TECHNIQUES FOR ASSESSING EXTRAMARKET VALUES

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Central to effective policy development and management of natural resources is an understanding of the trade-offs stakeholders are willing to accept and the values they hold. Although market prices reflect society's preferences to some degree, they clearly do not encompass all values or costs. Conjoint techniques offer a means to estimate and analyze stakeholder preferences.

Introduction

Demands on the planet's resources are intensifying as the earth's population expands by an astounding 93 million annually (Postel 1994). Growth in the consumption of many resources exceeds population growth and per-capita consumption for many goods will continue to rise as countries like China and India industrialize and demand a bigger slice of the consumptive pie (Durning 1994). These trends have led to a host of environmental concerns: lost biodiversity, species extinction, global warming, reduced water availability and quality, and many others.

Paralleling increased demands for goods is a realization that quality of life depends on more than pure consumption. This is reflected in society's views about how resources should be managed and is evident, for example, in the USDA Forest Service's emphasis on ecosystem management. Society is demanding more preservation, more environmental protection, and enhanced management for aesthetics, biodiversity, and wildlife habitats, but we also want to consume and recreate more. In short, we want more of everything from a shrinking resource.

Difficult choices must be made. Decision-makers need guidelines for determining the optimal way to allocate increasingly scarce resources. In a capitalistic society we generally look first to the market place to help allocate resources. Markets work to allocate some goods efficiently but fail dismally for others. There are many examples where markets fail to provide the appropriate allocation signals (prices). Two types of market failures that are of concern to resource managers have to do with the public good or common property nature of forest-related benefits and the presence of externalities. Both interfere with the ability of the price system to allocate resources efficiently. The nonexclusive or common nature of public goods (e.g., the air or water purifying benefits of forest ecosystems) provides an incentive for individuals to "free ride" by refusing to pay with the hope that others will provide this benefit. Externalities refer to interactions among firms or individuals that are not fully reflected in market prices. For example, damage to water quality, scenic vistas, wildlife habitats, or lost biodiversity are costs to society that are not fully accounted for in the market price of timber or recreation. There are many other examples of externalities that, in general, refer to costs or benefits that are not fully reflected in market transactions. The presence of market failures has been a strong argument in favor of public ownership of forest land. Public ownership effectively removes land from direct response to market signals.

When markets fail to provide the appropriate signals, there may be no clear guidelines for managers and they become caught in a lose-lose situation. No matter what they do, they fail to meet the expectations or desires of special interest groups and certain publics. This situation often leads to expensive and time-consuming litigation. Managers seek a systematic and rational means to analyze decisions that involve a wide range of biophysical, financial, social, and moral variables.

Central to effective policy development and decision-making is an understanding of the trade-offs stakeholders are willing to accept and the values they hold. Society has expressed that nonmarket benefits and costs are important and must be considered. A means is needed to translate society's preferences into meaningful goals and guidelines for decision-makers to follow. Conjoint techniques offer a tool for increasing our insight in this area.

Conjoint Analysis

Conjoint analysis, a technique used to measure psychological judgments, is frequently used in marketing studies to measure consumer preferences (Green et al. 1988). Respondents are asked to make choices between alternate products or scenarios with varying levels of selected attributes. For example, in a typical marketing application, an automobile manufacturer might be interested in consumer's preferences for certain features or attributes. The manufacturer may want to examine prospective consumers' willingness to accept decreased gas mileage for increased cargo space or their preferences for reduced prices or increased warranty length. Prospective consumers could be asked to choose between or rank their preferences for vehicles with various combinations of cargo capacity, gas mileage, warranty length, price, and other attributes of interest.

These data, which outline a respondent's preferences or the trade-offs he or she is willing to make, can be used to construct a predicted set of utilities for various factor or attribute combinations. Although the respondent evaluates complete bundles of attributes, conjoint techniques can be used to solve for the partial utility function for each attribute that is imputed from the overall trade-offs. These partial utilities can be combined to estimate any combination of interest, thus providing high leverage between the options actually evaluated and those that can be evaluated after the analysis.

A simplified hypothetical example will be used to illustrate the potential usefulness of conjoint techniques to resource or recreation managers. Suppose we are interested in managing a site for bird watching. Through discussions with experts, user surveys, or focus groups we might discover that the following attributes are important to bird watchers:

- total number of observations (birds);
- number of different species;
- condition of the understory;
- presence of interpretive information on the site.

We assume that one's bird watching experience is affected by both the number and diversity of observations, the presence of interpretive information, and the condition of the understory. Aesthetics, visibility, and perhaps the number and diversity of birds in the area could be influenced by management of the understory. We also assume that our preliminary work indicates that the following categorical breakdowns are meaningful:

Birds	Species	Understory	Interpretive
0 to 10	2 or less	Open	No
11 to 20	3 to 5	Moderate	Yes
21 to 30	6 or more	Dense	
31 or more			

There are many ways to collect the needed data (e.g., interview, focus group, and mail survey). Sample cards might be prepared, each card depicting a specific bundle of attribute levels. Each bundle of attributes might represent the outcome of a particular management strategy. Respondents could be asked to choose between pairs of sample cards, rank the cards in order of preference, or assign numerical ratings to each card. Obviously, numerical ratings provide the most information but also place the greatest cognitive demands on respondents. The analyst must consider the overall situation carefully when selecting a sampling technique and choosing the combinations of attribute levels to include on the sample cards. Green (1974) provides information on experimental design in the context of conjoint analysis.

In this example we assume that respondents were asked to give each of 18 sample cards a numerical rating from 1 to 10. Figure 1 shows 3 of the 18 sample cards. Multiple regression using dummy variable coding generally is used to estimate the part-worth or partial utility functions, which may be depicted graphically as in Figure 2. The part-worth functions can be used to estimate ratings for any combination of attribute levels. This provides high leverage between the data actually collected (18 different combinations of attributes) and those for which estimates can be developed (72 possible combinations in this example).

Card A	Card B	Card C
Birds: 11 to 20	**Birds:** 11 to 20	**Birds:** 31 or More
Species: 2 or Less	**Species:** 6 or More	**Species:** 3-5
Understory: Moderate	**Understory:** Open	**Understory:** Dense
Interpretive: No	**Interpretive:** Yes	**Interpretive:** No
Rating:_____	**Rating:**_____	**Rating:**_____

Figure 1. Sample cards.

For illustrative purposes, the estimated rating values for sample cards A and B in Figure 1 are calculated using the part-worth functions depicted in Figure 2 (see next page).

Card A values		Card B values	
11 to 20 birds	= 1.2	11 to 20 birds	= 1.2
Less than 2 species	= 0.0	6 or more species	= 2.0
Moderate understory	= 1.3	Open understory	= 1.5
No interpretive signs	= 0.0	Interpretive signs	= 0.7
Total estimated rating	= 2.5	Total estimated rating	= 5.4

Similar calculations can be performed to estimate the rating (preference) for any combination of attributes. Marginal rates of substitution among attributes or the trade-offs respondents are willing to make also can be calculated under various scenarios.

Researchers or managers may want to study the relationships between preferences and demographic or other background information on respondents. This is done by creating a matrix of attribute part-worths and demographic or sociological variables by respondent. These estimated relationships may be useful in forecasting the effects of demographic trends on future preferences and in understanding the preferences of various user groups. These types of analyses are somewhat analogous to identification of market segments in studies of consumer preferences.

The example cited illustrates the use of conjoint techniques to analyze preferences for various ways to meet a single objective (bird watching). Managers frequently must decide how to allocate funds or land areas to meet multiple and often conflicting objectives. Scientifically based recommendations or expert opinion may provide guidance in determining how and what land to manage to meet specific objectives, but determining the relative importance of objectives rests on human values. Although the analyses are more complex, conjoint techniques can be used to estimate preferences among objectives (e.g., bird watching, developed recreation, various wildlife habitats, and timber management). Results of these analyses provide estimates of the costs or trade-offs in terms of other objectives implied by the choices of the sample respondents.

Conjoint techniques also provide a viable means for collecting and analyzing public input. Respondents may be asked to express their preferences with respect to specific objectives and land areas, or with respect to more general value or allocational decisions. For example, Opaluch et al. (1993) described an approach that used paired comparisons to rank potential noxious facility sites in terms of their social impacts. Conjoint analyses are particularly useful in providing respondents with feedback concerning the acceptable trade-offs and values that their choices imply.

Summary

Difficult choices, often involving conflicting uses, must be made by resource and recreation managers. Biophysical information and technical expertise alone is not sufficient for choosing among alternative management strategies. Human wants, needs, beliefs, and values must be considered. Conjoint techniques are well suited for estimating and analyzing human preferences and values. Marginal rates of substitution or the trade-offs people are willing to accept among competing uses can be estimated and used to facilitate decision-making. Estimates of partial utilities that are implied by the respondent's choices can be used to estimate the effectiveness of various management or land allocation strategies. Conjoint techniques also provide a mechanism for collecting input from stakeholders, as required on National Forests and many other public lands.

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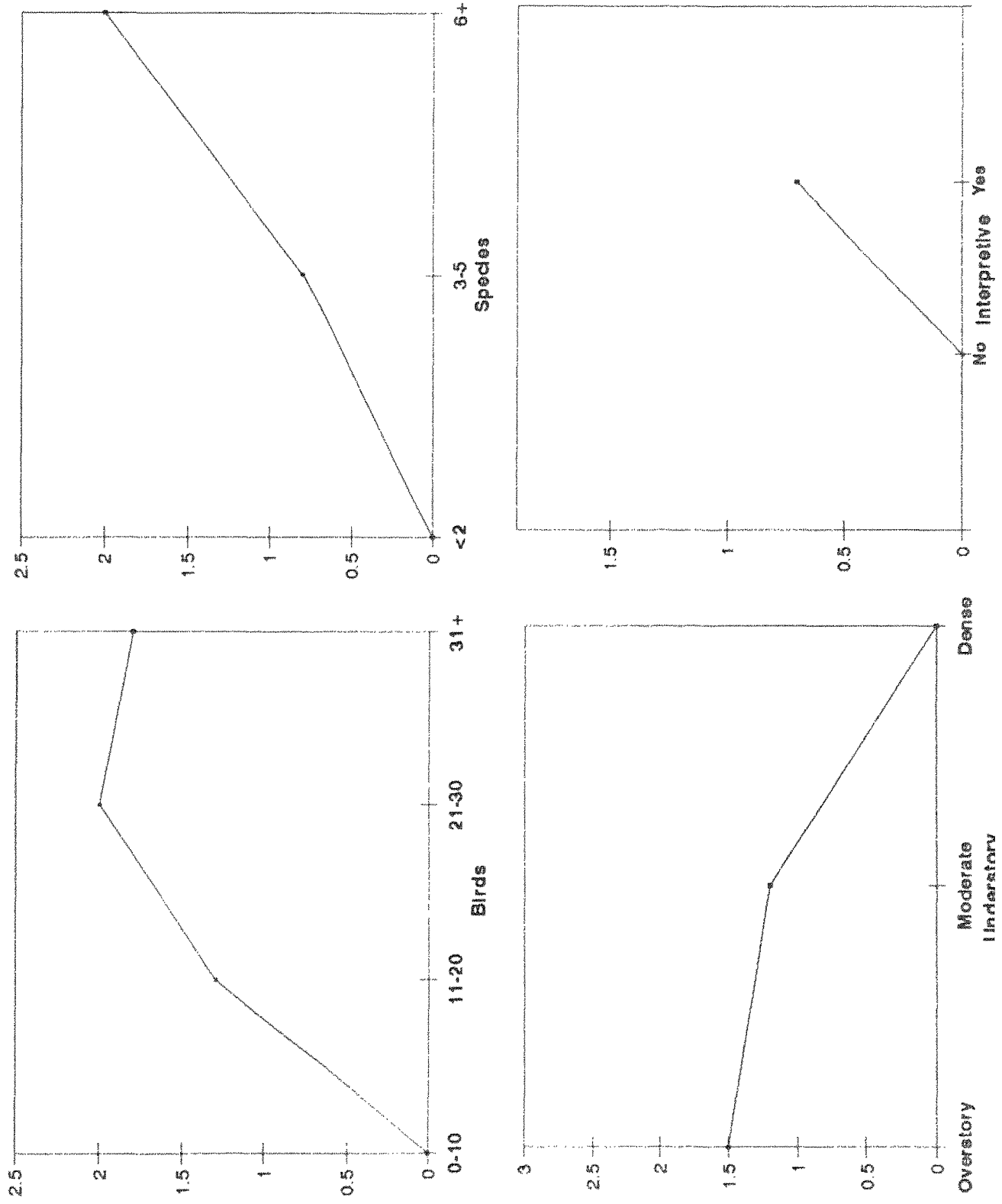

Figure 2. Part-worth functions.