with P-values exceeding 0.05 are not statistically significant. By looking at table 12, it is obvious that this is the case for the majority of the variables.

The variable LOWVIEW indicates that respondents value a low-level view over a high-level view. In fact, they are willing to pay an estimated 48 cents more for access to an area with near views than they would for vista views. The reason for this may be that
people usually do not recreate in a landscape which they view from a vista point, high above the forest floor. A forest at eye level looks more conducive to recreating. However, the variable is not significant, indicating that the difference between the two view options is not that great.

CLEAR is one of three significant variables. Its estimated coefficient of $-3.55$ shows that respondents value a clear-cut area $3.55$ less than they do an old-growth area (the base case). The fact that this variable is significant comes as no surprise, since there are striking differences between the images portraying the clear-cut area and those showing the old-growth areas. The negative coefficient reflects the fact that a clear-cut landscape is not very attractive-looking, especially not to recreationists who seek an aesthetic experience.

THIN on the other hand, is not significant, probably because the differences between the thinned area and the old-growth area are not that noticeable in the pictures. Additionally, the estimated coefficient is minute: $0.0018$, further alluding to the fact that the two management options are virtually identical to the casual observer. However, the thinned landscape in near-view was the image which achieved the highest mean WTP.

When it comes to the two interactive variables LOWCLEAR and LOWTHIN, they too are not significant, indicating that there are no interactive effects.

The dummy variable UC is the second significant variable, indicating that there is a difference between the UC respondents and the Gart Sport respondents (base case). The respondents encountered at the UC are willing to pay an estimated $1.45$ more for a recreational permit than would those encountered at Gart Sport. The dummy variable WEB turned out to be not significant, meaning that there is no real difference between the
web sample and the Gart Sport sample in terms of WTP. This was a surprise as the two on-site samples were expected to be similar, and the web sample different.

Frequency of recreational activity, represented by FREQ, turned out to be not significant as well. This was unexpected, because the more often someone recreates, the more he or she will benefit from buying a permit. Additionally, the estimated coefficient is rather small—only 0.018.

The likelihood variables POS and NEG turned up insignificant. It seems logical that WTP should be affected by a respondent’s reported likelihood of buying a permit, however this indicates that neither positive nor negative likelihood is much different from indifference2.

Level of post-high school education is usually directly associated with income, so the variable PHS was expected to have an important influence on WTP. Not only is the variable not significant, it also affects the equation negatively. If the sample were larger, and containing more respondents from the labor market rather than the student population, this variable would probably be significant and have a positive coefficient.

When it comes to number of children in household, the variable CIHH was expected to be significant because it seems parents would be likely to buy permits to allow them to spend quality time with their children. Again, the variable is not significant, and it has a negative coefficient. A possible explanation is the relatively

---

2 The directions of the effects associated with the POS and NEG variables were as expected. A WTP survey is a very hypothetical situation in which people’s reported behavior does not necessarily coincide with their actual behavior. A respondent may report that it is unlikely that he or she would buy a permit. When subsequently asked how much he or she is willing to pay for that same permit, their answer may very well be higher than the actual WTP, because as mentioned earlier, chances are slim they will ever actually buy one. Conversely, if the likelihood of buying a permit is high, the reported WTP will be lower, because this respondent may actually end up spending real money on one.
young sample, and the relatively low number of children per household (mean number is 0.82).

In light of the CIHH variable, it comes as something of a surprise that the variable HHS (household size) is the third significant variable in this regression model. Its coefficient suggests that respondents are willing to pay an additional 53 cents per household member for a recreational permit. Whether this is caused by an increased need to get out of the house as household size increases, or just due to the availability of recreational companions is unknown.

The last variable in the equation, RECS is very close to being significant. It is logical to conclude that the number of recreational activities a person is involved in should influence his or her WTP in some way, just as FREQ was expected to be significant. Although the coefficient on RECS is of a more measurable magnitude, it still not significant.

In this model, a rather large number of variables were found to be not significant. While discouraging at first, the lack of significance does not necessarily have to mean that these categories should be ignored. According to Purvis et al., this could simply mean that they need to be measured or quantified differently (Purvis et al., 1989). It could also mean that the sample populations lacked variation.

Strictly speaking, the results of this regression model should only be interpreted in relation to each of the images provided in the survey. However, some inferences can be made when dealing with generalizations of cut techniques. The final model does provide a value for willingness-to-pay, and it does indicate what factors influence this number. It
is important to keep in mind, however, that the fit of the model is poor, with an Adjusted-R² of only 0.1456.

\[
WTP = 4.844 + 0.483(LOWVIEW) - 3.550(CLEAR) + 0.002(THIN) + 0.813(LOWCLEAR) + 0.740(LOWTHIN) + 1.455(UC) + 1.011(WEB) + 0.018(FREQ) - 0.723(POS) + 0.030(NEG) - 0.176(PHS) - 0.330(CIHH) + 0.529(HHS) + 0.103(RECS)
\]

Table 11. The Final Model

A few examples should illuminate the meaning of this equation. First, let us consider the scene of a thinned forest landscape, seen from a vista point. The value for LOWVIEW is zero. Since we are considering a thinned landscape, the value for CLEAR is also zero, but the value for THIN is one. Since LOWVIEW=0, both the interactive variables, LOWCLEAR and LOWTHIN, will be zero. If we further imagine that the respondent in question filled out the survey on the web, the UC variable becomes zero, whereas the WEB variable will be one. We have information which indicates that the respondent recreates approximately once every other week (FREQ=26), considers himself likely to buy a permit (POS=1, NEG=0), and has 3 years of post-high school education. He lives in a household with one other person, with no children, and is involved in 7 different recreational activities. By substituting these values into the above equation, we can calculate the respondent’s WTP for a recreational permit which grants access to a piece of land which looks like the picture shown.
Next, we can consider the image of the clear-cut landscape, seen in near view. This yields LOWVIEW=1, CLEAR=1, THIN=0, LOWCLEAR=1 and LOWTHIN=0.

Additionally, let the questionnaire have been filled in at the UC (UC=1, WEB=0) by a respondent who recreates at least once a week (FREQ=52), considers herself unlikely to buy a permit (POS=0, NEG=1), and has five years of post-high school education (PHS=5). She has three children (CIHH=3), lives in a household of size five and engages in eleven recreational activities regularly (HHS=5, RECS=11).

This results in a higher WTP, due in part to the lower elevation of the point of view for each image.
CHAPTER IV

1. DISCUSSION

The ultimate purpose of this study was to determine whether using the World Wide Web as a survey tool provides a good way to measure people's visual preferences. By conducting one web-based survey and comparing it to the more traditional on-site survey, certain issues surfaced. There were certain differences in the sample populations, an expected result. There were also unexpected difficulties with the employed technology and with the response rate.

The survey in and of itself provided results that are comparable to those achieved from other studies. Hollenhorst et al. found that "... increased sunlight and a reduction in stand density (Hollenhorst et al., 1993)" increases the appeal of forest sites. Although that study dealt with eastern hardwood forests, not with western coniferous forest landscapes as is the case with our study, those findings are consistent with the preferences revealed here—the preferred landscape was the one thinned to 35 trees per acre.

As mentioned in the previous section, the model provided robust estimates of the coefficients involved, which further alludes to the reliability of the results.

The appeal of a forest site is a reflection of its scenic beauty, but how does this relate to the concept of recreation value? Hollenhorst et al., in quoting Ajzen and Peterson, states that the two ideas may be "... different measures of the same attitude", and can be used interchangeably (Hollenhorst et al., 1993). DeLucio and Mugica found that there are three aspects involved "... in the assessment of natural recreational
resources: physical suitability (whether an activity is possible), scenic quality (one site is more attractive than another), and accessibility (DeLucio and Mugica, 1994)

It has been shown that in a contingent valuation study, recreation value and thus the magnitude of reported WTP for a recreation license depends in large part on visual stimulation (Hollenhorst et al., 1993). Naturally, it is therefore important to provide imagery of superior quality for such studies, something which is difficult and costly when using mail surveys due to limited and expensive printing technology. On this level, a web-based survey shows promise in that a web page can reproduce and distribute top-notch graphics at virtually no cost to the researcher.

Web surveys are mostly compared to telephone polls conducted by large companies such as the Gallup Organization. Since this particular study required the use of visual imagery, conducting a telephone poll as a control was not an option. At this point in time, a web page survey cannot deliver results of the same quality and reliability as a telephone poll, and no meaningful comparisons have yet been made between a web-based survey and a mail survey. The approach used in this study uncovered a number of problems, some of which are easily corrected, and some of which are inherent in the method itself:

First and foremost, in the words of John Simons of the Wall Street Journal, “... Internet users are still too white, too rich, too educated and too male”, compared to the population as a whole. This was a well-known fact going into the study, but it bears repeating, although according to Gordon Black of the Harris Internet Poll, “... about 45% of Americans now use the Internet, either at home, at school, at work or in public libraries [... and] they are increasingly representative of the U.S. population at large
(Simons, 1999). The results from the regression analysis support this latter claim, and offer some hope that perhaps in the near future the issue can be revisited.

A second issue which was recognized beforehand was that of the non-random sample. People who respond to an Internet survey are not randomly selected, but rather "... self-selected, which could mean they are more comfortable with technology, more informed about news and events, and more politically engaged than Americans who aren't online (Simons, 1999)". Actively soliciting responses over the Internet can minimize this problem. By turning the web-based survey into an e-mail survey, with a process comparable to the traditional mail survey, the results can become more reliable. This introduces concerns with randomly selecting respondents, as well as with non-response rates, follow-up reminders, the availability of e-mail address lists and the issuing of passwords to ensure that each respondent answers only once.

One issue which unfortunately could not be appropriately addressed in this study was how the sense of anonymity compares from one method to the other. With a survey like this one, which is merely posted on the Internet waiting for people to find it, the sense of anonymity is different than for a mail survey. If the modified e-mail survey approach mentioned above were adopted, the researcher would most likely encounter different reactions. Many people react negatively when they receive unsolicited mail. How will they react when receiving unsolicited e-mail, and in turn, how will this reaction affect the response rate and the quality and accuracy of the responses themselves? Will it affect item-non response? Evidently more research is needed to fully understand people's relationships to their computers as a medium of personal communication.
One problem which can potentially hamper any survey no matter how well thought-out and planned, is the presence of technical difficulties. It may be easy to figure out how to make an attractive web page and to learn the appropriate programming to produce the right layout. Experience is required however, to foresee and then correct the inevitable problems which will occur. It is vital that the web page functions properly not only on the programmer's computer, but also on computers that are faster or slower, have smaller or larger screens, use older or newer software, and so on. People have different habits in how they use their mouse and their keyboard when browsing a web page, and this needs to be taken into account to ensure proper functioning under all circumstances. For instance, using the mouse to move around a web page should produce the same results as using the tab key. In this study, using the tab key to move between response categories resulted in the survey form resetting itself for some users. Other users encountered unexplainable error messages pertaining to the SQL script relating the survey information to the main database. It is likely that a more experienced programmer would have been able to foresee and circumvent these problems, albeit removing some the allure of the “quick and easy” approach.

Related to this issue is the main problem encountered in this study. It is the problem of low response rate, which threatens to make all possible inferences and conclusions null and void. Due to technical problems, responses were not captured for the first four weeks that the web page was posted. Even though the registration error was discovered, it proved impossible to recover the entries that were submitted in this time period. Only 15 additional responses were registered after the problem was corrected, providing a web-page sample much smaller than the on-site sample of 84.
Although some variation was displayed in the web-page sample responses, not enough was present to allow for any meaningful conclusions or predictions. This problem just highlights the need for technical expertise and the necessity of ensuring responses through solicitation, much like mentioned above.

On a separate note, it is important to mention that although a quantity of information with no direct influence on the main objective was collected, this information was gathered from the web page alone. Since there were only 15 web responses, it was felt that conducting an analysis of the additional answers would not yield useful results.
2. INFERENCES

If the DNRC were to conduct a full-scale version of this study, some steps have to be taken in order to achieve a consistent sample and to improve the usefulness of the results. Instead of sampling a web population and a non-web population, the dual population would consist of those not holding recreational permits and those who have purchased a General Recreational Use License in the past year. The former group would be sampled from the population in general, and the latter would be sampled from the permit archives of the Department of Fish, Wildlife and Parks. Both groups need to be checked for duplicate entries and consolidated to ensure no household is sampled twice.

As a preliminary measure, the samples should be checked for web access. This can be done by telephone. By calling up a random sample of one half of one percent of all the permit holders for last year (app. 150 people), the researcher can establish an idea of possible non-response rate ahead of time and adjust sample size accordingly.

The actual survey can employ roughly the same questionnaire as used here, with some technical improvements. When the questionnaire is ready and posted on the web, free of technical problems, the sample population can be alerted. This is best done by adhering to Dillman’s total survey design (Dillman, 1978). Each household in the sample would receive by mail a form letter containing all the necessary information, such as the name of the designated respondent, his or her nearest location for Internet access, the web address, a personal password which expires upon use, and of course information about the study itself. This letter has to be appealing enough for the recipient to volunteer his or her time to log onto the Internet, find the web page, and submit answers. It is the
equivalent of the cover letter of the traditional mail survey. Of course, the information in this "cover letter" should be elaborated and repeated on the web page itself.

As each respondent visits the web page and submits his or her answers, a log is created from the passwords that have to be entered in order to submit the responses. After two weeks, this log can be reviewed and postcard reminders can be mailed out as reminders to those who have not yet submitted their responses. After an additional two weeks, a new form letter, containing all the information from the first one, should be sent out to those still unresponsive.

By following these steps, a much larger sample would result than what was experienced in this study. By using a relational database, the data set would be ready for analysis at any time. The descriptive analysis would of course be different, as would the correlation analysis, but the same regression model can be used, hopefully providing both robust estimates and a better fit, as the data would be more diverse.
3. CONCLUSION

In short, there is no such thing as a free lunch. The Internet approach to sample surveying may be easier than a mail survey in some areas, but care must still be exercised in the design and execution stages. The method most certainly is not a quick fix, but used with care it can produce a result of equal, if not superior quality than what can be expected from a mail survey. If adhering to the principles of survey design and execution, there is no reason why this survey medium should not be developed into a full-fledged discipline. As with any survey method, the results have to be adjusted “...to account for the demographic disparity (Simons, 1999)” between the sample population and the general population. As with any research, a scientific approach must be employed to ensure scientific results.
BIBLIOGRAPHY:


APPENDIX A:

TRUST LANDS PERMIT SALES
## MONTANA

### STATE LANDS LICENSES SALES

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>State Lands Use*</td>
<td>29,081</td>
<td>31,450</td>
<td>31,526</td>
<td>34,683</td>
<td>28,164</td>
<td>27,008</td>
<td>$281,640.00</td>
<td>$270,080.00</td>
</tr>
<tr>
<td>Senior / Youth</td>
<td></td>
<td></td>
<td>4,752</td>
<td>4,340</td>
<td></td>
<td></td>
<td>$23,760.00</td>
<td>$21,700.00</td>
</tr>
<tr>
<td>Family</td>
<td>535</td>
<td></td>
<td>1,703</td>
<td></td>
<td></td>
<td></td>
<td>$10,700.00</td>
<td>$34,060.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>29,081</td>
<td>31,450</td>
<td>31,526</td>
<td>34,683</td>
<td>34,451</td>
<td>33,051</td>
<td>$316,100.00</td>
<td>$325,840.00</td>
</tr>
</tbody>
</table>

* First year of implementation was 1992. Fee was $5 until 1996, when it was raised to $10.

** First implemented in 1996 for $5. Allows youth 17 and younger and seniors 60 and older to purchase.

***First implemented in 1996 for $20. Allows a family of up to 6 people to purchase.
APPENDIX B:

WEB PAGE COVER LETTER AND QUESTIONNAIRE
Public Questionnaire

Are you a Montana resident? Do you use state lands to recreate? Has timber harvesting ever affected your recreational experience? Do you think it would? Would you like to tell us more about it?

This survey is aimed at the average Montana resident. We are collecting information concerning recreational habits and landscape preferences to find out how you, the public, want your recreational area to be managed. Sometimes the Department of Natural Resources and Conservation (DNRC), the agency in charge of state lands, and the people who recreate there do not agree as to how the land should be managed. The most common conflict involves the question of whether or not to harvest timber. We hope that the information we obtain from this study will aid in making better land management decisions in the future.

Forest Aesthetics Study

This questionnaire primarily seeks your opinion. There are no right or wrong answers. As will be apparent, these are questions that deal with your preferences concerning the areas in which you choose to recreate, so please be honest. Don't tell us what you think we may want to hear. While going through the questionnaire, keep in mind that this is an anonymous survey. No-one will know what you answered, so feel free to tell us what you really think.

The questionnaire is divided into four sections. For most of the questions, you will be asked to either check one of several options, or check all the options which apply to you and your situation. In a few instances we will ask you for more detailed input, and there will be text boxes provided for this purpose. At the very end, you will find a button which says "Submit Questionnaire". By clicking it, all the information you have entered will be transferred to a database here at the University. There's no need for you to send us anything by mail, e-mail or fax.

We have tried to make this questionnaire as intuitive and obvious as possible--hopefully we have succeeded. When the study is over, the results will be posted at this address--feel free to visit again to see what we learned!!! We thank you for your time, and hope that you will tell a friend about this web site!

Proceed to the Questionnaire
Forest Aesthetics Questionnaire

The first section contains nine questions pertaining to your recreational habits.

Question 1
For statistical purposes, please enter your zip-code:

Question 2
What kinds of recreational activities do you usually participate in? Please check all that apply.

☐ Back-Packing
☐ Berry-Picking
☐ Camping
☐ Canoeing / Kayaking
☐ Cross-Country Skiing
☐ Downhill Skiing
☐ Driving for Pleasure
☐ Fishing
☐ Hiking
☐ Horseback Riding
☐ Hunting
☐ Motor Boating
☐ Mountain Biking
☐ Off-Road ATV / 4WD
☐ Picnic-ing
☐ River Rafting / Floating
☐ Road Biking
☐ Rock Climbing
☐ Sailing / Windsurfing
☐ Snowboarding
☐ Snowmobiling
☐ Snowshoeing
☐ Swimming
☐ Waterskiing
☐ Wildlife Viewing
☐ Other (Please Specify):
Question 3
How often do you engage in any of these activities?

- Once a week or more
- Once every other week
- Once every month
- Once every other month
- Once every three months
- Once every four months or less

Question 4
Do you ever engage in any of these activities on State Lands? (State Trust Lands are marked in blue on the Forest Service's ownership maps, and are different from lands belonging to Montana Fish, Wildlife and Parks.) Please check your answer.

- Yes
- No
- Don't Know

Question 5
A General Recreational Use License is required to recreate on State Trust Lands. Have you ever bought one of these in the past? Please check your answer.

- Yes
- No

Question 6
If no is your answer to question 5, what is the reason for you not buying a Recreational Use License? Please check your answer (If your answer to question 5 is yes, please proceed to question 7).

- Don't usually recreate on State Trust Lands
- Resent buying a permit
Think the license is too expensive
- Lack of enforcement makes buying a license unnecessary
- Not aware of the existence of the Recreational Use Licenses

Question 7
Have you ever been stopped by a Montana Game Warden while recreating on State Trust Lands? Please check your answer.
- Yes
- No

Question 8
If yes is your answer to question 7, did the Game Warden ask to see your *General Recreational Use License*? Please check your answer (If your answer to question 7 is no, continue to question 9).
- Yes
- No

Question 9
Do you ever buy any other permits in order to recreate? Please check all that apply.
- State Parks Use permit
- National Parks use permit
- Tribal Recreational Permit
- Golden Eagle Pass
- Fishing Licence
- Hunting Licence
- Other (please specify):

The following questions deal with forest aesthetics and your personal preferences. There are no right or wrong answers, as we are looking for *your* opinion.
Question 10
If your recreation area looked like the image below, would you buy a Recreational Use License? Please check your answer.

[Image No. 1]

○ Very likely
○ Likely
○ Indifferent
○ Unlikely
○ Very Unlikely

How much would you be willing to pay each year to keep your recreation area in this condition?

○ $3 or less
○ $5
○ $7
○ $10
○ $12
○ $15
○ $18 or more

Question 11
If your recreation area looked like the image below, would you buy a Recreational Use License? Please check your answer.
Very likely
Likely
Indifferent
Unlikely
Very Unlikely

How much would you be willing to pay each year to keep your recreation area in this condition?

$3 or less
$5
$7
$10
$12
$15
$18 or more

Question 12
If your recreation area looked like the image below, would you buy a Recreational Use License?
Please check your answer.
How much would you be willing to pay each year to keep your recreation area in this condition?

- $3 or less
- $5
- $7
- $10
- $12
- $15
- $18 or more

Question 13
If your recreation area looked like the image below, would you buy a Recreational Use License?
Please check your answer.
How much would you be willing to pay each year to keep your recreation area in this condition?

- $3 or less
- $5
- $7
- $10
- $12
- $15
- $18 or more

Question 14
If your recreation area looked like the image below, would you buy a Recreational Use License?
Please check your answer.
Image No. 5

- Very likely
- Likely
- Indifferent
- Unlikely
- Very Unlikely

How much would you be willing to pay each year to keep your recreation area in this condition?

- $3 or less
- $5
- $7
- $10
- $12
- $15
- $18 or more

Question 15
If your recreation area looked like the image below, would you buy a Recreational Use License?
Please check your answer.
How much would you be willing to pay each year to keep your recreation area in this condition?

- $3 or less
- $5
- $7
- $10
- $12
- $15
- $18 or more

The following section deals with various issues related to recreational habits.

Question 16
If you encountered logging activity while recreating, which of the following statements best reflects your reaction? Please check your answer.

- Leave immediately
- Leave when done recreating
- Not return in the future
- Return when logging activity is likely to be finished
- Not buy a State Lands recreational permit in the future
Buy a State Lands recreational permit next year, but avoid logged area
Want to pay less for a State Lands recreational permit, but still buy it
Feel cheated because of the logging
Feel indifferent towards the logging activity
Other (Please specify):

Question 17
Would your reaction in question 16 be more positive if evidence of the logging, such as skid marks, slash and machinery, had been removed?

Yes
No

Question 18
How long have you lived in your community?
Please give your answer rounded off to the nearest whole year:

Question 19
How would you characterize the community in which you live?

Rural
Small town
Suburban
Urban

Question 20
How would you characterize the community you lived in before this one?

I have never lived in a different community
Rural
Small town
Suburban
This section is about you. The questions may seem nosey to you, but for statistical purposes, it is necessary to form a picture of the population of Montana which is as accurate as possible. Please take some time to complete these questions as well, and remember that the survey is completely anonymous.

Question 21
Please indicate your age in years: 

Question 22
Please indicate your gender:

- Male
- Female

Question 23
Have you completed high school?

- Yes
- No

Question 24
How many years of education have you completed after high school?

Question 25
What is your primary occupation? (If you are retired, what used to be your main occupation?)

- Managerial or Professional Specialty
- Technical, Sales, or Administrative Support
- Service Occupations
Precision Production, Craft, or Repair
Operator, Fabricator, or Laborer
Farming/Ranching, Forestry or Fishing
Household Worker (House Spouse)
Student
Not Employed

Question 26
In which sector do you work?

- Manufacturing, Construction and Industry
- Restaurant, Lodging and Retail Trade
- Finance, Insurance and Real Estate
- Health Care
- Education and Science
- Government
- Tourism Sector
- Household Services
- Self-Employed
- Retired
- Not Working
- Other (Please Specify): __________________________

Question 27
How many people are living in your household?

- One
- Two
- Three
- Four
- Five or more
Question 28
How many of these people are children (under 18 years of age)?

- None
- One
- Two
- Three
- Four
- Five or more

Question 29
What is your marital status?

- Single
- Married
- Divorced
- Widowed
- Live-in relationship
- Choose not to respond

Question 30
What is your household's approximate annual income?

- Less than $6,000 per year
- $6,000 - $11,999 per year
- $12,000 - $17,999 per year
- $18,000 - $23,999 per year
- $24,000 - $29,999 per year
- $30,000 - $35,999 per year
- $36,000 - $41,999 per year
- $42,000 - $47,999 per year
- $48,000 - $53,999 per year
- $54,000 or more
Choose not to respond

Return to top of page

For questions email thales@selway.umt.edu
APPENDIX C:

COLOR PRINTS OF LANDSCAPE IMAGES
Clear-Cut Landscape, Near View

Clear-Cut Landscape, High View
Old-Growth, Near View

Old-Growth, High View
APPENDIX D: ON-SITE QUESTIONNAIRE
This study primarily seeks your opinion regarding the areas in which you choose to recreate. We feel that if people's preferences regarding forest conditions were known, it would be easier to manage State Lands for maximum benefit to you, the recreationist, and to the state. We greatly appreciate you taking the time to answer our questions. Thanks for your help!!

1. What is your home zip-code? __________

2. What kinds of recreational activities do you usually participate in? Please check all that apply.
   - Back-Packing
   - Berry picking
   - Camping
   - Canoeing / Kayaking
   - Cross-Country Skiing
   - Downhill Skiing
   - Driving for Pleasure
   - Fishing
   - Hiking
   - Horseback Riding
   - Hunting
   - Motor Boating
   - Mountain Biking
   - Nature Photography
   - Off-Road ATV / 4WD
   - Picnicking
   - River Rafting / Floating
   - Road Biking
   - Rock Climbing
   - Sailing / Windsurfing
   - Snowboarding
   - Snowmobiling
   - Snowshoeing
   - Swimming
   - Waterskiing
   - Wildlife Viewing
   - Other (please specify): ________________

3. How often do you engage in any of these activities? Please check your answer.
   - Once per week or more
   - Once every month
   - Once every other week
   - Once every two months
   - Once every three weeks
   - Once every three months or less

4. Do you ever recreate on State Lands? (State Trust Lands are marked in blue on the Forest Service's ownership maps, and are different from lands belonging to Montana Fish, Wildlife and Parks.)
   - Yes
   - No
   - Don't Know

5. Do you ever buy any of the following permits in order to recreate? Please check all that apply.
   - State Parks Use Permit
   - Tribal Recreational Permit
   - Fishing License
   - General Recreational Use License
   - National Parks Use Permit
   - Golden Eagle Pass
   - Hunting License
   - Other (please specify): ________________
6.  We are interested in your preferences regarding the areas in which you recreate. How would you like your favorite recreational area to look? Please look at our picture display and rate the likelihood of you paying to recreate in each of the pictured areas:

# 1  o Very Likely o Likely o Indifferent o Unlikely o Very Unlikely
# 2  o Very Likely o Likely o Indifferent o Unlikely o Very Unlikely
# 3  o Very Likely o Likely o Indifferent o Unlikely o Very Unlikely
# 4  o Very Likely o Likely o Indifferent o Unlikely o Very Unlikely
# 5  o Very Likely o Likely o Indifferent o Unlikely o Very Unlikely
# 6  o Very Likely o Likely o Indifferent o Unlikely o Very Unlikely

7.  For each picture, please indicate how much you would be willing to pay each year to recreate in the pictured area.

# 1  o $3 or less o $5 o $7 o $10 o $12 o $15 o $18 or more
# 2  o $3 or less o $5 o $7 o $10 o $12 o $15 o $18 or more
# 3  o $3 or less o $5 o $7 o $10 o $12 o $15 o $18 or more
# 4  o $3 or less o $5 o $7 o $10 o $12 o $15 o $18 or more
# 5  o $3 or less o $5 o $7 o $10 o $12 o $15 o $18 or more
# 6  o $3 or less o $5 o $7 o $10 o $12 o $15 o $18 or more

8.  How long have you lived in your community? _______ years

9.  How would you characterize your community?
   o Rural o Suburban
   o Small Town o Urban

10. How would you characterize the community you lived in before this one?
    o Rural o Suburban
    o Small Town o Urban
    o I have lived in my community all my life

11. Have you completed high school? o Yes o No

12. How many years of education have you completed after high school? _______ years

13. How many people are living in your household? _______ people

14. How many of these people are children (under 18 years of age)? _______ children

Please use the space below to offer any comments you may have regarding this questionnaire. Also, if you would like a copy of the results of this study mailed to you, please include your name and address. The results should be ready early next year.

Thank you for your time— we appreciate it!!
APPENDIX E:

ON-SITE COMMENTS
FROM UC QUESTIONNAIRES:

"State lands are public lands, and the ‘economic value’ of aesthetics is difficult to put into monetary value, especially from 1 dimensional pictures which give very little information about the biological composition of the place except % tree coverage and deciduous or coniferous forest. State lands should be ‘valued’ not only for the economics of recreation but the biological diversity of the place and how forest wealth effects everything (not just people) downstream."

“I support the timber + mining industries. Wilderness = no jobs!”

“I like wilderness. We need more and we need ZERO CUT and ZERO extraction on public lands.”

“I enjoy recreating outdoors. One of the things I would like to be able to do is walk through old growth Ponderosa stands with big trees (3ft in diameter) spaced 25ft apart. Wouldn’t that be something?”

FROM GART SPORTS QUESTIONNAIRE:

“Fires should be left to burn in the Mission Range.”

“My taxes pay my fees!!”

“I would like to see the state and federal land use permits dropped.”
APPENDIX F:
DEFINITION OF VARIABLES
ORIGINAL VARIABLES

LOC = location of survey (survey method)
ZIP = zip code
RECS = number of recreational activities respondent is engaged in
FREQ = frequency with which activities are engaged in
   52 = 52 times or more per year (one per week)
   26 = 26 times per year (once every other week)
   17 = 17 times per year (once every three weeks)
   12 = 12 times per year (once per month)
   6 = 6 times per year (once every other month)
   4 = 4 times or less per year (once every three months)
AREA = if the respondent recreates on State Trust Lands
   1=Yes
   2=No
   3=Don’t know
OPERM = number of other permits respondent has bought
CUTLOW = clear-cut, low view (likelihood of paying to recreate)
   1=likely
   2=indifferent
   3=unlikely
CUTHIGH = clear-cut, high view (same as above)
THINLOW = thinned, low view (same as above)
THINHIGH = thinned, high view (same as above)
OLDLOW = old-growth, low view (same as above)
OLDHIGH = old-growth, high view (same as above)
CUTLOW$ = clear-cut, low view (willingness to pay per year)
   1=$5 or less
   2=$7-$12
   3=$15 or more
CUTHIGH$ = clear-cut, high view (same as above)
THINLOW$ = thinned, low view (same as above)
THINHIGH$ = thinned, high view (same as above)
OLDLOW$ = old-growth, low view (same as above)
OLDHIGH$ = old-growth, high view (same as above)
YCC = number of years in current community
HS = finished high school
PHS = Post High School education (in years)
HHS = Household Size (number of people)
CIHH = Children in Household (number of children under 18)
*WHY = the reason for a respondent not buying a GRUL
*STOP = has respondent ever been stopped by a Game Warden while recreating
*GWCL = if stopped by a Warden, did he/she check for GRUL
*AGE = respondent’s age in years
*GEN = gender

*These variables are not available for on-site surveys
APPENDIX G:

DEMAND CURVES
X-axis: Number of permits sold
Y-axis: Permit Price
X-axis: Number of permits sold
Y-axis: Permit Price
X-axis: Number of permits sold
Y-axis: Permit Price
APPENDIX H:

SHAZAM PROGRAM
sample 1 534
read(a:alldata.dif) / names dif

stat wtp recs freq hhs cihh / anova pmedian

**Kitchen Sink Approach**
ols wtp view cutl cut2 uc web freq pos neg phs cihh hhs recs

**Modified Version**
ols wtp view cutl cut2 uc web hhs recs

**Adding Interactive Variables**
ols wtp view cutl cut2 intcutl intcut2 uc web hhs recs / resid=e
**Residuals are saved to be used for White's test**

**Generating variables for use in White's test**
gen e2=e*e
gen sqhhs=hhs*hhs
gen sqrecs=recs*recs
gen hrecs=hhs*recs

**White's Test**
ols e2 view cutl cut2 uc web hhs recs sqhhs sqrecs hrecs

**Heteroscedasticity Correction**
ols wtp view cutl cut2 intcutl intcut2 uc web hhs recs / het

**OLS with SITE variable**
ols wtp view cutl cut2 intcutl intcut2 site hhs recs / het

stopD