



Factors Influencing Forest Values and Attitudes of Two Stakeholder Groups: The Case of the Foothills Model Forest, Alberta, Canada

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Canada's Model Forest Program was established as a means of implementing concepts of sustainable forest management. An initial step to achieving this is understanding stakeholders' forest values and attitudes. A study was undertaken to examine forest values and attitudes toward forest management of campers and hunters in the Foothills Model Forest of Alberta within the context of a cognitive hierarchy model. Data were collected by mail survey in 1996. Campers and hunters were primarily biocentric in their forest values orientation. These groups supported protection-oriented management strategies, were not in favor of economic development and timber-oriented strategies, and did not believe that current forest management is sustainable. Socioeconomic factors, social influences, and knowledge had little influence on values or attitudes. Forest values were related strongly to attitudes providing support for the cognitive hierarchy model.

Keywords attitudes, Foothills Model Forest, forest values, knowledge, management preferences

As the focus of forest management on public lands in North America shifts from sustaining timber production to sustaining a range of forest values, natural resource managers are struggling to understand what values should be included, whose values to include, how to incorporate these values into decision making, and how to accommodate conflicting values in forest management. In Canada, one approach to addressing these issues has been the establishment of the Model Forest Program.

The Foothills Model Forest (FMF) is one of 10 model forests established across Canada in 1992. The FMF lands consist of over 2.7 million hectares situated in the foothills and Rocky Mountains of west-central Alberta. The majority of the FMF is public land administered by the Province of Alberta and is managed for a variety of interests, including industrial forestry, oil and gas development, mining, and recreation.

One goal of the FMF is to bring a wide range of stakeholders together in an effort to better accommodate a broad range of forest values (Foothills Model Forest

Received 15 February 1999; accepted 9 August 1999.

This research was funded by the Foothills Model Forest and the Sustainable Forest Management Network, University of Alberta. The authors greatly appreciate the assistance of Alberta Environmental Protection in providing the hunter sample.

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1997). A primary step in achieving this goal is delineating stakeholders, understanding their forest values and attitudes toward forest management and the factors influencing these values and attitudes (Bengston 1994). This study examines forest values and attitudes of two recreation user groups of the FMF and uses a conceptual model to examine the association between socioeconomic variables, social influences, knowledge of forest-related facts, forest values, and management preferences and beliefs about current forest management among these two groups.

The Conceptual Framework

Previous studies examining the forest value-attitude relationship have generally lacked a theoretical framework. Drawing upon the literature on environmental concern and environmentalism (e.g., Dietz et al. 1998; Stern 1992) and human dimensions of wildlife (e.g., Fulton et al. 1996; Tarrant et al. 1997), we examine forest values and attitudes within the context of social-psychological theory. A cognitive hierarchy framework is examined whereby general beliefs or held forest values are hypothesized to influence more specific attitudes such as forest management preferences and beliefs about current forest management.

Figure 1 presents a conceptual representation of the cognitive hierarchy model used to guide our analyses. A cognitive hierarchy framework recognizes several layers of cognitions with basic values providing the foundation for higher order attitudes and behavior (Rokeach 1973). Basic values are few in number and rep-

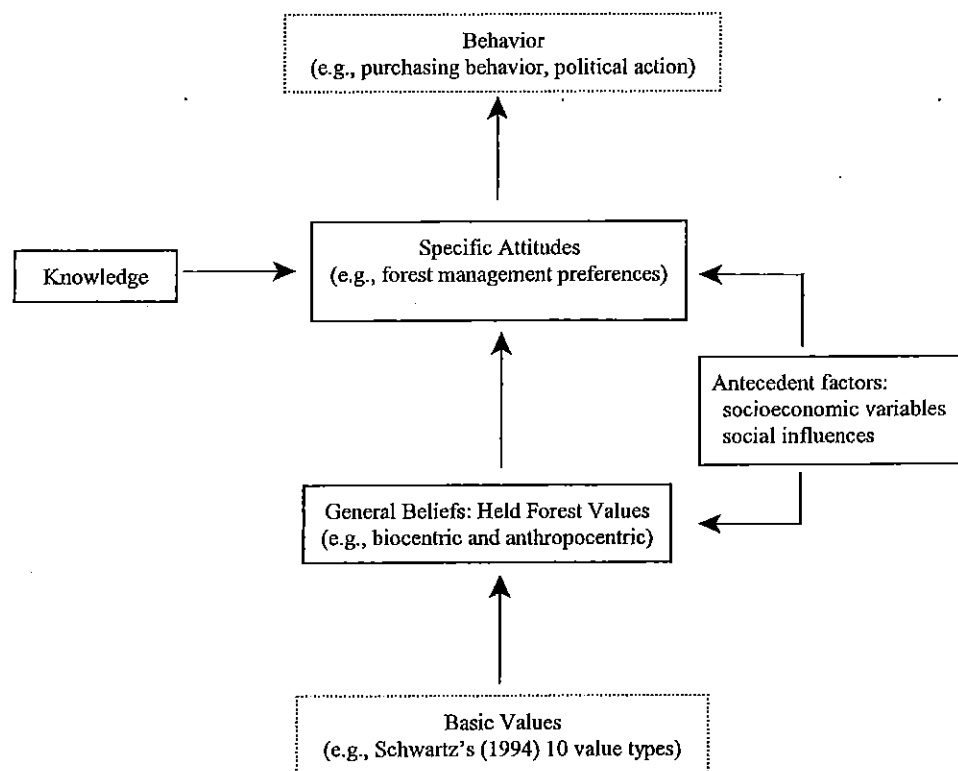


FIGURE 1 Conceptual representation of a cognitive hierarchy model of values and attitudes. (Boxes with solid lines are included in the analyses.)

resent fundamental social and biological needs. They are very stable, are difficult to change, transcend specific situations and experiences, are widely shared in society, and thus do not explain much variability in specific attitudes (Fulton et al. 1996). Although it is generally accepted that there are few basic values, the precise number is not known. For example, Rokeach (1973) identified 36 basic values and Schwartz (1994) identified 10 value types.

The influence of basic values in a cognitive hierarchy is primarily indirect through their influence on higher order cognitions such as general beliefs (Stern et al. 1995). In our model, general beliefs in relation to forests are represented by held forest values and represent an individual's orientation toward forests (Bengston 1994; Steel et al. 1994; Bourke and Luloff 1994). Held forest values have been defined as "relatively enduring conceptions of the good related to forests and forest ecosystems" (Bengston 1994). General beliefs in turn influence higher order attitudes such as forest management preferences. It is important to understand these value-attitude relationships and the factors influencing values and attitudes, because attitudes, in turn, are likely to affect individual consumer behavior (e.g., purchasing "green certified" wood products) and political action (e.g., blockading forestry operations) (Stern 1992), and these may impact forest policy and management. Although there may be reciprocal effects among variables in the model, the major flow of causation in a hierarchical framework is generally accepted as basic values providing the basis for forming general beliefs (e.g., held forest values), which elicit specific attitudes (e.g., forest management preferences), and these in turn elicit specific actions or behaviors (Fulton et al. 1996; Stern et al. 1995).

In the literature two categories of held forest values have been distinguished that reflect the evolution from sustained timber production to sustaining a range of forest values. They have been referred to as instrumental and intrinsic (Bengston 1994), instrumental and noninstrumental (Xu and Bengston 1997), and anthropocentric and biocentric (Steel et al. 1994). *Instrumental* and *anthropocentric* refer to those values associated with the utilization of forests for products and services that satisfy human wants and needs. If these human-centered values dominate natural resource management, then forests can be defined in terms of the resources they provide for humans, such as forest products, employment, and life support functions. *Intrinsic*, *noninstrumental*, or *biocentric* values refer to the worth of something as an end in itself, regardless of its usefulness to humans. Nature is recognized as having inherent worth and a right to exist for its own sake and human uses and benefits are not necessarily the most important uses of the forest (Steel et al. 1994).

Consistent with the cognitive hierarchy model described previously, held forest values have been associated with higher order cognitions such as specific attitudes that reflect forest management and policy preferences. For example, biocentric-oriented individuals are more likely to support protection-oriented management strategies and anthropocentric-oriented individuals are more likely to support traditional timber management (Bourke and Luloff 1994; Steel et al. 1994).

In natural resource management, the level of factual knowledge has been identified as an external variable that links values and attitudes (Tarrant et al. 1997). Although the effect of knowledge on attitudes is not conclusive, there have been numerous studies suggesting a link between the two. Research has shown that those with more knowledge about the environment or an environmental issue tend to have more polarized environmental attitudes. Individuals with higher knowledge levels have more positive attitudes than those with low levels of knowledge (Bright and Manfreda 1997; Fortner and Lyon 1985; Young 1980). Furthermore, it has

been suggested that general environmental knowledge enhances the association between general environmental value orientations and environmental policy preferences by increasing the explained variance when knowledge is included in the analysis (Pierce et al. 1989; Steel et al. 1990; Tarrant et al. 1997). Thus, knowledge of general forest-related facts was included in our analyses to examine the relationship between knowledge, forest values, and attitudes toward forest management.

Variation in forest values and attitudes may be influenced by a variety of antecedent factors including socioeconomic variables and social influences. Of socioeconomic variables, women, people with higher levels of education, younger individuals, urban residents, people living in non-timber-dependent regions, and those with a liberal political orientation hold stronger biocentric values and support the principles of sustainable forest management (Bourke and Luloff 1994; Steel et al. 1994; Reading et al. 1994).

In addition to personal circumstances, values and attitudes may be a reflection of the circumstances of one's community or the social influences in one's life (Dietz et al. 1998). By subscribing to organizational philosophies, joining leisure social worlds, and working in certain environments, individuals are subjected to social norms that may impact on their values and attitudes. For example, members of environmental organizations are more biocentric oriented than nonmembers (Bourke and Luloff 1994; Steel et al. 1994). Leisure social worlds, as represented by participation in different types of recreational activities, have been associated with natural resource attitudes. For example, participants in appreciative or nonconsumptive types of forest recreational activities such as hiking or birdwatching tend to have a more biocentric orientation toward the environment and are more supportive of resource preservation than people who prefer mechanized activities such as snowmobiling or consumptive activities such as hunting (Jackson 1986; Jackson 1987; Tarrant et al. 1997). An individual's working environment has been associated with forest values, whereby those who are dependent on the timber industry for their economic livelihood have a more anthropocentric forest value orientation (Steel et al. 1994).

Despite the potential links between socioeconomic and social influence variables, knowledge, forest values, and attitudes, little has appeared in the literature examining these relationships in a multivariate context. The current study extends the literature by examining forest values and attitudes toward forest management as a function of socioeconomic circumstances, social influences, and social-psychological processes, and includes knowledge as an independent variable in the analyses.

Methods

The Samples

Two important stakeholder groups of the FMF are campers and hunters. A sample of campers was obtained from personal interviews with Alberta residents at 13 of the 17 managed campgrounds and 29 unmanaged camping sites in the FMF during the summer of 1996. The 13 campgrounds represented 92% of the total nights spent at managed sites in the model forest. The interview collected information on camping characteristics and activities and collected names and addresses for a follow-up mail survey. Of those interviewed, 91% agreed to participate in the mail survey resulting in a total sample of 1439 individuals.

A sample of 3000 Alberta residents who held a moose, elk, or black bear hunting licence in 1996 was drawn at random from the hunting licence database maintained by Alberta Environmental Protection. A total of 87,592 Alberta residents held a big game licence in 1996. Although the hunter sample did not target users of the FMF, most big game hunters in Alberta hunt on forested public land. Therefore, their values and attitudes are relevant to forest management in the model forest.

The Questionnaire

Questionnaires were developed to collect information on forest values, attitudes toward forest management, knowledge of forest-related facts, and socioeconomic and social influence variables. The questionnaires were mailed to campers in May 1997 and hunters in June 1997. About 1 week later a reminder postcard was sent, and about 4 weeks after the initial mailing a second questionnaire was sent to those who had not responded. Response rates were 61% for hunters and 63% for campers.

Two broad categories were used to measure forest value orientations: biocentric and anthropocentric. The Forest Values Scale developed by Steel et al. (1994) was modified to include statements on the spiritual significance of forests (Xu and Bengston 1997) and nonuse aspects such as the existence of forests for future generations (see Appendix). Respondents rated a series of 15 statements on a 5-point scale ranging from "strongly disagree" to "strongly agree." The forest value statements were factor analyzed using principal factor analysis with varimax rotation. Factors were extracted until the eigenvalue fell below 1.0. A minimum loading of 0.35 was used to identify items belonging to a factor. Reliability of the factors was examined using Cronbach's alpha.

Measurement of attitudes toward forest management was based on a scale used previously in Alberta (McFarlane and Boxall 1996). Statements were developed to measure preferences for the protection of forest resources and economic development and timber-oriented management, and beliefs about aspects of management related to the sustainability of current forest management in the province (see Appendix). Respondents rated a series of 15 statements on a 5-point scale ranging from "strongly disagree" to "strongly agree." Factor analysis revealed that the statements formed one factor, with protection items having a negative loading. The factor had a Cronbach's alpha of .83.

Respondents familiarity with basic forest-related facts was measured based on questions contained in *treevia*, a forest trivia game produced by the Canadian Council of Forest Ministers, and questions developed by consulting experts in forest management. Respondents answered 13 statements as "true," "false," or "not sure." Questions were developed to indicate a general knowledge of forestry practices, protection of forests and species, and forest ecology.¹

Socioeconomic variables included age, gender, place of residence, education, and level of total household income. We treat membership in a conservation-related organization, dependence of a household member on the forest sector for economic livelihood, and participation in forest recreation activities as social influence variables.

Multiple Regression Analyses

Based on the relationships between socioeconomic variables, social influences, and social-psychological variables discussed previously, we estimated a block recursive

model in which assumptions about causality were made across blocks but not within a block. Although some causal effects may be reciprocal, a recursive model is appropriate for analyzing relationships of socioeconomic and social influence variables and the value-attitude relationship in an environmental context (Dietz et al., 1998). To assess the relative contribution of the independent variables, two regression models using ordinary least squares (OLS) were developed: The first examines the explanators of held forest values and the second examines the explanators of attitudes toward forest management.

Characteristics of the variables used in the analysis are presented in Table 1. A respondent was considered to live in an urban environment if the person resided in one of the two largest cities (Edmonton or Calgary) in the province, with populations of about 616,300 and 768,000 in 1996, respectively (Statistics Canada 1998). All other cities in the province have populations <100,000. A forest-dependent community was defined as a community in which more than 20% of the economic base is composed of forest industry activity (Korber 1997). To test for cohort effects

TABLE 1 Distributional Characteristics of Regression Variables

Variable name	Description	Mean	SD
Socioeconomic:			
Age	Respondent's age in years	42.50	12.30
Gender	1 = female 0 = male	0.15	0.36
Education	0 = never attended school 18 = advanced degree	12.83	2.84
Urban	1 = resident of Edmonton or Calgary 0 = else	0.27	0.44
Community	1 = resides in a forest-dependent community 0 = else	0.12	0.33
Income	5 = 1996 household income <\$10,000 105 = ≥\$100,000	60.37	25.80
Social influences:			
Forest	1 = household member dependent on forest sector for economic livelihood 0 = else	0.14	0.34
Organization	1 = member of a conservation-related organization 0 = else	0.31	0.46
Consumptive	1 = consumptive/mechanized activities 0 = appreciative activities	0.88	0.32
Forest values:			
Biocentric	Summed index of biocentric items 7 = low level of support 35 = high level of support	30.53	3.17
Anthropocentric	Summed index of anthropocentric items 6 = low level of support 30 = high level of support	16.28	3.70
Knowledge:			
Know	Summed index of forest-related facts 0 = little knowledge 13 = high knowledge	8.65	2.34
Forest attitudes:			
Attitude	Summed index of attitude items 15 = low level of support 75 = high level of support	35.55	7.73

of age, age was divided into 3 categories: those born before 1946, those born from 1946 to 1959, and those born after 1959. These were treated as dummy variables, with the baby-boomer cohort (born from 1946 to 1959) representing the reference category (Dietz et al. 1998). Education and total household income were measured in categories, and the midpoints of the ranges were used in the analyses. Forest recreation activities were divided into consumptive or mechanized use and nonconsumptive use. All respondents in the hunter sample, and campers who indicated they hunted, fished, or used off-highway vehicles were assigned to the consumptive or mechanized category. Campers who did not participate in consumptive or mechanized activities were assigned to the nonconsumptive category.

Two indices for forest values were created for each individual by summing the responses for each item that loaded on the corresponding factors. A composite knowledge score was calculated for each respondent by summing the number of correct responses. An attitudinal index was created by summing an individual's responses on the attitudinal statements. The protection statements that loaded negatively on the attitude factor were reverse coded such that the attitudinal index reflected support for current management practices, economic development, and timber-oriented management.

Correlation coefficients among the independent variables did not exceed $\pm .30$; therefore, we felt collinearity was not a concern (Asher 1983, 50–53).

Results

Forest Values

Two factors were identified that correspond to the biocentric and anthropocentric forest value dimensions proposed by Steel et al. (1994) (see Appendix). Factor 1 represents a biocentric orientation and factor 2 represents an anthropocentric orientation. Two items did not load on any factors and were dropped from the analysis. Both of these items related to the rights of forests and nonhuman species: "Forests have a right to exist without being managed by humans" and "Wildlife, plants, and humans have equal rights to live and develop."

Bivariate Analysis

Campers and hunters tend to be more biocentric than anthropocentric oriented in their forest values. Respondents agreed (mean > 3.0) with all of the biocentric statements and disagreed (mean < 3.0) with 4 of the 6 anthropocentric statements (see Appendix). An examination of the anthropocentric statements suggests that respondents are not opposed to using forests for human needs but disagree that human needs should be the only goal of forest management. For example, while the respondents agreed that forests should be managed to meet the needs of as many people as possible and that if forests are not threatened, we should use them to add to the quality of human life, most disagreed with statements that forests exist mainly to serve human needs, that forests that are not used are a waste of our natural resources, that the primary use of forests should be for products that are useful to humans, and that as many uses be made of as much forested land as possible.

On the attitudinal statements, campers and hunters agreed (mean > 3.0) with statements relating to protection-oriented management strategies and disagreed (mean < 3.0) with statements relating to the sustainability of current management

and economic development and timber-oriented management (see Appendix). Respondents agreed with two economic development and timber-related statements: "Logging forests is acceptable if the forest is not harmed" and "When making forest decisions, the concerns of communities close to the forest should be given a higher priority than other communities."

Respondents were quite knowledgeable of forest-related facts, with a mean composite score of 8.53 (66% correct).

Factors Influencing Values

Results of the regression analysis of the forest values are presented in Table 2. Three of the socioeconomic variables are significant explanators of both biocentric and anthropocentric forest value scores. Younger individuals, women, and those with lower incomes had higher biocentric scores and lower anthropocentric scores than their counterparts. Individuals living in an urban center were more biocentric, while those living in forest-dependent communities were less biocentric than their counterparts. Education was not associated with the values scores. Inclusion of age cohorts instead of age in the model adds support to the linear relationship between age and the values scores: The older birth cohort (born before 1946) was less biocentric and more anthropocentric than cohorts born later.²

Of the social influence variables, dependence on the forest sector for economic livelihood had a positive association with the anthropocentric score and a weak negative association ($p < .10$) with the biocentric score. Belonging to a conservation organization had a weak positive association ($p < .10$) with the biocentric score, while participation in consumptive and mechanized types of forest recreation had a weak positive association ($p < .10$) with the anthropocentric score.

Although the F -test indicates that both models were significant, the adjusted R^2 values were low, explaining less than 10% of the variance. The model works slightly

TABLE 2 Regression Analysis of Explanators of Forest Values

Independent variables	Biocentric score (β)	Anthropocentric score (β)
Socioeconomic:		
Age	-.0791 ^b	.2294 ^b
Education	-.0238	.0060
Income	-.0511 ^a	.0601 ^b
Gender	.0632 ^b	-.1056 ^b
Community	-.0760 ^b	.0373
Urban	.0635 ^b	-.0167
Social influences:		
Forest	-.0438	.0984 ^b
Organization	.0381	-.0249
Consumptive	-.0109	.0385
Adjusted R^2	.0234	.0761
F value	6.389 ^b	19.535 ^b

^a Significant at $p < .05$.

^b Significant at $p < .01$.

better for the anthropocentric score (adjusted $R^2 = .076$) than the biocentric score (adjusted $R^2 = .023$).

Factors Influencing Attitudes

Results of the OLS estimates for the attitudinal measure are presented in Table 3. Examining the full model shows that of the socioeconomic variables, younger individuals, those with lower levels of education, and those living in a forest-dependent community were more supportive of current management, economic development, and timber-oriented management. Income, gender, and living in an urban area were not associated with attitudes. The linear effect of age was supported by additional models using age cohorts instead of age in the analysis.²

Only one social influence variable was associated with attitudes. Those who had a household member dependent on the forest sector for their economic livelihood were more supportive of current management, economic development, and timber-oriented management. Membership in a conservation organization and participating in a consumptive or mechanized forest recreation activity were not associated with attitudes.

Of the social-psychological variables, both forest value scores were associated with attitudes. Those with higher biocentric scores were less supportive of current management, economic development, and timber-oriented management. Conversely, individuals scoring higher on anthropocentric values were more supportive. Knowledge was not associated with attitudes.

TABLE 3 Regression Analysis of Explanators of Forest Attitudes

Independent variables	Full model (β)	Model I (β)	Model II (β)	Model III (β)	Model IV (β)
Socioeconomic:					
Age	-.0898 ^b	-.0909 ^b	.0477 ^a	-.1026 ^b	
Education	-.0742 ^b	-.0748 ^b	-.0614 ^b	-.0809 ^b	
Income	-.0279	-.0282	.0067	-.0287	
Gender	.0194	.0201	-.0530 ^a	.0192	
Community	.0859 ^b	.0861 ^b	.1443 ^b	.1774 ^b	
Urban	-.0217	-.0216	-.0493 ^a	-.0291	
Social influences:					
Forest	.0750 ^b	.0743 ^b	.1327 ^b		.1231 ^b
Organization	-.0187	-.0195	-.0299		-.0347 ^a
Consumptive	.0136	.0135	.0339		.0176
Forest values:					
Biocentric	-.3513 ^b	-.3516 ^b		-.3580 ^b	-.3483 ^b
Anthropocentric	.4424 ^b	.4426 ^b		.4492 ^b	.4266 ^b
Knowledge:					
Know	-.0071		-.0455	-.0009	-.0249
Adjusted R^2	.4195	.4197	.0619	.4181	.3968
F value	112.82 ^b	123.12 ^b	15.38 ^b	150.29 ^b	235.60 ^b

^a Significant at $p < .05$.

^b Significant at $p < .01$.

The differential effects of the independent variables on attitudes were examined further by excluding each block of explanatory variables from the analysis and examining the resulting adjusted R^2 values. Model I (Table 3) shows that excluding knowledge had no effect on explaining attitudes. The forest values were excluded in model II, resulting in a large decrease in the adjusted R^2 from .42 to .06, showing the importance of the effect of forest values on attitudes toward forest management. Model III excludes the social influence variables and model IV excludes the socio-economic variables. Both of these models resulted in a minimal change in the adjusted R^2 value.

Discussion

The philosophical approach of sustainable forest management being taken by the Foothills Model Forest appears to be consistent with the values and preferences of campers and hunters. Our results suggest that a holistic approach to resource management that considers nontimber uses, manages for a variety of species (biodiversity), employs alternative harvest methods to clear-cutting, provides input from local communities into forest management decisions, and gives some protection especially for endangered species may be acceptable to hunters and campers in the model forest. These are often cited as elements in sustainable forest management (Bengston 1994). Therefore, by adopting sustainable forest management principles, the model forest seems to be successfully incorporating camper and hunter values and preferences into management.

However, even though the forest industry in Alberta purports to be practicing sustainable forest management, campers and hunters did not think that current management is sustainable. This suggests that these stakeholders may not be aware of changes that have occurred in forest management (i.e., less emphasis on timber production and the adoption of sustainable management principles) or that they do not believe it is being implemented successfully. While a lack of awareness suggests opportunities for the model forest to undertake an educational campaign on its management philosophy and practices, our results suggest that increasing knowledge may not be an effective solution. Knowledge of forest-related facts was not associated with attitudes. However, our study measured knowledge of general forest-related facts. Specific knowledge of the principles and practices of sustainable forest management may have a greater effect on the beliefs about sustainability than the knowledge items used in our study. Specific messages to communicate new forest management strategies and the efforts to achieve sustainable management being undertaken in the model forest might be appropriate in changing beliefs about sustainability of current management. Based on our results, communication messages that emphasize the importance of industrial development based primarily on jobs and economic development may not be very successful with these stakeholders. Forestry initiatives and communications will have to demonstrate incorporation of ecosystem functions and enhancement of a variety of benefits, not just economic, to be acceptable to these stakeholders.

Some comments about the forest values scale seem warranted. First, items related to the spiritual and existence values of forests loaded on the biocentric factor, suggesting these are important elements in the biocentric dimension of forest values. Second, two statements relating to the rights of nature did not load on the factors, suggesting that the stakeholders may not understand the concept of rights for nonhuman species. This concept is relatively new in the debate of natural

resource management, may be confined to the worlds of academia, environmentalism, and philosophy (Nash 1989, 3–12) and may have little relevance or practical meaning to those who use the resource. Our results suggest that the concept of the rights of nature and its understanding and support among forest stakeholders needs further exploration before it becomes incorporated into forest management and policy decisions in Alberta. Third, further research is needed to determine if the biocentric values identified in this study represent a new emerging set of values as some have suggested (Steel et al. 1994; Xu and Bengston 1997) or if they represent subdimensions of broader environmental values (Stern et al. 1998).

Although this study examined only two forest stakeholder groups, results are consistent with other studies examining factors influencing environmental values and attitudes of the general public. Age, education, and place of residence have been cited as the only consistent socioeconomic predictors of environmentalism (Dietz et al. 1998). Income and gender have shown inconsistent and weak associations. Our results confirm these associations in relation to forest attitudes. Having a household member dependent on the forest sector for economic livelihood was the only social influence variable associated with attitudes. The variables associated with biocentric values (i.e., age, gender, urban residence, living in a forest-dependent community, and belonging to a conservation organization) differ from those associated with attitudes but are consistent with the findings of Steel et al. (1994). The lack of age cohort effects in our study is contrary to some studies that have found significant cohort effects on environmentally relevant values (e.g., Dietz et al. 1998). The inclusion of income in our study suggests this might be an important factor associated with forest values. However, the associations of socioeconomic and social influence variables with forest values and attitudes are weak and account for little of the explained variance. Opponents to resource exploitation are often labeled as “environmentalists” whose judgements are value driven and not based on factual information (Stern and Dietz 1994). Our results suggest that attitudes are more value driven regardless of socioeconomic status, association with environmental organizations, forest-sector dependence, or level of knowledge.

Forest management is a long-term process whereby future generations will realize the benefits and values produced by current management practices. Managing for future values necessitates an understanding of the factors influencing forest value orientations and attitudes and the development of theories and models that can predict how values and attitudes will change over time. The strong association of forest values and attitudes found in this study provides support for a cognitive hierarchy model, with forest values providing the basis for forming forest management preferences and beliefs about current forest management. Further research is needed to examine the relationships among these variables in the general public, to investigate the consistency of these relationships across samples and over time, and to test alternate models of the value–attitude relationship.

Notes

1. See McFarlane and Boxall (1999) for details of the knowledge measure.
2. The model results are not presented but are available from the authors upon request.

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APPENDIX Forest Values Scale (Factors 1 and 2) and Attitude Scale

	Loading	Mean
Factor 1 (Biocentric, $\alpha = .79$)		
Forests let us feel close to nature	.72	4.51
Forests give humans a sense of peace and well-being	.68	4.50
Forests rejuvenate the human spirit	.67	4.09
It is important to maintain our forests so that future generations will enjoy the same benefits that we enjoy	.58	4.73
Humans should have more respect and admiration for our forests	.53	4.46
Forests are sacred places	.46	3.43
Whether or not I get to visit the forest as much as I like, it is important to know that forests exist in Alberta	.40	4.77
Factor 2 (Anthropocentric, $\alpha = .63$)		
The primary use of forests should be for products that are useful to humans	.53	2.11
Forests exist mainly to serve human needs	.52	2.08
As many uses (e.g., forestry, wildlife habitat, recreation, oil and gas) should be made of as much forested public land as possible	.47	2.85
Forests that are not used by humans are a waste of our natural resources	.45	1.73
Forests should be managed to meet the needs of as many people as possible	.42	3.93
If forests are not threatened, we should use them to add to the quality of human life	.36	3.59
Attitude scale ($\alpha = .83$)		
Protection items:		
Typical examples of Alberta's forest regions should be excluded from developments such as forestry, oil and gas, and tourism	-.39	3.25
Legislation should be established to protect endangered species of plants and wildlife in our forests	-.41	4.18
Forest management should emphasize a variety of plants and wildlife	-.36	4.13
Clear-cut logging should be banned on public land	-.40	3.75
Some existing protected areas such as parks should be opened to logging	.44	1.67
Sustainability items:		
Our forests are being managed successfully to meet our present and future needs	.59	2.70
Forestry practices generally produce to long term adverse effects on the environment	.65	2.12
Enough harvested trees are being replaced by planting new ones or by natural seeding to meet our future timber needs	.63	2.44
Economic development and timber management items:		
Setting aside forests from logging is not desirable if it means lower wages or fewer jobs	.55	2.38
Providing jobs and economic development is more important than setting aside forests from logging	.68	2.10
Forests should be managed mainly for timber and lumber products	.55	1.91
The economic benefits from forestry practices usually outweigh any negative consequences	.64	2.23
Logging forests is acceptable if the forest is not harmed	.31	3.58
When making forest decisions, the concerns of communities close to the forest should be given a higher priority than other communities	.21	3.41
Economic stability of communities is more important than setting aside forests from logging	.58	2.38

