# REPORT

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*POLICYMIX - Assessing the role of economic instruments in policy mixes for biodiversity conservation and ecosystem services provision*

# Finland: National level assessment of the role of economic instruments in the conservation policymix

**Eeva Primmer, Riikka Paloniemi, Jukka Similä, Pekka Leskinen, Pekka Punttila, Anna Tainio, Susanna Sironen, Niko Leikola**

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Finnish Environment Institute







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# Abstract

The POLICYMIX national level case study of Finland analyzes Finnish forest biodiversity conservation policies and policy instruments by recapitulating the recent forest biodiversity conservation policy development in Finland and by analyzing the institutional evolution of the introduction and implementation of new policy instruments into a mix of existing instruments. The current understanding of biodiversity conservation needs, the policy goals and the applied mix of policy instruments are reported based on reviews of secondary material as well as analyses policy evolution and the output of targeted workshops with the Case Study Advisory Board. Traditional protected area establishment relied on conservation programmes targeting certain habitat types and negotiating their implementation with forest-owners. As these programmes received heightened criticism particularly after the Natura 2000 implementation, the new payments for environmental services were introduced as a part of the Southern Finland Forest Biodiversity Programme (METSO) in 2002. After a 5-year pilot implemented jointly by environmental and forestry administration, the METSO payments were integrated in the pre-existing governance systems. They are currently channeled to non-industrial private forest owners to compensate timber income loss either for a fixed-term under the forestry administration, or for permanent protection under the environmental administration. The evolution analysis points to sequense effects of different types of instruments. Criticism agains centrally designed conservation programmes triggered voluntary payment-based instruments. The current mix of instruments is complementary in that sense that it reaches forest-owners with different views to preservation, income and property rights. Conflicting features within biodiversity conservation instrument mix can be detected in the channeling of new payment funds to making contracts on habitats that have a legally protected status and whose conservation was not compensated for in such large scale before the introduction of the current METSO payments. The coarse grain national case study analysis provides the background and scope for the local level case study analysis, to be carried out in South-Western Finland, and for a cross-level multi-criteria analysis.

*Forestry and environmental professionals discussing the application of voluntary conservation criteria in South-Western Finland in 2010.*

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# Summary and conclusions

## Case study location and conservation characteristics

Finland is a highly forested country, with at least two thirds of the land covered with productive forests. Out of these 20 million hectares, two thirds are owned by over half a million small-scale non-industrial private forest owners. A great share of Finland's biodiversity and also endangered species dwell in these commercially managed forests that concentrate in the southern parts of the country.

As only less than 2% of the forest land is preserved in Southern Finland and centrally designed protection has generated severe conflicts during the 1990s, the current approach to conservation is primarily voluntary. The payments for ecosystem services (PES) under the Southern Finland Forest Biodiversity Programme (METSO) currently form the core of the policy instrument mix in Finnish forest biodiversity conservation. The Finnish case study outlines the status of biodiversity and the policy instrument mix for biodiversity conservation at the national level in a coarse grain fashion. Further in the project, voluntary contracting and the impacts of the instrument mix will be analyzed in South-Western Finland.

## Current economic instruments in biodiversity conservation

Currently, the formal Finnish forest biodiversity conservation instruments include regulatory instruments and economic instruments as well as information and extension services. The traditional national parks, strict nature reserves and nature conservation programme areas (including the European Union Natura 2000) are supplemented with Forest Act habitats and Forested Nature Conservation Act habitats. Private protected areas are currently established dominantly through positive economic incentives under the METSO Programme attracting voluntary offers from forest owners, in a PES fashion. This protected area contracting is the responsibility of the environmental administration. Under the METSO Programme, PES contracts are also made for a fixed term by the forestry administration, under the Act for Financing Sustainable Forestry. The two PES-like mechanisms merge the ideas and practices of the PES contracts piloted jointly by the environmental and forestry administration in 2002-2007 and the pre-existing environmental subsidy that compensates for timber income loss.

## New and potential economic instruments

To scope for new potential conservation instruments, the Finnish case study has ran a focus group workshop with the Advisory Board members, representing environmental and forestry administration, land-use planning, forest owners and environmental NGOs of national level and local level. The already upcoming new instruments or changes in existing instruments identified in the focus group included broadening law-based habitat conservation to cover more habitat types, or providing significantly more subsidies or incentives for nature management and restoration of altered habitats or diversifying forest management and silviculture with uneven-aged forest management. More radical new instruments identified by the focus group include strengthening nature conservation by developing a biodiversity law, allocating more nature conservation power and budgetary resources to environmental administration, or backing up the environmental administration with more forest nature management competencies to allow forest administration to focus mostly on forestry. Also developing economic instruments by increasing incentives significantly

and paying for existing or increased nature values or developing land-use planning would be more radical developments.

## Instrument interactions in the national policymix

The different policy instruments in the current mix supplement each other in potentially attracting different types of forest-owners; more preservation oriented owners will choose a permanent private protected area and more forestry income oriented ones will choose the fixed-term METSO-PES. According to the Case Study Advisory Board members, fixed-term contracts have functioned as a gateway for forest-owners to enter a conservation contract, attracting them to consider also permanent conservation. This proposition will be examined further in the fine grain analyses. It is also possible that conservation programmes preceding the METSO era provide motivation for taking up less restrictive instruments. This potential 'regulatory assurance', where the existence of a regulatory instrument is crucial for the success of a voluntary instrument, will be further studied.

The sequence of the policy instruments has clearly played an important role in the evolution of the Finnish METSO PES. Without the criticism against the conservation programmes and the implementation of the Natura 2000 network, the METSO incentives would not have been developed. Similarly, the success of the PES has largely relied on the new opportunities and new practices brought by the voluntary scheme implemented in collaboration between the environmental and forestry administrations, although the piloted joint administration has discontinued. As our analysis of the institutional evolution demonstrates, the current application of the METSO-PES has reverted back to many institutional features that existed prior to the METSO pilot. Further analysis will rigorously test the prevalence of the different institutional factors that influence contract uptake currently and also examine how different institutional arrangements characterize the potential outcomes of future policy-mixes.

## Local fine grain analysis – research questions and challenges

### Fine grain case study site description

South-Western Finland is densely populated and has a diverse economy for the generally very rural Finland. The area has 1 million hectares forest land, out of which private people own 80%. These 37 000 non-industrial private forest holdings are generally small in size, averaging at 21 hectares. Compared to the rest of the country, forest owners in the area have acquired ownership actively and only a third has inherited the land. Typical of southern Finland, the forests in the area are fertile, productive and intensively managed. The same forests are used for recreation, berry and mushroom picking and hunting.

The area has low conservation coverage, with 2,5 percent of the forest area strictly protected and 0,4 percent of private forests designated as Forest Act habitats. The South-Western Finland Forestry Centre region piloted the METSO Programme during 2003-2007. Actually, the so-called ‘nature values trading’ PES instrument idea originates in the area. As the forest owners in the area are have been exposed to the voluntary policy instruments for a ten-year period already and the administration has been engaged in developing these instruments, South-Western Finland makes an ideal case study area.

### Economic instrument effectiveness

The ecological outcome of voluntary conservation payments and of instrument mixes should be evaluated against the conservation challenges that include low coverage and connectivity of protected areas. The case study will layer the METSO PES forest holdings on a general Zonation output to evaluate the conservation effectiveness in the fine grain analysis. Additionally, to allow scenario analysis, the structure and the quality of the forests that were included in the METSO PES holdings will be examined with spatial analysis of forest inventory data. The structure and the quality of the forests will be assessed with forest site types, dominant tree species, development classes, age classes, volume of the growing stock and increment of growing stock. These spatial analyses will be combined with spatially referenced views of forest owners regarding the ecosystem services that their forests provide from the survey responses.

### Economic instrument costs and benefits

For understanding the costs and benefits of conservation instruments, it is essential to understand the difference that the PES contract or instrument mix makes as compared to no conservation effort. Generally, opportunity costs are an important starting point when analysing the conservation of previously commercially managed forests. In addition to the opportunity costs, also the forest-owner views on what rights they give up generate an important cost factor. As regards the benefits, it is essential to acknowledge the ecosystem services that the forest owners identify their contracted sites to provide, as they are well aware of the functions of their forests and those who have already made a contract, have first-hand experience with both benefits and costs. The Finnish local level case study will evaluate the factors that have contributed to contracting and the payment request of contracted and non-contracted forest owners, as well as their perceptions of multiple benefits of conservation. The real contract fees will be used to validate the payment request.

The Finnish fine grain analysis will advance the understanding of contractual, institutional and social factors contributing to the payment request. Similarly, the fine grain analysis will allow measuring the value that the forest-owners place on the ecosystem services they provide by contracting. As the contracts are voluntary, and they are a genuine opportunity for any forest-owner who has an eligible site on their land, the payment request reflects the ecosystem service value of the service provider in a realistic fashion. Plotting the significant impacting factors on a map, the fine-grain analysis will also explore the possibilities of GIS analysis of timber-sale value (opportunity cost) on willingness to contract and payment request levels. Similarly, transaction costs can be evaluated both with the results of the survey (time invested in contracting and negotiation time) and GIS analysis (distance to agency).

### Economic instrument equity and legitimacy

Finnish forest-owners are relatively wealthy and often rather independent from regular forestry income, and the forest sector is rather powerful in steering timber production and also influencing forest biodiversity policy. With the conflictuous history, the administration seeks to treat forest-owners as equally and equitably as possible. The private benefits of conservation and PES experienced by forest-owners are often simplified to be expressed by income changes but they can be much broader. Benefits experienced by forest owners include perceived changes in benefit distribution, equal opportunity to contract and use multiple ecosystem services, autonomy to decide about conservation and forest use, justness of rights and responsibilities, security and predictability

of the policy and contract terms, and finally, biodiversity and ecosystem benefits. The Finnish local level case study will address both distributive impacts and legitimacy directly with the forest-owner survey.

The analysis will focus on perceived benefits and their contribution to contracting. The Finnish case study will contribute to the debate about fairness and equity in PES with experiences from a wealthy empirical context. With the forest-owner views on ecosystem service benefits and their relation to payment request, the survey will also allow discussing the generally held views that values placed on ecosystem services are of a public character and that their valuation should rely on contingent valuation methods. The Finnish forest-owner survey will address the forest owners' use of information, their trust and their shared interests relative to a range of relevant actors implementing and intermediating the METSO PES.

### Institutional opportunities and constraints for economic instruments

Introducing PES instruments will necessarily change forest owners' rights and responsibilities. By doing this, the PES re-determine also the rights and responsibilities of different administrative and organizational actors. In addition to these formal regulative institutions, changes occur in the normative institutions carried by professional and standardized practices as well as cultural cognitive institutions reflecting the perceived functions of forests, forest management and biodiversity conservation. Although the PES contract terms and their acceptability have been studied in Finland, and the role of the administration and intermediaries is also well known, the forest-owners' views on their own rights and responsibilities has not been analyzed together with their views of the rights and responsibilities of other actors. The Finnish fine grain analysis will close this knowledge gap.

Much of the Finnish local level case study focuses on the rights and responsibilities and the impacts of their redistribution, through forest-owner perceptions. In addition to analysing the influence of institutions on the take up of a PES contract and the payment request, the survey will allow in-depth analysis of the weight placed on the rights of different actors, which can be analyzed against earlier work on legitimacy and institutions of forest biodiversity governance. The results will enlighten the institutional options and constraints of METSO PES and other instruments. This will be backed up by the focus group work for the multicriteria analysis of instrument mix scenarios.

### Integrated policymix assessments

Environmental decisions and policy assessments are often complex, involve many different stakeholders and typically draw on multidisciplinary knowledge bases, incorporating natural, physical and social sciences, politics and ethics. To consider the multiple impacts and constraints of different instruments applied jointly, the Finnish case study will conduct a spatially referenced multi-criteria analysis (MCA) of instrument-mix scenarios. This will not be a full blown spatial MCA, but the method relies on combined use of geographic information systems (GIS), spatial analyses and MCA.

The GIS is used to produce and handle the geo-referenced data needed for producing the alternative conservation area configurations under the different instrument mix scenarios, and as a platform to present and visualise the results of the analyses as thematic maps. The MCA will draw from the fine-grain analysis of institutional, social, ecological and economic perceptions of forest owners. The scenarios will take the existing budget as a starting point and take the current implementation of METSO PES as baseline scenario. Based on stakeholder focus group work, the alternative scenarios

will be built around the following new instrument mixes 1) Voluntary permanent conservation; 2) Enforced spatially concentrated permanent conservation, 3) Voluntary permanent conservation with active nature management; 4) Voluntary temporary conservation. The ecological indicators considered for this analysis include carbon sequestration, forest age structure and its changes, the amount of fertile forest site types, connectivity and the amount of coarse woody debris. The economic indicators considered include opportunity costs (lost timber sales income), transaction costs (negotiation time) and employment opportunities. The social indicators considered include recreational opportunities, perceptions on who benefits and distribution of benefits in society, perception of legitimacy and fairness of the contracting process. The information for the indicators will be obtained from the administration, the forest owner survey, forest resource information and from the Streering Group of the Finnish case study. The Streering Group will represent the decision maker in the MCA and state preferences for the different criteria and indicators.

# 1 Introduction

## 1.1 Background

POLICYMIX focuses on the role of economic instruments in a mix of operational conservation policy instruments. The project aims to analyse economic instruments both in an existing policy instrument mix and in a sequence of policy instruments. It will evaluate biodiversity conservation policies at different levels of government and their ecological, economic, social and institutional conditions and impacts. The project assesses the integration of the various identified and developed policy impact assessment methodologies in seven case studies at national government and local levels, in consultation with case study advisory boards. The overall objective of the report is to:

- Describe the legal and institutional context of these economic instruments to be assessed at the fine grain at a regional level and further in a multicriteria analysis of instrument-mixes.

- Provide the basis for cross-case comparisons of legal and institutional context, and instrument roles by using the POLICYMIX analysis framework (WP2) and assessment criteria proposed in the draft guidelines (WP3-WP6).

This report depicts the Finnish "coarse grain" national level case study analysis. The objective of the report is to outline the status of biodiversity and biodiversity conservation, the evolution of economic instruments for forest biodiversity conservation in a policy instrument mix in Finland and the institutional conditions influencing this evolution. The coarse grain national case study analysis provides the background and scope for the local level case study analysis, to be carried out in South-Western Finland, and for a cross-level multi-criteria analysis to be carried out after this report is due.

The Finnish coarse grain analysis seeks to answer the following questions:

- What are the pressing ecological and societal needs for developing policy instruments and instrument mixes for biodiversity conservation?

- What are the existing instruments (policymix or regime) for biodiversity conservation in Finland?

- How have the payments for environmental services (PES) type economic instruments emerged and fitted in the policymix?

- What are the institutional constraints of applying PES instruments in a mix of instruments?

- What new instruments and instrument mixes could be feasible?

- What are the potential impacts of new instruments and instrument-mixes?

Additional instruments that are not directly addressed in the Finnish coarse grain analysis, but merely referenced, are instruments that would add to connectivity (e.g. collaborative planning and agglomeration bonus), or advance co-production of a range of different ecosystem services, particularly those related to soil health (e.g. through continuous growth /uneven-aged forest management). The report also pays attention to issues for the multi-level assessment from local level to European and global level.

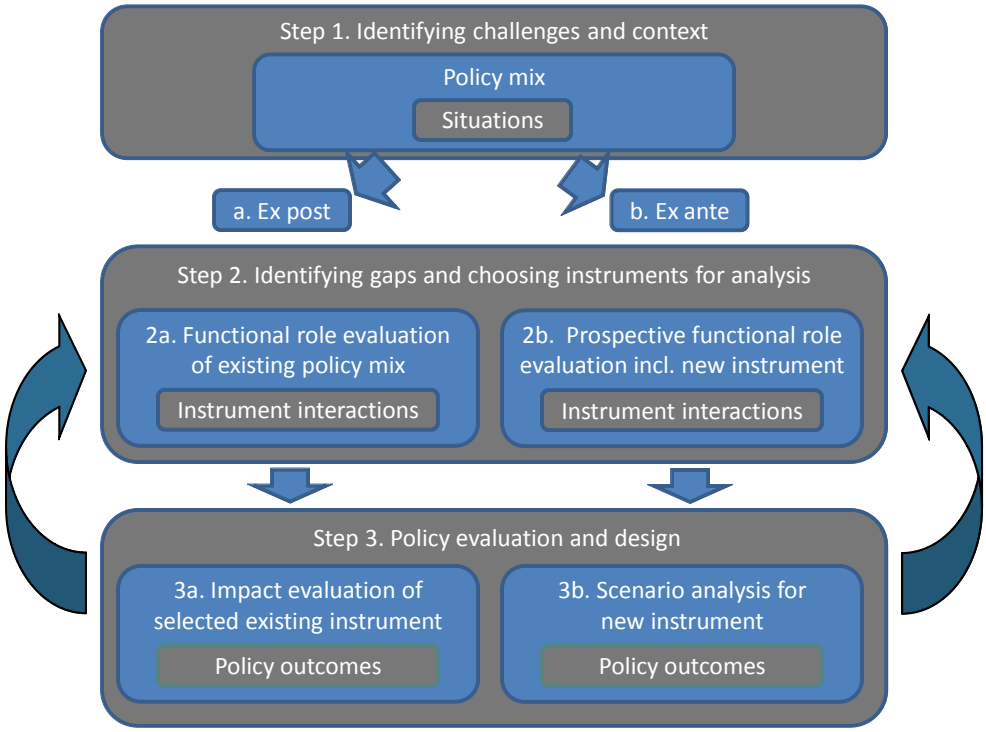



*Figure 1: Policymix analysis framework and pathways*

### 1.2.1 Biodiversity conservation needs and challenges

The status of Finnish forest biodiversity is reported based on secondary material, making reference to assessments of the ecological status as well as the conservation status of forest habitats and species. Also based on secondary analysis, the societal challenges of forest biodiversity conservation are outlined, paying particular attention to privately owned non-industrial forests.

### 1.2.2 Biodiversity conservation regime: categorisation of instrument types and their combinations in Finland

The existing biodiversity conservation instruments that span across different ecosystem types and administrative boundaries are charted based on the formal documents initiating the instruments and

statistics of their implementation. Additionally, the analysis regarding cross-sector and cross-level coordination, the report utilizes work done in the SCALES project. Based on all these sources, the current forest biodiversity conservation instruments are briefly described and their existing analysis reviewed.

Qualitative analysis of case study Advisory Board focus group work is used to make preliminary assumptions about the policy-mixes for later comparison with multi-criteria analysis as well as to scan for ecological, economic and social impacts that will be conducted after this report is due. (The fine grain analysis survey results will also feed into the multi-criteria analysis to be conducted outside the timeline of this report.)

### 1.2.3 Emergence of payments for environmental services in the sequence of policy instruments and the surrounding institutional context

The emergence of payments for environmental services (PES) type economic instruments and their fit in the instrument mix is analyzed through literature review and secondary analysis of legitimacy, power and practices.

### 1.2.4 The institutional constraints of applying PES instruments

The institutional constraints of applying PES instruments is assessed with primary legal analysis of EU competition laws and Finnish PES as well as through a primary analysis of institutional evolution, i.e., qualitative analysis the influence of regulative, normative and cultural-cognitive constraints on applying PES.

## 1.3 Case study comparisons: instrument, methodology and ecosystem services clusters

Regarding the context, the Finnish case study relates closely to the Norwegian case study, as both these case studies deal with biodiversity conservation in a setting where ecological deterioration is incremental (rather than dramatic land use change), forests provide a range of ecosystem services, including recreation and cultural identity, and where forest-owners are relatively wealthy and in a position to choose what they will do with their forests. Methodologically, these two cases are also similar in the sense that knowledge about forest biodiversity is at a high level, and added value will be generated through integrated analyses of several different effects as well as social and institutional conditions of conservation. Norway and Finland will both also apply forest-owner surveys in the fine grain empirical analyses.

As the Finnish case study focuses on a recently established and somewhat stabilized PES instrument, it has comparison points with the Costa Rican case. The Finnish case will also attempt to make use of ideas of administrative entities receiving fiscal transfers, analysed in the German and Portuguese case studies, as well as the institutional changes analysed in the Brazilian case studies.

*Table 1. Case study methods.*

| Case clusters | | | Costa Rica | Mato Grosso | São Paulo | Port-ugal | Fin-land | Ger many | Nor-way |
|---|---|---|---|---|---|---|---|---|---|
| **Instrument** | | **Specification** | | | | | | | |
| | **REDD+** | international/national | P | P | P | | | | |
| | **EFT** | national/state | | C&P | C | C&P | | P | P |
| | **Certification** | national/state | C | C | | | P | | C |
| | **Offsets/TDR/HB** | National/state | | C | C | | | | |
| | **PES** | national / state agri-env. | C | C&P | C&P | C | C | C | P |
| | | project /local | | C | C | | | | |
| | | *C=current, P=proposed or potential. Table includes only economic instruments addressed in 2 or more case studies* | | | | | | | |
| **Methodologies** | | *Only methodologies addressed in 2 or more cases studies* | | | | | | | |
| WP3 | **GIS mapping** | | | | | | | | |
| | | Composite B&ES indices | ? | ? | | ? | | ? | X |
| | | Biodiversity & habitat quality | X | X | X | X | X | X | X |
| | | Pollination&pest control | X | X | X | | | | |
| | | Carbon & timber | X | X | X | X | X | X | X |
| | | Run-off &infiltration&erosion | X | | X | X | | X | |
| | | Non-timber forest products | X | X | | | | | |
| | | Recreation | X | | | | | X | X |
| | | ? = subject to findings of the coarse grain analysis | | | | | | | |
| | **Landowner & forest user surveys** | | | | | | | | |
| WP4 & WP5 | | Value transfer - available datasets | ? | ? | | | | | X |
| | | Choice experiment - contract design | | | | X | X[1] | X | |
| | | Opportunity costs | X | X | X | X | X | X | X |
| | | Transaction costs | X | X | ? | ? | X | X | X |
| | | Social impact & legitimacy | | | | X | X[1] | | X |
| | | ? = subject to findings of the coarse grain analysis | | | | | | | |
| WP6 | **Existing instrument evolution, path dependency** | | X | ? | ? | X | X | ? | X |
| | **Proposed instrument architecture** | | X | X | X | X | X | X | X |
| | | | | | | | | | |
| WP3-WP4..WP9 | **BACI:Before-after-control-impact evaluation** | | PES | EFT | | ? | PES | | |
| WP3-WP6..WP9 | **Scenario evaluation, incl. GIS mapping** | | | EFT | | | | EFT | |
| WP3-WP6..WP9 | **MCA: Multi-criteria analysis** | | | | | | | | |
| | | MacBeth , other MCA software | ? | | X | | ? | | ? |
| | | Marxan - spatial site selection | X | | | ? | | | X |

**Composite B&ES indices:** Case studies that plan to combine data layers on B&ES for MCA, site selection, targeting or scenario analysis will probably be using composite indices

[1] **design and process** (rights and responsibilities) and **social impacts** and legitimacy will nbe analysed with land-owner perceptions that will be spatially referenced if spatial distribution appears meaningful.

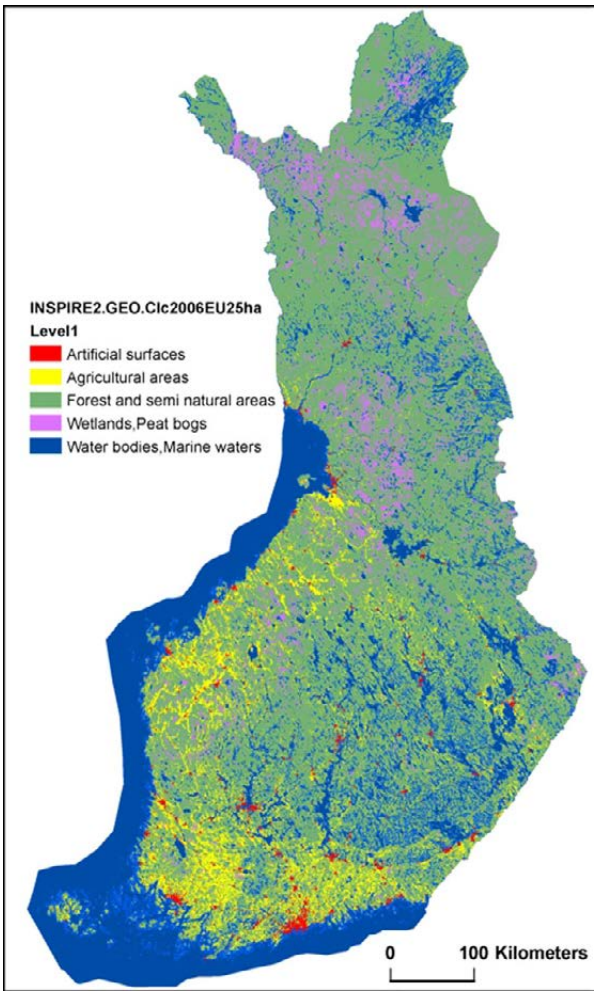
## 1.4 Outline of report

The report starts by describing the status of Finnish forest biodiversity and the main threats to it, and by identifying the biodiversity policy goals in Section 2. Before analysing the historical evlution of policy instruments, the report states the challenges that come with a thoroughly researched policy setting along with data and resource limitations. The historical policy evolution sets the scene for choosing the instruments that will be further analysed. Section 3 further frames the analysis of economic instruments by describing the current instrument-mix, i.e. the regulatory biodiversity conservation instruments, other sector instruments influencing forest biodiversity and payment for environmental services type economic instruments. Section 4 briefly depicts potential new instruments, and section 5 analyses the interaction between the different instrument types in Finland. Sections 6 and 7 describe the premises for the impact analysis to be carried out at fine grain and the multilevel multi-criteria scenario analysis of instrument mixes.

# 2 Identifying biodiversity status, challenges and context

## 2.1 Biodiversity status

Finland is a highly forested country, with at least two thirds of the land covered with productive forests (Map 1). With barren mire and rocky lands included, the proportion of forest land amounts to vlose to 80% of land-cover. Most of Finland's 20 million hectares of productive forests are owned by small-scale non-industrial private land-owners. They own 60% of the productive forest land and two thirds of the growing stock, and produce 80% of the domestic timber used by the forest industry. As a great share of Finland's endangered species dwell in commercially managed non-industrial private forests, biodiversity conservation policy and policy instruments as well as understanding ecosystem services in a very broad sense when assessing these policies are extremely important.




*Map 1. Land-cover map of Finland*

Boreal forests are almost exclusively managed for timber production, with only a very small proportion having remained in natural or seminatural condition. In Finland, about 95% of all (productive) forest land is silviculturally managed. Therefore, the native boreal biodiversity is dependent on what happens in these managed forests. The main concerns

related to the conservation status of Finnish forests include: (1) insufficient forest area protected for reaching the target of safeguarding the populations of native species and preventing further losses of declined species, (2) an inadequate quality and representativeness of the protected forests, and (3) the low structural and functional connectivity of the valuable forest areas. This last concern poses extreme challenges for forest biodiversity conservation and forest management on private lands as well as land use planning, highlighting the need for new innovative ways to tackle conservation.

At present, strictly protected areas cover 5.2% (1.041 million ha) of forest land (Metsien suojelualuetilasto, updates available at http://www.metla.eu/metinfo/tilasto/suojelu/) but these areas are biogeographically and ecologically unevenly distributed. The proportion of strictly protected forests on forest land is only 1.9% in Southern Finland (Finnish Forest Research Institute update Dec 31, 2008, available at http://www.metla.fi/metinfo/tilasto/suojelu/; Map 1).

A majority of the forest habitat types belong to different types of heath forests, covering 95% of the area of all forest and forming the majority of the habitat type Western Taiga (a habitat type of the European union habitats directive; Tonteri et al. 2008a, 2008b). The quality; and for some habitat types also the quantity, is currently so low that two thirds of the forest habitat types have been assessed to be endangered (75% and 55% in southern and northern Finland, respectively) (Tonteri et al. 2008a). The proportion of the area of threatened forest habitats of the total area of all forest habitat types is 49% and 27% in southern and northern Finland, respectively.

For most of the forest habitat types of western taiga, the most important threats are the decrease of the amount of dead wood (coarse woody debris, CWD) and changes in the forest age structure, e.g. decrease of old forests, and old, large trees (Tonteri et al. 2008a). The decrease in the amount of dead wood resulting from forest management is the most important threat for forest species in Finland (Rassi et al. 2010). Generally, approximately 20000-25000 species of the 45000 species known in Finland are forests species, out of which at least 20% (4000-5000 species) are dependent on dead wood (Siitonen 2001, Siitonen & Hanski 2004, Rassi et al. 2010). Altogether, 814 out of 2247 all threatened species (36.2%) are primarily forest species, and the main cause of threat is the decreasing amount of dead wood for 168 species out of these 814 forest species (20.6%) (Rassi et al. 2010). On the other hand, the most common cause of already materialized (regional) extinctions, is the reduction of old-growth forests and the decreasing number of old tree individuals (Rassi et al. 2010). Under natural conditions, the average amount of coarse woody debris would be of the order of 100 $m^3$/ha on landscape level; larger in the south than in the north (Siitonen 2001) but the average amount of CWD on forest land is only a few percent of this: 3.3 and 8.6 $m^3$/ha in southern and northern Finland, respectively (Ihalainen & Mäkelä 2009). The amount of coarse woody debris increases with stand age. The old age classes of managed forests sometimes have retained legacies from the past (e.g. old decaying logs) as these forests have never experienced clearcutting (Siitonen et al. 2000).

*Map 1. Protected areas in Finland.*

The overall amount of old (> 140 yrs) semi-natural old forests that have characteristics indicating naturalness, e.g. dead standing trees, fallen and broken trees, decayed live trees or multiple symptoms in over-mature senescent forests, has decreased from 4.9 to 4.4% in the whole country from the end of the 1980s to the end of the 1990s (Punttila 2000, Virkkala et al. 2000, Punttila & Ihalainen 2006). At the turn of the millennium, these seminatural old forests covered 4.4% of the forest land of the whole country (14.5% in the northern boreal vegetation zone but only 1.1% in more southern areas the lowest share, 0.3%, being in the hemiboreal and southern boreal zones); their share increased towards east and north (Punttila & Ihalainen 2006). It is noteworthy that a high proportion of these forests was located on land outside protected areas. The proportion of forest land with no signs of cuttings for a long time (> 30 yrs) and no forest drainage is very low in Southern Finland: only 1.9% in the age class > 120 years (9th National Forest Inventory of Finland, Antti Ihalainen, pers. comm., see also Kurttila et al. 2007).

Ongoing regeneration cuttings in these potential seminatural old forests outside the conservation area network will further reduce the amount of the habitat western taiga in Finland; even if all the forests in the conservation area network were in natural condition, their proportion would remain extremely small in large parts of the country. Presently, these potential seminatural old forests outside the protected areas contribute importantly to biodiversity conservation. The most uniform areas of western taiga are located in eastern and northern Finland. In southern and western parts of the country, the area of this habitat type is very small and occurs in isolated patches. There is a clear need to increase the area of protected forests in Finland. In southern Finland this need is acute, and should be accompanied with restoration and activities adding to connectivity, to improve the quality of forests across the landscape. To support these actions, analytical attention should be focused on how the old-aged and fertile habitats with natural characteristics can be maintained with the maximum connectivity to other protected areas and habitats.

## 2.2 Biodiversity policy goals, targets and key issues

Prior to the dramatic increase in ecological research and consequent understanding of biodiversity, the target of conservation was focused on pristine nature and cultural heritage scenic values as well as supporting research (Reunanen, 2006). Since the Convention on Biological Diversity in 1992, the formulation of conservation goals has been influenced; if not dictated, by the internationally agreed biodiversity targets that emphasise halting biodiversity loss and increasingly also providing ecosystem services. The Nature Conservation Act of Finland (1996) aims to 1) maintain biological diversity; 2) conserve nature's beauty and scenic value; 3) promote the sustainable use of natural resources and the natural environment; 4) promote awareness and general interest in nature; and 5) promote scientific research. The Forest Act (1996), enacted simultaneously, is targeted to advancing economically, ecologically and socially sustainable management of forests so that biological diversity is maintained.

*Table 2. Operational forest biodiversity conservation goals*

| Policy | Goal |
|---|---|
| **Protected areas** | Protect valuable areas (conservation programmes) |
| **Habitat conservation** | Protect valuable habitats (Forest Act 1996; Nature Conservation Act 1996) |
| **Voluntary conservation (METSO PES)** | Protect valuable areas and sites – and improve their connectivity in Southern Finland (METSO 2002; METSO 2008) |

The Finnish biodiversity strategy of 2005 states as the goals: 1) halting the decline of biodiversity in Finland by 2010; 2) establishing favourable trends in the state of the natural environment in Finland over the period 2010–2016; 3) preparing for global environmental change that may threaten the natural environment in Finland, particularly climate change by 2016; and 4) strengthening Finland's role in the preservation of biodiversity globally through international co-operation. These goals have been formulated after an evaluation of safeguarding biodiversity having not succeeded in stopping the decrease in original biodiversity by the year 2005 (Hildén et al., 2005). The new biodiversity strategy will follow the formulations from the Conference of Parties in Nagoya (http://www.cbd.int/cop/) and the EU Biodiversity Strategy 2020 (http://ec.europa.eu/environment/nature/biodiversity/comm2006/2020.htm)).

At a more operational level, the Finnish forest biodiversity conservation policy has evolved from a focus on establishing national parks and protected areas to considering ways of conserving the remnant valuable patches and conserving biodiversity in managed forests (Table 2). The Forest Act (1996) lists a set of valuable habitats whose characteristics must be preserved, and the Southern Finland Forest Biodiversity Programme (METSO, 2002) and its successor for the years 2008-2016 address particular ecological criteria and include a selection of new instruments ranging from improving the network of protected areas and nature management in managed forests to improving the knowledge base and collaboration between forest and environmental organisations, extension and advice to forest owners, training of professional foresters, and related communications work (METSO 2008).

Finnish forest policy design processes have a long history of engaging different stakeholders, to develop legitimate forest policy (Ollonqvist, 2002), which is primarily targeted at guiding and steering the 700 000 individuals who own 60% of the productive forest land, producing almost 70% of the annual increment. Broad engagement and corporatist-style policy design is explained by the number and significance of these non-industrial private forest owners and the historically very strong position of the timber processing industry and its labour movement (Ollonqvist, 2002; Donner-Amnell, 2004). On the contrary, forest nature policies have been accompanied by sometimes fierce conflicts between actors representing forest use and conservation (Reunala and Heikinheimo, 1987, Hellström, 2001; Rantala and Primmer, 2003; Hiedanpää, 2005). Against this backdrop and the fact that the conservation void is on the private lands, the latest forest biodiversity conservation policy has been developed in ways that warrant acceptance from the forest owners and also the organisations directly involved in managing these forests (Paloniemi and Tikka, 2008; Primmer, 2011). The METSO Programme (METSO 2002; 2008) has been developed as a response to the criticism of nature conservation being illegitimate; it places significant emphasis on collaboration

across organisational boundaries and on attracting non-industrial private forest-owners to participate in conservation on a voluntary basis, through payment for environmental services (PES) like arrangements.

Formally forest-owners make all forestry related decisions on their land, with the administration responsible for overseeing the conformance with the law (Forest Act 1996) . However, forest-owners are extremely dependent on professional advice in these decisions, and value the advice they receive highly (Hujala et al., 2007; Hujala and Tikkanen, 2008). In contrast, biodiversity conservation policies and environmental authorities have received suspicion from the forest-owners who have experienced these actors as placing constraints from the outside (Hiedanpää, 2005; Paloniemi and Tikka, 2008; Paloniemi and Varho, 2009). As biodiversity conservation requirements have been considered illegitimate, the forestry actors play a crucial role in communicating also biodiversity conservation targets to them (Paloniemi and Varho, 2009; Primmer and Karppinen, 2010; Primmer, 2011a; 2011b). Therefore, understanding the role of the different actors is paramount for the analysis of the implementation formal biodiversity policy. This analysis should consider forest-owners, environmental and forestry administration, other administration influencing land-use decisions as well as corporate and civil society actors. The rights and responsibilities of these actors as well as the impacts of policies should be addressed in the analysis of policy instruments designed for biodiversity conservation.

With the above mentioned general formal goals stated in law providing the basic justification for more operational targets, guidance and principles as well as budgetary allocations, the Finnish forest biodiversity policy has evolved in several fronts, and been advanced by a range of actors. Below we analyze the evolution – or sequence – of policy instruments directly targeting increased conservation in forests and the roles of different actors. In further analysis, the ways that of the specific goals of protecting areas across landscapes andconserving habitats with valuable characteristics on are implemented and how they can be reached, and how they influence forest owner motivations to conserve should be analysed.

## 2.3 Evaluating instrument effectiveness in a much researched setting and data gaps

The METSO Programme (METSO 2002, METSO 2003) introducing new policy instruments for attracting forest owners to participate in biodiversity conservation has been backed up by a significant research input to evaluating its ecological, economic and also social impacts. The Finnish case study therefore has to evaluate carefully the added value that can be produced with the limited project resources, to avoid repetition of earlier work and to produce new, innovative angles to analysing the conditions for and success of economic instruments in an instrument mix.

Based on the already completed analyses, we know that ecologically, METSO PES contracts yield relatively valuable habitats (Juutinen et al., 2009; Mönkkönen et al., 2009). The main ecological challenges relate to the patchiness of this conservation effort and poor connectivity (Syrjänen et al., 2007). As a response, ecologically informed site selection methods have been developed to support the implementation of the programme (Lehtomäki et al., 2009). The practical application of the science-based methods in real-life decision-making is only just starting, so the way that the use of these methods will affect the site selection procedures on private lands remains to be evaluated.

One can assume that the methods cannot be directly applied in the context of private ownership and high emphasis on voluntarism.

Cost savings as compared to traditional state-driven conservation instruments have been shown to not be significant due to the fact that renewing temporary contracts will start to consume the conservation budget after the first contract period (Juutinen et al., 2008b). Additionally, the implementation process does not attract forest-owners to conserve with payments notably lower than their economic loss from giving up timber production on the site (Juutinen et al., 2008b, see however, Juutinen and Ollikainen, 2010). However, the assessment of ecological benefits against public investment in conservation has been found to be very sensitive to the relative value placed on the ecological outcome and the timber income loss (Juutinen et al., 2008a). Similarly, the interest rate used in compensation level calculations plays a crucial role in defining the cost-effectiveness of conservation (Suihkonen, et al. 2011). The value that the participating landowners place on conservation or timber production is however reflected in the achieved contracts to some degree (Mäntymaa et al., 2009). Orientation towards financial investment, positive attitude toward conservation, and large holding size have been found to predict the forest-owners willingness to contract (Mäntymaa et al., 2009), and in more general terms, voluntary contracting has been found very attractive for forest-owners because it acknowledges their autonomy and empowers them in conservation (Paloniemi and Vanio, 2011).

Based on simulations, Mönkkönen et al. (2011) have evaluated the cost-effectiveness of four different policy instruments: permanent large reserves, permanent small reserves, temporary small reserves, and green-tree retention. The scenarios differ in terms of ecological outcome, rather than timber harvest level. The scenarios with permanent reserves produce better ecological outcomes and are more cost-effective than the temporary instruments in the long term. In the short term, temporary small reserves are the most cost-effective (Mönkkönen et al., 2011).

As the understanding of the ecological outcomes of the METSO Programme is at a high level, and also factors influencing the cost-effectiveness of applying METSO PES instruments, our analysis focuses on the institutional and social preconditions and consequences of introducing a PES scheme into a policy instrument mix.

Finnish forests have multiple functions and produce multiple benefits to Finns (Wolf and Primmer, 2006; Matero and Saastamoinen , 2007; Horne et al., 2009; Kniivilä et al., 2011), which has been recognized at a formal policy level in a qualitative fashion (National Forest Programme 2015, Primmer et al., 2012). Accounting of the value of the different ecosystem services of the Finnish forests has demonstrated that the monetary value of forests can be extremely high (Matero and Saastamoinen, 2007). Finns have been found willing to pay for additional conservation (Lehtonen et al., 2003; Horne et al., 2009), and forest-owners are willing to enroll particularly in fixed-term PES contracts (Horne, 2006; Horne et al., 2009). However, a broad range of ecosystem services that a conservation contract would be likely to secure has not been analyzed adjacent to willingness to accept of the contracting forest owner.

The spatial configuration of socio-economic and institutional factors influencing forest-owners uptake of PES contracts is another important novel approach that will be explored in the Finnish local level case study. Connected to this, the impact analysis will consider also opportunity costs and ecological impacts. However, these analyses are dependent on still insecure data availability.

## 2.4 Historical policy context: institutional evolution

Towards the end of last century, Finnish nature conservation was carried out under targeted conservation programmes adopted between mid-1970s and mid-1990s that were based on inventories of certain habitat types, e.g. fertile herb-rich forests or old-growth forests (Table 3; Table 4).

Implementation of these programmes was partly overlapping and partly followed by the Natura 2000 network implementation after Finland joined the European Union in 1995. These programmes could be called traditional regulatory instruments in that they were centrally designed and adopted by the government (Fromond et al., 2009). With the programmes targeting certain habitat types (Table 4), also on the private lands, their implementation entailed environmental administration initiated negotiation and typically purchase of the land to the state, which in some cases led to fierce resistance and law-enforced takings (Suvantola et al., 2006). Generally, there was strong polarization between those who were for conservation and those who were for economic utilization of forests (Hellström, 2001; Rantala and Primmer, 2003). Particularly the Natura 2000 implementation raised conflicts (Hiedanpää, 2002).

*Table 3. Sequence of biodiversity conservation policy instruments.*

| | | | | | Originally stated criteria | | |
|---|---|---|---|---|---|---|---|
| | Establish., year | Implem. Admin. | Nr of areas | Area 1000 ha | Ecol. criteria | Other criteria | Socio-econ. criteria |
| National parks[1] | 1923 | Env. / MH[2] | 35 | 885 | X | National heritage, large size, recreation | |
| Protected areas on private land [3,4] | 1923 | Env. / MH[2] | 7 773 | 59 | X | | |
| Strict nature reserves[1] | 1938 | Env. / MH[2] | 19 | 154 | X | Research, education | |
| Other protected areas on State land [1] | 1938 | Env. / MH[2] | 39 | 49 | X | | |
| Mire conservation areas [1] | 1977 | Env. / MH[2] | 171 | 460 | X | | |
| Wilderness areas [4] | 1991 | Env. / MH[2] | 12 | 1489 | X | Sami culture | Nature-based livelihood |
| Protected herb- rich forest areas [3] | 1992 | Env. / MH[2] | 52 | 1 | X | | |
| Protected old-growth forest areas [3] | 1994 | Env. / MH[2] | 91 | 9 | X | | |
| Forested Nature Conservation Act habitats [3] | 1997 | Env. | NA | 2 | X | | |
| Forest Act habitats [5, 6] | 1997 | For. | >120 000[6] | 160[3] | X | | |
| Habitats of especially protected species [3] | 1997 | Env. | NA | 20 | X | | |
| METSO Pilot PES 2002-2007 [7] | 2003 | Env.&For. | 121 | 1.22 | X | | Cost-effect. |
| METSO II PES 2008- [6,8] | 2008 | Env. | NA[8] | 5.36 | X | | Cost-effect. |

[1]Environmental administration 1.1.2011
[2] Metsähallitus governs the state-owned land.
[3]Ylitalo, 2011.
[4]Since 2008, Protected areas on private land have been established under the METSO II (METSO, 2008)
[5]Peltola, 2007.
[6]The number is inaccurate, as all habitats have not been inventoried (Kotiaho and Selonen, 2006). By the end of 2006, 120 000 habitats had been inventoried on private non-industrial lands (Peltola, 2007).
[7]METSO Pilot fixed term contracts in the nature values trading pilot project (Syrjänen et al., 2007)
[8]Tapion vuositilastot, 2007, 2008, 2009, 2010
[9]Reported together with Environmental subsidy (Tapion vuositilastot, 2007, 2008, 2009, 2010).

*Table 4. Habitat types / ecological criteria for conservation with different policy instruments.*

| | Herb-rich, fertile | Dead wood, old age | Small water-courses and springs | Mires and woody peat-lands | Swampy and flooded areas | Shores and coast-lines | Rocky areas and cliffs | Sandy habitats |
|---|---|---|---|---|---|---|---|---|
| National parks[1] | X | X | X | X | X | X | X | X |
| Mire conservation areas | | | | X | X | | | |
| Protected herb- rich forest areas | X | | | | | | | |
| Protected old-growth forest areas | | X | | | | | | |
| Forest Act habitats[2] | X | X | X | X | X | X | X | X |
| Forested Nature Conservation Act habitats[3] | X | X | X | X | X | X | X | X |
| METSO Pilot 2002-2007[4] | X | X | X | X | X | X | X | X |
| METSO II 2008-[5] | X | X | X | X | X | X | X | X |

[1]Typically large nature areas include several habitat types; altogether national parks cover all habitat types, although they are not always specifically stated.

[2]Immediate surroundings of springs, Brooks and rivulets, small lakes, Grass and herbrich hardwood spruce swamps, Eutrophic fens south of Lapland, Fertile patches of herb-rich forest, Heathland forests on undrained peatland, Gorges and ravines, Sandy Soils, Exposed bedrock and boulder fields, Sparsely forested mires, Alluvial forests (Forest Act 1996)

[3]Wild woods rich in broad-leafed deciduous species, Hazel woods, Common alder woods, Sandy shores in their natural state, Coastal meadows, Treeless or sparsely wooded sand dunes, Juniper meadows, Wooded meadows; and prominent single trees or groups of trees in an open landscape (Nature Conservation Act 1996).

[4] Heathland forests with plenty of decaying wood , Wooded mires , Flooded woodlands and wooded flood meadows, Successional stages of forest on land-uplift coast, Sunlit slopes on sandy esker ridges, Wooded heritage biotopes (Kriteerityöryhmä, 2003)

[5] Herb-rich forests, Heathland forests with plenty of decaying wood, Forests adjacent to springs and pools, Wooded mires and the wooded margins of open mires, Swampy woodlands and wooded flood meadows, Sunlit slopes on sandy esker ridges, Biodiversity sites along emergent coastlines, Wooded heritage biotopes, Wooded habitats on calcium-rich bedrock and ultra-alkaline soil , Wooded cliffs, bluffs and boulder fields important for biodiversity (METSO 2008)

In the 1990s, biodiversity conservation was integrated also to conventional management of forests. This was notably done through an obligation to conserve particular small-sized habitats defined in the Forest Act (1996; see Table 4). These Forest Act habitats were inventoried (Yrjönen, 2004, 2006) but their small size, large number and sometimes difficult distinction from the surrounding habitat generated challenges for their thorough identification (Kotiaho and Selonen, 2006; Pykälä, 2007; see also Timonen et al. 2010). The identification and delineation of these habitats depended largely on the resources of forestry professionals and administration (Tikka, 2003; Paloniemi and Varho, 2009; Primmer and Wolf, 2009; Primmer and Karppinen, 2010). Forest-owners were entitled to compensation for the economic loss from conservation of the habitats under a so-called environmental subsidy, if the loss was considerable but this compensation would generally be triggered only in situations where the area was planned to be logged. This compensation, along with funds for nature management planning and implementation projects, was allocated from the budget under the forestry financing that was principally aimed at supporting silviculture and improvement operations aimed at sustainability of timber production in non-industrial private forests (Act on Financing Sustainable Forestry 1996),.

The need to conserve forest biodiversity in Southern Finland became acute along with the recognition of insufficient preservation in southern parts of the country towards the end of the 1990s. With only less than 2% of the forest land preserved in this area, the need for increasing conservation was obvious (Ministry of the Environment, 2000). However, because of small-scale private land-ownership dominating in the area, and the earlier experienced conflicts, the programme that was drafted to address biodiversity conservation in Southern Finland introduced instruments that relied on voluntariness of forest-owners (METSO, 2002; Table 2; Table 3; Table 4). The so-called payments for nature values were experimented by forest-owners, natural-resource managers and decision-makers in the pilot phase of national biodiversity program during the following 6 years.

This METSO pilot shifted the attention in policy from hectares of certain habitat types in preservation areas and assigned through conservation programmes, to conservation of voluntarily offered sites with certain characteristics (Table 4, Paloniemi and Varho, 2009; Primmer et al., 2011). The piloting was carried out jointly by the environmental administration and the forestry administration in a region where many of the payments for nature values ideas had emerged (Hiedanpää, 2005). The eligibility of the sites was to be negotiated between the forest-owner and the administration *"The environmental and forestry authorities will consider proposals …"* (METSO, 2002, 4). The nature values trading was based on a set of ecological criteria, defined particularly under the pilot programme (Kriteerityöryhmä, 2003). They were further operationalized during the implementation, to actually account for certain euro per hectare per year payment levels (Paloniemi and Varho, 2009, Primmer et al., 2011).

The regionally experimented METSO pilot was followed by another programme for the years 2008-2016 (now continued to 2020), the METSO II (METSO 2008; Table 3). This programme that would cover the entire southern Finland listed the habitat types targeted (Table 4) and was also followed by a guideline on habitat criteria application (METSO-ohjelman luonnontieteelliset… 2008). The criteria and their application were standardized through a number of training courses for managers in the administration and forestry organizations (Koskela et al., 2010). The administration would be focused on the eligibility of the sites, and also searching the sites and marketing the opportunity to conserve areas meeting the set criteria (Paloniemi et al., 2010; Primmer et al., 2011).

In the METSO II, the payments for nature values were acknowledged under two actions points. First, "*Environmental and natural value support*" (METSO 2008, 5) incorporated the payments into the environmental support for forestry that had existed under the Act on Financing of Sustainable Forestry (1996) already prior to the pilot (Tikka, 2003). As this financial subsidy was targeted to compensating for economic loss from conserving Forest Act habitats as well as the newly defined habitat types, both the administrative and land-owner approaches to conservation were bound to differ from the experiences during the pilot. The emphasis shifted from payments for particular ecological characteristics to full compensation for economic loss: "*Forest-owners will be fully compensated for the costs of such measures and any consequent loss of income*" (METSO 2008, 3;), following the EU State Aid regulations (Raitanen et al., 2012). Recently, the compensation level has actually been evaluated to over-compensate timber sales income loss under realistic interest rate assumptions (Suihkonen et al., 2011).

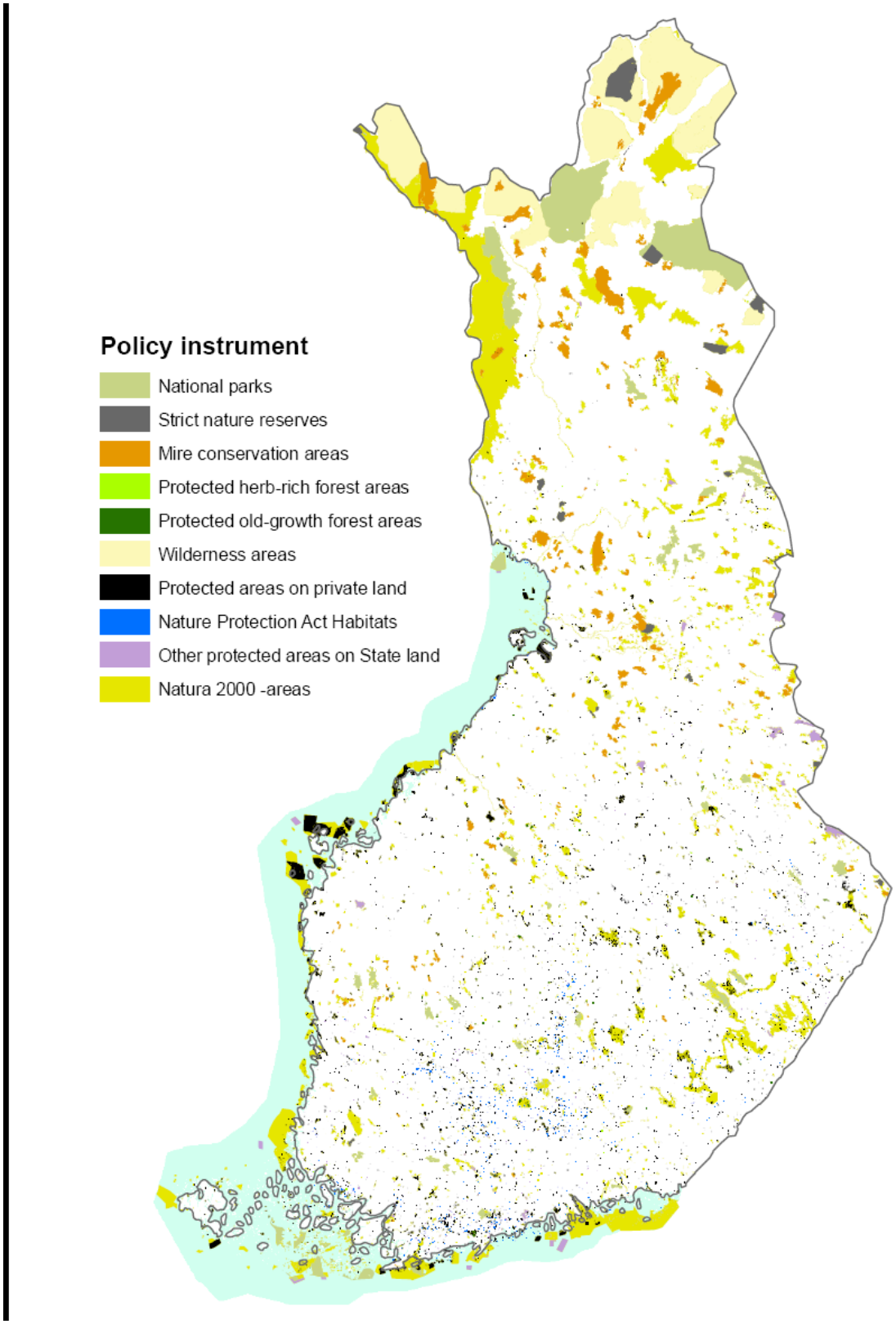
The second action where METSO II utilized the lessons from the piloted nature values trading PES was the planned forest-owner initiated offers of sites that would be compared before making

contracts: "*The environment and forestry centres draw up, on an annual basis, a joint invitation to tender for natural values based on the ecological selection criteria*" (METSO 2008, 7). However, this action was also incorporated into the general governance system where forest-owners were generally attracted to offer sites that would fulfill the habitat criteria (Paloniemi et al., 2010), and tender competition was not applied systematically. In the METSO II, the distinct implementation responsibilities were placed on the forestry administration and and environmental administration (Table 3), with a target to advance collaboration between forest and environmental organizations. Compared to the METSO pilot, collaboration has actually improved – or stabilized, despite the clearer role division between the two sector administrations (Paloniemi et al., 2010). Collaboration has been possibly developed even at the cost of consideration of different forms of landowner collaboration and reaching new landowner groups.

Both the shift in basis for payment and the administrative role division can be derived from institutional constraints. The professional norms and cultural-cognitive ideas regarding the functions of forests together with the EU state aid laws explain the friction in institutional evolution (Primmer et al., 2011, Raitanen et al., 2012). Although the METSO PES fell under the traditional administrative responsibilities and instrument characteristics, it set the scene for forest-owners enrolling voluntarily to conserve under contracts induced by positive incentives. These PES instruments merit attention as a new economic instrument that has emerged in the sequence of nature conservation instruments largely starting from habitat and implemented by negotiation and enforcement. The legitimacy of the METSO PES is at a very high level, and they are likely to set the scene for new instruments that rely on voluntary take up of incentives.

## 2.5 Choosing instruments for analysis

The Finnish case focuses on the METSO PES , and identifies its characteristics for further ex-post evaluation and exante scenario analysis. All analyses will pay careful attention to both history / sequence of policy instruments and the portfolio available at a certain time. As described above, the other instruments that have pre-existed the voluntary contract arrangements have importantly framed the way the METSO PES is received by different stakeholders. The METSO PES has also influenced the way new potential instruments are framed: the idea of financial incentives originates from the METSO pilot but as it has been amalgamated to pre-existing compensation systems, the incentive idea has also seeped into the current day policy discourse more broadly.




*Map 2. Areas protected under different policy instruments.*

# 3 Role of existing economic instruments

As described in the previous sections, the formal Finnish forest biodiversity conservation instruments include: regulatory instruments, i.e., national parks, strict nature reserves, nature conservation programmes areas (mire conservation, herb- rich forest protection, old-growth forest areas protection wilderness areas, Natura 2000, Forest Act habitats and Forested Nature Conservation Act habitats (Table 5, Map 2). Private protected areas are currently established dominantly through positive economic incentives under the METSO Programme that attract voluntary offers from forest-owners and can hence be considered a form of PES. The METSO PES include also fixed-term contracts merging the ideas and practices of the temporary PES contracts piloted in 2002-2007 and the pre-existing environmental subsidy to compensate for timber income loss (Table 5).

## 3.1 Direct regulations

The existing direct regulation of forest biodiversity conservation can be considered to consist of two policy instrument groups: 1) area protection under nature conservation programmes and 2) placing conservation requirements onto managed forests through protecting the characteristics of small sized habitats. As the conservation programmes cover large areas (Table 3, Map 1), much of the conservation debate highlights these instruments, and in analyses of forest owner preferences, these types of instruments have been contrasted with voluntary instruments (Lehtonen et al., 2003; Horne et al., 2009).

The conservation programmes aim at conserving areas with certain characteristics and are adopted by the government (Table3; Table5). The preparation of the programmes draws on broad ecological expertise and indicate the locations of future protected areas. The implementation of conservation programmes is incomplete but the largest implementation gaps are on state land (Auvinen et al., 2010; http://www.ymparisto.fi/default.asp?node=1748&lan=fi). The possibility of having a new programme for peat bogs has recently been initiated (Primmer et al., 2012).

Most areas protected under the natureconservation programmes are owned by the state does not already own the area, it typically acquires title to it before establishing the protected area and pays a full compensation. Alternative arrangements include establishing a private protected area, or, in the case of a dispute, the land can be taken for conservation with a compulsory purchase. In the period 1997-2004, 44% of the area was compensated for in cash and 22% in kind (Suvantola et al., 2006). On 22% of the area the land-owner established a private protected area. Land-taking type compulsory purchase has covered 7% of all areas acquired to the state for nature conservation purposes (Suvantola et al. 2006). Outside the conservation programme areas, new private protected areas are currently established through positive economic incentives under the METSO Programme; they will be described in more detail below.

The second group of direct regulation instruments is integrated to the economic use of forests; their implementation does not remove the forest-owners' property rights. Nature Conservation Act and Forest Act place restrictions on the use of specific sites meeting certain criteria (Table 4). Nature Conservation Act habitats require an administrative decision to come into force, while the Annex IV

species habitats of the Habitats Directive, particularly the numerous breeding and resting places of flying squirrels, as well as the Forest Act habitats are protected without an administrative decision.

Forest Act habitats are particular small sized habitats whose special characteristics must be maintained in forestry operations (Table 4). In practice this means that the habitats must be delineated outside a forestry operation or only very careful operations can be conducted, e.g. removing some tree individuals (Primmer and Karppinen, 2010). Since the law has come into force in 1997, the habitats have been inventoried (Yrjönen, 2004; 2006). The inventory has been criticized for for highlighting the distinctive characteristics and small size of the habitats (Kotiaho and Selonen, 2006, Pykälä, 2007; see also Timonen et al. 2010). The inventory data is held by the forestry administration that reviews all forestry operation notifications. Similar to other forestry data, the Forest Act habitat data have not been accessible to other sector administration or other actors (Pappila and Pölönen, 2012; Saarikoski et al., 2012).

Although landowners are legally responsible for maintaining the characteristics of the Forest Act habitats, in practice the delineation of these habitats is extremely dependent on professional interpretation (Primmer and Karppinen, 2010; Similä et al., 2012). Networks of forestry actors and biodiversity training contribute to delineation (Primmer and Wolf, 2009). Economic loss from conservation of the habitats is compensated for, if the loss is considerable. This environmental subsidy is allocated from the budget under the forestry financing that was principally aimed at supporting operations aimed at sustainability of timber production in non-industrial private forests (Table 5, Act on Financing Sustainable Forestry 1996).

All protected areas and also very small sized patches of endangered species' habitat are included in the different levels of land-use plans. Generally non-industrial private forests, i.e. those that are targeted with new conservation instruments, are outside these types of land-use planning processes. Sometimes, however master plans and urban plans cover also managed private forests. Legally protected habitats are an important way of including biodiversity considerations also in urban planning (Yli-Pelkonen, 2008).

The nature conservation programmes and establishment of some of the large national parks has been coupled with compensatory investments in the economy of the areas where forestry employment and entrepreneurial opportunities have been negatively influenced by the park (Lilja-Rothsten, 2011).

*Table 5. Existing economic instruments: volume of conservation under different instruments and responsible administration.*

| | Volume of conservation | | | |
|---|---|---|---|---|
| | Nr of areas | Area 1000 ha | Budget used 1000 eur | Responsible admin. |
| **Protected areas on State land** | | | | |
| New METSO purchase for state 2009 [1] | 40 | 1 | 4 787 | Environmental |
| 2010[2] | 84 | 1.66 | NA | Environmental |
| **Forest Act and Act on Financing Sustainable Forestry[2]** | | | | |
| Environmental subsidy t by th e end of 2007[3] | 3583 | 27.20 | NA | Forestry |
| New in 2008[4] | 814[4] | 6.65 | 4507[4] | Forestry |
| New in 2009[4] | 938[4] | 6.63 | 5329[4] | Forestry |
| New in 2010[4] | 1 110[4] | 5.01 | 7 642[4] | Forestry |
| **Nature management projects[2]** | | | | |
| Nature management projects 2007 | 486 | NA | 2257 | Forestry |
| 2008 | 577 | NA | 2352 | Forestry |
| 2009 | 664 | 100.82 | 2284 | Forestry |
| 2010 | 786 | 438.87 | 2543 | Forestry |
| **Protected areas on private land** | | | | |
| New METSO permanent conservation on private lands 2005-2007[5] | 23[6] | 0.16[6] | NA | Environmental |
| 2008[7] | 82 | 0.54 | NA | Environmental |
| 2009 [7] | 85 | 0.83 | 4 897 | Environmental |
| 2010 [7] | 245 | 2.30 | 12205 | Environmental |
| 2011 [7] | 329 | 2.96 | 14613 | Environmental |
| **METSO PES** | | | | |
| Fixed-termFixed term METSO pilot contracts 2002-2007[5,8] | 121 | 1.22 | 1176 | Env./ For. |
| New fixed-termfixed term METSO contracts 2008 [7] | NA[9] | NA | NA[9] | Forestry |
| 2009 [7] | NA[9] | 1.85 | NA[9] | Forestry |
| 2010[7] | NA[9] | 2.18 | NA[9] | Forestry |
| **METSO Nature management[2]** | | | | |
| Planning and implementation 2008 | - | 0.22 | | Forestry |
| 2009 | - | 0.35 | | |
| 2010 | - | 0.18 | | |

[1] Koskela et al., 2010
[2] Tapion vuositilastot, 2007, 2008, 2009, 2010
[3] Environmental subsidy to compensate income loss for Forest Act habitat conservation and other habitat conservation based o a 10-year contract.
[4] From 2008 on, number of environmental subsidy contractsenvironmental subsidy contracts and budget spent include also METSO PES.
[5] Syrjänen et al., 2007
[6] Permanent conservation in collaborative networks and through competitive tendering
[7]METSO-tilannekatsausraportti, 2010; 2011
[8]METSO pilot contracts in the nature values trading pilot project.
[9]METSO PES reported together with Environmental subsidy.

Finland's network of protected areas is considered representative in the northern and eastern parts of the country, although the need to improve the protection of forest biodiversity in Southern Finland is still pressing (Auvinen et al. 2010). The implementation of national conservation programmes and completion of Finland's Natura 2000 network will bring most threatened areas under protection (Auvinen et al., 2010). National parks, strict nature reserves, nature conservation programmes areas (mire conservation, herb- rich forest protection, old-growth forest areas protection), wilderness areas, Natura 2000, Forest Act habitats and Forested Nature Conservation Act habitats are shown in Map 2.

The protected areas vary greatly in terms of size, purpose and exact content of regulation. However, they all have the common feature that legal obligations are directly related to a specific area or site, which determines the role of the administration. Sites under the Nature-Conservation Act are governed by the environmental administration; state-owned protected areas by Metsähallitus and Forest Act habitats by the forestry administration.

## 3.2 Sector instruments affecting forest biodiversity conservation

A significant impact on forest biodiversity is evidently generated by forest policies. Finnish forest policy has a long history of advancing timber production and use by developing policy goals, allocating budgetary resources to forestry planning, extension and also direct subsidies to private forest-owners (Ollonqvist, 2002). The formal policy is designed in so called National Forest Programmes (e.g., National Forest Programme 2015, 2010), which are implemented by public and private sector forestry organizations and professionals (Primmer, 2011). The core of forest policy remains in advancing timber production but the recent policies and programmes have embraced biodiversity conservation and other ecosystem services (Primmer and Kyllönen, 2006; Saarikoski et al., 2012; Tiainen 2012). At a more operational level, biodiversity conservation is integrated to forest management through the delineation of Forest Act habitats (Primmer, 2011), the near complete coverage of participation in the PEFC Finland forest certification system (PEFC Finland, 2009) and the related leaving of retention trees on logging sites (Gustafsson et al. 2010). These integrated conservation efforts do not remove the fact that forestry poses the main threat to forest biodiversity.

Also energy and agriculture policies influence the use of private forest land. A recent significant increase in emphasis placed on renewable energy has introduced a new use for managed forests. Already the National Forest Programme 2010 (1999) stated a target of 5 million $m^3$ increase in energy timber production, and the latest National Forest Programme 2015 (2010) stated the further increase in fuelwood production and use, 13.5 million $m^3$ by 2020, and introduced a new set of funding schemes for increasing energy-wood production (however, these funding schemes have not been approved by the European Commission under the State Aid Law). Although intensive fuelwood harvesting is not generally focused on mature forest stands, the demand for fuelwood generates pressure also for intensifying the use of dead trees and fallen retention trees in connection with clearcutting, which together with the increased destruction of dead wood because of intensified harvesting poses a direct threat on forest biodiversity in managed forests. In any case, fuelwood production is an alternative income source for the forest owner, and could potentially compete with conservation contracts, at least at a psychological level.

Although forestry and agriculture are administered generally rather separately, agro-environmental schemes generate social learning in the area of incentive uptake; positive experiences of environmental subsidies may attract forest-owners to water protection measures that span also to forested areas or can simply raise the farming forest owners' awareness of economic incentives. Agri-environmental schemes are monitored by the same environmental administration as protected areas. This can allow searching for synergies as the administrative structures do not hinder knowledge sharing, which is often claimed to be a major multi-level governance and scale problem in environmental protection (Paloniemi et al., 2012).

## 3.3 Existing economic instrument: voluntary forest conservation with METSO PES

As indicate above, economic instruments have been adopted as a response to the criticism against the establishment of new conservation programmes. The Southern Finland Forest Biodiversity Programme (METSO, 2002) has introduced voluntary fixed-term contracts (mostly 10 years), alongside voluntarily initiated permanent private protected areas.

The programme was implemented jointly by the forestry administration and the environmental administration during a pilot phase in 2002-2007 (Table 4). As described above, these METSO PES sites were ecologically justified (Mönkkönen et al., 2009) but did not form a well-connected network of sites that would clearly conserve ecologically meaningful entities (Syrjänen et al., 2007). The METSO PES contracts did not generate significant cost savings as compared to traditional state-driven conservation instruments (Juutinen et al., 2008b) but their legitimacy was at a very high level (Syrjänen et al., 2007; Paloniemi and Varho, 2009). The METSO PES was based on a set of ecological criteria, defined particularly under the pilot programme (Kriteerityöryhmä, 2003, Table 3). They were further operationalized during the implementation, to actually account for certain euro per hectare per year payment levels (Paloniemi and Varho, 2009).

The current METSO Programme for the years 2008-2016 (METSO 2008) has standardized ecological criteria, with a high focus on the eligibility of the sites (Primmer et al., 2011). This current METSO Programme states hectare targets, for increasing permanent conservation by private forest owners: "*a total of 96,000 ha of areas voluntarily offered by landowners shall be established as private nature reserves or acquired by the State by 2016*" (METSO 2008, 4), and increasing fixed-term PES: "*the total area of sites where biodiversity is safeguarded in privately owned forests is increased by 82,000-173,000 hectares by 2016" (METSO 2008, 6)* . PES is incorporated into two pre-existing instruments: 1) the environmental support for forestry (Act on Financing of Sustainable Forestry, 1996) targeted to compensating for economic loss from conserving Forest Act habitats as well as the newly defined habitat types; and 2) attracting forest-owner offers for new sites that would meet the habitat criteria to be protected on their property. The METSO PES could also be done in an auction format where offers would be invited for particular habitat types (METSO, 2008).

In the current policy, the PES is aimed at compensating for economic loss from conserving the site "*Forest-owners will be fully compensated for the costs of such measures and any consequent loss of income*" (METSO 2008, 3). The compensation is based on loss of timber income and it is tax-free, as are other compensations of nature conservation. Also in the case of establishing a private protected area, the calculation of the tax-free compensation is based on timber sale income loss, and is negotiated between the forest-owner and the environmental administration.

In the current METSO, the implementation responsibilities are with the forestry and environmental administration, with a target to advance collaboration between forestry and environmental organizations, but with distinct roles for the sector administrations.

# 4 Roles of proposed and potential new economic instruments (Step 2b)

To scope for new potential conservation instruments, the Finnish case study ran a focus group workshop with the Advisory Board members, representing environmental and forestry administration, land-use planning,forest-owners and environmental NGOs of national level and local level (South-Western Finland where the local level fine-grain analysis will be carried out)[1].

The already upcoming new instruments or changes in existing instruments identified in the focus group included:

- Broadening habitat conservation of the Forest Act and Nature Conservation Act to cover more habitat types
- Providing significantly more subsidies or incentives for nature management and restoration of altered habitats
- Diversifying forest management and silviculture practices (easing strict standards) and taking up uneven-aged forest as a management alternative
- Utilizing agro-environmental schemes for protecting wooded heritage habitats, and coordinating with agricultural planning
- Providing incentives for nature management to generate buffers around protected areas
- Using land-use planning for channeling incentives

More radical new instruments identified by the focus group included the following:

- Strengthening nature conservation: developing a biodiversity law, allocating more nature conservation power and budgetary resources to environmental administration, backing up the environmental administration with more forest and forest nature management competencies, while allowing forest administration to focus mostly on forest management and forest nature management, however harnessing collaboration between the two administrative bodies
- Developing integrated conservation and forest management: nature management oriented uneven aged / continuous growth forest management at a large-scale.
- Developing economic instruments: increasing incentives significantly and paying for existing or increased nature values instead of compensating for loss of timber income. Incentives could be channeled in a fashion that generates less transaction costs, e.g. by taxation and channeling incentives to new activities that can be applied extensively, such as leaving retention trees .
- Developing land-use planning: coordinating across different land-uses, including forest, recreational, agricultural and urban areas utilizing existing master plans and other spatially referenced planning systems.

[1] South Western Finland Forestry Centre, Western Finland Forest Owners' Union, Finnish Environment Institute, Ministry of the Environment, Forestry Development Centre Tapio, Ministry of Agriculture and Forestry, Pellervo Economic Research PTT, Nature League Finland, Union of South-Western Finland municipalities; Central Union of Agricultural Producers and Forest Owners, Centre for Economic Development, Transport and the Environment of South-Western Finland

For developing new policy instruments and expanding existing successful instruments, the main sources of friction were considered to be a lack of political will and the budgetary constraint. The focus group considered a practice of just meeting the law and certification criteria to be the standard and identified an expectation that exceeding the standards would require incentives. For the multi-criteria analysis all these propositions for new instruments will be considered in developing the scenarios.

The METSO PES instrument being relatively new, the Finnish fine grain analysis will focus on its uptake, however considering also the forest-ownersowners' interest in taking up nature management planning that supports natural landscape patterns and taking up uneven aged (continuous growth) forest management, both with and without incentives.

# 5 Interactions of economic instruments and the policymix (synthesis of Step 2 assessment)

The different instruments in the current mix supplement each other in potentially attracting different types of forest-owners; more preservation oriented owners will choose a permanent private protected area and more forestry income oriented ones will choose the fixed-term METSO-PES. According to the Advisory Board members, fixed-term contracts have functioned as a gateway for forest-owners to enter a conservation contract, attracting them to consider also permanent conservation. This proposition should be examined further. It is also possible that conservation programmes preceding the METSO era provide motivation for taking up less restrictive instruments (Hiedanpää, 2005; Paloniemi and Tikka, 2008). This potential 'regulatory assurance' (Langpap and Wu, 2004), where the existence of a regulatory instrument is crucial for the success of a voluntary should be further studied.

The main conflict that the METSO-PES has generated has been the broad scale channeling of METSO funds to Forest Act habitats, which have a legal protected status based on their characteristics, and compensation is not the primary focus of the original instrument. The ambiguous interpretation of criteria for funding and the longer history of Forest Act habitat identification and delineation has allowed (or forced) the forestry administration to prioritize Forest Act habitat compensations over fixed-term METSO-PES, with the two types of payments coming from the same budget pot. The introduction of PES always has the risk of crowding out some forest-owners who would have conserved their sites without compensation. To understand whether this is a relevant risk in the Finnish context, the conditions that influence the forest-owners' willingness to accept compensation should be analyzed in detail. Another potential issue to consider, is the overlap between the instruments in that habitat types and ecological criteria they address. Whether targeting of similar habitats with different instruments is considered conflicting, should also be researched.

The sequence of the policy instruments has clearly played an important role in the evolution of the Finnish METSO PES. Without the criticism against the conservation programmes and the implementation of the Natura 2000 network, the METSO incentives would have not been developed. Similarly, the success of these PES have largely relied on the new opportunities and new practices brought by the voluntary scheme implemented in collaboration between the environmental and forestry administrations, parting from the old role-division during the pilot. As our analysis of the

institutional evolution demonstrates, the current application of the METSO-PES has reverted back to many institutional features that existed prior to the METSO pilot. Further analysis should rigorously test the prevalence of the different institutional factors that influence contract uptake currently and also examine how different institutional arrangements characterize the potential outcomes of future policy-mixes.

# 6 Impact evaluation (Step 3a)

The Finnish national coarse grain report does not report impact analysis. This section only outlines the local level impact analysis briefly. The Finnish fine grain case study will conduct a detailed analysis of factors that contribute to forest-owners enrolling in METSO PES-contracts, focusing particularly on the thus far poorly understood institutional and social factors, including the contract arrangements, the rights and responsibilities of the forest-owners and the different administrative bodies they deal with, networks of information sharing, trust and shared interests as well as perceived benefits and the distribution of different positive welfare impacts. This will be done through a survey of forest-owners who have made a METSO-PES contract and a control group of forest-owners who have not contracted but whose land has a valuable habitat and could therefore be eligible for a PES contract. The fine grain case study aims to draw conclusions about how these factors would influence the design of new instruments.

Additionally, GIS analysis of the spatial configuration of contracted holdings (size, distance from cities and administration, potential conglomerations) will allow further institutional inferences about the enrollment opportunities and constraints of new forest-owners.

## 6.1 Conservation effectiveness (WP3)

The Finnish case study will layer the METSO PES forest holdings on a general Zonation output to evaluate the conservation effectiveness in the fine grain analysis. Additionally, to allow scenario analysis, the structure and the quality of the forests that were included in the METSO PES holdings will be examined with primary spatial analysis of forest resource inventory data. The structure and the quality of the forests expressed by forest site types, dominant tree species, development classes, age classes, volume of the growing stock by tree species and timber assortments and increment of growing stock.

The analysis will utilize either the field measurement data of the Finnish National Forest Inventory (e.g. Tomppo, 2006) or forest information acquired from the multi source NFI (MS-NFI) (Tomppo et al., 2008). The first option, i.e. the forest resource information produced by NFIs, is based on extensive field measurements applying systematic sampling and field plot measurements. The field plots are located in clusters that form a regular network over the whole country of Finland. The second, and possibly the desirable option is the forest information acquired from the multi-source NFI (MS-NFI), which combines field measurements, digital maps and remote sensing data. The MS-NFI data can be presented as digital thematic maps directly, and these thematic maps expressing e.g. forest site types may be easily incorporated to a GIS system and combined with other geo-referenced data such as the layer of the METSO PES forest holdings or the survey responses that represent those. If we have only the field plot measurement data, the coordinates of the field plots have to be

combined with the layer of the areas included in the METSO PES programme. Then the measurement data of the field plots covering a particular METSO PES area has to be generalized for the whole area. There may be METSO PES farms or holdings where no information is acquired, i.e., no field plots. Therefore the MS-NFI thematic maps might be more suitable for this analysis, since some information would be attained for every METSO PES holding.

## 6.2 Cost-effectiveness and benefits (WP4)

The Finnish local level case study will evaluate the factors that have contributed to contracting and willingness to accept payment of contracted and non-contracted forest owners, as well as their perceptions of multiple benefits of conservation. The real contract fees will be used to validate the willingness to accept estimates.

Earlier studies have analysed some forest-owner views on contract terms, and the influence of these contract terms on the cost-effectiveness. Fixed-term contracts are preferred over permanent ones (Horne et al., 2004; 2006; 2009), but, at an interest rate of 4%, the cost-effectiveness of the two instruments is about the same (Juutinen et al., 2008b). Compared to a simulated auction model where the forest-owner is comparing the PES with the timber income opportunity, the forest-owners have made METSO PES pilot contracts at a lower payment level (Juutinen and Ollikainen, 2010). The influence of factors other than opportunity cost on forest-owners' willingness to accept (WTA) is poorly understood.

As the forest owners' actual compensation level is known from the METSO Programme statistics, and the understanding of forest-owner preferences for contract terms is at a high level, the Finnish fine grain analysis will advance the understanding of contractual, institutional and social factors contributing to WTA. Similarly, the fine grain analysis will allow measuring the value that the forest-owners place on the ecosystem services they provide by contracting. As the contracts are voluntary, and they are a genuine opportunity for any forest-owner who has an eligible site on their land, we consider the WTA to actually illustrate the ecosystem service value of the service provider in a realistic fashion.

Plotting the significant impacting factors on map, the fine-grain analysis will also explore possibilities for GIS analysis of timber-sale value (opportunity cost) and forest-owner networks could allow elaborating on willingness to contract and willingness to accept payment levels. Similarly, transaction costs can be evaluated both with the results of the survey (time invested in contracting and negotiation time) and GIS analysis (distance to agency).

## 6.3 Distributive impacts and legitimacy(WP5)

As described in the previous sections, the centrally organised design of forest biodiversity conservation has been criticised by Finnish forest-owners (Paloniemi and Tikka, 2008). Finnish forest-owners are relatively wealthy and often rather independent from regular forestry income, and the forest sector is rather powerful in directing timber production and also influencing forest biodiversity policy (Ollonqvist, 2002; Rantala and Primmer, 2003; Donner-Amnell, 2004; Primmer, 2011b). With the conflictuous history, the administration seeks to treat forest-owners as equally and equitably as possible (Saarikoski et al., 2012; Similä et al., 2012).

The private benefits of conservation and PES experienced by forest-owners are often simplified to be expressed by income changes but they can be much broader, including perceived changes in benefit distribution among forest-owners and also among broader range of actors, equal opportunity to contract and use multiple ecosystem services, autonomy to decide about conservation and forest use, justness of rights and responsibilities, security and predictability of the policy and contract terms, and finally, biodiversity and ecosystem benefits (Vatn, 2005; Pannell, 2008; Vatn, 2010; Pascual, 2011). The Finnish local level case study will address both distributive impacts and legitimacy directly with the forest-owner survey. The analysis will focus on perceived benefits and their contribution toinfluence on contracting. The Finnish case study will contribute to the debate about fairness and equity in PES with experiences from a wealthy empirical context. With the forest-owner views on ecosystem service benefits and their relation to WTA, thesurvey will also allow discussing the generally held views that values placed on ecosystem services are of a public character and that their valuation should rely on contingent methods (TEEB, 2009).

Collaboration and social networks are broadly considered crucial for take up and commitment to new practices and as well as for learning and developing adaptive responses to environmental problems (Ostrom, 1990; Agrawal, 2001; Rydin and Fallth, 2006; Bodin and Crona, 2009; Paloniemi and Varho, 2009; Primmer, 2011b; Robinson et al., 2012; Saarikoski et al., 2012). Networks are essential for implementing a policy (Jordan, 1999; Primmer, 2011b). They make a difference because they allow sharing information, developing trust and advancing shared goals (Saarikoski et al., 2012). The Finnish forest-owner survey will address the forest-owners-owners' use of information, trust and shared interests relative to a range of relevant actors implementing and intermediating the METSO PES.

## 6.4 Institutional options and constraints (WP6)

Although the PES contract terms and their acceptability have been studied in Finland (Horne et al., 2004; 2006; 2009; Paloniemi and Tikka, 2008), and the role of the administration and intermediaries is also well known (Primmer, 2011a), the forest-owners' views on their own rights and responsibilities has not been analyzed together with their views of the rights and responsibilities of other actors. The Finnish fine grain analysis will close this knowledge gap.

Use of PES instruments will necessarily determine and change forest-owners rights and responsibilities (Pannel, 2008; Muradian, 2010; Vatn, 2010). By doing this, the PES redetermine also the rights and responsibilities of different administrative and organizational actors, e.g., by assigning the mandates, developing monitoring systems and allocating resources. In addition to these formal regulative institutions, changes accour also in the normative institutions carried by professional and standardized practices and cultural cognitive institutions reflecting the perceived functions forests, forest management and biodiversity conservation (Primmer et al., 2011).

Much of the Finnish local level case study focuses on the rights and responsibilities and the impacts of their redistribution, through forest-owner perceptions. In addition to analysing the influence of institutions on the take up of a PES contract and WTA, the survey will allow in-depth analysis of the weight placed on the rights of different actors, which can be analyzed against earlier work on legitimacy and and institutions of forest biodiversity giovernance (Paloniemi and Tikka, 2008; Paloniemi and Varho, 2009; Primmer, 2011a; 2011b). The results will enlighten the institutional options and constraints of METSO PES and other instruments with similar and different

characteristics. This will be backed up by the focus group work for the multicriteria analysis of instrument mix scenarios.

## 6.5 Further research questions (for local fine grain analysis)

In a later report of the fine grain local level analysis of policy instrument mixes, the following questions will be addressed:

- What influences the willingness to accept PES compensation?
  - Experience with other instruments
  - Perceptions about changes in ecosystem service provision
  - Institutional factors: contract terms, procedures, information flow, perceived interests, autonomy and rights
- What are the impacts of PES instruments?
  - Perceptions about changes in economic opportunities
  - Perceptions about changes in welfare
  - Perceptions about changes in ecosystem service provision
- What are the conditions for contracting based on comparison of contracted-non-contracted
  - Experience with other instruments
  - Economic use of the forest and perceived loss of income
  - Importance of the basis/justification of the payment
  - Social factors: trust and perceived fairness
  - Institutional factors: rules, procedures, information flow, perceived interests, autonomy and rights

# 7 Scenario analysis

Environmental decisions and policy assessments are often complex, involve many different stakeholders and typically draw on multidisciplinary knowledge bases, incorporating natural, physical and social sciences, politics and ethics (Kiker et al., 2005). Multi criteria analysis (MCA) is one method to incorporate more than one objective into the decision process and analysing the relative importance of different objectives, which makes it an important method supporting policy assessment. It allows combining quantitative and qualitative information, as well as monetary and non-monetary values. The MCA process generally includes four phases: structuring the decision problem into objectives and criteria, defining the consequences of the decision alternatives, eliciting the decision maker's preferences and comparison of decision alternatives (e.g. Keeney, 1982; Kangas et al., 2008).

The Finnish case study will conduct a spatially referenced multi-criteria analysis (MCA) of instrument-mix scenarios. This will not be a full blown spatial MCA, but the method relies on combined use of geographic information systems (GIS), spatial analyses and MCA. The GIS is used to produce and handle the geo-referenced data needed for producing the alternative conservation area configurations under the different instrument mix scenarios, and as a platform to present and visualise the results of the analyses as thematic maps.

The MCA will draw from the fine-grain analysis of institutional, social, ecological and economic perceptions of forest owners. The scenarios will take the existing budget as a starting point and take the current implementation of METSO-PES as baseline scenario. Based on focus stakeholder group work, the alternative scenarios will be built around the following new instrument mixes (see also Table 6):

1) Voluntary permanent conservation
2) Enforced spatially concentrated permanent conservation
3) Voluntary permanent conservation with active nature management
4) Voluntary temporary conservation.

It has not been decided, whether the Finnish case study will have only these four alternatives, or whether alternative conservation area networks will be developed within each of these instrument mixes and the given budget.

The main purpose is to find the decision alternative, i.e., instrument mix that produces the most efficient solution with respect to the ecological, economic and social criteria and preferences. The indicators under these criteria are not fully decided yet. All the possible indicators are mapped out first and then only those indicators for which current information and future estimates are available will be included in the final MCA. This depends on e.g. the access to forest resource information and ability to calculate carbon sequestration or accumulation of coarse woody debris. The ecological indicators considered include carbon sequestration, forest age structure and its changes, the amount of fertile forest site types, connectivity and the amount of coarse woody debris. The economic indicators considered include opportunity costs (lost timber sales income), transaction costs (negotiation time) and employment opportunities. The social indicators considered include recreational opportunities, perceptions on who benefits and distribution of benefits in society, perception on legitimacy and fairness of contracting process.

The information for the indicators will be obtained from different sources: from the administration, from the forest-owner survey of the fine-grain analysis, digital maps, forest resource information and from the streering group of the Finnish case study. The streering group will also represent the decision maker in the MCA, i.e. they will express their preferences for the different criteria and indicators.

The scenarios will be conducted both covering the current situation and the future situation in 20 years. However, a longer time period may also be considered, since Mönkkönen et al. (2011) have discovered that the efficiency of the different conservation alternatives vary along the time scales. The permanent reserves tend to outperform other scenarios in the long term, while in the short term a strategy to invest in temporary small reserves is the most efficient.

*Table 6. Intitial framework for scenario analysis*

| | Voluntary permanent conservation | Enforced spatially concentrated permanent conservation | Voluntary permanent conservation with active nature management | Voluntary temporary conservation |
|---|---|---|---|---|
| **Institutional arrangements** | | | | |
| **Implementing authority (budget allocated to)** | • 100 % Environmental administration | • 80% Environmental administration<br>• 20% Forestry administration | • 50% Environmental administration<br>• 50% Forestry administration | • 100% Forestry administration |
| **Other active actors** | • NGOs | • Land-use planning authorities | • Local forest Managemnt Associations<br>• NGOs<br>• Forestry entrepreneurs | • Local forest management associations |
| **Site selection** | • Concentrated around existing protected areas areas with hight Forest Act habitat density | • Concentrated around existing protected areas | • First come, first serve basis: assumed to concentrate in areas with high Forest Act habitat density | • First come, first serve basis: assumed to concentrate in areas with high Forest Act habitat density |
| **Payment** | • Compensation for timber income loss + concentration bonus | • Compensation for timber income loss | • Compenstaion for timber income loss<br>• Incentive for restoration and management | • Compenstaion for timber income loss<br>• Incentive for restoration and management |
| **Ecological benefits** | • Accumulation of ecological values<br>• Connectivity<br>• Representativeness | • Accumulation of ecological values<br>• Connectivity | • Increasing ecological values<br>• Potential for representativeness | • Potential for representativeness |
| **Potential impacts** | | | | |
| **Costs (specific to instrument)** | • Pre-defined site preference increases<br>• Voluntariness decreases | • Pre-defined site selection increases | • Voluntariness decreases | • Voluntariness decreases |
| **Administrative costs (specific to instrument)** | • Attracting offers and marketing increases increases<br>• Comparing offers increases<br>• Certainty of ecoliogical outcome reduces | • Negotiating increases<br>• Litigating increases | • Guiding best management practices increases | |
| **Social legitimacy** | • Loss of rights reduces<br>• Voluntariness increases<br>• Certainty of ecological outcome increases | • Enforcement reduces<br>• Loss of rights reduces<br>• Certainty of ecological outcome increases | • Voluntariness increases<br>• Employment opportunities increase<br>• Uncertainty of ecological outcome decreases | • Voluntariness increases<br>• Temporariness increases<br>• Uncertainty of ecological outcome decreases |

One of the most important tasks in the case study is to produce the alternative networks of reserves/areas within each instrument mix with the given budget, that is, the site selection. The site selection method has not been decided. One option is to apply the Marxan site selection model as in other case studies. Obtaining some of the information needed in Marxan system is however quite time consuming. For example, the cost layer of opportunity costs cannot be calculated based on the field

measurement data for the whole area, since it is too time consuming, but it has to be based on average costs of conservation of permanent and temporary reserves. Another option for the site selection is that the Finnish case study may also receive a map of ecologically valuable areas constructed with Zonation-prioritazing for the study area (Lehtomäki et al., 2009). One important issue is, however, that in addition to, e.g., ecological values, connectivity and minimizing the patchiness, the site selection procedure should ideally take into account the forest-owners' willingness to contract or willingness to accept. If these cannot be generalized geographically or e.g. to holding size, timber income opportunity cost will be used instead. The needed information is obtained from the fine grain forest-owner survey and digital maps constructed. However, the final decision concerning the site selection modelling or method will depend on the data available and the time constraints.

The values of the ecological and economc indicators based on forest resource information have to be calculated after site selection owing to the limited time for the project. At least, it is not possible to calculate these measures based on the NFI field measurement data for the whole case study area. The typical Finnish forest stand size is about 4 ha, and this kind of spatial resolution could be possible only applying the Finnish multisource NFI data, which has the geometric resolution of 25 meters for both input data and resulted maps. However, it is not yet clear what kind of data are available; thematic maps covering one measure, e.g. volume of the growing stock, multisource-NFI data or field measurement data. The detailed analysis requires the possibility to make predictions about the future development of forest applying stand-level forest simulation program. In addition, detailed data is needed for the prediction of carbon sequestration of the growing stock. The Finnish case study may apply MOTTI stand-level forest simulator. The core of MOTTI is a stand-level simulator, which includes growth and yield models for e.g. natural regeneration, growth and mortality. MOTTI is designed to simulate stand development under alternative management regimes and growth conditions in Finland (Hynynen et al. 2002, Salminen et al., 2005). For the economic analysis, MOTTI includes stumpage prices by tree species and timber assortments, silvicultural costs and interest rate. The plot level field measurements have to be converted to stand level measures while applying stand-level forest simulator without knowing the true stand delineation. In large reserves this means averaging over multiple plots and calculating the stand-level information, e.g., basal-area of the stand and mean diameter, based on the averages. On the other hand, no information may be acquired for small reserves, since it is possible that none of the field plots cover them.

The MCA scenario analysis still includes many not fully decided issues. The main purpose, however, is to find the most efficient instrument mix now and in the future. Many issues involve uncertainty during the 20 years of time period.For example forest-owner preferences cannot be accurately predicted. Uncertainty of some issues may be analysed and sensitivity analyses made. These issues include, e.g., stumpage prices and interest rates.

## 7.1 Conservation effectiveness (WP3)

The age structure of the forests and changes in the age distribution under the different spatio-temporal instrument mix scenarios will be calculated from the forest inventory data. These inventory data are possibly either field plot measurement data from the Finnish NFI or multisource NFI data presented as thematic maps. In addition the volume of the growing stock by tree species and by timber assortments may be acquired through forest resource information. An estimate for the certainty for the ecological outcome will be derived from and the focus group work. Carbon

sequestration may be attained through field plot measurement data; however, the method or programme to calculate the carbon sequestration of the growing stock is not yet clear.

Perceptions of environmental benefits (ecosystem services) will be derived from Mönkkönen et al. (2011) and the survey and a focus group (to be held in August-September).

## 7.2 Cost-effectiveness and benefits (WP4)

The different scenarios conducted in the case study will always have the same budget, since the amount of funds allocated to conservation are typically limited. However, the budgets will be allocated to the different administrations in instrument mix specific ways, and the different instruments will generate differing levels of marketing and negotiation costs (Coggan et al., 2010)

The opportunity costs for giving up timber sales in varying degrees are derived from the forest inventory data applying MOTTI stand-level forest simulator and timber sales statistics.

Administrative costs – cannot be accurately estimated but qualitative estimates will be derived a from focus group (August-September) (see also Table 6).

## 7.3 Distributive impacts and legitimacy (WP5)

Legitimacy of different instrument characteristics and mixes will be derived from the survey and the focus group, with the assumptions derived from this croarse grain analysis.

Distributive impacts from survey and also based on forest holding size analysis.

## 7.4 Institutional options and constraints (WP6)

Perception of contract arrangements, rights and responsibilities as well as networks will be derived from the survey , with the assumptions derived from this croarse grain analysis.

Institutional feasibility of instrument mix will be assessed wiyth the focus group.

## 7.5 Further research questions

In a later report of the multicriteria scenario analysis of policy instrument mixes, the following questions will be addressed:

- What are the impacts would further application of PES instrument generate?
    - Economic opportunities
    - Changes in welfare
    - Changes in ecosystem service provision

- What are the conditions for contracting based on comparison of contracted-non-contracted
    - Economic use of the forest and perceived loss of income
    - Importance of the basis/justification of the payment
    - Influence of Social factors: trust and perceived fairness
    - Importance of institutional factors: rules, procedures, information flow and perceived interests
    - Importance of institutional factors: autonomy and rights

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