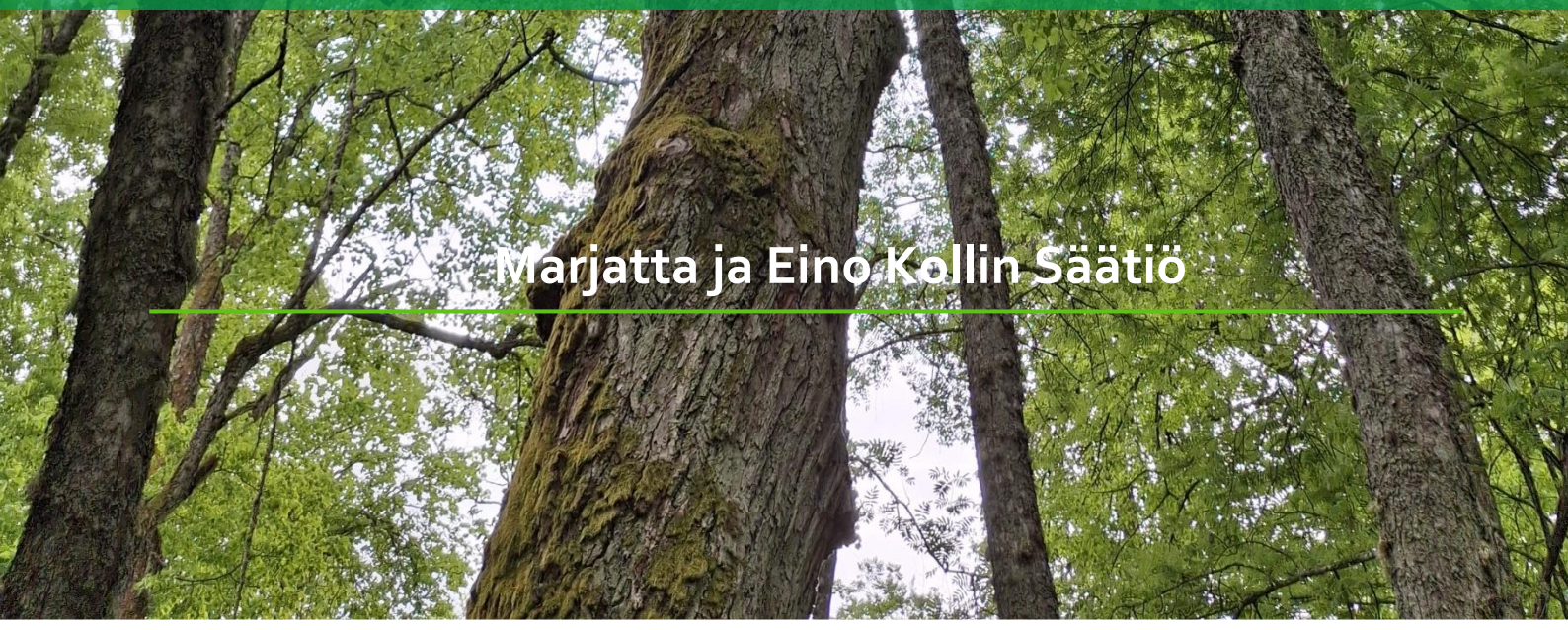


TAPIO

Forest nature management

Self-study material

30.10.2026



Marjatta ja Eino Kollin Säätiö

TAPIO

TAPIO

Riitta Raatikainen, 2026, Luonnonhoidon itseopiskelumateriaali, Tapio

Heli Mäntyranta (käännös), 2026, Forest nature management.

© Tapio Oy

Kansikuva:
Riitta Raatikainen

Työn tilaaja: Marjatta ja Eino Kollin säätiö

TAPIO

Contents

1 NATURE MANAGEMENT TEACHING CONTENT – SECTION 1 3
1.1 SUSTAINABLE FOREST MANAGEMENT 3
1.2 FOREST MANAGEMENT PRACTICES 4
1.3 FOREST CERTIFICATION 4
1.4 LEGISLATION AFFECTING FOREST MANAGEMENT AND USE 5
2 NATURE MANAGEMENT TEACHING CONTENT – SECTION 2 9
2.1 NATURE SITES 9
2.2 SAFEGUARDING HABITATS OF SPECIAL IMPORTANCE AS DEFINED IN SECTION 10 OF THE FOREST ACT 10
2.3 HABITATS PROTECTED UNDER NATURE CONSERVATION ACT 12
2.4 HABITATS SAFEGUARDED BY WATER ACT 13
2.5 OTHER VALUABLE HABITATS 13
2.6 INDICATOR SPECIES 14
2.7 IMPROVING THE STATE OF HABITATS 14
2.8 THREATENED FOREST SPECIES AND ATTENTION TO BIRDS 16
3 NATURE MANAGEMENT TEACHING CONTENT – SECTION 3 19
3.1 NATURE MANAGEMENT METHODS IN COMMERCIAL FORESTS 19
3.2 TAKING ACCOUNT OF LANDSCAPE AND MULTIPLE USE IN FOREST MANAGEMENT 23
4 NATURE MANAGEMENT TEACHING CONTENT – SECTION 4 25
4.1 CONTINUOUS-COVER SILVICULTURE 25
4.2 NATURE MANAGEMENT AND HARVESTING OF ENERGY WOOD 26
4.3 FOREST MANAGEMENT WITH A FOCUS ON GAME 27
4.4 SPECIAL AREAS IN COMMERCIAL FORESTS 28
4.5 CLIMATE BENEFITS OF SAFEGUARDING BIODIVERSITY 28
5 NATURE MANAGEMENT TEACHING CONTENT – SECTION 5 30
5.1 IMPACT OF FORESTRY ON WATER BODIES 30
5.2 FACTORS AFFECTING THE LOAD FROM FORESTRY ON WATER BODIES 30
5.3 CATCHMENT AREA 31
5.4 BUFFER ZONES ALONG WATER BODIES 31
5.5 PREVENTING DAMAGE TO TERRAIN DURING HARVESTING; CROSSING WATER BODIES 32
5.6 SOIL TYPES AND RISK SPOTS 32
5.7 WATER PROTECTION STRUCTURES USED IN FOREST MANAGEMENT 33
5.8 USE OF GEOSPATIAL DATA IN WATER PROTECTION 33

1 Nature management teaching content – Section 1

Legislation and recommendations on safeguarding forest biodiversity

- Statutory constraints on forest management operations
- Significance of forest certification systems in nature management
- Forest Management Recommendations and nature management

Competence requirements

Students are required to

- Understand the principles and goals of sustainable forestry
- Know the effects of legislation, forest certification and Forest Management Recommendations on forestry operations
- Be familiar with the legislation affecting forest use, forest nature and special features, as embodied in the Forest Act, Nature Conservation Act, Water Act, Antiquities Act and Land Use Act
- Be familiar with certification systems and their requirements
- Know how to use the Forest Management Recommendations to find information on nature management and when implementing operations

1.1 Sustainable forest management

Sustainability means that future generations will have the same, or even better, opportunities to meet their needs as the present ones do. Safeguarding sufficient forest resources and biodiversity, as well as adapting to and mitigating climate change are among the key elements of the sustainable use and management of forests. Forest policy establishes the framework for using forests in a sustainable way.

Sustainable forest management comprises the dimensions of economic, ecological, social and cultural sustainability.

- *Economic sustainability* means that the viability, productivity and profitability of forests are preserved in the long term.
- Actions to secure *ecological sustainability* include the protection of forest biodiversity and keeping the waters clean.
- *Social sustainability* means that people in general and the various stakeholders continue to have access to the benefits derived from forests.
- *Cultural sustainability* comprises the understanding of natural environments and human action, including views about the relationship between forest, economy and culture.

By taking care of all the dimensions of sustainability, we can safeguard the opportunities of future generations to use forests as a source of wellbeing.

The purpose of forest legislation is to promote economically, ecologically, socially and culturally sustainable forest management and use, in order that forests produce a good output in a sustainable way while preserving their biodiversity. The Forest Management Recommendations (national guidelines) describe the methods of managing and using forests while also meeting the goals of forest owners.

Forest owners may enter their forest holdings into a forest certification system. The certification criteria impose requirements on forest management and use that are stricter than those laid down by law. Forest certification is a voluntary, market-driven system to verify the compliance with these requirements. The certification systems currently in use in Finland are the PEFC and FSC.

1.2 Forest management practices

The profitability of Finnish forestry is based on the good timber production capacity of forests and a demand for Finnish timber. Forest management aims to promote the growth of valuable stands and improve the quality of roundwood. In addition to timber production, today's forest management focuses on the preservation of natural values, landscape management and recreational needs.

The Best Practices for Sustainable Forest Management are a collection of guidelines for forest owners on how to manage their forests. The guidelines offer alternatives for forest management and information on their effects. Following these practices is voluntary, and they complement national forest legislation with practical guidelines.

Sustainable forest management incorporates all the sub-areas of sustainability – economic, ecological, social and cultural – while also taking the climate into account. The best practices integrate climatic sustainability into the various aspects of forest management; for instance, regeneration, felling, water protection and the safeguarding of biodiversity.

The best practices for forest management are offered as a service by the Ministry of Agriculture and Forestry to Finnish forest owners and professionals and are part of the National Forest Strategy implementation. The aim of the best practices for forest management is, in line with that of the Forest Strategy, overall sustainability and increased wellbeing derived from forests.

The Best Practices https://metsanhoidonsuositukset.fi/en

1.3 Forest certification

Forest certification is a means of demonstrating that forests are used responsibly and sustainably. This requires that the management and treatment of forests is ecologically, economically and socially sustainable and does not reduce the opportunities of future generations. When practising targeted forestry, forest biodiversity and the cultural and recreational values of forests are taken into account. The purpose of forest certification is to strengthen the sales of Finnish wood-based products on the international market.

Forest certification includes forest management certification and chain of custody certification. Compliance with the criteria of forest certification is audited annually by an external party. Certification is

granted when forest owners and forestry operators commit to operating in accordance with the certification criteria, and compliance with the criteria is verified by auditing. Verification of the chain of custody of trees ensures that they come from certified forests. The chain of custody certificate is issued to forest industry production facilities that have a traceability system. In Finland, two major certification systems are in use: the PEFC and FSC. About 80 percent of Finland's forests are PEFC-certified, while about 10 percent are FSC-certified.

English - PEFC Suomi https://pefc.fi/english

FSC in English | Forest Stewardship Council https://fi.fsc.org/fi-fi/fsc-in-english

In Finland, forest certification is usually implemented as regional group certification. Forest owners participate in the certification either through membership in forest management associations or by registering with the Sustainable Forestry Association either directly or through an organization representing them, such as a timber procurement company.

Joining a forest certification system is voluntary for forest owners and forest holdings. The certification selected by them requires that biodiversity is taken into account, and it sets the minimum criteria for the nature management methods of commercial forests. Some of these requirements concern the number of live retention trees and volume of deadwood, as well as the stoutness of both, and the width of buffer zones surrounding water bodies. It is also possible to implement measures in excess of the minimum criteria, either on specific sites or during a particular operation, and to take account of the forest owner’s goals. Statutory requirements are to be complied with at all times. The criteria of forest certification concern both fellings and forest management operations.

1.4 Legislation affecting forest management and use

Forest Act

The Forest Act is the most important piece of legislation that affects forestry operations. Compliance with the Act is monitored by the Finnish Forest Centre. The Forest Act safeguards habitats of special importance which are in a natural or semi-natural state, clearly distinguishable from their surroundings and small in scale or with little significance for forestry. Habitats safeguarded by the Forest Act include, among others, the immediate vicinity of natural springs and brooks, luxurious herb-rich forest patches and islets of heath forest on mires. The characteristic features of habitats safeguarded by the Forest Act may not be deteriorated by forestry operations. In addition, the Act defines the operations either allowed or prohibited on the habitats.

The Forest Act contains restrictions on fellings during the nesting period of birds. The nesting sites defined in the Act are luxurious broadleaf-dominated forests, spruce mires and littoral forests. In addition, before fellings or other forestry operations, the operator carrying out the work or with the felling right must assess the bird populations of the site. The assessment is obligatory for all forests regardless of type.

The Forest Act requires that a notification of forest use is submitted to the Forest Centre on fellings. The Forest Centre must pass on this information to authorities who monitor compliance with other legislation, if the felling in question affects the breeding ground or resting place of the Siberian flying squirrel, for example.

Forest Damage Prevention Act

The Forest Damage Prevention Act was enacted, among other purposes, to curb the risk of insect or fungal damage to growing trees, caused by the storing of timber and storm damage. The Act obliges forest owners to remove from the forest recently damaged conifers to the extent that their volume is over 10 m^3 for spruce and 20 m^3 for pine per hectare and the base diameter is over 10 cm. Compliance with the Act is monitored by the Finnish Forest Centre.

Smaller volumes of recently fallen conifers need not be removed, as the risk of damage caused by single trees is small and the cost of removal may be higher than the value of the tree. Bark beetles feed on trees recently felled by storms and on weakened standing trees. If a stand contains storm-felled trees that have lost their needles and some of their bark, they no longer constitute a risk. When removing storm-damaged trees, some may be left to decay, to benefit species dependent on deadwood.

Nature Conservation Act

The Nature Conservation Act safeguards biodiversity, and compliance with it is monitored by the Finnish Supervisory Agency.

The Nature Conservation Act prohibits the significant deterioration of the natural values forming the basis of protection of areas in the Natura 2000 network. Nevertheless, on many Natura 2000 sites it is possible to carry out forestry operations, provided that the special value of the site is taken into account. The Nature Conservation Act also requires the preservation of nature reserves, such as national parks and private nature reserves, as well as the preservation of certain protected habitats. The occurrence of a protected habitat may not be destroyed deteriorated. The prohibition enters into force as soon as the owners or occupiers of the site are notified of the decision.

The Nature Conservation Act requires that threatened species and the sites on which they occur are protected. The site of occurrence may not be destroyed or deteriorated. The prohibition enters into force as soon as the owners or occupiers of the site are notified of the decision. Certain species are more strictly protected by the EU, such as the Siberian flying squirrel, together with its breeding grounds and resting places. The nesting trees of large birds of prey are also protected. The nesting trees of the golden eagle, white-tailed eagle, greater spotted eagle, lesser spotted eagle or osprey, where the nest is in repeated use and clearly visible, are protected. In addition, the Nature Conservation Act protects several animal species and their dens, and they may not be intentionally disturbed or killed.

To protect and maintain the beauty, historical characteristics or other special values related to landscape in a natural or cultural landscape, the Nature Conservation Act allows the setting up of national or regional landscape management areas.

Water Act

The Water Act defines flowing water bodies as rivers, brooks and rivulets. The definition is based on the size of the catchment area. The Water Act protects flowing water, small ponds and lakes, seashore formations (flads, gloe lakes) and the zones bordering on or affected by all of these. In particular, the Water Act protects the water course or basin and the areas bordering them.

The Water Act prohibits the endangering of the natural state of aquatic habitats without a relevant permit. Under the Water Act, a prohibition to endanger an aquatic habitat may cover a small body of water, but also the area bordering and affected by it, though not the nature values outside this. As an example, a brook is a body of water as defined by the Water Act, and endangering the natural state of a brook always requires a permit as stipulated in the Act. The definition of a water body under the Water Act can

also cover previously cleared courses of brooks, if sufficiently restored. The endangering envisaged in the Water Act may be caused, in particular, when crossing the watercourses, which should be primarily avoided in harvesting operations.

The Water Act and the Forest Act together protect water formations which are in a natural or near-natural state and are of natural origin, as well as their immediate vicinity. The Water Act is not applied to, for example, on the felling of trees in the immediate vicinity of a small water body; instead, this is covered by the Forest Act. Furthermore, flowing water bodies in particular may host threatened species which are protected under the Nature Conservation Act.

The Water Act safeguards the purity of groundwater. Due to this, in harvesting operations the fuel tanks, for example, must be stored away from groundwater basins, and eventual breakages of machinery must be anticipated by having at hand equipment for dealing with oil spills. As regards ditch maintenance and renovation and ditch mounding, the Water Act generally requires that a notification of ditching is submitted or a permit acquired from the Finnish Supervisory Agency, which monitors compliance with the Act.

Antiquities Act

Archaeological sites include, among others, different types of cairns, stone settings and circles, sacrificial springs and stones, ancient remains of dwellings, fortifications and earthworks, as well as boulders and cliff faces with ancient writings, images or other depictions.

Antiquities are protected under the Antiquities Act, the compliance with which is monitored by the Finnish Heritage Agency. By law, the excavating, covering, altering, damaging, removing or otherwise interfering with an antiquity is prohibited. An archaeological site is protected by law without a specific official decision. Archaeological sites must be taken into account in all land use, and this is also required by forest certification.

The Finnish Heritage Agency maintains a register of cultural heritage objects and sites (Kulttuuriympäristön palveluikkuna [Cultural Environments Service Window]; in Finnish). This can be used to check whether there are known archaeological sites on the work site or in its immediate vicinity. Even if an archaeological site is not shown on the register, it is still protected under the Antiquities Act.

Before any forestry operation, the presence of archaeological sites must be checked, and recorded in the work instructions. As a general instruction, trees should be removed from on top of an archaeological site and from a surrounding protective zone (2 metres). Retention trees may not be left on or near an archaeological site, to avoid storm damage to it. Strip roads may not be located on the site or on the protective zone, and the direction of felling must be chosen to prevent falling trees from damaging an archaeological site. An archaeological site may not be covered with felling residue. The site may be surrounded with long stumps to mark it before soil preparation. During regeneration, seedlings may not be planted on an archaeological site or within its protective zone.

Land Use Act

The Land Use Act (effective as of 1 Jan 2027) steers the planning of land use for various purposes. Land use planning affects forest management and use. On areas reserved in the plans for forestry (M) or recreational use (V), the Forest Act and planning ordinances are in force simultaneously. The plans may contain notes on areas important for biodiversity or reservations for nature reserves, which must also be taken into account in forest management.

Land use plans may also contain areas with landscape values, which will require a landscape work permit from the local authority, if the landscape is altered by an operation, such as the felling of trees.

Find the test:

Luonnonhoitokortti - Tapio → Valmistaudu Luonnonhoitokortin osaamiskokeeseen - Tapio
Nature management card → Get ready for the nature management card skills test

Put your knowledge to the test with these practice questions:

Section 1: Legislation and recommendations for safeguarding forest biodiversity

https://forms.cloud.microsoft/e/4Jnpnf4r0N

2 Nature management teaching content – Section 2

Safeguarding forest environments and species and nature management

- Identifying habitats and indicator species
- Maintenance and restorability of habitats and methods of nature management
- Threatened species important from the forestry perspective, their habitats and methods of safeguarding them

Competence requirements

Students are required to

- Understand the significance of nature sites for safeguarding biodiversity
- Be familiar with the habitats of special importance mentioned in Section 10 of the Forest Act, as well as their special features and how to safeguard them
- Know about other valuable nature sites to be accounted for and the grounds for sparing them
- Identify species that indicate the degree of biodiversity, as well as their habitats
- Be familiar with the habitat requirements of important threatened species that have an impact on forestry operations, and the practices of safeguarding them
- Be familiar with how to take account of the nesting trees, nests and nesting periods of birds
- Identify habitats which can be tended and restored, and know methods to improve their condition
- Know how to utilise map and geospatial data in identifying nature sites and occurrences of species

2.1 Nature sites

A nature site can be identified, among other things, because it looks clearly different from a commercial forest, possibly because of its the trees or vegetation. In contrast to customary forest and mire species, nature sites contain demanding or threatened species that thrive only under certain conditions. Nature sites can be small in scale, such as springs or patches of herb-rich forest, but also extensive, such as mires in their natural state. As a rule, the most recent felling or other forestry operation on a nature site has been carried out long ago, often several decades back. Nature sites often contain deadwood and uneven-aged stands. Nature sites can be found in areas difficult to access, such as in the middle of a mire, in a boulder field, on steep bluffs or in moist spots with poor load-bearing capacity.

Nature sites represent rare habitats, which, when preserved, safeguard the survival of many species, often of rare and threatened species. Nature sites are often valuable for game, the landscape and recreational use. Nature sites excluded from forestry will over time develop stout and old trees and later on stout deadwood, which are important for a variety of species. It is essential to safeguard existing nature sites, for otherwise the restoring of their species and special conditions is a lengthy process.
Thanks to nature management on nature sites and in commercial forests, a biodiversity network is created in forests, which will safeguard the survival of species and support their spreading to new habitats appropriate for each.

As regards nature sites, the factors to take into account include not only the forest owner's individual goals, but also the restrictions set by legislation and forest certification. Nature sites protected by law must always be safeguarded and excluded from forestry operations. In commercial forests, the methods of nature management, such as leaving retention trees and buffer zones are particularly targeted to the vicinity of nature sites. The forest owner can also recommend that other sites should be spared, and forest professionals can recommend that the forest owner should spare a particular site. Nature sites can be appropriate for voluntary protection. It may also be possible to bring a nature site closer to its natural state by nature management or restoration measures, such as blocking ditches on a mire.

2.2 Safeguarding habitats of special importance as defined in Section 10 of the Forest Act

The habitats mentioned in Section 10 of the Forest Act are also often called 'Forest Act habitats' or 'Section 10 habitats'. They differ from commercial forests in many ways and possess more diverse nature values than commercial forests. The preservation of nature sites protected by law must be safeguarded in all forestry. When planning fellings and tending operations, these sites are excluded from the rest of the operation site.

The responsibility for the proper treatment of nature sites protected by law rests with the forest owner, the actor planning the felling and the actor carrying it out. The forestry operator must identify any special habitats when planning operations, and the actor with the felling rights must do likewise when the work is carried out.

Known Forest Act sites are quite often entered in the geospatial data systems of companies and are regularly updated. No systematic mapping of these sites has been done, and so new sites can be discovered during planning or even when carrying out an operation; possible examples are springs and rivulets. Over time, the forest on the site may also have developed so as to meet the criteria of special habitats set in the Forest Act. Whenever there is a suspicion that a site may be a habitat of special importance in the sense of the Forest Act, the operation manager and, if necessary, the Forest Centre, must be contacted to ensure the site is properly assessed.

The habitats of special importance as defined in the Forest Act must meet three general criteria. In addition to these, the specific features defined for each habitat must be met.

The following general criteria must all be met by all habitats under consideration:
Criterion 1: The habitat is in its natural or semi-natural state, which is manifested, among other things, in that no fellings have been carried out for a long time, the forest canopy consists of different layers, there are trees growing densely and variation in density or decaying wood. In general, the forest consists of managed stands that are adult or older. Mixed and broadleaf forest can be younger if it has developed naturally. The site may contain old strip roads or ditches, provided they do not affect the special features of the site.

Criterion 2: The habitat is clearly distinguishable from its surroundings, which is manifested by, among other things, differences in vegetation, hydrology, tree stock and topography as compared to the surroundings. Extensive habitats cannot be clearly distinguishable from surrounding forest nature in the sense of the Act; extensive areas of scrub- and wasteland are some of these.

Criterion 3: The habitats are small-scale or of little importance in terms of forestry. Sites may be considered as being of little importance to forestry if the value of marketable timber on them is less than EUR

3,000. If a site with little importance for forestry is more than 5 hectares in size, the general rule is that it cannot be considered as clearly distinguishable from the surrounding forest nature, even if the other criteria set for habitats in the Act are met. As a general rule, sites can be considered small-scale if their area is no more than 2 hectares.

Habitats of special importance defined in Section 10 of the Forest Act and their special features

For each of the habitats defined in Section 10 of the Forest Act, a specific feature is defined that may not be deteriorated in forestry operations. This special feature is typical of the habitat and affects the range of species that can thrive on it. For example, the special feature may relate to what the habitat is like: that it is well lit, humid or cool.

1. The immediate surroundings of springs, brooks, rivulets constituting a permanent water flow channel, and ponds of less than 0.5 hectares whose characteristic features include the special growing conditions and microclimate due to the closeness of water and tree and shrub layer.

   Rivulets and brooks are defined in line with the Water Act according to the size of their catchment area. That of a rivulet is under 10 square kilometres, the water flow is not uninterrupted and the passage of fish is not possible to a significant extent. The catchment area of a brook is over 10, but under 100 square kilometres. The water flow in a brook is uninterrupted and the passage of fish is possible.
   Springs are discharge points of groundwater and may be located within a groundwater basin or outside it. The discharge points of groundwater protected by the Forest Act also include spring-fed mires and seepages. At a seepage, groundwater seeps through the ground without an obvious discharge point.

2. Mire habitats where the shared characteristic feature is their natural or semi-natural hydrology:
   a. herb-rich and grassy spruce mires where the characteristic features include luxuriant and demanding vegetation, uneven-aged tree stand and shrub vegetation;
   b. unbroken spruce mires with wood horsetail and cloudberry where the characteristic features include uneven-aged tree stand and dominance of uniform wood horsetail or cloudberry vegetation;
   c. rich fens where the characteristic features include nutrient-rich soil, few trees and demanding vegetation;
   d. wasteland and scrubland mires with few trees;
   e. swamps where the characteristic features include uneven-aged deciduous tree stand or shrub vegetation and permanent influence of surface water;

3. Luxurious herb-rich forest patches where the characteristic features include herb-rich forest soil, demanding vegetation and tree stand and shrub vegetation in natural or semi-natural state. A herb-rich forest can be dry, mesic or moist, and the range of typical species may vary from one site to another;

4. Heathland forest islets located in undrained peatlands or peatlands where the natural hydrology has for the most part remained unchanged;.

5. Gorges and ravines in the bedrock or furrowed in mineral soil with steep slopes, as a rule more than 10 metres deep, where the characteristic features include a typical vegetation deviating from the surroundings.

6. Steep bluffs for their main part more than 10 metres high, and the forest directly underneath.

7. Sandy soils, exposed bedrock and boulder fields with lower wood production potential than in barren heath forests, with extremely poor soil where the characteristic features include a relatively sparse tree stand.

2.3 Habitats protected under Nature Conservation Act

The Nature Conservation Act mentions 13 habitats to be conserved, some of which are forested. When an occurrence of such a habitat is in its natural state or a state comparable to that, it may not be destroyed or deteriorated. The prohibition enters into force when the Finnish Supervisory Agency has made a decision determining the boundaries of the habitat occurrence and notified the owners and occupants of the site.

Habitats most important from the forest management point of view and protected under the Nature Conservation Act include the following:

Hardwood stands of natural origin and containing stem-forming small-leaved lime, maple, ash, European white elm, wych elm or oak, with a minimum of 20 specimens per hectare, as one group or several adjacent groups.

Groves of hazel, with a minimum of 20 two-metre-high or -wide hazel shrubs within one hectare, as one or several groups on a contiguous area whose boundaries can be determined and marked.

Stands of black alder which form a mire, swamp or rich fen of natural origin and in which black alder is the most prolific species of the dominant trees, calculated by the number of stems.

Inland flooded forests; that is, broadleaf-dominated stands situated next to a water body and moist during the flood season though at times dry, with vegetation whose age structure and range of species show the effects of repeated flooding, and where conifers, dwarf shrubs and mosses are completely or nearly absent. Flooded forests are found throughout the country on the shores of water bodies susceptible to flooding.

Sunlit slopes of esker forests. These are sloping sites on eskers or on formations on their edges, with a SE-W orientation and a minimum inclination of five percent. The humus layer is thin, the ground layer sparse and the canopy cover is maximally 60 percent. The vegetation contains the spotted cat's ear, Solomon's seal, wild thyme, mountain everlasting or similar species typical of eskers.

In addition, the Nature Conservation Act mentions two strictly conserved habitats: serpentine rock outcrops and scree land surface which are above surface occurrences of rock outcrop or scree composed of serpentinite or some other ultrabasic rock type, and coastal open dunes. These may not be destroyed or deteriorated. The prohibition is in force directly under the Nature Conservation Act without a separate decision. In general, strictly conserved habitats are not included in forestry operations due to their lack of tree stands.

2.4 Habitats safeguarded by Water Act

The Water Act prohibits the deterioration of aquatic habitats in their natural state except where a permit has been issued. This concerns particularly the following: brooks and rivulets, springs, small ponds, special formations on the coast (flads, gloe lakes) and the zones bordering on and affected by these.

To take an example, a brook is a water body under the Water Act, and endangering the natural state of a brook always requires a permit as envisaged in the Water Act. The same also applies to a cleared watercourse which has returned to a state resembling its natural state. The Water Act does not apply, for example, to the felling of trees in the vicinity of a small water body; this is covered by the Forest Act. The Water Act and the Forest Act are applied in combination to protect water formations which are in their natural state or a state comparable to that and are natural in origin, as well as their immediate surroundings.

A project which affects hydrology must have a permit granted by the relevant supervisory authority if it may change the position, depth, water table or flow of a water body, or the shore, the aquatic environment or the quality or quantity of groundwater. The permit is applied for at the Finnish Supervisory Agency. A hydrological (water economy) project refers to measures or structures which may affect surface water or groundwater, the aquatic environment, the hydrology or the use of the water area. A forest management operation, such as ditching or the crossing of a watercourse in connection with harvesting, may require a permit.

Special attention must be paid to water bodies which host demanding or threatened aquatic species, such as the river trout and the freshwater pearl mussel. During the construction and major improvement of forest roads and what are called ‘piennartiet’ in Finnish, the culverts must be installed in a way that safeguards the unhindered passage under the road of fish and aquatic organisms. Forest certification systems impose various demands on the buffer zones of water bodies of all sizes and on safeguarding nature sites.

2.5 Other valuable habitats

In addition to habitats and biotopes protected by law, the voluntary protection options within the METSO programme (Forest Biodiversity Programme for Southern Finland) enable the protection of habitats selected for the programme, which may be larger in extent than those mentioned in the Forest Act or which do not meet all the statutory criteria. In addition, there are other habitats suitable for conservation, such as heath forests with plenty of deadwood and thus valuable for biodiversity, sunlit areas on eskers and wooded traditional biotopes. Habitats suitable for conservation must have a sufficient number of structural features that are an indication of biodiversity, such as deadwood, old tree stands, uneven-aged stands, threatened species or particular luxuriance.

A forest owner may always take the personal decision to exclude a site of personal importance from forestry. The site may be important to the owner because of landscape, recreation or other values. Other sites and formations to be preserved may include different water protection structures and their vicinity, such as wetlands, old stonewalls, structures reminding of bygone farming methods or their sites, including water mills and dams. Sites with buildings or constructions may also be protected under the Antiquities Act.

2.6 Indicator species

A more detailed identification and classification of habitats is based on the species hosted by them. Different habitats support species which are adapted to the conditions prevalent in them. The identification of indicator species, or species which reveal the specific conditions of their growing site, can lead to the identification of valuable nature sites, such as sites mentioned in the Forest Act or habitats which are not sufficiently well known. Among other things, such species may indicate luxuriance, the effect of groundwater or surface water or the plentiful nutrients in the bedrock.

Species which indicate a herb-rich forest or features resembling it:
Hardwood species: Small-leaved lime, ash, oak, maple, elm species.
Shrubs typical of herb-rich forests: guelder rose, fly honeysuckle, cinnamon rose, mezereon, common hazel, mountain currant, redcurrant, blackcurrant.
Other typical species: Woodland strawberry, lady-fern, melancholy thistle, unspotted lungwort, wild angelica, lily of the valley, baneberry species, ostrich fern, wood sorrel, meadowsweet, oak fern, wood cranesbill, mountain melick, water avens, common hepatica, herb Paris, wood anemone.

Species growing on luxuriant mires:
Marsh cinquefoil, long beech fern, alder buckthorn, wood horsetail, marsh marigold, cloudberry, bog arum.

Mosses growing on fertile, moist and shady sites:
Mniaceae species, big shaggy-moss, spiky bog-moss, tree climacium moss.

2.7 Improving the state of habitats

The managing of forests over a long period of time has deteriorated the natural characteristics of forests, which is shown, among other things, by the decrease of aged forests and tree specimens as well as of uneven-aged forests and deadwood. Some of the causes of changes in habitats and the regression of species living in them include the operations carried out in forests and on mires, such as fellings, drainage and soil preparation. Other contributing factors include the effects of climate change, the increasing dominance of spruce in herb-rich forests, the decrease of wildfires and the spreading of alien species.

The state of habitats and their species can be maintained and improved with methods of nature management in commercial forests, such as by leaving old trees as retention trees, conserving forests and tending and restoring habitats. Improving the state of habitats requires active work with a view to restoring a habitat closer to its natural state or, over time, fully to its natural state; by blocking ditches, for instance. In addition, the conditions required by species naturally present on the site can be preserved. In herb-rich forests, this could mean removing some trees, and on the sunlit slopes of eskers, carrying out controlled burnings. The restorability of habitats is assessed, among other things, on the basis of the recency of the changes and the range of species present. Essential factors include the benefit from the restoration, its cost and its feasibility. In assessing restorability, not only field assessments, but also old maps, historical aerial photographs and other geospatial material and sources of information may be used. Nature management operations may focus on the tree stands, the range of species, soil or soil hydrology. The bodies which carry out planning for the improvement of the state of habitats include the Economic Development Centres, Metsähallitus and businesses. The funding for the operations comes from both the Government, businesses and other sponsors.

Management of herb-rich forests
In herb-rich forests, the goals of management are to improve the conditions of species typical of the habitat; these include hardwood species and typical shrubs, for which sufficient space must be safeguarded. The management operations may include the felling and harvesting of trees that overshadow the species to be favoured, clearing away smaller trees, gathering, removing or burning felling and clearing residue, removing alien species, planting hardwood trees and generating deadwood.

Management of esker forests
In esker forests, the management goal is to improve the living conditions of insects and plants found on eskers, which are dependent on open, sunlit slopes. The management methods may include the felling and harvesting of overshadowing trees, clearing away smaller trees, gathering, removing or burning felling and clearing residue, controlled burning, manually removing the sod layer and transplanting heat-requiring species.

Restoration of springs
The goal of restoring a spring may be to raise the groundwater table in the spring, to reduce external load, to bring the feeding rivulet into its natural state and to safeguard the species typical for springs and their vicinity.

Appropriate restoration methods may be to block ditches which reduce water flow to the spring or cause a load on it, to restore an excavated outfall rivulet, to raise the water table in the spring with an underwater dam, to remove felling residue or other material from the spring pool, to remove well structures from the pool and to plant trees to provide shade.

Restoration of brooks or rivulets
For small water bodies, the restoration goal may be to improve the conditions for species in or near the water body, to reduce external load and to restore the watercourse closer to its natural state. Appropriate restoration methods include the blocking of ditches feeding the brook or rivulet or directing the ditch water to overland flow areas. Installing a water protection structure in the catchment area will improve the state of a small water body. Many brooks have been previously cleared to enable timber floating, and restoring stones to the cleared channel and bringing the water flow closer to its natural state can be used in restoration. The water flow can be brought closer to its natural state with stream deflectors and tree trunks used as groynes; also, structures preventing the passage of fish, such as culverts and dams, can be removed.

Adding gravel or wood material to the channel of small water bodies improves the conditions for fish in particular. The course of many brooks has been straightened by excavation, and it may be possible to restore the original course, at least in places.

Restoration of mires
On mires, the restoration goals include the returning of hydrology to its natural state, invigorating the species typical for mires and reducing the load caused on water bodies. The methods used in restoring mires include the blocking and damming of ditches, returning the water of a catchment area to a drained mire, felling and harvesting trees to control evaporation, clearing away small trees and generating deadwood.

© Tapio Oy - Forest nature management

2.8 Threatened forest species and attention to birds

According to the assessment of threatenedness (2019) and in terms of the number of species, forests are the most important environment for both least-concern and threatened species. Of threatened species (numbering 2,667), about one third (833) live primarily in forests. In particular, old forests (34% of the species), herb-rich forests (45%) and esker forests (9%) are important for threatened species. Forest management also affects the species in many other habitats, such as small water bodies, different types of mires, shorelines and wooded traditional biotopes. All groups of species contain species that are threatened. Threatened species are protected under the Nature Conservation Act, the compliance with which is monitored by the Finnish Supervisory Agency. The responsibility for preserving threatened species rests with the professionals who plan and carry out forestry operations and with the forest owner. Threatened species and many species commonly found in forests are protected by law. The monetary values of protected species are specified by Government Decree.

Information on species is provided by the Finnish Biodiversity Information Facility, and the information is used, among other purposes, when planning fellings and checking notifications of forest use. For the use of authorities and forest sector actors, the Laji.fi service contains specific search filters concerning threatened species; the filters are based on observations verified by authorities or experts.

The survival of a species can be supported by management and restoration operations, and with the nature management methods of commercial forests, such as preserving deadwood, careful placing of retention trees and creating buffer zones. Where occurrences of threatened species exist, forest management operations must be planned and work instructions written with particular care.

Safeguarding Siberian flying squirrel during forestry operations

The Siberian flying squirrel is strictly protected under the Nature Conservation Act, and its breeding grounds or resting places may not be destroyed or deteriorated. Even if the area is temporarily abandoned, yet suitable for the breeding or resting of the species due to its structural features, its protection under the Ac continues. The responsibility for taking account of the species during forestry operations rests with the body with the felling rights and the land owner. The Siberian flying squirrel primarily lives outside nature reserves, which means that the management methods in commercial forests and careful planning can have a favourable effect on its future. Important factors to bear in mind are the preservation of breeding grounds and resting places, the preservation of structural features important for the species, the possibility of moving about on the home range and access to feeding grounds, marking the boundaries of the operation site and choice of felling methods.

The typical habitat of the Siberian flying squirrel is an old or matured spruce-dominated mixed forest. The species is active in twilight, making it difficult to notice. The best method of identification is, especially in the spring, from yellowish droppings at the foot of large spruces or aspens. Flying squirrels can also be found on broadleaf-dominated sites, such as areas bordering arable fields or bodies of water. The dense boughs of spruces offer the Siberian flying squirrel shelter from predators and the weather, and their crowns are good for storing food. Besides spruces, forests inhabited by Siberian flying squirrels often contain large aspens and other broadleaves. The flying squirrel mainly feeds on the leaves and buds of aspen, birch and alder. The territory of a Siberian flying squirrel contains several nests, in the cavities in dead trees or in a nest constructed by a red squirrel. Occasionally even a bird’s nesting box or a building can be accepted for nesting. The Siberian flying squirrel moves about by gliding, and if forced to come down on the ground, it is easily caught by predators.

Threatened species in flowing water

Forests contain many types of flowing water, and these water bodies also host threatened and demanding species. Examples of the threatened species in flowing water are the freshwater pearl mussel, river trout and otter. Mosses and benthic organisms living in flowing water are sensitive to changes in water quality or the channel bottom, or to the removal of sheltering trees. In particular, crossing any watercourse should be avoided. In addition to river trout, flowing water hosts other salmonids, such as the common whitefish, grayling and salmon. Flowing waters with a salmonid population must be protected during forestry operations by leaving a sufficient buffer zone and installing water protection structures. The presence of salmonid populations in flowing waters can be checked in the Paikkatietoikkuna service.

Taking account of birds in forestry operations

All birds of prey are protected under the Nature Conservation Act. Birds of prey may abandon their nest and young if human activity causes disturbance near the nest. As to how easily this may happen depends on the species. In the case of large birds of prey (golden eagle, white-tailed eagle, greater and lesser spotted eagle), their nesting trees with the nest in repeated use and clearly visible are protected under the Nature Conservation Act. Even if a nesting tree is temporarily abandoned, it may not be felled.

For the various birds of prey, a buffer and disturbance-free zone around the nesting tree should be left, to minimise the harm from forestry to the birds during nesting. It is recommended that the buffer zone around the nest should be excluded from forestry. Forest certification requires that, at a minimum, the nesting trees of birds of prey are safeguarded.

Under the Forest Act, timber harvesting is prohibited on spruce mires and luxuriant broadleaf-dominated forests with a minimum area of 0.5 hectares in forest stands bordering water. The prohibition is in effect from 1 May to 31 July in northern Finland, and from 15 April to 15 July in other parts of the country.

Timber harvesting refers to the felling, de-branching and cutting of trees and the transport of stems from the forest to intermediate storage sites. Spruce mire refers to a forested mire with a minimum of 30-centimetre peat layer and tree stands dominated by spruce or birch. Luxuriant forests (that is, forests rich in nutrients) are defined as herb-rich forests, herb-rich heath forests, mesic heath forests and drained peatland forests of corresponding luxuriance. A forest is considered to be broadleaf-dominated if the share of broadleaves is over 50 percent of the total volume of stemwood. A forest bordering a water body refers to the wooded buffer zone along a water body,with a width of 10 metres. On sites under prohibition, the transport of timber is possible along existing strip roads or, if indispensable, along a new strip road.

Before felling or other forestry operations, the actor implementing the felling or in possession of the felling rights must assess the bird populations of the site. The obligatory assessment applies to all forests and must be done regardless of when the felling or other operation is to be carried out. The assessment of bird populations may be made on the basis of available data or, where needed, by visiting the site. On the basis of the assessment, preventive measures must be taken to avoid the death of birds and damage or disturbance to nests. It is prohibited to damage nests known to be found on the site or observed there if they are being used. This prohibition is in effect in all forests and at all times.

In addition to mechanical harvesting, the above obligations must be met in connection with soil preparation, the tending of seedlings and young stands, forest cultivation, forest fertilisation, the construction of forest roads, and the maintenance of ditches.

Find the test:

Luonnonhoitokortti - Tapio → Valmistaudu Luonnonhoitokortin osaamiskokeeseen - Tapio
Nature management card → Get ready for the nature management card skills test

Put your knowledge to the test with these practice questions:

Section 2: Safeguarding forest environments and species and nature management

https://forms.cloud.microsoft/e/VzBfNBJUUz

3 Nature management teaching content – Section 3

Nature management methods in management of commercial forests

- Structural characteristics with biodiversity value and their preservation or enhancement
- Effective targeting of nature management methods in commercial forests
- Consideration of the multiple use of forests and the landscape in forest management

Competence requirements

Students are required to

- Know the structural features valuable for forest biodiversity
- Understand the effect on forest nature of preserving and improving structural features valuable for biodiversity
- Be familiar with the nature management methods used in operations in commercial forests
- Know how to target effectively the nature management methods in commercial forests at different stages of forest management
- Know how to discuss with forest owners and argue for the need for nature management methods and their impact on biodiversity

3.1 Nature management methods in commercial forests

The requirements and instructions related to nature management in commercial forests are based on binding legislation (e.g., the Forest Act, Nature Conservation Act, Water Act), on programmes containing directions for action (e.g., National Forest Strategy 2023) and on the requirements in forest certification systems (FSC and PEFC), which are voluntary to forest owners. It is part of the forest professionals' duties to advise forest owners on the requirements, methods and impact of nature management in commercial forests, and to take into account the forest owners' individual nature management goals when planning operations.

The majority of Finland's forests are in commercial use, and therefore structural features valuable for biodiversity must be preserved, not only on nature reserves, but also in commercial forests. Structural features valuable for biodiversity include, among others, decayed wood, aged tree specimens, broadleaves valuable for biodiversity (such as goat willows, aspens and hardwood species), as well as uneven-aged tree stands.

Nature management in commercial forests means that during forestry operations, biodiversity and the benefits awarded by nature are preserved and enhanced. The methods of nature management can be used in all forestry operations and at every development stage of a forest.

Preserving retention trees

Retention trees should be left regardless of the felling method used (such as continuous-cover felling). Retention trees are live trees left permanently standing in commercial forests. Retention trees bring many kinds of benefits. Retention trees develop into old, live trees; trees with cavities; and deadwood, all of which provide habitats for many birds and other animals, plants and fungi. After dying, the permanently standing retention trees form stout deadwood stems, and groups of retention trees gradually form deadwood clusters.

Retention trees can also mitigate the impact of forestry on the landscape. It is advisable to select retention trees so that they form groups, but single trees can also be spared. Retention tree groups consisting of old tree specimens and of different species provide habitats for many other species. Retention trees should not be left near power lines, pathways or roads, as they could be dangerous if falling down.

The ecological impact of retention trees is maximised by leaving them in the vicinity of nature reserves, valuable nature sites and water bodies of different sizes. Other appropriate sites are near areas with an unusually large volume of deadwood, the occurrence of a threatened or rare species, or the nesting trees of birds of prey. Areas which are challenging for harvesting or regeneration, such as steep bluffs, exposed bedrock or boulder fields are suitable spots for leaving groups of retention trees.
Preserving thickets

Thickets consist of underbrush which is left uncleared during forestry operations. They can vary in size from a group of a few trees to somewhat over an are (10 by 10 meters). Thickets are spared at the tending of young stands, and also when carrying out advance clearing before a thinning or regeneration felling.

A thicket should contain a mix of tree species and trees of varying sizes. The most important species in thickets is underbrush spruce, with branches reaching down to the ground and thus providing a good shelter for grouse, for example. A good mix of tree species increases the value of thickets for other species. During the forest's rotation period, the placing of thickets can be varied. However, a thicket can also develop into a good retention tree group.

It is advisable to spare thickets where they occur naturally, such as beside moist depressions in the terrain, and by mires or ditches. Other good locations for thickets include the edges of open spaces, groups of broadleaves or of retention trees, the areas around bare clifftops or rocky outcrops and the areas round young stands. If well placed, thickets can also provide corridors between habitats and thus help species to travel between them.

Ensuring the presence of decayed wood

One quarter of the species living in Finnish forests are dependent on decayed wood at some stage of their lives. In particular, the small volume of stout decayed wood in commercial forests is the most important cause of a forest species becoming threatened and the main risk factor. Maintaining the populations of species dependent on deadwood requires the uninterrupted creation of new deadwood of different species; this is called a deadwood continuum. This is because a single deadwood stem can only provide a temporary habitat for any species, since it changes during the decaying process. Species dependent on deadwood include many kinds of polypores, insects, mosses and lichens. Many birds and mammals, too, nest in deadwood cavities.

Decaying wood is a rich source of nutrition in the forest environment. The activity of organisms which decompose wood returns the nutrients bound in wood to the circulation. Stout deadwood in particular

also forms a long-term carbon storage in the forest. Decaying trees do not pose a health hazard to forests. The diverse organisms thriving on deadwood contribute to preventing the proliferation of many pests.

Harvesting deadwood for energy should be avoided, and care should be taken that existing and intact dead trees are not broken up in connection with fellings and soil preparation. The type of deadwood least sensitive to being moved are trees that have died or fallen recently. Fallen deadwood stems must not be driven over. Instead, the stems should be avoided or moved away from the routes of machinery. The most trouble should be taken to avoid disturbing stout, long-decayed stems, as they are rare in nature and have taken a long time to reach their present state.
Creating long stumps

Long stumps are beneficial to insects and fungi dependent on deadwood, as well as to mammals and birds nesting in cavities. For breeding, many pollinator insects, for example, use the tunnels bored in standing dead broadleaves by beetle larvae. The maximum benefit as regards the number of species can be reached by favouring broadleaves, especially birch, when making long stumps, for they will help the nesting of the threatened willow tit, for example. Broadleaves valuable for biodiversity, such as goat willows and aspens, are best spared as live trees. Trees of poor quality, such as bent ones, are well suited for long stumps. If no broadleaves are available, conifers are used to make long stumps.

Maintaining a mix of broadleaves

It is advisable to maintain a mix of broadleaves in conifer-dominated forests, as this will improve the vitality of tree stock, the management of forest land and biodiversity. The presence of broadleaves and a mix of species in general will also provide variety in the landscape.

The more species there are in a forest, the more diversified will the range of other species be. This is why, during fellings and tending operations, the number of species found on the site before the operation should be preserved. The buds of broadleaves are a source of food in winter for many birds, including the hazel grouse and black grouse. The leaves, in turn, are important for many insects, such as butterfly larvae. Regressed and threatened species dependent on broadleaves are species which are particularly dependent on old, live broadleaves and stout decaying broadleaves.

A mix of broadleaves is also beneficial to forest health and well-being, as well as to soil fertility. The litter from broadleaves decreases soil acidification, improves the circulation of nutrients, improves soil productivity and diversifies the range of soil organisms. Maintaining a mix of broadleaves is recommended from the perspectives of both forest productivity and nature management. Broadleaved trees should be spared from the earliest tending of seedling stands onwards.

Identify broadleaved trees:

Aspen (Populus tremula)
Hazel grouse (Alnus incana)
Black grouse (Alnus glutinosa)
Rowan tree (Sorbus aucuparia)
Goat willow (Salix caprea)
Downy birch (Betula pendula)
Silver birch (Betula pubescens)
Bird cherry (Prunus padus)

Supporting pollinators in forest management

Pollinators are indispensable for the functioning of natural ecosystems and for maintaining biodiversity. Not only cultivated plants, but also many wild species, such as the bilberry and red whortleberry, require pollination by insects to produce a crop. Many wild plants also need pollinators to be able to reproduce.

From spring to autumn, pollinators need food, which they get from different nectar- and pollen-producing plants flowering at different times. This is why the diversity of forest vegetation and tree species is beneficial to them. As an example, a mixed forest with several broadleaf species can provide a diversity of food sources for pollinators. For their nests and hives, pollinators also need decayed wood. Supporting the living conditions of pollinators does not necessarily demand separate measures; what is needed is to select and target the methods of nature management in places appropriate for pollinators.

The forest habitats most important for pollinators include various open, sunny areas, including sunny and dry slopes, wooded traditional biotopes, uneven-aged tree stands beside arable fields and verges of forest roads, as well as wildfire and controlled burning sites.

Safeguarding species and habitats during forestry operations

A diversified stand can host several thousands of species. Safeguarding the diversity of species is based on three factors: safeguarding the occurrences of threatened species, preserving habitats important for particular species and groups of species, and sparing the structural features important for certain species.

Safeguarding threatened species as well as habitats or biotopes protected by law is one of the most important methods of nature management in commercial forests. Always when planning an operation, known occurrences of important species and known nature sites must be identified. During implementation, new occurrences or sites that may not have been properly documented before, must be examined and verified before work is continued.

Leaving buffer zones around water bodies

Buffer zones refer to wooded strips left along larger and smaller water bodies. Their purpose is to reduce the harm caused by forestry operations to water quality, biodiversity and the landscape. The buffer zones retain solids and nutrients, protect the watercourse and the shoreline against erosion, as well as maintaining the microclimate and the water content of the soil.

in addition to water protection, the buffer zones along large and small water bodies are important for both the biodiversity of forest and water environments and the landscape. The conditions and range of species in forests growing near water are generally quite different from the surrounding forest, and the buffer zone will maintain these special features.

A wooded buffer zone is important for regulating water temperature and for producing broadleaf and conifer litter and deadwood for aquatic organisms, such as benthic and fish species. Similarly, trees that fall naturally into water and are left there will increase biodiversity. Buffer zones also form ecological corridors, allowing species to travel more freely.

The width of a buffer zone, as required for water protection, depends on the type and size of the water body and on how close to natural state it is, as well as on the flow and volume of surface water, the steepness of terrain and the soil type. The conditions vary along different types of water bodies, which means that the buffer zones should also follow this variation and be of sufficient and varying width. Forestry machines are only taken to buffer zones along large or small water bodies if it cannot be avoided. No soil preparation is carried out or felling residue placed on buffer zones. The shrub layer on buffer zones is not cleared, and broadleaves are favoured.

In addition to buffer zones, water protection structures are used, such as overland flow areas and basin structures. They prevent the load caused by suspended solids and nutrients resulting from forestry operations, especially ditching and soil preparation.

Preserving the ecotone between mire and heath forest

The ecotone, or intermediate zone, between a mire and a heath forest is an area where the special features of trees and vegetation on the boundary between the two biotopes are preserved. These include tree stands of many species and layers, a vigorous cover of bilberry and other dwarf shrubs, and moist soil. Preserving this zone is beneficial to both mire and forest species. In particular, the diversity and abundance of insect species provides food for bird chicks, and the dense stands offer shelter near the feeding grounds.

The ecotone between mire and forest should be left uncleared, and thickets should be spared. The retention trees required for the site can be left on the ecotone. Strip roads should be located at a sufficient distance from the ecotone.

Controlled burning

Controlled burning for the purpose of nature management and improvement of biodiversity enhances the survival of the increasingly rare species dependent on wildfires. The aim is to increase the structural features valuable for biodiversity on forest compartments where the management objective is timber production.

The structural features produced by controlled burning are carbonised standing and decayed trees. At the same time, controlled burning brings forestry benefits, and it can improve the nutrient and temperature conditions of the site and the success of forest regeneration. Species dependent on fire and burnt wood require the maintenance of a fire continuum in forests.

3.2 Taking account of landscape and multiple use in forest management

The landscape in commercial forests is continually changing, due to the growth and management of trees. Landscape management is above all based on the forest owner's goals, as well as site quality and structure of tree stock. The overall goal is to bring into harmony the forestry operations and the long-distance views, and to maintain a pleasant short-distance view.

Commercial forests surrounding recreational areas and hiking trails are generally of special importance for landscape management. The importance of landscape management is also increased when operating on areas covered by a local master or detailed plan, and this may necessitate a permit for landscape work from the local authority before starting forestry operations. Other areas sensitive in terms of

landscape include littoral forests, forests on hilltops or slopes and forests bordering arable fields, open mires and roads or trails.

Decisions on forest use have a long-term impact on the landscape. The most notable changes are caused by regeneration fellings. This can be mitigated by choosing an appropriate felling method, by drawing the boundaries of the compartment to be felled appropriately, by leaving certain zones unfelled and by the placement of retention trees.

The multiple use of forests refers to the hiking and recreation potential of forests and the gathering of produce, such as berries and mushrooms, on the basis of everyone's rights. Incidental exercise and recreational sports also often take place in forests. Another notable element of the multiple use of forests is hunting. In the north of Finland, reindeer herding is an important livelihood. By the appropriate scheduling of fellings on sites important for the winter feeding of reindeer, it is possible to ensure that they have access to the Bryoria fuscescens lichen important as winter food.

Hiking trails, paths and structures put up for hikers, such as signposts and rest areas, enhance the recreational value of forests. Any agreements on these must be borne in mind in connection with regeneration fellings, soil preparation and other forestry operations. In general, it is advisable not to damage paths or make them difficult to move on.

Find the test:

Luonnonhoitokortti - Tapio → Valmistaudu Luonnonhoitokortin osaamiskokeeseen - Tapio
Nature management card → Get ready for the nature management card skills test

Put your knowledge to the test with these practice questions:

Section 3: Methods of nature management for forestry in commercial forests

https://forms.cloud.microsoft/e/SV1z6fj5t5

4 Nature management teaching content – Section 4

Diversification of forest management methods

- Requirements of continuous-cover silviculture and its methods
- Nature management on energy wood harvesting sites
- Forest management with a focus on game
- Climate benefits of safeguarding biodiversity

Competence requirements

Students are required to

- Know how to assess the requirements and methods of continuous-cover silviculture
- Identify sites suitable for harvesting energy wood and know how to take account of nature management
- Know how to maintain the presence of broadleaves in commercial forests, as well as the structural variation of the growing stock during all operations
- Be familiar with central recommendations dealing with game-oriented forest management and with sites specifically important for game
- Recognise special sites in commercial forests, such as herb-rich forests, sunny slopes of eskers and tree stands on mires, in all of which operations are carried out in ways different from conventional forestry methods
- Understand the climate benefits of safeguarding forest biodiversity

4.1 Continuous-cover silviculture

Continuous-cover silviculture refers to generally maintaining the canopy cover and not carrying out clear-cut fellings. Here, forest regeneration is based on the seedlings growing in the underbrush or on seedlings springing up spontaneously after a felling and the cultivation of these. Continuous-cover fellings can be implemented as selection fellings, group-selection fellings, opening-up fellings, hold-over fellings, shelterwood fellings, seed-tree fellings and strip fellings, especially on peatlands.

Stands best suited for continuous-cover silviculture are vigorous stands already containing trees of varying sizes and a presence of seedlings suitable for growing. Seedlings will spring up spontaneously in mineral soils with a thin layer of forest sod and a mix of species, and in which previous fellings have created a variation of tree density and size. Peatlands, especially drained spruce mires, are often more appropriate sites for continuous-cover silviculture than sites with mineral soil.

The structural features of an uneven-aged stand may develop over time, when even-aged stands are managed with methods aiming at continuous cover, such as leaving only small gaps when felling. Vigorous trees and the good condition of their crowns improve the production of seeds. Continuous cover is not recommended for stands infested with *Heterobasidion*. In this case, the recommendation is to change the cultivation from conifers to broadleaves. An untended forest with plenty of long, thin trees, and with smaller trees not thriving because of over-density, is a challenge to continuous-cover silviculture. A thick layer of forest sod, and on peatlands, a layer of undecayed humus and vigorously growing grasses all impede the spontaneous growth of seedlings.

Continuous-cover silviculture on its own is not a guarantee of sufficient biodiversity. In general, the varied mix of tree species and mixed forest resulting from continuous-cover silviculture do expand the range of species. In continuous-cover fellings, as in other fellings, it is recommended that a wide range of nature management methods are applied in order to maintain forest biodiversity.

Special attention should be paid to sparing retention trees and old tree specimens, since continuous-cover fellings often target the largest trees. Continuous-cover silviculture creates natural thickets, some of which should be spared as sheltering thickets during clearing. Dead trees should not be removed, and breaking them up in felling operations should be avoided. Forest certification requires that the nature management methods appropriate for commercial forests are used regardless of the type of felling.

Since certain species favour areas with few or no trees, a wide variety of forest management methods should be used to safeguard biodiversity. As an example, small-scale felling sites help light-favouring species, which means that such sites support biodiversity in connection with selection fellings. Continuous-cover silviculture has been found to benefit polypores, ants, beetles and many birds, among others. Continuous-cover silviculture can maintain forested corridors for species whose breeding and access to food may be hampered by conventional regeneration fellings. One of these species is the threatened Siberian flying squirrel: preserving its breeding grounds and resting places can be helped by the maintenance of continuous cover. Many species require a territory with sufficient cover, and suffer from the presence of clearings which hamper their movement. Bird species living in forests, such as the threatened willow tit, benefit from forests with a continuous cover. Compared to open areas, forests with sufficient cover provide a better shelter against predators to these species.

Sufficient canopy cover is also advantageous to dwarf shrubs. One of these is bilberry, which is the principal food plant of herbivorous insects. Herbivorous insects are an important source of food for grouse chicks, for example. Uneven-aged stands maintain the diversity of fungi and micro-organisms in forest soil, and this in turn guarantees a good growth environment for trees. A good degree of cover is particularly important for biodiversity near small water bodies, as the specific features there include sufficient shade and a humid microclimate. In addition to leaving buffer zones, water bodies can be protected by leaving continuous cover in stands adjacent to them. Other sites suitable for continuous cover include recreational forests and sites with important landscape values.

4.2 Nature management and harvesting of energy wood

The harvesting of energy wood may involve harvesting small-diameter wood during thinning, the gathering of felling residue during regeneration fellings or gathering firewood for use by the forest owner. Energy wood can be harvested in both tended and untended forests. As a rule, energy wood is harvested in connection with the tending of saplings and during first thinnings. The harvesting of energy wood increases the revenue from harvesting. When harvesting energy wood, biodiversity, water protection and recreational use must be taken into account.

As in all fellings, thickets must be left in energy wood fellings, and they must also be taken into account in pre-clearing. Also, retention trees are left and long stumps made near retention tree groups and elsewhere. The underbrush under retention trees is spared, and the trees in the group are not thinned. Particular attention should be paid to sparing standing deadwood, such as natural long stumps, and also fallen deadwood. When felling, a mix of broadleaves should be retained and structural variation preserved. A mix of species improves the growth of the forest and its resistance to damage, while the

presence of both stout and thin trees and an uneven age structure enhances biodiversity and gives a broader range of species. The aim is to retain the number of species that was present before the operation. Broadleaved trees and shrubs with a high biodiversity value, such as goat willow and aspen, should also be spared. Sufficient buffer zones are left along water bodies and on the zones, broadleaves and the shrub layer in particular are spared. Forest certification requires that nature management is taken into account in all fellings.

The harvesting of felling residue removes organic matter and nutrients from the forest. Leaving some felling residue in the forest will safeguard the growth of the next tree generation; the recommended amount of felling residue to be left is about 30%. In the long run, removing too much felling residue may lead to a shortage of nutrients and thus weaken tree growth and carbon sequestering. Harvesting of felling residue can be done in sub-xeric or mesic heath forests , on peatland heaths and especially on spruce-dominated sites. The harvesting of felling residue is more profitable near roads and storage sites. On pine-dominated regeneration felling sites, the total amount of felling residue is generally so low as not to be financially viable. On sites suitable for winter harvesting, gathering of felling residue is often completely impractical.

Leaving felling residue on buffer zones near water bodies of any size is not recommended, to prevent nutrients from ending up in water. When harvesting felling residue, standing or fallen deadwood of more than a 10-cm diameter should not be gathered. Deadwood is an important environment for many threatened species dependent on stout deadwood. As for the type of felling residue to be left in the forest, suitable types include, above all, broadleaf crowns and branches, which can provide an environment for regressed and threatened species living on deadwood.

4.3 Forest management with a focus on game

Forest management with a focus on game refers to management of commercial forests that takes account of species of grouse and other game. The methods of nature management in commercial forests also support this type of forest management. Game can be borne in mind in connection with all forestry operations throughout the rotation period of the forest. In game-oriented forest management it is possible to take into account grouse species in particular, to allow their shelters and feeding grounds to be preserved and develop further. The grouse species favour mixed forests with a varying density and tree size. The aim is to grow stands with at least three different tree species with plenty of undergrowth, game thickets and retention tree groups. The key factors in game-oriented forest management are to identify species of game living in the forests or their droppings or tracks, as well as sites particularly important for game and plants they feed on. Knowing the methods of game-oriented forest management is also important.

Food which is important for all grouse species includes berries and leaf- and flower- buds of alder and birch (for hazel grouse, willow ptarmigan and black grouse) and pine needles and aspen leaves (capercaillie). The chicks also feed on insects. In forests, on mires and near arable fields there are special areas important for game: the ecotones between mire and heath forest, forests bordering arable fields, littoral forests, spruce mires, low-yield peatlands, wetlands and the lekking grounds of capercaillies.

In commercial forests, game can be taken into account using suitable nature management methods, such as leaving retention trees in groups to provide shelter for game. Saving thickets and underbrush in forests of any age will also always be beneficial to game. Game also benefits from a mix of tree species. In soil preparation, dwarf shrubs should be spared where possible, and in clearing operations, the shrub layer should be treated sparingly. On peatlands, the tree cover on spruce mires and the ecotone

between mire and heath forest should be preserved. The restoration of mires benefits many species, including game. The methods of continuous-cover silviculture are well suited to game-oriented forest management.

4.4 Special areas in commercial forests

On herb-rich forest areas, hot and sunny slopes of eskers and stands growing on mires, conventional forestry operations may be replaced with others, in order to maintain and enhance the living conditions of species on these sites. Such special areas can be found and be maintained in commercial forests in the future, too. With careful planning and appropriate work instructions, such special areas can also be significant in terms of the species they host.

The features valuable for biodiversity in herb-rich commercial forests can be maintained and enhanced in parallel to financial goals. The diversity and range of species in a herb-rich forest can be maintained during felling and tending by sparing trees and shrubs of different species, by varying the density of the trees and by preserving the stratification of the forest. Commercial herb-rich forests are often dominated by spruce, and therefore space should be made for broadleaves and especially for hardwood species by clearing or felling spruces. Preserving deadwood is important in herb-rich forests, as in any other type of forest.

Hot and sunny environments and their species require active tending. To improve the condition of hot and sunny habitats, protection is not an indispensable requirement. An increase of overshadowing trees and a thicker forest sod layer are harmful to the survival of species favouring open and sunny environments. Forests growing on eskers can be managed as commercial forests, while also improving the living conditions of species favouring hot environments. This can be done by a heavier than normal thinning and creating small, sunny gaps in connection with felling. In addition, forest sod can be removed, uncovering patches of mineral soil for plant species to inhabit. It is often necessary to remove felling residue or to destroy it and the forest sod by controlled burning.

Spruce mires with a natural hydrology can be managed as commercial forests, if maintaining the structural features important for biodiversity, such as deadwood, broadleaves and underbrush. In fellings, it is possible to maintain or increase the variation of tree density and size. New ditching is not carried out in forests with a natural hydrology growing on mires; instead, sufficient evaporation by trees is maintained by continuous-cover silviculture.

4.5 Climate benefits of safeguarding biodiversity

Forests function as significant carbon sinks, in other words, they bind substantial amounts of atmospheric carbon dioxide. The more biodiversity there is in forests, the more effectively they can bind carbon. On nature reserves and on valuable habitats the trees will remain as a long-term carbon storage. Dead trees, especially stout stems, form a long-term carbon storage.

Forest biodiversity increases the flexibility, endurance and resilience of the ecosystem. Forests with a high biodiversity are capable of maintaining their functioning even under changing conditions, whereas one-sided forests can be vulnerable to sudden changes. Biodiversity works to spread the risk : for example, a harmful insect cannot spread as quickly when there are fewer food plants available and the forest has a more uneven age structure.

Diversified forests maintain a more stable microclimate and nutrient circulation. A dense and stratified canopy and a diversified vegetation regulate soil humidity and protect against drought, which is important because of the eventually worse draughts due to global warming. Diversified forests also help to prevent erosion, mitigate floods and improve factors related to water quality.

Diversified forests offer habitats for many species dependent on each other. A wide range of species helps to uphold the balance in nature, which in its turn improves the forest's capability of withstanding stress caused by climate change. The diversity of plants and animals living in forests can, for example, support the pollination services provided by insects, thanks to which forest vegetation can reproduce and grow a crop that even humans can use. Diversified forests, with diversified trees and other species, offer humans many opportunities to recreation.

Find the test:

Luonnonhoitokortti - Tapio → Valmistaudu Luonnonhoitokortin osaamiskokeeseen - Tapio
Nature management card → Get ready for the nature management card skills test

Put your knowledge to the test with these practice questions:

Section 4: Diversification of forest management methods

https://forms.cloud.microsoft/e/tVZZU223FL

5 Nature management teaching content – Section 5

Waterways control and prevention of load to waterways in forest management

- Planning on catchment-area level and use of geospatial data in management of water bodies
- Prevention of harm to water bodies in timber harvesting and soil preparation
- Selection and targeting of water protection structures

Competence requirements

Students are required to

- Know the effect of forest management operations on water bodies and the factors affecting load
- Understand the concept of catchment area and the methods of water management
- Know how to determine the buffer zones along various types of large and small water bodies and ditches in connection with forest management operations
- Know how to implement the crossing of water bodies without causing harm to waterways or living organisms
- Know how to avoid damaging the terrain in harvesting
- Identify risk points of water protection as well as different soil types
- Be familiar with the main water protection methods to prevent load to water bodies
- Know how to utilise geospatial data in planning and carrying out forest management operations

5.1 Impact of forestry on water bodies

The load to water bodies mainly refers to extra material ending up in water: nutrients (nitrogen, phosphorus), suspended solids and humus. In addition, load is caused by metals and acidification.
Nutrient load can be seen in water bodies as eutrophication. The load caused by suspended solids is marked by the turbidity of water and the accumulation of bottom sludge. Humus load causes the water colour to darken.

On acidic sulphate soils and in regions containing black schist, deep ditching causes metal and acidic load. Sulphate soils are found especially in coastal areas. Sulphate soils oxidise when in contact with air, which leads to the formation of sulphuric acid.
The resulting load affects aquatic organisms, such as the populations of the freshwater pearl mussel and trout. In particular, small water bodies in headwater regions, such as springs, brooks, rivulets and ponds are sensitive to forest management operations. Within groundwater basins, too, special attention must be paid, particularly with soil preparation.

5.2 Factors affecting the load from forestry on water bodies

The following forestry operations cause load on water bodies: ditching, felling and harvesting, soil preparation, construction of forestry roads and fertilisation. In order to prevent and minimise the load to water bodies, it is essential that prevention is taken into account when planning any forest management operation.

The most significant load is caused by ditch maintenance. In soil preparation, the method chosen should be the most appropriate for the site, one that breaks the ground as little as possible, and untouched zones must be left along water bodies. The most invasive preparation methods are furrow and ditch mounding. Furrows are not led directly into ditches; whereas in ditch mounding, this is done. The effect of Ditch mounding is, in fact, comparable to ditching. A careful consideration of the need for ditching and the placing of effective water protection structures are important elements of ditch maintenance.

As regards fellings, regeneration fellings in particular cause a load on water bodies. Felling residue and tree roots release nutrients. Through evaporation, trees maintain an appropriate water table. Regeneration felling stops the evaporation from trees, and the rising water table causes nutrients and suspended solids to be leached from the felling site.

During harvesting, depressions caused by strip roads and the crossing of water bodies and ditches cause leaching of suspended solids.

Research has not found fertilisation to cause significant nutrient loads, but the fertiliser must be prevented from getting to ditches and water bodies during the operation.

5.3 Catchment area

Catchment area refers to an area delimited by topographic features, from which water collects to a single discharge point or water body, such as a pond. The discharge point can be determined at the location desired along a single ditch, for example.

Using the catchment area as the starting point means that the area within which water collects into water bodies is determined and the forms of land use and risk spots within the area are identified. The details to be determined within the catchment area include, for example, valuable nature sites, small water bodies, types of soil and topography. To assist this, geospatial data can be used to complement field observation.

In planning forest management operations, it is important to identify the measures causing the most significant load and to plan effective water protection structures in appropriate places. When planning water protection in connection with forestry operations, it is important to know the catchment area from which water will flow to any structures planned, as well as the volume of water, because the choice and dimensioning of the structures are based on the size of the catchment area. The structures must be built in cooperation with the landowner, who must also give his permission to the work.

5.4 Buffer zones along water bodies

Buffer zone refers to a strip of land left between a felling site and a body of water, on which only minor or no forestry operations are carried out. The purpose of the buffer zone is to decrease erosion and the leaching of nutrients into water, to protect the flow channel and the shoreline from erosion and to maintain the microclimate and soil humidity. A buffer zone maintains biodiversity and the abundance of species in the water body and on the zone itself.

When determining the sufficient width of a buffer zone, the starting point is the shoreline marked by the top of annual flooding, while the furthest point is the depression caused by machinery or the tree stump on the felling site that is closest to the water body. Where necessary, it is advisable also to mark

the boundary of the buffer zone in the terrain with ribbon. Near small water bodies safeguarded by the Forest Act in particular, this can ensure the protection of the site during fellings.

If necessary, trees may be removed from the buffer zone, though the shrub layer and broadleaves should be spared. Buffer zones may be used for the sparing of retention trees. Trees must not fall into water, and felling residue is removed from the buffer zone. The ground on the buffer zone may not be broken and vegetation may not be disturbed. In stands bordering water bodies, continuous-cover silviculture should be favoured.

5.5 Preventing damage to terrain during harvesting; crossing water bodies

Good advance planning of harvesting in terrain with a poor load-bearing capacity can prevent damage to terrain and the resulting travelling of suspended solids and nutrients into water bodies. Setting the boundaries of the operation area and dividing it into harvesting sections are important elements of the planning. In general, areas with plenty of trees have a better load-bearing capacity than those with fewer trees. It is essential to choose the appropriate machinery for each site.

Sites to be felled during ground frost and outside it are to be separated from each other and marked. Soft spots in the terrain and the creation of depressions can be avoided by a good control of the loading of collector roads and the planning of strip roads. Sufficient provision of conifer boughs to cover the roads, short stumps, straight driving lines and gradual curves will prevent depressions on the roads. Storage sites can also be distributed in several places. Where necessary, structures to temporarily improve the load-bearing capacity, such as ramps, can be used, as well as verge and winter roads.

Crossing small bodies of water can cause erosion and solids load, alter the structure of the flow channel or destroy species. During harvesting it is recommended that the crossing of all flow channels is avoided, by using alternative routes. If this is not possible, the crossing should be made at a spot with the maximum possible load-bearing capacity. The crossing is protected during the operation with tree crowns and timber or a temporary bridge. The material used to protect the crossing is removed from the flow channel after the felling or soil preparation is complete. It is advisable to mention the crossing of small water bodies in the notification of forest use.

5.6 Soil types and risk spots

The characteristics of a growth site are largely dependent on the soil, and so it is important to identify the soil type when planning and implementing forestry operations. Soils are classified as mineral soils and peatlands. Mineral soils are divided into subgroups according to their particle size, and peatlands according to the degree of decay of the peat. Among mineral soils, those most sensitive to erosion are the finest ones; that is, till containing fine sand, silt or clay. All peatlands constitute a risk, as do acidic sulphate soils and regions containing black schist. The more fertile a growth site is, the greater is the risk of nutrient load.

Erosion, or the wear caused on the topsoil, is particularly caused by the effect of water; in connection with the melting of snow or rains, for example. The degree of erosion is affected by such factors as soil type, the quality and treatment of ground surface, the length and inclination of the slope, soil permeability and the volume of flowing water.

The more broken the ground surface is or the water channels altered, the greater is the likelihood of nutrients and solids ending in water bodies. The risk of load on water bodies is smallest in connection with thinning and the tending of young stands. The greatest risk of load on water bodies is linked to ditch maintenance, regeneration fellings, soil preparation and the harvesting of stumps. Fertilisation and fellings mainly cause nutrient loads. The construction of forest roads may cause solids load or, on peatlands, organic load.

Without exception, a risk of load on water bodies is present when a forestry operation takes place in the immediate vicinity of a water body of any size or within a groundwater basin. Similarly, areas adjacent to nature reserves and those containing important species, such as salmonids, always require special attention. The risks are higher if the felling site is traversed by a large volume of water; in other words, if the catchment area upstream of the felling site is extensive or if long-standing ditches can flow directly into natural water bodies.

5.7 Water protection structures used in forest management

In principle, the most effective and appropriate structure should always be chosen for water protection. The appropriateness is determined by the volume of water which the structure is expected to handle. Other things to be estimated are the quality of load, soil type, the size of the area available for the structure and other advantages desired, such as the benefits to recreation or multiple use.

Structures that are appropriate and most effective for storing water and retaining nutrients and solids include wetlands, overland flow areas, restoration of mires and channelling water into mires. For individual ditches, solutions to regulate flow and reduce erosion include pipe dams, two-level channels, underwater and other dams, cascade spillways and ditch and clearing breaks. As complementary structures for the sedimentation of solids, sedimentation basins and sludge pits may be used. The effect of structures can also be increased by placing wood material in the basin or ditch.

5.8 Use of geospatial data in water protection

Geospatial data can be utilised to assist the planning and implementation of forest management operations. For water protection, geospatial data may be used when considering, for example, the need for ditch clearing, the sensitivity to erosion and the choice and targeting of water protection methods. Geospatial data is also very useful when identifying and marking nature sites and when planning and implementing timber harvesting.

Geospatial data is openly accessible at the National Land Survey of Finland's Paikkatietoikkuna [Geospatial Data Window] Paikkatietoikkuna and the Finnish Forest Centre's forest and nature data Luonnonhoito | Metsäkeskus (Finnish and Swedish only).

Examples of the data sets:

- Virtausverkko [Flow Network]: Describes the direction of flow of surface waters and the size of the upstream catchment area. Allows a rough estimate of the appropriateness of water protection structures on the basis of water volume and location.

- Kosteusindeksi [Moisture Index]: Allows the identification of especially moist terrain or natural rivulets that may not be well known. Can also be used for planning the buffer zones along water bodies, in advance planning of strip roads and storage roads, as well as for planning the soil preparation methods to be used for different parts of a regeneration site.
- RUSLE-eroosiomalli [RUSLE Erosion Model]: Describes the sensitivity to erosion of soil, especially on mineral soils. It assists in marking buffer zones along water bodies and identifies areas sensitive to erosion before felling and soil preparation.
- Korjuukelpoisuus [Harvestability]: Describes the load-bearing capacity of terrain and assists in identifying sites that can be harvested in summer and those only suitable for winter harvesting.

Find the test:

Luonnonhoitokortti - Tapio → Valmistaudu Luonnonhoitokortin osaamiskokeeseen - Tapio
Nature management card → Get ready for the nature management card skills test

Put your knowledge to the test with these practice questions:

Section 5: Management of water bodies and prevention of load on water bodies in forestry

https://forms.cloud.microsoft/e/SV1z6fj5t5

TAPIO

Maistraatinportti 4 A

00240 Helsinki

tapio@tapio.fi

www.tapio.fi

© Tapio Oy - Forest nature management