



"METSO on jäljillä" - Research report of the Forest Biodiversity Programme for Southern Finland

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- **English Summary** (draft translation)

Background and purpose of the report

In Finland, forests have always played an exceptionally important role in social, economic and cultural development. Forest policy is steered by a National Forest Programme (NFP), which sets out detailed aims for forest use in Finland. Complementing NFP is the Forest Biodiversity Programme for Southern Finland – the METSO Programme. The METSO Programme consists of 17 sub-programmes aimed at expanding the network of conservation areas, improving their quality and laying a firm foundation on which to safeguard natural biodiversity.

The purpose of the METSO research report "METSO on jäljillä" - Research Report of the Forest Biodiversity Programme for Southern Finland - is to present a comprehensive review of the latest Finnish research data on forest biodiversity. The ecological, economic and social implications of safeguarding biodiversity are examined together. The report will assist those producing the final report on the monitoring and evaluation of the METSO Programme, and its fresh research findings will form a basis for decision-making. The monitoring period for the METSO Programme (2003–2006) is too short for many of the Programme's impacts to manifest themselves. In order to support the formulation of conservation policy, therefore, assessments of the METSO Programme's ecological, economic and social impacts in the longer term, when the Programme has been implemented more extensively, rely on the research data published in the report.

The report brings together the findings of three research programmes: the Forest Diversity and Monitoring Programme in Finland (MOSSE), the Environmental Cluster Research Programme, and the Finnish Forest Research Institute's 'Safeguarding Forest Biodiversity – Policy Instruments and Socio-economic Impacts'. Numerous research teams and individual research workers not connected with these programmes have also played a part. More than 140 researchers contributed to writing the report. Within the METSO Programme, biodiversity research is understood as a wide-ranging entity that incorporates not just ecology but also economic and social viewpoints and their implications. Those involved in the different research programmes and projects have worked extensively and closely together.

The report consists of two parts. The first contains sections written by leading figures in social sciences and ecology, whose research findings are presented on a subject-by-subject basis. The second part comprises summaries of new research findings presented by the researchers. New background information for the report was produced by the National Forest Inventory, Forestry Development Centre Tapio, and Metsähallitus (forestry and nature services).



Need to preserve forest biodiversity and the ecological impacts

Of Finland's total land area (including forested but poorly productive land), 11.2% is subject to conservation programmes. Northern Finland, where most forest is owned by the Finnish State, has the largest number of conservation areas, which account for 20.5% of the total land area. In Southern Finland, most forests are in the hands of private forest owners, and 2.2% of the land area here is protected under conservation programmes. In terms of forest vegetation zones, the need for further conservation continues to be greatest in Southern Finland. Conservation is most urgently needed in forests that are in a natural or semi-natural state and that provide suitable habitats for demanding and endangered species. On the other hand, the need for more conservation must be examined in the light of findings from the ongoing assessment of how endangered the different types of habitat are and from inventories of conservation areas, findings that will give a clearer idea of the need to preserve the different habitats. Use can also be made of theoretical ecology in assessing the need for habitat conservation.

Conservation area network

The biggest challenges facing the preservation of forest biodiversity in Southern Finland relate to three main questions:

1. How can the network of forest conservation areas be made sufficiently comprehensive ecologically, brought to a high standard, and made representative of the area?
2. How will the dynamics of forest succession and disturbance change the structure of conservation areas in the coming decades, particularly that of small conservation areas, and will these changes affect the ability of endangered species to exist in vital populations in such conservation areas?
3. What will be the combined effect of conservation areas and commercial forests as efforts are made to safeguard populations of endangered forest species, and which species can also live in commercial forests? Is the entity formed by conservation and commercial forests different in its ecological characteristics in different parts of the country and, if so, will the differences affect the basis for natural values trading in different parts of Finland?

The diminishing number of habitats and deterioration in their quality have been shown to be the main reasons why species are declining and becoming increasingly endangered. In small conservation areas populations of different species are often also small and the risk of their disappearance locally is consequently great. A network composed of small sites can, nevertheless, preserve thriving populations of some species over a larger area providing the network of such sites is sufficiently dense. A network of conservation areas can be made more effective through forest restoration and by expanding their size by protecting commercial forests that are in, or have been restored to, their semi-natural state. Nature management provides a way of improving the forest landscape by linking protected areas more closely together. The aim here would be to promote the spread of demanding species between sites within protected areas where the species in question are most abundant.



Restoration and safeguarding biodiversity

Information about the structure of forests that are in their natural state can be used as the basis for planning restoration. Based on studies of natural forests, the main aims of restoration at the regional level are to increase areas of forest that possess the features of old-growth forest and to secure ecological succession in forests containing large amounts of decaying wood following a fire. The almost complete absence of development stages in such forests typifies the structure of today's forests and distinguishes them from natural forests. The other extreme in forest succession – old spruce forests long unaffected by fire – has been the most common development stage of natural forest. Restoration work must not reduce the amount of old spruce forest or hamper its development in conservation areas.

The effects of restoration depend on how the measures used are distributed area-wise. Habitat restoration for species that do not spread easily should focus on areas close to where the species in question are most abundant. For species that spread readily, the number of habitats is more important than their location. Special attention at area and regional levels has to be given to rare endangered types of forest habitat requiring restoration or habitat management. Examples include woodland situated along ridges, hardwood-dominated forests, wooded flood meadows and traditional agricultural biotopes.

For small forest stands, controlled burning of areas with sufficient decaying wood is an effective tool in restoration, and its effects, notably on insects and the soil seed bank, are immediately visible. The beneficial effects on other species take years to appear. Burning is usually better carried out after restoration felling, which increases the amount of dead wood and combustible material. Restoration burning must be carried out over a sufficiently wide area and at sufficiently regular intervals to ensure continuity in the area and safeguard the species dependent on it.

Increasing the amount of decaying wood is another important restoration tool, although usually its effects are seen only in the longer term. However, securing the qualitative diversity and continuity of decaying wood poses a challenge. In natural forest, dead wood generally forms. The artificial production of decaying wood, on the other hand, is often a one-off measure, because returning again to the same site is not cost-effective. Unless the remaining trees are so far apart that they are susceptible to windthrow, such measures lead to a decrease in decaying wood because growing conditions for living trees improve as there is less competition. Marked variations in habitat availability pose problems for organisms that depend on dead wood. Close to concentrations of decaying wood there should be new areas available to which these organisms can move as their original site deteriorates.

New measures contained in the METSO Programme

The ecological effectiveness of the new measures tested during the METSO Programme will depend on the number of sites chosen and their particular features. Research data on the ecological effectiveness of natural values trading in Satakunta province shows that the new measures can lead to ecologically important areas being included in conservation, although there is considerable variation in the ecological value of the areas that have been committed under contracts. This large variation indicates the need for better assessment of how well sites meet the biological criteria for



nature protection. In terms of cost-effectiveness, the compensation paid to forest owners should vary, being higher for sites of greater ecological value than for sites of lesser ecological value. This has, in fact, been incorporated into the compensation principles of natural values trading, in which compensation is based partly on the ecological characteristics of the site. Under the competitive tendering scheme, the ecological features of the site tendered do not affect the size of payment unless specified by the forest owner when he decides on the asking price. In the case of voluntary measures, more consideration should be given to the sum paid in relation to the criteria set. Linking compensation more closely to ecological values would encourage forest owners to generate such values.

The ecological benefits also depend on the extent of conservation that can be achieved through voluntary schemes and with the funds available. Questionnaire findings show there is considerable interest on the part of forest owners in voluntary forest conservation, and significant areas of forest could be protected in this way. The new measures offer forest owners a new way to earn a living from their forests to supplement already existing uses. This gives the forest owner a genuine opportunity to consider what products and services he wants to generate in his forest. Actively generating natural values in parts of the owner's forest could be profitable, and could be carried out in conjunction with, say, thinning work.

It is too early to say how the new measures will affect the number of protected sites or their total area, as the aim of the pilot schemes was to develop new approaches and as the resources needed to harness the full conservation potential of the new measures were not available. If the market really begins to function and there is adequate demand (public funds allocated for conservation) and supply (willingness on the part of forest owners) the new measures will be considerably more ecologically effective than the present measures. Their effectiveness will also depend on the extent to which other existing conservation measures are employed.

Locally and for a certain period of time, voluntarily protected areas could provide an important addition to the conservation network, but in the longer term their significance could be affected by their uncertain conservation status. If the new measures result in a group of conservation sites that is constantly changing, and changing extensively, the ecological effectiveness based on the number of sites and their features will be smaller than predicted. Short-term contracts, such as the 10-year contracts agreed for natural values trading sites, are not compatible with the fact that populations that do not spread easily depend for their survival on stable conditions. Also, many ecologically important features need long periods to develop; establishment of a wood decay continuum, the formation of dead but still standing trees, development of a broad tree age structure, and the growth of large, old trees all take decades if not centuries. If large numbers of sites are made available to forestry on expiry of the contract, the new measures could be ecologically ineffective.

In order to assess the ecological uncertainty attached to a particular site, it is thus vital to know what is likely to happen to the site on expiry of the contract. Research findings show that, in the case of natural values trading contracts, roughly half of the sites will be offered again when the contract period expires, thus reducing the uncertainty attached to fixed-term agreements. Also, many forest owners are prepared to sign longer contracts for periods exceeding the 10 years currently employed in natural values trading. Competitive tendering contracts are in force for 20 years or indefinitely. Longer-term contracts provide a means of managing the ecological uncertainty associated with voluntary agreements.



Another key question relating to contract duration is whether the ecologically valuable features that form the basis for conservation develop slowly, or are they dynamic? Sites with dynamic features include the young and transitory stages of succession such as forests that have burned, either controlled or otherwise, and contain large amounts of charred wood, succession stages in birch or aspen woodland, and succession forests formed following flooding or land rise. Most of the biological criteria set for environmental protection that are used to assess the suitability of sites voluntarily offered for conservation can be regarded as slowly developing structure-related criteria. Dynamic features are emphasised mainly in the supplementary criteria. As a result, the sites in the Satakunta natural values trading pilot project are mainly heathland forests containing large amounts of decaying wood (65% of all contracted sites) and compensation has been paid principally in respect of features that develop slowly (decaying wood and large individual trees). Correspondingly, the sites have had very little burnt wood, the occurrence of which has thus had little impact on the amount of compensation paid.

Commercial forests

[Editor's explanation: In Finland, forestry is based on three indigenous tree species of the boreal climate zone, Scots pine, Norway spruce and birch, which reach economic maturity in 60-120 years. During the rotation period the stand is subjected to 1-3 thinnings and, when the stand has reached maturity, it is regenerated by clear-cutting or seed tree felling. Natural regeneration is used whenever possible (in practise in about one third of the forests). Clear-cutting is used in about two thirds of the regeneration fellings, the stand then being regenerated by planting or direct seeding. Clear-cutting is common in Finland because two of the most common tree species, pine and birch, are so-called pioneer species, which regenerate the best on open land where there is abundant light. The clear-cutting areas are usually very small, between one and two hectares, and part of the mature trees, so called **retention trees**, are left to maintain the landscape and biodiversity. Seedlings of indigenous tree species are used in planting almost without exception. The planted stands as well receive usually natural complement of other species, especially on fertile soils, tending to develop into mixed stands.]

The importance to biodiversity of the **habitats of special importance** as specified in the Forest Act varies with the type of habitat and the species in question. Preserving important habitats is the most effective way to maintain species biodiversity in naturally small habitat sites such as the areas around springs. Research has shown that important habitats support a wider range of species, including rare and demanding species, than the average commercially utilised forest. Current research data suggests that, in heathland forest, the small sites mentioned in the Forest Act are not of particularly great importance to populations of endangered species. There are, however, considerable variations in the occurrence of rare and endangered species from one site to another, variations that are connected with structural features – in particular the amount of decaying wood and the age of the trees. The small size of sites designated as being of special importance poses problems for species that depend on such structural features. Small sites offer few decaying trees of the right type or indeed any suitable trees to act as substrate, and these do not necessarily appear on a continuous basis.

Dead and decaying **retention trees** provide potentially important habitats for many species that, in natural forests, have adapted to forest fires and other natural disturbances. Many species favour dead trees in open environments. Some species are completely dependent on decaying trees in open



places and do not thrive in dense, old-growth forests. As forest that has regenerated following fire or other natural disturbance does not occur in commercial forests or to any extent in conservation areas either, the current practice of leaving trees standing in the clear-cutting areas is the only means – aside from conservation area restoration – of maintaining populations of such species.

However, current numbers of retention trees in commercial forests will probably not be enough to sustain endangered species that have adapted to disturbances. Concentrating numbers of retention trees in particular stands and areas is a worthwhile goal. More than average numbers of retention trees should be left in important habitats and concentrations of decaying trees close to conservation areas and in areas with populations of endangered species dependent on decaying wood. Controlled burning, especially when combined with retention of large numbers of trees, is a useful way to boost populations of fire-dependent species and numerous other rare and endangered species.

Several research findings suggest that, in Southern Finland, endangered species only begin to appear in old-growth forests when the volume of decaying wood reaches at least around 20 m³/ha. Present-day nature management methods will not significantly increase volumes of decaying wood in commercial forests. Achieving greater volumes of decaying wood requires further efforts, such as encouraging greater numbers of retained living and dead trees and of dead trees arising as a result of natural disasters. The increasing harvesting of energy wood is reducing volumes of dead wood as a result of regeneration felling and thinning in conflict with the goals set for nature management. More attention should be given in the future to reconciling energy wood harvesting with nature management goals.

Social impacts of safeguarding natural biodiversity

Impact at national level

The direct costs of conservation to the State arise from payment of compensation for conservation and from conservation area maintenance, management and data collection. The cost of compulsory purchasing made in the country as a whole has varied between 91–30,000 euros/hectare, averaging 1,271 euros/hectare in 2000–2005. Other measures, such as voluntary trading, have resulted in lower average costs per hectare than compulsory purchasing.

Natural values trading has not always been quite as effective financially as it might have been: offers by forest owners have not been subjected to competition and in some pilot projects individual contracts have been signed after each offer has been received, which has made it difficult to compare the amount of compensation paid with the natural value of the site. The conservation authority could improve trading by considering several tenders before finalising any contracts. This would facilitate cost-benefit comparisons of sites and the creation of a network that meets the goals set, and would also ensure fairer contracts as all sites would be evaluated in light of the same knowledge and within the same budget. Forest owners have by no means always presented their own request for compensation at the start of negotiations, and negotiations have therefore been started on the basis of price estimates made by the conservation authority. The difficulty of deciding the amount of compensation has been the biggest factor discouraging forest owners from putting



forward their own asking price. Informing forest owners of the ecological and economic values of their forests, together with the development and introduction of systems in support of decision-making, would make protection measures based on voluntary proposals financially more effective. A sound knowledge base and systems designed to facilitate assessments would better equip forest owners to make decisions.

The cost-effectiveness of restoration projects in nature conservation areas can be improved by specifying the area of forest to be restored, the restoration measures to be used, the factors affecting the difficulty of the work, etc. In preparing cost estimates for restoration projects use could be made of cost comparisons between earlier projects and of the good practices decided on in these projects. Restoration also affects the recreational use of the area in terms of both increasing its biodiversity and making changes to the landscape. Any recreational benefits accruing from restoration work merely increase the cost-effectiveness of the restoration investment.

According to the research findings, the effects of conservation on forest sector production, employment and trading in wood raw material could be smaller than previously thought. An increase in the standing reserve will make it possible to step up conservation, but increasing the number of conservation areas is not without its problems. Research shows that more conservation will lead to higher stumpage rates because it reduces wood supplies. Higher stumpage rates in turn mean higher costs for the forest industry leading to reductions in both capacity and production, mainly in the sawmilling industry. In the paper industry, the price of wood raw material is smaller in relation to overall costs and production would not be affected.

Although greater conservation means less forest available for felling, there will be little change at national level in forest owners' stumpage income. Research shows that stumpage rates rise in line with the decrease in harvesting volumes.

The biggest knock-on effects, both positive and negative, will stem from an increase in the area of forest placed under traditional strict conservation. Introduction of the new METSO measures is likely to affect production and employment less than strict conservation.

Impacts at regional and population group level

Although, according to the research, greater conservation will not have any major economic impact at national level, the situation at regional level, including the knock-on effects, may be different. Establishing a representative network of conservation areas throughout the country requires that consideration also be given to economic and social impacts at regional level.

Designating areas for conservation can bring economic and other benefits, for example by promoting recreational use and tourism. The benefits from recreational use are seldom distributed evenly between different population groups. Research shows that visitors to State conservation areas are of above-average education and more likely to be people with professions. Research should also be directed at the needs of those population groups that seldom or never visit conservation areas and the reasons identified.

To ensure that recreational benefits accrue, it is important to develop the use of conservation areas for recreational and tourism purposes bearing in mind the capacity of the areas to cope with the



load. In the countryside, encouraging tourism that relies on conservation areas changes the cultural and social identity of the countryside. Taking into account and accepting the views of local residents and stakeholders is important in such situations. At the same time, efforts should be made to ensure that the tourist attraction of the countryside is preserved.

Incentives and conservation planning

In terms of promoting biodiversity, the most potent and cost-effective conservation measures vary from one habitat to another. For example, the preservation of natural forest rich in decaying wood often requires permanent conservation and the exclusion of relatively large areas from commercial use, whereas the protection of herb-rich woodlands often implies a network of relatively small areas of woodland. The challenge is to find the right combination of conservation measures to meet the ecological criteria and at the same time achieve an economically viable and socially acceptable level of conservation.

The new measures contained in the METSO Programme, together with improving forest management practices, could be effective in securing biodiversity; however, the pilot projects have so far been fairly small and the areas somewhat restricted, thus preventing their impact from being fully assessed. The sites included under conservation in the pilot projects have averaged less than 10 hectares in size. Based on present ecological data, small sites are problematic in several respects, nor do they offer long-term protection for all the resident species. On the other hand, they can be suitable protected areas for groups of species that are capable of living in small areas and are not dependent on the changing resources resulting from succession. As forest owners' preferences vary in relation to contract duration, the practices based on voluntary measures could be made more flexible, for example contracts of longer or even indefinite duration could be sought for sites with slowly developing structural features and the associated ecological values. Sites with rapidly changing structural features could be protected by means of precisely the 10-year contracts used in the pilot projects. Traditional agricultural biotopes, for example, where conservation of natural values requires constant management, are suitable for fixed-term conservation contracts.

It might be difficult to guarantee conservation areas will be representative of their area unless new planning procedures and site tendering systems for protected areas are developed in conjunction with the new measures. The METSO Programme's cooperation network idea could be a suitable administrative tool for carrying out such a review and the related conservation planning.

What is needed is more information coupled with a change of attitude on the part of forest owners and those who advise them, and the environmental authorities. However, forest owners and stakeholders in the different sectors are already prepared to apply new measures to safeguard biodiversity. The acceptability of the new measures depends primarily on the retention of the forest owner's power to take decisions: he is basically the one to put forward the conservation initiative, he can decide on the asking price commensurate with the site's value, and he decides whether or not to sign the contract. The forest owner retains this decision-making autonomy even when he offers a site for permanent conservation. The same applies to fixed-term contracts, as the forest owner commits himself for only a specified period. The financial compensation paid to the forest owner is an important consideration in the acceptability of the new measures because it makes conservation a form of economic activity. Respecting the forest owner's independence and power to make



decisions poses a challenge when sites for protection extend into another owner's land. More needs to be understood about what incentives will encourage forest owners to work together. Aside from financial compensation, such incentives could be the provision of more information and the consequent improvement in decision-making autonomy, and less dependence on the information provided by the authorities.

Forest owners and representatives of the organisations that took part in the pilot projects have taken a positive view of the new measures and of the new channels of communication and greater social understanding gained during the projects. The information accruing from the projects will make the new measures not just more acceptable but also easier to apply. Possession of more information will help overcome prejudices and give forest owners, the authorities and other organisations the feeling that they are more in control. The strong emphasis placed on information during the projects is thus well justified.

Measures other than those used in the traditional strict conservation require forest-related advice and planning if they are to succeed. This in turn demands more resources as well as reallocation of existing resources. Improved forest planning could free resources from field work, and these could be used to provide advice to forest owners. This advisory service could give more attention not just to wood production but also to promoting biodiversity in line with the goals of both owners and society. The associated administrative problems would also have to be solved. The idea of developing incentives is to promote natural diversity, not administrative diversity.

The possibility of reallocating public funds could also be considered. The aim is to reach a situation where promotion of biodiversity is marketed to forest owners just as keenly as projects to promote forestry. One approach would be to set up a new and wide-reaching system of nature management subsidies for private owners of commercially used forests. Conditions for the granting of such subsidies would be imposed on an area basis and could include an obligation to leave far more than the average volume of retention trees (totalling around 10–100 m³/ha), to artificially produce snags during thinning and clear felling, to leave buffer zones around key biotopes to prevent incursion, to carry out controlled burning of areas prior to regeneration, and so on. The conditions could also include an opportunity to establish more extensive nature management areas, which would qualify for higher than average subsidies. The forest owner and the State would then sign a nature management agreement governing the granting and use of such subsidies.

In addition to bringing more forest under conservation, the choice of incentives will have a clear impact on the perceived benefits of conservation. Both the public and forest owners prefer the new incentives contained in the METSO Programme to the traditional approach to conservation based on land purchase. The results of cost-benefit analyses show that the area at present under conservation in Southern Finland is below the social optimum. This finding is provisional, however, and for the purpose of environmental policy decision-making more such analyses are needed, for example to show the costs and benefits of conservation based on a range of options. More research is also needed into how the reform of forest taxation will affect forest biodiversity. The taxation of sales income will make it more attractive to use forests for purposes other than wood production. It might thus encourage forest owners, especially those with small holdings, to discontinue wood production and in this way act as a temporary incentive to step up protection of biodiversity.

The effects of safeguarding biodiversity on society and at local level arise as an adaptation process, i.e. as an interaction between the administrative hierarchy and the local socio-ecological system.



The desired effects at local level cannot, therefore, be produced ‘to order’. On the other hand, provisional research findings suggest that offering a wide range of financial incentives could lead to the creation of positive local adaptation processes. Those who mediate between local bodies or forest owners and the administration will have an important part to play. At the same time, the incentives offered by the authorities must generate more ecological diversity and be as simple as possible. This issue requires further study, with particular attention to examining the interactions between ecological, economic and social interests.

Changes in the business environment

Several of the changes currently taking place in our society will affect how our forests are used and managed in the future, and how the need to protect natural biodiversity, and the means by which this is accomplished, also change. Encouraging greater use of forests for recreation and nature tourism, and reconsidering forest management recommendations to give greater importance to carbon sequestration and forest biodiversity are examples of changes that go hand in hand with safeguarding natural biodiversity. Social attitudes and values are to some degree shifting towards greater environmental friendliness. At the same time, the new measures proposed in the METSO Programme are encouraging forest owners to take a more favourable view of preserving biodiversity.

Of the environmental factors affecting forest biodiversity, the most notable perhaps is climate change, which is likely to bring both pluses and minuses with regard to biodiversity. Taking climate change into account will help to clarify the ecological and economic dimensions of the different conservation options.

From the economic point of view, the biggest factor that will affect and indeed hamper the protection of forest biodiversity could well be the difficult financial situation the State is expected to face due to ageing of the population. On the other hand, the Finnish forest sector is unlikely to increase its production volumes over the next few decades enough to jeopardise conservation or to significantly raise conservation costs from the present level. In fact, the trend could well be the reverse, as forest growth clearly outstrips domestic wood consumption. One major uncertainty, however, concerns the availability of imported wood. An energy policy that favours wood-based fuels, coupled with rising energy prices, poses a challenge to those seeking to integrate the growing of wood for energy purposes with forest cultivation in a way that reconciles economic goals with ecological sustainability.



English web site of the METSO Programme:
www.mmm.fi/metso/international