

# The history of a farm–shieling system in the central Swedish forest region

Hanna Karlsson · Marie Emanuelsson ·  
Ulf Segerström

Received: 15 June 2009 / Accepted: 5 October 2009 / Published online: 24 November 2009  
© Springer-Verlag 2009

**Abstract** The local vegetation history of three sites in the forested region of central Sweden was studied. These sites were the forest village site Ängersjö and the two nearby shieling sites, Gammelvallen and Öjingsvallen. The aim of the study was to elucidate the relationship between the establishment of the farm and of the shielings. The results indicate that agriculture began in the area in the Roman Iron Age or Migration period. There is evidence of contemporaneous human activity in the village of Ängersjö and the shieling at Öjingsvallen, suggesting the development of a farm–shieling system. We suggest that permanent farms and shielings were established concurrently as a local system, and that one of the main reasons was to demonstrate that the territory between the farm and the shieling was a potential resource area belonging to the farm. The problems of using pollen to differentiate between a shieling and a farm are also evaluated and it is concluded that multiple sites as well as a multidisciplinary approach is essential in order to be able to address such complex problems as the emergence of the farm–shieling system.

**Keywords** Animal husbandry · Arable history · Forest grazing · Iron Age · Pollen analysis · Summer farming

## Introduction

Animal husbandry has developed over thousands of years in different regions of the world, and nomadic or “semi-nomadic” systems have evolved, including shielings, summer farming and transhumance, usually reflecting seasonal specialisation and/or adaptation to ecological conditions.

Northern Sweden developed a system using summer-time shielings (Sw. *fåbod*, *säter*). The shielings were established in the forests at some distance from the permanent settlements, in locations where the resources were less heavily exploited than near the settlements (Frödin 1925; Nyman 1963). At the shielings, milk was produced and converted into milk products before both were transported to the farms in the villages. Grass for hay production, and occasionally cereals or other crops, were grown in small fields (Levander 1943; Segerström and Emanuelsson 2002). The livestock was tended on clearings and half open pastures in the surrounding forest.

The formation and development of the farm–shieling system in northern Scandinavia has been long discussed, with different scientific disciplines contributing to the body of knowledge (Frödin 1930, 1948; Svensson 1998; Rathje 2001). The postulated date of the genesis of the shieling system varies from the Late Neolithic to early Modern Times (Reinton 1955; Kvamme 1988; Sandnes 1991; Myrdal 1999; Larsson 2009). The reason behind the establishment of shielings is usually thought to be an increasing demand for fodder, especially winter fodder, which could not be satisfied by production in areas adjacent to the permanent settlements (Frödin 1948; Montelius 1975; Sandnes 1991) although recent theories relate the establishment to fundamental changes in agriculture and husbandry (Larsson 2009). Owing to the harsh climatic conditions during the winter and the importance of animal

---

Communicated by M.-J. Gaillard.

---

H. Karlsson · U. Segerström (✉)  
Department of Forest Ecology and Management, The Swedish  
University of Agricultural Sciences, SE 901-83 Umeå, Sweden  
e-mail: Ulf.Segerstrom@svek.slu.se

M. Emanuelsson  
Formas, Box 1206, SE 111-82 Stockholm, Sweden

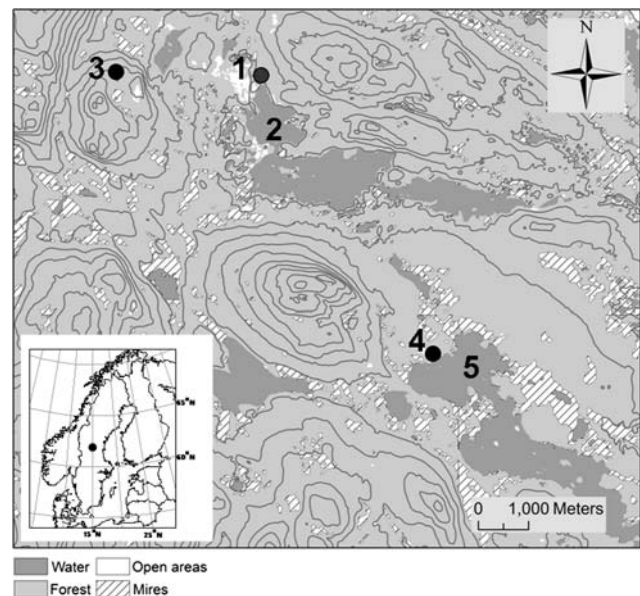
husbandry, a year-round supply of fodder was crucial once domestic livestock had been introduced into the pluralistic forest economy. Whether the fodder resources were limited or not is, however, still an open question. Although theories about an initial relationship between shielings and other seasonal settlements have been proposed (Frödin 1930), the use of shielings is often considered in relation to a permanent settlement with an agricultural economy (Mogren 1996; Emanuelsson et al. 2000, 2001).

During the last decade there have been a number of archaeological and vegetation history studies examining known shielings in central Sweden and the southern parts of Norrland (Segerström et al. 1996; Emanuelsson 1997; Svensson 1998; Emanuelsson and Segerström 1998; Emanuelsson et al. 2000; Liases and Olsson 2000; Emanuelsson and Segerström 2002; Segerström and Emanuelsson 2002; Emanuelsson et al. 2003; Liases 2003). This work has revealed that several of the shielings were already in use during the Viking and early Medieval periods, and that cereal cultivation was regularly practised at the sites. However, there still is an important lack of data relating to the shielings examined in those studies; they have not been studied in relation to the village or the farmstead to which they are presumed to have been connected. Therefore, it is hard to argue unequivocally that there were connections between the two in pre-historic or medieval times.

The aim of this study was to elucidate the relationships between the establishment of the permanent farm and its shielings in the central Swedish forest region. In order to do this, the local vegetation and land use history at the small forest village of Ängersjö and the nearby shielings at Gammelvallen and Öjingsvallen was studied. Our research questions concerned the age of the village and the shielings, and the development of local agriculture and animal husbandry. The results of the investigation are discussed in terms of the origin and development of the farm-and-shieling system in central Sweden; we also evaluate the problems of using pollen analysis for such a holistic assessment of the local settlement history of the village and its shielings.

### Study area

The parish of Ängersjö is situated in the north-western part of the province of Hälsingland in central Sweden (Fig. 1). The area is, and has always been, sparsely populated; in the mid 1920s, when the population was at its highest, about 470 people lived in Ängersjö, that is *ca.* 1.3 persons per km<sup>2</sup>. In 1990 the parish of Ängersjö had *ca.* 120 inhabitants (Lagerqvist 2003). The region is characterized by forests; the maximum level of cultivation was at the beginning of the 20th century, when only *ca.* 0.4% of the parish was under cultivation (Mogren 1996). Moreover, a hilly



**Fig. 1** Map of the study area; 1 The village of Ängersjö; 2 Lake Lill-Ängersjön; 3 Gammelvallen; 4 Öjingsvallen; 5 Lake Öjingen

topography and numerous lakes, rivers and mires are typical of the landscape. The soil is mainly sandy and silty till, but glaciofluvial sediments are deposited along the river valleys (Lundqvist 1969). The present day climate is slightly continental with an annual precipitation of about 500 mm. The mean temperature is 1.7°C, and the growing season extends from mid-April to mid-October (Ångström 1974). As part of the southern boreal forest region, *Pinus sylvestris* L. and *Picea abies* (L.) H. Karst are the dominant tree species. Deciduous trees such as *Betula pendula* Roth, *B. pubescens* Ehrh., *Alnus glutinosa* (L.) Gaertner, *A. incana* (L.) Moench and *Populus tremula* L. are also present (Sjörs 1956).

The village of Ängersjö, which is the major settlement in the parish, is located beside the lake Lill-Ängersjön (Fig. 1; Table 1). The name Ängersjö appeared in cadastral records for the first time in 1542, when four peasants were mentioned (Mogren 1996; Wennersten 2002). According to Wennersten (2002) the local inheritance principles imply that the origin of the village was, hypothetically, a single farm in the 13th century. The date is consistent with an archaeological investigation that dated the infields of Ängersjö to *ca.* A.D. 1000–1300 (Mogren 1996). However, pollen analyses from two lakes in the vicinity of the village suggest that animal husbandry was being undertaken from the period around the birth of Christ onwards (c.f. Pålsson 1988, unpublished data; Emanuelsson et al. 2000).

For the present palaeoecological study of Ängersjö, a small mire was chosen for sampling, this is surrounded by the eastern part of the village (Fig. 1). The mire surrounds a small pond, and is partly forested, and species of Cyperaceae

**Table 1** Characteristics of the sites selected for peat core sampling

Site name	Ängersjö	Gammelvallen	Öjingsvallen
Geographical position	61°60'N; 14°52'E	61°59'N; 14°49'E	61°55'N; 14°56'E
Distance from Ängersjö (km)	–	2.8	6.6
Altitude (m asl)	400	490	430
Size of mire (ha)	3 (incl. pond)	0.02	3.5
Peat sampler	Russian	Wardenaar	Wardenaar, Russian
Peat depth (cm)	200	79	155
Depth interval used for pollen analysis (cm) <sup>a</sup>	0–80	10–77	0–91
Number of analysed samples	25	33	33

<sup>a</sup> The depth interval represents the upper values of the sub-sampled peat cores, e.g. at Gammelvallen the first sample was taken at the depth of 10–11 cm, while the last was from 77 to 78 cm

and *Sphagnum* mosses are major components of the ground vegetation. The distance between the sampling site and the nearest fields, as indicated by the land regulation map (Sw. *storskifte*) from the beginning of the 19th century, is about 80 m (National land survey, [Sw. *Lantmäteriet* Ängersjö 6]).

Several shielings are located in the parish: at the end of the 18th century and the beginning of the 19th century there were either four or six shielings, the information varying depending on the sources used (National land survey, [Sw. *Lantmäteriet* Ängersjö 4]; Bringéus 1961). The two shielings chosen for this study were Gammelvallen (“the old pasture”, auth. transl.) and Öjingsvallen (the pasture beside lake Öjingen).

The abandoned shieling at Gammelvallen, which is a registered archaeological site, is situated on a plateau on the north-facing slope of the hill Frosktjärnsberget barely 3 km from the village (Fig. 1; Table 1). The distance to the next nearest villages/farmsteads (Kolsätt and Remmen) is more than 6 km NW, and more important is that until 1645 those villages were in Norway, separated from the Gammelvallen/Ängersjö area by the national border between Sweden and Norway. Gammelvallen has been the subject of archaeological excavations, and local pollen analysis has been conducted (Emanuelsson et al. 2000). Evidence of houses or cellar pits at the site has been dated to A.D. 600–900 (one radiocarbon date) and A.D. 1100–1600 (four radiocarbon dates). For the local pollen analysis relating to Gammelvallen, a small mire about 100 m from the site was selected (for more details see Emanuelsson et al. 2000). The mire is partly covered by trees and the ground vegetation is mainly made up of *Sphagnum* mosses, species of Cyperaceae and ericaceous dwarf-shrubs.

Öjingsvallen, the large shieling, is situated beside a lake called Öjingen (Fig. 1; Table 1) about 6 km south of Ängersjö. The next nearest village to Öjingsvallen is Vänsjö about 9 km NE, in fact also north of Ängersjö. The farmers in Vänsjö have their own shielings between 3 and

5 km to the north of the village. Historically, Öjingsvallen has been owned by households/families from Ängersjö. The shieling area encompasses approximately four hectares of open grassland, and the houses are currently used as summer cottages by families originating from Ängersjö. A storehouse has been dendrochronologically dated to the middle of the 17th century (Sundberg 2009). Soil and stone constructions similar to those at Gammelvallen are present 150 m north of the open shieling area of Öjingsvallen. One has been radiocarbon dated to A.D. 1000–1650 and, in addition, a horseshoe typologically dated to ca. A.D. 1000–1200 has been found in the area (cf. Karlsson 2001). For the pollen analysis relating to Öjingsvallen, a mire between the shieling area and the lake was chosen. The distance from the mire to the border of the shieling area is about 50 m. A few scattered trees of *P. sylvestris* grow on the mire, which is mainly covered by *Calluna vulgaris* and other ericaceous dwarf-shrubs, species of Cyperaceae and *Sphagnum* mosses.

## Methods

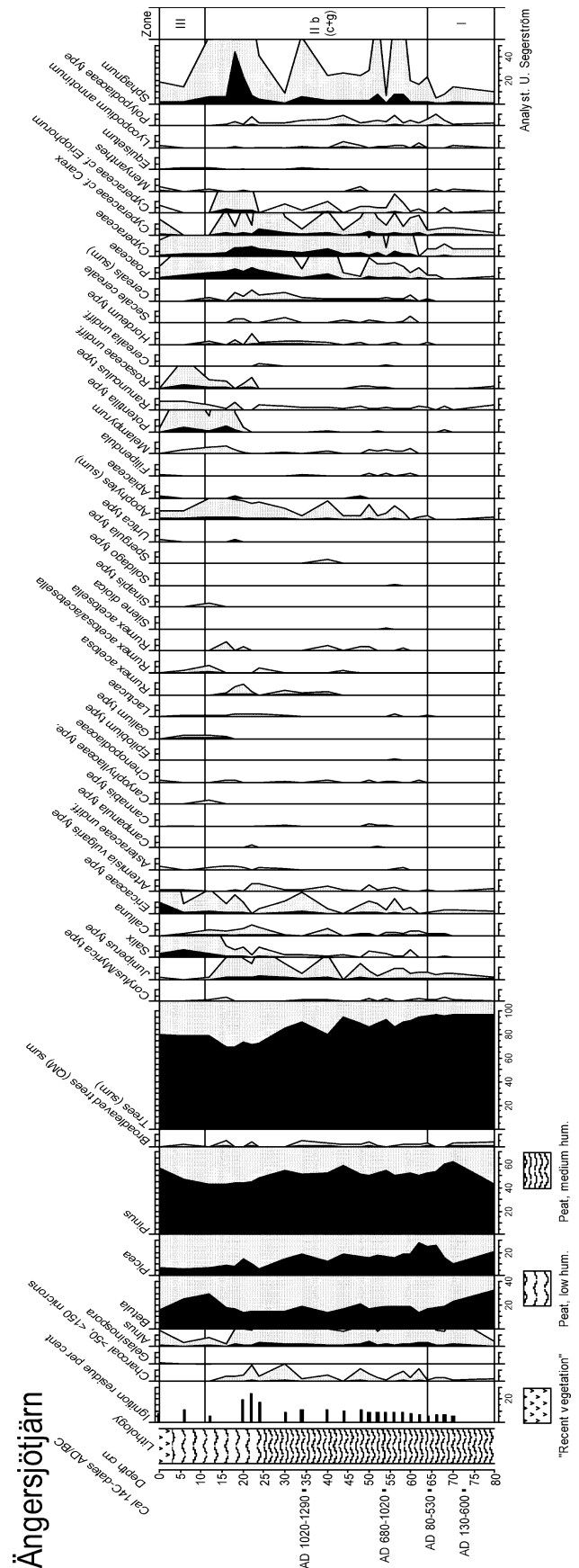
Sampling of the three mires was carried out using two types of peat samplers (Table 1). Peat samples 1 cm thick were taken from the peat cores for pollen and charcoal analysis, loss-on-ignition measurements and for dating. For pollen analysis, the sampling strategy was to begin with samples taken every 5 or 10 cm, and to increase the sampling resolution in those parts of the peat profiles where major changes related to farming occurred in the pollen assemblages. In the most recent part only a few samples were analysed since our study focused on the early establishment and development of the agricultural activities rather than on the last 100 years. The sampling resolutions are presented in the histograms for the loss-on-ignition residue (Figs. 2, 3, 4). The microscope slides for the pollen

**Fig. 2** Percentage pollen diagram from the village of Ängersjö. From the left: calibrated <sup>14</sup>C dates; depth scale in cm; lithology (key below the diagram, hum = humification); ignition residue in % of dry weight; presence of charcoal particles in % of total pollen; individual pollen and spore types, sum curves; pollen assemblage zones. Black fields represent the percentage of each pollen type and the grey fields represent the percentage values increased by a factor of 10

analysis were prepared using standard methods, namely treatment with KOH and acetolysis (Moore et al. 1991). The slides were mounted in safranine-stained glycerine. From each sample, about 500–700 pollen grains were counted. The general keys of Beug (1961), Moore and Webb (1978) and Moore et al. (1991) were used for identification of pollen types, and a reference pollen collection was available for critical examinations. Microscopic charred particles were also counted on the pollen slides; the size limits of the charred fragments, 50–150 µm and >150 µm respectively, were chosen to be indicative of charred particles originating predominantly locally or on-site (cf. Tinner et al. 1998; Pitkänen et al. 1999; Ohlson and Tryterud 2000). The loss-on-ignition residue in the peat was determined by drying small peat samples at 105°C for 12 h, then burning them at 550°C for 4 h to achieve organic combustion (Heiri et al. 2001).

The percentage frequencies of each pollen type were calculated based on the total terrestrial pollen sum, including Cyperaceae, for each sample. The calculation sum for the spore types was the sum of terrestrial pollen plus the number of counted spores of the particular type. The percentages of charcoal particles were calculated based on the sum of terrestrial pollen and the number of charcoal particles for each sample. The pollen data were calculated and the diagrams drawn using the programs TILIA and TILIA.GRAPH (Grimm 1991, 2004). Rare taxa that were regarded as being of minor importance for the interpretations were excluded from the pollen diagrams. However, all taxa were included in the calculations of sums and in the sum diagrams. *Plantago lanceolata* was included in the sum of apophytes (plants growing in habitats influenced by humans), whereas species in the Poaceae were not. The nomenclature follows Lid (1985) for vascular plants and Moore et al. (1991) for pollen types. The division of some of the Cyperaceae pollen into Cyperaceae cf. *Carex* and Cyperaceae cf. *Eriophorum* respectively was done using a reference slide collection.

The ages of layers within the peat profiles were determined by radiocarbon analysis (AMS) of selected bulk and macrofossil samples (Table 2). The analyses were carried out at the Ångström Laboratory at Uppsala University and the Radiocarbon Dating Laboratory at Lund University. Calibrations of the radiocarbon dates were performed using the programme Calib 4.4 (revised version of Calib 3.0; Stuiver and Reimer 1993).





Gammelvallen Frosktjärnsberget

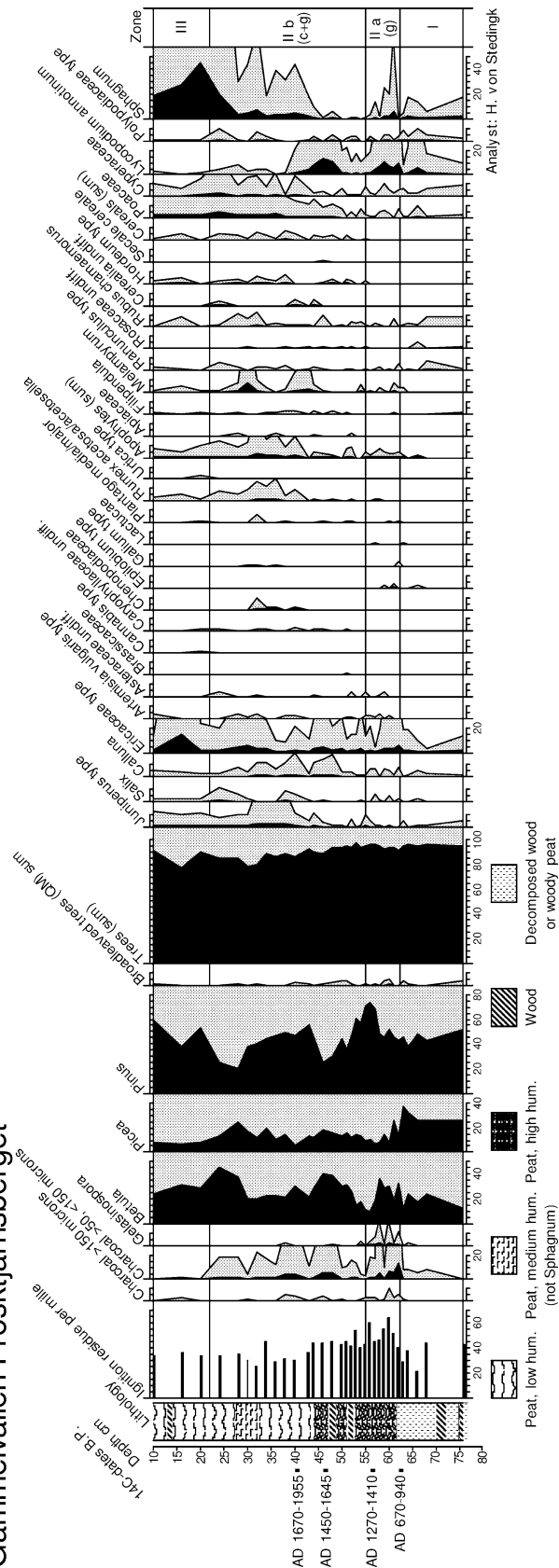


Fig. 3 Percentage pollen diagram from the Gammelvallen shieling; for explanation see caption to Fig. 2

Öjingsvallen

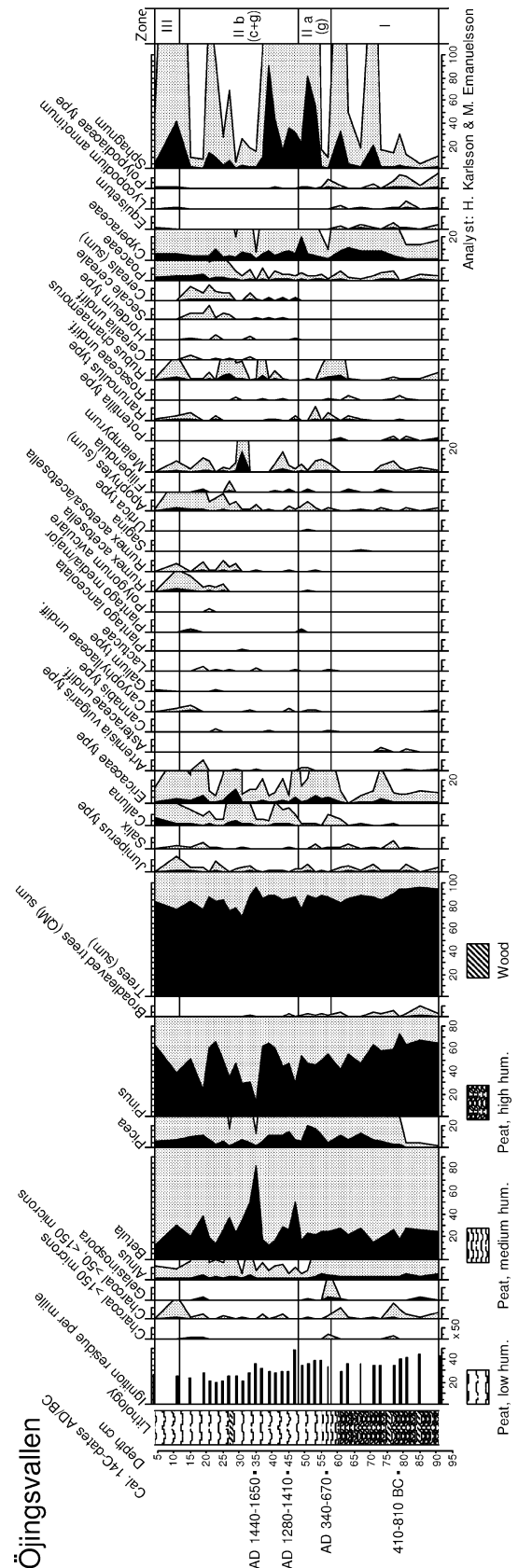


Fig. 4 Percentage pollen diagram from the Öjingsvallen shieling; for explanation see caption to Fig. 2

**Table 2** Radiocarbon dates and calibrated ages of the peat profiles from the village of Ängersjö, the shieling at Gammelvallen and the shieling at Öjingsvallen in the parish of Ängersjö, central Sweden

Site	Lab. code	Depth (cm)	Material	<sup>14</sup> C age (B.P.)	Calibrated age 1σ	Calibrated age 2σ
Ängersjö	LuA-4952	34–35	Bulk	855 ± 90	A.D. 1044–1261	A.D. 1018–1294
Ängersjö	Ua-19539	53–54	Macrofossil	1170 ± 90	A.D. 776–976	A.D. 683–1018
Ängersjö	LuA-4951	54–55	Bulk	870 ± 100	A.D. 1041–1253	A.D. 987–1297
Ängersjö	LuA-5121	64–65	Bulk	1735 ± 90	A.D. 180–418	A.D. 84–531
Ängersjö	LuA-4950	72–73	Bulk	1685 ± 95	A.D. 239–528	A.D. 129–596
Gammelvallen	Ua-14281	40–41	Bulk	55 ± 90	A.D. 1688–1955	A.D. 1669–1955
Gammelvallen	Ua-14825	40–41	Macrofossil	45 ± 65	A.D. 1694–1955	A.D. 1676–1955
Gammelvallen	Ua-14826	46–47	Macrofossil	345 ± 55	A.D. 1484–1633	A.D. 1447–1645
Gammelvallen	Ua-14827	56–57	Macrofossil	655 ± 60	A.D. 1289–1391	A.D. 1267–1410
Gammelvallen	Ua-14282	62–63	Bulk	1240 ± 55	A.D. 692–868	A.D. 665–936
Öjingsvallen	Ua-14829	34–35	Bulk	355 ± 60	A.D. 1476–1632	A.D. 1442–1645
Öjingsvallen	Ua-14830	44–45	Bulk	640 ± 60	A.D. 1296–1392	A.D. 1277–1414
Öjingsvallen	LuA-5120	56–57	Bulk	1520 ± 90	A.D. 436–616	A.D. 341–674
Öjingsvallen	Ua-14283	78–79	Bulk	2545 ± 55	B.C. 799–543	B.C. 811–413

The calibrations were made using the programme Calib 4.4 (revised version of Calib 3.0; Stuiver and Reimer 1993). The age ranges obtained from intercepts are given for all dates

## Results and interpretation

Three analogous vegetation and land use phases were identified within the local vegetation history of Ängersjö, its shielings and the forests around the sites (Figs. 2, 3, 4). These were based on simultaneous changes in several taxa. Phase I is characterised by the absence of agriculture. Phase II—the period of agriculture—is divided into two sub-phases: phase II(a) represents a time when the only agricultural activity was grazing; phase II(b) represents a period of both cultivation and grazing. During phase III agriculture ceased. In addition, the local pollen assemblages presented in the diagrams are summarised in Tables 3, 4, 5.

## Dating

The chronologies for the three site-specific local land use histories are based on altogether 14 radiocarbon dates. The results are presented in tabular form (Table 2), and as tentative depth–age curves for each site (Figs. 5, 6, 7). The depth–age curves were constructed by linear interpolation using smooth lines, assuming that the peat surface is dated to the present. The dates are discussed and evaluated in relation to the presence of *Picea abies* pollen, as indicated in the diagrams. The development of *P. abies* forests in the region has been dated to ca. 500 B.C. (Fig. 4; Engelmark 1978).

**Table 3** Ängersjöjärn; local pollen assemblage zones

Depth (cm)	Name and description
0–11	<i>III. Closure of the forest from around A.D. 1900 (estimated)</i> Dominated by <i>Betula</i> , <i>Picea</i> and <i>Pinus</i> . <i>Salix</i> and Ericaceae increase. Cereals and herbaceous plants indicating cultivated or grazed land are absent Boundary: Increase in <i>Betula</i> and <i>Pinus</i> . Decrease in <i>Juniperus</i> , cereals and apophytic weeds, together with the proportion of charcoal particles
11–64	<i>II b. Cultivation and grazing ca. A.D. 100–600 until ca. A.D. 1900 (estimated date)</i> Dominated by <i>Betula</i> , <i>Picea</i> and <i>Pinus</i> . <i>Juniperus</i> , <i>Melampyrum</i> , cereals, Poaceae and Cyperaceae as well as apophytic herbaceous plants such as e.g. <i>Rumex</i> spp. are present and increase in proportion, indicating cultivated or grazed land. Cereals indicate local cultivation of <i>Hordeum</i> and <i>Secale</i> . Frequent presence of charcoal indicates repeated fires Boundary: Increase in Poaceae and Cyperaceae. Occurrence of cereals and various apophytic herbs. Increasing proportion of charcoal
64–80	<i>I. Closed forest before agriculture, prior to ca. A.D. 100–500</i> Dominated by <i>Betula</i> , <i>Picea</i> and <i>Pinus</i> . Herbaceous taxa are rare

**Table 4** Gammelvallen; local pollen assemblage zones

Depth (cm)	Name and description
0–22	<i>III. Closure of the forest from around A.D. 1800 (estimated date)</i> Dominated by <i>Betula</i> , <i>Picea</i> and <i>Pinus</i> . Ericaceae increase. Cereals and herbaceous plants that indicate cultivated or grazed land decrease Boundary: Increase in <i>Pinus</i> . Decrease in <i>Alnus</i> , <i>Betula</i> and <i>Picea</i> as well as in apophytic weeds. The proportion of charcoal particles decreases
22–55	<i>II b. Cultivation and grazing from ca. A.D. 1300–1400 until ca. A.D. 1800 (estimated date)</i> Dominated by <i>Alnus</i> , <i>Betula</i> , <i>Picea</i> and <i>Pinus</i> . Increasing proportion of <i>Salix</i> , <i>Juniperus</i> , cereals, Poaceae, and apophytic herbs such as e.g. <i>Rumex</i> spp indicate that cultivated or grazed lands are common. Cereals indicate local cultivation of <i>Hordeum</i> . Frequent charcoal particles indicate fire was used for clearing land Boundary: Sharp shifts in the proportions of <i>Alnus</i> , <i>Betula</i> and <i>Pinus</i> . Occurrence of cereals
55–67	<i>II a. Grazing from ca A.D. 700–900 until ca. A.D. 1300–1400</i> Dominated by <i>Betula</i> , <i>Picea</i> and <i>Pinus</i> . <i>Calluna</i> and other ericaceous plants as well as apophytic herbs that indicate grazing are present and increase in proportion. Frequent presence of charcoal indicates repeated fires Boundary: Abrupt decrease in <i>Picea</i> . Occurrence of various apophytic herbs. Increasing proportion of charcoal
67–76	<i>I. Closed forest before agriculture, prior to ca. A.D. 700–900</i> Dominated by <i>Betula</i> , <i>Picea</i> and <i>Pinus</i> . Herbaceous taxa are rare

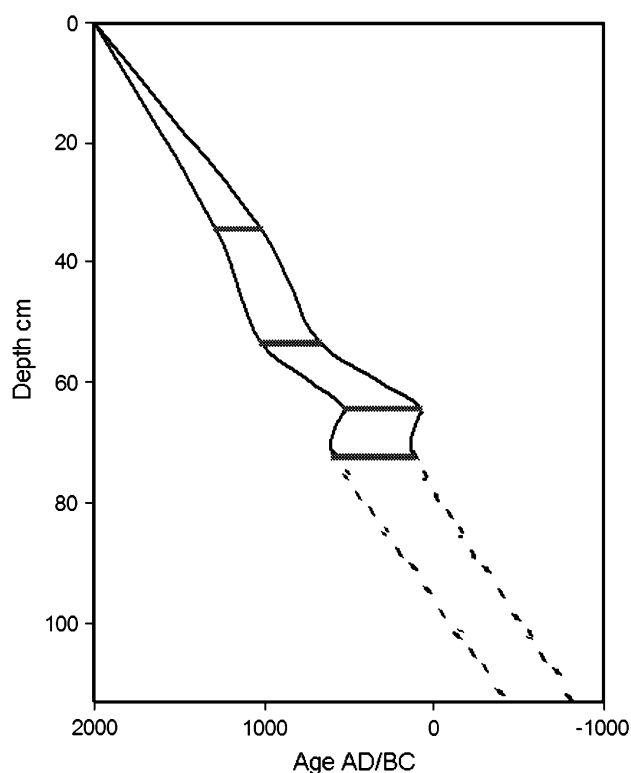
**Table 5** Öjingsvallen; local pollen assemblage zones

Depth (cm)	Name and description
0–10	<i>III. Closure of the forest from around A.D. 1900 (estimated date)</i> Dominated by <i>Picea</i> and <i>Pinus</i> . Decreasing proportions of <i>Betula</i> , Ericaceae, <i>Rumex</i> , and only few herbs in general Boundary: Increase in <i>Pinus</i> , and decrease in <i>Betula</i> , <i>Juniperus</i> and apophytes in general; peak in the proportion of charcoal particles
10–48	<i>II b. Cultivation and grazing ca. A.D. 900–1200 until ca. A.D. 1900 (estimated date)</i> Dominated by <i>Betula</i> , <i>Picea</i> and <i>Pinus</i> . Apophytic herbaceous plants such as e.g. <i>Rumex</i> spp., <i>Urtica</i> and other species, as well as cereals and Poaceae spp. indicate cultivated or grazed land. Cereals indicate local cultivation of <i>Hordeum</i> and <i>Secale</i> . Sharp fluxes in <i>Betula</i> , <i>Picea</i> and <i>Pinus</i> indicate local disturbances Boundary: Occurrence of cereals and first sharp increase in <i>Betula</i>
48–58	<i>II a. Grazing from ca A.D. 300–700 until ca. A.D. 900–1200</i> Dominated by <i>Betula</i> , <i>Picea</i> and <i>Pinus</i> . Increasing proportion of Ericaceae and apophytic herbs as well as e.g. <i>Melampyrum</i> that indicate grazing Boundary: Increase in apophytic herbs, <i>Calluna</i> and Ericaceae
58–91	<i>I. Closed forest before agriculture prior to ca. A.D. 300–700</i> Dominated by <i>Betula</i> , <i>Picea</i> , <i>Pinus</i> , and broad-leaved trees. Minimum of herbaceous plants in this zone

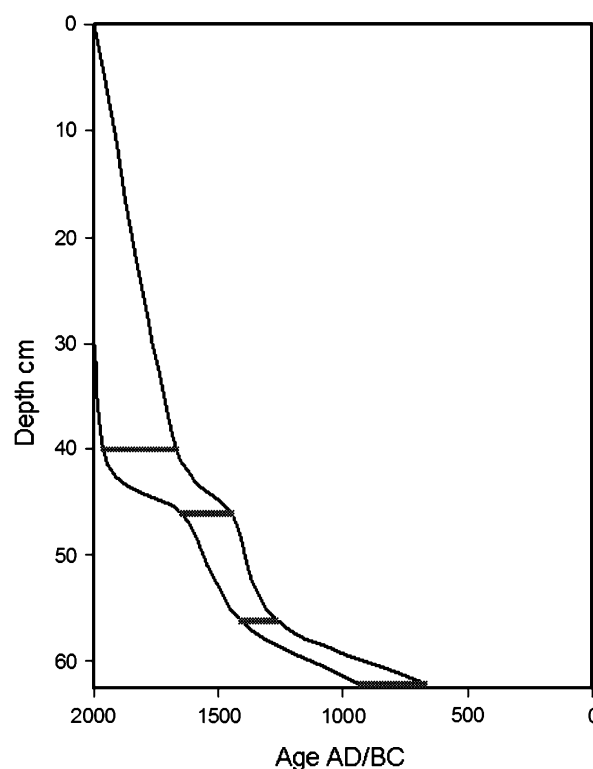
One of the five dates for the peat section from Ängersjö was discarded because it was considered to be too recent (LuA-4951, Table 2). The dating was performed on a bulk peat sample (Sect. 54–55 cm) and the age obtained may have been influenced by younger plant material, such as roots, penetrating down through the peat. A complementary  $^{14}\text{C}$  analysis was performed on macrofossil material obtained from the 53–54 cm level. Because the degree of humification of the peat is relatively low and without abrupt changes, and macrofossils are generally considered to be more reliable for dating (Rosén et al. 2001), the age for the 53–54 cm level determined in this way is likely to

be more reliable (Ua-19539, Table 2). Therefore the tentative depth–age curve (Fig. 5) is based on four radiocarbon dates and the regular appearance of *Picea* pollen that begins at a depth of 113 cm in the peat. At the neighbouring Öjingsvallen site, ca. 7 km distant, the equivalent *Picea* level dates to about 800–400 B.C. (Fig. 4).

The chronology of the vegetation changes at Gammelvallen is based on five  $^{14}\text{C}$  datings (Emanuelsson et al. 2000). The two dates for the uppermost level (one using bulk peat, and the other using macrofossils from 40 to 41 cm) indicate that the age of the sample is too young to be more precisely dated by the radiocarbon method, and



**Fig. 5** Tentative Age-depth curve based on calibrated  $^{14}\text{C}$  dates of peat from the Ångersjö site



**Fig. 6** Tentative Age-depth curve based on calibrated  $^{14}\text{C}$  dates of peat from the Gammelvallen site

that the sample is likely to be more recent than A.D. 1670 (Table 2, Fig. 6). However, given the degree of humification of the peat, a date later than the 19th century seems unlikely (Fig. 3). The other dates, of which two were determined using macrofossils, are considered to be reliable and the calculated change in the peat accumulation rate corresponds to the changes in the degree of humification in the relevant peat section.

For Öjingsvallen the  $^{14}\text{C}$  dates from the mire provided a consistent curve for the peat accumulation rate. The tentative depth–age curve (Fig. 7) is based on four radiocarbon dates (Table 2), and all  $^{14}\text{C}$ -dates seem reliable considering the changing degree of humification in the mid section of the peat (Fig. 4). The 78–79 cm level is equivalent to the pollen zone in which *Picea abies* is considered to have become an important component of the local and regional forests; here it was dated to ca. 800–400 B.C.

The local vegetation history of the village of Ångersjö (Fig. 2)

#### *I. Closed forest before agriculture, prior to ca. A.D. 100–500*

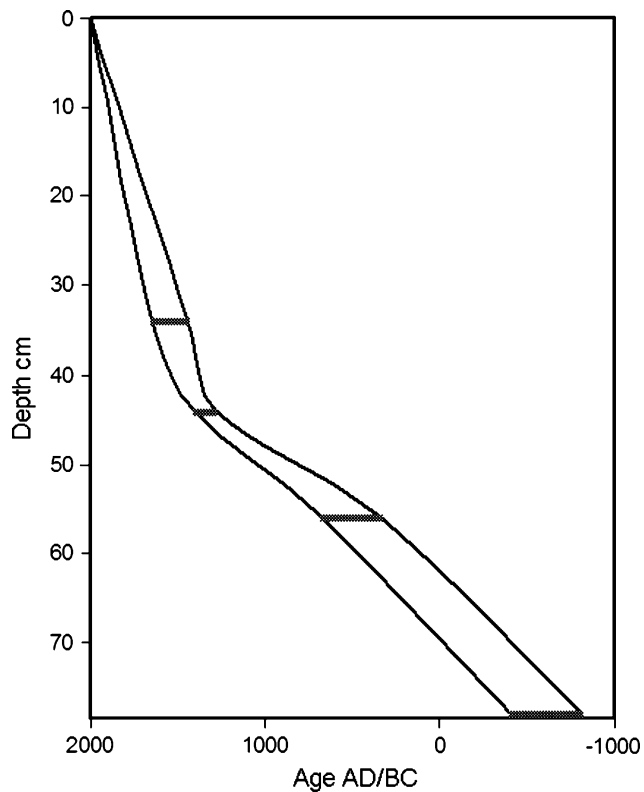
The forest consisted mainly of *P. sylvestris*, *P. abies* and *Betula* species; the high frequency of tree pollen in the

diagram implies a closed-canopy forest (Hicks 1988). Only very low proportions of pollen from shrubs such as *Salix* species, *Juniperus* and ericaceous species are present. Hardly any pollen from herbaceous species, and only low proportions of Poaceae and Cyperaceae are evident. Despite the occurrence of a few charcoal particles, the forest appears to have been relatively undisturbed by fires.

#### *II.b Cultivation and grazing ca. A.D. 100–600 until ca. A.D. 1900 (estimated date)*

The IIa period (grazing only) could not be identified here, instead the arable activities seem to include both grazing and cultivation from the outset. Unfortunately, it is still impossible to provide a more precise date than ca. A.D. 100–600 for the level of peat at which the first evidence of agriculture appeared (64–65 cm). However, it may be concluded that cereals were being cultivated by ca. A.D. 600 and perhaps earlier. The start of the period is identified on the basis of several simultaneous changes. The forest was cleared; this is primarily apparent because of the reduction in *Betula* and *Pinus*. The increasing portion of charred particles suggests that fire was used for clearing the land. Cereal cultivation was introduced; pollen grains of *Hordeum* and *Secale* are recorded more or less





**Fig. 7** Tentative Age-depth curve based on calibrated  $^{14}\text{C}$  dates of peat from the Öjingsvallen site

continuously throughout this land use phase. Single occurrences of *Chenopodiaceae*, *Spergula* and *Urtica*, all nitrophilous plants, suggests that the cereals were probably grown in permanent fields (Behre 1981; Viklund 1998). Grazing is indicated by the increase in anthropogenically favoured species in general, not least *Juniperus*, *Rumex* species and *Melampyrum* (Behre 1981; Vorren 1986; Vuorela 1986). The establishment of cleared areas is indicated by the increase in pollen of the *Poaceae*. It is possible that the hydrology of the pond and mire was manipulated in order to improve the production of mire hay, and this is suggested by the increase in *Cyperaceae* pollen (Segerström and Emanuelsson 2002). It appears that agriculture was introduced in Ängersjö as a system including both cultivation and animal husbandry from the outset.

During the late Medieval period (estimated A.D. 1300–1600) a slowly increasing proportion of pollen from cereals and apophytic species was recorded. The *Poaceae* increase markedly during the late Medieval period concomitant with a pronounced decrease in the sum of trees. This change suggests that there was a time period when open land was more important until the cessation of agriculture during the 20th century. The proportion of charred particles increased concomitantly. Increasing mineral matter content in the peat suggests a higher rate of erosion on the surrounding

dry ground. It is possible that larger areas came under cultivation, that agriculture expanded and increased slightly in importance in the village. This change is vague and is not comparable to the development that has been recorded in more coastal areas (Engelmark 1978).

### III. Closure of the forest from around A.D. 1900 (estimated)

The estimated date for the boundary between the zones (II/III) was set to around A.D. 1900. An estimate based on the tentative age/depth curve would rather suggest a date 100–200 years older (around A.D. 1750). However, our decision to set the date roughly at A.D. 1900 is based partly on the degree of humification of the peat, but also largely on the fact that at that time the forest started to recover after the extensive clear-cuts that took place in the Ängersjö region in the late 19th century. A photograph looking over the village with the hillsides of Ängersjöberget in the background shows that in the late 19th century a large portion of the surrounding forest had been clear cut (Fig. 8). By the end of the 19th century agriculture had begun to decline; in the pollen diagram this is indicated by the decreasing proportions of cereals, grasses and weeds. To some minor extent cereal cultivation occurred still in the first half of the 20th century, and hay was produced on a constantly diminishing number of fields as reflected by a reducing presence of *Galium*, *Melampyrum* and *Lactucaceae* species. The population numbers peaked in the early 20th century (Lagerqvist 2003) and thereafter declined rapidly as a result of the changes in the forestry, and as a result the need to produce food crops and livestock also decreased. The forest adjacent to the sampling site recovered after roughly 1,500 years of agriculture, and anthropogenically favoured species began to decline and disappear. Fire ceased to be important, and erosion from the land surrounding the mire was less pronounced over the last ca. 100 years. Increasing proportions of *Salix* and *Ericaceae* suggest that these groups of plants became more abundant on the mire when the putative manipulation of the hydrology of the pond and the surrounding wetland ceased. No cereals are cultivated in the village today, and neither is there any animal husbandry. Some areas are, however, still maintained as open land by mechanical means in order to preserve the aesthetics and the character of the village.

### The shieling at Gammevallen (Fig. 3)

#### I. Closed forest before agriculture prior to ca. A.D. 700–900

The forest consisted mainly of *P. sylvestris*, *P. abies* and *Betula* species. *Juniperus communis*, ericaceous species,

**Fig. 8** A photograph from A.D. 1878 overlooking the centre and the church place of the village in a north-easterly direction, and with the hill Ängersjöberget in the background. The village area is largely open land, and most of the forests near the village are thin or clear cut. Large clear cut areas are visible on the hillsides behind the church. The photo is part of the Folke Pålsson donation, and archived in Medborgarhuset, Sveg. It is archived under fp 353, Map P



*Ranunculus* species, Poaceae, Cyperaceae and *Rubus chamaemorus* were present in the forest and on the mire. The presence of frequent decomposed wood layers in the highly humified peat suggests that the mire was from time to time dry enough for trees to become established. The occurrence of rather few charcoal particles and the high proportion of tree pollen suggest that the forest was relatively undisturbed by fires, and not directly affected by human activity (Hicks 1988).

#### *II a. Grazing from ca. A.D. 700–900 until ca. A.D. 1300–1400*

At the beginning of this period, substantial changes took place in the tree species composition with a declining proportion of *Picea* and progressively increasing proportions of *Betula* and *Pinus*. These changes occurred concomitantly with increasing portions of charred particles, including particles larger than 150  $\mu\text{m}$ , and with the presence of spores of the fungus *Gelasinospora*, which may also be indicative of fire (type 1, van Geel 1978). Increased erosion from the surrounding dry land is suggested by a high proportion of mineral matter in the peat. In addition, plants such as *Calluna* and other ericaceous species, *Melampyrum* and anthropogenically favoured herbs, including *Artemisia vulgaris*, Asteraceae, *Epilobium*, *Plantago media/major* and *Rumex acetosa/acetosella* increased or were added to the ground flora of the forest. Taken together, these changes in the vegetation and the peat stratigraphy suggest that the forest became more open as a result of cattle grazing and the deliberate use of fire to improve the pastures (Behre 1981; Vorren 1986; Hicks 1988; Gaillard et al. 1994; Segerström

et al. 1996). Deliberate burning of land to improve pastures is also known historically (Levander 1943; Campbell 1948; Zackrisson 1976).

#### *II b. Cultivation and grazing from ca. A.D. 1300–1400 until ca. A.D. 1800 (estimated date)*

The presence of cereal pollen, mainly of the *Hordeum* type, demonstrates that cereal cultivation was initiated in or near Gammelvallen during the 14th century. However, no archaeological remains indicative of cultivation have been located at the shieling site (Emanuelsson et al. 2000); instead, the suggestion is based on the fact that pollen dispersal would be very limited from small fields surrounded by forest and therefore a local origin for the cereal pollen is suggested (Vuorela 1973; Hall 1988; Segerström 1991; Hicks 1998; Emanuelsson and Segerström 2002). The presence of arable weeds, such as members of the Chenopodiaceae, suggests that, at least for a while, manured and regularly cultivated fields were maintained (Viklund 1998). Forest grazing and pasture management by deliberate burning continued, and even increased, during this period. The stronger impact of forest grazing is indicated by several changes in the vegetation: the fluctuating tree species composition; the rising proportions of *Juniperus*, *Calluna*, Ericaceae, Poaceae, *Melampyrum* and *Rumex acetosa/acetosella*; and the presence of *Artemisia vulgaris*, Asteraceae, Caryophyllaceae, *Galium* and *Plantago media/major*. These latter species are favoured by grazing and trampling, dung from cattle and an open forest canopy that allows light to reach the ground (Behre 1981; Vorren 1986; Hicks 1988; Segerström et al. 1996).

### III. Closure of the forest from around A.D. 1800 (estimated date)

*Pinus*-dominated forest recovered after roughly 1,000 years of agriculture. The indicators of local fire decrease as do frequencies of species related to open land and agriculture. The age/depth curve suggests a date between A.D. 1800 and present. We regard it more reasonable to suggest an age for the zone boundary closer to A.D. 1800 mainly based on the fact that there are neither indications of cultivated fields nor the existence of the shieling on the land regulation map (Sw. *Storskifte*) from the beginning of the 19th century (Lantmäteriet [National land survey], Ängersjö 6). The temporary decrease in *Pinus sylvestris* in the middle of the zone is probably a reflection of the late 19th century clear-cuts in the area. The records of *Hordeum* pollen through this zone are most likely originating from the farmstead Halla, a permanent farm that was established in the early 19th century about 700 m distant from Gammelvallen (Emanuelsson et al. 2000). At that time there were, however, no longer any houses or any arable activities at Gammelvallen.

The shieling at Öjingsvallen (Fig. 4)

#### I. Closed forest before agriculture prior to ca. A.D. 300–700

The forest was initially made up of *P. sylvestris* and *Betula* species. During the last millenium B.C., *Picea abies* spread in the region. The low proportions of Poaceae, and absence of most forest and open land herbs indicate that the forest was closed and undisturbed by arable activities (Hicks 1988). Spores of *Gelasinospora* and charred particles were recorded frequently in this zone as a result of natural forest fires, and indicate that these were fire-prone pine-dominated forests.

#### II a. Grazing from ca. A.D. 300–700 until ca. A.D. 900–1200

Increasing proportions of pollen from *Calluna* and other ericaceous plants, *Artemisia vulgaris*, *Cannabis*-type, Caryophyllaceae, Lactuceae species, *Plantago medialis*, *Rumex acetosa/acetosella*, *Urtica*, *Melampyrum*, and *Ranunculus*-type suggest human activities in the Öjingsvallen area (Behre 1981; Vorren 1986; Hicks 1986, 1992). This probably involved introducing cattle to graze in the forest (Segerstöm et al. 1994, 1996; Emanuelsson and Segerstöm 2002). The presence of charred particles and *Gelasinospora* fungal spores (type 1, van Geel 1978) suggests that fires occurred in the vicinity of the mire, possibly as a result of deliberate burning to improve the

pasture. Taken together, the vegetation changes that indicate human influence are still weak however, and anthropogenic activities were probably limited or took place in the forest at some distance from the sampling site.

#### II b. Cultivation and grazing ca. A.D. 900–1200 until ca. A.D. 1900 (estimated date)

Human influence, in terms of both cultivation and grazing, became more evident during this period. The presence of cereal pollen, both from *Secale cereale* and of *Hordeum*-type, indicates that cereal cultivation had begun in the area. The low proportion of cereal pollen in the diagram suggests that only small fields were in use, but it is not possible to assess definitively whether the cultivation took place in permanent and manured fields, or if some other cultivation method was practised (Engelmark 1995; Viklund 1998). There was an increase in those species that are favoured by grazing, and at the same time *P. abies* and broadleaved trees, such as *Ulmus* and *Tilia*, declined (Lindbladh 1998; Segerstöm and Emanuelsson 2002). Altogether, these vegetation changes suggest an increased influence of grazing cattle in the Öjingsvallen area. Furthermore, the abrupt changes in the proportion of *Betula* and *Pinus* imply that areas of the forest were felled and that subsequent re-colonisation was by birch. The alternative interpretation that these vegetation changes merely reflect changes on the mire itself would imply that there would have been changes in other local plant communities too, such as Cyperaceae and Ericaceae; this is not, however, suggested by the records here. The agriculture at Öjingsvallen intensified from ca. A.D. 1500–1700 onwards. Cultivation of *Hordeum* and *Secale* continued, and the increase in the proportion of cereal pollen suggests that more or larger fields were established, or that the cereals were cultivated closer to the sampling site. From the vegetation changes, it is not possible to tell what kinds of cultivation systems were used. The enclosure map (Sw. *Inägoskifteskartan*) from A.D. 1814–1828, however, indicates that in the early 19th century the shieling was used for a system comprising short term field cultivation in combination with long term fallow. The proportion of species that benefit from grazing, e.g. *Juniperus communis*, Poaceae and *Rumex acetosa/acetosella*, also increased. It is suggested that the Öjingsvallen area became more open, and that grazing became increasingly important. The pronounced variation in the tree species composition is presumably due to the land management practices, primarily forest grazing, and deliberate burning to improve grazing (Segerstöm et al. 1994, 1996; Segerstöm and Emanuelsson 2002). According to the Delineation of Crown and Private Land 1854 (Sw. *Avvittringskartan*) the forests that surrounded the Öjingsvallen shieling were regarded as being very stony and of low value in terms of grazing.

### III. Closure of the forest from around A.D. 1900 (estimated date)

The approximate date for the boundary between phases II and III is based on the fact that the recovery of the forest from extensive clear-cuts in the late 19th century is reflected in the pollen composition. This is expressed mainly as an increase in *Pinus sylvestris* in the area. Cereal cultivation and grazing ceased and *Juniperus* and herbs that are favoured by open areas consequently diminished. The persistent high proportion of Poaceae reflects the open grasslands of the shieling, which continue to be kept open even today for recreational purposes.

## Discussion

### The development of the Iron Age farm–shieling system

Based on the current study and other recent studies of settlement and land-use history in northern Värmland and western Hälsingland (Svensson 1998; Emanuelsson et al. 2001, 2003; Karlsson 2001; Karlsson and Emanuelsson 2002), the following theory describing the development of the farm–shieling system in the central Swedish forest region is proposed. Permanent farms (within a permanent field-and-meadow system) and shielings were established simultaneously as a local system, during the period from the Roman Iron Age to the Vendel Period. Initially, the land use close to the shieling was mainly grazing, but hay was also harvested. Although the supply of fodder is difficult to assess (Emanuelsson et al. 2003), we argue that a deficiency of fodder in the vicinity of the farms was not the main reason behind the establishment of the shielings; some other aspects must have been more significant. Although the theory is quite simple, several factors are problematic and need more thorough examination.

First, there is the question of whether farms within the permanent field-and-meadow system existed at all in the forest areas of central Sweden during the Iron Age. In the traditional history of settlement, these areas are regarded as having been settled in the Middle Ages (e.g. Berglund et al. 1994). However, archaeological studies in western and northern Värmland have demonstrated the presence of permanent farms from the Roman Iron Age or the Migration Period onwards (Svensson 1998; Andersson and Svensson 2002; Emanuelsson et al. 2003). In addition, our palynological study of the village of Ängersjö in western Hälsingland suggests cereal cultivation from the same period (Fig. 2). Although cereals may have been cultivated in places with no known settlements (Emanuelsson et al. 2003), continual cultivation using manured fields is an essential aspect used to identify permanent

farms (Engelmark 1995; Pedersen and Widgren 1998; Viklund 1998). On the basis of pollen analysis and the historically established fact that Ängersjö was a village (Mogren 1996; Wennersten 2002), it can be supposed that there was a permanent agrarian settlement on the site from the Roman Iron Age or the Migration Period onwards. Thus, in contrast to the traditional history of settlement, recent archaeological settlement studies and pollen analyses suggest that permanent settlements based on an agricultural economy with a permanent field-and-meadow system existed in the central Swedish forest region during the Iron Age (Emanuelsson et al. 2003).

Secondly, the concurrence of the permanent farms and shielings must be examined. The pollen diagram from the village Ängersjö (Fig. 2) can be compared with analyses from two of its shielings (Figs. 3 and 4). The dating of the beginning of an agricultural economy in the village of Ängersjö to the Roman Iron Age or Migration Period (Fig. 2) suggests that the shieling at Gammelvallen on Frosktjärnsberget was not established at the same time as the village, but a few hundred years later (Emanuelsson et al. 2000; Fig. 3). However, the pollen analysis from Öjingsvallen, one of the major shielings in Ängersjö, demonstrates human impact from the time of the Roman Iron Age or Migration Period onwards (Karlsson 2001; Fig. 4, Karlsson and Emanuelsson 2002), thus confirming the contemporaneousness of the farm–shieling system in Ängersjö.

A similar link between a permanent settlement and its shieling is probable in northern Värmland, where the suggested date of permanent settlement coincides with the dating of house foundations and land use at the shieling; in this case during the Migration–Vendel Periods (Johansson et al. 1997; Emanuelsson et al. 2003). Consequently, the farms and the shielings were probably established at the same time in these parts of the central Swedish forest region.

Thirdly, it must be considered that shielings may not have been established primarily in order to supplement fodder production. Both grazing and hay-making were temporally variable, as some areas were abandoned for short periods of time and other areas were used more intensely (Emanuelsson et al. 2003). This suggests that the fodder resources were neither fully exploited nor deficient during the Iron Ages; presumably, fodder did not become a limited resource until the end of the Late Middle Ages or the Early Modern Times when the impact of animal husbandry was greater (Myrdal and Söderberg 1991; Svensson 1998; Segerström and Emanuelsson 2002). Hence, the initial development of shielings was probably not a response to a lack of fodder. So, why were shielings established at the same time as the permanent farms? What was the reason behind their location in the forest far away from the farms?



To answer these questions, factors such as the proximity to hay-mires, potential arable soils or south-facing slopes, which are assumed to have an effect on the location of the shielings, may be considered. However, the shieling sites are topographically diverse (Reinton 1955; Montelius 1975; Segerström et al. 1996; Emanuelsson 1997; Olsson 1998; Svensson 1998; Karlsson 2001; Emanuelsson et al. 2001, 2003; Segerström and Emanuelsson 2002), and no factor is easily singled out. Some other aspect must have been taken into account when selecting the use and location of the shielings. One important aspect is inevitably taking the livestock away from the infield area thus making it easier to protect the fields against destruction. On the other hand this does not explain the sometimes distant location of the shielings. Furthermore this explanation is contradicted by the fact that fields were also established at the shieling sites. We therefore hypothesise that one of the essential factors behind the use and the location of shielings was to demonstrate the extent of the territory of the permanent settlement (cf. Brink 1983; Nilsson 1996). This should not be understood as the positioning of the shieling to mark the border of the territory (Zachrisson 1998; Tollin 1999), but rather as indicating that the adjacent area as well as the area between the shieling and the farm were already in use and not available for further colonisation (Pedersen and Widgren 1998). In this way, the forest land of the farm—potentially important for resources—was partly protected. Although this tentative theory requires further examination, it does provide an answer to the questions of why the shielings were established simultaneously with the permanent settlements and why they were located at a distance from these.

Together, individual studies of permanent farms (Svensson 1998; Andersson and Svensson 2002) and of shielings (Olsson 1998; Liases 2003) demonstrate a general expansion of a sedentary agricultural economy in western and northern Värmland and in western Hälsingland during the Iron Age. Local studies of shielings directly linked to permanent settlements suggest that a system of farms and shielings was established during colonisation (Fig. 2; Mogren 1996; Emanuelsson et al. 2001, 2003; Karlsson 2001). Consequently, the farm–shieling system seems to have been the mode of successful Iron Age expansion in these parts of the central Swedish forest region.

#### Separating a shieling from a farm; the Öjingsvallen example

The definition of a shieling and the all-encompassing system, must address a number of aspects: variable agricultural land use, seasonality, and the relationship between the shieling and the village. Some of these aspects are easily assessed in the study of Öjingsvallen, while others require

more detailed investigations of the supposed shieling and the wider area around it. Since several complementary studies have been undertaken in the village of Ängersjö and the parish it is possible to discuss the shielings as a system, based on Öjingsvallen as an example. Can we identify forest grazing and other land use activities that were conducted at the shieling, including milk production and seasonal use, using the pollen based studies discussed above? Then, is it possible to determine the nature of the relationship between the shieling and the village?

The results show that the area was probably already used for forest grazing during the Iron Age. In addition, cereal cultivation was introduced during the Viking age/Early Middle ages. There were, however, no signs of hay-making, no distinct increase in, for instance, Cyperaceae pollen recorded at the sample mire or on the shieling where the houses are found (cf. Segerström and Emanuelsson 2002). These findings agree well with the pollen-based results from Gammelvallen (Eng. “the old pasture”) on Frosktjärnberget, where no hay-making on mires or meadows was detected in the analyses. In conclusion, the land use seems to have been what we expect on a shieling. However, the land use is also very similar to that which could be expected near a farmstead. Therefore, is it not possible to rely solely on the land use patterns to differentiate between a shieling and a farm (Emanuelsson 1997).

Accordingly, the vegetation history does not give any insights into identifying milk production and seasonal activities, and therefore, archaeological investigations are essential for further understanding of the shielings. At Öjingsvallen no archaeological investigations have been undertaken, unlike Gammelvallen where thorough excavations have been conducted. The square depressions (Sw. *Ängersjögrunder*) there have been interpreted as cellar pits under timber houses, and may have functioned as storage areas for milk products. Furthermore, there is a small dam construction, built of stones, in the small stream that runs along the edge of the shieling area, thus providing the possibility to keep the milk cold. These features, together with the palynological evidence indicating the importance of grazing, suggest that milk production and the preparing of milk products might have been important at Gammelvallen. Since similar square depressions have also been recorded at Öjingsvallen, it is probable that milk production and milk preparation also took place there. In addition, the Gammelvallen excavations provided only a few artefacts, and cultural layers were missing which contrasts markedly with the excavated medieval farms where the cultural layers are often significant and the finds numerous. Because *ca.* 1,000 years of occupation at Gammelvallen has not led to the deposition of any cultural layer we suggest that the site was used on a seasonal basis, i.e. it was probably a shieling.



Finally, a shieling must, by definition, be associated with a farm or village (Mogren 1996; Emanuelsson et al. 2000; Emanuelsson 2001; Karlsson 2001, Karlsson and Emanuelsson 2002). In reality, if Öjingsvallen was a shieling during the late Iron age, a concomitant and permanent settlement must have existed in the Ängersjö area. Pollen analysis indicates that arable land use in terms of both grazing and cereal cultivation took place in Ängersjö at that time, thus suggesting that Ängersjö could have been the permanent settlement and Öjingsvallen the associated shieling.

However, due to the lack of archaeological remains indicating an Iron Age settlement on the site of the village of Ängersjö, we cannot unambiguously determine whether Ängersjö was used seasonally or permanently. Therefore, it remains unknown whether Ängersjö was a shieling or a permanent farmstead during the Iron Age. In the former case Ängersjö, together with Öjingsvallen and Gammelvallen, would have been part of a more complex system of shielings, possibly associated with one or several of the villages in the valleys along the rivers Ljusnan and Voxnan about 10 and 40 km to the north and the south respectively. The present state of knowledge does not allow any further evaluation of the plausibility of either scenario. The historically known functions of the three sites, however, rather support the latter interpretation, i.e. that Ängersjö was the permanent settlement, and that the other two were the shielings. This interpretation also implies the simplest set up for a farm–shieling system, and is therefore the most plausible interpretation.

#### Land-use history in the Ängersjö area during medieval and modern times

The oldest written sources regarding the use of shielings date to Medieval times, and are from Dalarna and Hälsingland. According to Myrdal & Söderberg (1991) and Myrdal (1999) it is likely that a system similar to that we know from the 19th century dates back to late Medieval times in those provinces. The Öjingsvallen study suggests both forest grazing and cereal cultivation during the transition period between the Viking age and the early Medieval ages. Equally, the land use history at Gammelvallen implies that the exploitation during Medieval times was similar to that in later periods.

Myrdal (1999) demonstrated that the use of shielings developed and expanded during the early modern period. This increasing importance of the shieling system is also demonstrated in our studies of Öjingsvallen and Gammelvallen, where the grazing pressure during the early modern period seems to have been higher than during Medieval times. Animal husbandry was supposedly very important in Ängersjö during the early modern period,

probably due to the long distance (150–300 km) livestock trade with the mining districts (Stenqvist Millde 2007) located north of Lake Mälaren, mainly the provinces of Västmanland, Dalarna and Värmland, often referred to as Bergslagen. In Bergslagen mining and metallurgic industry have been important since the Middle Ages. Similarly, there was an increasing livestock trade to Bergslagen from other areas within the central Swedish forest region, i.e. Värmland and Härjedalen, during the 16th century expansion of mining (e.g. Myrdal and Söderberg 1991; Magnusson 1997; Jansson 1998). Probably, most of the livestock was sold to the mines or smelting houses where they were used as draught animals or the skins were used for producing ropes (Stenqvist Millde 2007). Thus there is a connection between the development of the mining industry in Bergslagen and the expansion of the forest grazing and shieling system during early modern times.

#### Conclusions

The studies of vegetation and land use history in the Ängersjö parish not only reflect the history of the local village and shieling development, but also the history of a plausible farm–shieling concept. Our evidence suggests that shielings were established simultaneously with the permanent farms during the time between the Roman Iron Age and the Vendel period. Hence, colonization not only differed in mode from that previously believed, but was also earlier. We think that the reason for establishing the farm–shieling system was not, as traditionally believed, a deficiency in fodder but was a way to make clear that the territory between and around the shieling and the farm was a potential, and claimed, resource area. However, this suggestion requires further examination. The study also emphasizes the value of examining the vegetation history at several neighboring locations, as well as a multidisciplinary approach in order to be able to discuss such complex problems as the emergence of the farm–shieling system.

**Acknowledgements** This study was funded by The Bank of Sweden Tercentenary Foundation and The Swedish Council for Forestry and Agricultural Research. We wish to thank the people who have helped us: Kristian Falk, Mats Mogren and Gert Magnusson for valuable discussions and fieldwork assistance; Ann-Britt Lindström for preparation of the pollen samples and loss-on-ignition analysis; Sees-editing Ltd for linguistic improvements; and two anonymous reviewers are acknowledged for valuable reviews of the manuscript.

#### References

- Andersson R, Svensson E (2002) Skramle—the true story of a deserted medieval farmstead. *Lund Studies in Medieval Archaeology* 27. Almqvist & Wiksell International, Stockholm

- Ångström A (1974) Sveriges klimat [The climate of Sweden]. Generalstabens litografiska anstalts förlag, Stockholm
- Behre K-E (1981) The interpretation of anthropogenic indicators in pollen diagrams. *Pollen Spores* 23:225–245
- Berglund B, Helmfriid S, Hyenstrand Å (1994) Tiotusen år i Sverige [Ten thousand years in Sweden]. In: Helmfriid S (ed) Kulturlandskapet och bebyggelsen [Landscape and settlements]. Sveriges nationalatlas [The National Atlas of Sweden], Höganäs, pp 12–17
- Beug H-J (1961) Leitfaden der Pollenbestimmung. Lieferung 1. Fischer, Stuttgart
- Bringéus N-A (1961) Sockenbeskrivningar från Hälsingland 1790–1791: tillkomna på anmodan av landshövdingen F.A.U. Cronstedt [Parsh descriptions from Hälsningland 1790–1791: on a request by the County governor F.A.U Cronstedt]. Lundequistiska bokhandeln, Uppsala
- Brink S (1983) Ortsnamnen och kulturlandskapet [The place names and the cultural landscape]. Ortsnamn och samhälle 8. Uppsala
- Campbell Å (1948) Från vildmark till bygd [From wilderness to settlement]. Skrifter utgivna genom Landmåls- och folkminnesarkivet i Uppsala B:5. Hermes AB, Uddevalla
- Emanuelsson M (1997) Bosättning, agrarkris och fäbodväsende, vegetations- och markanvändningshistoria i Läde, Dalarna [Settlement, agricultural crisis and summer farming, vegetation development and land use history in Läde, Dalarna] (in Swedish with English summary). Vegetations- och markanvändningshistoria i Läde, Dalarna. Arbetsrapport Dalarnas forskningsråd, Falun
- Emanuelsson M (2001) Settlement and land-use history in the central swedish forest region. The use of pollen analysis in interdisciplinary studies. *Acta Universitatis Agriculturae Sueciae. Silvestria* 223. Dissertation, Swedish University of Agricultural Sciences, Umeå
- Emanuelsson M, Segerström U (1998) Forest grazing and outland exploitation during the middle ages in Dalarna, central Sweden: a study based on pollen analysis. In: Andersson H, Ersgård L, Svensson E (eds) Outland use in preindustrial Europe. *Lund Studies in Medieval Archaeology* 20, pp 80–94
- Emanuelsson M, Segerström U (2002) Medieval slash-and-burn cultivation: strategic or adapted land use in the Swedish mining district? *Environ Hist* 8:173–196
- Emanuelsson M, Bergquist U, Segerström U, Svensson E, von Stedingk H (2000) Shieling or something else? Iron Age and medieval forest settlement and land use at Gammelvallen in Ångersjö, central Sweden. *Lund Archeol Rev* 6:1–16
- Emanuelsson M, Nilsson S, Wallin J-E (2001) Land use dynamics during 2000 years—a case study of agrarian outland use in a forest landscape, west-central Sweden. In: Emanuelsson M (ed) Settlement and land-use history in the central swedish forest region. The use of pollen analysis in interdisciplinary studies. *Acta Universitatis Agriculturae Sueciae. Silvestria* 223. Dissertation, Swedish University of Agricultural Sciences, Umeå
- Emanuelsson M, Johansson A, Nilsson S, Pettersson S, Svensson E (2003) Settlement, shieling and landscape—the local history of a forest hamlet. *Lund Studies in Medieval Archaeology* 32. Almqvist & Wiksell International, Stockholm
- Engelmark R (1978) Comparative vegetational history of inland and coastal sites in Medelpad, N Sweden, during Iron Age. *Ealy Norrland* 11:25–62. Kungliga Vitterhets Historie och Antikvitets akademien, Stockholm
- Engelmark R (1995) Experiment kring förhistoriskt svedjebruk [Experiments concerning Prehistoric slash- and burn agriculture] In: Larsson B (ed) Svedjebruk och röjningsbränning i Norden [Slash- and burn cultivation and swidden clearances in the Nordic countries]. *Skrifter om skogs- och lantbrukshistoria* 7, Stockholm, pp 28–36
- Frödin J (1925) Siljansområdets fäbodbygd [The shieling area in the region of Siljan]. *Skrifter utgivna av vetenskaps-societeten i Lund* 5, Lund
- Frödin J (1930) Svenska fäbodlar I, Övergångsformer inom vårt fäbodväsende [Swedish shielings I, transition forms of our summer farming]. In: Erixon S, Wallin S (eds) Svenska kulturbilder [Pictures of Swedish culture]. Skoglund, Stockholm, pp 79–96
- Frödin J (1948) Ångermanlands fäbodlar [The shielings in the province of Ångermanland]. *Meddelanden från Uppsala universitets geografiska institution, Ser. A, No 56*, Uppsala
- Gaillard M-J, Birks HJB, Emanuelsson U, Karlsson S, Lagerås P, Olausson D (1994) Application of modern pollen/land-use relationships to the interpretation of pollen diagrams—reconstructions of land-use history in south Sweden, 3000-0 BP. *Rev Palaeobot Palynol* 82:47–73
- Grimm EC (1991) *Tilia v. 2.0.b.4*. Illinois state museum, research and collections center
- Grimm EC (2004) *Tilia graph v. 2.0.2*. Illinois state museum, research and collections center
- Hall VA (1988) The role of harvesting techniques in the dispersal of pollen grains of Cerealia. *Pollen Spores* 30:265–270
- Heiri O, Lotter AF, Lemcke G (2001) Loss on ignition as a method for estimating organic and carbonate content in sediments: reproducibility and comparability of results. *J Palaeolimnol* 25: 101–110
- Hicks S (1986) Modern pollen deposition records from Kuusamo, Finland. II. The establishment of pollen: vegetation analogues. *Grana* 25:183–204
- Hicks S (1988) The representation of different farming practices in pollen diagrams from northern Finland. In: Birks HH, Birks HJB, Kaland PE, Moe D (eds) *The cultural landscape: past, present future*. Cambridge University Press, Cambridge, pp 111–121
- Hicks S (1992) Modern pollen deposition and its use in interpreting the occupation history of the island Hailuoto, Finland. *Veget Hist Archaeobot* 1:75–86
- Hicks S (1998) Fields, boreal forests and forest clearings as recorded by modern pollen deposition. In: Frenzel B (ed) *Quantification of land surfaces cleared of forest during the Holocene—Modern pollen/vegetation/landscape relationships as an aid to the interpretation of fossil pollen data*. Fischer, Stuttgart, pp 53–66
- Jansson U (1998) *Odlingssystem i Vänerområdet, en studie av tidigmodernt jordbruk i Västsverige* [Farming systems in the Lake Vänern region, a study of early modern farming in Western Sweden]. *Meddelanden från Kulturgeografiska institutionen vid Stockholms universitet* 103. Dissertation, Stockholm University, Stockholm
- Johansson A, Nilsson S, Pettersson S, Svensson E (1997) Bebyggelse och säterdrift i norra Värmland 1995–1996—en förstudie [Settlement and summer farming in the region of northern Värmland 1995–1996—a preliminary study]. Arbetsrapport 97:17. Samhällsvetenskap, Högskolan i Karlstad, Karlstad
- Karlsson H (2001) *Öjingsvallen vid sjön Öjingen, en pollenanalytisk studie av en fäbodvall i Ångersjö, Hälsingland* [Öjingsvallen by the lake Öjingen, a pollenanalytical study of a shieling site in Ångersjö, Hälsingland] (In Swedish with English summary). Master thesis. Department of vegetation ecology, Swedish University of Agricultural sciences, Umeå
- Karlsson H, Emanuelsson M (2002) Fäbodväsendets långa historia. En diskussion utifrån vegetationsförändringar vid Öjingsvallen under 1500 år. [The long term history of the farm-shieling system. A discussion based on vegetation changes at Öjingsvallen during 1500 years]. In: Johansson E (ed) *Periferens landskap. Historiska spår och nutida blickfält i svensk glesbygd*. Nordic Academic Press, Lund, pp 123–140

- Kvamme M (1988) Pollen analytical studies of mountain summer-farming in Western Norway. In: Birks HH, Birks HJB, Kaland PE, Moe D (eds) *The cultural landscape: past, present future*. Cambridge University Press, Cambridge, pp 111–121
- Lagerqvist C (2003) Vid vägs ände : strukturrationalisering, migrationsmönster, kvarboende och försörjningsstrategier i Ängersjö församling år 1925–1990 [In the middle of “nowhere”. Structural rationalisation, migration patterns, staying in the country side and strategies to earn a living in Ängersjö community, 1925–1990]. Dissertation, Uppsala University, Uppsala
- Larsson J (2009) Fäbodväsendet 1550–1920. Ett centralt element i Nordsveriges jordbrukssystem [Summer farms in Sweden 1550–1920. An important element in North Sweden’s agricultural system] (in Swedish with English summary). Dissertation. Acta Universitatis Agriculturae Sueciae 2009: 51. Jamtli Förlag, Östersund
- Levander L (1943) Övre Dalarnes bondekultur under 1800-talets förra hälft. 1 Självhushåll [The rural culture of Övre Dalarna during the former half of the 19th century. 1 Self-subsistence]. Skrifter utgivna av Kungl. Gustav Adolfs akademien för folklivsforskning
- Liasas K (2003) Torkelsbovallen—ett skogsbyte från yngre järnålden [Torkelsbovallen—A late Iron Age slash-and-burn grazing area] (In Swedish with English summary). *Fornvännen* 98:100–106
- Liasas K, Olsson R (2000) Torkelsbovallen—ett skogsbyte från järnåldern. Arkeologisk undersökning, Ljusdals socken, Hälsingland [Torkelsbovallen—A late Iron Age slash-and-burn grazing area. Archaeological excavation in the parish of Ljusdal, Hälsingland]. Rapport Länsmuseum i Gävleborg, Gävle
- Lid J (1985) Norsk, svensk, finsk flora [Norwegian, Swedish, Finnish Flora]. *Det norske samlaget*, Oslo
- Lindbladh M (1998) Long term dynamics and human influence in the forest landscape of southern Sweden. Acta Universitatis Agriculturae Sueciae. *Silvestria* 78. Dissertation, Swedish University of Agricultural Sciences, Alnarp
- Lundqvist J (1969) Beskrivning till jordartskarta över Jämtlands län [Description of the soil map of the province of Jämtland]. Avhandlingar och uppsatser Ser. ca NR 45 Sveriges Geologiska Undersökningar, Stockholm
- Magnusson L (1997) Sveriges ekonomiska historia [The economic history of Sweden]. Prisma, Stockholm
- Mogren M (1996) Dating Ängersjö. Trenching lynchets in quest of the origin and development of a boreal forest village. *Lund Archaeol Rev* 2:87–108
- Montelius S (1975) Leksands fäbodlar [The shielings of Leksand]. Leksands sockenbeskrivning del VII, Falun
- Moore PD, Webb JA (1978) *An illustrated guide to pollen analysis*. Hodder & Stoughton, London
- Moore PD, Webb JA, Collinson ME (1991) *Pollen analysis*, 2nd edn. Blackwell Scientific, Oxford
- Myrdal J (1999) *Det svenska jordbrukets historia. band 2, jordbruket under feodalismen: 1000–1700* [The history of Swedish agriculture. Part 2, The agriculture during the feudalism period AD 1000–1700]. Natur & Kultur, Stockholm
- Myrdal J, Söderberg J (1991) Kontinuitetens dynamik. Agrar ekonomi i 1500-talets Sverige [Dynamics of continuity: the agrarian economy of 16th century Sweden] (In Swedish with English summary). *Stockholm studies in Economic history* 15. Almqvist & Wiksell International, Stockholm
- Nilsson S (1996) Bondemyten och byfrågan [The myth about the peasant and the question about the village]. Undergraduate thesis. Department of human geography, Stockholm University
- Nyman A (1963) Den svenska fäboden—ålder, uppkomst, utbredning [The Swedish shieling—age, origin, distribution]. In: Lidman H (ed) *Fäbodlar [Shielings]*. LTs förlag, Kristianstad
- Ohlson M, Tryterud E (2000) Interpretation of the charcoal records in forest soils: forest fires and their production and deposition of macroscopic charcoal. *Holocene* 10:585–591
- Olsson M (1998) Pollenanalytiska undersökningar av sätermiljöer i Dalby och Gunnarskog socknar, Värmland [Pollenanalytical investigations of shieling environments in Dalby and Gunnarskog parishes, Värmland]. Lundqua Uppdrag, Lund
- Pålsson I (1988) Ängersjö—En pollenanalytisk undersökning. Opubliserad rapport till Ängersjö byalag [Ängersjö—A pollen analytical investigation. Unpublished report to The village community of Ängersjö]
- Pedersen EA, Widgren M (1998) Järnålder 500 f. Kr—1000 e. Kr [Iron Age 500 BC—AD 1000]. In: Welinder S, Pedersen EA, Widgren M (eds) *Det svenska jordbrukets historia. Band 1, Jordbrukets första femtusén år* [The history of Swedish agriculture. Part 1, The first five thousand years of agriculture]. Natur & Kultur, Stockholm
- Pitkänen A, Lehtonen H, Huttunen P (1999) Comparison of sedimentary microscopic charcoal particle records in a small lake with dendrochronological data: evidence for the local origin of microscopic charcoal produced by forest fires of low intensity in eastern Finland. *Holocene* 9:559–567
- Rathje L (2001) Amasonen och jägaren. Kön/genderkonstruktioner i norr [The amazon and the hunter. Sex/gender constructions in the north] (In Swedish with English summary). Dissertation. Department of Archaeology and Sami Studies, Umeå University, Umeå
- Reinton L (1955) Sæterbruket i Noreg. I. Sætertyper og driftsformer [Summer farming in Norway. I. Shieling types and farming strategies]. Instituttet for Sammenlignende Kulturforskning, Ser B, skrift XL VIII, Oslo
- Rosén P, Segerström U, Eriksson L, Renberg I, Birks HJB (2001) Holocene climatic change reconstructed from diatoms, chironomids, pollen and near-infrared spectroscopy at an alpine lake (Sjuodjijäure) in northern Sweden. *Holocene* 11:551–562
- Sandnes J (1991) Utmarksdrift og resursutnyttelse i Norge i eldre tid [Outland use and resource utilization in the old times in Norway]. In: Ilsø H, Jørgensen B (eds) *Plov og plen, Festskrift til Svend Gissel* 4. januar 1991. Copenhagen, pp 213–221
- Segerström U (1991) Soil pollen analysis—an application for tracing ancient arable patches. *J Archaeol Sci* 18:165–175
- Segerström U, Emanuelsson M (2002) Extensive forest grazing and hay-making on mires—vegetation changes in south-central Sweden due to land use since Medieval times. *Veget Hist Archaeobot* 11:181–190
- Segerström U, Bradshaw R, Hörnberg G, Bohlin E (1994) Disturbance history of a swamp forest refuge in northern Sweden. *Biol Conserv* 68:189–196
- Segerström U, Hörnberg G, Bradshaw R (1996) The 9000-year history of vegetation development and disturbance patterns of a swamp-forest in Dalarna, northern Sweden. *Holocene* 6:37–48
- Sjörs H (1956) *Nordisk växtgeografi* [Nordic phytogeography]. Svenska bokförlaget, Stockholm
- Stenqvist Mille Y (2007) Vägar inom räckhåll. Spåren efter resande i det förindustriella bondesamhället [Roads within reach. Traces of travel in the pre-industrial agrarian society] (In Swedish with English summary). *Stockholm Studies in Archaeology* 39. Dissertation. Stockholm
- Stuiver M, Reimer PJ (1993) Extended <sup>14</sup>C data-base and revised CALIB 3.0 <sup>14</sup>C age calibration program. *Radiocarbon* 35:215–230
- Sundberg A (2009) Jaktristningar på Öjingsvallen [Hunting carvings on Öjingsvallen] (In Swedish with English summary). *Bebyggelsehistorisk tidskrift* 57:26–34
- Svensson E (1998) Människor i utmark [People in the outland] (In Swedish with English summary). *Lund Studies in Medieval*

- Archaeology 21. Dissertation. Almqvist & Wiksell International, Stockholm
- Tinner W, Conedera M, Ammann B, Gäggeler HW, Gedye S, Jones R, Sägeser B (1998) Pollen and charcoal in lake sediments compared with historically documented forest fires in southern Switzerland since AD 1920. *Holocene* 8:31–42
- Tollin C (1999) Rågångar, gränshallar och ägoområden. Rekonstruktion av fastighetsstruktur och bebyggelseutveckling i mellersta Småland under äldre medeltid [Boundaries, boundary markers and property domains : reconstruction of property structure and settlement development in central Småland during the Early Middle Ages] (In Swedish with English summary). Meddelanden från Kulturgeografiska institutionen vid Stockholms universitet 101. Dissertation. Stockholm University, Stockholm
- van Geel B (1978) A palaeoecological study of Holocene peat bog sections in Germany and the Netherlands, based on the analysis of pollen, spores and macro- and microscopic remains of fungi, algae, cormophytes and animals. *Rev Palaeobot Palynol* 25:1–120
- Viklund K (1998) Cereals, weeds and crop processing in Iron Age Sweden. Methodological and interpretive aspects of archaeobotanical evidence. *Archaeology and Environment* 14, Dissertation, Umeå University, Umeå
- Vorren K-D (1986) The impact of early agriculture on the vegetation of Northern Norway. A discussion of anthropogenic indicators in biostratigraphical data. In: Behre K-E (ed) *Anthropogenic indicators in pollen diagrams*. Balkema, Rotterdam, pp 1–18
- Vuorela I (1973) Relative pollen rain around cultivated fields. *Acta Botanica Fennica* 102:3–27
- Vuorela I (1986) Palynological and historical evidence of slash-and-burn cultivation in south Finland. In: Behre K-E (ed) *Anthropogenic indicators in pollen diagrams*. Balkema, Rotterdam, pp 53–64
- Wennersten E (2002) Gårdar och folk i skogsbygd : om jordägandet och dess konsekvenser för människor, landskap och bebyggelse i Ängersjö by, Ytterhogdals socken 1734–1815 [Farms and people in the forest: about land-ownership and its consequences for people, landscape and settlement in the village Ängersjö, Ytterhogdal parish 1734–1815]. Kulturgeografiska institutionen, Stockholms universitet
- Zachrisson T (1998) Gård, gräns, gravfält. Sammanhang kring ädelmetalldepåer och runstenar från vikingatid och tidigmedeltid i Uppland och Gästrikland [Farm, boundary, cemetery: connections between precious metal deposits and rune stones from the Viking Age and early Middle Ages in Uppland and Gästrikland] (In Swedish with English summary). *Stockholm Studies in Archaeology* 15, Stockholm
- Zackrisson O (1976) Vegetation dynamics and land use in the lower reaches of the river umeälven. *Early Norrland* 9: 7–74. *Kungliga Vitterhets Historie och Antikvitets Akademin*, Stockholm