P-04-20

# Vegetation inventory in part of the municipality of Oskarshamn

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March 2004

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*Keywords: V*egetation inventory, Bottom layer, Field layer, Bush layer, Tree layer, Fungi, Vegetation.

# Summary

This investigation is a step in the process of finding a suitable site for deep repository of spent nuclear fuel in the community of Oskarshamn. During 2002–2003, 4 vegetation sample areas was chosen and divided into compartments, based on their vegetation and tree layer characteristics. 25 large squares, 30x30 m, was randomly put within these 4 vegetations sample sites and the vegetation coverage was estimated for the bottom-, field-, bush- and tree layer. The same data was also collected within 9 small squares, 1x1 metre, fixed within the large square and 15 random small squares within the current compartment. The result revealed that the vegetation class “old pine” dominate the investigated areas. *Pleurozium schreberi* dominate the bottom layer, both in coverage and in high appearance. The same is valid to *Vaccinium myrtillus* in the field layer, but there were larger variances. Furthermore, a fungi inventory was conducted during 2003, which found 4 endangered species and some ten indicating biological valuable forests.

# Sammanfattning

Inom projektet för undersökningarna av lämplig lokal för slutförvar av kärnbränsle i Oskarshamns kommun har en vegetationskartering genomförts. Under 2002–2003 identifierades 4 vegetationsprovytor, 87–170 ha stora. Varje vegetationsprovyta delades därefter in i avdelningar baserat på dess nuvarande vegetation och dess tillväxtsförutsättningar. På vegetationsprovytorna slumpades 25 storrutor ut, i vilka täckningsgraden av botten-, fält- busk- och trädskikt registrerades. Samma data registrerades även i 9 fasta smårutor inom storrutan och i 15 slumpade ytor inom den aktuella avdelningen. Storrutorna är 30x30 m stora och smårutorna 1x1 m. Resultaten visade att vegetationsklassen "gammal tall" var den typ som dominerade materialet. I bottenskiktet var väggmossa *Pleurozium schreberi* den dominerande arten, både i antal förekomster och i täckningsgrad. Samma sak gäller för blåbär *Vaccinium myrtillus* i fältskiktet även om spridningen i data var större. Även en kortare svampinventering har genomförts under 2003. Den visade förekomst av 4 rödlistade arter och ett 10-tal arter som indikerar biologiskt värdefull skog.

# Contents

# 1 Introduction

A site investigation is an important step in the process of siting a deep repository for spent nuclear fuel. In spring 2002 SKB started the site investigations in Oskarshamn. Each site investigation is divided into discipline-specific programmes for a number of disciplines. The discipline-specific programme for surface ecosystems aims at an all-round identification and characterization of the surface ecosystems for a comprehensive assessment of the biosphere conditions in the area. The site investigations of surface ecosystems are also supposed to furnish the information on area conditions that enable the site investigations to be carried out in consideration of nature conservation and environmental protection.

One part of the surface ecosystem programme is a general inventory of the area's vegetation types which is carried out in the initial phase of the site investigation. An estimate of the distribution of the area's biotopes as well as the distribution of dominating species is made and presented in GIS format. Existing information on the total quantity (biomass) of the dominant species will later be compiled and calculated for different entities using the vegetation maps. Based on the biomass determination, the annual production of biomass will be calculated enabling estimation of material flows of carbon, water and nutrients. The original description of the vegetation will also be used as a base-line from which long-time monitoring can be performed. The vegetation mapping of the three areas started in the summer of 2001 and continued during 2002 and 2003.

The activity was performed according to Activity plan, SKB AP PS 400-02-007 (SKB internal controlling document). This report describes the methods used and the results obtained from the vegetation inventory in Oskarshamn.

# 2 Material and methods

## 2.1 The Simpevarp area

The Simpevarp area (Oskarshamn community) is situated 30 km north of Oskarshamn. The investigation area is situatied north and west of the nuclear power plant, see Figure 2-1. The area is located in the hemiboreal zone /Ahti et al, 1968/. The forests are dominated by conifers but deciduous trees are present, especially in the vicinity of water.

The soils are mostly course moraines. Even if there are rich nutrient soil in the area, the dominating type is dry, nutrient poor rocky soils.

The land is mostly covered by forest. However, open acres and grazed pastures are present, especially in the Laxemar area west of Simpevarp, see Figure 2-2.


***Figure 2-1.*** *The Simpevarp area.*

## 2.2 Investigation methods

### 2.2.1 Identification of vegetation sample areas

The vegetation sampling areas were identified using a method with double purposes. The method gives detailed vegetation data and provides monitoring possibilities. The vegetation sampling areas are in some cases connected to the places where the initial boreholes for geological investigations were planned to be located. A circle with a radius of 500 m was drawn around each potential drilling site, which defined the vegetation sampling area. The vegetation sampling area was divided in compartments, based on the existing vegetation. Within some compartments a large square (30x30 m), was randomly located. To these, a number of small squares (1x1m) were connected as described in Section 2.2.3 Location of sampling squares. The location of all investigated vegetation sampling areas and random large squares at Simpevarp can be seen in Figure 2-2.

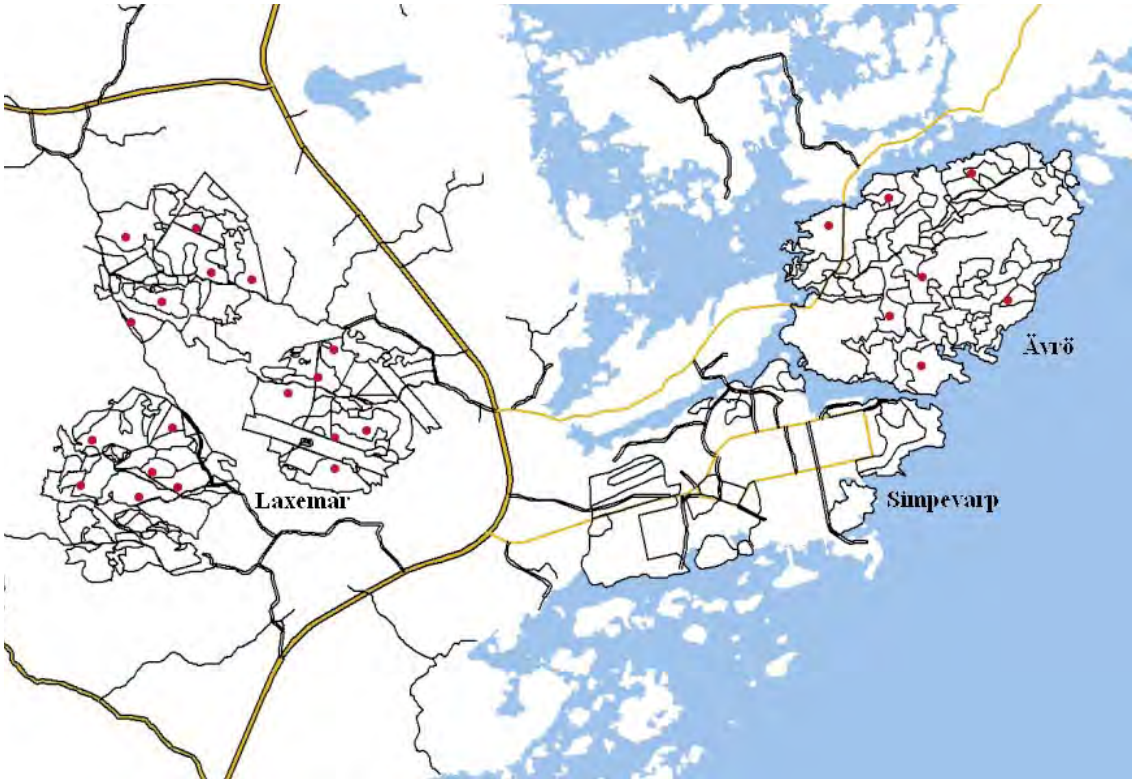
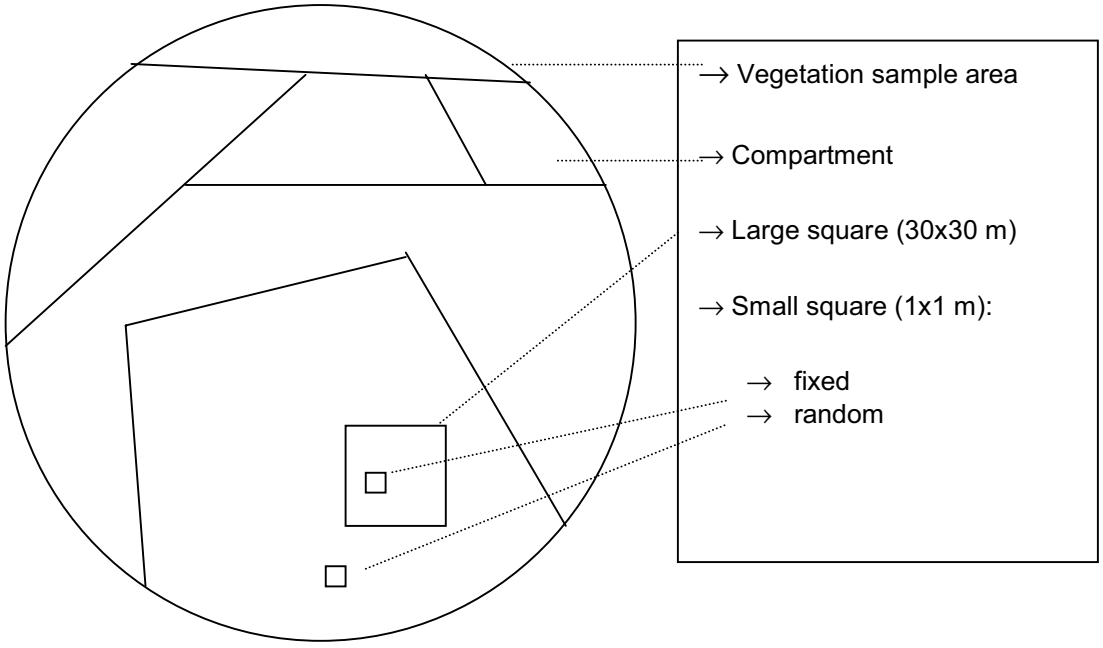



***Figure 2-2.*** *The five investigated areas at Simpevarp. The borders of the compartments are viewed. Large squares are marked with red circles.*

### 2.2.2 Selection of compartments

For each vegetation sampling area, ortophoto maps were studied. On the map (on screen), heterogeneous parts were divided by borders, so that areas with similar tree characters were delimited in compartments. Thereafter each area was visited. At this visit the borders drawn based on the maps were checked. The field layer characteristics were also studied. If sharp differences in the field layer were discerned, new borders were added. After this visit the borders between the compartments were built on both tree and field layer characteristics. The compartments are thereby describable units in the large circle area (see Figure 2-3). Each compartment was given a description considering dominant species and forest characteristics (site conditions, land use history, conservation values, etc).

Compartments were made for five vegetation sampling areas. During 2001, for an area close to the power plant and during 2002 for three areas west of Simpevarp and in 2003 a new vegetation sampling area were chosen, the island of Ävrö see Figure 2-2. The aim with the last compartment was to gather more coast near vegetation data, in an area with more simplified land owner structure. This vegetation sample area was given natural borders, due to the surrounding water.




**The Vegetation sample area** was in 2002 round with a radius of ca 500 metres. The borders were adjusted after the initial fieldwork.

**The Compartment** is a describable subunit in the circle area with similar tree- and field layer characteristics.

**The Large square** is 30x30 metre and represents a sample of the compartment.

**The Fixed Small squares** are samples of the large square. There are nine of them in each large square.

**The Random Small squares** are randomly placed samples of the compartment. They can be compared to the Fixed Small squares and show if the Fixed Small squares are representative to the compartment. There are 15 Random Small squares connected to each Large square.

***Figure 2-3.*** *The different areas and squares used in the vegetation inventory.*

### 2.2.3 Location of sampling squares

In 25 of a total of 166 compartments a large square (30x30 m) was randomly located. Within each large square, nine small squares (1x1 m) were identified. These are hereafter called fixed small squares. Another 15 small squares, located outside the large square but inside the compartment of interest, were also identified. These are hereafter called random small squares. In all, 24 small squares are thus connected to each large square. Exactly the same data were collected in the fixed and random small squares.

The following methods were used when large and small sampling squares were identified. The vegetation sample area were thought of as a system of co-ordinates where the centre point was origo. A number of co-ordinates were randomly selected by computer. These co-ordinates represented the randomly chosen location of the large square (the south-western corner). E.g. the co-ordinates (+210, –152) means that the south-western corner of the square should be positioned 210 m east and 152 m south of the centre point. The distance was paced out in field. When arriving at the point, it was considered whether it was very unrepresentative for the compartment it was situated within. If so, the next co-ordinates were checked up.

The fixed small squares were placed within a quadratic spacing (see Figure 2-4). The location of the random small squares was chosen randomly. By setting the south-western corner of the large square as origo, randomly sampled co-ordinates described their location.

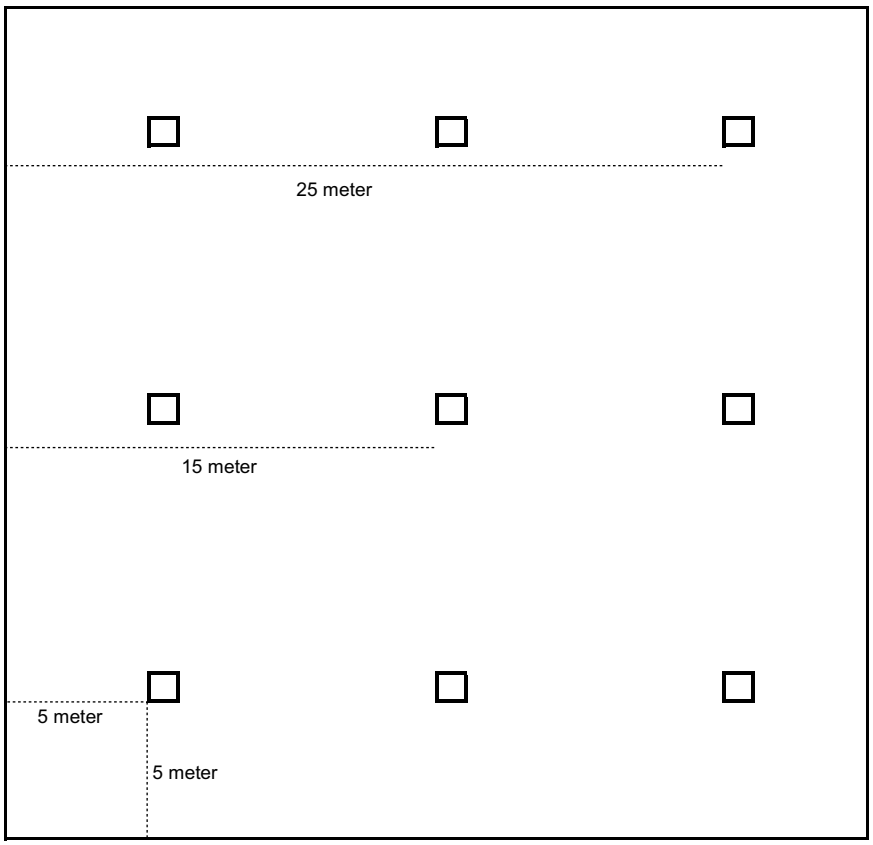



***Figure 2-4.*** *The large square (30x30 m) and the fixed small squares (1x1 m).*

### 2.2.4 Marking of sampling squares

Although there is a need to find the sampling squares on the next inventory occasion, none of the large or small sampling squares have been marked in field. This is due to the complex land owner situation in the area, which have forced us to use another approach. The south-west corner of each large square has a co-ordnate. In addition to this, there is also a description of the exact spot and photos are takes from both the south-west and the south-east corner into the area. This information gives a fairly good chans to relocate the exakt spot for the large sampling squares on the next inventory occation.

### 2.2.5 Parameters sampled

The sampled parameters are described below. Most parameters have been sampled for both large and small squares, but some were sampled only in small squares, see Table 2-1.

To describe the vegetation in a way that makes it possible to quantify and record changes, coverage was considered to be the major unit. The coverage was estimated by studying the vegetation with a vertical projection. If the plants were to be exposed with parallell light from above, the shadowed area would correspond to the coverage. When estimating coverage, all live plant parts above ground are observed. The coverage of bottom, field and bush layer was estimated in percent. In the large squares, the coverage of the three most dominant bottom layer species was estimated. Futhermore, the coverage of all field layer species covering more then 5% was estimated. However, the coverage of the five most dominant species was always estimated. In the bush layer, the three most common species have been recorded. Presence of other species/genera has been recorded in all layers. In the small squares the coverage of the bottom, field, bush and total layer species/genera was estimated. Minimum registration was 1%, which corresponds to 1 $dm^2$. This means that all species with a coverage less than 1.5 $dm^2$ was given the coverage value 1%.

The coverage of divergent base and substrate was also estimated. The divergent base includes e.g. large rocks, main haul roads and bare soil from uprooted stumps. The occurrence of such items is supposed to affect the plants long-term access to water and nutrient over long time. The divergent substrate includes elements considered to affect the plants for a short time or to a small degree, e.g. smaller rocks, soft (overgrown) logs and parts of tree roots.

The diameters of all trees with a diameter larger then five cm have been measured with a calliper. The height of 3–5 trees was measured so that a basal area weighted mean height could be obtained. A Silva height measurer was used for this purpose, which are common within forestry. From the diameter data a basal area was calculated. This is done by taking the total tree area in the large square divided by 900 (30x30 m), which gives the basal area per square metre. This number times 10,000, gives the basal area per hectare. The basal area and the mean height were input data to achieve a volume in forest cubic metre /Jonson, 1963/. The diameter data were registered per tree species, so that the estimated volume can be distributed on the present tree species.

Furthermore the litter was characterised using the following parameters: coverage and thickness of litter layer, litter type and dominating species/group in litter type.

Needle loss was estimated on the tree closest to the south-western corner of each small square. The term “needle loss” represents the lost share of needle mass and this parameter indicates the vitality of the tree. A fully vital tree with no noticeable needle loss is given the value “0%”. A dead tree without needles is given the value “100%”. The method and instruction applied is the same as The National Board of Forestry uses in their national/

international environmental observation areas /Inventory manual, 1999/. Needle loss was only estimated on pine (Pinus sylvestris) and spruce (Picea abies) with a breast height diameter exceeding five centimetres. Suppressed or mechanically injured trees were rejected. If no suitable tree was found within five metres of the south-western corner, no needle loss data were registered.

Finally, a brief inventory of fungi was made. During four days (in late September 2003) all of the sampling sites were searched for redlisted species and species considered as indicators of conservation values. The areas were selected on basis of the observations made during the main inventory work. The field work was carried out by Bo Norell, FORAN Sverige AB.

**Table 2-1. Data collected at the inventory.**

| **In both large and small squares** | **Explanation** |
|---|---|
| Divergent base (%) | This class includes e.g. large rocks, main haul roads and bare soil from uprooted stumps. The occurrence of such items is supposed to affect the plants long-term access to water and nutrients. |
| Bottom layer coverage (%) | The bottom layer consists of bryophytes and lichens. |
| Field layer coverage (%) | The field layer consists of vascular plants and ferns. |
| Bush layer coverage (%) | The bush layer consists of ligneous plants with a height between 1–3 m. |
| Total layer coverage (%) | The total layer includes bottom, field and bush layer. |
| Field layer average height (cm) | The average height of the field layer. |
| Bush layer average height (cm) | The average height of the bush layer. |
| Litter coverage (%) | The coverage of litter. |
| **In small squares only** | |
| Divergent substrate (%) | This class includes elements considered to affect the plants for a short time or to a minor degree. E.g. smaller rocks, soft (overgrown) logs and parts of tree roots. |
| Average thickness of litter layer (cm) | |
| Type of litter | Specifies the dominant kind of litter, e.g. needles, leaves or twigs. |
| Dominant litter species | The dominant species in litter layer. |
| Needle loss (%) | The estimated needle loss, indicates the vitality of the tree. |
| Tree species | Tree species (pine or spruce) |
| Diameter | Diameter of the tree. |
| **In large squares only** | |
| Tree data | Data collected so that volume per square metre is obtained. |

# 3 Results

The vegetation inventory of 2003 in Oskarshamn was carried out by Johan Andersson, FORAN Sverige AB. It started 2003-07-31 and ended 2003-09-10. The division of compartments in the area of Laxemar was carried out during 2002, but during early summer of 2003 on the island of Ävrö. The compartments close to the powerplant that were divided during 2001, were not included in this vegetation inventory and will therefor not be futher discussed. The data is reported to SICADA with FN 152.

Some results from the inventory are presented below. Species lists for the bottom, field, bush, and tree layers can be found in Appendix 1–4. As an example a photo showing one of the small squares is presented in Appendix 5 together with a list of the recorded species.

In the following figures, the vegetation data have been given a vegetation class according to the method of the vegetation maps constructed by SwedPower /Boresjö-Bronge and Wester, 2002/. The large squares have been matched and related to the tree layer code. In Oskarshamn the most covering tree layer type was “old pine”. Altogether nine large squares were placed in this tree layer type.

To ease the comparison with the similar vegetation inventory in Forsmark, the following result figures presented, are based on the 15 random small squares associated with each large square. These are located within the borders of the same compartment as the large squares.

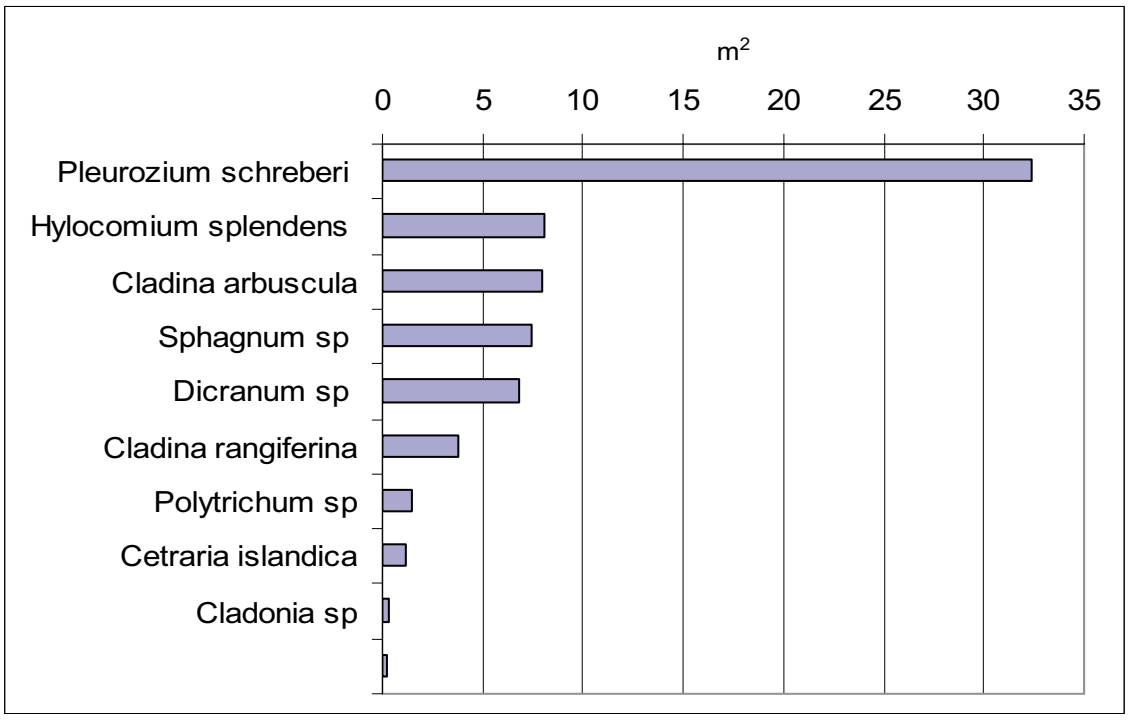
## 3.1 Bottom layer

A total of 25 species/genera in the bottom layer have been noted in the investigated Simpevarp areas. The most dominant species is Pleurozium schreberi. It occurres in 85% (511 of 600) of the total small squares inventoried in Simpevarp.

In Table 3-1 the dominant bottom layer species of tree layer type “old pine” are shown. Pleurozium schreberi is the most covering species. The average cover was 24.0% and it was registered in 110 of the 135 small squares (81%).

**Table 3-1. The ten most covering species in the bottom layer, from the tree layer type "old pine". The sample is based on the random small squares of nine large squares. Sample area is 135 m². Pleurozium schreberi is the most covering species. It covers 32.41 m² of the sampled 135 m².**

| | | Coverage | | | | |
|---|---|---|---|---|---|---|
| | | Mean | | Median | $Q_1$ | $Q_3$ |
| Species (Swedish) | Species (Latin) | $m^2$ | % | % | % | % |
| Väggmossa | Pleurozium schreberi | 32,4 | 24,0 | 18,0 | 5,0 | 51,3 |
| Husmossa | Hylocomium splendens | 8,1 | 6,0 | 15,0 | 3,0 | 43,0 |
| Gulvit renlav | Cladina arbuscula | 8,0 | 5,9 | 12,0 | 5,0 | 30,0 |
| Vitmossor | Sphagnum sp | 7,4 | 5,5 | 24,0 | 5,0 | 66,5 |
| Kvastmossor | Dicranum sp | 6,8 | 5,0 | 5,0 | 1,0 | 12,0 |
| Grå renlav | Cladina rangiferina | 3,8 | 2,8 | 5,0 | 1,0 | 10,3 |
| Björnmossor | Polytrichum sp | 1,4 | 1,1 | 5,0 | 1,3 | 10,8 |
| Islandslav | Cetraria islandica | 1,2 | 0,9 | 5,0 | 3,0 | 31,0 |
| Bägarlavar | Cladonia sp | 0,3 | 0,2 | 1,0 | 1,0 | 1,0 |
| Skedmossor | Calliergon sp | 0,3 | 0,2 | 25,0 | 25,0 | 25,0 |



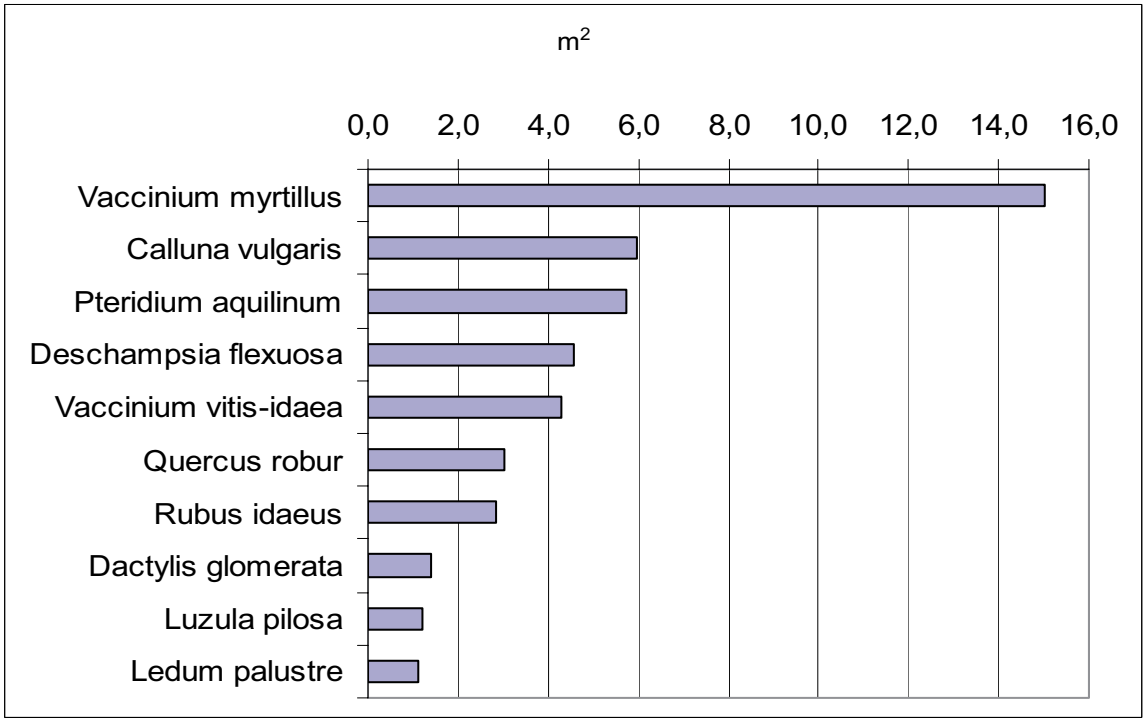
## 3.2 Field layer

A total of 150 species/genera have been noted in the field layer in the investigated Simpevarp areas. Vaccinium myrtillius was the most covering species. Although Deschampsia flexuosa was found in nearly twice the number of squares than Vaccinium myrtillius, 475 compared to 276, it only covered about half of the area.

In Table 3-2 the dominant field layer species of tree layer type "old pine" are illustrated. Vaccinium myrtillius is the most covering species. It was found in 69 of the 135 small squares (51%). The average cover was 11.1%. The eighth most covering species, Dactylis glomerata was found in only 5 of the small squares, to be compared with Luzula pilosa, which was identified in 50 small squares.

**Table 3-2. The ten most covering species in the field layer from the tree layer type "old pine". The sample is based on the random small squares of ten large squares. Sample area is 135 m². Vaccinium myrtillius is the most covering species. It covers 15.02 m² of the sampled 135 m².**

| | | Coverage | | | | |
|---|---|---|---|---|---|---|
| | | Mean | | Median | $Q_1$ | $Q_3$ |
| Species (Swedish) | Species (Latin) | m² | % | % | % | % |
| Blåbär | Vaccinium myrtillus | 15,0 | 11,1 | 17,0 | 5,0 | 34,0 |
| Ljung | Calluna vulgaris | 6,0 | 4,4 | 17,5 | 5,0 | 31,3 |
| Örnbräken | Pteridium aquilinum | 5,8 | 4,3 | 22,0 | 10,0 | 29,5 |
| Kruståtel | Deschampsia flexuosa | 4,6 | 3,4 | 2,0 | 1,0 | 6,0 |
| Lingon | Vaccinium vitis-idaea | 4,3 | 3,2 | 5,0 | 1,0 | 8,0 |
| Skogsek | Quercus robur | 3,0 | 2,2 | 2,0 | 1,0 | 12,0 |
| Hallon | Rubus idaeus | 2,9 | 2,1 | 8,5 | 3,0 | 24,3 |
| Hundäxing | Dactylis glomerata | 1,4 | 1,0 | 20,0 | 7,3 | 25,0 |
| Vårfryle | Luzula pilosa | 1,2 | 0,9 | 1,0 | 1,0 | 3,5 |
| Skvattram | Ledum palustre | 1,1 | 0,8 | 15,5 | 7,0 | 24,0 |



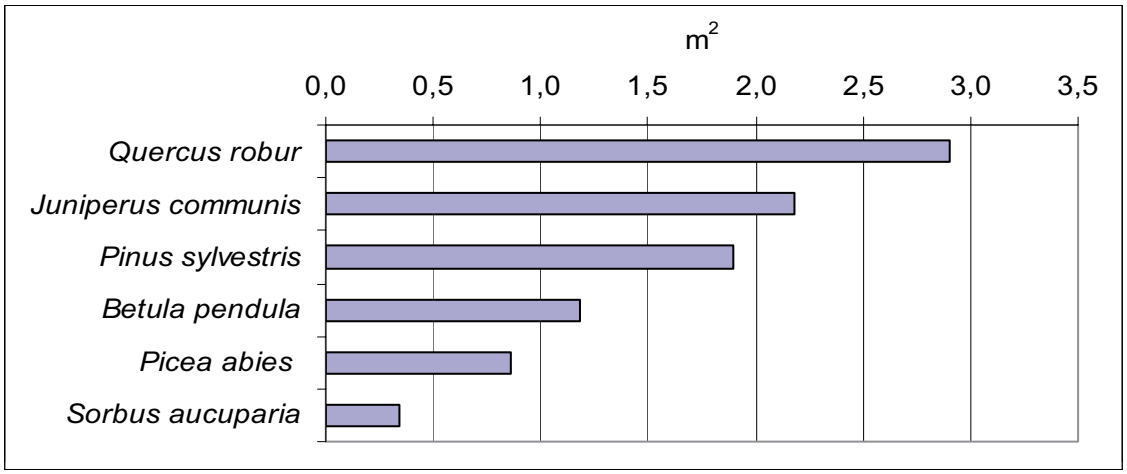
## 3.3 Bush layer

A total of 19 species/genera have been noted in the bush layer in the investigated Simpevarp areas. Quercus robur was the only one that was found in more than ten per cent of the small squares (13%). In Swedish forests the bush layer is normally rather sparsely developed. In Simpevarp, bushlayer occurrence (all species) was noted in 36% of the small squares.

In Table 3-3 the six most covering bush layer species of tree layer type "old pine" are illustrated. Quercus robur is the most covering species. It was found in 11% of the 135 small squares and covered in average 2.1%.

**Table 3-3. The six most covering registered species in the bush layer from the tree layer type "old pine". The sample is based on the random small squares of nine large squares. Sample area is 135 m². Picea abies is the most covering species. It covers 2.90 m² of the sampled 135 m².**

| | | Coverage | | | | |
|---|---|---|---|---|---|---|
| | | Mean | | Median | $Q_1$ | $Q_3$ |
| Species (Swedish) | Species (Latin) | m² | % | % | % | % |
| Skogsek | Quercus robur | 2,9 | 2,1 | 9,0 | 5,0 | 23,3 |
| En | Juniperus communis | 2,2 | 1,6 | 8,0 | 5,0 | 32,0 |
| Tall | Pinus sylvestris | 1,9 | 1,4 | 17,0 | 5,0 | 41,0 |
| Vårtbjörk | Betula pendula | 1,2 | 0,9 | 11,0 | 5,0 | 19,3 |
| Gran | Picea abies | 0,9 | 0,6 | 32,0 | 16,5 | 42,5 |
| Asp | Sorbus aucuparia | 0,3 | 0,3 | 8,5 | 4,0 | 14,5 |

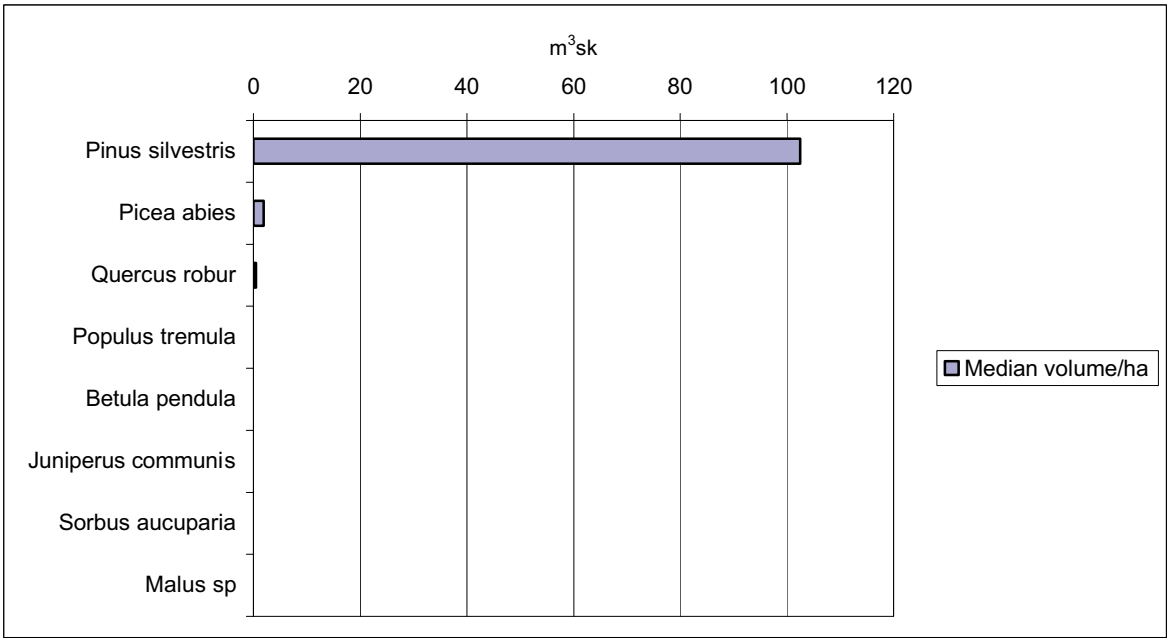


## 3.4 Tree layer

In the investigated Simpevarp areas 9 tree species/genera were noted in the tree layer (Appendix 4). Pine followed by spruce was most often dominating. Tree layer data are calculated from the basal area. The basal area is the combined area of all trees per hectare at the height of 1.3 m. With basal area and mean height as input data, a volume per hectar is obtained. Table 3-4 shows the volume of tree species in the tree layer type "old pine".

**Table 3-4. The eight registered tree species in the tree layer type "old pine". The sample is based on nine large squares. Sample area is 8100 m². Pinus silvestris has the most volume, in average 89.1 m³sk per hectare.**

| | | Volume | | | |
|---|---|---|---|---|---|
| **Species (Swedish)** | **Species (Latin)** | **Mean** | **Median** | **Q1** | **Q3** |
| | | $m^3$sk/ha | $m^3$sk/ha | $m^3$sk/ha | $m^3$sk/ha |
| Tall | Pinus silvestris | 89,1 | 102,5 | 50,4 | 131,6 |
| Gran | Picea abies | 2,8 | 1,9 | 0,4 | 4,2 |
| Skogsek | Quercus robur | 1,8 | 0,5 | 0,2 | 3,3 |
| Asp | Populus tremula | 0,6 | 0,0 | 0,0 | 0,0 |
| Våtbjörk | Betula pendula | 1,1 | 0,0 | 0,0 | 1,5 |
| En | Juniperus communis | 0,1 | 0,0 | 0,0 | 0,0 |
| Rönn | Sorbus aucuparia | 0,0 | 0,0 | 0,0 | 0,0 |
| Äpple | Malus sp | 0,0 | 0,0 | 0,0 | 0,0 |



## 3.5 Fungi

Several interesting species of fungi were found (see Table 3-5), some of them listed as indicator (Ind.) species by the national board of forestry. This means that they are often present at sites with redlisted species. Several of them are considered to indicate sites with high biodiversity and long forest continuity /Gärdenfors, 2000; Nitare, 2000/.

**Table 3-5. Interesting species of fungi found within the Simpevarp area.**

| Latin name | Swedish name | Site | List category |
|---|---|---|---|
| *Antrodia pulvinascens* | Veckticka | | NT, Ind. |
| *Bankera fuligineoalba* | Talltaggsvamp | | Ind. |
| *Bankera violascens* | Grantaggsvamp | | NT, Ind. |
| *Clavulina cristata* | Kamfingersvamp | | |
| *Craterellus cornucopioides* | Svart trumpetsvamp | | |
| *Gyromitra infula* | Biskopsmössa | | |
| *Heterobasidion annosum* | Rotticka | | |
| *Hydnellum aurantiacum* | Orange taggsvamp | | Ind. |
| *Inonotus tomentosus* | Luddticka | | NT |
| *Lactarius zonarioides* | Granriska | | Ind. |
| *Laetiporus sulphureus* | Svavelticka | | |
| *Macrolepicata procera* | Stolt fjällskivling | | |
| *Mycena galericulata* | Rynkhätta | | |
| *Phellinus pini* | Tallticka | | Ind. |
| *Phellodon tomentosus* | Trattaggsvamp | | Ind. |
| *Sarcodon imbricatus* | Fjällig taggsvamp (tallvar.) | | Ind. |
| *Sarcodon scabrosus* | Skrovlig taggsvamp | | Ind. |
| *Sarcodon squamosus* | Fjällig taggsvamp (granvar.) | | Ind. |
| *Sarcodon versipellis* | Brödtaggsvamp | | NT, Ind. |
| *Scleroderma citrinum* | Vitgul rottryffel | | |
| *Sparassis crispa* | Blomkålssvamp | | Ind. |

# 4 Discussion

## 4.1 Bottom layer

In the bottom layer Pleurozium schreberi is very dominant. It is found in 85 of all small squares, and covers in average 22% of the investigated area. No references have been found to compare this numbers to the region or to the country of Sweden.

Whether the field worker is able to do a good description of the bottom layer or not, is strongly affected by the field layer characteristics. In a plot with a well developed field layer it is very difficult to see and extract details of the bottom layer. This is true for the overall bottom layer as well as for single species. In the area of Simpevarp this was not major problem due to the dominating vegetation type, an open dry pineforest with rather few field layer species.

## 4.2 Field layer

The field layer species exhibit different patterns in nature. The most dominant species (Vaccinium myrtillius) are registered in many squares and have high coverage values. Others like Luzula pilosa and Descampsia flexuosa are noted in many squares but reach only a moderate coverage. Pteriduim aquilinium, on the other hand, was only noted in a fifth of the squares, but still reached the second highest coverage.

Vaccinium myrtillius was the overall dominating species. In average seven percent of the total area investigated was covered with this species and up to ten percent in the “old pine” and a “mixed forest” areas.

## 4.3 Bush layer

When working with squares of 1x1 m, the variation in the bush layer coverage is very high. One single bush can change the result in a small square from 0% up to 100%. In “old pine” areas bush layer species occurred in 28% of the squares. The total average of 36% of the squares seems quite high to my experiens, but no written references have been found.

## 4.4 Tree layer

The tree layer data is best used as a reference to bottom, field and bush layer data. When basal area is changed, conditions for plants will change too. E.g. if a thinning or a clearcut is performed, plant conditions will be affected. The tree layer data of this survey describes the condition prevailing when vegetation data were collected.

## 4.5 Fungi

Fungi have been subject to just a brief overview. Anyhow, it is evident that different species of interest are present in these areas, like Antrodia pulvinascens and Sarcodon scabrosus. If more intense inventory surveys were carried out, probably additional interesting species would be found. No efforts to quantify fungi biomass have been carried out, but the amount of fungi biomass would probably be lower then avarage for the country of Sweden. This due to the course, dry soils and the rather monotonous vegetation.

## 4.6 General

There are several factors influencing the data of this inventory. Some of the main difficulties are discussed below.

- The size difference between the large and the small squares. It is, especially in dense stands, difficult to overview 900 $m^2$. Even though segmentation is applied, difficulties are associated with estimating the layer of the large square.
- Whether the large square is representative for the compartment and the variation within the compartment. The data from the small squares can be gathered from an area of several hectares. The mosaic structure of the vegetation may lead to large variations within areas looking homogeneous at a first glance.
- The subjectivity of the field workers. Although the personnel have been calibrated together it is not possible to avoid the influence of subjectivity. Two different field workers most certainly give at least slightly different estimations. This is a part of the method and must be considered when interpreting and using the results. Luckily this not the case with the work in the Simpevarp area, due to the fact that it only was one fieldworker.
- Several vegetation types, that are present in the area has not yet been investigated, due to the random method in locating the large squares. More fieldwork can be carried out to complete the picture of the vegetation i the area of Simpevarp.

# 5 References

**Ahti, Hämet-Ahti, Jalas J, 1968.** Vegetation zones and their sections in northwestern Europe. Ann. Bot. Fennici. 5, 169–211.

**Boresjö Bronge L, Wester K, 2002.** Vegetation mapping with satellite data of the Forsmark and Tierp regions. SKB R-02-06, Svensk Kärnbränslehantering AB.

**Gärdenfors U, 2000.** Rödlistade arter i Sverige – The 2000 Redlist of Swedish species. ISBN 91-506-23-1.

**National Board of Forestry, 1999.** Inventory manual. Vitality. Opubl.

**Jonson T, 1963.** Massatabeller för träduppskattning. 7:th ed.

**Nitare J, 2000.** Signalarter-indikatorer på skyddsvärd skog. Skogsstyrelsens förlag.

# Appendix 1

## Bottom layer species/genera noted in small squares in the inventory 2001–2002

| *Latin names* | Swedish names |
|---|---|
| *Calliergion sp* | Skedmossor |
| *Calliergionella sp* | Spjutmossor |
| *Cetraria ericetorum* | Smal inlandslav |
| *Cetraria islandica* | Islandslav |
| *Cladina sp* | Renlavar |
| *Cladina arbuscula* | Gulvit renlav |
| *Cladina rangiferina* | Grå renlav |
| *Cladonia sp* | Bägarlavar |
| *Cladonia stellaria* | Fönsterlav |
| *Climacium dendroides* | Palmmossa |
| *Dicranum sp* | Kvastmossor |
| *Drepanocladus sp* | Krokmossor |
| *Drepanocladus uncinatus* | Krokmossa |
| *Grimmia trichophylla* | Kuddmossa |
| *Hylocomium splendens* | Husmossa |
| *Hypnum cupressiforme* | Cypressfläta (Bergklomossa) |
| *Mnium sp* | Stjärnmossor |
| *Peltigera sp* | Filtlavar |
| *Pleurozium schreberi* | Väggmossa |
| *Polytrichum sp* | Björnmossor |
| *Ptilium crista-castrensis* | Kammossa |
| *Rhytidiadelphus sp* | Hakmossor |
| *Rhytidiadelphus triquetrus* | Kranshakmossa |
| *Sphagnum sp* | Vitmossor |

# Appendix 2

## Field layer species/genera noted in small squares in the inventory 2003

| *Latin names* | Swedish names | *Latin names* | Swedish names |
|---|---|---|---|
| *Acer platanoides* | Lönn | *Lycopodium annotinum* | Revlummer |
| *Achillea millefolium* | Rölleka | *Lysimachia vulgaris* | Videört |
| *Achillea ptarmica* | Nysört | *Maianthemum bifolium* | Ekorrbär |
| *Agrostis canina* | Brunven | *Matricaria perforata* | Baldersbrå |
| *Agrostis capillaris* | Rödven | *Melampyrum pratense* | Ängskovall |
| *Agrostis gigantea* | Storven | *Melampyrum sylvaticum* | Skogskovall |
| *Allium oleraceum* | Backlök | *Melica nutans* | Bergsslok |
| *Alnus glutinosa* | Klibbal | *Mentha arvensis* | Åkermynta |
| *Andromeda polifolia* | Rosling | *Milium effusum* | Hässlebrodd |
| *Anemone nemorosa* | Vitsippa | *Moehringia trinervia* | Skogsnarv |
| *Anthoxanthum odoratum* | Vårbrodd | *Molinia caerulea* | Blåtåtel |
| *Athyrium filix-femina* | Majbräken | *Monotropa hypopitys* | Tallört |
| *Betula pendula* | Vårtbjörk | *Nardus stricta* | Stagg |
| *Betula pubescens* | Glasbjörk | *Oxalis acetosella* | Harsyra |
| *Calamagrostis arundinacea* | Piprör | *Phleum pratense* | Timotej |
| *Calamagrostis epigejos* | Bergrör | *Phragmites australis* | Vass |
| *Calluna vulgaris* | Ljung | *Picea abies* | Gran |
| *Campanula rotundifolia* | Ängsklocka | *Pinus sylvestris* | Tall |
| *Campanula persicifolia* | Stor Blåklocka | *Poa annua* | Vitgröe |
| *Carex acuta* | Vasstarr | *Poa compressa* | Berggröe |
| *Carex diandra* | Trindstarr | *Poa nemoralis* | Lundgröe |
| *Carex echinata* | Stjärnstarr | *Polypodium vulgare* | Stensöta |
| *Carex lasiocarpa* | Trådstarr | *Populus tremula* | Asp |
| *Carex nigra* | Hundstarr | *Potentilla erecta* | Blodrot |
| *Carex ovalis* | Harstarr | *Potentilla palustris* | Kråkklöver |
| *Carex rostrata* | Flaskstarr | *Primula veris* | Gullviva |
| *Cirsium arvense* | Åkertistel | *Prunus spinosa* | Slån |
| *Cirsium palustre* | Kärrtistel | *Pteridium aquilinum* | Örnbräken |
| *Convallaria majalis* | Liljekonvalj | *Quercus robur* | Ek |
| *Convolvulus arvensis* | Åkervinda | *Ranunculus acris* | Vanlig Smörblomma |
| *Corylus avellana* | Hassel | *Ribes alpinum* | Måbär |
| *Cystopteris fragilis* | Stenbräken | *Roegneria canina* | Lundelm |
| *Dactylis glomerata* | Hundäxing | *Rosa canina* | Nyponros |
| *Danthonia decumbens* | Knägräs | *Rubus idaeus* | Hallon |
| *Daucus carota* | Vildmorot | *Rubus nessensis* | Skogsbjörnbär |
| *Deschampsia cespitosa* | Tuvtåtel | *Rubus saxatilis* | Stenbär |
| *Deschampsia flexuosa* | Kruståtel | *Rubus sp* | Rubus sp |
| *Dryopteris carthusiana* | Skogsbräken | *Rumex acetosella* | Bergssyra |
| *Dryopteris filix-mas* | Träjon | *Salix caprea* | Sälg |
| *Elytrigia repens* | Kvickrot | *Salix cinerea* | Gråvide |
| *Empetrum sp* | Kråkbär | *Salix myrsinifolia* | Svartvide |
| *Epilobium adenocaulon* | Amerikansk dunört | *Salix sp* | Salix sp |
| *Epilobium angustifolium* | Mjölkört | *Sedum telephium* | Kärleksört |
| *Eriophorum vaginatum* | Tuvull | *Senecio viscosus* | Klibbkorsört |
| *Festuca ovina* | Fårsvingel | *Silene dioica* | Rödblära |
| *Festuca rubra* | Rödsvingel | *Solidago virgaurea* | Gullris |
| *Festuca sp* | Festuca sp | *Sorbus aucuparia* | Rönn |
| *Fragaria vesca* | Smultron | *Sorbus intermedia* | Oxel |
| *Fraxinus excelsior* | Ask | *Stachys sylvatica* | Stinksyska |
| *Lamium purpureum* | Rödplister | *Stellaria graminea* | Gräsown stjärnblomma |
| *Lathyrus pratensis* | Gulvial | *Stellaria longifolia* | Skogsstj.blomma |
| *Ledum palustre* | Skvattram | *Taraxacum sp* | Maskros |
| *Linaria vulgaris* | Gulsporre | *Thalictrum sp* | Thalictrum sp |
| *Linnaea borealis* | Linnea | *Trientalis europaea* | Skogsstjärna |
| *Luzula pilosa* | Vårfryle | *Trifolium medium* | Skogsklöver |

| *Latin names* | **Swedish names** |
|---|---|
| *Trifolium pratense* | Rödklöver |
| *Trifolium repens* | Vitklöver |
| *Trifolium sp* | Trifolium sp |
| *Tussilago farfara* | Tussilago |
| *Urtica dioica* | Brännässla |
| *Vaccinium myrtillus* | Blåbär |
| *Vaccinium vitis-idaea* | Lingon |
| *Verbascum thapsus* | Kungsört |
| *Veronica chamaedrys* | Teveronika |
| *Veronica officinalis* | Ärenpris |
| *Vicia cracca* | Kråkvicker |
| *Vicia sepium* | Häckvicker |
| *Vicia sylvatica* | Skogsvicker |
| *Vincetoxicum hirundinaria* | Tulkört |
| *Viola palustris* | Kärrviol |
| *Viola riviniana* | Skogsviol |
| *Viola tricolor* | Styvmorsviol |

## Appendix 3

# Bush layer species/genera noted in small squares in the inventory 2001–2002

| *Latin names* | Swedish names |
|---|---|
| *Alnus glutinosa* | Klibbal |
| *Betula pendula* | Vårtbjörk |
| *Betula pubescens* | Glasbjörk |
| *Corylus avellana* | Hassel |
| *Crataegus laevigata* | Rundhagtorn |
| *Fraxinus excelsior* | Ask |
| *Juniperus communis* | En |
| *Picea abies* | Gran |
| *Pinus sylvestris* | Tall |
| *Populus tremula* | Asp |
| *Prunus spinosa* | Slån |
| *Quercus robur* | Skogsek |
| *Ribes alpinum* | Måbär |
| *Rosa sp.* | Rosor |
| *Salix caprea* | Sälg |
| *Salix cinerea* | Gråvide |
| *Salix myrsinifolia* | Svartvide |
| *Sorbus aucuparia* | Rönn |
| *Sorbus intermedia* | Oxel |

## Appendix 4

# Tree species noted and measured in the large squares 2001–2002

| *Latin names* | Swedish names |
|---|---|
| *Betula pendula* | Vårtbjörk |
| *Juniperus communis* | En |
| *Malus sylvestris* | Vildapel |
| *Picea abies* | Gran |
| *Pinus sylvestris* | Tall |
| *Populus tremula* | Asp |
| *Querqus robur* | Ek |
| *Salix caprea* | Sälg |
| *Sorbus aucuparia* | Rönn |

# Photo of small square at Ävrö

The photo shows the fixed small square ASM 002026. It is situated on Ävrö and was investigated in 2003. The photo below show the registered bottom and field layer species. No bush layer species was present. The inventory was carried out in early August.

| Bottom layer | |
|---|---|
| **Species** | **Coverage (%)** |
| Pleurozium schreberi | 73 |
| Hylocomiens splendens | 5 |
| Dicranum sp. | 5 |

| Field layer | |
|---|---|
| **Species** | **Coverage (%)** |
| Vaccinium myrtillus | 55 |
| Pteridium aquilinum | 26 |
| Vaccinium vitis-idaea | 5 |
| Deschampsia flexuosa | 2 |
| Quercus robur | 1 |