METSÄHALLITUS
FOREST AND PARK SERVICE

Landscape Ecological Plan for State-owned Forests in Valtimo

Eija Pitkänen
Kaija Eisto
Alpo Toivanen
Arto Kammonen
Seppo Mustonen

Forestry Publications of Metsähallitus - Forest and Park Service 29 • 2000

Orders of publications:

Metsähallitus - Forest and Park Service
Forestry
P.O.Box 94
01301 Vantaa

Tel. + 358 205 64 100
Fax + 358 205 64 4500
www.metsa.fi/mta/

Printed matter

Forestry Publications of Metsähallitus - Forest and Park Service 29

Landscape Ecological Plan for State-owned Forests in Valtimo

Eija Pitkänen
Kaija Eisto
Alpo Toivanen
Arto Kammonen
Seppo Mustonen

Vantaa 2000

Photos: Timo Karreinen
Layout: Arja Halme, Taimi Tähtinen

Translation: Traduct Oy/Katja Kukkasjärvi, Rosemary Mackenzie

Oy Edita Ab, Helsinki 2000

ISSN 1239-1670
ISBN 952-446-185-4 (Printed)
ISBN 952-446-186-2 (Internet)

DOCUMENTATION PAGE

Published by
Metsähallitus - Forest and Park Service

Date of Publication
1.4.2000

Author(s)
Eija Pitkänen, Kaija Eisto, Alpo Toivanen,
Arto Kammonen, Seppo Mustonen

Type of Publication
Report

Commissioned by
Metsähallitus - Forest and Park Service

Date of Assigment / Date of the Research Contract

Title of Publication
Landscape Ecological Plan for State-Owned Forests in Valtimo

Abstract

A landscape ecological plan involves long-term planning of managed forest use towards multiple goals. It aims at harmonising the multiple uses of the forest in the best possible way. The objective is to steer forestry in such a way as to ensure the survival of viable populations of the forest species typical of the region in natural conditions. The planning must cover a minimum time-span of 50 years.

The landscape ecological planning district of Valtimo is located in eastern Finland, in the northern part of the region of North Karelia. The total area of the district is about 23,700 hectares, about 18,750 hectares of which is forest land used for commercial forestry. Most of the managed forests are less than 60 years old. The combined area of proposed old-growth forest protection sites and the Kuoppasuo drainage prohibition area amounts to some 1,300 hectares.

In connection with the planning, field inventories were carried out covering an area of 2,100 hectares, or about 11 per cent of the area of forest land belonging to the managed forests in the planning district. The natural sites were surveyed and data collected on the amount of deadwood in them. In the most important area, bracket fungi were also inventoried as a separate project.

On the basis of field inventories and other data, ecological corridors were planned that would connect the old-growth forest sites and act as routes by which the species inhabiting them could migrate. There are about 1,570 hectares of ecological corridors and "stepping stones". About 40 per cent of this area is mature forest. The ecological network also serves the other forest uses in the region.

The age distribution of the forests in the Valtimo district is such that the financial impact of the plan will be felt most strongly in the first ten-year period. At first the impact on earnings will be18 per cent, but as the planning period progresses, the possibilities for harvesting will naturally increase and the relative financial impact will diminish.

In drafting the landscape ecological plan for Valtimo, the principle of participatory planning has been applied. Two events were organised for the public and two for interest groups in the Valtimo district. In addition, a cooperation group consisting of the most important interest groups has met during the planning period. The project team wishes to thank all those who participated in the planning.

Keywords
Forest and Park Service, landscape ecolocigal planning, participatory planning, ecolocigal corridors

Other Information
Internet ISBN 952-446-186-2 (http:/www.metsa.fi/julkaisut/pdf/mta/29.pdf)

Series (Key Title and No.)	ISSN	ISBN
Forestry Publications of Metsähallitus - Forest and Park Service 29	1239-1670	952-446-185-4

Pages	Language	Price	Confidentiality
50 p. + 3 maps	English	50 FIM	Public

Distributed by	Publisher
Metsähallitus - Forest and Park Service, Forestry	Metsähallitus - Forest and Park Service

CONTENT

1 INTRODUCTION

Landscape Ecological Planning is a method developed in order to preserve natural biodiversity in managed forests, complementing the nature management carried out at stand level in accordance with forest management and other relevant guidelines. These plans will cover all coherent areas managed by Metsähallitus - the Forest and Park Service by the year 2000. The regional significance of these state-owned forests is greatest in eastern and northern Finland.

The utilisation of the state-owned forests in Valtimo has aroused conflicting expectations and exceptionally widespread interest in the 1990s. The Landscape Ecological Planning project was started at the end of 1996.

The working group appointed for the project included representatives of the Forest and Park Service's units. The project was headed by Senior Planning Officer Eija Pitkänen of the Forestry unit. Conservation Biologist Kaija Eisto represented the Natural Heritage Services of Eastern Finland and Service Manager Seppo Mustonen represented the Wild North, the recreational unit of the Forest and Park Service. Field Managers Timo Taskinen (until 1/98) and Alpo Toivanen (from 1/98 onwards) from Nurmes acted as representatives of local forestry. Environment Manager Arto Kammonen of the Eastern Finland Forestry unit was also member of the group. Hanna Soinne assessed the economic impacts of the project, and Eeva-Liisa Jorri and Ritva Niemi-Korpi compiled the map appendices.

2 OBJECTIVES OF THE PLAN

Landscape Ecological Planning involves planning of forest use towards multiple goals and aims at harmonising the multiple uses of the forest in the best possible way. The central ecological objective is to manage forestry in such a way as to ensure the survival of populations of forest-dwelling species typical of the region in its natural state. The planning covers a minimum time-span of 50 years.

In the Valtimo planning region, one of the aims was to ensure the survival and spread of possible old-growth forest species. For this purpose, the areas reserved for nature protection and other valuable habitats in the region have been linked to form an ecological network. The data have been entered in the compartment database and are shown on map 1. The ecological corridors and stepping stones also serve other forest uses.

The Landscape Ecological Plan is also a practical tool. Diverse data have been collected on the region, and they will be updated in the course of normal operations. An important local goal was to clarify the planning of management operations in the Valtimo area.

The participation of the various units of the Forest and Park Service in the planning and the cooperation with citizens and interest groups also offered an opportunity to obtain and communicate information on the utilisation of common forest lands.

3 PREPARATION OF THE PLAN

3.1 Collection of data

Before the field inventory, data were collected from the compartment database of the Forest and Park Service, forestry maps (compartment maps, thematic maps), base maps, aerial photos, soil-type maps, the threatened species database, old-growth forest protection proposals and from local residents and interest groups. The aim was to find data that would help us to choose the most practical sites for the field inventory. The same data sources have naturally been used throughout the project.

Landscape Ecological Planning concerns, by definition, managed forests. The field inventory sites were selected from the managed forestry compartments in Valtimo. In order to specify the selection criteria, a test selection was made from the compartment database. The sites selected for the biodiversity inventory in Valtimo were the following:

- mesic or more fertile mineral soil forests over 100 years old
- mesic or more fertile undrained spruce mires
- compartments which contain trees over 30 cm in diameter (excluding stands of seed-trees)
- mature birch-dominated *(Betula pendula, B. pubescens)* or mixed-species forests
- forestry status over-thick/damaged/over-aged
- mesic mineral soil forests or more fertile compartments containing aspen *(Populus tremula)*, goat willow *(Salix caprea)* and alder *(Alnus glutinosa, A. incana)*

- rare biotopes, (herb-rich forest, herb-rich heath, sand dune, bedrock outcrop)
- sites with special limitations on use
- compartments adjoining protected areas (excluding sapling stands)
- compartments and valuable habitats selected on the basis of maps and aerial photos
- compartments and valuable habitats selected on the basis of site-specific information from participatory planning

3.2 Field inventories

Field inventories were carried out in an area of approximately 2,100 hectares, which is about 11 % of the total area of the managed forests in the region. The inventories were carried out in summer 1997 by Veikko Korhonen, Eero Ovaskainen and Jussi Savolainen. Each worked for a duration of 2 to 3 months.

For the selected compartments, the existing data were first roughly checked. Biodiversity was assessed according to the Geographical Information System (GIS) fieldwork guidelines. The indicators used to evaluate biodiversity are based on a study of biodiversity assessment methods. The compartments were surveyed for valuable habitats, structural features and habitats indicating biodiversity, cultural sites, game habitats, valuable landscapes and the occurrence of various species. In addition, the amount, size and degree of decay of standing or fallen deadwood and retention trees were assessed per species.

A particularly intensive inventory was carried out for bracket fungi (Appendix 2). On the basis of the biodiversity assessment results, the compartments containing the most deadwood and other indicators of valuable habitats were selected for closer study. Susanna Anttila and Päivi Vehmaa carried out the fieldwork.

3.3 Compiling of the plan

The results of the biodiversity assessment and bracket fungi inventory were entered in the compartment database. At this stage, a test version of the MoniWin program was obtained to rank the compartments according to different biodiversity criteria. The order was determined primarily on the basis of the available environmental and deadwood data. In addition, the order by the amount of deadwood and the

occurrence of aspen, alder, rowan *(Sorbus aucuparia)* and goat willow was used in the ranking.

The MoniWin results were utilised in planning the ecological network. Local knowledge was supplemented by aerial photos, which were used, for instance, to evaluate the occurrence of broadleaves and the degree to which peatlands were in a natural state.

The focal point of the Landscape Ecological Plan was the Murtovaara area. At first, we concentrated on looking for ways to connect the five sites in the old-growth forest protection proposal to each other by ecological corridors. In addition, we chose separate sites best supporting the sustenance of biodiversity to serve as stepping stones. Through the feedback received from participatory planning and as the work progressed, the network took its current shape, in which the corridors follow the waterways in addition to the above-mentioned sites.

The valuable landscapes were chosen on the basis of field data and local residents' involvement. Valuable information on game habitats was obtained, for instance, from Hannu Heikkinen, a retired Forest Engineer of the Forest and Park Service.

The planning data were entered in the compartment database, where they have been available to the forest team even before the report was completed. In practice, the various codes in the compartment database usually refer to restrictions on use or instructions for non-standard management operations. All thematic maps are also based on the compartment-specific codes.

3.4 Participatory planning

A local cooperation group was founded to support planning, and representatives of major interest group were invited to participate. Exchange of views and information was encouraged throughout the planning process, and the cooperation proved constructive. The cooperation group met five times and provided written feedback. The group included representatives of the following organisations:

Enso Oy (now Stora Enso)
The Forest Machine and Rural Training Centre of Eastern Finland (ISMEK)
The North Karelian Association for Nature Conservation
The North Karelia Forestry Centre
The North Karelia Regional Environment Centre
The municipality of Valtimo
Natural Heritage Services and Forestry unit of the Forest and Park Service

In the course of the planning, the public had the opportunity to give feedback in both oral and written form. However, most contacts took place in meetings with the general public and interest groups. Two meetings of each kind were held. The first meetings were organised immediately at the beginning of the planning project. The second meetings took place when the ecological network was being drafted. The media were informed of the progress of the plan.

The meetings were positive experiences, but their concrete benefits are difficult to assess. At the very least, a relaxed contact was created with the local inhabitants, and information was obtained on their views and wishes. Some site-specific information was also obtained, which was of direct use to the planning project. The focus was on general discussion. The audience was male-dominated as is usual in meetings of this kind, but fortunately women were not altogether absent. Only few young people attended the meetings.

The first public meeting was held on 21 January 1997 at the Forest Machine and Rural Training Centre ISMEK and attended by 77 people. An invitation was published in the local newspapers and on the radio. Feedback was collected from oral accounts and on printed forms. The discussion was recorded in a memorandum. Central topics of discussion were the tourism and recreational opportunities, both existing and hoped for, and the municipality's employment and subsistence problems. For instance, a proposal was made that the protection of old-growth forests should be only temporary. The audience was interested in the draining of peatland and cloudberry mires, fishing, Landscape Ecological Planning in general and forest management. The lakes and streams in the region were mentioned in connection with several topics.

On the following day, 22 January 1997, a meeting was held for the interest groups. 64 written invitations had been sent to associations in various fields of life including forest organisations. In addition to our own people, 21 people came from the following organisations:

The Forest Machine and Rural Training Centre of Eastern Finland (ISMEK)
UPM-Kymmene
Valtimo Officers of the Reserve
Valtimon Vaeltajat, National Association for Recreational Sports and Outdoor Activities
The North Karelian Ornithological Society
The North Karelia Forestry Centre
4 H Club
Enso Oy
Valtimon yrittäjät, association of private businesses
Game management association
Valtimo fishing association
Sivakka village committee
Ylä-Valtimo hunting society
Ylä-Valtimo village committee
Valtimo society
Puukari farming society
Wood and Allied Workers' Union

The meeting provided a forum for general discussion of participants' wishes and the necessity of the Landscape Ecological Plan, the opportunities it offers and its possible impacts on employment. Topics discussed included the exchange of information between organisations, the management of fishing waters and game stock, and the Murtovaara farm museum located in the area.

The interest group meeting organised on 9 December 1997 was attended by fewer people than the one in January. In addition to the cooperation group, representatives of the ISMEK and village committees were present. The fieldwork and its results were reported, and the project team's proposal for an ecological network was presented. The representative of the Regional Environment Centre suggested some changes, which had already been discussed in the cooperation group. The proposal was approved as a basis for continuing the project. Among the topics discussed were the recreational opportunities in old-growth forests and ISMEK's difficulty in finding suitable sites for felling practice for their students. The Municipal Manager suggested linking the Metsäkartano area with Lake Peurajärvi by a snowmobile route.

The general public was invited to the second public meeting held on 9 December by newspaper and radio announcements. In addition, personal invitations were

sent to those whose addresses were available. The public was informed of the fieldwork, and the ecological network proposals were presented. The liveliest discussion and questions concerned the central role of deadwood in the Landscape Ecological Planning. Some new site-specific information was also obtained from the participants.

4 DESCRIPTION OF THE PLANNING REGION

4.1 General description

The state-owned forests in Valtimo, for which this Landscape Ecological Plan was drawn up, are located in the northern part of the municipality of Valtimo, on the border of the North Karelia and Kainuu regions. In the west and north, the region borders on the municipality of Sotkamo, in the southwest on the municipality of Rautavaara and in the east on the town of Nurmes.

The Valtimo municipality is decreasing in population, and networking is being promoted actively and new means of livelihood are being sought to replace lost ones. The municipality has a population of 3,200. Most of the settlement is concentrated on clay land along the rivers. The most peripheral and poorest areas have remained in state ownership.

The total area covered by the plan is approximately 23,700 hectares of state-owned land. Private lands split the region in two (see appended maps). Valtimo is part of the Ostrobothnia-Kainuu forest biotope zone. By its geobotanical location, the region belongs to the hemi-boreal coniferous zone. Its cumulative sum of effective temperature is about 1,000 degrees Celsius. (Table 1).

The forests administered by the Forest and Park Service are predominantly in commercial use. About one half of the special-use forests are reserved for protection, the rest are leased out (and were sold after this plan was completed) for peat production or used as research areas by the Finnish Forest Research Institute and the Regional Environment Centre. This plan includes no areas within the scope of municipal planning.

Table 1. Managed and special-use forests and main types (ha).

	Managed forests	Special-use forests
Forest land	18 750	1 540
Poorly productive land	1 560	490
Non-productive land	290	160
Other	260	10
Waters	650	
Total	21 510	2 200

4.2 Waterways

The Valtimo Landscape Ecological Planning region is located in the Maanselkä watershed area. The headwaters of the Vuoksi water system originate just north of the region, in the municipality of Sotkamo. The planning region belongs to the Rivers Valtimonjoki and Saramojoki water systems, which flow into Lake Pielinen.

The total area of waters in the region is 657 ha, which consists mostly of small lakes. The biggest lakes are shallow, low in nutrients and rich in humus. The lakes along roads and pathways have important landscape value. Most of the small lakes have paludified shores. Most of the streams in the area run from north to south or from northwest to southeast.

Some of the lakeside forests have been fertilised and cut and mires have been drained, even down to the shoreline, which has had a negative impact on the water quality especially in streams, rivers and lakes with paludified shores. The impacts of forestry on waters and the prevention of the impacts have been studied in the surroundings of the Murtopuro and Liuhanpuro streams in the METVE project planned by the North Karelian water and environmental board (now North Karelia Regional Environment Centre) (Saukkonen & Kenttämies 1995). The natural variation of the streams was monitored for four years, after which, in 1983 to 1987, an opening of 286 hectares was cut for the METVE project in a catchment area of about 500 hectares near the Murtopuro stream. The soil was treated by ploughing, ditching and hummocking and after this pine seedlings were planted in the area. The untreated Liuhanpuro stream area in the east was used as the reference area. Even in the earlier Nurmes plan, cuttings were not usually as extensive as this (see 4.5.1).

After clear felling, the snags and cutting waste release nutrients, which are flushed into waters in multiplied quantities. In the areas around Murtopuro which were clearcut, the phosphorus load entering the streams was four-fold. Ditching, ploughing and hummocking increased the load of suspended solids to 170-fold compared to the natural state, and in eight years from ditching the load of suspended solids was still four times the natural load (Ahtiainen & Huttunen 1995). In the METVE project, planned operations were carried out in order to find out the impacts on waters of very intensive forestry. Thus the results cannot be generalised to apply to all impacts caused by forestry work carried out in the mid-1980s.

4.3 Bedrock and topography

Hundreds of millions of years ago, the area of Finland had mountain ranges, which have been levelled down and have nearly disappeared over time. Today, only low hills remain of these mountain ranges. The western part of the region is part of a durable mica schist and quartzite zone, which is a remnant of the Karelian mountain range. Elsewhere in the region, the rock types are more heterogeneous, softer granites, migmatites and metabasites (Wilkman 1921).

The Valtimo region is part of the Maanselkä watershed area, whose landscape is marked by hills that stand out clearly from their surroundings. Most of the region is 170 to 240 metres above sea level. The highest point, 330 m above sea level, is in Marjomäki, in the quartzite zone in the western part of the region. The Murtovaara, Kivimäki and Sormusenvaara hills also rise above their surroundings to about 250 m above sea level. The Kuoppasuo mire on the eastern border of the region is the lowest area, 154 m above sea level. Cliffs are also significant features in the visual landscape; for instance on the western slopes of the Jysmänvaara and Kansikkovaara hills, the cliffs rise 40 metres over a distance of 100 metres.

Ukonkuivuuvaara has the largest bedrock outcrop in the region, and the tops of many hills are also bare rock or only covered by a thin layer of soil. During the ice age, the continental ice sheet ground up the bedrock, shifting and piling up loose rocks and stones. The area between Kivimäki and Lake Koivujärvi is a good example of this phenomenon, with large quantities of loose rocks and even unbroken fields of boulders. The soil is sandy in the eastern part of the region by the Mäntyjoki river, but there are no actual eskers (sand ridges) in the region. Half of the region is mineral soil, 46 % peatland, less than 3 % water and 1 % roads.

During the Ice Age, the ice sheet abraded the bedrock and piled up loose rocks and boulders.

Outokumpu Mining Oy is interested in the bedrock minerals in the region, and the company has staked a 46 hectare claim on Ukonkuivuuvaara. The company is expecting to find nickel in the area.

4.4 Nature protection

Nature protection areas have been set up on a total area of 26,000 hectares of state-owned lands in North Karelia. In addition, some 15,000 hectares of state-owned land belong to diverse national conservation programmes, which still have to be brought into effect. So far there are no statutory protection areas in the Valtimo region.

In the Valtimo region, as elsewhere in eastern Finland, slash-and-burn cultivation of forests was common from the 17th to the 19th century. After the slash-and-burn cultivation period, the impacts of human interference have been minor in places. The sites with the greatest ecological value in the region are in the old-

growth forests. Seven of the most valuable old-growth forest sites were proposed as statutory protection sites by the old-growth forest protection working group in 1992. The total area of these is 1,133 hectares (Table 2), which makes up 13 % of the total old-growth forest protection area in state forests in North Karelia. The nature protection programme for old-growth forests will also restrict forest operations in some locations, e.g. the Petäjävaara and Kansikkovaara areas, but due to their small size, these were not proposed for statutory protection. There are no areas belonging to other nature conservation programmes in the state-owned lands in Valtimo.

Table 2. Land areas of the old-growth forest protection proposal and Kuoppasuo drainage prohibition area in hectares.

	Forest land	**Poorly productive land**	**Non-productive land**	**Total**
Kivimäki	97	11	0	108
Marjomäki	96	14	2	112
Murtovaara forest	105	12	0	117
Nikara forest	169	12	0	181
Piilopirtinaho forest	364	36	42	442
Sormusenvaara	55	0	0	55
Ukonkuivuuvaara	113	0	5	118
Kuoppasuo mire	16	60	87	163
Total	1,015	145	136	1,296

The locations proposed as old-growth forest protection areas are clearly discernible from the surrounding forest by the age and structure of their tree stock. There are extensive sapling stands, especially in the western part of the region, where the difference between the managed forest and the proposed Piilopirtinaho and Marjomäki protection areas is particularly clear. These forests are predominantly over 120 years old, mesic or moderately dry spruce- or pine-dominated forests. The oldest forests in the region, 160 to 200 years of age, are in the Nikara and Piilopirtinaho area. The areas included in the protection proposals dominated by broadleaves are young forests of under 40 years of age. The proportion of broadleaves is small, 30 % of the growing stock at most.

Piilopirtinaho is an old spruce-dominated forest, for the most part growing on moderately dry mineral soil, with standing dead pines and fallen old spruces. Aspen and goat willow grow throughout the western part of the area. The eastern part is the untouched reference area of the METVE-project (see 4.2). In this area, old-growth mineral soil forests with abundant deadwood alternate with spruce mires and virgin pine bogs. The Liuhanpuro and Murtopuro streams, both in their natural state, flow through the area. Marjomäki, which is located at the highest point of the planning region, is a rocky mesic forest area with a hilltop spruce stand with some snow-bent birches among them. The proportion of broadleaves is 30 % at its most and goat willows are very abundant in places. Bird species favouring old-growth forests nest in the area, among them the Siberian jay *(Perisoreus infaustus)* and the three-toed woodpecker *(Picoides tridactylus)*.

The forests on Ukonkuivuuvaara are mostly nutrient-poor pine-dominated moderately dry forests with occasional moist depressions containing deadwood. The most fertile mesic spruce forests grow in the Murtovaara, Nikara and Sormusenvaara areas. In these areas, a few flying squirrel *(Pteromys volans)* territories have been found, and rare bird species include the greenish warbler *(Phylloscopus trochiloides)* and the red-breasted flycatcher *(Ficedula parva)*.

The Kuoppasuo mire is a typical nutrient-poor aapa mire. The mire is important because it is in a natural state, whereas 92 % of the peatlands in Valtimo and elsewhere in Upper Karelia have been drained. Even here, a few ditches have been dug on the edges of the mire. Kuoppasuo, the largest mire in natural state, was already set up as a drainage prohibition area by a decision of the Forest and Park Service in the 1970s. According to Heikkilä (1994), Kuoppasuo is one of the valuable unprotected peatlands in Finland. The peatlands in the region are mostly nutrient-poor mires. Some small undrained and even nutrient-rich mires remain outside the protection areas. These are valuable habitats that add value to the biodiversity of managed forestlands.

Statutory protection areas and the Kuoppasuo drainage prohibition area are also included in the Natura 2000 proposal. The area of these sites constitutes about 6 % of the Landscape Ecological Planning area. The Natura restrictions also cover some water areas and an area controlled by the ISMEK training centre, which are not within the planning area. The total of areas in Valtimo coming within the Natura proposal is 1,467 hectares. The planning region borders on the Hiidenportti National Park in the municipality of Sotkamo.

The North Karelian Association for Nature Conservation has proposed a total area of 2,864 ha of state-owned forests in Valtimo for protection within the Natura programme (Laitinen et al. 1998), which is almost twice the area suggested in the official Natura proposal. The largest suggested expansion (980 ha) is in the Murtovaara-Ukonkuivuuvaara area, which forms the largest and most significant coherent forest biotope area in Upper Karelia. According to the association, there are extremely valuable old-growth forest areas, which are not included in the official Natura proposal. They also propose the Syvälammit-Petäjäsuo, Simanaistenlehto and Petäjävaara areas for statutory nature protection. The association's proposals have been taken into account, along with the opinions of other interest groups when drawing up the landscape ecological network.

4.5 Commercial forestry

4.5.1 History

The forests administered by the Forest and Park Service in Valtimo have been subject to felling from the beginning of the 20th century, but the cuttings increased considerably in the 1940s with the fellings in the Palmikki and Sivakka areas because of war indemnities to the Soviet Union. Some of the stands were sold standing, whereby the buyer cut the thickest trunks in dimension cutting. The fellings carried out by the Forest and Park Service were mostly clearcuts. The clearcut mineral soils were usually burnt, manually scarified and seeded with pine. Later on, scarifying was carried out by machine. The clearcut peatlands were ditched by manual labour. Ditching ploughs were employed in the 1960s, and excavators in the 1970s. In spruce mires, broadcast sowing of spruce was used. Pine bogs were left to regenerate naturally.

In the forests of the region, the impact of the Nurmes plan started in 1967 is clearly visible. The Nurmes plan was a programme for efficient forestry implemented in the Nurmes, Valtimo and Rautavaara forestry areas. Its aim was, among other things, to "study, by means of a comprehensive experiment, whether it is possible, under the local conditions, to achieve an economically viable and sustainable wood yield using an average cycle of 80 years and all the available growth-enhancing methods" (Metsähallitus 1977). In this experiment in aggressive forest management and utilisation, the key operations included clearcutting, intense soil preparation, forest cultivation, ditching and fertilisation.

Parts of the planning area remain excluded from forestry operations.

Extensive clearcutting and rapid regeneration of old-growth forests formed an essential part of the Nurmes plan. The maximum size of a clearing was usually 50 ha. The aim was that all the forests in the area older than 100 years in 1966 would be regenerated by 1991. The most extensive single clearing was carried out in Palmikki in 1982 and 1983, when an area of 286 hectares was cut for research purposes at the request of the regional water board (predecessor of the Regional Environment Centre).

After felling, the areas were cleared mechanically, if necessary also chemically. At that time, even quite sturdy aspens were killed standing by the use of pesticides. The mineral soils were ploughed and either seeded or planted. Pine was favoured even in mesic mineral soil forests. Spruce was planted in the highest areas. Only in the late 1980s was the forest harrow employed along with the method of leaving seed-trees standing for natural regeneration. In the early years of the Nurmes plan, broadcast sowing of spruce was carried out in spruce mires. In the 1970s, hummocking became the preferred technique. The hummocked areas were mostly planted with pine. Some of the spruce mires were left to regenerate on their own. Two generations of trees often grew in pine bogs, so that felling often consisted of cutting hold-overs.

Ditching was efficient. The aim was to improve the growth conditions of forest land and to turn drainable poorly productive and non-productive lands into forest land by the year 1990. Mires were considered drainable if wood production could be made profitable by means of efficient measures, such as fertilisation. By this definition, almost all mires were drainable. The mires were first ditched by ploughs and with the help of excavators from the 1970s onwards. In addition, open mires were furrowed to ease artificial regeneration and to secure its success. Cultivation took place either by planting saplings or by seeding. Ditch cleaning and improvement ditching started in the 1970s. No first-time ditching has been started since 1994.

The aim of sapling care was to obtain clean, open coniferous sapling stands. The sparse planting of trees was based on the wish to achieve faster diameter growth of the stock. The intense soil preparation helped forest cultivation, but it also increased the need to weed the sapling stands. Mechanical treatment alone was not always sufficient, so that chemical and chemi-mechanical methods were also used. The sapling stands taken over by young aspens were treated by spraying chemicals from the air or backpack pressure sprayers. The technique of smearing stems was also used to some extent. In chemi-mechanical sapling treatment, the stumps of broadleaves were separately smeared with pesticides. Later on, brush cutters were furnished with separate equipment applying the liquid. The use of pesticides was discontinued in the 1980s.

Fertilisation was a basic means of increasing productivity in the Nurmes plan. It was used to ensure the opportunities for future felling as the volume of regeneration cutting was expected to decrease in the 1990s. In mineral soils, fertilisation was started only a couple of years after the last sapling treatment. It was repeated every 5 to 7 years. In peatlands, fertilisation was started 2 to 5 years after ditching, with intervals of 10 to 15 years. When open mires were cultivated, spot fertilisation was used. The fertilisation at the sapling stage and the low number of stems caused the trees to grow knotty and thick-butted, and this practice has later been discontinued. Special-use forest airfields were built for the aircraft carrying out fertilisation.

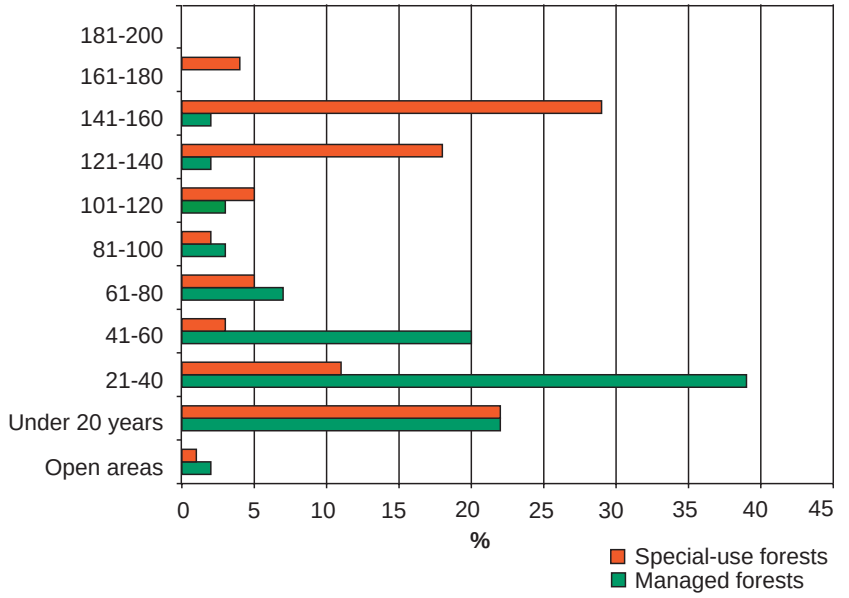
The implementation of the Nurmes plan came to an end in the late 1980s, as the project was found to be unprofitable and environmentally damaging.

4.5.2 Importance of forestry in the region today

Commercial forestry is and will remain the most important use of the forests in the region. Due to the variety and value of the cut, it is also profitable. Forestry is an important employer in the region. The employment effect of forestry has decreased as cutting has become mechanised, but manual labour is still essential in the management of young forests. The forests administered by the Forest and Park Service are also important practical training grounds for the Forest Machine and Rural Training Centre operating in Valtimo.

4.5.3 The forests today

The history of forest management is visible in the growing stock of the region today. The large proportion of young forests bears witness to the war indemnity fellings and the implementation of the Nurmes plan with its regeneration cuts and ditching. (Graph 1, Table 3). The average volume of growing stock in these managed forests is slightly below the average on state-owned land in North Karelia.



Graph 1. Age of the forest stand.

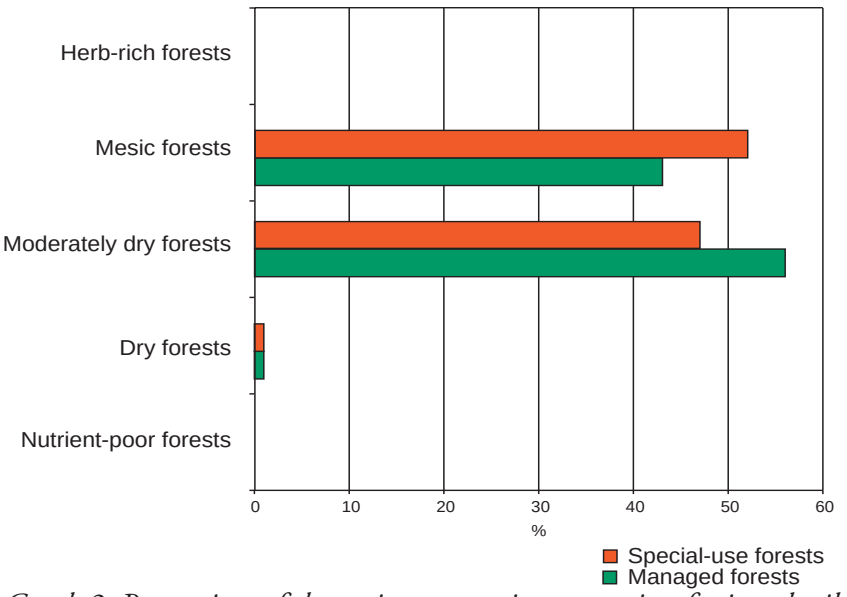
The proportion of old-growth forests in the managed forests is minor. A significant part of the old-growth forests is now included in the ecological network or within some other use restriction. Regeneration felling will decrease and intermediate felling increase in the near future.

Some of the special-use forests are areas proposed for protection. Half of the poorly productive lands in special-use forests are peat production sites. These were first leased and then sold to a peat production company Vapo Oy after this plan was completed. Due to the impact of draining the mires, some of the non-productive land has changed into poorly productive land and some of the poorly productive land into forest land.

Table 3. Area and growing stock by land use and main category.

	Area, ha	**Growing stock, m^3**	**Growing stock, m^3/ha**
Managed forests			
- forest land	18,750	1,358,000	73
- poorly productive land	1,560	27,000	17
- non-productive land	290		
Special-use forests			
- forest land	1,540	205,000	134
- poorly productive land	490	3,700	8
- non-productive land	160		
Total			
- forest land	20,290	1,563,000	77
- poorly productive land	2,050	30,700	15
- non-productive land	450		

A large portion of the managed forests are pine *(Pinus sylvestris)* stands. A stand is defined as mixed forest if the proportion of the dominant tree species is less than 80 % of the total volume. The predominance of pine is due to the large proportion of pine bogs and to the fact that pine has been favoured in regeneration. In the Ostrobothnia-Kainuu forest vegetation zone, pine has often been held to be more suitable than spruce *(Picea abies)* for regeneration, even in mesic forests. (Graph 2). Most of the birch stands have evolved naturally from downy birches in spruce mires. (Table 4).



Graph 2. Proportions of the various vegetation categories of mineral soils in the forest land.

Most of the open bogs drained in the past are now classified as pine bogs. In all, approximately 86 % of the peatlands in the region have been drained. Improvement ditching is considered feasible in 87 % of the ditching areas. (Table 5).

In the managed forests, 3,440 ha of the area are spruce mires, and only 260 ha of these have not been drained. The tree stand in these is mostly growing mixed forest. The average stock volume is 73 m^3/ha. Pine bogs cover 4,420 ha of the managed forests, and 90 ha of these remain undrained. Most of the stock in these is growing pine stands, with an average stock volume of 71 m^3/ha.

Table 4. Dominant tree species in managed and special-use forests.

	Managed forests, %	**Special-use forests, %**
Pine	49	31
Pine-mixed	23	14
Spruce	7	22
Spruce-mixed	11	30
Birch	4	2
Birch-mixed	5	1
Other	1	
Total	100	100

Table 5. Drained and undrained mires.

	Area, ha	Undrained, %	Drained, %
Spruce mires	3,880	11	89
Pine bogs	6,730	12	88
Open bogs	310	93	7
Total	10,920		

4.6 Natural dynamics of forests

The Swedish ASIO model has been applied to classify the frequency of fires in mineral-soil forests. The data were collected from the compartment database:

A (never) herb-rich forests
paludified and wet herb-rich mineral soil forests

S (seldom) other herb-rich mineral soil forests
mesic mineral soil forests with very fine sand, silt and clay soil
paludified and wet areas in mesic forests with other soil types

I (sometimes)
other mesic mineral soil forests
all moderately dry mineral soil forests
dry mineral soil forests with moraine, very fine sand and clay soils

O (often) dry mineral soil forests with gravel, sand and fine sand soils
all nutrient-poor mineral soil forests

This experimental classification showed that 97.4 % of the mineral soils in the area are in class I, i.e. they can be expected to have burned sometimes. Land types that burn seldom accounted for 2.2 % of the area and areas that burn often for 0.4 % of the area. The classification was used to assess the theoretical annual area likely to burn. The result was 108 ha/a. The classification has not been utilised for other purposes in the plan.

The present forest stands are considerably more uniform than they would be if regenerated naturally through fire. Unevenly burned trees of various sizes and unburned islets tend to remain in fire-affected areas. After the fire, birch grows first and later gives way to mixed forest.

On the other hand, the usual rhythm of forest management corresponds to the ASIO model. Because the forest has regenerated in an average cycle of 110 years, there have theoretically not been large old-growth forests in mineral soil areas.

5 SUB-SECTIONS OF THE PLAN

5.1 Important sites for biodiversity

5.1.1 Valuable habitats

Nature protection areas form the core areas of nature protection, and they are supplemented by sites outside protection areas, which are defined as valuable habitats. Data on the valuable habitats were obtained from the landscape ecological field inventory (Table 6) and from earlier inventories (Hottola 1996, Laitinen et al. 1998, Lindgren 1997, Pohjois-Karjalan ympäristökeskus 1997). The ecological network has been designed in such a way that most of the valuable habitats are located within the network. However, it is not expedient to include the remotely located valuable habitats scattered here and there in the network, but these will be considered in forestry planning.

Sites defined as habitats of particular significance as referred to in the Forest Act were found to constitute 89 ha of the planning region, or just 0.4 % of the total area. However, the actual area of statutory sites is probably larger. The fieldwork covered only a portion of the planning region, and the data will be completed in the course of operational planning. The Environmental Guidelines to Practical Forest Management (Forest and Park Service 1997) and the Forest and Water Acts require that valuable habitats, even those outside the landscape ecological network, should be protected.

In the inventory of valuable minor water bodies, nine valuable habitats were found in the Valtimo state-owned forests (Pohjois-Karjalan ympäristökeskus 1997). One of North Karelia's most valuable minor water bodies, including Lakes Särkilampi, Salmijärvi, Koivujärvi and Murtojärvi and the connecting rivers and streams, is located in the planning region.

Table 6. Number and area of valuable habitats in managed forests in the region.

	Compartments, no	Area, ha			
		Forest land	Poorly productive land	Non-productive land	Total
Spring	4	7.1	12.2		19.3
Stream	40	77.5		2.6	80.1
Small lakes	6	0.5	2.8	6.4	9.7
Rock	3		3.2	0.3	3.5
Cliff, shady slope	2		7.1		7.1
Fertile mire	1	2.0			2.0
Nutrient-poor mire	9		5.4	13.7	19.1
Old-growth forest	4	11.7			11.7
Young succession stage	4	8.0			8.0
Natural monument	3	15.6			15.6
Other valuable habitat	1		0.7		0.7
Total		122.4	31.4	23.0	176.7

Felling, drainage and water quality in the surrounding forest have had an impact on the minor water bodies. The state of many minor water bodies, for instance, the Kuoppapuro stream and Lake Matalajärvi, was slightly altered (grades 3 and 3-4), while others, such as Lakes Salmijärvi and Murtojärvi, were found to be very nearly in their natural state (Grade 4). According to the classification of the North Karelia Regional Environment Centre (1997), a water area can be said to be very nearly in a natural state when its shores are entirely and its catchment area almost entirely mature, uncut and undrained forest or mire. The valuable minor water bodies are included in the ecological network. The ecological network contains at least the inventoried minor water body itself and the adjoining shore compartment.

Only eight per cent of the peatlands in the managed forests in the area remain undrained, which means that all virgin mires can be considered valuable habitats. By decision of the Forest and Park Service, virgin mires are no longer drained, which means that they will remain in their current state, even though they are not all included in the landscape ecological network. Fertile mires also deserve attention, even if drained. The data on mires in table 6 are deficient, as field data were mostly collected from forested compartments (see 3.1). The data will be

supplemented when nutrient-poor and fertile mires are coded as valuable habitats at the same time as the compartment database is updated.

Along the streams and on lakeshores, there are small alluvial herb-grass spruce mires and cloudberry *(Rubus chamaemorus)* and horsetail *(Equisetum sylvaticum)* spruce mires. The most fertile mires in the region, mesotrophic and eutrophic pine fens, are located in Ruostekorpi and along the Kolkonjoki river. The vegetation of these mires includes melancholy thistle *(Cirsium helenioides)*, lesser clubmoss *(Selaginella selaginoides)*, juniper, cotton deergrass *(Trichophorum alpinum)*, dioecious sedge *(Carex dioica)* and purple moor-grass *(Molinia caerulea)*. The bedrock in the area contains alkaline minerals, which makes the mires fertile. The only biotope in the region protected under the Nature Conservation Act is a 2-hectare common alder type spruce mire in the Palmikki area. The area has been drained, and is not currently in a natural state as required in the Act.

One objective of Landscape Ecological Planning is to restore valuable habitats to the state they were in before silvicultural management. In the field inventory, most of the valuable habitats (58 %) were assessed as being in an almost natural state, and no measures are proposed for them (Table 7). One fourth of the valuable habitats are not in a natural state, but they are expected to return to this state without active management.

Most often restoration means that we try to return the natural state of drained peatlands. As a rule, the ditches in drained peatlands now assessed as undrainable are no longer cleared; their banks are allowed to collapse and to grow over. In the managed forest area, these mires account for 1,148 hectares, or 12 % of the drained mires. Also, all drained mires within the ecological corridors are left uncleared (737 ha); 28 % of these have been found to be undrainable. In the plan, these areas have been assigned no management or valuable habitat codes. Areas to be actively restored to their natural state are the mires surrounding the Kuoppasuo drainage prohibition area, and the common alder-spruce mire in Palmikki, a total of 7.4 hectares. In these areas, the ditches are refilled mechanically. By decision of the Forest and Park Service, all drained mires in nature conservation areas are to be restored to their natural state, which means a restoration task of about 20 hectares in Valtimo's Natura proposal areas, e.g. at the old-growth forest protection sites of Ukonkuivuuvaara and Sormusenvaara.

Table 7. The need for management of valuable habitats in managed forests in the region.

	Required operations; area, ha				
	No management required	**Natural state restored without management**	**Requires restoration**	**Un-defined**	**Total**
Spring	3.8	15.5			19.3
Stream	56.8	15.3		8.0	80.1
Small lakes	9.2	0.5			9.7
Rock	3.4				3.4
Cliff, shady slope	4.8			2.4	7.2
Fertile mire			2.0		2.0
Nutrient-poor mire	5.2	8.5	5.4		19.1
Old-growth forest				11.7	11.7
Young succession stage	5.8	2.2			8.0
Natural monument	10.6			4.9	15.6
Other valuable habitat	0.7				0.7
Total	100.2	42.0	7.4	27.0	176.7

5.1.2 Occurrences of threatened species

In autumn 1997, an inventory was made of the bracket fungi in the managed forest compartments in the region. The inventory focused on the central Murtovaara-Ukonkuivuuvaara area, mostly on compartments between the proposed old-growth forest protection sites. Selection criteria for the compartments included the amount of standing and fallen deadwood, abundance of broadleaves and the development class of the stock. In the inventory, 17 nationally and 4 regionally threatened species of bracket fungi were found (Appendix 2). In addition, 16 old-growth forest indicator species were found in the managed forests in the region (Kotiranta & Niemelä 1996), some of which are at the same time indicators in the GIS fieldwork guidelines (Forest and Park Service 1997). In a few sites in the region, bracket fungi had been inventoried previously (Lindgren 1997). Penttilä (1996) has found 18 nationally threatened bracket fungi species in the Hiidenportti National Park and Porkkasalo areas bordering on the planning region, although in this case the period of inventory was considerably shorter.

The planning region includes a few flying squirrel territories, some of them in the proposed old-growth forest protection sites, some in the managed forest compartments. In bird-life inventories, the merlin *(Falco columbarius)* and the red-breasted flycatcher, which are among the nationally threatened species, have been found in the area, along with several territories of the regionally threatened Siberian jay (Hottola 1996). All in all, the bird population indicative of old-growth forests is diverse. Specific inventories have not been carried out for other groups of organisms.

Table 8. Number of habitats of valuable species.

	Habitats of valuable species, no	Managed forest compartments no	ha
Species requiring special protection	5	5	45.2
Nationally threatened species	99	47	263.5
Regionally threatened species	64	11	36.9
Other important species	4	2	4.6
Total	172	65	350.2

In the most valuable compartments, several species classified as threatened co-exist. In 65 forestry compartments in the region, there were a total of 172 occurrences of species requiring special protection, nationally or regionally threatened species or other important species (Table 8). Other important occurrences refer, for instance, to the nesting trees of birds of prey that are not threatened. The ecological network was designed to connect most habitats of threatened species by means of the ecological corridor. If there are several occurrences of one species within one compartment or several adjacent compartments, these were called stepping stones. Individual occurrences of threatened species remaining outside the ecological network will be taken into account in operational planning.

5.1.3 Enhancement of biodiversity

It was not considered practical to name actual sites for the enhancement of biodiversity in this plan. The region has broadleaves growing in young managed forests as the primary and secondary tree species. Purely coniferous stands are not typical of the area. Burned wood is expected to be obtained from prescribed burning. However, the code reserved for sites where biodiversity is to be enhanced

has been used exceptionally for those drained mires outside the ecological network which are left to return to their natural state on their own.

5.1.4 Ecological network

The proposed old-growth forest protection areas form the cores of the ecological network. However, no data were collected on these sites, as the fieldwork focused primarily on the managed forests in the region. Two main principles were followed in the design of the ecological network: to include firstly the currently most valuable habitats and secondly those ecological entities that will in time develop to serve the conservation of biodiversity.

The field inventories provided information on the priorities of the assessed forest compartments in terms of biodiversity. In the Valtimo context, the most valuable compartments are those with the greatest number of structural features and/or occurrences of species typical of old-growth forests. In the compartment database, these sites are considered of equal value to valuable habitas and are then proposed as ecological corridors. Other proposals for ecological corridors are young waterside forest stands, whose ecological value will increase as the planning period progresses. So far, it is not known how well the corridors consisting of sapling stands and young forests will promote the spread of threatened species. The corridors consist mostly of entire forestry compartments, virgin mires and drained mires in which the ditches are no longer cleared (see 5.1.1). For this reason the width of the corridors varies a great deal (30–500 m).

Table 9. Ecological corridors by vegetation category.

	Area, ha				Proportion, % of	
	Forest land	**Poorly productive land**	**Non-productive land**	**Total**	**Forest land in managed forests**	**Total area of managed forests**
Herb-rich	17			17	0.1	0.1
Mesic	454.2	0.7		454.9	2.4	2.1
Moderately dry	339.6		3	342.6	1.8	1.6
Dry	284.7	356.1	115	755.8	4.0	3.5
Total	1,095.5	356.8	118	1,570.3	8.3	7.3

A total area of 1,665 ha has been classified as ecological corridors or biodiversity enhancement areas in the region; of this, 1,104 ha (66 %) is forest land, 427 poorly productive land and the rest non-productive land. 40 % of the forest land in the corridors is mature for regeneration felling. Compartments with predominance of broadleaves were favoured in the planning of waterside corridors. The total area of the ecological network, consisting of the proposed protection areas, Kuoppasuo drainage prohibition area, ecological corridors and individual valuable habitats is 3,086 hectares, which is approximately 13 % of the planning region (Table 10).

Table 10. Ecological network by vegetation category.

	Protected area, ha	**Important sites for biodiversity in managed forests, ha**				
		Forest land	**Poorly productive land**	**Non-productive land**	**Total in managed forests**	**Total**
Herb-rich		22.5			22.5	22
Mesic	491.3	530.3	0.7		531.0	1,022
Moderately dry	434.1	350.0		3.0	353.0	787
Dry	373.5	304.9	436.1	140.2	881.2	1,255
Total	1,298.9	1,207.7	436.8	143.2	1,787.7	3,086

The ecological network includes protected areas in the region and valuable habitats, occurrences of species requiring special protection, ecological corridors and biodiversity enhancement areas in the managed forests.

The ecological networks in the two parts of the planning region have not been connected since there is intervening private land. Five proposed old-growth forest protection areas: Nikara, Ukonkuivuuvaara, Kivimäki, Murtovaara and Sormusenvaara, and the Syvälammit old-growth forest area, are connected by a continuous ecological corridor. The Marjomäki and Piilopirtinaho forests, separated from these, are interconnected by a corridor following the Palmikkijoki river.

In areas bordering on state-owned lands, the ecological corridors reach municipal boundaries at several points and continue as part of the landscape ecological networks of the Nurmes and Sotkamo municipalities. In this way, a connection is created to the core areas of these neighbouring regions, e.g. the Hiidenportti and Tiilikka National Parks and the Peurajärvi recreational fishing area.

The stepping stones included in the ecological network are predominantly old-growth forest compartments, which complement the ecological corridors or protected cores. For instance, there are four stepping stones north of the proposed Nikara protection area; the northernmost of these is the old Simanaistenlehto area. In the course of the inventories, valuable species were found in these sites.

The corridors in the managed forests do not preclude recreational use. On the contrary, it is expected that the ecological corridors and valuable habitats within them will promote recreation in the area.

5.2 Forest management operations

5.2.1 Forest management operations in the valuable habitats

Valuable habitats have been marked in the compartment database by codes for restricted utilisation. The operations in these areas will follow guidelines provided by the Forest and Park Service, published in various guidebooks (Environmental Guidelines to Practical Forest Management, forest management guidelines and the landscape ecological planning manual). Usually, key biotopes are completely excluded from operations. Valuable landscapes are managed on their own terms, using participatory planning. Forest operations in game habitats take into account the special needs of the game species concerned.

The ecological corridors include a variety of sites in the Valtimo region. Poorly productive and non-productive land is left untouched. Young sapling stands and thinning sites are treated normally, in keeping with the Environmental Guidelines to Practical Forest Management and as the need for management arises. Broadleaves are favoured in sapling management and thinnings. This will result in the growth of sturdy broadleaves, which are scarce at the beginning of the planning period. Here and there dense stands of these trees will be allowed to develop in their natural state.

The management operations carried out in the ecological corridors where stands are mature for regeneration will depend on the dominant tree species. Spruce-dominated stands will not be cut at all, and in pine-dominated areas, an over-extended cycle will be applied (150 to 170 years). According to the principles of Landscape Ecological Planning, regeneration cutting may not take place simultaneously on both sides of an ecological corridor.

5.2.2 Proportion of old-growth forests

The definition for old-growth forest is a forest which is 20 years past the normal regeneration felling age, i.e. over 120 years of age. The proportion of these forests is currently about 8 % of the managed and special-use forest area. Some of the compartments are in normal commercial use, which means that in another 50 years, the old-growth forests will consist mainly of the older parts of the protection areas and ecological corridors. At that time, they will constitute 6 to 7 % of the forest land. In the meantime, the percentage will temporarily be lower.

In the regeneration felling sites in managed forests, individual hectares of forest will be left uncut around valuable habitats. A variety of restrictions apply to old-growth forests. The preservation of the current 8 % of old-growth forests in the planning region will be a challenging, but rather realistic target on a 50-year time span. In Valtimo, this target can be achieved by postponing the regeneration felling of stands regardless of dominant tree species.

The current stands of over 120 years of age are almost exclusively coniferous. In the old-growth areas of the managed forests, the proportion of broadleaves is less than 6 % of the total volume.

Target: The 8 % proportion of old-growth forests will be preserved in the planning period. In 10 years' time, however the proportion wil be just 6 %.

5.2.3 Proportions of various tree species

The proportion of stands dominated by broadleaves in the forest land of the managed forests is now 9 % of the area. This includes all-birch stands and mixed stands where the proportion of birches or other broadleaves is over one half. The proportion accounted for by broadleaves in the stock volume is higher, currently 13 %, counting all ages.

When the existing forest management guidelines are followed, the proportion of forests dominated by broadleaves will gradually increase in the managed forests. The aim is to increase the area dominated by broadleaves to about 10 % of forest land in 50 years. This figure presupposes an increase of birch at a rate of 5 hectares a year.

Broadleaves are also present in young forests and coniferous sapling stands in the region. The predominant species are birch, aspen and grey alder. These will have to be favoured in future operations in order to preserve and enhance biodiversity. In current research, new beneficial functions of broadleaves are being discovered in terms of forestry and the forest ecology: they have a positive impact on threatened species, forest litter, climatic change and the carbon cycle in the mycorrhiza. The target for the 50-year period is to increase the stock of broadleaves to 15 % of the total volume of managed forests in the region; according to calculations, this would appear to be more difficult than increasing their proportion in terms of area.

Target: In managed forests, to reach a 10 % proportion of broadleaves of the area and a 15 % proportion of the total stock volume in 50 years.

5.2.4 Proportion of deadwood

In the inventoried compartments, the average volume of deadwood is 10 m^3/ha, of which 7 m^3/ha are fallen trees. In two thirds of the area inventoried, the volume was less than 10 m^3/ha. It is striking that slightly decayed wood is almost absent from the inventoried sites (0.6 m^3/ha). Semi-decayed and completely decayed wood was more common (5.2 and 4.5 m^3/ha). The data on decaying wood have been utilised in the planning of ecological corridors.

It is easy to suggest measures to ensure the existence of deadwood: the forest is managed in accordance with the Environmental Guidelines to Practical Forest Management and current forest management guidelines. Tree patches or stands should be retained on site, and small numbers of wind-fallen trees should be retained on the ground. The general aim is an average leave volume of 5 m^3/ha at regeneration felling sites. Patches containing abundant deadwood should be favoured. Even though the aim is to save some of all the tree species in the area, it is especially important to leave some sturdy broadleaves standing. Visual landscape values shall be taken into account when selecting the trees. Suitable trees are also retained in intermediate cuts.

5.2.5 Proportion of burnt wood

No separate inventory has been made to assess the volume of burnt wood. Prescribed burning has not been carried out in the area since 1975, and there have been no significant forest fires, so the volume of burnt wood is small.

The theoretical annual burned area in natural forest in the region, according to the ASIO model, has been 108 hectares. This has meant a larger proportion than at present of burnt wood and birch stands arising naturally after fires. The low proportion of broadleaves also in the areas proposed for protection could be increased by prescribed burning.

The goal is to burn one regeneration felling site with retention trees at 10 km intervals in the region every 2 to 3 years. Since the region borders on at least three other planning regions, it would be wise to extend this policy to a larger geographical area. The size of the burned-over area is decided individually in each case. In practice, the economically feasible minimum is probably 5 to 10 hectares.

5.2.6 Maintenance of drained areas

Most of the first-time ditching was carried out during the implementation of the Nurmes plan. 92 % of mires in the managed forests in the area have been drained. No new ditching has been started since 1994.

An important natural value in the drained mires is the large proportion of broadleaves. In spruce mires in the managed forests, birch stands account for about 15 % of the area and mixed stands for 19 %. In addition, broadleaves succeed as secondary species in forests dominated by conifers. Other than this, the ecological values of the drained mires are minor, as the areas are mostly young managed stands.

Ditch cleaning and improvement ditching is carried out in the old ditching areas of the managed forests, if the location fulfils the requirements for managed forests. Water protection is taken into account as prescribed in the Environmental Guidelines to Practical Forest Management.

The ecological corridors contain approximately 740 hectares of drained mires, which are left to return to their natural state. In addition, 95 hectares of mires have been selected from outside the corridors to be excluded from ditch cleaning and improvement ditching. The restoration of the most valuable habitats can be accelerated by felling and by refilling ditches.

5.2.7 Road network

The significance of forest roads has increased, as the forest industry today needs fresh wood throughout the year. The heavier transport vehicles also place higher demands on forest roads. The forest road network built for wood procurement also makes hunting, fishing, picking of mushrooms and berries and other forest uses more accessible.

The region has about 200 km of forest roads accessible around the year, which equals about 1 km per 100 hectares. There is not much need for new roads. However, roads are still needed in areas where wood was in the past forwarded to the roadside in winter only, and where the first thinnings are about to take place. Before planning a new forest road, the usability of the winter road is assessed. The winter road remains a practical choice in harvesting mires and in areas with high landscape or protection value. The road-building operations in the future will mainly consist of repairing old roads. The public roads in the area also serve commercial forestry purposes.

The building of a forest road may have negative impacts on the landscape, water system, game and the ecological values of an area. The roads are planned and built carefully in order to minimise environmental damage. The routing follows the formation of the terrain. Major embankments and cuttings crossing valuable landscapes are avoided. An effort is also made to avoid crossing ecological corridors and streams.

5.3 Recreational use and natural economies

5.3.1 Recreation

The areas administered by the Forest and Park Service are accessible for recreation in accordance with the public right of access. The Forest and Park Service does not provide special recreational services or facilities in the area, as these are concentrated in the adjacent Peurajärvi area in the municipality of Nurmes. The Forest and Park Service does not intend to build snow-mobile routes in the area. Possible routes constructed and maintained by municipalities or companies are agreed on an individual basis. A privately maintained recreational route already exists in the region and is allowed for in all activities.

5.3.2 Game management

Game management on state-owned lands administered by the Forest and Park Service is based for the most part on forestry practices that take into consideration the game populations in the region. The game habitats are inventoried and updated in the geographical information system, where they are available for forest management planning (Table 11).

The game habitats are managed in accordance with the Environmental Guidelines to Practical Forest Management. Lekking sites are managed in such a way that mating rituals can continue in them undisturbed. Clearing of undergrowth or thinning may be necessary at some leks to keep them attractive to capercaillie *(Tetrao urogallus)*. Good waterside habitats for the hazel grouse *(Bonasa bonasia)* and the black grouse *(Tetrao tetrix)* will evolve naturally in the ecological corridors.

Table 11. Number of game habitats in the managed forests in the region.

	Area, ha			
	Forest land	**Poorly productive land**	**Non-productive land**	**Total**
Capercaillie lek, in use	837.1	66.5	10.6	914.2
Capercaillie lek, confirmation required	116.3	1.3		117.6
Black grouse lek		10.6	8.5	19.1
Game habitat	33.9			33.9
Hazel grouse habitat	14.3			14.3
Waterfowl lake	3.6			3.6
Elk *(Alces alces)* wintering area	52.0			52.0
Beaver *(Castor canadensis)* habitat	32.3	0.7	2.4	35.4
Other game habitat	23.8			23.8
Feeding site	23.6	1.5		25.1
Other feeding site	1.3			1.3
Total	1,138.2	80.6	21.5	1,240.3

The Forest and Park Service's small game hunting area of Halmejärvi, where hunting is subject to licence, and parts of the Siera and Peurajärvi hunting areas are within the Valtimo region. Smaller areas have been leased to local hunting associations. Licences for elk hunting are granted annually.

5.3.3 Fish management

Landscape Ecological Planning targets at ensuring the high quality of waters and maintaining the conditions for survival for fish. Forestry operations are planned and carried out in such a way as to minimise the nutrients and solids discharged into waters. The watersides are excluded from the forestry operations, and the channels are not cleaned.

The use and management of fishing waters is based for the most part on the exploitation of the existing fish stock. One-year old plankton whitefish *(Coregonus pallasii)* fry can be planted in some of the lakes (e.g. Autiojärvi and Kivijärvi). There is a small brown trout *(Salmo trutta)* stock in some of the streams and rivers (e.g. Saarijoki) resulting from fish stocking. Trout waters can be developed so that a naturally evolving trout stock is created.

5.3.4 Nature tourism

Landscape Ecological Planning has succeeded in harmonising multiple forest uses. This also enables local inhabitants to enjoy the surrounding areas in variety of ways. One of the focal points in Valtimo is the Murtovaara farm museum, a site of cultural-historical interest, which is also surrounded by valuable forest sites.

The North Karelian forest strategy reflects hopes for increasing the number of visitors to the area. The environment in Finland and especially in North Karelia offers experiences that are unattainable in densely populated areas. Nature tourism is still in its infancy in Finland. There are also enterprises engaged in nature tourism operating on land administered by the Forest and Park Service. The greatest commercial interest has been in hunting-related products. The Wild North, the recreational unit of the Forest and Park Service, cooperates with private enterprises to develop nature tourism services based on sustainable utilisation of the environment.

5.3.5 Valuable landscapes

The variety brought by different tree species is an asset to the visual landscape. The presence of broadleaves brings variety as the seasons change. The ecological network with its variety of uneven-aged trees and different soil types contributes to the diversity of the landscape in the Valtimo region. There are several stands in the stepping stones that function as eye-catching points amongst the growing sapling stands.

A visual landscape only exists in the eye of the beholder. In this context, the route to the Murtovaara farm museum was discussed in participatory meetings with interest groups. Some of the compartments are included in the ecological network, and some are road-side forest, where extensive areas of regeneration felling are prohibited. The project group assigned the Pykäläkangas site the status of a stepping stone, and the visual landscape will be given special consideration in any operations in the area. In the meeting with the general public, a proposal was made to carry out thinning of the undergrowth spruces in the area.

The recreational route "Peasant's Trail" with its shoreline forests is a typical valuable landscape. Its most vulnerable part is the isthmus between Lakes Autiojärvi and Syrjäjärvi. Any operations on the isthmus will have to tread the narrow line between keeping the landscape open and retaining the feeling of a forest. Lake Autiojärvi, like other waters in the region, was also discussed in the meetings with the public. Other sites with landscape values include the upland areas of Jysmänvaara and Petäjävaara, which are both included in the plan as stepping stones.

Impacts on the visual landscape are among the most significant environmental aspects of forestry. This means that landscape considerations are to be taken into account in all forestry operations. Visual landscape is a major attraction for outdoor recreation.

5.3.6 Cultural sites

There are no actual national heritage sites in the region. The Murtovaara farm museum surrounded by state-owned lands is not officially part of the planning region, but it is an integral part of the cultural heritage of the Valtimo region. The national landscape working group classified Murtovaara as a valuable national heritage landscape in 1992.

The Murtovaara farm is one of the best examples of the traditional rural building style in Finland. Fortunately for Valtimo there was not enough room for the entire farmyard in other outdoor museums, so that all the log buildings built between the early 19th century and the 1950s remain on their original site. The Foundation for Advancement of Karelian Culture has maintained the buildings in good condition. The location of the museum is remote, but not as remote as it was before the forest road existed, when the farm was still in year-round use. The museum is open in the summer months. The sides of the road now leading to the location are partly included in the ecological network, and due to the

special nature of the area, the primary concern of operations in the corridor is landscape management.

The streams in the region still display signs of log floating. Remnants of old floating constructions still remain in the Murtojoki, Palmikkijoki and Autiojoki rivers.

The boulder with old dates carved on it situated by the Kolkonjoki river is a relic of the past. The Forest and Park Service is proposing that it should be conserved under the Act on Archaeological Remains. There is a sturdy ancient pine on the shore of Lake Murtojärvi, which has the dates 1895 and 1946 carved on its trunk. Another similar tree stands near the Murtovaara farm museum, with carved dates signifying important dates in the lives of the owners of the farm and other significant local events (Kolehmainen & Laine 1976).

5.4 Summary of sites with special values

Some 16 % of the area of managed forests in the region is subject to various restrictions. Proportionally most restrictions concern old-growth forests. Table 12 is compiled so that each site is listed only once, within the first category it belongs to. In this way, the same site is not presented under two headings. The same hierarchy applies to the shading in the first map appendix.

Table 12. Sites with special values in the managed forests in the region.

	Compartments, no	Area, ha				% of	
		Forest land	Poorly productive land	Non-productive land	Total	Forest land in managed forests	Total area of managed forests
Habitats of valuable species	65	350			350	1.9	1.6
Valuable habitats	73	110	31	23	164	0.9	0.8
Ecological network	491	731	352	102	1,185	6.3	5.5
Biodiversity enhancement areas	12	20	62	17	99	0.5	0.5
Game habitats	239	1,011	49	11	1,071	5.7	5.0
Valuable landscapes	172	202	6		208	1.1	1.0
Sites with special values, total		2,424	501	153	3,078	16.4	14.3

6 IMPLEMENTATION AND MONITORING OF THE PLAN

The environmental data gathered will be taken into account in operational planning. The information in the compartment database (GIS) will be updated by adding the new data changed due to forest management operations and other new data. Those in charge of forestry operations in the area are responsible for the implementation, updating and monitoring of the plan. The implementation of the Landscape Ecological Plan is monitored with the aid of the compartment database. The achievement of the objectives relating to area is monitored in 5-year periods. The preservation of valuable habitats is monitored in connection with the annual follow-up inventories of nature management. The feedback from participatory planning is also included in follow-up data.

Objectives of the plan and their monitoring:

Objective	Monitoring	Follow-up
Proportion of stands aged over 120 years, % of forest area	GIS	every 5 yrs
Proportion of stands dominated by broadleaves in managed forests, % of forest area	GIS	every 5 yrs
Proportion of broadleaves in managed forests, % of volume	GIS	every 5 yrs
Prescribed burning, ha	GIS	every 5 yrs
Implementation / management of the ecological networks	follow-up inventory	annually based on sampling
Preservation of valuable habitats	follow-up inventory	"
Preservation of populations	follow-up inventory	"
Preservation of game habitats	follow-up inventory	"
Preservation of valuable landscapes, cultural sites and other sites with special values	follow-up inventory	"

The first follow-up review of the Valtimo Landscape Ecological Plan will be held in five years' time. The review will be organised by the representatives of the various units of the Forest and Park Service at the initiative of the Forestry unit. Interest groups will be informed of the results of the review. A public meeting will be held to report the results if it is considered that there are grounds for it.

7 IMPACTS OF THE PLAN

7.1 Ecological impacts

So far, there is little research information on how Landscape Ecological Planning has affected the conservation of forest biodiversity in Finland. The Forest and Park Service has made this system of steering forest management by comprehensive ecological assessments of extensive coherent areas part of its natural resources planning (Forest and Park Service 1997). We are constantly obtaining more information on the impacts of Landscape Ecological Planning, and the new information can be applied to practice immediately, as the Landscape Ecological Plans are being revised continuously as part of ongoing operational planning.

According to current information, approximately 700 threatened species (43 %) live in the Finnish forests, more than half of them in herb-rich forests (Rassi et al. 1991). Nearly all threatened species in the mineral soil forests (86 %) depend on decaying wood and old-growth forests. The amount of deadwood has decreased, and felling has broken up extensive coherent old-growth forests. The fragments become isolated, and the distance between them grows. The edge effect is magnified, and the quality of the habitat is affected more than could be expected from the decrease in area.

The Landscape Ecological Plan of the Valtimo region will most likely have a positive impact on forest biodiversity in the area, especially on the protection of threatened species requiring decaying wood for survival. This is the first time that valuable habitats and populations important for biodiversity have been inventoried so comprehensively in the managed forests of the area. The data have been fed into the compartment database, and numerous sites have been proposed for exclusion from forestry operations. With the help of the ecological networks, these sites have been connected to each other and to the old-growth forest protection areas. Valuable habitats and ecological corridors add significantly to the nature protection network. The planning region is located between the Hiidenportti and Tiilikka National Parks, so that the corridors proposed in this plan will also form part of the network between these two protection areas.

According to current knowledge, the ecological corridors have beneficial impacts. The corridors enable species to move from one islet to another in a fragmented

habitat and they can therefore be recommended for use in compliance with the prudence concept (Kouki 1993). Some species profit from the corridors, but not all. Several species were found in the old-growth forest compartments in Valtimo that need deadwood for survival, and it can be expected that corridors containing these compartments will promote the spread of these threatened species from one protection area to another. Corridors containing sapling stands and young forests will in future also be ecologically significant routes for the spread of threatened species.

The monotonous structure of the managed forests in the area is mostly attributable to felling trees because of war indemnity payments and the implementation of the Nurmes plan. The structure of stands will gradually be changed towards greater variety. Broadleaves will be favoured, sturdy broadleaves and aspen will be retained in cuts, so that the amount of deadwood in managed forests will increase with time. The volume of burned wood will be considerably increased when the long-forgotten method of prescribed burning is reintroduced in Valtimo with the aim of burning a regeneration site with its retention trees once every few years. The proportion of old-growth forests, 8 % of the forest area, is considered sufficient in Valtimo. Currently 65 % of the mature forests in the region fall within the scope of special-use forests, the landscape ecological network or within some other restriction as to use.

The plan will have a positive effect on the game stocks in the region. The game habitats have been entered in the geographical information system and they are taken into consideration for in forest management operations. Protected areas and the ecological network increase the biodiversity of the region, which is of benefit both to game and threatened species.

Landscape Ecological Planning gives forestry planning an ecological focus. The recognition and consideration of special ecological features provides the participants in the process with information that will help the Forest and Park Service to protect and increase the biological diversity of the forests through concrete measures. With the help of these measures, the Valtimo planning region will have greater biodiversity in 50 years' time than today.

7.2 Economic impacts

The economic impacts of the plan have been studied theoretically by a forest cutting budget calculation system (MELA). Three comparative calculations have been made for the region. The basic calculation A is based on normal forest management in accordance with current forest management guidelines and the Landscape Ecological Plan. Calculation B converts the restrictions on use necessitated by the occurrence of rare species (Table 8), valuable habitats (Table 7) and ecological corridors into Finnish markka and cubic metres. Calculation C takes these, plus all other restrictions, including the landscape and game habitats into account. The difference between these calculations is the calculated impact of the Landscape Ecological Plan. (Appendix 1).

Due to the age structure of the forest, the felling opportunities in the area will increase considerably as time passes. According to the cutting budget, the economic impacts of the Landscape Ecological Plan will be proportionally greatest in the first 10-year period. The impact on the calculated cut is approximately 18 per cent. The theoretical employment effect of the plan, without consequential effects, is 1.7 man-years.

In the second 10-year period, the difference in cutting volumes will be about 12 %, and in later years 1–4 %. The planning period is 50 years. The estimates are based on a 4 % interest rate.

7.3 Social impacts

The principle of participatory planning has been applied in drafting the Landscape Ecological Plan for the Valtimo region. Interest groups have reacted positively to the opportunity to participate, and both the interest groups of the Forest and Park Service and private citizens have cooperated in the drafting of the plan. The project group has obtained valuable information and the chance to create a plan that has the widest possible approval. Citizens and interest groups have provided information and views for the project and, in turn, gained information on Landscape Ecological Planning and the Forest and Park Service. Equally valuable is the fact that in the various meetings, the personnel of the Forest and Park Service has had the opportunity to get to know local residents and interest groups' representatives, and vice versa.

Employment is a controversial topic in Valtimo. Forestry has traditionally been a good employer, but the decrease in the estimated cut will affect the region in coming years, although a variety of other factors will also affect employment in the area. The young forests will require management, working methods are developing and the job of the forest worker is subject to constant change. Interest groups' and employers' expectations also change over time.

One of the objectives of the Landscape Ecological Plan is to improve Valtimo's congeniality as a place to live and visit. This will benefit both local residents and people coming from elsewhere. As the lively discussion of the 1990s proves, the small region of Valtimo has already made its mark.

LITERATURE In Finnish

Ahtiainen, M. & Huttunen, P. 1995. Metsätaloustoimenpiteiden pitkäaikaisvaikutukset purovesien laatuun ja kuormaan. Teoksessa Saukkonen, S. & Kenttämies, K. 1995 (toim.). Metsätalouden vesistövaikutukset ja niiden torjunta. METVE-projektin loppuraportti. s. 33–50. Suomen Ympäristö 2 - ympäristönsuojelu. Suomen Ympäristökeskus. Helsinki.

Angelstam, P. & Rosenberg, P. 1993. Aldrig, sällan, ibland, ofta. Skog & Forskning 1/93:34–41.

Hallman E., Hokkanen, M., Juntunen, H., Korhonen K-M, Raivio, S.,Savela O, Siitonen, P., Tolonen, A. & Vainio, M. 1996. Alue-ekologinen suunnittelu. Metsähallituksen metsätalouden julkaisuja 3. 59 s.

Heikkilä, R. 1994. Suomen suojelemattomat luonnoltaan arvokkaat suot. Käsikirjoitus. Kainuun ympäristökeskus. 420 s.

Hoffren Jukka 1994. Ympäristötaloustieteen perusteet. Gaudeamus/Tammer-paino 125 s.

Hokajärvi T. (toim.) 1997. Metsänhoito-ohjeet. Metsähallituksen metsätalou den julkaisuja 10. 60 s.

Hottola, P. 1996. Pohjois-Karjalan linnustollisesti arvokkaat vanhat metsät. Moniste 6 s. ja liitekartat.

Hänninen, E., Oulasmaa, K. ja Salpakivi-Salomaa, P. 1997. Metsämaiseman hoito. Metsätalouden kehittämiskeskus Tapio. 25 s.

Kniivilä, M. 1998. Euroopan metsämaakunta 2010. Pohjois-Karjalan metsästrategia vuosiksi 1998-2010. Pohjois-Karjalan liitto. Julkaisu 37. 95 s. + liitteet.

Kolehmainen, A. & Laine, V. A. 1976. Murtovaara, talomuseo Valtimolla. Karjalaisen Kulttuurin Edistämissäätiö. 131 s. Lappeenranta.

Kotiranta, H. & Niemelä, T. 1996. Uhanalaiset käävät Suomessa. Toinen, uudistettu painos. Suomen Ympäristökeskus. Ympäristöopas 10. 184 s.

Kouki, J., 1993. Luonnon monimuotoisuus valtion metsissä - katsaus ekologisiin tutkimustarpeisiin ja suojelun mahdollisuuksiin. Metsähallituksen luonnonsuojelujulkaisuja. Sarja A 11. 88 s.

Laitinen, T., Junninen, K. Tikkanen, O.-P. (toim.) 1998: Natura 2000 Pohjois-Karjalan itä- ja pohjoisosissa. Pohjois-Karjalan luonnonsuojelupiirin esitys. Osa 2: Kohdekuvaukset. 78 s. ja 4 liitettä.

Lindgren, M. 1997. Uhanalais- ym. lajihavaintoja Kainuun - Pohjois-Karjalan vedenjakajaseudulta sekä Kaakkois-Suomussalmelta 1997. Moniste 6 s. + liitekartat.

Maisema-aluetyöryhmän mietintö II 1992. Arvokkaat maisema-alueet. Ympäristöministeriö, työryhmän mietintö 66/1992. 204 s.

Metsähallitus 1977. Nurmes-suunnitelma. Nurmeksen ja Rautavaaran hoitoalueiden metsätalouden tehostamissuunnitelma. 58 s.

Metsähallitus 1997. Alue-ekologisen suunnittelun ohje 8.12.1997. Moniste.

Metsähallitus 1997. Metsätalouden ympäristöopas. 130 s. Helsinki.

Metsähallitus 1997.PATI-maastotyöohje 21.5.1997. Moniste.

Niemelä, T. 1999. Suomen kääpien määritysopas. Kahdestoista uusittu painos. Helsingin yliopiston kasvitieteen monisteita 169. 138 s. Helsinki.

Penttilä, R. 1996. Kainuun vanhojen metsien kääpälajisto. Metsähallituksen luonnonsuojelujulkaisuja. Sarja A, No 35.

Pohjois-Karjalan ympäristökeskus 1997. Pohjois-Karjalan arvokkaat pienvedet. Luonnos. 81 s., liitekartat.

Rassi, P., Kaipainen H., Mannerkoski, I. & Ståhls, G (toim.) 1991. Uhanalaisten eläinten ja kasvien seurantatoimikunnan mietintö. Komiteamietintö 1991:30. Ympäristöministeriö. 328 s.

Rissanen, K., Hirvonen, R., Mahosenaho, J. & Ollila, H. 1997. Pyhännän alue-ekologinen suunnitelma. 59 s.

Saukkonen, S. & Kenttämies, K. 1995 (toim.). Metsätalouden vesistövaikutukset ja niiden torjunta. METVE-projektin loppuraportti. Suomen Ympäristö 2 - ympäristönsuojelu, 419 s. Suomen Ympäristökeskus. Helsinki.

Sevola Yrjö 1983. Metsähallinnon Nurmeksen hoitoalueen voimaperäinen puunkasvatus: seurantajärjestelmä ja tuloksia. Folia Forestalia 574. Metsäntutkimuslaitos, Helsinki 83 s.

Siitonen, P. 1997a. Alue-ekologisen metsäsuunnittelun maastokohteiden valintaehdot. 22.4.1997 Moniste.

Siitonen, P. 1997b Monimuotoisuuden arviointi MoniWin-ohjelmalla. 5.12.1997 Moniste.

Vanhojen metsien suojelutyöryhmän osamietintö 1992. Vanhojen metsien suojelu valtion mailla Etelä-Suomessa. Ympäristöministeriö, työryhmän mietintö 70/1992. 59 s. + 169 karttasivua.

Wilkman, W. W. 1921. Suomen geologinen yleiskartta. Lehti D4. Nurmes. Vuorilajikartan selitys.

Virkkala, K. 1948. Suomen geologinen yleiskartta. Lehti D4. Nurmes. Maalajikartan selitys. 101 s.

Virkkala, R. 1996. Metsien suojelualueverkon rakenne ja kehittämistarpeet - ekologinen lähestymistapa. Suomen ympäristökeskus. Suomen ympäristö 16. 53s.

ADDITIONAL READINGS

Metsähallitus - Forest and Park Service 1998. Environmental Guidelines to Practical Forest Management. 124 p.

Loikkanen, T., Simojoki, T. & Wallenius, P. 1999. Participatory Approach to Natural Resource Manaegement. Forest and Park Service. 96 p.

REPORT OF ECONOMIC IMPACTS, LANDSCAPE ECOLOGICAL PLAN FOR STATE-OWNED FORESTS IN VALTIMO

- Maximised yield value 4 %
- Usage restrictions included
- Optimisation restrictions for management categories
- Sustainability restrictions on optimisation

	A **All special values included** **Basic calculation**	**B** **Codes 400-612 (rare species, valuable habitats, ecological corridors) excluded**	**C** **All ecological codes excluded**
Forest area, ha	20,282	20,282	20,282
forest stock, m^3	1,553,345	1,553,345	1,553,645
forest growth, m^3/a	90,272	90,141	90,141
Area per management category, ha			
1.0 Managed forest	16,759	17,738	19,195
2.0 Retention trees	18	12	0
3.0 Extended cycle	1,251	1,437	0
4.0 Over-extended cycle	652	83	83
5.0 Selective cutting	68	0	0
6.0 No management operations	539	17	8
7.0 Protection areas	995	995	995
Area, total	20,282	20,282	20,281
1998–2007			
Difference in the first period, %	100 %	117 %	118 %
Difference later in the calculation period			
2008–2017			
planned cut	100	112	112
2018–2027			
planned cut	100	100	102
2028–2037			
planned cut	100	100	103
2038–2047			
planned cut	100	103	104

Appendix 2.

BRACKET FUNGI SPECIES IN MANAGED FORESTS IN THE VALTIMO REGION

The level of endangerment classified according to Rassi et al. (1991) and Niemelä (1999).

Nationally threatened species

Amyloporia crassa	V (vulnerable)
Antrodiella citrinella	V
Gloiodon strigosus	V
Anomoporia bombycina	Md (monitored, declining)
Antrodia albobrunnea	Md
Antrodia pulvinascens	Md
Gelatoporia pannocincta	Md
Skeletocutis lenis	Md
Skeletocutis stellae	Md
Antrodia infirma	Mr (monitored, rare)
Haploporus odorus	Mr
Perenniporia subacida	Mr
Postia hibernica	Mr
Postia lateritia	Mr
Protomerulius caryae	Mr
Sistotrema raduloides	Mr
Skeletocutis odora	Mr

Regionally threatened species

Clavicorona pyxidata	V
Phlebia centrifuga	Mr
Amylocystis lapponica	Mr
Phellinus viticola	Mr

Old-growth forest indicators

Asterodon ferruginosus
Fomitopsis rosea
Gloeoporus taxicola
Junghuhnia luteoalba
Leptoporus mollis
Oligoporus sericeomollis
Onnia leporina
Phellinus chrysoloma
Phellinus ferrugineofuscus
Phellinus lundellii
Phellinus nigrolimitatus
Phellinus pini
Phellinus populicola
Phlebia cornea
Postia leucomallella
Postia placenta

Metsähallitus, Luonnonvarayksikkö, Tikkurila NUR2B/PO

7088.000 7088.000

3567.000 3610.000

Map 1.

Sotkamoon
Hiidenportin kp.
Kuhmoon
Iso-Loute
Sivakkajärvi
Alalampare
Valtimojärvi
Ylä-Valtimojärvi
Koppelojärvi
Scale 1:100 000

Landscape ecological plan

- Forest land
- Other
- Waters
- Poorly productive land
- Non- productive land
- Protection areas
- Special-use forests established by decission of FPS
- Valuable habitats
- Ecological restoration
- Ecological network
- Enhancement of biodiversity
- Cultural site
- Game habitat
- Valuable landscape

7066.000 7066.000

Metsähallitus, Luonnonvarayksikkö, Tikkurila NUR28/P0

7088.000

7088.000

3567.000

3610.000

Map 2.

Sotkamoon

Alasenjärvi

Sotkamoon

Matojoki

Sokijärvi

Saarijärvi

Hietajärvi

Sirppilammit

Hiidenportin kp.

Salmilammit

Kuhmoon

Valkealampi

Houkilahti

Syrjä

Autioja

Kivijä

Suo

Mäntyjärvi

Peuravaara

Peuraloki

Verkkoloki

Kokkoloki

Sivakkajärvi

Iso-Loute

Rumonjoki

Harjatok

Pääkarinjärvi

Nuolijärvi

Holmisoppi

Yläjärvi

Salmijärvi

Koivujärvi

Kuljärvi

Ylimmäinen Jokijärvi

Holmejärvi

Kuusijärvi

Peuralampi

Saarilampi

Sivakkajoki

Alalampare

Iso Kivilampi

Kenilampi

Iso Teerilampi

Kuusipaasko

Mäntyloki

Valkeislampi

Ylimmäinen Jokijärvi

Honkajärvi

Palsikkojoki

Pieni Siirajärvi

Koppelojärvi

Ylä-Valtimojärvi

Valtimojärvi

Valtimo

Joensuuhun

Reutavaaralle

Ylimmäisenjärvi

Dominant tree species

- Non- productive land and other land
- Waters
- Protection areas
- Special-use forests established by decission of FPS
- Pine
- Pine-mixed
- Spuce
- Spruce-mixed
- Birch
- Birch-mixed
- Other

Scale 1:100 000

7066.000

7066.000

Metsähallitus, Luonnonvarayksikkö, Tikkurila NUR28/P0

Map 3.

7088.000

3567.000

Sotkamoon

Sotkamoon

Matojoki

Hietajärvi

Sirppilammit

Kolkonjärvi

Kolkonjoki

Verkkojoki

Kokkojoki

Hiidenportin kp.

Salpilammit

Kuhmoon

Autiojärvi

Kivijärvi

Subjärvi

Sivakkajärvi

Sivakkajoki

Peurajoki

Iso-Loute

Rumonjoki

Palmikkojoki

Koppelojärvi

Ylimmäisenjärvi

Valtimojärvi

Valtimo

Ylä-Valtimojärvi

Kolmisoppi

Honkajärvi

Ylimmäinen Jokijärvi

Iso Teerilampi

Mäntyjoki

Alalampare

Saarilampi

Kerilampi

Scale 1:100 000

Age of stand

Forest land

- 1-20
- 21-40
- 41-60
- 61-80
- 81-100
- 101-120
- 121-140

Poor- and non-productive land and other land

7066.000

Nurmes 25, 27, 28 1:100000 28.10.98 Copyright Metsähallitus ja Maanmittauslaitos lupa nro 1/MAR/98

ISSN 1239-1670
ISBN 952-446-185-4 (Printed)
ISBN 952-446-186-2 (Internet)