



# **Instruction for Inventory of Habitats in MOTH**

English version

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## Introduction

According to the Habitats Directive, all countries within the EU are required to regularly report presence and status for a number of species and habitat types that are in special need of protection. These habitat types and species are listed in the Habitats Directive's appendices. In Sweden, 88 habitat types and 154 species or species groups are represented. As a first step, The Swedish Environmental Protection Agency has granted funds for inventory within already existing national monitoring projects. Since 2008, terrestrial habitat types are inventoried within the National Inventory of Landscapes in Sweden (NILS) and the Swedish National Forest Inventory (NFI). In 2009 an extended inventory of sparse terrestrial habitat types was conducted, using a point-grid method combining aerial photo interpretation and field inventory, within the environmental monitoring project "Monitoring of Terrestrial Habitats" (THUF). During 2010-2014 this monitoring is organized in the project "Demonstration of an Integrated North-European system for Monitoring Terrestrial Habitats" (LIFE08/NAT/S/000264), using the acronym MOTH. The project, which is funded by The EU program LIFE+ and the Swedish Environmental Protection Agency, is an extended part of THUF, with the objective to collect information about the status and distribution of more unusual terrestrial habitat types. The purpose of this manual is to facilitate the classification of habitats within the above mentioned environmental monitoring programs.

This manual contains classification keys and habitat descriptions for terrestrial habitats that are found in Sweden and listed in the Habitats Directive. Included are also Alpine rivers and Fennoscandian natural rivers, since these are inventoried within NILS and MOTH in the alpine region using line intersect sampling. Some additional grassland (non-Annex 1) habitat types used by the Swedish Board of Agriculture in their National survey of meadows and pastures are also included. We have chosen to throughout this manual use the as of yet unofficial short names for the Annex 1 habitat types that the Swedish Species Information Center has created. The code system used is from BIDOS, which is a completely numerical system where all letters in the habitat codes have been replaced by numbers. This is why the code for e.g. Mire woodland in this manual is 9740 instead of 91D0. BIDOS also includes a large number of codes for sub-habitats and non-habitats, which are also used here. Some sub-types within apamires lacked codes altogether and have therefore been named by us.

Maps of distribution used in this manual are obtained from the report on Article 17 from 2013 and should only be regarded as guidelines. Maps for habitats that are not listed in the appendix of the Habitats Directive have been created by us. The information for the habitat descriptions are in most cases obtained from the "Swedish interpretation of the EU's definition of Annex 1 habitat types within the Natura 2000 network". Great care has been taken to largely use the same criteria for habitat classification as described in the Swedish interpretations of the EU's classification of habitat types within the Natura 2000 network and in the instructions published from the Base inventory performed by the County Administrative Boards and its follow-up projects. The methodology is however adjusted to suit the sample plot inventory used by NILS and the Swedish NFI. This affects some of the criteria. Some criteria have also been modified as a result of discussions held during habitat meetings in 2007. For example, 10 % canopy cover for trees is used throughout as a differentiator between open and wooded habitats (however, canopy cover is always estimated within the sample plot, which facilitates an adjustment of our habitat classifications if this percentage is deemed inappropriate at a later time).

In order to differentiate between rich and poor forest types, we utilize the forest vegetation classes used in the site class quality system. In order to separate habitats with calciophilic species or other rich soil areas, e.g. calcareous grasslands, we have created three species lists: one for alpine habitats, one for grasslands and one for wetlands. Occurrences of the listed species determine the habitat classification.

The age criterion for forest habitats is based on the lowest recommended final stand age (Irfsa). A forest area can only be classified as an Annex 1 habitat type if the basal area weighted mean age is at least 20 years older than the lowest recommended final stand age. It follows that the age criterion is higher for slow-growing forests and lower for fast-growing forests with high site class quality. In order to estimate the lowest recommended final stand age, a site quality class assessment is usually needed. A full site quality class assessment is not performed for all inventory types and we have therefore created a simplified table from growth curves of production stands where these are found.

This manual is written by Hans Gardfjell and Åsa Hagner within the project “Demonstration of an Integrated North-European system for Monitoring Terrestrial Habitats” (LIFE08/NAT/S/000264), MOTH. Earlier versions (until 2010) are developed as part-projects within the projects “Co-ordination of landscape monitoring and follow-up of Natura 2000” and “National habitat monitoring of selected terrestrial Annex 1 habitat types” at SLU. These projects are financed by the Swedish Environmental Protection Agency.

This English version of the “Instruction for Inventory of Habitats in NILS and MOTH, 2014” includes all parts of the Swedish version except the distribution maps and description of individual habitat.

# Method of Habitat Inventory

## General Working Process

1. **Identify different habitat types within the sample plot.** Which of these are located within the 10 m sample plot (10 m radius in NILS, 7 m radius in NFI)? If the sample plot is divided – in which sample plot section do they occur? (More than one habitat type can be present within the same section and there is no reason to create a new section based on habitat type alone!)
2. Determine the **field layer type** according to the site quality class system for each sample plot section in forest. In other habitat types, find and record **rich soil species** if present within the assessed area (lists for rich soil indicator species in wetlands, grasslands and alpine regions).
3. **Complete a separate habitat classification** or use the key for all identified habitat types. Always start with the habitat type with the largest area. Read and **check the description for the habitat.**
4. **Check the criteria for natural conditions.** General criteria are found in the introduction of the manual. **Specific criteria** may be found in each habitat description and these **hold precedence** when applicable.
5. **Check smallest required unit.** If the criterion for smallest required unit is not fulfilled, the area is generalized to the surrounding habitat type. Re-start from 1.
6. **Enter the habitat code** for all sample plot sections which fulfill the criteria. If more than one habitat type is found within the section, the sizes of the second and possibly third type are also registered. Note that if there is both a habitat and a non-habitat within the sample plot section, the code for “Non-Annex 1 habitat” (9999) must also be entered.

## Example: Inventory of a “mire island” in the province of Västerbotten

1. The sample plot is located mainly in old mixed coniferous forest on solid ground (figure 1). The sample plot is undivided and the entire 10 m sample plot is located in the forest. Outside the sample plot, but within the 20 m distance (area used for describing forest stand characteristics) there is a sloping mire. The mire located in the outer part of the 20 m range is therefore not included in the inventory
2. Mesic soil. The vegetation is dominated by the dwarf shrubs *Vaccinium myrtillus*, *Vaccinium vitis-idaea* and the grass *Deschampsia flexuosa*. The field layer type is classified as blueberry (*Vaccinium myrtillus*) type (code 13).
3. The habitat is determined by using the classification key. No anthropogenic impact, coniferous forest, poor soil and mixed conifers results in code 9010 Western taiga.
4. Criteria for wooded units. Natural forest (criterion 1 OK). No forestry activities during the past 25 years. Sparse very old tree stumps (criterion 2 OK). Site class G16 in county AC (Västerbotten). Dead wood around 15 m<sup>3</sup>/ha. Stand age estimated to 165 years (criterion 5 OK).
5. The forest area is larger than 0.25 ha. Since the “mire island” is situated in a mosaic of forested areas at the edge of the mire complex, this particular area could have been considered to be forest even if the area of this specific island had been slightly smaller than 0.25 ha.
6. Enter the habitat code in the hand-held computer.

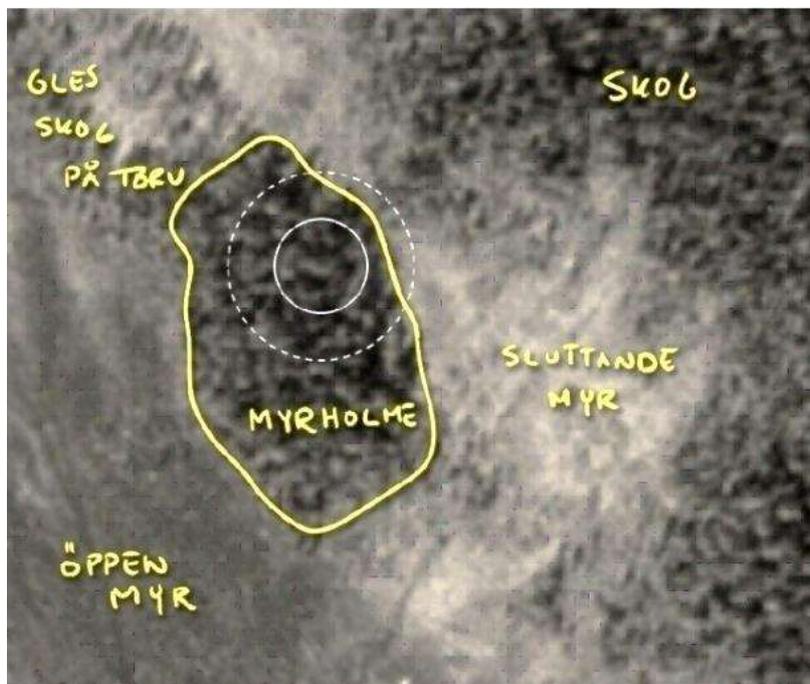


Figure 1. Aerial photo of the sample plot area. The solid circle marks the 10 m sample plot while the dotted circle marks the 20 m distance from the centre used for describing sample plot forest structure.

## General Criteria for Natural Conditions

General criteria for wooded, wetland and grassland habitats. The following criteria should be fulfilled. Note that there are exceptions and some criteria are not required for certain habitats. If that is the case, this is clearly stated in the habitat description for the habitat in question. Criteria for natural conditions do not need to be fulfilled for non-actual Annex 1 habitat types (codes 6911-6916 and 9915).

### Forests

These criteria are applicable for all habitat types with at least 10 % canopy cover of trees if not stated otherwise in the habitat descriptions. Criterion 1-3 and at least one of criterion 4-8 should be fulfilled. Criteria for forested wetlands are found under Wetlands. When determining stand age in criterion 4-7, all trunks should be taken into account.

#### Criterion 1-3 should be fulfilled:

1. The stand is naturally regenerated.
2. No large-scale cutting, thinning or understory clearing has occurred during the past 25 years. Older or limited exploitation felling or felling for wood is allowed.
3. In moist or wet stands there are no ditches with obvious hydrological impact within 25 m from the sample plot center. Also consider other types of hydrological impact, e.g. forest roads. The impact of larger ditches may be noticed even further away.

At least one of criterion 4-8 should be fulfilled (Note: When determining stand age in criterion 4-7, all trees are taken into account).

4. Basal area weighted stand age is at least 40 years older than lowest recommended final stand age (i.e.  $I_{rfsa} + 40$  years). See table 1 for  $I_{rfsa} + 20$  years, or "Field instruction for the Swedish National Forest Inventory", 2013 (Swedish version), tables 6:14-15.
5. Basal area weighted stand age is at least  $I_{rfsa} + 20$  years when: the amount of dead wood exceeds  $10 \text{ m}^3/\text{ha}$  OR the stand is multi-layered.
6. The stand varies in age and there are at least 8 standard trees (value trees) of oak, beech, linden or maple per hectare within the estimated area. The age of the standard trees exceed  $I_{rfsa} + 40$  years.
7. The stand varies in age and there are at least 80 standard trees of spruce or pine per hectare within the estimated area. The age of the standard trees exceed  $I_{rfsa} + 40$  years.
8. The area is affected by major natural disturbance (e.g. fire, storm or flooding) or by management activities designed to imitate such disturbances, e.g. nature conservation burning, placement of dead wood, release cutting of trees or removal of exotic/unwanted tree species.

### Wetlands

These criteria are applicable for all areas with peat soil or continuous thin layers of peat. Wetlands can be open or wooded. Wooded wetlands should fulfill criterion 1-3 above.

**Criterion 9-10 should be fulfilled:**

9. There are no ditches with obvious hydrological impact within 25 m from the sample plot center. Also consider other types of hydrological impact, e.g. forest roads. The impact of larger ditches may be noticed even further away. Signs of hydrological impact are for instance that solid ground mosses are becoming dominant on top of the peat.
10. No extensive chemical impact occurs on the main part of the area. Examples of chemical impact are liming or fertilizer leakage from nearby agricultural land. Also, no apparent effect of nitrogen fallout or acidification should be noticeable (this is often very difficult to judge in the field, and is normally not possible to determine).

Note that effects of mowing, digging ditches for improving fodder production or grazing domesticated animals are allowed. Especially in southern Sweden, cultural impact can be high and extensive resources are used by nature conservation initiatives in order to maintain management of wetlands.

## **Grasslands (natural pastures and meadows)**

Applicable for all natural grasslands. **Criterion 11-12 should be fulfilled.**

11. The area is not affected by fertilization or extensive cultivation (harrowing or plowing). Note: Increased damage by trampling and (natural) fertilization by animals near a gate is allowed.
12. If the area is in the process of being overtaken by shrubs and trees, values connected to the tree- and field layer should still be present.

A common dilemma when classifying open grassland is how to define the tree layer. For this purpose, only trees that are typical of the open grassland should be considered. If the open area is in the process of being overtaken by shrubs and trees, those types of trees should be ignored, e.g. young spruces and deciduous trees. It follows that the actual canopy cover in "open grasslands" often exceeds 10 %. There is no limit as to how much the area has been overtaken, as long as values connected with the field layer are still present.

## **Shores (coastal, lakes and waterways)**

Unless otherwise stated in the corresponding habitat description, the criteria for natural conditions are estimated on shores up to the high water mark. Criterion 13-15 should be fulfilled for all habitats on coastal shores, for lakeshores also criterion 16. Nature conservation activities, such as clearing of reeds, are allowed.

13. The shore is not exploited or built-up. Small jetties are accepted.
14. The shoreline is not significantly affected by digging, dredging or the construction of piers. This also includes reinforcements to prevent erosion.
15. Forests along the shore line have not been affected by large-scale cutting or thinning. Limited exploitation felling or felling for wood is allowed.
16. Lakeshores do not bear apparent signs of water-level regulation.

## Dunes and sand fields

These criteria for natural conditions are preliminary and will be developed and revised. The criteria are applicable for all dune habitats above the high water mark. Criterion 17-19 should be fulfilled:

17. The hydrology within the dune or sand field is not significantly affected by ditches.
18. The area is not exploited or built-up. Sample plots within recreational areas, i.e. ski slopes, running tracks or other facilities associated with tourism or recreation, are usually not classified as Annex 1 habitat types. Hiking trails are allowed if they do not cause significant damage by erosion.
19. Forest stands on dunes are natural or evolved from old plantations (protective forest). However, only forests of tree species naturally occurring in Sweden are allowed, whereby stands of e.g. dwarf mountain pine (*Pinus mugo*) are always classified as non-Annex 1 habitats.

## Alpine regions

Applicable in nature types above the coniferous tree line. Wetlands in the alpine region should also fulfill criteria 9-10, and if forested, also criteria 1-3.

20. The area is not heavily affected by erosion or ditching caused by off-road vehicles, tourism etc.
21. Sample plots within recreational areas, i.e. ski slopes, running tracks or other facilities associated with tourism or recreation, are usually not classified as Annex 1 habitat types. Hiking trails are allowed if they do not cause significant damage by erosion.
22. In Nordic sub-alpine birch forest (habitat code 9040), the base area weighted stand age exceeds 60 years. The forest is not affected by large-scale cutting or thinning (caused by other than natural disturbance, e.g. insects, snow- or mudslides). Limited exploitation felling or felling for wood is allowed.

## Measuring dead wood

During the collection of detailed tree data, the diameter at breast height (dbh) of standing and fallen dead trees is measured with calipers. This generates a thorough measurement of the volume of dead wood and the results are used in analysis of trends and occurrences. The complete method is described in the instruction for the Swedish NFI and NILS. In other situations, i.e. when determining if the nature type in the sample plot meets the criteria for natural conditions, the amount of dead wood can be estimated by using a relascope. Below is a simple instruction of how this is done:

All dead wood with a diameter of at least 10 cm at 130 cm height (diameter at breast height for standing trees) is measured. Stumps are not included in the volume of dead wood. If you are using a relascope with more than one gap, use the gap where each hit corresponds to 1 m<sup>2</sup> of basal area.

1. Determine how much of each piece of dead wood (standing or fallen) is wider than the gap in the relascope. Exclude pieces smaller than 10 cm in diameter.
2. Measure the length of these pieces (i.e. wider than the relascope gap).

3. The sum of these lengths (in meters) equals the volume of dead wood in  $\text{m}^3/\text{ha}$ . The volume does not need to be measured separately for different species.
4. Ideally, three separate measurements are performed in different sites within the habitat. The mean value is then used as the quantity of dead wood within the estimated habitat area (0.25 ha for forest habitats, 0.1 ha for wooded wet- or grasslands).

An example: Figure 2 shows six different pieces of dead wood. The other dead trunks or branches are either too narrow (less than 10 cm in diameter) or are too far away to be included – no part of the trunk or branch is thicker than the gap in the relascope. The lengths of the trunks or branches that are included are 4 m, 7 m, 1.2 m, 0.3 m, 1 m and 0.2 m. The sum is 13.7 m and the volume estimate of dead wood is subsequently  $13.7 \text{ m}^3/\text{ha}$ . In reality, this measurement is conducted in a complete circle ( $360^\circ$ ).



Figure 2. Dead tree trunks and branches that are taken into account when measuring the volume of dead wood within wooded habitats. The Y-shape symbolizes the relascope. Dead wood lesser than 10 cm in diameter is ignored

## Age criterion for forests

When considering the criteria for natural conditions in wooded habitats, the stand age is an important factor. The basal area weighted stand age is assessed in each sample plot (10 m radius) or each area of at least 0.1 ha. If necessary, drilling can be performed on appropriate trees. The stand age is then compared to the lowest recommended final stand age (Irfsa). The age criterion is always fulfilled if the stand age exceeds Irfsa + 40 years. If other criteria are also fulfilled, Irfsa + 20 years will suffice.

Lowest recommended final stand age is normally determined from a table, using the geographic location and site quality class of the stand. NILS does not estimate site quality class, wherefore the age criterion must be assessed by using other methods. Table 1 shows the lowest stand height to be expected at a certain stand age if the criterion "Irfsa + 20 years" is met.

Note that by age, we mean the number of years since the seed sprouted. If the age is measured by drilling at 1.3 m (breast height age), additional years are added in order to acquire the actual tree age according to figure 3 (developed from NFI's "addition to breast height age", chapter 6.3).

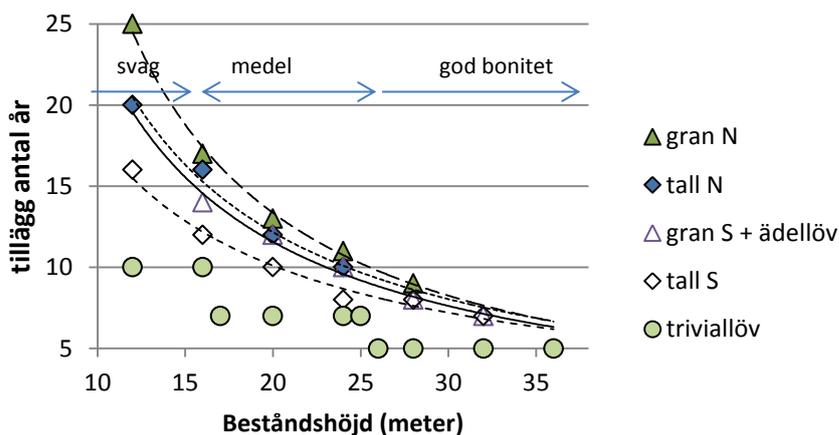


Figure 3. Number of years added to breast height age in order to acquire the actual tree age, vis-à-vis stand height, site quality class and tree species.

How to use the table:

1. Determine the stand height.
2. Find the appropriate age of comparison (Irfsa + 20) in the table below.
3. Determine the basal area weighted stand age (by drilling or other methods) for the stand in question.
4. If the age of the stand is equal to or older than age of comparison from the table, the age criterion is met. If the age of the stand is more than 20 years over the age of comparison, the criterion Irfsa + 40 is also met.

There are no Irfsa-tables for white birch (*Betula pubescens*), alder species (*Alnus*) or other softwood deciduous tree species. Softwood trees are considered to have met the lower age criterion (Irfsa + 20) if the basal area weighted stand age is over 60 years, regardless of geographic region. Similarly, there are no tables for impediments on bare bedrock or mires, or for coniferous forests in alpine regions. In these cases, use the highest age of comparison in the table for the specific tree species and region.

Table 1. Age criterion (Irfsa + 20 years) for tree species in relation to stand height.

Tree species	Stand height					
	< 15 m	20 m	25 m	30 m	32 m	35 m
Pine ( <i>Pinus sylvestris</i> )*	145 yrs	130 yrs	110 yrs	95 yrs		
Spruce ( <i>Picea abies</i> ) Southern Sweden		125 yrs	115 yrs	95 yrs		90 yrs
Spruce ( <i>Picea abies</i> ) Northern Sweden	160 yrs	135 yrs	120 yrs	100 yrs	90 yrs	
Oak ( <i>Quercus robur</i> )	150 yrs	135 yrs	120 yrs	110 yrs		
Beech ( <i>Fagus sylvatica</i> ) and other broad-leaved deciduous tree species	120 yrs	115 yrs	110 yrs	105 yrs		100 yrs
Silver birch ( <i>Betula pendula</i> ) Central and mid-north Sweden	70 yrs	65 yrs	60 yrs	60 yrs		
Silver birch ( <i>Betula pendula</i> ) in northern-most Sweden, white birch ( <i>B. pubescens</i> ) alder ( <i>Alnus</i> ) and other softwood deciduous trees: 60 years.						

\* In the northern-most counties, 10 years should be added to the age of pine. In the southern-most counties, the age can be reduced by 5 years.

## Criteria for rocky slopes and screes

When determining habitat class for rocky slopes and screes, a smallest required area is difficult to use as a delineator. Instead, criteria for height, horizontal expanse and incline are used. These are illustrated in figure 4 below.

In order for a rocky slope to be classified as one of the habitats sea cliffs (1230), calcareous rocky slopes (8210) or siliceous rocky slopes (8220), the following criteria should be met:

1. The height of the slope is at least 5 m.

2. The (horizontal) width is at least 20 m.
3. The incline is at least 30 degrees. This corresponds to 5.8 m in height over 10 m horizontal distance.
4. The slope or steep incline consists of solid bedrock.
5. The slope or steep incline is not covered with a continuous layer of vegetation.

In order for a scree to be classified as siliceous scree (8110) or calcareous scree (8120) the following criteria are to be met:

1. The incline is at least 30 degrees.
2. The (horizontal) width is at least 20 m.
3. The width of the ground level is at least 20 m (this is represented by the hypotenuse if a triangle with a 90° corner is drawn).
4. The scree is naturally evolved by weathering and erosion.
5. At least 70 % of the scree surface consists of boulders, rocks, gravel or annual vegetation.

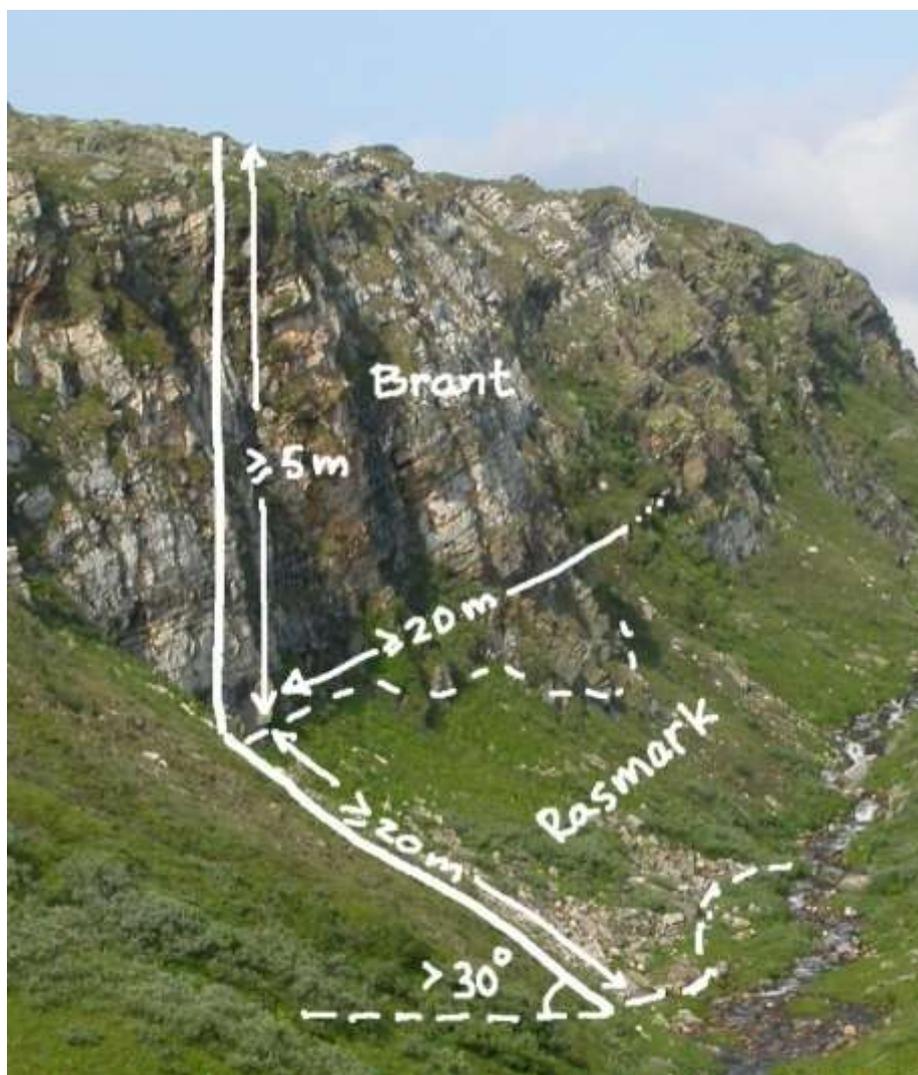


Figure 4. Criteria for height, horizontal width and incline for rocky slopes (brant) and screes (rasmark).

## Habitat list and smallest required unit

Smallest required units are appointed as follows:

Forests should be at least 0.25 ha to be classified as Annex 1 habitats. Open habitats, e.g. mires and natural grasslands, are allowed if they are larger than 0.1 ha. Note that wooded mires and natural grasslands also have a smallest required unit of 0.1 ha. Springs are regarded as point objects and are classified regardless of size. 0.1 ha is equivalent to a circle area with 18 m radius – somewhat smaller than the 20 m sample plot, or about three 10 m sample plots. 0.25 ha is equivalent to a circle with 28 m radius or two 20 m sample plots. Specific criteria apply for certain habitats; check the description of each habitat. It is important to record if a habitat type is incorporated within an aapamire complex. If that is the case, a special habitat code is used. An aapamire complex should be at least 10 ha when the areas of all included mires and wetlands are combined.

Habitat code	Name	Smallest required unit
9999	Non-Annex 1 habitat	
1210	Drift lines	See habitat description
1220	Boulder/gravel-dominated banks	0.1 ha
1230	Sea cliffs	See p 16 and habitat description
1310	Shores with <i>Salicornia europaea</i>	0.1 ha
1330	Atlantic coastal meadows	0.1 ha
1610	Baltic esker islands	0.25 ha
1620	Baltic islets	0.1 ha
1630	Baltic coastal meadows	0.1 ha
1640	Sandy shores	0.1 ha
1952	Boulder or gravel on land upheaval coasts (Glacial till shore)	0.1 ha
2110	Embryonic shifting dunes	See habitat description
2120	White dunes	See habitat description
2130	Grey dunes	See habitat description
2140	Dunes with dwarf shrubs	See habitat description
2170	Dunes with <i>Salix repens</i>	See habitat description
2180	Coastal wooded sand dunes	0.25 ha
2190	Humid dune-slacks	0.1 ha

<b>2320</b>	Inland dry sand heaths with dwarf shrubs	0.1 ha
<b>2330</b>	Inland grass dominated sand dunes	0.1 ha
<b>3210</b>	Fennoscandian natural rivers	See habitat description
<b>3220</b>	Alpine rivers and the herbaceous vegetation along their banks	See habitat description
<b>4010</b>	Wet heaths	0.1 ha
<b>4030</b>	European dry heaths	0.1 ha
<b>4060</b>	Alpine and boreal heaths	0.1 ha
<b>4080</b>	Sub-Arctic <i>Salix</i> areas	0.1 ha
<b>5131</b>	<i>Juniperus communis</i> formations on heaths below tree line	0.1 ha
<b>5132</b>	<i>Juniperus communis</i> formations on calcareous grasslands	0.1 ha
<b>6110</b>	Basophilic grassland communities on calcareous bedrock	100 m <sup>2</sup>
<b>6120</b>	Sand steppes	0.1 ha
<b>6150</b>	Alpine siliceous grasslands	0.1 ha
<b>6170</b>	Alpine calcareous grasslands	0.1 ha
<b>6210</b>	Calcareous grasslands	0.1 ha
<b>6211</b>	Calcareous grasslands with orchids	0.1 ha
<b>6230</b>	Grasslands with <i>Nardus stricta</i>	0.1 ha
<b>6270</b>	Siliceous grasslands	0.1 ha
<b>6280</b>	Nordic alvar	0.1 ha
<b>6411</b>	Wet calcareous grasslands	0.1 ha
<b>6412</b>	Wet grasslands	0.1 ha
<b>6430</b>	Tall herb communities	0.1 ha
<b>6450</b>	Alluvial meadows	0.1 ha
<b>6510</b>	Low-land hay meadows	0.1 ha
<b>6520</b>	Mountain hay meadows	0.1 ha
<b>6530</b>	Meadows with deciduous trees	0.1 ha

<b>6911</b>	Open cultivated pastures	0.1 ha
<b>6912</b>	Open cultivated hay meadows	0.1 ha
<b>6913</b>	Wooded cultivated pastures	0.1 ha
<b>6915</b>	Meadows with <i>Deschampsia cecpitosa</i>	0.1 ha
<b>6916</b>	Shrub lands	0.25 ha
<b>7110</b>	Active raised bogs	1 ha
<b>7130</b>	Blanket bogs	50 ha
<b>7140</b>	Open mires	0.1 ha
<b>7143</b>	Transitional mires	0.1 ha
<b>7161</b>	Springs	point
<b>7162</b>	Spring fens	0.1 ha
<b>7210</b>	Calcareous fens with <i>Cladium mariscus</i> (and <i>Caricion davallianae</i> )	0.1 ha
<b>7220</b>	Petrifying springs with tufa formation	point
<b>7230</b>	Alkaline fens	0.1 ha
<b>7234</b>	Mineral-rich spring in alkaline fens	point
<b>7240</b>	Alpine solifluction fens	100 m <sup>2</sup>
<b>7294</b>	Springs i aapamire	Point (10 ha for entire complex)
<b>7295</b>	Spring fens in aapamire	0.1 ha (10 ha for entire complex)
<b>7296</b>	Alkaline fens in aapamire	0.1 ha (10 ha for entire complex)
<b>7297</b>	Spring in alkaline fens in aapamire	Point (10 ha for entire complex)
<b>7298</b>	Open mires in aapamire	0.1 ha (10 ha for entire complex)
<b>7310</b>	Aapamires	0.1 ha (10 ha for entire complex)
<b>7311</b>	Petrifying springs with tufa formation in aapamire	Point (10 ha for entire complex)
<b>7318</b>	Mire woodlands in aapamire	0.1 ha (10 ha for entire complex)
<b>7320</b>	Palsa mires	0.1 ha
<b>8110</b>	Siliceous screes	See page 16
<b>8120</b>	Calcareous screes	See page 16
<b>8210</b>	Calcareous rocky slopes	See page 16

<b>8220</b>	Siliceous rocky slopes	See page 16
<b>8230</b>	Dry meadows on siliceous bedrock	100 m <sup>2</sup>
<b>8240</b>	Limestone pavements	0.1 ha
<b>8340</b>	Permanent glaciers	0.25 ha
<b>9007</b>	Western taiga, coniferous swamp forests	0.25 ha
<b>9009</b>	Western taiga with natural disturbances	0.25 ha
<b>9010</b>	Western taiga	0.25 ha
<b>9020</b>	Nordic broad-leaved hardwood forests	0.25 ha
<b>9030</b>	Primary successional forests on land upheaval coast	0.25 ha
<b>9040</b>	Nordic subalpine birch forests	0.25 ha
<b>9050</b>	Herb-rich <i>Picea abies</i> dominated forests	0.25 ha
<b>9060</b>	Coniferous forest on glaciofluvial eskers	0.25 ha
<b>9070</b>	Wooded pastures	0.1 ha
<b>9080</b>	Deciduous swamp forests	0.25 ha
<b>9110</b>	Poor beech forests	0.25 ha
<b>9130</b>	Herb-rich beech forests	0.25 ha
<b>9160</b>	Herb-rich oak forests	0.25 ha
<b>9180</b>	Broad-leaved hardwood forests in slopes, screes and ravines	0.25 ha
<b>9190</b>	Poor oak forests	0.25 ha
<b>9740</b>	Mire woodlands	0.1 ha
<b>9750</b>	Alluvial forests	0.25 ha
<b>9760</b>	Alluvial broad-leaved hardwood dominated forests	0.25 ha
<b>9915</b>	Wooded inland dunes	0.25 ha

Note: In areas classified as 9999, the smallest required unit is 0.25 ha for forests and 0.1 ha for other habitat types.

## **Classification of “rich” and “poor” habitat types**

The classification system used in the Habitats Directive often distinguishes between “rich” and “poor” habitat types, e.g. when differentiating between rich and poor beech forests or open mires (“poor”) and alkaline fens (“rich”). What determines if a habitat type is rich or poor is usually the existence of base cations in the ground water and the water movement in the area.

The forestry sector and the Swedish National Forest Inventory (NFI) have for a long time been using the ground vegetation with some complementary variables in order to determine the production capability of a forest stand. Tall herbs are found in very rich areas, whereas poor areas are dominated by low herbs, dwarf shrubs or lichens.

Vascular plant species can also be used as indicators in wetlands and grasslands. Since there are no vegetation types corresponding to those in forests, a point-system where different species yield different points depending on their qualities as indicators is used. Since the species composition in the alpine region is radically different from the rest of the country, a separate list has been compiled for this region. The listed species have been chosen based on how common they are in each specific habitat type and how easily recognized they are. We have chosen to refer to them “rich soil indicator species”, since they do not necessarily indicate the same phenomenon. Some species indicate calcareous bedrock; others might indicate high content of phosphorus or nitrogen. The corresponding Swedish name for rich soil indicator species – rikmarksväxter – is originated from Smålands Flora by Germund Tyler.

## **Ground vegetation classes for the classification of forest habitats**

Within this habitat manual, the ground vegetation types described in the site quality class system will be used in order to distinguish between rich and poor forest types (table 2).

The area in which the ground vegetation is assessed, should be representative of the soil nutrient content within the forest habitat (at most 0.25 ha). This does not include areas that have been disturbed, or where the vegetation is otherwise affected. Examples of areas that should be excluded are trails, tracks, ditches, roadsides, boulders (over 0.5 m), tree stumps, trunks, fallen trees etc. Note that bare bedrock is included in the ground surface, as well as the vegetation in clearings.

Table 2. The ground vegetation types used in NFI and NILS used in order to distinguish between rich and poor forest types.

Ground vegetation classes	NFI code	NFI code	NILS code	
	Bottom layer type	Field layer type	Forest type	
Lichen type	1		01	Poor
Lichen rich type	2		02	
Tall herbs, no dwarf shrubs	3-6	01	03	Rich
Tall herbs with <i>V. myrtillus</i>	3-6	02	04	
Tall herbs with dwarf shrub except <i>V. myrtillus</i>	3-6	03	05	
Low herb type, no dwarf shrubs	3-6	04	06	
Low herbs with <i>V. myrtillus</i>	3-6	05	07	
Low herbs with dwarf shrub except <i>V. myrtillus</i>	3-6	06	08	
Field layer absent <sup>1</sup>	3-6	07	09	Poor/Rich
Broadleaved grass type, with <i>Pteridium</i> <sup>2</sup>	3-6	08	11	Poor
Thin leaved grass type	3-6	09	12	
High Carex-Equisetum type,	3-6	10	10	
Low Carex-Equisetum type	3-6	11	10	
Carex-Equisetum type, Fräken	3-6	12	10	
<i>V. myrtillus</i> type	3-6	13	13	
<i>V. vitis-idaea</i> type	3-6	14	14	
<i>Empetrum</i> -- <i>Calluna</i> type	3-6	15	15	
Dry ericoid type	3-6	16	16	

<sup>1</sup>Normally included as a nutrient rich ground vegetation type. NOTE! For Beech forests, use the sparse vegetation present –if no shadetolerant species is found (vernal flora), then classify as poor

<sup>2</sup>Recognized as Rich in northern Sweden, poor in southern Sweden

## Rich soil indicator species

In order to determine if a habitat type should be classified as rich or poor in base cations, indicator species can be used. Lists of species that should be registered in alpine regions, wetlands and grasslands are presented below. The lists differ slightly between northern and southern Sweden; the large river Dalälven is used as the differentiator in this respect. Normally, presence of one species yields one point, but some species are weighted depending on their quality as an indicator in a certain part of the country. Note that some species yield 1/3 point, and that *Parnassia palustris* does not yield any points in the north. Species lacking a point marker are not expected to occur naturally in that part of the country.

The rich soil criterion is fulfilled when the species found within the 20 m sample plot add up to 3 points. If the sample plot is divided, an area outside the 20 m radius can be surveyed, as long as the surveyed area does not exceed 0.125 ha.

Example: In a fen in northern Sweden, *Cypripedium calceolus*, *Eriophorum latifolium*, *Selaginella selaginoides*, *Tofieldia pusilla*, *Campylium stellatum* and *Paludella squarrosa* are found. In the list "rich soil indicator species in wetlands", these species yield  $1 + 1 + 1/3 + 1/3 + 1/3 + 1/3 = 3.33$  points. The rich soil criterion is thus fulfilled.

All listed species are registered if they are found within the surveyed area.

## Rich soil indicator species in alpine regions

Used for all habitat types above the coniferous tree line.

Scientific name	Points
<i>Anthyllis vulneraria</i>	1
<i>Asplenium viride</i>	1
<i>Carex atrofusca</i>	1
<i>Carex bicolor</i>	1
<i>Carex capillaris</i>	1
<i>Carex capitata</i>	1
<i>Carex flava</i> coll.	1/3
<i>Carex fuliginosa</i>	1
<i>Carex rupestris</i>	1
<i>Carex saxatilis</i>	1
<i>Cassiope tetragona</i>	1
<i>Draba</i> sp.	1
<i>Dryas octopetala</i>	1
<i>Equisetum scirpoides</i> + <i>variegatum</i>	1
<i>Gymnadenia conopsea</i>	1
<i>Juncus biglumis</i>	1/3
<i>Juncus triglumis</i>	1
<i>Primula scandinavica</i> + <i>stricta</i>	1
<i>Pseudorchis straminea</i>	1
<i>Rhododendron lapponicum</i>	1
<i>Salix reticulata</i>	1
<i>Saxifraga adscendens</i>	1
<i>Saxifraga aizoides</i>	1
<i>Saxifraga oppositifolia</i>	1
<i>Thalictrum alpinum</i>	1/3
<i>Tofieldia pusilla</i>	1/3
<i>Calliargon giganteum</i>	1
<i>Campylium stellatum</i>	1/3
<i>Catoscopium nigratum</i>	1
<i>Cinclidium stygium</i>	1/3
<i>Cratoneuron filicinum</i>	1
<i>Leiocolea rutheana</i>	1
<i>Meesia triquetra</i>	1
<i>Meesia uliginosa</i>	1
<i>Moerckia hibernica</i>	1
<i>Paludella squarrosa</i>	1/3
<i>Palustriella decipiens</i> + <i>falcata</i>	1
<i>Preissia quadrata</i>	1
<i>Scorpidium cossonii</i>	1
<i>Scorpidium scorpioides</i>	1/3
<i>Scorpidium revolvens</i>	1/3
<i>Tayloria lingulata</i>	1
<i>Tomentypnum nitens</i>	1/3

## Rich soil indicator species in wetlands

Scientific name	South	North
<i>Bartsia alpina</i>	1	1
<i>Carex appropinquata</i>	1	1
<i>Carex capillaris</i>	1	1
<i>Carex capitata</i>	-	1
<i>Carex flacca</i>	1	-
<i>Carex flava</i> coll.	1/3	1/3
<i>Cypripedium calceolus</i>	1	1
<i>Dactylorhiza incarnata</i> coll.	1	1
<i>Eleocharis quinqueflora</i>	1	1
<i>Epipactis palustris</i>	1	-
<i>Equisetum scirpoides+variegatum</i>	1	1
<i>Eriophorum latifolium</i>	1	1
<i>Gymnadenia conopsea</i>	1	1
<i>Listera ovata</i>	1	1
<i>Ophrys insectifera</i>	1	1
<i>Parnassia palustris</i>	1	-
<i>Primula farinosa</i>	1	1
<i>Schoenus ferrugineus</i>	1	1
<i>Selaginella selaginoides</i>	1	1/3
<i>Tofieldia pusilla</i>	1/3	1/3
<i>Calliergon giganteum</i>	1	1
<i>Campylium stellatum</i>	1	1/3
<i>Catoscopium nigratum</i>	1	1
<i>Cinclidium stygium</i>	1	1/3
<i>Cratoneuron filicinum</i>	1	1
<i>Leiocolea rutheana</i>	1	1
<i>Meesia triquetra</i>	-	1
<i>Meesia uliginosa</i>	-	1
<i>Moerckia hibernica</i>	1	1
<i>Paludella squarrosa</i>	1	1/3
<i>Palustriella commutata+decipiens+falcata</i>	1	1
<i>Preissia quadrata</i>	1	1
<i>Scorpidium cossonii</i>	1	1
<i>Scorpidium scorpioides</i>	1	1/3
<i>Scorpidium revolvens</i>	1	1/3
<i>Tayloria lingulata</i>	-	1
<i>Tomentypnum nitens</i>	1	1/3

## Rich soil indicator species in grasslands

Scientific name	South	North
<i>Anthyllis vulneraria</i>	1	1
<i>Arabis hirsuta</i>	1	1
<i>Bartsia alpina</i>	1	1
<i>Briza media</i>	1/3	1/3
<i>Carex capillaris</i>	1	1
<i>Carex flacca</i>	1	-
<i>Carex flava</i> coll.	1/3	1/3
<i>Carlina vulgaris</i>	1	-
<i>Cirsium acaule</i>	1	-
<i>Crepis praemorsa</i>	1	-
<i>Dactylorhiza viride</i>	1	1
<i>Epipactis palustris</i>	1	1
<i>Eriophorum latifolium</i>	1	1
<i>Filipendula vulgaris</i>	1/3	1/3
<i>Gentianella amarella</i>	1	1
<i>Geranium sanguineum</i>	1	-
<i>Gymnadenia conopsea</i>	1	1
<i>Helictotrichon pratensis</i>	1/3	1/3
<i>Inula</i> sp.	1	-
<i>Linum catharticum</i>	1	1
<i>Listera ovata</i>	1	1
<i>Ophrys insectifera</i>	1	1
<i>Orchis mascula</i>	1	-
<i>Parnassia palustris</i>	1	-
<i>Phleum phleoides</i>	1	-
<i>Plantago media</i>	1/3	1/3
<i>Polygala amarella</i>	1	1
<i>Potentilla crantzii</i> + <i>tabernaemontani</i>	1/3	1
<i>Primula farinosa</i>	1	1
<i>Sedum album</i>	1/3	1/3
<i>Sedum sexangulare</i>	1	-
<i>Selaginella selaginoides</i>	1	1
<i>Sesleria caerulea</i>	1	1
<i>Tofieldia pusilla</i>	1/3	1/3
<i>Trifolium montanum</i>	1	-
<i>Veronica spicata</i>	1	-

## Main classification key

- 1 Area in the alpine region, above the coniferous tree line .....  
..... **Classification key for habitats in the alpine region**
- 1 Below the coniferous tree line ..... **2**
- 2 Coastal shore ..... **Classification key for habitats on coastal shores**
- 2 Different ..... **3**
- 3 Sand dune (above the high water mark) or sand field .....  
..... **Classification key for habitats on dunes and sand fields**
- 3 Different ..... **4**
- 4 Open (not forested) area dominated by bare substrate (bedrock, boulders, gravel or sand) .....  
..... **Classification key for habitats on bare substrate**
- 4 Area with at least 50 % cover of vegetation (except crusty lichens) ..... **5**
- 5 Area with peat ..... **Classification key for habitats in wetland**
- 5 Area with solid ground ..... **6**
- 6 Area where the vegetation is heavily affected by mowing or grazing, or open areas affected by  
some form of management or other natural impact inhibiting growth of trees and shrubs.  
Natural pastures, grazed pastures, meadows etc. ....  
..... **Classification key for habitats in grassland**
- 6 Forested area, below the coniferous tree line ..... **Classification key for habitats in forest**

**Springs** are regarded as point objects and are always registered when encountered within the sample plot. Springs are included in the classification key for habitats in Alpine regions, wetlands, grasslands and forests, but should also be registered if found in other types of habitats.

Along **rivers and lakes**, the area below the high water mark is regarded as the shore. There is no separate classification key for these types of habitats; the Annex 1 habitats found on fresh water shores appear in several classification keys: alpine regions (3210, 3220, 4080, 6450), bare substrate (3210), wetlands (7140, 7210), grasslands (6450, 66430, 7210) and forests (9750, 9760).

## Classification key for habitats in the alpine region

This key is only used for “natural” forest areas above the coniferous tree line (Swedish definition). Areas heavily influenced by e.g. agriculture, ongoing management or recreation (for instance ski slopes) are not classified as Annex 1 habitats. Wetlands where off-road vehicles have caused serious damage to the hydrology or hydrochemistry are also not included.

Springs are regarded as point objects. Smallest required unit for forests is 0.25 ha (0.1 ha for 9070 Wooded pastures) and for wetlands normally 0.1 ha. However, 7240 Alpine inundated fens are classified if they are a part of a mire mosaic of at least 100 m<sup>2</sup>. In order to classify a habitat type as incorporated in an aapamire, the entire aapamire complex should be at least 10 ha.

Rich soil indicator species (mosses and vascular plants) are awarded points according to the provided table; the total score determines if the habitat should be classified as a rich or poor habitat type (list of rich soil indicator species in alpine regions).

1	Area covered in snow or ice with a permanent ice core .....	<b>8340 Permanent glaciers</b>
1	Different.....	<b>2</b>
2	Peat soil or spring. Mire types with normally at least 30 cm <i>Sphagnum</i> peat, or fens with a thinner layer of peat.....	<b>3</b>
2	Solid ground .....	<b>13</b>
3	Bog complex with blanket bog larger than 50 ha, with a peat layer of about 100 cm .....	<b>7130 Blanket bogs</b>
3	Not a blanket bog .....	<b>4</b>
4	Mire of palsa type, at least 1 m high palsa within 50 m from the sample plot .....	<b>7320 Palsa mires</b>
4	No palsa present.....	<b>5</b>
5	<b>Use the map:</b> Is the wetland included in a larger fen or bog area (at least 10 ha) with fens or transitional mires with hummock-strings or flarks in the central parts, i.e. aapamire complex? .....	<b>Use option II in all cases below 6</b>
5	Not part of a larger fen or bog area (i.e. smaller than 10 ha) . <b>Use option I in all cases below 6</b>	
6	Spring.....	<b>7</b>
6	Not a spring .....	<b>8</b>
7a	Spring with calcareous water and ongoing tufa formation. Tufa is present in or near the spring .....	<b>I) 7220 Petrifying springs with tufa formation</b> <b>II) 7311 Petrifying springs with tufa formation in aapamire</b>
7b	A spring is present in a nearby rich fen. No tufa, but calcareous sinter may be present.....	<b>I) 7234 Mineral-rich spring in alkaline fens</b> <b>II) 7297 Mineral-rich spring in alkaline fens in aapamire</b>
7c	Other type of spring .....	<b>I) 7161 Spring</b> <b>II) 7294 Spring in aapamire</b>

8	Rich soil indicator mosses or plants yield at least 3 points (alpine regions list!) .....	9
8	Rich soil indicator mosses or plants yield less than 3 points or are missing.....	10
9	Thin layer of peat or patches of mineral soil, with apparent damage from repeated freezing. On inundated areas in slopes and wet hollows, by springs or alpine creeks.....	
	.....	<b>7240 Alpine inundated fens</b>
9	Open or wooded fen with presence of rich soil indicator species (at least 3 points). Peat land or continuous thin peat layer.....	<b>I) 7230 Alkaline fen</b>
	.....	<b>II) 7296 Alkaline fen in aapamire</b>
10	Open or wooded fen impacted by moving ground water, in contiguity to springs. Spring fens are often located in slopes. The vegetation is more species-rich than in surrounding fens with e.g. <i>Epilobium spp.</i> , <i>Chrysosplenium spp.</i> , <i>Scapania spp.</i> and <i>Philonotis spp.</i> .....	
	.....	<b>I) 7162 Spring fens</b>
	.....	<b>II) 7295 Spring fens in aapamire</b>
10	No apparent impact of moving ground water .....	11
11	Wooded mire, with trees higher than 3 m and canopy cover at least 10 %. Common trees are <i>Betula pubescens</i> , <i>Picea abies</i> and <i>Pinus sylvestris</i> . The field- and bottom layers are dominated by dwarf-shrubs, <i>Carex</i> - and <i>Sphagnum</i> species. Signs of limited exploitation felling are allowed. ....	<b>I) 9740 Mire woodlands</b>
	.....	<b>II) 7318 Mire woodlands in aapamire</b>
11	Mire with no trees, or canopy cover less than 10 % . ....	12
12	Fen with hummock-strings and flarks, or transitional mire with alternating fen and bog areas . ....	<b>I) 7143 Transitional mires</b>
	.....	<b>II) 7310 Transitional mires in aapamire</b>
12	Open or sparsely wooded mires. Mire types included are flat or slightly raised bogs (< 1 m) as well as flat or sloping fens. The peat layer is normally at least 30 cm .....	<b>I) 7140 Open mires</b>
	.....	<b>II) 7298 Open mires in aapamire</b>
13	Heavily sloping ground, with bare areas void of vegetation. The soil is subject to weathering and erosion .....	14
13	Different.....	18
14	Scree or cliff area.....	15
14	Sloping moist ground with sand, gravel or silt. Calcareous or basic soil drifting along alpine slopes (due to moisture loadings and frost heavings), with partly bare soil or peat. Low but species-rich vegetation consisting of mosses, <i>Juncus</i> - and <i>Carex</i> -species (including <i>Carex atrofusca</i> ).....	<b>7240 Alpine inundated fens</b>
15	Scree. Course material such as boulders, rocks and gravel cover at least 70 % of the surface....	16
15	Cliff or bare rock face with vegetation in crevasses. Thin soil layer (2 cm) in 70 % of the sample plot.....	17
16	Easily weathered basic (e.g. lime stone and calcareous shale) and ultramafic rock type (e.g. serpentinite).....	<b>8120 Calcareous screes</b>

- 16 Other rock type. Scree with siliceous rock, often minimally weathered and nutrient-poor rock type (e.g. granite, gneiss, slate, gabbro and amphibolite). Often with large boulders at the base of the talus ..... **8110 Siliceous screes**
- 17 Bare rock face and cliff on calcareous or ultramafic (e.g. serpentinite) rock type with species-rich vegetation in crevasses. Often rich in crusty lichens (including *Caloplaca* spp) on the rock face. .... **8210 Calcareous rocky slopes**
- 17 Siliceous, often minimally weathered rock type, e.g. calcium-poor shale. Lichens of the genera *Parmelia*, *Umbilicaria*, *Rhizocarpon*, *Lecanora* och *Lecidea* are found on the rock face.....  
..... **8220 Siliceous rocky slopes**
- 18 Canopy cover (crown and if alpine birch, also trunk) at least 10 % and tree height higher than 2 m.....**19**
- 18 Different..... **22**
- 19 Forest with **clear** signs of anthropogenic influence (e.g. grazing or felling for wood) .....**20**
- 19 No clear signs of grazing and few or no signs of felling for wood ..... **21**
- 20 With long-lasting management by grazing ..... **9070 Wooded pastures**
- 20 No long-lasting management by grazing. Logged forest or young forest developed after final felling ..... **9999 Non-Annex 1 habitats**
- 21 Birches constitute at least 50 % of the basal area .....**9040 Nordic subalpine birch forests**
- 21 Birches constitute less than 50 % of the basal area ..... **9010 Western taiga**
- 22 *Salix* shrubs (mean height at least 0.3 m) constitute the main part of the vegetation.....  
..... **4080 Sub-arctic *Salix* areas**
- 22 Mean height of *Salix* shrubs is lower; the total cover is lower (excluding dwarf species of *Salix*) or *Salix* species are absent ..... **23**
- 23 In contiguity to water, below the flood line ..... **24**
- 23 Above the flood line or not in contiguity to water..... **26**
- 24 Annually flooded grassland along the shore of a large river. The area has been or is used as a hay meadow. The vegetation consists mainly of *Carex aquatilis*, *Carex acuta*, *Calamagrostis canescens*, *Calamagrostis purpurea* or *Equisetum fluviatile*. ..... **6450 Alluvial meadows**
- 24 Not along a large river or overtaken by shrubs due to discontinued management ..... **25**
- 25 Species-rich, herb-rich shore by an alpine or subalpine river with natural water level fluctuations. Shore vegetation consists largely of sub-arctic plants (e.g. *Cerastium alpinum*, *Oxyria digyna*, *Saxifraga aizoides*, *Anthyllis vulneraria*, *Salix hastata/daphnoides/phylicifolia* and *Astragalus alpinus*) with *Deschampsia cespitosa* and *Calamagrostis stricta*.....  
..... **3220 Alpine rivers and the herbaceous vegetation along their banks**
- 25 Shore not rich in herbs ..... **9999 Non-Annex 1 habitats**
- 26 Tall herbs dominate the field layer..... **6430 Tall herb communities**
- 26 Grassland dominated by graminids, or dwarf shrub heath, including nearby snowbed..... **27**
- 27 The field layer (excluding dwarf *Salix* species) covers at least 10 % ..... **28**
- 27 The field layer (excluding dwarf *Salix* species) covers less than 10 %. E.g. boulder areas (for vegetation in snowbeds, see 4060) ..... **9999 Non-Annex 1 habitats**

- 28 Dwarf shrub cover is **lower than** the cover of other field layer species. Grassland usually influenced by long-lasting grazing by reindeer .....**29**
- 28 Dwarf shrub cover is **higher than** the cover of other field layer species. Snowbed surrounded by heath vegetation is included ..... **4060 Alpine and boreal heaths**
- 29 Rich soil indicator species yield at least 3 points (alpine regions list!). Species-rich vegetation with e.g. *Oxytropis lapponica*, *Dryas octopetala*, *Carex rupestris*.....  
.....**6170 Alpine calcareous grasslands**
- 29 Rich soil indicator species yield less than 3 points, or are missing. Species-poor vegetation dominated by grasses, sedges, and herbs. Soil layer usually thin, mostly consisting of weathered materials ..... **6150 Alpine siliceous grasslands**

## Classification key for habitats on coastal shores

This key covers open habitat types on coastal shores where the vegetation is influenced by salt- and brackish water. The areas are demarcated by the median water mark (lowest point) and the high water mark (highest point), with exceptions for 1220, 1230 and 2110. There is uncertainty as to how the interpretations of the EU's definitions by the Swedish Environmental Protection Agency are to be construed. This key should therefore be considered as preliminary and is most likely subject to change. Boulder or gravel on land upheaval coasts (1952) is not an original Annex 1 habitat type, but has been included since several of the endemic species to the Baltic Sea region are found mainly on these types of shores. Similarly, drift lines should be registered if found on esker islands or islets in the Baltic Sea, since this can be corrected a posteriori if needed. Herein lies the difference to the Swedish Environmental Protection Agency's interpretations, where 1610 and 1620 are given precedence to 1210. It is not completely clear how parts of cliffs with no vegetation are to be regarded. Consequently, we have chosen to single out low cliffs and rock faces with no vegetation in a separate class: Cliff shore (1239). This habitat type is common along the entire Swedish coast. 1239 is only mentioned within the habitat description for Sea cliffs (1230), and no separate habitat description has been provided.

- |   |  |                                      |
|---|--|--------------------------------------|
| 1 | Drift line (at least 30 m long) of algae, reeds or other vegetation deposited in bank-like formations, on which new vegetation has been established..... | <b>1210 Drift lines</b>              |
| 1 | No drift line, or without established vegetation .....   | <b>2</b>                             |
| 2 | Shore on a glaciofluvial island .....  | <b>1610 Baltic esker islands</b>     |
| 2 | Shore on the mainland or on another type of island.....  | <b>3</b>                             |
| 3 | Shore on a sea cliff or islet with no continuous tree layer .....  | <b>1620 Baltic islets</b>            |
| 3 | Shore on the mainland or on a larger, tree-covered island .....  | <b>4</b>                             |
| 4 | Area with clay or sand sediment; regularly flooded and mainly colonized by <i>Salicornia europaea</i> and other annual plant and grasses.....            | <b>1310 Atlantic coastal meadows</b> |
| 4 | Different .....  | <b>5</b>                             |
| 5 | Shore with low-moderate exposure to waves where accumulation of fine sediments occur, usually with continuous vegetation. ....                           | <b>6</b>                             |
| 5 | More exposed shore .....   | <b>7</b>                             |
| 6 | On the Swedish south- or east coast, east of Falsterbo.....  | <b>1630 Baltic coastal meadows</b>   |
| 6 | On the Swedish west coast, north of Falsterbo.....   | <b>1330 Atlantic coastal meadows</b> |
| 7 | Area dominated by sand .....   | <b>8</b>                             |
| 7 | Not dominated by sand.....   | <b>9</b>                             |
| 8 | Sandy shore influenced by wind at the high water mark, creating small (decimeter high) drifts. These can be sparsely covered with herbs or grasses. .... | <b>2110 Embryonic shifting dunes</b> |
| 8 | Sandy shore with no wind influence, often sparsely covered with grasses and perennials at the high water mark.....                                       | <b>1640 Sandy shores</b>             |

- 9 Shore consisting mainly of rocks or gravel ..... **10**
- 9 Rock face, cliff or bluff. Usually with vegetation influenced by salt ..... **11**
  
- 10 Shore consisting of rock or gravel drifts, including fossil drifts, often with clear terraces. The vegetation is contingent on exposure..... **1220 Boulder- or gravel dominated banks**
- 10 Shore with medium-high exposure consisting of moraine (till) or sediment gravel or rock. No terraces. The vegetation is usually clearly zoned. .... **1952 Boulder or gravel on land upheaval coasts**
  
- 11 Cliff or bluff with at least a 30° incline and a height of 5 meters. Usually with vegetation influenced by salt..... **1230 Sea cliffs**
- 11 More level rock face or cliff, or lower bluffs. .... **1239 Cliff shore**

Note: In the specific shore line inventory conducted by MOTH, the coastal shore is inventoried along a transect beginning at the border between the hydro- and geolittoral zones, continuing through the entire supralittoral zone (i.e. above the high water mark but influenced by waves) and even further into the area above the shore. This inventory also registers coastal habitats within the supralittoral zone. Habitat types found along the transect above the supralittoral zone are classified with the appropriate terrestrial habitat classification key.

## Classification key for habitats on dunes and sand fields

This key is used to classify coastal sand dunes and inland sand fields. This key is not yet tested and should be considered as preliminary. Coastal dunes are separated from shore habitats by the influence of (semi-annual) water movement that affects a shore, while dunes are located above the actual shore line. Dune structures are created by wind, with the exception of embryonic shifting dunes, which may occur on the upper part of the shore.

The classification of dune habitats is different from the classification of other habitats. While conducting the base inventory and the monitoring of protected areas, very small sections have been registered and classified as habitats – sometimes sections of only a few decimeters. Therefore, a somewhat simplified method is suggested when assessing a dune habitat. First, determine whether the sample plot is located in a dune area. The entire dune area should be at least 0.1 ha (excepting embryonic shifting dunes on shores, which may be smaller). Second, determine which habitats are included in the dune area and are represented in the sample plot. Register all habitats of at least 10 m<sup>2</sup>.

- 1 The sample plot is located on a flat sand field not in proximity to a coastal sand dune, or the sample plot is located in a sand dune more than 5 km from the coast.....**2**
- 1 The sample plot is located in a coastal sand dune (less than 5 km from the coast).....**4**
- 2 Wooded (more than 10 % canopy cover) dune or sand field..... **9915 Wooded inland dunes**
- 2 Not wooded.....**3**
- 3 Heath-like vegetation with at least 10 % cover of *Empetrum nigrum* and *Calluna sp.* ..... **2320 Inland dry sand heaths with dwarf shrubs**
- 3 Cover of *Empetrum nigrum* and *Calluna sp.* less than 10 %. Sparse grassy vegetation with some herbs ..... **2330 Inland grass dominated sand dunes**
- 4 Wooded (more than 10 % canopy cover) coastal dune. Often in close proximity to open dune habitats.....**2180 Coastal wooded sand dunes**
- 4 Open dune habitats .....**5**
- 5 Mobile sand only partially stabilized in the dunes. Often light-colored sand since no leaching has yet occurred.....**6**
- 5 The sand is mainly bound with vegetation, sand patches may occur. The sand is leached and has a darker, grey color. ....**7**
- 6 Only smaller, temporary drifts on the outer parts of white dunes or the upper beach. Usually decimeter-high, sometimes with sparse grasses or herbs..... **2110 Embryonic shifting dunes**
- 6 Taller (often more than 1 m) dunes with grass binding the sand, e.g. *Ammophila arenaria* or *Leymus arenarius*. The dunes often constitute a front between the beach and the more stabilized inner dunes. ....**2120 White dunes**
- 7 *Salix repens*, *S. repens var. argentea* or their hybrids cover at least 50 % within an area of at least 10 m<sup>2</sup> ..... **2170 Dunes with *Salix repens***
- 7 No or less cover of *Salix repens* and/or *S. repens var. argentea* or their hybrids .....**8**

- 8 Wet or waterlogged hollow in the dune with varied vegetation that may be dominated by herbs, dwarf shrubs, grasses, wetland mosses or shrubs. Mosses are mainly wetland varieties, such as *Sphagnum* species and *Aulacomnium palustre*..... **2190 Humid dune-slacks**
- 8 No wet hollow. If mosses occur, they are usually varieties associated with heath vegetation, such as *Pleurozium schreberi*.....**9**
- 9 The vegetation mainly consists of dwarf shrubs. .... **2140 Dunes with dwarf shrubs**
- 9 The vegetation consists of grasses and herbs. Dwarf shrubs are absent ..... **2130 Grey dunes**

## Classification key for habitats on bare substrate

Open areas (not wooded) where bare bedrock, screes, boulders, rocks, gravel or weathered soil is exposed. The vegetation often covers less than 50 % (excluding crusty lichens). For habitats on sand fields and dunes, see the classification key for sand habitats.

- 1 Bare substrate close to the sea, with clear influence of salt- or brackish water.....**2**
- 1 No influence from salt- or brackish water, or vegetation heavily affected by management .....**3**
  
- 2 Cliff close to the sea, with clear influence of salt- or brackish water. .... **1230 Sea cliffs**
- 2 Fossil shore made up of rock- or gravel drifts. Often with distinct terraces.....  
..... **1220 Boulder/gravel-dominated banks**
  
- 3 Shore by a large river dominated by bare substrate (below the high water mark) .....  
..... **3210 Fennoscandian natural rivers**
- 3 Different .....**4**
  
- 4 Flat or gently sloping bare bedrock with an incline less than 30° .....**5**
- 4 Steep cliff or scree with an incline of at least 30° .....**9**
  
- 5 Calcareous bedrock.....**6**
- 5 Siliceous bedrock .....**8**
  
- 6 Calcareous rock surface with deep, widened fissures and loose flags, known as “shattered pavements”. The rock surface is more or less devoid of soil, the vegetation is dominated by succulents (*Sedum sp.*), annuals, lichens and moss cushions. Shrubs, herbs and trees may occur at the bottom of the crevasses where soil has been gathering. .... **8240 Limestone pavements**
- 6 Fissures narrow, not widened .....**7**
  
- 7 Bare bedrock and lichen-covered rock face cover at least 50 %. The area consists of basic rock types with thin, calcareous or basic soil with drought-tolerant vegetation, dominated by succulents (*Sedum sp.*), grasses and annual herbs, as well as mosses and lichens. Narrow fissures filled with soil may contain different vegetation and form ridges of grasses and herbs. ...  
..... **6110 Basophilic grassland communities on calcareous bedrock**
- 7 Limestone flatrock. Bare bedrock (including lichen-covered rock face) cover less than 50 % of the surface. Open areas with vegetation on thin or non-existing weathered soil and in small depressions filled with water (“våtar”). (Found in the provinces of Öland, Gotland and Västra götaland) ..... **6280 Nordic Alvar**
  
- 8 Plant community with drought-tolerant vascular plants, lichens and mosses on siliceous and sometimes very dry rock surface. A thin, patchy soil layer may cover at most 50 % of the surface. ....  
..... **8230 Dry meadows on siliceous bedrock**
- 8 The rock surface lacks drought-tolerant vascular plants and annuals. Other types of bare substrate, e.g. boulder field, depression in bedrock, or scree with slight incline.....**9999 Non-Annex 1 habitat**
  
- 9 Cliff with steep rock face (more than 30° incline) .....**10**
- 9 Scree.....**11**
  
- 10 Calcareous or ultramafic rock type, e.g. cambro-silurian rock types, limestone, phyllite and other calcareous shale types (also serpentinite)..... **8210 Calcareous rocky slopes**

- 10 Minimally weathered rock type, e.g. granite, gneiss, slate, gabbro, amphibolite .....  
..... **8220 Siliceous rocky slopes**
- 11 Scree with more than 30° incline in the upper part and a talus cone of at least 20 m. More than  
70 % of the surface consists of boulders, rocks, gravel or annual vegetation. .... **12**
- 11 Smaller scree. .... **9999 Non-Annex 1 habitat**
- 12 Scree consisting of siliceous, minimally weathered rock types (granite, gneiss, slate, gabbro,  
amfibolite). .... **8110 Siliceous screes**
- 12 Scree consisting of cambro-silurian rock types, limestone, phyllite and other calcareous shale  
types (and serpentinite). .... **8120 Calcareous screes<sup>1</sup>**

<sup>1</sup>Screes below the coniferous tree line are not normally defined as Annex 1 habitat types. However, within this inventory all rocky slopes and screes are included regardless of bio-geographic region.

## Classification key for habitats in wetlands

This key includes all habitat types below the coniferous tree line where peat is forming. In some habitat types peat is only formed in patches, and the depth of the peat may therefore be less than 30 cm. Some of these habitats will be found in the classification keys for grasslands and forests.

The smallest required unit for wetlands is 0.1 hectares. Springs are regarded as point objects and are inventoried regardless of size.

The Annex 1 habitat type *aapamire* consists of large mire complexes which are hydrologically connected. In order to be classified as an aapamire, the entire mire complex should cover an area of at least 10 ha. A fen with hummock-strings and flarks or another type of transitional mire should also be present within the complex. Wooded mires are often found on the outer parts. Aapamires are common in the northern part of Sweden, in the boreal and alpine regions, and scarce south of the river Dalälven. The map or an aerial- or satellite photo is used to determine if the area is part of a large complex. If the area belongs to an aapamire complex, the sub-code for aapamire habitat type is used when classifying the habitat. If a fen with hummock-strings and flarks (or other transitional mire type) is not located within a large mire complex, it is classified as "7143 Transitional mire".

Rich soil indicator species (mosses and plants) are awarded points according to the provided table; the total score determines if the habitat should be classified as a rich or poor habitat type (list of rich soil indicator species in wetlands).

Note that many wetland habitat types besides "9740 Mire woodlands" may contain trees. For example, 2180 Coastal wooded sand dunes (if on peat), 7230 Alkaline fens, 7110 Active raised bogs, 7160 Spring and spring fens (sub-types 7161 and 7162), and within 7310 Aapamire (sub-types 7294, 7295, 7296, 7297, 7311 and 7318).

- |   |  |  |
|---|--|--|
| 1 | Moist or wet wetland in a coastal sand dune area (less than 5 km from the coast).....  | 2  |
| 1 | Wetland not in a coastal sand dune area.....   | 3  |
| 2 | Dune wetland with more than 10 % canopy cover of trees.....  | <b>2180 Coastal wooded sand dunes</b>  |
| 2 | Dune wetland with less than 10 % canopy cover .....  | <b>2190 Humid dune-slacks</b>  |
| 3 | Wetland with an abundance of <i>Cladium mariscus</i> , by lake shores, alkaline fens, or other types of moist land. Large, continuous communities of <i>Cladium mariscus</i> should be present. These fens are common on Gotland and Öland, and rare on the mainland. ....   | <b>7210 Calcareous fens with <i>Cladium mariscus</i> (and <i>Caricion davallianae</i>)</b> |
| 3 | No or sparse presence of <i>Cladium mariscus</i> .....   | 4  |
| 4 | The sample plot is located in a raised bog. A raised bog consists of a clearly domed bog, at least 1 meter high. The bog is delimited by a fen (lugg). Just inside the lugg, pines usually grow on the rand slope. The rand slope transforms into the bog plateau, which can be bare or contain low pines or birches. Hollows or pools are abundant on large bog plateaus. This Annex 1 habitat type refers to the entire complex: the bog plateau, rand slope and lugg. | <b>7110 Active raised bogs</b>   |
| 4 | Different .....  | 5  |

- 5 **Use the map/aerial photo:** Is the wetland included in a larger fen or bog area (at least 10 ha) with fens or transitional mires with hummock-strings or flarks in the central parts, i.e. aapamire complex? See above for a detailed description. Aapamires are common north of the river Dalälven, only sparsely found in the south ..... **Use option II in all cases below 6**
- 5 Not part of a larger fen or bog area (i.e. smaller than 10 ha) ... **Use option I in all cases below 6**
- 6 Spring ..... **7**
- 6 Not a spring ..... **8**
- 7a Spring with calcareous water and ongoing tufa formation. Tufa is present in or near the spring..  
..... **I) 7220 Petrifying springs with tufa formation**  
..... **II) 7311 Petrifying springs with tufa formation in aapamire**
- 7b A spring is present in a nearby rich fen. No tufa, but calcareous sinter may be present .....  
..... **I) 7234 Mineral-rich spring in alkaline fens**  
..... **II) 7297 Mineral-rich spring in alkaline fens in aapamire**
- 7c Other type of spring ..... **I) 7161 Spring**  
..... **II) 7294 Spring in aapamire**
- 8 Open or wooded fen where rich soil indicator species yield at least 3 points. Peat soil or continuous thin peat layer ..... **I) 7230 Alkaline fen**  
..... **II) 7296 Alkaline fen in aapamire**
- 8 Rich soil indicator species yield less than 3 points or are missing..... **9**
- 9 Open or wooded fen impacted by moving ground water, in contiguity to springs. Spring fens are often located in slopes. The vegetation is more species-rich than in surrounding fens with e.g. *Epilobium spp.*, *Chrysosplenium spp.*, *Scapania spp.* and *Philonotis spp.*..... **I) 7162 Spring fens**  
..... **II) 7295 Spring fens in aapamire**
- 9 No clear impact of moving ground water ..... **10**
- 10 Wooded mire, with trees higher than 3 m and canopy cover of at least 10 %. Common trees are *Betula pubescens*, *Picea abies* and *Pinus sylvestris*. Field- and bottom layers are dominated by dwarf-shrubs, *Carex*- and *Sphagnum* species. Signs of limited exploitation felling are allowed. ...  
..... **I) 9740 Mire woodlands**  
..... **II) 7318 Mire woodlands in aapamire**
- 10 Mire with no trees, or canopy cover less than 10 %..... **11**
- 11 Fen with hummock-strings and flarks, or transitional mire with alternating fen- and bog areas ..  
..... **I) 7143 Transitional mires**  
..... **II) 7310 Transitional mires in aapamire**
- 11 Open or sparsely wooded mires. Mire types included are flat or slightly raised bogs (< 1 m) as well as flat or sloping fens. The peat layer is normally at least 30 cm..... **I) 7140 Open mires**  
..... **II) 7298 Open mires in aapamire**

## Classification key for habitats in grasslands

This key is applicable to areas where the vegetation is clearly influenced by mowing or grazing, or open land affected by other types of management or natural disturbance that inhibit the overtaking of trees and shrubs. Only areas below the coniferous tree line are classified with this key. Areas above the tree line are classified with the key for habitats in the Alpine region.

Springs located within grassland habitats are regarded as point objects and are registered regardless of size.

Rich soil indicator species (mosses and plants) are awarded points according to the provided table; the total score determines if the habitat should be classified as a rich or poor habitat type (list of rich soil indicator species in grasslands).

- |   |  |  |
|---|--|--|
| 1 | Area with ongoing agriculture (field) where the ground is regularly plowed, used as a ley (for grazing or mowing) or is currently in fallow within a crop rotation system. <u>Or</u> , land heavily influenced by human management, with bare soil where ruderal plants are found (i.e. ruderal land)..... | <b>9999 Non-Annex 1 habitat</b>                                    |
| 1 | Other type of land use .....   | <b>2</b>   |
| 2 | Coastal area with vegetation influenced by salt- or brackish water .....   | <b>See key for habitats on coastal shores</b>                      |
| 2 | Different.....   | <b>3</b>   |
| 3 | Area dominated by bare bedrock, and/or land with a thin layer of gravelly, calcareous weathered soil. Often sparse, mosaic vegetation (may be abundant in crevasses). ....   | <b>4</b>   |
| 3 | Area with deeper soil layer and usually abundant vegetation. ....  | <b>8</b>   |
| 4 | Cliff or scree with at least 30° incline .....   | <b>See key for habitats on bare substrate</b>                      |
| 4 | Different.....   | <b>5</b>   |
| 5 | Calcareous dry meadow on bare bedrock or calcareous weathered soil (not till!). Rich soil indicator species on grasslands (mosses and plants) yield at least 3 points .....  | <b>6</b>   |
| 5 | Siliceous dry meadow on bedrock with a thin, patchy soil layer. The vegetation consists of drought-tolerant vascular plants, lichens and mosses. Bare bedrock (including lichen-covered rock surface) covers at least 50 % .....   | <b>8230 Dry meadows on siliceous bedrock</b>                       |
| 6 | Limestone flatrock. Bare bedrock (including lichen-covered rock face) covers less than 50 % of the surface. Open areas with vegetation on thin or non-existing weathered soil and in small depressions filled with water ("våtar"). (Found in the provinces of Öland, Gotland and Västra götaland).....    | <b>6280 Nordic Alvar</b>   |
| 6 | Bare bedrock (including lichen-covered rock surface) covers more than 50 %.....  | <b>7</b>   |
| 7 | Bare rock with thin, calcareous or basic soil and drought-tolerant vegetation, dominated by succulents ( <i>Sedum sp.</i> ), grasses and annual herbs, as well as mosses and lichens. Narrow fissures filled with soil may contain different vegetation and form ridges of grasses and herbs. ....         | <b>6110 Basophilic grassland communities on calcareous bedrock</b> |
| 7 | Calcareous rock surface with deep, widened fissures and loose flags, known as "shattered pavements". The rock surface is more or less devoid of soil, the vegetation is dominated by   |  |

	succulents ( <i>Sedum sp.</i> ), annuals, lichens and moss cushions. Shrubs, herbs and calciophilic ferns may be present at the bottom of wide crevasses .....	<b>8240 Limestone pavements</b>
8	Canopy cover of trees more than 10 %, or tree cover lower while cover of shrubs is at least 30 % (secondary succession on previously open areas are not to be included).....	<b>9</b>
8	Canopy cover of trees lower than 10 %.....	<b>13</b>
9	Area clearly influenced by fertilization or other soil management.....	<b>6913 Wooded cultivated pastures</b>
9	No or few signs of soil management .....	<b>10</b>
10	No signs of soil management or mowing. Canopy cover of shrubs more than 30 %, but canopy cover of trees is less than 10 %. Influenced by grazing .....	<b>6916 Shrub lands</b>
10	With continuous tree layer. Vegetation influenced by mowing or grazing. Managed trees or shrubs are common on meadows .....	<b>11</b>
11	Characterized by mowing. The area consists of a mosaic of managed trees (pollards), shrubs and open meadows. The habitat type has evolved from long-lasting gathering of leaf fodder and mowing, with or without subsequent grazing.....	<b>6530 Meadows with deciduous trees</b>
11	Characterized by grazing. No or few managed trees in the tree layer .....	<b>12</b>
12	Forest or pasture with old, often wide trees and with long tree continuity. Grazing is or has been occurring and species (or values) favored by management are present in the area. Pastures are dominated by deciduous trees, often oak, birch, linden, ash and pine. Forests are usually dominated by conifers, birch, oak or beech.....	<b>9070 Wooded pastures</b>
12	Forest with brief tree continuity (or extensive grazing). Species favored by grazing are few or missing. Canopy cover of trees is lower than 10 % and old, valuable trees are missing (if sufficient values associated with forest habitats are present, see classification key for habitats in forests) .....	<b>9999 Non-Annex 1 habitat</b>
13	Open, grazed grassland with sparse trees (more than 8 trees/ha). The trees are managed (pollards) or old with a wide crown (have been growing in favorable light conditions).....	<b>9070 Wooded pastures</b>
13	Different, or the ground bears evidence of earlier soil management or fertilization .....	<b>14</b>
14	Soil moisture moist – wet .....	<b>15</b>
14	Soil moisture dry – mesic.....	<b>25</b>
15	Spring.....	<b>16</b>
15	Not a spring.....	<b>18</b>
16	Spring with calcareous water and ongoing tufa formation. Tufa is present in or near the spring .....	<b>7220 Petrifying springs with tufa formation</b>
16	No tufa formation.....	<b>17</b>
17	No tufa, but calcareous sinter may be present.....	<b>7234 Mineral-rich spring in alkaline fens</b>
17	Other type of spring .....	<b>7161 Spring</b>
18	Rich soil indicator species in grasslands yield at least 3 points.....	<b>19</b>
18	Rich soil indicator species in grasslands yield less than 3 points or are missing.....	<b>21</b>

- 19 Gley-like and calcareous soil with a thick, peat-like sward. The vegetation consists mainly of low herbs and grasses..... **6411 Wet calcareous grasslands**
- 19 Peat land. The peat may be thinner than 30 cm and occur in patches, usually consisting of “brown” (calciophilic) mosses, occasionally *Sphagnum*..... **20**
- 20 Calcareous fen, lake area or other moist soil with an abundance of *Cladium mariscus*. Found mainly on shores by calcareous water, on heavily managed wet meadows and in spring-influenced fens..... **7210 Calcareous fens with *Cladium mariscus* and (*Caricion davallinae*)**
- 20 Alkaline fen with rich soil indicator species (mosses and plants). Sometimes with calcareous sinter..... **7230 Alkaline fens**
- 21 Open, moist heath with dwarf shrubs, dominated by e.g. *Erica tetralix*. Peat depth less than 30 cm. Characterized by long continuity of grazing, often in conjunction with repeated burning, but can also be found on the verge of mires, lakes and rivers. .... **4010 Wet heaths**
- 21 Different..... **22**
- 22 Grassland along a large river, flooded during spring and summer. Vegetation dominated by high *Carex*-species, e.g. *Carex aquatilis/acuta*, *Calamagrostis canescens/purpurea* or *Equisetum fluviatile*. The area is or has been used as a mowing meadow (in Swedish “raning”).  
..... **6450 Alluvial meadows**
- 22 Different..... **23**
- 23 Tall herb community along a lake or river where disturbance such as management, flooding or braking up of ice inhibits tree growth. Meadows with *Deschampsia cespitosa* that are becoming overtaken with *Filipendula ulmaria* are not included, nor are verges with only more commonly found species favored by nitrogen..... **6430 Tall herb communities**
- 23 Different..... **24**
- 24 Wet heaths with *Molinia caerulea*, *Juncus*- or *Carex*-species on acidic, often peat-rich soil. Or neutral-basic soil with reasonably species-rich vegetation. Developed by heavy management and is reliant on continued mowing. Canopy cover of trees and shrubs (not in the process of overtaking an open area) is less than 10 %..... **6412 Wet grasslands**
- 24 Tall or grazed grassland dominated by *Deschampsia cespitosa*. ....  
..... **6915 Meadows with *Deschampsia cespitosa***
- 25 Thin soil layer on sand. Inland sand dune or dune field. .... **26**
- 25 Other soil type..... **28**
- 26 Calcareous area with low vegetation in a sporadic layer of vegetation. The character species *Koeleria glauca* should be present, along with other rich soil indicator species. Found in small areas in the provinces of Skåne and Öland. .... **6120 Sand steppes**
- 26 Rich soil indicator species in grasslands yield less than 3 points ..... **27**
- 27 Sand dune or sand field with species-poor vegetation consisting of herbs, *Corynephorus canescens*, *Agrostis capillaris* and usually many annuals. Shrubs may be present, but are not abundant. Dwarf shrubs cover less than 10 %. Bare sand covers usually more than 10 %.....  
..... **2330 Inland grass dominated sand dunes**
- 27 Inland sand dune or sand field dominated by open heath vegetation consisting of *Calluna vulgaris* and *Empetrum nigrum*. Dwarf shrubs cover at least 10 %. Bare sand is present .....  
..... **2320 Inland dry sand heaths with dwarf shrubs**

28	Mowing is ongoing, or clear signs of earlier mowing.....	29
28	The area is grazed or kept open by other means of disturbance .....	31
29	The area is clearly influenced by fertilization or other soil management. Species favored by management are missing.....	<b>6912 Open cultivated hay meadows</b>
29	No or few signs of soil management .....	30
30	The area is located in the region of Götaland, or below the high coast line in Norrland or Svealand.....	<b>6510 Low-land hay meadows</b>
30	The area is located above the high coast line in Norrland or Svealand.....	<b>6520 Mountain hay meadows</b>
31	The area is clearly influenced by fertilization or other soil management. Species favored by management are missing.....	<b>6911 Open cultivated pastures</b>
31	No or few signs of soil management .....	32
32	Rich soil indicator species in grasslands (mosses and plants) yield at least 3 points .....	33
32	Rich soil indicator species yield less than 3 points or are missing .....	35
33	Abundance of orchids (five or more species), or at least one species from the national red list (see list of species in the habitat description) .....	<b>6211 Calcareous grasslands with orchids</b>
33	Fewer than five orchid species and none from the national red list.....	34
34	Nutrient-poor calcareous grassland (or heath) with an abundance of old junipers influenced by grazing. Canopy cover of junipers at least 5 %.....	<b>5132 Juniperus communis-formations on calcareous grasslands</b>
34	Calcareous grassland with an abundance of herbs. Canopy cover of junipers influenced by grazing less than 5 %.....	<b>6210 Kalkgräsmark</b>
35	Grazed grassland dominated by <i>Nardus stricta</i> on dry-mesic siliceous soil. Developed during a long continuity of management, but can be in the process of being overtaken by shrubs and trees. Low heath or grass vegetation (less than 40 % dwarf shrubs).....	<b>6230 Grasslands with <i>Nardus stricta</i></b>
35	Not dominated by <i>Nardus stricta</i> .....	36
36	Species-rich grassland where the vegetation is dominated by grasses and herbs. Dwarf shrubs cover less than 40 %. Developed during a long continuity of grazing or earlier mowing. Species favored by management are present.....	<b>6270 Siliceous grasslands</b>
36	Heath with dwarf shrubs and grass where the field layer is dominated by dwarf shrubs or narrow-leaved grasses or <i>Carex</i> species.....	37
37	Heath with dwarf shrubs and grass. Canopy cover of junipers <u>influenced by grazing</u> is less than 5 % .....	<b>4030 European dry heaths</b>
37	Nutrient-poor heaths with a significant amount of old junipers influenced by grazing. Canopy cover of junipers is at least 5 %.....	<b>5131 Juniperus communis-formations on heaths below tree line</b>

## Classification key for habitats in forests

The smallest required unit for forest habitats is 0.25 ha. Note that other wooded habitats may have smaller mapping units. For instance, the smallest required unit for wooded pastures, meadows with deciduous trees and wooded mires is 0.1 ha. Springs are regarded as point objects and are inventoried regardless of size.

Normally, the area should fulfill the criteria for FAO forest (more than 10 % canopy cover).

1	Canopy cover less than 10 % .....	<b>2</b>
1	Canopy cover at least 10 % .....	<b>3</b>
2a	The area has recently been disturbed by fire, flood or storm. Wind-felled trees, trees with fire damage or other dead wood generated by the disturbance are present (at least 10m <sup>3</sup> /ha). .....	<b>9009 Western taiga with natural disturbance</b>
2b	Large forest area with sparsely distributed trees, or clearing larger than 0.1 ha.....	<b>Not a forest habitat. Return to the main classification key.</b>
2c	Clearing smaller than 0.1 ha, or small forest area with sparsely distributed trees within an otherwise dense stand. Continue classification in a representative nearby area. ....	<b>3</b>
3	Forest in the sub-alpine region, dominated by birch (at least 50 % basal area).....	<b>9040 Nordic subalpine birch forest</b>
3	Different.....	<b>4</b>
4	Stand influenced by management. With present-day or historic signs of mowing, grazing, gathering of leaf fodder (pollards) or cultivation.....	<b>5</b>
4	No clear signs of management.....	<b>9</b>
5	The ground vegetation bear signs of present-day or historic mowing. There may be a significant amount of trees influenced by mangement (pollards).....	<b>6530 Meadows with deciduous trees</b>
5	No signs of mowing. ....	<b>6</b>
6	Forest sprouted or planted on previous natural pasture or cultivated land (old field). No old, wide or managed trees (pollards). No significant tree continuity. No species favored by mowing or grazing are present in the ground vegetation. ....	<b>9999 Non-Annex 1 habitat</b>
6	Clear signs of grazing .....	<b>7</b>
7	The area has been grazed for a long time and the species composition in the field layer is typical for open pastures and meadows.....	<b>8</b>
7	Forest with extensive grazing, or area where grazing has just begun. The vegetation shows only minor signs of grazing and the species composition in the field layer is identical to that in un-grazed forest. Continue with forest types with no signs of management (grazing is recorded in the hand-held computer). ....	<b>9</b>
8	Canopy cover for trees not in the process of overtaking open areas is at least 10 % and these trees fulfill the age criterion for Annex 1 habitats. There is a significant amount of sward with species favored by grazing. ....	<b>9070 Wooded pastures</b>
8	Canopy cover for trees not in the process of overtaking open areas is less than 10 %, <u>or</u> the trees do not fulfill the age criterion .....	<b>See the classification key for habitats in grasslands</b>

9	Naturally formed forest on land upheaval coast. The area is in contact with the shore and does not rise more than 3 m above sea level. The forest includes both the deciduous trees closest to the shore and the coniferous forest on higher ground. ....	
	..... <b>9030 Primary successional forest on land upheaval coast</b>	
9	Not on land upheaval coast .....	<b>10</b>
10	Forest on sand field or sand dune .....	<b>11</b>
10	Not on sand .....	<b>12</b>
11	Forest on coastal sand dune (within 5 km from the coast), often in conjunction with sand dune habitats .....	<b>2180 Coastal wooded sand dunes</b>
11	Forest on inland sand dune, or on glaciofluvial flat sand field in coastal or inland area .....	<b>9915 Wooded inland dunes</b>
12	Deciduous forest by a river (annually flooded with sediment deposition, but otherwise not wet). Deciduous trees dominate at least the highest tree layer (at least 50 % basal area) .....	<b>13</b>
12	Other deciduous forest, or coniferous forest .....	<b>14</b>
13	Dominated by softwood deciduous trees and ash (basal area softwood + ash at least 50 %). Common species are <i>Alnus incana</i> , <i>A. glutinosa</i> and <i>Fraxinus excelsior</i> . ...	<b>9750 Alluvial forests</b>
13	Significant amount of broad-leaved hardwood trees. Oak, elm and ash constitute at least 30 % of the basal area. Aspen, birch, alder and pine may be present.....	<b>9760 Alluvial broad-leaved hardwood dominated forests</b>
14	Deciduous forest (deciduous trees constitute at least 50 % of the basal area) where broad-leaved hardwoods constitute at least 30 % of the basal area (at least in the top layer) .....	<b>15</b>
14	Softwood deciduous forest and coniferous forest.....	<b>21</b>
15	Broad-leaved hardwood forest in ravine, rocky slope or scree with boulders. The incline should be least 30° (corresponds to NFI: ground slope class 11). The slope or scree should be at least 5 m high, with a horizontal expanse of at least 20 m.....	<b>9180 Broad-leaved hardwood forest in slopes, screes and ravines</b>
15	Different. Ravine or slope with slighter incline or narrower. ....	<b>16</b>
16	Beech ( <i>Fagus sylvatica</i> ) constitutes at least 50 % of the basal area .....	<b>17</b>
16	Beech is not dominant.....	<b>18</b>
17	Flora with high nutrient demand. The flora is classified by the ground vegetation type (forest classification unit based on field and ground layer vegetation). All herb types and "with no field layer but inundated" are included [NFI: 01-07] [NILS: 03-09]. If the field layer is missing and the area is not inundated, the flora is classified using what sparse vegetation there is.....	<b>9130 Herb-rich beech forests</b>
17	On more acidic soil, no flora with high nutrient demand [NFI: lichen types + 08-16], [NILS: 01-02 + 10-16]. .....	<b>9110 Poor beech forest</b>
18	<i>Quercus robur</i> and/or <i>Carpinus betulus</i> constitute more than 50 % of the basal area in the oldest tree layer .....	<b>19</b>
18	<i>Q. robur</i> and/or <i>C. betulus</i> are not dominant .....	<b>20</b>

19	On acidic soil, no flora with high nutrient demand [NFI: lichen types + 08-16], [NILS: 01-02 + 10-16].....	<b>9190 Poor oak forests</b>
19	On nutrient-rich soil, flora with high nutrient demand is present, all herb types and ground without field layer [RIS: 01-07], [NILS: 03-09]. .....	<b>9160 Herb-rich oak forests</b>
20	Wet or moist soil influenced by high ground water level. Normally flooded on a yearly basis, leading to development of hummocks around the base of the trees. May occasionally be completely dry.....	<b>9080 Deciduous swamp forests</b>
20	Other broad-leaved hardwood forest on dry-mesic soil. During occasional inundation or moving ground water, the soil may become moist.....	<b>9020 Nordic broad-leaved hardwood forests</b>
21	Naturally generated young stand, as a result of natural disturbance (e.g. storm, fire or flood) .....	<b>9009 Western taiga with natural disturbances</b>
21	Older, or no natural disturbance.....	<b>22</b>
22	Forest on peat, or on moist-wet soil, periodically influenced by high ground water level .....	<b>23</b>
22	Forest on dry-mesic soil, or moist soil influenced by moving ground water .....	<b>25</b>
23	Forest on peat or a thin, continuous peat layer of either <i>Sphagnum</i> or “brown” (caciophilic) mosses: both productive and slow-growing forest is included. Peat thinner than 30 cm is allowed only for “brown” mosses. ....	<b>See classification key for habitats in wetlands</b>
23	Not on peat. Small patches of peat may be present. ....	<b>24</b>
24	Softwood deciduous trees and ash constitute more than 50 % of the basal area .....	<b>9080 Deciduous swamp forests</b>
24	Mixed or coniferous forest .....	<b>9007 Western taiga, coniferous swamp forests</b>
25	Softwood deciduous trees and ash constitute more than 50 % of the basal area. ....	<b>9010 Western taiga</b>
25	Mixed or coniferous forest (deciduous trees constitute less than 50 % of the basal area) .....	<b>26</b>
26	Forest on top of, or on the slope of a glaciofluvial esker. ....	<b>9060 Coniferous forest on glaciofluvial eskers</b>
26	Not on a glaciofluvial esker .....	<b>27</b>
27	Spruce ( <i>Picea abies</i> ) constitutes more than 50 % of the basal area. Nutrient-rich, often on basic soil. Tall or low herb types, flora with high nutrient demand. The ground vegetation types [NFI: 01-07] [NILS: 03-09] are allowed. In northern Sweden also “broad-leaved grass” [NFI: 08], [NILS: 11].....	<b>9050 Herb-rich <i>Picea abies</i> dominated forest</b>
27	Spruce forest on poor soil and other pine-dominated or mixed conifer forest on both poor and rich soil types. In forest dominated by spruce, the ground vegetation types [RIS: lichen type + 09-16], [NILS: 01-02 + 10 + 12-16] are allowed, in southern Sweden also “broad-leaved grass” [RIS: 08], [NILS: 11].....	<b>9010 Western taiga</b>

## **Habitat descriptions with maps\***

The information in the habitat descriptions is obtained from the “Swedish interpretation of the EU’s definition of habitat types within the Natura 2000 network”. Great care has been taken to use the same criteria for habitat classification as those used by the Base inventory performed by the County Administrative Boards and its follow-up projects regarding protected areas. However, the descriptions are adjusted to suit the sample plot sizes used by NILS and the Swedish NFI.

Maps of distribution used in this manual should only be regarded as guidelines. They are mainly obtained from the report on Article 17 from 2013. Maps for habitats that are not listed in the appendix of the Habitats Directive (i.e. 6911-6916 cultivated grasslands, and 9915 wooded inland dunes) have been created by us for this manual, using information from NILS, the National survey of meadows and pastures, the Swedish NFI and MOTH 2008-2013. The distributions of wetland habitat types included in an aapamire complex are indicated by a raster.

\*NOTE: Not part of this English version of the “Instruction for Inventory of Habitats in NILS and MOTH, 2014”