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Forsmark site investigation

Vegetation inventory in part of the municipality of Östhammar

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July 2003

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Keywords: vegetation inventory, bottom layer, field layer, bush layer, tree layer, fungi

Contents

1 Introduction

A site investigation is an important step in the process of siting a deep repository for spent nuclear fuel. In spring 2001 SKB was interested in conducting thorough investigations in three municipalities; Oskarshamn, Tierp and Östhammar. Since April 2002 Tierp is not longer in the process. 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.

The activity was performed according to Activity plan, SKB AP PF 400-02-20 (SKB internal controlling document). This report describes the methods used and the results obtained from the inventories in Östhammar. Data from the inventory in Oskarshamn will be published in a separate report. Data from the inventory in Tierp have been incorporated in the database SICADA but no separate report has been written.

2 Material and methods

2.1 The Forsmark area

The Forsmark area (Östhammar community) is situated south-west of the Forsmark 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 rather common, especially in the vicinity of water. The shore displacement is a factor strongly forming the landscape. The lower parts are slowly changing from sea bays to fens as the land uplift proceeds.

The soils are mostly fine grained moraines. They harbour a large share of calcium, which was transported by the land ice from calcareous bedrock further north-east.

The land is mostly covered by forest. However, open acres and grazed pastures dominate.

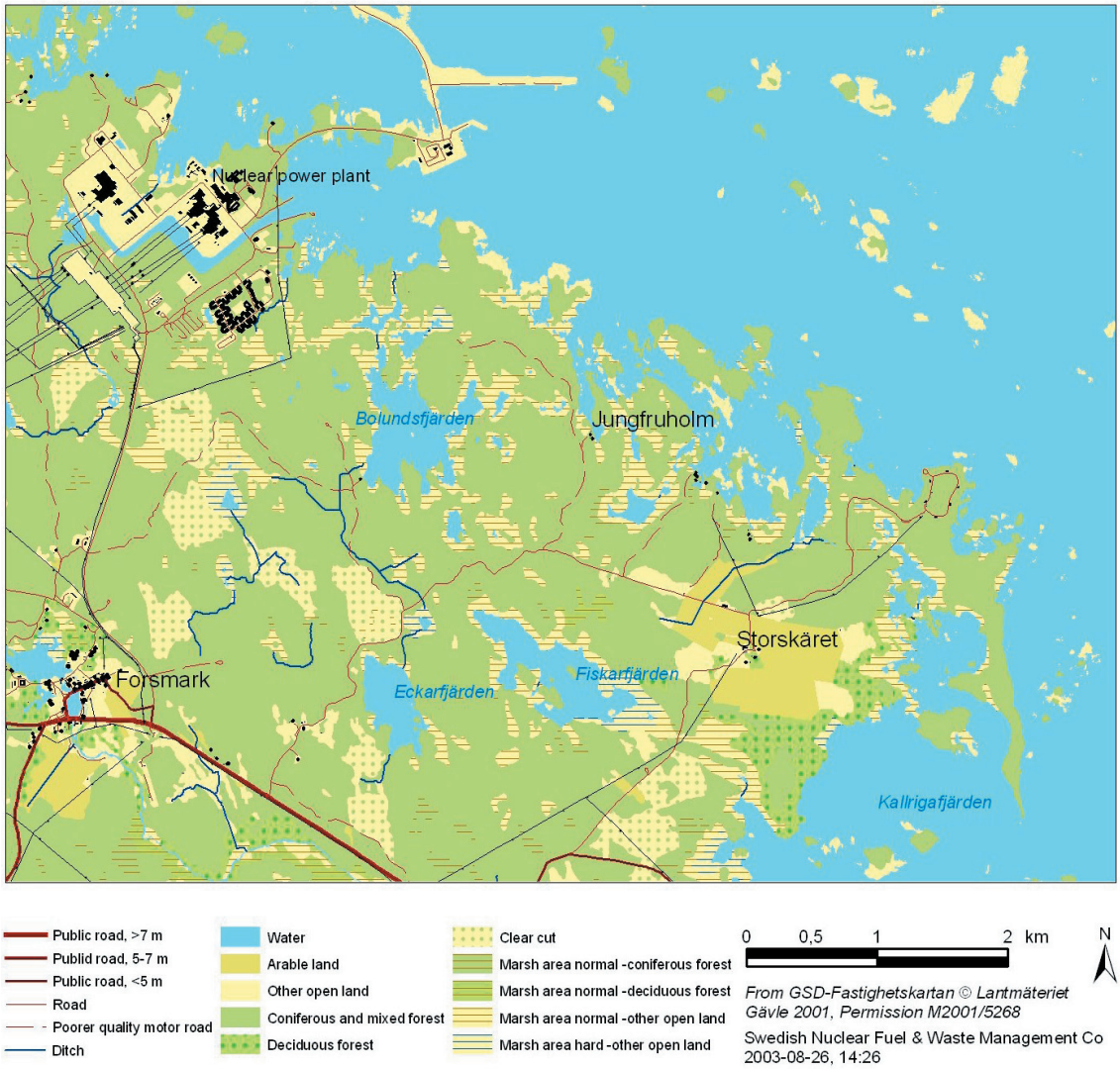


Figure 2-1. *The Forsmark area.*

2.2 Investigation methods

2.2.1 Identification of vegetation sample areas

The sampling sites were identified using a method with double purposes. The method gives detailed vegetation data and provides monitoring possibilities. The 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. In 2002 the inventory was expanded. Three new areas, independent of drilling sites, were selected to collect data from other biotopes. Within some (randomly selected) compartments a large square (30x30 m) was located. To these a number of small squares (1x1 m) were connected as described in the section "Location of sampling squares". The location of all investigated areas at Forsmark can be seen in Figure 2-2. The number of circle areas and large squares identified is shown in Table 2-1.

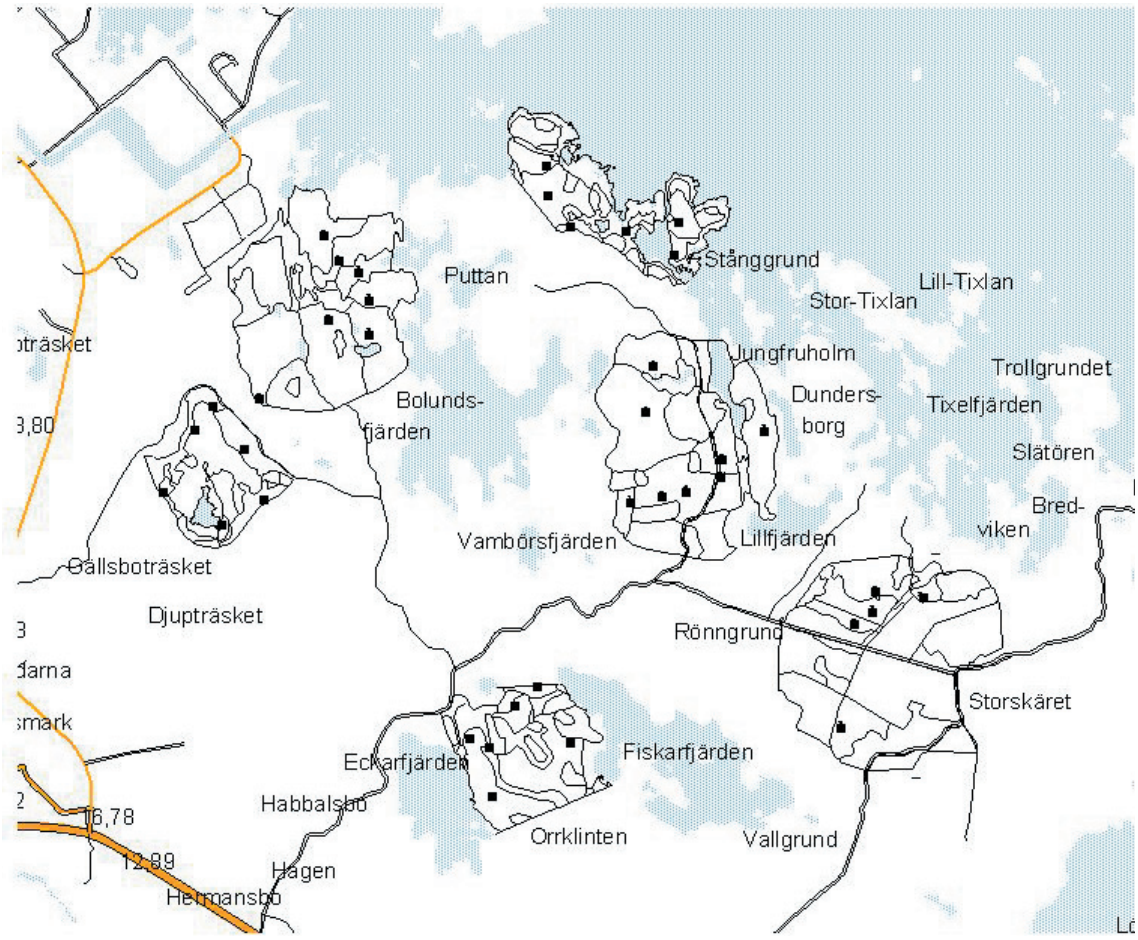


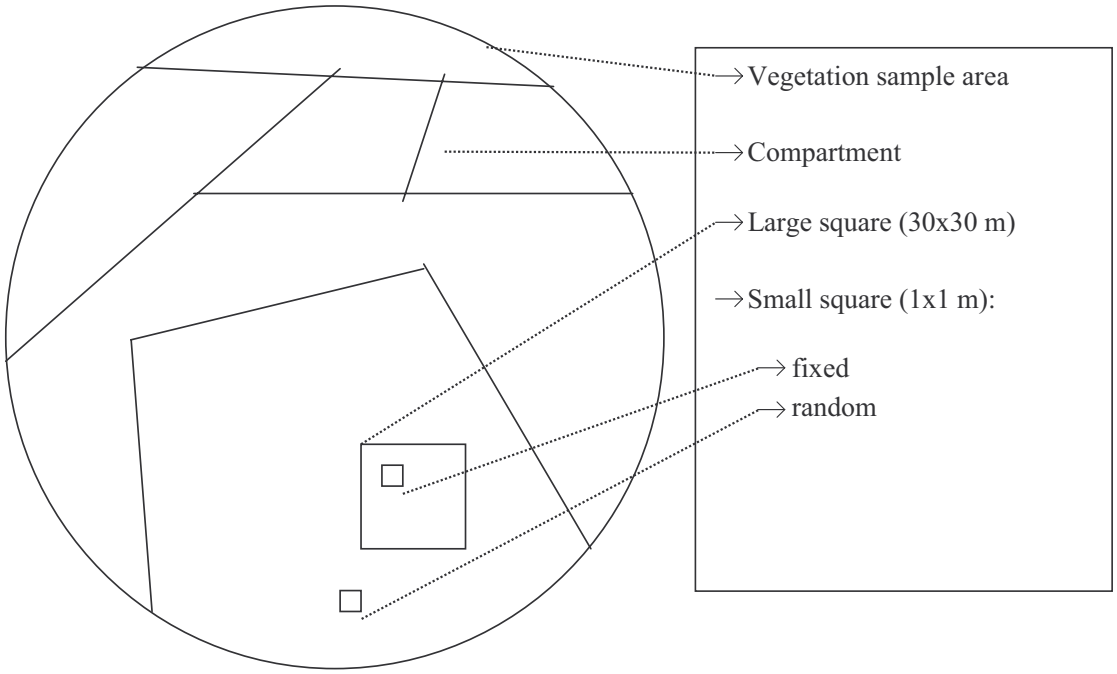
Figure 2-2. *The investigated areas at Forsmark. The borders of the compartments are viewed. Large squares are marked with black symbols.*

Table 2-1. The different areas investigated during 2001 and 2002 respectively.

Year	Number of circle areas	Number of large squares
2001	3	20
2002	3	18

For each 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).

In 2002 three new areas were chosen in Forsmark, independent of potential drilling sites. The aim was to gather vegetation data from specific biotopes. Therefore, a wetland, a coastal and a forest area were selected. These vegetation sample areas were given natural borders.



The Vegetation sample area was in 2001 round with a radius of ca 500 metres. In 2002 borders were adjusted to catch a certain vegetation type.

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 whether 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.*

Location of sampling squares

Within some (randomly chosen) compartments a large square was located (30x30 m). 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 metres east and 152 metres 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.

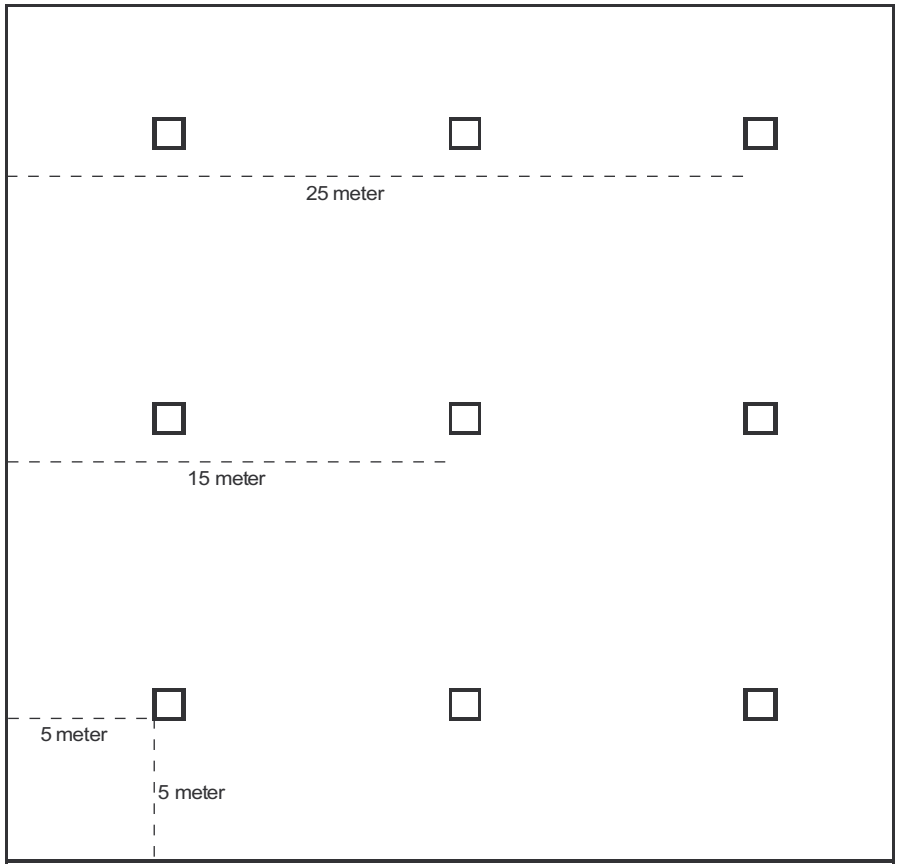


Figure 2-4. *The large square (30x30 m) and the fixed small squares (1x1 m). In each corner of the large square a tree stick is placed. In the southwest corner of the fixed small square an aluminium profile is placed, shooting up 10–20 cm. In addition a 15 cm nail is placed below ground level.*

Marking of sampling squares

In order to find the sampling squares on the next inventory occasion, both large and small sampling squares have been marked in field. In each corner of the large squares a tree stick has been placed. The small squares are permanently marked, in the south-western corner, underground with a 15 cm nail, and above ground with an aluminium profile emerging 10–20 cm.

2.2.2 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 2-2.

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 determined. 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 assessed. 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. From the diameter data a basal area was calculated. The basal area and the mean height were input data to achieve a volume. 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 was the same as that used by the National board of forestry. 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.

Table 2-2. 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 metres.
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.

Finally, a brief inventory of **fungi** was made. During five days (early September 2001) two 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.

In September 2002 the three new areas were searched for fungi. The remaining area from 2001 was also included.

3 Results

The vegetation inventory of 2001 in Forsmark was carried out by Tommy Abrahamsson and Bo Norell, both working for Foran Sverige AB. It started 2001-07-30 and ended 2001-09-12. The vegetation inventory of 2002 in Forsmark was carried out by Bo Norell. It started in 2002-08-07 and ended 2002-09-15. All data were stored in the database SICADA, the Field Note number is Forsmark 95.

Data 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 fixed small squares is presented in appendix 5 together with a list of the recorded species.

In the following figures the vegetation data have been adjusted to 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 Forsmark the most covering tree layer type was “old pine”. Altogether (2001–2002) ten large squares were placed in this tree layer type. The following figures are based on the 15 random small squares associated with each large square.

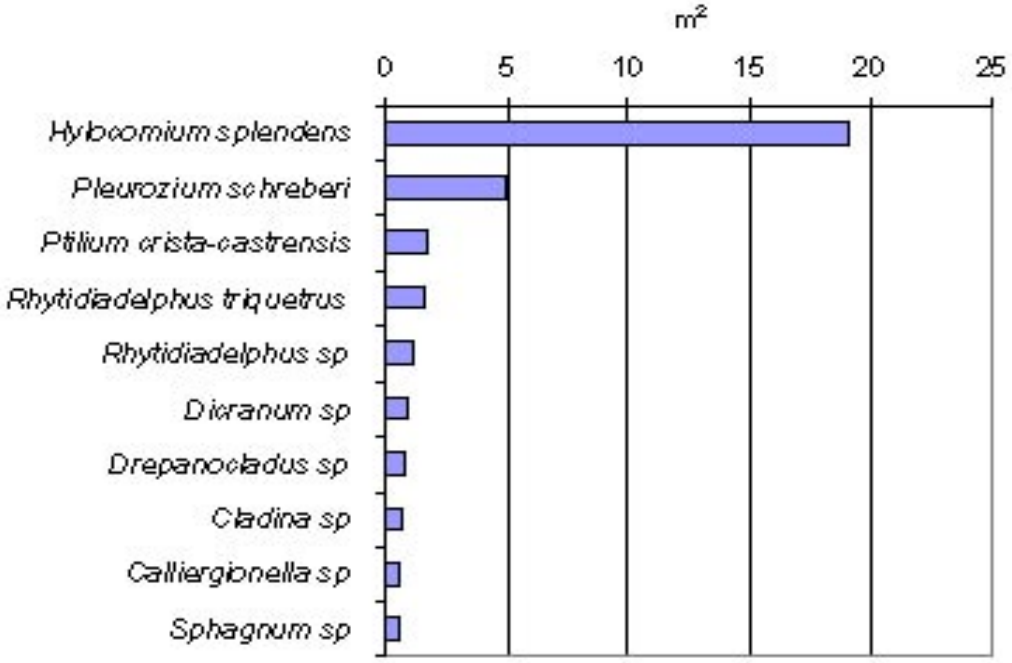
3.1 Bottom layer

In Forsmark altogether (all tree layer types) 36 species/genera have been noted in the bottom layer. The two most dominant species are *Hylocomium splendens* and *Pleurozium schreberi*. They both occurred in one third (301 and 320 of 912) of the total small squares inventoried in Forsmark 2001–2002.

In Table 3-1 the dominant bottom layer species of tree layer type “old pine” are shown. *Hylocomium splendens* is the most covering species. The average cover was 12.7%. It was registered in 71 of the 150 small squares (47%).

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 ten large squares. Sample area is 150 m². *Hylocomium splendens* is the most covering species. It covers 19.12 m² of the sampled 150 m².

Species (Swedish)		Coverage m²	%
Husmossa	*Hylocomium splendens*	19.12	12.7
Väggmossa	*Pleurozium schreberi*	4.95	3.3
Kammossa	*Ptilium crista-castrensis*	1.74	1.2
Hakmossa	*Rhytidiadelphus triquetrus*	1.68	1.1
Hakmossor	*Rhytidiadelphus sp*	1.09	0.7
Kvastmossor	*Dicranum sp*	0.91	0.6
Krokmossor	*Drepanocladus sp*	0.76	0.5
Renlavar	*Cladina sp*	0.68	0.5
Spjutmossor	*Calliergionella sp*	0.65	0.4
Vitmossor	*Sphagnum sp*	0.60	0.4



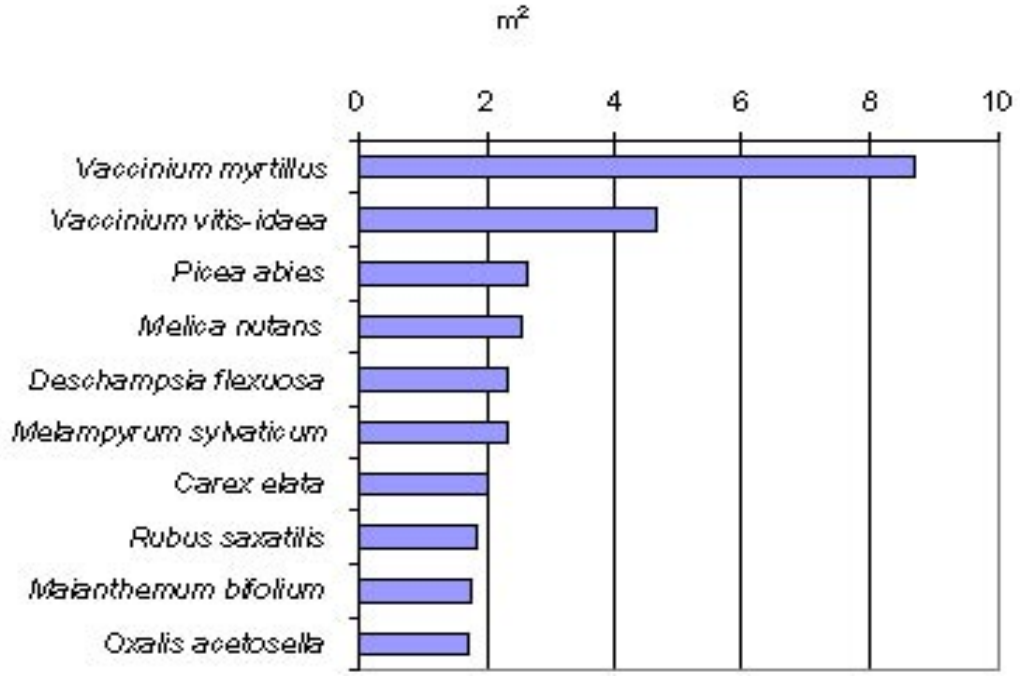
3.2 Field layer

A total of 273 species/genera have been noted in the field layer in the Forsmark area. 17 of these were found in more than ten per cent of the small squares. *Vaccinium myrtillius* was the most covering species. Although *Deschampsia flexuosa* was found in a larger number of squares, it only covered less than half of the area covered by *Vaccinium myrtillius.* 31 of the species have only been noted in one square.

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 73 of the 150 small squares (49%). The average cover was 5.8%. The seventh most covering species, *Carex elata* was found in only 19 of the small squares, to be compared with *Oxalis acetosella*, which was identified in 24 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 150 m². *Vaccinium myrtillius* is the most covering species. It covers 8.68 m² of the sampled 150 m².

Species (Swedish)		Coverage m²	%
Blåbär	*Vaccinium myrtillus*	8.68	5.8
Lingon	*Vaccinium vitis-idaea*	4.66	3.1
Gran	*Picea abies*	2.64	1.8
Bergslok	*Melica nutans*	2.56	1.7
Kruståtel	*Deschampsia flexuosa*	2.35	1.6
Skogskovall	*Melampyrum sylvaticum*	2.34	1.6
Bunkestarr	*Carex elata*	2.05	1.4
Stenbär	*Rubus saxatilis*	1.83	1.2
Ekorrbär	*Maianthemum bifolium*	1.77	1.2
Harsyra	*Oxalis acetosella*	1.72	1.1



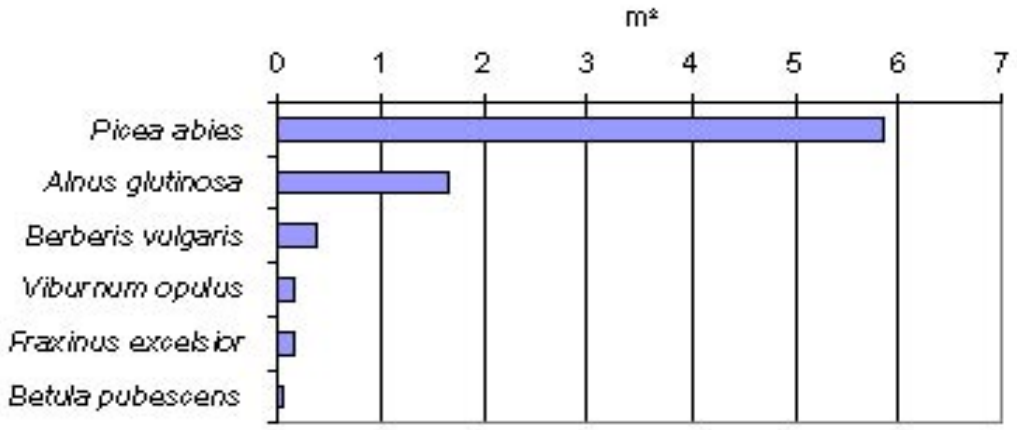
3.3 Bush layer

A total of 19 species/genera have been noted in the bush layer in the Forsmark area. *Picea abies* was the only one that was found in more than ten per cent of the small squares (18%). In Swedish forests the bush layer is normally rather sparsely developed. In Forsmark, bushlayer occurrence (all species) was noted in 16 per cent of the small squares.

In Table 3-3 the six bush layer species of tree layer type "old pine" are illustrated. *Picea abies* is the most covering species. It was found in 20% of the 150 small squares and covered in average 3.9%.

Table 3-3. All registered species in the bush layer from the tree layer type "old pine". The sample is based on the random small squares of ten large squares. Sample area is 150 m². *Picea abies* is the most covering species. It covers 5.87 m² of the sampled 150 m².

Species (Swedish)		Coverage m²	%
Gran	*Picea abies*	5.87	3.9
Klibbal	*Alnus glutinosa*	1.64	1.1
Berberis	*Berberis vulgaris*	0.38	0.3
Olvon	*Viburnum opulus*	0.17	0.1
Ask	*Fraxinus excelsior*	0.16	0.1
Glasbjörk	*Betula pubescens*	0.05	0.0



3.4 Tree layer

In Forsmark 14 tree species/genera were noted in the tree layer (Appendix 4). Spruce followed by pine was most often dominating. Tree layer data are calculated from the basal area. With basal area and mean height as input data, a volume per hectar is obtained. This value has then been converted to volume per square metre.

3.5 Fungi

Some interesting species of fungi were found (see Table 3-4), some of them listed as indicator 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.

Table 3-4. Interesting species of fungi found within the Forsmark area.

Latin name	**Swedish name**
Cordyceps ophioglossioides	Smal svampklubba
Geastrum sp	Jordstjärna
Cantharellus aurora	Rödgul trumpetsvamp
Phellodon niger	Svart taggsvamp
Hydnellum suavolens	Dofttaggsvamp
Hydnellum ferrugineum	Dropptaggsvamp / Skarp droptaggsvamp
Hygrocybe sp	Hagvaxskivling
Sarcodon imbricatus	Fjällig taggsvamp

4 Discussion

4.1 Bottom layer

In the bottom layer *Hylocomium splendens* and *Pleurozium schreberi* are very dominant. Together they constitute 71% of all registered bottom layer coverage in Forsmark.

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.

4.2 Field layer

The field layer species exhibit different patterns in nature. The most dominant species (*Vaccinium myrtillius, Vaccinium vitis-idea)* 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 noted in a few squares, but still reached a high coverage.

Vaccinium myrtillius was the overall dominating species. In average almost 6 per cent of the “old pine” area was covered with this species. The field layer species list has a rather long “tail” with many species of only sparse occurrence.

4.3 Bush layer

When working with squares of 1x1 m, the variation in the bush layer coverage is very high. In “old pine” areas bush layer species only occurred in one square of five.

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. 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.

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.

References

Ahti H-A, 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 report R-02-06.

Inventory manual. Vitality, 1999. National board of forestry.

Appendix 1

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

Latin names	**Swedish names**
Aneura pinguis	Fetbålmossa
Antitrichia curtipendula	Fällmossa
Brachythecium sp	Gräsmossor
Calliergion sp	Skedmossor
Calliergionella sp	Spjutmossor
Campylium sp	Spärrmossor
Cladina sp	Renlavar
Cladonia arbuscula	Gulvit renlav
Cladonia rangiferina	Grå renlav
Cladonia sp	Bägarlavar
Cladonia stellaria	Fönsterlav
Climacium dendroides	Palmmossa
Dichelyma sp	Klomossor
Dicranum sp	Kvastmossor
Drepanocladus sp	Krokmossor
Helodium blandowii	Kärrkammossa
Herzogiella striatella	Spretmossor
Hylocomium splendens	Husmossa
Hypnum cupressiforme	Cypressfläta (Bergklomossa)
Hypnum sp	Fläta-arter
Hypogymnia sp	Blåslavar
Lophozia sp	Flikmossor
Mnium sp	Stjärnmossor
Peltigera sp	Filtlavar
Plagiochila asplenioides	Praktbräkenmossa
Plagiochila sp	Bräkenmossor
Platismatia sp	Näverlavar
Pleurozium schreberi	Väggmossa
Polytrichum sp	Björnmossor
Pseudotaxiphyllum elegans	Platt skimmermossa
Ptilidium pulcherrinum	Tät franslevermossa
Ptilium crista-castrensis	Kammossa
Rhizocarpon sp	Kartlavar
Rhytidiadelphus sp	Hakmossor
Rhytidiadelphus triquetrus	Kranshakmossa
Scorpidium scorpioides	Korvspionmossa
Sphagnum sp	Vitmossor
Thuidium sp	Tujamossor
Tomentypnum nitens	Gyllenmossa
Warnstorfia exannulata	Kärrkrokmossa

Appendix 2

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

Latin names	Swedish names
Acer platanoides	Lönn
Achillea millefolium	Rölleka
Agrimonia eupatoria	Småborre
Agrostis canina	Brunven
Agrostis capillaris	Rödven
Agrostis stolonifera	Krypven
Alchemilla sp	Daggkåpa
Alnus glutinosa	Klibbal
Anemone nemorosa	Vitsippa
Angelica sylvestris	Strätta
Anthoxanthum odoratum	Vårbrodd
Anthriscus sylvestris	Hundkex
Arrhenatherum elatius	Knylhavre
Athyrium filix-femina	Majbräken
Berberis vulgaris	Berberis
Betula pendula	Vårtbjörk
Betula pubescens	Glasbjörk
Brachypodium sylvaticum	Lundskafting
Briza media	Darrgräs
Calamagrostis arundinacea	Piprör
Calamagrostis canescens	Grenrör
Calamagrostis epigejos	Bergrör
Calamagrostis purpurea	Brunrör
Calamagrostis stricta	Madrör
Callitriche stagnalis	Dikeslånke
Caltha palustris	Kabbeleka
Campanula patula	Ängsklocka
Campanula persicifolia	Stor Blåklocka
Cardamine pratensis	Ängsbräsma
Carex acuta	Vasstarr
Carex appropinquata	Tagelstarr
Carex canescens	Gråstarr
Carex capillaris	Hårstarr
Carex cespitosa	Tuvstarr
Carex cuprina	Blankstarr
Carex diandra	Trindstarr
Carex digitata	Vispstarr
Carex disticha	Plattstarr
Carex elata	Bunkestarr
Carex elongata	Rankstarr
Carex flacca	Slankstarr
Carex flava	Knagglestarr
Carex globularis	Klotstarr
Carex lasiocarpa	Trådstarr
Carex lepidocarpa	Näbbstarr
Carex nigra	Hundstarr
Carex nigra juncella	Styltstarr
Carex ovalis	Harstarr
Carex pallescens	Blekstarr
Carex panicea	Hirsstarr
Carex pseudocyperus	Slokstarr
Carex pulicaris	Loppstarr
Carex rostrata	Flaskstarr
Carex vesicaria	Blåsstarr
Centarium littorale	Kustarun
Centaurea jacea	Rödklint
Cerastium fontanum	Hönsarv
Chrysosplenium alternifolium	Gullpudra
Circaea alpina	Dvärghäxört
Cirsium arvense	Åkertistel
Cirsium helenioides	Brudborste
Cirsium palustre	Kärrtistel
Cirsium vulgare	Vägtistel
Coeloglossum viride	Grönkulla
Convallaria majalis	Liljekonvalj
Corylus avellana	Hassel
Crepis paludosa	Kärrfibbla
Cypripedium calceolus	Guckusko
Dactylis glomerata	Hundäxing
Dactylorhiza fuchsii	Skogsnycklar
Dactylorhiza incarnata	Ängsnycklar
Danthonia decumbens	Knägräs
Daphne mezereum	Tibast
Dapne mezereum	Tibast
Deschampsia cespitosa	Tuvtåtel
Deschampsia flexuosa	Kruståtel
Dryopteris carthusiana	Skogsbräken
Dryopteris cristata	Granbräken
Dryopteris filix-mas	Träjon
Eleocharis uniglumis	Agnsäv

Latin names	Swedish names
Elymus caninus	Lundelm
Elytrigia juncea	Strandkvickrot
Elytrigia repens	Kvickrot
Empetrum niger	Kråkbär
Empetrum sp	Kråkbär
Epilobium adenocaulon	Amerikansk dunört
Epilobium angustifolium	Mjölkört
Epilobium palustre	Kärrdunört
Epilobium sp	Epilobium sp
Epipactis helleborine	Skogsknipprot
Epipactis palustris	Kärrknipprot
Equisetum arvense	Åkerfräken
Equisetum fluviatile	Sjöfräken
Equisetum palustre	Kärrfräken
Equisetum pratense	Ängsfräken
Equisetum scirpoides	Trådfräken
Equisetum sylvaticum	Skogsfräken
Eriophorum angustifolium	Ängsull
Eupatorium cannabinum	Hampflockel
Euphrasia frigida	Fjällögontröst
Euphrasia sp	Euphrasia sp
Festuca arundinacea	Rörsvingel
Festuca ovina	Fårsvingel
Festuca rubra	Rödsvingel
Festuca sp	Festuca sp
Filipendula ulmaria	Älggräs
Filipendula vulgaris	Brudbröd
Fragaria vesca	Smultron
Frangula alnus	Brakved
Fraxinus excelsior	Ask
Galeopsis bifida	Toppdån
Galium album	Stormåra
Galium boreale	Vitmåra
Galium palustre	Vattenmåra
Galium sp	Galium sp
Galium uliginosum	Vattenmåra
Galium verum	Gulmåra
Gentianella uliginosa	Sumpgentiana
Geranium robertianum	Stinknäva
Geranium sanguineum	Blodnäva
Geranium sylvaticum	Midsommarblomster
Geum rivale	Humleblomster
Glaux maritima	Strandkrypa
Glechoma hederacea	Jordreva
Glyceria fluitans	Mannagräs
Goodyera repens	Knärot
Gymnocarpium dryopteris	Ekbräken
Hepatica nobilis	Blåsippa
Hieracium grp silvaticiforma	Skogsfibbla
Hieracium sp	Hieracium sp
Hieracium umbellatum	Flockfibbla
Hippophae rhamnoides	Havtorn
Huperzia selago	Lopplummer
Hypericum maculatum	Fyrkantig Johannesört
Hypericum perforatum	Äkta johannesört
Hypochoeris maculata	Slåtterfibbla
Iris pseudacorus	Svärdslilja
Juncus articulatus	Ryltåg
Juncus balticus	Östersjötåg
Juniperus communis	En
Knautia arvensis	Åkervädd
Lactuca sativa	Skogssallat
Lathyrus linifolius	Gökärt
Lathyrus pratensis	Gulvial
Lathyrus vernus	Vårärt
Ledum palustre	Skvattram
Lemna minor	Andmat
Leontodon autumnalis	Höstfibbla
Leucanthemum vulgare	Prästkrage
Linaria vulgaris	Gulmåra
Linnaea borealis	Linnea
Listera ovata	Tvåblad
Lithospermum officinale	Stellaria sp
Lonicera xylosteum	Skogstry
Luzula pallescens	Blekfryle
Luzula pilosa	Vårfryle
Lycopodium annotinum	Revlummer
Lycopus europaeus	Strandklo
Lysimachia thyrsiflora	Topplösa
Lysimachia vulgaris	Videört
Lythrum salicaria	Fackelblomster
Maianthemum bifolium	Ekorrbär
Malus sylvestris	Vildapel
Melampyrum nemorosum	Natt och dag
Melampyrum sylvaticum	Skogskovall
Melica nutans	Bergsslok
Mentha aquatica	Vattenmynta
Mentha arvensis	Åkermynta
Menyanthes trifoliata	Vattenklöver
Milium effusum	Hässlebrodd
Molinia caerulea	Blåtåtel
Monotropa hypopitys	Tallört
Myosotis sylvatica	Skogsförgätmigej
Myrica gale	Pors
Ophioglossum vulgatum	Ormtunga
Origanum vulgare	Kungsmynta

Latin names	Swedish names
Orthilia secunda	Björkpyrola
Oxalis acetosella	Harsyra
Paris quadrifolia	Ormbär
Parnassia palustris	Slåtterblomma
Pedicularis palustris	Kärrspira
Peucedanum palustre	Kärrsilja
Phegopteris connectilis	Hultbräken
Phleum pratense	Timotej
Phragmites australis	Vass
Picea abies	Gran
Pimpinella saxifraga	Bockrot
Pinus sylvestris	Tall
Plantago lanceolata	Svartkämpar
Plantago maritima	Gulkämpar
Platanthera bifolia	Nattviol
Plathanthera chlorantha	Grönvit nattviol
Poa nemoralis	Lundgröe
Poa palustris	Sengröe
Poa pratensis	Ängsgröe
Poa trivialis	Kärrgröe
Polygala vulgaris	Jungfrulin
Polygonatum multiflorum	Storrams
Polygonatum odoratum	Getrams
Polypodium vulgare	Stensöta
Populus tremula	Asp
Potentilla anserina	Gåsört
Potentilla erecta	Blodrot
Potentilla palustris	Kråkklöver
Potentilla reptans	Revfingerört
Primula farinosa	Majviva
Primula veris	Gullviva
Prunella vulgaris	Brunört
Prunus padus	Hägg
Pteridium aquilinum	Örnbräken
Puccinellia capillaris	Saltgräs
Puccinellia distans	Grått saltgäs
Pulmonaria obscura	Lungört
Pyrola chlorantha	Grönpyrola
Pyrola rotundifolia	Vitpyrola
Quercus robur	Ek
Ranunculus acris	Vanlig Smörblomma
Ranunculus flammula	Ältranunkel
Ranunculus lingua	Sjöranunkel
Ranunculus repens	Revsmörblomma
Ribes alpinum	Måbär
Roegneria canina	Lundelm
Rosa canina	Nyponros
Rosa sp	Rosa sp

Latin names	Swedish names
Rubus caesius	Blåhallon
Rubus idaeus	Hallon
Rubus saxatilis	Stenbär
Rubus sp	Rubus sp
Rumex acetosa	Ängssyra
Sagittaria natans	Trubbpilblad
Salix aurita	Bindvide
Salix caprea	Sälg
Salix cinerea	Gråvide
Salix myrsinifolia	Svartvide
Salix pentandra	Jolster
Salix repens	Krypvide
Salix sp	Salix sp
Sanicula europaea	Sårläka
Satureja vulgare	Bergmynta
Satureja vulgaris	Bergmynta
Schoenoplectus lacustris	Säv
Scrophulaira nodosa	Flenört
Sedum telephium	Kärleksört
Selaginella selaginoides	Dvärglummer
Sesleria caerulea	Älväxing
Silene dioica	Rödblära
Solanum dulcamara	Besksöta
Solidago virgaurea	Gullris
Sonchus arvensis	Åkermolke
Sorbus aucuparia	Rönn
Sorbus intermedia	Oxel
Sparganium natans	Dvärgigelknopp
Stachys sylvatica	Stinksyska
Stellaria graminea	Grässtjärnblomma
Stellaria longifolia	Skogsstj.blomma
Stellaria nemorum nemorum	Nordlundarv
Succisa pratensis	Ängsvädd
Taraxacum sp	Maskros
Thalictrum flavum	Ängsruta
Thalictrum simplex	Backruta
Thalictrum sp	Thalictrum sp
Thelypteris palustris	Kärrbräken
Trientalis europaea	Skogsstjärna
Trifolium medium	Skogsklöver
Trifolium pratense	Rödklöver
Trifolium sp	Trifolium sp
Triglochin maritima	Havssälting
Triglochin palustre	Kärrsälting
Tussilago farfara	Tussilago
Typha latifolia	Bredkaveldun
Ulmus glabra	Alm
Utricularia intermedia	Dybläddra

Latin names	**Swedish names**
Utricularia vulgaris	Vattenbläddra
Vaccinium myrtillus	Blåbär
Vaccinium oxycoccos	Tranbär
Vaccinium vitis-idaea	Lingon
Valeriana sambucifolia	Strandvänderot
Veronica chamaedrys	Teveronika
Veronica officinalis	Ärenpris
Veronica scutellata	Dyveronika
Viburnum opulus	Olvon
Vicia cracca	Kråkvicker
Vicia sepium	Häckvicker
Vicia sylvatica	Skogsvicker
Viola canina	Ängsviol
Viola mirabilis	Underviol
Viola palustris	Kärrviol
Viola riviniana	Skogsviol

Appendix 3

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

Latin names	Swedish names
Alnus glutinosa	Klibbal
Berberis vulgaris	Berberis
Betula pendula	Vårtbjörk
Betula pubescens	Glasbjörk
Betula sp	Björk (obest)
Corylus avellana	Hassel
Fraxinus excelsior	Ask
Juniperus communis	En
Myrica gale	Pors
Picea abies	Gran
Pinus sylvestris	Tall
Populus tremula	Asp
Rosa sp	Rosor
Salix caprea	Sälg
Salix cinerea	Gråvide
Salix sp	Salix sp
Sorbus aucuparia	Rönn
Ulmus glabra	Alm
Viburnum opulus	Olvon

Appendix 4

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

Latin names	Swedish names
Alnus glutinosa	Klibbal
Betula pendula	Vårtbjörk
Betula pubescens	Glasbjörk
Betula sp	Björk (obest)
Fraxinus excelsior	Ask
Juniperus communis	En
Picea abies	Gran
Pinus sylvestris	Tall
Populus tremula	Asp
Querqus robur	Ek
Salix caprea	Sälg
Salix pentandra	Jolster
Sorbus aucuparia	Rönn
Ulmus glabra	Alm
Viburnum opulus	Olvon

Appendix 5

A photo of a small square with vegetation data

The photo shows the fixed small square AFM000633. It is situated in Forsmark and was investigated 2002. Below the photo the registered bottom, field, and bush layer species are listed. The inventory was carried out in early July and the photo was taken two months later. This might explain why no *Melampyrum silvaticum* is shown on the photo. The *Melampyrum-species* wilt in August.

Bottom layer Species	Coverage (%)
Hylocomium splendens	50
Polytrichum sp	2

Bottom layer Species	Coverage (%)
Picea abies	3

Field layer Species	Coverage (%)
Vaccinium myrtillus	50
Melampyrum sylvaticum	11
Calamagrostis arundinacea	5
Deschampsia flexuosa	4
Vaccinium vitis-idaea	1