OBJECTIVES OF NON-INDUSTRIAL PRIVATE FOREST OWNERS: DIFFERENCES AND FUTURE TRENDS IN SOUTHERN AND NORTHERN FINLAND

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ABSTRACT

The study describes and explains the differences in the objectives of non-industrial private forest owners between southern and northern Finland, and provides a forecast of the changes in these objectives for southern Finland. The analysis was based on a mail inquiry data covering the whole country (n=2056). The results suggest that economic objectives were more important in southern Finland than in northern Finland, where objectives seem to be less divergent. Future changes in the objectives will not substantially affect the roundwood supply from southern Finland, where the most of the industrial roundwood is purchased.

Keywords: values, regional differences, forecasting.

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INTRODUCTION

The main trends in the socio-economic change of industrialized countries have been occupational and regional differentiation as well as urbanization of the population. In Finland, this development has taken place rather late but it has been particularly rapid. These changes have also had powerful impacts on non-industrial, private forestry (NIPF), which plays a very important role in the Finnish economy. NIPF forestry provides around 80 % of the domestic roundwood used by export-oriented forest industries (Sevola, 1997). The main characteristics of the structural change among Finnish NIPF owners have been the transfer of forest ownership from farmers to non-farmers through the inheritance mechanism, the fragmentation of forests, the aging of forest owners, an increased ownership by women, and an increase in absentee and joint ownership (Ripatti & Järveläinen, 1997).

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The structural change of forest ownership is often considered to be the most important reason for changes in forest owners' values and long-term objectives. Different kinds of people with different objectives, education and occupations become forest owners through ownership transfers. According to a long-lived assumption, the structural change should be reflected in a reduction of roundwood supply due to an increased emphasis on non-timber objectives. Such a decrease in NIPF timber supply can neither be detected from statistics nor it is supported by empirical studies (Ovaskainen & Kuuluvainen, 1994). The studies, nevertheless, suggest that objectives of forest ownership have direct effects on timber supply and silvicultural behavior (Kuuluvainen *et al.*, 1996; Karppinen, 1998).

Objectives of forest ownership have been studied, *inter alia,* by Hahtola (1973), Lammel (1977), Kurtz & Lewis (1981), Ferretti (1984), Bliss & Martin (1989), Lönnstedt (1989; 1997) and Carlén (1990). The Finnish studies have dealt mainly with southeastern Finland (Kuuluvainen *et al.*, 1996, Karppinen, 1998). However, regional differences in landowner objectives may also be considerable (c.f. Marty *et al.*, 1988). The contribution of this paper is the explicit comparison of regional differences in the objectives of the Finnish forest owners. First, *regional differences in the objectives of NIPF owners are described and explained*. Second, based on the forecasts concerning the structure of forest ownership (Ripatti & Järveläinen, 1997), *an assessment is made of the future development of these objectives*.

The paper is organized as follows. The second chapter describes the differences between northern and southern parts of the country which are relevant from the point of view of private forestry. The third chapter presents the country-wide mail inquiry data on 2056 NIPF owners as well as describes analysis methods (principal component, cluster, logit, regression and transformation analyses). The regional differences in landowner objectives are presented in the fourth chapter, and the future trends in these objectives are forecast for southern Finland in the following chapter. The results suggest that economic objectives are more important in the South than in the North, where objectives seem to be less divergent. The last chapter discusses the results and draws conclusions.

SOUTHERN AND NORTHERN FINLAND

In the forestry literature, Finland has often been divided into southern and northern regions. The two northernmost provinces (Oulu and Lapland) form northern Finland with the rest of the country being regarded as southern Finland. Besides obvious climatic differences, the northern region differs from the southern one socio-economically and culturally. In the North, income per household has earlier been below the national average, but nowadays the income differences between the two regions are rather small. The rate of unemployment has also been high in the North, even during economic booms. Furthermore, agriculture and forestry are more important in northern Finland than in the South, measured by their proportion of gross domestic product (Nenonen, 1985; Statistical... 1993;1995;1996; Valkonen *et al*., 1985). Forest industries are also very significant in the northern economy, but besides roundwood, northern forests provide substantial recreational benefits used by a large number of tourists (Lapin... 1996).

Considering cultural differences, Melkas (1985) concluded that the regional culture and values in northern Finland favor the *status quo* rather than the dynamic change.A prejudice against new ideas "imported from the south" is readily detectable (e.g., Aaltonen, 1994). Religious life also has its special features in the North. The support for the Laestadian revivalist movement, which can be seen as the religion of the agrarian village community, is widespread. This movement underlines the maintenance of traditional agrarian values (Suolinna, 1993). If northern Finland can be regarded as a more traditional society, the classical sociological theories of change suggest that value structures, in this case objectives of forest owners, are less divergent in the North than in the South (e.g., Durkheim, 1933; Giddens, 1985).

Regional differences in the climate and soil naturally affect the growth and structure of forests. Northern forests are considerably older than those in the south of the country which is partly due to the longer rotation applied in northern Finland. The mean growing stock per hectare and the annual increment per hectare are in the southern private forests, on average, double those of the northern private forests. The proportions of damaged and low-yield-

ing forests are also larger in the North than in the South. Landowner objectives may also be affected by the fact that ninety-four percent of the forest-covered nature protection areas are located in northern Finland, although mainly on state-owned land (Sevola, 1997).

There are also differences in the ownership of forests between the two regions. In southern Finland, NIPF owners form the most significant owner category (76 % of forest land). Their share is substantially smaller in northern Finland (43 %), where state-owned forests account for as much as half of the forest land (48 %) (Sevola, 1997). Northern forest owners also differ from their southern counterparts in terms of owner and holding characteristics. For instance, northern forest holdings are generally larger and more often jointly owned — by heirs or concerns — than southern holdings. In the North, the proportions of non-farmers and female owners are both larger than in the South, and northern owners are also, on average, older and reside more often outside their holding.

Northern private forest owners receive only one tenth of the gross stumpage earnings obtained from the Finnish private forests. The proportion is small compared to the area covered by the northern private forests. The profitability of private forestry, measured by net income per hectare or per holding, is therefore substantially lower in the North than in the South. The relatively small sales income in the North is also partly due to lower roundwood prices (Sevola, 1997; Simula & Keltikangas, 1990).

Regional differences in forest owners' behavior have not been studied recently, although Järveläinen' s studies (1974; 1981) suggested the existence of such differences. Northern forest owners have often been attributed with excessive utilization of their forest resources, but current statistics suggest that removals are below the level of growth in northern as well as in southern private forests. Nonetheless, the relatively large proportion of young stands in northern private forests suggests that growth based calculations overestimate "real" cutting possibilities. The age structure also implies a formerly intensive utilization of northern forest resources (Sevola, 1997; Forest statistics, Finnish Forest Research Institute, see also Karppinen & Hänninen, 1990).

DATA AND METHODS

Sample and Variables

Survey data covering the whole country were collected by mail inquiry in 1990. The sampling procedure 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 & Hänninen, 1990).

The response rate to the mail inquiry was 72 %. Small forest holdings included in the sample (forest land < 5 ha) were excluded from the analysis because of their minor significance from the point of view of the timber production. Forty-four forest holdings were omitted from the calculations because their owners had not responded to any question on the objectives of their forest ownership. Thus, the sample used in the analyses comprised 2056 holdings, 1430 in southern Finland (the fifteen Forestry Board Districts to the south of Oulu province) and 626 in northern Finland (four northernmost Forestry Board Districts). [1]

The analysis of sampling error could be carried out for the part of the data collected from southeastern Finland (Karppinen *et al.*, 1994). The mail inquiry data used in this study was compared to the personal interview data collected for other purposes (e.g., Karppinen, 1998) from the area using the same sample. The analysis did not find any non-response bias that would affect the results. However, the non-responding forest owners were younger and had higher formal education than the respondents. Furthermore, Ripatti (1991), using the same country-wide data, found no statistically significant differences in the mean sizes of forest land and arable land between non-respondents' and respondents' holdings.

Landowner objectives were measured by asking the respondents to assess the importance of twenty-one different objectives connected to forest ownership using a three-point scale (Important, Don't know, Not important). The potential goals comprised monetary objectives as well as recreational, emotional, and aesthetic considerations. In-

[1] Since 1996 these administrative units are called Forestry Centres (10 in the South, 3 in the North).

formation on owner and holding characteristics, e.g., the demographic status of the owners, was also collected. Furthermore, the silvicultural measures and annual timber sales carried out during the five-year period preceding the inquiry were ascertained.

Research Methods

The use of original variables describing landowner objectives was handicapped in the analysis by their large number. On the other hand, the large number provided a wide coverage of the various aspects of owning forest land. However, a limited number of broad categories was required for the analysis. The original variables describing objectives of forest ownership were therefore condensed by means of principal component analysis into a few interpretable combined variables in both regions (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 southern Finland, forest owners could be classified into groups based on their objectives of forest ownership. The principal component scores were used as criterion variables in clustering the owners. Grouping of 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 this procedure, the groups based on landowner objectives were identified by owner and holding characteristics using logit models (Maddala, 1984; Hosmer & Lemeshow, 1989). The dependent variable in the models was dichotomous: "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.

In the case of northern Finland, the principal component scores were also used as grouping variables in clustering the owners, but no interpretable solution was found. Linear regression models were therefore used to study the relationships between the principal components describing landowner objectives and owner and holding characteristics.

Regional differences in objectives of forest ownership were analyzed by comparing the structures of the principal components in both areas by means of transformation analysis (Appendix 2). Finally, future trends in objectives of forest ownership in southern Finland were forecast using the logit models identifying the owner groups by owner and holding characteristics. The parameters obtained from the logit models were used with the data on the present and projected owner characteristics describing an average forest owner (Ripatti & Järveläinen, 1997), and the corresponding probabilities of belonging to groups based on landowner objectives were calculated. Forest owners in northern Finland defied grouping, which prevented the attempts to forecast changes in landowner objectives.

LANDOWNER OBJECTIVES IN SOUTHERN AND NORTHERN FINLAND

Southern Finland

Forest owners in southern Finland could be divided into four groups based on their objectives of owning forest land, as suggested by the previous studies dealing with the southeastern part of the country (Kuuluvainen *et al.*, 1996; Karppinen, 1998). First, the twenty-one original variables on landowner objectives were condensed into three principal components (Table 1). The reliability of the solution was good (Carmines' theta = 0.82) and the explained proportion of the total variation of the original variables was 42 %. The interpretation of the principal components is based on the objectives with the highest loadings.

Variables describing various non-market aspects of forest ownership had high loadings on the first component. These concerned outdoor recreation, solitude and meditation, aesthetic values, nature protection, berry-picking etc. The principal component was interpreted to represent *non-*

TABLE 1. LANDOWNER OBJECTIVES IN SOUTHERN FINLAND.
Principal component analysis. Varimax rotation. (Loadings below 0.250 denoted by asterisk.)

	NON-TIMBER OBJECTIVES	SALES INCOME AND SELF-EMPLOYMENT OPPORTUNITIES	ECONOMIC SECURITY AND ASSET MOTIVE
Outdoor recreation	0.693	*	*
Solitude and meditation	0.688	*	*
Aesthetic values	0.643	*	*
Nature protection	0.605	*	*
Residential environment	0.592	0.267	*
Roots in native locality	0.588	*	0.353
Berry-picking	0.577	*	*
Inherent value	0.479	*	0.399
Labor income & employment	*	0.750	*
Regular sales income	*	0.627	0.318
Household timber	0.312	0.586	*
Forest work	0.275	0.571	*
Hedging motives	*	0.566	0.412
Funding of investments	*	0.563	0.393
Credibility	*	0.465	0.323
Asset motive	*	*	0.672
Security against inflation	*	*	0.630
Security in old age	*	0.297	0.629
Speculative motives	*	*	0.517
Bequest motive	*	*	0.490
Hunting	*	*	*
Eigenvalue	3.314	2.786	2.663
Proportion explained	16 %	13 %	13 %
Carmines' theta[i]	0.82		
n	1430		

[1] 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 λ_1 is the largest (the first) eigenvalue. Theta may be considered a maximized Cronbach's alpha coefficient. (BMDP... 1992; Carmines & Zeller, 1979).

timber objectives. The second component was characterized by regular sales income and labor income from delivery sales [2] as well as other aspects of self-employment. Also the

2 The seller does the logging and hauling.

importance of household timber and the forest holding as a source of funds for investments and as a safeguard against exceptional circumstances were emphasized. This dimension was taken to represent *sales income and self-employment opportunities*. Monetary objectives such as economic security against inflation and security in old age, as well as the asset motive, were highly loaded on the third principal component. The component was labeled *economic security and asset motive* accordingly.

The principal component scores describing landowner objectives were used as grouping variables in the 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. The groups could also be identified by easily observable owner and holding characteristics. Forest owners were classified into four groups (Table 2). The standard deviations of the principal components by groups were reasonable compared to the means. F-ratios also suggest that the components discriminated quite well.

Multiobjective owners (representing 39 % of forest land area and 33 % of forest owners) valued both the monetary and amenity benefits of their forests. All three principal

TABLE 2. FOREST OWNER GROUPS BASED ON OBJECTIVES OF FOREST OWNERSHIP IN SOUTHERN FINLAND. *K-MEANS CLUSTERING*.

OWNER GROUP	N	MEAN OF PRINCIPAL COMPONENT SCORE (STANDARD DEVIATION)		
		Non-timber objectives	Sales income and self-employment opportunities	Economic security and asset motive
I Multiobjective owners	534	0.515 (0.494)	0.369 (0.644)	0.776 (0.520)
II Recreationists	235	0.732 (0.760)	–0.710 (0.827)	–0.886 (0.928)
III Self-employed owners	459	–0.629 (0.673)	0.808 (0.600)	–0.494 (0.604)
IV Investors	202	–1.210 (0.938)	–1.142 (0.739)	0.630 (0.934)
	Σ 1430			
F-ratio		570.235	560.694	512.279
P-value<		0.000	0.000	0.000

component scores had rather high positive means for this group. *Recreationists* (15/25 %) emphasized the non-timber and amenity aspects of their forest ownership. On the other hand, s*elf-employed owners* (31/27 %) valued regular sales and labor income as well as employment provided by their forests. *Investors* (15/15 %) regarded their forest property as an asset and a source of economic security. Cutting and silvicultural behavior in these groups resembled the results concerning southeastern Finland (Kuuluvainen *et al.*, 1996; Karppinen, 1998).

The owner groups were identified by directly observable owner and holding characteristics using logit models. Only those structural characteristics the development of which had been forecast by Ripatti & Järveläinen (1997) were included in the analysis. This restriction was made in order to enable the prediction of future trends in landowner objectives by these models. Table 3 summarizes the coefficients and test statistics of the four probability models. The dependent variables in the models were dichotomous: the "membership choice" of the specific group v. the other three groups. The results are discussed in more detail in connection with the regional comparisons.

Instead of calculating the odds ratios or marginal effects (Hosmer & Lemeshow, 1989; Demaris, 1992), the direct probabilities of the group assignment were calculated by the different value combinations of the background variables, as suggested by Roncek (1991, see also Schuster, 1983). Calculation of the probabilities of the group assignment was considered to be the most informative way to interpret the models. Appendix 1 indicates that the probability of a forest owner to belong to recreationists was 64 % in the most "favorable" case, i.e. the value combination with the highest probability. On the other hand, the models for investors, multiobjective and self-employed owners do not identify the observable characteristics of the group with equal clarity, the highest probabilities being 41%, 41% and 50 %, respectively.

Northern Finland

In northern Finland, landowner objectives were best described by two principal components (Table 4). The reliability of the solution was good (Carmines' theta = 0.86)

TABLE 3. IDENTIFICATION OF FOREST OWNER GROUPS.
Identification of forest owner groups based on objectives of forest ownership in southern Finland by owner and holding characteristics. Logit analysis. Maximum likelihood estimates.[i]

VARIABLE	MULTIOBJECTIVE OWNERS	RECREATIONISTS	SELF-EMPLOYED	INVESTORS
		Coefficient (Wald statistics)		
Constant	-0.976 (7.96)	1.294 (3.83)	-1.572 (4.75)	-2.928 (13.8)
Age of owner, yrs	–	-0.019 (3.63)	-0.019 (3.82)	–
Duration of ownership of holding, yrs	0.016 (4.06)	–	–	0.024 (4.24)
Area of forest holding, ha	0.005 (2.80)	-0.031 (6.95)	–	–
Residence on holding Permanent = 1	–	–	0.325 (2.08)	–
Part-time = 1	–	–	–	–
Absent = 1	-0.652 (4.97)	–	–	1.896 (10.2)
Holding owned jointly by heirs,Yes = 1	–	0.421 (2.44)	–	–
Farmer,Yes = 1	–	-0.641 (4.70)	1.106 (7.45)	-0.602 (3.08)
Male, Yes = 1	–	-0.633 (4.37)	0.941 (5.42)	–
Log-likelihood	-875.206	-701.184	-738.696	-496.272
R_L^2 (likelihood ratio index)	0.04	0.12	0.12	0.17
n	534	235	459	202

[i] Initial models were estimated by stepwise procedure. Final models presented in the table contain only statistically significant variables. Only those structural characteristics the development of which had been forecast by Ripatti & Järveläinen (1997) were included in the analysis.

and the explained proportion of the total variation of the original variables was 39 %. The interpretation of the components was straightforward. The first principal component

TABLE 4. LANDOWNER OBJECTIVES IN NORTHERN FINLAND.
Principal component analysis. Varimax rotation.(Loadings below 0.250 denoted by asterisk.)

	ECONOMIC OBJECTIVES	NON-TIMBER OBJECTIVES
Hedging motives	0.741	*
Regular sales income	0.725	*
Labor income & employment	0.717	*
Credibility	0.704	*
Funding of investments	0.694	*
Asset motive	0.666	*
Security in old age	0.650	*
Forest work	0.552	0.282
Security against inflation	0.499	*
Speculative motives	0.490	*
Household timber	0.434	0.278
Bequest motive	0.396	0.250
Solitude and meditation	*	0.776
Outdoor recreation	*	0.686
Aesthetic values	*	0.671
Roots in native locality	*	0.612
Inherent value	*	0.556
Residential environment	*	0.545
Nature protection	*	0.511
Berry-picking	*	0.504
Hunting	*	0.281
Eigenvalue	4.744	3.460
Proportion explained	23%	16%
Carmines' theta[i]	0.86	
n	626	

[i] See footnote in Table 1.

could be labeled as *economic objectives* of forest ownership and the second as *non-timber objectives*. The two principal component scores were used as grouping variables in clustering the owners, but no interpretable solution was found. The clustering experiments suggest that northern forest owners do not clearly separate from each other economic and non-timber aspects of their forest ownership.

TABLE 5. RELATIONSHIP BETWEEN OWNER AND HOLDING CHARACTERISTICS AND LANDOWNER OBJECTIVES IN NORTHERN FINLAND.
Linear regression analysis. OLS-estimates.[i]

VARIABLE	ECONOMIC OBJECTIVES	NON-TIMBER OBJECTIVES
	Coefficient (t-value)	
Constant	-0.240	0.036
Area of forest holding, ha	0.007 (8.12)	–
Forest in addition to the sample forest, Yes=1	0.386 (3.50)	–
Residence on holding Permanent = 1	–	0.430 (5.03)
Part-time = 1	–	–
Absent = 1	–	–
Permanent residence more than 30 km from the holding, Yes = 1	-0.279 (3.17)	–
Holding purchased on the free market,Yes = 1	–	0.492 (4.18)
Holding owned jointly by heirs,Yes = 1	-0.439 (5.29)	-0.236 (2.61)
Farmer,Yes = 1	0.421 (5.14)	-0.719 (8.09)
Retired, Yes= 1	-0.262 (3.52)	–
R^2	0.26	0.13
n	594	595

[i] Initial models were estimated by stepwise procedure. Final models presented in the table contain only statistically significant variables.

The correlations between the two principal components and forestry behavior indicated that economic objectives were more associated with active forestry behavior than

non-timber objectives. Economic objectives were correlated with, for instance, sales frequency (0.35), sales amounts — m^3/year/holding (0.22), number of silvicultural measures (0.28), and use of own labor in silvicultural measures (0.28).

The connection between landowner objectives and owner and holding characteristics was analyzed by means of linear regression models (Table 5 on page 159). In the two models, the dependent variables were the principal component scores. The results are discussed in more detail in the next chapter.

Regional Differences

The structures of principal components describing landowner objectives could be compared by regions using transformation analysis (Appendix 2). To enable the comparison, a two-component solution was estimated also for southern Finland. The transformation matrix indicated that the structures were rather close to each other in general. However, the residual matrix suggested the existence of some interesting, although minor differences.

In northern Finland, forest work was clearly connected to economic aspects of forests. It is obvious that northern owners do not regard forest work as mainly a recreational activity. This assumption was supported by the closer relationship between labor income from forestry and economic objectives in northern Finland. Also household timber appears to be more associated with economic aspects of forestry in northern Finland than in the southern part of the country.

A two-component solution, i.e., economic and non-timber objectives, could be estimated also for the whole country. The means of the principal component scores by regions revealed that economic objectives were more important in the South than in the North. The result was supported by the cross-tabulations of the original twenty-one objectives.[3] The difference in the emphasis of economic objectives may partly be explained by the lower economic value of northern forests due to climatic reasons and, to

[3] As expected, northern owners emphasized hunting clearly more often than southern owners.

some extent, differences in roundwood prices. In the South, roundwood sales income amounted to ten percent of the gross income of the households but the proportion was only five percent in the North.

The regional comparison of landowner objectives was handicapped by the fact that no cluster solution was found concerning northern Finland. In the North, only connections between two sets of variables, principal components describing landowner objectives and owner and holding characteristics, could be established. In southern Finland, owner groups based on objectives of forest ownership could be identified by background characteristics.

The comparison of the results in Tables 3 and 5 suggests that non-timber objectives are typical of non-farmers in both regions. The owners of small forest holdings are likely to be recreationists in southern Finland, but no connection between the size of the forest area and non-timber objectives was detected in the northern part of the country. In the North, non-timber objectives seemed to be associated with permanent residence on the holding, although their connection with non-farmer ownership would have suggested absenteeism. Furthermore in northern Finland, non-timber objectives were related to ownership of holdings purchased on the free market.[4] Obviously these holdings are often used for recreational purposes. On the other hand, younger age, joint ownership by heirs, and ownership by women were characteristics which identified recreationists' holdings in the South.

In the North, economic objectives seemed to be associated with a large forest area, farmer ownership, permanent residence either on the holding or close to it but not with retiree ownership. In southern Finland, economic goals were common both among farmers (self-employed owners) and non-farmers (investors). Self-employed owners tended to be active farmers: they were rather young, male and resided permanently on the holding. Investors were typically rather old (long duration of ownership), absentee non-farmers.

[4] Inheritance and purchase from relatives are clearly the most common ways of acquiring forest land.

FUTURE TRENDS IN LANDOWNER OBJECTIVES

Long-term objectives of the individual owners are not regarded to be sensitive to changes (see Rescher, 1969). The most important reason for changes in forest owners' objectives is therefore considered to be generational change (c.f. Inglehart, 1977), i.e. the structural change in forest ownership.[5] Different kinds of people with different objectives, education and occupations become forest owners through ownership transfers. Assuming that the relationships between the groups based on landowner objectives and owner and holding characteristics resist over time, future trends in objectives of forest ownership can be forecast for southern Finland. Forest owners defied grouping in northern Finland, which prevents the attempts to forecast changes in objectives.

The prediction for southern Finland was carried out by using the parameters obtained from the logit models identifying the owner groups by owner and holding characteristics (Table 3) with the data on the present (1990) and projected owner characteristics describing an average forest owner (Appendix 3). The corresponding probabilities of belonging to groups based on objectives were calculated (Table 6).

The results suggest that the most dramatic change would concern the probability of a forest owner to belong to self-employed owners, characterized by active farmers. The probability would diminish substantially within thirty years. On the other hand, the probability of belonging to investors and recreationists — both non-farmer groups — would increase moderately in the future. The probability of belonging to multiobjective owners would seem to remain rather stable.

[5] The use of the owner's age (or duration of ownership) is problematic in forecasting. Although objectives of an individual forest owner may change during his life-cycle, the major reason for changes in objectives is hypothesized to be the different values and objectives of different generations of forest owners. The forecasts fail to take into account this permanency of objectives in different age cohorts. It is probable that this permanency in objectives is more eminent among recreationists than among self-employed owners or investors, whose objectives may be more responsive to changes during their life-cycle.

TABLE 6. FORECASTS OF CHANGES IN LANDOWNER OBJECTIVES IN SOUTHERN FINLAND.

The Table shows the probabilities for an average forest owner in southern Finland of belonging to groups based on objectives of forest ownership in 1990, 2005 and 2020. Calculations based on forecasts of owner and holding characteristics.

YEAR	MULTI-OBJECTIVE OWNERS	RECREATIONISTS	SELF-EMPLOYED	INVESTORS
	Probability of belonging to group (p), %			
1990[i]	32	21	24	10
2005	32	22	20	12
2020	32	23	16	14
Change in 15 years	0	+1	-4	+2
Change in 30 years	0	+2	-8	+4

[i] Actual proportions 33 %, 25 %, 27 % and 15 % of forest owners.

Due to the inability of the procedure to incorporate age cohort effects (footnote on p. 162), tentative calculations were made including dichotomous age cohort variable (< 60 and > 60 years) in the models and assuming that all owners would behave like younger cohort in 1990 in the becoming years. The results suggest that the forecasts presented in Table 6 may exaggerate the speed of change as regards to self-employed owners and investors, but underestimate the change of the probability of assignment to recreationists.

DISCUSSION

The results indicate that regional differences exist in the objectives of forest owners. These differences may be partly due to climatic, cultural and socio-economic differences between northern and southern Finland. As suggested by classical theories of social change (e.g., Durkheim, 1933; Giddens, 1985), the objectives appear to be less divergent in the North, in a more traditional society, than in the South.

On the other hand, owner and holding characteristics indicate that structural change in private forestry has been

more severe in the northern part of the country than in the South. For instance, the proportion of non-farmers is clearly larger and permanent residence outside the holding more common in the North than in the South. One of the causes of the rapid structural change particularly in northern Finland has been the post-war settlement activities (see Kähönen, 1966; Siuruainen, 1978), which were partly unsuccessful. The abandonment of non-viable farms (with forests) (Selby, 1975) has accelerated the increase in the proportion of non-farmers among forest owners. In conclusion, structural change and diversification of landowner objectives appear to be linked with each other in a rather straightforward manner in southern Finland, but their interrelationship is more complicated in northern Finland.

Economic objectives seemed to be more important in the South than in the North, where forest work and household timber were considered economic aspects of forestry rather than recreational benefits. Owner and holding characteristics were related to landowner objectives in both regions, but often with the North differing from the South.

In southern Finland, landowner objectives could be described by three dimensions: non-timber objectives, sales income and self-employment opportunities, and economic security and asset motive. Based on these objectives, four groups could be identified: multiobjective owners, recreationists, self-employed owners and investors. Because similar groups of forest owners could be found both in southeastern Finland (Kuuluvainen *et al.*, 1996; Karppinen, 1998) and throughout southern Finland, the subdivision of the country only into northern and southern parts appears justifiable.

In northern Finland, landowner objectives could be described by two dimensions, i.e. economic and non-timber objectives, but no grouping of forest owners could be established. However, the clustering experiments suggest that northern forest owners do not clearly separate from each other economic and non-timber aspects of their forest ownership.

Forecasts dealing with southern Finland suggest that the probability of a forest owner of belonging to self-employed owners, active farmers, would diminish substantially in the future. Assuming the permanency of objectives by age co-

horts, the speed of change would be smaller. On the other hand, the prediction cannot take into account future changes in the institutional environment, e.g., the possibility of a considerable decrease in the number of active farms due to Finland's adjustment to the EU's Common Agricultural Policy.

The probability of assignment in multiobjective owners would seem to remain rather stable. On the other hand, the probability of belonging to investors and recreationists — both non-farmer groups — would increase moderately in the future. The predicted change in the probability of assignment to recreationists is probably too small due to exclusion of age cohort effects in forecasts. For the same reason, the change in the probability of belonging to investors might be smaller than presented in the forecast.

According to previous studies (Kuuluvainen *et al.*, 1996; Karppinen, 1998), multiobjective owners are most active in silvicultural and harvesting behavior. Recreationists, investors and self-employed owners sell approximately 1 m^3 less roundwood per hectare and year than multiobjective owners. Future changes in the objectives of forest ownership will therefore not substantially affect the roundwood supply in southern Finland, where the most of the industrial roundwood is purchased.

The results of the study provide one set of answers, but many questions remain to be answered in the future. In particular, further research should address the causes of regional differences in landowner objectives. Furthermore, transformation analysis revealed that economic and nontimber objectives have, to some extent, different contents by regions. This underlines the need of validity evaluations.

The results offer support for decisions in the planning and implementation of public forest policy. In particular, the allocation of forestry extension services could be designed to match the various motivations of forest owners. Regional information on landowner objectives is also important to the roundwood purchasing firms.

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APPENDIX 1.

Probability of assignment (π) to groups based on objectives of forest ownership in southern Finland by owner and holding characteristics.

VARIABLE	MULTI-OBJECTIVE OWNERS		RECREA-TIONISTS		SELF-EMPLOYED OWNERS		INVESTORS	
	I	II[i]	I	II[i]	I	II[i]	I	II[i]
Age of owner, yrs (Q_1= 43 and Q_3= 64)[ii]	–	–	Q_1	Q_3	Q_1	Q_3	–	–
Duration of ownership of holding, yrs (Q_1= 8 and Q_3=28)[ii]	Q_3	Q_1	–	–	–	–	Q_3	Q_1
Area of forest holding, ha (Q_1= 10.76 and Q_3= 36.87)[ii]	Q_3	Q_1	Q_1	Q_3	–	–	–	–
Residence on holding Permanent = 1	–	–	–	–	1	0	–	–
Absent = 1	0	1	–	–	–	–	1	0
Holding owned jointly by heirs,Yes = 1	–	–	1	0	–	–	–	–
Farmer,Yes = 1	–	–	0	1	1	0	0	1
Male, Yes = 1	–	–	0	1	1	0	–	–
Probability of assignment (π), %	41	19	64	9	50	6	41	3

[i] Most "favorable" (I) and "unfavorable" (II) combinations of variables

[ii] Lower quartile (25%) and upper quartile (75%).

APPENDIX 2.

Regional differences in the structures of principal components describing landowner objectives. Comparison of two-component varimax solutions using transformation analysis.

	PRINCIPAL COMPONENTS			
	SOUTHERN FINLAND		NORTHERN FINLAND	
	Economic objectives	Non-timber objectives	Economic objectives	Non-timber objectives
Residential environment	0.012	0.634	0.006	0.545
Outdoor recreation	-0.034	0.703	0.128	0.686
Berry-picking	0.066	0.607	0.187	0.504
Hunting	0.175	0.181	0.215	0.281
Forest work	0.239	0.381	0.552	0.282
Regular sales income	0.652	0.062	0.725	-0.061
Funding of investments	0.667	0.049	0.694	-0.020
Labor income & employment	0.532	0.135	0.717	0.011
Household timber	0.231	0.422	0.434	0.278
Nature protection	0.057	0.615	0.209	0.511
Aesthetic values	0.010	0.629	0.033	0.671
Credibility	0.519	0.318	0.704	0.210
Security in old age	0.657	0.127	0.650	0.087
Hedging motives	0.675	0.127	0.741	0.021
Security against inflation	0.512	0.057	0.499	0.147
Bequest motive	0.399	0.228	0.396	0.250
Inherent value	0.265	0.467	0.158	0.556
Solitude and meditation	0.047	0.678	0.064	0.776
Roots in native locality	0.169	0.560	-0.022	0.612
Asset motive	0.576	0.054	0.666	0.121
Speculative motives	0.389	0.019	0.490	0.222
Eigenvalue	3.464	3.603	4.744	3.460
Proportion explained	16%	17%	23%	16%

	TRANSFORMATION MATRIX	
	Economic objectives	Non-timber objectives
Economic objectives	0.9961	-0.0880
Non-timber objectives	0.0880	0.9961

	RESIDUAL MATRIX	
	Economic objectives	Non-timber objectives
Residential environment	0.0617	0.0855
Outdoor recreation	–.1000	0.0173
Berry–picking	–.0679	0.0948
Hunting	–.0248	–.1161
Forest work	–.2804	0.0765
Regular sales income	–.0701	0.0654
Funding of investments	–.0253	0.0101
Labor income & employment	–.1752	0.0767
Household timber	–.1668	0.1220
Nature protection	–.0981	0.0966
Aesthetic values	0.0323	–.0453
Credibility	–.1590	0.0611
Security in old age	0.0156	–.0183
Hedging motives	–.0574	0.0461
Security against inflation	0.0160	–.1353
Bequest motive	0.0215	–.0580
Inherent value	0.1471	–.1141
Solitude and meditation	0.0425	–.1048
Roots in native locality	0.2396	–.0690
Asset motive	–.0875	–.1179
Speculative motives	–.1008	–.2373

Transformation analysis (Mustonen, 1966; 1992; 1995; Lahti *et al.*, 1996) is a special case of confirmatory factor analysis. It can be used to compare the (rotated) factor matrix with a given theoretical matrix or two factor/principal component matrices obtained from different data sets can be compared with each other. The symmetric analysis used in the study enables the comparison of orthogonal structures. Transformation analysis is based on two (or more) factor matrices estimated using the same initial variables. The invariance between the matrices A_1 and A_2 can be expressed $A_1L_{12} \sim A_2$ where L_{12} is the *transformation matrix*. If the scores of the transformation matrix are close to one or zero, the factor structures are similar. L_{12} is estimated using ordinary least squares, which makes the sum of squares of elements in the *residual matrix* $E_{12} = A_1L_{12} - A_2$, i.e. total residual, as small as possible.

APPENDIX 3.

Owner and holding characteristics in southern Finland in 1990 and forecasts for the years 2005 and 2020. Sources: Ripatti 1996, personal communication; Ripatti & Järveläinen, 1997.

CHARACTERISTIC	YEAR		
	1990	2005	2020
		Mean[i]	
Age of owner, yrs	54	56	58
Duration of ownership of holding, yrs	19	20	21
Area of forest holding, ha	29	30	31
	% of forest holdings/owners[ii]		
Residence on holding			
Permanent=1	60	54	47
Part-time=1	8	9	11
Absent =1	32	37	42
Holding owned jointly by heirs, Yes = 1	16	21	26
Farmer,Yes = 1	50	42	35
Male, Yes = 1	73	63	52

[i] Forecasts based on linear trends extrapolated from the period 1975 – 1990.

[ii] Forecasts based on log-linear models estimated from the period 1975 – 1990.