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THE EFFECT OF PERCEIVED CONFLICT ON EVALUATIONS OF
NATURAL RESOURCE MANAGEMENT GOALS

The University of Arizona

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THE EFFECT OF PERCEIVED CONFLICT ON EVALUATIONS
OF NATURAL RESOURCE MANAGEMENT GOALS

by
Herbert Waldemar Schroeder

A Dissertation Submitted to the Faculty of the
DEPARTMENT OF PSYCHOLOGY
In Partial Fulfillment of the Requirements
For the Degree of
DOCTOR OF PHILOSOPHY
In the Graduate College
THE UNIVERSITY OF ARIZONA

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THE UNIVERSITY OF ARIZONA
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As members of the Final Examination Committee, we certify that we have read
the dissertation prepared by Herbert Waldemar Schroeder

entitled The Effect of Perceived Conflict on Evaluations of
Natural Resource Management Goals

and recommend that it be accepted as fulfilling the dissertation requirement
for the Degree of Doctor of Philosophy.

April 16, 1980
Date

April 16, 1980
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TABLE OF CONTENTS

	Page
LIST OF TABLES	v
LIST OF ILLUSTRATIONS	vi
ABSTRACT	vii
INTRODUCTION	1
METHOD	11
RESULTS	15
Analysis of Conflict Ratings	15
Analysis of Importance Ratings	19
Follow-up Questions	40
DISCUSSION	49
CONCLUSIONS	57
APPENDIX A: QUESTIONNAIRE	59
APPENDIX B: MEAN CONFLICT AND IMPORTANCE RATINGS	77
APPENDIX C: MULTI-DIMENSIONAL SCALING OF CONFLICT RATINGS	81
LIST OF REFERENCES	86

LIST OF TABLES

Table	Page
1. Mean Conflict Ratings Averaged Across All Groups	18
2. Correlations Between Importance Ratings	20
3. Fisher's r-to-z Transformation of Changes in Correlation Coefficients from High to Low Conflict Conditions	22
4. ANOVA of Importance Ratings	24
5. ANOVA of Importance Ratings with Wilderness Attitude Groups	28
6. Proportion of Sample Variance (Eta square) of Importance Ratings Explained by Effects	33
7. Frequency With Which Goals Were Selected as Most Important	42
8. Frequency With Which Goals Were Selected as Least Important	42
9. Frequency With Which Pairs of Goals Were Selected as Having the Highest Conflict	43
10. Frequency of Responses to Attitude Questions	44

LIST OF ILLUSTRATIONS

Figure	Page
1. Goal Importance Ratings	25
2. Goal Importance Ratings for the High-Wilderness Group	29
3. Goal Importance Ratings for the Low-Wilderness Group	30
4. Importance Ratings for the Wilderness Goal	34
5. Importance Ratings for the Wildlife Goal	35
6. Importance Ratings for the Scenic Beauty Goal	36
7. Importance Ratings for the Timber Goal	37
8. Importance Ratings for the Local Employment Goal	38
9. Importance Ratings for the Water Goal	39

ABSTRACT

Natural resource management requires the simultaneous consideration of many different and often conflicting goals. For resource decisions to accurately reflect public values and desires, a systematic method is needed for assessing the importance which public groups attach to different management goals. Direct judgments of the importance of goals are often used as weights in additive utility models for evaluating alternative resource decisions. The overall value of each alternative is assessed by assigning it a value with respect to each relevant goal, multiplying each value by the corresponding goal's importance weight, and summing the weighted values. The validity of this procedure depends on the assumption that each goal's importance is judged independently of all other goals and is not affected by perceived conflicts between goals. Otherwise, the importance of some goals will be overestimated (double-counted). This study tested the validity of this assumption for direct judgments of the importance of forest management goals.

Subjects read a description of a hypothetical national forest and rated the importance of six forest management goals on a ten-point scale. They also rated the amount of conflict between each possible pair of goals. The management scenarios were varied to represent two levels of conflict between a wilderness preservation goal and a timber production goal, and two levels of scarcity of existing wilderness areas

in the region of the national forest. The conflict and scarcity manipulations were crossed, creating four conflict/scarcity conditions in a two-by-two ANOVA design.

Analysis showed that both conflict and scarcity produced effects on ratings of the management goals' importance. The effects differed depending on the nature of the individual goal. In particular, goals which conflicted with wilderness preservation were rated lower in importance when the conflict was higher and when wilderness scarcity was high. This suggests that people discount the importance of goals which are perceived as conflicting with a highly valued goal, such as wilderness preservation. Importance ratings would therefore underestimate the importance of goals such as timber production if they were used as weights in an additive utility model. Further analysis revealed the presence of a single strong dimension underlying the ratings of conflict between goals. This dimension also seemed to be related to judgments of goal importance. It is possible that both conflict and importance judgments are made with respect to general cognitive attributes of the goals (for example preservation/utilization orientation).

The results of this study show that direct judgments of goal importance may not satisfy the requirements of additive utility models, and that public perception of conflict between goals must be taken into account when interpreting judgments of the importance of management goals. A resource planner must be aware of what preconceptions the public holds about conflicts between goals and how these preconceptions affect the expressed importance of the goals.

INTRODUCTION

The management of natural resources is a task requiring the cooperation of many different scientific fields. A knowledge of the physical and biological functioning of the environment is necessary to define feasible goals and to find ways of accomplishing them. But to establish which goals are worth achieving we need a knowledge of how humans perceive and evaluate different environmental states. Failure to understand the physics and biology of the environment may result in desirable goals not being achieved. Failure to understand human perceptions and values with respect to the environment may lead to attempts to achieve undesirable or inappropriate goals.

Plans for managing natural resources may be formulated and evaluated at different levels. Each alternative plan has effects on the objective physical attributes of the environment. The plan may simultaneously be assessed as to how well it achieves any of a range of more general goals. When these general goals are stated in terms of some intangible quality (for example, the goal of preserving wilderness character), we must make inferences about how physical attributes combine in people's minds to create a subjective impression of a whole setting.

When the plan's performance with respect to each general goal has been evaluated, the problem still remains of placing a value on the entire alternative. No alternative will achieve all relevant

goals, so we must decide which goals are the most important, and which plan represents the best compromise or trade-off between conflicting goals. Clashes between special interest groups (for example, environmentalists and industry) occur because different people place importance on different goals, and because individuals perceive other people's goals as conflicting with their own. The study of value conflicts between management goals is therefore an important topic for social scientists in the field of resource management.

One of the simplest approaches which has been proposed for evaluating trade-offs and resolving conflicts is additive utility theory (also called multiattribute utility theory). Each management alternative is assigned values according to how well it will satisfy each goal. Each goal is assigned a weight representing its importance in the overall decision. Weights and values are then combined by means of a linear additive rule:

$$V_j = \sum_i w_i v_{ij}$$

where V_j is the overall evaluation of alternative j , w_i is the importance weight assigned to goal i , and v_{ij} is the value of alternative j with respect to goal i . Additive models have been studied extensively with respect to perception and impression formation (Anderson 1971, 1974) and behavioral decision theory (Slovic and Lichtenstein 1971, Slovic, Fischhoff, and Lichtenstein 1977). Similar models have been developed for application to a wide variety of practical decision situations, such as highway corridor selection (Mason and Moore 1971) and power plant siting (Seiple 1974). The popularity of such simple models

makes desirable a careful examination of their underlying assumptions and an evaluation of how well they can account for complex human judgments. Given the salience of goal conflicts in natural resource decision problems, special attention should be directed to the possible effects of perceived conflicts between goals on the validity and usefulness of additive models.

Additive utility theory presumes that "the utility of a whole equals the sum of utilities assigned to its parts" (Fishburn 1967). That is, additive models assume that utilities may be assigned separately to each component of an alternative, then simply added together to obtain an evaluation of the whole alternative. For this to be possible, judgments of the effects of any one factor must be independent of the levels which other factors happen to assume. In analysis of variance terminology this implies the absence of interactions between factors in determining the overall utility of an alternative.

Fishburn (1966) reviews different systems of axioms about individual preferences which will lead to an additive utility formulation. Additivity may fail if the scales for measuring attributes of the alternatives and people's preferences for whole alternatives are not linearly related to the subjective preference continuum. That is, if a one-unit change in a single attribute produces a different psychological effect depending on whether that attribute already has a high or a low value, then the additivity assumption may be invalid. In this case, it may be possible to rescale the alternatives in a way which will lead to additivity being satisfied (Bogartz and Wackwitz 1970,

1971). Failure of additivity may also, however, result from the nature of the cognitive process by which attributes are combined to form an overall impression. For example, a high level of scenic beauty might be important when it occurs in combination with certain types of recreational opportunities, but less so with other types.

Research has shown that linear additive models of human judgment perform quite well in predicting actual preferences and decisions (Slovic and Lichtenstein 1971, Hoffman 1968, Louvierre 1974). Deviations from additivity are, however, detectable with sensitive ANOVA designs (for example, Lampel and Anderson 1968, Sidowski and Anderson 1967) and are of undeniable theoretical importance. But these deviations typically involve only a small proportion of the total variance in preferences, and do not necessarily invalidate additive models for practical predictions of human preferences.

There may be a special need for caution, however, in applying additive models to natural resource management. As mentioned before, there may be serious conflicts between different resource management goals. Furthermore, different people may not agree in their perception of these conflicts. For example, one person may see no conflict between allowing hunting in an area and simultaneously preserving the wilderness character of the area. Someone else, however, might argue that the sound of gunshots spoils his "wilderness experience." If a person is presented with a management alternative which claims to achieve two goals which that individual believes are incompatible, the person will view the alternative as inconsistent. Inconsistency of

this sort has been identified as one cause of nonadditivity in human judgment (Hoffman 1968). When faced with inconsistent information, a person may disregard or discount one or the other of the conflicting goals, or he may view the inconsistency as a negative attribute in its own right and give the alternative a lower evaluation (Anderson 1974). Additive utility theory may therefore be invalid when the public's perception of conflicts between goals differs from that of the resource planner who is drawing up alternative plans.

A further problem arises when different approaches to determining the importance weights for goals are considered. Most experimental studies determine weights indirectly by obtaining subjects' evaluations of many different alternatives and then inferring the weights statistically, for example by regression analysis. This method is not suitable for practical use, because it would require public participants to spend much time in a repetitive task. Also, the statistical determination of weights requires that factors be varied independently in the alternatives presented to subjects. But when the factors are actually correlated in the real world, as in natural resource management, this will result in some of the alternatives appearing inconsistent.

Most applications of additive utility theory use the simple method of asking people to state directly the importance they think each factor or goal should be given. This requires much less time, and is a more meaningful task for people to perform. Ideally, directly stated weights should correspond closely to the weights which could be obtained by indirect statistical analysis of responses to whole

alternatives. Unfortunately, this is not always the case. Slovic and Lichtenstein (1971) review results which show that even though people's judgments of whole alternatives may conform closely to an additive model, their judgments of the importance of the individual factors comprising the alternatives often do not agree with statistically inferred weights. When questioned directly, respondents may indicate that they are considering all the different factors when evaluating alternatives. Statistical analysis of their responses reveals, however, that they have been basing their evaluations on only one or two factors and that the other factors have had little or no effect on their evaluations.

An example of a discrepancy between stated and inferred importance weights in a natural resource context occurs in Burnham, Nealey, and Maynard (1975). The importance of eight environmental impact factors relating to nuclear power plant siting were assessed directly by rank-ordering, and indirectly by regression analysis of expressed preferences for different alternatives. For a group of environmentalists, the rank-order correlation between the directly and the indirectly determined weights was .643. However, a group of high school students and a group of businessmen each produced a correlation of $-.095$. The high school students stated that the cultural/recreational impact category was the least important, but according to the regression analysis it was the most important factor in determining their judgments. Similarly, the businessmen stated that esthetic impact was the least important, but statistically it had the most weight in their actual

judgments. Burnham et al. suggest that the relatively high correlation obtained with the environmentalists may have occurred because they were more motivated and better informed about environmental issues.

Gardiner and Edwards (1975) compared predictions of people's preferences for proposed coastal developments derived from a more sophisticated additive utility model with their actual judgments of the proposals. The subjects in this study were people who were directly involved in coastal land use planning. There was very good agreement between the model and the actual judgments, so it appears that in at least some circumstances, the careful use of an additive utility model may result in meaningful and consistent evaluations of proposed alternatives.

Potential discrepancies between stated and inferred weights present obvious problems for the application of additive utility theory to the assessment of public values. But even if formal models are not used for representing public values, the problem remains. For example, an agency using a questionnaire to obtain public input has the option of asking people to assess the importance of general management goals, or of asking them to evaluate specific management proposals, each having effects on multiple goals. If people implicitly give goals different weights when evaluating proposals than when evaluating goals directly, these two options may produce inconsistent results, regardless of whether the public responses are analyzed informally or with a mathematical utility model.

To be able to interpret public input meaningfully, an attempt must be made to understand the causes of inconsistencies and discrepancies in human judgments of complex alternatives. One hypothesis that has been suggested is that people have trouble integrating information about complex alternatives, and therefore adopt simplified decision strategies which do not adequately represent their real preferences (Shepard 1964, Slovic and Lichtenstein 1971, Tversky 1969, 1972). If this is true, then importance weights inferred statistically from responses to complex multiattribute alternatives may be inaccurate. In this case it would be better to ask people to evaluate directly the importance of individual components or goals of a decision problem, and then use a formal model to combine these judgments into overall evaluations of each proposed plan.

An alternative hypothesis is that direct statements of the importance of goals are an inaccurate reflection of their real importance in public evaluations of resource management plans. The use of directly stated weights in additive utility models requires that the factors of the model be logically and cognitively independent of each other (Kaufmann 1968, Churchman, Ackoff, and Arnoff 1957). That is, when people evaluate the importance of factors or goals, they must be able to think about each goal as though it had no effect on any other goal. In natural resource management, where conflicts and trade-offs between goals are likely to be a prominent feature, this kind of detachment may be difficult to achieve. For example, if wilderness preservation and utilization of forest resources are two goals in a forest

management decision situation, a person may believe that utilization of resources always means that wilderness values will be destroyed. The person may then evaluate resource utilization negatively because of its presumed impact on wilderness when, in fact, he might have no objection to resource utilization per se, if he could be convinced that it need not compromise the preservation of wilderness. If this person's directly stated importance weights for the two goals are used in an additive utility decision model, the value of wilderness will be double-counted (Oglesby, Bishop, and Willeke 1970; Gardiner and Edwards 1975). That is, the importance which this person attaches to wilderness would be counted twice; once in the importance weight of the wilderness goal itself, and again via the reduced importance weight for the resource utilization goal. It is important to note that this occurs because of the person's beliefs (possibly mistaken) about the relationships between goals, and need not depend on the actual relationships.

The experiment reported below is a first step toward investigating the relationship of perceived conflicts between natural resource management goals and direct judgments of the importance of the goals. Specifically, the experiment was designed to determine whether judgments of a goal's importance are influenced by the extent to which that goal is perceived as conflicting with other goals. If this hypothesis is true, then direct statements of importance may not conform to the assumption of cognitive independence, and additive utility models based on these importance weights may not accurately reflect public values.

In addition, the experiment investigates the sensitivity of goal importance judgments to the regional context of the resource management problem. The perceived importance of a goal in a specific management problem might depend on what other opportunities are available for achieving the same goal in the same general region. For example, if a particular mountain offers the only opportunity for skiing within hundreds of miles and the demand for skiing is high, the goal of providing skiing on that particular mountain may be evaluated as more important than if there are many other places nearby already offering sufficient opportunities for skiing. On the other hand, importance judgments might be based upon general, fixed attitudes or orientations of the respondents, in which case they might not be sensitive to conditions of scarcity or demand. Observing the effect (or lack of effect) of scarcity on importance judgments may contribute to our understanding of the psychological processes by which people make such judgments.

METHOD

This experiment was designed to investigate how the perception of conflict between resource management goals and the evaluation of the importance of the goals are related. The major hypothesis is that people may discount the importance of a goal when it conflicts with another goal which they value highly. Subjects were given questionnaires (Appendix A) which presented information about a hypothetical forest planning situation. They made judgments of the importance of six different management goals, and of the extent to which goals conflicted with each other. The questionnaire was designed to resemble a type of response form which might be used in a public involvement program. The questionnaire consisted of the following parts.

1. An introduction describing the general nature of the study:

Participants were told that the management scenario in the questionnaire represented the kinds of situations which actually occur in real decision making. They were also told that their responses would contribute to our understanding of how the public places values on different management goals. The introduction did not say anything about conflicts or trade-offs between goals.

2. Description of the management scenario: The scenario dealt with a "typical" national forest in the western United States. Different subjects were given different descriptions, designed to vary along two dimensions.

a. Conflict: Two levels of a specific conflict between goals were represented in the scenarios. In the high conflict condition there was an area of virgin forest containing large amounts of timber which could be economically harvested. This represented a conflict between the goal of preserving wilderness and the goal of producing timber, since cutting trees would destroy the virgin character of the forest. In the low conflict condition, timber harvesting in the virgin area was not practical due to severe terrain, so that this conflict did not exist.

b. Scarcity: Two levels of scarcity with respect to the goal of preserving wilderness were presented. In the low scarcity condition there was a large officially designated wilderness area already existing close to the national forest described in the questionnaire. In the high scarcity condition there were no existing wilderness areas nearby.

The conflict and scarcity dimensions were crossed, resulting in four different scenarios in a two-by-two factorial arrangement. The manipulation of conflict and scarcity were embedded in a fixed context of information pertaining to the general management situation. For comparison, an additional group was given no management scenario at all, but was asked to make responses with respect to national forests in general.

3. Descriptions of the management goals: The six goals used in the questionnaire are summarized below:

- a. Maintain a maximum level of timber production.
- b. Maintain a high level of scenic beauty.
- c. Preserve wilderness in its natural state.
- d. Benefit the economy of local communities.
- e. Maintain healthy wildlife populations.
- f. Provide a source of water for local communities.

Each goal was explained briefly (see Appendix A).

4. Importance ratings: Participants were asked to rate each goal according to how important they thought it should be in deciding how to manage the forest described in the questionnaire. The rating scale had a low point of zero, meaning that the goal had no importance and should be disregarded. The highest possible rating was ten. The goals were presented in different random orders to different participants.

5. Conflict ratings: Participants were asked to rate the degree to which goals conflicted in the management scenario. All 15 possible pairings of the six goals were presented in different random orders to different subjects. A rating of zero indicated that two goals did not conflict at all, and a rating of ten indicated that the goals were very incompatible.

6. Follow-up questions: Participants were asked which goals they thought were the most and the least important, and why. They were also asked which two goals conflicted the most, and why. This section also included four questions to determine the respondents' general attitudes toward preservation of wilderness and environmental protection. Each

question was a statement of opinion about an environmental issue, with which the subject could agree or disagree.

7. Open-ended comments: At the end of the questionnaire, participants were given an opportunity to comment on the questionnaire and to say anything they wanted to about the goals and problems with which it dealt.

Participants were obtained from psychology classes where an extra credit incentive was offered. One hundred and thirty-five students took part in the study, 28 in the high-conflict/high-scarcity condition, 26 in the low-conflict/low-scarcity condition, and 27 each in the high-conflict/low-scarcity, low-conflict/high-scarcity, and control (no scenario) conditions.

RESULTS

The study was designed to investigate the way in which perceived conflict and scarcity affect evaluations of the importance of resource management goals. The analyses below first addressed the effect of the experimental conflict and scarcity manipulations on the rated conflicts between goals. The principle analysis focused upon the effects of the experimental manipulations on importance evaluations, and on the relationship between rated conflict and rated importance. Finally, responses to the follow-up questions were analyzed to provide additional insight into how importance and conflict judgments may have been made.

The conflict manipulation was aimed directly at the timber and wilderness goals, and the scarcity manipulation specifically targeted the wilderness goal. Depending on how individuals perceived the interrelationships between goals, the experimental manipulations could also affect evaluations of other goals and conflicts. The analyses below, therefore, include importance and conflict ratings for all of the six management goals.

Analysis of Conflict Ratings

Two-by-two ANOVA's were performed on each of the 15 conflict ratings (one for each pair of goals) to see whether the specific conflict and scarcity manipulations had any effects on the ratings of

conflict between goals. (Mean conflict ratings for each goal pair are tabled in Appendix B). The conflict between the wilderness and timber goals was rated consistently higher in the high conflict conditions. The mean conflict rating was 8.09 under low conflict, and 9.13 under high conflict. This difference is statistically significant ($F = 6.31$, $df = 1,103$). This confirms that the conflict manipulation, which targeted the timber and wilderness goals, had the intended effect. Note, however, that even in the low conflict conditions the conflict between wilderness and timber production was rated quite high.

The effect of the conflict manipulation on the rated conflict between wilderness and timber was expected, since these were the goals targeted. There were also some unanticipated effects of the wilderness scarcity manipulation on goals not specifically targeted by the experimental manipulations. The rated conflict between wilderness and water supply was higher in the low scarcity condition ($\bar{x} = 4.53$) than in the high scarcity condition ($\bar{x} = 3.33$). The rated conflict between scenic beauty and water supply also shows this effect of the wilderness scarcity manipulation ($\bar{x} = 3.87$ and 2.85). These differences are statistically significant ($F = 5.21$ and 4.27 , respectively; $df = 1,103$). It is not immediately evident why these effects occurred. From responses to the follow-up questions it appears that different respondents interpreted the water goal in quite different ways, and this may have contributed to these effects. In any event, the effects are quite small in magnitude.

The conflict ratings give information about which specific goals were perceived as conflicting the most. Generally, the differences between the four experimental groups are less than the differences between pairs of goals within groups. That is, the different groups perceived the conflicts in much the same way. In addition, the control group, who had no specific management scenario, rated the conflicts in much the same way as the experimental groups. For example, the conflict between wilderness and timber was given a mean rating of 8.37 by the control group. Under the high conflict manipulation, this conflict was rated slightly higher ($\bar{x} = 9.13$) and under the low conflict manipulation it was rated slightly lower ($\bar{x} = 8.09$). It appears that subjects in this study already had preconceptions about which goals conflicted with each other before reading the scenarios, and that these preconceptions were only slightly altered by the specific conflict manipulation.

Table 1 shows the conflict ratings averaged across all five groups (experimental and control) in the form of a conflict matrix. The wilderness, wildlife, and scenic beauty goals were clearly perceived as being compatible with each other, while the timber goal is seen as conflicting strongly with all the first three goals. Employment is compatible with timber and conflicts with the first three goals, though not as strongly as timber does. Water supply shows intermediate conflicts with most of the other goals and seems most compatible with local employment.

Table 1. Mean Conflict Ratings Averaged Across All Groups

	Wildlife	Scenic Beauty	Timber	Local Employment	Water
Wilderness	.75	1.74	8.57	6.67	4.06
Wildlife		1.44	7.62	5.54	3.63
Scenic Beauty			7.86	4.99	3.38
Timber				1.19	3.44
Local Employment					2.25

From the conflict ratings there appear to be two groups of goals. Wilderness, wildlife, and scenic beauty form one group, and timber, employment and possibly water supply form another. Goals within the same group are perceived as compatible, while goals in different groups are seen as conflicting. Goals in the first group are generally preservation oriented, while goals in the second group are utilization oriented. This classification will be useful later in discussing the effects of perceived conflict on importance ratings.

Analysis of Importance Ratings

If importance ratings for a goal are partly determined by the perceived conflict of that goal with other goals, then ratings of two goals which conflict would tend to be negatively correlated. That is, people who rate one goal high in importance would tend to rate a conflicting goal low in importance. In addition, if perceived conflict affects importance ratings, then the negative correlation between conflicting goals should become weaker in a low conflict situation than in a high conflict situation.

To test this hypothesis, correlation coefficients were calculated between importance ratings for each pair of goals in each of the two levels of conflict. (The two levels of scarcity were combined to obtain enough cases for Fisher's r -to- z transformation). Table 2 shows the correlation matrices for the high and low conflict conditions. Under the high conflict condition, the correlations show the expected pattern. Pairs of goals with high rated conflict (see Table 2)

Table 2. Correlations Between Importance Ratings

	Wildlife	Scenic Beauty	Timber	Local Employment	Water
<u>High Conflict</u>					
Wilderness	.59	.43	-.19	-.12	.02
Wildlife		.39	-.27	-.03	.04
Scenic Beauty			-.10	.00	-.08
Timber				.39	.30
Local Employment					.42
<u>Low Conflict</u>					
Wilderness	.75	.50	.11	.12	.17
Wildlife		.47	.19	.22	.27
Scenic Beauty			.10	-.01	.11
Timber				.64	.42
Local Employment					.46

generally have negatively correlated importance ratings, and pairs of goals with low rated conflict have positively correlated importance ratings. The correlations in the low conflict condition show a striking change from this pattern. Nearly all the correlations are greater under the low conflict condition, and the correlations between conflicting goals actually change from negative to positive.

The significance of the increases was assessed using Fisher's r -to- z transformation. The z values corresponding to changes in the correlation coefficients are shown in Table 3. The correlation between wilderness and timber, the goals directly targeted by the conflict manipulation, shows a substantial increase, confirming the hypothesis stated above. Under high conflict, people who rate wilderness high rate timber low, but under low conflict the opposite is true. People who rate wilderness high also rate timber high. The same result holds between the wildlife and timber goals. This is not surprising, since wilderness and wildlife were viewed as being very compatible goals. In the follow-up questions, many people referred to wilderness and wildlife as though they were a single goal, and one person even called them "synonomous."

The correlations between wildlife and wilderness and between timber and employment also increased substantially in the low conflict condition. This suggests that the effect of the conflict manipulation was not limited to the goals specifically targeted, but carried over even to some non-conflicting pairs of goals.

Table 3. Fisher's r-to-z Transformation of Changes in Correlation Coefficients from High to Low Conflict Conditions. -- Normal probabilities for one-tailed significance test in parentheses.

	Wildlife	Scenic Beauty	Timber	Local Employment	Water
Wilderness	1.53 (.063)	.47 (.318)	1.53 (.062)	1.21 (.114)	.78 (.218)
Wildlife		.45 (.327)	2.38 (.009)	1.27 (.102)	1.17 (.120)
Scenic Beauty			1.00 (.158)	-.05 (--)	.94 (.173)
Timber				1.76 (.039)	.70 (.243)
Local Employment					.26 (.396)

To study the effect of the experimental manipulations on the amount of importance attached to specific goals, an ANOVA was performed on importance ratings, with conflict, scarcity, and goals as independent variables. (A few subjects were deleted at random to yield equal N's of 26 in all four conflict/scarcity conditions). The results of the ANOVA are shown in Table 4, and the mean importance ratings for all goals and groups are plotted in Figure 1. In most conditions, wilderness and wildlife were given the highest importance, while timber and employment were rated the lowest. The ANOVA shows a significant effect of the goal factor, indicating that these differences are statistically reliable.

There is a main effect of scarcity, with importance ratings being generally higher in the low scarcity conditions. This appears to be more true for goals in the utilization group (timber, employment, and water) than for goals in the preservation group (wilderness, wildlife, and scenic beauty). It also appears that the two groups of goals were affected differently by the conflict manipulation. The utilization goals are rated consistently lower in the high conflict conditions, but this difference does not occur with the preservation goals. This is what would be expected if people are discounting a goal's importance when it conflicts with another goal which is valued highly.

This interpretation is supported by comparing the control group's ratings of the timber goal's importance to the experimental groups' ratings (see Appendix B). The high conflict/high scarcity group rated timber lower in importance ($\bar{x} = 4.79$) than the control group

Table 4. ANOVA of Importance Ratings

Source	DF	SS	MS	F	P
G	5	704.32	140.86	35.10	<.01
S	1	42.58	42.58	4.29	<.05
C	1	6.36	6.36	.64	
GS	5	24.66	4.93	1.23	
GC	5	35.96	7.19	1.79	
SC	1	13.86	13.86	1.40	
GSC	5	42.42	8.48	2.11	
P(SC)	100	992.07	9.92		
P(SC)G	500	2006.81	4.01		
Total	623	3869.04			

G = goals

S = scarcity

C = conflict

P = participants

Figure 1. Goal Importance Ratings

($\bar{x} = 6.07$) while the low conflict/low scarcity group rated it higher ($\bar{x} = 6.65$). The control group's rating of wilderness importance ($\bar{x} = 8.74$) is higher than any of the experimental groups' ratings, and all the groups rated wilderness as more important than timber. It appears that subjects in this study already regarded wilderness as much more important than timber before even reading the management scenario. The specific conflict and scarcity manipulations then caused people to modify their judgment of the timber goal, though still always rating it as less important than wilderness.

The interactions of the goal factor with the conflict and scarcity manipulations, which would reflect the effects of the manipulations on specific goals, are not statistically significant in this ANOVA. Examination of subjects' ratings showed that while most of them rated wilderness very high in importance, several subjects in each condition gave wilderness substantially lower ratings. This suggests that the failure of the ANOVA to detect significant effects may be due to a diversity in subject's initial attitudes toward wilderness preservation.

Systematic variation in ratings due to attitude differences could increase the size of the error terms, making the effects harder to detect. To remedy this, individuals were placed in different groups, depending on how they rated the wilderness goal. The ten people in each experimental condition who gave wilderness the lowest ratings were placed in a "low-wilderness" group, and ten (randomly selected) people from each condition giving wilderness a rating of ten were placed in

a "high-wilderness" group. (The other six people in each condition were omitted to maximize the difference between the groups). The ANOVA was then repeated, adding wilderness attitude as an additional factor, and omitting wilderness from the goals factor (because it was used as the criterion for forming the wilderness attitude groups).

The results of the ANOVA are displayed in Table 5. The mean ratings for the high-wilderness group are plotted in Figure 2, and for the low-wilderness group in Figure 3. Overall, the low-wilderness group gave lower ratings to the goals than did the high-wilderness group (perhaps indicating different rating criteria). An interaction between goals and wilderness attitude appears because the high-wilderness group rates wildlife and scenic beauty higher relative to the other goals than does the low-wilderness group. The low-wilderness group seems to have been more sensitive to the wilderness scarcity manipulation, giving consistently higher ratings, especially to the utilization goals, when wilderness scarcity was low than when it was high.

Wilderness scarcity and conflict between wilderness and timber both have significant effects on importance ratings, and the three-way interaction of goals with scarcity and conflict confirms that these effects were different for different goals, and therefore, not due to a general shift in response bias. In particular, under the high conflict/high scarcity condition, the three goals which conflict the most with wilderness preservation (the utilization goals) are given relatively low ratings compared to the other conditions, and the two goals which

Table 5. ANOVA of Importance Ratings with Wilderness Attitude Groups

Source	DF	SS	MS	F	P
G	4	355.19	88.80	23.79	<.01
W	1	103.02	103.02	15.36	<.01
S	1	36.60	36.60	5.46	<.05
C	1	27.56	27.56	4.11	<.05
GW	4	78.89	19.72	5.17	<.01
GS	4	23.01	5.75	1.51	
WS	1	41.60	41.60	6.20	<.05
GC	4	28.00	7.00	1.84	
WC	1	11.22	11.22	1.67	
SC	1	10.56	10.56	1.57	
GWS	4	7.51	1.88	.49	
GWC	4	6.34	1.59	.42	
GSC	4	41.2	10.30	2.70	<.05
WSC	1	8.12	8.12	1.21	
GWSC	4	25.94	6.49	1.70	
P(WSC)	72	482.78	6.71		
P(WSC)G	288	1097.92	3.81		
Total	399	2385.48			

G = goals
 W = wilderness attitude
 S = scarcity
 C = conflict
 P = participants

Figure 2. Goal Importance Ratings for the High-Wilderness Group

Figure 3. Goal Importance Ratings for the Low-Wilderness Group

are most comparable with wilderness (wildlife and scenic beauty) are given relatively higher ratings. Timber was rated especially low by the high-wilderness group in the high conflict/high scarcity condition. This again confirms the hypothesis that importance ratings of different goals are not made independently, but are influenced by the amount of conflict between the goals. The people who value wilderness the most have discounted the importance of timber strikingly when wilderness is both scarce and threatened by proposed timber harvesting.

It seems unlikely that this shift in rated importance was due to a deliberate attempt by the respondents to undervalue timber in order to make wilderness receive more emphasis. Since the management scenario in this study was hypothetical, there would be no motivation for people to deliberately misrepresent their attitudes in the hopes of influencing the final decision of how to manage the forest.

A more detailed analysis of the effect of the experimental conflict and scarcity manipulations on rated goal importance was carried out by performing a separate ANOVA on the ratings of each individual goal. Factors in the ANOVA's were conflict, scarcity, and wilderness attitude. A subject was placed in the high wilderness group if he gave wilderness an importance rating of ten, and in the low wilderness group if he gave wilderness a rating of eight or less. This breakdown resulted in approximately equal numbers of subjects in all conditions. (The breakdown was not used in the ANOVA of the wilderness goal).

The results of the ANOVA's are summarized in Table 6, which gives the magnitude (eta square) of each effect on each goal for this sample of subjects. The mean ratings for each condition are plotted in Figures 4 through 9 and tabled in Appendix B. Distinctively different patterns of effects appear for the preservation goals than for the utilization goals. Both the wildlife and scenic beauty goals were rated lower by the low-wilderness group than by the high-wilderness group. Both of these goals also show an interaction between the conflict and the wilderness scarcity manipulations. In the low-wilderness scarcity conditions, high conflict generally caused the ratings of wildlife and scenic beauty importance to go down, while in the high-wilderness scarcity conditions high conflict usually caused the importance ratings to increase. This interaction also appears for the wilderness goal, though it is not statistically significant. In addition, the effects of wilderness scarcity and conflict on the wildlife goal occur only for people in the low-wilderness attitude group. People in the high-wilderness group rated wildlife high in all conditions. For the scenic beauty goal, on the other hand, the conflict-scarcity interaction appears to be strongest in the high-wilderness group.

The hypothesis proposed earlier in this study makes predictions about the effects of the specific conflict and scarcity manipulations on ratings of goals which are perceived as conflicting with wilderness, but says nothing specific about what might happen to ratings of goals which are seen as compatible with wilderness. One possible explanation

Table 6. Proportion of Sample Variance (Eta square) of Importance Ratings Explained by Effects

	C	S	W	CS	CW	SW	CSW
Wilderness	.00016	.00003	--	.014	--	--	--
Wildlife	.007	.012	.255**	.044**	.0011	.012	.031**
Scenic Beauty	.0016	.0021	.107**	.027*	.0036	.022	.012
Timber	.036*	.055**	.00012	.0033	.026*	.0023	.00
Local Employment	.033*	.051**	.011	.0054	.016	.020	.016
Water	.050**	.0033	.0027	.00020	.00126	.023	.0038

*p < .10

**p < .05

C = conflict

S = scarcity

W = wilderness attitude

Figure 4. Importance Ratings for the Wilderness Goal

Figure 5. Importance Ratings for the Wildlife Goal

Figure 6. Importance Ratings for the Scenic Beauty Goal

Figure 7. Importance Ratings for the Timber Goal

Figure 8. Importance Ratings for the Local Employment Goal

Figure 9. Importance Ratings for the Water Goal

of the significant conflict/scarcity interaction observed for the preservation goals is that if wilderness is not scarce, people will rate the importance of a preservation goal higher when it does not conflict with other goals. But if wilderness is scarce, people will rate the importance of a preservation goal higher when it is threatened by other conflicting goals. That is, preservation-oriented people may react more defensively if wilderness is perceived as being scarce.

In contrast to the preservation goals, the utilization goals are all affected by the experimental conflict manipulation as a main effect. These goals were rated less important in the high conflict condition than in the low conflict condition. Also, the effect of conflict on timber importance depends on wilderness attitude. There is a large effect of conflict in the high-wilderness group, and virtually no effect in the low-wilderness group. The timber and employment goals are additionally affected by the wilderness scarcity manipulation. When wilderness is scarce, timber and employment are evaluated as less important. It is particularly interesting that the scarcity manipulation, which was directed at the wilderness goal, had no direct effect on wilderness importance ratings, but did affect the ratings of the timber and employment goals, which were perceived as conflicting with wilderness. This shows that each goal's importance is not judged independently, but is assessed in terms of its relationship to the other goals.

Follow-up Questions

After rating the importance of the goals and the conflicts between goals, subjects were asked to tell which goals they thought were

most important and least important, and which pair of goals conflicted the most. Tables 7-9 show the frequency with which different goals were selected by people in the four experimental groups and the control group. There were no real differences between groups in the selection of the most important goal. Wilderness preservation and wildlife were selected most often, and timber production and local employment least often. Some differences between groups appear in the selection of the least important goal (Table 8). Most of the groups selected local employment most often, scenic beauty next, and timber production third, but the high conflict/high scarcity group chose timber most often, local employment next, and scenic beauty third. The shift toward choosing timber as the least important goal reflects the tendency for people in this group to rate timber particularly low in importance.

As shown in Table 9, wilderness and timber were selected as having the highest conflict more often than any other pair of goals, and there are no appreciable differences between the experimental and control groups. Nor are there any noticeable differences between groups with respect to the four attitude questions (Table 10). The responses to the questions show that most of the people in this study said they favored preservation of wilderness and wildlife, and did not think that environmental protection should be compromised for economic reasons.

The explanations given by people for their selection of most and least important goals offer some interesting insights into how importance judgments were made. Some people justified their choice of wilderness or wildlife as most important by referring to the value of

Table 7. Frequency With Which Goals Were Selected as Most Important

	High Conflict		Low Conflict		Control
	High Scarcity	Low Scarcity	High Scarcity	Low Scarcity	
Wilderness	14	11	10	9	12
Wildlife	8	8	7	9	10
Scenic Beauty	4	4	3	3	1
Timber	0	1	1	1	1
Local Employment	1	1	2	0	1
Water	1	1	4	2	2

Table 8. Frequency With Which Goals Were Selected as Least Important

	High Conflict		Low Conflict		Control
	High Scarcity	Low Scarcity	High Scarcity	Low Scarcity	
Wilderness	0	2	1	2	3
Wildlife	0	0	1	0	1
Scenic Beauty	4	7	6	6	3
Timber	13	3	3	5	5
Local Employment	9	12	15	8	14
Water	2	2	1	4	1

Table 9. Frequency With Which Pairs of Goals Were Selected as Having the Highest Conflict

	High Conflict		Low Conflict		Control
	High Scarcity	Low Scarcity	High Scarcity	Low Scarcity	
WP - WL	0	0	0	0	0
WP - SB	0	0	0	0	0
WP - TP	15	11	14	13	12
WP - LE	2	3	5	5	4
WP - WS	0	1	0	0	0
WL - SB	0	0	0	0	0
WL - TP	6	6	3	3	6
WL - LE	1	0	0	0	1
WL - WS	0	0	0	0	0
SB - TP	4	6	3	4	1
SB - LE	0	0	1	0	1
SB - WS	0	0	0	0	1
TP - LE	0	0	0	0	0
TP - WS	0	0	0	0	0
LE - WS	0	0	0	1	1

WP = wilderness preservation
 WL = wildlife
 SB = scenic beauty
 TP = timber production
 LE = local employment
 WS = water supply

Table 10. Frequency of Responses to Attitude Questions

		High Conflict		Low Conflict		Control
		High Scarcity	Low Scarcity	High Scarcity	Low Scarcity	
Wilderness is a precious national heritage which should be protected and preserved.	DS	0	1	0	0	0
	D	0	1	1	1	0
	A	7	4	4	5	4
	AS	21	21	22	20	23
Mountain lions should not be shot, even if they occasionally kill sheep and cattle.	DS	1	1	1	1	2
	D	5	4	8	7	5
	A	15	14	14	12	12
	AS	7	7	4	6	8
If stopping pollution means many people will lose their jobs, then pollution should be allowed to continue.	DS	10	10	10	7	7
	D	17	9	14	12	17
	A	1	5	2	6	3
	AS	0	0	0	0	0
We should be prepared to relax environmental pollution standards if it will help to alleviate the energy crisis.	DS	12	11	13	8	9
	D	12	11	11	9	13
	A	4	4	3	8	4
	AS	0	0	0	1	1

DS = Disagree strongly

D = Disagree

A = Agree

AS = Agree strongly

living things, and the need for people to have natural places to enjoy. The scarcity of remaining wilderness areas in this country and the impossibility of recreating wilderness once it has been destroyed were also mentioned frequently. Many people said that wilderness was important because it had no substitutes. On the other hand, low ratings of timber, employment, and water supply were often justified by saying that there are many other ways to achieve these goals outside of the national forests.

Conflicts between goals were frequently mentioned as reasons for selecting goals as most or least important. Wilderness was selected as important because it was threatened by logging and development, and also because it was compatible with other valued goals, such as wildlife and scenic beauty. Timber and employment were both often selected as unimportant because they were seen as interfering with wilderness, scenic beauty, and wildlife. One person who selected timber as least important illustrated this attitude by commenting that "logging is very important because we do need lumber, but not at the expense of such things as wildlife, wilderness preservation, etc." It appears that preconceptions about wilderness scarcity and conflicts between goals may have had large impacts on judgments of importance, and that these preconceptions were affected little by the features of the scenarios. People often explained their selection of wilderness-timber or wildlife-timber as the most conflicting pair by saying that the goals "obviously" conflict or are a contradiction in terms. Only a few people referred to specific features of the scenarios to explain their

judgments. Most people explained their selection of most and least important goals by making very general statements about the nature of the goals and their conflicts.

Two of the goals were interpreted in varying ways by different people. Some wilderness enthusiasts reacted negatively to the scenic beauty goal, because they thought it meant deliberately changing or manipulating the landscape to make it attractive. They felt that this would alter the "natural beauty" of the landscape, and so rated scenic beauty low in importance. Other people felt that maintaining scenic beauty was almost synonymous with preserving wilderness, and therefore, gave it high ratings. Still another group said that scenic beauty was the least important goal because if wilderness was preserved, scenic beauty would automatically be taken care of too, so there was no need to worry about it.

There were also differing interpretations of the water supply goal. A few people thought the water supply was intended for the forest and wild animals, rather than the local residents. Some rated water low in importance because they assumed underground water supplies would be available, while others viewed water as a vital necessity for the local community and gave it high ratings.

The specific conflict and scarcity manipulations used in this study had consistent effects on the rated importance of the management goals. The magnitudes of these effects were rather small, compared to the general differences between the rated importance of preservation goals (e.g., wilderness) and utilization goals (e.g., timber production).

The responses to the follow-up questions suggest, however, that importance ratings may have been greatly affected by fixed preconceptions about conflicts between goals, and that these preconceptions were relatively unaffected by the experimental manipulations.

A further study of the relationship between perceived conflict and evaluations of importance was carried out with multi-dimensional scaling (MDS). The conflict ratings were treated as dissimilarity judgments (that is, goals which did not conflict were taken as being similar to each other). Two different methods of MDS were applied to the conflict ratings of each of the subject groups as described in Appendix C. Both procedures revealed a single strong dimension underlying the conflict judgments, with preservation goals lying at one end of the continuum, and utilization goals at the other. The dimension resulting from the MDS of conflict ratings is virtually the same from one group of subjects to another, and is consistently correlated with the judged importance of the goals. The correlation is particularly strong (around .95) for the high-conflict/high-scarcity group.

It is not possible to conclude from this analysis that importance evaluations are determined by fixed preconceptions about conflicts (or vice versa) but the results suggest that there is a substantial relationship between the two types of judgments. It may be that both conflict and importance judgments in this study were made with respect to an underlying cognitive dimension (such as preservation versus utilization) and that this underlying dimension became more

salient in the scenario which emphasized the conflicts between preservation and utilization.

DISCUSSION

The purpose of conceptualizing a resource management problem in terms of a small set of goals or factors is to make possible a systematic assessment of proposed alternatives, to guide the formulation of new alternatives, and to provide a reasonable means for including public values in the decision process. Public values may take the form of weights in an additive utility model. Alternatively, evaluations of different goals may be used more informally by planners to anticipate public response to proposed management actions. In either case, it is important to understand the various factors which can affect judgments of goals, and to identify the assumptions which underlie any particular interpretation or use of such judgments.

This study has shown that conflicts between goals can influence the way in which people evaluate the importance of the goals, as can the availability of other opportunities for achieving specific goals. The goals used in this study seemed to fall into two groups, which for convenience are referred to as the preservation and utilization goals. Goals within the same group were perceived as not conflicting very much with each other, and were affected similarly by the experimental conflict and wilderness scarcity manipulations. The preservation goals were generally affected by an interaction between conflict and scarcity. Conflict between wilderness and timber harvesting increased the rated

importance of preservation goals when wilderness was scarce, but decreased their importance when there was an existing wilderness area nearby.

The conflict and scarcity manipulations affected the utilization goals as main effects. High conflict and high wilderness scarcity both usually acted to decrease the rated importance of utilization goals. This is especially true for the timber goal, but the effects also carried over to utilization goals not specifically targeted by the conflict manipulation. These results are in accordance with the hypothesis that people discount the importance of a goal when it is perceived as conflicting with another highly valued goal (e.g., wilderness preservation). The effects of the conflict and wilderness scarcity manipulations also differ depending on the subject's attitude toward wilderness preservation (as inferred by his or her rating of the wilderness goal). People who rated wilderness high were generally more sensitive to the conflict manipulation, while people who gave wilderness lower ratings were more sensitive to the scarcity manipulation.

The effects of the conflict and scarcity manipulations are consistent, but relatively small compared to the overall differences between goals. In all experimental groups the preservation goals were rated higher in importance than timber and employment. Also, conflict ratings were not very strongly affected by the manipulations. While conflict ratings for some particular pairs of goals (e.g., wilderness versus timber) were affected, the multidimensional scaling analysis showed that a single dimension which seemed to underlie conflict ratings was almost identical from group to group. This dimension also seems

to be related to the importance judgments, especially for the high conflict/high scarcity condition. In the other conditions, the deviation of the importance ratings from the preservation/utilization dimension occurs mainly because water supply is rated relatively high in importance while scenic beauty is rated lower than the other preservation goals. These are the two goals which were apparently somewhat ambiguous, judging from people's responses of the follow-up questions.

It may be that the experimental conflict and scarcity manipulations did not have much effect on perceived conflict itself, but changed the extent to which people were sensitized to the underlying preservation/utilization dimension while making their importance judgments. That is, the high conflict/high scarcity manipulation may have made people more acutely conscious of the preservation/utilization dimension and the assumed conflicts with which it is associated, so that their importance judgments were based largely on that dimension. In the other conditions the preservation/utilization dimension was less salient, so that other factors could enter into the importance judgments, especially for goals which were ambiguous. For example, water supply seems to have been rated higher in importance by some people because they thought it was a vital necessity for the local town. This consideration may have been over-ridden when preservation/utilization conflicts were more salient.

When importance ratings are to be used as weights in a formal decision model, the findings of this study have definite theoretical and practical implications. To avoid the problem of double-counting,

formal models require that importance weights reflect the importance of each goal independently of all other goals. That is, the judged importance of a goal should not reflect the effects which actions toward achieving that goal will have on other goals relevant to the decision. But in natural resource decision situations, a person is likely to react very strongly to the conflicts between different goals, and these perceived conflicts may dominate the person's judgment about which goals should be emphasized. It may be difficult or impossible for people to judge each goal independently of its interrelationships with other goals. The fact that the timber goal; for example, was rated less important under the specific high conflict condition in this study suggests that its importance would be underestimated if these important ratings were used as weights in a decision model.

The major alternative to direct judgments of goal importance is the regression method. People are asked to make holistic evaluations of many alternative outcomes, and then regression analysis is used to infer the weights which were (implicitly) applied to each goal. Unfortunately, the salience of strong conflicts between goals causes serious problems for this method, too. If alternatives are presented which claim to achieve highly conflicting goals, then they may appear inconsistent to the people evaluating them. As explained earlier, this can lead to violations of the additivity assumption, and hence to inaccurate estimates of the regression weights. On the other hand, if only "consistent" alternatives are used, some of the goals will be correlated in the sample of alternatives presented (e.g., wilderness

and timber objectives would be negatively correlated in a set of realistic alternatives). This will produce multicollinearity which can make it impossible to estimate the regression coefficients.

The consistent pattern of effects of a specific conflict manipulation on rated importance in this study indicates that these are real problems which must be considered when using formal decision models. The effects of the conflict manipulation were relatively small, but the MDS analysis and the answers to the follow-up questions suggest that fixed, preconceived attitudes about conflicts also played a role in producing lower ratings for utilization goals than for preservation goals.

The MDS analysis also suggests that value and conflict judgments may be made with respect to general, underlying attributes of the goals (such as preservation/utilization). If this is so, then decision models might be improved by formulating them in terms of such underlying attributes. If orthogonal attributes can be inferred from conflict and importance ratings, and importance weights attached to them, the problems discussed above could perhaps be surmounted.

The results reported here also suggest some more general considerations, which apply to any attempt at assessing public values about resource management goals. If public groups react negatively to a particular goal, the planner will need to find out whether this is because the goal is seen as intrinsically irrelevant (or undesirable), or whether it is because the goal is perceived to conflict with

some other important goal. An assessment of how the public perceives conflicts between goals should routinely accompany the assessment of importance of the goals, since misunderstandings will result if the planner does not know which goals are seen as incompatible. When some of the goals being assessed are closely related in people's minds (e.g., wilderness and scenic beauty) attention must be paid to how this affects importance evaluations. Two drastically different reactions to the scenic beauty goal occurred in this study. Some people gave it a low rating, not because they disapproved of it, but because they felt there was no need to worry about it as long as the wilderness goal was carried out. The responses to the scenic beauty and water supply goals also illustrate that different people reading the same goal description may interpret it in very different ways. To avoid misunderstandings, some kind of check should be made to be sure that people have interpreted the goals or factors in the way intended by the planner.

If people use general cognitive dimensions, such as preservation/utilization, as a basis for evaluating importance and conflict, then it would be very helpful to identify any such general dimensions and to identify the circumstances in which preconceptions about them will dominate responses to goals. The type of questionnaire used in this study, with very brief, general descriptions of goals, a hypothetical scenario, and a rapid response format, may have enhanced the tendency to rely on preconceptions about how the goals are related to such general cognitive dimensions. Perhaps in a real planning situation, in which interested people deal with more detailed information about

real decision problems, and in which they can be instructed more carefully about the types of judgments they are to make, specific features of the planning problem would play a larger role in evaluations of the goals.

The present study has some limitations which must be considered when interpreting the results. The population was quite limited, consisting mostly of undergraduate psychology students, the majority of whom were in favor of wilderness preservation. This group represents one type of person who is likely to be concerned about resource management, but a more general study would have to include a broader sampling from the general public, including individuals who are disposed toward development and use of natural areas. Many of the people in the study hurried through the questionnaire, and probably did not read the material very carefully. This could have reduced the effectiveness of the experimental manipulations.

The type of rating scale used may also have caused some problems. There may have been a ceiling effect on ratings of wildlife and wilderness, which were very often given the highest possible rating. A ceiling effect could have reduced the strength of correlations between importance ratings. A magnitude estimation response format might have avoided this problem, but it would have been a less familiar type of response for most of the subjects.

The rating scale also created standardization problems. Some of the people may have tended to use the top of the rating scale, and others the bottom, even though their relative evaluations of the goals

may have been similar. This would increase the size of the error terms in the ANOVA's, making the effects of the manipulations harder to detect. None of the goals appeared to be stable enough across the experimental conditions to use as a reference point for standardizing the importance ratings. A point-allocation procedure, in which a fixed number of importance points must be allocated among the goals, might have avoided this problem, but it would have artificially induced negative correlations between ratings of different goals, making the analysis of correlation coefficients difficult to interpret.

These problems would be expected to make the effects of the experimental manipulations more difficult to detect. The fact that a consistent pattern of effects was observed in spite of the shortcomings of the study strengthens the conclusion that for this group of people, the evaluation of the importance of the resource management goals was influenced by the specific conflicts between goals in the management scenario.

CONCLUSIONS

This experiment was intended to be an exploratory study of how the importance of resource management goals is judged by members of the public. The results indicate that there is a real and consistent relationship between the evaluation of goal importance and the perception of conflict between goals. This relationship should be considered and explicitly dealt with in the assessment of public values, whether by means of formal decision models or through more general methods of public involvement.

To improve our understanding of the process by which these judgments are made, the present research should be extended to include more general public groups and more realistic planning situations. A wider selection of goals should be investigated, and different response formats tried. It may be that formal decision models will work better in workshop situations, where time can be taken to explain to participants how their responses will be used, and to discuss in detail the goals and the management situation.

An attempt should also be made to find ways of identifying general cognitive dimensions and fixed preconceptions about goal conflicts which may influence people's evaluations of the goals. If such preconceptions exist, it would be good to know under what specific circumstances people will rely on them for evaluating goals, and under what

circumstances they will use specific features of the management problem to make their judgments.

APPENDIX A

QUESTIONNAIRE

PUBLIC VALUES IN NATURAL RESOURCE MANAGEMENT

This study is part of a research program about public values in natural resource management. The purpose of the study is to learn how different people place values on different goals in resource management decision problems. This information will help us to develop better ways to include public views in resource management. This study will take about forty minutes of your time. Your participation is voluntary, and your completion of the written questions will indicate your consent as a willing participant in this study. All of your responses will be anonymous, so you need not put your name on any of the materials. You are free to withdraw from the study at any time without incurring ill will or in any way affecting your university standing or course grades.

Figure A.1. Questionnaire Page 1, All Groups

The national forests in this country are the source of many important natural resources. These include timber, water, minerals, wildlife, land for cattle grazing, and opportunities for recreation and scenic enjoyment. Congress has directed that all of these uses must be considered when deciding how to manage any national forest. In this study you will be given a description of a typical national forest. This description contains features which frequently appear in real forest management situations. Several management goals are also described which could be used as a basis for deciding how to manage the forest. You will be asked to answer some questions concerning these goals and the national forest which has been described. Think about the questions carefully, and answer them as accurately as you can. If you wish, you may refer back to the descriptions of the national forest and the management goals while you are answering the questions.

The national forests in this country are the source of many important natural resources. These include timber, water, minerals, wildlife, land for cattle grazing, and opportunities for recreation and scenic enjoyment. Congress has directed that all of these uses must be considered when deciding how to manage any national forest. In this study you will be given a description of several management goals which could be used as a basis for deciding how to manage a national forest. You will be asked to answer some questions concerning these goals. Think about the questions carefully, and answer them as accurately as you can. If you wish, you may refer back to the descriptions of the management goals while you are answering the questions.

Figure A.3. Questionnaire Page 2, Control Group

The map above represents a typical national forest in the western United States. The forest consists mainly of pine, fir, and spruce trees in a mountainous region. Like all national forests, this forest provides many different resources, and is used in different ways by many different people.

Timber, harvested from several places in the forest, supplies sawmills in a nearby town, from which wood products are distributed nationwide. The wood industry provides jobs for many of the residents of the town. Some of the residents also find employment in businesses related to recreation and tourism. Water run-off from the watershed on the east side of the forest serves the domestic and industrial needs of the town. Water from the forest is also used for irrigation by local farms.

Figure A.4. Questionnaire Page 3, Experimental Groups

The national forest contains an area of virgin forest in which logging has never taken place. This virgin forest contains large stands of commercially valuable trees which, if logged, would significantly increase the amount of wood produced by the forest. The timber industry has offered to cooperate with the Forest Service in cutting timber in the virgin forest and transporting it to local sawmills.

Hiking and backpacking enthusiasts have asked that the virgin forest be set aside and preserved as an official wilderness area. There are presently no official wilderness areas closer than three-hundred miles to the national forest. The virgin forest provides one of the only opportunities for people living close to the national forest to hike and camp in a wilderness environment.

Recreation opportunities in the forest include hunting, backpacking, off-road recreational vehicle use, picnicking, and pleasure driving. There are several maintained hiking trails and campgrounds, and the scenic attractions of the forest attract many recreational users. The forest also provides habitat for deer and elk herds, as well as turkey, squirrel, rabbit, and many non-game birds and animals.

The national forest contains an area of virgin forest in which logging has never taken place. Timber in this virgin forest would be extremely difficult to harvest, because it is located on steep terrain which is inaccessible to logging equipment. For this reason, neither the Forest Service nor the timber industry has expressed any interest in trying to cut trees in the virgin forest.

Hiking and backpacking enthusiasts have asked that the virgin forest be set aside and preserved as an official wilderness area. There is already a large official wilderness area adjacent to the forest on the west side. This area already offers many opportunities for people living close to the national forest to hike and camp in a wilderness environment.

Recreation opportunities in the forest include hunting, backpacking, off-road recreational vehicle use, picnicking, and pleasure driving. There are several maintained hiking trails and campgrounds, and the scenic attractions of the forest attract many recreational users. The forest also provides habitat for deer and elk herds, as well as turkey, squirrel, rabbit, and many non-game birds and animals.

Management Goals

The decision of how to manage a forest could be guided by many different considerations. Six possible goals for forest management are listed and described below. The managers of a forest could try to achieve any one of these goals, or they might try to achieve several, or even all of the goals at the same time.

SCENIC BEAUTY - Many people come to the forest to enjoy natural scenery. One goal of forest management could be to maintain or increase the attractiveness of the forest land, so that there will be abundant opportunities for scenic enjoyment.

TIMBER PRODUCTION - The national forests are an important source of wood for housing and other uses. One goal could be to produce as much timber as possible by cutting trees which are suitable for lumber, and improving growing conditions for new trees to replace those that have been cut.

WILDERNESS PRESERVATION - The national forests contain many areas which are essentially unchanged by human intrusion and civilized development. This goal would try to protect such areas from future human activity and preserve them in their natural condition.

Figure A.7. Questionnaire Page 5, All Groups

LOCAL EMPLOYMENT - Communities close to national forests often obtain economic benefits from the forest. Examples of such benefits include employment opportunities and income from the logging industry and from tourist-related business. This goal would seek to increase these benefits for local citizens.

WILDLIFE - The forest is a habitat for many species of wildlife, for example deer, squirrels, and birds. One goal of forest management could be to improve forest habitats for the benefit of wildlife populations.

WATER SUPPLY - Many communities depend on forest watersheds for their municipal water supplies. Forest management actions may affect the amount of water supplied by watersheds. This goal would try to guarantee local communities a reliable and sufficient supply of water.

All of the goals described above could be used to formulate a detailed plan for managing the national forest described in this study. One of the tasks facing a forest planner is to decide how important each goal is, and how much emphasis should be placed on trying to achieve each goal. A planner might decide that all the goals are equally important, or he may think that some goals should be emphasized more than others.

For each of the six goals, decide how much emphasis you think should be placed on that goal in managing the national forest described in this study. In the space after each goal below, write a number from zero to ten indicating how important you think that goal is. A zero means that you think the goal is very unimportant and should receive no emphasis. A ten means that you think the goal is extremely important and that every effort should be made to achieve it. Remember that your answers should relate specifically to the national forest described earlier.

Goal	Importance
WILDLIFE	-----
TIMBER PRODUCTION	-----
SCENIC BEAUTY	-----
WATER SUPPLY	-----
WILDERNESS PRESEPVATION	-----
LOCAL EMPLOYMENT	-----

Figure A.9. Questionnaire Page 7, Experimental Groups

All of the goals described above could be used to formulate a detailed plan for managing a national forest. One of the tasks facing a forest planner is to decide how important each goal is, and how much emphasis should be placed on trying to achieve each goal. A planner might decide that all the goals are equally important, or he may think that some goals should be emphasized more than others.

For each of the six goals, decide how much emphasis you think should be placed on that goal in managing a national forest. In the space after each goal below, write a number from zero to ten indicating how important you think that goal is. A zero means that you think the goal is very unimportant and should receive no emphasis. A ten means that you think the goal is extremely important and that every effort should be made to achieve it.

Goal	Importance
WILDLIFE	-----
TIMBER PRODUCTION	-----
SCENIC BEAUTY	-----
WATER SUPPLY	-----
WILDERNESS PRESERVATION	-----
LOCAL EMPLOYMENT	-----

Figure A.10. Questionnaire Page 7, Control Group

It may not be possible to achieve all the goals which have been described here. Some goals may conflict with each other, that is, trying to achieve one goal may make it difficult or impossible to achieve a different goal. For each pair of goals listed below, decide how much you think the two goals conflict with each other in the national forest described earlier. In the space after each pair of goals write a number from zero to ten indicating the amount of conflict between the two goals. A zero means that there is no conflict, that is, it would be possible to achieve both goals at the same time because neither goal interferes with the other. A ten means that the goals conflict very strongly, that is, it would be very difficult or impossible to achieve both goals at the same time. Remember that your answers should relate specifically to the national forest described in this study.

Goals	Conflict
WILDLIFE and SCENIC BEAUTY	-----
TIMBER PRODUCTION and WATER SUPPLY	-----
SCENIC BEAUTY and TIMBER PRODUCTION	-----
WILDLIFE and TIMBER PRODUCTION	-----
WILDLIFE and WILDERNESS PRESERVATION	-----
WATER SUPPLY and WILDLIFE	-----

(continued on next page)

Figure A.11. Questionnaire Page 8, Experimental Groups

Goals	Conflict
WILDERNESS PRESERVATION and SCENIC BEAUTY	-----
WILDERNESS PRESERVATION and TIMBER PRODUCTION	-----
TIMBER PRODUCTION and LOCAL EMPLOYMENT	-----
LOCAL EMPLOYMENT and SCENIC BEAUTY	-----
LOCAL EMPLOYMENT and WILDERNESS PRESERVATION	-----
SCENIC BEAUTY and WATER SUPPLY	-----
WATER SUPPLY and WILDERNESS PRESERVATION	-----
LOCAL EMPLOYMENT and WILDLIFE	-----
WATER SUPPLY and LOCAL EMPLOYMENT	-----

Figure A.12. Questionnaire Page 9, Experimental Groups

It may not be possible to achieve all the goals which have been described here. Some goals may conflict with each other, that is, trying to achieve one goal may make it difficult or impossible to achieve a different goal. For each pair of goals listed below, decide how much you think the two goals conflict with each other. In the space after each pair of goals write a number from zero to ten, indicating the amount of conflict between the two goals. A zero means that there is no conflict, that is, it would be possible to achieve both goals at the same time because neither goal interferes with the other. A ten means that the goals conflict very strongly, that is, it would be very difficult or impossible to achieve both goals at the same time.

Goals	Conflict
WILDLIFE and SCENIC BEAUTY	-----
TIMBER PRODUCTION and WATER SUPPLY	-----
SCENIC BEAUTY and TIMBER PRODUCTION	-----
WILDLIFE and TIMBER PRODUCTION	-----
WILDLIFE and WILDERNESS PRESERVATION	-----
WATER SUPPLY and WILDLIFE	-----
WILDERNESS PRESERVATION and SCENIC BEAUTY	-----
WILDERNESS PRESERVATION and TIMBER PRODUCTION	-----

(continued on next page)

Figure A.13. Questionnaire Page 8, Control Group

Goals	Conflict
TIMBER PRODUCTION and LOCAL EMPLOYMENT	-----
LOCAL EMPLOYMENT and SCENIC BEAUTY	-----
LOCAL EMPLOYMENT and WILDERNESS PRESERVATION	-----
SCENIC BEAUTY and WATER SUPPLY	-----
WATER SUPPLY and WILDERNESS PRESERVATION	-----
LOCAL EMPLOYMENT and WILDLIFE	-----
WATER SUPPLY and LOCAL EMPLOYMENT	-----

Figure A.14. Questionnaire Page 9, Control Group

Please take a few more minutes to answer the following questions:

1) Which of the six goals do you think is the most important?

Explain briefly why you think it is important.

2) Which goal do you think is the least important?

Explain briefly why you think it is less important than the others.

3) Which two goals do you think conflict with each other the most?

Explain briefly why you think these goals conflict with each other.

4) Indicate whether you agree or disagree with each of the following statements by placing a check in the appropriate space.

	DISAGREE STRONGLY	DISAGREE	AGREE	AGREE STRONGLY
A) Mountain lions should not be shot, even if they occasionally kill sheep and cattle.	-----	-----	-----	-----
B) If stopping pollution means many people will lose their jobs, then pollution should be allowed to continue.	-----	-----	-----	-----
C) We should be prepared to relax environmental pollution standards if it will help to alleviate the energy crisis.	-----	-----	-----	-----
D) Wilderness is a precious national heritage which should be protected and preserved.	-----	-----	-----	-----

Figure A.16. Questionnaire Page 11, All Groups

If you have any further comments about the issues that have been raised in this study, or about the study itself, please write them on this page.

Thank you for your time and cooperation in completing this study.

APPENDIX B

MEAN CONFLICT AND IMPORTANCE RATINGS

Table B.1. Mean Conflict Ratings

	High Conflict		Low Conflict		Control
	High Scarcity	Low Scarcity	High Scarcity	Low Scarcity	
WP - WL	1.04	.56	1.00	.92	.22
WP - SB	1.75	1.50	1.44	1.46	2.56
WP - TP	9.25	9.00	7.93	8.27	8.37
WP - LE	6.32	7.12	7.15	6.31	6.46
WP - WS	3.79	4.85	2.85	4.19	4.63
WL - SB	1.21	1.77	1.33	1.65	1.26
WL - TP	8.04	7.12	7.33	7.73	7.89
WL - LE	5.57	5.96	5.41	5.89	4.89
WL - WS	3.96	3.56	2.89	4.12	3.63
SB - TP	8.18	7.96	7.78	8.08	7.35
SB - LE	4.57	5.81	5.70	5.15	3.73
SB - WS	3.00	3.23	2.70	4.54	3.48
TP - LE	1.00	1.04	1.70	1.35	.85
TP - WS	2.96	3.67	4.00	4.35	2.30
LE - WS	1.61	2.85	2.52	2.65	1.67

WP = wilderness preservation

WL = wildlife

SB = scenic beauty

TP = timber production

LE = local employment

WS = water supply

Table B.2. Mean Importance Ratings

	High Conflict		Low Conflict		Control N=27
	High Scarcity N=28	Low Scarcity N=27	High Scarcity N=27	Low Scarcity N=26	
Wilderness	8.39	7.85	7.89	8.50	8.74
Wildlife	8.79	8.44	7.67	8.92	8.67
Scenic Beauty	7.39	6.82	6.63	7.65	7.26
Timber	4.79	6.22	5.82	6.65	6.07
Local Employment	5.21	5.82	5.33	6.31	5.11
Water	6.39	7.04	7.59	7.62	7.59

Table B.3. Mean Importance Ratings for the High Wilderness Group

	High Conflict		Low Conflict		Control N=14
	High Scarcity N=12	Low Scarcity N=12	High Scarcity N=13	Low Scarcity N=11	
Wilderness	10.00	10.00	10.00	10.00	10.00
Wildlife	9.58	9.42	9.23	9.36	9.29
Scenic Beauty	8.83	6.92	7.39	8.27	7.50
Timber	4.33	5.58	6.46	7.09	6.14
Local Employment	5.42	4.92	5.92	7.09	5.21
Water	6.75	6.67	8.15	7.46	7.14

Table B.4. Mean Importance Ratings for the Low Wilderness Group

	High Conflict		Low Conflict		Control N=8
	High Scarcity N=9	Low Scarcity N=13	High Scarcity N=13	Low Scarcity N=11	
Wilderness	5.78	5.69	5.69	6.82	6.38
Wildlife	8.11	7.39	6.08	8.46	7.50
Scenic Beauty	5.44	6.23	5.77	7.09	7.13
Timber	4.89	6.62	5.31	6.46	6.13
Local Employment	4.33	6.15	4.85	6.18	5.25
Water	6.33	7.00	6.92	8.00	7.88

APPENDIX C

MULTI-DIMENSIONAL SCALING OF CONFLICT RATINGS

The object of the multi-dimensional scaling (MDS) of conflict ratings was to represent the six goals as points in a multi-dimensional space so that the amount of perceived conflict between two goals is proportional to the distance between their corresponding points in the space. The dimension of the space and the configuration of the points in the space may then provide information about the cognitive process by which conflict judgments are made.

Conflict ratings for each experimental group were first submitted to a Thurstone categorical judgment scaling analysis to obtain standardized conflict scores for each goal from each group of subjects. The conflict scores were adjusted so that a pair of goals which received conflict ratings of zero from all members of a group would have a standardized conflict score of zero. These conflict scores were then used as interpoint distances in two different kinds of MDS.

A classical metric MDS was performed by converting the matrix of interpoint distances for each group into a matrix of scalar products (Torgerson 1958) then doing a principle components analysis of this matrix. A single very strong factor emerged for each group, indicating that the conflict scores could be fitted well by a one-dimensional space. The locations of each goal on this dimension for each group

are given in Table C.1. Clearly, this dimension separates the preservation goals from the utilization goals, and thus might be thought of as a preservation/utilization dimension. The fact that only one dimension is needed to fit the conflict scores suggests that conflict judgments were based almost exclusively on this one attribute of the goals. Furthermore, the relative positions of goals on this dimension are virtually identical from one experimental group to another, in spite of the conflict manipulation. (Correlations between groups across the six goals range from a low of .975 to a high of .998).

A non-metric MDS (Kruskal 1964) produced almost identical results. A one-dimensional space fitted the conflict ratings very well for each group, and the relative positions of the goals on this dimension are very similar from group to group. (Correlations between groups range from .888 to .999). Table C.2 shows the location of goals on the dimension revealed by the non-metric MDS. Correlations between the metric MDS and the non-metric MDS scale values were very high for all groups (from .939 to .990), showing that the two different methods each discovered the same underlying dimension.

To investigate the relationship between the dimension revealed by the MDS analysis and the rated importance of goals, the importance ratings given by each experimental group to the six goals were analyzed with the same categorical judgment model as was used for the conflict ratings, to get standardized importance scale values (Table C.3). Correlations between these importance scale values and the MDS scale values (Table C.4) show that there is a consistent relationship between

Table C.1. Scale Values from Classical MDS of Conflict Ratings

	High Conflict		Low Conflict		Control
	High Scarcity	Low Scarcity	High Scarcity	Low Scarcity	
Wilderness	160	144	130	134	142
Wildlife	124	95	105	119	130
Scenic Beauty	109	116	108	119	81
Timber	-234	-191	-190	-212	-202
Local Employment	-114	-130	-138	-118	-98
Water	-45	-35	-15	-41	-54

Table C.2. Scale Values from Non-Metric MDS of Conflict Ratings

	High Conflict		Low Conflict		Control
	High Scarcity	Low Scarcity	High Scarcity	Low Scarcity	
Wilderness	118	95	88	93	102
Wildlife	98	94	87	94	102
Scenic Beauty	67	90	87	93	96
Timber	-142	-131	-171	-132	-105
Local Employment	-102	-129	-89	-128	-100
Water	-40	-19	-3	-20	-95

Table C.3. Importance Scale Values

	High Conflict		Low Conflict		Control
	High Scarcity	Low Scarcity	High Scarcity	Low Scarcity	
Wilderness	135	114	130	126	142
Wildlife	164	155	125	164	143
Scenic Beauty	102	82	97	103	96
Timber	4	73	76	58	50
Local Employment	28	68	64	51	13
Water	83	102	146	102	103

Table C.4. Correlations Between Importance Scale Values and Conflict MDS Scale Values

	High Conflict		Low Conflict		Control
	High Scarcity	Low Scarcity	High Scarcity	Low Scarcity	
Classical (metric) MDS	.94	.63	.67	.84	.83
Non-metric MDS	.96	.70	.66	.88	.78

importance ratings and the dimension underlying conflict ratings. This relationship is particularly strong for the high conflict/high scarcity group. This analysis suggests that people in this study may have held relatively fixed preconceptions about conflicts between goals, based largely on a single perceived attribute of the goals (preservation/utilization orientation), and that the judged importance of the goals was also partly based on the same perceived attribute.

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