SURVEY TECHNIQUES FOR ASSESSING PUBLIC PREFERENCES FOR ALTERNATE SILVICULTURAL TREATMENTS IN THE ADIRONDACKS

Donald F. Dennis
Research Forester,
USDA Forest Service
Northeastern Research Station
P.O. Box 968,
Burlington, VT 05402
dondennis@fs.fed.us

Mark J. Twery
Research Forester, USDA Forest Service
Northeastern Research Station

Michael A. Rechlin
Principia College

Bruce Hansen
Economist
USDA Forest Service
Northeastern Research Station

Abstract

Forest management that includes timber harvesting is sometimes controversial. Silvicultural prescriptions influence stand appearance, wildlife habitats, and recreational opportunities, as well as timber characteristics. We used a conjoint ranking survey, a form of stated choice modeling, to assess public preferences and acceptable tradeoffs with respect to silvicultural treatments to be applied on private lands in the Adirondacks. A series of demographic and attitudinal questions also were completed by respondents, enabling us to examine how preferences for silvicultural treatments and the resulting benefits vary by respondent category. Survey procedures, statistical methods, and techniques for segmenting respondents by their preference structures will be discussed. Results will provide insight into public views on landowner and societal rights and responsibilities regarding private lands as well as the relative values and preferences for alternative silvicultural treatments on privately owned forests.

1.0 Introduction

Nearly three-quarters of the northeastern forest is held by a diverse array of nonindustrial private forest landowners (USDA Forest Service 1988, 1995). The extent of these holdings makes obvious their potential importance in meeting society's needs for timber, outdoor recreation, wildlife habitats, aesthetics, biodiversity, and other benefits that forests offer. Selection of a method for harvesting timber and regenerating a new forest has a profound effect on the appearance of the landscape as well as the mix of forest-related benefits to be provided.

The primary focus of most prior research has been on the perspectives of individual forest landowners regarding their attitudes toward timber harvesting, forest management, and the benefits that they derive from their land. In this study we examine broader public perspectives toward private lands, specifically, public preferences for various silvicultural techniques used to harvest timber, change habitat conditions for wildlife, and regenerate a new forest. Public perspectives are important because the public has an increasing role and interest in the management of private lands. Public funding, such as tax incentives, direct cost sharing, and provision of technical help, frequently is used to pay for programs to promote forest management on private lands. The public also considers regulations and taxes designed to influence the method and extent of harvesting on private forests.

To gain insight into public perspectives concerning forestry practices on private lands, we administered a conjoint ranking survey and a series of attitudinal questions to visitors at the Adirondack Visitor Interpretive Center located in Paul Smiths, New York. The survey focused on public preferences for regeneration treatments as parts of four alternative silvicultural systems: single tree selection, two-aged management, shelterwood management, and clearcutting.

2.0 Methods

2.1 Analytical

Conjoint analysis, a form of stated choice modeling, is a technique for measuring psychological judgments that is used frequently in marketing research to measure consumer preferences (Green et al. 1988). Respondents choose between alternative products or scenarios that display varying levels of selected attributes. The utility of each attribute can be inferred from the respondent's overall evaluations. These partial utilities or part worths indicate the relative importance of each attribute's contribution to overall preference or utility. They can be combined to estimate relative preferences for any combination of attribute levels. Conjoint techniques are

well suited for soliciting and analyzing preferences in environmental decisions that frequently entail tradeoffs between costs and benefits that are not represented efficiently in market transactions.

A random utility model is used to explain public preferences toward the use of different silvicultural treatments on varying portions of the landscape. When presented with a set of alternatives, individuals are assumed to make choices that maximize their utility or satisfaction. The utility that the ith individual derives from the jth alternative (Uij) can be represented as:

$$U_{ij} = X'_{ij} + e_{ij} \quad (1)$$

where Xij is a vector of variables, which may include transformations of variables, that represent values for each of the four attributes (silvicultural treatments) of the jth alternative to the ith individual; is a vector of unknown parameters; and eij is a random disturbance, which may reflect unobserved attributes of the alternatives, random choice behavior, or measurement error. In the empirical study under consideration, a respondent's utility level (Uij) for each alternative is not observed, but a ranking (rj) is observed that is assumed to proxy for his or her underlying utility. McKelvey and Zavoina (1975) developed a polychotomous probit model to analyze ordinal level dependent variables.

Following McKenzie (1990, 1993) and others, the analytical capabilities of the conjoint ranking model can be illustrated by assuming that ranking (rj) can be modeled as a linear combination of the variables representing the attribute levels. Quadratic terms can be included to examine nonlinear relationships among the variables (increasing or decreasing marginal returns). Although quadratic terms are often important, they are not included here to simplify the presentation and interpretation. Nonlinear relationships will be examined in the final analyses.

$$r_j = a + b_1x_{1j} + b_2x_{2j} + \ldots + b_nx_{nj} \quad (2)$$

The estimated partial utilities are the linear effects (bn's) of a discreet change in the level of the associated attribute on overall preference (n references attributes). Relative overall preference for any alternative (combination of attribute levels) can be determined by summing across Equation 2.

ALTERNATIVE # (1-9)	
PORTION OF LANDSCAPE:	
CLEARCUTTING	NONE, 5%, 10%
SHELTERWOOD	NONE, 5%, 10%
2-AGED	NONE, 10%, 20%
SELECTION	NONE, 20%, 40%
RANK ? (1-9)	

Figure 1.—Sample card layout for the conjoint ranking survey.

The marginal rate of substitution (MRS) is the rate at which an individual is willing to trade one good for another while remaining equally well off (Nicholson 1978). The MRS, or acceptable tradeoff of one attribute for another, is determined by the ratio of the marginal responses. Setting the total differential of (2) to the point of indifference and solving yields the marginal rates of substitution or the acceptable tradeoffs for the respective attributes:

$$dr_j = b_1dx_{1j} + b_2dx_{2j} + \ldots + b_ndx_{nj} = 0 \quad (3)$$

$$dx_{1j} / dx_{2j} = - b_2 / b_1$$

2.2 Survey

Surveys were conducted in person at the Adirondack Visitor Interpretive Center in Paul Smiths, NY. Each respondent was asked to rank nine alternative scenarios depicting varying levels in the proportion of the landscape in which the different cutting treatments might be noticeable at any time. The range of each variable was determined by estimates of how long a treatment would remain visible, how often a system required application of a treatment, an estimated 100-year rotation for mature trees, and a maximum of half the forested lands under management. About 50 percent of the forested land in the Adirondacks is publicly owned and does not receive active forest management. Each alternative was displayed on a sample card that contained a different mix of the levels for the four attributes depicted in Figure 1. Only one level of each attribute was presented in a single alternative. An orthogonal sample design was used to select the particular levels to be included on each card to allow estimation over the entire range of alternatives (34 = 81) with the minimum number of ranked alternatives. Respondents also completed a series of attitudinal questions using a 5-point Likert scale (strongly agree/agree/neutral/disagree/strongly disagree) and a brief demographic survey.

The orthogonal design also allows estimation of partial utilities for each respondent, thus outlining each respondent's preference structure. A clustering procedure can then be used to segment respondents into groups that have similar preferences. The groups or segments can then be compared and contrasted with respect to demographic and attitudinal information.

3.0 Demonstration Area

Before completing the surveys, respondents took a guided walking tour of demonstration sites that show the effects of different silvicultural treatments on timber growth and quality, wildlife habitats, aesthetics, and recreational opportunities. These topics were discussed during the tour. Upon returning to the visitor center, respondents were provided with an explanation of the purpose and form of the conjoint survey and were given an opportunity to ask questions or discuss any portion of the survey or tour. The walking tour and survey took approximately 60 minutes and 20 minutes to complete, respectively.

The demonstration area was implemented entirely within a large northern hardwood stand that had not had any cutting treatments for approximately 30 years. The area included two control sites (5 acres each) where no cutting took place and natural tree death and replacement can be witnessed. The demonstration area and tour also included five sites (5 acres each) where silvicultural treatments were applied. On the single tree selection site about one-third of the mature trees were cut. Scattered trees were cut so that no large openings exist. This type of cutting is designed to provide timber products at approximately 20-year intervals and to increase or maintain shade-tolerant species such as sugar maple, hemlock, and beech. Trees of all sizes and ages are maintained providing habitat for forest interior bird species. About one-third of the trees also were cut on the group selection site but the cutting was concentrated in small groups to provide light to the forest floor. This allows some additional tree species to prosper. On the two-aged site, most trees larger than 10 inches in diameter were cut to create a new stand with two age classes approximately 50 years apart. This treatment creates a new, less crowded forest with medium sized trees and many seedlings. The cut was distributed evenly to provide light to the ground and promote new growth. This system is designed to provide timber products at 50-year intervals and to maintain current forest composition. On the shelterwood site, 60-70 percent of the basal area was cut from the middle of the diameter distribution. The residual large trees are well distributed and provide seed, shade, and protection for new seedlings. The remaining canopy trees may be removed in 10-20 years. The purpose is to create a new forest mixed with light-loving species such as yellow birch and cherry, as well as maple and spruce. This treatment creates habitat for birds that require open areas but maintains enough large trees to keep the look of a forest until the new trees are well established. Deer browse and berries increase but some shade is maintained to protect forest interior ground plants. All trees were cut on the clearcut site to create an even-aged forest of light-loving trees. The stand is converted to predominantly shade intolerant species such as white birch, aspen, and cherry. Deer browse and berries are greatly increased and the area provides habitat for birds requiring open areas. There is one major disturbance per 100 years in both the shelterwood and clearcut treatments.

4.0 Results and Discussion

Although the conjoint data has not been fully analyzed, some descriptive statistics and preliminary data can be reported. Three hundred and seventy-three respondents completed the surveys. This included students enrolled in several introductory forestry classes from nearby Paul Smith's College. Eighty percent of the respondents were male and nearly 75 percent were younger than 30 years. Thirty-eight percent of the respondents owned some forest land; 13 percent were raised in a large city and 8 percent currently live in a large city.

While this sample is not representative of the public at large, primarily due to the rural location of the survey, inclusion of college students, and possible self selectivity of those choosing to participate, we believe it will provide useful information. As mentioned previously, the orthogonal sample design allows estimation of partial utilities or preference structures for each respondent. These may be segmented by demographic profile to identify and analyze differences in the preferences for various segments of the sample.

Several interesting results emerged from analyzing responses to the attitudinal questions. Most respondents (85%) strongly agreed or agreed that the availability of forest recreation is important to society, and 82 percent believe landowners should be permitted to restrict access to their land. However, only 48 percent believe

landowners should be given incentives to allow public recreation on their land.

Most respondents (90%) also strongly agreed or agreed that rare or threatened species should be protected and 77 percent believe that landowners should be given incentives to enhance wildlife habitats on their lands. Nearly 60 percent agreed that keeping land in forest was important and would vote to give tax relief to landowners who agree not to develop their land.

Nearly half of the respondents believe landowners should be permitted to do as they please with their land, but 88 percent disagreed with the statement "Society has no responsibility to provide healthy forests for future generations". About half of the respondents agreed that land should provide an economic return to cover expenses associated with ownership, though many believe too much emphasis is placed on economics in land-use decisions. Most respondents agreed that both ecology and economics should be considered along with the needs of future generations.

Nearly 90 percent of the respondents agreed that wood products are important to society, but only about 40 percent agreed with separate statements indicating that either public or private lands should be a source for wood products. Seventy-two percent agreed that landowners should be able to earn a profit from their land.

5.0 Citations

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