METSÄHALLITUS

Guidelines for Landscape Ecological Planning

Lauri Karvonen

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Orders of publications:
Metsähallitus
Forestry
P.O. Box 94
01301 Vantaa

Tel. + 358 205 64 100
Fax +358 205 64 4500
natureinfo@metsa.fi

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Lauri Karvonen

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Guidelines for Landscape Ecological Planning

Abstract

This publication describes the Landscape Ecological Planning model applied in Metsähallitus in 1996–2000. During this period, Landscape Ecological Planning has been carried out on some 6.4 million hectares of state-owned forest land in Finland. Other organisations administering relatively large continuous forest areas can easily apply the planning process described in this report.

Before initiating the planning process, a region has to be outlined for which it is possible to set clear objectives for local forest usage. The region's ecological characteristics and multiple use of forests should be taken into account when setting the goals. The goal-setting should aim at harmonising the ecological, social, cultural and economic interests in the region.

The planning process involves two stages: data collection and actual planning. The initial data collection stage focuses on inventorying all existing and possible new sites of special value. This work is supported by existing geographical information systems, prior inventories and other plans made for the region. Further information is gathered by means of participatory planning. A list of potential sites of special value, based on selected criteria, is derived from Metsähallitus' geographical information system and verified in field inventories. Field inventories should cover 5–10% of the total area and involve defining certain structural landscape features, measuring deadwood volumes and recording detected species. The data collected is recorded in the geographical information system for use in the actual planning.

At the planning stage, the gathered data is analysed and valuable habitats, game habitats, valuable landscapes and cultural sites are outlined. The sites are selected on the basis of the initial goals. Ecological links can be established to connect nature conservation areas and valuable biotopes. Special goals can also be set for the proportion of broadleaf stands, old-growth forests or prescribed burning areas. Certain habitats can also be selected for biodiversity enhancement or restoration. If need be, several alternative plans can be made and assessed in terms of ecological, social and economic impacts. The alternative which best corresponds to the local goals is then chosen.

The selected sites are recorded in the geographical information system, from which they can be retrieved for the purpose of planning actual management operations. The plan should be continuously updated as information on new sites arrives. Metsähallitus provides separate guidelines for recommended measures in various sites and stand management operations. The preservation of sites is monitored by annual follow-up inventories, while the regional goals set for the growing stock are monitored at five-year intervals. The composition and goals of the entire plan should also be re-evaluated at regular intervals in order to take advantage of the latest research information, feedback and follow-up results.

Keywords
Landscape Ecological Planning, valuable habitats, threatened species, ecological links, game habitats, valuable scenery

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1 INTRODUCTION

The development of Landscape Ecological Planning in Finland started as a cooperative project between Metsähallitus and the Finnish Environment Institute in 1994 (Hallman et al. 1996). It was at that time that the foundations of the work were laid, partly based on Swedish studies (see e.g. Rulcker & Angelstam 1994). The biodiversity assessment part of the planning method has been developed in a separate research project (Siitonen 1999, Siitonen & Lehtinen 1999, and Siitonen et al. 2000). The practical planning method has taken shape in the course of pilot projects, which were started in areas administered by Metsähallitus in 1996 (Keto-Tokoi et al. 1996, Karvonen et al. 1997, Korkalo et al. 1997, Rissanen et al. 1997, Näpänkangas et al. 1998, Pitkänen et al. 2000 and Luhta 1999). The principles of participatory planning have also been applied from the start (Loikkanen et al. 1999). In this way local residents, nature lovers and other interested parties have been able to give direct feedback to the compilers of the individual plans.

A specialist working group convened by Metsähallitus and made up of researchers and representatives of the various interest groups has supported the planning development work. In addition, extensive research on Landscape Ecological Planning is currently under way, and its results can be utilised in further development of the planning method (Annila 1999 and Walls et al. 1999). This means that the planning method is constantly being updated not only through experience gained in practice but also with new research information.

This report describes the Landscape Ecological Planning Method used by Metsähallitus in the form it has assumed during the past few years. The planning method as described can also easily be applied elsewhere after adapting certain of its organisation-specific aspects for more general application. In these guidelines, aspects specific to our organisation involve references to other Metsähallitus guidelines and issues presented in chapters 3, 6 and 9. The report was compiled on the basis of the internal guidelines used in Metsähallitus, first edited by Erkki Hallman in 1997 and revised by Lauri Karvonen in 1999. In this report, we have included more practical procedures and instructions for planning and omitted some organisation-specific details.

2 OBJECTIVE OF PLANNING

Landscape Ecological Planning involves the planning of multiple forest use, in which ecological goals are aligned with different forms of forest use, while bearing in mind the objectives of forestry in the area. Landscape Ecological Planning views an extensive forest area as a whole including managed forests, nature conservation areas and special areas for recreational use.

The long-term objective of Landscape Ecological Planning is to assure the survival of the area's native species as viable populations. Among other things, this requires the conservation of existing valuable habitats and ensuring that new ones can evolve. In this way the planning contributes to the continued existence of valuable habitats as defined in the Forest Act and Nature Conservation Act. Planning can also be used to focus nature management activities on the sites that are the most crucial in ecological terms. The planning also involves the effort to assure the conditions for the spread of various species. In this effort, the valuable habitats and ecological links in managed forests complement already existing nature conservation areas. Together these form an ecological network, which preserves biodiversity. (Fig. 1).

Another central goal of planning is to ensure that the conditions exist for multiple forest uses and for nature-based sources of livelihood. The procedure thus involves inventories of game habitats, scenic values and cultural, educational and research sites. In Northern Finland, the demands of reindeer husbandry play an important role. The weight given in planning to recreational use depends on the characteristic features of the area and on the recreational needs of the region. In areas located near tourist centres or in areas otherwise significant for nature tourism, recreational use and it needs play a major role in the planning work.

When compiling a Landscape Ecological Plan, special attention is paid to the objectives of the region's strategic natural resource plan and to feedback gained while drafting it. Landscape Ecological Planning is, in fact, one of the ways in which the strategic decisions made in the regional natural resource plan are implemented. Landscape Ecological Planning in turn provides site-specific information on stands to be preserved and those requiring special treatment in operational planning. In this sense careful Landscape Ecological Planning provides a good basis for operations in the forest area.

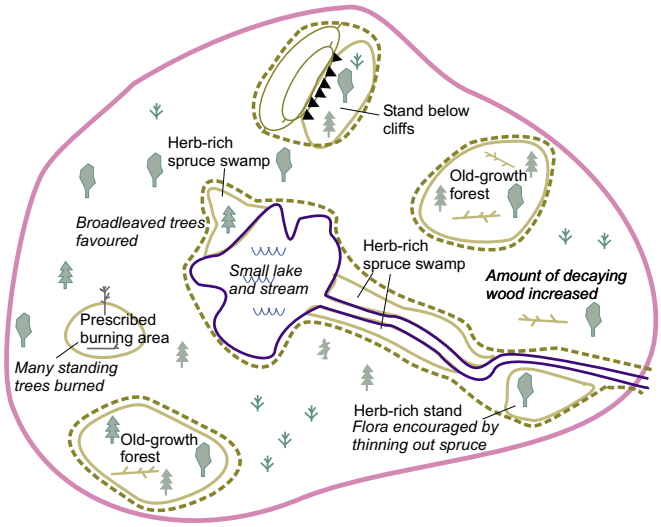

Figure 1. Schematic view of Landscape Ecological Planning and its objectives. In areas where forest use has been intensive, measures should concentrate on certain parts of the area (e.g. the biodiversity enhancement areas).

3 ORGANISATION OF PLANNING IN METSÄHALLITUS

The planning is carried out by the units of Metsähallitus as separate projects for each individual planning area. Each project team includes representatives of the Forestry unit and Natural Heritage Services. The wildlife and fishing and tourism specialists of Metsähallitus also participate in planning. The project leader usually comes from the Forestry unit, while Property Services participate in the production of maps.

According to the principles of participatory planning, a cooperation group is set up, if possible consisting of representatives of the various interest groups. It may be expedient in some cases for the same group to coordinate several plans. Important cooperation partners include municipalities, Environment and Forestry Centres, forest industry companies, nature organisations, reindeer owners' associations and other local interest groups.

The aim is usually to complete the project within one year. However, more extensive plans may be carried out in stages over several years. Regional heads of Metsähallitus units approve the completed plans.

4 STAGES OF PLANNING

4.1 Defining the planning area

The aim is to define the area so that it encompasses ecological entities. When drawing the outlines of the area, it is necessary to consider not only the actual implementation of the plan but also the area's feasibility for subsequent follow-up. Where the planning area forms an extensive coherent area, a suitable size is some 50,000 to 100,000 hectares.

Sometimes the fragmentary character of forest areas may prevent the formation of extensive coherent planning areas. In this case cooperation with other landowners may prove useful in creating planning areas. A plan can be made even for relatively small areas (2,000–3,000 ha). In such cases these guidelines can be applied in an appropriate scope.

4.2 Detailed specification of objectives

The objectives of the plan are individually specified for each planning area. This is necessary as the silvicultural history, number of nature conservation areas and ecological and scenic features may vary considerably between areas. The ecological objectives are always defined on the basis of the natural features and special values of the particular location. The objectives set for the ecological network should take into account the significance of the area in a larger context. Special goals are also defined with respect to recreational use, nature tourism and nature-based sources of livelihood.

If the planning area has particular significance for nature conservation, or if another land use (tourism, nature-based sources of livelihood) plays a particularly important role in the area, this is taken into account in the allocation of resources for the project and in the definition of its focus. When defining the objectives, the decisions made in connection with the natural resource plan should also be kept in mind.

4.3 Collection of data

4.3.1 Collection of data from various sources

Information on the *natural environment of the area* is gathered to form a groundwork for the plan. This involves an assessment of soil and bedrock, waters, forests, peatlands etc. Basic information on the various *land uses* in the area is also gathered. Forestry, tourism and other recreational use in the area and its significance for other uses, such as reindeer husbandry, are recorded. In addition, information is gathered on the size of areas reserved for various purposes and the tree stands, as well as the distribution of the areas and stands. Managed forests are distinguished from nature conservation areas and reserves, and where necessary, special recreational areas. Existing *recreational routes and constructions* are also recorded.

All existing data on sites of special value in the area are also collected. Sites of special value include:

- key biotopes and other habitats of probable ecological value
- occurrences of threatened species
- valuable landscapes
- capercaillie *(Tetrao urogallus)* leks and other sites of significance for game management
- special sites for nature-based sources of livelihood and multiple use
- cultural sites
- educational and research sites

Information on the planning area is gathered from a variety of sources. The possibilities of participatory planning are also effectively exploited. The publications used in the compilation of the plan are listed in the bibliography of the final report.

The following sources may be utilised in planning:

- forest management plans
- game management plans
- management and utilisation plans for fishing waters
- management and utilisation plans for recreational areas and other special areas
- reports of Environmental Centres, municipalities and provincial authorities

- regional plans (now provincial plans)
- base maps, bedrock and soil maps
- aerial photos, orienteering maps and other special maps
- compartment selection from the geographical information system
- previously marked sites of special value
- vegetation category – fertile habitats identified in particular
- drainage situation – unditched peatlands and possible restoration sites identified
- features reducing land productivity – special habitats identified
- dominant tree species – rare stands of broadleaves identified in particular
- age of stands – stands exceeding the regular rotation time by 20 years identified
- proportion of broadleaves – e.g. mixed aspen stands identified
- special compartment notes – e.g. windfall areas, special compartments identified
- threatened species database
- data on threatened species from museums and nature lovers
- various nature inventories, such as old-growth forest and valuable small water bodies inventory data
- records on ancient monuments
- interviews with local residents

4.3.2 Field inventories

The primary purpose of field inventories is to supplement and specify in more detail the data on ecological values in the area. Field data is needed to select valuable habitats for conservation or special treatment as well as for planning the ecological network. Inventories can also be carried out to supplement data on valuable landscapes, game habitats and cultural sites in the area.

The size and location of field inventories are determined with consideration for special features in the area and the local planning goals derived from these. The potentially valuable sites where field inventories are to be carried out are chosen on the basis of preliminary work. The objective of the preliminary work is for all potentially valuable sites to be included in the comparison of sites. Another objective is to target field inventories accurately in order to avoid unnecessary (and expensive) fieldwork. In the selection of sites, use is made of the geographical information system, various maps, earlier ecological inventories and information gained from participatory planning (cf. 4.3.1).

In the field inventory, the limits of compartments are checked on site. The main principle is that valuable habitats and other sites that have markedly different requirements in terms of silvicultural measures are marked out to form their own stands. Some sites may be defined as mere spots on the map (e.g. certain cultural sites and occurrences of certain species) or as broader areas (sites including several stands, e.g. an extensive valuable landscape). The presentation and classification of sites is explained in the fieldwork guidelines on geographical information (Soinne 1999, in Finnish).

The field inventory is carried out in accordance with these guidelines. The inventory comprises the following measures:

- checking the correctness of land use data
- assessing the structural features of terrain and habitats indicating biodiversity in the area
- judging whether the site falls within the scope of the Forest Act, the Nature Conservation Act or other legislation
- assessing the need for special measures (such as restoration)
- inventorying the data on biodiversity indicator species
- inventorying deadwood and retention trees and their distribution into various stages of decay
- checking the data on living tree stands
- checking the habitat data
- if threatened species are identified, a card is filed for the threatened species database with reference to the threatened species category and level of statutory protection measures

The stand-specific information gathered in the inventory is recorded in the geographical information system (GIS).

The specially designed MONIWIN application can be used for analysing the results and comparing the sites. The stand-specific data needed in the analyses can be transferred from the geographical information system (GIS) in file format directly to the MONIWIN application. The analysis requires field data on the habitat and deadwood ratings indicating biodiversity, general habitat data on the compartment, and information on the living trees. The value of a compartment is assessed on the basis of the amount, quality and rarity of these indicative features. The application uses the indicators to list the compartments in a rough order of priority, thus facilitating the comparison of different types of compartments. This biodiversity assessment method is based on a study,

carried out as a cooperative project by Metsähallitus and the Finnish Environment Institute, on a method for measuring biodiversity (Siitonen 1999, Siitonen & Tanskanen 1999 and Siitonen et al. 2000).

The results of the analyses are utilised when selecting the sites to be conserved. The data on the compartments to be conserved are updated in the geographical information system, but the sites may also be evaluated and selected in other ways.

In field inventories, identified occurrences of threatened species are recorded and their exact location is entered in the geographical information system. The threatened species category and legal status of each species are recorded.

4.4 Compiling the plan

A short general description of the area is to be included in the planning report. It should address the ecological features, waterways, forest use history, forest structure and natural dynamics of the area. It should also include a brief description of the existing nature conservation areas and their ecological values. (Figures 2 and 3).

The following steps are to be taken on the basis of the information gathered in the area:

- identify valuable habitats for conservation and special treatment (statutory sites marked)
- identify occurrences of threatened species
- plan ecological links
- set a target for the proportion of old-growth forests
- set a target for the proportion of broadleaves and stands dominated by broadleaves
- set a target for prescribed burning
- identify valuable landscapes, game habitats and cultural sites
- identify biodiversity enhancement areas
- identify restoration sites

It is usually not necessary to set all the above-mentioned targets if the planning area is small or fragmented.

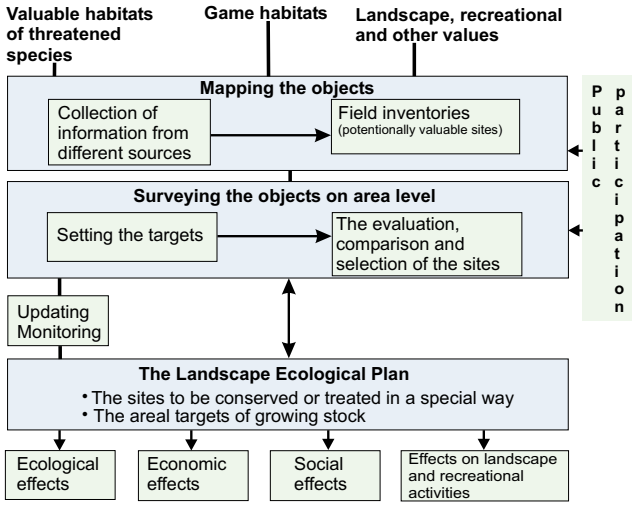

Figure 2. The procedure of Landscape Ecological Planning.

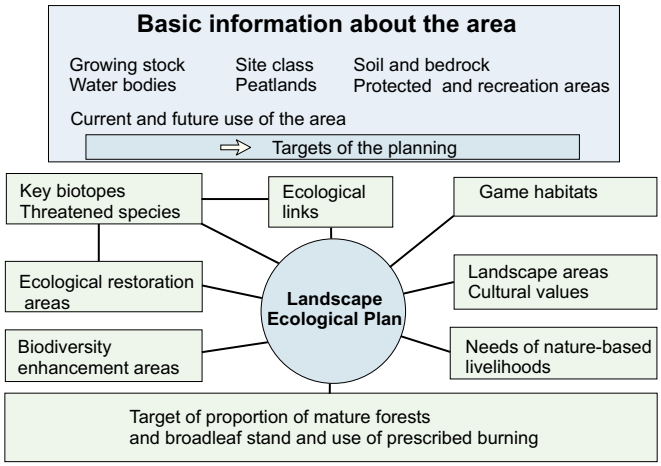

Figure 3. Structure of Landscape Ecological Plan.

4.5 Documentation of the plan

The location-specific information is recorded in the geographical information system. Valuable habitats are usually marked out to form their own compartments. Other sites of special value are marked out as compartments or as broader areas. Sites of very small area may be marked as spots. The starting situation is recorded as shown in chapter 9.

A written report is compiled for the plan using the outline presented in Appendix 1 as applicable. Various thematic maps can be printed out for the planning area, indicating valuable landscapes, cultural sites and game habitats. One thematic map including all sites of special value can also be produced. However, it must be kept in mind that the report and thematic maps describe the situation in the planning area at the time when the plan was drafted.

The report should include summaries on the following aspects:

- total areas of managed and recreational forests and conserved forests; their division by vegetation, tree species and age categories
- the number of valuable habitats, specifying
- the proportion of statutory valuable habitats
- the proportion of restorable valuable habitats
- the occurrences of species belonging to the various threatened species categories

- the number of valuable landscapes, cultural sites and game habitats divided according to categories
- the size of the ecological network and its distribution by vegetation categories
- the total number of sites of special value (size and stand type) in the managed and recreational forests.

5 PRINCIPLES OF PLANNING

5.1 Valuable habitats and occurences of species

Valuable habitats are biologically the most diverse areas in the ecological network, complementing the conservation areas, which serve as the core areas of nature protection. The natural conditions, the history of forest use and therefore the selection criteria for valuable habitats vary a great deal from one planning area to the next. Thus no detailed selection criteria can be laid down for the selection of valuable habitats – these have to be defined separately for each individual area.

Criteria for defining valuable biotopes include structural features, amount of deadwood and occurrences of species on the site. A valuable biotope can be, for instance, a riverside spruce stand with abundant deadwood, a so-called fire refugium.

Some of the sites to be protected are statutory. The Forest Act (1093/96) and the Nature Conservation Act (1096/96) define certain important habitats whose characteristic features are to be preserved. In addition to these, there are certain other habitats which are to be taken into account in forest management (Metsähallitus 1998). In addition, it should be understood that the statutory conservation only applies to the most valuable occurrences of each habitat type. Valuable habitats may include

- minor water bodies (springs, seepage areas, rivulets, streams, small lakes)
- herb-rich forests
- natural forest succession stages (young succession stage, old broadleaf forest, old-growth forest)
- various peatlands (fertile mires, nutrient-poor bogs, swamps, common alder type swamp woods)
- eskers (deep glacial hollows and sunny south-facing slopes)
- boulder fields, bedrock outcrops, cliffs and gullies
- recent wildfire and prescribed burning areas.

Fertile herb-rich stands are often small and they usually meet the criteria for protected sites under the Forest Act.

The selection of sites is based on the information concerning the structural features indicating various habitats, living trees, deadwood and species in the area. The valuable habitats are selected according to the general principles

presented in the Environmental Guidelines to Practical Forest Management (Metsähallitus 1998) and the goals and criteria specified for the individual planning area. The important forest habitats according to the Forest Act and the protected habitats according to the Nature Conservation Act are always to be considered in planning. The valuable habitats are inventoried and recorded in the geographical information system according to the fieldwork guidelines (Soinne 1999, in Finnish). The aim is to mark out the valuable habitats as separate compartments already at the fieldwork stage, although the final lines are often only drawn at the operational planning stage.

In the selection of valuable habitats, the number and quality of species occurrences are taken into consideration. The occurrences of species to be given special protection under the Nature Conservation Act are identified and always recorded in the geographical information system. The occurrence is then included in an area large enough to support the species. The aim is also to inventory other occurrences of threatened species and to record them in the geographical information system. Occurrences of species cannot, however, be sufficiently inventoried in the course of fieldwork, and hence the selection of valuable habitats is primarily based on habitat-specific structural features, the amount of deadwood and observed indicator species. This being the case it is assumed that the conservation of compartments including deadwood and indicator species will protect threatened species.

The aim of selecting and marking out valuable habitats is to reduce the fragmentation of forests. At the same time, the valuable habitats function as ecological links between conservation areas and other valuable habitats. The preservation of larger entities will help to prevent the impacts of fragmentation and reduce the edge effect. The edge effect may reach as far as 2–3 times the length of a tree inward from the edge of a stand. When selecting valuable habitats, one larger old-growth forest site is preferred to several small patches. It is also necessary to consider the location of the patches in relation to each other and to conservation areas: it is better to preserve adjacent patches than ones that lie far apart. If there are no conservation areas in the planning area, an effort should be made to select habitats or concentrations of habitats to function as core areas. If there are conservation areas, the habitats to be conserved are selected so that they form stepping stones between these areas. However, the prevailing ecological conditions should always be kept in mind; even a small herb-rich forest stand in the midst of nutrient-poor mineral soils is to be registered as a valuable habitat. The selection criteria for valuable habitats are presented in figure 4.

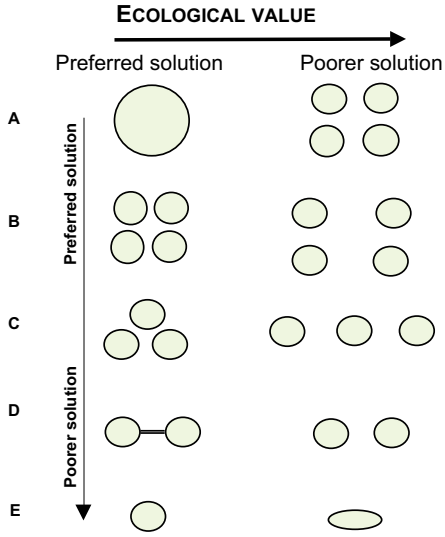

Figure 4. A model of the impact of size, form and mutual location on the ecological value of valuable habitats (adapted from Diamond 1975). Here it is assumed that the marked area is of uniform quality. The figures explained:
One coherent area is preferred to several small patches (A).
Clustered sites are preferred to ones far apart (B, C).
Connected sites are preferred to separate ones (D).
Round sites are preferred to narrow ones (E).

The valuable habitats are mainly to be excluded from forest management operations. Any operations carried out are only to develop the characteristic features of the site, as for example to prevent spruce from taking over a herb-rich broadleaf stand. All measures should ensure that the characteristic features are maintained. The general principles concerning forest management operations in valuable habitats and other sites of special value defined in Landscape Ecological Planning are presented in Appendix 2 (see also Metsähallitus 1998). Regional Environment Centres must be informed before commencing operations near habitats of species requiring special protection under the Nature Conservation Act.

Detailed conservation plans have been or are being drafted for certain threatened species. This is the case with the nesting areas of the golden eagle *(Aquila chrysaetos)*and the white-tailed eagle *(Haliaeetus albicilla)*, for instance. Occurrences of these species are recorded in the geographical information system as required in the conservation plan. The actual nesting area is defined as well as an impact area, in which operations are restricted during the nesting season.

The nests of other birds of prey (such as the osprey *(Pandion haliaetus)*, the peregrine *(Falco peregrinus)*, the gyr falcon *(Falco rusticolus)* and the eagle owl *(Bubo bubo)*) are recorded, either as compartments or as spots in the geographical information system. Operating guidelines on the nesting areas of birds of prey are provided in the Environmental Guidelines (Metsähallitus 1998).

Certain valuable habitats may also require restoration measures (cf. 5.4).

5.2 Ecological links

The purpose of ecological links is to maintain or improve the conditions for the spread of species, mainly of those living in old-growth forests. It is important to pay special attention to the species thriving in spruce-dominated old-growth forests, as these usually spread poorly and depend on the stability of conditions. Various types ecological links are presented in figure 5.

The aim is to create connections not only between conservation areas, but also between valuable habitats or clusters of such habitats in managed forests. Hence the significance and nature of the links vary from one area to the next. The location, number and width of corridors and stepping stones, as well as their silvicultural treatment, are always decided on the basis of local conditions.

Ecological corridors are primarily planned to follow watercourses, moist areas and other related key biotopes. If need be, the network can be complemented by peatland or mineral soil edge zones. The aim is that the corridors should in themselves be valuable sites in terms of biodiversity. Corridors should not be planned if the natural conditions for them are not present. Individual valuable habitats constituting stepping stones, such as old-growth forest stands, can either complement the corridors or replace them altogether. An ecological corridor or stepping stone can also be used to 'tie' adjacent valuable habitats together.

The width of ecological corridors should vary flexibly depending on the terrain and conditions, thus avoiding stereotyped solutions. The corridors may include wider sections consisting of herb-rich forests, moist areas or old-growth forest stands, and correspondingly narrower sections if required by the terrain. Sometimes a stepping stone may be a more functional alternative than a corridor. The advantage of the round stepping stone is that in proportion to land area, it contains more core area protected from the edge effect than a narrow corridor.

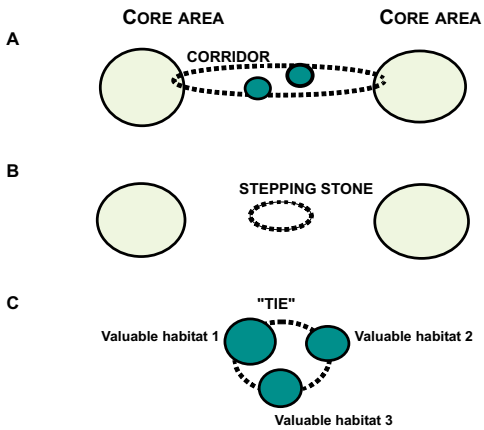

Figure 5. Different ecological links (area outlined by the broken line). Corridor (A), stepping stone (B) and 'tie' (C). In cases A and B the core area may be either a nature conservation area or a habitat cluster. In case C the valuable habitats are tied together to form a cluster.

No regeneration cuttings are carried out in spruce- and broadleaf-dominated ecological corridors. Pine-dominated forests (moderately dry or nutrient-poorer mineral soils), on the other hand, can be regenerated in stages on the basis of an extended rotation time (e.g. 1.7 x the normal rotation time). The regeneration method used is either natural regeneration or small-scale clearings. More trees are to be retained than is normally the practice (at least 15 m^3/ha).

In ecological corridors made up of young forests, careful thinning operations can be carried out. The purpose of thinning is to encourage the trees, especially broadleaves, to grow sturdier. The ecological corridors are, however, always treated with consideration for local conditions. When making decisions on forest management operations, the target proportion of old-growth forests must be kept in mind.

Small-scale measures carried out in forests bordering on the ecological network should aim at making the ecological corridors at least partly viable habitats for species demanding moist and stable microclimates. Regeneration cuttings are not to be carried out simultaneously on both sides of narrow corridors susceptible to edge effects. The other side of the forest bordering on the corridor will not be regenerated until the dominant height of the stand on the side regenerated first has reached at least one third of the dominant height of the stand in the corridor. This will prevent excessive impacts arising from the edge effect. The functioning of the corridors can be improved by retaining more

deadwood than usual in the adjacent forests and also by favouring broadleaves in them.

In the Landscape Ecological Plan, the conservation areas together with valuable habitats and occurrences of species form the core of the ecological network. Following the method described above, ecological links are defined to complement these valuable habitats. The ecological links are usually selected so that they have ecological values, even if they do not in all respects match the criteria for a valuable habitat. In time, features characteristic of valuable habitats will become more frequent. For instance, spruce-dominated ecological corridors will gain features of forests in their natural state.

5.3 Biodiversity enhancement areas

The purpose of the biodiversity enhancement areas is to support the conservation of ecological values in valuable habitats and clusters of them and in small conservation areas. The area usually includes several different stands, i.e. a variety of valuable habitat compartments, and managed forest compartments functioning as their back-up area. Such an area may, therefore, consist of a habitat cluster made up of a couple of separate old-growth forest stands and occurrences of threatened species together with their adjacent areas. The adjacent forests function as a back-up area for the valuable habitats, but do not usually have special ecological values in themselves. The purpose of special treatment within them is to assure and, in the long run, improve the living conditions of species in the valuable habitats. The area may also include restorable habitats (cf. figure 6.)

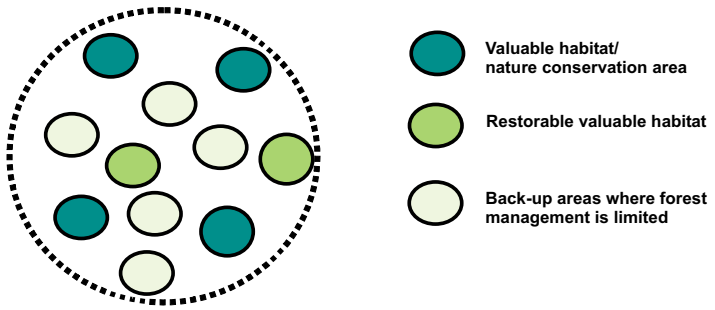

Figure 6. A model of a biodiversity enhancement area and its formation. The compartments where forest management operations take place form a back-up area for the valuable habitats.

Biodiversity enhancement areas are formed, for instance, in areas where habitats with broadleaves and deadwood are scarce. In such cases the forests are treated in such a way that more deadwood than usual is produced. In regeneration cuttings in these areas, retention trees amount to 10–20 m^3/ha. Broadleaves are also favoured more than usual, both as mixed and dominant species. Prescribed burning may also be recommended, which means that the retention trees are also burned. In some cases an extended rotation time can be used to increase the amount of deadwood and to minimise the edge effect.

The biodiversity enhancement area may also be a forest area which has previously been managed with the effect of producing an ecologically poor area, such as a young, even-aged pine stand. In such a stand, biodiversity and variation can possibly be restored by measures such as minor regeneration cuttings. However, it must be noted that under the Forest Act, regeneration cuttings in growing stands are only possible in sites of special value. It is therefore necessary to consult the relevant authorities beforehand.

5.4 Ecological restoration

Ecological restoration means taking active measures to return habitats affected by silvicultural operations to their natural state. In Landscape Ecological Planning, the sites selected for restoration will have special ecological value and importance for biodiversity. In terms of location, priority is given to sites that are included in the ecological networks or biodiversity enhancement areas or that border on nature conservation areas. When selecting the sites, priority is given to statutory valuable habitats and threatened peatlands, which are listed in the original Finnish version of the Environmental Guidelines to Practical Forest Management (Metsätalouden ympäristöopas, Metsähallitus 1997).

A restoration site may be a cleared stream, whose flow and channel is to be returned to its natural state. Drained peatlands, on the other hand, can be restored by blocking or damming ditches and harvesting the new trees which have grown after draining. The necessary measures are prescribed individually for each site. In the case of larger areas, a special restoration plan should be made in advance. Detailed information on peatland restoration is provided in the guidelines for restoring drained forest peatlands (Heikkilä & Lindholm 1995, in Finnish).

In Landscape Ecological Planning, sites may also be defined which are allowed to return to their natural state through natural progress, without active restoration measures. Such self-restoring sites may include previously cut waterside forests and drained fertile peatlands of relatively small area.

5.5 Use of prescribed burning

The trees in prescribed burning and wildfire areas assure the conditions for species requiring burnt wood for their survival. These species usually spread rather easily, but some of them need newly burned wood. For the sake of these species, prescribed burning should be carried out in the same area (within a radius of some 10 km) at least every 2 or 3 years. This will ensure the continued availability of burnt wood. Stands burned for restoration purposes in nature conservation areas help to maintain a continuing supply of burnt wood for species depending on this.

The local burning target is set when the plan is drafted. The targets are divided between planning areas, so that the total volume of prescribed burning remains at a realistic level, while ensuring the continued availability of burnt wood in at least some of the areas.

More trees than usual are to be retained in the areas to be burned, preferably in groups or small-scale stands. It is also important to leave a few sturdy trees standing.

5.6 Proportion of broadleaves and broadleaf-dominated forests

Broadleaf forests and individual broadleaves are important for biodiversity. Aspens, goat willows and rarer broadleaves, in fact, any sturdy broadleaf trees along with deadwood help to maintain a great variety of species and are crucial for several threatened species.

The plan should set targets both for the proportion of broadleaves (% of total wood volume in managed forest land) and for forests where broadleaves are the dominant species (% of area). The targets are to be based on the expected long-term results to be achieved in the planning area (in 50 years). An additional

intermediate target may also be set for the first 10 years. If no target is set for the proportion of broadleaves, its development should be monitored on the basis of the targets set in the silvicultural guidelines (Hokajärvi 1997, in Finnish).

If the forest is in its natural state, the proportion of broadleaves can be estimated roughly on the basis of two factors: the ASIO model based on wildfire frequency and the prevailing habitats. In mesic and herb-rich mineral soil, approximately a half of the forests can be estimated to have been predominantly broadleaves. Relying on this information, a realistic long-term target should be set for the future proportion of broadleaf-dominated forests in the area. The target proportion may, for instance, be half of that in forests in their natural state. It is also important to have broadleaves mixed in stands where other species dominate. One of the aims is to maintain or increase the proportion of the less common broadleaves, such as the aspen, goat willow and rarer species.

Young broadleaf forest succession stages in their natural state are important habitats for certain species. The number of these should be increased gradually, for instance, in the biodiversity enhancement areas or in the ecological networks.

5.7 Decaying wood

The extent and quality of decaying wood are major indicators when measuring biodiversity and selecting the sites for conservation. They are used as selection criteria when classifying sites in their natural or near-natural state, such as virgin old-growth forests. The volume of deadwood in the valuable habitats is also recorded in the geographical information system. Data recorded include the total volume of deadwood per species, its distribution between fallen and standing trees, and the distribution of decay stages. The proportion of trunks over 30 cm thick is also recorded.

In Landscape Ecological Planning, an effort is made to create concentrations of deadwood, e.g. in the valuable habitats, ecological networks and biodiversity enhancement areas. The deadwood concentrations are more useful for the threatened species than individual retention trees in regeneration sites. The plan can include special targets for the volume of trees to be retained in operations near certain valuable sites.

The general principles for retaining deadwood in cuttings are given in the Environmental Guidelines to Practical Forest Management (Metsähallitus 1998). Compliance with the targets is monitored by measuring the volume of retained trees and deadwood in follow-ups of cuttings.

The amount of deadwood has decreased in areas which have been in commercial use for a long time. The objective can be to increase the volume of deadwood, for instance, by leaving retention trees in the area.

5.8 Proportion of old-growth forests

Landscape Ecological Planning aims at maintaining a satisfactory proportion of old-growth forests, especially those dominated by spruce or broadleaves. Means to this end include the protection of existing old-growth forests and in the long term, promoting the development of new areas of old-growth forest.

The plan sets a target for the proportion of old-growth forests. An old-growth forest is defined as a forest stand exceeding the regular rotation time by 20 years. When setting the targets, the starting point is the expected proportion to be achieved in the planning area in the long term (in 50 years). An additional, realistic intermediate target can also be set for the first 10 years.

When specifying the target for the proportion of old-growth forest, the aim is to ensure that in the long term the required proportion is found mainly in the existing conservation areas and in sites of special value as defined in the plan. These include the ecological network, virgin old-growth forest stands and other key biotopes, as well as waterside and scenic forests and other sites with an extended rotation time. Depending on the previous forest use, it is possible that a considerable amount of old-growth forest may be present in conventionally managed forests.

In areas where the proportion of fire refugia and rarely burned forests is significant (categories A and S), the target percentage of old-growth forests (% of forest land area) should, in the long term, be higher than in other areas, at least 6–10%. On the other hand, in areas where most of the forests have been burned by wildfires (categories I and O), the target percentage of old-growth forests may be lower, e.g. 4–8%. In areas where the proportion of poorly productive forests is significant, the target percentage can also be lowered correspondingly.

5.9 Valuable landscapes and cultural sites

Valuable landscapes are those sites in the planning area which have special scenic values. Both the near and the distant landscape should be taken into account. Important sites in terms of near landscape may include forests bordering on minor water bodies and forest roads and those near residential areas and recreational structures or routes. In these cases it usually suffices to define as valuable landscapes those forest stands that are particularly visible or prominent and whose treatment thus differs from the usual. This is important, as scenic values are to be considered in all operations.

When drafting the plan, it is also necessary to assess which parts of the planning area are critical in terms of landscape management. Forestry operations carried out in these areas are usually clearly visible in the distant landscape. Critical areas may include the shores of extensive water bodies, islands, sides of roads in frequent use, as well as hill and fell areas. In these areas, the impact of future operations on the visual landscape should be assessed and valuable landscapes marked out accordingly (landscape analysis). The delineation of valuable landscapes should be given special attention near tourist centres.

In landscape analysis, the areas important for landscape management are marked out using various maps and aerial photographs. The assessment is made from a general vantage point (waterways, roads, residential area or various routes). The delineated areas may include the tops and profiles of hills, shores of water bodies, peninsulas and islands, national heritage landscapes (meadows and logging camp sites), and geological formations and contours such as eskers, gorges and cliffs. The aim of the analysis is to specify the sites where special attention should be paid to the location and designing of silvicultural operations with a view to scenic values. In addition, sufficient local forest cover must be left even at the regeneration stage.

Each landscape area should be treated individually. The areas are treated on the basis of an extended rotation time, but they may include some stands where it is best to refrain from any operations and also stands that can be treated according to normal silvicultural principles. Scenic forests in general can be thinned, and the aim is to regenerate the stands in stages, avoiding large regeneration areas. If need be, the stands can be grown in two stages for as long as it takes to ensure forest cover in the area.

Cultural sites include, among others, non-moveable ancient relics protected under the Act on Archaeological Remains (265/1963). These include prehistoric human dwellings, burial grounds and other sacred sites and sites relating to hunting culture (such as deer pitfalls). Historic monuments include sites relating to old sources of livelihood, such as tar pits and ore-smelting furnaces, stone walls resulting from the clearing of fields and old logging camp remains. Furthermore, ancient monuments include old battlefields, border markers, monuments and sacrificial trees. The sites are recorded in the geographical information system as spots, but the actual marking out should be done under the guidance of the National Board of Antiquities, in which context the site's buffer zone and need for maintenance will also be assessed. Other cultural sites to be considered in planning include sites used in present-day occupations, such as reindeer corrals. Some places have also acquired a valuable vegetation structure as a result of slash-and-burn-cultivation, cattle grazing and flooding, which is now disappearing as old cultivating and grazing methods are being abandoned. These sites are valuable habitats due to their unique species. Detailed guidelines on ancient monuments are provided in a guidebook (Metsähallitus 1993, in Finnish).

5.10 Game habitats

Game habitats are defined according to the classification laid down in the fieldwork guidelines for data collection for the geographical information system (Soinne 1999). Sites to be recorded include capercaillie and black grouse *(Tetrao tetrix)* lekking sites, hazel grouse *(Bonasa bonasia*) environments, goose bogs and various caves used by game animals. Guidelines for game habitat management are presented in the Environmental Guidelines to Practical Forest Management (Metsähallitus 1998; cf. also Helle et al. 1999).

In forest management operations, special attention should be given to capercaillie leks. These stands are to be treated on the basis of an extended rotation time, and the surrounding forests are to be regenerated in stages. Sufficient space must be preserved for the capercaillie lekking site. The average size of a lek is 20 hectares, although the size varies depending on the number of cocks in the lek. Capercaillie leks are also classified according to their use in active sites, monitored sites and sites requiring development measures. Where possible, uncertain leks are checked in inventories. A lekking site may be removed from the geographical information system after it has been found to be inactive in several consecutive years. (Figure 7).

Figure 7. View from the GIS database. Lekking sites of capercaillie are shown in red and those of hazel grouse in light green (strip by the stream). Unclassified game habitats are shown in brown.

The inventory of hazel grouse habitats is also important, as the hazel grouse is very attached to its territory. If need be, special game management measures or sites can be included in the plan. In certain areas the focus of forest management operations can also be adjusted so as to make special provision for game species. Valuable habitats and ecological corridors also function as feeding sites and refuges for certain game species. When selecting valuable habitats, the presence of game habitats in the area increases their value. The plan should assess the impacts of the proposed solutions on the game habitats and the general environments for the game species in the area.

5.11 Forest roads

The local ecological impacts of forest roads are assessed in a general forest road network plan, which is linked with the Landscape Ecological Plan. If necessary, the planning work should involve drafting a plan for expanding the existing forest road network, which must be in harmony with other land use objectives in the area. Special aspects to be taken into account can be specified individually for every new road to be built. The density of the road network can be calculated by road category in the area, and this calculation can be used to assess not only the usefulness of the roads for forestry but also the wilderness rating of the planning area.

The areas where roadbuilding would cause unwarranted damage to the environment are also to be outlined in the road network plan. Careful planning and the use of winter roads are the main means of reducing the environmental damage caused by forest roads. The use of existing year-round roads can be restricted in the thaw season and at other environmentally critical times. The road can even be cut off completely. This may be a solution with roads leading to or crossing conservation areas.

In northern Finland, winter roads can partly take the place of summer roads. The Landscape Ecological Plan can lay down special areas reserved for winter-only activities, where no summer roads are built. The use of winter roads requires special consideration, particularly when procuring wood from sensitive areas, such as:

- islands, peninsulas and other waterside forests
- areas with frequent minor water bodies
- areas with boulder fields and rocky outcrops

- swamp woods in their natural state
- hilltop areas

Areas including numerous valuable habitats, nests of birds of prey or capercaillie leks can also be left aside for winter-time operations only.

6 LANDSCAPE ECOLOGICAL PLANNING IN OLD-GROWTH FOREST INVENTORY AREAS

The inventories of ecological values in old-growth forests gathered a great deal of information on the ecological values of managed forests and special-use forests, some of which were left outside the scope of conservation by a government resolution. These areas failed to meet the criteria for setting up a conservation area for a variety of reasons, such as small size, earlier commercial use or location.

Ultimately, some 72,000 ha of old-growth forest land remained outside conservation programmes in northern Finland, along with an additional 6,000 ha in the North Karelia and South Kainuu regions. Based on the government resolution, the ecological values in these areas will be maintained in connection with commercial use by means of Landscape Ecological Planning (cf. Old-growth Forest Conservation Committee 1996).

Within these areas, the parts which are of special value will be excluded from operations, either by compartment-specific restrictions or by giving them the status of special-use forests of Metsähallitus. The restrictions will be specified in the Landscape Ecological Planning process by the Forestry unit in cooperation with Natural Heritage Services. The sources used when drafting the plan include the material gathered from the old-growth forest inventories, ecological information from other sources and the results of the field inventories.

Landscape Ecological Planning also takes into account the other old-growth forest inventory sites which did not meet the conservation criteria. If such sites are to be affected by forest management operations before the Landscape Ecological Plan has been drafted, their ecological values must be reviewed, for each compartment, by the Forestry and Natural Heritage units in cooperation before the operations are started.

7 PARTICIPATORY PLANNING IN LANDSCAPE ECOLOGICAL PLANNING

Participatory planning is used as an aid in Landscape Ecological Planning. Participatory planning aims at transparent and multi-directional cooperation with local interest groups and residents. Open cooperation is useful in gathering important information, including opinions on management and usage needs in the forest area. The aim is to achieve an ecologically sustainable but at the same time widely accepted plan on the management of forests in the area. More information on the use of participatory planning is available in Participatory Approach to Natural Resource Management – A Guide Book (Loikkanen et al. 1999).

The opportunity for participation must be effectively publicised in order to allow people to have their say on the development of their own environment. A key element of good cooperation is efficient communication on the plan at various stages of the project. At an early stage of drafting the Landscape Ecological Plan, it is often a good idea to arrange an open meeting for the residents and interest groups in the area. The meeting provides an opportunity to explain the goals of Landscape Ecological Planning and to shed light on the opportunities of interest groups, residents and other interested parties to participate in the process. It also provides an opportunity to explain the project schedule and decision-making system to the audience.

It is important to collect, analyse and record all feedback carefully. Records are kept of the feedback received in the public meeting. Feedback is also collected from questionnaires, which can either be filled in at the meeting or returned afterwards. The questionnaires ask the respondents for information on the area and for their views on the planning work. The respondents are also asked to fill in their contact details so that their responses can be answered and cooperation can continue. The questionnaire can also be sent to local residents by mail.

All feedback gained at various stages and by various means is equally important. Newspaper articles, letters to editors and radio and TV programmes are also forms of feedback. Feedback delivered in various forms can be recorded in a comparable format, for instance on the feedback questionnaires.

For the purpose of systematic evaluation, the following background information is recorded for all comments: Date of reception, topic, reception channel and the contact details of the respondent. The aim is to allow the planners and decision-makers to form an optimally correct opinion of the feedback given. The planning report should include a summary on feedback received and its implications for the plan. The summary will also include an account of the participatory methods used and the number of participants in the meetings.

Local interest groups usually provide comprehensive feedback on the project, while individual citizens more often comment on concrete location-specific information or details of personal interest. Important interest groups include village committees, hunting societies, tourist entrepreneurs, nature organisations etc. It is also possible to form cooperation groups made up of representatives of the interest groups, which can then meet when necessary and take a stand on various issues.

Towards the end of the planning project, the participants and the general public are to be given information on the decisions made and on the completed plan.

It is important that Landscape Ecological Planning projects remain open for cooperation with other landowners, especially when this is required to form suitable regional planning entities.

The general public can usually be activated with the support of the media, and substantial amounts of feedback are received. The participatory planning procedure in turn provides people and various interest groups with information on the activities of the planning body and the new forest planning and operating methods used.

8 ASSESSMENT OF IMPACTS OF THE PLAN

8.1 Ecological impacts

The ecological assessment should include an evaluation of the impacts of the plan on the preservation of habitats of threatened and game species and on the possibilities for the species to survive in the planning area in the future. If necessary, the impacts of the plan on reindeer grazing lands are also assessed in reindeer husbandry areas.

The ecological impacts of the plan can be assessed indirectly on the basis of the various habitats belonging to the ecological network. The number and quality of the different habitats and their proportion in relation to the entire planning area can be monitored. This monitoring is, however, less useful by the fact that no corresponding figures are currently available for nature conservation areas. Another figure to be controlled is the extent to which each vegetation type is represented in the ecological network. A similar control can be carried out on the basis of dominant tree species. It must be kept in mind, however, that the age and tree species distribution in the area may differ considerably from the situation of a similar forest in its natural state. In fact, the targets set for the development of age and tree species distribution should be compared to the estimated natural state.

The ecological situation of the area and the impacts of the plan can also be assessed directly on the basis of the number and quality of occurrences of species found in the area. In this case, an effort is also made to assess how the plan (e.g. the ecological networks) affects the survival of populations. Wherever possible, the assessment should also take into account the long-term development of tree species and age distribution in the forests. The results of the forest cutting budget calculations (MELA) can be utilised in this task.

The assessment should also take into consideration the impacts of operations complying with existing forest management and environmental guidelines (such as retention of trees and deadwood in the managed areas) on the ecological development of the area. In addition, decisions made in the planning area can be assessed by comparison with the adjacent planning areas and the larger whole made up of several planning areas.

8.2 Economic impacts

The economic impacts of the plans are to be assessed. It is often advisable to use the cutting budgets for this purpose. These assess the relative impacts of the plan on the potential cut in the managed forests in the area. The impacts on net income can also be monitored. The assessments are made to cover a time span of 10 to 40 years. The calculations address the relative impact of the following categories on the planned cutting in the area:

- statutory valuable habitats and occurrences of valuable species
- other valuable habitats, occurrences of valuable species and ecological networks
- valuable landscapes, cultural sites and game habitats
- regional forest development goals (proportion of broadleaves and old-growth forests).

For the purpose of the calculation, the sites of special value are classified into so-called treatment categories according to the degree to which they restrict forest management operations (see Appendix 2). The forest management operations and level of treatment permitted are specified for each treatment category. Actual cutting plans are not made, as the planning areas are too small for this. Silvicultural impacts can also be assessed on the basis of the relative proportions represented by the stands and their area within the special sites in managed forests.

Cutting budget calculations (MELA) can also be utilised for drawing up alternative plans and assessing their economic impacts. When carrying out alternative assessment, it is important to define the goals of each option clearly and also to assess the ecological and social impacts of the various alternatives.

8.3 Social and cultural impacts

The impacts of the plan on employment in the forestry branch can be assessed on the basis of the cutting budget calculations. The planning area is usually too small for a detailed analysis. A separate assessment is made of the impacts of the plan on the conditions for local tourist entrepreneurs, reindeer husbandry and other nature-based sources of livelihood.

The social impacts can further be assessed on the basis of the number of valuable landscapes and cultural sites specified in the area.

The social assessment also reviews the feedback received from participatory planning. The received feedback is summarised and an evaluation is made of the extent to which feedback concerning the use and management of the area has contributed to the plan.

9 MONITORING AND UPDATING OF THE PLAN IN METSÄHALLITUS

The completed Landscape Ecological Plans are stored in electronic format for eventual evaluation and monitoring. The electronic format serves the needs of monitoring better than a printed report, as the planning data is constantly updated. The information for each planning area is stored separately. The compartment-specific data on the special features and map locations are saved in their own separate files. The records and other documents produced in the course of the planning process should also be stored.

The data on the geographical information system are kept up to date by entering any changes to compartment-specific information. The system can thus be used for monitoring the implementation of the Landscape Ecological Plan. The implementation of areal targets is monitored in 5-year periods. The preservation of valuable habitats and other sites of special value, and the volume of retention trees left in cuts, are monitored annually by ecological follow-up inventories based on random sampling.

Objectives of the plan and monitoring of objectives

Objective period	Monitoring	Follow-up
- Proportion of forests exceeding the rotation time by more than 20 years, % of area	GIS	every 5 years
- Proportion of forests broadleaf-dominated in managed forest land, % of area	GIS	- ” -
- Proportion of broadleaves in managed forest land, % of stand volume	GIS	- ” -
- Prescribed burning, ha	GIS	every 5 years
- Implementation/treatment of ecological networks	ecol. inv.	annually based on random sampling
- Operations in biodiversity enhancement areas	ecol. inv.	- ” -
- Preservation of valuable habitats	ecol. inv.	- ” -
- Preservation of habitats of threatened species	ecol. inv.	- ” -
- Preservation of game habitats	ecol. inv.	- ” -
- Preservation of valuable landscapes and cultural sites	ecol. inv.	- ” -
- Preservation of sites relating to nature-based sources of livelihood	ecol. inv.	- ” -

The planning data are supplemented as new sites are identified. The new data on sites of special value are recorded in the geographical information system. The units agree which of them is responsible for updating and maintaining the data for each planning area.

The plan will be reviewed after five years at the latest (Figure 8). The review will be arranged in line with the principles of participatory planning. The follow-up review will chart the present status of implementation and the action necessary to update the plan and to achieve the goals set. If necessary, additional inventories will be arranged to chart the implementation status. The objectives of Landscape Ecological Planning will also be reviewed in the context of monitoring the natural resources plan. The follow-up reviews of both the natural resource plan and the Landscape Ecological Plan can also be combined. The review should state any new land use decisions, new research results and the feedback received on operations, which are then used as a basis for evaluating

whether the plan is up to date and for making any necessary changes to the plan. Any changes to the threatened species classification should also be allowed for in the evaluation of the plans.

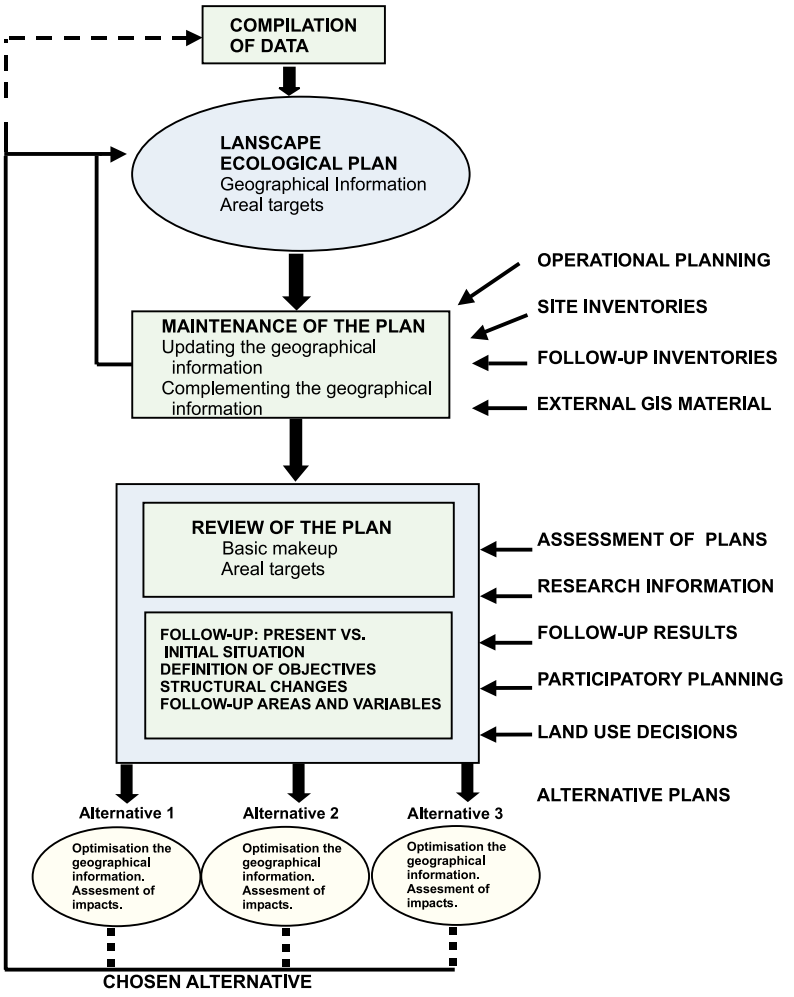

Figure 8. The completed plan is updated by adding new sites into the geographical information system. It is also recommended that the entire plan, its overall composition and goals are re-evaluated after a set period.

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STANDARD OUTLINE FOR THE REPORT

1 INTRODUCTION

2 OBJECTIVES OF THE PLAN

3 PREPARATION OF THE PLAN
- 3.1 Collection of data
- 3.2 Field inventories
- 3.3 Compiling the plan
- 3.4 Participatory planning (implementation and summary of the feedback received)

4 DESCRIPTION OF THE PLANNING AREA
- 4.1 General description (location, vegetation zone, areas per land use category)
- 4.2 Waterways
- 4.3 Bedrock and topography
- 4.4 Nature conservation
- 4.5 Forestry (history, present state)
- 4.6 Multiple use (reindeer husbandry, fishing, hunting, tourism)
- 4.7 Natural dynamics of forests

5 SUB-SECTIONS OF THE PLAN
- 5.1 Nature conservation areas and valuable habitats
  - 5.1.1 Nature conservation areas
  - 5.1.2 Valuable habitats
  - 5.1.3 Occurrences of threatened species
  - 5.1.4 Biodiversity enhancement areas
  - 5.1.5 Ecological network
- 5.2 Forest management
  - 5.2.1 Management models and retention trees
  - 5.2.2 Proportion of old-growth forests
  - 5.2.3 Distribution of various tree species and fire successions
  - 5.2.4 Volume of deadwood
  - 5.2.5 Volume of burnt wood
  - 5.2.6 Maintenance of drainage areas
  - 5.2.7 Road network
- 5.3 Recreational use and nature-based sources of livelihood
  - 5.3.1 Reindeer husbandry
  - 5.3.2 Game and fish management
  - 5.3.3 Tourism (incl. nature tourism)

Appendix 1. 2(2)

SITES OF SPECIAL VALUE IN LANDSCAPE ECOLOGICAL PLANNING AND THEIR TREATMENT IN FOREST MANAGEMENT OPERATIONS

The valuable habitats and other sites of special value identified in the Landscape Ecological Plan are recorded in the geographical information system using the codes given in the GIS fieldwork guidelines.

The sites of special value usually cover one or more forest compartments. The delineation of compartments can be checked to match the site if necessary. Sites of very small area can be identified as sites smaller than a compartment. It is also possible to identify several sites of special value within one compartment.

The valuable habitats and sites of special value identified in the Landscape Ecological Plan are either totally excluded from forest management operations or subject to special treatment as required by the particular site. The management of sites of special value is based on the Environmental Guidelines to Practical Forest Management. Any silvicultural operations are planned individually for each case during the general operational planning. The delineation of the sites is also checked at this stage.

The following sites of special value are mainly outside the scope of silvicultural operations:

- Occurrences of species requiring special conservation
- Valuable habitats
- Ecological link

Occurrences of species requiring special conservation are left outside the scope of operations according to the needs of each species. Operations are carried out in valuable habitats only for the purpose of developing the characteristic features of the site. For instance, in herb-rich forests or along minor water bodies, careful thinning may be carried out in order to maintain the proportion of broadleaves or encourage the development of ground vegetation. Valuable habitats also include sites which have previously been managed but are now subject to active restoration measures or which are being allowed to return to their natural state.

The ecological corridors and stepping stones are mainly situated in forests where spruce or broadleaves are dominant and where no regeneration cutting is carried out. Careful thinning may be carried out in young forests. Pine-dominated forests can be regenerated in stages by small-scale cutting on the basis of an extended rotation time.

Appendix 2. 2(2)

Other sites of special value to be taken into account in silvicultural operations:

- Biodiversity enhancement areas (back-up areas, i.e. areas outside the valuable habitats)
- Occurrences of species (other threatened species or species otherwise in need of special attention)
- Cultural sites
- Game areas
- Valuable landscapes and special recreational sites

The details of operations are planned with a view to the special features of the site. In a biodiversity enhancement area, for instance, the objective may be to support a concentration of valuable habitats by increasing the volume of broadleaves and deadwood in the surrounding area. Provision is made for occurrences of species either when identifying valuable landscapes or alternatively they are treated with special care in forest management in order to save local occurrences. Forest management operations in valuable landscape areas and game habitats are on a smaller scale than normal. Regeneration cutting is usually carried out in stages on the basis of an extended rotation time.

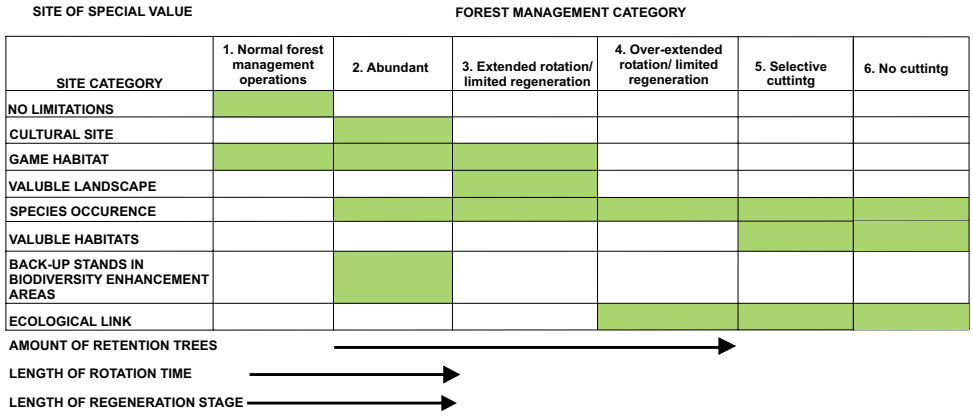
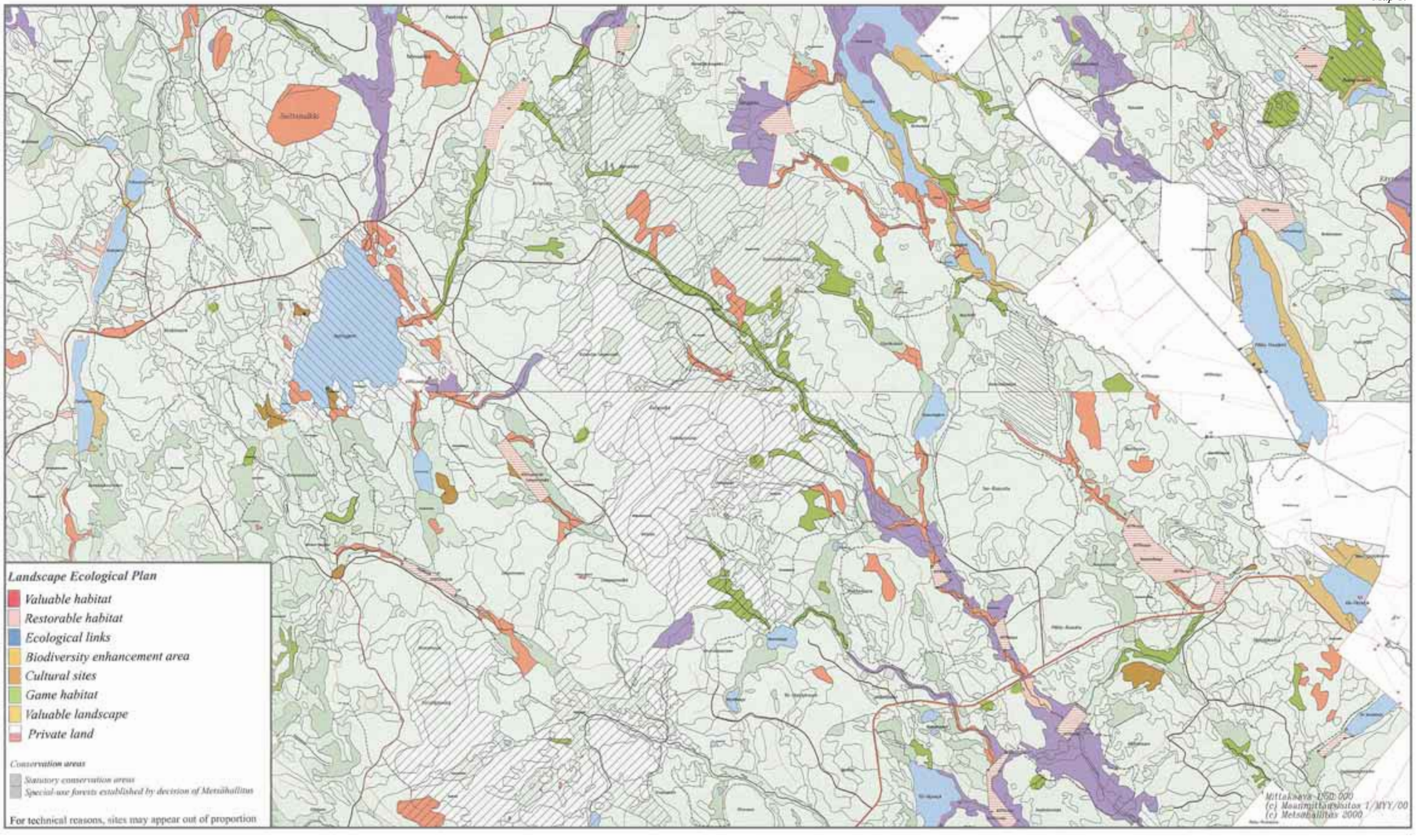


Figure 1. Forest management operations in Landscape Ecological sites. The goal is to preserve the characteristic features of each site. The forest management category indicates the restrictions on operations required by the site.

Map 1.


Landscape Ecological Plan
Valuable habitat
Restorable habitat
Ecological links
Biodiversity enhancement area
Cultural sites
Game habitat
Valuable landscape
Private land
Conservation areas
Statutory conservation areas
Special-use forests established by decision of Metsähallitus
For technical reasons, sites may appear out of proportion
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