Forest owners and attitudes towards conservation policy in Sweden

Miguel Rivière

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Abstract

In 1993, Sweden issued a new forestry act, which gives equal importance to timber production and nature protection, and uses a wide range of policy tools, known as the Swedish forestry model, to achieve its goals. However, there is evidence that the Swedish forestry model does not perform as well as expected, especially regarding the involvement of Non Industrial Private Forest owners (NIPFs) in conservation. To better understand this situation, this thesis project investigates NIPFs' values, backgrounds and attitudes towards conservation and the Swedish forestry model by realizing an owner typology. Using data from a national survey on NIPFs, Principal Component Analysis (PCA) and the K-means clustering method are used to identify groups of NIPFs based on their reasons for owning forests. Background information about the owners and their forests are compared among owner groups, as well as their attitudes towards conservation, towards the Swedish forestry model and their knowledge of environmental issues. Results reveal the existence of five owner groups with significantly different motivations and backgrounds. Environmental values constitute the main factor that differentiates NIPFs regarding their motivations, while economic and traditional values influence their attitudes and knowledge the most. Overall, the Swedish forestry model is well accepted by all owners, but differences appear regarding acceptance of state intervention, individual commitments to conservation and knowledge of environmental issues.

Résumé

En 1993, la Suède a mis en place une nouvelle loi forestière avec deux objectifs de même importance: la production de bois et la protection de l'environnement. Le nouveau système, connu sous le nom de *modèle suédois pour la gestion forestière*, diminue le nombre de régulations et introduit des instruments volontaires et non-obligatoires. Malgré le nouveau système, l'implication des petits propriétaires privés (NIPFs) dans la protection de l'environnement reste faible, et moindre que pour les propriétaires publics et industriels. Afin de mieux comprendre cette situation, les motivations des NIPFs, leurs caractéristiques (âge, niveau d'études, emploi, etc.) ainsi que celles de leurs forêts sont analysées et mises en relation avec leurs opinions vis-à-vis de la protection de l'environnement et du modèle suédois. Utilisant les données récoltées lors d'une enquête nationale, une typologie des NIPFs, basée sur leurs motivations et les valeurs qu'ils accordent à leurs forêts, est réalisée par le biais d'une Analyse en Composante Principale (PCA) et de la méthode des K-means. Les résultats révèlent l'existence de cinq groupes de NIPFs aux motivations et caractéristiques différentes. La présence ou non de valeurs environnementales chez les propriétaires est le principal facteur permettant de les différencier. Cependant, ce sont les valeurs économiques et traditionnelles qui influencent le plus leurs opinions. Globalement, le modèle Suédois est bien accepté par les NIPFs, mais des différences entre les groupes apparaissent vis-à-vis de leurs opinions sur le rôle de l'Etat et des autorités ainsi que sur la place à donner aux engagements personnels dans la protection de la nature. Le niveau de familiarité des NIPFs vis-à-vis des problématiques environnementales varie également entre les groupes. A cause des intérêts et opinions divergents des NIPFs, des instruments politiques diversifiés doivent être utilisés afin d'être efficace auprès de tous les groupes de propriétaires.

Sammanfattning

Sverige utfärdade en ny skogsvårdslag 1993 där virkesproduktion och miljömål likställdes. Ett brett spektrum av politiska instrument används för att uppnå uppsatta miljömål, under det gemensamma namnet Svenska modellen för skogsbruk. Utvärderingar visar att svenska modellen för skogsbruk inte fungerar lika bra som förväntat, särskilt privata skogsägares (NIPF) medverkan i naturvårdande åtgärder. För att bättre förstå denna situation, skapar detta examensarbete en ägartypologi genom att undersöker privata skogsägares

värderingar, bakgrund, attityder till naturvård och attityder till svenska modellen för skogsbruk. Med hjälp av data från en nationell undersökning riktad till privata skogsägare identifieras kategorier av ägare baserat på syfte med skogsägande, med hjälp av en "Principal Compontent Analysis (PCA)" och en klustermetod (K-means clustering method). Bakgrundsinformation om ägare och deras skogsinnehav jämförs därefter mellan kategorierna. Även attityder till naturvård, till svenska modellen för skogsbruk och kunskap om vanliga begrepp kring naturvård jämförs mellan kategorierna. I resultaten identifieras fem ägarkategorier med signifikant olika motiv till ägande och bakgrundsfaktorer. Miljövärden utgör den viktigaste skillnaden mellan ägarkategorierna, medan ekonomiska och traditionella värderingar påverka attityder och kunskap. Sammantaget är den svenska modellen för skogsbruk väl accepterade av alla ägarkategorier, men skillnader finns i godkännande av statligt ingripande, enskilda åtagande för bevarande och kunskap om miljöfrågor.

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1. Introduction

Recent trends in Swedish forestry

Forests are a defining feature of the Swedish landscape. More than two thirds of Sweden are covered in forestland (National Forest Inventory, 2015), and forestry is one of the country's leading industries (KSLA, 2015). However, there is evidence that Sweden is today facing increasing threats to the environment (Skogsstyrelsen, 2015; Westling, 2015). Biodiversity is being lost, habitats are being destroyed, and, while many red-listed species and key habitats happen to be located in the forest, forestry is partly responsible for the situation (Jonas et al., 2015; Sundberg et al., 2015).

Non-industrial private forest owners (NIPFs) are central to Swedish forestry .They own half of all forestland in Sweden, are the main source of fellings and timber for the industry (KSLA, 2015; Skogsstyrelsen, 2015) and most habitats with high natural values are located on their land (Skogsstyrelsen, 2015). As a consequence, NIPFs are a key factor which must be taken into consideration when talking about conservation in Swedish forests.

Aware of the worsening environmental situation, Sweden revised its conservation policy and passed a new Forestry Act in 1993 (KSLA, 2009; Nylund, 2009). While previous policies focused mostly on timber production, the new legislation marked a notable paradigm shift: nature conservation was given equal status to timber production (KSLA, 2009; Lindahl et al., 2015; Skogsstyrelsen, n.d.). The new system, often called the Swedish forestry model (Fig. 1), is based on a pyramid of tools which comprise formal, mandatory protection schemes as well as day-to-day considerations of environmental issues to be taken in forest management (KSLA, 2009).
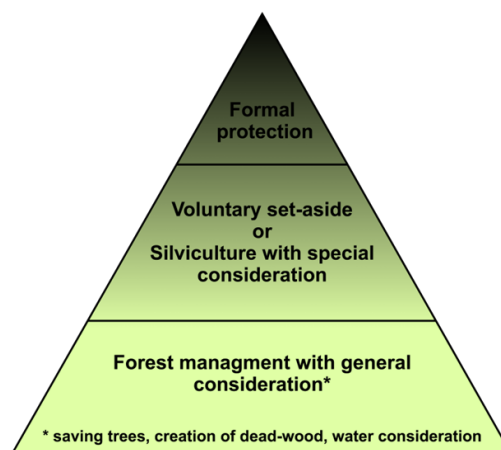
Figure 1 - *The Swedish forestry model*

This new range of policy tools is particularly interesting when thinking about NIPFs, who happen to be impacted by all three levels of the Swedish forestry model. While formal protection comes from the authorities, the way voluntary practices are carried out relies entirely on the owner's will. Consequently, because NIPFs are the most important owner group in Sweden, their involvement in voluntary practices, general considerations especially, is likely to heavily influence the future state of forests. Understanding their relation to the Swedish forestry model is of crucial importance to improve conservation in Swedish forests.

The problem is, recent data show that NIPFs get involved less than other owners in voluntary conservation practices, tend to perform silvicultural operations harmful to the environment more often, and a significant part of them do not carry out general considerations (Fig. 2). Even more, in recent years, this trend has been worsening (Skogsstyrelsen, 2015).
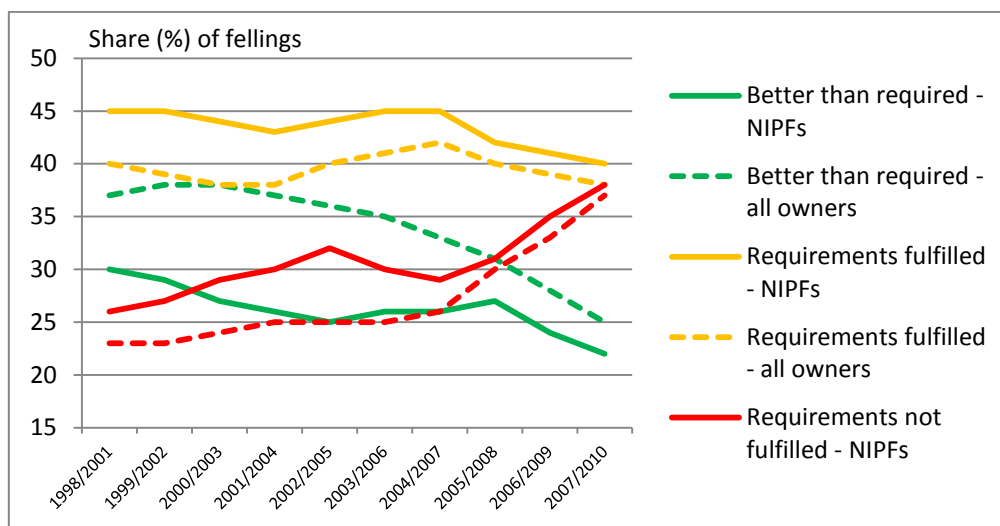
Figure 2 - *Fulfilment of environmental requirements while felling over time* (Skogsstyrelsen, 2015)

The importance of attitudes to understand NIPFs' behaviour

This trend leads to two major questions: why is Swedish conservation policy not working as well as expected, and why do NIPFs have such a behaviour regarding the new policy? At its base, forest management practices depend on the owner's goals, which in turn are determined by the owner's values and background (e.g., Hallikainen, Hyppönen, Pernu, & Puoskari, 2010; Ingemarson, 2006; Karppinen, 1998; Kuuluvainen, Karppinen, & Ovaskainen, 1996). As explained by Ajzen (1985) in his Theory of Planned Behaviour (ToPB), one's attitudes towards a certain behaviour are of crucial importance when trying to understand and predict the behaviour itself. Attitudes, which reflect one's opinions, are in turn based on one's beliefs, values and background.

Applied to NIPFs, this means that their motivations and personal backgrounds must be studied in order to solve the problem and answer the aforementioned questions. Some studies have shown that owners' values have been changing recently, and that NIPFs with new backgrounds have become more numerous (Ingemarson, 2006; Wiersum et al., 2005). A study on NIPFs' attitudes and backgrounds is necessary to understand their behaviour, their relation to the new policy and the results it has produced.

Purpose of the thesis

For all those reasons, this thesis focuses on analysing NIPFs' values, backgrounds and attitudes towards conservation. The thesis has several purposes:

1. Getting a deeper understanding of the values which are important to Swedish NIPFs, and at eliciting possible relationships between these values and the owners' backgrounds.
2. Analysing NIPFs' general attitudes towards conservation in general and the Swedish forestry model for conservation in particular.

3. Creating an owner typology based on NIPFs' reasons for owning forests. More than a method used for the two previous purposes, the owner typology is a goal in itself since it provides a baseline for future studies regarding NIPFs in Sweden.

This will give a better picture of who NIPFs are, what motivates them and why the aforementioned trend in NIPFs behaviours has been observed. The results will be used as part of a broader project, which aims at bringing a background for evaluating Swedish forest policy based on an analysis of NIPFs' behaviours.

The approach I develop in my thesis is based on exploratory statistics. Indeed, the project uses data from a national survey on NIPFs whose results had just been received at the moment this thesis project was started. Because several years of research will be based on this large and yet unexplored dataset, an exploratory approach which aim at uncovering potential patterns and interrelationships within the data will be useful for future analyses.

Using data from the survey, a forest owner typology based on the owners' reasons for owning forest is created. Forest owner typologies are a useful tool for summarizing information about forest owners when a lot of data is available. Using Principal Component Analysis (PCA), the main values which differentiate NIPFs from one another are extracted. A clustering algorithm is then used to form owner groups based on the values NIPFs share. The background of owners within each owner group is then analysed, as well as their attitudes towards and knowledge of conservation and conservation policy. Comparisons between groups are made using statistical tests.

While another owner typology has already been made in Sweden, owners' values change over time, and a new study such as this one will give insight about this evolution. What's more, this study aims at analyzing attitudes based on the typology, and as such goes further than only creating a typology.

2. Background of the study

2.1 Forests and forestry in Sweden

In this first part, I give information about forestry in Sweden, and central place of NIPFs is discussed.

2.1.1 Swedish forests

2.1.1.1 General facts about Swedish forests

In Sweden, forests constitute the main land use. Out of the 40.8 million hectares (Mha, see Fig. 3) of land in Sweden, 68% (28Mha) are covered by forestland. This forestland is divided into two categories: productive forests (23Mha, 56%) and non-productive forests (5Mha, 12%). Sub-mountain forests and other woodlands constitute separate categories which account for an additional 3.1 Mha (7.5%) (National Forest Inventory, 2015).
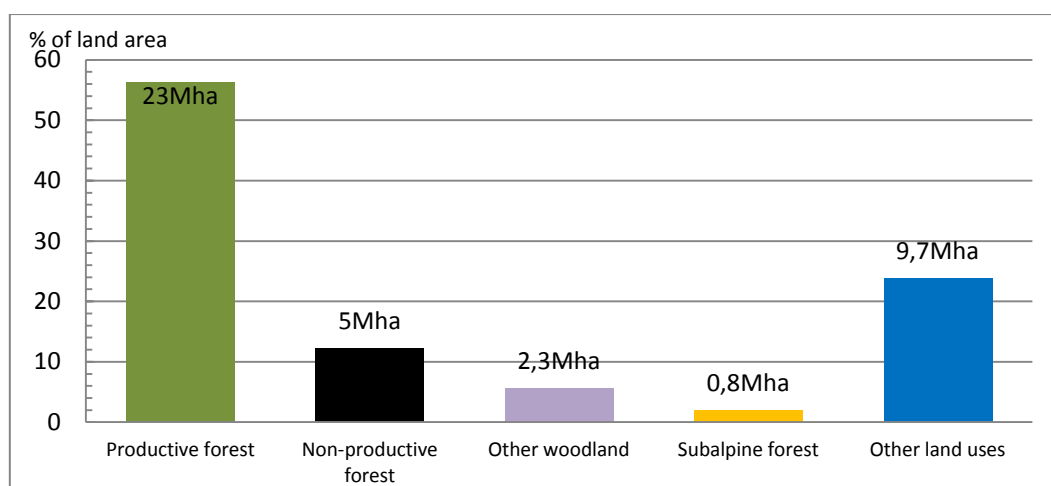
Figure 3 - *Forests and woodlands land uses in Sweden*

Sweden has a climate ranging from nemoral in the south to boreal in the north. The nemoral climate is characterized by moderate temperatures, and frost consistently occurs in winter. The boreal climate is colder, with shorter summers and longer winters. The southern half of the country has an intermediate climate called the boreo-nemoral climate, while the mountain areas in the west have an north alpine climate which is similar to the one found in the Alps, but at lower altitudes (Bogers, n.d.; KSLA, 2015). Sweden is also characterized by nutrient deficient soils (KSLA, 2015).

These conditions affect tree species diversity and repartition in Sweden. Three species account for over 90% of the total standing volume in Swedish forests (see Fig. 4): Scotts pine (*Pinus silvestris*), Norway spruce (*Picea abies*) and Silver birch (*Betula pendula*) (National Forest Inventory, 2015). The remaining species are mostly oak species (*Quercus sp.*), the European beech (*Fagus sylvatica*), the black alder (*Alnus glutinosa*) and the European aspen (*Populus tremula*). Most broadleaf forests are located either in the southern part of the country, where the climate is more favourable, or in the mountainous areas of the west. Their share has been increasing since the 1980s (National Forest Inventory, 2015; Skogsstyrelsen, 2015).
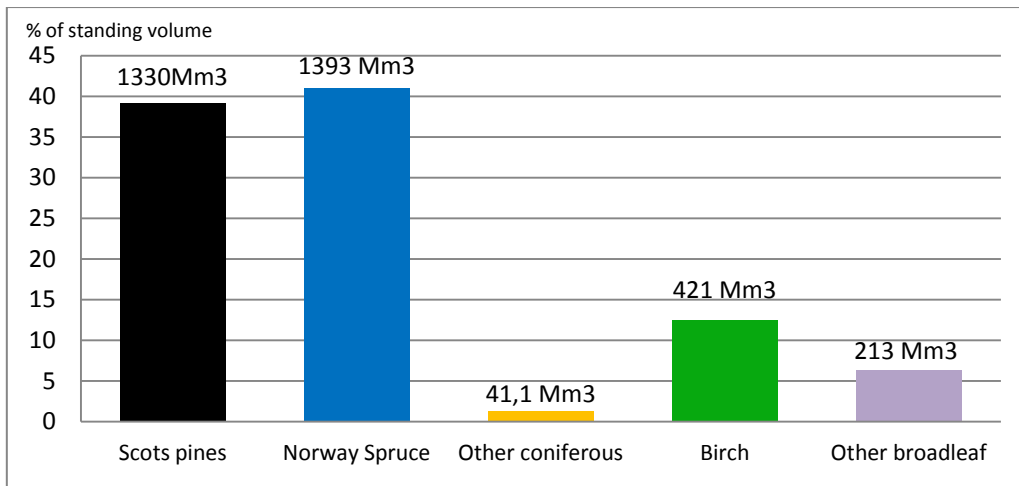
Figure 4 - *Repartition of the standing volume in Swedish forests*

Old forests, defined in the National Forest Inventory as forests older than 120 years and 140 years in the nemoral and boreal zones respectively, are quite rare in Sweden. They are mostly found in the mountainous regions along the border with Norway. There, they often represent more than 20% of the forest area which does not belong to parks and reserves (National Forest Inventory, 2015).

2.1.1.2 Ownership structure

In Sweden, 81% of all forestland is privately owned, and the main owner category is private owners (50%, see Fig. 5). In this case, the land is owned either by an individual person (sole ownership), or by a group of people (shared ownership). This represents over 200 000 owner: NIPFs are a very important factor in Swedish forestry. One quarter (25%) of the forest is owned by private companies, which are only a few in numbers. Other private owners include the church of Sweden and associations. The state owned company, Sveaskog, owns 14% of the forest area, and is the main public owner (KSLA, 2015).
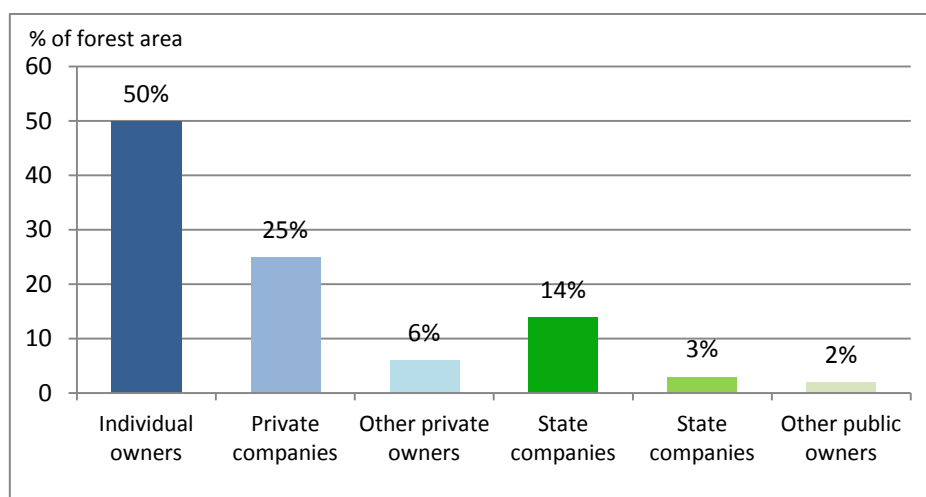
Figure 5 - *Ownership structure for forestland in Sweden*

2.1.2 The forestry sector in Sweden

2.1.2.1 Silvicultural system, harvests and main products

The main silvicultural system in Sweden uses even-aged monocultures. It is a cyclical process, where forests are first planted or naturally regenerated. While the forest is growing, several thinnings are performed, and the forest is finally harvested by a clear-cut. Most disturbances are controlled and reduced, such as forest fires, pests and diseases (KSLA, 2015; Skogsindustrierna, 2014).

The standing volume has been increasing consistently over the last century, and is now 85% higher than it was in 1923 (KSLA, 2015). Wood harvest stays lower than forest growth: in 2014, an annual cut of 82 million cubic metres (Mm^3) was performed, while annual the mean increment for 2010-2014 is of 123 Mm^3 per year (National Forest Inventory, 2015). The main source of wood is final felling, followed by thinning. More than half of the harvested volume comes from non-industrial private owners, which stresses their importance once again, while private companies represent the second source of wood fellings (Skogsindustrierna, 2014).

Regarding certification, 12Mha are FSC certified in Sweden, and 11.3Mha are PEFC certified: this represents more than 60% of all forestland in Sweden (some properties are certified under the two schemes) (KSLA, 2015).

2.1.2.2 Forestry within Swedish economy

The forestry sector is very important for Sweden's economy: it accounts for between 9 and 12% of industrial jobs, sales and added value in Sweden (KSLA, 2015), and represents 55 000 employments (Skogsindustrierna 2014). It is mostly directed towards exports: for instance, out of the production of paper and pulp, 90% is destined to foreign markets, while 75% of sawn-wood is exported (KSLA, 2015; Skogsindustrierna, 2014). Exports in 2014 were valued to 124 billion SEK (Skogsindustrierna, 2014).

Forestry also contributes to Sweden's trade balance and is one of Sweden's most important sectors in value. Especially, Sweden's trade balance for forestry products is largely positive, with exports being more than three times as important as imports (KSLA, 2015). As a whole, exports linked to forestry represented 11% of all Swedish exports in value in 2013 (Skogsstyrelsen, 2015).

Finally, Sweden holds a dominant place on the global wood market. As shown by Fig. 6, despite representing less than 1% of the world's total forest area, Sweden is a very important exporter of wood products, especially in paper (9% of world's exports) and sawn wood (11% of world's exports). When compared to other countries in terms of quantity of wood products exported, Sweden ranks 3rd overall, behind Canada, the USA, and ahead of Finland (KSLA, 2015; Skogsindustrierna, 2014).
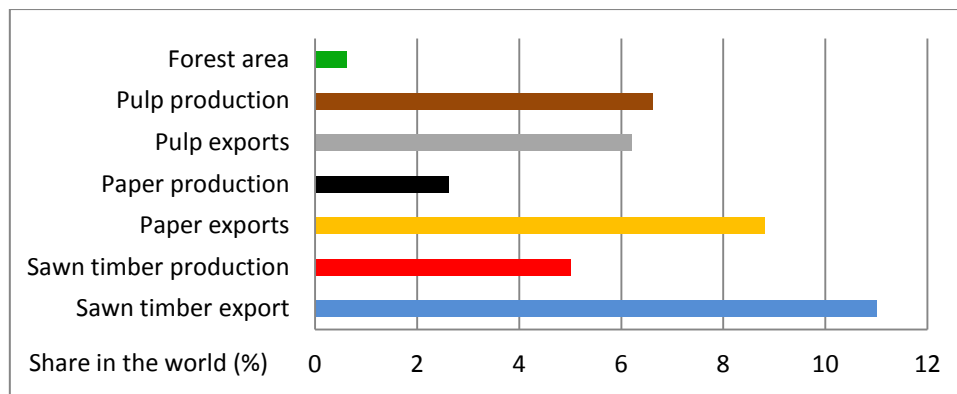
Figure 6 - *Share of Sweden's forestry sector in the world* (Skogsindustrierna, 2014)

2.1.3 NIPFs in Swedish forestry

The average size of a forest owned by an NIPF is 50 ha, and forest is usually part of a farm with both agricultural and forestry activities. Three quarters of NIPFs are older than 50 years old, and there are more male than female owners (Skogsstyrelsen, 2015). Single owners own 59% of forests, while two or more owners own other properties jointly. 64% of properties are locally owned (KSLA, 2015; Skogsstyrelsen, 2015). Around 50% (90 000 properties) of NIPFs belong to a forest owner association, which aims at giving them a stronger position on the market, as well as provides them with management advice and services (KSLA, 2015). Regarding timber production, NIPFs represented 60% of all fellings in the period 2010-2014 (Skogsstyrelsen, 2015), making them the first source of timber in Sweden.

2.2 Conservation in Swedish forests

In this section, we will see that Swedish forests are confronted to environmental issues, namely the erosion of biodiversity and habitat destruction. The Swedish forestry model addresses these issues with a pyramid of tools aimed at forest owners. NIPFs are central to this question, but there is evidence that their involvement in conservation could be improved.

2.2.1 Conservation issues in Sweden in relation with private forest owners and forestry

2.2.1.1 Red-listed species

Red-listed species are species which appear on the *International Union for Conservation of Nature's red list of threatened species* (IUCN, 2015). The red list categorizes species according to their risk of becoming extinct, and comprises seven main categories, ranging from least concern to extinct. It is based on scientific data and criteria for evaluating each species' status. When data is not available, the species falls into the data deficient category. The red list of threatened species is a tool aiming at monitoring the evolution of species' threat statuses as well as facilitating the creation of conservation policy (IUCN, 2015).

The list of red-listed species is a convenient tool to monitor the changes in species conservation in Sweden (Westling, 2015). Even though the number of threatened species has been increasing (see Fig. 7), analyses report that the inclusion of new species in the study accounts for a big part of it. In addition to that, classification methods have changed over time. Reports actually point out that there is little change over the years. However, forest is the most threatened environment in number of red-listed species in Sweden: 53%

of threatened species live in forest environments, and 43% need the forest to survive. Most of these are fungi, plants and beetle species (Jonas et al., 2015; Sundberg et al., 2015; Westling, 2015).
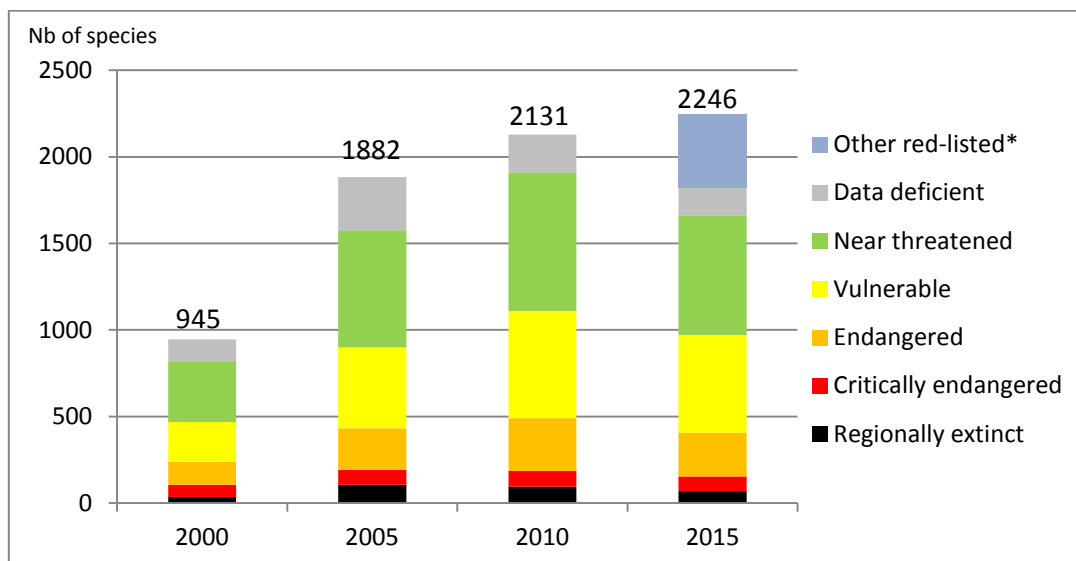
Figure 7 - *Evolution of red-listed species' status in Sweden* (Skogsstyrelsen, 2015; Westling, 2015)

* Before 2015, all red-listed species occurring in forests appeared in the data. In 2015, only those which require a forest habitat to survive are categorized. The "other red listed" category comprises all other species who occur on forestland and are red-listed. They may belong any of the red-listed categories.

2.2.1.2 Key habitats

Key habitats (in Swedish, Nyckelbiotoper) are habitats which have a high conservation value: they are defined as critical for endangered species, which they usually host. More than 50 different key habitat types have been defined, and inventories have been carried. Advice on how to preserve key habitats are given to the landowners (Skogsstyrelsen, 2015). Today, there are approximately 100 000 identified key habitats, which together represent 1% of Sweden's forest area. Most key habitats are protected, either through voluntary protection scheme originating from the owner, or through mandatory schemes such as nature reserves (see section 2.2.2.2 for more details about those tools) (Skogsstyrelsen, 2007). Forest key habitats belong to a broader range of habitats, called sensitive habitats, which can also be classified as such because of high cultural or historical value. They require special care while performing forestry operations (Skogsstyrelsen, 2015).

2.2.2 The Swedish forestry model: a pyramid of tools

2.2.2.1 The Swedish forestry model for forestry

The Swedish forestry model for forestry was established in 1993 with the writing of a new forestry act. Historically, Sweden had had strong regulations for forestry with an emphasis on wood production. The new forestry act marked a shift in Swedish forestry as it focused on two equal goals: an economic goal and an

environmental goal in order to get a balanced and sustainable forest management. It decreased the amount of regulations and introduced the concept of "freedom with responsibility" for forest owners (KSLA, 2009) Its approach can be described as holistic as it integrates broader issues compared to the previous system (Lindahl et al., 2015).

Regarding the economic goal, several guidelines have been introduced for forestry operations: limitation of clear-cut areas, mandatory regeneration after felling, etc. The environmental goal comprises three main parts (Fig. 1, in the introduction) (KSLA, 2009; Lindahl et al., 2015):

- General considerations, which are measures in favour of the environment that owners should take in their forest management.
- Voluntary measures of protection, which does not lead to formal protection (i.e., no contract is involved). This comprises voluntary set-aside areas and special considerations in silvicultural activities, to be taken when an area has a high natural value. They belong to the "freedom with responsibility" concept of the forest act, and are the owner's own responsibility.
- Formally protected areas, where forestland is set-aside and protected through an agreement involving the competent authorities.

A policy goal to be reached was created under the name of "levande skogar" (sustainable forests), which aimed at, among other things, reaching 1,2Mha of formally protected areas and 0,7Mha of set-asides on productive forestland (KSLA, 2015; Lindahl et al., 2015). In addition to the formally protected areas, all unproductive forest land (14% of Sweden's forests, see Fig. 8) is protected through the 1979 Forestry act (KSLA, 2015; Skogsstyrelsen, 2015).

The Swedish forest agency (in Swedish, skogsstyrelsen) is in charge of enforcing and monitoring forest policy. It also provides training and advice related to forestry, and is in charge of environmental issues regarding forests. The Swedish environmental protection agency (in Swedish, naturvårdsverket) is in charge of environmental issues in general (KSLA, 2009; Naturvårdsverket, 2015; Skogsstyrelsen, 2015).

Even though the Swedish forestry model gives economic and environmental goals equal importance, it is criticized for still putting a stronger emphasis on wood production, which is mostly due the country's past forestry practices and the economic importance of forestry to the Swedish economy (Lindahl et al., 2015; Malin, 2011).

As a result of this model which combines different levels of protection, 25% of all Swedish forests benefit from some level of protection as shown in Fig. 8. Unproductive land is the main category of protected forests. Outside of unproductive forests, formal protection schemes are more developed than voluntary set-asides.
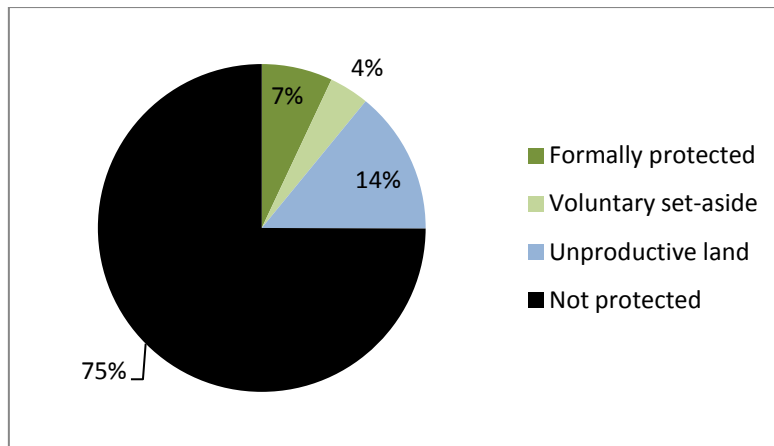
Figure 8 - *Protected forest land in Sweden* (Skogsstyrelsen, 2015)

2.2.2.2 Formally protected areas

<u>a/Nature reserves (in Swedish, naturreservat) and parks: a mandatory protection scheme</u>

Nature reserves are a formal form of protection established on public or private land by the county administration. A nature reserve can be composed of several important habitats of forestland, open areas, water bodies and wetlands. According to the environmental code, the main goals of nature reserves are to preserve biodiversity, natural environments of high value, protect and restore habitats, and meet needs for outdoor recreation. Nature reserves are managed according to a management plan, and only operations with a conservation goal are permitted (KSLA, 2015). In case a private owner owns land on a nature reserve, he gets a full refund for the land's value, and an added 25%. (Arby and Naturvårdsverket, 2010; KSLA, 2015; Naturvårdsverket, 2015; Skogsstyrelsen, 2015)

National parks are the strongest protection scheme in terms of regulation in Sweden. They are established by the government and voted in parliament, however, the county administration board most often manages them. Their main goal is to preserve the natural value of landscapes while maintaining them. Secondary goals include research, recreation and tourism (Naturvårdsverket, 2015; Skogsstyrelsen, 2015).

Today, there are 3800 nature reserves in Sweden, covering about 9% (4.4Mha) of Sweden's territory. There are 29 national parks which cover 1.6% of Sweden's area (739 000ha) (Arby and Naturvårdsverket, 2010; Skogsstyrelsen, 2015). In terms of forestland, nature reserves and national parks cover 6.8% of Sweden's productive forests (Skogsstyrelsen, 2015).

<u>b/Habitat protection areas (in Swedish, Biotopskydd)</u>

Habitat protection areas are a non-mandatory, formal protection scheme, which aims at protecting small areas (maximum 20ha) of high natural values (and social values since 2015). The area protection ordinance gives a list of habitats, which can be protected under this scheme, and 19 occur in forests. For those, the forest agency is responsible for initiating the schemes, even though landowners can also ask for it. Together, the owner, the forest agency and local authorities decide upon a perimeter to protect, and a valuation study is carried out. Unlike nature reserve, habitat protection areas can only be composed of one habitat. The agreement is signed for an unlimited amount of time, and the owner receives full compensation and an added value of 25%. Only conservation operations can be carried out on the protected land, and the forest

agency monitors the area every four years. As of 2014, there are 25 000ha of habitat protection area, which accounts for a total compensation value of 1.6 billion Swedish crowns (Naturvårdsverket, 2015, 2014; Skogsstyrelsen, 2015, 2007).

<u>c/Nature conservation agreements (in Swedish, Naturvårdsavtal)</u>

Nature conservation agreements are also a form of non-mandatory, formal protection scheme between the landowner and the forest agency or the county administration board (in Swedish, länsstyrelsen). Unlike the stricter habitat protection area, the nature conservation agreement lasts for a period of 1-50 years, and landowners receive a maximum compensation of 60% of the land's value depending on the length of the contract. As of 2014, nature conservation agreements cover 30 000 ha of land, and compensation for 1993-2014 have been of 383 Mkr (Naturvårdsverket, 2015; Skogsstyrelsen, 2015).

Together, habitat protection areas and nature conservation agreements represent only 0.19% of Sweden's productive forest area (Skogsstyrelsen, 2015).

2.2.2.3 Voluntary set-asides (in Swedish, Frivilliga avsättningar)

Set-asides are areas of productive forests of at least 0.5ha which are voluntarily excluded from forestry by the owners. It is a non-mandatory scheme, with no formal agreement being signed: it is part of the "freedom with responsibility" concept of the forestry Act. Certification schemes require at least 5% of a property to be set-aside in order to receive the certification label. In 2010, there were 1.1Mha (3.9% of forests) of set-asides in Sweden, which is more than the target are of 730 000 ha which was described in the parliament's *levande skogar* goal.

2.2.2.4 General considerations (in Swedish, generell hänsyn) in forest management, a legal requirement

General are a set of actions aiming at preserving and enhancing the natural value of productive forests, and should be taken into account in day-to-day forest management by forest owners. They comprise actions such as leaving buffer zones around water bodies while felling, limiting the maximum area for clearcuts, keeping groups of trees and creating/leaving dead and decaying wood on stands that have been harvested. Taking general considerations is a legal requirement.

2.3 NIPFs in nature conservation

2.3.1 Impact of forest operations on red-listed species

Forest operations are an important threat to species in Sweden. Harvesting for instance has an effect on 30% of all threatened species in Sweden. An important factor on which many species rely is the presence of old, big trees and dead wood, which explains why many red-listed species occur mainly in non-managed forests (Jonas et al., 2015; Sundberg et al., 2015; Westling, 2015).

According to Jonas et al. (2015), forest certification schemes as well as individual commitments from NIPFs have contributed to the stabilization of the number of red-listed species, which would have otherwise increased. However, the report underlines the fact that forest management operations should be adapted to prevent further decline in species populations. The importance of non-protected forests is also pointed out,

as well as the need to give them some level of protection (Jonas et al., 2015; Sundberg et al., 2015; Westling, 2015).

2.3.2 NIPFs and key habitats

NIPFs are very important when talking about key habitats. In 2009, 41% of key habitats were located on non-industrial private forestland, which mostly includes NIPFs (Skogsstyrelsen, 2015). Because owner classification has changed in official data, no precise data is available for NIPF before 2013. In 2013, NIPFs alone owned 125 454 ha of key habitats, of which 84% were composed of productive forestland (Skogsstyrelsen, 2015).

Fig. 9 shows the share of final fellings performed on sensitive habitats with high, moderate and no negative impacts for years 1998-2014 for NIPFs and all forest owners combined. Two main comments can be made. Overall, NIPFs seem perform fellings with negative impacts more often than all owners combined, and there is a trend towards stronger negative impacts on sensitive habitats.
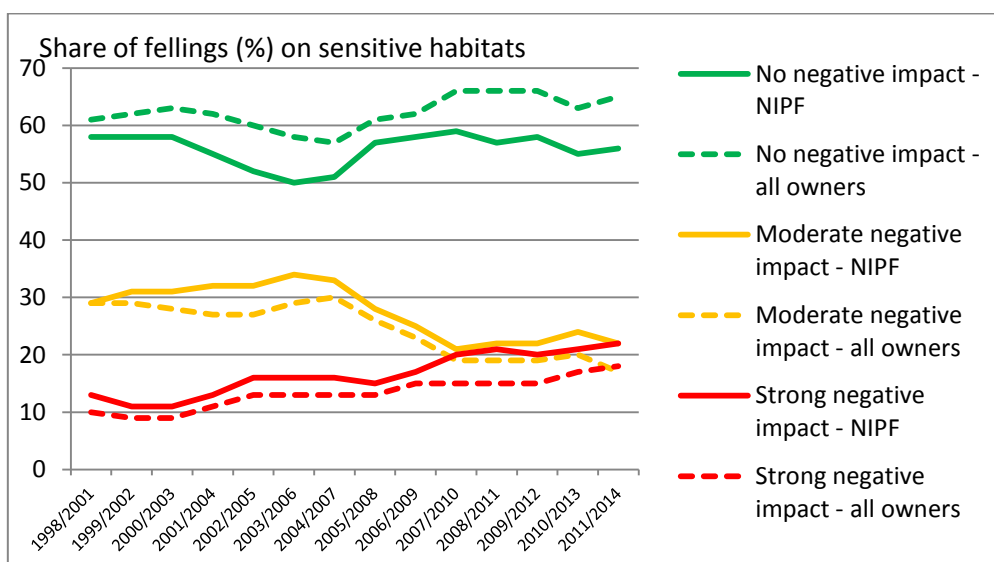
Figure 9 - *Impacts of fellings on sensitive habitats over time* (Skogsstyrelsen, 2015)

2.3.3 Involvement of NIPFs in voluntary set-asides

While they represent 50% of all forest area in Sweden, NIPFs own only one quarter of set-asides, while 31% and 44% of set-asides are located on other private land and public land, respectively (Naturvårdsverket, 2015; Skogsstyrelsen, 2015). NIPFs are thus underrepresented in voluntary set-asides compared to the total amount of productive forest they own.

2.3.4 NIPFs' fulfilment of general considerations

Fig. 2 (in the introduction) shows the overall fulfilment of legal requirements for all final fellings and for final fellings performed by NIPFs, between 1998 and 2010 (Skogsstyrelsen, 2015). Overall, NIPFs tend to not fulfil requirements more often than all owners combined. They are also less likely to do better than required. Over time, there is a trend for NIPFs to less and less fulfil legal requirements while felling.

3 Theoretical framework of the thesis

3.1 The theory of planned behaviour

3.1.1 Introduction to the theory: behaviour, intentions and behavioural control

The theory of planned behaviour (ToPB) (Ajzen, 1985) aims at explaining and predicting human behaviour. According to ToPB, the probability of someone having a certain behaviour depends on that person's intention to perform the behaviour: the stronger the intention, the more likely it is that the behaviour will be performed. It captures someone's willingness to act a certain way.

However, the theory stipulates that this is true only when the behaviour is under *volitional control*, i.e., if there are no exterior constraints on the behaviour. Such non-motivational factors can be the availability of money or the opportunity to perform the behaviour. These factor fall into what Ajzen defines as behavioural control, which is linked to the ability to perform the behaviour. It reflects people's self-confidence about their own capacity to perform the behaviour. Behavioural control and intentions are at the origin of the behaviour (Fig.10) and interact with one another.
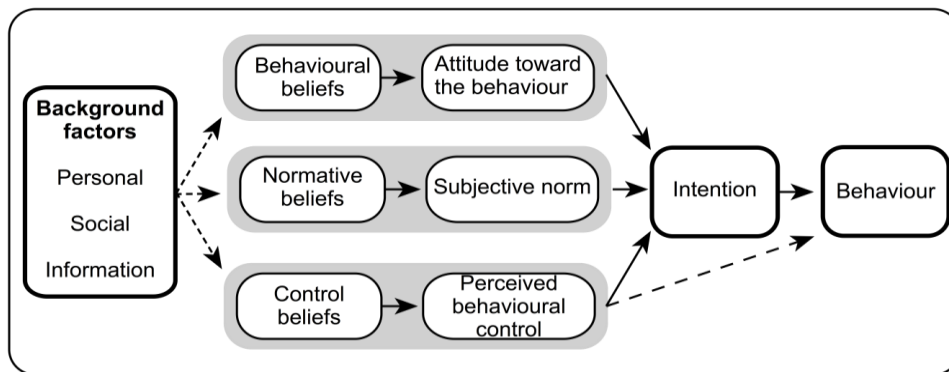
Figure 10 - *The Theory of Planned Behaviour* (Ajzen, 2005)

3.1.2 The three determinants of intention

In order to predict behaviour, the intention must be understood. According to Ajzen's theory, there are three determinants of the intention, which relative importance depends on the people and the situation:

- *Perceived behavioural control*, which was explained earlier. While it directly influences the behaviour directly, it also influences the intention to perform the behaviour. If one perceives he lacks the opportunity to perform the behaviour, the intention will be weaker.
- *Attitudes toward the behaviour*. An attitude is someone's personal opinion about the behaviour, which can be a negative or a positive evaluation of it.
- *Subjective norm*, which is the social pressure on whether one should or should not perform the behaviour, as perceived by the subject. A high pressure will lead to a weaker intention.

3.1.3 Beliefs and background

The three determinants of intention are in turn functions of beliefs that people hold, which are either based on previous experiences with the behaviour or on second-hand information about it. There are three kinds of beliefs:

- *Behavioural beliefs*: attitudes towards a behaviour are derived from one's opinion about the behaviour itself and its consequences. For instance, a behaviour with consequences seen as positive with lead to having a positive attitude towards the behaviour.
- *Normative beliefs*, which are one's perception of how others would react, approve or disapprove a behaviour. It determines the subjective norm.
- *Control beliefs*, which are linked to the presence or absence of resources and/or opportunities needed to perform the behaviour.

Finally, one's background influences one's beliefs. Together, background and beliefs are at the origin of the three determinants of intention. Intention and behavioural control determine the likelihood of the behaviour being performed.

3.1.4 Link with the study

We have seen previously that NIPFs do not seem to respond as positively as expected to conservation policies aimed at them. But why? Following the ToPB, their intention to get involved in conservation depends on their beliefs: their beliefs on conservation and conservation policy, their beliefs on social pressure and their beliefs on their own capacity to get involved in conservation. Within this framework, this thesis project aims at investigating NIPFs' attitudes towards conservation and conservation policy, and study the possible link it has with their background and their values. It is thus limited to the attitudes and background parts of the ToPB. This is done through an owner typology based on the owners' reasons for owning forests.

3.2 Review of previous forest owner typologies

3.2.1 Introduction to forest owner typologies

3.2.1.1 Different kinds of typologies

Forest owner typologies are tools, which aim at creating categories of forest owners, based on a criterion or on several criteria. Several types of typologies exist:

- Typologies based on empirical, quantitative data. Most forest owner typologies fall into this category (e.g., Boon et al. 2004; Boon & Meilby 2007; Jennings & Putten 2006; Herzele & Gossum 2008; Urquhart et al. 2012; Urquhart & Courtney 2011; Karppinen 1998; Kuuluvainen et al. 1996; Hallikainen et al. 2010), and gather their data using surveys. This thesis project falls into this first category.
- Typologies based on qualitative data. These typologies usually use data from interviews conducted with a limited amount of owners, such as Stanislovaitis & Brukas (2015), or Madsen (2003), who used geographical data.

- Typologies based on a theoretical background: they use the chosen theory to develop forest owner categories. For instance Hugosson & Ingemarson (2004) used a theoretical framework to analyse forest owners' motivations in Sweden.

3.2.1.2 Purpose of typology studies

The majority of typologies aim at describing the objectives/values/motivations of forest owners, in order to better understand the population of forest owners. A second goal common to all typology is to analyse the background of owners and their forests' characteristics in each owner group, in order to get descriptive profiles for each owner groups.

Besides these goals, which are shared by all typologies, some go further. Two kinds of secondary goals can be found in the literature:

- Studying forest owners' behaviours and predicting it. Examples are for instance Kuuluvainen et al. (1996) who investigates the timber supply function and management behaviour of forest owner groups in Finland, or Kline et al. (2000), who assesses the owners' willingness to accept incentives for protection of riparian habitats in the United States.
- The development of public policy. Based on the group classification, some studies assess the acceptance and/or effectiveness of already existing policy tools, and predict those of future ones. A good example is (Serbruyns and Luyssaert, 2006), who assess the degree to which owners accept different models of policies according to their own objectives, or Boon & Meilby (2007), who discuss the effects different policy tools would have on different owners.

The typology presented in this study includes an analysis of the owners' attitudes and opinions regarding conservation policy and the Swedish forestry model. It has an applied goal, which is to lay the basis for a future discussion on the improvement of policy tools regarding conservation in Sweden.

3.2.2 Methods and findings

3.2.2.1 Methods leading to a classification of forest owners

Even though they may differ in the specific methods and algorithms used, previous empirical typology studies follow the same approach to the problem, and several steps can be identified:

- The choice of a criterion on which the typology is based. It is most often the owners' values regarding forests, their forestry goals or motivations, or the reasons why they own forests. Some typologies add other criteria, for instance attitudes towards policy tools (Serbruyns and Luyssaert, 2006) or recreation (Hallikainen et al., 2010).
- The choice of a way to get the information. The most common way of getting information is through owners' surveys, either in paper form (mail survey), in electronic form (online survey) or on the phone (interviews).
- A preparatory step before building the typology. Depending on how many criteria are used, past studies have chosen whether or not to use a dimension reduction technique prior to building owner groups, in order to simplify the problem. The most common technique applied is Principal Component Analysis (e.g., Kuuluvainen et al. 1996; Karppinen 1998; Jennings & Putten 2006; Kendra

& Hull 2005; Hallikainen et al. 2010; Urquhart & Courtney 2011Kline et al. 2000). This method is also used in my study (see Methods section).

- The building of the typology. Previous typology studies have mostly built the owner groups through a clustering procedure, such as K-means clustering (e.g., Kuuluvainen et al. 1996; Jennings & Putten 2006; Hallikainen et al. 2010), which is the method used in this study. Other methods include Ward's method (e.g., Bieling 2004; Boon et al. 2004) or Q methodology (Urquhart and Courtney, 2011). A notable exception is Wiersum et al. (2005), who did not use a clustering technique but created the owner groups directly from the data.
- The analysis of background information for each group. It has been previously performed using two main methods: either models (probit, logit, e.g., Karppinen 1998; Kuuluvainen et al. 1996; Serbruyns & Luyssaert 2006) or statistical tests, which is the most used method, also used in this study.
- The study of the secondary goal of the typology (i.e., policy development, behaviour analysis, etc.). The methods here depend heavily on the goals of each typology.

3.2.2.2 Classification of forest owners in previous studies

This subsection is based on Dhubháin & Cobanova's (2007) reviews of forest owner groups in previous typologies, with references to studies published after 2007 being added. Owner groups used in previous typologies can be classified in two to three families of owner groups, according to their general goals (Urquhart and Courtney, 2011).

a/ Owners with production goals

Owners with production goals are interested in producing timber and getting a monetary benefit from their forestry activity. They see forests as an investment. This category comprises the *timber agriculturists* (Kurtz and Lewis, 1981; Marty et al., 1988), *businessmen* from Mizaraite & Mizaras (2005), *economists* (Herzele and Gossum, 2008) and *investors* from Urquhart & Courtney (2011) which want to generate profit in a productive way.

Some studies have separated the production goal from the profit-maximizing goal. For instance, *owners with economic goals* (Lönnstedt, 1997), *economic efficiency goals* (Hugosson and Ingemarson, 2004) and *investors* (Karppinen, 1998) have the economic goal as their primary motivation. On the other hand, some owners have timber production and wood sales as a primary motivation. Those include *owners with production motivations* (Hugosson and Ingemarson, 2004) and *owners with production goals* (Lönnstedt, 1997).

Finally, Karppinen (1998) identifies *self-employed owners*, who are oriented towards timber production for their own use, and see the forest as a source of employment for themselves and their family.

b/ Owners with consumption goals

Owners within this group do not wish to produce goods nor services, but to consume goods and services, such as timber, non timber products or amenities. *Consumers* (Mizaraite and Mizaras, 2005), *individualists* (Urquhart and Courtney, 2011) and *self-interested owners* (Wiersum et al., 2005) are mostly interested by timber and non wood forest products, while *forest environmentalists* (Kurtz and Lewis, 1981), *recreationists* (Herzele and Gossum, 2008; Karppinen, 1998; J. Kline et al., 2000; Marty et al., 1988) and *amenity owners* (Urquhart and Courtney, 2011) are interested in outdoor recreation, biodiversity, privacy and the aesthetic

value of the forest. *Custodians*, as described by Urquhart et al. (2012), mostly want to pass the forest on to the next generation.

c/ Owners with protection goals

While Dhubháin & Cobanova (2007) only distinguish between production and consumption goals, the more recent study by Urquhart & Courtney (2011) proposes a classification of owner groups which include a third motivation: forest protection. Indeed, owners such as *ecologists* (Mizaraite and Mizaras, 2005), *environmentalists* (Wiersum et al., 2005), *conservationists* (Hallikainen et al., 2010) and *owners with conservation objectives* (Hugosson and Ingemarson, 2004) and *environmental goals* (Lönnstedt, 1997) are mostly concerned with species and habitat conservation, biodiversity and the protective function of forests.

d/ Multi-objective owners and passive owners

A last kind of owners which, has been consistently identified, is owners with several of the aforementioned goals. They are either called *multi-objective* or *multifunctional owners* (Boon et al., 2004; Hallikainen et al., 2010; Karppinen, 1998; J. Kline et al., 2000; Mizaraite and Mizaras, 2005; Urquhart and Courtney, 2011; Wiersum et al., 2005) and have production/economic goals as a main motivation, alongside consumption and/or protection goals.

Finally, several studies have shown the existence of owners with little motivation and involvement regarding the forest. They are described as *passive* (Herzele and Gossum, 2008; D. Kline et al., 2000) or *indifferent owners* (Wiersum et al., 2005).

3.2.3 NIPFs values in Sweden

Hugosson & Ingemarson (2004) realized an empirical study on NIPFs' values in Sweden, and came with a model consisting of four motivations for owners (Table1): utilities, conservation, amenities and economic efficiency. Because these results are recent and concern Swedish NIPFs, they will be used later on when discussing the results.

Table 1 - *Motivations of NIPFs in Sweden* (Hugosson and Ingemarson, 2004)*.*

Utilities	Conservation	Amenities	Economic efficiency
Game production	Natural conservation	Emotional ties	Yield of capital
Berries production	Cultural conservation	Forestry tradition	Liquidity reserve
Mushroom production	Water conservation	Challenge of silviculture	Annual income
Forest grazing production	Soil conservation	Aesthetics	Tax planning

4. Data, theory and method

4.1 Origin of data and creation of the survey

4.1.1 Survey construction

The intention of the postal survey was to study the self-reported attitudes toward natural consideration in Swedish forestry. The survey was directed to NIPFs, with representation from every county in Sweden. The survey was constructed using the ToPB as a starting point (Ajzen, 2005). The survey was divided into five main sections: questions on the forest estate, general questions on Swedish environmental work, questions on information retrieval, questions on future management of forest estates, and lastly general background information. Questions for the survey were developed in researcher meetings within the Future Forests program, with representatives from both natural as well as social sciences, to ensure that all aspects of natural consideration in Swedish forests were captured in the survey. The questions were developed to meet at least one of the factors in the ToPB, as illustrated in annex 2.

4.1.2 Respondent selection and response rate

A selection of 3000 forest owners registered with a Swedish address and owning at least 5ha of forests was made. The sampling was stratified so that, within each county, the number of owners selected would be representative of the share of Swedish forest owners who live in that county (i.e., if a county hosts 5% of all owners, 5% of surveys would be sent to owners in that county). Out of the 3000 chosen respondents, 2987[1] respondents received a postal survey in December 2014, as well as a reminder in January 2015.

1296 surveys were returned, of which 32 were blank, yielding a response rate of 43,4 %, and there are no systematic non-responses. When comparing the share of owners in each county to the share of responses coming from the same county, differences range between -2% and +1%. For eight counties, the difference between the two percentages is of -1%, while one county has a difference of -2% between the two percentages: these counties are underrepresented in the sample. Six counties have a difference of +1%, and are overrepresented in the sample. The six remaining counties have the same percentage for the share of owners and the share of respondents and are adequately represented. 2% of the respondents did not fill in which county they owned forest estate in.

Empty and non-useable questionnaires were removed from the data prior to starting any analysis: out of the 1296 responses, 1260 are used in the general description of the data.

4.2 Analysis of background data

4.2.1 Description of the general population and choice of the background variables

The very first analysis conducted on the useable data is a description of the general population. This general description is based on background data concerning the owner (e.g., age, gender, education, etc.), his or her relation to the forest (e.g., duration of ownership, etc.) and the management of the property (e.g., recent operations, certification, membership of forest owner associations, etc.) extracted from the survey (see

---

[1] 13 forest owners in the selection owned more than one estate and were thus omitted.

survey questionnaire in annex 1). For each background question, data is treated in such a way that categorical variables for which at least 90% of information is available would be created.

4.2.2 Treatment of data

For each question, consistency of answers is checked, with several cases arising:

- For questions with a single possible answer, multiple answers are treated as NA (no answer).
- For questions where multiple answers are permitted, each answer is treated separately and all combination are taken into account in the making of the categorical variables.
- For questions with different levels (i.e., comprising sub-questions), or questions dependent on previous questions, consistency was checked and all non-consistent answers were considered as NAs.
- In case a respondent answered a sub-question but neglected to answer the question on which it depends, the answer to that question was deduced from the answer to the sub-question.
- "I don't know" answers are taken into account when describing the whole population, but are treated as NAs for subsequent analyses.

Table 2 - *List of categorical background variables and categories used in the study.*

Variable	Categories	Percentage of useable answers	Non-useable answers (NA/I don't know)
age	18-50 years old 51-65 years old > 65 years old	96	48/-
gender	male female	94,4	68/-
education level	primary secondary university	95,9	51/-
education field	agriculture, forestry or biology other fields	96,3	47/-
occupation field	agriculture or forestry other fields	98,6	17/-
self employment	self-employed not self-employed	98,7	16/-
retirement	retired not retired	98,5	17/-
part of income from forestry	0-5 % 6-25% > 25%	88,6	45/99
living environment	rural area urban, <50 000 inhabitants urban, >50 000 inhabitants	91,1	112/-

Percentages of useable answers of at least 90% were achieved when building the categories (see Table 2). Only two variables do not satisfy the condition: the part of income derived from forestry and certification. In both cases, the lower percentage of useable answers is due to a high number of owners answering "I don't know". This is understandable, since a number of owners may have contracted a company to manage their

property on their behalf, and may consequently not know about whether or not their forest is certified. Because of the low percentage of useable answers, forest certification is not used in subsequent analyses. Concerning the part of income derived from forestry, since the percentage is much higher (88.6%) than for certification, and because the variable measures something no other variable can approximate, it is kept for subsequent analyses.

4.3 Principal Component Analysis (PCA)

The owner typology is based on the owners' reasons for owning forests. PCA is a commonly used method in multivariate statistics analysis to simplify the representation of datasets with many variables: it is a dimension reduction method (Jolliffe, 2002). Since the typology is based on 17 reasons for owning forests, i.e. 17 variables and dimensions, PCA is useful as a preliminary step in order to reduce the complexity of subsequent analyses.

4.3.1 Theoretical framework of PCA

In a dataset such as ours, variables describing the data are (1) multiple, and (2) correlated to each other. PCA analyses the interrelations between variables and creates a new set of variables, called principal components (PC) which are linear combinations of the variables (Yong & Pearce 2013):

$$Xj = a_{j1} * F_1 + a_{j2} * F_2 + \dots\dots + a_{jm} * F_m + e_j \quad (1)$$

Where:

- Xj are the *old* variables describing the dataset
- (F1,...Fm) are *new* variables extracted from PCA, i.e., the principal components
- a_{ji} are the coefficients linking the old variables to the principal components.
- e_j are the residuals

In short, PCA operates a projection of data from one coordinate system to another. The principal components are built in such a way that:

1. They are ordered: the first PC returned by the PCA accounts for a maximum of variance within the dataset. All following PCs account for less global variance than the previous one. In total, there are as many PCs as variables, and together they account for the whole variability within the dataset.
2. Each PC is orthogonal to the others , which means that they are uncorrelated (unlike the base variables).

The main idea of PCA is that, since PCs are ranked in order of decreasing explained variance, a small number of components can be kept for further analysis while conserving a high amount of variance, which reduces the number of variables to be used and simplifies the analysis.

4.3.2 Extraction of principal components

Even though the principal components are ordered, one still has to decide how many to keep for further analysis. There is a wide range of softer or harder criteria used for that purpose (Jolliffe, 2002). Often, the more computationally complex methods perform well in narrow cases only, while the softer criteria

presented here are expected to perform well in most cases (Jolliffe, 2002). Consequently, I focus here on the three most commonly used soft criteria, as well as on one harder criterion.

4.3.2.1 The Kaiser criteria

An eigenvalue is a measure attributed to each principal component, which is equal to the sum of square scores that each observation has on the considered principal component. It measures how much variance a PC explains in comparison to the original variables. A PC with an eigenvalue lower than 1 means that it explains less variance than the original variables. According to Kaiser (1960), principal components should be kept only if their eigenvalues are more or equal to one. However, there is evidence in the literature (e.g., Cattell & Vogelmann, 1977; Costello & Osborne, 2011; Ledesma & Valero-Mora, 2007) that this criteria may not be very efficient, and often overestimates the amount of principal components to keep. However, it is still widely used and Jolliffe (2002) advocates for its use with flexibility.

4.3.2.2 Variance of principal components and cumulative variance (Jolliffe's criteria)

A criteria presented in Jolliffe (2002), among others, is to use a threshold of variance (often between 70 to 90%) and keep as many principal components as necessary to reach that threshold. Even though this method is likely to overestimate the amount of components (Costello and Osborne, 2011), Jolliffe (2002) advocates once again for a more flexible use, where the threshold can be diminished if needed. A variation of this criterion is to use a threshold for each individual principal component, usually between 5 and 10% of explained variance.

4.3.2.3 The scree test

The scree test was developed by Cattell (1966), and is more consistent than the two previous criteria. The method consists in plotting the eigenvalues of consecutive principal components on a graph, and linking them. The inflexion point of the curve corresponds to the last principal component to keep. Even though, according to Zwick and Verticer (1986, cited in Ledesma & Valero-Mora 2007), it can still overestimate the number of principal component, Costello & Osborne (2011) bring evidence that the scree test is the best out of the three criteria presented so far. Jolliffe (2002) recommends using it instead of Kaiser's eigenvalue criteria, and Yong & Pearce (2013) advocates for its use in conjunction with previously presented criteria.

4.3.2.4 Parallel analysis

Parallel analysis is a method recommended by Ledesma & Valero-Mora (2007) to choose how many components to keep. Because it is a more computationally complex method compared to the previous criteria, it is not detailed here. A ready-to-use function on R was used to realize the parallel analysis, which directly yields an optimal number of principal components to keep.

4.3.3 Rotation and analysis of results

4.3.3.1 Rotating the solution of PCA: Kaiser's VARIMAX and analysing results of the rotation

The final result of the PCA is a loadings matrix, which comprises factor loadings. A factor loading measures the correlation between the principal components and the old variables. Because a loadings matrix is rarely

interpretable directly, a rotation is carried out to simplify the interpretation (Abdi and Williams, 2010; Costello and Osborne, 2011; Tabachnick and Fidell, 2001; Yong and Pearce, 2013).

The idea behind a rotation is to rotate the projection space made of the extracted principal components in order to get a new loadings matrix, which has a simpler structure and is easier to interpret. The rotation from the un-rotated loadings matrix (and un-rotated principal components) to the rotated loadings matrix (and rotated principal components) is done through the use of a matrix R comprising the cosines of angles used in the rotation. Fig. 11 illustrates this principle (Abdi, 2003):

$$R = \begin{pmatrix} cos\theta_{1,1} & cos\theta_{1,2} \\ cos\theta_{2,1} & cos\theta_{2,2} \end{pmatrix}$$
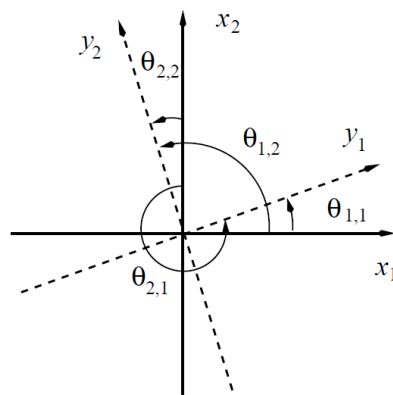
Figure 11 - *Illustration of an orthogonal rotation in a two dimensions space*

VARIMAX rotation, developed by Kaiser (1958), is the most widely used rotation method. It is an orthogonal rotation, which means that rotated axes are still orthogonal to each other, and rotated components are uncorrelated. VARIMAX minimizes the number of variables with high loadings and further decreases the already low loadings, making the matrix easier to understand. In an optimal rotated solution, each principal components has a high loading on at least 3 variables, maximum 5, and no variable should have a high loading on several principal components (Tabachnick and Fidell, 2001).

4.3.3.2 Analysing the rotated loadings matrix

Loadings can be understood as weights the original variables have on each principal component. These can be interpreted as the contribution a variable has made to the construction of a principal component (Yong and Pearce, 2013).

4.3.3.3 Calculation of factor scores and use in further analysis

Finally, after the rotated principal components have been interpreted, the rotated factor scores are calculated. They represent the score of each observed individual on each of the rotated principal component. They are used as an input in the clustering of forest owners. The overall consistency of the rotated PCA solution will be assessed using Carmines' theta indicator alongside Cronbach's alpha, as recommended by Carmines & Zeller (1979).

4.3.4 Data treatment in PCA

4.3.4.1 Extraction of data from the survey

In the survey, owners were asked in question A13 (translated to English) to state how important these were to them.

> **A13: How do you position yourself regarding the following statements on the reasons why you own forest?**
>
> - A13.1 Revenue from the forest is a source of regular income (for consumption)
> - A13.2 My property is used to finance larger investments
> - A13.3 My property gives me economic stability for when I am older
> - A13.4 My property creates employment for me and my family
> - A13.5 My property is a good investment for the future
> - A13.6 I get firewood for household use from my forest
> - A13.7 I want to pass on the forest to the next generation
> - A13.8 I want to have access to berries and mushroom picking
> - A13.9 My property is part of the local environment where I spend time
> - A13.10 My property gives me access to fishing and hunting
> - A13.11 My property provides me with a meaningful spare-time occupation doing forest work
> - A13.12 My property gives me possibilities for outdoor activities
> - A13.13 My property gives me the opportunity to relax and think
> - A13.14 My property offers me the possibility to protect biodiversity, cultural heritage sites and water sources
> - A13.15 My property offers me an aesthetics experience
> - A13.16 My property enables me to keep contact with my home
> - A13.17 My property gives me the opportunity to continue with the family tradition

Five different answers were possible, located on a scale:

> 4 Very important - 3 Important- 2 Rather unimportant - 1 Completely unimportant - 5 No opinion

4.3.4.2 Handling and deletion of part of the data in PCA analysis

A total of 1260 responses were available for the PCA analysis. However, 18 respondents had not answered question A13 at all. Since all further analysis is based on PCA results, those respondents were removed from the dataset prior to the PCA. Since they do not fit on the scale of importance, answers "5 No opinion" were treated as NAs for the PCA analysis. After this change, a total of 5 respondents had NA values for all items of question A13. They were consequently removed from the dataset prior to PCA. As a result of those deletions, a total of 1237 respondents are used further analyses. Since PCA does not tolerate missing values (NAs), all remaining missing values were imputed using an iterative Principal Component algorithm (Josse, J & Husson, F. 2013) prior to the analysis.

Transformation and deletion of data was done using MS Excel. PCA was conducted on R software, using the *principal* function from the *psych* package. Missing values were imputed using the *imputePCA* function from the *missMDA* package.

4.3 Cluster analysis

4.3.1 Cluster analysis theory and link with PCA analysis

4.3.1.1 Clustering analysis theory

Cluster analysis is a method of data exploration, which aims at assigning objects to categories, called clusters, based on their level of similarity. The similarity of observations within each category is expected to be higher than the similarity across categories (Anderberg, 2014; Jolliffe, 2002)

For that purpose, a measure of similarity or dissimilarity is required. The most common measure used is Euclidean distance (Likas et al., 2003; Morissette and Chartier, 2013). Let us consider two observations X and Y, with respective coordinates (x1, x2, ..., xn) and (y1, y2, ..., yn). The Euclidean distance between X and Y is defined as:

$$d(X,Y) = \left\lVert X - Y \right\rVert = \sqrt{\sum_{i=1}^{n}(x_i - y_i)^2} \qquad (2)$$

Cluster analysis enables to elicit a structure within data when no previous information is known (Jolliffe, 2002; Morissette and Chartier, 2013). It is also a way to simplify a problem (Jain, 2010) and generalize conclusion to the groups created (Anderberg, 2014). In our case, cluster analysis is used to uncover groups of forest owners with similar motives.

4.3.1.2 Use of principal component scores as data for clustering

In typology studies, the use of standardized scores on principal components calculated after PCA is commonly used as the base data for clustering (Jolliffe, 2002; Karppinen, 1998; J. Kline et al., 2000). Using the distance between observations in a space of variables is equivalent to using the distance between principal components: it is a valid measure of dissimilarity (Jolliffe, 2002). In terms of results, prior reduction of the dataset's dimensionality through PCA is expected to improve the results obtained from the clustering (Ding and He, 2004). This is all the more true in my study, where there are many correlated basic variables, while the principal components are less numerous and orthogonal, which avoids problems of multicollinearity (Karppinen, 1998).

4.3.2 The K-means clustering technique

4.3.2.1 The theory of K-means method

The K-means method is a partitioning-based clustering algorithm (Jain and Dubes, 1988), first developed by Lloyd (1957) and later improved by Hartigan & Wong (1979). The method was chosen because it is particularly well adapted to big datasets, and computationally easy to use compared to other algorithms (Morissette and Chartier, 2013). The method starts by defining a number of clusters and assigning each observation to one of these clusters. The observations are then reassigned to other clusters in a loop, trying

to optimize a criterion derived from the measure of similarity chosen. The process is repeated until the criterion comes to an optimal value (Jain and Dubes, 1988; Jain, 2010).

The goal of K-means clustering is to minimize the variance within each cluster (Morissette and Chartier, 2013). Let us consider $J(c_k)$, the within cluster squared error within cluster k of centre μ_k (Likas et al., 2003):

$$J(c_k) = \sum_{x_i \in c_k} ||x_i - \mu_k||^2 \quad (3)$$

The within-cluster squared error calculates, for a given cluster, the sum of squared Euclidean distances between each observation x_i and the cluster centre μ_k: it is a measure of variation within the cluster, and the criterion which the K-means methods aims at minimizing for all clusters. Therefore, let us define the sum of squared errors as J(c), where K represents the total number of clusters chosen by the user (Likas et al., 2003):

$$J(c) = \sum_{k=1}^{K} \sum_{x_i \in c_k} ||x_i - \mu_k||^2 \quad (4)$$

At each iteration of the loop, J(c) is calculated and if the new value is smaller than the previous one, then the new partitioning of observations is used as the basis for the next iteration. Otherwise, the previous partitioning is kept, and a new reassignment is tried (Jain, 2010; Likas et al., 2003)

Because the original cluster centres are either randomly chosen or chosen by the user, the method is sensitive to starting conditions and may return a local optimum instead of a global one (Jain and Dubes, 1988; Morissette and Chartier, 2013). For this reason, the algorithm is repeated 100 times and the best solution is kept.

4.3.2.2 Hartigan and Wong's K-means algorithm

There are three main algorithms within the K-means method (Hartigan & Wong, 1979; Lloyd, 1957; MacQueen, 1967). For my thesis, I have chosen to use Hartigan's (1979) method, which is the default setting on R and is expect to perform better than other algorithms in most cases (Telgarsky and Vattani, 2010).

4.3.2.3 Choice of the number of clusters

While running the K-means method, the user must choose the number of clusters prior to computing. Because previous studies have found between 3 and 5 clusters, the algorithm is run with 3, 4 and 5 clusters. Each respondent is then assigned to a cluster, which are called owner groups in further analyses. For each owner group, the mean score on each principal component in calculated. This is repeated for each of the three solutions considered (3, 4 and 5 clusters). The choice of the best solution is based on the interpretability of the results. Clusters of similar sizes are favoured (Boon et al., 2004).

4.4 Analysis of cluster results

4.4.1 Description and comparison of owner groups according to their reasons for owning forests

Once the best clustering solution has been chosen, each respondent is assigned to its final owner group. Since the relationship between principal components and motives for owning forests is known, each owner group can be described in terms of which motives are the most important to the owners within it. Similarly,

each group is described in terms of background, using demographics data available. In addition to being described, groups are also compared regarding their reasons for owning forests and their background features.

4.4.2 Description and comparison of owner groups according to their attitudes towards nature conservation

To go further, respondents' attitudes towards conservation, conservation policy in Sweden, as well as their level of knowledge regarding environmental concepts are analysed. These three aspects are studied using answers to three different sets of questions from the survey.

4.4.2.1 General attitude towards conservation and environmental issues

Question B1 was used to assess forest owners' general attitude towards conservation and environmental issues, here translated to English:

B1: To what extent do you agree with the following statements concerning environmental issues?

- B1.1 People worry too much about damages caused to the environment and too little about economic growth and activities.
- B1.2 Modern sciences will solve our environmental problems without us needing to really change our lifestyle.
- B1.3 I don't worry much about environmental problems.
- B1.4 I consider that it is important to get everyone involved in environmental issues so that the next generation gets a better environment to live in.
- B1.5 Many statements about the environment are exaggerated.
- B1.6 There is no point in me doing anything for the environment if no one else is doing it.
- B1.7 I think it is difficult to know if my lifestyle is good or harmful to the environment.
- B1.8 I do what I think is best for the environment, even if it costs money or takes more time.
- B1.9 I think the government should do more to protect the environment by writing laws, even if it limits people's freedom of choice.
- B1.10 I think individual people and companies should make their own decisions concerning the environment.

Where each item could be answered using a scale with five different choices:

---

4 Strongly agree - 3 Agree - 2 Disagree - 1 Strongly disagree - 5 No opinion

---

Because answers are located on an ordered scale of agreement, "no opinion" could not be located on the same scale as the four other possibilities. Consequently, answers "5 no opinion" were counted as NAs for further analyses. Just as for background statistics, answers of the general population is described, and owner groups are compared to each other.

4.4.2.2 Knowledge of conservation concepts

Question B4, in English below, was used to assess the respondents' knowledge about conservation concepts.

B4: How familiar are you with the following ecological concepts?

- B4.1 Biodiversity
- B4.2 Habitat area
- B4.3 Voluntary set-aside
- B4.4 General considerations
- B4.5 Sustainable forestry
- B4.6 Nature reserve
- B4.7 Wildlife conservation area
- B4.8 Key habitat
- B4.9 Red-listed species

Answer choices were located on a four-point scale as follows:

4 Good knowledge - 3 Fairly good knowledge -2 I have heard about it - 1 No knowledge

4.4.2.3 Attitudes towards the Swedish forestry model

Question B5, in English below, was used to assess forest owners' attitudes towards the Swedish forestry model for conservation in forests.

B5: To what extent do you agree with the following statements about environmental measures in Swedish forestry?

- B5.1 Landowners alone cannot take care of conservation, it is the state's responsibility.
- B5.2 All forest owners should take environmental measures to improve biodiversity in forests for next generations
- B5.3 I feel confident that the Swedish forestry model for environmental considerations in forestry secures biological diversity in forests.
- B5.4 The Swedish forestry model for forestry is too vague and unfocused to be efficient and to reach environmental goals
- B5.5 Swedish environmental policy rules are too restrictive, which limits individual owners' freedom of choice.
- B5.6 The parliament's environmental goal of "sustainable forests" is adequately regulated to reach Swedish environmental goals.

The possibilities for answers are the same as for question B1, and data was treated the exact same way.

5. Results

5.1 Description of the general population

5.1.1 Background of the owners

Survey respondents are predominantly male (77,9%, see Table 3), and more than 80% of the population is older than 51. The level of education varies greatly among respondents: even though secondary education is the predominant trait (40.4%), University level education is quite common (33.9%). Education in the fields related to life sciences (agriculture, forestry and biology) remains rather rare, with only 19.9% of respondents who specialized in it, at any level of education. However, occupation in the fields of farming and/or forestry is reported by 25.5% of the owners, meaning one fourth of our population has regular contact with the forest. Almost half of the respondents (45.9%) was retired at the moment of the survey, which correlates with the high mean age of the sample. 34.9% of the respondents report being self-employed, either because they run their own farm, forestry farm or any other business. Forestry remains quite unimportant in terms of income for most people, with 60.4% of the sample deriving less than 5% of their revenues from their forests. However, 29% of the respondent relied heavily (>25% of income) on the forest. There was a high rate of non-responses (12%) to this question. This can be due to owners either not knowing the answer, or not willing to communicate about their income. Most owners (88.1%) report living either in a rural area, or in a small urban community of less than 50.000 inhabitants.

Table 3 - *Background information about the respondents*

Variables	Categories and percentages	
Gender	Female	22,1
	Male	77,9
Age	18-50 years old	18,9
	51-65 years old	33,3
	>65 years old	47,8
Education level	Primary	25,7
	Secondary	40,4
	University	33,9
Education field	Agriculture, forestry or biology	19,9
	Other	80,1
Occupation field	Forestry or farming	25,5
	Other	74,5
Self employment	Self employed	34,9
	Not self employed	65,1
Retirement	Retired	45,9
	Not retired	54,1
Part of income from forestry	0-5%	60,4
	6-25%	10,4
	>25%	29,2
Living environment	Rural area	70,6
	Urban, <50 000 inhabitants	17,5
	Urban, >50 000 inhabitants	11,9

Note: NAs and "I don't know" answers were removed from the dataset, so the sum of proportions for each variable equals 100%.

5.1.2 Background of the owners' forests

Ownership regimes are quite balanced, with 58.8% (see Table 4) of sole ownership, and 41.2% of shared ownership (at least two owners). Half of the owners in the sample have owned their forest for more than 20 years, while one fourth (23.8%) has done so for less than ten years. Overall, a high 67% of owners declared not having inherited their property. A high share of owners have a close connection to their forest property: most owners (60.5%) own either a primary or a secondary residence on the property, and 47.8% declared visiting it at least once a week, while only 10% of owners visit their property less than once a month. Concerning management, forests in the sample are managed quite actively. One in ten owners only (10.9%) have not performed any management activity in the five years preceding the survey, and 81.3% of owners report having performed a commercial operation, either harvesting of commercial thinning, in the same period, meaning almost all owners who performed an operation performed at least a commercial operation.

Table 4 - *Background information about the respondents' properties*

Variables	Categories and percentages	
Ownership regime	Shared	41,2
	Sole	58,8
Duration of ownership	< 10 years	23,8
	11-20 years	24,9
	> 20 years	51,3
Frequency of visits	Weekly	47,8
	Monthly	40,8
	Rarely	11,4
Residence on the property	Yes (primary or secondary)	60,5
	No	39,5
Inheritance	Inherited	33,0
	Not inherited	67,0
Forest owner association membership	Member	50,6
	Not member	49,4
Recent operations	Yes	89,3
	No	10,7
Commercial operations	Yes	81,3
	No	18,7

The mean forest size in the sample is of 113ha, ranging from 2ha up to 6000ha. There is a very high variation in forest size, with a standard deviation of 314. In order to reduce the weight given to the few very big forest properties over the many smaller sized ones, the log function was applied to forest size in subsequent analyses.

5.1.3 Comparison with official data

Background data about respondents can be compared (see Fig. 12) to official data on NIPFs, obtained from Skogsstyrelsen (2015). When looking at the size of properties, forests smaller than 200ha are underrepresented, and there is no difference for big properties between 201 and 1000ha. Properties over 1000ha are overrepresented, which is due to a small number of respondents owning very big forests (with a

maximum of 6000ha). However, since the study is based on forest owners, let us have a look at the representation of forest size by number of owners: there is an underrepresentation of owners with forests smaller than 20ha. Forest owners owning forests between 20ha and 400ha are slightly overrepresented.

Concerning the owners themselves, there is an overrepresentation of people aged over 65 (10.1%), and males are also overrepresented (16.3%). There is a small underrepresentation of locally owned properties (8%), and ownership regimes are almost perfectly represented.

Graph a - Forest size (number of properties)
Size classes are in ha

All NIPFs / Respondents

Size class	6-20	21-50	51-100	101-200	201-400	401-1 000	1 001-
All NIPFs	33,4	28,7	19,1	11,7	5,2	1,7	0,3
Respondents	19,9	32,5	22,4	14,9	7,0	1,9	1,4

Graph b - Forest size (sum of area)
Size classes are in ha

Size class	6-20	21-50	51-100	101-200	201-400	401-1 000	1 001-
All NIPFs	6,9	16,2	21,4	23,2	17,3	10,4	4,7
Respondents	2,4	9,9	14,4	19,1	17,0	9,8	27,3

Graph c - Age

Age	0-50 years old	51-65 years old	65+ years old
All NIPFs	25,9	37,3	36,7
Respondents	18,9	33,3	47,8

Graph d - Gender

Gender	Male	Female
All NIPFs	61,6	38,4
Respondents	77,9	22,1

Residence	Full or part time resident	Non resident
Al NIPFs	72,5	27,5
Respondents	60,5	39,5

Graph e - Residence on the property

Ownership	Sole ownership	Shared ownership
All NIPFs	58,8	41,2
Respondents	58,8	41,2
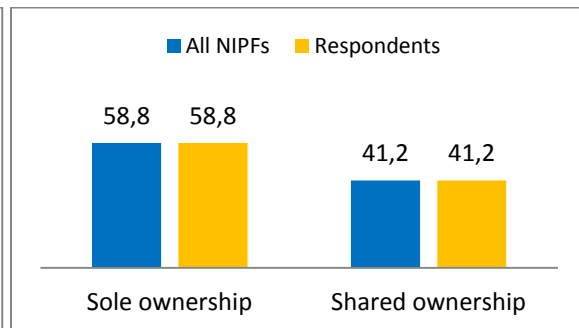
Graph f - Ownership regime

Figure 12 - *Comparison of background data between all Swedish NIPFs and respondents*
Values represent the share (%) in each category

5.2 Results of PCA analysis: identification of the owners' main motivations

5.2.1 Extraction of the principal components

5.2.1.1 Kaiser's test, Jolliffe's criteria and scree test

As seen in Table 5, PC1 to PC3 have eigenvalues higher than 1, while PC4 has an eigenvalue equal to 1. The test would therefore have me keep 3 to 4 principal components.

Table 5 - *Eigenvalues and variance explained by the first eight principal components*

Principal components	Eigenvalues	Proportion of variance	Cumulative proportion
PC1	5,85	34%	34%
PC2	2,03	12%	46%
PC3	1,27	7%	54%
PC4	1,00	6%	60%
PC5	0,86	5%	65%
PC6	0,81	5%	69%
PC7	0,74	4%	74%
PC8	0,67	4%	78%

According to Jolliffe's criteria, PCs should be kept until 70% of variance is explained, and each PC retained this way should account for at least 10% (or 5%) of the total variance. However, only PC1 and PC2 account for more than 10% of variance each, and 6 PCs would be necessary to achieve 70% of cumulative variance. Retaining so many PCs would also mean using PCs with a low eigenvalue and explained proportion of variance. Since most guidelines in literature are given for natural or mathematical sciences, the threshold of 70% of cumulative variance can likely be lowered in this study, and less than 6 PCs could be kept.

The scree test advises to keep PCs up to the breaking point of the scree plot (Fig. 13). The breaking point is located at PC3, so PC1 to PC3should be kept. Since the scree test is a visual criterion, one could argue that the breaking point could also be located at PC4.

Figure 13 - *Scree plot for PCA analysis*

Note: The black line links eigenvalues together. The red segments show where the inflection point is.

5.2.1.2 Parallel analysis

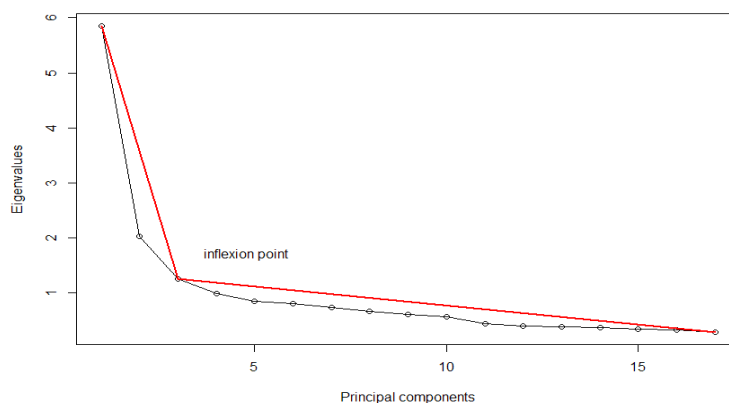Parallel analysis was run and returns an optimal number of principal components of 3. A 3 principal components solution, besides being indicated by parallel analysis, satisfies to most of the three aforementioned soft criteria:

- PC1, PC2 and PC3 are the only PCs with an eigenvalue greater than 1
- PC1 and PC2 account for more than 10% of the total variance, and PC3 accounts for more than 5% of it.
- Together, PC1, 2 and 3 explain 54% of total variance within the sample population. This is a bit low, but soft criteria are to be followed with flexibility and often overestimate the amount of PCs to keep.
- The inflexion point on the scree plot is located at PC3.

5.2.1.3 Reliability assessment

Furthermore, two indices of consistency were used to assess the overall reliability of the PCA: Cronbach's alpha and Carmines' theta. While Carmines' theta stays high (0.85) for solutions with 3, 4 and 5 PCs, Cronbach's alpha drops from 0.54 to 0.45 when adding a fourth PC. Since a Cronbach's alpha smaller than 0.5 shows weakness in the analysis, the solution with 3 PCs seemed preferable. Consequently, a solution with 3 PC was kept.

5.2.2 Rotation and interpretation of the loadings matrix

The 3 PCs solution was rotated, and the following loadings matrix was obtained (Table 6):

Table 6 - *Loadings matrix from VARIMAX rotation on PCA results*

Reasons for owning forest	PC1	PC2	PC3
Source of regular income	-	**0,722**	-
Finance investments	-	**0,742**	-
Economic stability for the future	-	**0,766**	-
Source of employment	0,439	**0,653**	-
Investment for the future	-	**0,664**	-
Firewood	0,485	-	-
Next generation	-	-	0,594
Berries and mushrooms	**0,606**	-	-
Environment to spend time in	**0,728**	-	-
Fishing and hunting	0,529	-	-
Forest work as a hobby	**0,618**	-	-
Outdoor activities	**0,77**	-	-
Relaxation and thinking	**0,795**	-	-
Protection of biodiversity, culture and water	0,556	-	-
Aesthetics	**0,648**	-	-
House on the property	-	-	**0,7**
Family tradition	-	-	**0,826**

Note: Loadings lower than 0.32 are removed, and loadings higher than 0.6 are in bold.

Overall, the loadings matrix is very close to a simple structure, meaning that each variable is only highly correlated with one PC: the VARIMAX rotation was successful. The only notable exception is the item on forest as a source of employment, which correlates highly with both PC1 and PC2. However, the correlation with PC2 is much higher than with PC1, which makes the analysis easier.

By looking at the correlation (a high loading means a high correlation) between PCs and reasons for owning forests, we can assign a meaning to each PC:

- PC1 correlates highly (i.e., has high loadings) with items dealing with outdoors, such as berry picking, outdoor activities or forest work, as well as with nature protection. Thus, it encompasses **recreational values**.
- PC2 correlates highly with all items dealing with finance and income, and as such can be understood as representing **economic values**.
- PC3 correlates highly with the items of family tradition, taking care of the house on the property, and also correlates fairly high with the item concerning the passing of the forest on to the next generation: it encompasses **traditional values**.

5.3 Clustering results: identification of five owner groups

5.3.1 Choice of the number of clusters

Respondents were clustered according to their score on each of the three extracted PCs. Solutions with 3, 4 and 5 clusters were compared based on the mean scores each cluster had on each PC, and the interpretability of the solutions was the main criterion.

While the solutions with 3 and 4 clusters lacked some of the main owner profiles identified in previous studies, the 5-clusters solution encompassed a wider range of owners' motives. It was also the easiest to interpret based on mean PC scores (see Table 7) and gave groups of similar sizes. For these reasons, the five-cluster solution was chosen.

Table 7 - *Mean PC scores for the 5-cluster solution.*

	1 Production oriented	2 Passive	3 Traditionalist	4 Multi-objective	5 Recreationist	P-value
PC1: recreational values	-1,107[a]	-1,292[a]	0,556[b]	0,462[b]	0,515[b]	2,00E-16
PC2: economic values	0,899[a]	-0,838[b]	-0,651[c]	0,940[a]	-0,402[d]	2,00E-16
PC3: traditional values	-0,387[a]	0,237[b]	0,665[c]	0,363[b]	-1,297[d]	2,00E-16
Cluster size	173	195	311	324	234	

Notes: 1 -P-value is based on an analysis of variance on all five clusters.

2 -Pairwise t-tests with Holm-Bonferroni correction are used to test for significant differences between each pair of clusters. Different superscripts reveal significantly different mean PC scores at the 5% level.

5.3.2 Analysis of mean PC scores and labelling of owner groups

Overall, mean scores on principal components are significantly different between the five clusters, as shown by the p-values, all lower than 0.05. This is not surprising, since the clustering was done on PC scores so as to create different and non-overlapping clusters. In order to analyse and label each cluster, results from the pairwise tests are used.

The main features of each cluster are:

- Production oriented owners: cluster 1 scores high on economic values only (PC1), and has the highest score on it (on par with cluster 4). Owners in this group see their forests as an investment, in the form of a regular source of income at the present time, or as a way to achieve long-term economic safety.
- Passive owners: cluster 2 has low scores on each PC. The mean score on PC1 is negative and also the lowest among the five clusters (on par with cluster 1). The mean score on PC2 is also negative, and the lowest among the five clusters. While the score on PC3 is positive, it is also the second lowest score on traditional values. Owners in this cluster seem to find limited value in their forest.
- Traditionalists: Cluster 5 has the highest score on traditional values. Traditionalist owners see their forest as part of a family heritage, and consider important to keep a close relationship to it, while passing it on to the next generation.
- Multi-objective owners: cluster 4 scores positively on all three PCs, and ranks first on economic values (on par with cluster 1) and recreational values (on par with clusters 3 and 5). Owners within this cluster seem to find multiple values in their forest. While economic profitability is their main goal, multi-objective owners are interested in having a multi-functional forest, and have a high interest in recreation and tradition.
- Recreationists: owners in cluster 5 only find recreational values in their forests, and have the highest score on it (on par with clusters 3 and 4). Recreationists put a high value on recreation activities in the forest, as well as nature protection. However, unlike traditionalists, they don't see their forest as part of a heritage to pass on.

5.3.3 Description and comparison of owner groups

5.3.3.1 Influence of background factors on the overall cluster classification

An analysis of variance is conducted to check for significant differences between owner groups on background data. Since all but one of the background variables are categorical, a chi-squared test is used as a test of independence in multiple 2-ways contingency tables. A p-value lower than 0.05 denotes a significant influence of the categorization of the background variable on the repartition of owners between clusters (see Tables 8 and 9). The tests proved significant correlations for all categorical background variables except for the ownership regime. This means that background of owners varies significantly among owner groups.

Table 8 - *Comparison of owner background among clusters*

Variables	Production oriented	Passive	Traditionalist	Multi-objective	Recreationist	p-value
Gender						
Male	80,5	70,5	70,5	81,0	78,8	4,96E-03
Female	19,5	29,5	29,5	19,0	21,2	
Age						
18-50 years old	19,9	8,3	18,1	21,2	25,6	3,64E-04
51-65 years old	39,8	34,2	32,9	30,5	33,5	
65+ years old	40,4	57,5	49,0	48,2	41,0	
Education level						
Primary	21,2	26,0	27,1	30,0	19,5	4,77E-04
Secondary	44,8	30,7	36,3	43,8	46,9	
University	33,9	43,2	36,6	26,2	33,6	
Education field						
Agriculture, forestry or biology	34,5	13,0	16,8	22,0	16,3	1,55E-06
Other	65,5	87,0	83,2	78,0	83,7	
Occupation field						
Forestry or farming	36,3	10,8	16,6	42,2	18,6	2,20E-16
Other	63,7	89,2	83,4	57,8	81,4	
Self employment						
Self-employed	43,3	21,1	27,7	47,8	32,3	9,49E-11
Not self-employed	56,7	78,9	72,3	52,2	67,7	
Retirement						
Retired	38,0	54,1	50,8	42,9	42,0	4,35E-03
Not retired	62,0	45,9	49,2	57,1	58,0	
Income						
0-5	46,0	72,4	76,3	37,5	73,6	2,20E-16
6 to 25	37,3	25,3	21,8	39,5	21,3	
25+	16,8	2,4	1,9	23,0	5,1	
Living environment						
Rural area	79,2	52,5	70,9	79,1	65,9	5,23E-09
Urban, (<50,000 inhabitants)	13,6	22,9	17,3	14,2	21,0	
Urban, (>50,000 inhabitants)	7,1	24,6	11,8	6,8	13,1	

Variables	Production oriented	Passive	Traditionalist	Multi-objective	Recreationist	p-value
Duration of ownership						
< 10 years	26,4	23,1	22,3	20,1	30,3	1,86E-02
11-20 years	23,3	23,1	27,6	21,7	28,6	
> 20 years	50,3	53,8	50,2	58,3	41,1	
Frequency of visits						
Weekly	37,2	18,7	52,7	61,3	55,8	2,20E-16
Monthly	49,4	46,0	40,2	34,0	39,3	
Rarely	13,5	35,3	7,1	4,7	4,9	
Residence on the property						
Yes (primary or secondary)	59,0	35,9	61,7	71,0	64,0	3,71E-13
No	41,0	64,1	38,3	29,0	36,0	
Inheritance						
Inherited	28,9	46,4	34,4	34,4	21,6	3,06E-06
Not-inherited	71,1	53,6	65,6	65,6	78,4	
Membership of an owner association						
Member	57,1	47,0	45,1	58,8	43,1	4,70E-04
Not member	42,9	53,0	54,9	41,2	56,9	
Recent operations						
Yes (primary or secondary)	90,0	82,6	86,2	97,2	87,9	6,72E-07
No	10,0	17,4	13,8	2,8	12,1	
Commercial operations						
Yes (primary or secondary)	82,9	72,8	79,0	92,3	75,4	2,13E-08
No	17,1	27,2	21,0	7,7	24,6	

Forest area is the only numerical continuous background variable. An analysis of variance is conducted to compare mean forest are in each cluster, as well as pairwise t-tests (Table 10). The very low p-value for the overall test reveals a significant variation of mean forest size between clusters.

Table 10 - *Comparison of forest size between clusters*

Variables	Production oriented	Passive	Traditionalist	Multi-objective	Recreationist	P-value
Forest area						
mean	153,27	92,54	93,45	135,58	98,28	
LN Forest area						
mean	4,22[a]	3,74[b]	3,74[b]	4,29[a]	3,72[b]	2.88×10^{-14}

Note: P-value is calculated by an ANOVA on the whole population of owners

5.3.3.2 Description and comparisons of each owner group

Cluster 1: Production oriented owners. This group presents a high share of male owners (80%), which is more than passive and traditionalist owners, and is characterized by a close relationship to forestry and agriculture: 34.5% of owners in it have studied in these field, which is the highest share of all owner groups, and 36.3% of owners work in the field of forestry or farming, making the group second only to multi-objective owners in that regard. This close relationship can also be seen in the owners' living environment: 79.2% of production oriented owners live in a rural area, which is more than any other group. They are also quite active and rely heavily on the forest: the share of self employed owners reaches 43.6%, and 62% of production-oriented owners are not retired, which are respectively the second and first highest shares among the five groups, and only 46% of owners in the group declare getting less than 5% of their income from the forest, which is the second lowest percentage. Concerning the management, production-oriented owners tend to favour an active management: 90.0% of owners have performed operations in the last five years, and 82.9% have performed commercial operations, which, once again, are the second highest percentages, behind multi-objective owners. The group also has the second highest share of membership to owner associations. With a mean forest size of 153ha, they have the biggest properties on average.

Cluster 2: Passive owners. Passive owners do not see much interest in their forest, and only slightly see it as part of a tradition, but much less than traditionalist owners. The mean forest size in this group is 92ha, which belongs to the lowest category, on par with traditionalist and recreationist owners. Passive owners tend to be older than owners in other groups, represent the highest share of retirees (54.1%) and are the best educated, with 43.2% having reached university level. They seem to have a distant relationship to forestry and agriculture, with the lowest shares of education (13%) in the field, as well as for occupation (10.8%). This distant relationship to forests can also be seen when looking at where passive owners live: one fourth (24.6%) of them live in large urban area, and 64.1% do not have any residence on their forest property, which are both the lowest shares of their categories. Concerning management, with 82.6% of recent operations and 72.8% of commercial operations, passive owners are, as expected, the least active owners of all five groups. These percentages are however quite high, showing that passive owners still care about their forests. 46.4% of passive owners have inherited their forest, which is the highest share among the five groups.

Cluster 3: Traditionalists. Traditionalist owners see their forest as part of a family heritage, and consider important to keep a close relationship to it, while passing it on to the next generation. They also have a high interest in recreation. Traditionalist owners have the highest share of female owners (29.5%), and are rather old, with the second highest percentage of owners older than 65 (49%) and of retired owners (50.8%). Even thought they have a low professional involvement in the forest, with high shares of education completed in other fields (83.2%) and of occupation in other fields (83.4%), they keep a close relationship with their own property. Even though only 1.9% of them declare receiving more than 25% of their income from it, only 7.1% of traditionalists visit their forest less than once a month, and a high 61.7% of them own a residence on the property, which is consistent with their reasons for owning forests. Concerning management, traditionalists are quite active, with 86.2% of owners declaring having performed operations recently.

Cluster 4: Multi-objective owners. Just like production-oriented owners, multi-objective owners are mostly male, at 81%, which is the highest share. Still similarly to production-oriented owner, they are quite active, with the second lowest share of retired owners (42.9%), and they rely heavily on the forest for income. They are also very close to their forests: 79.1% of them live in rural areas (second highest share), and they have

the most residences of their properties (71%). Concerning management, multi-objective owners are the most active of all five groups: 97.2% have conducted operations within the last five years, and 92.3% declare at least one commercial operation over the same period. Their properties are rather big, with a mean of 135ha, which places them in the first category, on par with production-oriented owners.

Cluster 5: Recreationists. Recreationists have the highest share of short-term ownership (30.3% under 10 years), and are rather young, with the highest percentage of owners under 50 years old (25.6%). They also have the lowest rate of inheritance (21.6%). As such, they can be seen as a category of younger, newer owners who may have purchased their forests to respond to their needs for recreation, which is consistent with their lack of interest in forest tradition. They have the lowest rate of primary education only at 19.5%, and the second highest rate of forestry or agriculture related education, at 16.3%. Even though their connection to the forest may be more recent, it is strong: only 4.9% of recreationists visit their forest less than once a month, and 64% of them own a residence on their property, which are respectively the second lowest and highest shares among all five groups. While a share of 43.1% membership of owner association, the lowest one, could suggest a low involvement in forest management, 87.9% of recreationists have performed operations recently. However, they have the second lowest rate of commercial operations, showing that management, even if quite active, is not aimed at making profit as much as in other groups.

5.4 Attitudes towards conservation and conservation policy

To test for significant differences in answers to the chosen questions among owner groups, a Kruskal-Wallis analysis of variance is performed (Kruskal and Wallis, 1952). Kruskal-Wallis analysis of variance is the non-parametric equivalent to the usual analysis of variance, used when the data is not normally distributed. This is especially the case with ordinal data, since answers to the questions are on an scale ranking from 1 to 4 (Mizaraite and Mizaras, 2005). Since the Kruskal-Wallis analysis of variance only tests for rejection of the null hypothesis considering all owner groups at once, Dunn's test is used to investigate pairwise differences (Dunn, 1964). Dunn's test is the non-parametric equivalent to pairwise t-tests, used when data is not normally distributed.

5.4.1 Attitudes towards general environmental issues

5.4.1.1 General attitude of the whole population of respondents towards environmental issues

Owners are in general concerned with environmental issues: 78% of them disagree with the fact that statements about environmental issues are exaggerated (B1.6, see Fig. 14). While opinions are quite mixed regarding whether others worry too much about the environment (B1.1), forest owners consider themselves not to worry too much (85% of agreement) about environmental problems (B1.3). Concerning how to solve these issues, 75% of owners do not believe that science will be the solution, but that instead a change in lifestyle will be necessary (B1.2): they overwhelmingly support an overall involvement for the next generation (B1.4, 94% of agreement), and 85% consider already doing what is best for the environment (B1.8) without waiting for others to do so (B1.5, 66%). Answers to questions B1.9 and B1.10 support this point of view: 65% of respondents favour individual owners and companies making their own decisions (B1.10), while only 30% would want the government do more at the cost of individual liberties (B1.9). Concerning knowledge, half of respondents agree with the fact that it is hard for them to know what is harmful for the environment (B1.7).
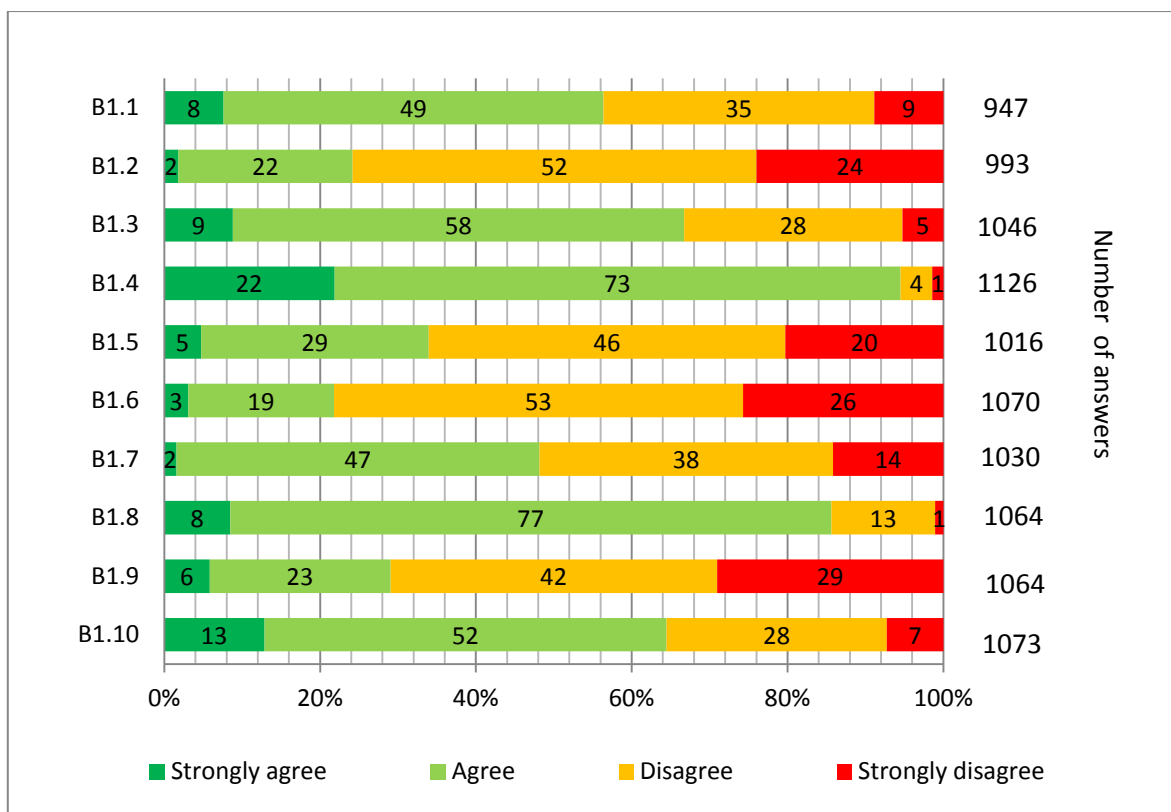
Figure 14 - *Answers to question B1: To what extent do you agree with the following statements concerning environmental issues?*

Note: numbers on bars represent percentages of answers

5.4.1.2 Comparison of attitudes towards environmental issues between owner groups

Owners with economic motivations (production-oriented and multi-objective owners) are the ones who think the most that people worry too much about environmental issues (B1.1, see Table 11). Concerning the owners themselves, owners with traditional values (traditional and multi-objective owners) worry less than owners in other groups (B1.3). They are also the main proponents of a general involvement for the next generations (B1.4), which is consistent with their motives. Production oriented-owners are the most likely to not get involved if others don't do anything, while traditionalists are most likely to act by themselves (B1.6). Similarly, traditionalist owners have a stronger belief that they do what they think is best for the environment even thought it may cost them money and time in comparison to production-oriented owners (B1.8). Finally, owners with economic motivations are the least inclined to accept an involvement of the state in managing environmental issues, contrary to owners with traditional values (B1.9). Passive owners and recreationists mostly do not present significant differences with other groups.

Table 11 - *Mean answers to items within question B1 for each owner group*

Questions	Production oriented	Passive	Traditionalist	Multi-objective	Recreationist	Whole population	P-value
B11	2,7[ab]	2,4[c]	2,5[ac]	2,7[b]	2,5[ac]	2,6	**1,21E-05**
B12	2,0	2,0	2,0	2,1	1,9	2,0	1,21E-01
B13	2,6[a]	2,6[ab]	2,8[bc]	2,8[bc]	2,7[ac]	2,7	**3,36E-03**

						P-value
B14	$3,0^a$	$3,1^{ab}$	$3,2^c$	$3,2^{bc}$	$3,1^a$	3,1	**3,58E-04**
B15	2,2	2,1	2,2	2,3	2,1	2,2	1,28E-01
B16	$2,1^a$	$2,0^{ab}$	$1,9^{bc}$	$2,0^{ac}$	$2,0^{ac}$	2,0	**4,21E-02**
B17	2,4	2,5	2,3	2,3	2,3	2,4	2,68E-01
B18	$2,8^a$	$2,9^{ab}$	$3,0^{bc}$	$3,0^{ac}$	$2,9^{ac}$	2,9	**2,53E-03**
B19	$1,9^a$	$2,2^b$	$2,2^b$	$2,0^a$	$2,1^{ab}$	2,1	**4,28E-04**
B110	$2,8^{ab}$	$2,6^b$	$2,7^{ab}$	$2,8^a$	$2,6^{ab}$	2,7	**2,53E-03**

Notes: 1- Different superscripts denote significantly different means at the 5% level
2- P-value is calculated by an ANOVA on the whole population of owners

5.5.2 Knowledge of conservation concepts

5.5.2.1 General level of knowledge of the whole population of respondents

General knowledge of conservation concepts and tools is quite good. As shown by Fig. 15, at least 60% of owners declared having at least fairly good knowledge of them, except for the sustainable forests goal (B4.5) and the tool of wildlife conservation areas (B4.7). Similarly, all items had at least 20% of owners declaring a good knowledge while the share of owners with no knowledge at all is consistently smaller, except for the sustainable forest (in Swedish: Levande skogar) goal.
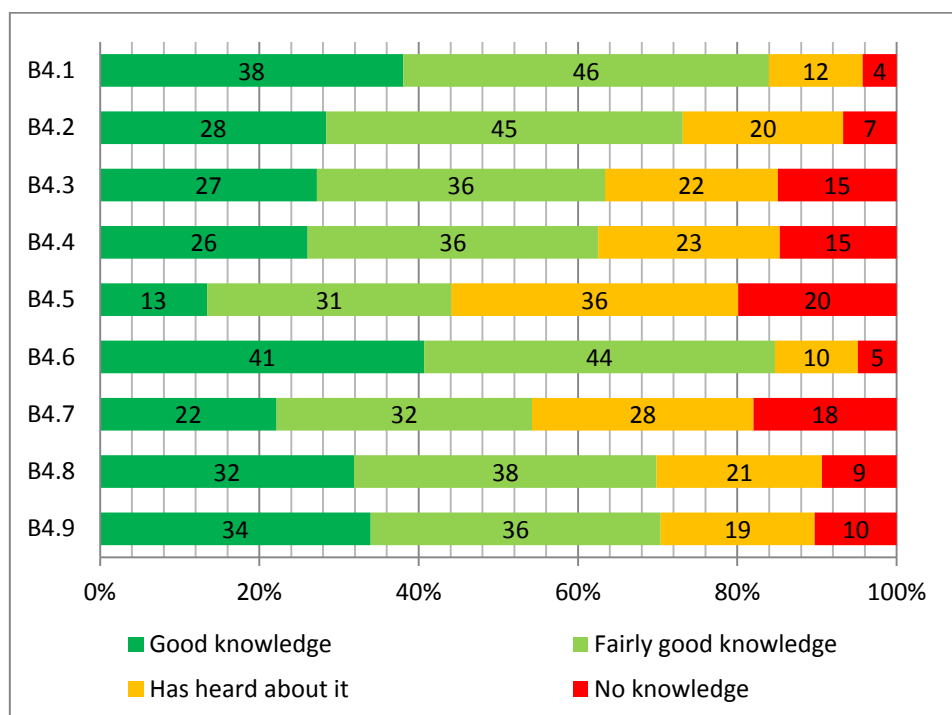

Figure 15 - *Answers to question B4: How familiar are you with the following ecological concepts?*

Note: numbers on bars represent percentages of answers

Tests on individual items (Table 12) reveal that some concepts and tools are significantly better known than others. Generally, concepts such as biodiversity of habitats are better known than conservation tools. Unsurprisingly, the concept of biodiversity (B4.1) is the best know, on par with of nature reserves (B4.6). These concepts have been part of the public debate for a long time, and it comes with no surprise that owners know them best. The three concepts of habitat area (B4.2), key habitat (B4.8) and red-listed species

(B4.9) form the second most well known category. They are followed by the voluntary conservation tools of general considerations (B4.4) and voluntary set-asides (B4.3), which are better known than the least advertised mandatory tool of wildlife conservation area (B4.7). The least known item overall was the sustainable forest goal (B4.5), which is neither a tool nor a concept, but a goal to be reached through policy.

Table 12 - *Comparison of items within question B4 in terms of knowledge level*

Question	Amount of answers	Mean	Standard deviation
B41	1198	3,18[a]	0,80
B42	1191	2,95[b]	0,87
B43	1193	2,7[c]	1,01
B44	1193	2,74[c]	1,00
B45	1191	2,38[d]	0,95
B46	1190	3,21[a]	0,82
B47	1186	2,58[e]	1,02
B48	1195	2,92[b]	0,95
B49	1195	2,94[b]	0,97

Notes: 1- Different superscripts denote significantly different means at the 5% level
2- P-value is calculated by an ANOVA on all items of B4. The P-value for the overall table was inferior to $2*10^{-16}$.

5.5.2.2 Comparison of knowledge between owner groups

Difference for knowledge has been tested among owner groups (see Table 13). Concerning overall knowledge as well as each item individually, the level of knowledge differs between owner groups (except for nature reserve).

Owners with economic motivations consistently have the highest level of knowledge. Multi-objective owners have a significantly higher level of knowledge than passive, traditionalist and recreationist owners. Production-oriented owners, while still having a high level of knowledge and not being significantly different from multi-objective owners, are closer to the three other owner groups. Passive owners consistently belong to the category with the least knowledge.

Table 13 - *Mean answers to items within question B4 for each owner group*

Questions	Production oriented	Passive	Traditionalist	Multi-objective	Recreationist	Whole population	P-value
B4	2,9[ab]	2,6[c]	2,8[a]	3,0[b]	2,9[a]	2,8	**8,08E-07**
B41	3,1[ab]	3,0[a]	3,2[b]	3,2[b]	3,2[b]	3,2	**1,02E-03**
B42	2,9[ab]	2,7[a]	2,9[ab]	3,1[b]	3,0[ab]	2,9	**2,02E-04**
B43	2,8[ac]	2,5[b]	2,7[ab]	3,0[c]	2,7[ab]	2,8	**1,63E-05**
B44	2,8[ab]	2,4[c]	2,7[a]	2,9[b]	2,8[ab]	2,7	**1,01E-05**
B45	2,3[ab]	2,1[a]	2,5[bc]	2,5[b]	2,3[ac]	2,4	**3,37E-06**
B46	3,2	3,1	3,2	3,3	3,2	3,2	4,22E-01

B47	2,7^{ac}	2,3^{b}	2,5^{ab}	2,8^{c}	2,5^{ab}	2,6	**1,07E-07**
B48	2,9^{ab}	2,7^{a}	2,8^{a}	3,1^{b}	2,9^{a}	2,9	**7,12E-06**
B49	2,9^{ab}	2,8^{a}	2,9^{ab}	3,0^{b}	3,0^{ab}	2,9	**3,00E-02**

Notes: 1- Different superscripts denote significantly different means at the 5% level
2- P-value is calculated by an ANOVA on all items of B4

5.5.3 Attitudes towards Swedish conservation policy

5.5.3.1 General attitudes of the whole population of owners towards Swedish conservation policy

According to answers to question B5 (see Fig. 16), most owners support a system where individual owners should get involved (91% of agreement with B5.2) and are confident that individual initiatives are efficient instead of having the state responsible for conservation (66% of disagreement with B5.1). This is consistent with results found in B1.4, B1.9 and B1.10.

Concerning the Swedish forestry model for conservation, owners are quite satisfied: 85% are confident that it secures biodiversity in forests (B5.3) while only 20% find it too vague and unfocused to reach environmental goals (B5.4). However, owners feel concerned by the regulations and possible restrictions of their freedom of choice, with 58% of them finding the policy to be too restrictive (B5.5). This confirms previous responses given concerning the role of the state versus the role of individuals.

Finally, owners agree that the goal of sustainable forests is well designed to reach Sweden's environmental goals (84% of agreement to B5.6). However, analysis of question B4 demonstrated a low level of knowledge regarding this item, and question B5.6 has the lowest rate of response of all items analysed so far. Therefore, this result does not have strong support, and thus should be considered carefully.
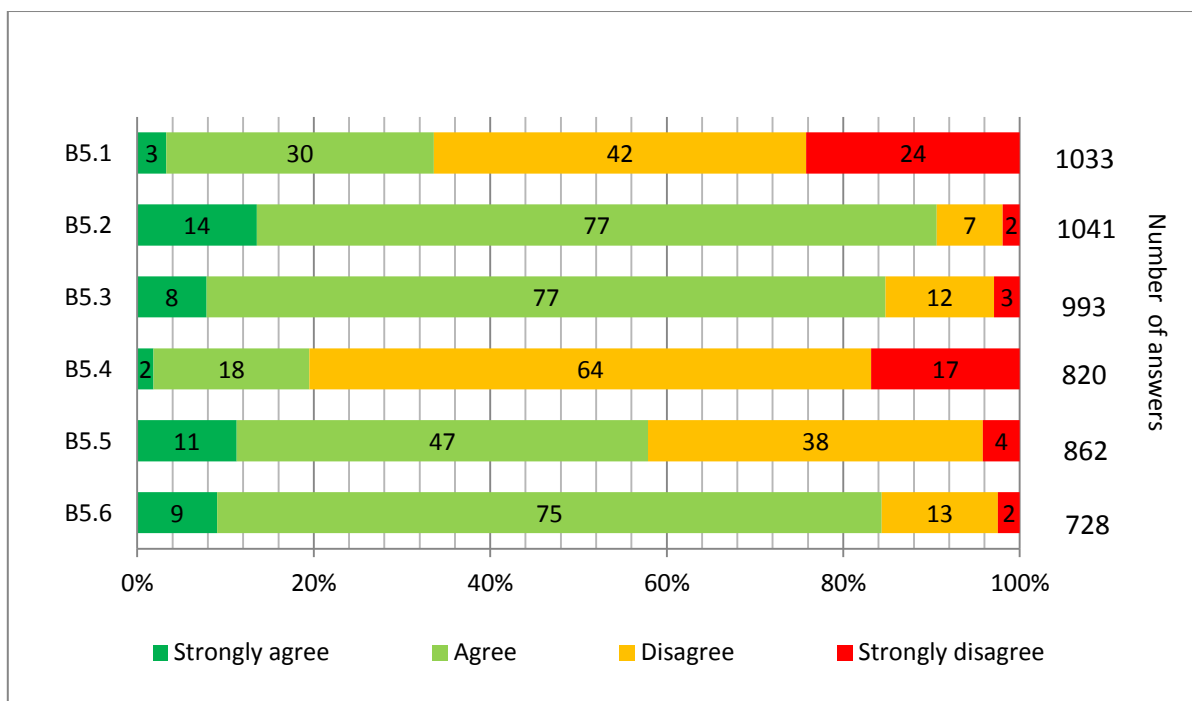
Figure 16 - *Answers to question B5: To what extent do you agree with the following statements about environmental measures in Swedish forestry?*

Note: numbers on bars represent percentages of answers

5.5.3.2 Comparison of attitudes towards Swedish conservation policy between owner groups

Groups are more homogeneous regarding their opinion on the Swedish forestry model than they were for question B1 and B4: out of the six items tested, there was a significant difference between groups for three only (Table 14). Owner groups show no difference regarding their opinion on the state's role in conservation, their confidence in the efficiency on the Swedish forestry model and the goal of sustainable forests.

Traditionalist owners have a stronger belief than production oriented owners that all owners should get involved in conservation to improve the future for the next generations (B5.2), which is consistent with their traditional values as well as answers to question B1.

The group of passive owners agrees the most that the Swedish forestry model is too unfocused to be efficient (B5.4), while production-oriented owners are the group that disagrees the most with the statement. Production oriented-owners have a strongest belief that the regulation is too restrictive compared to passive owners (B5.5).

Table 14 - *Mean answers to items within question B5 for each owner group*

Questions	Production oriented	Passive	Traditionalist	Multi-objective	Recreationist	Whole population	P-value[2]
B5.1	2,0	2,2	2,2	2,1	2,1	2,1	1,16E-01
B5.2	$2,9^a{}_1$	$3,0^{ab}$	$3,1^b$	$3,0^{ab}$	$3,0^{ab}$	3,0	**4,62E-04**
B5.3	2,9	2,9	2,9	2,9	2,8	2,9	1,67E-01
B5.4	$1,9^a$	$2,2^b$	$2,1^{bc}$	$2,0^{ac}$	$2,1^{ab}$	2,0	**5,87E-04**
B5.5	$2,8^a$	$2,5^b$	$2,6^{ab}$	$2,7^{ab}$	$2,6^{ab}$	2,6	**2,30E-02**
B5.6	3,0	2,9	2,9	3,0	2,9	2,9	6,00E-02

1- Different superscripts denote significantly different means at the 5% level
2- P-value is calculated by an ANOVA on all items of B4

6. Discussion

6.1 Values and groups of owners

6.1.1 NIPFs and their values

The analysis showed that NIPFs can be described and compared according to three main kinds of values:

- **Recreational values**, which encompass nature protection, outdoor activities and aesthetics. These values showed to be the main factor, which differentiates NIPFs in their motivation, with the associated principal component explaining 34% of variance in the sample.
- **Economic values**, which encompass both short and long term economic benefit to the owner as well as employment and investment security.
- **Traditional values**, which relate to the passing on of the forest to the next generations, the keeping of the property in the family and forestry as a traditional activity.

Together, these three groups of values define NIPFs in Sweden, and explained 54% of the variation in the owners' reasons for owning forests. As a tool, PCA has been successful, since it achieved summarizing a complex set of values into a smaller one, while retaining much of the information.

Even though the three values derived from the PCs were constrained by the items present in the survey, they can be compared to results from Hugosson and Ingemarson (2004) concerning Swedish NIPFs' values, which were presented in section3. Some comments can be made regarding similarities and differences between the two studies:

- Our study seems to confirm the existence of economic values as an important motivation for Swedish owners. Both studies group short and long term benefits under the same motivation.
- The *amenities* motivation bears resemblance to the traditional values identified in the PCA. Indeed, they both include forestry tradition in the family as well as a link to the forest property.
- The recreational values identified in this study groups together the two separate motivations that were identified by Hugosson & Ingemarson (2004): *utilities* (non wood products and recreational aspect) and *conservation (*protection aspects*)*. We also included aesthetics in recreational values rather than in traditional values.

6.1.2 Groups of owners and NIPFs' motivations

The study revealed the existence of 5 groups of NIPFs in Sweden. Two of the groups are **one-dimensional**: production-oriented owners (economic values only) and recreationists (recreational values only), while two other groups are **more complex** and defined by several values: traditionalists (traditional and recreational values) and multi-objective owners (all three values). Finally, passive owners are characterized by **no strong value** regarding the forest. Using the framework provided by Dhubháin & Cobanova, (2007) and Urquhart & Courtney (2011) (see Fig. 17), we can analyse the owner groups regarding their goals, in comparison with previous typologies. It appears that, out of the five groups, four fit in usual archetypes found it past studies.
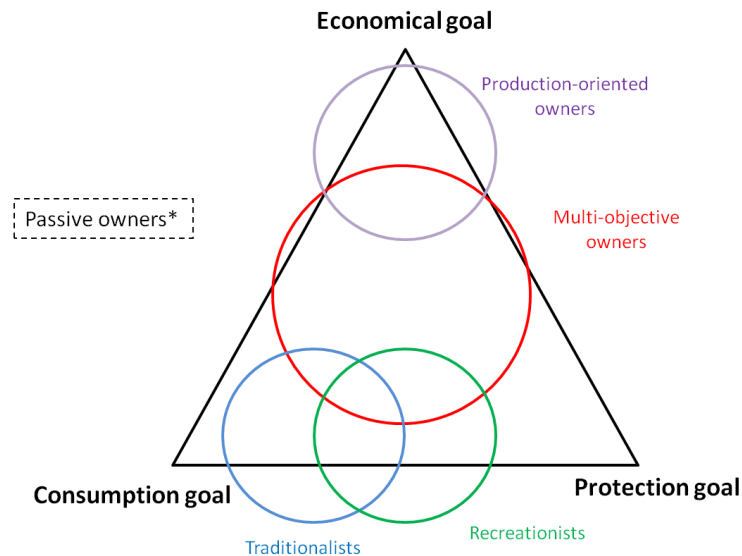
Figure 17 - *Owner groups and their goals* (Urquhart and Courtney, 2011)

*Note: passive owners are outside of the figure because they have to stated goal

- Production oriented owners fall into the category of owners with production goals only. Our results do not show a separation between the timber production goal and the economic goal per se as previous studies did (e.g., Lönnstedt, 1997).
- Recreationists fall into the category of owners with consumption and protection goals. Even though Urquhart & Courtney (2011) makes a difference between those two goals, our analysis only showed a single motivation (PC1), which comprises both the consumption (recreation) and protection aspects. In that sense, our study is closer to the analysis of Dhubháin & Cobanova (2007). This is consistent with our merging of *utilities* and *conservation* motivations identified by Hugosson & Ingemarson (2004) into recreational values.
- Multi-objective owners have been consistently identified in other studies (e.g., Hallikainen, Hyppönen, Pernu, & Puoskari, 2010; Ingemarson, 2006; Jennings & Putten, 2006; Kline, Alig, & Johnson, 2000; Urquhart, Courtney, & Slee, 2012), and usually encompass economic, protection and consumption goals (Dhubháin and Cobanova, 2007; Urquhart and Courtney, 2011).
- Passive owners are also a common feature in previous typologies (Dhubháin and Cobanova, 2007; Urquhart and Courtney, 2011), and are characterized by no affiliation to a certain goal.

6.1.3 The special case of traditionalists

Traditionalists however, are less commonly identified in previous typologies, and not mentioned in reviews (Dhubháin and Cobanova, 2007). Because they score high on recreational values, they lean towards both consumption and protection goals. However, they are also motivated by inheritance, passing on the forest to the next generation in a good state and keeping the link with their housing on site, which are consumption goals as well. As such, they can be considered, like recreationists, to be aligned with consumption and protection goals, but leaning towards consumption goals more.

Considering this, they bear resemblance to several owner groups from previous studies: like *forest-utilitarians* (Marty et al., 1988) and *conceptually interested owners* (Bieling, 2004), they own the forest for

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their own use (recreation, amenities, property) and consider it more important than economic profit. At the same time, they also value forest as a tradition like *custodians* (Urquhart et al., 2012) and *conceptually interested owners* (Bieling, 2004), and manage it for the next generation. A similar group of owners has been identified by Ingemarson (2006) in Sweden, who describes *traditionalists* as close to *environmentalists*, but with an added dimension of expecting children to take on the forest in the future. Our results highlight the importance of forest tradition in Sweden.

6.2 NIPFs' background compared to other studies

This section puts our findings on NIPFs' backgrounds into context by comparing them to what was previously found in other studies. Because many differences are found across Europe and different regions (Wiersum et al., 2005), comparisons with typologies in Northern Europe are favoured.

6.2.1 Production-oriented owners

Production-oriented owners were found to own larger properties and to rely more heavily on forest income than other groups, which is in accordance with previous studies (e.g., Bieling, 2004; Boon, Meilby, & Thorsen, 2004; Ingemarson, 2006; Mizaraite & Mizaras, 2005; Stanislovaitis & Brukas, 2015). Their strong relationship to forestry, agriculture and a rural environment is also a common trait found in similar owner groups across Europe. In Germany, Bieling (2004) for example describes *economically-interested* owners as well integrated in their social, countryside surroundings. We also showed they perform an active forest management, which is a trait compatible with findings from Boon et al (2004), who reveal that Danish *classic forest owners* mostly consider themselves full-time forestry workers. Other studies also confirm this active management for their economically-aligned owners (e.g., Ingemarson, 2006; Stanislovaitis & Brukas, 2015).

6.2.2 Recreationists

We described recreationists as younger owners, who acquired their properties recently. They visit their forest often and have a strong relation to it. This profile is confirmed by Ingemarson, (2006), whose *conservationists* (in Sweden as well) are younger owners, with a shorter-term ownership and who acquired their forest through inheritance less often. They also live further away from their properties and often come from cities. These two observations of the same phenomenon could show the arrival of a new generation of forest owners: city dwellers less interested in timber production than in recreation and amenities. This trend has also been evocated by Wiersum, Elands, & Hoogstra (2005) in their study of NIPFs across Europe. According to our results, they are still active in their management, but do not perform as many commercial operations as other owners. This agrees with Karppinen, (1998) who found in Finland that non-timber objectives do not exclude timber production altogether.

6.2.3 Passive owners

We described passive owners as owners with smaller properties, which is a trait having been found in *passive, indifferent* and *ad hoc* owners from other studies in Northern Europe (Bieling, 2004; Boon et al., 2004; Ingemarson, 2006). According to Ingemarson (2006) and Boon et al. (2004), they visit their estate less often, while Bieling (2004) describes *uninterested owners* as less integrated to their surroundings. This comes as a confirmation of our finding of passive owners having a more distant relationship to their forests when compared to other groups.

6.2.4 Multi-objective owners

Multi-objective owners in our study own larger properties, perform an active management and have a close relationship to their forest and to forestry. In Sweden as well, Ingemarson (2006) also found similar traits, with *multi-objective owners* owning large estates for a longer time, and relying more heavily on forestry as a source of income. We also described their high level of knowledge about conservation, while Hallikainen et al. (2010) and Ingemarson (2006) also report a high level of knowledge, in Finland and Sweden respectively.

6.2.5 Traditionalists

Traditionalists were described as older owners with a close relationship to their forest, who engage into an active management. Because similar groups of owners are rare in other studies, comparisons are harder to make. Ingemarson (2006) describes *traditionalists* in Sweden as living in the municipality where their forest is located, half of them living on their estate, and 80% having inherited the property.

6.2.6 Summary

Overall, the profiles which we built for the five owner groups, in terms of motivations as well as background appear to be consistent with what has been found in previous studies. It confirms previous results that there is a strong link between owners' motivations and values, their background demographics and the characteristics of their forests.

6.3 Relationship to conservation policy and the Swedish forestry model

6.3.1 Attitudes towards the Swedish forestry model as a whole

Forest owners are in general aware of current issues, agree that something must be done and are aware that a change in lifestyle is necessary. The general opinion towards the Swedish forestry model is good, and NIPFs are confident that the model is adequately designed. There is a tendency towards individual commitments, and concern regarding state intervention, regulations and possible limitations to the freedom of owners. It can be deducted from this result that the 1993 forestry Act, which introduced the concept of "freedom with responsibilities" for owners as well as the reduced amount of regulation has been well accepted by NIPFs.

6.3.2 Level of knowledge

The analysis revealed two main facts regarding conservation-related knowledge. First, conservation policy remains less well known than general conservation concepts, and more recent tools such as habitat protection areas remain less known than older ones, such as nature reserves, which have been advertised for a shorter time. This suggests that some effort is still to be done in order for NIPFs to be fully aware of how the Swedish forestry model works, for them not to have access to part of it only. Developing forest extension, communication and education could prove useful for that purpose. Secondly, owners with high economic values have a better knowledge than others, and passive owners have the lowest amount of knowledge, which is consistent with those groups' respective level of involvement in forestry. This means that efforts should focus on reaching passive owners and owners with less economic motivations, in order to bring them knowledge of conservation, policy and the Swedish forestry model.

6.3.3 Diverging attitudes regarding conservation policy

Regarding differences between owner groups, an interesting fact is that, even though recreational values explain most of the variation in owners' motivations, it has little influence on their attitudes regarding conservation and conservation policy. Indeed, economic values and traditional values seem to be a determining factor leading to diverging attitudes. There are two main points on which opinions are diverging:

- **The role of state intervention**: strong economic values lead to a lower acceptance of state intervention and a stronger belief that regulations are too restrictive while traditional values provoke the opposite.
- **Individual commitments:** strong traditional values lead to a higher involvement in actions in favour of the environment, even at the cost of time and money. Strong economic values lead to some reluctance regarding these commitments, and production-oriented owners are less likely to engage into costly voluntary practices.

Owners with traditional values are concerned with passing on their properties in a good state to the next generation, so it doesn't come as a surprise that they would be willing to get involved on an individual basis to ensure the good state of forests.

Owners with economic values value profit, but they do not value the future after themselves as high as owners with traditional values. Consequently, since actions in favour of the environment would likely diminish profit and may not produce short nor medium term results, the reluctance of those owners is consistent with their motivations. Besides, forestry is a competitive sector. In order to keep a competitive advantage on other owners, owners with high economic values should not engage into costly actions alone: it is a problem of free-riding. At the same time, they more strongly reject an intervention of the state. They prefer a status-quo which maintains their situation and position in the industry.

Owners with both traditional and economic values have a intermediate position overall: they are reluctant towards state intervention and more regulations because of their economic interests, but are ready to get involved at the individual level because of their traditional values. This shows all the complexity of understanding owners' motivations and values to design policy.

6.3.4 Relationship to different policy instruments

These contrasting positions highlight the fact that values, goals, backgrounds, attitudes and behaviours are linked in forest owners, which was the conclusion to which many other typology studies came (e.g., Jennings & Putten, 2006; Karppinen, 1998; Kuuluvainen, Karppinen, & Ovaskainen, 1996). Because of the different reactions to policy tools, a wide range of policies is likely needed in order to reach all owner groups (Boon and Meilby, 2007; Herzele and Gossum, 2008; J. Kline et al., 2000; Urquhart and Courtney, 2011), and each instrument will affect owner groups differently (Kendra and Hull, 2005; Pregernig, 2001). Indeed, owners tend to accept policies which help them achieve their goals while not being contradictory to their values (Bliss and Martin, 1989; Serbruyns and Luyssaert, 2006).

Consequently, policies need to be (1) varied and (2) targeted, with some tools aiming at some owners more than others, while still applying equally to all. We can use the framework provided by Bemelmans-Videc, C. Rist, & Verdung (2011) which distinguishes between three kinds of policy instruments: (1) regulatory

instruments (sticks), which are pieces of law issued by governments, (2) economic instruments (carrots), which are market-based tools such as subsidies and fines, and (3) informative instruments (sermons), which include communication, education, etc.

Multi-objective owners: since they pursue many different goals and value different things, they would likely be the easiest group to target through economic, regulatory or informative instruments. Indeed, their practices and the goals of public policy, which both aim at providing a wide range of goods and services, are compatible (Boon et al., 2004; Urquhart and Courtney, 2011).

Passive owners: because of their lack of interest and involvement, they would probably be the hardest to reach (Ingemarson, 2006; Kendra and Hull, 2005). In this case, regulations and incentives are likely to not work, which leaves informative tools as the best solution (Bieling, 2004; Boon et al., 2004). As pointed out earlier, education and communication would help raise their awareness about conservation and forests in general.

Production-oriented owners: their main motivation being timber production and profit, they are concerned with monetary loss and gain (Boon et al., 2004; Urquhart and Courtney, 2011). Thus, financial tools such as incentives through subsidies are likely to work best, which has been pointed out in previous studies (Bieling, 2004; Boon and Meilby, 2007; J. Kline et al., 2000). This is especially true if they promote practices compatible with the owners actual management (Serbruyns and Luyssaert, 2006). For this reason, even though fines would probably work on production-oriented owners, subsidies are preferable. Since this group of owners seems to dislike regulations, they should be avoided.

Traditionalists: as we have seen, owners with traditional motivations are the easy to get involved in conservation: regulations are not needed. Subsidies promoting actions in favour of the environment, which these owners may already carry out, are to be preferred. However, they lack economic interest, which would limit their effectiveness. Since we saw that not all owners know if their lifestyles are good for conservation, providing more information could also be beneficial.

Recreationists: This group of owners is harder to target. Indeed, they lack economic interest, which makes financial tools less efficient. Like other NIPFs, they are reluctant towards regulations. Informative tools are left: because recreationists are newer owners and already have a high environmental awareness, information should focus on forestry and silvicultural-related knowledge, and how owners can improve the state of their forests through management. For instance, T. Boon & Meilby (2007) propose to focus on their existing will to improve the environment.

Overall, education and information seem to be the way to go in order to reach most owner groups. This was previously pointed out by several other studies (e.g., Bieling, 2004; Mizaraite & Mizaras, 2005; Wiersum et al., 2005). Policy instruments also need to be diversified. The Swedish forestry model already combines regulatory, financial and informative instruments. The pyramid of tools we described previously includes mandatory policies as well as voluntary ones, and the concept of "freedom with responsibility" gives freedom to the owner. For those reasons, the Swedish forestry model is already diversified in its approach to conservation, and has already reduced the amount of regulations when passing the new forestry Act in 1993. This observation is confirmed by NIPFs having an overall good opinion of the Swedish forestry model. Thus, effort should be made to reach the groups which are the least involved in conservation: passive owners and

production-oriented owners. Further analyses of the survey data should focus on examining the attitudes and behaviours of NIPFs regarding each of the specific tools in the Swedish forestry model, one by one, which has not been done in this study.

Conclusion

Originating from the observation that the Swedish forestry model, based on a wide range of policy tools, did not meet the expected success with NIPFs regarding conservation, this thesis project used data from a national survey to create an owner typology and investigate NIPFs' attitudes towards conservation and conservation policy. In particular, three purposes were defined:

1. Getting a deeper understanding of the values which are important to Swedish NIPFs, and at eliciting possible relationships between these values and the owners' backgrounds.
2. Analysing NIPFs' general attitudes towards conservation in general and the Swedish forestry model for conservation in particular.
3. Creating an owner typology based on NIPFs' reasons for owning forests. More than a method used for the two previous purposes, the owner typology is a goal in itself since it provides a baseline for future studies regarding NIPFs in Sweden.

Using PCA, three main values have been identified as critical to understand variation among NIPFs': recreational values, economic values and traditional values. Based on these, the K-means clustering method was used to identify five owner groups with significantly different motivations: production-oriented owners, recreationists, passive owners, multi-objective owners and traditionalists. The typology has been successfully created, and the subsequent analysis of background information revealed differences between owner groups, thus eliciting a link between the owners' values and backgrounds.

Regarding attitudes, results revealed a high awareness of environmental issues, and the Swedish forestry model was generally well accepted by owners. However, attitudes were proved to be significantly different between owner groups, which thus links them to the owners' values and backgrounds. While recreational values explain most variation in NIPFs' motivations, it is economic and traditional values which influence the owners' opinions and attitudes the most. Owners with economic values rejected state intervention more strongly, while owners with traditional values were keener on getting involved in conservation at the individual level. Knowledge also proved to be correlated to the owners' values, and economically interested owners had a higher level of knowledge, while passive owners were the least knowledgeable on conservation.

Overall, the methods of exploratory statistics used were successful at eliciting relationships between NIPFs' motivations, backgrounds and attitudes, and at creating a typology which can serve as a baseline to understand Swedish NIPFs. Because of their diverging interests, NIPFs react differently to policy, which is revealed by their attitudes. In order to successfully ensure the protection of the natural value of forests, a wide range of policy tools with different focuses should be used in order to reach as many owners as possible. While Sweden already combines different approaches to conservation in its policy, efforts should be made to reach owners who appear to be the least involved. Education and communicative tools such as forest extension have been proposed for this purpose.

This study focused on the involvement of NIPFs in conservation in general, and no analysis was made regarding their involvement in and attitudes towards individual policy tools within the Swedish forestry model. The typology could be used in conjunction with data from the survey regarding involvement in voluntary set-asides and general consideration to further analyse NIPFs behaviours regarding those particular tools, which the Swedish forestry model introduced back in 1993.

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Future Forests

Formellt
avsatt skog

Frivilligt avsatt skog eller
skogsskötsel med förstärkt
hänsyn

Skogsproduktion med generell hänsyn*

*Sparande av träd och trädgrupper, hänsyn mot vatten,
skapande av död ved m.m.

Naturvård i svenskt skogsbruk

Undersökningen du håller din i hand är en del av ett projekt som syftar till att ta reda på vad svenska skogsägare tycker om naturvård i skogen. Enkäten skickas ut till 3 000 privata skogsägare i hela Sverige under november/december 2014.

Förutsättningarna för att förena naturvård och skogsbruk är en fråga som diskuteras i samhället idag. Det är också högaktuellt inom forskningen, inte minst inom forskningsprogrammet Future Forests. De privata skogsägarna äger omkring femtio procent av den svenska skogen och utgör en viktig grupp när det gäller skogsskötsel och naturvård. Vi vet dock fortfarande väldigt lite om hur skogsägare ser på naturvård i samband med skogsbruk och hur naturvård utförs idag. Kunskapen om de privata skogsägarnas inställning till naturvård är en viktig pusselbit för framtida beslut om naturvård. Därför är dina svar viktiga.

Vi hoppas du kan avsätta ca 30 minuter för att svara på enkäten. Känns det svårt att svara på någon fråga, markera hellre "vet inte" än att lämna frågan tom.

Resultaten av studien kommer att redovisas i bland annat Future Forests tidskrift "Skog och framtid" under våren 2015, för att komma dig som skogsägare till dels. Får du inte redan tidskriften, registrera dig på Future Forests hemsida.

Om du vill kan du fylla i enkäten via internet, använd länken nedan och ange den kodsiffra som finns på nedre vänstra hörnet på svarskuvertet. Numret används enbart för att skicka eventuell påminnelse.

www.slu.se/naturvard

Dina svar kommer att behandlas anonymt och enskilda svar kommer inte att kunna urskiljas när resultatet av enkäten redovisas. Vi behöver ditt svar senast **9 januari**.

Om du har frågor är du välkommen att ringa, 090-786 85 96, eller skicka email: camilla.widmark@slu.se.

Tack för din medverkan!
Ditt svar är viktigt!

Umeå 2014-11-25
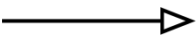
Camilla Widmark
Forskare, Institutionen för Skogsekonomi

Del A – Frågor om din skogsfastighet

Här ställer vi frågor om din skogsfastighet, ditt ägande och varför du valt att äga skog. Om du äger flera fastigheter, besvara frågorna utifrån den fastighet som nämns på adressetiketten på kuvertet.

För varje fråga, markera ett svarsalternativ, utom i de fall då vi särskilt ber om flera alternativ.

A1: Hur ser fastighetens ägarförhållande ut?

○ Ensam ägare
○ Äger tillsammans med min partner
○ Delat ägarskap ⟶
    ○ 2 ägare
    ○ 3 ägare
    ○ 4 eller fler ägare
○ Ägs av ett dödsbo

A11: Hur fattas beslut om åtgärder på fastigheten?

○ Jag är huvudansvarig
○ Annan person är huvudansvarig
○ Alla ägare har ungefär lika stort ansvar

A2: Hur länge har du varit ägare till fastigheten?

○ 0 – 5 år
○ 6 -10 år
○ 11-15 år
○ 16 – 20 år
○ 21 år -
○ Vet inte

A3: Hur förvärvade du fastigheten?

○ Genom arv/generationsskifte
○ Genom gåva
○ Genom köp av förälder eller släkting
○ Genom köp på marknaden

A4: Hur ofta besöker du i genomsnitt din fastighet under ett år?

○ Aldrig
○ Minst 1 gånger per dag
○ Mellan 1 – 5 gånger per vecka
○ Mellan 1 – 5 gånger per månad
○ Enstaka tillfällen, någon gång månad
○ Enstaka tillfällen, någon gång per år

↳ **A41: Om du besöker din fastighet, ange de viktigaste anledningarna?**
Ange max 3 anledningar.

☐ Bär- och svampplockning

☐ Friluftsliv (gå med hunden, promenera, utflykt.)

☐ Jakt/fiske

☐ Naturvårdsåtgärder (såsom restaurering av vattendrag, fågelliv och växtliv)

☐ Produktionsinriktade åtgärder (såsom planering, röjning, gallring och avverkning)

☐ Annat: _____

A5: I vilken kommun är din fastighet i huvudsak belägen? _____

Del A – Frågor om din skogsfastighet

A6: Hur stor är din fastighet? _____ha

A7: Är fastigheten certifierad?

◯ Ja ◯ Nej ◯ Vet inte

    ↳ **A71: Enligt vilken standard?**
    Flera svar är möjliga

    ☐ Enligt FSC

    ☐ Enligt PEFC

    ☐ Annat: _____

A8: Är du medlem i en skogsägarförening?

◯ Ja ◯ Nej ◯ Vet inte

    ↳ **A81: Vilken förening är du medlem i?**
    Flera svar är möjliga

    ☐ Norra skogsägarna   ☐ Södra

    ☐ Skogsägarna norrskog   ☐ LRF Skogsägarna

    ☐ Mellanskog   ☐ Annan: _____

    ↳ **A82: Varför blev du medlem i en skogsägarförening?**
    Rangordna påståenden, notera att det bara ska finnas en 5:a, en 4:a, en 3:a osv.

	Viktigaste anledning			Minst viktiga anledning	
	5	4	3	2	1
Ekonomi	◯	◯	◯	◯	◯
Information	◯	◯	◯	◯	◯
Gemenskap	◯	◯	◯	◯	◯
Rådgivning	◯	◯	◯	◯	◯
Tradition	◯	◯	◯	◯	◯
Annat:	◯	◯	◯	◯	◯

_____

A9: Har du tecknat en separat försäkring för din fastighet?

◯ Ja ◯ Nej

    ↳ **A91: Varför har du valt att inte teckna en separat försäkring?**
    Flera svar möjliga

    ☐ Jag anser att det är för dyrt.

    ☐ Det finns ingen försäkring som täcker det jag vill försäkra mig mot.

    ☐ Jag har inte tänkt på att jag kan försäkra fastigheten.

    ☐ Annat: _____

**A10: Har din fastighet under de senaste 10 åren drabbats av storm eller brand.
I så fall, hur stor del av din fastighetsareal uppskattar du påverkades?**
Om ja, ange vilken/vilka och till vilken utsträckning

◯ Nej ◯ Ja

⌐▷ ☐ Stormfällning
◯ > 75 % ◯ 50-75 % ◯ 25-50 % ◯ < 25 %

☐ Brand
◯ > 75 % ◯ 50-75 % ◯ 25-50 % ◯ < 25 %

A11: Hur ser din fastighet ut?
Uppskatta hur stor andel av din fastighet består av:

	Ungskog, ej avverknings-mogen skog	Avverknings-mogen skog	Impediment	Frivillig avsättning	Omfattas av naturvårds-avtal/ biotopskydd
0 %	◯	◯	◯	◯	◯
1-10 %	◯	◯	◯	◯	◯
11-30 %	◯	◯	◯	◯	◯
31-50 %	◯	◯	◯	◯	◯
51-70 %	◯	◯	◯	◯	◯
71-90 %	◯	◯	◯	◯	◯
91 % -	◯	◯	◯	◯	◯
Vet inte	◯	◯	◯	◯	◯

Annat: _____ uppskattat till _____%

A12: Har några åtgärder skett inom fastigheten under de senaste 5 åren?

◯ Ja ◯ Nej ◯ Vet inte

⌐▷ **A121: Vilka åtgärder har skett?**
Flera svar är möjliga

☐ Avverkning ☐ Plantering

☐ Frivilliga avsättningar ☐ Röjning

☐ Gallring ☐ Skogsdikning

☐ Gödsling

☐ Annat: _____

A13: Hur ställer du dig till följande påståenden om din skogsfastighet?
Markera ett alternativ per påstående.

	Mycket viktigt	Ganska viktigt	Ganska oviktigt	Helt oviktigt	Saknar uppfattning
Inkomster från fastigheten ger regelbunden inkomst för konsumtion.	○	○	○	○	○
Min fastighet används för att finansiera större investeringar (såsom bil, hus, maskiner etc.).	○	○	○	○	○
Min fastighet ger mig ekonomisk trygghet för ålderdomen.	○	○	○	○	○
Min fastighet skapar sysselsättning för mig och/eller min familj.	○	○	○	○	○
Min skogsfastighet är en bra investering för framtiden.	○	○	○	○	○
Jag får brännved för husbehov från min fastighet.	○	○	○	○	○
Jag vill förvalta skogen för nästa generation.	○	○	○	○	○
Jag vill ha tillgång till bär- och svampplockning.	○	○	○	○	○
Min fastighet är en del av min närmiljö som jag tillbringar tid i.	○	○	○	○	○
Min fastighet ger mig jakt och/eller fiskemöjlighet.	○	○	○	○	○
Skogen ger mig en meningsfull syssla i form av skogsarbete på min fritid.	○	○	○	○	○
Min fastighet ger mig möjligheten till friluftsliv (såsom vandra, utflykter, jogga).	○	○	○	○	○
I skogen på min fastighet kan jag koppla av vilket ger mig möjlighet att varva ner och fundera.	○	○	○	○	○
Min fastighet erbjuder mig möjlighet att bidra till biologisk mångfald, skydda kulturlämningar (exv. torpruiner) och vattenkällor.	○	○	○	○	○
Min fastighet erbjuder mig skönhetsupplevelser.	○	○	○	○	○
Min fastighet gör att jag kan hålla kontakt med min hembygd.	○	○	○	○	○
Min skogsfastighet ger mig möjlighet att föra en familjetradition vidare.	○	○	○	○	○

Del B – Frågor om svensk skogspolitik

Här ställer vi frågor om din inställning till svensk skogspolitik relaterat till miljöfrågan.

För varje fråga, markera ett svarsalternativ, utom i de fall vi särskilt ber om flera alternativ.

B1: Hur ställer du dig till följande påståenden om miljöpolitik i Sverige?

Markera ett alternativ per påstående	Instämmer starkt	Instämmer	Tar avstånd	Tar starkt avstånd	Har ingen uppfattning
Folk oroar sig för mycket om hur människor skadar miljön och för lite om ekonomisk tillväxt.	◯	◯	◯	◯	◯
Den moderna vetenskapen kommer att lösa våra miljöproblem utan att vi behöver förändra vårt levnadssätt särskilt mycket.	◯	◯	◯	◯	◯
Miljöproblem är något jag oroar mig över ofta.	◯	◯	◯	◯	◯
Jag anser att det är viktigt att alla är med och bidrar till miljöarbetet för att framtida generationer ska få en förbättrad miljö.	◯	◯	◯	◯	◯
Många påståenden om miljöhot (såsom klimatförändringar) är överdrivna.	◯	◯	◯	◯	◯
Det är ingen idé att jag gör vad jag kan för miljön om/när inte andra också gör det.	◯	◯	◯	◯	◯
Jag tycker att det är svårt att avgöra om mitt sätt att leva är bra eller skadligt för miljön.	◯	◯	◯	◯	◯
Jag gör utifrån egen kunskap, vad jag kan för bättre miljö, även om det kostar pengar och tar längre tid.	◯	◯	◯	◯	◯
Jag anser att riksdag/regering borde göra mer för att värna om miljön genom att stifta lagar även om det begränsar möjligheten till självbestämmande.	◯	◯	◯	◯	◯
Jag anser att individer och företag själva bör fatta beslut om sitt miljöarbete.	◯	◯	◯	◯	◯

B2: Hur ställer du dig till följande påståenden om naturvård i skogen?

◯ Oavsett ägare, ska all skog och skogsmark omfattas av samma regler för naturvård.

◯ Enbart skog och skogsmark som ägs av staten bör omfattas av regler för naturvård. För övriga bör inga regler finnas, det är upp till enskilda ägare att fatta beslut om naturvård.

○ Enbart skog och skogsmark som ägs av privata skogsägare och skogsbolag bör omfattas av regler för naturvård. För statligt ägd mark bör inga regler finnas, det är upp till staten att fatta beslut om naturvård.

B3: Vad anser du om behovet av att skydda biologisk mångfald i privata skogar?

◯ Skyddet av skogarna borde ökas från det nuvarande

◯ Den nuvarande nivån av skydd är lämplig

◯ Det har redan skyddats för mycket skog

◯ Har ingen uppfattning

B4: Beskriv hur väl du känner till innebörden av följande:

Markera ett alternativ per påstående

	Känner väl till innebörden	Känner till innebörden i stora drag	Har hört talas om det	Har ingen vetskap om det
Begreppet biologisk mångfald	◯	◯	◯	◯
Biotopskyddsområde	◯	◯	◯	◯
Frivilliga avsättningar	◯	◯	◯	◯
Generell hänsyn	◯	◯	◯	◯
Miljömålet "Levande skogar"	◯	◯	◯	◯
Naturreservat	◯	◯	◯	◯
Naturvårdsavtal	◯	◯	◯	◯
Nyckelbiotop	◯	◯	◯	◯
Rödlistade arter	◯	◯	◯	◯

Den svenska modellen för skogsbruk bygger på tre pelare för naturvård; formella avsättningar, frivillig avsättning och generell hänsyn. Målet är att se till att den biologiska mångfalden över hela landet säkras samtidigt som skogsproduktion och sociala värden värnas (se bild på enkätens framsida).

De formella avsättningarna är avtal och kan innefatta exempelvis naturreservat, naturvårdsavtal eller biotopskydd.

Den individuelle skogsägaren kan göra frivilliga avsättningar av skog med höga miljövärden på mindre områden (0,5 – 20 ha). Det som lämnas kan ha höga naturvärden, kulturmiljövärden och/eller sociala värden. Idag finns ca 1 350 000 ha skog frivilligt avsatt i Sverige.

Dessutom bör alla skogsägare ta generell hänsyn vid avverkningar (enlig Skogsvårdslagen §30). Det kan vara att spara värdefulla träd och träddungar, skapa död ved eller att undvika markskador vid vatten. Ca 10 % av virkesvolymen lämnas i genomsnitt vid avverkning.

I Sverige har vi också 16 miljömål, varav ett behandlar skogen, "Levande skogar", som bland annat syftar till att skydda gammal skog, främja skapandet av död ved, fågelliv, forn- och kulturlämningar och lövrik skog. Miljömålen beslutades av riksdagen 1999 och utvärderas kontinuerligt.

Källa: www.skyddadskog.se

Del B – Frågor om svensk skogspolitik

B5: Hur ställer du dig till följande påståenden om miljöarbete inom svenskt skogsbruk?

Markera ett alternativ per påstående

	Instämmer starkt	Instämmer	Tar avstånd	Tar starkt avstånd	Har ingen uppfattning
Ensamma markägare kan inte avgöra naturvård, det måste vara statens ansvar att naturvård kommer till stånd.	○	○	○	○	○
Alla skogsägare bör ta sitt ansvar i miljöarbetet för att stärka biodiversitet i skog och mark för framtida generationer.	○	○	○	○	○
Jag känner mig trygg att svenska modellen för miljöhänsyn i skogsbruket säkrar biologisk mångfald i skogen.	○	○	○	○	○
Svenska modellen för skogsbruk är för odetaljerad och vag för att vara tillräcklig för att nå upp till svenska miljömål.	○	○	○	○	○
Svensk miljöpolitik reglerar miljöhänsynen i skogsbruket för hårt vilket påverkar den individuella skogsägarens valfrihet i val av skötselmetoder.	○	○	○	○	○
Riksdagens miljömål "Levande skogar" är tillräckligt reglerade för att nå svenska miljömål.	○	○	○	○	○

B6: Hur ställer du dig till följande påståenden om generell hänsyn enligt den svenska modellen (Skogsvårdslagen §30)?

Markera ett alternativ per påstående

	Instämmer starkt	Instämmer	Tar avstånd	Tar starkt avstånd	Har ingen uppfattning
Den generella hänsynsparagrafen är för svagt reglerad för att bidra till att svenska miljömål uppnås.	○	○	○	○	○
Markägaren är den som bär huvudansvaret för att generell hänsyn tas vid avverkning på min fastighet.	○	○	○	○	○
Rådgivande organ, såsom skogsstyrelsen eller skogsägarförening är huvudansvarig för att generell hänsyn tas vid avverkning på min fastighet.	○	○	○	○	○
Virkesköpare och/eller entreprenörer är huvudansvariga för att generell hänsyn tas vid avverkning på min fastighet.	○	○	○	○	○

x

Del B – Frågor om svensk skogspolitik

B7: Omfattas din fastighet i helhet eller delvis av biotopskydd, naturvårdsavtal eller naturreservat?

◯ Ja   ◯ Nej   ◯ Vet inte

B71: Vad är din inställning till det skydd som inrättats på din fastighet?

◯ Mycket positiv
◯ Delvis positiv
◯ Delvis negativ
◯ Mycket negativ
◯ Har ingen uppfattning

B72: Vem tog initiativ till att inrätta ovanstående skydd på din fastighet?

◯ Du själv som ägare
◯ Länsstyrelsen
◯ Kommunen
◯ Skogsstyrelsen
◯ Annan: _____

B73: Har du fått ekonomisk ersättning för ovanstående skydd?

◯ Ja   ◯ Nej   ◯ Vet inte

B731: Vad fick du i ersättning och vilken karaktär hade den?

◯ Engångsbelopp

◯ Årlig ersättning

Ersättning var: _____kr

B732: Är du nöjd med ersättningen?

◯ Ja

◯ Nej

◯ Vet inte

B74: Vilket var ditt motiv till att ingå ovanstående avtal?
Flera svar är möjliga

☐ För min egen skull.

☐ För kommande generationers skull.

☐ För grannars och besökares skull.

☐ För att ta mitt samhällsansvar för att bevara naturvärden.

☐ Av ekonomiska skäl.

☐ Tvingade beslut av annan part.

☐ Annat: _____

B8: Har du gjort avverkning eller gallring under de senaste 5 åren?

◯ Nej   ◯ Ja

Om du har gjort avverkningar eller gallringar de senaste 5 åren, vänligen svara på de tre följande frågorna. Om inte, fortsätt till avdelning C.

B9: Om du har gjort avverkning eller gallring de senaste 5 åren, gjorde du någon frivillig avsättning?

○ Nej　　　　○ Ja　　　　　　　　　　○ Vet inte

B91: Av vilken anledning gjorde du frivilliga avsättningar?
Flera svar är möjliga

○ Det är höga naturvärden på den delen av fastigheten

○ Vill skydda kulturmiljön

○ Av estetiska skäl, det ser bra ut

○ För kommande generationers skull

○ För grannars och besökares skull

○ För att ta mitt samhällsansvar för att bidra till bättre miljö

○ Annat: _____

B92: Hur länge avser du att behålla din frivilliga avsättning?

○ 0-5 år　　○ 10-15 år　　　○ Vet inte
○ 5-10 år　　○ 15 år eller mer　　○ Har inte planerat hur länge än

B93: Om du inte gjorde några frivilliga avsättningar, varför inte?
Flera svar är möjliga

☐ Det finns inga naturvärden att skydda på den delen av fastigheten.

☐ Det är ekonomiskt olönsamt att göra avsättningar.

☐ Jag har för liten kunskap för att kunna bedöma vad som är värt att skydda.

☐ Jag har redan gjort frivilliga avsättningar på andra delar av min fastighet.

☐ Annat: _____

B94: Om du gjort avsättningar vid avverkning/gallring, uppskatta hur mycket lägre din nettointäkt blev jämfört med om du inte gjort avsättning.

○ 1 – 5 % lägre nettointäkt　　　　○ 16 – 20 % lägre nettointäkt
○ 6 – 10 % lägre nettointäkt　　　　○ 21 – 25 % lägre nettointäkt
○ 11 – 15 % lägre nettointäkt　　　　○ 25 % eller mer lägre nettointäkt
○ Vet inte

B10: Om du gjort avverkning eller gallring de senaste 5 åren, tog du någon generell hänsyn?

◯ Nej   ◯ Ja   ◯ Vet inte

B101: Vilken hänsyn tog du?
Flera svar är möjliga

☐ Aktivt undvikt markskador i närheten av vattendrag/myrar

☐ Beaktat sociala värden

☐ Lämnat träd eller trädgrupper

☐ Skapat död ved

☐ Annat: _____

B102: Vilket är ditt motiv till att ta generell hänsyn?
Flera svar är möjliga

☐ Av estetiska skäl, det ser bra ut

☐ Det är tvingande enligt lag

☐ För att ta mitt samhällsansvar för att bidra till bättre miljö

☐ För grannars och besökares skull

☐ För kommande generationers skull

☐ Vill skydda kulturmiljön

☐ Annat: _____

B103: Om du inte tog någon generell hänsyn, varför inte?
Flera svar är möjliga

☐ Det finns inga naturvärden att skydda på den delen av fastigheten.

☐ Det är ekonomiskt olönsamt att ta generell hänsyn.

☐ Jag har för liten kunskap för att kunna bedöma vad som är värt att skydda.

☐ Jag har redan tagit generell hänsyn på andra delar av min fastighet.

☐ Annat: _____

B104: Om du tagit generell hänsyn vid avverkning/gallring, uppskatta hur mycket lägre din nettointäkt blev jämfört med om du inte tagit generell hänsyn.

◯ 1 – 5 % lägre nettointäkt   ◯ 16 – 20 % lägre nettointäkt

◯ 6 – 10 % lägre nettointäkt   ◯ 21 – 25 % lägre nettointäkt

◯ 11 – 15 % lägre nettointäkt   ◯ 25 % eller mer lägre nettointäkt

◯ Vet inte

Del C – Frågor om information

> *I den här delen vill vi veta hur du får information och vilken information du har om naturvård i skogsbruket.*
>
> *För varje fråga, markera ett svarsalternativ, utom i de fall då vi särskilt ber om flera alternativ.*

C1: När jag tar beslut om hur jag ska sköta min fastighet

Markera ett alternativ per påstående	Instämmer starkt	Instämmer	Tar avstånd	Tar starkt avstånd	Har ingen uppfattning
är det viktigt att veta hur fastigheterna runt min sköts (exv. planer för avverkning och trädslagsval).	◯	◯	◯	◯	◯
är det viktigt att förstå vilka ekonomiska konsekvenser olika åtgärder har/får.	◯	◯	◯	◯	◯
är det viktigt att veta grannarnas inställning till naturvård.	◯	◯	◯	◯	◯
är det viktigt att följa de trender och influenser som är mest populära i samhället för tillfället.	◯	◯	◯	◯	◯
tar jag alltid rådgivning från Skogsstyrelsen, skogsägarförening eller LRF skogsägarna.	◯	◯	◯	◯	◯
är det viktigt att jag har den senaste informationen om forskning kring naturvård och skogsvård.	◯	◯	◯	◯	◯

C2: Anser du att du har tillräckligt med kunskap och information för att fatta beslut om din skogsfastighet med avseende på naturvård?

◯ Ja   ◯ Nej   ◯ Vet inte

C21: Hur har du skaffat dig information och hur viktig är informationskällan?
Markera de du använder, och markera de du använder utifrån hur relevant information du anser källan är.

	Mest relevant 5	4	3	Minst relevant 2	1
Skogsinriktade tidskrifter	◯	◯	◯	◯	◯
Dagstidningar	◯	◯	◯	◯	◯
Radio/TV	◯	◯	◯	◯	◯
Internet	◯	◯	◯	◯	◯
Kunskapsöverföring från tidigare generation	◯	◯	◯	◯	◯
Samtal med grannar	◯	◯	◯	◯	◯
Samtal med övriga ägare (om flera ägare finns)	◯	◯	◯	◯	◯
Rådgivning av Skogsstyrelsen	◯	◯	◯	◯	◯
Rådgivning av skogsägarförening eller LRF skogsägarna	◯	◯	◯	◯	◯
Nyhetsbrev från forskningsorganisation (exv. SLU, Skogforsk)	◯	◯	◯	◯	◯
Virkesköpare	◯	◯	◯	◯	◯
Skogsbranschens utbildningar	◯	◯	◯	◯	◯
Miljöorganisationer	◯	◯	◯	◯	◯
Annat: _____	◯	◯	◯	◯	◯

C3: Skulle du vara intresserad av att samarbeta med andra skogsägare i närområdet, för att grunda ett mer omfattande område som är lämpligt för naturvård via antingen skyddade områden (biotopskydd/naturvårdsavtal/naturreservat) eller frivilliga avsättningar?

◯ Jag skulle absolut vara intresserad av samarbete

       ⌊▷ ◯ Jag kan tänka mig ta initiativet till ett sådant samarbete

          ◯ Ja, men bara om det är någon annan som tar initiativet

◯ Jag skulle kanske kunna vara intresserad av att samarbeta

◯ Jag skulle vara intresserad, men det finns inget skyddsvärt objekt på min fastighet

◯ Jag är inte alls intresserad av att samarbeta

◯ Jag vet inte

C4: Om du har gjort avverkning eller gallring de senaste 5 åren, sökte du rådgivning hos någon?
Flera svar är möjliga

☐ Ja, hos Skogsstyrelsen

☐ Ja, hos skogsägarförening

☐ Ja, hos LRF skogsägarna

☐ Ja, hos något skogsbolag

☐ Ja, hos virkesköpare

☐ Ja, hos _____

☐ Nej

C5: Antag att en storm eller brand, likt stormarna Gudrun och Per eller branden i Västmanland, inträffade på din fastighet, vem är mest troligt att du söker rådgivning hos?
Markera den som du anser är mest trolig till den som är minst trolig att du skulle söka dig till.

◯ Jag behöver ingen rådgivning

	Mest trolig 5	4	3	2	Minst trolig 1	Inte lämplig att ge råd
Annan skogsägare	◯	◯	◯	◯	◯	◯
Andra ägare av fastigheten (om fler ägare)	◯	◯	◯	◯	◯	◯
Skogsstyrelsens rådgivare	◯	◯	◯	◯	◯	◯
Skogsägarföreningens rådigvare	◯	◯	◯	◯	◯	◯
LRF skogsägarna	◯	◯	◯	◯	◯	◯
Virkesköpare	◯	◯	◯	◯	◯	◯
Länsstyrelsen	◯	◯	◯	◯	◯	◯
Kommunen	◯	◯	◯	◯	◯	◯
Annan, vilken _____	◯	◯	◯	◯	◯	◯

Del D – Frågor om inställning till framtida naturvård och skogsbruk

I det här avsnittet ställer vi frågor om framtida naturvård generellt och på din fastighet. Vi ställer också frågor kring olika möjliga alternativa skötselmetoder.

För varje fråga, markera ett svarsalternativ, utom i de fall då vi särskilt ber om flera alternativ.

D1: Anser du att det i framtiden generellt behöver avsättas mer eller mindre av följande naturvårdsåtgärder enligt svenska modellen för skogsbruk för att Sverige ska nå upp till miljömålen?
Markera ett alternativ per påståenden

	Behöver avsättas mycket mer	Behöver avsättas mer	Dagens avsättningar är tillräckliga	Behöver avsättas mindre	Behöver avsättas mycket mindre	Har ingen uppfattning
Biotopskyddsområden	○	○	○	○	○	○
Frivilliga avsättningar	○	○	○	○	○	○
Generell hänsyn	○	○	○	○	○	○
Naturreservat	○	○	○	○	○	○
Naturvårdsavtal	○	○	○	○	○	○

D2: Om du skulle satsa arbete eller andra resurser inom en 5-års period för att förändra din skogsfastighet på någon av nedanstående punkter, vilken skulle du satsa på?

☐ Tillväxt av timmer

☐ Möjlighet till jakt

☐ Möjlighet till rekreation och friluftsliv, utöver jakt

☐ Inget

☐ Mångfald av växter och djur

☐ Den estetiska upplevelsen, "skönhetsupplevelse"

☐ Annat: _____

D3: Skulle du kunna tänka dig att avsätta en större del, eller hela din fastighet för någon form av naturvård i framtiden (såsom biotopskydd, naturvårdsavtal, naturreservat), göra frivilliga avsättningar eller utöka den generella hänsynen vid avverkning?

○ Ja   ○ Nej   ○ Vet inte

D31: Varför kan du inte tänka dig det?
Flera svar är möjliga

☐ Det finns redan tillräckligt skog som skyddats i Sverige

☐ Jag vill fortsätta med ett aktivt skogsbruk på min fastighet.

☐ Finns inga objekt som är värdefulla att spara.

☐ Jag vill inte binda beslutanderätten för fastigheten för nästa ägare.

☐ Jag har inte tillräcklig kunskap för att fatta ett sådant beslut.

☐ Jag anser att förlusterna är för stora för mig som ägare.

☐ Jag anser att kunskapen om effekterna av avsättningar är för låg.

☐ Fastigheten är för liten.

☐ Annat: _____

D4: Det har uppskattats att klimatförändringar inverkar på mängden växt-, svamp- och insektsskador samt mängden stormskador. Hur tror du att sådana skador kommer att uppstå och utvecklas inom din fastighet under kommande 10 år?

○ Skadorna ökar märkbart

○ Skadorna ökar något

○ Skadorna minskar något

○ Skadorna minskar märkbart

Del D – Frågor om inställning till framtida naturvård och skogsbruk

○ Jag kommer inte att se någon förändring   ○ Har ingen uppfattning

D5: Hur ställer du dig till följande påståenden om yttre faktorer som kan påverka din fastighet?

Markera ett alternativ per påstående	Instämmer starkt	Instämmer	Tar avstånd	Tar starkt avstånd	Har ingen uppfattning
Skogens stormkänslighet är en naturhändelse som jag som skogsägare inte kan skydda mig mot.	○	○	○	○	○
Allt tyder på att vårt klimat förändras, vilket jag måste ta hänsyn till när jag planerar åtgärder i min skog.	○	○	○	○	○
Skogens känslighet för brand är en naturhändelse som jag som skogsägare inte kan skydda mig mot.	○	○	○	○	○

Nu ställer vi några frågor om alternativa skötselmetoder.

D6: När du planerar föryngring överväger du andra trädslag än de som traditionellt växt där?

○ Ja

D61: Vilken är den viktigaste anledningen?
Flera svar är möjliga

☐ Att föryngra med hybridlärk eller contorta ger mig en högre lönsamhet än med traditionella trädslag.

☐ Att föryngra med hybridlärk eller contorta ger mig en snabbare avkastning än med traditionella trädslag.

☐ Att föryngra med löv där det traditionellt växt barrträd, ökar stormfasthet eller är viktigt av andra naturvårdande skäl.

☐ Det är högre lönsamhet att föryngra med barrträd än med lövträd, då produktionen är högre med barrträd.

☐ Att föryngra med gran istället för tall är viktigt för att minska betesskador.

☐ Skogen ser bättre ut och är trevligare att besöka om lövträd växer där istället för barrträd.

☐ Skogen ser bättre ut och är trevligare att besöka om contorta växer där istället för löv eller traditionella barrträd växer där.

☐ Annat: _____

○ Nej

C62: Vilken är den viktigaste anledningen?
Flera svar är möjliga

☐ Jag vet för lite om vilka effekter en föryngring med hybridlärk eller contorta skulle få för min fastighet.

☐ Att plantera lövträd medför stor risk för skador (betningsskador eller insekter).

☐ Jag anser att en föryngring med hybridlärk eller contorta är negativt för biodiversiteten.

☐ Jag vet för lite om vilka effekter en föryngring med lövträd istället för barr skulle få för min fastighet.

☐ Av tradition planterar jag samma trädslag som alltid varit på fastigheten.

☐ Klimatförändringar påverkar inte barrträden, så det finns ingen anledning att plantera contorta istället.

☐ Lövträd ger mig inte samma avkastning som barrträd gör.

☐ Snabbväxande hybridlärk eller contorta ger lägre avkastning jämfört med nuvarande trädslagsval.

☐ Annat: _____

Del D – Frågor om inställning till framtida naturvård och skogsbruk

D7: Använder du dig av hyggesfria metoder (sk. kontinuitetsskogsbruk) på din fastighet?

○ Ja, jag använder hyggesfria metoder vid avverkning

⮫ **D71: Vilken är den/de viktigaste anledningarna till detta?**
Flera svar är möjliga

- ☐ Av ekonomiska skäl.
- ☐ Jag anser att naturvården blir med hyggesfri metod.
- ☐ Landskapet blir vackrare utan hygge.
- ☐ Mindre risken för katastrofer (stormfällning/brand) med hyggesfri metod.
- ☐ Annat: _____

○ Nej, jag använder mig inte av hyggesfria metoder

⮫ **D72: Vilken är den viktigaste anledningen?**
Flera svar är möjliga

- ☐ Jag kan för lite om metoden för att det ska vara ett alternativ.
- ☐ Det finns för lite information/forskning om metoden.
- ☐ Metoden ger lägre avkastning jämfört med trakthyggesbruk.
- ☐ Landskapet blir vackrare med blandning av hygge och skog.
- ☐ Mindre risk för katastrofer (stormfällning/brand) med trakthyggesbruk.
- ☐ Av ekonomiska skäl, jag behöver avkastningen.
- ☐ Av tradition har vi alltid använt trakthyggesbruk.
- ☐ Annat: _____

D8: Använder du dig av förlängda eller förkortade omloppstider på något av dina bestånd på din fastighet?
Dvs. kortare eller längre tid innan avverkning sker, jämfört med vad som är bäst ur ekonomiskt perspektiv.

○ Ja, överhållning med mellan 1 – 20 år.　　○ Ja, överhållning med 20 år eller mer.　　○ Nej

⮫ **D81: Vilken är den viktigaste anledningen?**
Flera svar är möjliga

- ☐ För att skydda kulturmiljön eller förstärka naturvården.
- ☐ För att producera sågvirke av stora dimensioner.
- ☐ För att bidra till att bromsa klimatförändringarna, genom att lagra kol i skogen.
- ☐ För att jag vill ha kvar möjligheten till jakt, eller bär- och svampplockning.
- ☐ För kommande generationers skull, de får avgöra hur fastigheten ska förvaltas.
- ☐ För grannarna och besökarnas skull.
- ☐ Jag vill ta mitt samhällsansvar för att bidra till en bättre miljö.
- ☐ Jag vill inte avverka, jag tycker om min fastighet som den är.

Del D – Frågor om inställning till framtida naturvård och skogsbruk

- [ ] På inrådan av skoglig rådgivare.
- [ ] Annat: _____

○ Ja, förkortning med mellan 1 – 20 år.   ○ Ja, förkortning med mer än 20 år.   ○ Nej

↳ **D82: Vilken är den viktigaste anledningen?**
Flera svar är möjliga

- [ ] För att få snabbare ekonomisk avkastning från min fastighet.
- [ ] För att minska risken för sjukdomar och insektsangrepp (exempelvis rotröta).
- [ ] För att minska risken för stormfällning eller brand.
- [ ] För att snabbare kunna möta förändringar i efterfrågan på skogsråvara.
- [ ] Jag tror att klimatförändringarna gör att skogen växer fortare vilket gör att omloppstiden kan kortas utan att försämra ekonomisk avkastning.
- [ ] På inrådan av skoglig rådgivare.
- [ ] Annat: _____

○ Nej, jag använder varken förlängd eller förkortad omloppstid.

↳ **D83: Vilken är den/de viktigaste anledningarna till att du inte använder förlängd eller förkortad omloppstid?**
Flera svar är möjliga

- [ ] Förlängd omloppstid eller förkortad omloppstid är ekonomiskt olönsamt.
- [ ] Förlängd omloppstid gör att skogen blir oframkomlig och otillgänglig för att vistas i, eller jaga, eller plocka bär- och svamp.
- [ ] Jag anser inte att klimatförändringar kan påverka skogsbruket i så stor utsträckning att förkortad omloppstid kan bli ekonomiskt lönsamt.
- [ ] Jag kan för lite om förlängd eller förkortad omloppstid för att det ska vara ett alternativ.
- [ ] Jag tror inte att förkortad omloppstid ger något skydd mot storm, brand, sjukdomar eller insektsangrepp.
- [ ] Jag tror att förkortade omloppstider ger en sämre naturvård jämfört med min nuvarande omloppstid.
- [ ] Jag tror inte förlängd omloppstid ger högre miljövärden.
- [ ] Annat: _____

Del D – Frågor om inställning till framtida naturvård och skogsbruk

Nu ställer vi två liknande frågor med olika antagande. Vi undrar här hur du skulle agera utifrån dessa antagande.

D9: Scenario 1.
När du planerar för din fastighet i framtiden (tänk 5-10 års sikt), vilka av nedanstående alternativ kan du tänka dig genomföra, _utan ekonomisk kompensation_?
Flera alternativ är möjliga

☐ Aktivt undvika markskador i närheten av vattendrag/myrar, restaurera redan förstörda vattendrag

☐ Beakta sociala värden

☐ Frivillig avsättning under en kortare tidsperiod (maximalt 10 år)

☐ Frivillig avsättning under evig tid

☐ Lämna träd eller trädgrupper

☐ Skapa död ved

☐ Ta initiativ till biotopskyddsområde

☐ Ta initiativ till naturvårdsavtal

☐ Annat: _____

☐ Inget av alternativen

D10: Scenario 2.
När du planerar för din fastighet i framtiden (tänk 5-10 års sikt), vilka av nedanstående alternativ kan du tänka dig göra, om du _får ekonomiska kompensation_?

Ange också vilken ekonomisk kompensation du anser att du MINST vill ha för att genomföra åtgärden.

Flera alternativ är möjliga		Andel av förlust som täcks av kompensation					
		100 %	75-99%	50-74%	25-49%	1-24%	0%
☐	Aktivt undvika markskador i närheten av vattendrag/myrar, restaurera redan förstörda vattendrag	☐	☐	☐	☐	☐	☐
☐	Beakta sociala värden	☐	☐	☐	☐	☐	☐
☐	Frivillig avsättning under en kortare tidsperiod (maximalt 10 år)	☐	☐	☐	☐	☐	☐
☐	Frivillig avsättning under evig tid	☐	☐	☐	☐	☐	☐
☐	Lämna träd eller trädgrupper	☐	☐	☐	☐	☐	☐
☐	Skapa död ved	☐	☐	☐	☐	☐	☐
☐	Ta initiativ till biotopskyddsområde	☐	☐	☐	☐	☐	☐
☐	Ta initiativ till naturvårdsavtal	☐	☐	☐	☐	☐	☐
☐	Annat: _____	☐	☐	☐	☐	☐	☐

☐ Inget av alternativen

Slutligen behöver vi veta lite mer om dig. För varje fråga, ange ett svarsalternativ.

E1: Kön
○ Kvinna
○ Man

E2: Ålder
○ 18-40 år
○ 41-50 år
○ 51-65 år
○ 65 - år

E3: Var bodde du under uppväxttiden och var bor du nu?

	Nuvarande boendeort	Ort under uppväxttiden
På landsbygd (i glesbygd)	○	○
I mindre tätort mindre än 50 000 invånare	○	○
I tätort 50 000 – 100 000 invånare	○	○
I tätort med 100 000 – 250 000 invånare	○	○
I tätort med över 250 000 invånare	○	○
Inte i Sverige	○	○

E4: Bor du på fastigheten?
○ Ja   ○ Nej
   ○ Ja, fast boende   ○ Nej, men inom samma kommun
   ○ Ja, fritidsboende   ○ Nej, inte i samma kommun
                        ○ Nej, det finns inga byggnader på min skogsfastighet

E5: Hur många personer består ditt hushåll av?
○ 1   ○ 2   ○ 3   ○ 4   ○ 5 eller fler

Av dessa är _____ under 20 år.

E6: Vilken är din högsta utbildning?
○ Grundskola
○ Gymnasieskola/folkhögskola
   ○ Inriktad mot jord- eller skogsbruk
   ○ Inriktad mot biologi
   ○ Annan inriktning
○ Högskola/Universitet
   ○ Inriktad mot jord- eller skogsbruk
   ○ Inriktad mot biologi
   ○ Annan inriktning

E7: Vilken är din huvudsakliga sysselsättning?

- ○ Anställd
- ○ Studerande
- ○ Driver eget lantbruk
  - ○ Enbart skogsbruk
  - ○ Jord- och skogsbruk
- ○ Driver eget företag (ej skog- eller jordbruk)
- ○ Arbetslös
- ○ Pensionär

E8: Ungefär hur stor del av din nettoinkomst har, under de senaste 5 åren, kommit från skogsinkomster?

- ○ 0 – 5 %
- ○ 5 – 25 %
- ○ 25 – 50 %
- ○ 50 % -
- ○ Vet inte

Övriga kommentarer:

TACK FÖR DIN MEDVERKAN!

Annex 2 - Questions in the survey related to the Theory of Planned Behaviour

ToPB	Questions in the survey

Background factors	Questions on background factors
	• Forest estate
	    o Size and estate composition
	    o Storm/fire exposure
	• Social
	    o Living conditions and living place
	    o Ownership conditions and ownership time
	    o Age, gender
	    o Education and occupation
	    o Income from forest estate
	• Information
	    o Certification and membership in Forest Owner associations
	    o Knowledge retrieval
	• Personal
	    o General attitude toward environmental policy in Sweden
	    o Purpose of ownership

Behavioural beliefs	• Alternative management
	    o Alternative tree species
	        ▪ Hybrid tree species
	        ▪ Deciduous or coniferous forests
	    o Alternative management methods
	        ▪ Continuous cover forestry
	        ▪ Prolonged/shorten rotation age
	• Consequence of unplanned situations
	    o Fire or storms
	    o Consultations in unplanned situations
	• Swedish forestry model (SFM)
	    o What parts of the model is used at the estate
	    o Economic consequences
	    o Scenarios for the future on parts of the SFM

Normative beliefs	• Advice and information retrieval
	    o From whom and what
	• Effect of media
	    o From whom and what
	• Cooperation with neighbours
	• Certification and forest ownership associations

Control beliefs	• General Swedish environmental policy
	• Responsibility for environmental consideration at the estate
	    o Who
	    o What
	    o Potential changes at the estate