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Forest values and the objectives of forest ownership

Heimo Karppinen

HELSINGIN TUTKIMUSKESKUS – HELSINKI RESEARCH CENTRE

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Heimo Karppinen

Doctoral dissertation
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Abstract

This dissertation analyzes Finnish NIPF owners' forest values and long-term objectives of forest ownership, and their effects on forestry behavior. The study consists of three published articles and an essay. A review section considers values and objectives from a theoretical point of view, and presents the empirical approach of the study. The study is based on mail inquiry and interview data. The results suggest that the connection between general forest values and the objectives of forest ownership is rather weak. A biocentric type of value orientation, primitivism-mysticism, is, nonetheless, associated with non-timber objectives. Based on their landowner objectives, forest owners can be classified into four groups (multiobjective owners, recreationists, self-employed owners and investors), and a link can be established between ownership objectives and observed harvesting and silvicultural behavior. The multiobjective owners who value both monetary and non-monetary benefits are more active than other owners in their forestry behavior. On the other hand, an emphasis on non-timber objectives is not found to exclude wood production. Regional differences in the objectives of forest owners are also identified; objectives being less divergent in the more traditional northern society, than in the South. From the point of view of microeconomic approach, the results indicate that the multiobjective owners' harvesting behavior seems to be closest to the present-value maximizing harvesting policy. For the single-objective owners, forest and owner characteristics are important determinants of timber harvest. Their behavior seems to be consistent with the assumed credit-rationed utility maximization. The results of this study can be used in planning and implementation of public forest policy, such as allocation of the resources of the forestry extension services.

Keywords: non-industrial private forests, landowner objectives, forest values, environmental attitudes, owner characteristics, timber supply, value theories

Abstrakti

Väitöskirja käsittelee suomalaisten yksityismetsänomistajien yleisiä metsiin kohdistamia arvoja ja oman metsänomistuksen tavoitteita sekä niiden yhteyttä metsätaloudelliseen käyttäytymiseen. Tutkimus koostuu kolmesta julkaistusta artikkelista ja yhdestä esseestä sekä yhteenveto-osasta, jossa tarkastellaan arvoja ja tavoitteita teoreettisesti sekä kuvataan tutkimuksen empiiristä lähestymistapaa. Tutkimus perustuu haastattelu- ja kyselyaineistoihin. Tulosten mukaan yleisten arvojen ja metsänomistuksen tavoitteiden yhteys osoittautui heikoksi. Tosin biosentristyyppinen arvo, primitivismi-mystismi, oli selkeästi yhteydessä metsänomistuksen aineettomiin tavoitteisiin. Metsänomistajat voitiin luokitella tavoitteidensa suhteen neljään ryhmään (monitavoitteiset, virkistyskäyttäjät, metsästä elävät ja taloudellista turvaa korostavat), ja tavoitteilla todettiin olevan suoraa vaikutusta metsätaloudelliseen käyttäytymiseen. Monitavoitteiset metsänomistajat, jotka korostavat sekä metsänomistuksen taloudellisia että aineettomia näkökohtia, osoittautuivat olevan aktiivisimpia puun myynneissä ja metsänhoidollisessa toiminnassa. Toisaalta aineettomien tavoitteiden korostus ei näytä sulkevan pois puuntuotantoa ja hakkuita. Tulokset viitaavat myös alueittaisiin eroihin metsänomistajien tavoitteissa. Kulttuuriltaan perinteisemmässä Pohjois-Suomessa tavoitteet olivat eriytymättömämpiä kuin maan eteläosassa. Mikrotaloustieteen näkökulmasta, tulokset viittasivat siihen, että monitavoitteisten metsänomistajien puunmyyntikäyttäytyminen olisi lähinnä kantorahatulojen nykyarvoa maksimoivaa hakkuupolitiikkaa. Muiden tavoiteryhmien mallissa myös metsään ja omistajaan liittyvät piirteet osoittautuivat merkittäviksi puun tarjonnan selittäjiksi. Heidän hakkuukäyttäytymistään voitaisiin näin luonnehtia lähinnä luotonsaantirajoitteiseksi hyödyn maksimoinniksi. Tutkimuksen tuloksia voidaan hyödyntää julkisen metsäpolitiikan suunnittelussa ja toimeenpanossa, erityisesti yksityismetsätalouden neuvonnan kohdentamisessa.

Avainsanat: yksityismetsät, metsänomistuksen tavoitteet, metsäarvot, ympäristöasenteet, metsänomistajien taustapiirteet, puun tarjonta, arvoteoriat

Preface

The original idea of studying forest owners' values and objectives came from Veli-Pekka Järveläinen and Ilpo Tikkanen who then worked at the Department of Forest Economics at the University of Helsinki. In fact, I have been privileged to have the opportunity to work at "two places at the same time". Although I have had my office at the Department of Forest Economics, I have been employed by the Finnish Forest Research Institute. This arrangement has given me excellent working conditions, providing me with the inspiring atmosphere of both institutions. I have especially enjoyed the opportunity to work with my closest colleagues in the project "Monitoring system for non-industrial private forestry" at the Finnish Forest Research Institute.

I am particularly indebted to my supervisor and collaborator Jari Kuuluvainen for his encouragement and experienced advice throughout the work. I would also like to thank my pre-examiners John Bliss and Klaus Helkama for their constructive comments. My gratitude is also extended to Harri Hänninen and Ville Ovaskainen who have collaborated in the separate studies of this dissertation. Acknowledgements are also extended to Veli-Pekka Järveläinen, Lauri Hetemäki, Riitta Hänninen, Erkki Kilpinen, Martti Makkonen, Eija Pouta, Tapio Rantala, Mika Rekola, Pekka Ripatti, Tuija Sievänen, Anne Toppinen, Timo Tuomivaara and Esa-Jussi Viitala for their valuable comments and suggestions. I am also grateful to Ashley Selby for his well-aimed comments and for checking the language of the manuscript, and to Anna-Kaisu Korhonen as well as Lea Suhonen for their technical assistance.

Finally, I wish to express my deepest gratitude to my beloved wife Riitta, and to our children Henriikka and Pietari, for their support and understanding.

Helsinki, December 1999 *Heimo Karppinen*

Contents

List of separate studies

This dissertation includes the following separate studies, which are referred to by roman numerals in the text as follows:

I) Karppinen, H. 1998. Values and objectives of non-industrial private forest owners in Finland. Silva Fennica 32(1): 43–59.

II) Kuuluvainen, J., Karppinen, H. & Ovaskainen,V. 1996. Landowner objectives and nonindustrial private timber supply. Forest Science 42(3): 300–309.

III) Karppinen, H. 1998. Objectives of non-industrial private forest owners: Differences and future trends in southern and northern Finland. Journal of Forest Economics 4(2): 147–173.

IV) Karppinen, H. & Hänninen, H. 1999. Attitudes towards the protection and economic utilization of forests in Finland. (submitted)

The first three articles are reprinted with permission.

1 Introduction

1.1 Background

Private forest management is primarily a voluntary action which is constrained by laws to a limited extent. This means that forest owners themselves can largely decide what management activities they pursue in their forests. The characteristics of the forest holding are naturally important in this decision-making. However, forest owners' objectives concerning their forest property are the most important factor affecting the management decisions. This is an underlying assumption in many empirical studies on non-industrial private forest owners' (NIPF) forest management behavior. Nevertheless, it has mostly been considered implicitly rather than explicitly based on direct measurements of motivational factors.

The objectives of forest ownership can be seen as subordinate to general values concerning the relationship between humans and nature. However, studies concerning general forest values of NIPF owners are rare. Forest values, attitudes and opinions of the public concerning public forests have been investigated more frequently (e.g., Shindler *et al.* 1993, Steel *et al.*1994, Xu and Bengston 1997).

The objectives of forest ownership[1] have been studied directly in numerous surveys on NIPF owners. For instance, the reasons for owning forest land have often been inquired in studies conducted in the U.S. (e.g., Birch 1983, MacConnell and Archey 1986, Carpenter 1989). Also, the German tradition of assessing the importance of the functions of the forest – *Waldfunktionen* – (Lammel 1977) is an attempt to uncover NIPF owners' objectives. In Finland, Hahtola (1973) used a factor analytic approach to study forest owners' decision-making. In Sweden, objectives of forest ownership have been studied by Lönnstedt (1989) and Carlén (1990). Qualitative interview methods have also been used (Bliss and Martin 1989, Lönnstedt 1997).

A Finnish study by Tikkanen (1978) suggested that landowner objectives could be condensed into three dimensions. Forests can be regarded as a source of finance and income, and they can provide the owner with economic security, or recreational and aesthetic benefits. Kurtz and Lewis (1981), in an American study, went a step further by presenting a theoretical framework including the motivations and objectives of NIPF owners and classifying owners into four types: timber agriculturalist, range pragmatist, timber conservationist, and

1. The following terms are used synonymously referring to objectives of forest ownership: landowner objectives, forest owners' objectives and ownership objectives.

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) concluded that forest owners can be divided into two groups based on their motives: owners driven by personal utilization of forest benefits (consumption motive) and those emphasizing income generation from their forest (production motive).[1]

In the present study, general values concerning the relationship between humans and nature and the long-term objectives of forest ownership 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, which is a an important factor inducing value changes (Rescher 1969, p. 117–118). The study aims to classify forest owners according to their forest values and ownership objectives. An attempt is also made to go beyond the scope of the former empirical studies (Kurtz and Lewis 1981, Ferretti 1984), and to identify the owner groups based on values and objectives by directly observable owner and holding characteristics. This is crucial for the application of the results, for instance, to forestry extension.

Regional differences in forest values and landowner objectives may also be considerable (cf., Marty *et al.* 1988). In Finland, the differences in climate and soil, culture, and socio-economic environment are crucial to the issue. For instance, northern Finland represents more traditional society compared to southern Finland. According to classical theories of social change (e.g., Durkheim 1933, Giddens 1985), values, and obviously objectives of forest ownership also, should be less divergent in the North.

The empirical literature concerning NIPF owners' forest management behavior is extensive (e.g., Järveläinen 1971, 1981, 1988, Binkley 1981, Kurtz and Lewis 1981, Greene and Blatner 1986, Loikkanen *et al.* 1986, Romm *et al.* 1987, Hyberg and Holthausen 1989, Kuuluvainen 1989, Carlén 1990, Dennis 1989, 1990, Kuuluvainen and Salo 1991, Egan and Jones 1993). However, the implications of NIPF owners' motivations for actual forest management behavior have not been studied sufficiently. What is new in this study and without a precedent in the literature, is the establishment of a link between landowner objectives and observed harvesting behavior by simultaneously controlling for other theoretically justified explanatory variables. The results

1. The primary motivation of production is consumption, either the owner's own consumption or that of other consumers. It would be perhaps more precise to use here the term household production -orientation (concerning mainly non-timber benefits) referring to the consumption (consumptive) motive in Ferretti's terminology, and market production -orientation referring to the production (productive) motive.

indicate that differences in landowner objectives may have a quantifiable effect on timber harvest rates. Silvicultural behavior is also analyzed by landowner objectives.

The possible attitudinal differences between non-industrial private forest owners and non-owners are also investigated in the study. Forest attitudes are compared in order to find out whether it is possible to generalize the results concerning forest owners' values on the public at large. The U.S. studies suggest that there are minor differences between forest attitudes of the forest owners and the public (Bliss *et al.* 1994, 1997, Bourke and Luloff 1994), whereas evidence from Finland suggests that non-owners are more pro-environmentally oriented than forest owners (Kangas and Niemeläinen 1996).

1.2 Aim and scope of the study

The dissertation concerns Finnish forest owners' forest values and long-term objectives of forest ownership, and their effects on forestry behavior on woodlots. Immediate or short-term decisions, such as whether to cut a certain stand or not, are not considered here. The investigation aims of the four separate studies can be summarized as follows:

1) to describe the Finnish NIPF owners' general forest values and their long-term objectives of forest ownership and their interrelationships (I)

2) to classify forest owners empirically based on a theoretical typology on the relationship between humans and nature describing forest values (I) and create an empirical classification of owners based on their objectives of forest ownership (I and III).

3) to systematically identify these owner types based on their values and objectives by directly observable owner and holding characteristics describing the structure of forest ownership (I and III)

4) to describe and explain regional differences in the objectives of NIPF owners and assess the future development of these objectives (III)

5) to analyze harvesting and silvicultural behavior of these owner groups based on values and objectives (I and II)

6) to compare forest attitudes of the forest owners and non-owners (IV)

Apart from paper II which uses a microeconomic approach and econometrics, the present investigation is sociological or social-psychological. Both forest values and the objectives of forest ownership are studied descriptively. In other words, the study aims to describe the values and objectives of forest owners. The ethical or normative philosophical approach to investigate moral

ideals is beyond the scope of this study. Values and objectives are, however, also used to explain behavior. The approach is not descriptive in this sense.

The values and objectives of forest ownership are measured by standardized interview and inquiry techniques. Universal, social-psychological value theories, such as Rokeach's (1973) and Schwartz's (1992) theories are briefly discussed in order to find a theoretical standpoint for describing the relationship between humans and nature. Pietarinen's (1987, 1991) theoretical typology concerning this relationship is chosen for operationalization and empirical testing as regards to forest owners. The empirical adoption of Pietarinen's typology (Pohjalainen 1987) has been rare in the study literature.

The study approach is pragmatic, which is in line with most of the studies in social economics of forestry. This means that the research objectives of the study are influenced by practical problems in the forest sector. In this case, the main concern has been the NIPF timber supply and owners' investments in forestry: do assumed changes in forest owners' values and objectives affect the roundwood supply and the extent of silvicultural measures? Basically, an economic – or forest policy – problem, the sufficiency of roundwood supply, is the impetus for this study. The adopted sociological/social-psychological approach can be considered to be subjugated to economics, based on the Schumpeterian connection between economics and sociology: "Economic analysis deals with the questions how people behave at any time and what the economic effects are they produce by so behaving; economic sociology deals with the question how they came to behave as they do" (Schumpeter 1955, p. 21). Especially the second article (II) of this dissertation can be regarded to address this kind of hierarchical relation.

The remainder of the study is organized as follows. Section 2 highlights the main characteristics of structural change of private forest ownership in Finland. Section 3 presents the theoretical framework of the study. The basic concepts are defined, and general value theories and a theoretical typology specifically based on the relationship between humans and nature are presented. Next, the objective of forest ownership is defined, and hypotheses concerning the relationship between forest values, landowner objectives and forestry behavior are presented. Changes in values and objectives of forest ownership are discussed in Section 3.2. The approach of the empirical part of the study is presented in Section 4, and the four specific studies are summarized in Section 5. Schwartz's value theory is compared with the empirical results of the present study in Section 6. The results are discussed and conclusions drawn in Section 7.

2 Structural change of private forest ownership in Finland

The main part of the Finnish forests are owned by non-industrial private forest owners. Their proportion is almost two thirds (62%) of the total forest area. Other owner categories are the state (24% of the forest area), private companies (9%) and a miscellaneous group (5%) consisting of municipalities, church parishes and other collective bodies. Non-industrial private forests are mainly located in the southern part of the country where soil and climatic conditions are more favorable compared to northern Finland. Therefore, private forests provide around 70–80% of the domestic roundwood used by export-oriented forest industries. The value of exports of forest industry products accounts for around 30% of the value of total exports of goods. (Finnish Statistical... 1998)

The full utilization of forest resources has been among the key issues in public forest policy in Finland. However, the total drain has been clearly below the volume increment since the early 70's (Finnish Statistical... 1998). The main part of these potential "cutting reserves" has accumulated in the southern private forests. According to a long-lived assumption, one of the main reasons for this "underutilization" of forest resources has been the structural change of forest ownership due to an increased emphasis on non-timber objectives of forest ownership. Environmental and recreational aspects of forest ownership have become more significant. Nevertheless, there is no evidence that the structural change of forest ownership would diminish roundwood supply from private forests. Such a decrease in private timber supply can neither be detected from statistics (Finnish Statistical... 1998) nor it is supported by empirical studies (Ovaskainen and Kuuluvainen 1994).[1]

The structure of society can be described by social statuses, such as class, occupation, age and gender structures (Riihinen 1990, p. 10–11). Such socio-demographic attributes are used to describe the structure of forest ownership (owner and holding characteristics). The structural change in private forest ownership is, of course, consequent upon the general trends of socio-economic change in Finland.

During the past thirty years, the main trends have been occupational and regional differentiation, migration and a general urbanization of the population. These trends have been associated with a rising standard of living and wealth. This development has taken place rather late compared with other

1. During the 1990's there has been a rising trend in the commercial removals of NIPF owners (Finnish Statistical... 1998).

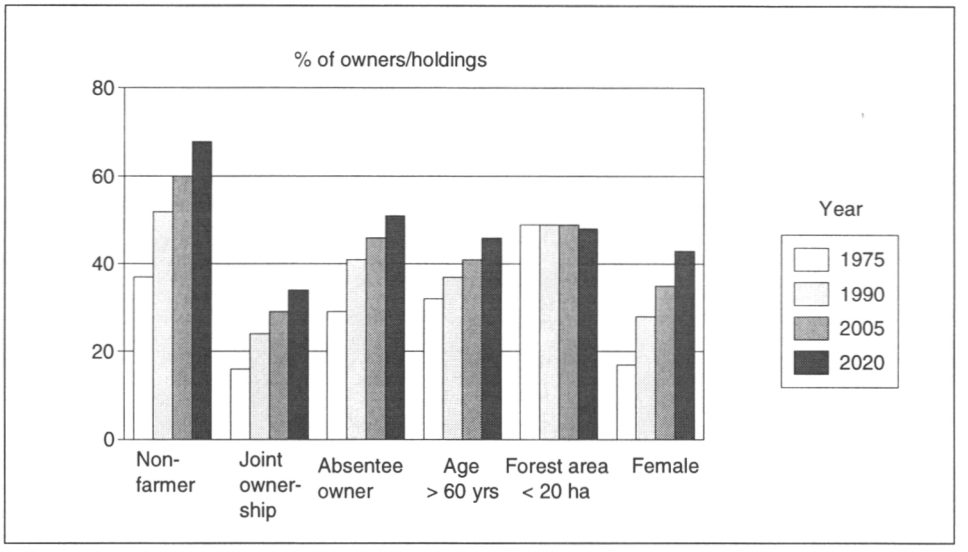

Figure 1. Structural change in forest ownership, past (1975 and 1990) and predicted development (2005 and 2020). Source: Ripatti and Järveläinen 1997, p. 226.

industrialized countries, but it has been particularly rapid. The general changes have had a powerful impact on private forestry: the structure of forest ownership has changed dramatically.

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. Non-farmers now account for more than half of the forest owners and their proportion is rapidly increasing (Fig 1., Ripatti and Järveläinen 1997, p. 226).

Along with this trend, several other changes have taken place. Forest owners are, on an average, rather old (54 years) (Ripatti 1996, p. 29) and the proportion of aged owners is still increasing. Other features of the structural development are an increased ownership by women, and an increase in absentee and joint ownership by heirs or family concerns (Ripatti and Järveläinen 1997). The forest size distribution has polarized somewhat, which means that especially the number of small holdings but also the number of large holdings is increasing (Ripatti 1996, p. 64).

In the present study, it is assumed that the structural change in forest ownership has been the main channel for changes in forest values and objectives of forest ownership. Different kinds of people with different values, education and occupations become forest owners through ownership transfers, mostly by inheritance (see Section 3.2.3). How values and objectives have actually changed cannot be investigated in this study due to lack of relevant data.

3 Theoretical framework

This section concerns theoretical aspects of the study. First in Section 3.1, the concept of value is discussed and defined. Other concepts closely linked to values are also summarized. Next, general social-psychological value theories are discussed and a theoretical typology specifically based on the relationship between humans and nature is presented. Thereafter the concept of a long-term objective of forest ownership is introduced and defined, and preliminary hypotheses on the connection between values, objectives and forest management behavior are presented.

Section 3.2 considers modes and causal factors inducing value changes in general, and describes especially the connection between structural changes in private forest ownership and changes in forest owners' values and objectives. Also regional differences in landowner objectives are discussed.

3.1 Values and objectives

3.1.1 Concept of value

In sociology, values are regarded as social phenomena and factors explaining human action. Value is a very diffuse concept and prior to defining it, it is useful to make a few conceptual distinctions.

Adler (1956, p. 272) divides concepts of value into four basic types:

1) Values are absolutes, existing in the mind of God as eternal ideas.

2) Values are in material or non-material objects.

3) Values are located in man, originating in his/her biological needs or in his/her mind. Values can be held by individual persons, groups, classes or society and culture as a whole.

4) Values are equated with action.

The first and fourth categories represent extreme conceptions of values. The former definition excludes values beyond the scope of empirical research and the latter considers the concept of value completely useless. However, the two intermediate categories include two basic distinctions which are useful prior to defining values. Values can be considered either subjective human conceptions or properties of objects (Rokeach 1973, p. 4–5, Schwartz 1992, p. 1). Another distinction is made based on value subjects, or using Rescher's (1969, p. 7) terminology on value subscribers. Values can be held either by

individual persons or by collective actors such as groups, classes or whole societies.

Weber's (1968, p. 24–26, also Käsler 1988, p. 154) distinction between instrumentally rational (*zweckrational*) and value-rational (*wertrational*) action is important in analyzing the concept of value. Instrumentally rational action is "determined by expectations as to the behavior of objects in the environment and of other human beings; these expectations are used as 'conditions' or 'means' for the attainment of the actor's own rationally pursued and calculated ends". Value-rational action, on the other hand, is "determined by a conscious belief in the value for its own sake of some ethical, aesthetic, religious, or other form of behavior, independently of its prospects of success". Instrumentally rational behavior is based on the actor's own interests, whereas value-rational action presupposes, for instance, a moral or religious orientation.

Allardt (1964) makes these three distinctions prior to defining the concept of value. First, he makes the subjective–objective distinction: values can be considered either human conceptions influencing selective behavior or properties of objects. Subjective and objective values are obviously dependent on each other. Second, the distinction is made based on value subscribers. Values can be held by groups or cultures, or by individual persons. Values are usually learned from the social environment, so they can be concluded to be collective properties, but it is also reasonable to assume that both groups and individual persons can hold values. Single individuals may have deviant values compared to the values of the majority.

Third, values can be defined as "desired" or "desirable". Basically, the distinction is made between instrumentally rational and value-rational. In this context, desired means that which people actually desire, and desirable is that which they think they ought to desire (Hofstede 1984, p. 20). Defining values as desirable emphasizes the influences of the norms of the society or the group on individual choices. On the other hand, desired values presuppose that an individual's personal choice is most important (Verkasalo 1996, p. 2). Based on these three distinctions, Allardt (1964, p. 661, 1983 p. 51) defines values in a comprehensive manner: *"Value is a common and permanent conception of a desire or the desirable, learned from the environment, influencing the selection of goals."*

The various definitions of value can be analyzed using the three distinctions: subjective – objective, collective – individual and desired – desirable. One of the widely accepted definitions of value in the social science literature regards values as "conceptions of the desirable, influencing selective behavior" (Williams 1968, p. 283). Consequently, values are considered subjective and normative. Another subjective and normative definition is

presented by Kluckhohn (Rescher 1969, p. 2): "A value is a conception, explicit or implicit, distinctive of an individual or characteristic of a group, of the desirable which influences the selection from available means and ends of action."

An example of an object-based concept is the definition presented by Sinden and Worrell (1979, p. 4). "Value is a property of things, but things only have value when their existence does make a difference to someone. The value of a thing derives basically from some need or desire which it has the capacity to satisfy." Value can be presented as a function of this capacity.

In this study, values are defined according to Allardt' s value concept. The concept allows value subscribers to be individual persons or collective actors, and values are seen as human conceptions influencing selective behavior. Although Allardt's concept can be criticized for being too permissive as it allows values to include also desires besides normative aspects, its comprehensiveness is useful in considering the relationship between humans and nature.

3.1.2 Attitudes, norms and preferences

Value is a diffuse concept and can be defined in many different ways, but it should be distinguished from other determinants of action, such as attitudes, norms, preferences, needs, meanings and interests (e.g., Maslow 1943, Williams 1968, Rokeach 1973, Suhonen 1988). In this section, attitudes, norms and preference concept in economics are briefly discussed.

Attitudes have naturally been defined in several ways (see e.g., Allardt 1983, p. 55, Lutz 1991). Although Allardt's value concept is utilized in the present study, the comparison of the concepts of a value and an attitude is well presented by Rokeach (1973), which is therefore quoted here. According to Rokeach (1973, p. 5) "A value is an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence. A value system is an enduring organization of beliefs concerning preferable modes of conduct or end-states of existence along a continuum of relative importance." Rokeach defines attitude as "a relatively enduring organization of beliefs around an object or situation predisposing one to respond in some preferential manner" (Rokeach 1972, p. 112).

Values and attitudes are both regarded as organized beliefs. An attitude refers to an organization of several beliefs around a specific object or situation, whereas a value refers to a specific single belief. Values are more permanent than attitudes, and the scope of values is more general: a value transcends objects and situations, it does not concern only one specified object or situation as does an attitude. Furthermore, values can be considered to be a standard

guiding selection or action, but attitudes do not have such a function. The number of values is also clearly smaller than that of attitudes. Values have a more central position within personality than attitudes and they are therefore determinants of both attitudes and behavior. (Rokeach 1973, p. 18)

Norms are also closely linked to values. They can be defined as means to achieve the choices suggested by values. A social norm is a rule of conduct which is supported by sanctions. (Williams 1968, p. 284, Allardt 1983, p. 58) Rokeach (1973, p. 19) distinguishes values from social norms in three ways. First, a value can refer either to mode of conduct or end-state of existence, whereas a social norm always refers only to a mode of behavior. Second, a value transcends specific situations but norms are always situation-specific. Third, norms are always external to the person unlike values which can be held by either individuals or collective subjects.

Preference is a basic concept in economics. It is essential to the rational, utility-maximizing approach, which is the core of neoclassical microeconomic theory (Lea 1992, p. 165). In the microeconomic consumer theory, demand functions are derived using a model of utility-maximizing behavior of consumers constrained by underlying economic factors. Individuals or consumers are faced with a problem of choosing among a possible set of objects, X, which is considered to be a space of consumption bundles. X is assumed to be a non-negative orthant in R^k. The consumer is assumed to have preferences on the consumption bundles in X. If the consumer says that the bundle x is at least as good as the bundle y in X, x is preferred to y, or formally $x \succeq y$. If preferences are supposed to order these bundles, certain standard properties have to be assumed. (Kreps 1990, p. 18–19, Varian 1992, p. 94–95)

The preference relation should be at least complete, reflexive and transitive:

COMPLETE For all x and y in X, either $x \succeq y$ or $y \succeq x$ or both.

REFLEXIVE For all x in X, $x \succeq x$.

TRANSITIVE For all x, y, and z in X, if $x \succeq y$ and $y \succeq z$, then $x \succeq z$.

The first assumption states that any two bundles can be compared and the second is trivial. Transitivity assumption is necessary for the idea of maximizing preferences. Before defining a consumer's ordinal and continuous utility function, a continuity assumption of preferences is needed:

CONTINUITY For all y in X, the sets $\{x: x \succeq y\}$ and $\{x: x \preceq y\}$ are closed sets. It follows that $\{x: x \succ y\}$ and $\{x: x \prec y\}$ are open sets.

$x \succ y$ in the definition of continuity means strict preference, i.e., x is strictly preferred to y or x is better than y. Now it is possible to define the continuous

utility function as follows: u: $X \rightarrow R$ such that $x \succ y$ if and only if $u(x) > u(y)$. Thus, if the preference order is complete, reflexive, transitive, and continuous, it can be presented by a continuous utility function. Although utility function is a convenient way to describe preferences, it should not be interpreted psychologically. The only relevant feature is its ordinality. (Varian 1992, p. 95)

Traditionally, the assumption of rationality, expressed in the utility maximization principle, is not a theory to be tested in economics, because rationality as such is not assumed to have empirical content (Lea *et al.* 1992, p. 6). The ordinal preference order is taken as given. The ignorance of the empirical validity of the rationality assumption can be justified by assuming that individuals – using Friedman' s postulate – behave "as if" they were utility maximizers, and testable hypotheses concern, in turn, aggregate market behavior (Shapira 1986, p. 622). However, there are economists who claim that rational utility maximization really has empirical content. Some have even argued that rationality is meaningful and true, and represents a unique and valuable contribution of economics to social sciences in general (Lea *et al.* 1992, p. 7).

The dominant economic approach to studying mental determinants of behavior is very different from social-psychological measurement of values and attitudes. In the second article (II) of this dissertation, the microeconomic approach was extended to include direct measurement of ownership objectives, which are considered to reflect preferences. Objectives were directly included in a theoretically derived timber supply function simultaneously controlling for the other explanatory variables.

3.1.3 Value theories

There is a limited number of basic human problems for which all cultures must find a solution. The relationship between humans and nature is included in the five most important problems of mankind. The relationship can be exploitative, harmonious or subjugated. (Kluckhohn 1957, p. 84–85) The universal value theories should cover all the basic requirements of human existence (Schwartz 1992, p. 4, Helkama 1999, p. 62–63), including the relationship between humans and nature. Two universal value theories, those of Rokeach (1973) and Schwartz (1992), are briefly discussed below in order to assess their applicability for describing forest values.

Rokeach's definition of a value was presented above (Section 3.1.2). A basic distinction in Rokeach's theory is the division between instrumental and terminal values, the former referring to modes of conduct and the latter end-states of existence (Rokeach 1973, p. 7–12). Terminal values can be divided

into personal (e.g., peace of mind) and social (e.g., world peace). Instrumental values are means to achieve the sought end and can be either moral or competence values (e.g., honest v. logical). Instrumental and terminal values are, however, not connected to each other in a straightforward manner: moral values are not necessarily associated with social ends and competence values to personal end-states. There are also more instrumental values than terminal values, and one mode of behavior can be instrumental to the achievement of several terminal values, and vice versa.

Rokeach's theory has been measured empirically by using eighteen terminal and eighteen instrumental values, which are regarded to describe basic requirements for human existence (Rokeach 1973, p. 28). The respondent has to rank these two sets of values in order of personal importance.[1] Rokeach (1973) has also studied the explanatory power of the values on actual behavior. According to the results, certain values explain, for instance, interracial relations and religious behavior. Rokeach's value measure has also been used in consumer behavior studies (Munson 1984, p. 14–15).

Values explicitly associated with the relationship between humans and nature are almost entirely lacking in Rokeach's list of values. The only directly relevant terminal value concerns aesthetics: a world of beauty, considering beauty of nature and the arts. Obviously, this kind of general value theory is not useful, at least without further modifications, to depict values related to forests.

A more recent endeavor to develop a universally applicable value theory has been carried out by Schwartz (1992). The theory is a successor of Rokeach's theory and assumes that values have a universal content and structure (Helkama 1999, p. 62). It is therefore a more solid theory than Rokeach's theory, which is, in fact, merely a list of two sets of values with loose connections with each other.

Schwartz (1992, p. 4) defines the concept of value as follows: "Values are concepts or beliefs, they pertain to desirable end-states or behaviors, they transcend specific situations, they guide selection or evaluation of behavior and events, and they are ordered by relative importance." Besides the content and structure of values, comprehensiveness and equivalence of meaning are also analyzed. Value structure is described by consistent conflicts and compatibilities among values. (Schwartz 1992, p. 2–4)

According to the theory, eleven motivational or value types can be distinguished and measured by 57 specific values. The motivational types can be summarized as follows (Schwartz 1992, p. 5–12, Puohiniemi 1995, p. 16):

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1. Ranking procedure has been widely criticized and recently values have been measured by rating (Helkama 1999, p. 62).

SELF-DIRECTION	Independence of thought and action – choosing own goals, creating, exploring
STIMULATION	Excitement, novelty, challenge in life
HEDONISM	Pleasure or sensuous gratification for oneself
ACHIEVEMENT	Personal success through demonstrating competence according to prevailing cultural standards
POWER	Social status and prestige, control or dominance over people and resources
SECURITY	Safety, harmony and stability of society, of relationships and of self
CONFORMITY	Restraint of actions, inclinations and impulses likely to upset or harm others, and violate social expectations or norms
TRADITION	Respect, commitment and acceptance of the customs and ideas that one's culture or religion impose on the individual
BENEVOLENCE	Preservation and enhancement of the welfare of people with whom one is in frequent personal contact
UNIVERSALISM	Understanding, appreciation, tolerance and protection of the welfare of all people and nature
SPRITUALITY[1]	Endowing life with meaning and coherence in the face of the seeming meaninglessness of everyday existence

The structure of the ten motivational types – excluding spirituality – is shown in Fig. 2. The conflicting value types are located at the opposite side of the figure and compatible types close to each other. The ten motivational types form two bipolar dimensions called self-transcendence – self-enhancement and openness to change – conservation. (Schwartz 1992, Helkama 1999, p. 63–65)

Puohiniemi (1995) studied the behavioral implications of Schwartz's theory and found the relationships between values and consumer behavior to be rather weak. However, universalism was clearly connected to pro-environmental attitudes and behaviors (Puohiniemi 1995, p. 96). Also Schultz and Zelezny (1998) studied the relationship between values and pro-environmental behaviors in a cross-cultural context. Self-transcendence – especially the environment-oriented items in Schwartz's list of values – was found to be positively connected to pro-environmental behavior.

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1. Spirituality may have different meanings in different cultures and therefore can be considered to be universal only to a limited extend.

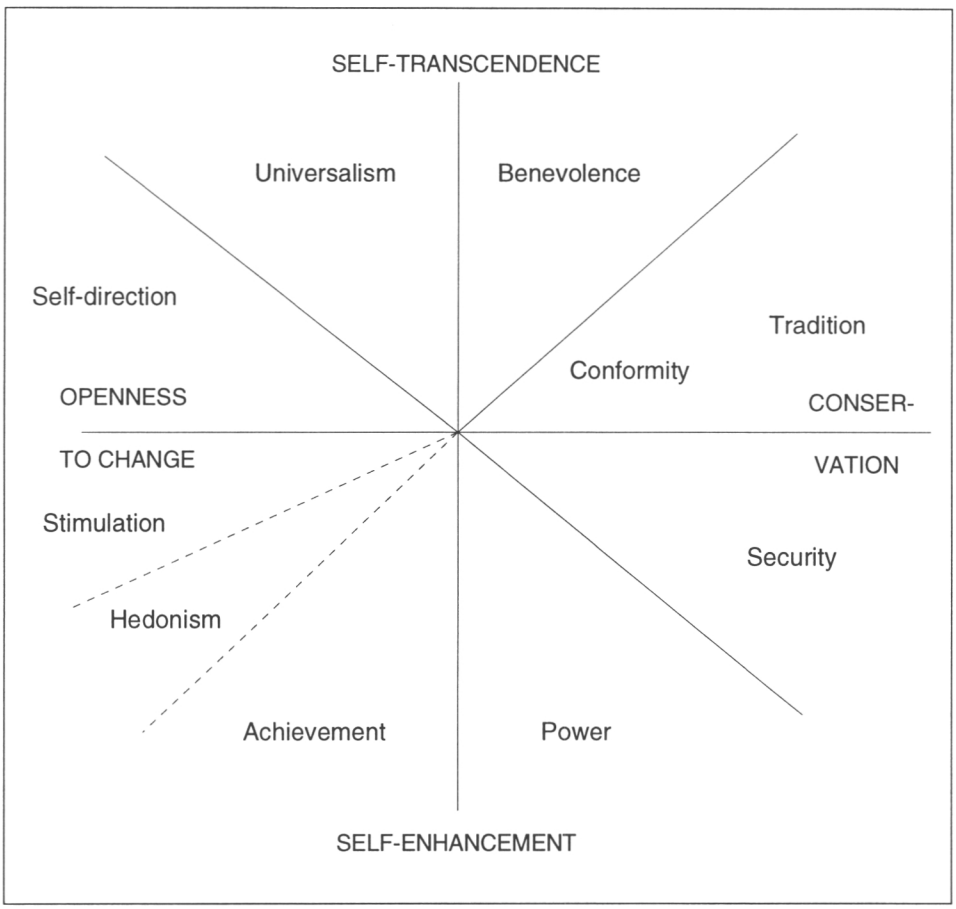

Figure 2. The structure of value types in Schwartz's model. Sources: Schwartz 1992, p. 45, Helkama 1999, p. 64.

From the point of view of this study, it is useful to have a closer look at the contents of the motivational types with regards to the relationship between humans and nature, without going into details of the whole theory. The specific values attached to universalism are interesting in this respect. Unity with nature, a world of beauty (see Rokeach's theory) and protecting the environment can be found among the eight indicators in this motivational type. These are the environment-oriented indicators which Schultz and Zelezny (1998) combined into nature-type self-transcendence. Consequently, Schwartz's theory considers mystic, aesthetic and pro-environmental aspects of the relationship between humans and nature.

Schwartz's value theory is obviously too general to be directly adopted in the analysis. However, it can be utilized as the basic theory of human requirements which are present also in the relationship between humans and nature.

3.1.4 Forest values

Pietarinen (1987, 1991) has presented a specific typology of value orientations towards nature and forests in general (Table 1). The typology includes the three types of relationships between humans and nature, exploitative, harmonious or subjugated-to-nature presented by Kluckhohn (1957, p. 84–85). According to Pietarinen, mankind's relations to nature can be described by four value orientations: materialism, humanism, mysticism and primitivism.[1]

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.[2] For instance, increased production may lead to increased material standard of living, but at the expense of the quality of environment.

Humanism stresses that forests should be used to promote many cultural pursuits, not only material benefits. These pursuits, of course, presuppose material well-being. Nature should provide mankind with aesthetic satisfaction, advance moral character, promote mental health and positive relations between persons. 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. The idea of self-control, included in the Socratic virtues, aims at rejecting unnecessary production and consumption, which is certainly not easy. Though humanists optimistically believe in the possibility of harmony with nature, they also face the problem of contrafinality.

Mysticism addresses the immediate experience of the unity of humans and nature, it seeks something beyond objective reason. The sacredness of nature can especially be experienced in natural 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 sanctity of nature. Mysticists,

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1. Pietarinen's term utilism has been replaced here by materialism. Utilism could confuse the reader with its connotation to utilitarianism, the well-known ethical doctrine. For the fourth value orientation Pietarinen has used both the term primitivism and naturism.
2. The action is contrafinal if it finally turns out to be opposite to its original goals.

Table 1. A typology of the relationship between humans and nature. Sources: Pietarinen 1987, 1991.

Materialism	Humanism
End: High level of welfare for people **Conception of nature:** Nature is a system regulated by causal laws and it provides a huge and valuable source of energy and raw materials **Legitimization:** Human beings have an unlimited right to use nature for their welfare **Relation to technology:** Science and technology are important, technology helps to improve the effectiveness of production and thereby increase human welfare **Optimism:** All problems concerning the welfare of humans can be solved by developing and utilizing science and technology	**End:** Intellectual, moral and aesthetic development of humans (promotion of Socratic virtues) **Conception of nature:** Nature as such is raw and primitive, but it contains potential for development of human culture **Legitimization:** Humans have right to use and develop nature for promoting Socratic virtues **Relation to technology:** Science and technology are necessary but technology should be developed and used in accordance with humanistic ideals **Optimism:** Development of culture is progressive although not without tribulations and crises
Primitivism	**Mysticism**
End: Conservation of nature as original and pristine as possible **Conception of nature:** Nature is a uniform system acting according to the laws of ecology, humans are only part of this system **Legitimization:** All parts of nature have equal inherent value, humans should respect the inherent value of nature **Relation to technology:** All technology that endangers the life of other species and causes excessive ecological disturbances must be rejected **Optimism:** Conserving nature presupposes that mankind abandons their privileges with respect to nature, and regard themselves as a species among others	**End:** Experience of the unity between humans and nature through intuition or some other method to penetrate into the spirit of nature **Conception of nature:** Nature is essentially a spiritual and divine totality **Legitimization:** The highest of human ends is to reach out for the sanctity of nature **Relation to technology:** Science and technology should be rejected, because they disturb and violate the spirituality of nature, worsening the possibilities to experience the mystical unity with nature **Optimism:** Humans can cause serious damage to nature, but they can never destroy the sanctity of nature

nevertheless, optimistically consider that the 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. Humans have no right to endanger other forms of life: nature has inherent value. Each species should be considered equally important and therefore have the same right to exist. All ideals of civilization and material well-being must be rejected and human beings must "return to nature" to live in primitive circumstances. Primitivistic ideals may be brought about, for example, by an ecological catastrophe or via events leading to the violent reduction of the population and the destruction of industrial society.

Pietarinen's typology in fact considers the commonly used distinction between anthropocentric v. biocentric orientations (e.g., Rolston and Coufal 1991, Steel *et al.* 1994). Materialism and humanism in Pietarinen's typology can be regarded as mainly anthropocentric and primitivism as biocentric in orientation. The typology also distinguishes a mystic value orientation which is not very common in the literature.

The biocentric orientation towards nature can be divided further into animal-centered, life-centered and ecosystem-centered (Vilkka 1993, 1995). According to the animal-centered orientation, common for both human beings and animals, is ability to suffer and feel pain. Animal well-being is the key issue. For instance, Singer (1973) is a representative of this orientation. The life-centered orientation, on the other hand, respects all living creatures, both plants and animals (Taylor 1981).

The ecosystem-centered value orientation emphasizes the beauty, integrity and diversity of nature. Besides plants and animals also non-living elements of nature, e.g., mountains and rivers, are taken care of and respected for. One of the most eminent representatives of the ecosystem-centered value orientation is Aldo Leopold. His land ethic can be summarized in the following quotation (Leopold 1968, p. 224–225): "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." According to the land ethic, the management and use of natural resources is allowed, when the right of land-community to continued existence is ascertained, and some places are preserved in their natural state (Leopold 1968, p. 204). The Leopoldian land ethic can be considered to be the philosophical basis of the ecosystem management principle adopted in the management of the U.S. national forests (e.g., Zeide 1998, Callicott 1998).

Allardt defined value as "a common and permanent conception of a desire or the desirable, learned from the environment, influencing the selection of goals" (Section 3.1.1). The four value orientations by Pietarinen can be defined

using this concept. In humanism, and especially in primitivism[1], a normative orientation (i.e., desirable) is emphasized. Materialism and, to some extent mysticism, aims at the satisfaction of personal interests (desire), although mysticism also recognizes nature's own purpose.

In this study, Pietarinen's theoretical typology was chosen for empirical operationalization and testing. The typology has utility for describing basic value orientations towards nature in a form applicable for the purposes of the present study, although the primitivistic orientation, for instance, is not fully capable to represent the wide spectrum of biocentric values (see e.g., Oksanen 1997, Oksanen and Rauhala-Hayes 1997). This kind of description of forest owners' relation to nature is complemented by the empirical analysis of more concrete objectives of forest ownership. Schwartz's value theory is used as a basic description of universal human values, to which forest values and landowner objectives are compared.

3.1.5 Objectives of forest ownership and forest values

Forest values, as defined above, describe value orientations towards nature and forests in general. On the other hand, long-term objectives of forest ownership are characteristically based on owners' interests concerning their forest property, such as provision of monetary, recreational, emotional, and aesthetic benefits (e.g., Tikkanen 1978, Kurtz and Lewis 1981, Järveläinen *et al.* 1983, Young *et al.* 1985, Brooks and Birch 1986, Marty *et al.* 1988, Lönnstedt 1989, 1997, Carlén 1990, Lönnstedt and Törnqvist 1990, Sennblad 1990, Pesonen 1996, Jokinen 1998).[2]

The objectives of forest ownership are more concrete than forest values and can be considered to be subordinate to values in personal decision hierarchies. According to Allardt's general value definition, values "influence the selection of goals". The concept of a goal is not defined here at the general level. When considering private forest ownership, goals can be called long-term objectives of forest ownership. It is a value-type concept, which can be defined as a *rather permanent conception of a desire concerning one's own forest property and influencing forestry behavior.*

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1. Here primitivistic value orientation is seen as a human conception influencing selective behavior. The philosophical consideration whether living organisms or inorganic constituents of nature have inherent value or not (e.g., Oksanen 1997) is beyond the scope of this study. In the descriptive (non-normative) analysis of values adopted here this potential conceptual difference is not problematic.
2. For the interested reader a literature review on objectives of forest ownership is presented in Karppinen (1995) in Finnish.

The general forest values are in a hierarchical relation with the objectives of forest ownership concerning own forest property. It is possible to present a few hypotheses concerning the relationship between values, objectives and actual forestry behavior. Materialism is assumed to be associated with economic (monetary) objectives of forestry, either with immediate, regular sales income or economic security provided by the forest property, or both. These kind of objectives may refer to a rather active and intensive forestry on the woodlot including large cutting volumes for sale.

Humanism is hypothesized to be associated with both economic and non-timber (non-monetary) objectives in a balanced way. Forests are managed less intensively, taking into account the non-timber aspects of forests besides economic ones. Cuttings are carried out to a limited extent and "heavy" management practices, such as the use of chemical herbicides or mechanized cutting, are avoided.

Pure primitivists and mysticists may be rare among forest owners. They can be assumed to emphasize non-timber benefits provided by their forests. Small amounts of timber may be cut for household use and other forest management activities are infrequently executed.

3.2 Value changes

Values are considered to be rather permanent and they are acquired during the socialization process. Socialization in a culture takes place mainly during childhood and adolescence through family upbringing and school education. However, values are not monolithic. Later in life, assignments to various groups in society and especially value discussions, for instance, in the mass media, may influence individual values. (Rose 1956, p. 5–6, Chitambar 1976, p. 253, Suhonen 1988, p. 65–68) Social status and professional education may also affect to which values a person subscribes in his/her adulthood (Kohn and Schooler 1983, p. 1–2, Pohjanheimo 1997, p. 39, 42–47).

The analysis of actual changes in forest owners' values and objectives is beyond the scope of the present study. The cross-sectional data on values and objectives does not enable such an analysis.[1] However, certain assumptions concerning changes in forest values and landowner objectives are made in this study. Therefore, a short description of the various modes and causal origins of value change in a society is presented below.

1. The assessment of future development of owners' objectives (article III) is not based directly on past development but on forecasts of structural changes of forest ownership.

3.2.1 Modes of value change

Value changes can occur in many modes. At least seven different types can be distinguished (Rescher 1969, p. 111–115, Pohjanheimo 1997, p. 32–35). The most radical mode is *total value acquisition* and *value abandonment*, which often takes place in connection with religious or ideological conversion. Values can also be *redistributed* throughout a society or a group, e.g., values of some minority group receive widespread acceptance. In some situations, a value can be *emphasized* or *de-emphasized*, because changes in the environment force it to our attention. For instance, economic security may be de-emphasized in a stable affluent society, but again emphasized during economic and social disorder. Furthermore, changes can occur in hierarchical ranking of values, i.e., values can be *rescaled*. This means a change in value subscribers' commitment to certain values, not total acquisition or abandonment of values.

Redeployment of existing values to concern new objects occurs when values are applied over an enlarged domain (e.g., legal and political equality of the black population in South Africa). A mode of value change that is particularly sensitive to social, economic and technological change in society is a change in the standard of implementation of a value, i.e., *value restandardization*. For instance, the common standards of environmental protection have changed. During the 1970's, there was a great concern for the pollution control of the forest industries, and now the maintenance of the biodiversity of nature is the key issue.

According to the definition used in this study, values "influence the selection of goals". A value subscriber has a specific goal – a value realization target – the achievement of which makes progress in the realization of a certain value. If the goal has already been accomplished or cannot be achieved, the value subscriber adopts some other goal for implementing the value at issue. This change is called *value implementation retargeting*. A forest owner can, for instance, protect a small part of his/her forest property in order to maintain biodiversity to make progress in the realization of his/her values. The next step could be the total protection of his/her forests.

3.2.2 Causal origins of value change

The modes of value change do not deal with causal origins of value changes. Rescher (1969, p. 115–118) considers four different types of direct causal impetus (also Pohjanheimo 1997, p. 35–38). Value change can be induced by *a change of information*, such as the introduction of a new scientific discovery. The basic cause of the value change is cognitive. Values can also be indoctrinated by *ideological* and *political change*. The change can happen gradually,

for instance, by means of advertising and promotion, by political propaganda, or suddenly through "conversion" to a new doctrine.

Furthermore, value "erosion" can be induced by *boredom, disillusionment and reaction.* A value can be "eroded" away along with its substantial realization in society, e.g., efficiency in the era of automation, and economic security in an affluent society. Some erosion may be caused by the mere passage of time: change itself may be considered good by society, and some values become "old-fashioned".

The fourth causal impetus of value change is the most important one considering this study. Changes in values can be induced by *changes in social, cultural, demographic, economic and technological factors, i.e., the operating environment of a society.* The value changes caused by changes in the operating environment are often evolutionary rather than revolutionary, unlike the value changes induced by the other three types of causal roots. Therefore these value changes can be forecast more easily than those caused by the other three causal impetus.

3.2.3 Changes in forest values and the objectives of forest ownership

In the present study, it is assumed that the structural change of forest ownership has been the main channel for changes in forest values and objectives of forest ownership (see Section 2). It is hypothesized that this structural change reflects many changes in the operating environment of society.

The connection between structural and value change is not straightforward, however. In Finland, the clear majority of the forest holdings is inherited or bought from parents and relatives. This means that most present forest owners have lived on farms or at least in the countryside during their childhood and adolescence, when values are initially adopted through the socialization process. This would suggest that forest owners' values would be rather similar. It is, however, reasonable to expect that values are not so monolithic and solely determined by the socialization environment of childhood and adolescence, as suggested by Inglehart (1977). Later life experiences can also influence values (e.g., Kohn and Schooler 1983, p. 1–2).

The mean age of Finnish forest owners is rather high. This suggests that the new generation of forest owners is not longer young when it inherits or buys the forest property from its parents. Owners' values have probably already been formed. Objectives of forest ownership are more concrete than forest values and can be considered to be subordinate to values in personal decision hierarchies. Naturally, objectives cannot be considered to exist at all before the ownership transfer has taken place.

Following the above arguments, it can be assumed that the most important reason for changes in forest owners' values and long-term objectives is the

structural change in forest ownership. Different kinds of people with different values, education and occupations become forest owners through ownership transfers.[1]

3.2.4 Regional differences

Regional differences in long-term objectives[2] were also considered in the study (article III) by comparing southern and northern Finland (two northernmost provinces). Besides obvious climatic differences, the northern region differs from the southern one socio-economically and culturally. Forest 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. In the North, the proportions of non-farmers and female owners are larger than in the South, and northern owners are also, on average, older and more often reside off their holding. Northern forest holdings are generally larger and more often jointly owned – by heirs or concerns – than southern holdings. The more diversified structure of forest ownership in northern Finland would suggest diversification in landowner objectives.

Considering cultural differences, Melkas (1985) concluded that the regional culture and values in northern Finland favor the *status quo* rather than 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 culturally more traditional society, the classical sociological theories of change (e.g., Durkheim 1933, Giddens 1985) suggest that values, in this case objectives of forest owners, would be less divergent in the North than in the South. This conclusion is thus opposite to the above-mentioned one.

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1. This does not mean that an individual forest owner's values and objectives could not change during his/her life-cycle. Non-timber objectives are, obviously, more permanent than economic objectives (regular sales income and economic security), which may be more responsive to the forest owner's financial needs during his/her life-cycle.
2. Data on forest values was available only for the southeastern part of the country.

4 Empirical approach of the study

Two studies concerning forest owners' values and objectives seem to be of special interest when considering the empirical approach of the present study. Kurtz and Lewis (1981) have studied landowner objectives in their analysis of the decision-making framework within which NIPF owners make their forest management decisions. They suggest that owners' motivations and objectives on the one hand, and constraints on the other, guide and restrict the selection of forest management strategies. Five distinct motivations connected to forest ownership are identified: 1) financial return, 2) investment, 3) satisfaction and aesthetics including intangible qualities of forest environment, 4) permanent residence, and 5) social responsibility defined as concern of preserving forest for future generations. Whereas motivations are regarded as guiding forces, objectives represent the end state to be sought. Four objectives can be distinguished: i) timber production for sale on the market, ii) recreation and wildlife – enhancing recreational potential and the proliferation of wildlife, iii) grazing – providing wooded pasture for domestic livestock, and iv) preservation of forests – maintaining forestland in an undisturbed state.

According to Kurtz and Lewis (1981), management constraints can be caused by market conditions (e.g., anticipated timber prices and costs of growing timber), personal characteristics of the owners (management and marketing experience, socio-demographic characteristics), forest resources and societal and institutional factors (legislation, forestry regulations, public incentive programs). Based on this theoretical framework, Kurtz and Lewis classified NIPF owners into four categories: timber agriculturalist, range pragmatist, timber conservationist, and forest environmentalist.

Lönnstedt and Törnqvist (1990, p. 14) provide another description of the forest owners' decision framework which is also useful for the purposes of this study. Superimposed on the decision hierarchy of a forest owner is the idea of preserving the forest cover and to take care of the forest, which could be interpreted to represent values. On the next level in the hierarchy are more concrete objectives: direct benefits (life-style, residential environment), objectives connected to the state of the forest (tree species, growing stock, age structure etc.), consumption objectives (household timber, hunting etc.), and economic objectives (income, funding of investments etc.). The objectives in turn establish the general guidelines for forest management behavior through forest management strategy, which guides concrete decisions to manage or cut certain stands (cutting and silvicultural program).

Lönnstedt and Törnqvist (1990, p. 103–104) also describe various forest management strategies. A balanced strategy is based on sustainable wood

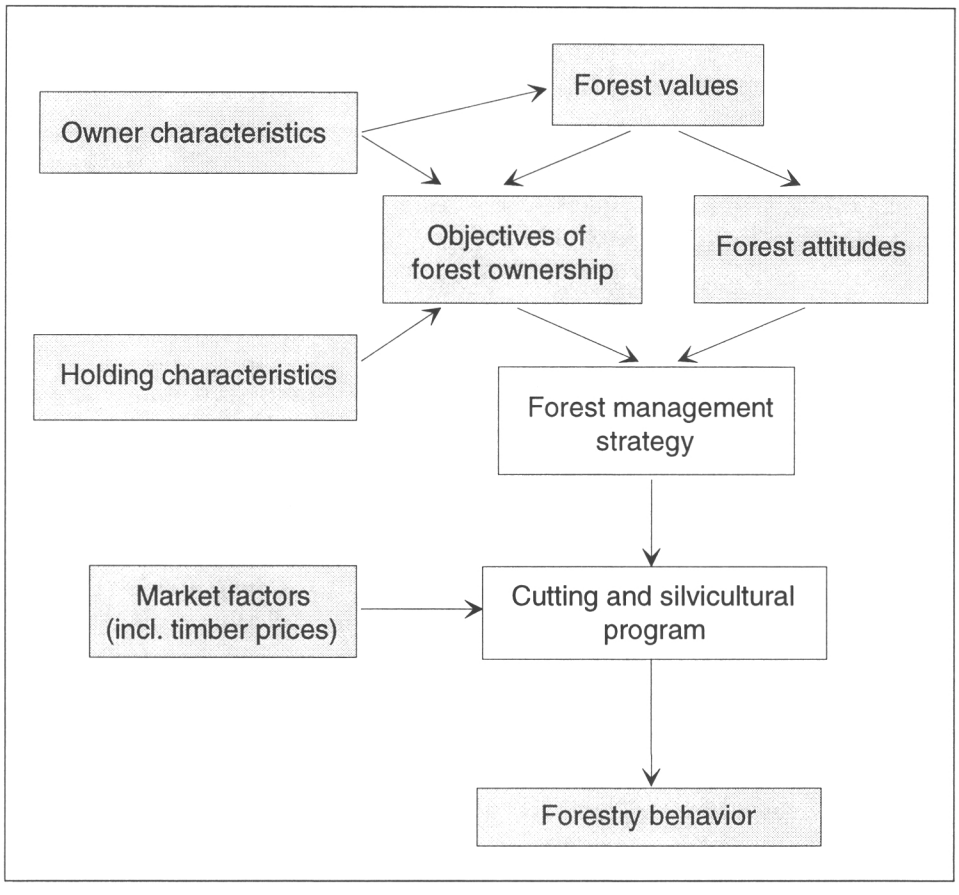

Figure 3. Empirical framework of the study. Shaded factors are analyzed empirically.

production. An extensive strategy implies that cuttings are well below the level of growth and consequently the growing stock increases. For instance, a strong bequest motive would suggest the extensive utilization of forests. On the other hand, an intensive strategy, implying a high level of cuttings, may be a contemporary choice for various reasons.

This dissertation considers Finnish forest owners' values, the long-term objectives of forest ownership, and their effects on forestry behavior on woodlots. A modification of the model by Lönnstedt and Törnqvist (1990) is included in the empirical framework of the study (Fig. 3). Forest values are at the top of the decision hierarchy of the forest owner and guide more concrete objectives of forest ownership and attitudes towards forest. According to Rokeach (1973, p. 18) values have a more central position than attitudes within personality and hence values determine both attitudes and behavior. Forest values constitute the basic orientation towards nature in general, and owners' objectives concerning their forest property have a more direct effect on the

actual behavior towards their forest. The effects of values, objectives and attitudes are mediated through management strategies and cutting and silvicultural programs, which are not directly studied here.

The owner's characteristics may be associated with his/her values and objectives, and may in turn influence forestry behavior. For instance, aged owners often have clear bequest objectives which can be reflected in diminished cuttings. Earlier studies (e.g., Kuuluvainen 1989, p. 154–155) have indicated that an owner's age is negatively associated with harvest rates.

Holding characteristics may also influence landowner objectives. An owner of a small forest holding may emphasize non-timber objectives and less intensive forestry practices. The area of the forest holding naturally largely determines the absolute cutting potential. Also a small volume of standing stock per hectare may lead to a low emphasis on economic forest benefits. Regular roundwood sales income is an unrealistic objective, if there is nothing to sell.

Market factors, such as timber prices, are also relevant from the point of view of the forest owners' cuttings and silvicultural behavior (Fig. 3). Some important factors – such as the effects of forestry extension both on cuttings and silvicultural activities, and the role of state subsidies on silvicultural measures – had to be excluded from the study. Therefore, the effects of norms expressed in forestry legislation and in the content of forestry extension were not directly studied here. Actual decisions to manage or cut certain stands are naturally affected by many situational factors, which could not be taken into account in the analysis.

NIPF owners' forest values and long-term objectives and their relationships are described in the first article (I). An empirical owner typology based on objectives is also introduced and identified by directly observable owner and holding characteristics. Harvesting and silvicultural behavior of these groups based on objectives is then tentatively analyzed.

A more thorough analysis of harvesting behavior is presented in the second article (II) where a link is established between ownership objectives and observed harvesting behavior. This is achieved by estimating a theoretically (microeconomics) derived timber supply function based on a Fisherian two-period consumption–savings model, and simultaneously controlling for other explanatory variables as well as group dummies indicating assignment to owner groups based on ownership objectives. Other explanatory variables include timber prices, the volume of growing stock (per hectare), mean growth, and certain owner characteristics such as the owner's age, income and wealth. The two studies (I and II) are based on data collected from southeastern Finland.

The third article (III) describes and explains regional differences in the objectives of NIPF owners. The similar owner groups, based on objectives, are established for the whole of southern Finland, and systematically identified by directly observable owner and holding characteristics. No grouping of forest owners is established for northern Finland. In southern Finland, an assessment is also made of the future development of these owner groups based on landowner objectives.

The fourth article (IV) concerns the attitudes of the Finnish public towards the economic utilization of forests and forest protection. Forest attitudes of forest owners and other citizens are compared in order to conclude on the generalizations based on forest owner studies. The differences in forest attitudes are regarded to reflect differences in forest values. Forest owners' attitudes are not used to explain forestry behavior because of the lack of behavioral data.

5 Summary of the studies

5.1 Values and objectives of non-industrial private forest owners in Finland (I)

The purpose of this study was to describe the Finnish NIPF owners' general forest values and their long-term objectives of forest ownership, and the interrelationships between values and objectives. The study also aimed to classify forest owners empirically according to their forest values based on a theoretical typology concerning the relationship between humans and nature, as well as to create an empirical classification of owners based on the objectives of their forest ownership. The study aimed, furthermore, to identify these owner groups by directly observable owner and holding characteristics which describe the structure of forest ownership, and to analyze the harvesting and silvicultural behavior in these groups. The analysis was based on interview and forest inventory data on 245 forest owners in southeastern Finland.

In consequence of the structural changes in Finnish society and their effect on forest ownership, the values and long-term objectives of non-industrial private forest owners have obviously become increasingly diversified. The study indicated that forest owners supported different kinds of forest values (materialism, humanism, primitivism-mysticism), which were, to some extent, reflected in landowner objectives. For instance, a biocentric type of

value orientation, here called primitivism-mysticism, was associated with non-timber objectives of forest ownership. However, the general forest values and objectives of forest ownership were not strongly correlated.

A link was established between landowner objectives, owner and holding characteristics as well as harvesting and silvicultural behavior. The method involved the classification of forest owners into groups based on their objectives described by three dimensions: i) non-timber objectives, ii) sales income and self-employment opportunities, and iii) economic security and asset motive (cf., Tikkanen 1978). The dimensions describing forest values were also used as criteria for clustering the owners, but no interpretable solution was found.

Four groups could be identified: multiobjective owners, recreationists, self-employed owners and investors. The groups were then identified by owner and holding characteristics, and silvicultural and harvesting behavior was analyzed in these groups. The approach was similar to that presented by Kurtz and Lewis (1981) and Marty *et al.* (1988). Both studies, however, failed to identify the background characteristics of the forest owner groups, which are crucial for the application of the results to, e.g., forestry extension.

Although values and objectives are dependent on the cultural, institutional, social and economic environment in each country, it is worth while comparing the grouping based on landowner objectives introduced in this study with a grouping applied in the U.S. literature (Kurtz and Lewis 1981, Ferretti 1984). According to the latter typology, the forest owners can be divided into consumption-oriented and production-oriented (see Section 1.1). Recreationists could be mainly characterized as consumption-oriented, whereas investors and self-employed owners as production-oriented. Nevertheless, self-employed owners also emphasized the importance of the consumption of household timber. Multiobjective owners, who valued both monetary and non-timber benefits, represented a mixture of the two orientations.

The results of the study suggested that a 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. On the other hand, non-timber objectives did not appear to exclude wood production: recreationists also cut, but slightly less than other owners. Recreationists also used mechanized site preparation and mechanized cutting less frequently than other owners. Regression experiments, however, suggested that non-timber objectives and humanistic values would have a positive effect on silvicultural activity.

5.2 Landowner objectives and nonindustrial private timber supply (II)

The aim of the study was to empirically identify non-industrial private forest owners' objectives and to establish a link between ownership objectives and observed harvesting behavior. This was done by estimating a theoretically derived timber supply function where other explanatory variables, in addition to ownership objectives, were simultaneously controlled. Interview and forest inventory data were used concerning 146 forest owners from southeastern Finland and their timber sales in 1987–91.

Prior to the estimation of the supply model, forest owners were classified into four groups according to their ownership objectives (multiobjective owners, recreationists, self-employed owners, and investors). The tobit timber supply model was derived using a Fisherian two-period consumption–savings model. It was assumed that a forest owner perceives credit rationing in the capital market and values the non-timber benefits of his/her forest property. Dummy variables indicating group assignment were included in the supply function.

The results suggested that NIPF owners' timber sales were linked to the objectives of forest ownership. Multiobjective owners, who valued both monetary and non-monetary benefits, harvested more (m^3/ha/year) than the other owner groups, *ceteris paribus*. The largest difference in mean annual timber sales was found between multiobjective owners and investors. The differences between the single-objective groups (self-employed owners, recreationists, and investors) were small and statistically insignificant. On average, the single-objective groups sold approximately one cubic meter less per hectare per year than the multiobjective owners.

The results indicated that the multiobjective owners' harvesting behavior seemed to be closest to the present-value maximizing harvesting policy. For the single-objective owners, forest and owner characteristics were important determinants of timber harvest. Their behavior seemed to be consistent with the assumed credit-rationed utility maximization. Furthermore, the results did not provide empirical support for the hypothesis that recreationists' per hectare timber stocks would be larger than those of the other groups.

5.3 Objectives of non-industrial private forest owners: Differences and future trends in southern and northern Finland (III)

The purpose of this study was to describe and explain the differences in the objectives of non-industrial private forest owners between southern and northern Finland. An assessment was also made of the future development of these objectives, based on the forecasts concerning the structure of forest ownership (Ripatti and Järveläinen 1997). Mail inquiry data covering the whole country (n=2056) were used in the analysis.

The results indicated the existence of regional differences 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 concerning diversification of values (e.g., Durkheim 1933, Giddens 1985), the objectives were less divergent in the North, in a more traditional society, than in the South.

On the other hand, owner and holding characteristics indicated that structural change in private forestry has been more severe in the northern part of the country than in the South.[1] This might have suggested diversification in landowner objectives in northern Finland. In conclusion, structural change and diversification of landowner objectives appeared to be linked with each other in a rather straightforward manner in southern Finland, but their interrelationship was more complicated in northern Finland.

In southern Finland, landowner objectives could be described by three dimensions: i) non-timber objectives, ii) sales income and self-employment opportunities, and iii) economic security and asset motive. Based on these objectives, four groups could be identified: multiobjective owners, recreationists, self-employed owners and investors. In northern Finland, the 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 suggested that northern forest owners do not clearly separate from each other economic and non-timber aspects of their forest ownership.

Economic objectives were 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.

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1. Despite the rapid change, the majority of northern owners live on their forest holdings (50%) or in the same municipality (26%).

Forecasts dealing with southern Finland indicated that a forest owner's probability of belonging to self-employed owners, active farmers, would diminish substantially in the future. However, 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 to multiobjective owners would seem to remain rather stable. On the other hand, the probability of belonging to investors and recreationists – both non-farmer groups – could increase moderately in the future. Taking into account differences in the roundwood sales behavior, it can be concluded that future changes in the objectives of forest ownership will not substantially affect the roundwood supply in southern Finland, where the most of the industrial roundwood is purchased. Forest owners defied grouping in northern Finland, which prevented any attempts to forecast changes in objectives there.

5.4 Attitudes towards the protection and economic utilization of forests in Finland (IV)

The main contribution of the study was to demonstrate a procedure for overcoming the danger of misinterpretation present in separate analyses of single attitude statements. In this study, multivariate methods were employed to discern between persons with distinct and more flexible attitudes towards forest protection and economic utilization. The procedure allowed the assessment of the proportion of the Finnish public which were singularly pro forest protection at the expense of economic utilization, and vice versa. In addition to the analysis of these extreme groups, the study also enabled the evaluation of the extent to which Finns were more flexible towards these issues.

The supporters of forest protection, economic utilization and the two "more flexible" groups were further identified by directly observable socio-demographic characteristics. Finally, non-industrial private forest owners and non-owners were compared as regards to their forest attitudes. The analysis was based on interview data covering the whole country (n=970). Despite the fact that the data were originally collected for another purpose, it was considered to be suitable for meeting the objectives of the present study.

More than one third of the respondents belonged to the supporters of forest utilization and close to one fourth to the supporters of forest protection. This implied that every third person would be ready to increase utilization of forests at the expense of forest protection, and one in four citizens would be ready to increase forest protection at the expense of wood production. Thus,

about sixty percent of the population seemed to have a distinct (either – or) attitude towards these issues.

One fourth of the Finns were multifunctionalists who simultaneously supported the increased protection and economic utilization of forests. This kind of attitude is in line with the international environmental agreements emphasizing multiple-use of forests. One sixth of the Finns took a negative attitude towards both the increased forest protection and economic utilization of forests. These kind of indifferent citizens obviously accepted the present situation or were disinterested in the whole issue.

According to the results, a person was more likely to belong to the supporters of forest utilization if he was male, and more than 30 years old, had a college or academic degree, lived in the southern part of the country (to the south of Oulu province), and was a forest owner. The supporters of forest protection were not as clearly distinguished from other citizens by standard demographics. However, the probability of belonging to the supporters of protection increased to some extent if the person was less than 30 years old, female, and lived in northern Finland. The hypotheses on the connection between socio-demographic characteristics and environmental attitudes were only partly confirmed. Similar models were estimated for both multifunctionalists and the indifferent.

Forest owners' attitudes towards forestry differed from those of other Finns. Forest owners supported the utilization of forests clearly more often than other Finns. About half of the forest owners belonged to the supporters of economic utilization of forests while only every third of the non-owners shared this attitude. One fifth of the forest owners supported protection, whereas protection supporters amounted to one fourth of the non-owners. Forest owners supported protection almost as often as other citizens. The hypothesis suggesting that non-owners are more pro-environmentally oriented than forest owners (Kangas and Niemeläinen 1996) was therefore only partly confirmed.

6 Schwartz's value theory, forest values and landowner objectives

Schwartz's (1992) value theory is too general to be directly adopted in the analysis of the relationship between humans and nature. It is, nevertheless, a useful description of universal human values, to which forest owners' values, landowner objectives and forest attitudes of the public investigated in this study can be compared. The forest attitudes of the public, which can also be considered to reflect values concerning the relationship between humans and nature, are compared first, followed by the analysis of forest owners' values and objectives. Hypothetical connections between certain value types by Schwartz and landowner objectives are presented in Appendix 1.

In the fourth sub-study, forest attitudes of the public were condensed into two dimensions: "support for forest protection" and "support for economic utilization of forests". The first attitude dimension is directly represented in Schwartz's universalistic values (Appendix 1). The closest counterpart in Schwartz's theory for "support for economic utilization of forests" is wealth (motivational type power). However, the second attitude dimension is more collective than individual – it concerns Finnish forests in general – unlike power in Schwartz's typology (Schwartz 1992, p. 42).

The empirical results concerning forest owners (article I) indicated that their forest values could be divided into three dimensions labeled materialism, humanism, primitivism-mysticism. According to Schwartz (1992, p. 9), one of the main goals of power values is control over resources. Consequently, power, especially wealth, and perhaps also achievement, are associated with materialism (Appendix 1, see footnote on p. 40).

The motivational goals of universalism are understanding, appreciation, tolerance, and protection for the welfare of all people and for nature (Schwartz 1992, p. 12). Humanism represents aesthetic and pro-environmental aspects of the relationship between humans and nature, and is connected to such universalistic values as a world of beauty and protecting the environment. No doubt, also wisdom is among humanistic virtues. Primitivism-mysticism is a mixture of two theoretical types by Pietarinen (1987, 1991). It represents both universalistic (unity with nature, protecting the environment) and spiritualistic ideals in Schwartz's typology.

Finally, landowner objectives (articles I and III) are compared with certain value types by Schwartz. As shown in Appendix 1, non-timber objectives are associated with security, tradition, spirituality and universalism. On the other hand, sales income and employment objectives can be considered to

reflect values in power, security and tradition types, at least to some extent.[1] Economic security is associated with the same three value types.

The general trends of value change among the Finnish public can be also contrasted with the predicted change in forest owners' objectives in southern Finland (article III). According to the study results, the values of the public have diversified. This is evidently the basic trend also among forest owners. The studies also indicate that during the 1980's and early 1990's the self-transcendence values have become less important, and self-enhancement values slightly more important among the public. Self-transcendence values were still on top of value hierarchies, but the direction was towards individualistic values. (Helkama 1997, p. 254, Pohjanheimo 1997, p. 183–184) This would mean that economic values – power and achievement – (Helkama 1999, p. 72) would be more emphasized and universalistic and benevolence values would lose their importance.

Forecasts concerning landowner objectives (article III) indicated that a forest owner's probability of belonging to self-employed owners would diminish substantially in the future. On the other hand, the probability of belonging to investors and recreationists would increase moderately in the future. The probability of assignment to multiobjective owners would remain rather stable.

In conclusion, the forecasts suggest that economic objectives of forest ownership would be slightly less important in the future than now. Whereas regular sales income and employment would become clearly less important for forest owners, economic security would be somewhat more important. The importance of non-timber aspects of forests would increase. The basic direction of changes in landowner objectives seems to be opposite to the general value changes.

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1. Schwartz's self-enhancement dimension – power and achievement – has been considered to represent economic values in general (Helkama 1999, p. 72). The indicators of achievement (ambitious, influential, capable, successful, intelligent, self-respect) do not appear to be relevant considering landowner objectives. It is, for instance, hard to see the connection of this kind of values and the "simple" objective to get income from roundwood sales.

7 Conclusions

According to the study as a whole, the connection between general forest values and the long-term objectives of forest ownership turned out to be rather weak. However, a biocentric type of value orientation, primitivism-mysticism, was associated with non-timber objectives of forest ownership, as was hypothesized. The assumption of decision hierarchies with landowner objectives subordinate to values (Fig. 3) would have suggested stronger associations. The rather weak connection between values and objectives may be partly caused by insufficient validity of the measurement of forest values.

It was not possible to empirically verify the theoretical typology concerning the relationship between humans and nature (Pietarinen 1987, 1991). Forest owners could not be grouped into the four theoretical categories by their forest values. However, two "pure" value dimensions and a mixed one could be distinguished: humanism and materialism, as well as primitivism-mysticism.

On the other hand, forest owners could be classified based on their objectives of forest ownership, and a link was established between ownership objectives and observed harvesting and silvicultural behavior. The procedure first involved the classification of forest owners into groups based on landowner objectives. Similar groups of forest owners – multiobjective owners, recreationists, self-employed owners and investors – could be found both in south-eastern Finland (articles I and II) and throughout southern Finland (III), but not in northern Finland. Therefore, the subdivision of the country only into northern and southern parts seems to be reasonable in the analysis of landowner objectives.

The information on the group assignment was then introduced directly in the timber supply model, and used descriptively as a classifying factor in the analysis of silvicultural behavior. This approach to the analysis of timber supply is new in the literature, and may be generally applicable. The experiment indicated that landowner objectives can be empirically incorporated in a regression-based timber supply model as dummy variables indicating group assignment.

After clustering the owners, the groups based on ownership objectives were identified by directly observable owner and holding characteristics. This procedure has not been applied in earlier studies (Kurtz and Lewis 1981, Ferretti 1984, Marty *et al.* 1988). The identification is crucial for the application of the results, for instance, to forestry extension tailored to serve differently forest owners with varying objectives. However, such empirical

typologies should be seen rather as ideal types showing the direction than exact categories actually existing among forest owners.

The multiobjective owners who valued both monetary and non-monetary benefits harvested for sale more timber – per hectare per year – than the single-objective groups and they were also the most active as regards to silvicultural behavior. This indicates that the sole emphasis on economic benefits of forests does not lead to the most active silvicultural and harvesting behavior. Plural objectives mean multiple interests concerning forests and, perhaps, better knowledge of own forests and forestry in general, which could be reflected in active forestry behavior.

On the other hand, non-timber objectives did not appear to exclude wood production: recreationists also sold roundwood. However, recreationists used mechanized site preparation and mechanized cutting less frequently than other owners. Such differences in the use of logging machines can be partly explained by the small mean size of recreationists' forest holdings. The results further suggested that non-timber objectives and humanistic values would have a positive effect on silvicultural activity. It may be that recreationists are willing to invest in forestry but are, to some extent, selective with respect to management practices.

The results also indicated the existence of regional differences in the objectives of forest owners. As suggested by classical theories of social change concerning diversification of values (e.g., Durkheim 1933, Giddens 1985), the objectives appeared to be less divergent in the North, in a more traditional society, than in the South. Economic objectives were more important in the South than in the North.

From the point of view of microeconomic approach, the results indicated that the multiobjective owners' harvesting behavior seemed to be closest to the present-value maximizing harvesting policy. For the single-objective owners, forest and owner characteristics were important determinants of timber harvest. Their behavior seemed to be consistent with the assumed credit-rationed utility maximization.

The fourth sub-study of this dissertation concerned forest attitudes of the public. The data of this sub-study allowed also the assessment of the number of forest owners. It was estimated that about 850 000 persons own forest in one way or another, which means that every sixth Finn is a forest owner.

The possible attitudinal differences between forest owners and non-owners were investigated in order to find out whether it is possible to generalize the results concerning forest owners' values on the public at large. Earlier Finnish studies suggest that non-owners would be more pro-environmentally oriented than forest owners (Kangas and Niemeläinen 1996). According to the present study, forest owners' attitudes towards forestry differed from those of

other Finns. The hypothesis suggesting that non-owners are more pro-environmentally oriented than forest owners was partly confirmed. It is therefore too straightforward to assume that Finnish forest owners' forest attitudes or values would represent those of the general public. It is interesting to note, that the U.S. studies have shown that there are minor differences between forest attitudes of the forest owners and the public (Bliss *et al.* 1994, 1997, Bourke and Luloff 1994).

This dissertation has discussed about the diversification of forest owners' values and objectives. On the other hand, one could also ask, what are the values which forest owners hold in common. At least the comparison of non-owners and forest owners (article IV) suggests that forest owners more often support the economic rationale of forestry and forest industries than other citizens.

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 effects of forestry extension activities both on cuttings and silvicultural activities, as well as the role of state subsidies on silvicultural measures could not be taken into account. It is probable that forestry extension activities, which are widespread in Finland, have reduced the differences in forestry behavior between forest owners with different values and objectives.

Many other questions remain to be answered more thoroughly in further studies. In particular, the link between values, ownership objectives and observed silvicultural and harvesting behavior requires further examination. Special attention should be paid to establishing reliable and valid measurement of values and more concrete landowner objectives. The comparison between Schwartz's value theory, forest values and landowner objectives suggests that one avenue – though a rather challenging one – is to develop universal value theories further, so that they would more specifically take into account the relationship between humans and nature.

Research should also address the causes of regional differences in landowner objectives. Forecasts concerning the development of ownership objectives could also be refined by collecting new data to monitor the actual changes in the proportions of the groups based on objectives, instead of analyzing probabilities of group assignment.

The results of this study can be used in planning and implementation of public forest policy. The information on the forest attitudes of the public is naturally important in democratic policy-making. A knowledge of the values and objectives of forest owners is essential 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. This is not to say that certain owner groups should be left entirely outside public extension services. Instead, the diversification of the contents of extension is important: recreationists' requirements for useful extension services differ certainly from those of self-employed owners.

The results concerning the role of ownership objectives in harvesting behavior can be used in evaluating long-term trends in NIPF owners' timber supply and in predicting their responses to forest policy. Forest industries should also benefit from a knowledge of the objectives of roundwood sellers.

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Appendix I.

Hypothetical connections between certain value types by Schwartz (1992) and landowner objectives (articles I and III). Common characteristics are denoted by ticking.

SCHWARTZ'S VALUE TYPES	NON-TIMBER OBJECTIVES (variables with highest loadings on principal components)							
	Outdoor recre-ation	Soli-tude& medita-tion	Aes-thetic values	Nature protec-tion	Residen-tial environ-ment	Roots in native locality	Berry-picking	Inherent value
SECURITY								
National security								
Reciprocation of favors								
Family security					X			
Sense of belonging					X	X		
Social order								
Healthy	X				X		X	
Clean					X			
TRADITION								
Respect for tradition					X	X	X	
Devout								
Accepting my portion in life								
Humble								
Moderate								
SPIRITUALITY								
A spiritual life		X						
Meaning in life		X						
Inner harmony		X						
Detachment		X						
UNIVERSALISM								
Equality								
Unity with nature		X						
Wisdom								
A world of beauty			X					
Social justice								
Broad-minded								
Protecting the environ-ment				X				X
A world at peace								

Appendix 1. (continuation)

SCHWARTZ'S VALUE TYPES	SALES INCOME AND SELF-EMPLOYMENT OPPORTUNITIES (variables with highest loadings on principal components)				
	Labor income & employ-ment	Regular sales income	Household timber	Forest work	Hedging motives
POWER					
Social power					
Wealth	x	x			x
Authority					
Preserving my public image					
Social recognition	x			x	
SECURITY					
National security					
Reciprocation of favors					
Family security	x	x			x
Sense of belonging					
Social order					
Healthy			x	x	
Clean					
TRADITION					
Respect for tradition	x		x	x	
Devout					
Accepting my portion in life					
Humble					
Moderate					

SCHWARTZ'S VALUE TYPES	ECONOMIC SECURITY AND ASSET MOTIVE (variables with highest loadings on principal components)					
	Asset motive	Security against inflation	Security in old age	Funding of invest-ments	Bequest motive	Specula-tive motives
POWER						
Social power						
Wealth	x	x	x	x	x	x
Authority						
Preserving my public image						
Social recognition						
SECURITY						
National security						
Reciprocation of favors						
Family security		x	x		x	
Sense of belonging					x	
Social order						
Healthy						
Clean						
TRADITION						
Respect for tradition					x	
Devout						
Accepting my portion in life						
Humble						
Moderate						

I

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

Heimo Karppinen

Karppinen, H. 1998. Values and objectives of non-industrial private forest owners in Finland. Silva Fennica 32(1): 43–59.

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 owing 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 characteristics 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 between 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).

	Objectives		
	Non-timber objectives	Economic security and asset motive	Sales income and self-employment opportunities
Values			
Primitivism-mysticism	**.34**	.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 monetary 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.[1)]

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

[1] 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^3/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

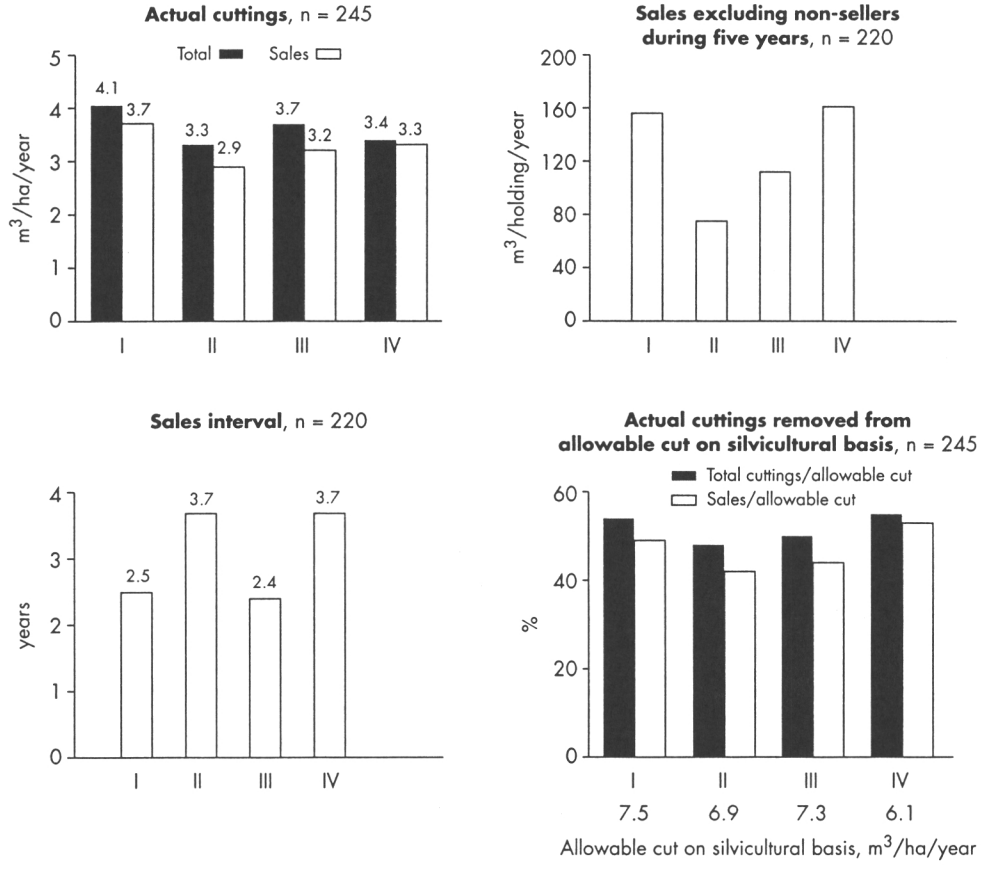

Fig. 1. Actual cuttings and use of allowable cut by forest owner groups based on landowner objectives. (Cutting years 1986/87–1990/91, I = multiobjective owners, II = recreationists, III = self-employed owners, IV = investors).

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[1)]				
In total	$3.4^{II,III,IV}$	2.4^{I}	2.6^{I}	2.6^{I}
Owner or family member participated	$2.4^{II,IV}$	1.8^{I}	2.0^{IV}	$1.4^{I,III}$
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^{II}	$49^{I,III,IV}$	69^{II}	81^{II}
Mechanized cutting, % of the holdings	25^{IV}	16^{IV}	20^{IV}	$50^{I,II,III}$

[1] 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^3/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 (Lönnstedt 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 Karppinen 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[1)]	0.65		
n	245		

[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 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[1)]	0.82		
n	245		

[1] See footnote in Appendix 1.

Appendix 3. Probability of assignment (π) to forest owner groups based on landowner objectives by owner and holding characteristics. The most "favorable" and "unfavorable" combinations of the variables.

AGE (Q_1,Q_3)[1)]	FOR (Q_1,Q_3)[1)]	PER	PART	ABS	RES	FARM	ACAD	CONC	ADFOR	Probability of assignment π (%)
Multiobjective owners										
67(Q_3)	40.90(Q_3)	1	–	–	–	–	–	–	–	43
45(Q_1)	12.00(Q_1)	0	–	–	–	–	–	–	–	11
Recreationists										
–	12.00(Q_1)	–	1	–	–	0	–	–	–	77
–	40.90(Q_3)	–	0	–	–	1	–	–	–	11
Self-employed owners										
45(Q_1)	–	–	–	–	–	0	–	0	1	–	79
67(Q_3)	–	–	–	–	–	1	–	1	0	–	1
Investors										
67(Q_3)	40.90(Q_3)	–	–	1	1	–	1	–	1	85
45(Q_1)	12.00(Q_1)	–	–	0	0	–	0	–	0	1

[1] 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)

II

Landowner Objectives and Nonindustrial Private Timber Supply

Jari Kuuluvainen, Heimo Karppinen, and Ville Ovaskainen

ABSTRACT. In this paper, nonindustrial private forest owners' objectives are empirically identified, and the link between ownership objectives and observed harvesting behavior is established by estimating a theoretically derived timber supply function. Survey data on 146 Finnish forest owners and their timber sales in 1987–1991 is used. Prior to estimation, forest owners are classified into four groups according to their ownership objectives by K-means clustering. Dummy variables indicating cluster membership are included in the supply function. According to the results, "multiobjective owners" harvest significantly more (m^3/ha/yr) than the other owner groups (self-employed owners, recreationists, and investors), *ceteris paribus*. The results further indicate that the multiobjective owners' harvesting policy can be described as present-value maximizing while the other (single-objective) groups' harvesting behavior seems to reflect the effect of market imperfections, as assumed by the theoretical model of the study. For. Sci. 42(3):300–309.
Additional key words: Amenities, credit rationing, Tobit model.

An important conclusion of the empirical studies on the forest management behavior of nonindustrial private forest (NIPF) owners is that their harvesting decisions are influenced by a number of forest and owner characteristics (e.g., Binkley 1981, Järveläinen 1981, 1988, Loikkanen et al. 1986, Carlén 1990, Dennis 1988, 1990, Kuuluvainen and Salo 1991). A theoretical explanation put forward for this is that in the presence of market imperfections, NIPF owners cannot pursue present-value maximizing harvesting policies. Empirically, however, the effects of owner characteristics tend to be fairly small as compared with the effects of prices and the timber stock.

Generally, a significant part of the variance in NIPF owners' observed annual harvest rates remains unexplained. This may be due to the difficulty of identifying the individual restrictions on optimizing behavior. Another explanation is the individual variation in private landowners' management motivations. Following this line of reasoning, we hypothesize that the diversity of ownership objectives should be recognized when modeling NIPF owner behavior.

In the theoretical models, the multiplicity of objectives has usually been taken into account by assuming that the forest owner derives utility not only from income but also from the nonmarketed amenity services of the forest. Assuming that the flow of nontimber services is monotonically increasing in stand age (standing stock), this will extend the optimal rotation (stock) beyond the present-value maximizing one (e.g., Hartman 1976, Hyberg and Holthausen 1989, Max and Lehman 1988, Ovaskainen 1992). However, due to insufficient empirical data on landowners' objectives, harvest rates, and standing stock, there is no conclusive evidence on whether the formulation is relevant and whether landowners who also value nontimber benefits actually use longer rotations or harvest less often. The comparison between industrial and NIPF owners by Newman and Wear (1993) is interesting in this sense.

The other line of research has focused directly on landowner attitudes, beliefs, and objectives (Järveläinen 1971, Hahtola 1973, Kurtz and Lewis 1981, Ferretti 1984, Gramman et al. 1985, Young and Reichenbach 1987, Marty et al. 1988, Blatner and Greene 1989, Bliss and Martin 1989, Lönnstedt 1989, Egan and Jones 1993). While these studies have been able to identify different types of NIPF owners and describe their motivations, the relative importance of motivations vs. other explanatory factors for actual behavior has not been sufficiently analyzed.

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In this paper, NIPF owners' objectives are empirically identified, and the link between ownership objectives and observed harvesting behavior is established simultaneously controlling for other explanatory variables. We show that attitudes and ownership objectives can actually have a quantifiable role in the variation of timber harvest rates. Thus, information on the objectives of different NIPF owner groups can be used to forecast major trends in future timber supply. Even more important may be the implications that the diversity of motivations has for the content and marketing of forestry extension services. Also, different objectives may give rise to very different responses to forest policy measures.

We first present a Fisherian two-period consumption–savings model for a forest owner who perceives credit rationing in the capital market and values the nontimber benefits of his forest property. To our knowledge, these two features have not been considered simultaneously in earlier theoretical models of NIPF behavior. We then present our survey data on 146 NIPF owners in southern Finland and their timber sales in 1987–1991. Using principal component and cluster analysis, we next classify the forest owners into four groups according to the relative importance of three major types of objectives: nontimber values, sales income and economic security, and self-employment opportunities. Finally, we estimate a Tobit timber supply model with dummy variables indicating group membership. The results are reported for the entire sample and for two subsamples (multiple vs. single objective landowners).

Theoretical Framework

Assume that the forest owner behaves as if he maximized his discounted utility over two periods (the present period and the "future"). Utility is an increasing, concave, and additively separable function of the consumption of goods and services (c_1, c_2) and the postharvest stock of standing timber (v_1, v_2), representing nontimber amenities. Modeling nontimber amenities as an increasing function of the standing stock alone is a simplification (cf. Swallow et al. 1990, Swallow and Wear 1993) but it will suffice to demonstrate the qualitative implications.

Timber sales income depends on the harvest rates (h_1, h_2) and exogenous timber prices (p_1, p_2) during the two periods. In addition, the forest owner has exogenous nonforestry income (m_1, m_2). Capital market imperfections are recognized by assuming that the forest owner perceives a credit limit which he cannot exceed (cf. Koskela 1989). Further, timber growth is assumed to be a strictly concave function of the standing stock after the first-period harvest. The forest owner's problem can be presented as follows:

Maximize

$$U = (1-\alpha)[u(c_1)+\beta u(c_2)]+\alpha[g(v_1)+\beta g(v_2)] \quad (1)$$

s. t.

$$v_1 = v_0 - h_1 \quad (2a)$$

$$v_2 = v_0 - h_1 + F(v_0 - h_1) - h_2 \quad (2b)$$

$$c_1 = p_1 h_1 + m_1 + B \quad (2c)$$

$$c_2 = p_2 h_2 + m_2 - (1+r)B \quad (2d)$$

$$B \le B^u \quad (2e)$$

In Equation (1), α ($0 \le \alpha < 1$) is a parameter that measures the relative utility weight between nontimber amenities and consumption of goods and services. We use $\beta = (1+\delta)^{-1}$ to denote the discount factor of future utility, where δ is the forest owner's subjective rate of discount. The exogenous market interest rate is denoted by r.

Our interest is in the short-term timber supply (i.e., supply from a given stock of standing timber). We therefore focus on the first-period harvesting decision only.[1] Assume that the borrowing constraint (2e) is binding, i.e., the forest owner would like to borrow more than is allowed by the credit limit. In effect, borrowing will be replaced by the exogenous credit limit (denoted B^u), and we can substitute $B \equiv B^u$ into (2c) and (2d). The first-order conditions for utility maximizing harvest rates are obtained by substituting (2a)–(2d) into (1) and differentiating with respect to h_1 and h_2. Rearranging, the "cutting rule," or equilibrium condition for the first-period harvest, can be written as follows (an interior solution is assumed and primes are used to denote derivatives of functions of one variable): [2]

$$[1+F'(v_1)](p_2/p_1) = u'(c_1)/\beta u'(c_2) - \alpha g'(v_1)/(1) - \alpha\beta u'(c_2)p_1 \quad (3)$$

Because of the binding borrowing constraint, the interest rate does not enter the equilibrium condition explicitly, and the marginal value product of the forest must be equated to the marginal rate of time preference. The second quotient on the right-hand side adjusts the marginal rate of time preference to take into account the valuation of the nontimber

[1] When the terminal stock has value, the entire stock will not be harvested during the second period. That is, the second-period harvest is also endogenous, which is not the case in the two-period model without nontimber or bequest values. For empirical purposes, however, we need not consider the comparative statics for the second period. As shown in Ovaskainen (1992), the qualitative results for the first period remain unchanged when the number of periods is increased.

[2] The first-order conditions for the optimization problem in (1)–(2e) can be written as

$$\partial U/\partial h_1 = (1-\alpha)u'(c_1)p_1 - \alpha[g'(v_1)+\beta g'(v_2)(1+F'(v_1))] = 0$$
$$\partial U/\partial h_2 = \beta[(1-\alpha)u'(c_2)p_2 - \alpha g'(v_2)] = 0,$$

according to which the marginal utility of consumption must be equated to the marginal utility of the nontimber services, i.e., standing stock (cf. Binkley 1981, Max and Lehman 1988). Alternatively, the same results can be derived by first stating (2e) as $c_1 - p_1 h_1 - m_1 \le B^u$ and writing the Lagrangian function $Z(c_1,h_1,h_2,\lambda) = U + \lambda(B^u - c_1 + p_1 h_1 + m_1)$.

amenities. If $\alpha = 0$, the nontimber benefits are not valued and this term vanishes.

Note that the model in (1) through (2e) combines two sources of nonseparation which have previously been analyzed separately. Credit rationing (Koskela 1989) implies that the forest owner will harvest more at any given initial stock level, and that the remaining stock will be less, than is implied by present-value maximization. For nontimber benefits positively related to the standing stock, the opposite is true (Ovaskainen 1992). Thus, it is not *a priori* clear whether the first-period harvest and optimal stock in the present case will be greater or less than is implied by present-value maximization of commercial timber profits only. This is because one cannot say whether the right-hand side of Equation (3) is greater or less than $(1 + r)$.

The ordinary behavioral timber supply function is obtained by straightforward comparative statics analysis. The results can be stated as follows:

$$\begin{matrix} h_1 = h(p_1, p_2, r, v_0, m_1, m_2, \delta, B^u, \alpha) \\ \quad ? \quad ? \quad - \quad + \quad - \quad + \quad + - \quad - \end{matrix} \tag{4}$$

The signs under the variables indicate the direction of the expected effects. Because of market imperfections, the supply decision is influenced not only by prices and timber stock but also by the owner's income, subjective preferences with respect to consumption and nontimber benefits, and the credit limit. Prices have both a substitution effect and an income effect, and their total effects cannot be signed *a priori* (see Kuuluvainen 1990). Present and expected income have negative and positive effects, respectively. Generally, the liquidity effects of credit rationing dominate those of nonmarket amenities. (This compares with the case of price uncertainty under credit rationing (Koskela 1989), where the wealth effects due to uncertainty are replaced by liquidity effects.) For example, the interest rate, representing the relative price of the first-period consumption, has a negative income effect only. This is consistent with the general result concerning the price effects of rationed goods (Neary and Roberts 1980). The effect of the timber stock is unambiguously positive, yet not equal to unity as is the case with credit rationing alone.

The supply equation (5) includes three more variables which vary over individuals but which cannot be directly observed: the subjective rate of discount δ, the relative utility weight of the nontimber amenities, α, and the credit limit B^u. The rate of time preference has a positive effect, while the effect of the credit limit is negative (i.e., improved availability of credit will reduce timber harvests). The result for the amenity weight α provides some predictions about the behavior of landowners with different objectives. The higher the valuation of the amenity services, the smaller will be the harvest in the present period and, since $v_1 = v_0 - h_1$, the larger the desired timber stock.

Data

We use survey data collected by a mail inquiry in 1990 and personal interviews in 1991 from a sample of NIPF owners in southern Finland. The sampling procedure was two-stage areal cluster sampling where a farm's probability to enter the sample was proportional to its total land area (see Karppinen and Hänninen 1990). The response rate in the mail inquiry was 78%. The analysis of the sampling error (Karppinen et al. 1994) did not indicate any nonresponse bias that would affect the present results. In the personal interviews the response rate was 94%. The number of observations used in the estimation was 730 (146 owners over 5 yr).

Annual microdata on the quantities and prices of timber sold during the 5 yr preceding the interview were collected in the personal interviews in 1991 on the basis of written sales contracts. The annual prices used in estimations are quantity-weighted averages of the prices of different timber assortments sold. For the years where the owner had not sold, regional average timber prices and owner and forest characteristics were used to forecast the price. The forests of those interviewed were also inventoried. For each woodlot, the timber stock at the beginning of each year was calculated using the recursion equation $v_t = v_{t-1} + f(v_{t-1}) - h_t$. The average percentage growth was iterated assuming that growth $f(.)$ is linear in the stock and using information on the actual stock in 1982, 1986, and 1991 and the actual harvest in each year. The data set was augmented by annual microdata on forest owners' income and wealth. All monetary units are measured in real terms deflated by the wholesale price index with the base year 1990.

The information on landowner objectives is based on the mail inquiry of the same sample in 1990. In the mail inquiry, the forest owners were asked to assess the importance of 21 different objectives of 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.

Landowner Objectives

Three of the variables in the theoretical supply equation (4)— subjective rate of discount, relative weight of amenity services, and the credit limit—are directly unobservable. To find a proxy variable, we assume that the unobservable preferences are reflected in the landowner's objectives, which can be examined using survey techniques. The problem is how to utilize the survey data in the analysis.

It is, of course, impossible to include all 21 different objectives directly in the regression equation. Even though the degrees of freedom do not pose a problem, the use of the original variables is prevented by multicollinearity. Using the most "representative" original objectives is further handicapped by the fact that the objectives cannot be measured in a meaningful and comprehensive manner with single variables. What we need to find for the statistical analysis is a limited number of broad categories of objectives. Therefore, we initially used principal component analysis to condense the information in the original variables into a few interpretable combined variables (e.g., Harman 1970, Mulaik 1972, Lewis-Beck 1994). Orthogonal by construction, the principal components are a convenient way to avoid the problem of multicollinearity.

The resulting three dimensions of objectives are presented in Table 1.

The interpretation of the principal components is based on the objectives with the highest loadings on each component (loadings equal the correlations between the original variables and the principal component). As regards the first principal component, variables describing various nonmarketed, recreational, and aesthetic aspects had high loadings. Consequently, it was taken to represent the "nontimber values" of forest ownership. Monetary objectives were highly loaded on the second principal component. This component was therefore labeled "sales income and economic security." The third principal component was characterized by the employment opportunities and labor income from delivery sales, as well as forest work "for its own sake." This dimension was therefore called "self-employment opportunities." [3]

However, the principal components as such are not very useful in explaining timber supply. If the principal component scores are included directly as explanatory variables in the supply equation, their coefficients lack a meaningful quantitative interpretation. Also, it is obvious that different *combinations* of the main dimensions should be allowed. For these reasons, the principal component scores were subsequently used as grouping variables in a cluster analysis. We used the K-means clustering method (e.g., Anderberg 1973, Hartigan 1975, Engelman 1980), which is a combination of hierarchical stem-to-leaf algorithm and iterative partitioning.[4]

Table 1. Objectives of forest ownership. Principal component analysis, Varimax rotation (loadings below 0.250 are denoted by 0.000).

	I	II	III
Outdoor recreation	**0.735**	0.000	0.000
Solitude and meditation	**0.638**	0.000	0.000
Residential environment	**0.636**	0.000	0.386
Berry-picking	**0.608**	0.000	0.000
Nature protection	**0.587**	0.000	0.000
Aesthetic values	**0.580**	0.000	0.000
Inherent value	**0.571**	0.000	0.000
Roots in native locality	**0.506**	0.403	−0.346
Asset motive	0.000	**0.655**	0.000
Funding of investments	0.000	**0.602**	0.000
Regular sales income	0.000	**0.578**	0.252
Security against old age	0.000	**0.505**	−0.337
Hedging motives	0.000	**0.452**	0.356
Speculative motives	0.266	**0.470**	0.000
Labor income and employment	0.000	0.379	**0.651**
Forest work	0.000	0.000	**0.639**
Household timber	0.000	0.000	**0.611**
Security against inflation	0.354	0.322	−0.391
Hunting	0.000	0.322	0.371
Credibility	0.000	0.341	0.000
Inheritance	0.280	0.277	0.000
Eigenvalue	3.430	2.593	2.183
Proportion explained	0.18	0.12	0.10

NOTE: Interpretation of the principal components:
I "Nontimber values"
II "Sales income and economic security"
III "Self-employment opportunities"

It turned out that the forest owners could be classified into four groups: *"multiobjective owners"* (36% of forestland area), *"recreationists"* (18%), *"self-employed owners"* (26%), and *"investors"* (20%). Except for the multiobjective owners, the group labels are based on the principal component with the highest mean score (Table 2).

Multiobjective owners value both the monetary and amenity benefits of their forests, as indicated by the fact that all three principal components have relatively high positive scores. *Recreationists* emphasize the nontimber and nonmonetary values of forest ownership. *Self-employed owners* emphasize the employment opportunities and labor income provided by the forest property. For the *investors*, the forest property is an asset and a source of regular sales income and economic security. For the interested reader, the groups are characterized in Table 3 in terms of directly observable owner and forest characteristics.

There were few statistically significant differences between the owner groups at the 5% level. In part, however, this may be due to small sample size. Using basically the same data ($N = 245$) and logit models, another study by Karppinen (1995) suggests that owner and forest characteristics can actually be used to identify owner groups with different objectives.

Table 2. Forest owner groups based on the objectives of forest ownership ($N = 146$).

		Mean of principal component scores		
Owner group	*n*	I	II	III
Multiobjective owners	51	0.649	0.768	0.324
Recreationists	25	0.668	−0.722	−1.254
Self-employed owners	42	−0.262	−0.766	0.675
Investors	28	−1.386	0.395	−0.482
F-ratio		75.843	46.857	44.531
P-value		0.000	0.000	0.000

NOTE: Interpretation of the principal components:
I "Nontimber values"
II "Sales income and economic security"
III "Self-employment opportunities"

[3] Some seemingly contradictory loadings are explained by the institutional environment in Finland. First, "regular sales income" has a high loading on principal component II but "labor income and employment" on component III. The explanation is that only about 25% of timber sales are delivery sales where the seller does the logging and hauling, and even in that case, stumpage is the dominant part of total sales income. Thus, regular sales income and labor income are not the same thing. Second, hunting has only low loadings because very few landowners own sufficiently large areas to enable hunting on their own land alone (hunting rights are mostly hired by hunting clubs).

[4] In K-means clustering, each case is first assigned to the cluster whose center has the smallest Euclidean distance from the case. Second, the maximum distance of a case from the center of an original cluster is minimized. Thus, K-means clustering algorithm iteratively reallocates cases into clusters whose center is closest to the case. As the Euclidean distance is sensitive to the units of measurement and multicollinearity of the grouping variables, principal component scores [standardized N(0,1) and orthogonal] have desirable properties as grouping variables.

Table 3. Owner and forest characteristics by groups of ownership objectives.

	Multiobjective owners	Recreationists	Self-employed owners	Investors
		Owner background, percent of forest owners or farms		
Farmer	58	27	46	61
Nonfarmer	42	73	54	39
Resident owner	75	29	80	43
Absentee owner	25	71	20	57
Small woodlots (5–20 ha)	37	57	40	30
		Forest and owner characteristics, group means		
Forestland (ha)	37	26	31	40
Standing stock (m^3/ha)	121	126	132	122
Arable land (ha)	7	3	9	5
Owner's age (yr)	62	60	53	55
Income (1000 FIM/yr)	124	128	112	140
Wealth (1000 FIM)	413	366	360	524
		Sales behavior, group means		
Average sales (m^3/ha/yr)	3.0	3.4	3.0	3.1
Sales interval (yr)	2.7	3.3	2.7	3.1

Econometric Analysis of Factors Affecting NIPF Timber Supply

Estimable Timber Supply Function

A cross-sectional censored regression or Tobit model (Tobin 1958, Maddala 1983) is estimated. We denote by h^*_{tij} the latent dependent variable—the harvesting intensity. It is assumed that the harvesting intensity can be positive, negative, or zero even though the actual harvest has to be nonnegative, and that the intensity is a linear function of the exogenous variables. The Tobit model uses the information available for h^*_{tij} above zero. Therefore,

$$h_{tij} = h^*_{tij} = \beta' x_{tij} + \varepsilon_{tij} \quad \text{if the right – hand side is positive}$$
$$h_{tij} = 0 \quad \text{otherwise}$$

where h_{tij} is the actual harvest in m^3/ha of owner i ($i = 1, \ldots, 146$) in Forestry Board District j ($j = 1,2,3$; relevant for regional prices only) in year t ($t = 1, \ldots, 5$). Further, x_{tij} are the exogenous variables, β is the vector of the parameters to be estimated, and ε_{tij} is the normally distributed error term. The independent variables and their expected signs are as follows:

p_{it}	=	timber price level (net of harvesting costs), FIM/m^3	(?)
$\Delta p_{j(t-1)}$	=	first difference of regional timber price ($j = 1,2,3$)	(?)
$v_{i(t-1)}$	=	standing stock of timber per hectare, m^3/ha	(+)
$growth_i$	=	mean percentage growth for the 5-yr period, %	(?)
m_{it}	=	total annual pretax income, 1000 FIM	(–)
w_{it}	=	taxable wealth (permanent income), 1000 FIM	(+)
age_{it}	=	forest owner's age, yr	(–)
$d1$	=	multiobjective owner	(0)
$d2$	=	self-employed owner	(+)
$d3$	=	investor	(?)
$d4$	=	recreationist	(–)

As shown theoretically, the harvesting decision depends on timber prices and, out of equilibrium, on the timber stock, as well as on owner characteristics. In addition, dummy variables representing owner groups with different objectives are included.

The ordinary Tobit model assumes that each forest owner in each year is an independent observation, which means that all coefficients are constant, and the disturbance captures the differences over time and individuals (Judge et al. 1985). Obviously, this assumption is restrictive. One way to relax the assumption, and to allow for the effects of omitted owner-specific factors, would be to assume individual constant terms (e.g., MaCurdy 1981). Instead of this, however, we take the variation due to the "preference-related" factors into account by introducing dummy variables indicating the landowner's membership in one of the four groups based on ownership objectives. This allows us to test, at the first stage, whether there are differences in the harvest rates between forest owners with different objectives.

Theoretical justification for the expected signs of the group dummies is provided by the result for the amenity weight, α, in Equation (4). The multiobjective owners, who value both monetary and nonmonetary benefits, can be taken to represent a "medium" amenity weight (the reference case). In comparison with this, self-employed owners can be expected to place less weight on nontimber services and to harvest more, *ceteris paribus*. The recreationist owners' emphasis on nontimber values can be interpreted as a high amenity weight, so they can be expected to harvest less. As the investors indicated no marked interest in nontimber values, they could harvest intensively. On the other hand, they may prefer a relatively high timber stock as an insurance against unexpected events and therefore harvest conservatively. Thus, the total effect remains *a priori* ambiguous.

The present timber price level is used to take into account the "medium-term" price effect.[5] The price level refers to the data on individual prices collected during the interview, so there are 730 observations for this variable in all. The impact

(short-term) price effect is accounted for by the first differences of the regional timber prices. Using differences is a common practice in time-series econometrics (e.g., Hendry and Ericsson 1991). Here, it implies the hypothesis that even if the forest owners do not sell timber every year, they do follow short-term price changes as indicated by the regional average prices. For the price difference, we have 15 observations (3 regions over 5 yr).

In addition to the volume of the per hectare timber stock at the beginning of each period, we include the average percentage growth of the stock. The latter captures the effects of the woodlot's age structure and average site quality. The effect remains *a priori* ambiguous, because high mean percentage growth can either be due to good sites (with a high harvest potential) or reflect the dominance of immature stands (implying a low probability of harvest). The interest rate could not be included, because we did not have access to the actual interest rates that individual forest owners currently paid for their loans or to their interest rate expectations. The aggregate interest rate, in turn, was strongly correlated with the price difference ($r = -0.87$).

Estimation Results for the Entire Sample

The estimation results for the Tobit model are reported in Table 4. Column 2 gives the estimated coefficients and their t-values (in parentheses). The elasticities for all observations are given in column 3. Tobit elasticities for all observations express the total effects of the independent variables on the expected average harvest, including effects on the probability of entering the market and on the quantity harvested for observations above the limit (cf. McDonald and Moffit 1980).

According to the Bera–Jarque chi-square test, the symmetrically trimmed residuals of the model are normal, which suggests that the parameter estimates are unbiased. The reported *R*-squared is almost twice as high as it is turned out to be without the group dummies. As is typical of cross-sectional models, it is still rather low.

Some of the coefficients for the group dummies in Table 4 are consistent with *a priori* expectations. In part, however, the results are at variance with conventional presumptions. First, the group with the largest timber sales turns out to be the *multiobjective owners* (the reference group). The elasticity for *d*3 shows that the *investors'* mean annual timber sales per ha are 1.1 m^3/ha/yr smaller than the multiobjective owners', *ceteris paribus*. The difference is significant at the 5% level. *Recreationist* and *self-employed owners* also harvest less than multiobjective owners (at 7.1% and 8.5% levels of significance, respectively). In summary, forest owners who assign more or less equal weights to both the monetary and nonmonetary aspects of forest ownership seem also to be more active users of their property's harvesting potential than are "single-objective" owners, who exclusively value one dimension of their forest property.

[5] In time-series econometrics this is normally referred to as the long-term price effect, but the medium-term effect is more relevant here as we are dealing with the adjustment of the timber supply at the given level of timber stock and silvicultural activity.

Table 4. The estimated coefficients, t-values and elasticities of the Tobit model for Finnish NIPF owners' annual timber sales (m^3/ha), 1987-1991 (N = 730 for 146 owners over 5 yr).

Independent variable	Coefficient (t-value)	Elasticity
Constant	−8.40	
	(2.67)	
Timber price level (p_{it})	1.66	0.41
	(1.49)	
Price difference ($p_{jt}-p_{j(t-1)}$)	0.06	0.03
	(1.55)	
Standing stock ($v_{i(t-1)}$)	5.06	0.99
	(4.81)	
Mean percentage growth ($growth_i$)	0.55	0.36
	(2.72)	
Income (m_{it})	−0.73	−0.13
	(1.37)	
Wealth (w_{it})	0.31	0.25
	(2.85)	
Owner's age (age_{it})	−0.06	−0.47
	(2.03)	
Multiobjective owners ($d1$)	Reference group	
Self-employed owners ($d2$)	−1.51	−0.77[a]
	(1.72)	
Investors ($d3$)	−1.98	−1.11[a]
	(2.03)	
Recreationists ($d4$)	−1.90	−1.01[a]
	(1.80)	
σ	8.3	
	(26.53)	
Log-likelihood	−1,655.3	
Pseudo R^2 [b]	0.08	
Expected harvest at means	3.35	
Bera–Jarque χ^2 [c]	1.21	

[a] The "elasticities" for the group dummies directly express the average difference (m^3/ha/yr) in expected sales compared to the reference group.

[b] Pseudo $R^2 = \beta\Sigma_x\beta/(\sigma^2+\beta\Sigma_x\beta)$ where Σ_x is the sample covariance matrix of the regressors (see e.g. Laitila 1993).

[c] The Bera-Jarque χ^2 test statistics for normality is computed using the symmetrically trimmed Tobit residuals, $\varepsilon_i = I(x_i'\beta>0)[min(y_i, 2x_i'\beta) - x_i'\beta]$ where I is the indicator function (cf. Pagan and Vella 1989). The 5% critical value with two degrees of freedom is 5.99.

Secondly, there are no significant differences in the annual per ha harvest rates between the recreationists, investors, and self-employed owners. This is interesting given that on the basis of stated objectives, the investors and self-employed owners assign the most weight to the monetary benefits and could be expected to harvest more than the recreationists. The results suggest that we could have used only one dummy variable, multiple vs. single objective landowners. When tried, this dummy produced an expected difference of 1 m^3/ha/yr (significant at the 5% level). However, considering all four groups separately demonstrates that rather different objectives can result in a very similar harvesting behavior as regards at least the average harvest level.

Of special interest is the result for the recreationists. On the basis of stated objectives, this group would seem to be the most far removed from the investors or self-employed owners, who emphasize the monetary aspects. In terms of harvest rates, however, they do not differ that much. This should

serve as a warning that too far-reaching conclusions should not be made concerning the effects of owner objectives on timber supply without simultaneously considering the objectives and actual harvest rates. Further, the usual assumption that nontimber benefits are a monotonically increasing function of the standing stock might suggest that recreation-oriented owners' properties tend to be dominated by fully stocked mature stands. Our empirical data, however, does not support this conjecture. There were no statistically significant differences between different owner groups' per ha timber stocks at the 5% level. [6]

For the other independent variables, it suffices to note that the effects are rather similar to those obtained in earlier studies. The dominant determinant of timber sales is the per ha standing stock. The elasticity is close to unity (cf. Dennis 1988, 1990, Kuuluvainen and Salo 1991). The mean percentage growth is also significant with a positive effect that would seem to reflect differences in site quality rather than the age structure of the woodlot. The medium-term elasticity with respect to timber price is 0.4, which seems reasonable. The fairly high *t*-value for the price difference suggests that the owners do follow market developments. However, the *t*-values indicate that both price variables are only significant at somewhat more than 10% risk.

Multiple vs. Single Objective Landowners

A difference was found between the multiobjective and single-objective owner groups as regards harvest levels. However, when using the group dummies in a single model, we implicitly assumed that different objectives give rise to differences in harvest levels only, while the effects of other independent variables are the same for all groups. Theoretically, it is obvious that we should also test whether owner groups with different objectives have different parameter vectors as well. The problem is that our sample size does not support the estimation of four separate supply equations. We therefore chose to estimate separate models for two subsamples: the multiobjective owners as defined above vs. single-objective owners comprising all three other groups.

The results are reported in Table 5. The Bera–Jarque statistics indicate normality of residuals for both models. According to the Wald statistics, the parameter vectors for the two subsamples do differ at the 1% level of significance.[7] Some interesting remarks can be made.

For *multiobjective owners*, the only variable that is statistically significant at the 5% level is the first difference of the regional stumpage price. The interpretation is that the multiobjective owners' short-term harvesting decisions actually follow the present-value maximizing harvesting policy. That is, the forest owners in this group do not seem to perceive liquidity constraints while making their short-term supply decisions. In addition, their harvest rate and timber stock seem to be close to the long-term equilibrium level, because even the standing stock has no statistically significant effect. (The interest rate, which is theoretically important for present-value maximizing harvest policy, could not be included.)

For the *single-objective owners*, neither the price level nor price change are statistically significant. Instead, the effects of the timber stock, mean percentage growth, present income, and wealth (i.e., expected permanent income) are all significant at the 5% level. The results suggest that the harvesting behavior of the single-objective groups is more clearly liquidity-constrained and their lifecycle harvest reflects perceived credit rationing. Unlike the multiobjective owners, they do not seem to follow short-term price changes. This interpretation is supported by the fact that single-objective owners are often absentee owners (46%) for whom timber sales are less frequent and following the market therefore more difficult (the sales probabilities for single vs. multiobjective owners are 0.46 and 0.57, respectively). Theoretically, however, the result can also be explained by substitution and income effects that cancel each other out.

For single-objective owners, the coefficients of owner and forest characteristics differ from zero at the 1% level of significance, according to the Wald statistics. For multiobjective owners, these coefficients differ from zero at the 5% level. Due to the "almost" significant coefficients of the present income and owner's age, it remains somewhat ambiguous whether the multiobjective owners follow the unconstrained present-value maximizing harvest policy. The positive coefficient of present income suggests that the assumption about the separability of utility over time and between consumption and amenities may be too strong (cf. Binkley 1981). The negative coefficient of the owner's age refers to the bequest motive, because timber sales were fairly constant in all age classes except for owners over 65 years of age (not reported).

Conclusion

This paper suggests that NIPF owners' timber sales are connected with the objectives of forest ownership. Unlike earlier studies on landowner attitudes, we considered the role of ownership objectives using a statistical model in which other theoretically justified variables were simultaneously controlled. The biggest difference in mean annual timber sales was found between the multiobjective owners, on the one hand, and investors, on the other. The differences between the single-objective groups (self-employed owners, recreationists, and investors) were small and statistically insignificant. On average, the single-objective groups sold approximately 1 m^3 less per ha per yr than the multiobjective owners.

In the earlier discussion on NIPF owners' harvesting behavior a division has been made between "profit maxi-

[6] Similar conclusions were obtained by asking the landowners whether they considered their farm to be used mainly for agricultural and/or forestry production or for recreation and residence. The farm's orientation had no impact on harvesting behavior. Further, the average timber stock for the recreational farms was 114 m^3/ha while 129 m^3/ha for the production-oriented farms. Notably, the stated main orientation may not be truly exogenous. Some answers in favor of mainly recreational use may reflect a very small harvesting potential due to intensive cut earlier.

[7] The groups are separate subsamples with different values for both dependent and independent variables, and the "restricted" model for all owners cannot be deduced from the unrestricted one by any linear restriction on the parameters. That is why we use the (nonnested) Wald test for structural change, which allows unequal variances for the two owner groups (Greene 1990, p. 215; see also footnote to Table 5).

Table 5. The estimated results for the Tobit timber supply model for multiple vs. single objective landowners.

Independent variable	Multiobjective owners		Single-objective owners	
	Coefficient (t-value)	Elasticity	Coefficient (t-value)	Elasticity
Constant	−1.37		−12.90	
	(0.32)		(3.00)	
Timber price level (p_{it})	0.95	0.26	1.91	0.45
	(0.69)		(1.17)	
Price difference ($p_{jt}-p_{j(t-1)}$)	0.15	0.08	0.01	0.006
	(2.75)		(0.21)	
Standing stock ($v_{i(t-1)}$)	1.37	0.29	6.74	1.28
	(0.87)		(4.84)	
Mean percentage growth ($growth_i$)	0.03	0.02	0.72	0.45
	(0.11)		(2.51)	
Income (m_{it})	1.18	0.24	−1.72	−0.32
	(1.59)		(2.37)	
Wealth (w_{it})	0.13	0.12	0.40	0.32
	(0.87)		(2.85)	
Owner's age (age_{it})	−0.06	−0.56	−0.06	−0.46
	(1.49)		(1.61)	
σ	6.77		9.17	
	(17.29)		(20.26)	
N	255		475	
Log-likelihood	−620		−1024	
Pseudo R^2	0.10		0.09	
Expected harvest at means	3.47		3.27	
Probability of sales	0.57		0.46	
Bera–Jarque χ^2	2.14		0.71	
Wald statistics [a]	27.7			

[a] The Wald statistics for structural change between the subsamples is obtained as $(\beta_1-\beta_2)(V_1+V_2)^{-1}(\beta_1-\beta_2)$ where β_i and V_i are the estimated coefficient vectors and variances for the two subsamples (i = 1,2). The critical χ^2 with 8 df at the 1% risk level is 21.7.

mizers," with monetary objectives only, and "utility maximizers" who also value the nonmarket benefits (e.g., Hyberg and Holthausen 1989). However, it seems that NIPF owners' objectives are rather more complicated. Naturally, landowner attitudes and objectives depend on the cultural, institutional, and economic environment in each country so that the actual grouping presented in this paper is specific to Finland. However, our general approach—i.e., attempting to empirically identify landowner objectives and incorporating the information in a regression-based model—seems more generally applicable.

Contrary to *a priori* expectations, the multiobjective owners who value both monetary and nonmonetary benefits harvested significantly *more* per ha per yr than the other groups, *ceteris paribus*. Furthermore, it was the multiobjective owners whose harvesting behavior seemed to be closest to the unconstrained, present-value maximizing harvesting policy. For the single-objective owners, forest and owner characteristics were important determinants of timber harvest. Reflecting the effects of perceived liquidity constraints, their behavior seemed to be consistent with the theoretical model presented in this paper.

Another finding contrary to the expectation that nontimber considerations imply a larger standing stock was that the recreationists' per hectare stocks did not differ significantly from the other groups. In fact, our theoretical model showed that the expectation is not even *a priori* justified if the forest owner simultaneously faces constraints such as perceived or actual credit rationing. On the other hand, the assumption that nontimber amenities are monotonically increasing in the standing stock may not be justified. Empirical findings by Englin and Mendelsohn (1991) indicate that people eventually become oversatiated with respect to old-growth stands (see also Binkley 1981, Swallow et al. 1990, Swallow and Wear 1993).

The results concerning the role of ownership objectives can be used in evaluating long-term trends in NIPF owners' timber supply and in predicting their responses to forest policy. Even more importantly, the knowledge of ownership objectives may help forestry extension organizations in allocating their resources and in adjusting the supply and contents of extension services to match NIPF owners' diverse motivations. For these purposes it is important that owner groups with different objectives can be identified in terms of more easily observable owner and forest characteristics. However, this is outside the scope of the present investigation.

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List of Symbols

B Borrowing

B^u Exogenous credit limit

c_t Consumption of goods and services

$F(.)$ Timber growth function

$g(v_t)$ Instantaneous utility from the timber stock

h_t Harvest

t Time period subscript

i Individual subscript

j Forestry Board District subscript

m_t Exogenous (nonforest) income

p_t Net timber price

r Interest rate

U Utility function for the whole planning period

$u(c_t)$ Instantaneous utility from consumption of goods and services

v_t Standing timber stock

w_t Real wealth

x Vector of exogenous variables

α Relative weight of amenities in the utility function ($0 \leq \alpha < 1$)

β Vector of parameters to be estimated; subjective discount factor $(1+\delta)^{-1}$ in the two-period model

ε Vector of error terms

δ Subjective rate of discount of future utility

σ Standard error estimate of the harvesting intensity in the Tobit model

III

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

HEIMO KARPPINEN*

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[1]	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, *self-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 OWNERS	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 OWNERS	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		RECREATIONISTS		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.

IV

Attitudes towards the protection and economic utilization of forests in Finland

Heimo Karppinen and Harri Hänninen

Abstract

Attitudes of the Finnish public towards the economic utilization of forests and forest protection are examined using interview data collected in 1994. Principal component and cluster analyses are used to discern between persons with flexible and inflexible attitudes towards these issues. Four attitude groups are identified; citizens who support either increased forest utilization or increased forest protection, and reject the alternative, citizens who support both increased protection and economic utilization of forests and citizens who oppose both. The groups are further described by socio-demographic characteristics, including ownership of forest land, and their proportion strengths are estimated.

Keywords: environmental attitudes, forestry, public opinion, private forest owners, multivariate methods

Introduction

In most western countries, forestry has recently been subject to public criticism. Until the late 1980's, these criticisms mainly focused on forest management practices. Since then, the main theme in the ongoing debate has been the question of biodiversity. In particular, the protection of old-growth forests and endangered biotopes and species have been given considerable attention (Hellström, 1994; Hellström & Reunala, 1995). For instance, in the US Northwest, the spotted owl debate has caused a clear reduction in cuttings of old-growth forests (Yaffee, 1994; Sedjo, 1995). Criticisms are also reflected in international environmental agreements, such as the Rio declaration, which emphasize multiple-use principle and sustainability (Report ..., 1992; Second Ministerial ..., 1993). On the global scale, the pressure to protect forests will almost certainly increase in the future, but the demand for wood and wood products is also expected to rise (Solberg, 1996; FAO, 1997).

Active groups in forestry conflicts, such as the forest industries, environmental groups and landowners, have easy access to the mass media. For the general public, opinion polls offer an important participatory channel. The public's attitudes and opinions concerning forestry have been studied in several countries (e.g., Hoen & Winther, 1993; Shindler *et al.*, 1993; Bliss *et al.*, 1994; Bourke & Luloff, 1994; Public... , 1995; Kangas & Niemeläinen, 1996; Zimmermann, 1996; Schmithüsen *et al.*, 1997). However, as a whole, public opinion concerning these apparently contradictory tendencies to protect forest and intensify the utilization of forests is insufficiently understood.

Previous studies have mainly presented only responses to single statements, which always involves a danger of misinterpretation. The one-item scales are not proportioned to each other, which may result in an exaggerated impression of inconsistency in the attitudes of the public. Public attitudes concerning "abstract" environmental issues are invariably inconsistent to some extent (Uusitalo, 1990). The construction of summated and cumulative scales of attitudes (Tull & Albaum, 1973; deVaus, 1996) will probably yield more reliable and more consistent results. On the other hand, multivariate methods enable simultaneous analysis of several statements, making it possible to cluster persons with flexible and inflexible attitudes.

The main contribution of this study is to demonstrate a procedure for overcoming the danger of misinterpretation present in separate analyses of single attitude statements. In this study, multivariate methods are employed to discern between persons with distinct and more flexible attitudes towards forest protection and economic utilization. Principal component analysis is used to condense a number of statements into a few interpretable attitude

dimensions, and two of these dimensions are employed as criteria for clustering the citizens into four attitude groups.

The procedure allows the assessment of the proportion of the Finnish public which is singularly pro forest protection at the expense of economic utilization, and vice versa. Besides the analysis of these extreme groups, the study also enables the evaluation of the extent to which Finns are more flexible towards these issues. The supporters of forest protection, economic utilization and the two other groups are further identified by readily observable socio-demographic characteristics. The study results are useful in planning and implementing national environmental and forest policies.

The attitudinal differences between Finnish non-industrial private forest owners and non-owners are particularly interesting. The American studies suggest that there are minor differences between forest attitudes of the forest owners and the public (Bliss *et al.*, 1994; 1997; Bourke & Luloff, 1994), whereas evidence from Finland suggests that non-owners are more pro-environmentally oriented than forest owners (Kangas & Niemeläinen, 1996).

The paper is organized as follows. A review of the literature on socio-demographic differences in environmental attitudes is presented first, and hypotheses are introduced. Personal interview data on 970 Finnish citizens is outlined in the next section, which also includes a short description of the methods used in the analysis. The empirical results are then presented, and finally conclusions are drawn.

Socio-demographic differences in environmental attitudes

The public's environmental attitudes are often explained by demographics. For instance, age or generation (age cohort) are considered to be important. Younger persons seem to be more concerned about environmental issues than older people (Steel *et al.*, 1990; 1994; Kangas & Niemeläinen, 1996). Also Inglehart's (1977) well-known, although heavily criticized, materialism–postmaterialism hypothesis suggests that younger generations "born in prosperity" express more pro-environmental attitudes than older generations who emphasize material needs.

Women are also considered to be more concerned about the condition of the environment than men. The assumption regarding differences between the attitudes of the sexes is based on the argument that women are socialized from childhood to raise and care for their families, and this "motherhood mentality" is reinforced by the roles women occupy during their adulthood in the family

as homemakers and mothers. Nurturing attitudes have been translated into the environmental domain. On the other hand, men are socialized to be family breadwinners and economic providers, and this "marketplace mentality" is again reinforced in their workplace roles. (Mohai, 1992; Steel *et al.*, 1994)

Formal education is often associated with environmental concerns. Persons with higher levels of education are more likely to show concern for environmental problems than those with lower levels of education. The rationale behind this kind of reasoning is that education makes it easier to understand complex environmental issues (Steel *et al.*, 1994). However, it has also been argued that education may not matter because environmental concern depends more on values than knowledge (Steel *et al.*, 1990). Furthermore, Bliss *et al.* (1997) claim that formal education contributes to an increased approval of certain forest management methods, such as clearcutting and the use of herbicides.

Previous studies suggest that urban residents are more likely to support pro-environmental attitudes than rural residents (Lowe & Pinhey, 1982; Steel *et al.*, 1994; Kangas & Niemeläinen, 1996). Urban people have better access to environmental knowledge and educational opportunities, and they also may have more experience from the environmental deterioration in their neighborhoods than rural residents. The interest in forest protection can be considered to have its roots in urban culture (Steel *et al.*, 1994). On the other hand, rural residents are often more involved with nature exploitative occupations, e.g., the utilization of forests, and therefore express less concern for the preservation of pristine nature. In Finland, this urban–rural difference could also be interpreted regionally. As suggested by Kangas and Niemeläinen (1996), pro-environmental attitudes may be associated with the residence in the more developed and more densely populated southern part of the country than in northern Finland.

The American studies suggest that there are minor differences between forest attitudes of the forest owners and the public (Bliss *et al.*, 1994; 1997; Bourke & Luloff, 1994). Taking into account the economic importance of wood production in Finnish private forestry, it is reasonable to expect, as suggested by Kangas and Niemeläinen (1996), that private forest owners are not as pro-environmentally oriented as other citizens.

To sum up, the socio-demographic characteristics hypothesized to be *in connection with pro-environmental attitudes are: young age, female gender, high level of education, urban residence, residence in southern Finland and non-ownership of forests.*

Data and methods

The countrywide survey data were collected by personal interviews in 1994 by a commercial enterprise specialized in opinion polls (Taloustutkimus Inc.). The population consisted of all Finnish citizens between 15 and 74 years. The sample size was 982, but the number used in the analysis was 970 due to non-response to the question on forest ownership. The sampling procedure was quota sampling (Bailey, 1994), which was based on the proportions of the age classes, sex and place of residence (urban/rural) of the population in the particular province. Case weights were therefore applied in the analysis.

The data were originally collected for another purpose, and the effect of non-response bias could not be investigated in this study. The rate of non-response has usually been rather small (5–8%) in opinion polls executed by Taloustutkimus (personal communication, Hannu Ilkas). Furthermore, differences were not detected in the comparison of the sample demographics and population census statistics. The sample is therefore considered to be statistically representative of the Finnish population.

The objectives of the primary study have determined the contents of the questions. This may cause validity problems particularly in attitude measurement and restricts the adoption of a theoretical framework (see, e.g., Lutz, 1991). The wording of the attitude statements can be assessed to be somewhat value-laden and perhaps biased in favor of economic utilization of forests. The data were, however, considered to be suitable for meeting the objectives of the present study. The questionnaire included 15 statements concerning attitudes towards forestry measured by a five-point Likert scale (Strongly agree, Agree, Cannot tell, Disagree, Strongly disagree). Respondents' socio-demographic characteristics were also inquired.

In order to group persons with flexible and inflexible attitudes towards forest protection and economic utilization of forests, the attitude statements were first condensed into a few interpretable combined variables by means of principal component analysis (e.g., Harman, 1970; Lewis-Beck, 1994). The principal component scores describing support for the forest protection and the economic utilization of forests were then used as grouping variables in cluster analysis. Grouping the owners allowed different combinations of the two dimensions of attitudes, and the groups could be identified by socio-demographic characteristics. Orthogonal in construction, principal component scores provided a convenient way to avoid the problem of multicollinearity which could distort clustering (Engelman, 1980). K-means clustering, based on Euclidean distances, was employed. It is a combination of a hierarchical stem-to-leaf algorithm and iterative partitioning (Anderberg, 1973; Hartigan, 1975).

The groups based on attitudes were identified by demographics using logit models (Maddala, 1984; Hosmer & Lemeshow, 1989). The dependent variable in the models was dichotomous: assignment to the specific group versus other citizens. Multinomial models were also technically possible, but binary models were preferred because they permitted the identification of a specific group of citizens from other citizens instead of comparing all groups with each other simultaneously. The attitude groups were further used in the comparisons between forest owners and non-owners.

Results and discussion

Attitude groups

Fifteen statements describing the attitudes of the public concerning forestry were condensed into four attitude dimensions using principal component analysis (Table 1). The reliability of the solution was satisfactory (Carmines' theta = 0.69).[1] The explained proportion of the total variation of the original variables was 49%. The first component was considered to describe *support for forest protection* because of the high loadings for the statements "Cuttings and forest management should be reduced to maintain virgin nature", "The majority of forests should be maintained as untouched virgin nature", "Forest management and cuttings in our forests form a menace to the profusion of flora and animal species", and "More tax funds should be used for the protection of old-growth forests".

The following statements received high loadings on the second principal component: "Timber cuttings are necessary for the health of forests", "The welfare of our country will be based on forests also in the future", "The utilization of forests should be intensified to improve our standard of living", "A well-managed forest is suitable for berry and mushroom picking as well as for hiking", and "Our forests have roundwood in abundance as a raw material for industry". The component was therefore considered to describe *support for economic utilization of forests*.

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1. Carmines' theta is computed for the unrotated solution as follows: $\Theta = \frac{N}{N-1}(1-\frac{1}{\lambda_1})$, where N is the number of items in the total principal component analysis and λ_1 is the largest (the first) eigenvalue. Theta can be regarded as a maximized Cronbach's alfa coefficient. (BMDP..., 1992; Carmines and Zeller, 1979)

Table 1. Public's attitudes towards forestry. Principal component analysis. Varimax rotation. (Loadings below 0.250 denoted by asterisk).

	I	II	III	IV
Cuttings and forest management should be reduced to maintain virgin nature.	0.758	*	*	*
The majority of forests should be maintained as untouched virgin nature.	0.711	*	*	*
Forest management and cuttings in our forests form a menace to the profusion of flora and animal species.	0.680	*	*	*
More tax funds should be used for the protection of old-growth forests.	0.597	*	*	*
Timber cuttings are necessary for the health of forests.	*	0.642	*	*
The welfare of our country will be based on forests also in the future.	*	0.638	0.333	*
The utilization of forests should be intensified to improve our standard of living.	*	0.614	*	0.274
A well-managed forest is suitable for berry and mushroom picking as well as for hiking.	*	0.583	*	*
Our forests have roundwood in abundance as a raw material for industry.	–0.267	0.524	*	*
The forest industries cope well with the requirements of international competition.	*	*	0.800	*
The forest industries are the most important foundation and maintainer of welfare in our country.	*	*	0.747	*
The forest industries are an old-fashioned and stagnant branch of industry.	*	*	–0.582	*
Mechanized site preparation to ensure the development of plants is acceptable in principle.	*	*	*	0.785
Clearcutting and planting or sowing seeds is acceptable in principle.	*	*	*	0.763
Modern methods enable roundwood harvesting from the forest without damaging nature.	–0.250	*	*	0.505
Eigenvalue	2.117	1.923	1.689	1.656
Proportion explained	14%	13%	11%	11%
n	970			

Interpretation of the principal components:

I "Support for forest protection"
II "Support for economic utilization of forests"
III "Positive image of the forest industries"
IV "Acceptance of present forest management methods"

The third attitude dimension could be interpreted to represent *positive image of the forest industries* as a competitive, modern branch of industry that forms a foundation of economic well-being. Finally, the fourth component was considered to describe *acceptance of present forest management methods* (e.g., clearcutting, mechanized site preparation).

Two of these attitude dimensions, support for forest protection and economic utilization of forests describe attitudes that are often viewed as contrary to each other. They were therefore chosen for further analysis. Moreover, the differences between the attitudes of the forest owners and other citizens were manifested only with respect to these two dimensions.

The objective of the cluster analysis was to discern between those persons with strong attitudes towards forest protection and economic utilization of forests, and those persons with more flexible attitudes towards these attributes. A four-group solution proved to be interpretatively straightforward and satisfactory as to the group size (Table 2). F-ratios suggest that the components discriminate rather well.

In the first group, the mean of the principal component score describing support for forest protection was positive and that of support for utilization negative. In other words, the interviewees belonging to this group emphasized forest protection and did not support economic utilization. Consequently, such persons can be characterized as *supporters of forest protection.* In the second group, the signs of the means of the principal component scores were the opposite: economic utilization of forests was emphasized at the expense of

Table 2. Grouping of the public by their attitudes towards forestry. K-means clustering.

Attitude group	n	Mean of principal component score (standard deviation)	
		I Support for forest protection	II Support for economic utilization of forests
I Supporters of forest protection	233	0.893 (0.581)	– 0.393 (0.481)
II Supporters of forest utilization	334	–0.934 (0.546)	0.414 (0.516)
III Multifunctionalists	229	0.708 (0.606)	0.942 (0.398)
IV The indifferent	174	– 0.334 (0.748)	–1.508 (0.755)
	Σ 970		
F-ratio		549.889	804.646
P-value <		0.000	0.000

nature protection. Thus the group can be labeled *supporters of forest utilization*. In both groups, the coefficient of variation of the principal component score representing support for forest protection was distinctively smaller than that of support for utilization. This suggests that attitudes concerning forest protection were more consistent than attitudes towards economic utilization.

In the third group, the means of both support for forest protection and economic utilization of forests were high and positive. The persons belonging to this group considered that forest protection and economic utilization could be increased at the same time. The group was therefore labeled *multifunctionalists*. The respondents of the fourth group took a negative attitude towards both forest protection and economic utilization. They did not want to increase forest protection or economic utilization. The group was labeled *the indifferent*. The analysis of the coefficients of variation in these two groups suggested that the attitudes related to the economic utilization of forests were clearly more consistent than the attitudes towards protection.

More than one third of the respondents belonged to the supporters of forest utilization and close to one fourth to the supporters of forest protection (Fig.1). This implies that every third person would be ready to increase utilization of forests at the expense of forest protection, and one in four citizens would be ready to increase forest protection at the expense of wood production. Thus, about sixty percent of the population seem to have a distinct (either – or) attitude towards these issues.

One fourth of the Finns in the investigation were multifunctionalists who simultaneously supported the increased protection and economic utilization of forests. This kind of attitude is in line with the international environmental agreements emphasizing multiple-use of forests (Report..., 1992; Second Ministerial..., 1993). The abundant forest resources in Finland enable a simultaneous increase in the forest protection and utilization of forests to meet the roundwood demand of the forest industries.

One sixth of the Finns had a negative attitude towards both the increased forest protection and economic utilization of forests. Such indifferent citizens obviously accept the present situation or are disinterested in the whole issue. It is also possible that some respondents classified into this category have not fully understood the contents of the statements.

The results also reveal that forty-seven percent of the population supported the increased forest protection and sixty percent the increased economic utilization of forests, when multifunctionalists were included. This proportion of the supporters for protection is close to the estimate given by Kangas & Niemeläinen (1996) based on responses to a single statement.

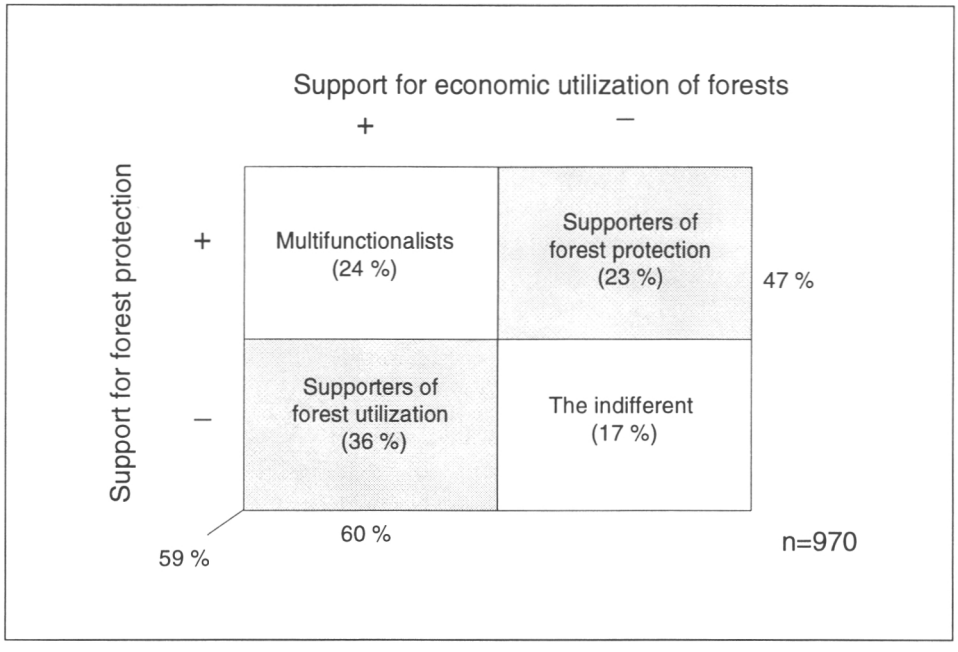

Figure 1. Grouping of the public by their attitudes towards forestry (+ positive attitude, – negative attitude).

Demographics of the attitude groups

The socio-demographic characteristics of the supporters of forest utilization and protection were identified using separate logit models for both groups. The objective was to identify the persons belonging to the specific group from other people (three other groups). According to the results, a person was more likely to belong to the *supporters of forest utilization* if he was male, and more than 30 years old, had a college or academic degree, lived in the southern part of the country (to the south of Oulu province), and was a forest owner (Table 3). Given these attributes, the probability of belonging to the group was 68% (Appendix 1).

The *supporters of forest protection* could not be as clearly distinguished from other citizens by standard demographics.[1] However, the probability of belonging to the supporters of protection increased to some extent if the person was less than 30 years old, female, and lived in northern Finland (Table 3). Given these attributes, the probability of belonging to the group was 53% (Appendix 1). The model identifying the supporters of protection does not give

1. The socio-demographic characteristics of the supporters of forest protection were also compared with those of supporters of forest utilization but the analysis did not reveal any additional information to that presented in Table 3.

Table 3. Identification of the attitude groups by socio-demographic characteristics. Logit analysis. Maximum likelihood estimates.[i]

Characteristic	Supporters of forest protection	Supporters of forest utilization	Multi-functionalists	The indifferent
	Coefficient (Wald statistics)			
Constant	0.105 (0.443)	–2.342 (8.57)	–1.361 (7.44)	–1.064 (7.53)
Sex Male=1	–0.722 (4.50)	0.775 (5.43)	–0.445 (2.81)	–
Age More than 30 yrs=1	–0.905 (5.65)	0.629 (3.82)	0.904 (4.71)	–0.669 (3.74)
Forest owner Yes=1	–	0.491 (3.01)	–	–0.424 (1.91)
Education College or academic=1	–	0.521 (3.30)	–1.095 (5.21)	–
Occupation Manager/private entrepreneur=1	–	–	–	0.633 (2.44)
Location of permanent residence Urban or rural center=1	–	–	0.470 (1.90)	–
Location of permanent residence Southern Finland=1	–0.422 (1.94)	0.674 (2.91)	–	–
Log-likelihood	–503.464	–583.868	–499.521	–445.424
R_L^2 (likelihood ratio index)	0.05	0.06	0.06	0.02
n	967	967	967	970

[i] Initial models were estimated by a stepwise procedure. The models presented in the table contain only statistically significant (or almost significant) variables at the 5% level. Other variables included in the analysis were occupational status (e.g., farmer, worker, clerk, private entrepreneur, manager, housewife, student, retired) and family income.

a distinct picture of what type of Finns are so much in favor of forest protection that they are willing to compromise on the economic utilization of forests.

The hypotheses on the connection between socio-demographic characteristics and attitudes were only partly confirmed. As expected (Steel *et al.*, 1990; 1994; Kangas & Niemeläinen, 1996), the support for forest protection was linked with youth. Women showed more pro-environmental attitudes than men, which is also in accordance with the previous studies (Mohai, 1992; Steel *et al.*, 1994).

Contrary to the hypothesis, the results suggest that a higher level of education tends to increase support for the economic utilization of forests. The result is similar to that of Bliss *et al.* (1997) who noted that formal education contributes to an increased approval of clearcutting and the use of herbicides. It is possible that education deepens the insight of the economic importance of forests in Finland, or leads to a more favorable attitude towards dominant economic thinking in general. It may also be that environmental concerns depend more on values than knowledge (Steel *et al.*, 1990).

According to the previous studies, urban residents are more likely to support pro-environmental attitudes than rural residents (Lowe & Pinhey, 1982; Steel *et al.*, 1994; Kangas & Niemeläinen, 1996). However, no difference was detected in the forest attitudes of rural and urban residents in this study. This may be because there is obviously no distinct cleavage between urban and rural culture in Finland. Furthermore, environmental deterioration is rather limited even in urban surroundings. The study result is also in accordance with the American study by Bliss *et al.* (1997).

Forest protection was more strongly supported in sparsely populated northern Finland than in more developed and densely populated southern Finland. The result contradicts previous studies (Kangas & Niemeläinen, 1996). The majority of the protected forests are located in northern Finland. It is therefore possible that northern inhabitants consider that the restrictions on timber cuttings maintain or improve the preconditions for tourism.

Similar models were estimated for both multifunctionalists and the indifferent (Table 3 and Appendix 1). Multifunctionalists could not be distinctly identified from other citizens by socio-demographic characteristics. The probability of belonging to this group increased somewhat if the person was female, and more than 30 years old, did not have a college or academic degree, and lived in urban or rural center. In this "favorable" case, the probability of belonging to multifunctionalists was 50%. On the other hand, the assignment to the indifferent was more probable if the person was less than 30 years old, was a manager/private entrepreneur, and did not own forest. The explanatory power of the model was poor.

Forest owners and other citizens

There are about 440 000 non-industrial private forest holdings in Finland (Sevola, 1998). However, there are considerably more persons who own forest.[1] The data of this study suggests that about 850 000 persons own forest, which means that every sixth Finn is a forest owner. This is close to the estimate given by Ripatti (1994).

Forest owners' attitudes towards forestry differed from those of other Finns (Fig. 2, see also Table 3). About half of the forest owners belonged to the supporters of economic utilization of forests while only every third of the non-owners shared this attitude. One fifth of the forest owners supported protection, whereas protection supporters amounted to one fourth of the non-owners. Forest owners supported protection almost as often as other citizens.

Forest owners supported the utilization of forests clearly more often than other Finns. Many forest owners also considered forest protection important. The hypothesis suggesting that non-owners are more pro-environmentally oriented than forest owners (Kangas & Niemeläinen, 1996) was therefore only partly confirmed.

American studies have not reported significant differences between the attitudes of forest owners and other citizens (Bliss *et al.*, 1994; 1997; Bourke & Luloff, 1994). Nonetheless, Bliss *et al.* (1997) found attitudinal differences among forest owners. Differences were detected between timber sellers who used professional forestry assistance, and non-sellers.

The different results for Finland and the USA could be explained by the relatively high frequency of timber sales and the intensity of contacts to forestry extension organizations among Finnish forest owners. It is obvious that the majority of the Finnish forest owners resemble American timber sellers. The average sales interval is only three years in Finland (Karppinen, 1998b), and according to Hänninen (1993), extension organizations reach more than 80 percent of the forest owners during a five-year period. Nevertheless, the primary reason for these behavioral discrepancies rests on landowner objectives. Finnish owners use their forest land clearly more often for timber production than their American counterparts (e.g., Birch, 1996; Karppinen, 1998a).

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1. Forest can be owned either alone, together with the spouse and/or children, or as a member of heirs or family concern.

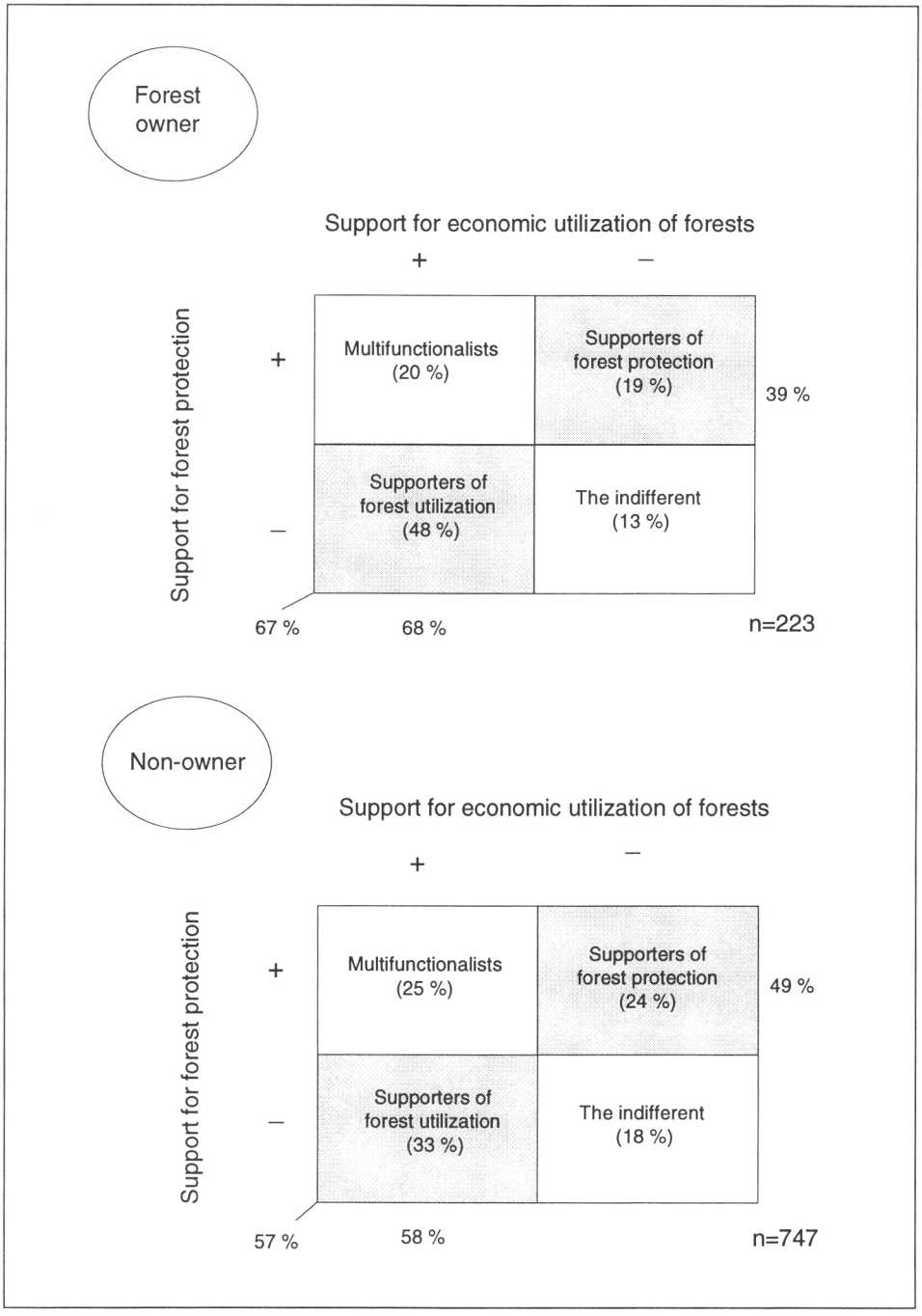

Figure 2. Grouping of forest owners and non-owners by their attitudes towards forestry (+ positive attitude, – negative attitude).

Conclusion

Attitudes and opinions of the public are taken into account in policy-making by inquiries and opinion polls, using various attitude statements in questionnaires. Opinion polls have, nevertheless, been criticized (e.g., Bourdieu, 1979) and the relevance of knowledge concerning specific environmental attitudes has been questioned. Especially, attitude–behavior inconsistency has been considered a major problem in environmental studies (e.g., Uusitalo, 1990; Ungar, 1994). Opinion polls are, however, a channel through which the knowledge of the opinions and attitudes of the citizens can be provided to the decision-makers at a relatively low cost.

This study demonstrates one procedure for overcoming the danger of misinterpretation present in separate analyses of single attitude statements. Multivariate methods were employed to enable the simultaneous analysis of several statements, in order to group persons with distinct and more flexible attitudes towards forest protection and economic utilization of forests. The procedure also allowed the identification of different attitude groups by readily observable socio-demographic characteristics, which increases the utility of the results in environmental decision-making.

Some reservations must be kept in mind when interpreting the results. First, the validity of the attitude statements can be questioned, because only data designed for a different study were available. The wording of the attitude statements can be assessed to be biased in favor of economic utilization of forests. The statements should also have been designed to take into account the owner category of forests in question. For instance, Bliss *et al.* (1997) found differences in the willingness to accept clearcutting in private and public lands. Second, the classification of respondents into attitude groups would be more valid if there had been some external criteria – other questions measuring the same phenomenon – with which the groups could have been compared.

One step further from opinion polls is direct participation. For instance, in the formulation of Finland's National Forest Programme 2010 (Finland's ..., 1999), the public was, for the first time, given the opportunity for direct participation in policy formulation through public forums and via an internet discussion group. This procedure is well in accordance with the forestry principles agreed in UN Conference on Environment and Development in Rio de Janeiro which emphasize opportunities to participate in the planning and implementation of national forest policies (Report..., 1992).

One of the pre-requisites of the effective and useful participation in a public debate is relevant knowledge. The public knowledge of forestry issues is obviously insufficient, and more information should be distributed to the general public. Forestry extension organizations, which have traditionally

concentrated on forest owners, should also serve the public at large. Interaction between professionals and the public should be encouraged. Forestry professionals should extend their expertise to cover not only ecological and economic knowledge but also social and psychological skills.

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Appendix 1.

Probability of assignment (π) to attitude groups by socio-demographic characteristics. The most "favorable" and "unfavorable" combinations of the variables.

Sex Male=1	Age More than 30 yrs=1	Forest owner Yes=1	Education College or Academic =1	Occupation Manager/ private entrepreneur =1	Location of permanent residence Urban or rural center =1	Location of permanent residence Southern Finland =1	Probability of assignment to the group (π),%
Supporters of forest protection							
0	0	–	–	–	–	0	53
1	1	–	–	–	–	1	13
Supporters of forest utilization							
1	1	1	1	–	–	1	68
0	0	0	0	–	–	0	9
Multifunctionalists							
0	1	–	0	–	1	–	50
1	0	–	1	–	0	–	5
The indifferent							
–	0	0	–	1	–	–	39
–	1	1	–	0	–	–	10

Instead of calculating the odds ratios or marginal effects (Hosmer & Lemeshow, 1989; Demaris, 1992) the direct probabilities of the group assignment were calculated. This was carried out by using different value combinations of the socio-demographic variables, as suggested by Roncek (1991). The table indicates, for instance, that the probability of a respondent to belong to the supporters of forest utilization was 68% in the most "favorable" case, i.e., the value combination with the highest probability, and 53% considering supporters of forest protection, respectively.

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