

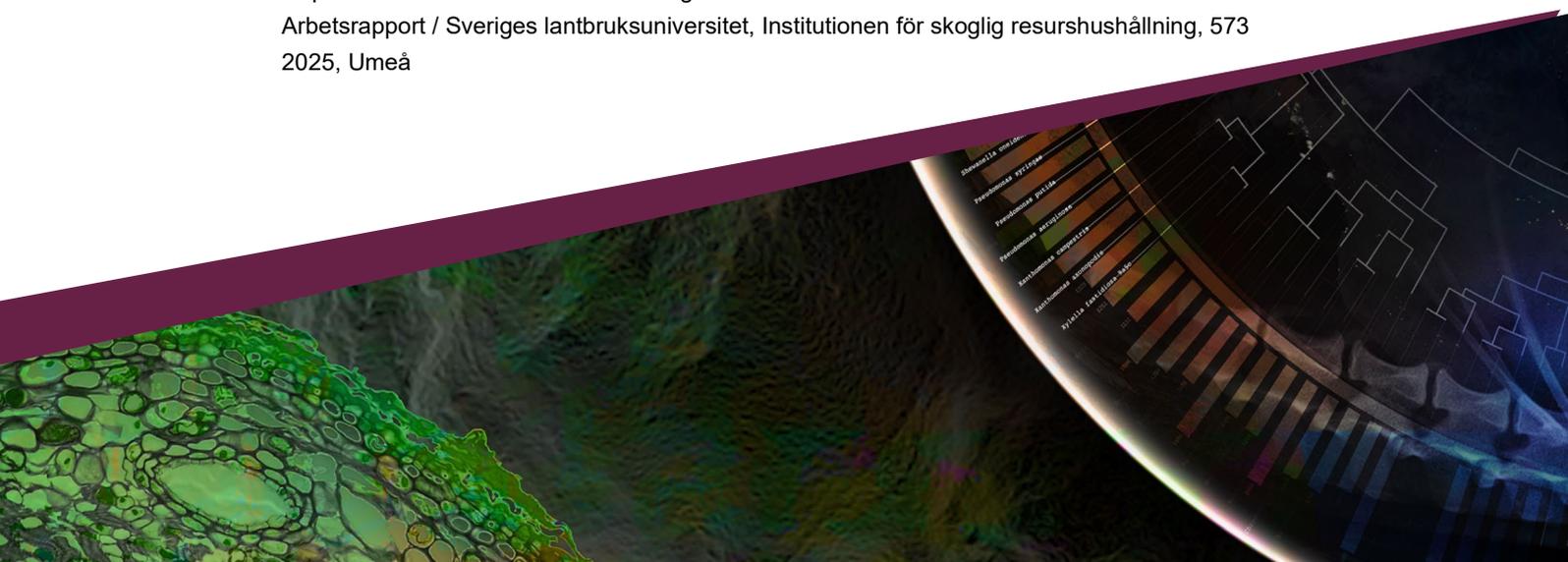


# Field Manual for the National Inventories of Grasslands and Deciduous Forests NILS, 2024

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2025, Umeå





## Field Manual for the National Inventories of Grasslands and Deciduous Forests, NILS, 2024

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## **Abstract**

This field manual presents the methods, definitions, and survey procedures used in the National Inventories of Landscapes in Sweden (NILS) for the Grassland and Deciduous Forest Inventories. These inventories were developed by the Swedish University of Agricultural Sciences (SLU) on behalf of the Swedish Environmental Protection Agency, primarily to support Sweden's reporting obligations under Article 17 of the EU Habitats Directive.

The manual describes the standardized approach used to collect data on grasslands and mature deciduous forests that are underrepresented in other national monitoring programs. The inventories aim to provide reliable information on these habitat types, including associated species and quality variables, to enable detection of changes in both area and quality over time.

Detailed instructions are provided for all parts of the field workflow, including navigation and sample plot establishment, delineation and subdivision of land types, habitat type definitions, and minimum mapping units. The manual further outlines the protocols for data collection in sample plots, sub-sample plots, and small sample plots, together with workflows for digital registration, data submission, and self-validation.

This document is an English translation of the original Swedish field manual (Hedenås et al. 2024) and is intended to support its use and understanding in international contexts, thereby facilitating transparency and the sharing of methodology.

*Keywords: Agricultural landscape, Annex I-habitats, Article 17-reporting, Broad-leaved forests, Deciduous Forest Inventory, Environmental monitoring, Environmental Objectives, Grassland Inventory, Habitats directive, Meadows, National Inventories of Landscapes in Sweden (NILS), Pastures, Quality indicators, Sampling design*

## Preface

Sweden has an obligation to report the area, distribution, and conservation status of Annex I-habitat types under Article 17 of the EU Habitats Directive. On behalf of the Swedish Environmental Protection Agency (Naturvårdsverket), the NILS and THUF programs have further developed a statistical design aimed at providing an efficient and effective survey method for collecting data on Annex I-habitats to support accurate Article 17 reporting. The focus of these surveys is on habitat types that are underrepresented in other national monitoring programs. The assignment includes ensuring that changes in both area and quality can be detected for the habitat types, or aggregations thereof, that each survey targets. The collected data are used for reporting on the status of Annex I-habitats under the EU Habitats Directive, which occurs every six years. The data also contribute to the evaluation of Sweden's national environmental quality objectives.

The monitoring programme National Inventories of Landscapes in Sweden (NILS) currently serves as a general framework under which several national environmental monitoring programs are coordinated. These include the NILS Alpine inventory, NILS Grassland inventory, NILS Deciduous Forest inventory, and the THUF Sea-Shore inventory. The primary funding agency for NILS is the Swedish Environmental Protection Agency.

This field manual covers:

- **The NILS Grassland Inventory**, initiated in 2020. This is a national inventory of all grassland types, with particular emphasis on those of high conservation value as designated under Annex I of the EU Habitats Directive.
- **The NILS Deciduous Forest Inventory**, also initiated in 2020. This is a national inventory of mature deciduous forests, designed to complement data from the Swedish National Forest Inventory. The focus is on broad-leaves forests, riparian forests, swamp forests, and mature deciduous forests in the western taiga, habitat types that are included in Annex I of the EU Habitats Directive.

This document is an English translation of the original Swedish field manual (Sjödín et al. 2024). The translated version is intended to facilitate use in international contexts.

Umeå, 19 November 2025

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# 1. Introduction

## Structure of the Manual

The manual begins with a general description of NILS – National Inventories of Landscapes in Sweden – inventories of grasslands and deciduous forests, as well as the inventory design. This is followed by a chapter outlining the main components of the field survey. The workflow in the field is described in overview, with references to chapters that provide more detailed guidance for each step. The habitat types targeted in the inventories, along with the minimum mapping units applied, are described in Chapter 5. Chapter 6 addresses delineation and subdivision between different land types. The variables included in the inventories are presented in individual chapters for each data collection application (Chapters 7–9). Species lists for those taxa noted during the inventories are provided in Appendices 1 and 2. Further, chapter 10 addresses how to report errors, provide supplementary information useful for the resurvey, and how to confirm the completion of sample plots in the survey system.

### 1.1 Purpose

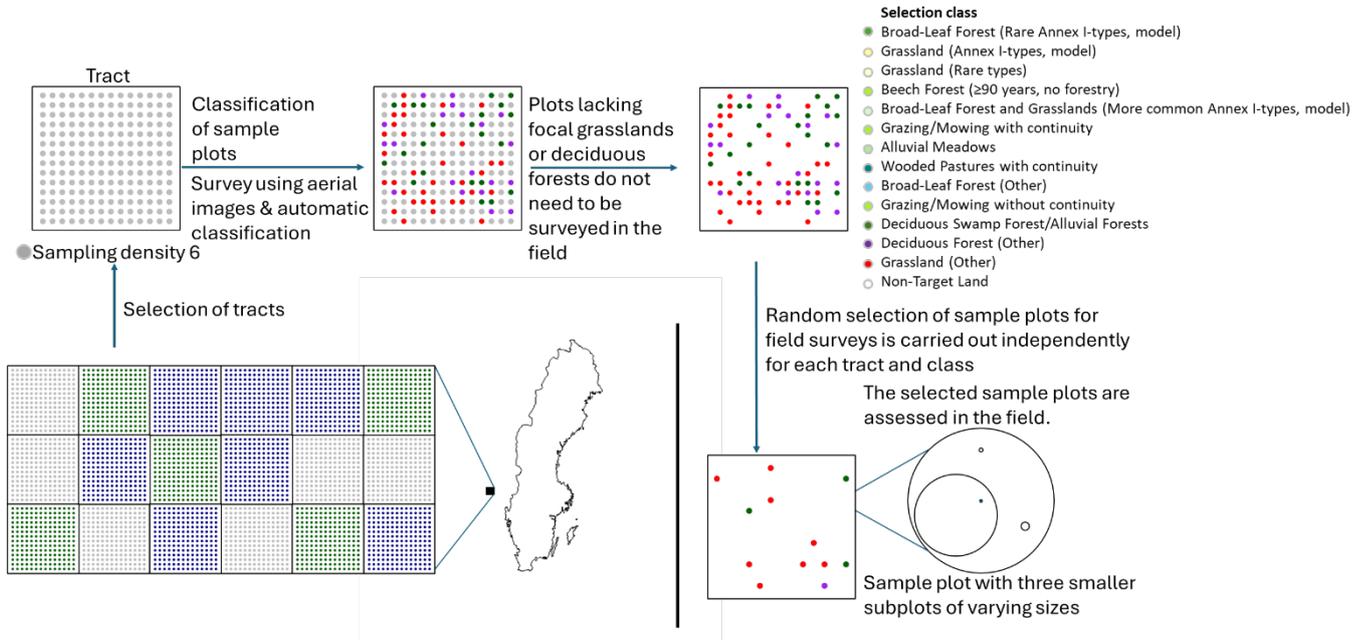
Sweden is obligated to report the area, distribution, and status of Annex I-habitat types under Article 17 of the EU Habitats Directive. For several of these habitat types, data from the National Forest Inventory and previous National Inventory of Landscapes in Sweden (NILS) have proven insufficient as a basis for this reporting. A national inventory of grasslands has been lacking, and the data for broad-leaved and mature deciduous forests need to be strengthened to complement the National Forest Inventory. NILS and THUF have jointly further developed a statistical design to support an efficient inventory capable of delivering high-quality data on Annex I-habitats for adequate Article 17 reporting, while also providing general information on grasslands and deciduous forests across Sweden.

The field inventory aims to provide information on the location, extent, and conservation status of grasslands and deciduous forests. A key component of the survey is the collection of data on species associated with these habitat types in grasslands and deciduous forests.

### 1.2 Inventory Design

The sampling design and the aerial photo and field survey methodologies used in the grassland and deciduous forest inventories are described, in Swedish, in Adler et al. (2020), Allard et al. (2021), and Ranlund et al. (2021). The inventories follow a two-phase sampling design, where the field plots to be visited are selected through several steps (Figure 1.1). First, a sample of tracts is drawn from the sampling frame using balanced sampling. In each selected tract, all sample plots are classified through aerial photo interpretation and automated classification by models. Selection classes are thereafter derived from these initial classifications and used for random selection of field plots. Tracts and plots that can be confidently excluded from containing the targeted habitat types, based on the aerial photo interpretation, are not visited in the field. This enables the fieldwork to be focused on the plots most relevant to the inventory.

Both the aerial photo interpretation and field inventories are carried out jointly for the grassland and deciduous forest inventories. This allows the aerial photo interpreters to classify each plot only once and enables field assessors to visit both grassland and deciduous forest plots within the same tract in a single field visit.



**Figure 1.1.** A schematic illustration of how sample plots within a tract are classified using aerial photo interpretation and automated classification, and how they are selected for field visits within the grassland and deciduous forest inventories, based on the sparsest sampling design (Sampling stratum 6, represented by the grey colour in panel A).

To allow geographic adaptation of the inventories according to the landscape-level prevalence of the targeted habitat types, Sweden is divided into four regions: the Alpine region, the Northern Boreal region, the Southern Boreal region, and the Continental region. These regions correspond to the zones used in Biogeographical Monitoring, with the exception that the Boreal region is split into northern and southern subregions.

Each tract consists of 196 sample plots (arranged in a 14 × 14 grid), which together cover a 1 km × 1 km square.

a) Sampling of tracts is first conducted randomly from the sampling frame using balanced sampling.

b) Each sample plot within the selected tracts is then subject to aerial photo interpretation and automated classification based on overlaying various thematic map layers: the Natura Habitat Map (Swedish Environmental Protection Agency 2023), the TUVa database (Swedish Board of Agriculture 2024), maps of broad-leaved forests (Adler et al. 2020), and maps of steep slopes (unpublished). Based on these layers, plots are assigned to various grassland or deciduous forest classes. c) Plots that do not contain grasslands or deciduous forests are excluded from the field survey.

d) The classification of sample plots based on aerial photo interpretation and automated classification are combined to form selection classes. e) From the plots that, according to either method, potentially contain grassland or deciduous forest, a random selection is made for field visits, independently for each tract and class. f) Finally, the selected plots are assessed in the field. The sampling densities illustrated with different colours in panel A are schematic representations; in reality, the samples are less dense. (Figure modified from Ranlund et al. 2021).

## 2. Survey procedures

### 2.1 Field Workflow – An Overview

Fieldwork consists of several steps that can be illustrated in a flowchart according to the order in which they are carried out (Figure 2.1). In addition to the actual survey and data collection, the workflow includes navigation to the sample plot, establishment of the plot center and sub-sample plots, subdivision of the plot, determination of survey method and survey type, as well as self-check of submitted data.

#### 2.1.1 Navigation and Plot Center Positioning

Navigation and orientation in the field are fundamental components of the fieldwork. For this inventory, smartphone GPS is used to navigate to the selected tract and to the center point of the sample plot. Using the ArcGIS Field Maps app, directions to the tract can be accessed via Google Maps. Field Maps is also used for navigating to the sample plot, while precise positioning of the plot center is carried out using the Avenza Maps app. A georeferenced infrared orthophoto serves as the reference map in Avenza, allowing the field assessor to accurately position the plot center using the GPS point in relation to visible landscape features. Navigation and positioning of plot centers are described in Chapter 3.

#### 2.1.2 Establishing Small Sample plots (SSP)

Three small sample plots are established within each sample plot at predetermined positions relative to the plot center. In the sub-sample plots, species and other field layer variables are noted. Whether a sub-sample plot should be established and surveyed depends on the survey type of the plot or the specific sub-sample plot where the sub-sample plot is located. Therefore, the three small sample plots are only established after any subdivision and once the survey method and type have been determined. A small sample plot to be surveyed is placed at the correct distance and bearing from the center point using a logger's tape and a sighting compass. Details about small sample plot placement are provided in Section 3.2.

#### 2.1.3 Survey Method and Survey Type

Immediately after navigating to and positioning the plot center, the survey method and survey type are determined.

##### *Survey Method*

A sample plot can be surveyed in two ways depending on the field assessor's ability to access the site: either as a field survey or a distance survey. The method is selected using the decision key provided in Chapter 4. At this stage, it is also determined whether the plot should be subdivided or not.

### *Survey Type*

After any subdivision, the survey type is determined for the entire plot or for each sub-sample plot individually. The survey type is defined based on whether the area consists of a targeted habitat type or not (see definitions in Chapter 5). The survey type determines which variables are to be noted for each sub-sample plot. There are three survey types: detailed survey, minimal survey, and distance survey. The different types are described in Section 4.2.

#### 2.1.4 Sample Plot Sectioning

If a plot includes several habitat types or management regimes, and at least one of these represents a targeted habitat type, the plot must be divided. Sectioning is carried out according to the criteria and guidelines in Chapters 5 and 6. The field assessor uses the sectioning form and the Sectioning App to draw and calculate the area of each sub-sample plot. For sub-sample plots, all relevant variables are noted separately.

#### 2.1.5 Survey of Plots, Sub-sample plots, or Species

Once the plot center and sub-sample plots have been established and any necessary subdivision has been completed, the actual survey begins. In the Field Maps app, the field assessor selects the plot to be surveyed. From Field Maps, there are links to three data collection apps: the Sample Plot App (Pro-app in Swedish), the Sub-Sample Plot App (Delyte-app), and the Species App (Art-app). Field team members divide tasks among themselves; make sure everyone agrees on who is responsible for what before proceeding.

#### 2.1.6 Photography and Coordinates

Each sample plot is documented with photographs. The number of photos taken depends on the survey method and type, as well as the number of sub-sample plots surveyed. Photos of both the main plot and the sub-sample plots are taken in the **Sample Plot App**. For distance surveys, one overview photo is taken. For field surveys, five photos document the plot and center, and three photos are taken for each surveyed sub-sample plot. Evaluation polygons are also photographed. Instructions on photo angles and distances are provided in Section 7.4.

Coordinates are noted for each surveyed plot. For field surveys, coordinates are measured at the plot center; for distance surveys, distance-based coordinates are noted. Coordinates are collected in the **Sample Plot App** with instructions found in Section 7.5.

#### 2.1.7 Plot Registration (Sample Plot App)

Workflow and variables noted in the **Sample Plot App** are described in Chapter 7.

#### 2.1.8 Survey of Sub-sample plots (Sub-Sample Plot App)

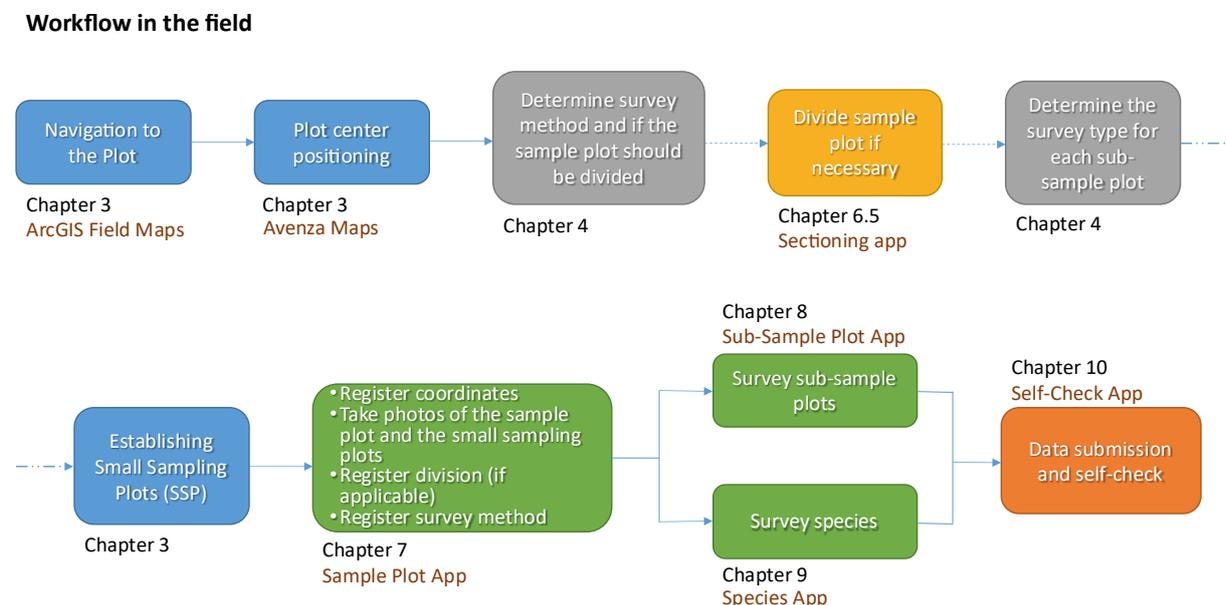
Workflow and variables noted in the **Sub-Sample Plot App** are described in Chapter 8.

#### 2.1.9 Species Survey (Species App)

Workflow and variables noted in the **Species app** are described in Chapter 9.

## 2.1.10 Data Submission and Self-Check (Status Portal)

See Chapter 10.



**Figure 2.1.** Workflow in the field, with references to the corresponding chapters in the field manual, as well as which data collection or support app is used. Which steps are carried out in each data collection app (Sample Plot, Sub-sample Plot, or Species App) depends on the survey method and survey type. See Chapter 4 and the workflow overview at the beginning of Chapters 7–9.

## 2.2 Assessment Areas

The survey steps are conducted within assessment areas of different sizes depending on the variable being noted (see Table 8.1.1). Variables are measured or estimated either at the plot/sub-sample plot level (circular area with a 10 m radius) or within the three small sample plots. However, for many variables, the field assessor must extend beyond the 10 m radius into the so-called assessment polygon (Appendix 7).

The assessment polygon should correspond to 0.1 ha (100 m<sup>2</sup> up to 0.1 ha for dry rocky grasslands, such as Siliceous rock with pioneer vegetation (8230), and base-rich rock outcrops) of the assessed habitat type that is closest to and includes the sample plot. If the plot is not divided, this corresponds to a circular radius of 17.8 m from the plot center. In the case of elongated habitat patches, the assessment polygon may become relatively long in order to reach the minimum mapping unit.

Tables 8.1.1 and 9.1.1 specify which survey steps are carried out within each type of assessment area.

## 2.3 Technical Instructions

Field phones are used during the survey, equipped with several applications for navigation, data collection, and support functions (Table 2.3.1). For more detailed technical guidance, please refer to the separate technical instructions document.

**Table 2.3.1.** Overview of the applications used during the field survey.

App	App Type	Description
Survey123: 1. Sample Plot App 2. Sub-Sample Plot App 3. Species App	Data Collection	The primary data collection applications used during the survey. Implemented as three separate surveys within the Survey123 app on field devices. Different tasks are performed in each app.
Status Portal	Data Verification	Web-based application for checklist management, reporting, and self-checking of submitted data.
Sectioning App	Support App	Used during sample plot sectioning. The app helps visualizing the plot sections, numbering them in correct order and calculates their individual areas.
ArcGIS Field Maps	Navigation	Used for navigating to the tract and plot. Directions can be opened in Google Maps through Field Maps.
Avenza Maps	Navigation	Used for positioning and marking the center point of the sample plot.
Min karta	Support/Navigation App	An app with maps by Lantmäteriet (Swedish mapping authority). Provides terrain maps, colour orthophotos, historical orthophotos (from ~1960 and ~1975), and hill-shade layers.

## 3. Navigation and Setting up of Sample Plots

### 3.1 Navigation and Positioning of Sample Plot Center

To locate the sample plots, the apps ArcGIS Field Maps and Avenza Maps are used in conjunction with the phone's GPS. First, determine which area to visit in the field, then select an appropriate sample plot within this area. Choose the tract and sample plot in Field Maps. Click on the sample plot and select "Directions" in the app. Google Maps will open and provide directions to the sample plot. If the sample plot is within walking distance, the "Compass" function can instead be used. This will display the distance to the sample plot, and the map will rotate according to the direction of travel.

Once the field assessor is close enough to the sample plot, Avenza Maps is used to measure the center of the plot as accurately as possible. In Avenza Maps coordinate-referenced infrared orthophotos as PDF files are used. The field assessor's position, according to the phone's GPS, will be shown as a blue dot on the map. Distinct objects in the map, such as rocks, shrubs, or solitary trees, are used to determine the position. Aim to position the center as precisely as possible on the orthophoto. The position of the center should never be adjusted subjectively, as this would introduce a significant risk of systematic errors. Once the center is positioned as accurately as possible, the sample plot center is marked with a center stake or rod. To start the survey, the field assessor returns to Field Maps and clicks on the link to the appropriate data collection app. The theoretical coordinates of the sample plot are transferred to the data collection apps and should not be altered afterwards.

**Note:** Remember to download background maps (e.g., in Google Maps, Field Maps, My Maps, etc.) for areas with poor coverage in advance. If an offline map for an area is downloaded in advance, the field assessor will have access to terrain maps, orthophotos, historical orthophotos, and terrain shading even without coverage.

### 3.2. Setting Up the Three Small Sample plots

The three small sample plots have different areas and are placed at predetermined positions relative to the center of the sample plot within the 10 m radius. Only the small sample plots located in a sub-sample plot that will be surveyed in detail are set up. The centre point of the three small sample plots are positioned in different directions and at varying distances from the sample plot center. Small sample plots of different areas are surveyed around the centre points, see Table 3.2.1 and Figure 3.1. Additionally, 1 m<sup>2</sup> areas are surveyed around the same centre points, see Table 3.2.2 and Figure 3.1. Normally, measuring tapes are used to measure the distance from the sample plots center to the middle of each small sample plot.

Note that if the sample plot is located on a slope, the Vertex and transponder are used to ensure that the three small sample plots are positioned at the correct distances from the sample plot center. The small sample plots are set up during detailed surveys.

The following applies:

- Never move the predetermined position of the small sample plots. No corrections should be made to distance or direction.

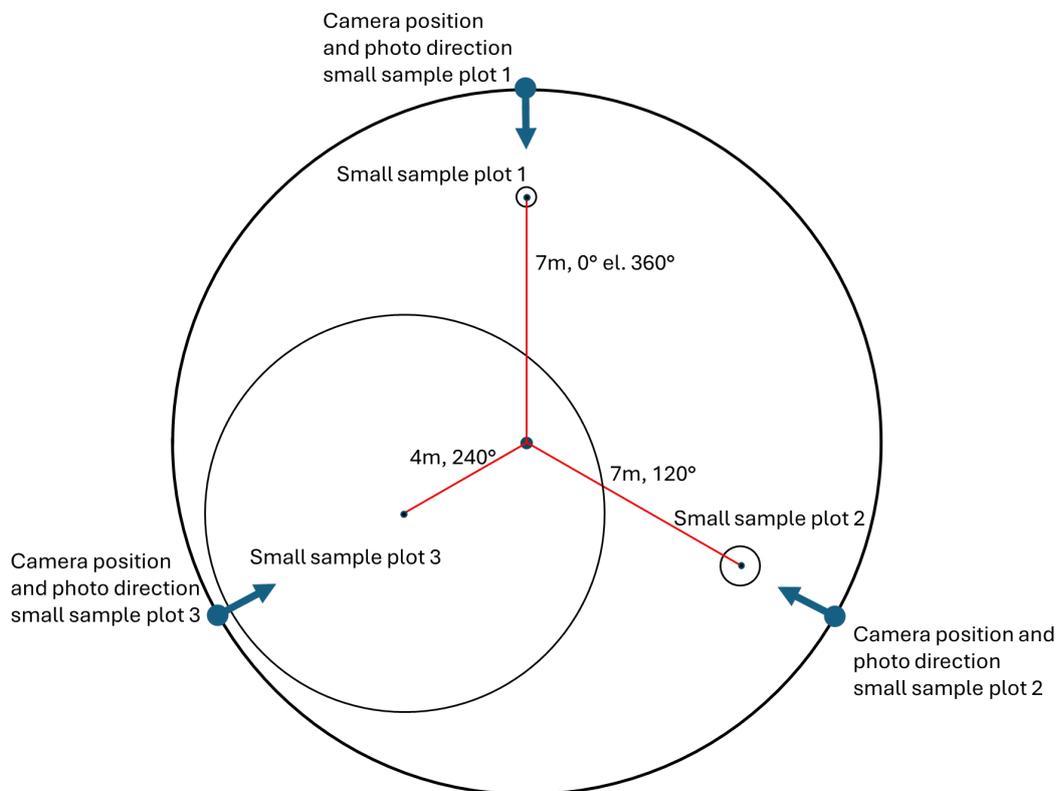
- The positioning should be measured very accurately to ensure consistency during future surveys. During subsequent re-inventories, the photographs of the small sample plots will be used to place them in the same location each time.

**Table 3.2.1** Placement of Small Sample plots

Small Sample plot	Radius [m]	Bearing from Plot Center [°]	Distance from Plot Center [m]	Area [m <sup>2</sup> ]
1	0.28	0° or 360°	7	0.25
2	0.56	120°	7	1
3	5.64	240°	4	100

**Table 3.2.2** Placement of 1 m<sup>2</sup> plots.

1 m <sup>2</sup> plot	Radius [m]	Bearing from Plot Center [°]	Distance from Plot Center [m]	Area [m <sup>2</sup> ]
1	0.56	0° or 360°	7	1
2	0.56	120°	7	1
3	0.56	240°	4	1



**Figure 3.1.** Shows the placement of the small sample plots within the sample plot, along with the photo point and photo direction for each small sample plot.

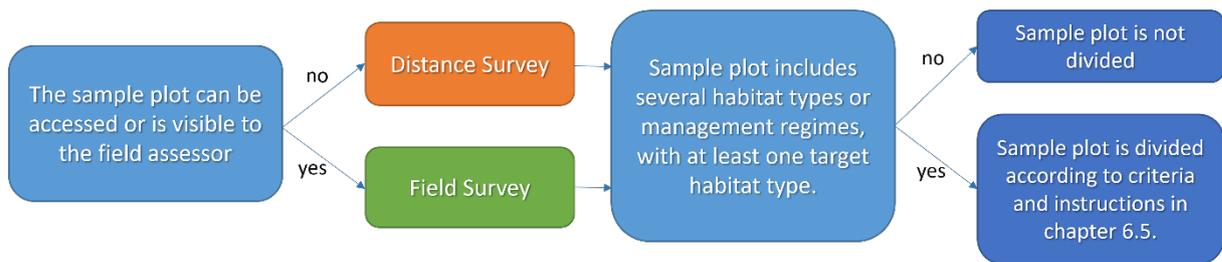
## 4. Survey Method and Survey Type

After navigating to the sample plot and setting up the sample plot center, the survey method is determined, i.e., whether the sample plot will be surveyed in the field or via distance survey. Afterward, it is decided whether the sample plot should be divided or not. The survey method and division decision are based on the key in Figure 4.1. For criteria and instructions on dividing the sample plot, see Chapter 6. After any division, the type of survey to be performed for each sub-sample plot is determined (Chapter 4.2).

### 4.1 Survey Method

The survey can be carried out in two different ways, depending on the conditions of the site: field survey or distance survey. Descriptions of each survey method are provided below. The survey method (Chapter 7.3) and any division (Chapter 6.5) are noted in the Sample Plot App.

#### Key for Survey Method



*Figure 4.1. Key for determining the survey method and whether the sample plot should be divided or not.*

#### 4.1.1 Field Survey

The sample plot can be accessed or is visible to the field assessor. The sample plot will undergo detailed surveying or minimal surveying. When any part of a sample plot can be accessed or observed at close range (as opposed to distance survey), field surveying is conducted on all sub-sample plots. Some survey tasks may be performed from the edge of the sample plot. The field assessor is responsible for collecting as much acceptable quality data as possible, even from a sub-sample plot that cannot be accessed.

#### 4.1.2 Distance Survey

The purpose of a distance survey is to collect data that can be gathered with acceptable quality for a sample plot that is not accessible. The details of the sample plot are beyond the reach of the field assessor and cannot be accessed, but the survey can be conducted, for example, from the edge of homogeneous habitats where conditions can be assessed even if the actual area cannot be observed. This method may also be used for areas where grazing animals prevent access or when surveying near buildings (Chapter 4.1.3). In the Sample Plot App, the reason for the distance survey is noted, and a distance photo is taken (Chapter 7.3.1). In the Sub-

Sample Plot App, the survey type "distance survey" is selected, which means that the same variables as those in minimal surveying are collected, with the addition that NILES habitat type and Annex I-habitat class can be noted (Chapter 4.2).

### 4.1.3 Surveying Near Buildings

For areas near buildings, a field survey is conducted wherever public access is deemed possible. Clear property boundaries define when a field survey should be conducted or if the area should be surveyed distantly. In some cases, clear property boundaries are not marked, such as on certain agricultural properties or in recreational areas. The following basic principles apply:

- In open areas around residential buildings, recreational properties, and frequently visited farm buildings, the survey is conducted by visiting the sample plot up to 40 meters from the building.
- In forested areas, shrubland, and hilly rock areas, the survey is conducted up to 20 meters from corresponding buildings.

## 4.2 Survey Type

The survey type is determined for each sub-sample plot or undivided sample plot based on whether it is a target habitat type or a non-target land in the plot, as defined in Chapter 5. Table 4.2.1 provides an overview of the data collection procedures in each application, depending on the assigned survey type. The survey type is recorded in the Sub-Sample Plot Application and determines which variables are collected (see Chapter 8.1).

**Table 4.2.1.** Overview of survey types in the Sub-Sample Plot and Species Apps. The variables recorded for each survey type are described in Chapters 8.1 and 9.1.

Categories	Survey Type	Sub-Sample Plot App	Species App
Sample plot at a distance	Distance survey	Reduced number of variables	No inventory of species
Deciduous forests	Detailed survey (with small sample plots)	All variables	Small sample plots + assessment polygon
Wooded grasslands	Detailed survey (with small sample plots)	All variables	Small sample plots + assessment polygon
Open grasslands	Detailed survey (with small sample plots)	All variables	Small sample plots + assessment polygon
Non-relevant land	Minimal survey	Reduced number of variables	No inventory of species

### 4.2.1 Detailed Survey

A detailed survey using small sample plots is conducted in all deciduous forests and grasslands, both open and wooded, as defined in Chapter 5 and the Habitat Manual. In the Sub-Sample Plot App, all variables are noted (see Chapter 8). In the Art application, both

small sample plots and species occurrences within the assessment polygon are surveyed (see Chapter 9 and Appendix 7).

#### 4.2.2 Minimal Survey

A minimal survey is conducted in areas that are not relevant, meaning areas that are not classified as any target nature type. In the Sub-Sample Plot App, the number of noted variables is reduced so that only land classification is registered. Small sample plots and species in the assessment polygon are not surveyed. However, data about this should still be submitted from the Art app where the field assessor confirms that no species inventory was conducted.

#### 4.2.3 Distance Survey

This is used exclusively when the survey method is distance surveying. The same variables as those in minimal surveying are noted, with the addition that NILES habitat type and habitat class can be noted.

## 5. Definitions and Area Requirements

It is essential to determine whether a landscape unit constitutes a target habitat type. Units that do not qualify as target habitats are here referred to as *non-target land*. Different landscape units are distinguished based on various structural characteristics, such as tree cover, field layer composition, soil moisture, land management, and other influencing factors. The delineation of units and the principles guiding this process are described in Chapter 6.

Below, the target habitat types are defined and grouped into three overarching classes, followed by the definition of what constitutes non-target land. The main target habitat types, *open grassland*, *wooded grassland*, and *deciduous forest*, correspond to the main categories within the variable “NLS habitat type” (see Chapter 8.5). Target habitats are surveyed using detailed survey methodology. Non-target land is surveyed using a minimal survey approach. If two or more adjacent non-target land units are contiguous, they are merged into a single subunit. In the classification of non-target land, the dominant class within the assessment polygon is noted, based on those units intersecting the sample plot and fulfilling the MMU (Minimum Mapping Unit).

The habitat types surveyed as target habitats include **open grasslands, wooded grasslands, and deciduous forests** that meet the following criteria:

1. They can be classified as one of the main target habitat types, open grassland, wooded grassland, or deciduous forest, according to the definitions below (Chapter 5.1).
2. They meet the applicable area requirements (Chapter 5.3).

Chapter 5.2 defines what is not targeted (i.e., non-target land), and Chapter 5.4 describes how units that do not fulfill the area requirements are handled.

It is important to note that a unit classified at this stage as, for example, wooded grassland, may not necessarily receive the same classification under other classification systems used in the survey. Multiple classification systems are used to enhance compatibility with other monitoring programs.

### 5.1 Definitions of Main Target Habitat Types

#### *Open Grassland*

Open areas where the vegetation is clearly influenced by mowing or grazing, or by other forms of traditional land use or natural disturbance. The field layer is dominated by graminoids, forbs, or dwarf-shrubs. Canopy cover of trees  $\geq 5$  meters in height must be less than 10%. Trees shorter than 5 meters are not included in this measurement. Shrubs may be present.

The category *open grassland* includes:

- Traditionally managed (including visibly historically managed) semi-natural grasslands: pastures, meadows, heathlands, dry grasslands on bedrock, coastal meadows, and periodically flooded meadows.
- Cultivated grasslands with signs of historical or current management (including visible historical evidence): pastures and meadows on improved land showing signs of fertilization,

sown grass species, or modern soil preparation.

- Naturally open grasslands maintained by natural disturbances: flooded meadows, coastal meadows, naturally open dune areas, tall herb meadows, and alpine grasslands and heaths below the treeline.
- Extensively managed grasslands and grasslands maintained for purposes other than fodder production, such as areas that are mowed or cleared a few times per year or at multi-year intervals. Examples include field margins, roadsides, grasslands along and under power lines, airfields, sports facilities, ski areas, shooting ranges, motocross tracks, and overgrown sand pits.
- Lawns, e.g., in urban areas, parks, residential lots, football fields, and golf courses. The ground may be artificially constructed (i.e., excavated or filled).
- *Overgrown grasslands* are still classified as grassland as long as a grass sward is present. As tree and shrub cover increases and shade becomes dominant, the grass sward eventually disappears. For further details on how overgrown grasslands are treated in this survey, see separate section below.

### ***Wooded Grassland***

Wooded grasslands must have  $\geq 10\%$  canopy cover of trees  $\geq 5$  meters in height (trees under 5 meters are not included), and possess a grass sward or other vegetation clearly shaped by historical or current traditional land use (e.g., grazing or mowing). All tree species are allowed, including common deciduous tree species, broad-leaves, and conifers. Shrubs may be present.

The category *wooded grassland* includes:

- Wooded pastures and wooded meadows on natural land, where the field layer has been influenced by present or past grazing or mowing.
- Wooded cultivated grasslands: arable land or former arable land that is currently or has previously been used for grazing or mowing, or other fertilized grasslands with trees.
- Other wooded grasslands not managed for fodder production, but for aesthetic or other values, and lacking clear influence from grazing or mowing.

### ***How Are Overgrowing Grasslands Treated?***

In grasslands where the intensity of traditional land use (such as grazing or mowing) decreases or ceases entirely, natural succession leads to the gradual encroachment of trees and shrubs. A recurring challenge is how to assess encroaching trees. Several classification systems are employed to improve comparability with other surveys, and encroaching trees are assessed differently depending on the system. As a result, the boundary between open grassland and wooded grassland will vary depending on the classification method used.

*Boundary Between Open Grassland and Wooded Grassland:* In grasslands, canopy cover of trees is the decisive criterion, as the field layer must reflect traditional land use (management history) in both open and wooded grasslands. If the canopy cover of trees  $\geq 5$  meters in height is  $\geq 10\%$ , the area is classified as wooded grassland. An overgrowing grassland is considered forest land once the field layer no longer exhibits signs of traditional

land use, i.e. when it lacks a grass sward and no longer supports a flora shaped by historical or current management.

*Boundary Between Open or Wooded Grassland and Forest Land:* There is no strict upper limit for the amount of encroaching trees that can be present for an area to still be classified as wooded grassland. The decisive factor is how the values associated with the field layer have been affected. When the field layer no longer exhibits any signs of traditional land use, lacking both a grass sward and a characteristic managed flora, the land is considered forest. In such cases, the field layer, both in terms of ground cover and species composition, has transitioned to a forest character.

### ***Deciduous Forest***

Forest land in which deciduous trees constitute  $\geq 50\%$  of the total basal area and the basal area-weighted mean age (see Glossary) is at least 50 years. *Forest land* here refers to a contiguous area where tree canopy cover is  $\geq 10\%$  and tree height is at least 5 meters or has the potential to reach this height and canopy cover without productivity-enhancing measures. If the field layer exhibits characteristics of traditional management, refer to the definition of wooded grassland above. The basal area-weighted mean age is determined according to the methods described in Sections 6.7.2–3. Stands in which deciduous trees account for  $< 50\%$  of the basal area or in which the basal area-weighted age is less than 50 years are not included in the survey.

The deciduous forests targeted in this inventory include:

- Broad-leaved forests (e.g., dominated by *Quercus*, *Fagus*, *Ulmus*)
- Common deciduous forests (e.g., *Betula*, *Populus*, *Salix*)
- Mixed forests where deciduous trees comprise  $\geq 50\%$  of the total basal area
- Wet or seasonally flooded stands, such as deciduous swamp forests and riparian deciduous forests, though not on peat-forming soils. Some swamp forests may have a basal area-weighted mean age below 50 years due to high tree turnover, but still qualify due to long-term continuity of tree cover. These stands are included in the inventory and shall be surveyed in detail. Use historical orthophotos and maps to support age assessment.

## **5.2 Definitions of Non-Target Land**

Land that does not meet the criteria for classification as open grassland, wooded grassland, or deciduous forest (see Section 5.1) is categorized as *non-target land*. These areas are subject to minimal surveying, using a reduced set of variables. Note that such areas must also meet applicable area requirements in order to be delineated as separate units (see Section 5.3).

Non-target land includes:

- Water: All permanent freshwater or saltwater below the mean water level (including the shoreline).
- Constructed/sealed/developed land: Land that is paved, excavated, or covered by buildings or infrastructure. *Note:* Grassland established on developed land, such as lawns in urban areas, constitutes a target habitat type.
- Arable land in active crop rotation.

- Forest land that does not meet the criteria for deciduous forest: This includes mixed and coniferous stands where deciduous trees account for < 50% of the total basal area, and deciduous forests with a basal area-weighted mean age below 50 years.
- Peat-forming wetlands: Includes both open and forested mires, bogs, and fens.
- Exposed soil/substrate land: Areas lacking vegetation cover due to natural causes, such as shingle fields or bare rock in low-productive forest land. *Note:* These are not to be confused with dry rock outcrop grasslands or calcareous rock outcrops.
- Alpine zone: Areas located above the natural tree line.
- Reed beds: Shoreline areas heavily dominated by dense stands of common reed (*Phragmites australis*), where the ground layer consists almost exclusively of the reed's root mat.

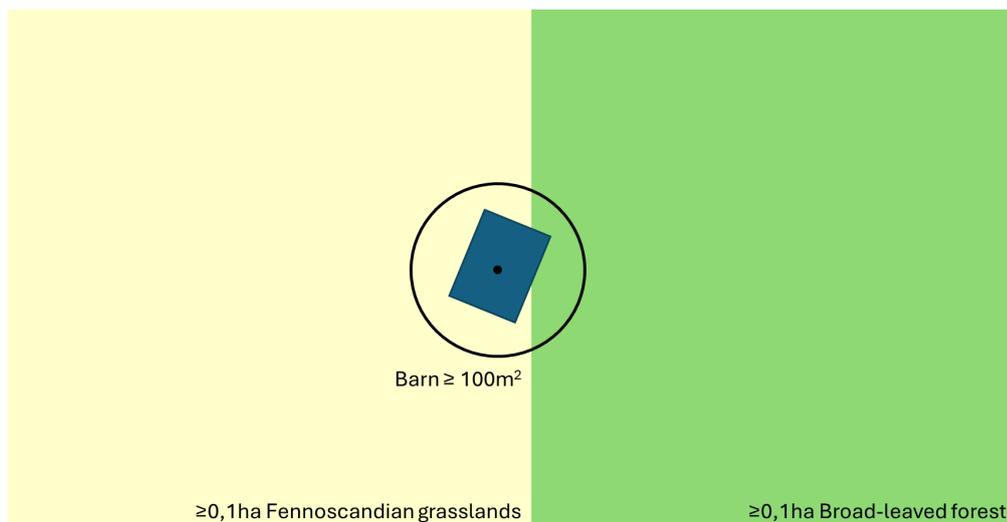
### 5.3 Minimum Mapping Unit (MMU)

A unit must meet the applicable requirements for the minimum mapping unit (see Tables 5.3.1 and 5.3.2) in order to be delineated as a separate entity. Units that are smaller than the minimum mapping unit are merged with surrounding or adjacent land according to specific principles described in Section 5.4. Guidelines for how to delimit different units are provided in Section 6.1.

The minimum mapping unit requirements consist of a minimum area threshold and, in most cases, a minimum width that the unit must meet. The width criterion is primarily applied to elongated areas, such as roadside verges, field margins, grass-covered shoreline zones, or strips of deciduous forest along lakes and watercourses. See Section 6.2 for more details on elongated areas. "Octopus-shaped" polygons (i.e. narrow extensions from a central unit) should be avoided. It is important to note that all units, whether they represent a target habitat type or not, must fulfil the minimum area requirement to be delineated as independent units.

General requirements for area and width (Table 5.3.1):

- In general, a unit must have a total area of at least 0.1 hectares (1,000 m<sup>2</sup>) and a minimum width of 10 meters. The minimum width requirement may be relaxed over short stretches (less than 20 meters) in the case of elongated features.
- Two exceptions apply for grasslands: the Annex I-habitat types, *siliceous rock with pioneer vegetation* (8230) and *Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi* (6110) have an area requirement of 100 m<sup>2</sup>, but no minimum width requirement.
- For wooded areas, in addition to the 10-meter minimum width, the unit must also consist of at least two rows of trees to qualify as a separate unit. For example, a single row of trees lining a road does not qualify as a separate unit, even if the crown width exceeds 10 meters.
- The minimum area requirement for constructed/sealed/developed land and permanent water bodies is  $\geq 100$  m<sup>2</sup>, with a minimum width of  $\geq 5$  meters (see Figure 5.1).



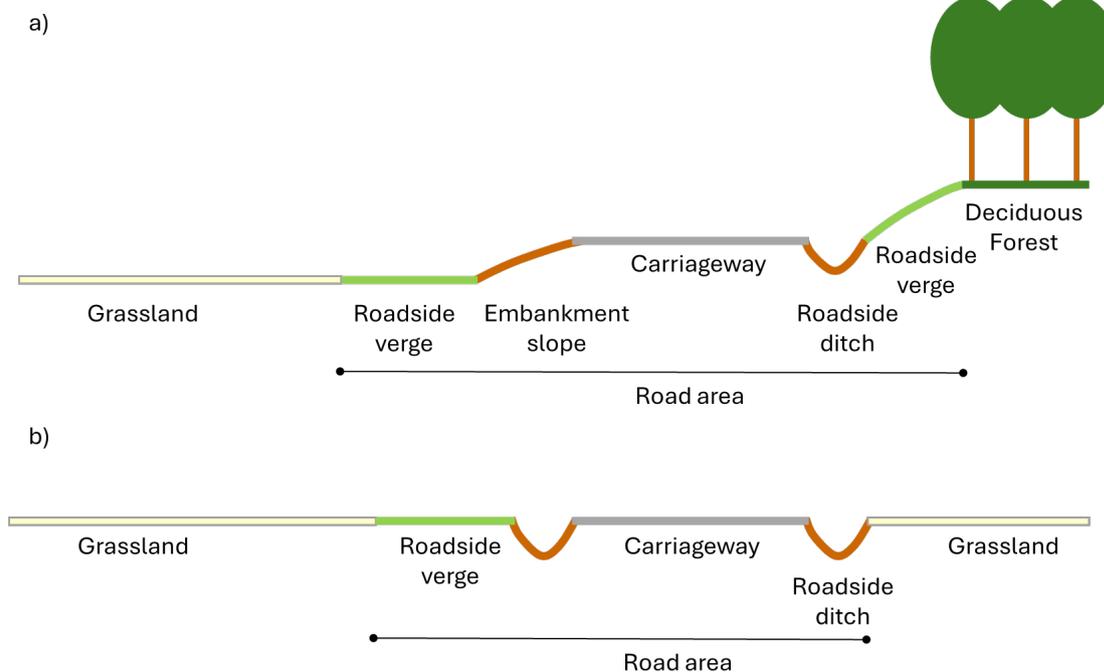
**Figure 5.1.** An example of developed land that meets the minimum mapping unit requirement of  $\geq 100 \text{ m}^2$  in area and  $\geq 5$  meters in width. The object is delineated as a separate subunit. For more detailed information on unit division, see the technical guidelines in Section 6 and Figure 6.11.

### Road and Track Area

A road area consists of a paved carriageway and the adjacent land maintained for road purposes (Figure 5.2). Dirt roads (see glossary) are not considered road areas.

Road and track areas  $\geq 5$  m in width are delineated as separate units.

Grasslands along roads and railways that are  $\geq 10$  m wide on one side of the paved carriageway are delineated as separate units.



**Figure 5.2.** Two examples of road areas; the same principle applies to track areas. A road area consists of a paved carriageway and the adjacent land managed for the purpose of road maintenance. Note that grassland within road and track areas that is greater than or equal to 10 meters wide on one side of the paved carriageway is delineated as a separate unit and surveyed as "Grasslands along roads and railways."

**Table 5.3.1.** Minimum mapping unit (area and width requirements) for target habitat types and non-target land. Definitions for different land types are provided in various classification systems, as referenced in the first column of the table.

Definition	Class	Area Requirement	Minimum Width	Inventory type
Habitat Manual	Siliceous rock with pioneer vegetation and grassland communities on calcareous bedrock.	100 m <sup>2</sup>	No requirement	Detailed survey
Chapter 5.1	Other open grasslands	0.1 ha	10 m	Detailed survey
Chapter 5.1	Wooded Grassland	0.1 ha	10 m and at least two tree rows	Detailed survey
Chapter 5.1	Deciduous forest	0.1 ha <sup>1</sup>	10 m and at least two tree rows	Detailed survey
Table Footnote	Other forest land	0.1 ha <sup>1</sup>	10 m and at least two tree rows	Minimal survey
Chapter 5.3	Road and track areas not meeting the definition or Minimum Mapping Unit (MMU) criteria for grassland	0.1 ha	5 m	Minimal survey
Land Cover, Chapter 8.4.1	Constructed/sealed/developed land	100 m <sup>2</sup>	5 m	Minimal survey
Land Cover, Chapter 8.4.1	Permanent water	100 m <sup>2</sup>	5 m	Minimal survey
Chapter 5.1	Other land not subjected to survey	0.1 ha	10 m	Minimal survey

<sup>1</sup> Note that for habitat classification, the area requirement is 0.25 ha for forest land.

<sup>2</sup> Forest land is here defined as a contiguous area where the tree canopy cover is ≥ 10% and the trees are at least 5 meters tall or have the potential to reach this height and canopy cover without productivity-enhancing measures. If the field layer exhibits characteristics of traditional land use (grazing or mowing), see the definition of wooded grassland (Section 5.1).

**Table 5.3.2** Area requirements expressed in hectares, square meters, as the radius of a circle, and as the side length of a square.

Area		Geometry	
ha	m <sup>2</sup>	Circle Radius (m)	Square Side (m)
0.0025	25	2.82	5.00
0.01	100	5.64	10.00
0.05	500	12.62	22.36
0.1	1000	17.84	31.62
0.25	2500	28.21	50.00

## 5.4 Units Smaller than the Minimum Mapping Unit (MMU)

Units that do not meet the area requirements are assigned to adjacent or surrounding land according to the principles described below. For linear features (Section 6.2) that are narrower than the minimum width requirement, such as roads, road verges, field margins, and watercourses, special rules apply, which are described in separate paragraphs below. The basic principle is that units smaller than the minimum area requirement are incorporated into the surrounding land. This applies if the unit is entirely surrounded by another land type, e.g., an arable island within improved pasture or a small conifer-dominated patch within deciduous woodland. If the unit is not fully enclosed, it is assigned to one of the adjacent units according to the principles below, in the stated order. If Principle 1 cannot be applied, Principle 2 is used instead. Special rules apply to field margins and grasslands in road areas, see separate sections below.

### *Principle 1*

The first principle states that a unit not meeting the area requirement and located between two or more other land types is merged according to the following hierarchy:

1. Constructed/impervious land is merged with constructed/impervious land.
2. Grassland (including wooded grassland) is merged with grassland.
3. Forest land is merged with forest land.
4. Terrestrial/semi-aquatic land is merged with terrestrial/semi-aquatic land (not with water).

For definitions of constructed land, grassland, and forest land, see Table 5.3.1.

### *Principle 2*

If Principle 1 cannot be applied, e.g., the sub-MMU unit is not similar to any of the adjacent land types, such as a shed <100 m<sup>2</sup> located between an arable field and pasture, the following rule applies: the unit is assigned to the land type that it is most surrounded by. The field assessor imagines polygon boundaries between the adjacent land types and determines to which assessment polygon the shed, in this case, should be assigned. Being “most surrounded by” also includes having the largest shared area.

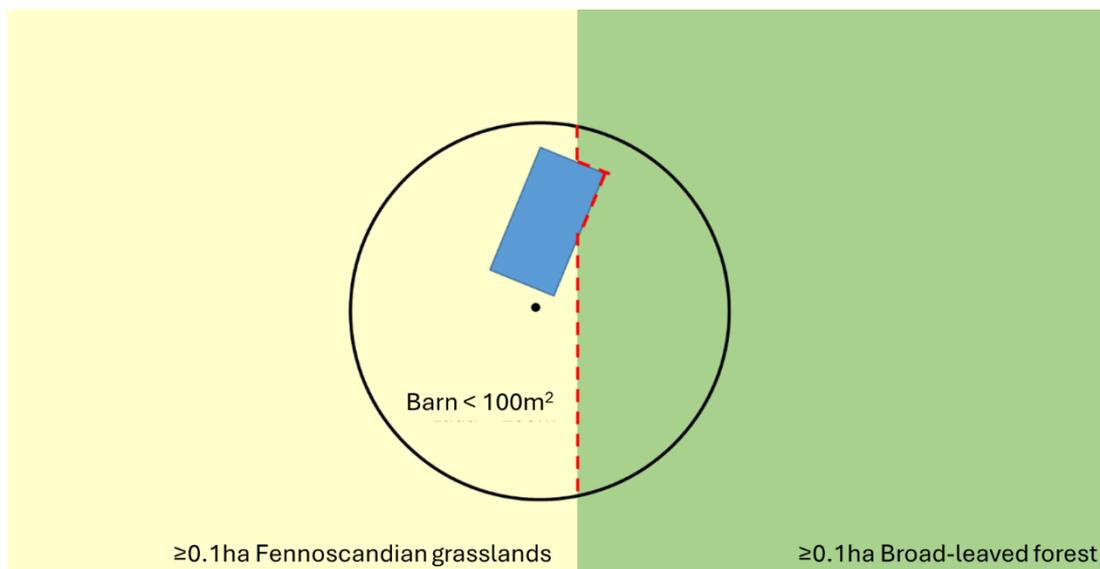


Figure 5.3. The figure illustrates principle 2. Yellow and green represent two different target habitat types, e.g., silicate grassland and broadleaf forest, each of which is at least 0.1 ha. The shed represents constructed/impervious land  $< 100 \text{ m}^2$ , which is smaller than the minimum mapping unit (MMU). Therefore, it does not form its own unit and should instead be included in one of the surrounding habitat types. The area of the shed is assigned to the habitat type it is most predominantly located within, which in this case is the silicate grassland. The red dashed line indicates the division line.

### Grasslands along Roads and Railways

For the definition of road and track areas, see Chapter 5.3, Figure 5.2. Only if the width of the grassland is  $\geq 10$  meters on one side of the paved roadway is it considered a separate unit; otherwise, it is always included in the road or track area and inventoried with minimal assessment.

### Field Strips

Field strips are vegetation bands located next to arable land but not within a road area. This category also includes buffer zones with perennial vegetation. The vegetation is often influenced by its proximity to the field and is fertilized, often with broad-leaved grasses. Field strips that do not meet the minimum mapping unit are assigned to the adjacent field.

### Road and Track Areas, and Watercourses

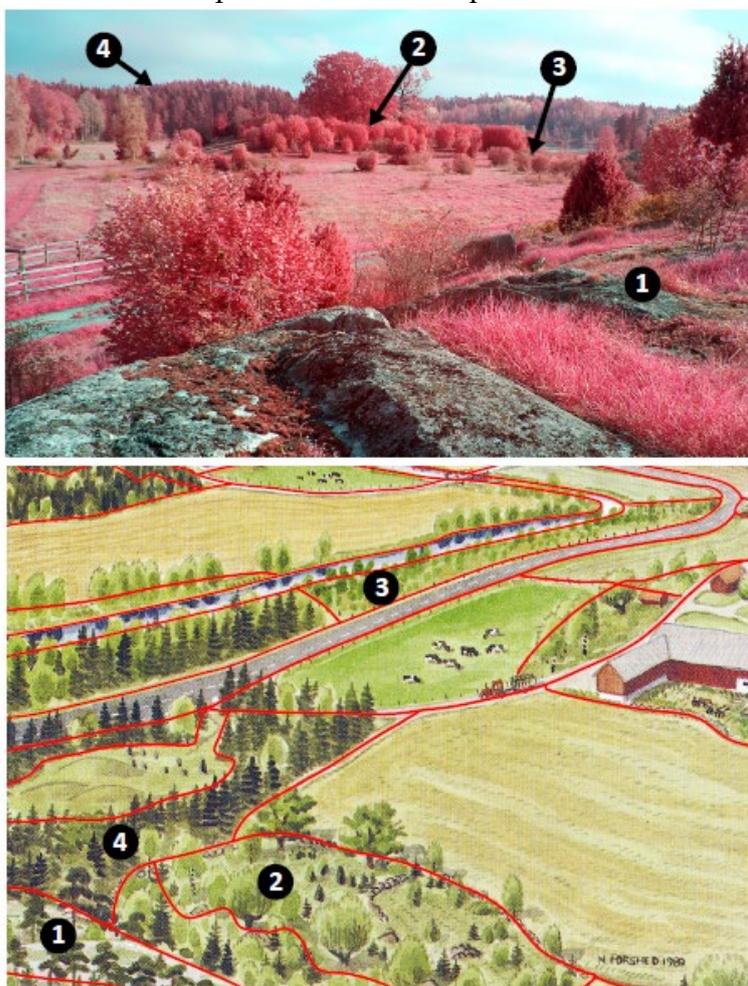
For the definition of road and track areas, see Chapter 5.3, Figure 5.2. The width of a watercourse is measured from the mean waterline to the mean waterline. If the road or track area or watercourse is narrower than 5 meters, they are included in the adjacent land according to the following:

- Road and track areas and watercourses at the boundary between forest and agricultural land are assigned to agricultural land. However, if a tree belt exists between the road or watercourse and the agricultural land, they are assigned to the forest.
- Road and track areas and watercourses at the boundary between wetland and agricultural land are assigned to agricultural land.
- Road and track areas and watercourses between wetland and forest are assigned to the forest.

## 6. Boundary and Division

### 6.1 Polygon Geometry

When working in the field, the field assessor needs to envision the landscape divided into units (polygons). This is necessary to determine whether a unit meets the minimum mapping unit, if it is a sought-after habitat type, and whether and how a potential division of the plot should be made. A unit or polygon in this context refers to an area that consists of one of the classes listed in Table 5.3.1. Special rules apply to how boundaries between different units should be established, which are described in Chapter 6.2. The minimum mapping unit is discussed in Chapters 5.3 and 5.4. Division is addressed in Chapter 6.5. Figure 6.1 provides an example of boundary delineation between different units in practice and how the field assessor must conceptualize the landscape divided into various units.

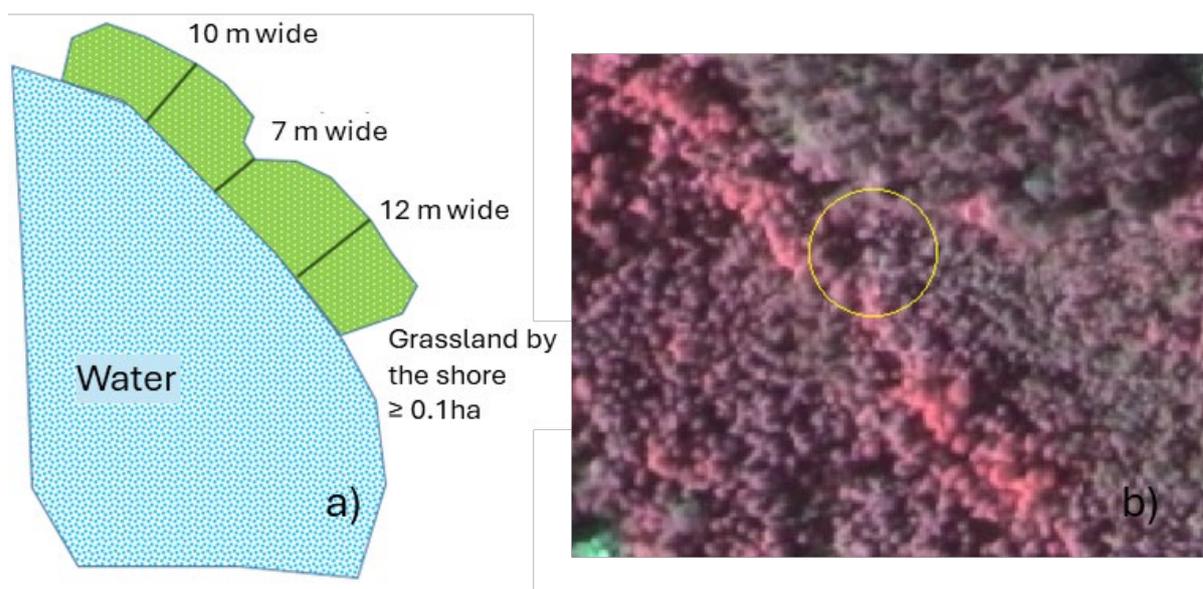


**Figure 6.1.** Example of boundary delineation between different units in practice and how the field assessor must conceptualize the landscape. The upper part of the image is a photo taken from the ground using infrared colour film. The lower part is a corresponding landscape image with examples of polygon boundaries marked in red (Allard, 2012). Several examples are highlighted with numbers. No. 1, a natural boulder and rocky terrain, previously grazed but now abandoned. No. 2, a natural pasture, in an early stage of succession, but upon closer inspection in the drawing, small rows in the grassland indicate replanting with coniferous trees. No. 3, an older agricultural field that likely had a period of grazing, before being abandoned and now being overgrown with shrubs. No. 4, a grazed wooded area, which after grazing has grown into a coniferous forest with some deciduous tree inclusion. Photo: C. Hättestrand. Drawing: N. Forshed. Source: Aldentun et al (1991).

## 6.2 Long, Narrow Polygons

Special rules apply for long, narrow polygons that the field assessor must consider. For the classes that have a width requirement of 10 meters, the minimum width can be exceeded for stretches shorter than 20 meters. For example, such long, narrow areas might be a grass-covered shoreline zone along a lake or river, which has a winding outer edge, see Figure 6.2. Another requirement is that a tree stand must contain at least two rows of trees. A row of trees along a road, or a single tree row along the edge of a lake, is not considered a separate unit, even if the trees have a canopy width exceeding 10 meters.

For the classes with a width requirement of 5 meters, they are not classified as separate units if they are narrower than 5 meters. This applies to, for example, paths, smaller roads (including road areas), and watercourses. For instance, a road area less than 5 meters wide that runs through a natural pasture should not be delineated separately if the pasture continues on the other side. Similarly, deciduous forests on both sides of a watercourse less than 5 meters wide are considered as one contiguous deciduous forest if they are otherwise similar. The width of a watercourse is measured between the mean waterlines.



**Figure 6.2** Illustration of (a) the principle that allows short sections of a long, narrow area to be narrower than 10 meters without interrupting the polygon. In this case, it is a grass-covered shoreline, where the area as a whole reaches 0.1 ha. Here, the section that is too narrow is generalized to the majority of the polygon, which is wider than 10 meters. Image (b) is an example of a polygon that is too narrow to be registered: a strip of deciduous swamp forest along a small watercourse, where the width of the deciduous swamp forest is 7.5 meters at its widest, making it too narrow to be delineated as a separate unit.

### 6.3 Delimitation between units

The inventories include many sought-after natural types, and it is important to be able to determine where the boundaries lie between these. It is also important to distinguish non-target land. The units that meet the minimum mapping unit criteria and are encountered by the survey plot will be noted in the inventory, either through detailed inventory or minimal inventory. To count as a "hit," the delineated unit must reach at least 1.5 meters into the survey plot. The land types being inventoried do not need to cover the entire survey plot. It is sufficient if they cover part of the survey plot, but with a margin of at least 1.5 meters inside the edge (Figures 6.3, 6.4), and the minimum mapping unit (usually 0.1 ha) must be achieved for the polygon being assessed (Figure 6.3).

Typically, the polygons are relatively homogeneous in appearance (Figure 6.3). In Figure 6.3, the size of the area (0.1 ha, red circle) that a class needs to cover for a survey plot (yellow circle) that intersects it to be noted is shown. If the polygon is smaller than 0.1 ha, it is generalized to surrounding land, such as a small grove in grassland or conversely, a small clearing in a forest (Chapter 5.4).

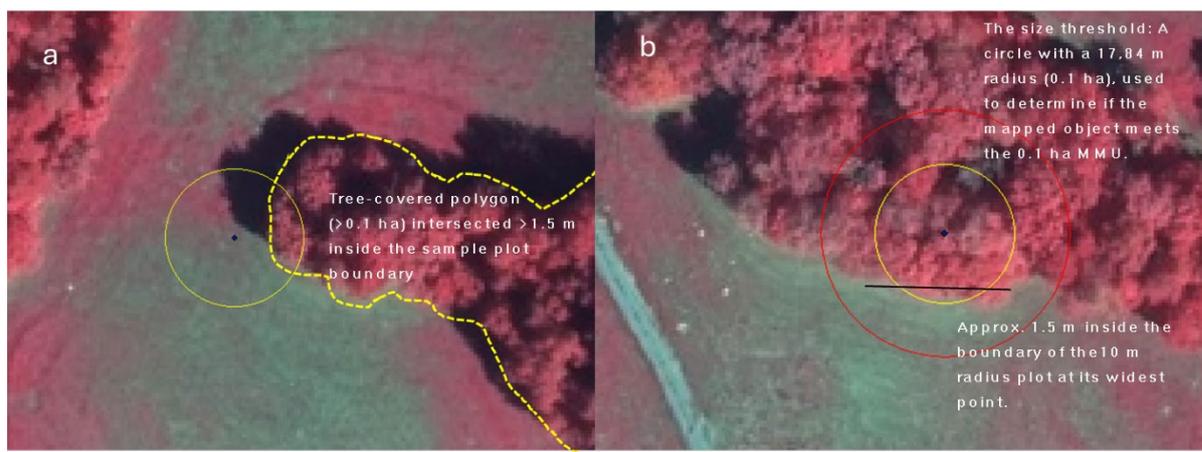


**Figure 6.3.** Example of how the field assessor perceives polygons in the landscape. The dashed line illustrates a polygon, a conceptual boundary between a deciduous forest and surrounding grassland. The smaller circles represent the survey plots. The larger circles indicate 0.1 ha, which is the area requirement for many classifications. The deciduous forest is assessed to meet the species composition and age criteria for the deciduous forest class, as well as the minimum mapping unit of 0.1 ha. We also see that the grassland, which extends 1.5 meters into the survey plot, meets the criteria for being a sought-after open grassland and is larger than 0.1 ha. In this case, the survey plot will be divided, with one subunit inventoried as deciduous forest and the other as open grassland.

### 6.3.1 Delimitation Between Different Units of Open or Tree-Covered Land

Delimitation between different types of open habitats, as well as between open and tree-covered habitats, is primarily based on changes in the field layer vegetation (Figure 6.4). The field layer often differs between open and wooded sections of a grassland due to factors such as shading from trees, grazing intensity, and other ecological influences. If no discernible difference in the field layer is observed, the delimitation is instead made at the tree crown boundary.

- If the field layer differs between subunits of different open habitats, or between subunits of open and tree-covered habitats, delimitation and subdivision shall primarily be based on the field layer.
- If the field layer does not differ between subunits of tree-covered and open habitats, and management practices are the same, delimitation and subdivision are made at the boundary of the tree crowns.
- Between different forest stands, or between tree-covered grasslands with differing tree species composition, the boundary is generalized to a median line between the stands, i.e., at the crown boundary. See also Section 6.3.2.



**Figure 6.4.** The images show two examples where a sample plot must be divided, and two habitat types noted. These are cases where the sample plot (yellow circle) intersects multiple land types, in this instance, a cultivated grassland and a deciduous forest. Both categories meet the criteria for registration and extend at least 1.5 meters into the sample plot, which means that classifications are noted under both the "Deciduous Forest" and "Grassland" categories (example from tract 19 532, survey year 2020).

The yellow circle represents the sample plot (10 m radius), while the red circle represents 0.1 ha and is used in aerial photo interpretation as a reference for estimating polygon size. In image (a), the circular plot intersects a cultivated grassland but also touches a tree-covered polygon. In image (b), the black line indicates the boundary between the grassland and the tree-covered polygon. The grassland extends beneath the tree canopy, and the delimitation will therefore be based on the characteristics of the field layer. The grassland reaches at least 1.5 meters into the sample plot.

### 6.3.2 Delimitation Between Different Forest Units

At times, the sample plot may lie within a gradual transition between a deciduous forest and adjacent forest types such as mixed forest, coniferous forest, or young forest. Between different forest stands, the boundary is generalized as much as possible to an approximate median line between the stands, i.e., along the canopy edge. Figure 6.5 illustrates a case where the upper half of the sample plot lies within the deciduous forest, while the lower half is situated in a mixed forest, which is not of interest. The red line marks the boundary between these forest types. The line in Figure 6.5 is drawn well outside the sample plot to clarify the irregular shape of the deciduous forest and to show that it meets the minimum mapping unit requirement ( $\geq 0.1$  ha). During aerial photo interpretation, shorter guiding lines are drawn and sent out to the field (Chapter 6.4, Figure 6.6).

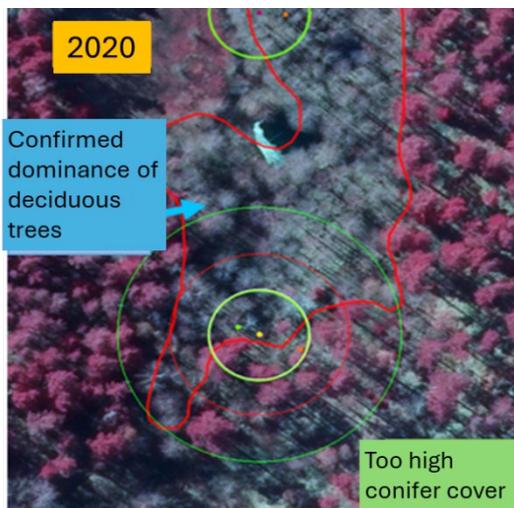
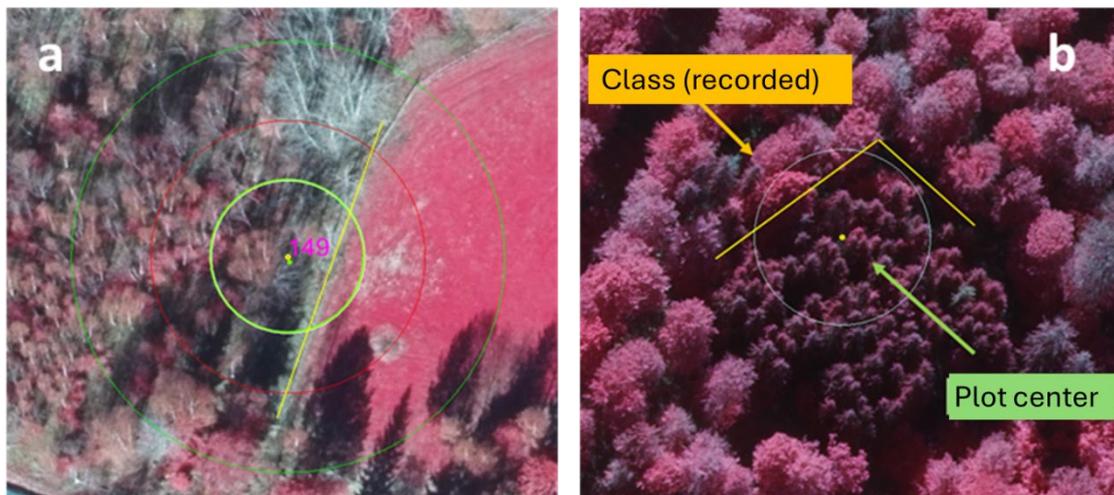


Figure 6.5. Example from the 2020 surveys, where a deciduous-dominated forest stand partially covers a sample plot. The smallest, light green circle represents the sample plot (10 m radius). The middle circle (red) indicates 0.1 ha, which is the minimum mapping unit for deciduous forests, and the outermost circle (dark green) represents 0.25 ha, the minimum area required for habitat classification of forest. The lower part of the sample plot lies within a mixed forest stand with >50% coniferous trees. The red line marks the estimated boundary of the deciduous forest stand. In this case, the sample plot intersects two different forest stands. Both units meet the minimum mapping unit (MMU) requirement, but only one is a target habitat type. The sample plot will therefore be divided: the deciduous forest stand will be surveyed using detailed inventory, while the conifer-dominated mixed stand will be surveyed using minimal inventory.

## 6.4 Guidelines from Aerial Photo Interpretation

During the aerial photo interpretation, a guideline has sometimes been added to indicate that the sample plot contains more than one habitat type (Figure 6.6). This is intended to flag potential divisions of the plot. Such lines have mainly been applied in forested areas where field visibility may be limited. In contrast, guidelines are generally not included when boundaries between habitat types are clearly visible. These guidelines are not definitive; any actual division and classification of sub-sample plots is determined in the field. In some cases, additional subdivisions may be warranted, or the reason for a flagged division might not be identifiable in the field. It is recommended to cross-reference with the Min karta app.

When a sample plot includes multiple classes that may require clarification during fieldwork, the aerial photo interpreter may map a line that is then displayed on the field map. This line does not affect the classification method but serves solely as a signal to the field assessor that multiple habitat types may be present within the plot. Figures 6.6a–b provide examples of when a line may be used to mark the boundary between a target habitat type and a non-target land within a sample plot.



**Figure 6.6.** Example of delineation lines that may be generated during aerial photo interpretation to clarify classification during field surveys when the appropriate class for a sample plot may not be immediately apparent. The sample plot is represented by the smallest circle. A line may be drawn, for example, when: a) the center of the sample plot lies within young forest, while a pasture extends at least 1.5 meters into the plot, resulting in a grassland classification; b) the center of the plot lies within coniferous forest, while a deciduous stand extends at least 1.5 meters into the plot, resulting in a deciduous forest classification.

## 6.5 Sample Plot Sectioning

### 6.5.1 General Information

All units that meet the minimum mapping unit and that extend at least 1.5 m into the sample plot from the perimeter of the circular plot are delineated as separate sub-sample plots. Within a habitat type, the division also considers differences in management practices such as forestry, grazing, or disturbance processes (see Table 6.5.1). Precisely determining where a dividing boundary should be drawn can often be difficult. This is particularly true for transitions between substrate types such as boulder/bedrock and surrounding grassland, as such boundaries are often diffuse. Therefore, the boundary is frequently generalized to an approximate median line.

Division is carried out in the following cases:

- If the 10 m plot contains both units of target habitat types and non-target land types, a division is primarily made between these.
- If the 10 m plot contains two or more different units of target habitat types (Annex I-habitats or NILS habitat types), a division is made between them.
- If two or more units of non-target land adjoin each other, no division is made between them.
- If one and the same habitat type (Annex I or NILS) differs due to different management practices, forestry measures, or disturbance processes, a division is made between these units. Division is based on whether these differences can be identified using the criteria listed in Table 6.5.1. Different livestock types on adjacent grazed areas do not constitute different management unless the grazing has resulted in distinct Annex I or NILS habitat types.
- Division is performed during both field surveys and distance surveys (see Chapter 4.1).

**Table 6.5.1** Division criteria for habitat types based on management.

Additional division criteria	Deciduous Forests	Wooded and Open Grasslands
Forest management practices, e.g. clear-cutting, thinning, pre-commercial clearing, or absence of silvicultural interventions	X	X
<b>Disturbance processes</b> , e.g. fire, windthrow, flooding	X	X
Management, various forms of land-use practices, such as grazing, mowing, burning or absence of management.	(X)	X

## 6.5.2 Technical Instructions for Dividing Sample Plots

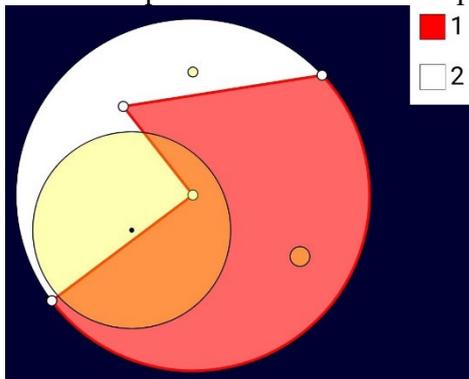
The unit being divided must have a margin of at least 1.5 m inside the perimeter of the 10 m plot (Figure 6.4, image b). The division boundary is indicated by division points, which form a so-called division chain. The division points are defined by distances (dm) and compass directions (degrees) from the center of the sample plot. The points are marked on the ground with wooden stakes, which are removed once the inventory is completed. Each sub-sample plot is described with a division chain, except for the sub-sample plot that forms the remaining part (Figure 6.7). The number of division chains is always one less than the number of sub-sample plots.

The following rules apply to the description of sub-sample plots:

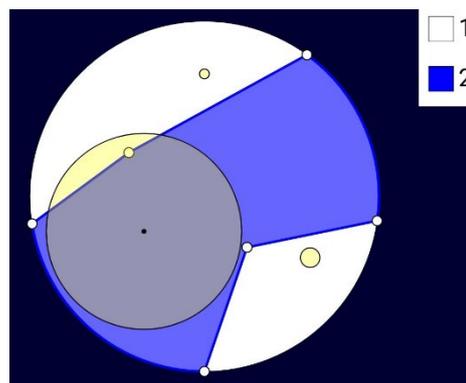
- Each sub-sample plot must be partially delimited by the perimeter of the 10 m plot, as shown in the example in Figure 6.11.
- The first and last points must lie on the perimeter of the circular sample plot, i.e., they must have a distance of 100 dm.
- The division points must be described in a clockwise direction.
- The first line in the chain may not be a circular arc.
- If two division points between the first and last division points lie on the perimeter, the line between them must be a circular arc. Otherwise, one of the points must be moved inward toward the center by 1 dm so that the distance to the point is not equal to the 10 m radius.
- The number of division points may not exceed 6 per division chain, with the exception of division units located entirely within the 10 m plot, where the number may be up to 8.
- A sample plot may be divided into a maximum of 5 sections.

Sub-sample plots are numbered 1, 2, 3, etc., in the order in which they are encountered from south to north. If two or more sub-sample plots are encountered simultaneously, they are numbered from west to east. A sub-sample plot does not need to be physically contiguous within the sample plot. If two sub-sample plots belong to the same evaluation polygon, both receive the same sub-sample plot number. In this case, only the division chain for the central sub-sample plot is provided (Figure 6.10). The inventory may choose which sub-sample plots to provide a division chain for. Figures 6.7 – 6.11 provide examples of different sample plot divisions.

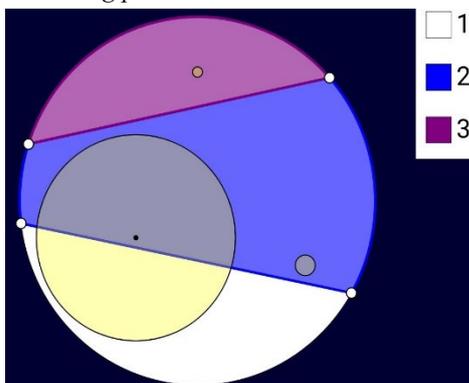
Five Examples of Division Techniques:



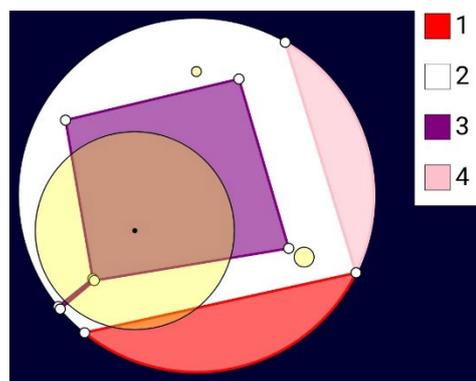
**Figure 6.7.** Two-part sample plot, described with distance (*dist*) in dm and direction (*dir*) in degrees. Division points for sub-plot 1 (*dist:dir*) 100:233, 0:0, 64:322, 100:47. In the sectioning description, 360 degrees is indicated as 0. Sub-plot 2 becomes the remaining part.



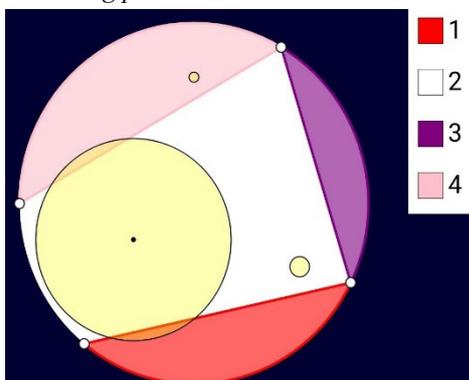
**Figure 6.10.** Two sub-sample plots belong to the same assessment polygon and are assigned the same sub-sample plot number. In these cases, only the partitioning line for the central sub-sample plot is provided.



**Figure 6.8.** Three-part sample plot where sub-plot 2 is described as (*dist:dir*) 100:288, 100:48, 100:120, 100:263 and sub-plot 3 is described as (*dist:dir*) 100:48 and 100:288. Sub-plot 1 becomes the remaining part.



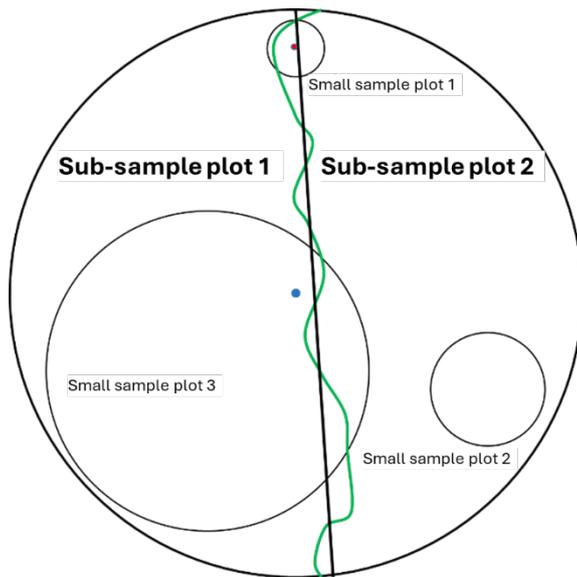
**Figure 6.11.** Four-part sample plot with a unit, e.g., a building larger than 100 m<sup>2</sup> (101.75 m<sup>2</sup>) entirely within the 10 m sample plot. Sub-sample plot 3 is described with the first partitioning point on the periphery, placed one degree from the last partitioning point of the partitioning line. The distance point on the second point and the penultimate one is at the same distance. The partitioning line for sub-sample plot 3 (*distance: direction*) 100:231, 80:231, 80:300, 70:20, 60:120, 80:230, 100:230.



**Figure 6.9.** Four-part sample plot described with 3 partitioning lines, one for each sub-sample plot 1, 3, and 4. Sub-sample plot 2 becomes the remaining part.

### 6.5.3 Sub-sample plot Assignment for Small Sample plots (SSP)

The two smaller sample plots (0.25 m<sup>2</sup> and 1.0 m<sup>2</sup>) are not divided, but instead, each is assigned to the sub-sample plot within which its center lies, as shown in Figure 6.12. However, the largest small sample plot, small sample plot 3, is divided if it intersects multiple sub-sample plots, with each resulting part numbered according to the sub-sample plot it belongs to (Figure 6.12).



**Figure 6.12.** The two smaller of the small sample plots (small sample plot 1 and 2) are not divided but belong to the sub-sample plot in which their center lies. In this case, small sample plot 1 belongs to sub-sample plot 1 and small sample plot 2 belongs to sub-sample plot 2. Small sample plot 3, however, will be divided into two parts, with the larger part belonging to sub-sample plot 1 and the smaller part belonging to sub-sample plot 2. The green line in the figure represents a hypothetical difference in, for example, the field layer, and the black line shows the generalized boundary line.

## 7. Sample Plot Registration

### 7.1 Workflow Summary

The field inventory process is divided among three separate apps: the Sample Plot App (Table 7.1.1), the Sub-Sample Plot App (Table 8.1.1), and the Species App (Table 9.1.1). The Sample Plot App is used to register general information about the sample plot. Plot subdivision (if applicable) is registered here, photographs of the sample plot and any small sample plots (SSP) are taken, and the coordinates of the sample plot are noted.

**Table 7.1.1.** The connection between variables and the survey method and type. A shaded cell indicates that the variable is noted for that survey method. The table also shows where the variable is referenced in the manual.

Survey Steps / Variables	Chapter	Survey method		
		Distance Survey	Field Survey Type	
			Detailed Survey	Minimal Survey
Tract and plot number	7.2.1			
Survey method	7.3			
Photography	7.4			
Coordinates	7.5			
Subdivision	7.6			

### 7.2 Plot Information

To begin the inventory for a sample plot, select the current plot in Field Maps and then click the link to the Sample Plot App. This launches the plot record in Survey123. Tract number, sample plot number, and theoretical coordinates are imported from Field Maps and should not be altered manually in Survey123. Carefully verify that the tract and plot numbers match the location you are at by comparing them to the field map in Avenza.

#### 7.2.1 Tract Number and Sample Plot Number

The tract number consists of up to six digits and is pre-filled in the Sample Plot App. Confirm that the number matches the one shown on the field map in Avenza. Each tract originally contains 196 sample plots, numbered from 1 to 196. The number of plots to be inventoried in the field varies between tracts. The sample plot number is also pre-filled in the Sample Plot App, ensure it matches the one shown in Avenza.

## 7.3 Survey Method

See Chapter 4.1 for determining the appropriate survey method. Select either field survey or distance survey. Additional steps are required in the Sample Plot App when distance survey is selected.

### 7.3.1 Distance Survey

When conducting a distance survey, complete the following steps in the Sample Plot App:

- Answer "No" to the question "Is it possible to collect coordinates at the plot center?"
- Take a distance coordinate and specify both distance and direction to the plot center. Use the field map in Avenza Maps to measure distance and bearing to the center. If the center location is visible, a compass direction may be used instead.
- Indicate the reason for performing a distance survey (Table 7.3.1).
- Take a distance photograph in the direction of the sample plot, from the nearest accessible point. If photographing toward private property or residences, maintain appropriate distance to avoid causing concern.

**Table 7.3.1.** Reason for conducting a distance survey, registered when access to certain steps is restricted due to obstacles.

Reason	Description
1 Permanent water	Permanent freshwater or saltwater below the mean water level.
2 Temporary under water >30 cm	The plot/sub-sample plot is not accessible due to water depth.
3 Inaccessible wetland	The plot/sub-sample plot (semi-aquatic) is inaccessible for safety reasons (e.g., quaking bog). Survey conducted from the edge of a nearby sub-sample plot. Minimal inventory
4 Arable land, annual crop	Growing or newly sown crop, or recently tilled soil. The plot/sub-sample plot must not be entered. Minimal inventory.
5 Mown ley	Arable land that is regularly ploughed and used for a forage crop consisting primarily of sown grass species. This perennial grass crop is periodically reseeded and harvested by mowing, not grazing. The plot or sub-sample plot must not be entered.
6 Inaccessible field islet	The plot/sub-sample plot cannot be accessed.
7 Island < 0.1 ha	The island is not visited.
8 Inaccessible steep terrain	Steep or difficult terrain. Slope > 25° in areas with rocks, cliffs, or boulder fields; > 35° in areas with established perennial vegetation.
9 Inaccessible due to landslide risk	Area with significant risk of landslides, erosion, or similar hazards.
10 Residential/industrial/private property	Enclosed or otherwise inaccessible private land near dwellings, facilities, or industrial sites.
11 Restricted access	Land with access restrictions (e.g., military areas) where permission could not be obtained during the survey season.
12 Not in Sweden	
13 Other reason – comment required	Specify the reason, e.g., railway area. Provide a comment in the app.

## 7.4 Photography

All sample plots must be documented with photographs. Photos of the sample plot and small samplings plots should be taken as one of the first steps after establishing the plot center and locating the small sample plots. The purpose of this photography is to:

- Document the location of the sample plot to facilitate future re-surveys.
- Capture the structure of the permanent plot in the field to support calibration of modelling and aerial photo interpretation.
- Create a photo archive for future studies of vegetation and landscape changes, as well as a reference library for evaluating different land cover types. Photos have, for example, been used in studies of recreational landscape preferences.
- Provide visual material for presenting survey results.
- Serve as a valuable aid in data validation and correction, as well as in understanding and illustrating changes.

Hold the phone in **landscape mode** when photographing (i.e., take horizontal images). Keep the phone steady until the photo is fully taken, especially in low-light conditions. Use the camera's auto-flash and the full wide-angle setting (no zoom). In bright backlight conditions, using forced flash may help highlight details. Try to shade the lens (without covering the image) to minimize glare. Survey123 uses the camera app's settings, do not alter them or remove GPS tagging. After taking the photos, check the quality on the screen. If a photo is poor, take another one. However, a bad photo is better than none at all.

### 7.4.1 Photo Documentation in Distance Survey

When a sample plot cannot be accessed (i.e., during distance survey), take a photo toward the plot from a reachable location.

- Specify the direction to the plot center from where the photo is taken.
- Specify the distance to the plot center from that location.

### 7.4.2 Photo Documentation in Field Survey

In field survey, photos are taken at plot level for all survey types, both detailed and minimal. Photos of the small sample plots are only taken for those that are surveyed. If the center of small sample plot 3 does not fall within a detailed survey sub-sample plot, only a side photo is required.

#### *Sample plot Photography*

Photos are taken using the Sample Plot App (landscape mode).

All field-inventoried sample plots are photographed in the same way, regardless of whether the plot contains a target habitat type or not (i.e., for both detailed and minimal survey types).

Five photos are taken of the plot (Table 7.4.1):

One photo is taken in each cardinal direction (north, east, south, west) from a point approximately 4 meters behind the plot center, facing the respective direction. Ensure the

center marker is visible and centered in the frame. Do not include any equipment or people in the photo.

The fifth photo is taken straight up from the center of the sample plot at a height of 1.3 meters. It is important to point the camera directly upward and avoid capturing any body parts. This photo is intended for future crown cover analysis using image processing.

**Table 7.4.1** Cardinal Direction and Canopy Cover Photographs. Photographs taken in landscape orientation.

Photo Direction	Description
Photo N	Photo facing north, taken 4 meters behind the plot center
Photo E	Photo facing east, taken 4 meters behind the plot center
Photo S	Photo facing south, taken 4 meters behind the plot center
Photo W	Photo facing west, taken 4 meters behind the plot center
Canopy Cover Photo: Plot Center	Taken straight upward from the plot center at a height of 1.3 meters

### Photography of the small plots

Note: These photographs are only taken when a detailed inventory is carried out.

Photographs of the small plots are taken using the Sample Plot App.

For each small plot to be inventoried, three photographs are taken in landscape mode (see Figure 3.1):

1. A photo is taken from the edge of the sample plot, looking inward toward the small plot, with the center of the small plot and the center of the sample plot aligned. The small plot center must be visible in the image.
2. A second photo is taken directly from above, capturing the central part of the small plot. This photo is taken with the field assessor standing **north** of the small plot to minimize shadows in the image. A closed folding ruler is placed horizontally at the lower northern edge of the photo, just outside the 0.56 m radius, and this applies to all three small plot positions.
3. The third photo is taken straight upward, from a height of 1.3 meters, at the center of the small plot, without pressing down the vegetation inside the plot. It is important to photograph directly upward without capturing any body parts. This image is used for crown cover analysis through image processing.

**Table 7.4.2.** Photographs of Small Sample plots. All photos must be taken in landscape orientation.

Photograph of		
Small sample plot 1, 2, 3	Side	See description Photographing Small Sample plots
	Downward	Photo taken vertically downward over the plot
	Canopy	Photo taken straight upward from plot center

**Table 7.4.3.** Photography options. For each photo that includes objects or individuals protected under GDPR, this must be indicated during image capture.

Option per Photograph Taken	
Submit via survey	Default option
Submit via survey, GDPR*	If the image includes e.g. houses, vehicles, or people
Not taken / Other reason	

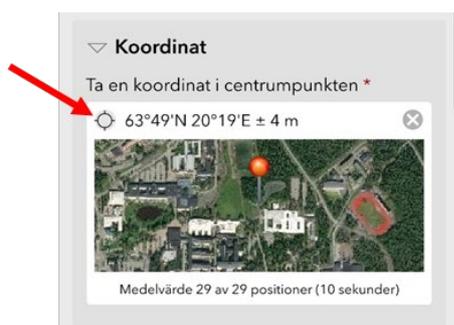
\* GDPR = general data protection regulation

## 7.5 Coordinates

Allow the phone's GPS to stabilize for a while before recording the center coordinate of the sample plot. It may be advisable to take the coordinate at the end of the inventory flow.

When data collection begins in the Sample Plot App, a coordinate is automatically noted regardless of where the field assessor is located, this could be at the sample plot, at the car, or elsewhere. This coordinate must be updated to reflect the correct location, i.e., the center of the sample plot. It is essential to actively update the coordinate by tapping the "location button" indicated by the red arrow (Figure 7.1), which updates the coordinate to the center point. Hold down the "location button" until it begins averaging positions, e.g. "Mean value 58 of 58 positions (60 seconds)." Finish recording when acceptable precision has been reached. A precision of up to 7 meters is acceptable. If precision is worse, check satellite availability using satellite prediction tools and, if possible, adjust the timing of the coordinate capture accordingly.

If it is not possible to record a coordinate at the center of the sample plot, this must be noted in the app.



**Figure 7.1.** The red arrow points to the "location button" that the field assessor should press when recording coordinates. Record the coordinate for the sample plot centre by allowing the phone's GPS accuracy to reach the best possible level, i.e., up to 7 meters.

## 7.6 Subdivision

Subdivision is noted in the Sample Plot App using the Subdivision App (see Section 6.5).

## 8. Sub-Sample Plot Inventory

### 8.1 Workflow Summary

In the Sub-Sample Plot App, variables related to the 10-meter plot and the assessment polygon are noted. An overview is provided in Table 8.1.1.

**Table 8.1.1** Link between variables, survey method, and survey type. A coloured cell in the table indicates that the variable is noted for that specific survey type. The table also shows where the variable is described in the manual, and which plot it is assessed on when applicable.

Survey Steps / Variables	Chapter	Survey method			Assessment area	
		Distance Survey	Type of survey		Plot (10-m radius)/sub-sample plot	Assessment polygon
			Detailed Survey	Minimal Survey		
Land cover	8.4.1					
Land use	8.4.2					
Angle count sampling	8.4.3					
Stand type	8.4.3					
Shoreline presence	8.4.4					
Soil type	8.4.5					
NILS habitat type classification	8.5.1					
Habitat classification	8.5.2					
Photograph of the assessment polygon	8.5.3					
Shrubs	8.6					
Tree cover	8.7					
Forest data	8.8					
Quality assessment	8.9					
Diameter measurements and dead wood	8.10					

## 8.2 Plot Information

To begin the inventory of a sub-sample plot, select the current sample plot in Field Maps and then click the link to the Sub-sample plot App. This launches the sub-sample plot survey in Survey123. The tract and sample plot numbers as well as the theoretical coordinates are transferred from Field Maps and should therefore not be manually edited in Survey123. Carefully verify that the tract and sample plot numbers match the plot you are at, comparing with the field map in Avenza.

### 8.2.1 Tract Number and Sample Plot Number

The tract number consists of up to six digits and is pre-filled in the Sub-sample plot App from Field Maps. Check against the field map in Avenza to ensure the number is correct. Initially, there are 196 sample plots in each tract, numbered from 1 to 196. The number of sample plots per tract to be inventoried in the field varies between tracts. The sample plot number is also pre-filled in the Sub-sample plot App, verify that the number is correct using the Avenza field map.

### 8.2.2 Sub-Sample Plot Information

Enter the sub-sample plot number and the total number of sub-sample plots for the sample plot. Enter the area of the sub-sample plot in square meters with two decimal places, based on the calculation from the sectioning app. Also specify the survey method used.

## 8.3 Survey Type

The survey type is determined based on whether the sub-sample plot contains a target habitat type or if the land is considered not relevant. For definitions of target habitat types and non-target land, see Chapter 5.1. For description and determination of survey types, see Chapter 4.2. The field assessor typically determines the survey type before any sectioning is performed and before the survey begins. The survey type determines which variables are collected in the sub-sample plot (Figure 8.1).

Select the survey type in the app:

- Detailed Survey
- Minimal Survey
- Distance-Based Survey

## 8.4 Land Classification

Landscape classification is commonly applied both nationally and internationally and plays a crucial role in reporting related to, for example, national environmental objectives, the EU Habitats and Birds Directives, and cross-country comparisons. Therefore, a set of different land classes is needed to meet the needs of various stakeholders, particularly for international reporting purposes.

The classification is conducted at the *assessment polygon* level. This means that when registering land use, land cover, and stand type for a specific sub-sample plot, the field assessor may often need to step outside the 10-meter plot boundary to accurately determine land use and land cover.

**Note:** This classification applies to all sample plots, including those surveyed at a distance as well as those inventoried in the field under both detailed and minimal survey protocols.

### 8.4.1 Land Cover

Land cover is registered for all sample plots and sub-sample plots, regardless of whether a detailed or minimal survey is conducted. Land cover refers to the physical and biological surface features of the land (e.g., vegetation, rock, soil, water, and artificial surfaces), independent of land use or management intention. The land cover classes are listed in Table 8.4.1.

- Registration is conducted for the entire sample plot or separately for each sub-sample plot if such divisions exist.
- If multiple land cover types are present within a sub-sample plot, the dominant type is noted.
- Assessment is made at the **assessment polygon** level. Field assessors may need to step outside the 10-meter area to correctly classify both land use and land cover.

**Table 8.4.1.** Land cover within the assessment polygon

Land cover	Definition/Description
1. Permanent water	Water (all permanent freshwater and/or saltwater below the mean waterline, including the shoreline).
2. Constructed land	Land that is paved, excavated, or covered by buildings or constructions.
3. Arable land	Regularly plowed land with crops in the crop rotation, including annual crops, mown ley, and pasture meadows. Fallow arable land is included. Also includes other cultivation on previously plowed/processed land such as energy forests and commercial fruit and berry cultivation. Small plots on residential land, such as potatoes, are classified as Built/Hard/Developed land. NOTE! Arable land planted with forest trees is not considered arable land but forest land. Temporarily plowed pasture (included in the crop rotation) is considered arable land. NOTE! However, permanently grazed land is not classified as arable land, but as other natural land. This is indicated by the absence of clear plowing marks in the land and vegetation.
4. Urban land	Urban land (e.g., urban green spaces and residential land).
5. Bare land	Land naturally without vegetation cover.
6. Tree-covered wetland	Peatland $\geq 10\%$ canopy cover and tree height $> 5$ meters or has the potential to reach this height and canopy closure without production-enhancing measures.
7. Mountain birch forest	Forest in the Scandinavian mountain with dominance of birch ( $\geq 50\%$ GY), canopy cover $\geq 10\%$ and height $> 5$ meters, or has the potential to reach this height and canopy closure without production-enhancing measures.
8. Other tree-covered land	Other tree covered land $\geq 10\%$ canopy cover, height $> 5$ meters, or has the potential to reach this height and canopy closure without production-enhancing measures, i.e., clear-cut phase is included. This includes forests and tree-covered grasslands.
9. Open wetland	Peatland $< 10\%$ canopy cover.
10. Glacier	Permanent core of ice.
11. Permanently snow-covered	Permanently snow-covered land
Low vegetation (For classes 12-16)	Land with vegetation cover of grasses, dwarf-shrubs, shrubs, and sparsely distributed trees that do not meet the criteria for forest or open wetland. Land kept open by climatic conditions or natural/anthropogenic disturbance.
12. Shrubland: Field layer dominated by grasses or herbs	Shrubs cover $\geq 30\%$ of the area. The field layer is dominated by grasses and/or herbs. Not tree-covered land or open wetland.
13. Shrubland: Field layer dominated by shrubs	Shrubs cover $\geq 30\%$ of the area. The field layer is dominated by shrubs. Not tree-covered land or open wetland.
14. Shrubland: Other	Shrubs cover $\geq 30\%$ of the area. Not tree-covered land or open wetland.
15. Open land dominated by dwarf-shrubs	Land with a vegetation cover of dwarf -shrubs.
16. Open grassland	Land with a vegetation cover of grasses and/or herbs.

Source: <https://www.lantmateriet.se/contentassets/85c3aea770ab45f2a74fab18a1d0d724/natspec-marktacke-v1.0.1.pdf>

## 8.4.2 Land Use

Current land use is noted for all sample plots and sub-sample plots, including those subject to detailed or minimal surveys. Land use is documented to provide insight into how the land is being utilized.

The assessment is carried out at the **assessment polygon** level.

- If multiple types of land use are present within the sub-sample plot, the dominant one is noted.
- Registration is performed for the entire sample plot or separately for each sub-sample plot, if applicable.
- “Current land use” generally refers to activities taking place in the current year or the four preceding years, or when there is clear evidence that the activity will continue.

*Table 8.4.2. Land use within the assessment polygon.*

Land Use	Definition/Description
1. Water	Water (all permanent freshwater and/or saltwater below the mean waterline, including the shoreline). Water is not considered land use, but we are only interested in terrestrial land use.
2. No visible land use	Insignificant land use. Example of when the class is normally used: Extensive land use such as reindeer grazing (see reindeer enclosure below) or berry picking, which is not significantly used for other purposes. Non-productive forest land and other forestry impediments. NOTE! Productive forest land that could be used for forestry and is not strongly affected by other land use should be noted as 17. Forestry.
3. Buildings	Area with various types of building and construction areas containing building structures.
4. Animal husbandry	Area for breeding, raising, training, and caring for pets and other animals kept fully or partially in captivity. The purpose may be the production of food or other goods.
5. Mine	Area where mining activities take place, including slurry ponds and land with equipment for mining. Comment: Refers to active mines and closed mines that have not been reclaimed.
6. Green area	General term for any type of area in built environments not covered by buildings or hardened surfaces. Park or natural areas. Areas with opportunities for recreational activities, e.g., walking, picnicking, etc. Includes: Parks, Lawns (not lawns on residential plots, which fall under buildings), Tall grass areas, Natural areas with minimal maintenance.
7. Harbor	Area at sea, lake, or watercourse providing natural or artificial protection against waves or tides for anchoring ships.
8. Industry (not quarry, mine, wind farm, or solar park)	Land primarily used for industrial activities. The type of industry is defined by the purpose of the buildings.
9. Agriculture: Grazing and mowing	Area used for or previously used for grazing or mowing, not part of a crop rotation, and not regularly plowed.
10. Agriculture: Short Rotation Coppice for energy	Area for growing fast-growing trees or shrubs for energy, often willow, poplar etc.
11. Agriculture: Christmas tree cultivation	Area for cultivating Christmas trees.

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12. Agriculture: Arable, hay, and crop rotation, fruit, and berry cultivation	Land plowed for the cultivation of grains, forage plants, oilseeds, root vegetables, and vegetables. Fruit and berries cultivated on trees and shrubs. Also includes occasional plowing of pastures as part of crop rotation. Fallow arable land is reported as arable land. Hayfields and gardens near residential homes are excluded.
13. Military area	Area for military training activities or military facilities.
14. Recreation	Land primarily used for activities related to sports, leisure, or culture.
15. Reindeer enclosure	Enclosure used for separating and slaughtering or marking reindeer. Reported if the reindeer enclosure is used.
16. Public service area	Area used for public utility activities, e.g., cemeteries, correctional facilities, sewage treatment plants, waste facilities, traffic training areas, civil training fields, school areas, hospital areas, or areas with other health facilities, transformer areas.
17. Forestry	Includes forest land used or potentially usable for forestry and not strongly influenced by other land use. NOTE: Unlike the formal definition (productive forest land according to Swedish definition, see Chapter 7.6.4), abandoned agricultural land not actively replanted and where regrowth has not yet resulted in 10% canopy cover and 5-meter height (land type Other/Natural land) is not included. This category also includes forest reserves, clear-cuts, and seed orchards. Some types of forest pastures where the tree layer and vegetation still resemble forest land are also included, along with smaller recreational areas (rest areas, jogging tracks) in otherwise forest-dominated environments, as well as all forests planted on former agricultural land.
18. Solar power plant	Solar power plant.
Transport	System for transporting goods, people, and services.
19. Transport: Railway area	Area for railways or trams, including embankments.
20. Transport: Railway facility area	Defined area around railways or tramways, railway yards, engine sheds, etc.
21. Transport: Airport area	Area used for air transport, e.g., airports and associated services.
22. Transport: Road area	Land occupied by road infrastructure, including road verges.
23. Quarry	Quarry is the term for a site or deposit exploited for the extraction, mining, or collection of gravel, moraine, rock, peat, blocks, stone, clay, sand, limestone, soil, or other material from property for the purpose of utilizing the extracted material through sale or personal use.
24. Wind farm	Wind farm.
25. Other agricultural industries like nurseries, horticultural businesses	Area for growing plants of garden, forestry, or agricultural species from seeds or vegetative propagation units for later planting in gardens, forests, or fields. Area used for professional cultivation and/or sale of vegetables, fruits, berries, ornamental plants, and nursery plants.

Land use classes are based on: <https://www.lantmateriet.se/contentassets/8201fbfc9bce4b1998a84d9bbe245b0c/natspec-markanvandning-v1.0.1.pdf>

### 8.4.3 Basal Area, Stand Type, and Stand Age > 50 Years

#### *Basal Area – Relascope*

Relascope measurements are conducted within the assessment polygon in all tree-covered areas to determine the distribution of tree species. In open grasslands, 0 relascope measurements are noted, and the stand type is marked as not applicable. Enter the number of relascope measurements to be taken, filling in 0 for distance-based surveys. Conduct one to three relascope measurements to assess the basal area. If the sample plot or sub-sample plot is located at the edge of the stand, the relascope measurements should be taken further into the assessment polygon or in a semicircular pattern towards the stand, with the results then multiplied by two. If the stand has an elongated, narrow shape, the wider slot on the relascope may be used, and the totals should be multiplied according to the instructions of the instrument.

For each relascope measurement, the number of trees in each category should be noted as specified in Table 8.4.3.

To assess the basal area, a relascope is used. The principle is that the field assessor, from a fixed point, sequentially views all living tree trunks in the surrounding area. Those trees that fully fill the instrument's sighting aperture when aimed at breast height (1.3 meters above ground) are noted. For trees with upward-branching stems splitting below 1.3 meters, the main stem, as well as any other stems filling the aperture, should be noted in the same way as other stems. Each tree species is counted separately. The total basal area is then automatically calculated.

**Table 8.4.3.** *Tree Categories.*

<b>Tree categories</b>	
Coniferous trees <sup>1</sup>	All coniferous trees including larch
Birches	Native birch trees: silver birch and downy birch
Elms <sup>1,2</sup>	Native elm trees
Ash <sup>1,2</sup>	European ash
Hornbeam <sup>1,2</sup>	European hornbeam
Beech <sup>1,2</sup>	European beech
Oak <sup>2</sup>	Native oak trees: English oak and sessile oak
Other broad-leaved trees <sup>2</sup>	Includes linden trees, Norway maple, and wild cherry
Exotic deciduous trees <sup>1</sup>	Non-native deciduous trees. Include a blue note (see Glossary and Chapter 10.4), with comments on tree species and photo.
Common deciduous trees <sup>1</sup>	Common deciduous trees, not specified above.

1. See the Tree List in Appendix 1

2. Broad-leaved Trees

*Forest Type*

The Forest Type (NFI) classification used in this manual follows the definitions established by the Swedish National Forest Inventory. These definitions form the basis for how Forest Type (NFI) are recorded within both the NILS Grassland Survey and the NILS Deciduous Forest Inventories.

The Forest Type (NFI) is noted for both the sub-sample plots that are fully surveyed and those that are minimally surveyed. Only one Forest Type can be selected for each sub-sample plot. Forest Type should be specified for all plots/sub-sample plots. In distance-based surveys, 0 relascope measurements are noted, and the stand type is assessed visually.

*Table 8.4.4 Forest Type.*

<b>Forest Type (NFI)</b>	<b>Description</b>
Not applicable	Canopy cover <10%
Coniferous forest	Proportion of coniferous trees $\geq$ 65% of basal area
Mixed forest	Proportion of coniferous trees 35–64% of basal area
Birch forest	Proportion of birch $\geq$ 65% of basal area
Deciduous forest	Proportion of deciduous trees $\geq$ 65% of basal area, with broad-leaved trees < 45% of basal area, but not classified as birch fores
Broad-leaved forest	Proportion of deciduous trees $\geq$ 65% of basal area and broad-leaved trees <sup>1</sup> $\geq$ 45% of basal area

*1. Broad-leaved trees include oaks, beech, elms, lindens, (forest) maple, hornbeam, and sweet cherry.*

*Stand Age Below 50 Years*

This variable is noted for both fully and minimally surveyed sub-sample plots. Since deciduous forests younger than 50 years are not subject to full surveys, a variable is needed to indicate that the minimal survey method was chosen due to the stand being below the required age threshold.

*Table 8.4.5 Stand Younger than 50 Years.*

<b>Younger than 50 years?</b>	<b>Definition for each class based on tree species composition</b>
Not applicable	Canopy cover <10%
Yes	Noted when the stand is estimated to be younger than 50 years, regardless of stand typ.
No	Noted when the stand is estimated to be 50 years or older, regardless of stand type.

#### 8.4.4 Presence of Shoreline

This variable is noted for all sub-sample plots, regardless of survey type, and includes both freshwater (limnic) and marine shorelines (Table 8.4.6). The presence of shoreline adjacent to permanent water bodies is documented within the sub-sample plot.

**Table 8.4.6** *Presence of Terrestrial Shoreline. The table includes terrestrial shore zones between the mean water level and the high-water mark for freshwater bodies, as well as the presence of shoreline at the sea, where extreme high-water levels and the splash zone are included.*

Presence of Shoreline	Definition/Description
No shoreline	No terrestrial shoreline present.
Freshwater shoreline: watercourse width >0-2 m	Presence of terrestrial shoreline is noted for small watercourses with a width of 0–2 meters from mean water level to mean water level.
Freshwater shoreline: watercourse width >2-6 m	Presence of terrestrial shoreline is noted for small watercourses with a width >2–6 meters from mean water level to mean water level.
Freshwater shoreline: watercourse width >6 m	Presence of terrestrial shoreline is noted for larger watercourses with a width >6 meters from mean water level to mean water level.
Freshwater shoreline at standing water	Presence of terrestrial shoreline is noted for standing water bodies (e.g. lakes, ponds) $\geq 100 \text{ m}^2$ in area and with a minimum width of 5 meters from mean water level to mean water level.
Coastal shoreline	Presence of coastal terrestrial shoreline is noted along the marine coast, including areas affected by extreme high-water levels and the marine splash zone.

#### 8.4.5 Land Type (Markslag)

To enable joint analysis of the collected data with REMIIL, this shared variable is noted. Land type (*markslag*), based on Allard (2019), with modifications from the Regional Environmental Monitoring of Small Biotopes, Grasslands and Wetlands (REMIIL), is assigned at the assessment polygon level.

**Table 8.4.7** *Land Type (markslag), Main Category in the Assessment Polygon. The key first identifies the primary land type category, followed by the appropriate subgroup to which the land can be assigned.*

Land Type, Main Category	Description
Terrestrial semi-natural grassland	Land with grassland vegetation suitable for grazing or mowing, but which is not suitable for ploughing or is strongly influenced by previous arable use. This category also includes grazed rocky outcrops and bare rock. When tree and shrub cover exceeds 60%, the vegetation is typically too shaded to maintain grassland species indicative of traditional management.
Arable and former arable land	Land that is or has been ploughed and used for cultivation of field crops or ley, but has not transitioned into forest or another non-agricultural use. Unmanaged or abandoned land undergoing natural succession is classified as forest land once tree and shrub cover exceeds 60%.
Constructed land (excluding arable land)	Land that is engineered or modified (typically for a specific purpose), including paved surfaces, buildings, or intentionally planted/sown vegetation. This type excludes land defined as arable or former arable.
Natural terrestrial land, excluding forest	Unmodified land kept open by natural processes or by thin soils (e.g. mountain heaths, scree slopes, natural rocky outcrops), or land maintained open by other human uses (e.g. managed

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recreational areas on natural ground, nature house lots). Includes low-productive forest land on exposed rock.

Natural land with forest and/or forestry use	Forested land with no use or used for forestry (e.g. clearcuts and young forest). The land is productive forest land with a potential yield of at least 1 m <sup>3</sup> sk per hectare and year. On low-productive sites with older forest, this corresponds to roughly 60% tree cover. This does not include constructed land with dense tree cover, such as urban parks. Land dominated by trees and shrubs that is not maintained open by other land use or is used for forestry (e.g. clearcuts and young forest). Also includes dense woody areas in e.g. grazing pastures. Constructed land with dense trees (e.g. in parks) is excluded. This is considered productive forest land.
Semi-aquatic land, excluding forest	Land with peat-forming vegetation due to high soil water saturation (e.g. mires), or otherwise shaped and maintained by hydrological conditions. Includes seasonally flooded shorelines, with or without vegetation. The boundary between terrestrial and semi-aquatic land is defined by the high-water mark in an average year. Land may have tree cover but should not have the potential to yield 1 m <sup>3</sup> sk/ha/year.
Aquatic surface	Permanently water-covered land (excluding artificial basins in constructed land). The boundary with semi-aquatic land generally follows the low-water mark in an average year. Where this boundary is difficult to determine during a single field visit, it may be drawn at the actual waterline observed during the survey. Alpine streams should use the land type classification of the terrestrial shoreline.

Land Type Subgroup	Description
<b>Terrestrial semi-natural grassland</b>	
1. Managed pasture/mowing meadow	Permanent pasture or meadow with grassland vegetation that is maintained but unsuitable for ploughing and not strongly influenced by historical arable use. Includes newly reclaimed pastures if vegetation is continuous and suitable for grazing. If the vegetation is not suitable for grazing but grazing is clearly intended, classify as class 16.
2. Abandoned pasture/mowing meadow	Permanent pasture or meadow with grassland vegetation not strongly affected by ploughing, suitable for grazing or mowing but currently unmanaged. To be classified here, the land must be restorable for grazing/mowing without major interventions. If tree and shrub cover exceeds 60%, the land is typically reclassified as forest.
3. Grazed rocky outcrop/bare rock	Rocky or exposed bedrock areas with thin soils (<10 cm) lacking grassland vegetation but clearly affected by grazing. Often with a sparse or disturbed ground layer. May include weathered gravel. (Motivation: although unproductive, these areas are integral to the pasture system.)
<b>Arable and former arable land</b>	
4. Arable land in use (cropland/ley)	Arable land in crop rotation, under cultivation of field crops or ley, fallow, or recently tilled/sown. Includes energy crops and orchards/berry cultivation on arable land.
5. Arable land with permanent grazing/mowing	Arable land suitable for ploughing and cropping but currently used as permanent pasture or meadow. Few or no trees/shrubs >1.3 m.
6. Unused arable land	Arable land suitable for ploughing and cropping but not currently in agricultural use. Few or no trees/shrubs >1.3 m.
7. Former arable with grazing/mowing	Previously ploughed land now used for permanent grazing or mowing but no longer suitable for ploughing due to encroachment of trees/shrubs, frost heave of stones, or excessive wetness. Tree cover <60%.

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8. Unused former arable land Land formerly used for ploughing and cropping but now unsuitable for ploughing due to woody encroachment, frost-heaved stones, or waterlogging. Tree cover <60%.

### Constructed land, excluding arable land

9. Agricultural area on constructed land Constructed land adjacent to arable areas or farmsteads with agricultural functions (not residential yards), e.g. field margins, wide ditches, or farmyards.

10. Transport infrastructure Constructed land with roads or other transport infrastructure (railways, parking lots, harbours, airports, etc.). Includes road verges, ditches, and carriageways.

11. Residential and commercial buildings Constructed land with housing, public or commercial buildings, e.g. cemeteries, shops, offices.

12. Industrial area Constructed land with industrial activity, e.g. workshops, factories, large-scale gravel/rock quarries, utility facilities (e.g. transformer stations).

13. Recreational area Constructed land with recreational infrastructure, e.g. golf courses (incl. golf course ponds), campsites, or sports facilities.

### Natural terrestrial land, excluding forest

14. Natural bedrock and boulder field Bedrock or boulder areas with no or thin soil (<10 cm) and no evident grazing influence. Often covered by lichens, mosses, or a thin humus layer. May contain trees but should lack the capacity to produce  $\geq 1 \text{ m}^3\text{sk/ha/year}$ . If canopy cover >10% and tree height >5 m, classify as 18 or 19.

15. Other land shaped by harsh climate/natural disturbance Land kept open due to natural processes or thin soil cover. Includes alpine habitats above the productive forest line and areas influenced by avalanches, wind erosion, or similar disturbances. Excludes flood-affected or semi-aquatic land. Temporary events like wildfire or windthrow are not included.

16. Mountainous unproductive forest Includes all unproductive mountain birch and coniferous forests in the transitional zone between productive forest and alpine tundra. Productivity <1  $\text{m}^3\text{/ha/year}$ . The threshold is set at 10 m average height for conifers and 12 m for mountain birch.

17. Other land shaped by human disturbance/use Unconstructed land kept open by human activity other than agriculture or forestry. Includes natural vegetation patches (e.g. sparse tree groups, nature lots) within campsites or developed areas. Also includes wide utility corridors with spontaneous vegetation, possibly managed by mowing. Field edges and road verges next to constructed roads are excluded.

18. Unproductive forest land without evident forestry impact Unproductive forest land without evident forestry impact Unproductive forest land with older trees showing no signs of logging, thinning, or clearance. Tree cover >10%, height >5 m. Mountain Forest areas belong to class 16.

19. Unproductive forest land with evident forestry impact Unproductive forest land with evident forestry impact Unproductive forest with signs of logging, thinning, or soil preparation. Tree/shrub density varies by successional stage.

### Natural land with forest and/or forestry use

20. Productive forest land without evident forestry impact Productive forest with older, naturally regenerated trees, not visibly affected by forestry. Excludes constructed land, even if densely wooded (e.g. parks).

21. Productive forest land with evident forestry impact Productive forest land with evident forestry impact Productive forest showing signs of logging, thinning, or site preparation. Tree/shrub density varies depending on stage. Recently afforested farmland is included if significantly altered by forestry (e.g.

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harrowing). If vegetation retains grassland character, classify as 17 until tree/shrub cover exceeds 60%.

22. Productive forest of encroachment character	Productive forest of encroachment character Productive land with dense tree/shrub cover (>60%) primarily resulting from natural encroachment on previously open land. Includes former constructed land if abandoned and reverting to natural succession.
23. Semi-aquatic land with forest, no evident forestry impact	Defined similarly to terrestrial counterparts but affected by water (flooding, high groundwater). Transition to more open semi-aquatic land (e.g. forested mire) is at ~60% canopy cover, aligning with the definition of "swamp forest".
24. Semi-aquatic land with forest, with evident forestry impact	As above, but visibly affected by forestry. Often drained to reduce waterlogging, though not enough to eliminate semi-aquatic character.
25. Semi-aquatic land with forest of encroachment character	Defined as for terrestrial encroachment forests, but with significant water influence. Common examples include productive zones along ditches in peatlands or former farmland that has become waterlogged and overgrown (e.g. abandoned peat cultivation fields) now considered productive forest land.
<b>Semi-aquatic land without forest (unproductive land)</b>	
26. Peat-forming land (mire), excluding shorelines	Open or semi-open land with active peat-forming vegetation, including areas with thin peat layers (e.g. rich fens). Usually minerotrophic (topogenic or soligenous), nutrient-poor, dominated by white or brown mosses. Also includes peat cuttings with potential for mire restoration. Tree cover <60%.
27. Peat-forming land (mire), shoreline influenced	Open or semi-open peat-forming land with limnogenic influence (from lakes, rivers), resulting in higher nutrient input and typically more lush vegetation. Peat may be mixed with mineral material due to wave action or currents.
28. Non-peat-forming land, excluding shorelines	Land kept open by non-shore-related water effects (e.g. saturation, temporary flooding), but not forming peat. Includes waterlogged soils, wet depressions, and fluctuation zones.
29. Non-peat-forming land at shorelines	Open land near water bodies kept open by fluctuating water levels, waves, current, and ice scouring, but not forming peat. Includes both natural and semi-managed shore meadows. The upper boundary toward terrestrial land is defined by the annual high-water mark.
30. Semi-aquatic land shaped by human disturbance/use	Wet land kept open by non-forestry human activity, such as clearing woody vegetation in transmission line corridors through wetlands.
<b>Aquatic surfaces</b>	
31. Aquatic surface excluding mire mosaics	All permanently water-covered surfaces not part of mire mosaics, or not "secondarily formed" in peat (e.g. not flark pools). Includes lakes and ponds with mineral or organic bottom where mire vegetation gradually encroaches from the edges. Water levels may fluctuate. Pools in artificial basins (e.g. tiled or concrete) are excluded.
32. Aquatic surface in mire mosaics	Permanently water-covered areas within peatland mosaics, especially "secondarily formed" pools (e.g. flarks). Typically, nutrient-poor and surrounded by peat. Excludes temporarily flooded, soft-bottom mires that are not clearly separated waterbodies.

## 8.5 Habitat Type Classifications

### 8.5.1 NILS Habitat Type Classification

Assessment is conducted at the level of the assessment polygon, meaning that the field assessor typically must move beyond the 10 m plot boundary (into the assessment polygon) to classify the habitat type. Definitions of the overarching classes, open grasslands, wooded grasslands, and broad-leaved forests, are provided in Chapter 5.1. A target habitat type must be classifiable as one of the NILS habitat types (Table 8.5.1).

For broad-leaved forests, if the habitat meets the naturalness and age criteria for EU habitat classification, the same class is used as for the NILS classification. In contrast, for grasslands, NILS habitat types and EU habitat classes do not correspond directly, and the habitat classification must therefore be conducted separately.

Table 8.5.1 NILS Habitat Type Classification. Select the appropriate habitat class.

NILS Habitat Type	Description
Not applicable	Non-target land; see definition in Chapter 5.2. Includes active arable fields and fallow land. The land does not meet the criteria for main target habitat types. All land not classified as open grassland, wooded grassland, or deciduous forest according to the definitions in Chapter 5.1.
NILS Habitat Type	Description
Open Grasslands	
Managed semi-natural grassland	Ongoing grazing or mowing on semi-natural grassland. Grasslands on mineral soil that have been grazed by livestock or mown for a long period of time. The land shows no or only minor signs of cultivation (ploughing, harrowing) or fertilisation. Includes grazed boulder and bedrock areas. Mires used for mowing are excluded.
Formerly managed semi-natural grassland	Formerly managed semi-natural grassland not grazed or mown for at least the past 5 years. Previously grazed or mown for a long period of time. The land shows no or only minor signs of cultivation or fertilisation. Currently undergoing succession at various stages.
Managed cultivated/improved grassland	Ongoing grazing or mowing on improved or cultivated grassland. The soil shows signs of fertilisation, sown leys, or modern cultivation. Species typical of long-term management are absent or occur only sparsely.
Formerly managed cultivated/improved grassland	Formerly managed improved or cultivated grassland not grazed or mown for at least the past 5 years. The soil shows signs of fertilisation, sown leys, or modern cultivation. Species typical of long-term management are absent or occur only sparsely. Currently undergoing succession.
Moist meadow	Moist meadow. Managed moist meadows on acidic to basic, sometimes peat-rich soils. The habitat has developed through long-term continuity of management (mainly grazing) but may now be undergoing succession. Moist meadows resemble coastal meadows but are not influenced by salt or brackish water and do not occur along the seashore. Found below the tree line.
Tall-herb meadow	Tall-herb meadow. Dominated by tall herbs. Occurs on moist to wet soils along lakes and rivers where disturbances such as grazing, flooding, or ice-scouring prevent shrub and tree establishment; also found in alpine areas above the coniferous forest line.
Managed alluvial meadow	Ongoing grazing or mowing on grasslands along large rivers that flood during spring and summer. Vegetation dominated by tall sedges (e.g., <i>Carex aquatilis</i> , <i>C. acuta</i> ),

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	Calamagrostis stricta or Equisetum fluviatile. Traditionally used as hay meadows (“raningar”).
Unmanaged alluvial meadow	Grasslands along large rivers that flood during spring and summer without ongoing grazing or mowing (for at least the past 5 years). Vegetation dominated by tall sedges (as above). Formerly used as hay meadows (“raningar”).
Managed coastal meadow	Ongoing grazing or mowing along the seashore. Bounded downwards by the mean water line and upwards by the mean high-water line. Usually with a fully closed vegetation cover.
Unmanaged coastal meadow	Coastal grasslands without ongoing grazing or mowing for at least the past 5 years. Usually with a closed vegetation cover of perennial vascular plants. Bounded downwards by the mean water line and upwards by the mean high-water line. May be naturally open or formerly used for grazing or mowing.
Managed sandy grassland	Sandy areas under ongoing grazing or mowing where the sand is mostly stabilised by vegetation cover. No longer subject to sand accumulation, though small patches of bare sand may occur (e.g., heaths or sandy grass heaths).
Unmanaged sandy grassland	Sandy areas without ongoing grazing or mowing where the sand is mostly stabilised by vegetation cover. No longer subject to sand accumulation, though bare sand patches may occur (e.g., naturally open dune areas).
Sand pit	Abandoned or overgrown sand extraction sites.
Power line corridor dominated by grass	Cleared strip maintained for power lines. Classified here only if the area is kept open solely for the power line. If the line crosses open land belonging to another class, that class takes precedence. Actively used or fallow arable fields are not included.
Grassland along roads and railways	Roadside and railway grassland. Includes those parts of the road or railway area not consisting of the constructed surface itself. Road verges, ditches, and edge zones kept open for road or railway maintenance are included.
Arable field margin	Vegetated strips adjacent to arable fields but outside the road area. Includes buffer zones with perennial vegetation. Vegetation often influenced by fertiliser runoff from nearby fields, typically dominated by broad-leaved grasses.
Abandoned arable land	Ungrazed, grass-covered former arable land. Fallow fields are not included. Currently undergoing succession at various stages without a phase of grazing or mowing management.
Farmyard vegetation (semi-managed)	Farmyard influenced by management. The immediate area around farm buildings (not including maintained lawns).
Lawn	A dense, even, regularly mown grass surface not used for agricultural purposes. Found in gardens, parks, sports fields, and golf courses. Mown regularly to a short, even height using a lawn mower.
Other extensively managed grassland	Extensively managed grasslands such as large field islets, ruderal sites, training areas, ski slopes, or reindeer enclosures. Excludes power line corridors, road verges, sand pits, or any of the other grassland types listed above.

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<b>NILS Habitat Type</b>	<b>Definition/Description</b>
<b>Wooded Grasslands</b>	
Wooded Meadows	Deciduous trees $\geq 50\%$ of basal area (BA). Ground vegetation is influenced by current or historical mowing. Presence of traditionally managed trees (e.g., pollarded) can be significant.
Wooded Pastures (Deciduous Dominated)	Common deciduous trees + ash $\geq 50\%$ of BA. Presence of grazed or formerly grazed sward should be noticeable in the field layer.
Wooded Pastures (Broadleaved Dominated)	Deciduous trees $\geq 50\%$ of BA and broadleaved trees $\geq 30\%$ of total BA. Presence of grazed or formerly grazed sward should be noticeable in the field layer.
Wooded Pastures (Not Deciduous Dominated)	Deciduous trees (regardless of species) $< 50\%$ of BA. Presence of grazed or formerly grazed sward should be noticeable in the field layer.
Other Wooded Grassland	Tree-covered grasslands without influence of grazing or mowing. Grassland is managed not for fodder production but e.g., for aesthetic values. Examples include areas close to settlements and parks.

<b>NILS Habitat Type</b>	<b>Definition/Description</b>
<b>Deciduous Forests</b>	
Broadleaved Forest (including such forests in slopes)	Deciduous trees $\geq 50\%$ of BA; broadleaved trees $\geq 30\%$ of BA. Broadleaved forest on dry to fresh-moist soils (excluding oak forest, beech forest, floodplain broadleaved forest, or broadleaved wooded pasture). Soil may sometimes be moist due to seepage or groundwater movement.
Nutrient Poor Beech Forest	Beech $\geq 50\%$ of BA. Ground vegetation types, NILS codes 1, 2, 10–16 (Appendix 6).
Nutrient Rich Beech Forest	Beech $\geq 50\%$ of BA. Ground vegetation types, NILS codes 3–9 (Appendix 6).
Nutrient Poor Oak Forest	Oak or hornbeam $\geq 50\%$ of BA. Ground vegetation types, NILS codes 1, 2, 10–16 (Appendix 6).
Nutrient Rich Oak Forest	Oak or hornbeam $\geq 50\%$ of BA. Ground vegetation types, NILS codes 3–9 (Appendix 6).
Deciduous Swamp Woods	Common deciduous trees + ash $\geq 50\%$ of BA. Wet or moist soils influenced by high groundwater. Normally flooded annually, often causing buttress formation on trees. Can dry out completely during dry periods.
Alluvial Deciduous Forest	Common deciduous trees + ash $\geq 50\%$ of BA. Deciduous forest by watercourses, flooded annually with sediment deposits but not continuously wet. Deciduous trees dominate at least in the upper tree layer ( $\geq 50\%$ of BA).
Alluvial Broadleaved Deciduous Forest	Deciduous trees $\geq 50\%$ of BA; broadleaved trees $\geq 30\%$ of BA. May include aspen, birch, alder, and pine. Occurs by watercourses flooded annually with sediment deposits but not continuously wet.
Taiga (Deciduous Dominated)	Common deciduous trees + ash $\geq 50\%$ of BA.
Forest on Land-Upheaval Coast (Deciduous Dominated)	Common deciduous trees + ash $\geq 50\%$ of BA. Naturally formed forests on post-glacial uplift coasts. The area must be connected to the shoreline and extend maximally 3 meters above sea level. Includes the deciduous zone/belt.
Mountain Birch Forest	Subalpine forest dominated by birch ( $\geq 50\%$ of BA) above the conifer tree line.
Non-native Deciduous Forest	Deciduous trees $\geq 50\%$ of BA. Non-native tree species (deciduous or conifer) $\geq 50\%$ of BA.

### 8.5.2 EU Habitat Type

Sweden, like all other EU member states, is required under the Habitats Directive to report the presence and conservation status of a number of protected habitat types and species. Habitat classification is carried out using a separate habitat key on all sub-sample plots. In addition, variables are collected that can later be used to assess conservation status. These status assessment variables are partly based on the naturalness criteria described in Gardfjell & Hagner (2019) and, for grasslands, partly on Rūsiņa (2017b).

Habitat classification is performed using the habitat key (Gardfjell & Hagner 2019). In field surveys, all sub-sample plots are classified except those with minimal inventory. In distance-based surveys, habitat classification is carried out for all sub-sample plots classified as broad-leaved forest, grassland, or wooded grassland.

To conduct the classification, the field assessor must move beyond the 10 m plot boundary into the assessment polygon. Measured and estimated variables obtained from within the plot or sub-sample plot are not always fully representative of the entire forest stand or grassland to which the sub-sample plot belongs. Therefore, while these variables may be used as supporting information, the habitat classification must be an independent assessment based on a broader area of the stand or grassland.

The assessment polygon is typically 0.1 ha. For dry rock outcrop grasslands and calcareous rocky outcrops, the area is 100 m<sup>2</sup>.

Clarifications related to the habitat manual:

Alluvial meadows

To meet the habitat requirements for floodplain meadows, the width between the high-water line and the mean water line must be at least 10 meters on one side of the watercourse.

#### *69-codes*

In grasslands that do not meet the requirements for Annex I-habitat types, a 69-code is often applicable. These codes are defined in the habitat manual. To assess whether a grassland should be coded as 9999 or receive a 69-code, the following quality variables may be used:

If the Annex I criteria are not met, but at least 2 of the 3 criteria below are fulfilled, a 69-code is generally assigned (rather than 9999):

- Presence of 1–4 positive indicator species
- Partially or well-developed grass sward
- No dominance of negative species

**Table 8.5.2** *Annex I-habitat classification. Select the appropriate habitat class.*

<b>Annex I-habitat, code</b>	<b>Annex I-habitat, name</b>
1210	Annual vegetation of drift lines
1220	Perennial vegetation of stony banks
etc.	etc.

### 8.5.3 Photographing the Assessment Polygon

An additional photograph must be taken in the Sub-Sample Plot Application for each assessment polygon. The primary purpose is to capture an overview of the habitat type present within the polygon.

### 8.5.4 Description of the Assessment Polygon

Providing a description of the assessment polygon is optional, with a limit of 500 characters. This description can assist in identifying the polygon during subsequent visits.

## 8.6 Shrubs

The composition and cover of shrub species provide important indicators of land use history and soil nutrient status within the sample plot and are noted during detailed surveys. Shrub cover is estimated using a diffuse cover approach. Refer to Appendix 3 for details on diffuse cover. Cover includes live foliage (including damaged or dying parts of otherwise living shrubs) and stems/branches. For shrubs with late leaf emergence, cover is assessed as if the leaves were fully developed. In cases of defoliation, shrub cover is estimated as if the shrub retained its foliage. Entirely dead individuals are excluded. Note that *Salix* spp. (willows), *Populus tremula* (aspen), and *Sorbus hybrida* (Finnish whitebeam) with stem diameters below 20 mm at breast height (DBH) are classified as shrubs (willows). If the stem is 20 mm DBH or greater, they are considered trees. *Corylus avellana* (hazel) is always classified as a shrub. A full list of shrub species is provided in Appendix 1.

Criteria for recording:

- Shrub cover is noted within each subunit.
- Diffuse shrub cover is estimated, and the average height is measured for individual species or species groups within the subunit.
- If shrub cover is less than 1 dm<sup>2</sup>, record 0.01 m<sup>2</sup> to indicate presence.

### 8.6.1 Shrub Cover of Individual Species

Shrub cover of individual species or species groups refers to diffuse cover within the subunit (within a 10 m radius). The cover is expressed in square meters for each shrub species listed in Appendix 1. If shrub species grow in different vertical layers, the total summed cover may theoretically exceed the area of the subunit. Low cover values should be reported with higher precision than high ones (Table 8.6.1).

**Table 8.6.1** Estimated diffuse shrub cover (m<sup>2</sup>) of individual species within the subunit.

Coverage [m <sup>2</sup> ]	Reporting Precision
0.01 m <sup>2</sup> (1 dm <sup>2</sup> ) to 0.50 m <sup>2</sup>	Reported to the nearest 0.01 m <sup>2</sup> (1 dm <sup>2</sup> )
>0.50 m <sup>2</sup> to 1.0 m <sup>2</sup>	Reported to the nearest 0.1 m <sup>2</sup>
>1.0 m <sup>2</sup> to 5.0 m <sup>2</sup>	Reported to the nearest 0.5 m <sup>2</sup>
>5.0 m <sup>2</sup>	Reported to the nearest 1.0 m <sup>2</sup>

Note: If a shrub is present but the cover is less than 0.01 m<sup>2</sup> (i.e., less than 1 dm<sup>2</sup>), record it as 0.01 m<sup>2</sup> to indicate presence.

## 8.6.2 Mean Height of Shrubs by Species

Height refers to the average height of the living individuals of a given species or species group within the 10 m subunit and is noted to the nearest decimetre.

Note: Height is measured as vertical height from the ground (not along the stem).

While the mean height of tree stands is calculated as the basal area–weighted mean height (see Glossary), shrub height is assessed as a cover-weighted mean height, representing the typical height where the majority of the shrub cover for a given species/group occurs within the subunit. In other words, height classes with greater shrub cover should carry more weight in estimating the average height. Mean height is noted in conjunction with the species-specific cover values.

## 8.6.3 Total Shrub Cover

Diffuse total cover of all living shrubs within the 10 m subunit/subunits, without species-level separation. This variable describes how much of the subunit’s area is covered by shrubs when their canopy projection is viewed from above.

Note: The estimated total area cannot exceed the area of the subunit.

**Table 8.6.2** Total shrub cover within the subunit is noted in square metres according to the following scale.

Coverage [m <sup>2</sup> ]	Reporting Precision
0	Report 0 if there is no cover present.
0.01 m <sup>2</sup> (1 dm <sup>2</sup> ) to 0.50 m <sup>2</sup>	Reported to the nearest 0.01 m <sup>2</sup> (1 dm <sup>2</sup> )
>0.50 m <sup>2</sup> to 1.0 m <sup>2</sup>	Reported to the nearest 0.1 m <sup>2</sup>
>1.0 m <sup>2</sup> to 5.0 m <sup>2</sup>	Reported to the nearest 0.5 m <sup>2</sup>
>5.0 m <sup>2</sup>	Reported to the nearest 1.0 m <sup>2</sup>

*Note: If shrubs are present but cover less than 0.01 m<sup>2</sup> (i.e., 1 dm<sup>2</sup>), record the value as 0.01 m<sup>2</sup> to indicate presence.*

## 8.7 Tree Cover

The composition and cover of tree species reflect both land-use history and the moisture and nutrient status of the sample plot and are noted during detailed field survey. Changes in the tree layer can clearly indicate alterations in site conditions, such as anthropogenic disturbance.

Criteria for registration:

- Tree cover is noted within the sub-sample plot.
- All trees, regardless of height, are included.
- Dead branches on living trees are included.
- If tree cover is less than 1 dm<sup>2</sup>, record as **0.01 m<sup>2</sup>** to indicate presence.

### 8.7.1 Tree Cover by Species

Diffuse estimation of tree cover is applied; see Appendix 3 for details on diffuse cover.

Inventory must be conducted thoroughly, and all tree species present should be noted (though disproportionate effort should not be spent locating scattered, small individuals).

Cover is expressed in square metres for each species. All trees are included regardless of height. Dead parts of the crown on living trees are also counted. For species with late leaf-out,

estimate cover as if foliage is fully developed. In cases of defoliation, estimate cover as if foliage is intact.

If tree species occupy different canopy layers, the total species cover may exceed the area of the sub-sample plot (at least theoretically). Low cover values should be noted with greater precision than high values (see Table 8.7.1).

Note: *Salix caprea* (goat willow), other *Salix* species, and *Sorbus aucuparia* (rowan) with stem diameters  $\geq 20$  mm (measured at breast height) are classified as trees. If the stem diameter is  $< 20$  mm, they are classified as shrubs. *Corylus avellana* (hazel) is always classified as a shrub. A complete species list is provided in Appendix 1.

**Table 8.7.1** Tree cover by species within the sub-sample plot, noted in  $m^2$  according to the following scale.

Coverage [ $m^2$ ]	Reporting Precision
0.01 $m^2$ (1 $dm^2$ ) to 0.50 $m^2$	Reported to the nearest 0.01 $m^2$ (1 $dm^2$ )
>0.50 $m^2$ to 1.0 $m^2$	Reported to the nearest 0.1 $m^2$
>1.0 $m^2$ to 5.0 $m^2$	Reported to the nearest 0.5 $m^2$
>5.0 $m^2$	Reported to the nearest 1.0 $m^2$

Note: If a tree is present but the crown cover is less than 0.01  $m^2$  (i.e., 1  $dm^2$ ), record the value as 0.01  $m^2$  to indicate presence.

## 8.7.2 Total Tree Cover

Diffuse crown cover estimation without distinction between species, encompassing all living trees within the sub-sample plot (10 m radius). This variable measures the total area covered by tree crowns as projected vertically onto the ground surface.

Note: The estimated area must not exceed the area of the sub-sample plot.

All trees, regardless of height, are included. Dead portions of the crowns of living trees are also counted. Cover is expressed in square metres, with low cover values noted more precisely than high ones (see Table 8.7.2).

**Table 8.7.2** Total tree cover in the sub-sample plot, noted in  $m^2$  according to the following scale.

Coverage [ $m^2$ ]	Reporting Precision
0	Report 0 if there is no cover present.
0.01 $m^2$ (1 $dm^2$ ) to 0.50 $m^2$	Reported to the nearest 0.01 $m^2$ (1 $dm^2$ )
>0.50 $m^2$ to 1.0 $m^2$	Reported to the nearest 0.1 $m^2$
>1.0 $m^2$ to 5.0 $m^2$	Reported to the nearest 0.5 $m^2$
>5.0 $m^2$	Reported to the nearest 1.0 $m^2$

Note: If trees are present but the crown cover is less than 0.01  $m^2$  (i.e., 1  $dm^2$ ), record the value as 0.01  $m^2$  to indicate presence.

## 8.8 Forest Data

This section includes estimates of forest-related data within the assessment polygon during detailed surveys. In the case of grasslands, "stand" refers to the trees located within the assessment polygon. The data estimated include, among other things, the mean height and mean age of trees, as well as whether the land qualifies as forest land.

Data are noted according to Table 8.8.1 and Table 8.8.2.

**Table 8.8.1** Mean stand age (breast height age) variables

Variable	Description
Presence of tree stems?	Yes/No Select Yes if there are any trees present, including those shorter than 1.3 meters. Select No if no tree stems are present within the assessment polygon.
Mean height	Basal area-weighted mean height, 1–500 dm.
Is it possible to estimate the mean age of the stand?	Yes/No Select No in mountain birch forests where no age determination is conducted. No may also be used in exceptional “impossible” situations (report using a “blue note” as described in Chapter 10.4). In grassland stands, the trees included are those within the assessment polygon.
Are all trees shorter than 1.3 meters?	Yes/No Select Yes when all trees are shorter than 1.3 meters.
Age at Breast	0–999 years: Basal area-weighted mean age at breast height (1.3 meters). If there are trees taller than 1.3 m, estimate the breast height age and the additional time. If all trees are shorter than 1.3 m, only the additional time is recorded; set breast height age to 0. An age of 0 is also used if there are current-year shoots taller than 1.3 m.
Additional time	Enter the number of years it took the stand to reach breast height, i.e. the growth period to 1.3 m height (Chapter 8.8.3). If no tree reaches 1.3 m, the additional time equals the total age.
Was an increment borer used for age estimation?	Yes/No

*Note: During resurveying, increase the noted value by five years if no management actions or changes have occurred within the sub-sample plot.*

### 8.8.1 Mean Height of the Tree Stand

The mean stand height is noted between 5–500 dm and is determined as the basal area-weighted mean height.

Note: In plantations or young forests where a layer of seed trees or conservation trees has been retained, these trees are excluded when determining the height, unless the most of the tree seedlings are shorter than 0.5 meters, in which case the mean height is based solely on the retained larger trees.

### 8.8.2 Breast Height Age

The basal area-weighted mean age at breast height (1.3 meters) is noted. The age is determined by coring one or two representative trees outside the sample plot but within the assessment polygon. In plantations or young forests with a sparse upper layer of seed or habitat trees, these older trees are excluded from age determination.

If the tree layer is very sparse or heterogeneous, the age is typically assessed visually rather than by coring. This also applies to high-value timber stands (e.g., oak forests). In young stands, age at breast height may be estimated by counting annual shoot growth or branch whorls from 1.3 meters upward.

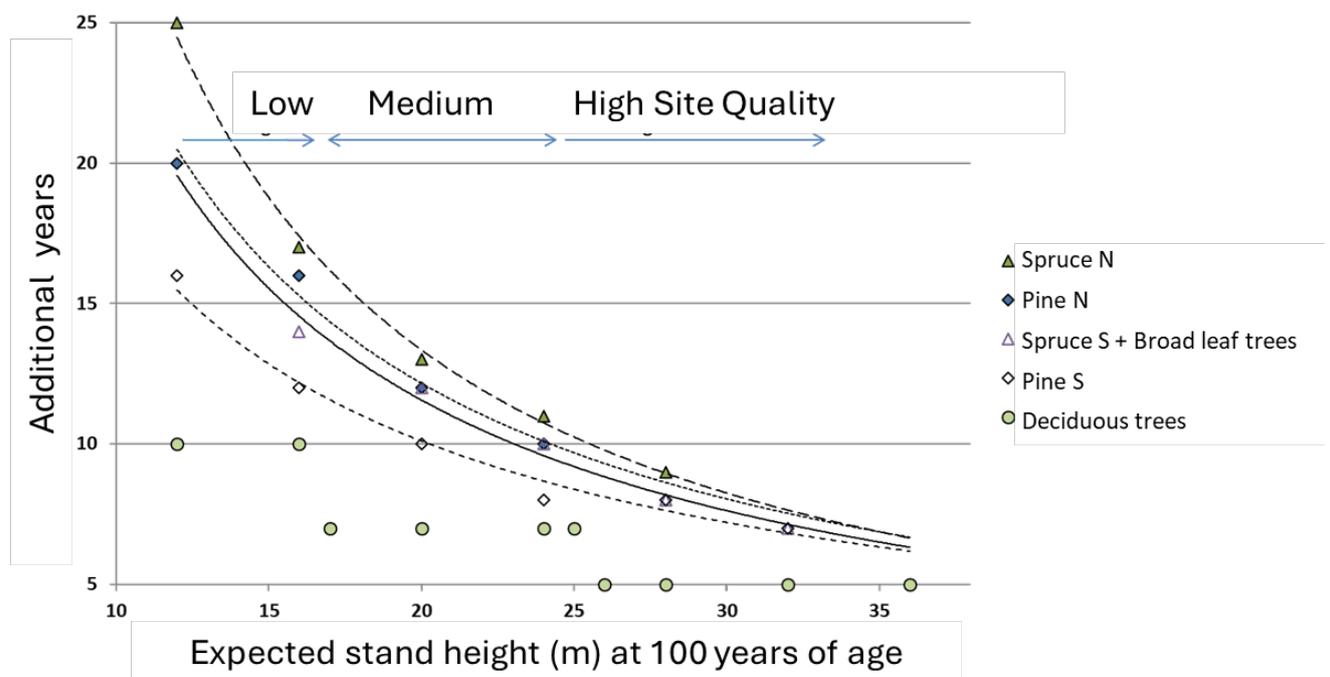
### 8.8.3 Height Growth Adjustment (Establishment Time)

Record the number of years it took the stand to reach breast height (1.3 m), this is referred to as the establishment time. The number of years added varies with the site's productivity (site index). Since maximum tree height increases with site productivity, tree height development often reflects fertility.

To standardize, the dominant height (see Glossary) at a reference age of 100 years is used. Typically, a relationship exists between expected stand height at age 100 and the time required to reach breast height, lower productivity sites require longer establishment time (see Figure 8.1).

Although site index is not explicitly determined in this survey, the stand's mean height (Section 8.8.1) and breast height age (Section 8.8.2) are used to estimate the expected stand height at age 100.

Note that expected height at 100 years increases with site fertility, latitude, and altitude. This expected height is then used to obtain the establishment time from Figure 8.1 for each respective main tree species.



**Figure 8.1.** Number of years required for the stand to reach breast height (1.3 m) in relation to stand height and tree species. *The figure is a modified version of Figure 3 in Gardfjell and Hagner (2019).*

### 8.8.4 Age Estimation by Coring

Was an increment borer used for estimating stand age, Yes/No

### 8.8.5 Productive Forest

Productive forest land, as defined by Swedish standards, is noted according to Table 8.8.2. The assessment is conducted at the assessment polygon level.

**Table 8.8.2** *Noted for sub-sample plots that are subject to detailed inventory at the assessment polygon level.*

Class	Value	Definition
Productive Forest Land	Yes/No	Productive forest land is defined as land capable of producing, on average, at least 1 m <sup>3</sup> of forest per hectare per year. This roughly corresponds to stands with a mean tree height of 10 meters for mature trees growing in relatively continuous stands, or 12 meters in mountain birch forests.  This category should also be selected for areas such as clear-cuts, provided that no other primary land use is present. Hence, pastures are not considered forest land. Abandoned arable land is to be classified as forest land under this definition if no cultivation has taken place in the past three years and it is certain that the land is not lying fallow. This category also applies within nature reserves.

### 8.8.6 FAO Land Use Class

Forest land according to the FAO definition (FRA 2000, 2018) is classified according to Table 8.8.3.

**Table 8.8.3** *One of the following classes is selected. Noted for sub-sample plots that are subject to detailed inventory. The assessment is conducted at the assessment polygon level.*

Class	Definition
Not applicable	None of the below.
FAO Forest land	Land not used for other primary purposes (e.g. grazing), with ≥10% canopy cover of trees (tree species according to Appendix 1), and with trees capable of reaching a height of 5 meters or more. This refers to the potential rather than the current condition. However, in areas that have remained relatively unaffected by forestry over a long time, the assessment should be based on the actual condition.
FAO Other wooded land	Land without clearly defined alternative land use, with trees taller than 5 meters and crown cover of 5–10%, or with combined cover of shrubs (Appendix 1) and trees exceeding 10%. This also refers to potential. In areas that have been more or less unaffected for a long time, the assessment is based on the actual condition.

ForestFAO and TreeShrubFAO, FRA 2000 (<http://www.fao.org/3/ad665e/ad665e00.htm#TopOfPage>) and FRA 2018 (<http://www.fao.org/3/18661EN/i8661en.pdf>)

## 8.9 Quality Variables

Quality variables are collected during detailed inventory. For information regarding the size and layout of the assessment polygon, see Chapter 2.2. Measured and estimated variables obtained earlier within the sample plot/sub-sample plot are not always fully representative of the area, i.e., the assessment polygon, where habitat classification is conducted. The quality variables can be used to assess the condition of the habitat type. The quality variables are partly based on the naturalness criteria described in Gardfjell & Hagner (2019), and for grasslands partly on Rūsiņa (2017b).

### 8.9.1 NILS Habitat Type Extent

Estimate the extent of the NILS habitat type found in the sub-sample plot within the surrounding landscape.

Do not confuse this with the area used for classifying the habitat type (i.e., the assessment polygon).

**Table 8.9.1** Area of the NILS Habitat Type.

Area of NILS-habitat type
< 100 m <sup>2</sup>
100–999 m <sup>2</sup>
0.1–0.25 ha
> 0.25 ha

### 8.9.2 Canopy Cover of Trees ≥1.3 m

Only trees with a height of at least 1.3 meters are included.

**Table 8.9.2** Canopy cover of trees ≥1.3 m within the assessment polygon.

Canopy cover
0
> 0 to 10 %
10–30 %
> 30–60 %
> 60 %

### 8.9.3 Shrub Cover

**Table 8.9.3** Shrub cover includes all shrubs, as well as trees shorter than 1.3 meters within the assessment polygon.

Shrub cover
0
> 0 to 10 %
10–30 %
> 30–60 %
> 60 %

### 8.9.4 Cover of Shrubs and Trees of Encroachment Origin

Trees and shrubs of encroachment origin typically exhibit suppressed lateral growth and narrow crowns, having established under closed or shaded conditions with high stem density.

**Table 8.9.4** Includes all shrubs and trees of encroachment origin within the assessment polygon.

Cover of Shrubs and Trees of Encroachment Origin
Not applicable, no grassland
0
> 0 to 10 %
10–30 %
> 30–60 %
> 60 %

### 8.9.5 Management Measures: Shrub and Tree Layer

The purpose of this variable is to capture human impact on the tree and shrub layer within the assessment polygon. This records whether extensive forestry or conservation management actions have been undertaken to actively remove trees. *This variable relates, among other things, to Naturalness Criterion 2 in the Habitat Manual.*

**Table 8.9.5** Management Measures: Shrub and Tree Layer. Records the type and extent of management actions targeting the shrub and tree layer within the assessment polygon.

Management Measures: Shrub and Tree Layer	Description
No visible signs of felling or clearing	
Final felling	Clear-cutting conducted for regeneration purposes within an even-aged forest management system. Often includes retention of seed trees or habitat trees. Also recorded when the felling is intended to convert the land to a different land use.
Conservation/selective felling	Includes conservation thinning, selective logging, or continuous cover forestry.
Thinning	Removal of trees primarily with a diameter at breast height (DBH) > 10 cm, typically to reduce stand density.
Clearing	Encompasses various types of clearing involving primarily small-diameter trees (< 10 cm DBH): <i>Pre-commercial thinning:</i> Density reduction in young stands for silvicultural purposes. <i>Understory clearing:</i> Removal of small trees beneath larger trees in older stands, conducted in both forested areas (often preceding final felling) and in grazed or park-like environments. <i>Visibility clearing:</i> Clearing to improve visibility, e.g., towards water bodies. <i>Shrub removal:</i> Removal of shrubs, in either forested or grassland environments.
Miscellaneous felling	Tree removal not fitting other categories, such as felling of single mature trees, conservation cutting in semi-open pastures, or clearing along property boundaries or utility corridors.

### 8.9.6 Management Actions: Conservation Measures

Conservation measures may include, for example, the addition of dead wood, the release of individual trees from competition, or the removal of exotic/unwanted tree species.

**Table 8.9.6** Conservation Measures within the Assessment Polygon.

Conservation Measures	Description
No conservation action	No conservation-related measures have been carried out.
Release of key trees / removal of undesired trees	Selective removal of surrounding or competing trees to reduce competition and improve light conditions.
Addition of dead wood	Placement of coarse dead wood to enhance habitat structure and biodiversity.
Artificial conservation measure	Artificial creation of structural features such as standing dead trees (snags), girdling of trees, or notching etc.

### 8.9.7 Hydrological Impact

Human-induced hydrological modifications refer to drainage or water level reduction, such as in wetlands, often intended to increase arable land for agriculture or forestry. Drainage may have a positive effect and be essential for the conservation of a formed habitat type (e.g. dry to mesic sites), or a negative one (e.g. drainage of wetlands leading to degradation of peat-forming systems). If no drainage ditches are present within 25 m, the category “Not applicable” is selected. This variable relates in part to Naturalness Criteria 3 and 9 in the Habitat Manual.

**Table 8.9.7** Hydrological Impact.

Hydrological Impact	Description
Significant impact	Significant negative anthropogenic hydrological impact on the habitat type
Present but no impact <sup>1</sup>	Drainage/damming/road present nearby but without negative impact
Unaffected	The habitat type is hydrologically unaffected

*1. Present but with no negative effect: This indicates that drainage, damming, or roads are present nearby but do not cause any observable negative hydrological impact on the habitat. For example, a ditch in grassland is not necessarily detrimental, whereas a ditch in a wetland may have negative effects.*

### 8.9.8 Hydrological Regime

Indicates whether the site is near a regulated watercourse or reservoir. Does the site experience a controlled hydrological regime? For example, is the assessment area located near a regulated river or storage reservoir, and is it influenced by a managed water flow regime, Yes/No.

### 8.9.9 Root Collars (Buttresses)

Wet or moist soil conditions affected by high groundwater levels or flooding can lead to the formation of root collars (buttresses) on trees. Indicate whether buttresses are present on tree stems and whether they occur on more or less than 50% of the trees. A buttress is defined as a tree where the vertical distance between the germination point of the seed and the ground surface is 20 cm or more.

**Table 8.9.8** *Root Collars (Buttresses).*

Root Collars (Buttresses)	Description
No	No root collars
Yes ≤ 50 %	Yes, root collars are present on ≤ 50% of the stems.
Yes > 50 %	Yes, root collars are present on > 50% of the stems.

### 8.9.10 Age Class of the Forest Stand

Is the tree population old or young? Estimate the basal area–weighted age class of the tree population. The basal area–weighted mean age applies to tree-covered habitats and is assessed in relation to the *minimum recommended final felling age* (MRFFA). Normally, a site productivity assessment (site index) is required to determine MRFFA for a forest stand. However, no such assessment is conducted in this inventory.

Annex 5 provides a simplified table, copied from the habitat manual by Gardfjell & Hagner (2019), which uses stand growth curves for commercial tree species where available to estimate MRFFA + 20 years. *This variable relates to Naturalness Criteria 4 and 5 in the Habitat Manual.*

Note: *Avoid coring broad-leaved trees.*

#### *Age Class*

The basal area–weighted mean age is applied to tree-covered habitats and categorized based on the minimum recommended final felling age (MRFFA).

**Table 8.9.9** *Age Class. Estimate the basal area–weighted age class of the tree population.*

Mean age (Basal Area-Weighted) <sup>1</sup>	Description
Not applicable	Non-forested habitat
Young (< MRFFA)	The tree stand is younger than the final felling age (MRFFA)
Mature (MRFFA ≤ age < MRFFA + 20)	The tree stand has reached final felling age but not yet MRFFA + 20
Overmature (MRFFA + 20 ≤ age < MRFFA + 40)	The tree stand is at least MRFFA + 20 years but not yet MRFFA + 40
Old (≥ MRFFA + 40)	The tree stand has reached an age of MRFFA + 40 or more

<sup>1</sup> MRFFA refers to the Minimum Recommended Final Felling Age.

### 8.9.11 Volume of Coarse Dead Wood

Estimate the amount of dead wood ( $\geq 10$  cm in diameter) within the assessment polygon. Use relevant information from Section 8.8.2. For the method of measuring dead wood, refer to the Habitat Manual. This variable is linked to Naturalness Criterion 5 in the Habitat Manual.

**Table 8.9.10** *Volume of Coarse Dead Wood. Includes both standing and downed coarse dead wood with a diameter of  $\geq 10$  cm.*

Volume of Coarse Dead Wood $\geq 10$ cm
No coarse dead wood present
< 10 m <sup>3</sup> /ha of coarse dead wood
10–20 m <sup>3</sup> /ha of coarse dead wood
> 20 m <sup>3</sup> /ha of coarse dead wood

### 8.9.12 Tree Layers

A tree layer is defined as a group of trees with roughly similar height, whose mean height differs significantly from other such groups. In order to distinguish multiple layers, the difference in mean height between layers must exceed one-third of the mean height of the next tallest layer. If the tallest layer is less than 10 metres in height, only one layer is recognized. To be classified as a separate layer, a stratum must have a basal area of at least 5 m<sup>2</sup> per hectare or a stem density of at least 500 stems per hectare. Only tree individuals at least 1 dm in height are counted towards the stem density. Thus, a dense regeneration layer (approximately 50 stems in a 0.1 ha plot) in an otherwise tall forest qualifies as a distinct layer.

For overstorey trees (seed trees, retained veteran trees, older trees in wooded pastures, etc., over 10 metres tall), only 10 trees per hectare are required for the layer to be recognized. When stem densities are low, the trees should be relatively evenly distributed across the plot. A layer may consist of a mix of several tree species. Note: Only living trees are included when defining tree layers. If the height difference between layers is too small, the layers are merged. This *variable relates to Naturalness Criteria 5, 6, and 7 in the Habitat Manual*. In stands with very low tree densities, the population is considered single-layered, even if trees of different sizes are present.

**Table 8.9.11** *Tree Layer: Describes the vertical stratification of the tree layer within the stand.*

Tree Layer	Description
No tree layer	No tree layer is present
Single-layered	The stand has a single canopy layer
Two-layered	The stand has two distinct canopy layers
At least three layers	The stand has three or more vertical layers

### 8.9.13 Veteran Trees (Värdeträ)

The term “veteran trees” refers to old native living trees in Sweden (older than the minimum recommended final felling age, MRFFA, plus 40 years), trees with wood mould, large-diameter trees, wide-crowned trees, pollarded trees, etc. Trees considered to be of large diameter (dbh) include: Norway spruce/Scots pine  $\geq 70$  cm, oak/beechn  $\geq 80$  cm, elm/ash  $\geq 60$  cm, goat willow/rowan  $\geq 40$  cm, and other deciduous tree species  $\geq 50$  cm.

Trees with wood mould are defined as large hollow trees with a dbh greater than 40 cm. Wide-crowned trees are typically developed in open, well-lit environments, with thick branches emerging relatively low compared to trees grown in denser conditions. The presence of broad-crowned and pollarded trees within forests may indicate former meadow management, even where understory features connected to the open habitat have disappeared in the now-closed canopy forests.

Record whether valuable trees are present within the assessment area (the assessment polygon).

**Table 8.9.12.** *Veteran trees.*

<b>Veteran trees</b>	<b>Description</b>
Deciduous Trees: Number of Veteran Trees	Record Number of Deciduous Veteran Trees
Coniferous Trees: Number of Veteran Trees	Record Number of Coniferous Veteran Trees

### 8.9.14 Deciduous Trees of High Conservation Value (Skyddsvärda lövträd)

Deciduous Trees of High Conservation Value are native tree species found in the cultural landscape. Indicate whether such living trees are present within the assessment polygon, Yes/No.

For each registered Deciduous Trees of High Conservation Value, note the tree species and one or more attributes according to Table 8.9.13. If the tree species is elm or ash, record also the presence of visible disease symptoms according to Table 8.9.13a (Dutch elm disease or ash dieback).

**Table 8.9.13.** *Deciduous Trees of High Conservation Value. Multiple categories may be selected per tree. All registered trees must be documented with photographs.*

<b>Deciduous Trees of High Conservation Value, Multiple choice categories</b>	<b>Description</b>
Tree species	Tree species according to Appendix 1 Tree Species.
Giant trees	Deciduous tree with a diameter greater than 1 metre at the narrowest point below breast height.
Cavity tree (large-diameter)	Deciduous tree with a diameter $\geq$ 40 cm and a cavity $>$ 30 cm deep or extending down to the ground.
Very old deciduous trees	Oak and beech trees older than 200 years; other deciduous species older than 140 years.
Pollarded (ongoing)	Trees that have been pollarded within the past 5 years.
Signs of pollarding	Pollarded more than 5 years ago.
Disease symptoms (Dutch elm disease or ash dieback)	If the tree species is elm or ash, record visible disease symptoms according to Table 8.9.13a.

*Source: Höjer, O. & Hultengren, S. 2004. Åtgärdsprogram för särskilt skyddsvärda träd i kulturlandskapet. ÅGP. (Action Programme for Particularly Valuable Trees in the Cultural Landscape). Rapport 5411 Naturvårdsverket, Stockholm. In Swedish*

**Tabell 8.9.13a** *Assessment of disease symptoms (Dutch elm disease or ash dieback).*

<b>Variable</b>	<b>Description</b>	<b>Alternatives</b>
Dutch elm disease	Record if the tree is elm. Assess whether the tree shows visible symptoms of Dutch elm disease. Common symptoms: wilting or yellowing leaves, dead branches, brown streaks in the sapwood (visible under the bark).	No visible infection / Visible infection
Ash dieback	Record if the tree is ash. Assess whether the tree shows visible symptoms of ash dieback. Common symptoms: wilted shoots, brown leaf spots, dead branches or crown dieback.	No visible infection / Visible infection

### 8.9.15 Coppicing (Low Pollarding)

Record the presence of coppicing. Is coppicing present? Yes/No.

Traces of coppicing consist of regrowth from stools, sometimes emerging from a pronounced root collar, more often forming ring-shaped tufts whose basal diameter increases with age (Ljung et al. 2015). Should not be confused with regrowth caused by grazing or forest harvesting.

### 8.9.16 Woodpecker Holes

Record the number of living and dead deciduous trees with woodpecker holes (nesting cavities) within the assessment polygon.

*Table 8.9.14 Woodpecker holes.*

Woodpecker holes	Description
Number of trees with woodpecker holes	

### 8.9.17 Ant mounds

Record the number of ant mounds that are 25 cm or taller within the 0.1 ha assessment polygon.

These are primarily constructed by wood ants (genus *Formica*), recognizable by their red and black colouration. The nests are typically composed of conifer needles and resin. Ant hills built by other ant species, often in the form of humps and composed of other materials, should not be included.

*Table 8.9.15 Ant mounds.*

Ant mounds	Description
Number of ant mounds	

### 8.9.18 Natural Disturbance

Has the area been affected by a natural disturbance? The area is influenced by significant natural disturbance processes (e.g., fire, storms, flooding), or by management measures intended to mimic such disturbances. Flooding includes the effects of beaver dams.

This variable relates to Naturalness Criterion 8 in the Habitat Manual.

*Table 8.9.16 Natural Disturbance.*

Natural Disturbance	Description
No disturbance	
Fire	Wildfire, prescribed burning
Storm	
Flooding	Flooding, beaver damming

### 8.9.19 Land-use History, i.e. Active or Traditional management

Is the site currently grazed or are there other signs of historical management, including contemporary signs? For example, clearance cairns, field edges, fence posts, or hay-drying poles.

**Table 8.9.17 Land-use History.** Active management or visible signs of historical use. Considered "active" if signs of ongoing grazing or management are present, e.g., dry dung, presence of "rator" (i.e. patches of vegetation avoided by grazing animals), trampling, or amount of graminoid litter.

Land-use History	Description
No signs of grazing/use	No visible signs of past or present grazing or land use
Signs of former grazing/use	The site shows indications of past management or grazing, e.g., presence of species associated with mowing or grazing
Active grazing/management	The site is actively grazed or managed

### 8.9.20 Grass Sward

The grass sward refers to the upper soil layer in a grassland, rich in roots, together with the grasses and herbs growing in it. In managed environments, root development forms a dense turf layer. Depending on light availability, grazing intensity, and management method, the sward may be more or less developed. In grazed forests, the sward is often best developed in canopy gaps. The more shaded the site, the less well-developed the sward is. Excessive trampling or overgrazing, or soil disturbance (e.g., by digging animals), may damage or destroy the sward.

**Table 8.9.18 Grass Sward in the Assessment Polygon.**

Grass Sward	Description
Not applicable	Forest with field layer typical of woodland
Well-developed dense sward	Even and dense turf layer
Partially developed sward	Patchy development, mosaic of dense and sparse areas
Poorly developed sward	Sparse sward, may show signs of historical cultivation or other disturbance

### 8.9.21 Grazing Intensity

Can a vegetation mosaic typical of grazed pasture be observed, with grazed and ungrazed patches? This variable describes the intensity of ongoing grazing, even if animals are not present at the time of the survey. Estimate how much of the vegetation has been grazed. The assessment may vary depending on the timing of the visit, i.e., early or late in the grazing season.

**Table 8.9.19 Grazing Intensity.** Presence of a vegetation mosaic typical of grazed pastures, with a mix of grazed and ungrazed patches.

Grazing Mosaic	Description
Low or no grazing intensity	Animals graze elsewhere or are few in number
Patchy high grazing intensity	Some parts of the area are frequently grazed, others rarely or not at all
High grazing intensity	Most of the area is heavily grazed

### 8.9.22 Graminoid Litter

The amount and distribution of old graminoid litter (from previous seasons) reflects the strength of ongoing land use (e.g., grazing or mowing). If a handful of litter (and moss) can be gathered, or if very little is present, this serves as an indicator. High and continuous grazing, mowing with biomass removal, or regular cutting reduces the amount of graminoid litter that remains in the following season. Graminoid litter consists of dead leaves and shoots from grasses and grass-like plants, often as a diffuse layer partly mixed into the ground vegetation.

*Tabell 8.9.20 Graminoid Litter.*

<b>Graminoid Litter</b>	<b>Description</b>
Not applicable	Forest with field layer typical of woodland
Sparse or thin litter layer	High grazing intensity or mowing with biomass removal
Patchy, variable thickness	Patchy high and low intensity of land use across the area
Thick, evenly distributed	Low or no land use intensity across the entire area

### 8.9.23 Grazing Animals

Indicate the main type of grazing animal.

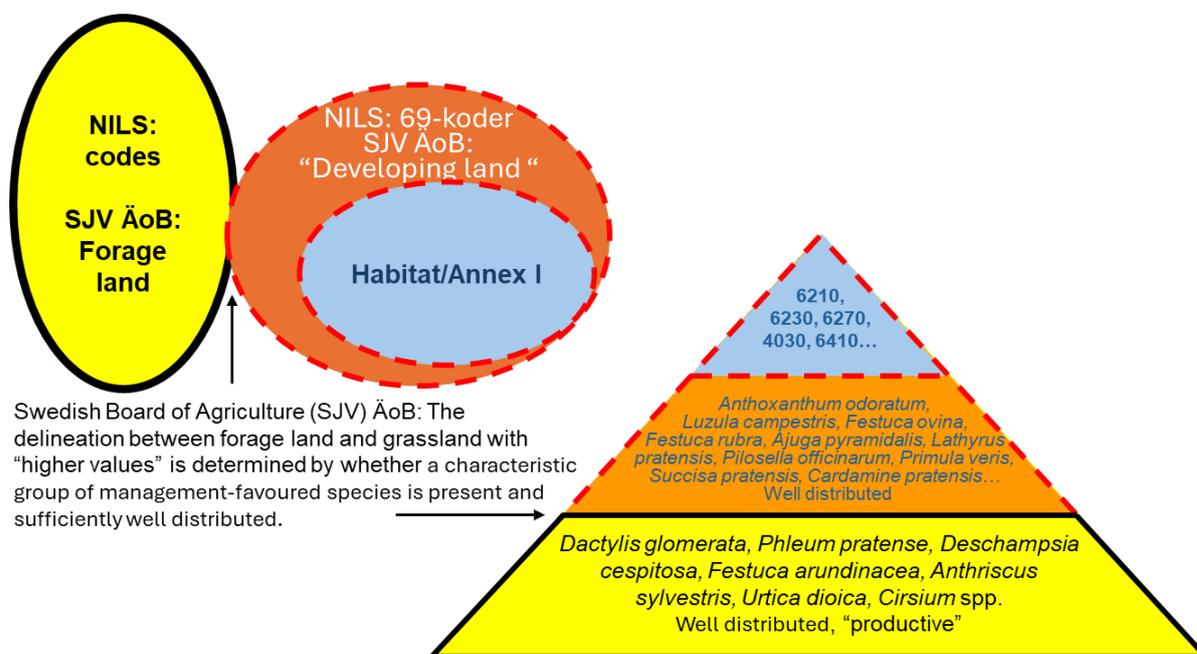
*Table 8.9.21 Grazing Animal Species.*

<b>Grazing Animals</b>	<b>Description</b>
Not applicable	
Cattle	Cows, heifers, steers, calves, etc.
Sheep	
Horses	
Deer	Deer kept in enclosures.
Reindeer – reindeer enclosures	Reindeer in fenced grazing areas.
Goats	
Pigs	Includes pigs and wild boar kept in enclosures.
Domestic fowl	
Other species	Other grazing species.
Unknown species	Use only in exceptional cases. A qualified guess is better than choosing this option. May also be used if no grazing has occurred in recent seasons.

### 8.9.24 Positive Indicator Species

Are there positive indicator species (i.e. species favoured by grazing or mowing) present in the herbaceous layer of the grassland? Use the species registration and Figure 8.2 as support. Note: Species typical of their habitat are always considered positive indicators within that habitat.

See the list of grazing- or mowing-favoured species in the Species App.



**Figure 8.2.** Illustrates similarities and differences between classification systems used in the NILS grassland survey and the Swedish Board of Agriculture’s Meadow and Pasture Inventory (Ängs- och betesmarksinventeringen, ÄoB), specifically for ÄoB sites qualified for Full Inventory, in relation to the presence of plant species with different indicator values. Modified after the Swedish Board of Agriculture methodological report (Persson 2005).

**Table 8.9.22 Positive Indicator Species.**

Positive Species	Description
Not applicable	Forest with a field layer typical of woodland habitats.
No positive indicator species present	
1–4 positive species	Few species favoured by grazing or mowing.
≥ 5 positive species, limited distribution	Grazing- or mowing-favoured species present, but with limited and scattered occurrence.
≥ 5 positive species, well distributed	Grazing- or mowing-favoured species present and well distributed across the site.

### 8.9.25 Negative Indicator Species

Is there any negative indicator species present in the herbaceous layer of the grassland? Negative indicator species are nitrogen-favoured, often large species that outcompete other grassland species

Refer to the list of negative indicator species in the Species App and include sown ley species. See also Figure 8.2.

**Tabell 8.9.23** *Negative Indicator Species.*

Negative Species	Description
Not applicable	Forest with a field layer typical of woodland habitats.
No negative indicator species present	
Negative indicator species present but with limited distribution	
Negative indicator species dominates	

### 8.9.26 Litter in the Assessment Polygon

Record the degree of littering according to Table 8.9.23. If litter is present in the assessment polygon, also record the types of litter using Table 8.9.24. If littering is substantial, a photo should be taken. If a litter type is found that is not listed in Table 8.9.24, take a photo and submit it along with a descriptive note via the “Blue Note” system (Chapter 10.4).

**Table 8.9.24** *Litter in the Assessment Polygon.*

Litter Presence	Description
No litter	No litter was found within the assessment polygon.
Some litter	Litter is present but covers a negligible area.
Substantial litter	Litter is present and meets one or more of the following criteria: <ul style="list-style-type: none"> <li>• Scattered across large parts of the assessment polygon.</li> <li>• Large items that cannot be removed without considerable effort (e.g., car wreck, landfill).</li> <li>• Includes hazardous materials such as batteries, oil spills, chemicals, or sharp debris (e.g., glass shards or metal) in grazing enclosures.</li> </ul> A photo must always be taken in cases of substantial litter.

**Table 8.9.25** *Litter Types.*

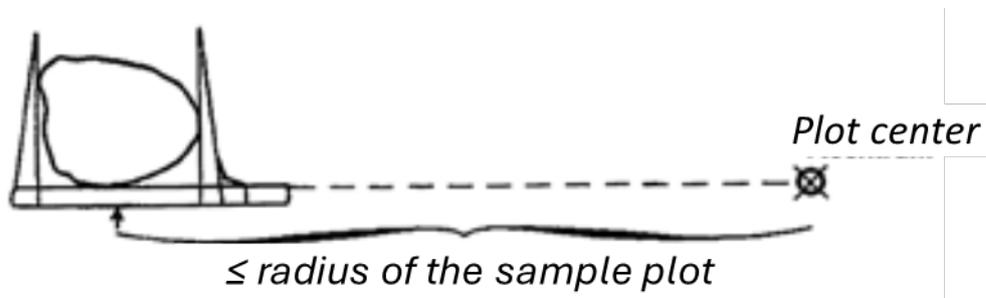
Litter Type	Description
Glass: Bottle	
Glass: Other	
Metal: Beverage can or similar	
Metal: Other metal packaging	
Metal: Other	
Paper/Cardboard: Food packaging	
Paper/Cardboard: Other	
Plastic: Beverage container	
Plastic: Plastic bag	
Plastic: Other plastic packaging	
Plastic: Silage plastic	
Plastic: Other	
Other: Battery	
Other: Chemicals/oil, etc.	
Other: Cigarette butt	
Other: Snus (oral tobacco)	
Other: Chewing gum	
Other: Miscellaneous	Add a comment and photo via “Blue Note”, category: Miscellaneous

## 8.10 Callipering of Living Trees and Standing or Downed Dead Wood

Callipering involves counting stems and recording diameter and tree species. This is carried out in each sub-sample plot subjected to detailed inventory. Callipering is performed for living trees (Section 8.10.1) as well as dead trees (Section 8.10.2). For dead trees, their position is also recorded, i.e., standing, leaning, lying, or lying in piles (see Table 8.10.3).

### 8.10.1 Diameter Measurement (Callipering): Living Trees

Tree diameter is generally measured using a calliper (see Figure 8.3). For very thick trees where the calliper does not suffice, diameter is determined by measuring the circumference with a tape measure (diameter = circumference / 3.14). Callipering is performed with the calliper's ruler oriented toward (or away from) the center of the plot. Trees should be measured at breast height, i.e., 1.3 meters above the ground surface (or from the level where the seed germinated). Normally, ground level is considered to be the upper boundary of the humus layer or the exposed mineral soil. On sloped terrain, the measurement is taken from the side of the tree corresponding to the average ground level. In certain cases, determining ground level can be challenging, for instance, in wet sites, or when trees grow on hummocks, stumps, or rocks. In such cases, the upper branching point of the roots often provides a good approximation of ground level. For leaning trees, the 1.3-meter measurement is taken along the stem from ground level.



**Figure 8.3.** Callipering should be conducted at breast height (i.e., 1.3 meters above the tree's point of germination), with the calliper ruler oriented toward the plot center. Trees are to be measured if their germination point lies within the radius of the sample plot.

The calliper must be held perpendicular to the tree's longitudinal axis. Diameter is recorded to the nearest lower millimetre. For edge trees, the following rules apply: a tree is considered part of the plot if the point where the seed is deemed to have germinated lies within the plot. Specifically:

- Trees that are upright and straight between the ground and breast height are included if the midpoint of the calliper measurement at breast height lies within the plot.
- For leaning or curved trees (between the ground and breast height), an assessment is made as to whether the germination point lies within the plot. The midpoint of a calliper measurement at stump height may aid in this determination.

- If the measurement point falls on an abnormal surface irregularity, it should be shifted up or down, whichever is shorter, to bypass it. If the bark is missing at the measurement point, no adjustment is made.

### *Recording of disease symptoms on elm and ash*

For living elm and ash trees, record the visible presence of Dutch elm disease (*Ophiostoma ulmi*, *O. novo-ulmi*) and ash dieback (*Hymenoscyphus fraxineus*). These diseases have caused extensive damage to elm and ash populations in Sweden and Europe. The information is used to monitor the extent of the diseases. Assessment is visual only, i.e., only clearly visible symptoms may be recorded.

**Table 8.10.1** Callipering: Living Trees.

Variable	Description
Tree species	Tree species according to Appendix 1 Tree Species
Diameter (mm)	See Table 8.10.2
Disease symptoms (Dutch elm disease or ash dieback)	If the tree species is elm or ash, record visible disease symptoms according to Table 8.10.1a.

**Table 8.10.1a** Assessment of disease symptoms (Dutch elm disease or ash dieback).

Variable	Description	Alternatives
Dutch elm disease	Record if the tree is elm. Assess whether the tree shows visible symptoms of Dutch elm disease. Common symptoms: wilting or yellowing leaves, dead branches, brown streaks in the wood beneath the bark.	No visible infection / Visible infection
Ash dieback	Record if the tree is ash. Assess whether the tree shows visible symptoms of ash dieback. Common symptoms: wilted shoots, brown leaf spots, dead branches or crown dieback.	No visible infection / Visible infection

**Table 8.10.2** Summary of Size Classes for Callipering.

Variable	Individual stems	Plot radius
Trees ≥ 100 mm Ø	Measure living trees	10 m
Trees ≥ 40 - 100 mm Ø	Measure living trees	3.5 m

### 8.10.2 Diameter Measurement (Callipering): Standing and Downed Coarse Dead Wood

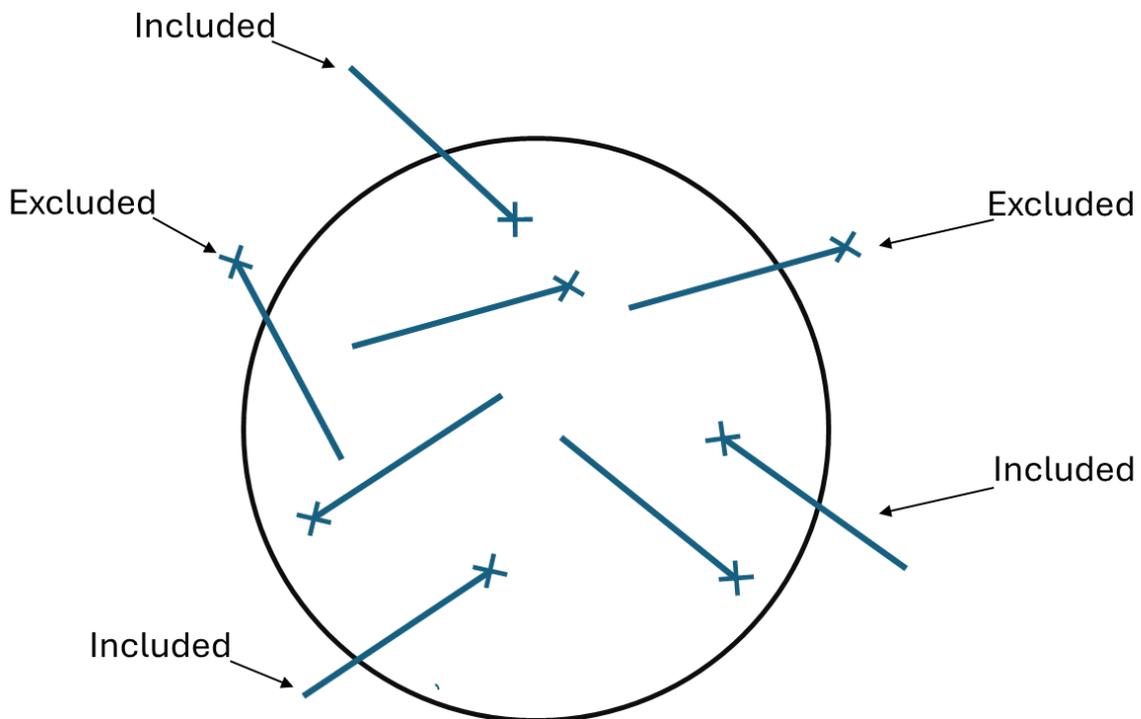
Diameter is measured for dead trees and branches  $\geq 100$  mm in diameter within a 10 m radius.

A tree is considered dead if it has no living needles, leaves, or buds. In addition, all downed trees are always classified as dead. Standing or leaning trees suspended in other trees are considered dead if the root system is judged to be so damaged that it no longer functions. Cut high stumps with green needles or leaves are not classified as coarse dead wood.

Recently processed but not yet removed logs should not be recorded. However, abandoned processed logs, whether as single stems or in piles (e.g., logs, pulpwood stacks, firewood piles), should be included. Harvest residues such as branches are not inventoried. Stems that are so decomposed that the stem form is no longer discernible should not be recorded. For stems where the sapwood is entirely or partially gone, such as old fallen Scots pine trunks, the current diameter should be measured.

Stems that have decomposed from the inside, but still retain all or parts of the wood along the outer surface, should be measured if their diameter, in the direction of measurement, is  $\geq 100$  mm. The degree of decay is determined based on the decomposition of the remaining wood. Large branches are recorded as individual items if they meet the diameter criteria; it should be noted that the object is a branch.

Note: Coarse woody debris lying on the ground is recorded if the lower part of the stem or the thickest part of the branch lies within the plot area (see Figure 8.4; Ståhl et al. 2001). If the base of the stem or thickest part of the branch lies outside the plot, it is not included. For standing coarse dead wood, the same inclusion criteria apply as for living trees.



**Figure 8.4.** Shows an example of which coarse woody debris (CWD) should be included. CWD is included if the base of the stem or the thickest part of the branch lies within the plot area (marked with an X). If the base of the stem or the thickest part of the branch lies outside the plot, it is not included. The figure is based on Ståhl et al. (2001).

**Tabell 8.10.3** Callipering: Coarse dead wood variables.

Variable	Description
Tree species	Tree species according to Appendix 1 Tree Species.
Diameter	See Table 8.10.4. For standing or leaning trees and for lying stems with roots, diameter is measured at breast height (1.3 m). For lying tree parts, diameter is measured 1.3 m from the thicker end. For wood piles, record the estimated mean diameter weighted by basal area. Diameter is measured over bark when present; if the bark is absent, the measurement is taken under bark without adjustment
Position	<ul style="list-style-type: none"> <li>- Standing (predefined)</li> <li>- Leaning (more than 45°)</li> <li>- Lying</li> <li>- Lying in pile (three or more stems stacked or placed side-by-side)</li> </ul> <p>Broken trees are recorded as standing if the remaining standing part is at least 1.3 m tall; otherwise, they are recorded as lying. For trees broken below 1.3 m, the stump section is assigned to the lying piece. Note that trees broken above 1.3 m are counted as two separate items: one standing and one lying.</p> <p>Broken trees are also considered as root parts provided that the break occurred below 1.3 m and the lying section is located within 2 m of the stump. There must be no doubt that the parts belong to the same tree. In such cases, the stump section should be included in the recorded length of the stem.</p>
Stem or coarse branch	<ul style="list-style-type: none"> <li>- Stem (predefined)</li> <li>- Coarse branch (recorded as such if diameter threshold is met)</li> </ul>
Height/Length [dm]	Recorded for all standing/leaning trees and coarse branches. Note that the total length of the tree is recorded, including any parts extending outside the plot. Broken trees are also considered root-connected (i.e. root parts) if the break occurred below 1.3 m and the lying part is within 2 m of the stump. Furthermore, there must be no doubt that the parts belong to the same tree. In such cases, the stump section should be included in the recorded stem length. For lying stems without root connection, the recorded length includes the entire stem, even if parts extend beyond the plot boundary.
Top diameter	Measured including bark. If bark is missing, measure under bark without adding.
Decay stage	See Table 8.10.5.

**Table 8.10.4** Summary of diameter measurement class limits for Coarse Woody Debris (CWD).

Trees for diameter measurement	Individual stems	Plot radius
≥ 100 mm Ø	Measure coarse dead trees and branches	10 m

**Table 8.10.5** Decay classes. Definitions of deadwood decay classes following NFI (2021).

Class	Description
0. Raw wood	For example, recently fallen windthrown trees that still have green needles or leaves. Trees with green cambium are also classified as fresh wood, even if green foliage is absent.

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1. Hard dead wood	More than 90% of the stem volume consists of hard wood, including a firm outer surface. The stem shows minimal signs of decomposition by wood-decaying organisms.
2. Some broken dead wood	Slightly decayed dead wood. Between 10–25% of the stem volume consists of soft wood; the rest remains hard. A tool (e.g. soil probe) can be pushed through the surface but not through the entire sapwood.
3. Decomposed dead wood	26–75% of the stem volume consists of soft or very soft wood.
4. Very decomposed dead wood	76–100% of the stem volume consists of soft or very soft wood. A tool (e.g. soil probe) can be pushed through the entire stem. A hard core may still be present.

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## 9. Species Inventory

Small sample plots of varying sizes are used to record species presence, abundance, and flowering, as well as the coverage of the field layer, species groups, and non-vegetated ground. Estimates of species abundance and area unsuitable for field-layer vegetation are made within three different plot sizes (Table 3.2.1). Species occurrences are recorded within all three small sample plots and within the assessment polygon. Coverage of the field layer and species groups is always assessed within a circular plot with a radius of 56 cm (i.e. 1 m<sup>2</sup> plots).

### 9.1 Workflow Summary

Small sample plots are surveyed only within certain sub-sample plots (see Table 4.2.1). Species within the assessment polygon are surveyed in all sub-sample plots that are subject to detailed inventory. The small sample plots to be inventoried are placed according to the instructions in Chapter 3.2. An overview of the steps to be carried out in the Species App is provided in Table 9.1.1.

Workflow:

- Indicate which **sub-sample plot of the sample plot each small sample plot belongs to**. If the sample plot is divided, assign the sub-sample plot based on where the center of the small sample plot falls (Figure 6.12).
- If the largest of the small sample plots (Plot 3) straddles the boundary between two sub-sample plots, it is split, and species observations are attributed to the respective sub-sample plot.
- The two smaller of the small sample plots (Plot 1 and 2) are not divided but are attributed to the sub-sample plot in which their center lies (Figure 6.12).
- Estimate the strict coverage of the field-layer species groups (m<sup>2</sup>). All cover estimates refer to the conditions at the time of measurement. All plant parts that fall within the plot area should be recorded. Pay special attention to vertical projection being the reference.
- Within the field layer, different groups may overlap, but the layer may also be sparse. As a result, the summed coverage of the field-layer groups can range from 0 m<sup>2</sup> to well over 1 m<sup>2</sup>. However, the coverage for “field layer total” must be at least equal to the specified area.
- An estimate of the total field-layer cover (maximum 1 m<sup>2</sup>) is also made, without considering individual species groups. NOTE: Strict vertical projection applies.
- Record the presence of all species listed in the species list that are found within the small sample plots or the assessment polygon. All species with any living shoot part (leaf, inflorescence, etc.) within the plot, as seen from above, must be recorded.
- Record coverage (m<sup>2</sup>) as well as cover of non-vegetated ground (Chapter 9.4.1). NOTE: Strict vertical projection applies.
- Submit the survey, even in cases where neither the small sample plots nor the assessment polygon were surveyed in the app.

**Table 9.1.1** The connection between survey steps/variables, their section in the manual, and the area assessed when applicable.

Survey Steps/ Variables	Chapter/ Section	Survey Method				Assessment area			
		Distance Survey	Minimal Survey	Detailed Survey without SSP <sup>1</sup>	Detailed Survey with SSP <sup>1</sup>	SSP <sup>1</sup> 1	SSP <sup>1</sup> 2	SSP <sup>1</sup> 3	Assessment Polygon
Placement of small sample plots	3.2	no	no	no	yes				
Sub-Sample plot Assignment for Small Sample plots	6.5.3	yes	yes	yes	yes				
Coverage field- layer, graminoid litter	9.3	no	no	no	yes	1 m <sup>2</sup>	1 m <sup>2</sup>	1 m <sup>2</sup>	no
Ground unsuitable for field-layer vegetation	9.4	no	no	no	yes	0.25 m <sup>2</sup>	1 m <sup>2</sup>	100 m <sup>2</sup>	no
Species recording, abundance of selected species	9.4	no	no	only in assessment polygon	yes	0.25 m <sup>2</sup>	1 m <sup>2</sup>	100 m <sup>2</sup>	0.1 ha*
Flowering	9.4	no	no	yes	yes	0.1 ha*	0.1 ha*	0.1 ha*	0.1 ha*

*T. SSP = small sample plot*

*\* The assessment polygon may be smaller (100 m<sup>2</sup> to 0.1 ha) for siliceous rock with pioneer vegetation and grassland communities on calcareous bedrock.*

## 9.2 Plot Information

To begin the species survey, select the relevant sample plot in Field Maps and then click the link to the Species App. This action initiates the survey for the current plot in Survey123. The stand and plot numbers, as well as theoretical coordinates, are automatically transferred from Field Maps and should not be altered manually in Survey123. Carefully verify that the stand and plot numbers correspond to the location you are currently surveying, using the field map in Avenza for reference.

### 9.2.1 Tract and Plot Number

The tract number consists of up to six digits and is pre-filled in the Species App. Verify the number against the field map in Avenza to ensure accuracy. Each tract initially contains 196 sample plots, numbered from 1 to 196. The number of plots to be surveyed in each stand may vary. The sample plot number is also pre-filled in the Species App; confirm its accuracy using the Avenza field map.

## 9.3 Field-Layer Cover and Graminoid Litter

The assessment of field-layer vegetation cover is conducted on each of the three 1 m<sup>2</sup> small sample plots. A **strict** cover estimation is applied to each 1 m<sup>2</sup> small sample plot. See Appendix 3 for details on strict cover estimation. The estimation of the field layer refers to the coverage present at the time of measurement. However, consideration is given to whether the

vegetation belongs to the current or previous growing season. Residual standing dead plants or other plants remains from the previous year are not included in the assessment.

### 9.3.1 Field Layer: Coverage of Species Groups

The coverage of different species groups is measured on a 1 m<sup>2</sup> area for each small sample plot as outlined in Table 9.3.1.

**Table 9.3.1** Species Groups in the Field Layer. Coverage is given in m<sup>2</sup> according to Table 9.3.2.

Species Groups*	Description
Broad-leaved grasses (BG) <sup>1</sup>	Grasses with flattened, furrowed, or slightly rolled leaves, often (but not always) broader than 2 mm. This group also includes <i>Festuca rubra</i> !
Narrow-leaved grasses (SG) <sup>1</sup>	Grasses with thread-like or bristle-like leaves (i.e., tightly folded/rolled without the ability to unfold the leaf blade), narrower than 2 mm. <i>Festuca ovina</i> , <i>Nardus stricta</i> , <i>Avenella flexuosa</i> , <i>Festuca brevipila</i> , <i>Festuca filiformis</i> och <i>Festuca vivipara</i> are considered narrow-leaved grasses.
True sedges (ST) <sup>1</sup>	All species within the genus <i>Carex</i> (true sedges).
Other graminoids (ÖG) <sup>1</sup>	All species within the Cyperaceae (sedge family), except for <i>Carex</i> species, as well as all species within the Juncaceae (rush family) and Typhaceae (cattail family).
Dwarf-shrubs (R) <sup>1</sup>	All living shoots of Ericaceae (heather plants), excluding <i>Pyrola</i> and <i>Monotropa</i> species.
Herbs (Ö) <sup>1</sup>	Herbs include all vascular plant species, including <i>pyrola</i> species, excluding ferns, dwarf-shrubs, graminoids, trees, and shrubs.
Ferns (OB) <sup>1</sup>	All species within the class <i>Polypodiopsida</i> , ferns.
Horsetails (Fr) <sup>1</sup>	All species within the genus <i>Equisetum</i> , horsetail plants.
Lycophytes (Lu) <sup>1</sup>	All species within the class <i>Lycopsida</i> , clubmosses.

\* The abbreviations BG, SG, ST, ÖG, R, Ö, OB, FR, and Lu correspond to the "Coverage Group" column in the species appendices (Appendix 2) and represent (NOTE!) a subset of the species included in each species group.

### 9.3.2 Total Field Layer Coverage

Total coverage of the field layer is assessed within a 1 m<sup>2</sup> area for each of the three small sample plots. This measurement represents the overall vegetation cover, irrespective of individual species groups. Total field layer coverage includes all herbs, vascular cryptogams, dwarf shrubs (heaths), and graminoids. Coverage is recorded in square meters (m<sup>2</sup>) and can reach a maximum of 1 m<sup>2</sup>. Coverage is recorded according to Table 9.3.2.

**Table 9.3.2** Field Layer Coverage and Abundance in Small Sample plot 2.

Coverage [m <sup>2</sup> ]	
0	Absent
0.0001 (1 cm <sup>2</sup> ) to 0.01 m <sup>2</sup>	Recorded with a precision of 0.0001 m <sup>2</sup> (i.e. 1 cm <sup>2</sup> ).
0.01 (1 dm <sup>2</sup> ) to 1.0 m <sup>2</sup>	Recorded with a precision of 0.01 m <sup>2</sup> (i.e. 1 dm <sup>2</sup> ).

Note: If a specific species group is present in the field layer but the coverage is less than 0.0001 m<sup>2</sup> (i.e., < 1 cm<sup>2</sup>), it is still recorded as 0.0001 m<sup>2</sup>.

### 9.3.3 Graminoid Litter

Graminoid litter refers to dead plant material derived from graminoids, i.e., grasses, sedge-like plants, rushes, and cattails. It does not include any living leaves or shoot parts, nor recently yellowed or dead plant material from the current growing season. Such material is instead included in the assessment of the living field layer and the individual species groups. This distinction is particularly important during periods of prolonged drought or if the survey is conducted late in the growing season. Coverage of graminoid litter is measured within a 1 m<sup>2</sup> area across all three small sample plots. Coverage is recorded in square meters (m<sup>2</sup>) according to Table 9.3.3.

**Table 9.3.3** *Graminoid Litter. Coverage is recorded in square meters (m<sup>2</sup>) as follows (same method as for the field layer).*

Coverage [m <sup>2</sup> ]	
0	Absent
0.0001 (1 cm <sup>2</sup> ) to 0.01 m <sup>2</sup>	Recorded with a precision of 0.0001 m <sup>2</sup> (i.e. 1 cm <sup>2</sup> ).
0.01 (1 dm <sup>2</sup> ) to 1.0 m <sup>2</sup>	Recorded with a precision of 0.01 m <sup>2</sup> (i.e. 1 dm <sup>2</sup> ).

*Note: If graminoid litter is present but the coverage is less than 0.0001 m<sup>2</sup> (i.e., < 1 cm<sup>2</sup>), it is still recorded as 0.0001 m<sup>2</sup>.*

## 9.4 Species Occurrence, Abundance, and Flowering

A species list has been developed to serve as a quality indicator and assessment tool for the habitat types being surveyed (Appendices 4–5). In the species list, taxa are presented in alphabetical order by their common names, followed by the scientific names and a series of columns in which the species are categorized. As of 2024, selected wood-inhabiting fungi, tree, and shrub species will also be recorded within the assessment polygons.

The species list is a compilation based on multiple sources. Initially, all characteristic species associated with the targeted Article 17 habitat types were included, these form the core of the list, as their presence functions as an indicator of habitat quality. The list was subsequently expanded to include species from other sources: the 2020 Swedish Red List, the species of interest from the Grassland and Pastureland Inventory, the Swedish Forest Agency's signal species list, the Swedish Species Information Centre's list of invasive alien species (referred to here simply as invasive species), the REMIIL species list, the NILS (National Inventory of Landscapes in Sweden) baseline survey species list, and the National Forest Inventory species lists. Species deemed too geographically restricted, difficult to identify, or not representative of this survey were excluded.

For certain species, additional data beyond presence, such as abundance or flowering status, are also recorded. The level of detail at which these registrations are made is specified in Table 9.4.3. In general, abundance is recorded for species considered ecologically significant or for comparison with abundance metrics from other surveys (e.g., NILS and the National Forest Inventory). A summary of recorded species by category is compiled prior to finalizing the fieldwork using the Art-app.

### 9.4.1 Coverage of Substrates Unsuitable for Field Layer Establishment

To evaluate the coverage of each small sample plot that cannot support the establishment of vascular plants, the total area occupied by specific substrate types and standing stems (both living and dead) is recorded (Table 9.4.1). This assessment is conducted across all three plot sizes (i.e., 0.25 m<sup>2</sup>, 1 m<sup>2</sup>, and 100 m<sup>2</sup>), with coverage expressed in square meters (m<sup>2</sup>) using the same level of precision applied to field layer and graminoid litter estimates (see Table 9.4.2).

**Table 9.4.1** *Substrates Unsuitable for Field Layer Establishment. Coverage is recorded in square meters (m<sup>2</sup>) using the same accuracy standards as those applied to field layer vegetation and graminoid litter, as detailed in Table 9.4.2.*

Substrate Type	Description
Water Surface	Permanent bodies of water within the plot, including small ponds or tarns.
Artificial Surface	Surfaces constructed to prevent vegetation growth, including asphalt, paving stones, compacted gravel, macadam, and concrete.
Exposed Rock, Stones, or Boulders > 20 mm	Bare rock, stones, or boulders larger than 20 mm, or bedrock with no humus layer and little or no vegetation cover, except crustose lichens.
Standing Stems	Standing stems of trees or shrubs, both living and dead.
Permanent Snow or Glacier (alpine only)	Areas with permanent snow cover or glacial ice, applicable only in alpine tundra.

**Table 9.4.2** *Coverage of Substrates Unsuitable for Field Layer Establishment Abundance of Selected Species in the Small Sample plot 3, recorded in m<sup>2</sup>.*

Coverage [m <sup>2</sup> ]	
0	Not present
0.0001 (1 cm <sup>2</sup> ) to 0.01 m <sup>2</sup>	Recorded with a precision of 0.0001 m <sup>2</sup> (= 1 cm <sup>2</sup> )
0.01 (1 dm <sup>2</sup> ) to 0.50 m <sup>2</sup>	Recorded with a precision of 0.01 m <sup>2</sup> (= 1 dm <sup>2</sup> ).
>0.5 to 1.0 m <sup>2</sup>	Recorded with a precision of 0.1 m <sup>2</sup> .
>1 to 5 m <sup>2</sup>	Recorded with a precision of 0.5 m <sup>2</sup> .
>5 to 100 m <sup>2</sup>	Recorded with a precision of 1 m <sup>2</sup> .

*Note: If coverage is less than 0.0001 m<sup>2</sup>, it is recorded as 0 m<sup>2</sup>.*

### 9.4.2 Species Survey

Species are recorded at four different levels: within each of the three small sample plots and at the polygon level. Since the polygon also encompasses the small plots, any species recorded within a small sample plot are automatically transferred to the polygon dataset. Consequently, there is no need to record a species again at the polygon level if it has already been noted in a small sample plot within the same assessment unit. In the small sample plot, a species is registered if any part of the plant or bryophyte is present within the plot. Note: This does not include individuals that have been incidentally displaced into the plot, such as through trampling or other unnatural means.

### 9.4.3 Abundance of Selected Species

Abundance estimates for selected species are recorded in the two largest small sample plots. Abundance is always expressed as exact coverage in square meters (m<sup>2</sup>). The relevant species are listed under columns "SSP2" and "SSP3" in the species list. When one of these species is selected, a data entry field appears for entering the coverage. The recorded abundance should follow the precision levels specified in Table 9.3.2 for Small Sample plot 2 and Table 9.4.2 for Small Sample plot 3.

### 9.4.4 Flowering

The presence of active flowering in a number of important nectar-producing species is recorded at the polygon level; see the column "Flowering" in the species list (Appendix 2). These species also serve as phenological indicators, as they include common taxa flowering throughout the growing season. When any of these species is registered, a prompt appears asking whether it is in flower. This prompt appears regardless of the registration level, but the flowering assessment must always be made at the polygon level. If the species occurs in several small plots, the question must be answered multiple times, but the same answer should be used each time. Flowering refers to the presence of fully open flowers.

*Table 9.4.3 Overview of Species Occurrence, Abundance, and Flowering Observations by Sampling.*

Variable	Sampling Level
Species occurrence	In each of the three small sample plots and the assessment polygon
Abundance of selected species (area, m <sup>2</sup> )	In the two largest small sample plots
Flowering of selected nectar species	Within the assessment polygon

## 9.5 Supplementary Recording of Typical Species in Coastal and Alpine Habitats

To improve the ability to perform combined estimations of the area of grassland habitats across different survey programs, certain grassland habitats, primarily surveyed within the NILS alpine inventory or THUF seashore inventory, will also be included. In these cases, additional data on typical species are required to evaluate the conservation status of the habitats. If any of the habitats listed in Table 9.5.1 are recorded within a sample plot, a supplementary species registration must be conducted for either coastal or alpine habitats. Select the relevant habitat category (coastal or alpine) and record all observed species from the corresponding species list.

Note: Even if none of the listed species are observed, it is still important to record that the assessment unit has been classified as a coastal or alpine habitat.

**Table 9.5.1** Habitats subject to supplementary recording of typical species.

<b>Annex I-habitat</b>	<b>Coastal habitat</b>	<b>Alpine habitat</b>
1310 Salicornia mud		
1330 Atlantic salt meadows		
1630 Baltic coastal meadows		
2120 White dunes		
2130 Grey dunes		
2140 Decalcified Empetrum dunes		
2170 Dunes with creeping willow		
4060 Alpine and subalpine heath		
6150 Siliceous alpine and boreal grasslands		
6170 Alpine and subalpine calcareous grasslands		

## 10. Reporting and Self-Validation of Submitted Data

This chapter outlines how to report errors, provide supplementary information useful for the resurvey, and how to confirm the completion of sample plots in the survey system.

### 10.1 Self-validation of Submitted Data (Status Portal)

The Status Portal is part of the data quality assurance system. In this application, field teams can review and validate the data they have submitted.

### 10.2 Completion Check

Once a survey unit (tract) has been fully inventoried in the field, it is marked as complete using the checklist in the Field Portal.

### 10.3 Green Notes (Tract Information)

“Green notes” contain descriptive information about the tract and its sample plots to support future resurveys. This may include the estimated time required to survey the tract/plots, recommendations on accommodation and transport, accessibility during fieldwork, contact details for access keys, etc. A green note is completed for each inventoried tract and updated as needed upon resurvey. **If specific information applies to multiple plots within a tract, one can refer to the plot where the tract-level details have been entered.**

### 10.4 Blue Notes (Error Reports)

A “blue note” is a comment or explanation attached to submitted data and typically includes both a photo and a written description. Blue notes are categorized according to Table 10.4.1. By the end of the field season, submitted data should be as accurate as possible. It is crucial for data quality that decisions in the field are made by the field personnel, with guidance from the survey coordination team when needed. Any corrections that can be made by the field personal should therefore be done by the field personal.

Blue notes must not contain questions. Methodological or species-related questions should be directed to the field support team or posted in our designated Teams channels.

While not all blue notes will be reviewed during the ongoing field season, they are highly valuable for quality control and data analysis. Write each blue note so that the issue and any suggested data changes are clearly understandable to someone unfamiliar with the site.

**Tabell 10.4.1** Blue Note Categories.

<b>Type of Blue Note</b>	<b>Description and Example</b>
Decision Rationale	Explanation of why a certain value was chosen that might seem unexpected, or how a choice was made between two alternatives. <i>Example: “80% canopy cover in the plot, but since the plot was too small, it merged with the surrounding open pasture.”</i>
Office Corrections	Used in rare cases when the field assessor is unable to correct submitted data themselves or is uncertain whether the correct information has been submitted. <i>Example: “Began detailed survey of sub-sample plot 2 before realizing it was too young. Deleted as much of the recordings in the app as possible.”</i>
Photo Notes	Brief explanation of why standard protocol was not followed when taking photos. <i>Example: “Photo facing east was taken from approximately 290 degrees due to the lake.”</i>
Species Notes	Names of additional tree or shrub species not available in the menus, or noteworthy species not included in the survey. (Note: time should not be spent on this unless something of interest is observed incidentally.) <i>Example: “Camarops polysperma on alder snag in stand in sub-sample plot 3,” or “The shrub that was noted as unidentified shrub is common holly (Ilex aquifolium), which was not listed in the species list in the app.”</i>
Decision Rationale	Explanation of why a certain value was chosen that might seem unexpected, or how a choice was made between two alternatives. <i>Example: “80% canopy cover in the plot, but since the plot was too small, it merged with the surrounding open pasture.”</i>

## 10.5 Travel Notifications

Travel notifications are required for water crossings or helicopter transport. Both departure and estimated return must be communicated via SMS to the field support team. Messages must be sent at both departure and return. Failure to send a return message by the expected time may trigger an emergency alert.

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## Appendix 1. Trees and Shrubs

### Shrubs

Swedish name	Scientific name
blåhallon	<i>Rubus caesius</i>
blåtry	<i>Lonicera caerulea</i>
brakved	<i>Frangula alnus</i>
druvfläder	<i>Sambucus racemosa</i>
dvärgbjörk	<i>Betula nana</i>
en	<i>Juniperus communis</i>
fläder	<i>Sambucus nigra</i>
getapel	<i>Rhamnus cathartica</i>
hagtorn-arter	<i>Crataegus</i>
hallon	<i>Rubus idaeus</i>
harris	<i>Cytisus scoparius</i>
hassel	<i>Corylus avellana</i>
havtorn	<i>Hippophaë rhamnoides</i>
häggmisplar	<i>Amelanchier</i>
krusbär	<i>Ribes uva-crispa</i>
liguster	<i>Ligustrum vulgare</i>
mahonia	<i>Mahonia aquifolium</i>
murgröna	<i>Hedera helix</i>
måbär	<i>Ribes alpinum</i>
olvon	<i>Viburnum opulus</i>
oxbär-arter	<i>Cotoneaster</i>
parkolvon	<i>Viburnum lantana</i>
pors	<i>Myrica gale</i>
ros-arter	<i>Rosa</i>
röda vinbär	<i>Ribes rubrum</i> agg.
skogskornell	<i>Cornus sanguinea</i>
skogstry	<i>Lonicera xylosteum</i>
slån	<i>Prunus spinosa</i>
snöbär	<i>Symphoricarpos albus</i>
spirea-arter	<i>Spirea</i>
spärroxbär	<i>Cotoneaster divaricatus</i>
svarta vinbär	<i>Ribes nigrum</i>
syren-arter	<i>Syringa</i>
tibast	<i>Daphne mezereum</i>
tok	<i>Dasiphora fruticosa</i>
videkornell	<i>Cornus sericea</i>
viden	<i>Salix</i>
vildkaprifol	<i>Lonicera periclymenum</i>
vresros	<i>Rosa rugosa</i>
äkta kaprifol	<i>Lonicera caprifolium</i>

### Trees

Swedish name	Scientific name
almar	<i>Ulmus</i>
apel-arter	<i>Malus</i>
ask	<i>Fraxinus excelsior</i>
asp	<i>Populus tremula</i>
avenbok	<i>Carpinus betulus</i>
bergtall	<i>Pinus mugo</i>
björkar	<i>Betula</i>
bok	<i>Fagus sylvatica</i>
cembratall	<i>Pinus cembra</i>
contortatall	<i>Pinus contorta</i>
ekar	<i>Quercus</i>
gran	<i>Picea abies</i>
gråal	<i>Alnus incana</i>
hägg	<i>Prunus padus</i>
hästkastanj	<i>Aesculus hippocastanum</i>
idegran	<i>Taxus baccata</i>
jolster	<i>Salix pentandra</i>
klibbal	<i>Alnus glutinosa</i>
lindar	<i>Tilia</i>
lärkar	<i>Larix</i>
lönn	<i>Acer platanoides</i>
oxlar	<i>Sorbus</i>
pilar	<i>Salix alba</i> agg.
plommon/krikon	<i>Prunus domestica</i>
päron	<i>Pyrus communis</i>
rödek	<i>Quercus rubra</i>
rönn	<i>Sorbus aucuparia</i>
sälg	<i>Salix caprea</i>
sötkörsbär	<i>Prunus avium</i>
tall	<i>Pinus sylvestris</i>
tysklönn	<i>Acer pseudoplatanus</i>
ädelgranar	<i>Abies</i>

## Appendix 2. Species List

Swedish name	Scientific name	Indicator spp. 1	Typical spp. 2	Invasive spp. 3	Rich Ind. Grassland 4	Rich Ind. Wetland 5	Tall herb 6	Low herb 7	Flowering 8	spp 2* 9	spp 3* 10	Cover cat. 9
Adam och Eva	<i>Dactylorhiza sambucina</i>	P	X									Ö
arun-arter	<i>Centaurium</i>	P										Ö
aspticka	<i>Phellinus tremulae</i>											
axag	<i>Schoenus ferrugineus</i>					X						ÖG
axveronika	<i>Veronica spicata</i>	P	X		X							Ö
backglim	<i>Silene nutans</i>	P										Ö
backklöver	<i>Trifolium montanum</i>	P	X		X				X			Ö
backnejlika	<i>Dianthus deltoides</i>	P	X						X			Ö
backruta	<i>Thalictrum simplex</i>	P										Ö
backsippa	<i>Pulsatilla vulgaris</i>	P	X						X			Ö
backtimjan	<i>Thymus serpyllum</i>	P	X						X			Ö
baronmossor	<i>Anomodon</i>	P										
berggrör	<i>Calamagrostis epigejos</i>	N								X		BG
bergsskrabba	<i>Globularia vulgaris</i>	P	X									Ö
bergsslok	<i>Melica nutans</i>		X									BG
bergsyra	<i>Rumex acetosella</i>											Ö
björkticka	<i>Piptoporus betulinus</i>											
björnbrödd	<i>Tofteldia pusilla</i>				X	X						Ö
blekbalsamin	<i>Impatiens parviflora</i>			X								Ö
blodnäva	<i>Geranium sanguineum</i>	P			X				X			Ö
blodrot	<i>Potentilla erecta</i>		X									Ö
blåbär	<i>Vaccinium myrtillus</i>		X							X		R
blåmossa	<i>Leucobryum glaucum</i>		X									
blåmunkar	<i>Jasione montana</i>		X									Ö
blåsippa	<i>Hepatica nobilis</i>		X					X	X	X		Ö
blåsuga	<i>Ajuga pyramidalis</i>	P	X									Ö
blåtåtel	<i>Molinia caerulea</i>									X		BG
bockrot	<i>Pimpinella saxifraga</i>	P	X									Ö
boerstånds	<i>Senecio inaequidens</i>			X								Ö
borsttåg	<i>Juncus squarrosus</i>	P	X									ÖG
borsttåtel	<i>Corynephorus canescens</i>	P	X									SG
bredgentiana	<i>Gentianella campestris</i>	P	X									Ö
brudborste	<i>Cirsium heterophyllum</i>		X				X	X	X	X		Ö
brudbröd	<i>Filipendula vulgaris</i>	P	X		X				X			Ö
brudsporre	<i>Gymnadenia conopsea</i>	P	X		X	X			X			Ö
brunnrör	<i>Calamagrostis phragmitoides</i>											BG
brännässla	<i>Urtica dioica</i>	N					X			X		Ö
buskstjärnblomma	<i>Stellaria holostea</i>		X				X					Ö
bäckbräsma	<i>Cardamine amara</i>		X									Ö
cikoria	<i>Cichorium intybus</i>								X			Ö
darrgräs	<i>Briza media</i>	P	X		X							BG
doftticka	<i>Haploporus odoratus</i>		X									
dunmossa	<i>Trichocolea tomentella</i>		X									

## Grasslands and Deciduous Forests 2024

Swedish name	Scientific name	Indicator spp. <sup>1</sup>	Typical spp. <sup>2</sup>	Invasive spp. <sup>3</sup>	Rich Ind. <sup>4</sup> Grassland	Rich Ind. Wetland <sup>5</sup>	Tall herb <sup>6</sup>	Low herb <sup>7</sup>	Flowering <sup>8</sup>	ssp2*	ssp3*	Cover cat. <sup>9</sup>
duvnäva	<i>Geranium columbinum</i>	P	X									Ö
dvärghäxört	<i>Circaea alpina</i>		X									Ö
dvärglummer	<i>Selaginella selaginoides</i>	P	X		X	X						Lu
ekbräken	<i>Gymnocarpium dryopteris</i>							X				OB
ekorrbar	<i>Maianthemum bifolium</i>		X									Ö
ekticka	<i>Fomitiporia robusta</i>		X									
enbjörnmossa	<i>Polytrichum juniperinum</i>											
fackelblomster	<i>Lythrum salicaria</i>		X						X			Ö
fjädermossor	<i>Neckera</i>											
fjällgröe	<i>Poa alpina</i>	P	X									BG
fjällruta	<i>Thalictrum alpinum</i>	P	X									Ö
fjällskära	<i>Saussurea alpina</i>	P	X									Ö
fjälltimotej	<i>Phleum alpinum</i>	P	X									BG
fjällvedel	<i>Astragalus alpinus</i>		X									Ö
flentimotej	<i>Phleum phleoides</i>	P			X							BG
flugblomster	<i>Ophrys insectifera</i>				X	X						Ö
fläcknycklar	<i>Dactylorhiza maculata</i>	P	X						X			Ö
fnöskticka	<i>Fomes fomentarius</i>											
foderlost	<i>Bromopsis inermis</i>											BG
färsvingel	<i>Festuca ovina</i>	P								X		SG
fällmossa	<i>Antitrichia curtipendula</i>		X									
fältmalört	<i>Artemisia campestris</i>	P										Ö
fältsippa	<i>Pulsatilla pratensis</i>	P	X						X			Ö
färgmåra	<i>Asperula tinctoria</i>	P	X									Ö
getrams	<i>Polygonatum odoratum</i>		X									Ö
getväppling	<i>Anthyllis vulneraria</i>	P			X				X			Ö
granspira	<i>Pedicularis sylvatica</i>	P	X									Ö
grenrör	<i>Calamagrostis canescens</i>											BG
groblad	<i>Plantago major</i>									X		Ö
grusbräcka	<i>Saxifraga tridactylites</i>	P	X									Ö
gruskammosa	<i>Abietinella abietina</i>	P	X									
grusviva	<i>Androsace septentrionalis</i>	P	X									Ö
gråbo	<i>Artemisia vulgaris</i>	N										Ö
gräshakmosa	<i>Rhytidiadelphus squarrosus</i>	N										
gräsull	<i>Eriophorum latifolium</i>				X	X						ÖG
grönkulla	<i>Coeloglossum viride</i>		X		X							Ö
guckusko	<i>Cypripedium calceolus</i>					X						Ö
gul fetknopp	<i>Sedum acre</i>	P	X									Ö
gul skunkkalla	<i>Lysichiton americanus</i>			X								Ö
guldspärrmossa	<i>Campyllum stellatum</i>					X						
gulkämpar	<i>Plantago maritima</i>	P								X		Ö
gullpudra	<i>Chrysosplenium alternifolium</i>		X									Ö
gullris	<i>Solidago virgaurea</i>											Ö

Grasslands and Deciduous Forests 2024

Swedish name	Scientific name	Indicator spp. 1	Typical spp. 2	Invasive spp. 3	Rich Ind. Grassland 4	Rich Ind. Wetland 5	Tall herb 6	Low herb 7	Flowering 8	ssp 2*	ssp 3*	Cover cat. 9
gullviva	<i>Primula veris</i>	P	X						X			Ö
gulmåra	<i>Galium verum</i>	P										Ö
gulplister	<i>Lamium galeobdolon</i>		X				X					Ö
gulsippa	<i>Anemone ranunculoides</i>		X				X					Ö
gulvial	<i>Lathyrus pratensis</i>											Ö
gvllenmossa	<i>Tomentypnum nitens</i>					X						
gökbloster	<i>Lychnis flos-cuculi</i>	P	X									Ö
gökärt	<i>Lathyrus linifolius</i>		X						X			Ö
hampflockel	<i>Eupatorium cannabinum</i>		X									Ö
harklöver	<i>Trifolium arvense</i>	P							X			Ö
harmynta	<i>Clinopodium acinos</i>	P	X									Ö
harsyra	<i>Oxalis acetosella</i>							X				Ö
havssälting	<i>Triglochin maritima</i>	P										Ö
hedsäv	<i>Trichophorum cespitosum</i> subsp. <i>germanicum</i>	P	X									ÖG
hirsstarr	<i>Carex panicea</i>	P	X									St
hultbräken	<i>Phegopteris connectilis</i>							X				OB
humleblomster	<i>Geum rivale</i>							X	X			Ö
hundkäv	<i>Anthriscus sylvestris</i>								X		X	Ö
hundäxing	<i>Dactylis glomerata</i>									X		BG
husmossa	<i>Hylocomium splendens</i>											
huvudstarr	<i>Carex capitata</i>					X						St
hårbjörnmossa	<i>Polytrichum piliferum</i>											
hårklomossa	<i>Dichelyma capillaceum</i>		X									
hårnervmossa	<i>Campylopus introflexus</i>			X								
hårstarr	<i>Carex capillaris</i>	P	X		X	X						St
hässlebrodd	<i>Milium effusum</i>											BG
hässleklocka	<i>Campanula latifolia</i>		X									Ö
hästhov	<i>Tussilago farfara</i>											Ö
höstfibbla	<i>Scorzoneroides autumnalis</i>								X			Ö
höstlåsbräken	<i>Botrychium multifidum</i>	P	X									OB
jordtistel	<i>Cirsium acaule</i>	P	X		X							Ö
jungfrulin	<i>Polygala vulgaris</i>	P	X									Ö
jättebalsamin	<i>Impatiens glandulifera</i>			X					X			Ö
jättegröe	<i>Glyceria maxima</i>	N										BG
jätteleka	<i>Heracleum mantegazzianum</i>			X					X			Ö
jätteslide	<i>Reynoutria sachalinensis</i>			X								Ö
kalklungmossa	<i>Marchantia quadrata</i>					X						
kalkmossor	<i>Tortella</i>	P										
kammossa	<i>Ptilium crista-castrensis</i>											
kanadensiskt gullris/ höstgullris	<i>Solidago canadensis</i> agg.			X								Ö
kantig fetknopp	<i>Sedum sexangulare</i>	P	X		X							Ö

## Grasslands and Deciduous Forests 2024

Swedish name	Scientific name	Indicator spp. <sup>1</sup>	Typical spp. <sup>2</sup>	Invasive spp. <sup>3</sup>	Rich Ind. <sup>4</sup> Grassland	Rich Ind. Wetland <sup>5</sup>	Tall herb <sup>6</sup>	Low herb <sup>7</sup>	Flowering <sup>8</sup>	ssp2*	ssp3*	Cover cat. <sup>9</sup>
kattfot	<i>Antennaria dioica</i>	P	X									Ö
kirskål	<i>Aegopodium podagraria</i>	N					X			X		Ö
klasefibbla	<i>Crepis praemorsa</i>	P	X		X				X			Ö
klibbticka	<i>Fomitopsis pinicola</i>											
klippfrullania	<i>Frullania tamarisci</i>		X									
klockgentiana	<i>Gentiana pneumonanthe</i>	P	X						X			Ö
klockjulros	<i>Helleborus foetidus</i>			X								Ö
klockljung	<i>Erica tetralix</i>		X									R
klockpyrola	<i>Pyrola media</i>		X									Ö
klomossa	<i>Dichelyma falcatum</i>		X									
knagglestarr-gruppen	<i>Carex flava</i> agg.	P			X	X						St
knapptåg/veketåg	<i>Juncus conglomeratus</i> agg.	N									X	ÖG
knippfryle	<i>Luzula campestris</i>	P	X							X		ÖG
knutnarv	<i>Sagina nodosa</i>		X									Ö
knylhavre	<i>Arrhenatherum elatius</i>	N								X		BG
knägräs	<i>Danthonia decumbens</i>	P	X							X		BG
knölmörblomma	<i>Ranunculus bulbosus</i>	P	X						X			Ö
korallrot	<i>Corallorhiza trifida</i>		X									Ö
korskovall	<i>Melampyrum cristatum</i>	P	X									Ö
korvskorpionmossa	<i>Scorpidium scorpioides</i>					X						
kransmossa	<i>Rhytidiadelphus triquetrus</i>											
kransrams	<i>Polygonatum verticillatum</i>		X									Ö
krisslor	<i>Inula</i>	P			X							Ö
krustistel	<i>Carduus crispus</i>											Ö
kruståtel	<i>Avenella flexuosa</i>											SG
kråkbär	<i>Empetrum nigrum</i>											Ö
kvickrot	<i>Elytrigia repens</i>	N								X		BG
kåltistel	<i>Cirsium oleraceum</i>		X									Ö
källmossor	<i>Philonotis</i>											
källtuffmossa	<i>Cratoneuron filicinum</i>					X						
käringtand	<i>Lotus corniculatus</i>		X						X			Ö
kärleksört	<i>Hylotelephium telephium</i>											Ö
kärrbräken	<i>Thelypteris palustris</i>		X									OB
kärrfibbla	<i>Crepis paludosa</i>		X				X		X			Ö
kärrknipprot	<i>Epipactis palustris</i>				X	X						Ö
kärrmörkia	<i>Moerckia flotoviana</i>					X						
kärrspira	<i>Pedicularis palustris</i>	P	X									Ö
kärrsälting	<i>Triglochin palustris</i>		X									Ö
kärtistel	<i>Cirsium palustre</i>						X		X	X		Ö
kärrtrumpetmossa	<i>Taylora lingulata</i>					X						
lentåtel	<i>Holcus mollis</i>	N										BG
liljekonvalj	<i>Convallaria majalis</i>		X						X			Ö

## Grasslands and Deciduous Forests 2024

Swedish name	Scientific name	Indicator spp. <sup>1</sup>	Typical spp. <sup>2</sup>	Invasive spp. <sup>3</sup>	Rich Ind. Grassland <sup>4</sup>	Rich Ind. Wetland <sup>5</sup>	Tall herb <sup>6</sup>	Low herb <sup>7</sup>	Flowering <sup>8</sup>	ssp2*	ssp3*	Cover cat. <sup>9</sup>
lingon	<i>Vaccinium vitis-idaea</i>									X		R
liten blåklocka	<i>Campanula rotundifolia</i>	P	X							X		Ö
liten fetknopp	<i>Sedum annuum</i>	P	X									Ö
ljung	<i>Calluna vulgaris</i>								X			R
luddhavre	<i>Avenula pubescens</i>											BG
luddlosta	<i>Bromus hordeaceus</i>		X									BG
luddtåtel	<i>Holcus lanatus</i>											BG
lundarv	<i>Stellaria nemorum</i>		X				X					Ö
lunddraba	<i>Draba muralis</i>		X									Ö
lundelm	<i>Elymus caninus</i>											BG
lundslok	<i>Melica uniflora</i>		X									BG
lundstarr	<i>Carex montana</i>	P	X									St
lundtrav	<i>Arabis hirsuta</i>	P	X		X							Ö
lunglav	<i>Lobaria pulmonaria</i>		X									
lupiner	<i>Lupinus</i>			X					X		X	Ö
luserner	<i>Medicago</i>											Ö
långsvingel	<i>Schedonorus giganteus</i>											BG
läkevänderot/fläder vänderot	<i>Valeriana officinalis</i> agg.		X									Ö
majbräken	<i>Athyrium filix-femina</i>		X				X				X	OB
majviva	<i>Primula farinosa</i>	P	X		X	X			X			Ö
mandelblomma	<i>Saxifraga granulata</i>	P	X						X			Ö
maskrosor	<i>Taraxacum</i>								X			Ö
midsommarblomster	<i>Geranium sylvaticum</i>								X			Ö
missne	<i>Calla palustris</i>		X									Ö
mjölke	<i>Chamaenerion angustifolium</i>	N							X		X	Ö
mjölon	<i>Arctostaphylos uva-ursi</i>		X									R
myrbjörnmossa	<i>Polytrichum strictum</i>											
myrlilja	<i>Narthecium ossifragum</i>		X									Ö
myrduddmossa	<i>Cinclidium stygium</i>					X						
myskmadra	<i>Galium odoratum</i>	P	X				X					Ö
månårsbräken	<i>Botrychium lunaria</i>	P	X									OB
månviol	<i>Lunaria rediviva</i>		X									Ö
mörk husmossa	<i>Hylocomiastrum umbratum</i>		X									
mörk lungört	<i>Pulmonaria obscura</i>		X					X				Ö
nattviol	<i>Platanthera</i>	P							X			Ö
nordisk stormhatt	<i>Aconitum lycoctonum</i> subsp.		X				X					Ö
nordlåsbräken	<i>Botrychium boreale</i>	P	X									OB
nunneörter	<i>Corydalis</i>							X				Ö
nysört	<i>Achillea ptarmica</i>											Ö
orrbär	<i>Paris quadrifolia</i>						X					Ö
ormrot	<i>Bistorta vivipara</i>	P	X									Ö

Grasslands and Deciduous Forests 2024

Swedish name	Scientific name	Indicator spp. <sup>1</sup>	Typical spp. <sup>2</sup>	Invasive spp. <sup>3</sup>	Rich Ind. Grassland <sup>4</sup>	Rich Ind. Wetland <sup>5</sup>	Tall herb <sup>6</sup>	Low herb <sup>7</sup>	Flowering <sup>8</sup>	ssp2*	ssp3*	Cover cat. <sup>9</sup>
oxtung	<i>Anchusa officinalis</i>											Ö
oxtungssvamp	<i>Fistulina hepatica</i>											
palmossa	<i>Climacium dendroides</i>											
parkslide	<i>Reynoutria japonica</i>			X								Ö
pillerstarr	<i>Carex pilulifera</i>	P	X									St
piprensarmossa	<i>Paludella squarrosa</i>					X						
platticka	<i>Ganoderma applanatum</i>											
plattlumner	<i>Lycopodium complanatum</i>		X									Lu
porellor	<i>Porella</i>											
praktbrunört	<i>Prunella grandiflora</i>	P										Ö
Praktbräkenmossa	<i>Plagiochila asplenioides</i> subsp. <i>asplenioides</i>											
praktflikmossa	<i>Leiocolea rutheana</i>					X						
prästkrag	<i>Leucanthemum vulgare</i>	P	X						X			Ö
ramslök	<i>Allium ursinum</i>						X					Ö
renfana	<i>Tanacetum vulgare</i>								X			Ö
revsmörblomma	<i>Ranunculus repens</i>											Ö
rosettjungfrulin	<i>Polygala amarella</i>	P	X		X							Ö
rutläsbräken	<i>Botrychium matricariifolium</i>	P	X									OB
ryssgubbe	<i>Bunias orientalis</i>	N								X		Ö
röd skorpionmossa	<i>Scorpidium revolvens</i>					X						
rödblåra	<i>Silene dioica</i>						X					Ö
rödclint	<i>Centaurea jacea</i>											Ö
rödkläver	<i>Trifolium pratense</i>											Ö
röd kämpar	<i>Plantago media</i>	P	X		X					X		Ö
rödven	<i>Agrostis capillaris</i>	P								X		BG
röllika	<i>Achillea millefolium</i>											Ö
sandkrassing	<i>Teesdalia nudicaulis</i>			X								Ö
sandnarv	<i>Arenaria serpyllifolia</i>	P										Ö
Sankt Pers nycklar	<i>Orchis mascula</i>	P	X		X							Ö
skallror	<i>Rhinanthus</i>	P										Ö
skavfräken	<i>Equisetum hyemale</i>											Fr
skogsbingel	<i>Mercurialis perennis</i>		X				X					Ö
skogskläver	<i>Trifolium medium</i>											Ö
skogskorn	<i>Hordelymus europaeus</i>		X									BG
skogslving	<i>Lysimachia nemorum</i>		X									Ö
skogssallat	<i>Lactuca muralis</i>						X					Ö
skogsstjärna	<i>Lysimachia europaea</i>		X									Ö
skogssvingel	<i>Drymochloa sylvatica</i>		X									BG
skrovellav	<i>Lobaria scrobiculata</i>		X									
slankstarr	<i>Carex flacca</i>	P	X		X	X						St
slätterblomma	<i>Parnassia palustris</i>	P	X		X	X			X			Ö
slätterfibbla	<i>Hypochaeris maculata</i>	P	X									Ö

## Grasslands and Deciduous Forests 2024

Swedish name	Scientific name	Indicator spp. <sup>1</sup>	Typical spp. <sup>2</sup>	Invasive spp. <sup>3</sup>	Grassland <sup>4</sup>	Rich Ind. Wetland <sup>5</sup>	Tall herb <sup>6</sup>	Low herb <sup>7</sup>	Flowering <sup>8</sup>	ssp2*	ssp3*	Cover cat. <sup>9</sup>
slätterroubhe	<i>Arnica montana</i>	P	X						X	X		Ö
smalfräken	<i>Equisetum variegatum</i>					X						Fr
smultron/backsmultron	<i>Fragaria vesca</i> agg.	P										Ö
smultronklöver	<i>Trifolium fragiferum</i>	P										Ö
smörblomma	<i>Ranunculus acris</i>											Ö
smörbollar	<i>Trollius europaeus</i>	P	X				X		X			Ö
solvända	<i>Helianthemum nummularium</i>	P	X						X			Ö
sommarfibbla	<i>Leontodon hispidus</i>	P	X						X			Ö
spjutmossa	<i>Calliergonella cuspidata</i>	N										
springkorn	<i>Impatiens noli-tangere</i>		X									Ö
sprängticka	<i>Inonotus obliquus</i>											
spätistel	<i>Carlina vulgaris</i>	P	X		X							Ö
späd skorpionmossa	<i>Scorpidium cossonii</i>					X						
spärrvitmossa	<i>Sphagnum squarrosum</i>											
stagg	<i>Nardus stricta</i>	P	X							X		SG
stenmåra	<i>Galium saxatile</i>	P	X									Ö
stinksyska	<i>Stachys sylvatica</i>						X					Ö
stjärnstarr	<i>Carex echinata</i>		X									St
stor aspticka	<i>Phellinus populicola</i>		X									
stor björnmossa	<i>Polytrichum commune</i>											
stor blålocka	<i>Campanula persicifolia</i>	P	X									Ö
stor fetknopp	<i>Petrosedum rupestre</i>	P	X									Ö
stor kvastmossa	<i>Dicranum majus</i>											
stor revmossa	<i>Bazzania trilobata</i>											
stor skedmossa	<i>Calliergon giganteum</i> agg.					X						
storgröe	<i>Poa remota</i>		X									BG
stormåra	<i>Galium mollugo</i>	N								X		Ö
storrams	<i>Polygonatum multiflorum</i>		X									Ö
strandrödtoppa	<i>Odontites litoralis</i>	P										Ö
strutbräken	<i>Matteuccia struthiopteris</i>		X				X				X	OB
strätta	<i>Angelica sylvestris</i>						X		X		X	Ö
strävlost	<i>Bromopsis benekenii</i>		X									BG
stymorsviol	<i>Viola tricolor</i>		X									Ö
stångfibblor	<i>Pilosella</i>	P								X		Ö
sumpmåra	<i>Galium uliginosum</i>	P	X									Ö
svalört	<i>Ficaria verna</i>							X				Ö
svanmossa	<i>Meesia uliginosa</i>					X						
svart trolldruva	<i>Actaea spicata</i>		X				X					Ö
svarthö	<i>Bartsia alpina</i>	P	X		X	X						Ö
svartknoppsmossa	<i>Catoscopium nigratum</i>					X						
svartkämpar	<i>Plantago lanceolata</i>	P	X									Ö
svavelticka	<i>Laetiporus sulphureus</i>											
svinrot	<i>Scorzonera humilis</i>	P	X						X		X	Ö

## Grasslands and Deciduous Forests 2024

Swedish name	Scientific name	Indicator spp. <sup>1</sup>	Typical spp. <sup>2</sup>	Invasive spp. <sup>3</sup>	Rich Ind. Grassland <sup>4</sup>	Rich Ind. Wetland <sup>5</sup>	Tall herb <sup>6</sup>	Low herb <sup>7</sup>	Flowering <sup>8</sup>	ssp2*	ssp3*	Cover cat. <sup>9</sup>
sårläka	<i>Sanicula europaea</i>	P	X				X					Ö
sälgticka	<i>Phellinopsis conchata</i>											
tagelstarr	<i>Carex appropinquata</i>					X						St
tagelsäv	<i>Eleocharis quinqueflora</i>					X						ÖG
tandrot	<i>Cardamine bulbifera</i>		X				X					Ö
terpentinmossa	<i>Geocalyx graveolens</i>		X									
teveronika	<i>Veronica chamaedrys</i>								X			Ö
timotej	<i>Phleum pratense</i>	N								X		BG
tjärblomster	<i>Viscaria vulgaris</i>	P	X						X	X		Ö
topplåsbräken	<i>Botrychium lanceolatum</i>	P	X									OB
torta	<i>Lactuca alpina</i>						X				X	Ö
trampört	<i>Polygonum aviculare</i>											Ö
trekantig svanmossa	<i>Meesia triquetra</i>					X						
trift	<i>Armeria maritima</i>	P										Ö
trubbfjädermossa	<i>Homalia trichomanoides</i>		X									
trådfräken	<i>Equisetum scirpoides</i>					X						Fr
tuffmossor	<i>Palustriella</i>					X						
tulkört	<i>Vincetoxicum hircundinaria</i>	P										Ö
tuvtåtel	<i>Deschampsia cespitosa</i>		X							X		BG
tvåblad	<i>Neottia ovata</i>	P			X	X	X			X		Ö
underviol	<i>Viola mirabilis</i>		X									Ö
vanlig rörsvepemossa	<i>Liochlaena lanceolata</i>		X									
vass	<i>Phragmites australis</i>	N									X	BG
vildlin	<i>Linum catharticum</i>	P	X		X							Ö
vintergröna	<i>Vinca minor</i>			X								Ö
vit fetknopp	<i>Sedum album</i>	P	X		X							Ö
vitblära	<i>Silene latifolia</i>		X									Ö
vitklöver	<i>Trifolium repens</i>								X			Ö
vitknavel	<i>Scleranthus perennis</i>	P	X									Ö
vitmåra	<i>Galium boreale</i>											Ö
vitsippa	<i>Anemone nemorosa</i>							X	X	X		Ö
vågig praktmossa	<i>Plagiomnium undulatum</i>											
vågig sidenmossa	<i>Plagiothecium undulatum</i>											
vårbrodd (aggregat)	<i>Anthoxanthum odoratum</i> agg.		X							X		BG
vårfingerört/småfingerört/ grå småfingerört	<i>Potentilla crantzii</i> agg.	P			X							Ö
vårfryle	<i>Luzula Pilosa</i>											ÖG
vårlökar	<i>Gagea</i>							X				Ö
vårspärgel	<i>Spergula morisonii</i>	P	X									Ö
vårtåtel	<i>Aira praecox</i>	P	X									BG
vårärt	<i>Lathyrus vernus</i>		X					X	X			Ö
väddklint	<i>Centaurea scabiosa</i>	P							X			Ö
väggmossa	<i>Pleurozium schreberi</i>											
vägtistel	<i>Cirsium vulgare</i>								X			Ö

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Swedish name	Scientific name	Indicator spp. <sup>1</sup>	Typical spp. <sup>2</sup>	Invasive spp. <sup>3</sup>	Grassland <sup>4</sup>	Rich Ind. Wetland <sup>5</sup>	Rich Ind. Grassland <sup>4</sup>	Tall herb <sup>6</sup>	Low herb <sup>7</sup>	Flowering <sup>8</sup>	ssp2*	ssp3*	Cover cat. <sup>9</sup>
västlig hakmossa	<i>Rhynchospora alba</i>												
vätters	<i>Lathraea squamaria</i>		X										Ö
åkerfräken	<i>Equisetum arvense</i>	N											Fr
åkertistel	<i>Cirsium arvense</i>	N								X		X	Ö
åkervädd	<i>Knautia arvensis</i>	P								X	X		Ö
älggräs	<i>Filipendula ulmaria</i>							X		X		X	Ö
älvväxing	<i>Sesleria uliginosa</i>	P	X		X								BG
ängsbrämsa	<i>Cardamine pratensis</i>	P	X										Ö
ängsfryle/blekfryle/ svartfryle	<i>Luzula multiflora</i> agg.	P											ÖG
ängsgentiana	<i>Gentianella amarella</i>	P	X		X					X			Ö
ängshaverrot	<i>Tragopogon pratensis</i>									X	X		Ö
ängshavre	<i>Helictochloa pratensis</i>	P	X		X						X		BG
ängskavle	<i>Alopecurus pratensis</i>												BG
ängsklocka	<i>Campanula patula</i>	P											Ö
ängskovall/skogskovall	<i>Melampyrum pratense</i> agg.		X										Ö
ängsnycklar	<i>Dactylorhiza incarnata</i>	P	X			X							Ö
ängsruta	<i>Thalictrum flavum</i>	P	X										Ö
ängsskära	<i>Serratula tinctoria</i>	P	X							X			Ö
ängsstarr	<i>Carex hostiana</i>	P	X										St
ängssyra	<i>Rumex acetosa</i>							X					Ö
ängsvädd	<i>Succisa pratensis</i>	P	X							X	X		Ö
ärenpris	<i>Veronica officinalis</i>												Ö
ögonpyrola	<i>Moneses uniflora</i>		X										Ö
ögontröster	<i>Euphrasia</i>	P											Ö
örnbräken	<i>Pteridium aquilinum</i>	N										X	OB

1. Indicator species. P denotes positive indicator species, i.e. species favoured by grazing or mowing. N denotes negative indicator species, i.e. nitrogen-favoured, mainly large and strongly competitive species (see 8.9.24 Positive Indicator Species and 8.9.25 Negative Indicator Species).

2. Typical species. These are the typical species listed in the Swedish habitat guidance for each habitat type, and which are recorded in the field.

3. Invasive species. Based on the EU-listed invasive alien plant species as of autumn 2023, with the addition of lupins (*Lupinus* spp.).

4. Rich Ind. Grassland. Species used as indicators of base-rich conditions in grasslands (see Gardfjell & Hagner 2019 for details).

5. Rich Ind. Wetland. Species used as indicators of base-rich conditions in wetlands (see Gardfjell & Hagner 2019 for details).

6. Tall herb. Species considered to be tall herbs.

7. Low herb. Species considered to be low herbs.

8. Flowering. An X indicates that active flowering should be recorded for that species (see 9.4.4 Flowering).

\* An X indicates that abundance should be recorded for that species in either small sample plot 2 (ssp2) or small sample plot 3 (ssp3) (see 9.4.3 Abundance of Selected Species).

9. Coverage. The coverage of different species groups is recorded (see 9.3.1 Field Layer: Coverage of Species Groups): Broad-leaved grasses (BG), Narrow-leaved grasses (SG), True sedges (ST), Other graminoids (ÖG), Dwarf-shrubs (R), Herbs (Ö), Ferns (OB), Horsetails (Fr), Lycophytes (Lu).

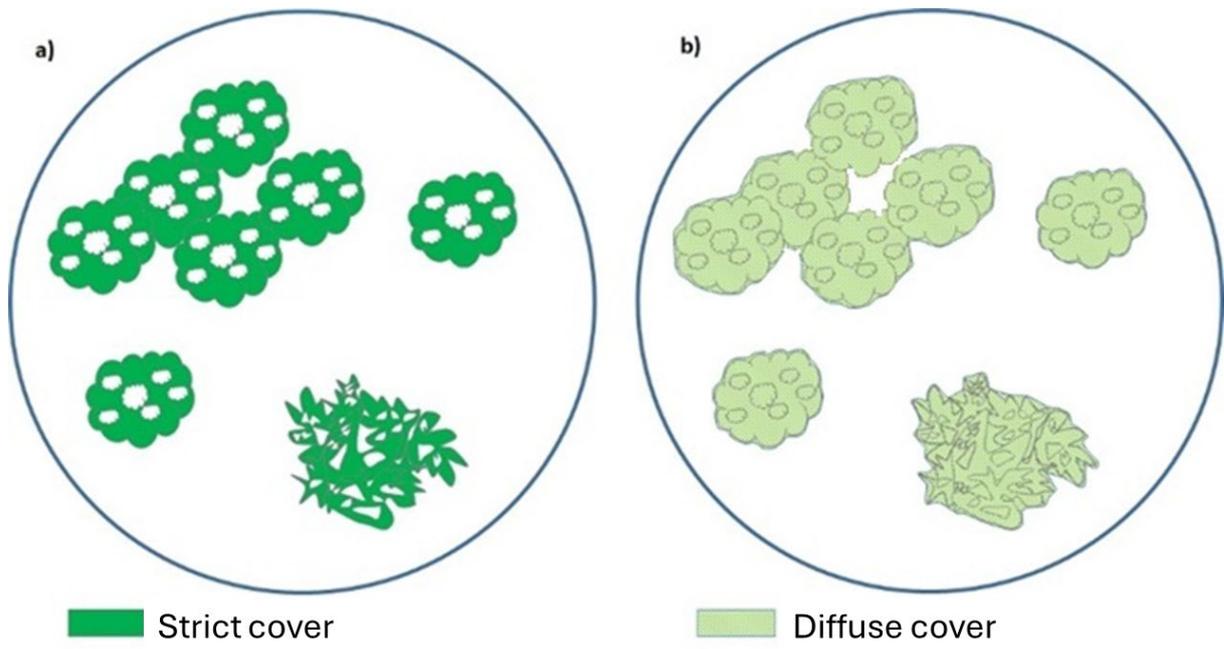
## Appendix 3. Strict and Diffuse Cover

Cover can be assessed using two different approaches: strict or diffuse cover (Figure A3.1).

In this survey, trees and shrubs are recorded using diffuse cover (i.e., cover where the boundary is defined by the outer edge of the tree crown or shrub). According to this principle, all areas within the outer perimeter of a tree crown are considered to be 100% covered.

The herbaceous layer, on the other hand, is assessed using strict cover (i.e., precise cover, where any gaps in the vegetation are excluded).

Strict cover percentages are always less than or equal to diffuse cover, strict cover can never exceed diffuse cover.



*Figure A3.1. a) Strict cover, b) Diffuse cover.*

## Appendix 4. Conversion between $\text{cm}^2$ , $\text{dm}^2$ and $\text{m}^2$

*Table A4.1. Conversion between  $\text{cm}^2$ ,  $\text{dm}^2$  and  $\text{m}^2$ .*

$\text{cm}^2$	$\text{dm}^2$	$\text{m}^2$
1	0.01	0.0001
10	0.1	0.001
100	1	0.01
1000	10	0.1
5000	50	0.5
10000	100	1
	150	1.5
	500	5
	1000	10
	10000	100

## Appendix 5. Minimum Recommended Final Felling Age (MRFFA)

How to use the table:

1. Begin by measuring the stand height. Then, determine the comparison age (i.e. minimum recommended final felling age + 20 years, MRFFA + 20) using Table A5.1 below.
2. Measure the basal area-weighted stand age of the stand under assessment.
3. If the measured stand age is equal to or greater than the comparison age, the (MRFFA + 20) criterion is met. If the stand age exceeds the comparison age by more than 20 years, then the stricter criterion (MRFFA + 40) is also considered fulfilled.

MRFFA tables are not available for downy birch/mountain birch (*Betula pubescens* ssp.), grey alder (*Alnus incana*), black alder (*Alnus glutinosa*), or other common deciduous species. For these species, the MRFFA + 20 criterion is considered fulfilled if the basal area-weighted stand age exceeds 60 years, regardless of geographic region. There are likewise no MRFFA values for low-productive sites (e.g. rocky outcrops, mires) or for coniferous forests in alpine or subalpine zones. In these cases, apply the highest listed age for the relevant tree species and geographic region.

**Table A5.1.** Relationship between stand height and comparison age (MRFFA + 20) for different tree species.

Tree species	Stand height					
	< 15 m	20 m	25 m	30 m	32 m	35 m
Scots pine*	145 yrs	130 yrs	110 yrs	95 yrs		
Norway spruce, Southern Sweden		125 yrs	115 yrs	95 yrs		90 yrs
Norway spruce, Northern Sweden	160 yrs	135 yrs	120 yrs	100 yrs	90 yrs	
Oak	150 yrs	135 yrs	120 yrs	110 yrs		
Beech + other broad-leaved tree species	120 yrs	115 yrs	110 yrs	105 yrs		100 yrs
Silver birch, Svealand and southern Norrland	70 yrs	65 yrs	60 yrs	60 yrs		

Silver birch (northern Norrland), downy birch, mountain birch, grey alder, black alder, and other common deciduous tree species: 60 years

\*Note: For northernmost counties, add 10 years to Scots pine values. For southernmost counties, subtract 5 years. Source: Gardfjell & Hagner (2019).

## Appendix 6. Classification of Ground Vegetation Types in Beech and Oak Forests

When classifying Annex I-habitat types in beech or oak forests, a distinction is made between nutrient-poor and nutrient-rich types. This is based on an assessment of the ground vegetation according to the table and key provided below. The area where the vegetation is assessed should be representative of the soil's nutrient availability within the Beech or Oak Forest (maximum 0.25 ha). Areas that are disturbed or otherwise deviate from the typical vegetation pattern should be excluded. Examples of such excluded features include trails, skid roads, road verges, ditches, surface boulders (>0.5 m), stumps, tree bases, and large downed logs. Note: Exposed bedrock is included in the ground surface area, as is vegetation occurring in canopy gaps.

The term ground surface area refers to the portion of the sample plot (or sub-sample plot) that is representative of the site's nutrient status. This typically constitutes a smaller area than the full sample plot, as disturbed or atypical areas are excluded. Again, bedrock outcrops and vegetation in canopy openings are considered part of the ground surface area. Note: When assessing ground vegetation type, the diffuse cover of the field layer and cryptogams (mosses and lichens) is evaluated across an area corresponding to a circle with a 10-meter radius.

**Table A.6.1** Ground vegetation type.

Ground vegetation type	NILS-code	
Lichen, dominating, "Lavtyp"	1	Poor
Lichen, frequent occurrence, "Lavrik typ"	2	
Rich-herb vegetation without dwarf-shrubs, "Högörttyp utan ris"	3	Rich
Rich-herb vegetation with bilberry ( <i>Vaccinium myrtillus</i> ), "Högörttyp med blåbär"	4	
Rich-herb vegetation with dwarf-shrubs, without bilberry ( <i>Vaccinium myrtillus</i> ), "Högörttyp med ris utom blåbär"	5	
Low-herb vegetation without dwarf-shrubs, "Lågörttyp utan ris"	6	
Low-herb vegetation with bilberry ( <i>Vaccinium myrtillus</i> ), "Lågörttyp med blåbär"	7	
Low-herb vegetation with dwarf-shrubs, without bilberry ( <i>Vaccinium myrtillus</i> ), "Lågörttyp med ris utom blåbär"	8	Different
No field-layer, "Mark utan fältskikt" Note: This type is generally associated with nutrient-rich habitats, especially where groundwater seepage (upslope water flow enriching the soil) occurs. Important: In beech forests ( <i>Fagus sylvatica</i> ) that are not influenced by seepage, the nutrient status is assessed based on the sparse vegetation present within this ground vegetation class. If typical woodland species are entirely absent, the habitat is classified as a nutrient-poor forest type, despite being beech-dominated.	9	
Broad-leaved grass type with bracken fern ( <i>Pteridium aquilinum</i> ), ("Bredbladig grästyp med örnbräken")	11	

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Note: This vegetation type is considered nutrient-rich in northern Sweden; however, in southern Sweden, it is regarded as nutrient-poor.		
Narrow-leaved grass type/Thin-leaved grass type "Smalbladig grästyp"	12	Poor
Sedge–Equisetum type, Sedge high, "Starr-fräken typ, Hög starr"	10	
Sedge –Equisetum type, Sedge low, "Starr-fräken typ, Låg starr"	10	
Sedge–Equisetum type, Equisetum, "Starr-fräken typ, Fräken"	10	
European blueberry, bilberry type, "Blåbärstyp"	13	
Lingonberry type, "Lingontyp"	14	
Crowberry-heather type, "Kråkbär-ljungtyp"	15	
Poor dwarf-shrub type, "Fattigristyp"	16	

**Table A.6.2.** Rich-herbs ("högorter") refer to the species in the table.

Rich-herbs		
Brudborste ( <i>Cirsium heterophyllum</i> )	Myskmadra ( <i>Galium odoratum</i> )	Strätta ( <i>Angelica sylvestris</i> )
Brännässla ( <i>Urtica dioica</i> )	Nordisk stormhatt ( <i>Aconitum lycoctonum</i> )	Sårläka ( <i>Prunella vulgaris</i> )
Buskstjärnblomma ( <i>Stellaria holostea</i> )	Ornbär ( <i>Paris quadrifolia</i> )	Tandrot ( <i>Dentaria bulbifera</i> )
Gulplister ( <i>Lamium galeobdolon</i> )	Ramslök ( <i>Allium ursinum</i> )	Torta ( <i>Tordylium maximum</i> )
Gulsippa ( <i>Anemone ranunculoides</i> )	Rödblära ( <i>Silene dioica</i> )	Trolldruva ( <i>Actaea spicata</i> )
Kirskål ( <i>Aegopodium podagraria</i> )	Skogsbingel ( <i>Mercurialis perennis</i> )	Tvåblad ( <i>Listera ovata</i> )
Kärrfibbla ( <i>Crepis paludosa</i> )	Skogssallat ( <i>Mycelis muralis</i> )	Älggräs ( <i>Filipendula ulmaria</i> )
Kärrtistel ( <i>Cirsium palustre</i> )	Smörbollor ( <i>Trollius europaeus</i> )	Ängssyra ( <i>Rumex acetosa</i> )
Lundstjärnblomma ( <i>Stellaria nemorum</i> )	Stinksyska ( <i>Galeopsis tetrahit</i> )	
Tall-growing ferns (excluding bracken, <i>Pteridium aquilinum</i> )	Midsommarblomster ( <i>Geranium sylvaticum</i> , in northern Sweden)	

**Table A.6.3.** Low-herbs ("lågörter") refer to the species in the table.

Low-herbs		
Blåsippa ( <i>Hepatica nobilis</i> )	Lungört ( <i>Pulmonaria obscura</i> )	Svalört ( <i>Ficaria verna</i> )
Ekbräken ( <i>Gymnocarpium dryopteris</i> )	Midsommarblomster ( <i>Geranium sylvaticum</i> , in southern Sweden)	Vitsippa ( <i>Anemone nemorosa</i> )
Harsyra ( <i>Oxalis acetosella</i> )	Vårlök ( <i>Gagea lutea</i> )	Humleblomster ( <i>Geum rivale</i> )
Hultbräken ( <i>Phegopteris connectilis</i> )	Nunneörter ( <i>Corydalis</i> spp.)	Vårärt ( <i>Lathyrus vernus</i> )

**Table A.6.4.** If at least one of the above species (either rich or low herb) is present, the following species are also considered low herbs.

Low-herbs if a species from Table A.6.2 or A.6.3 is present		
Daggkåpor ( <i>Alchemilla</i> spp.)	Stenbär ( <i>Rubus saxatilis</i> )	Smörblommor* ( <i>Ranunculus</i> spp.)
Ekorrhör ( <i>Maianthemum bifolium</i> )	Gullviva* ( <i>Primula veris</i> )	Veronikor* ( <i>Veronica</i> spp.)
Hönsbär ( <i>Cornus suecica</i> )	Smultron* ( <i>Fragaria vesca</i> )	Violer* ( <i>Viola</i> spp., excluding <i>Viola arvensis</i> , <i>Viola canina</i> and <i>Viola tricolor</i> )

\*Not considered as low herbs on heavily culturally influenced land, or if the area has been used for agriculture or enclosed grazing within the past 50 years (signs such as house foundations, stone piles, fence remains etc. should be present).

**Table A.6.5.** On peatland, the following species in the table are also included as low-herbs.

Low-herbs on peatland		
Björnbrod ( <i>Narthecium ossifragum</i> )	Dvärglummer ( <i>Lycopodiella inundata</i> )	Orkidéer ( <i>Orchidaceae</i> )
Blodrot ( <i>Potentilla erecta</i> )	Kärrfräken ( <i>Equisetum palustre</i> )	Slätterblomma ( <i>Parnassia palustris</i> )

**Table A.6.6.** Indicator species for sedge and horsetail vegetation types.

Indicator species	
Short sedges and rushes:	Low-growing sedges (up to knee height), such as tuvsäv ( <i>Trichophorum cespitosum</i> ), tuvull / ängsull ( <i>Eriophorum vaginatum</i> / <i>Eriophorum angustifolium</i> ), and klotstarr ( <i>Carex globularis</i> ). Note: Excludes strängstarr ( <i>Carex chordorhiza</i> ).
Tall sedges:	Graminoids exceeding knee height, including strängstarr ( <i>Carex chordorhiza</i> ).
Horsetail types:	presence of skogsfräken ( <i>Equisetum sylvaticum</i> ) and vattenklöver ( <i>Menyanthes trifoliata</i> ). Hjortron ( <i>Rubus chamaemorus</i> ) is also included if it co-occurs with any of the above species.

**Key for Ground Vegetation Type in Site Productivity Classification**

1.	Lichens/mosses cover more than 1% of the ground surface (NOTE: See definition!)	2
1	Lichens/mosses cover less than 1% of the ground surface	4
2.	Lichens cover more than 25% of the ground surface	3
2.	Lichens cover less than 25% of the ground surface	4
3.	Lichens cover 25–50% of the ground surface	Lichen, frequent occurrence
3.	Lichens cover more than 50% of the ground surface	Lichen, dominating
4.	Rich- or low-herbs are present	5
4.	Rich- or low-herbs are absent	18
5.	At least three rich-herb species are present	(Rich-herb vegetation) 14
5.	Fewer than three rich-herb species are present	6
6.	Rich- and/or low-herbs cover more than 1% of the ground and are spread over more than ¼ of the sub-sample plot	8
6.	If not the case	7
7.	Individual specimens of rich or low herbs occur in gaps within a closed planted spruce stand	8
7.	Not a planted spruce stand	18
8.	At least one rich-herb species is present	9
8.	No rich-herb species present	12

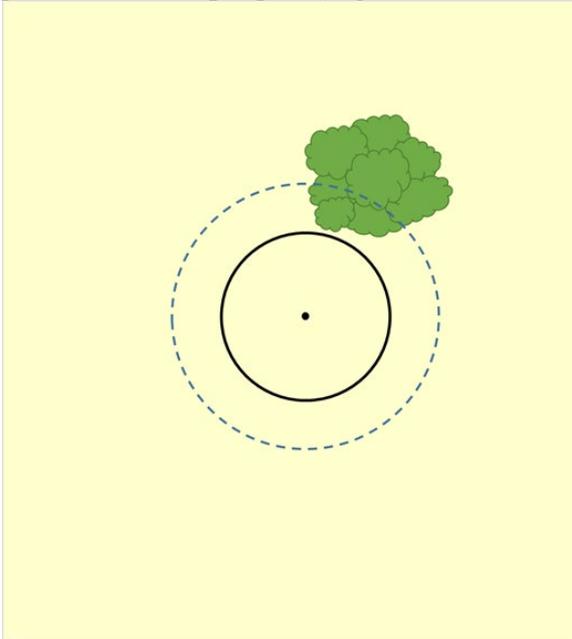
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9.	Two rich-herb species jointly make up at least 6% of total field-layer cover .....	14
9.	One rich-herb species, or two species together < 6% of total field-layer cover .....	10
10.	One rich-herb species covers at least 12% of the ground surface .....	14
10.	Rich-herb species cover less than 12% of the ground surface .....	11
11.	<i>Aconitum</i> or <i>Lactuca alpina</i> (stormhatt or torta) covers at least 6% of the ground surface .....	14
11.	<i>Aconitum</i> or <i>Lactuca alpina</i> covers less than 6% .....	12
12.	At least two low-herb species, or one rich + one low-herb together > 6% of field layer .....	16
12.	If not the case .....	13
13.	One low-herb species ( <i>Hepatica nobilis</i> (common hepatica/liverleaf)— <i>Lathyrus vernus</i> (Spring vetchling)) covers > 12% .....	16
13.	If not the case .....	18
14.	Dwarf-shrubs cover more than 25% of the ground surface .....	15
14.	Dwarf-shrubs cover less than 25% .....	Rich herb type without dwarf-shrubs
15.	<i>Vaccinium myrtillus</i> (bilberry is the dominant dwarf shrub .....	Rich-herb type with bilberry
15.	<i>V. myrtillus</i> (bilberry is not dominant .....	Rich-herb vegetation with dwarf-shrubs, without bilberry
16.	Dwarf shrubs cover more than 25% of the ground surface .....	17
16.	Dwarf shrubs cover less than 25% .....	Low-herb vegetation without dwarf-shrubs
17.	<i>Vaccinium myrtillus</i> (bilberry) is the dominant dwarf shrub .....	Low-herb vegetation with bilberry
17.	<i>V. myrtillus</i> (bilberry) is not dominant .....	Low-herb vegetation with dwarf-shrubs, without bilberry
18.	Field layer in total covers more than 6% of the ground surface (NOTE: See definition!) .....	19
18.	Field layer covers less than 6% .....	No field-layer
19.	Grasses, <i>Pteridium aquilinum</i> (bracken fern) and herbs together > 25% of total field layer .....	20
19.	Grasses, <i>Pteridium aquilinum</i> (bracken fern) and herbs cover less .....	21
20.	Broad-leaved grasses, bracken fern, and tall/low herbs dominate over narrow-leaved grasses and other herbs .....	Broad-leaved grass type with bracken fern
20.	Narrow-leaved grasses and other herbs dominate .....	Narrow-leaved grass type
21.	Indicator species for sedge and horsetail types cover more than 25% of field layer .....	22
21.	These indicator species cover less .....	23
22.	<i>Vaccinium myrtillus</i> (bilberry) covers more than low-growing sedges/rushes where the indicator species dominate .....	European blueberry, bilberry type
22.	<i>Vaccinium myrtillus</i> (bilberry) has lower cover than low sedges/rushes .....	Sedge–Equisetum type
23.	Herbs, grasses, ferns, Lycopodiopsida (clubmosses) and <i>Vaccinium myrtillus</i> (bilberry) > 50% of field layer .....	European blueberry, bilberry type
23.	Total cover less than 50% .....	24
24.	Above species plus <i>Vaccinium vitis-idaea</i> (lingonberry) and <i>Arctostaphylos uva-ursi</i> (bearberry) > 50% field layer cover .....	Lingonberry type
24.	Still less than 50% .....	25
25.	All above plus <i>Empetrum nigrum</i> (crowberry) and <i>Calluna</i> (common heather) > 50% .....	Crowberry-heather type
25.	All above plus <i>Empetrum nigrum</i> (crowberry), <i>Calluna vulgaris</i> (common heather), <i>Vaccinium uliginosum</i> (bog bilberry), <i>Rhododendron tomentosum</i> (marsh Labrador tea/wild rosemary) <i>Andromeda polifolia</i> (bog-rosemary) and <i>Vaccinium oxycoccos</i> agg. (Cranberry/ small cranberry) > 50% .....	Poor dwarf-shrub type

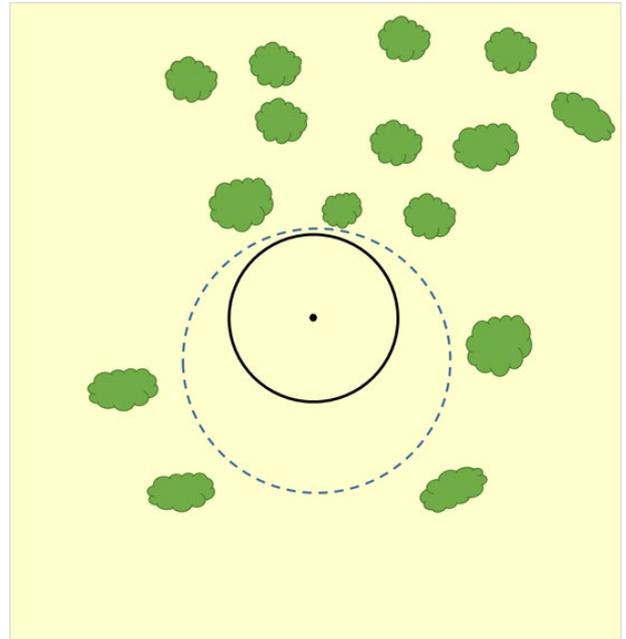
## Appendix 7. Assessment Polygons

For most of the variables, the field assessor must go beyond the boundary of the 10 m plot and into the so-called assessment polygon. The assessment polygon should represent 0.1 ha (from 100 m<sup>2</sup> up to 0.1 ha for rocky dry grasslands and grassland communities on calcareous bedrock.) of the assessed habitat type that is closest to and includes the sample plot.

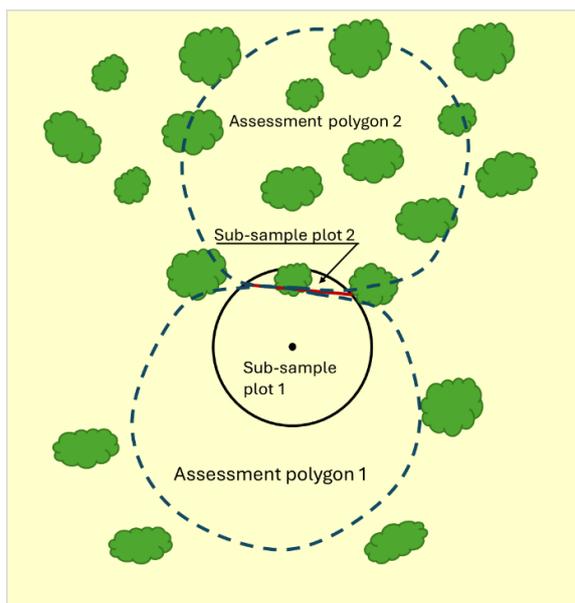
If the plot is undivided, the assessment polygon corresponds to a circular radius of 17.8 meters from the plot center (Figures A7.1–A7.2, A7.4). In elongated habitat patches, it is important that the assessment polygon extends equally in both directions. For divided plots, the assessment polygon should be placed so that it includes the habitat type found in the respective sub-sample plot (Figures A7.3, A7.5).



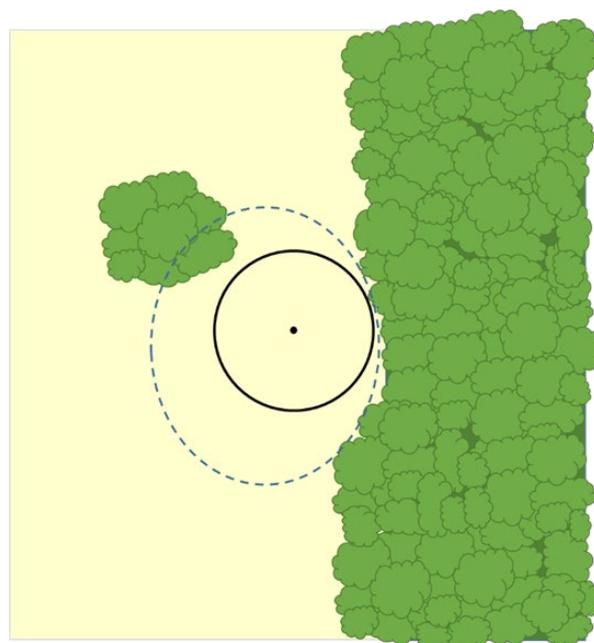
**Figure A7.1.** The sample plot is undivided, as it contains only one habitat type, and is entirely surrounded by the same habitat type (marked in yellow, e.g., open grassland). A small tree clump (patch of trees) is present within the area but is smaller than the minimum mapping unit and is therefore not classified as a separate habitat type. The assessment polygon covers 0.1 hectares and is defined as a circle with a radius of 17.84 meters centered on the midpoint of the sample plot. According to the NILES habitat classification, the area is assigned to open habitat classes. However, tree cover is recorded as a quality variable.



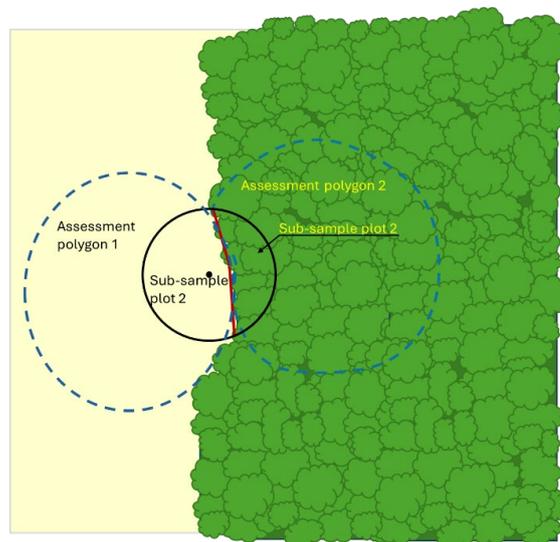
**Figure A7.2.** The sample plot is undivided, and the assessment polygon is placed so that it includes only the habitat type present within the sample plot. It is not possible to position the assessment polygon as a circle with a radius of 17.84 meters centered on the midpoint of the plot, as this would incorporate a habitat type not occurring within the plot. Therefore, the shape of the assessment polygon must be adjusted to cover exactly 0.1 hectares without extending into the adjacent habitat type. This means that the delineation criteria must be considered when placing the assessment polygons.



**Figure A7.3.** The sample plot is subdivided because it contains two different habitat types. The assessment polygons are placed to include only the habitat type present in each respective sub-sample plot. It is not possible to position the assessment polygons as circles with a radius of 17.84 meters centered on the midpoint of the sample plot, as this would result in the inclusion of both habitat types. Therefore, the shape of each assessment polygon must be adjusted to cover exactly 0.1 hectares without extending into the adjacent habitat type. In Sub-sample plot 1, the NILES habitat type and habitat class will correspond to one of the open grassland classes. In Sub-sample plot 2, the NILES habitat type and class may correspond to one of the wooded grassland classes.



**Figure A7.4.** The sample plot is undivided, as it contains only one habitat type. However, it is not possible to place the assessment polygon as a circle with a radius of 17.84 meters centered on the midpoint of the plot, since this would incorporate a different habitat type (deciduous forest). Therefore, the shape of the assessment polygon must be adjusted to cover exactly 0.1 hectares without extending into the adjacent habitat type.



**Figure A7.5.** The sample plot is divided, as it contains two different habitat types. It is not possible to delineate the assessment polygons as circles with a radius of 17.84 meters centered on the midpoint of the plot, since this would incorporate both habitat types. Therefore, the shape of each assessment polygon must be adjusted to cover exactly 0.1 hectares without extending into the adjacent habitat type.