

# APPLICATION OF PAIRED COMPARISON METHODOLOGY IN MEASURING CANADIANS' FOREST VALUES

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## INTRODUCTION

The evolution of the environmental movement in the latter half of the 20th century has been in large measure a result of growing public concerns about the impacts of industrialization, and its increasing pressure on both human health and physical ecosystems. Today, decision-makers must give careful consideration to public priorities and values in addressing environmental issues, and balancing them with economic and social pressures. Industries can no longer extract resources and discharge untreated waste without regulatory oversight, governments are under increasing pressure to tighten up and enforce environmental standards, while consumers are increasingly facing their own responsibility for environmental problems. An environmental ethic has taken root in our society, but its position vis a vis other social values with which they come into conflict (e.g. economic) remains to be resolved.

Social research has played a role in the emergence of environmental values in North America, in providing a means of identifying this trend in the population-at-large, understanding its social dynamics, and documenting its evolution. Over the past 20 years, in-depth studies and broad-based public opinion polls documenting consistent and broad-based public support for stronger environmental protection have been a catalyst in the development of new legislation, institutions and a better understanding of our collective values.

One area in which social science has yet to make a substantive contribution is in gauging the relative priority which citizens place on different priorities, or values, as they relate to the use and management of cherished natural resources; values which often conflict. Important natural resources, such as old growth forests or marine estuaries, provide a multitude of benefits - environmental, economic, recreational - but these are often in conflict, if not incompatible. Societal values, of course, are difficult to measure. Social surveys are highly effective in measuring opinions, perceptions and attitudes, but are not well suited to obtaining accurate discriminations among positive attributes, such as broad social values. The central problem is one of establishing a clear

measure of the relative priority which individuals place on what they value in their region's natural resources, all of which may be important, but which often times also conflict with one another.

This paper presents a study which addressed the measurement of environmental values through an innovative application of an old methodology (paired comparison scaling), to gauge the relative priority which Canadians place on their forest resources. The paper discusses the application of the techniques for measuring forest values, provides an overview of the results of the study, and discusses the strengths and limitations of this method for future applications.

## STUDY DESIGN

The method of paired comparison is a form of psychometric scaling which yields ratio-level ordering of items along a given dimension (e.g. preference, importance), based on a series of independent judgements made between all possible pairs of items. For instance, in developing a scale of preference among five brands of a specific product, consumers might be presented with each pair of these brands (10 pairs in all) in some specified (or random) order, from which an overall rating of brand preference could be derived.

Paired comparison scaling was first developed in the late 1920s as one of several psychometric scaling methods developed by psychologists to evaluate psychological phenomena (e.g. attitudes, preferences) for which there was no physical stimuli on which to base measurement (cf. Guilford, 1928, 1954). These methods had their origin in psychophysics, but were gradually incorporated into broader applications in experimental and social psychology. The value of paired comparison scaling is that it produces results which are statistically robust (being based on a series of judgements, and yielding ratio-level data) and conceptually meaningful.

While paired comparison methods have not been used in public opinion studies, this technique was identified as a potentially effective means of addressing a particular challenge facing a study being conducted of forest values in Canada. In 1991, the Canadian Department of Forestry (Forestry Canada) commissioned a national public opinion study to assess the relative importance which Canadians place on different forest values, such as those involving

economic, recreational and environmental benefits. Canada's forests have always played a vital role in the development, prosperity and identity of the country, but in recent years the purpose and use of these forest resources have become significant and contentious issues, reflecting fundamental conflicts among underlying "values", often pitting economic livelihood against wilderness preservation.

Paired comparison methods were considered a potentially effective means of obtaining a clear discrimination among importantly-held forest values, because the data would be based on a series of specific comparisons which respondents would be asked to make between pairs of values, rather than on single rating or ranking of items. The values used in this study consisted of six broadly-defined values, or types of benefits, which Canadians attach to their forests.

Initially, consideration was given to using focus group research to develop the value statements to be used in the survey, although this was not possible because of practical constraints. Instead, the values were developed based on another recently-completed project, which included discussions on the topic of forest values among various stakeholder groups. On the basis of this information, and extensive discussions with professionals in Forestry Canada, a set of six forest values was developed, representing both traditional timber values, as well as recreational values and the emerging environmental values. These values were defined as follows:

- A place for recreation and relaxation
- A source of economic wealth and jobs<sup>1</sup>
- As a habitat for a variety of animal and plant life
- Balancing the global ecosystem
- Protection of Canada's water, air and soil
- Wilderness preservation

These values were incorporated into a broader survey of forest issues, placed near the front of the questionnaire. The six values were first read to respondents, who were then presented with all 15 of the different possible pairs of these values (in randomized order), and asked in each case to indicate which value in the pair they considered to be more important to them personally. This questionnaire was carefully pre-tested (n=30) before being finalized, in order to ensure the questions and terms were comprehensible to respondents.

The questionnaire was administered by telephone in English and French by professional survey research companies from three locations across Canada. The sample for the study consisted of 2,510 Canadians, 18 years of age or older, from households randomly

selected using the Waksburg-Mitofsky method. Respondents were selected using the "next birthday" method. The data were collected between November 12 and December 2, 1991.

## ANALYSIS AND RESULTS

The responses on value importance were analyzed in a straight-forward fashion by examining a matrix of preferences and calculating an arithmetic average of the preference for each value across all other values with which it was paired. While this is somewhat different from the classical approach to paired comparison scaling, it was decided in this case to use the average preference scores because their origin was more intuitively obvious, which was an important consideration given the broad audience who would be using these data. Moreover, scaling the scores would have not produced different results.

The results showed a clear ordering of forest values within the Canadian population. This ordering was internally consistent to the extent that similar values were given similar ratings. As well, the results were consistent with other data (on this survey and on others) reflecting the importance placed on environmental issues (contrary to the views of those who think environmental values are highly placed only in good economic times).

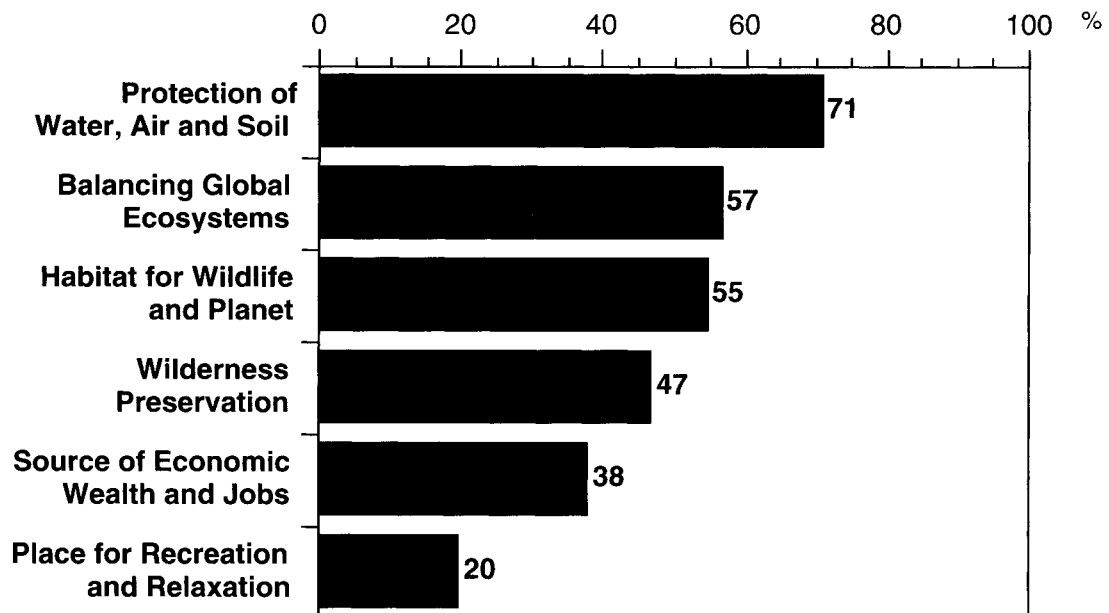
A more formal test of transitivity was conducted to assess the consistency of response. The test examined cases where Value "A" was judged more important than Value "B" and Value "B" was judged more important than Value "C", and then measured the frequency with which the same respondent also judged Value "A" to also be more important than Value "C". In 84 percent of the cases, the results were consistent.

The data show that Canadians place the greatest importance on the forest value of protecting the country's water, air, and soil. Next most important are those values pertaining to the role of the forests in maintaining ecosystems, including the balancing of global ecosystems, providing habitat for animal and plant life, and wilderness preservation. Forests are less likely to be valued as a source of economic wealth and jobs, while the least importance is placed on providing a place for recreation and relaxation.

While the overall results are largely as predicted, the differences across sub-groups are surprisingly small. Despite substantial variation across Canada in terms of the presence of forest lands and the role of the forest industry, the overall rank order importance of these forest values is essentially the same across all regions of the country, as well as across demographic and lifestyle characteristics of Canadians.

Some differences do occur, however, in the scores

# Importance Placed on Forest Values



of importance themselves. For instance, forests as a source of economic wealth and jobs is more highly valued in Atlantic Canada and Quebec, while lowest in the Prairie provinces. Nevertheless, this value remains only fourth or fifth in rank order of importance in all provinces, except Newfoundland (where it is the second most important value behind environmental protection), which is by far the most economically-depressed province in the country.

Given the economic importance of the forest industry to certain regions, and taking into account the current economic pressures of the recession, it is notable that the economic value of forests did not score higher. Particularly in British Columbia, where battles between the forest industry and environmentalists have been legendary, it is surprising to see so little polarization of forest values among the general public.

Some variation in value importance is seen across other demographic variables, such as age: older Canadians (55 years plus) are more likely to place priority on economic values, while less apt to emphasize the ecological values of wildlife habitat and wilderness preservation (although forests as an economic resource remains only fourth in importance within this age group).

As might be expected, the importance which Canadians place on forests as a place for recreation

and relaxation increases with the frequency of outdoor recreational pursuits, such as hunting, fishing, camping, and hiking. The importance placed on wilderness preservation also increases among those who frequently use forests for recreation (with the exception of active hunters, who place much lower importance on this forest value).

The size of the community in which Canadians live is not highly correlated with the values they place on forests. The overall rank order importance of the six forest values is essentially the same among urban and rural Canadians. The importance of wilderness preservation is greater, however, among residents of Canada's major urban centres than among those living in the smallest communities and rural areas.

## DISCUSSION

Apart from providing a clear picture of the relative priority which Canadians place on the value of their forests, the results of this study indicate that paired comparison scaling techniques can effectively be adapted to telephone survey applications, and provide conceptually meaningful ordering of values on a scale of importance. As a new application, several noteworthy lessons can be drawn from this experience.

From a methodological perspective, the most notable aspect of this study is that respondents had no difficulty in understanding and responding to the

values questions over the telephone, despite the redundancy in covering a small set of rather broad terms in 15 separate comparisons. What is also noteworthy is that most respondents appeared to have no difficulty in providing judgements about which value in each pair they considered to be more important; for each pair no more than five percent were unable or unwilling to make a choice. These results indicate that the technique of presenting respondents with only two choices is an effective means of obtaining judgements which might be more difficult to make using another format.

As important, the results on value importance were internally consistent and conceptually meaningful, indicating that respondents were making judgements based on a clear sense of what they consider to be most important, rather than responding in an erratic or inconsistent fashion. This provides further evidence that the questions were understood, and that the overall results reflect a true ordering of the relative importance which Canadians place on the benefits derived from their forests.

Similarly, the results proved to be valuable in addressing Forestry Canada's need to identify the relative importance which Canadians place on their forests, as important input in making policy and program decisions affecting the management of forest lands across the country. The results were helpful, in part, because they provided decision-makers with a clear ordering of the six values (providing both an overall rank order of the values, and an indication of the intervals separating them) that was conceptually consistent (e.g. the two environmental values are ranked 1-4) and intuitively valid. What helped enhance decision-makers acceptance of these results was the fact that the analysis was relatively simple (without substantial manipulation or rescaling) and the results were presented on a 100 point scale with which those unfamiliar with research could easily understand and feel comfortable.

While this application of paired comparison techniques was successful, the experience also indicates some limitations in how the technique might be applied in the future. First, there is clearly a limit in the number of items which can be judged, particularly if being used as part of a telephone survey. The use of six items in the forest values survey - which requires the presentation of 15 pairs - is probably the limit; adding a seventh item would require 21 pairs, which likely would be too many. The use of more than six pairs may be possible if each respondent is only given a specified subset of the possible pairs, so that all pairs would be adequately covered across the sample. Although this approach

has been discussed in the research literature, its applicability to field surveys remains to be tested and validated.

Second, there may also be limits in the type of items that would effectively lend themselves to be rated through paired comparison techniques. The best applications are likely those which consist of items which can be succinctly described, readily understandable to respondents, and which can be clearly distinguished from one another while at the same time being clearly comparable. The items must go together as a set, so that the comparisons have some real meaning to respondents.

Finally, the cost and space constraints of most survey research projects are likely to be limiting factors in using paired comparison techniques, which require a lengthy series of questions to address a specific issue. This technique may be best suited to those applications in which a strong case can be made to clients or sponsors that such an investment in research "space" is warranted.

In conclusion, the study reported in this paper has taken the first step in exploring a promising approach to measurement in survey research that offers a valuable alternative to more conventional methods of measuring preferences and importance. But it is not by any means the final word. Further applications of paired comparison techniques are needed (e.g. addressing different topics), in order to refine the techniques and more clearly identify where they can and cannot provide an effective tool for making discriminations between items and obtaining measures of importance.

## NOTES

<sup>1</sup>In Canada, where the economy has a substantial public sector component, the connotation of "economic wealth" is more societal than personal, and is more similar to the idea of economic prosperity for all than the personal or private wealth of individuals.

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