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## Reasoning of family forest owners – survey of forest management and biodiversity protection problems

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### Abstract

This study aimed at figuring out the distributions of spatial and temporal scales of Finnish family forest owners' decisions as well as the relative commonness of various topics and popularity of alternative decision service types. A specific emphasis was given to biodiversity-related decision making from a forest planning perspective. Mail questionnaire data (n=1244 with response rate 59.7%) were analyzed with standard statistical methods. Results show that owners most commonly consider the next year's silvicultural treatments or timber trade from their whole forest holding. Some 40% of owners indicated a willingness to protect some part of their forest holding temporarily. About 10% were ready to protect without compensation, and 30% for compensation. Some 7% would be satisfied with compensation below the economic opportunity cost. The results indicate that Finnish family forest owners would benefit from contextual services that complement the tactical forest plans on a yearly basis. Biodiversity protection and nature-friendly forestry do seem to rise as a topic of notable interest. Game and aesthetic values associate positively with biodiverse stands. To better attract today's diverse forest owners, forest management planning needs to be re-designed towards decision support service modules that respond to the questions arisen in owners' actual decision situations.

**Keywords:** cost-share, decision problems, forest planning, spatial scale, time horizon, voluntary protection

## 1. Introduction

In Finland, there is limited knowledge about how common various decision problems are among family forest owners. Holding-specific forest management planning may partly fail to recognize and grasp the actual decision situations of today's owners with more and more varying lifestyles. This is a potential reason for forest plans to insufficiently assisting owners' decisions and ineffectively promoting national forest policy objectives such as timber supply and biodiversity protection (Hokajärvi et al., 2009).

An ongoing renewal of the Finnish forest planning system from state-subsidized activity to market-driven services provides an opportunity to start pursuing a co-configuration of decision-aid services between forestry experts (service providers) and forest owners (customers) (Tikkanen et al., 2010). This challenging opportunity carries potential for better serving owners' varying needs via adaptable services (e.g. Hujala et al., 2009a; Leskinen et al., 2009). Parallely, research has recently observed some encouraging signs of voluntary biodiversity protection (Horne, 2006; Hujala et al., 2008; Horne et al., 2009) of family-owned forests. It has also been noticed that protection-related consultancy would be most fruitful when integrated with general forestry decision aid (Laitila et al., 2009).

With possibilities related to temporary and permanent protection, bioenergy harvestings, and climate change mitigation (e.g. carbon balance and tree species composition), forest owners now face new kinds of real decision situations. Multiple/joint use of forests often means that owners are to some degree ready to drop, restrain, modify or change timings of cuttings. To help owners make informed decisions, meaningful alternatives should be delivered for their comparison (e.g. Eyvindson et al., 2010).

Forest planners, in turn, can apply various data and communication forms to make owners' considerations and decisions easier. There are, however, knowledge gaps concerning appropriate procedures, even though both owners' objectives and their communication motives have been recently studied in Finland (Hujala et al., 2010). In addition to concrete market-based services, there is a need to design attractive and effective policy instruments and working models.

Objectives of the present study are:

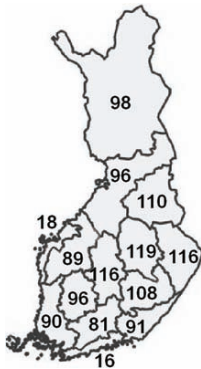
1. To figure out how common various decision situations are among forest owners.
2. To learn about forest owners' views on temporary and permanent biodiversity protection.
3. To inform service providers in designing services that fit owners' most common and most frequent problems.
4. To inform policymakers in actualizing policies in ways that fit forest owners' anticipations.

## 2. Materials and Methods

A mail questionnaire was sent to those 2084 family forest owners who had already answered to an earlier mail questionnaire of the large “*Finnish forest owner 2010*” study (Hänninen et al., 2010). Due to responding to the first questionnaire, the response rate in the latter questionnaire was as high as 59.7% and the number of valid responses was 1244.

In the large forest owner study, a non-response analysis was carried out and in the calculations of its results an appropriate weighting was used so that the responses correspond to the Finnish population of family forest owners. A response analysis of the present data showed a bit lower response rate for female and Swedish-speaking owners. The same weights as above were however used in this study as no other significant differences between the respondents and non-respondents were observed. Respondents represent the owners in continental Finland fairly well (see Fig. 1).

Themes of the survey were forest management decisions, decision service types, biodiversity protection, and owners’ social networks in timber trade (the last theme is not reported in this study). Analysis was performed with standard statistical methods: (classified) response distributions, cross-tabulations, and two sample t-tests. In addition, some results were combined with owner groupings with respect to ownership’s objectives (Favada et al., 2009) and communication motives Hujala et al. (2009b), derived from statement sets to the same respondents in the preceding survey (Table 1; see details of the respective multivariate analyses in Hujala et al. (2010)).



**Figure 1.** Number of valid responses from each of the 13 forestry regions in Finland. The map is based on the locations of the holdings.

**Table 1.** Owner groupings by Favada et al. (2009)(A), and Hujala et al. (2010)(B) applied in the present data and used in the analysis as background variables.

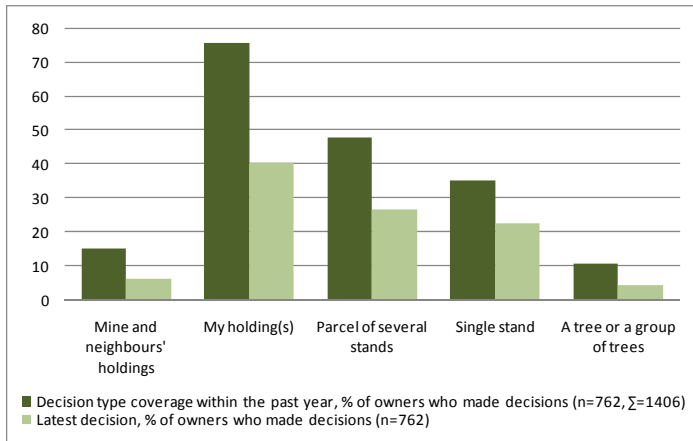
Owner group	Share, % (unweighted)
<b>A) Ownership’s objectives (n=1044)</b>	
Multiobjective owners	33
Recreationists	22
Self-employed owners	16
Investors	16
Indifferent owners	13
<b>B) Decision-making style (n=974)</b>	
Studios learners	41
Self-reliant owners	18
Delegators	20
Deliberate thinkers	21

### 3. Results

#### 3.1 Forest management decisions

Holding-level considerations are both common and frequent (Fig. 2). Thirty-one percent of respondents announced not having made decisions within the past year. Three quarters of the remaining 69% of owners had made holding-level considerations during the past year. Decisions at parcel or single stand-level were much less common. It is notable that both cross-border and sub-stand-level decisions were rare.

When looking closer<sup>1</sup> at the distribution of the spatial scale of the latest decision, holding-level decisions were most frequent among owners with holding size less than 50 ha and parcel-level decisions with holding size more than 50 ha. Studios learners reported parcel-level more than self-reliant owners, who in turn reported more single-stand level decisions.

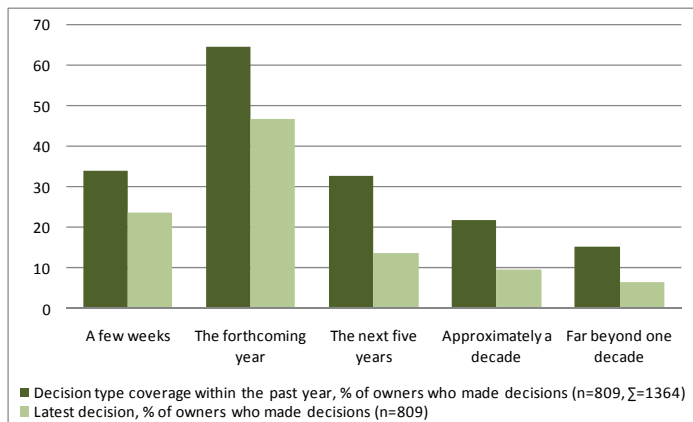


**Figure 2.** Owners' spatial scales of decision considerations over the past year. Owners who did not make any decisions excluded. Dark columns show the commonness of items among owners and they sum up to over 100%, because owners were allowed to tick all options that apply. Light columns show the relative frequencies of items summing up to 100%.

<sup>1</sup> Only statistically significant ( $p < 0.05$ ) differences are reported throughout the study.

In the appearance distribution of the temporal scale of the decisions within the last year, considerations of the next year's activities dominate with a share of more than 60% (Fig. 3). One third of owners who had made decisions had considered a few weeks ahead, as was the case with thinking about the next five years. In turn, 15–20% of owners had had thoughts as far as a decade or more ahead at least once within the past year.

Owners under 58 years of age had more frequently considered the forthcoming year than had owners over 64 years, who in turn had more frequently considered the next five years. Farmers and forestry entrepreneurs had considered the forthcoming year more and the next five years less often than had retirees.



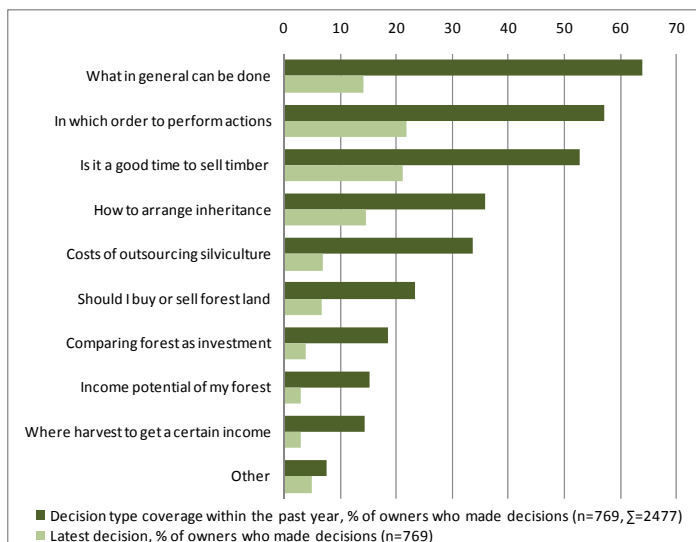
**Figure 3.** Owners' temporal scales of decision considerations over the past year. Dark columns show the commonness of items among owners and they sum up to over 100%, because owners were allowed to tick all options that apply. Light columns show the relative frequencies of items summing up to 100%.

The most common considerations was what in general can be done in the forest, followed by the right order of actions and whether it is a good time to sell timber (Fig. 4.). These three questions had once or more been in minds of over half the owners who had made decisions. Latest decision scores show that the two latter ones were the two most frequent with the share of some 20% of decisions having been made.

“What in general can be done” was particularly considered by small-holding owners, recreationists over investors, and new owners with less than

five years of ownership. The order of actions was especially contemplated by the younger segment of owners, studious learners over delegators, and farmers and forestry entrepreneurs over retirees.

Results also show that organizing inheritance and learning about the costs of outsourcing silviculture were rather common topics with a coverage above one third of respondents. Income- or investment-related ponderings were in turn rather rare. Other than pre-defined optional questions having been thought of (n=60) were e.g. voluntary protection, general future of forest ownership, young stand management, and energy wood trading.



**Figure 4.** Questions having been thought of within the latest year. Dark bars show the commonness of items among owners and they sum up to over 100%, because owners were allowed to tick all options that apply. Light columns show the relative frequencies of items summing up to 100%.

Owners judged a free-formed discussion with a forestry expert as the most useful decision-service type with half of owners rating it as either rather or very helpful in their latest decision problem (sum count of values 3 and 4 in a four-point response scale; Table 2). Up-to-date data on forest and its opportunities were rated second.



Free-formed discussion was in particular appreciated by the post-war baby-boom generation (age 58–64 years) and recreationists and investors as well as studious learners over self-reliant owners. Up-to-date forest data were especially appreciated by large-holding owners, investors, studious learners, and delegators. Independent information of timber market was valued highest among large holders and farmers and forestry entrepreneurs.

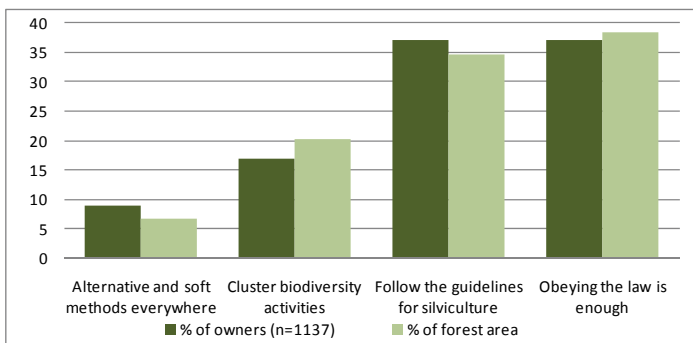
**Table 2.** Perceived helpfulness of five optional decision service types: rather or very helpful services in the latest decision problem.

Service option	Share of perceived helpfulness	
	% of owners (n=700-762)	% of forest area
Free-formed discussion with an expert	50	52
Up-to-date data of forest and its opportunities	43	48
Planning of concrete actions (timber trade etc.)	38	38
Independent information of timber market	35	38
Contact information of forestry professionals	27	27

### 3.2 Ways and means to protect biodiversity on owners' own forests

Nine percent of owners expressed interest to treat all their forests in a way that better contributes to biodiversity, and 17% would preferably cluster biodiversity-friendly activities to certain stands/areas which probably often have smaller economic importance (Fig. 5). The majority (74%) wants to stay on the level of what the forest law requires or what the guidelines for good silviculture suggest.

Analysis of background variables revealed that self-reliant owners significantly more often selected alternative and soft methods everywhere than did other decision-making groups. Clustering biodiversity-friendly activities was particularly favored by large-holding owners. Retirees selected only actions that are in line with the forest law more often than employees, who were more often willing to do more than the minimum.



**Figure 5.** The preferred way to handle biodiversity protection in respondents' own forests.

Some 11% of owners would protect the most valuable biodiversity stand/parcel from their holding temporarily for free and approximately 7% with a reduced compensation (Table 3). Corresponding figures for a permanent protection (donating/selling the land to the state or establishing a private protection zone) were clearly smaller, only 6% and 3%. Protection willingness for free was on the same level for small and large holdings, but owners of large holdings were a bit more interested in protecting for compensation than were small-holding owners.

While a small share of owners was ready to participate to a protection contract with a compensation demand smaller than the economic opportunity cost, a similar or a bit larger number (some 9% with temporary and 8% with permanent protection) asked for a compensation above 100%, which reflects a strong intrinsic value of ownership among these owners.

**Table 3.** Owners' willingness to protect their biodiverse stand temporarily and permanently: shares for protecting for free, for a compensation, with different compensation demands and not at all.

Protection type	Temporary, 20 years		Permanent		
	% of owners (n=1140)	% of forest area	% of owners (n=1089)	% of forest area	
<b>Response category</b>					
Yes, for free	11	11	6	6	
Yes, for compensation	30	34	25	27	
	0-50	0.6	0.4	0.3	0.1
	50-80	2.1	2.6	1.0	0.8
Compensation demand, % of full compensation	80-100	4.0	5.6	1.5	2.2
	<b>100</b>	<b>5.1</b>	<b>7.4</b>	<b>5.0</b>	<b>6.6</b>
	100-120	3.8	3.2	3.3	3.6
	120-150	2.1	2.7	1.6	2.4
	over 150	2.9	2.3	3.5	2.2
	cannot say	9.6	9.6	8.7	9.0
No, not at all	59	56	69	67	

Considering an overlapping multiple use of forest, respondents' perceptions of a biodiverse stand were queried. It was assumed that if a biodiverse stand produces also other benefits to the owner, treating the stand according to the owner's wishes simultaneously benefits biodiversity.

Nearly half of the owners assessed a biodiverse stand to be clearly or slightly better habitat for game species (Fig. 6, part A). In addition, more than 40% thought that a biodiverse stand is better for recreation and that there is a stronger "true forest" feeling compared to a stand that is treated normally according to the silvicultural recommendations.

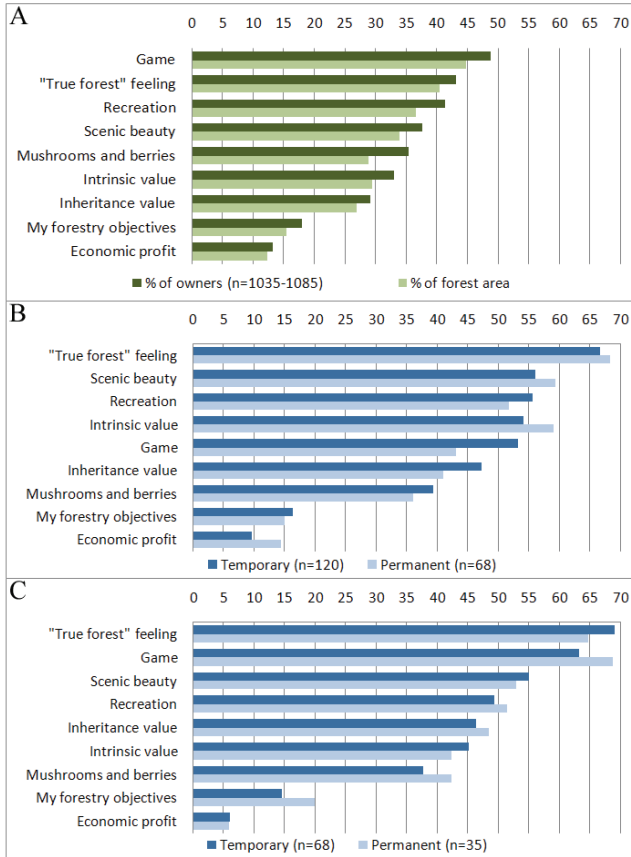
Economic profit and biodiversity, in turn, do not contribute each other according to the majority (86%) of respondents (Fig. 6, part A). Owners of small holdings considered biodiverse stands more often suitable for overlapping multiple-use than did the owners of large holdings.

Owners who revealed a willingness to protect their stand for free showed clearly higher scores for various aesthetical and multiple use benefits on a biodiverse stand than did owners in general (Fig. 6, part B). When willing to protect for free, temporary protectors valued highest "true forest" feeling, scenic beauty, and recreational value, while permanent protectors valued highest "true forest" feeling, scenic beauty, and intrinsic value (feeling good when owning a nice forest). With those owners who were willing to protect with a reduced compensation, in turn, game-

friendliness of the habitat scored notably high both with temporary and permanent protection (Fig. 6, part C).

Game habitat value was perceived on a biodiverse stand particularly often by recreationists (57%), self-reliant owners (57%), and retirees and salaried employers (53/51%) over farmers and forestry entrepreneurs (38%). “True forest” feeling was perceived particularly by recreationists (60 %) over the other objective groups, and distance owners and new owners over their respective counterparts. This feeling also became more popular along with the owner’s educational level.

Recreational value in a biodiverse stand was especially perceived by recreationists (52 %) over the other objective groups, distance owners (49%) over near-the-holding dwellers, and salaried employees over both retirees and farmers and forestry entrepreneurs. Also small-holding owners and self-reliant owners perceived recreational overlapping value rather often.



**Figure 6.** Various perceptions associated with a biodiverse stand: share of those who either fully or rather much agree with each related statement among: all respondents (A), those who are willing to protect their forest stand(s) for free (B), and with a reduced compensation (C).

#### 4. Discussion and Conclusions

According to the results of this study (Figures 2 and 3), yearly-based decision aid services which extend over the owner's whole forest holding are needed. For these considerations, especially the "right" order of treatments of stands is asked for (Fig. 4). From a forest planning perspective

and in comparison with current practices, this means a shift towards operational planning, where more accurate timings of treatments are suggested for all stands that could be managed during the forthcoming planning period. This kind of service would especially fit the younger segment of owners. These are important messages for both service designers and forest planning methodology developers. Internet-supported consultation services could be of help in yearly-based decision-making, particularly for joint ownership holdings (Eyvindson et al., 2010).

Due to the high age of contemporary forest owners in Finland, inheritance arrangements have been relatively commonly considered, as shown in Fig. 4. It is thus evident that inheritance consultancy will remain as an important decision-support type. At least a listing of available alternatives and preferably also calculations that describe their various impacts would be needed among a large number of elderly forest owners. Retirees and elderly owners appeared generally rather conservative: they were more often than others satisfied with tactical planning and the operational level following the forest law, i.e. without a great interest towards biodiversity protection or operational planning services.

The needed service options (Table 2) revealed that many owners value free-formed discussions with experts, which confirms the result by Hujala et al. (2007). Particularly the owner groups of investors and recreationists as well as new forest owners would need this kind of service. It is possible that the forest management situations of recreationists are so case-specific that numerical planning products based on predefined calculation principles seldom answer to the questions they have. In turn, calculative services based on up-to-date forest data would be beneficial to large-holding owners, who would also be able to pay for these services.

Small-holding owners appreciated multiple-use and communicative services more than did large-holding owners. They seem to place higher "soft" values on their forest (due to smaller economic significance or to reflect hobby ownership). However, a question arises: what might be their willingness to pay for communicative decision aid, which will be expensive per hectare as cost-corresponding market-driven service?

According to the preferred ways to handle biodiversity protection (Fig. 5), a quarter of owners could be interested in biodiversity-related, holding-specific planning services (e.g. Kurttila et al., 2008). This observation is well in line with e.g. the results of von Boehm (2008), who recorded even a higher demand towards so-called "green forest plans". The herein observed general interest towards biodiversity protection among forest owners was on the same level as in the study by Horne et al. (2009). Also the findings of owners' self-active protection motivations by Laitila et al. (2009) gain support from the present results. In sum, the observed owner segment

potentially keen on biodiversity-oriented topics is sufficiently large (~20-30%) for specialized planning services.

Owners were more willing to do temporary biodiversity protection (in this questionnaire 20 years) than to do permanent protection. Owners may not want to bind their own or their inheritors' hands. About 18% of owners would be willing to protect a part of their forest by reduced compensation demands (temporarily for free and under 100% demand in Table 3). This group, in particular, should be reached to improve the cost-efficiency of voluntary protection (although it here stays unknown how many of these owners own forests that actually have notable ecological protection values).

Hypothetically in the Finnish case, if e.g. one fourth of these owners would have a suitable forest stand of averaging, e.g. 1 ha, this would mean ( $\frac{1}{4} * 18\% * 345,000 \text{ holdings} * 1 \text{ ha} \rightarrow 15,525 \text{ ha}$ ) a possibility to temporarily protect over 15 000 hectares of forests with reduced compensations. The total monetary value of owners' own contribution to the protection schemes would be around €10 million. In these cases also the administrative costs (negotiations etc.) would possibly be lower due to the positive attitudes these owners already have towards protection.

One important future development aspect would thus be to adopt a market-oriented approach to biodiversity protection, where the limited state budget could be used more cost-efficiently. On the other hand, an increased flexibility in the terms of the protection contracts would further enlarge these areas and/or increase the share of voluntary protectors. These impacts could also be achieved by integrating game management aspects in voluntary protection schemes, since the perceptions of a good game habitat and of a biodiverse forest seemed to associate with each other among (protection-positive) owners (Fig. 6).

The true demand of the above discussed forest management and biodiversity protection decision aid services should be investigated in more detail in further marketing and/or case studies (e.g. choice experiments), where the above products and services would have realistic price tags. Other tasks for further research would be the development and testing of solutions for devising and presenting the recommended order for cuttings and silvicultural work (based on, e.g. the owner's economic and recreational objectives). Interesting observations relating to the functioning of practical policy instruments could in future be achieved by action-researching biodiversity-centered forest planning, and by incorporating biodiversity protection values and holding-level opportunity costs (see Kurttila et al., 2006) into further compensation-demand studies.

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