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Abstract

Finland has launched a new policy programme to encourage conservation of forest biodiversity, based on economic incentives and voluntarism on the part of non-industrial private forest owners. This study examined the factors that affect the acceptability of biodiversity conservation contracts and the amount of compensation needed in private forests, using the choice experiment method. Data were collected by surveying 3 000 Finnish private forest owners. Analysing separately those respondents who were willing to enter into a conservation contract allowed an assessment of the impact of forest owners' heterogeneity on compensation amount.

Key words: Forest owners, Heterogeneity, Compensation.

1. Introduction

Forests in Finland produce a multitude of environmental services alongside consumable goods like timber and berries. Some of these goods and especially the services are so-called public goods. Provision of public goods on private lands is not necessarily at a socially optimal level, as private decision makers might not internalise them into their objective function. The conservation of native species or biodiversity provides typically public goods, the benefit of which cannot be exclusive to the private forest owner.

The definition of the ownership of different forest goods and services is specific to national jurisdiction, and thus varies between countries. Depending on the definition of ownership, environmental public goods can be viewed as either positive or negative externalities. If the property rights were complete and exclusive covering all the aspects of forestland, any conservation values provided in the forest would be positive externalities. Alternatively, a national law might forbid a landowner from reducing conservation values, thereby implying that the property rights for the service reside with society. According to Coasian logic the compensation obligation depends on the property rights. Were the land ownership complete and exclusive, the owner should be compensated for all the lost private values, e.g. timber revenue, when the resource is used to produce public services (Innes et al. 1998).

In Finland about three quarters of the land area is forested. Over a third of the threatened species are forest organisms. Management over centuries has changed the forest composition in such a way that many species that are dependent on decayed wood or old-growth forests are now threatened (Rassi et al. 2001). Currently, 7.5 per cent of productive[1] forestland is protected in Finland. Most of the protected areas are located in the northern part of the country where 17 per cent of the forest area is protected by law. However, most of the habitats of endangered species are located in Southern Finland where only 1.8 per cent of forestland is protected. (Virkkala et al. 2000, Ympäristöministeriö 2000).

In order to achieve conservation goals in the long run, the social sustainability of the forest conservation policy should be assessed. One aspect of social sustainability is the general acceptance of the goals, impacts and implementation of the policy. The so-called non-industrial private forest (NIPF) owners own 61 per cent of forests in Finland, and almost 75 per cent in the southern part of the country. State ownership in Southern Finland is less than 10 per cent. Nearly 20 per cent of Finnish households own a forest holding. Hence the economic and social implications of forest protection fall predominantly on this sector of society.

Most citizens are concerned with justice toward forest owners and their sovereignty. A clear majority of citizens is in favour of full compensation to the forest owners for lost revenues and possible costs of nature conservation action, and support forest owners' sovereignty in forest management decisions (Horne 2002).

Conventionally, Finnish nature conservation policy has been implemented through the Government buying areas that have conservation value to the state. The NIPF owners have not always approved these top-down approaches to nature conservation. Along with the recent trend in international biodiversity governance, there has been a shift toward incentive based policy mechanisms. In 2002, the Finnish government accepted a programme for action that introduces pilot projects that use incentive based mechanisms based on the voluntarism of forest owners.

[1] Forestland with an annual yield of more than 1 m^3/hectare.

The new policy measures are hoped to bring about positive social and economic impacts through improvements in the acceptability of conservation among forest owners, and the cost effectiveness both for the state and for the forest owner. This study examined the factors that affect the acceptability of voluntary contracts of biodiversity conservation in NIPF and the amount of compensation required.

2. Method and Data

Choice Experiment Method

In order to evaluate preferences for contract terms we applied the choice experiment method where respondents are presented with a number of choice sets consisting of two or more alternatives from which he/she is to choose their preferred alternative. Each alternative is described by various levels of a set of attributes, which are influenced by the chosen forest management strategy. Attributes can be quantitative or qualitative in nature, and the ability to combine these two types of data is one of the main benefits of the choice experiment approach.

Choice experiments are consistent with random utility theory and offer a wide range of information on trade-offs among the benefits provided by the choices (Adamowicz et al. 1997, 1998). The theory is based on probabilistic choice, where individuals are assumed to choose a single alternative, which maximises their utility from a set of available alternatives. Probabilistic choice models rely on random utility theory which describes the utility of each alternative (U) as the sum of systematic and error components. The systematic component, V, is a vector of individual and alternative specific attributes that are observable. The presence of an error component, ε, makes the choice random, and it includes all the impacts and factors affecting the choice that are not observable by the researcher (Louviere et al., 2000).

Random utility theory posits that an individual n, chooses alternative, i, from the choice set, C_n, if the indirect utility of i is greater than that of any other choice j. The following equation identifies this notion:

$$U_{in} > U_{jn} \Rightarrow V_{in} + \varepsilon_{in} > V_{jin} + \varepsilon_{jn} \qquad \forall\ j \neq i;\ i, j \in C_n. \tag{1}$$

Random utility theory describes the probability with which an alternative is chosen given its systematic and error components. The probability of individual n choosing an alternative i is the same as the probability that the utility of alternative i *is* greater than the utility of any other alternative of the choice set. Thus:

$$P(i) = P(V_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn}) \qquad \forall\ j \neq i;\ i, j \in C_n. \tag{2}$$

The conditional logit model is the most commonly used method in the analysis of multi-attribute choices. Assuming that the error components have a IID Gumbel distribution (Ben-Akiva and Lerman, 1985, p.104), the probability of choosing i is:

$$P(i) = \frac{\exp^{Vin}}{\sum_j \exp^{Vjn}}. \tag{3}$$

The model is estimated using maximum likelihood estimation procedures and assumes a linear-in-parameters functional form for the systematic portion of the conditional indirect utility

function (Ben-Akiva and Lerman, 1985). The coefficient of an attribute in a linear specification is the marginal utility of that attribute. Utility at various attribute levels can be determined by multiplying the various levels by their marginal utilities.

Observing the choices made and the association of different attribute levels to monetary changes allows the estimation of changes in economic welfare. The Hicksian compensating variation (CV) for the case we examine can be written as:

$$CV = -\frac{V_{jn}^{0} - V_{jn}^{1}}{\alpha}, \qquad (4)$$

where α is the marginal utility of money, and V_{jn}^{0} and V_{jn}^{1} are the initial and new states of the resource (Hanemann, 1982). The initial state, or *status quo*, thus provides the basis for economic welfare analysis (Carson et al., 1994). Typically the marginal utility of money is derived from the parameter estimated in the choice model for some monetary attribute.

Data Gathering

The data were collected using a postal survey of 3 000 Finnish private forest owners in spring 2003. The sample represents the private forest owners across the whole country. The response rate was 42 %.

The questionnaire used in the survey contained six choice sets. Each choice set included two contract options for forest conservation that were described using five attributes, and the so-called status quo in which the level of conservation in private forests would not be increased. Respondents were instructed to choose their preferred alternative in each choice set.

The five attributes describing the alternative contract options were who initiated the conservation contract, the restrictions on forest use, the compensation per hectare annually, the duration of contract and the cancellation policy (Table 1).

Initiator
The first option is that the fores owner herself or himself is active in initiating the conservation contract. Conventionally, environmental organisations, the second option, have been active in initiating conservation actions, while the forest organisations, the third, have dealt with timber trading and extension of silvicultural practises. The new policy programme suggests the formation of a conservation trust that would be funded by voluntary payments for biodiversity conservation purposes, which is given as a fourth option of an initiator.

Restrictions
About a third of forest owners leaves some small patches of forests unmanaged, so the small patches of forest protected would be an attractive option for many forest owners. The second option, a nature management plan would involve a voluntary plan that safeguards and enhances nature values in the forests but also allows harvesting. The third option for restrictions on forest use is a total ban on silvicultural practises. The most restrictive management option is a creation of a strict nature reserve that might impose restrictions on other uses as well as forestry.

Table 1 Attributes used in the study and their levels.

Attribute	Levels
Initiator of the contract	Forest owner him/herself
	Forest organisation
	Environmental organisation
	Conservation trust
Restrictions on forest use	Small patches of forest protected
	Nature management plan
	No silvicultural practises allowed
	Strict nature reserve
Compensation/ha/year	0 euros
	70 euros
	140 euros
	210 euros
	280 euros
	350 euros
Duration of contract	5 years
	10 years
	30 years
	100 years
Cancellation policy	Forest owner can cancel
	New owner can cancel
	Binds also new owner

Compensation per hectare per year
The amount of compensation proposed varied between 0 to 350 euros.

Duration of a contract
The levels of the duration of contract ranged from five years and to one hundred years that would already cover in average three generations of forest owners.

Cancellation policy
The levels of cancellation policy varied according to who is allowed to cancel the contract. One level was that the forest owner who enters into a contract might cancel it and, naturally, return the compensation due. Alternatively, the contract would bind the forest owner but a new owner would be allowed to cancel the contract. Lastly, the contract would also bind the new forest owner.

Hetergeneity of Preferences for Nature Conservation

Many empirical valuation studies ignore the taste variations across the respondents in the sample. If the quantity of environmental good demanded varies significantly between individuals this preference heterogeneity might lead to misinterpretation of results. A growing number of recent studies have accounted explicitly for heterogeneity in preferences through the use of econometric techniques. For example, Siikamäki (2001) used random coefficient models to demonstrate preference heterogeneity for conservation policy among the population. Adamowicz et al. (1997) interacted respondent specific socio-demographic characteristics with the design attributes to incorporate the impact of different preferences on choices.

Assuming that the supply of forest stands offered for conservation contracts exceeds the demand, a conservation policy where forest owners take an initiative themselves might prove to be a cost effective conservation policy for the country. Those forest owners who internalise some of the

nature values into their own objective function for forest ownership might enter into a conservation contract at a lower price per hectare than those with no conservation interests. Alternatively, some forest owners might not take advantage of the potential harvesting revenue in any case, and thereby a conservation contract might offer them a way of profiting from forest ownership without timber sales. Finnish forest owners have been found to have varying goals in their forest ownership (Karppinen et al. 2000), and this heterogeneity might bring about both social and economic benefits in forest conservation.

In this study, the heterogeneity in forest owners' attitudes towards forest conservation and incentive based policy mechanisms was taken into account by examining the choices for the status quo alternative. The *status quo* provides respondents with something familiar and also provides a means to say that no change is preferable. When a respondent always chooses the status quo alternative he or she indicates a preference for the status quo over all other options that have been available. In this study, a consistent choice of the status quo option indicates that the respondent is not willing to enter into any conservation contract, at least within the contract term levels presented in the choice sets (Nae sayer). On the other hand, the respondents who have chosen either of the contract options at least once indicate willingness to negotiate a conservation contract if the terms are agreeable.

3. Results

Estimation of Multinomial Logit Models

About one third of the respondents always selected the status quo alternative in their choices. Two models were thus estimated; one using all the observations in the data set collected, and one from where the respondents who had always chosen the status quo had been omitted.

The status quo option was assigned the alternative specific constant (ASC). The positive and statistically significant constant indicates strong preferences for no additional conservation. The compensation parameter estimate is also positive for both models, indicating that the higher the compensation in the option, the higher the probability of it being chosen.

All the other variables were effects coded. At least one of the levels was statistically significant for all the variables. Nearly all the signs of variable levels are the same in both models, and the preference order of the levels is likewise similar. "Forest owner" was the most preferred alternative for the initiator of the contract, while the "environmental organisations" were least favoured. Respondents were willing to conserve small patches of forest or manage their forest according to a nature management plan, rather than take more restrictive measures. Short contract periods were preferred to longer ones, with the practically permanent one hundred years being a highly unpopular choice. Respondents also preferred flexibility in decision, opting to have a possibility of withdrawing from the contract at their will.

What differs between the two models is the magnitude of the ASC co-efficient. The status quo ASC is much smaller for the respondents who are willing to make a contract. They would also like to have a higher compensation demand, and the role of themselves as the initiators of the contract is more important. Also the sovereignty in decision making shows in the high preference for a flexible cancellation policy.

Table 2. Estimated model parameters (and standard errors) using all data and data with status quo respondents excluded.

Variable		Parameters (SE)	
		All data	Nae sayers
Alternative specific constant for the status quo		1.7385***	0.7756***
		(0.0762)	(0.0967)
Compensation		0.0033***	0.0047***
		(0.0003)	(0.0004)
Initiator	Forest owner	0.4626***	0.6294***
		(0.0607)	(0.0722)
Initiator	Forest organisation	0.0573	-0.0752
		(0.0664)	(0.0791)
Initiator	Environmental organisation	-0.2503***	-0.289***
		(0.0642)	(0.0796)
Initiator	Conservation trust	-0.155	-0.2650
		-	-
Restriction on use	Small patches conserved	0.4601***	0.545***
		(0.0580)	(0.0729)
Restriction on use	Nature management plan	0.2373***	0.3693**
		(0.0695)	(0.0830)
Restriction on use	No silviculture	-0.1379**	-0.2440**
		(0.0660)	(0.0787)
Restriction on use	Strict nature reserve	-0.5595	-0.6706
		-	-
Duration of contract	5 years	0.4841***	0.6432***
		(0.0592)	(0.077)
Duration of contract	10 years	0.2865***	0.3328***
		(0.0609)	(0.0721)
Duration of contract	30 years	0.0713	0.0474
		(0.0637)	(0.0756)
Duration of contract	100 years	-0.8419	-1.0234
		-	-
Cancellation policy	Present owner can cancel	0.1725***	0.3080***
		(0.0497)	(0.0594)
Cancellation policy	New owner can cancel	0.0591	0.1319**
		(0.0537)	(0.061)
Cancellation policy	Binds also new owner	-0.2316	-0.4400
		-	-
Log-likelihood		-2490.18	-1555.72
ρ^2		0.1889	

***significant at $p < 0.01$; **significant at $p < 0.05$, * significant at $p < 0.10$

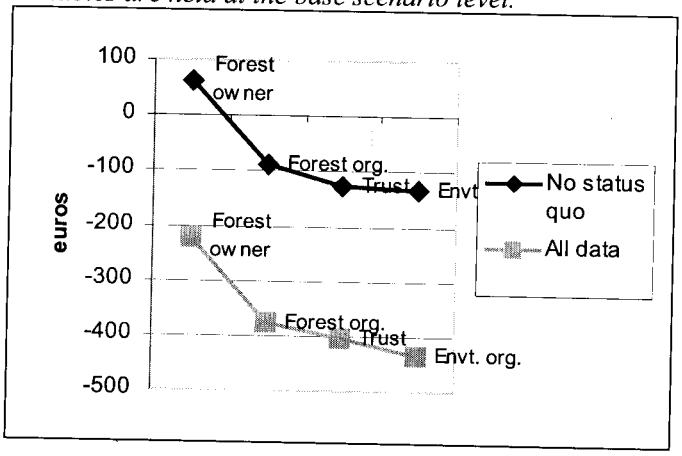
Welfare Analysis

The welfare analysis shows that the terms of the contract are of great importance to forest owners as the demand for compensation rises manyfold with undesirable factors. The base scenario was

selected to have the forest owner as the initiator of the contract, the contract binds a new as well as the present forest owners, small patches are protected and the duration of contract is 10 years. In this base scenario the impact on forest owners welfare is -224 € per hectare annually when using all data. So at least this amount should be paid to a forest owner on average as compensation for biodiversity conservation services to hold his or her welfare constant. However, the welfare impact for the same contract but estimated using the "Nae sayer excluded" model results in a positive figure of +62 € per hectare annually. Thus these forest owners would have a positive welfare impact of the described contract. In other words, these forest owners would be made better off with the introduction of the contract to the extent of 62 € per hectare per annum.

If the contract terms are changed, the welfare impact shifts accordingly. For example, if the contract is initiated by any other agent rather than the forest owner, the welfare change declines drastically for both data, being now negative also for the non status quo group (Fig. 1). Similarly, if the restrictions on forest use are changes from only small patches to be protected to larger areas left outside silvicultural management, the welfare impact would be -400 € and -105 € per hectare annually, respectively.

Figure 1. Changes in welfare by data when the initiator of contract is changed while the other variables are held at the base scenario level.



4. Conclusions

This study examined Finnish NIPF owners' preferences for biodiversity conservation in private forests. The choice experiment method was applied to study the trade-offs between compensation and the terms of voluntary conservation contracts. Heterogeneity among forest owners was examined by modelling separately those respondents who had made choices between the status quo situations and the contract options.

The results show how the welfare of forest owners shifts when the contract terms are changed. To keep the forest owners' welfare constant before and after the conservation contract, the owner would have to be compensated the amount of the welfare change. In a base scenario the forest owner was assumed to be the initiator of the contract that would require only small patches of forest to be protected, and would also bind new forest owners over its duration of ten years. For all respondents, the average demand for compensation would be around 224 €. This is slightly higher than the average annual revenue from timber sales from a hectare over the rotation period.

However, if the respondents who were not willing to choose a conservation contract are excluded from the data, the average welfare impact would be + 62 €. This is not surprising in that many forest owners are already leaving some patches of their forest intact without getting any compensation of it. However, if the restrictions on forest use were more severe involving a larger area to be left outside silvicultural management, the welfare impact would be –105 €.

For a conservation policy to be socially accepted and cost effective for both the government and the forest owner, the heterogeneity in forest owners' preferences and goals for the forest holding should be taken into account. Instead of using a top down approach of imposing a conservation status on a NIPF holding, those forest owners willing to protect parts of their forest should be allowed to enter voluntarily into contracts with environmental officials of the state .

The goal of nature conservation is to secure the protection of nature values in situ. Strict nature reserves provide a secure core for conservation networks and present a low risk level in the stability of conservation status. Considering only ecological values, the acquisition of forestland by the state for strict biodiversity conservation purposes would seem like an attractive option. However, t he optimal choice of conservation policy and implementation mechanism is a complex matter of trade-offs between ecological values and socio-economic considerations. Tailoring the policy mechanisms to suit the ecological requirements in a cost-effective and socially acceptable manner is a challenging task for the policy makers.

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