

# Values and Objectives of Non-industrial Private Forest Owners in Finland

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The purpose of the study was to create an empirical typology of non-industrial private forest owners based on forest values and long-term objectives of forest ownership, to identify these types by owner and holding characteristics, as well as to analyze silvicultural and harvesting behavior in these groups. The analysis was based on survey data on 245 forest owners in southeastern Finland. The results indicated that general forest values and long-term objectives of forest ownership are not strongly correlated. The results further suggested that the sole emphasis on economic benefits of forests does not lead to the most active silvicultural and harvesting behavior. Multiobjective owners, who underlined both monetary and amenity benefits of their forest property, were the most active in their silvicultural and cutting behavior. Non-timber objectives seemed not to exclude wood production: a group called recreationists harvested slightly less than other owners. Recreationists were willing to invest in forestry but were selective with respect to management practices. The results can be used in planning and implementation of public forest policy such as allocation of the resources of forestry extension services. Forest industries should also benefit from a knowledge of the objectives of roundwood sellers.

**Keywords** non-industrial private forests, landowner objectives, forest values, owner characteristics, forestry behavior

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## 1 Introduction

The harvesting and silvicultural behavior of non-industrial private forest (NIPF) owners, as any human behavior, is affected by various structural, institutional and cultural factors. Explanations can be given in terms of causes, habits or motives (Allardt 1972). It is perhaps justified to claim that forest management as a voluntary action is primarily driven by the motivations of the owners, i.e., values and objectives. This assumption has also been taken into account in empirical studies on NIPF owners' forest management behavior. Unfortunately, this is more often done implicitly than by direct measurements of mental variables.

The objectives of forest ownership have been studied directly in numerous surveys on NIPF owners. For instance, the reasons for owning forest land have often been inquired in American studies (e.g., MacConnell and Archey 1986, Carpenter 1989, Birch 1996). Also the German tradition of assessing the importance of the functions of the forest – *Waldfunktionen* – (Lammel 1977) is an attempt to uncover NIPF owners' forest ownership objectives. In Finland, Hahtola (1973) used factor analytic approach in studying forest owners' decision-making, and Kuuluvainen et al. (1996) found landowner objectives to have effects on timber supply. Objectives of forest ownership have also been studied in Sweden by Lönnstedt (1989, 1997) and Carlén (1990).

Kurtz and Lewis (1981) presented an interesting theoretical framework including the motivations and objectives of NIPF owners which they used to classify owners into four types: timber agriculturalist, range pragmatist, timber conservationist, and forest environmentalist (see also Marty et al. 1988). The first two types can be described as production-oriented, timber conservationists expressed a combined production-consumption disposition, while forest environmentalists displayed a consumption orientation. Ferretti (1984) also concluded that forest owners can be divided into two groups based on their motives: owners driven by personal utilization of forest benefits (consumptive motive) and those emphasizing income generation from their forest (productive motive). The two studies above, nevertheless, fail to identify the background charac-

teristics of the forest owner groups. These are crucial to the application of the results, for instance, in forestry extension.

In this paper, forest values and long-term objectives of the NIPF owners are studied using data from Finland. The Finnish case is particularly interesting due to the rapid socio-economic change during the past thirty years, characterized by occupational and regional differentiation, migration and urbanization of the population. According to Rescher (1969) the changes in the operating environment of a society are an important causal factor inducing value changes. Also classical sociological theories of change (e.g., Durkheim 1933, Giddens 1985) suggest that value structures diverge along with modernization.

The most significant characteristic of the structural change among NIPF owners has been the transfer of forest ownership from farmers to non-farmers through the inheritance system. Along with this trend, several other changes have taken place: the fragmentation of forests, the aging of forest owners, an increased ownership by women, and an increase in absentee and joint ownership (Ripatti and Järveläinen 1997).

According to a long-lived assumption, the structural change of forest owners should be reflected in a reduction of roundwood supply due to an increased emphasis on non-timber values. However, such a decrease in NIPF timber supply can neither be detected from statistics nor it is supported by the empirical studies (Ovaskainen and Kuuluvainen 1994). The value change of forest owners will obviously be manifested through silvicultural practices and willingness to invest in forestry. The multiple use and environmental aspects will become more prominent. This kind of development would be well in line with the recent changes in the Finnish forest legislation and new forest management recommendations.

Thus, the purpose of this paper is (1) to describe the forest values and long-term objectives of the NIPF owners in Finland and to create an empirical typology of owners based on these values and objectives. The study also seeks, as a new feature in the literature, (2) to systematically identify the owner types based on values and objectives by easily observable owner and holding characteristics describing the structure of for-

est ownership. Such an approach will increase the practical applicability of the typology. Finally, (3) the silvicultural and harvesting behavior of these owner groups is analyzed.

## 2 Forest Values, Landowner Objectives and Forestry Behavior: Theoretical Aspects

Studies on values are often motivated by the rapid value changes in modern societies. Value changes can occur for various reasons and in different directions. Rescher (1969) emphasizes the connection of changes in values and changes in social, cultural, demographic, economic and technological factors, i.e. the operating environment of a society. However, he points out that values are generally not very sensitive to environmental changes. In the Finnish case, the most important reason for changes in forest owners' values is considered to be the structural change in forest ownership, which is characteristically manifested by an increasing non-farmer ownership. Different kinds of people with different values, education and occupations become forest owners through ownership transfers.

Value is a very diffuse concept and can be defined in several ways (Williams 1968, Rescher 1969, Rokeach 1973, Sinden and Worrell 1979, Schwartz 1992). Allardt (1964, p. 661, 1983, p. 51) defines value as follows: *Value is a common and permanent conception of a desire or the desirable, learned from the environment, influencing selection of goals.* The concept is not too restrictive and it was used to describe the forest values in this study. The empirical operationalization of forest values was based on the theoretical typology presented by Pietarinen (1987).

According to Pietarinen's typology, four different value orientations towards forests (or nature in general) can be distinguished: materialism, humanism, mysticism and primitivism. In *materialism*, forests are regarded merely as a means to increase the material standard of living. Natural resources are considered to be the storage of raw material for industrial and energy

production. Materialism expresses a strong faith in technology which is seen to be able to solve all mankind's problems. The main problem of this orientation is contrafinality. For instance, increased production may lead to increased material standard of living, but at the expense of the quality of environment.

*Humanism*, on the other hand, stresses that forests should be used to promote many cultural pursuits, not only material benefits. These pursuits, of course, presuppose material well-being. The ideal is a "socratic" human being who aims at ethical, aesthetic and intellectual perfection. As Passmore (1980, p. 33) puts it: "to perfect nature is to humanize it, to make it more useful for men's purposes, more intelligible to their reason, more beautiful to their eyes." The main problem in humanism is how to strike a balance between culture and nature. Though humanists optimistically believe in the possibility of this balance, they also face the problem of contrafinality.

*Mysticism* addresses the immediate experience of the unity of man and nature. The sacredness of nature can especially be experienced in forests. Mysticism argues for the preservation of nature in as virgin state as possible. The problem is achieving a balance between material well-being and the sacredness of forests. However, mysticists optimistically consider that sacredness of nature cannot be totally destroyed. The American transcendentalists (such as Ralph Emerson and Henry Thoreau) are typical representatives of mysticism.

*Primitivism* denies all human privileges in nature. Man has no right to endanger other forms of life: nature has intrinsic value. All ideals of civilization and material well-being must therefore be rejected and human beings must "return to the nature" to live in primitive circumstances. Primitivistic ideals may be achieved, for example, by an ecological catastrophe or via events leading to the violent reduction of the population and the destruction of the industrial infrastructure. This kind of value orientation is eminent, for instance, in "deep ecology" (Naess 1985).

Allardt's value concept covers these four value orientations. In humanism, and especially in primitivism, a normative orientation (i.e. the desirable) is emphasized. Materialism and, to some

extent mysticism, aims at the satisfaction of personal interests (desire), although the mysticism also recognizes nature's own purpose.

According to classical sociological terminology (Weber 1968), materialism is a instrumentally rational (*zweckrational*) orientation of action, whereas the other three value orientations – primitivism, humanism and perhaps also mysticism, can be considered to be closer to a value-rational (*wertrational*) orientation of action. On the other hand, using a well-known division into anthropocentric and biocentric values (e.g., Rolston and Coufal 1991, Steel et al. 1994), materialism and humanism in Pietarinen's typology can be regarded to be mainly anthropocentric while mysticism, and especially primitivism, are biocentric in orientation.

Long-term objectives of forest ownership are more concrete than forest values and can be considered to be subordinate to values in personal mental hierarchies (e.g., Lönnstedt and Törnqvist 1990). Values and objectives establish the general guidelines for concrete decisions to manage or cut certain stands. These decisions are also affected by many institutional (e.g., legislation, extension) and situational factors.

Long-term objectives are characteristically based on owners' interests concerning their forest property such as provision of monetary, recreational, emotional, and aesthetic benefits (e.g., Kurtz and Lewis 1981, Young et al. 1985, Brooks and Birch 1986, Marty et al. 1988, Lönnstedt 1989, 1997, Carlén 1990). Furthermore, objectives of individual owners are rather stable and the most important reason for change is considered to be the structural change of forest ownership caused by ownership transfers.

In this study, cutting and silvicultural behavior of the owners was analyzed by their forest values and landowner objectives. The aim was to reveal long-term effects on forestry behavior caused by changes in values and objectives due to ownership transfers. Cross-sectional data on values and long-term objectives, measuring variation between forest owners, was considered to be suitable for this purpose. The adoption of causal explanatory models was beyond the scope of this study for two reasons. First, the effects of forest owners' objectives on timber supply have been studied in Kuuluvainen et al. (1996) using similar data. Second,

causal explanations of human behavior by values and objectives are problematic from the philosophical point of view. Value explanations can be considered to be closer to teleological (cultural) explanations than causal (structural) ones (Rescher 1969, Allardt 1972).

## 3 Data and Methods

### 3.1 Sample and Variables

Two sets of survey data concerning the same forest owners were used in the study. The interview and forest inventory data were collected in 1991 covering three Forestry Board Districts in southeastern Finland. The interview data included information on values, background characteristics and behavioral features of the forest owners.

A mail inquiry seeking information on landowner objectives was conducted for the same area in 1990, as a part of the countrywide study covering several other topics. The sampling procedure in both surveys was two-stage areal cluster sampling where a holding's probability to enter the sample was proportional to its total land area. Because of varying sampling probabilities, case weights were used in the analysis (for details, see Karppinen and Hänninen 1990).

The response rate in the mail inquiry was 78 %. In the personal interviews, the response rate was 94 %. The analysis of sampling error was carried out by comparing the mail inquiry data with the personal interview data using the same sample (Karppinen et al. 1994). The analysis did not find any non-response bias that would affect the results. However, the non-respondent forest owners were younger and had higher formal education than the respondents.

The two sets of data were combined to include information on the same forest owners from both samples in southeastern Finland. Small forest holdings (< 5 ha) were excluded from the analysis because of their minor significance from the point of view of timber production, and due to the difficulties in the use of case weights ( $n = 3!$ ). Thus, the sample used in the analyses consisted of 245 forest holdings or owners.

Forest values based on the theoretical typology by Pietarinen (1987) were measured in the personal interviews by ten statements using a five-point Likert scale ranging from Strongly disagree to Strongly agree (Appendix 1). Landowner objectives were measured in the mail inquiry. The respondents were asked to assess the importance of twenty-one different forest ownership objectives using a three-point scale (Not important, Cannot say, Important). The potential goals concerned monetary, recreational, emotional, and aesthetic considerations (Appendix 2).

The information concerning the structure of forest ownership, such as the demographic characteristics of the owners, were collected in the interviews. Simultaneously, the use of silvicultural measures and cutting practices (e.g., mechanized cutting) were determined. The assessment of annual timber sales, carried out during the five-year period preceding the interview (cutting years 1986/87–1990/91), was based on written sales contracts. Cuttings for household use were determined for the same period. If the duration of ownership was less than five years, only sales and household use cuttings of the current owner were included in the analysis. Forest inventory data of the sample woodlots were used to calculate the allowable cut on silvicultural basis five years prior to the interview. The estimate describes the immediate cutting potential of the woodlot during the following ten years.

### 3.2 Research Methods

The use of original variables describing forest values and landowner objectives was handicapped by their large number. On the other hand, the large number provided a wide coverage of the various aspects of values and objectives. However, a limited number of broad categories was required for the analysis. The original variables describing values and objectives were therefore condensed by two separate principal component analyses into a few interpretable combined variables (e.g., Mulaik 1972, Lewis-Beck 1994). Principal component analysis was preferred to other factor analytic methods because it takes into account the total variation in the observed variables. In order to describe the relationships be-

tween values and objectives, the correlation coefficients between the corresponding principal component scores were computed.

From the technical point of view, combined variables could have been condensed by one principal component analysis using all thirty-one original mental variables. On the other hand, this procedure would not have allowed the analysis of the relationships between different levels of the mental hierarchy due to orthogonality of the principal components.

The principal component scores describing forest values were used as criterion variables for clustering forest owners, but no interpretable solution was found. However, owners could be classified into groups based on their objectives of forest ownership. Grouping the owners permitted different combinations of the main dimensions of objectives and the owner groups could be identified by owner and holding characteristics. Orthogonal principal component scores provided a convenient way to avoid the problem of multicollinearity which could distort clustering (Engelman 1980). The method used, K-means clustering, is a combination of hierarchical stem-to-leaf algorithm and iterative partitioning (Anderberg 1973, Hartigan 1975).

After clustering the owners, the groups based on objectives were identified by owner and holding characteristics using logit models (Maddala 1984, Hosmer and Lemeshow 1989). The dependent variable in the models was dichotomous: the “membership choice” of the specific group versus other groups. Multinomial models were also technically possible, but binary models were preferred because they identify the specific group of forest owners from all other owners, instead of comparing all groups with each other simultaneously. Finally, cutting and silvicultural behavior of these groups based on landowner objectives were described by sample means and cross-tabulations. Statistical differences were tested by the t-test.

## 4 Results

### 4.1 Forest Values and Landowner Objectives

The variables describing forest values were condensed into three dimensions by principal component analysis (Appendix 1). The reliability of the solution was satisfactory (Carmines'  $\theta = 0.65$ ) and the explained proportion of the total variation of the original variables was reasonable (52 %). The statements expressing primitivism or mysticism had high loadings on the first component. Consequently, it was taken to represent *primitivism-mysticism*. Pietarinen's theory suggests, nevertheless, that both primitivism and mysticism should form their own dimensions. Unidimensionality may indicate lack of validity in operationalization of values.

The statements concerning helping nature in its development and sustainability, which express humanistic ideals, were highly loaded on the second component. However, the statement based on materialism describing faith in technology had the highest loading. The second component was considered to describe mainly *humanism*. The third component was characterized by two distinctly materialistic aspects, and was, subsequently, interpreted to represent *materialism*.

The twenty-one original variables dealing with landowner objectives were condensed into three principal components (Appendix 2). The reliability of the solution was good (Carmines'  $\theta = 0.82$ ) and the explained proportion of the total variation of the items was 43 %. On the first

component, variables describing various non-market, recreational, aesthetic and emotional aspects of forest ownership received high loadings. It was therefore interpreted to represent *non-timber objectives*.

Monetary objectives dealing with economic security against inflation and security in old age, as well as asset and bequest motives, were highly loaded on the second principal component. The component was consequently labeled *economic security and asset motive*. The third component was characterized by high loadings of regular sales income and labor income from delivery sales (the seller does the logging and hauling), as well as other self-employment aspects. The importance of household timber was also emphasized. This dimension was taken to represent *sales income and self-employment opportunities*. The interpretations of the three dimensions of objectives slightly differ from the results obtained by Kuuluvainen et al. (1996).

The two sets of principal components were correlated with each other (Table 1). The matrix revealed weak relationships between values and long-term objectives. Only primitivism-mysticism correlated clearly with non-timber objectives, as expected. Materialism had negative connection with non-timber objectives, and was positively correlated with both economic objectives, but the three coefficients were not statistically significant.

The principal component scores describing forest values were used as grouping variables for clustering the owners, but no interpretable solution was found. On the other hand, owners could

**Table 1.** Forest values and landowner objectives. Correlations between principal component scores. (Boldface coefficients are statistically significant at the 5 % level,  $n = 245$ ).

Values	Objectives		
	Non-timber objectives	Economic security and asset motive	Sales income and self-employment opportunities
Primitivism-mysticism	<b>.34</b>	.02	.09
Humanism	.05	.05	.06
Materialism	-.09	.07	.08

**Table 2.** Forest owner groups based on objectives of forest ownership. K-means clustering.

Owner group	n	Mean of principal component score (standard deviation)		
		Non-timber objectives	Economic security and asset motive	Sales income and self-employment opportunities
I Multiobjective owners	81	0.411 (0.499)	0.739 (0.445)	0.653 (0.433)
II Recreationists	52	0.829 (0.530)	-0.435 (1.282)	-0.634 (0.739)
III Self-employed owners	80	-0.730 (0.691)	-0.482 (0.662)	0.689 (0.633)
IV Investors	32	-1.174 (0.928)	0.657 (0.978)	-1.408 (0.689)
	Σ 245			
F-ratio		118.313	39.276	139.315
P-value <		0.000	0.000	0.000

be classified into groups based on their objectives of forest ownership. The principal component scores were used as grouping variables in a K-means cluster analysis. Grouping permitted different combinations of the main dimensions of objectives and enabled measuring the coverage of the support of these combinations among forest owners. Furthermore, the groups could be identified by easily observable owner and holding characteristics.

It turned out that the forest owners could be classified into four groups as suggested by Kuuluvainen et al. (1996) (Table 2): *multiobjective owners* (representing 33 % of forest land area and 26 % of forest owners), *recreationists* (21/31 %), *self-employed owners* (31/30 %) and *investors* (14/13 %). Except for the multiobjective owners, the group labels are based on the principal component with the highest positive mean score. The standard deviations of the principal components by groups were reasonable compared to the means. Only the principal component describing economic security had rather large standard deviations and lowest discriminatory power compared to other components ( $F = 39.3$ ). This suggests problems of consistency particularly in the fourth group (investors).

*Multiobjective owners* valued both the mone-

tary and amenity benefits of their forests, as indicated by the fact that all three components had rather high positive mean scores. *Recreationists* emphasized non-timber and amenity aspects of their forest ownership. On the other hand, *self-employed* owners valued regular sales and labor income as well as employment provided by their forests. Finally, *investors* regarded their forest property as an asset and a source of economic security.

## 4.2 Landowner Objectives and Owner Characteristics

The owner groups based on objectives were identified by directly observable owner and holding characteristics using logit models. Table 3 summarizes the coefficients and test statistics of the four models. The dependent variables in the models were dichotomous: the "membership choice" of the specific group vs. other three groups. Instead of calculating the odds ratios or marginal effects (Hosmer and Lemeshow 1989, Demaris 1992), the direct probabilities of belonging to the groups were calculated by the different value combinations of the background variables (Appendix 3), as suggested by Roncek (1991, see

**Table 3.** Identification of forest owner groups based on landowner objectives by owner and holding characteristics. Logit analysis. Maximum likelihood estimates.<sup>1)</sup>

Characteristic	Multiobjective owners	Recreationists	Self-employed owners	Investors	Coefficient
					(Wald statistics)
Constant	-3.400 (4.523)	-0.118 (0.433)	1.085 (1.510)	-7.071 (4.985)	
Age of owner, yrs	0.025 (2.202)	–	-0.027 (2.198)	0.037 (2.035)	
Area of forest holding, ha	0.011 (2.036)	-0.025 (2.669)	–	0.017 (2.037)	
Residence on holding					
Permanent = 1	1.001 (3.135)	–	–	–	
Part-time = 1	–	1.634 (4.006)	–	–	
Absent = 1	–	–	–	1.804 (3.151)	
Permanent residence more than 30 km from the holding, Yes = 1	–	–	-2.751 (4.269)	1.325 (2.655)	
Farmer Yes = 1	–	-0.942 (2.516)	–	–	
College or academic education, Yes = 1	–	–	-1.102 (2.067)	1.446 (2.891)	
Holding owned jointly by family concern, Yes = 1	–	–	1.441 (2.632)	–	
Forest in addition to the sample forest, Yes = 1	–	–	–	1.055 (2.113)	
Log-likelihood	-130.183	-126.295	-120.682	-62.762	
$R_L^2$ (likelihood ratio index)	0.08	0.17	0.19	0.33	
n	81	52	80	32	

<sup>1)</sup> Initial models were estimated by stepwise procedure. Final models presented in the table contain only statistically significant variables.

also Schuster 1983). Calculation of the probabilities of the group assignments was considered to be the most informative way to interpret the models.

According to the model for recreationists, the probability of belonging to the group increased, when the forest area diminished and the owner was a non-farmer residing on the holding part-time. The probability of belonging to the recreationists was 77 % in the most “favorable” case, i.e. when the owner was a non-farmer residing on the

holding part-time and when his forest holding was rather small (Appendix 3). In the most “unfavorable” case the probability was only 11 %.

The probability of belonging to the investors increased along with the aging of the owner and an increase in the size of the forest property. Other factors affecting positively to the group assignment were the residence outside the holding and college or academic education. The model for the investors seems to explain group assignment quite well. The probability in the most

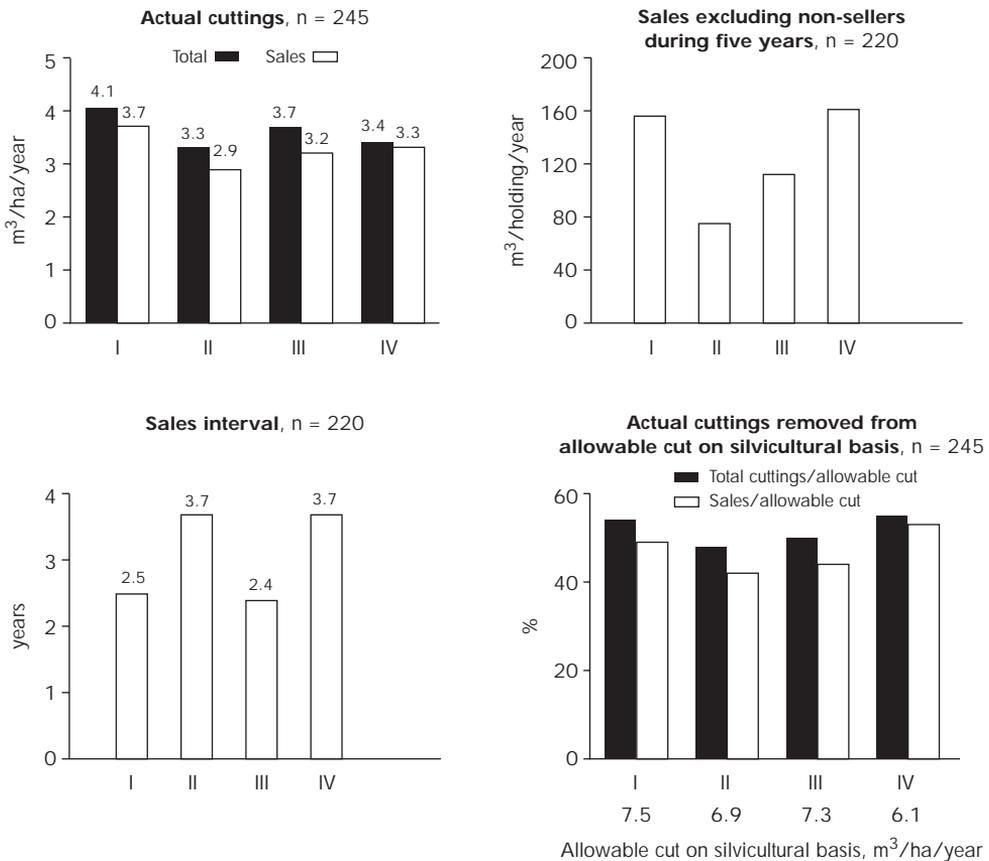
“favorable” case, i.e. with the value combination with the highest probability, was 85 %.

Self-employed owners were characteristically young, resided on the holding or close to it, were members of the family concern, and had no higher education. In this case the probability of belonging to the group was 79 %. The model for the multiobjective owners did not sufficiently identify the observable characteristics of the owners. In the most “favorable” case the probability of belonging to the group was only 43 %. The results suggest, however, that permanent residence on the holding, the aging of the owner and an increase in the size of the forest holding would raise the probability of belonging to the multiobjective owners.

### 4.3 Landowner Objectives and Forestry Behavior

The econometric analysis of timber supply taking into account landowners objectives has been published elsewhere (Kuuluvainen et al. 1996). Cutting behavior of NIPF owners was analyzed in this study only descriptively. The analysis revealed, nevertheless, some interesting differences between the groups based on landowner objectives.

Multiobjective owners harvested more for sale and household use together (m<sup>3</sup>/ha/year) than other forest owners during the five-year period preceding the interview (Fig. 1). The total cuttings of the recreationists and investors were



**Fig. 1.** Actual cuttings and use of allowable cut by forest owner groups based on landowner objectives. (Cutting years 1986/87–1990/91, I = multiobjective owners, II = recreationists, III = self-employed owners, IV = investors).

**Table 4.** Silvicultural measures and cutting practices by forest owner groups based on landowner objectives. (Differences marked by superscripts statistically significant at the 5 % level, n = 245).

	Multiobjective owners I	Recreationists II	Self-employed owners III	Investors IV
Number of silvicultural measures during five years <sup>1)</sup>				
In total	3.4 <sup>II,III,IV</sup>	2.4 <sup>I</sup>	2.6 <sup>I</sup>	2.6 <sup>I</sup>
Owner or family member participated	2.4 <sup>II,IV</sup>	1.8 <sup>I</sup>	2.0 <sup>IV</sup>	1.4 <sup>I,III</sup>
Silvicultural measures and cutting practices during current ownership:				
Chemical herbicides in seedling stand improvements, % of the holdings	15	19	22	15
Mechanized site preparation during forest regeneration, % of the holdings	67 <sup>II</sup>	49 <sup>I,III,IV</sup>	69 <sup>II</sup>	81 <sup>II</sup>
Mechanized cutting, % of the holdings	25 <sup>IV</sup>	16 <sup>IV</sup>	20 <sup>IV</sup>	50 <sup>I,II,III</sup>

<sup>1</sup> These included eight different measures such as planting/seeding, pruning, draining, seedling stand improvement, etc.

smaller than those of the self-employed owners. Furthermore, recreationists harvested less for sale than all the other forest owners, as might be expected. However, none of the differences was statistically significant.

The annual sales per holding (m<sup>3</sup>/holding/year) describe the mean size of the sales contract if the owner sells once a year, excluding non-sellers during the study period. The results indicate that recreationists sold less per holding annually than other owners. Investors and multiobjective owners sold more than self-employed owners. All the differences were not statistically significant.

Sales intervals varied between the groups and the differences were statistically significant. Multiobjective and self-employed owners sold more frequently than recreationists and investors. On the other hand, the proportion of the actual cuttings removed from the allowable cut estimated on silvicultural basis did not vary substantially by landowner objectives. Recreationists, for example, had cut approximately half of their potential, just as the other owner groups.

Finally, the results do not support the common assumption that non-timber considerations imply a large standing stock. Recreationists' allowable cut was smaller than that of the multiobjective and self-employed owners (Fig. 1). The differences were, however, not statistically significant.

Concerning silvicultural behavior, multiobjective owners were found to be the most active group assessed by the number of silvicultural measures practiced during five years (Table 4, statistical significance shown by superscripts). Unexpectedly, recreationists did not differ substantially from self-employed owners in the number of executed measures. Multiobjective owners were also eager to participate in the activities themselves. Investors were the most passive group concerning their own labor input.

The area of all silvicultural measures per forest hectare during the five-year period was regressed on principal component scores describing values and objectives. The results of this experiment suggest, perhaps unexpectedly, that non-timber objectives and humanistic values in

particular would have a positive effect on silvicultural activity.

Forest owners were also asked if they had used chemical herbicides in seedling stand improvement. No distinct differences could be found between the groups (Table 4). On the other hand, mechanized site preparation during forest regeneration was most often applied in the forests of the investors and most infrequently – but not rarely – on the forest holdings of the recreationists. Similar differences were found concerning the use of mechanized cutting. Even half of the investors had sometimes used logging machines in their forests.

The differences in the use of logging machines can be partly explained by the differences in the size of forest area, because mechanized cutting is, in general, not profitable in small stands. Recreationists' forest holdings were, on average, smaller than those of the investors (21 and 35 ha, respectively). However, the rather infrequent use of logging machines on the holdings of self-employed owners is probably explained by the large proportion of delivery sales on these holdings. The forest holdings in this owner group were, on average, only three hectares smaller than those of investors.

## 5 Discussion

In consequence of the structural changes in Finnish society and their effect on forest ownership, the values and objectives of non-industrial private forest owners have become increasingly diversified. The study indicates that forest owners support different kinds of forest values, which are, to some extent, reflected in long-term landowner objectives. For instance, biocentric value orientation, here called primitivism-mysticism, is associated with non-timber objectives of forest ownership. The assumption of personal mental hierarchies with landowner objectives subordinate to values (Lönstedt and Törnqvist 1990) would have suggested stronger associations. It is, however, possible that the rather weak connection between values and objectives is due to insufficient validity, especially, concerning the measurement of forest values.

Furthermore, a link is established between landowner objectives, owner and holding characteristics as well as harvesting and silvicultural behavior. The method involved the classification of forest owners into four groups based on their objectives (multiobjective owners, recreationists, self-employed owners and investors), the identification of these groups by owner and holding characteristics, and the analysis of silvicultural and harvesting behavior in these groups. The approach is similar to the one presented by Kurtz and Lewis (1981) and Marty et al. (1988). Both studies, however, fail to identify the background characteristics of the forest owner groups, which are crucial to the application of the results.

The results suggest that the sole emphasis on economic benefits of forests does not lead to the most active silvicultural and harvesting behavior. Multiobjective owners, who underline both monetary and amenity benefits of their forest property, are the most active in their silvicultural and cutting behavior. This confirms former results concerning timber supply (Kuuluvainen et al. 1996).

On the other hand, non-timber objectives do not appear to exclude wood production: recreationists also cut, but slightly less than other owners. The proportion of recreationists is increasing along with the increasing number of non-farmers and owners in part-time residence (see also Karpinen 1997), but this development will probably not substantially diminish roundwood supply from private forests.

Recreationists use mechanized site preparation and mechanized cutting less frequently than other owners. The regression experiments further suggest that non-timber objectives and humanistic values have a positive effect on silvicultural activity. It may well be that recreationists are willing to invest in forestry but are, to some extent, selective with respect to management practices.

Values and objectives are dependent on the cultural, institutional, social and economic environment in each country, which handicaps the comparison of the present results with other countries. However, it is worth while comparing the grouping based on landowner objectives with another classification adopted in the American literature, i.e. consumptive vs. productive orienta-

tion (Kurtz and Lewis 1981, Ferretti 1984). It appears that recreationists are mainly consumption-oriented, whereas investors and self-employed owners are production-oriented. Nevertheless, self-employed owners also emphasize the importance of the consumption of household timber. Multiobjective owners, the most active group with respect to silvicultural and cutting behavior, represent a mixture of the two orientations.

Several factors affecting the forestry behavior of NIPF owners had to be excluded from the study, which must be taken into account when interpreting the present results. For instance, the effect of forestry extension and market factors such as roundwood prices could not be taken into account. Moreover, the link between mental variables and observed silvicultural and harvesting behavior requires further examination. An econometric analysis of timber supply taking into account landowners' objectives has already been published elsewhere (Kuuluvainen et al. 1996).

The results of this study can be used in planning and implementation of public forest policy. A knowledge of the values and objectives of forest owners is important especially when matching the supply and contents of forestry extension services to the varying motivations of forest owners. The identification of owner groups with different objectives by readily observable owner and holding characteristics is crucial in this respect. Finally, forest industries should also benefit from a knowledge of the objectives of roundwood sellers.

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*Total of 48 references*

**Appendix 1.** Forest values of NIPF owners. Principal component analysis. Varimax rotation. (Loadings below 0.250 denoted by asterisk).

	Primitivism- mysticism	Humanism	Materialism
Holiness of nature ought to be respected in forest management.	0.751	*	*
Man has no right to suppress other elements of nature to serve his own goals.	0.646	*	*
Man should experience spiritual unity with the entirety of nature.	0.643	0.306	*
Roundwood cuttings should be diminished substantially in order to save original nature even with a decrease in standard of living.	0.587	-0.381	*
Man is obliged to take care of forests by managing and cutting them in a nature saving way.	0.585	*	*
Pollution emissions threatening the health of forests can be cut down by new technology.	*	0.756	*
Man has to help nature in its development to meet both material and immaterial human needs.	0.387	0.630	*
Future generations' cutting potentials should be taken into account in forest management.	*	0.531	*
Forest resources ought to be utilized as much as necessary in order to increase well-being.	*	*	0.841
Utilization of forests should be intensified in order to secure industrial roundwood supply.	*	*	0.805
Eigenvalue	2.258	1.507	1.429
Proportion explained	23 %	15 %	14 %
Carmines' theta <sup>1)</sup>	0.65		
n	245		

<sup>1</sup> Carmines' theta is computed for the unrotated solution as follows:

$$\Theta = \frac{N}{N-1} \left( 1 - \frac{1}{\lambda_1} \right)$$

where  $N$  is the number of items in the total principal component analysis and  $\lambda_1$  is the largest (the first) eigenvalue. Theta may be considered a maximized Cronbach's alpha coefficient (BMDP... 1992, Carmines and Zeller 1979).

**Appendix 2.** Landowner objectives. Principal component analysis. Varimax rotation. (Loadings below 0.250 denoted by asterisk).

	Non-timber objectives	Economic security and asset motive	Sales income and self-employment opportunities
Outdoor recreation	0.782	*	*
Berry-picking	0.690	*	*
Residential environment	0.645	*	0.374
Solitude and meditation	0.590	0.346	*
Aesthetic values	0.564	*	*
Roots in native locality	0.543	0.450	*
Inherent value	0.519	0.413	*
Nature protection	0.489	*	*
Security against inflation	*	0.693	*
Asset motive	*	0.580	*
Funding of investments	*	0.578	0.324
Security against old age	*	0.573	*
Bequest motive	*	0.528	*
Labor income & employment	*	*	0.824
Regular sales income	*	*	0.698
Household timber	0.350	*	0.589
Hedging motives	*	0.475	0.517
Forest work	*	*	0.487
Credibility	*	0.403	0.342
Hunting	*	*	0.329
Speculative motives	*	0.344	*
Eigenvalue	3.310	2.982	2.670
Proportion explained	16 %	14 %	13 %
Carmines' theta <sup>1)</sup>	0.82		
n	245		

<sup>1</sup> See footnote in Appendix 1.

**Appendix 3.** Probability of assignment ( $\pi$ ) to forest owner groups based on landowner objectives by owner and holding characteristics. The most “favorable” and “unfavorable” combinations of the variables.

AGE (Q <sub>1</sub> ,Q <sub>3</sub> ) <sup>1</sup>	FOR (Q <sub>1</sub> ,Q <sub>3</sub> ) <sup>1</sup>	PER	PART	ABS	RES	FARM	ACAD	CONC	ADFOR	Probability of assignment $\pi$ (%)
<b>Multiobjective owners</b>										
67(Q <sub>3</sub> )	40.90(Q <sub>3</sub> )	1	–	–	–	–	–	–	–	43
45(Q <sub>1</sub> )	12.00(Q <sub>1</sub> )	0	–	–	–	–	–	–	–	11
<b>Recreationists</b>										
–	12.00(Q <sub>1</sub> )	–	1	–	–	0	–	–	–	77
–	40.90(Q <sub>3</sub> )	–	0	–	–	1	–	–	–	11
<b>Self-employed owners</b>										
45(Q <sub>1</sub> )	–	–	–	–	0	–	0	1	–	79
67(Q <sub>3</sub> )	–	–	–	–	1	–	1	0	–	1
<b>Investors</b>										
67(Q <sub>3</sub> )	40.90(Q <sub>3</sub> )	–	–	1	1	–	1	–	1	85
45(Q <sub>1</sub> )	12.00(Q <sub>1</sub> )	–	–	0	0	–	0	–	0	1

<sup>1</sup> Lower quartile (25 %) and upper quartile (75 %).

Abbreviations:

Continuous variables

Age of owner, yrs (AGE)

Area of forest holding, ha (FOR)

Dichotomous variables (Yes = 1, No = 0)

Residence on holding

Permanent (PER)

Part-time (PART)

Absent (ABS)

Permanent residence more than 30 km from the holding (RES)

Farmer (FARM)

College or academic education (ACAD)

Holding owned jointly by family concern (CONC)

Forest in addition to the sample forest (ADFOR)