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Bo Jellesmark Thorsen

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What Science
Can Tell Us

The Provision of Forest Ecosystem Services

Volume II: Assessing cost of provision
and designing economic instruments for
ecosystem services

Bo Jellesmark Thorsen, Robert Mavsar, Liisa Tyrväinen,
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The stated preference approach to costs of provision

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Why use the stated preference approach?

Apart from the engineering and econometric approach to assessing the cost function, the costs of enhanced provision of ecosystem services can also be estimated using stated preference approaches. Rather than “objective” estimates provided by simulation or revealed cost methods, this method considers the costs of provision as perceived by the forest owner or, more specifically, the minimum compensation that the private forest owner is willing to accept to engage in a voluntary contractual arrangement, which will provide a payment to him against taking actions to enhance ecosystem services, a so-called PES (payments for environmental services) scheme. Following the stated preference approach common in environmental valuation, a willingness to accept compensation (WTA) measure can be derived through survey-based data in order to anticipate the expected costs of a specified PES initiative.

The basic rationale for the stated cost approach is that the forest owners' compensation claims constitute the supplier's net cost of providing a given level of ecosystem services. The supplier's net costs include the direct, opportunity, and transaction costs accruing to the forest owner minus the owner's private benefit from the ecosystem services provided.

There are several reasons for using the stated cost approach. First, the approach accounts for the fact that the compensation required for a private forest owner to commit to the obligations of a voluntary PES scheme must cover all of the cost components, some of which are not easily estimated and possibly not third-party observable at all.

The simulated opportunity costs – typically forgone revenue due to harvesting restrictions and specific environmentally friendly harvesting and regeneration practices – are by no means the sole, or sometimes even the dominant, cost component. There can be additional direct costs, e.g. related to measures for enhanced recreation opportunities. These are difficult to assess. This is even more so for transaction costs related to information search, planning, and contract making which may sometimes be the most important cost component. Apart from these, the acceptable compensation to the forest owner is likely to depend on his/her own preferences for the ecosystem services being promoted, as well as on his/her preferences for participation per se. The latter may be affected by, for example, a perceived loss of sovereignty in decision making regarding one's own property.

Second, the stated cost approach can be used to assess the costs of new actions for which no data are currently available. Accordingly, stated cost methods may be almost the only

feasible way to estimate the supplier's cost *ex ante* for new PES initiatives and action types that are only at the planning stage. While auctions (also known as competitive tendering) can be used at the actual implementation stage of a PES scheme, survey-based estimates of stated costs may be useful and cost-effective in simulating such auctions in advance.

Further, multiattribute methods, such as the choice experiment (CE) method, also allow the assessment of the effects of policy alternatives through the terms of the PES scheme (i.e. contract terms other than the payment). Such survey-based data readily allow us to consider the heterogeneity of forest owners and the related distributional aspects of the policy alternatives.

Despite its obvious merits, the stated cost approach is not without potential problems. One is strategic answering in the sense that forest owners may have incentives to understate their willingness to participate in the different PES scheme alternatives, effectively overstating the true acceptable compensation. A second possible bias, with somewhat contrary effect, is sample selection. In a voluntary survey, it is likely that forest owners who are more interested in the concerned ecosystem service and more favourable to the PES regime may be more likely to participate and respond. Standard procedures for investigating non-response can be used to avoid the potential bias in the average WTA compensation.

Box 5. Cost of provision components that the stated preference approach can reveal related to a PES scheme

- Direct costs include the costs caused by increased and/or changed management actions the forest owner has engaged in a PES contract.
- Opportunity costs comprise of the forgone benefits that could be derived from the most profitable, feasible alternative use of a forest.
- Transaction costs refer to the costs of information search, planning, and contract making related to a PES contract.

Choice experiments for stated cost assessments

In what follows we consider two CE studies that assess forest owners' stated costs of PES initiatives. They share the same basic structure. The respondents were presented with tables (choice situations) each suggesting three alternatives: their current situation and two different contracts. The contracts were presented as varying combinations of the values of selected attributes. These included the management changes required by the contract and the monetary compensation for accepting it, as well as other terms such as duration of the contract. The respondents then selected the alternative they preferred, i.e., the preferred contract alternative or the current situation.

We first consider forest owners' marginal compensation claims related to each proposed management change with other terms of the contract unchanged. These WTA results reflect, directly or indirectly, the marginal supplier's costs with respect to changes in the provision of various environmental services of the forest, such as the landscape and recreational quality. Next we illustrate the assessment of the costs of alternative PES schemes by comparing scenarios that involve a mixture of several management changes.

Table 5. Management changes (contract terms) considered in the Finnish CE study with the estimated marginal compensation claims.

| Proposed management changes | Current practice | Alternative practices | Compensation claim, €/ha/yr |
|---------------------------------|------------------------------------|--------------------------------|-----------------------------|
| Accepting a contract (constant) | No contract | | 98.6 |
| Harvesting restrictions | Existing previous regulations only | No clear-cutting | -68.0 |
| | | No regeneration cuttings | 30.0 |
| | | No harvesting at all | 103.9 |
| Coverage of restrictions | 0% | 5, 10 or 20% of forest area | 5.4 ^a |
| Length of new routes | 0 meters | 500 meters | n.s. |
| | | 1000 meters | n.s. |
| Contract duration | No contract | 5, 10 or 20 years | 10.4 |
| Compensation, €/ha/yr | No compensation | 30, 60, 120, 180, 240 or 300 € | |

^a Per percentage point; ^b per additional year of contract; n.s.: no significant effect

Enhanced provision of landscape and recreational amenities: A Finnish case

As a means of integrating the interests of tourism entrepreneurs and forest owners, the Landscape and Recreational Values Trading (LRVT) scheme has been proposed in Finland. In this scheme, private forest owners would make voluntary fixed-term contracts whereby they commit to enhance the provision of landscape and recreational values in their forests for a monetary compensation. The contracts would aim to preserve or enhance the landscape characteristics and recreational quality in areas important for recreation and tourism near outdoor recreation routes, shores, and resting places. The funds for the compensations would be collected from tourists as payments connected with the prices of accommodation or other services.

The expected costs are important information regarding the viability of the LRVT scheme. To obtain such information, we use survey data of 471 forest owners in the Ruka-Kuusamo tourism area. The CE approach was applied to assess the minimum compensation that the forest owners would be willing to accept for a LRVT contract. Their compensation claims can be seen as the stated supplier's costs of provision of enhanced landscape and recreational amenities.

The respondents were asked to imagine that a LRVT scheme were to be started in the area. The proposed management changes and other terms of the contracts included the type of harvesting restrictions, their coverage in percent of the property's forest area, length of new outdoor routes, duration of the contract, and the compensation in €/hectare/year. The proposed management changes and the estimated marginal compensation claims are shown in Table 5.

Compensation claims for proposed management changes

To accept a PES contract, the forest owners claim a compensation of 98.6 €/hectare/year irrespective of any specific management changes required. This constant 'threshold value' reflects the forest owner's perceived cost of moving away from the current situation.

A compensation of 30.0 €/hectare/year would be claimed if no regeneration cuttings were allowed, and expectedly a larger one (103.9 €/ha/year) would be required if no harvesting were allowed at all. Considering the coverage of the restrictions, the compensation claim increases by 5.4 €/percentage point/year. Accordingly, the compensation for restrictions affecting 5% of the forest area, for example, should be 27.0 €/ha/year. Interestingly, the figure for prohibiting clear-cuttings is negative (-68.0 €/ha/year). This suggests that rather than claiming a compensation, the forest owners on average considered this change as a benefit and should already be ready to implement it. The establishment of new outdoor routes had no significant effect on the compensation claimed.

The largest compensation claims are associated with changes in the duration of the contract. The claim of 10.4 €/ha per year of contract means that the forest owner's commitment to the enhanced provision of landscape and recreational services for a 20-year rather than 5-year contract would increase the required compensation from 52 to 208 €/hectare/year. This suggests that the forest owners are quite reluctant to accept obligations that restrict their decision-making regarding the management of their property for considerable periods of time.

Distributional aspects of policies

The compensation claims for forest owners on average can give a rough idea of the costs of a PES scheme. However, because the stated costs and welfare effects depend on the individual owner's preferences and characteristics, they may vary considerably across different groups of forest owners. The distributional effects are reflected in the way compensation claims vary by the forest owner's income level, for example. In this case, the compensation claims for the 'No harvesting at all' restriction or for a 20-year contract by the high-income group would be around a half of the average level, while the respective compensations required by the low-income group would be approximately three times higher than the average level.

Management changes for biodiversity and recreational access: A Danish case





A similar CE study was made to evaluate Danish forest owners' demand for compensation for specific management changes on their property. The Danish forest area is geographically fragmented and the ownership is distributed across a large number of owners. The implementation of new politically desired changes in management will therefore often involve voluntary schemes targeting a large number of forest owners, each with their view on nature management policies and different management objectives for their land.

A stated cost approach was used to assess forest owners' compensation claims for currently debated management changes related to Natura 2000 policies. The management changes investigated here range from small-scale changes like leaving a number

Valg mellem tilskudsordninger (1 ud af 6)

Hvis tilskudsordningen f.eks. indeholder en lavere ejendomsskat på 75 kroner per ha, og din største skov udgør 100 ha, så vil din kompensation i alt udgøre 7500 kroner hvert år (udbetalt efter skat) for hele skoven.

Hvilken af disse tilskudsordninger foretrækker du for hele din største skov?

| Elementer i ordningen: | Tilskudsordning A | Tilskudsordning B | C - Ingen af disse tilskudsordninger |
|--|---|--|--|
|  Krav om urørt skov: | 15 % udlægges som urørt skov | Ingen ændring | Ingen ændring |
|  Krav om træer der efterlades til naturligt henfald: | Ingen ændring | 5 træer/ha efterlades til naturligt henfald | Ingen ændring |
|  Krav om andel af løvtræer i skoven: | Ingen ændring | 50 % løvskov | Ingen ændring |
|  Krav om adgang for offentligheden: | Adgang for offentligheden til fods over alt | Nuværende adgangsregler: Adgang til fods på vej og sti | Nuværende adgangsregler: Adgang til fods på vej og sti |
| Lavere ejendomsskat per hektar for din skov, der svarer til (udbetalt efter skat): | 25 kr/ha/år | 150 kr/ha/år | Ingen kompensation |

Sæt ét kryds: ☐ ☐ ☐

Figure 6. Visual presentation of the CE to Danish forest owners. The introductory text reads: If the subsidy scheme includes e.g. a lower property tax of 75 DKK per hectare, and your largest forest is 100 hectares, then your compensation will amount to 7,500 DKK every year (in cash after tax) for the whole forest. Which of these subsidy schemes do you prefer for your (whole) largest forest?

of trees per hectare for natural decay to comprehensive changes like setting aside areas as untouched forest, change in tree species from coniferous to broadleaved trees and increased access rights for the general public. The forest owners would select the alternative they preferred from two alternative contracts and the current situation with existing management regulations. Figure 6 shows how the choice question was presented to Danish forest owners in the online web-survey. The proposed management changes with the estimated marginal compensation claims are presented in Table 6.

Compensation claims for proposed management changes

A survey of 283 Danish forest owners was used to estimate how much the owners require in compensation if they were to accept a PES scheme involving the specified management changes. The compensation levels below are per hectare per year payments to the forest owner for the entire forest area – even though some of the initiatives (e.g., setting aside areas as untouched forest) only involve a part of the forest area.

Similar to the Finnish case, the Danish forest owners have a significant compensation claim (43.0 €/ha/year) for accepting a PES contract *per se*. As the compensation for each specific management change is added to this threshold value, the compensation claim for a contract which only entails a 75% broadleaved restriction becomes $43.0 + 7.0 = 50.0$ €/ha/year.

On average, the forest owners are most reluctant to accept a PES scheme involving increased access for the general public in their forests. If they are to allow the public access

Table 6. Management changes considered in the Danish CE study with the estimated marginal compensation claims – intermediary results.

| Proposed management changes | Current practice | Alternative practices | Compensation claim, €/ha/yr |
|---|--------------------------------|---|-----------------------------|
| Accepting a contract (constant) | | | 43.0 |
| Set aside as untouched forest, % of forest area | 0% | 7%, 15% | 0.5 ^a |
| Leave old trees for natural decay | 0 trees | 5 trees | -1.0 |
| Increase the area with broadleaved trees | 0% | Min. 25% broadleaved | n.s. |
| | | Min. 50% broadleaved | n.s. |
| | | Min. 75% broadleaved | 7.0 |
| Increase the public's access | Access on roads and paths only | Access on foot up to 15 meters from roads and paths | 17.2 |
| | | Access on foot everywhere | 34.4 |
| Compensation, €/ha/yr | | 0, 3.5, 7, 10, 13.5, 17, 20.3, 23.6 € | |

^a Per percentage point; n.s.: no significant effect

on foot up to 15 meters from roads and paths, they require 17.2 €/ha/year in compensation, and 34.4 €/ha/year to allow access on foot for the public everywhere on the forest floor. Moreover, 69% of the respondents stated that even if they received an appropriate amount of compensation they would still not be willing to allow access everywhere in the forest. Despite potential strategic answering, this type of survey also shows the scope for which type of ecosystem services the majority of forest owners may be willing to provide through voluntary mechanisms, and for which services only limited results are likely to be achieved through this type of mechanism.

On the other hand, the forest owners on average have a positive attitude towards initiatives to promote biodiversity by leaving old trees for natural decay in the forest and thereby keeping some amount of dead wood. They are willing to accept a smaller compensation when this is a part of the PES scheme. Also, the owners do not require compensation for accepting a restriction of up to 50% minimum broadleaved cover in the forest. For the acceptance of a 75% minimum broadleaved cover, a compensation of 7 €/ha/year is required. Based on these results, a part of the Danish forest owners are remarkably willing to accept high percentages of broadleaved tree species on their property.

If the PES scheme involves setting aside 15% of the forest as untouched, the owner of a 100-hectare forest property requires approximately 750 € in compensation per year. As mentioned above, there may be a bias since this type of survey is likely to attract respondents who are more interested in providing ecosystem services. In the present survey, 60% of forest owners stated that they have already set aside 5% of their forest. The number may suggest that forest owners more prone to take initiatives for biodiversity protection are overrepresented in the sample.

Policy alternatives involving a mixture of management changes

So far, we dealt with marginal compensation claims related to a single management change with other attributes unchanged. However, from a policy point of view it is more illuminating to consider the costs of alternative programmes involving several management

Table 7. Forest owners' overall compensation claims for three different scenarios, €/hectare/year.

| Management changes required | Marginal compensation claims | Scenario | | |
|---------------------------------|------------------------------|-------------------|--------|------------------|
| | | Least restrictive | Middle | Most restrictive |
| Accepting a contract (constant) | 98.6 | 98.6 | 98.6 | 98.6 |
| No clear-cutting | -68.0 | -68.0 | | |
| No regeneration cuttings | 30.0 | | 30.0 | |
| No harvesting at all | 103.9 | | | 103.9 |
| 5% of forest area | 5.4 ^a | 26.9 | | |
| 10% of forest area | | | 53.7 | |
| 20% of forest area | | | | 107.4 |
| 5-year contract | 10.4 | 52.1 | | |
| 10-year contract | | | 104.1 | |
| 20-year contract | | | | 208.2 |
| Overall claim, €/ha/yr | | 109.6 | 286.4 | 518.1 |

^a €/percentage point/year

changes in combination. To illustrate this, three scenarios were constructed for the Finnish case. The overall compensation claims, representing the forest owners' average stated costs for each alternative LRV scheme, are obtained by adding up the estimated compensation claims for the specific management changes required by the scheme in question.

For the least restrictive scenario with 'No clear-cutting', 5% coverage of the forest area and 5-year contract period, the overall compensation claim becomes 109.6 €/ha/year (Table 6). For the middle scenario, with each of the management requirements tightened by one step in the more demanding direction, the overall claim increases to 286.4 €/ha/year. A further tightening of the contract terms results in the most restrictive scenario with no harvesting at all, 20% coverage of the forest area and a 20-year contract period. The compensation claim then increases to 518.1 €/ha/year, which is more than 4.5 times as high as the compensation for the least restrictive scenario.

How do the stated costs, based on the potential suppliers' own assessments, compare with the simulated opportunity costs of provision of forest amenities? We cannot expect that these be equal or even of the same order of magnitude, as the approaches measure a fundamentally different array of cost components (and benefits, as regards the stated cost approach). In the present Finnish example, the stated costs in Table 7 exceed the simulated opportunity costs for the closest scenario by a factor of ten. This is expected, as the forest owners' acceptable compensation must cover not only the computational opportunity costs (loss of income from harvesting restrictions and specific management practices) and potential direct costs but all perceived costs as well. Maybe the decisive cost category is the transaction costs that are not easily estimated in advance. Further, for the contract to be acceptable to the forest owner the payments should also compensate for the loss of sovereignty regarding the management of one's own property.

Concluding remarks

The above examples illustrate the potential advantages of the stated cost approach in assessing the cost of provision of ecosystem services. Above all, the approach can be used to

assess the costs of PES initiatives that are only at the planning stage. The marginal compensation claims related to specific management changes highlight the importance of the detailed terms of the suggested PES scheme. It should be born in mind, though, that the supplier's costs are not an estimate of the full purchaser's budget costs for a PES initiative, as they do not include the scheme manager's transaction and management costs.

It is also worth noting that there is significant heterogeneity in forest owners' preferences for all of the ecosystem services. Part of this is linked to the fact that many forest owners already provide some of these services on their property on a voluntary basis. This is the case especially in Finland, where access for traditional recreational use of the nature is an everyman's right, but also in Denmark with a different recreational tradition. This means that part of the forest owners may accept a contract of the provision of these services without experiencing major additional costs.

All in all, the stated cost approach applied here has the strength of providing compensation estimates of both present and future policies targeting nature conservation and provision of recreational services from forest areas. This is the kind of knowledge that typically would not be available until several years after the implementation of a specific scheme.

Key messages

- The stated cost approach is useful for assessing the total costs as experienced by the forest owner.
- The approach can gather direct, opportunity and transaction costs (for the owner) – adjusted for the potential benefits experienced by the forest owner.
- A significant strength is that new policies or proposed management changes can be evaluated before they are implemented in practice.
- A weakness of the method is the hypothetical setting it relies on. This may induce strategic answering, meaning in this case that landowners might overstate their compensation requirements.
- The supplier's transaction costs, such as the cost of collecting payments for the LRV scheme in Finland, is not assessed in this approach.

Recommended reading

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