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The Archaeology of the Commons

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ABSTRACT

Karl-Johan Lindholm, Emil Sandström & Ann-Kristin Ekman 2013. The Archaeology of the Commons

The literature is rich in descriptions of different forms of commons in the later pre-industrial agrarian society of northern Sweden. The industrial era resulted in a noticeable shift in the use of forests and in the introduction of firmer property rights and rigid land boundaries. A large number of commons from the pre-industrial period has never been officially registered and can therefore partly be seen as 'hidden' resources. The objective of this paper is to discuss the concept of commons in relation to a variable archaeological record, mainly associated with the forested regions of Sweden. Is it possible to identify commons by an archaeological landscape approach and to what extent can a long-term perspective contribute to current theoretical discussions concerned with commons?

KEYWORDS: Environmental Humanities, Commons, Common Pool Resources, archaeology, historical ecology, integrated history, landscape analysis, GIS, Ängersjö, natural resource management, rural development.

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The Archaeology of the Commons

Introduction

Commons are resources that are maintained by principles of cooperative management or joint ownership. The main objective of this paper is to test an archaeological approach to identifying areas that were held as commons in the past. This will be done by a landscape analysis of a variable archaeological record located in the forested inland regions of central Sweden. An additional objective is to discuss to what extent an archaeological long-term perspective can contribute to current theoretical discussions concerned with commons.

This paper is a partial study within the Formas research project 'Commons as Hidden Resources - Analysing the Shifting Roles of the Commons in Rural Development Processes', which commenced in 2012. The aim of the research project is to create a better understanding of past and present forms of cooperative natural resource management in the rural regions of northern Sweden. The next report from the project aims to discuss the levels of social organisation linked to commons and to enquire into their role for social sustainability and for expressing local culture, gender and identity. The final report will provide a synthesis of the different kinds of historical, social and ecological networks that surround the commons – as well as insights into the future role of commons in the context of rural development. The study recognises the importance of diachronic research approaches for shaping adaptation strategies for the future (e.g. Crumley 2007; Van der Leeuw *et al.* 2011).

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Beyond the Tragedy of the Commons

For a long time, research in economics and ecology was guided by a negative view on commons. This view was to largely derived from Garrett Hardin's influential paper the 'Tragedy of the Commons' (1968), in which he predicted that natural resources held in common will result in overexploitation and ultimately in the degradation of the resource. According to Hardin, rational and sustainable tenure could only be granted through government control or private property rights. For a considerable time, the general conclusion – which favoured state or private ownership before a common property regime – was almost granted the status of a 'scientific law' in research and in policy concerned with the management of natural resources (Feeny *et al*. 1990:2).

Over the last decades, a number of studies have resulted in an alternative understanding of commons. Case studies have shown both negative and positive examples of collective forms of natural resource management and recognised that a common *per se* does not result in overexploitation (Feeny *et al*. 1990; Ostrom 1990; Sandström 2008). Rather, it seems that previous research had overlooked the important role of various institutional arrangements associated with commons, characteristics that also distinguish commons from land-use regimes based on open access. A common is characterised by user rights regulated by a specific user group of users, attached to the resource either by collective land ownership or through customary tenure. In contrast, an open access situation describes unregulated use of an undefined group of users (Bromley 1991). The confusion between open access and common pool resources can be considered the major reason for the debate that followed the publication of Hardin's article (Acheson 2011).

Furthermore, it has been noted that many of the institutions that manage commons are fairly successful and able to maintain sustainable use of natural resources. The best example of the new insights is no doubt Elinor Ostrom's (1990) 'Common Pool Resource' theory, which resulted in the 2009 Nobel Prize in economy. The general objective of Ostrom's work was to understand the evolution and the conditions for successful collective action in order to develop institutional design principles for sustainable resource management arrangements. The increasing concern in the concept of commons can partly be related to a general interest in grass-root democracy, local participation and planning, together with anxiety regarding the status of our global commons, such as the atmosphere, the oceans, or more recently the internet (Ostrom 1990; Reid & Taylor 2010; Milun 2011).

A significant trait of current commons research is the foundation on theoretical frameworks expressing strong notions of rational choice and new institutionalism (e.g. Falk *et al*. 2003). A critique has been raised stressing the fact that current research risks perpetuating a stereotyped view on commons obscuring important contexts related to local heritage, identity, history, landscape ecology, resilience and social change (e.g. Mosse 1997; Olwig 2003; Sandström 2008; Cleaver 2012). In addition, the concept of commons has an

'enormous symbolic importance to society as an epitome of shared abstract values and democracy' (Olwig 2003:15). Present research is largely fuelled by Olwig's notion that considers commons as a viable management option for the future. However, it is evident that the concept of commons is complex and that it includes a great variation in terms of geographical scales, resources used, types of associated institutions and related decision-making arrangements that needs further attention (Rotherham 2013).

Commons in Northern Sweden

The literature is rich in descriptions of different forms of cooperation and collective ownership in the later pre-industrial agrarian society of northern Sweden (e.g. Holmbäck 1920; Matsson 1943; Frödin 1952; Hellspong & Löfgren 1994). Some of these collaborations involved the maintenance and use of facilities such as the shielings[4] (Sw. 'fäbodar' pl. sing: 'fäbod'), mills, roads or the maintenance of commons for allocating rights to grazing and other essential natural resources. In the late 17th century, the Swedish state distributed forest grants for charcoal production to the evolving iron industry. Following this and up until the end of the 19th century, an increased pressure on forest resources in the rural regions of Sweden can be noted, as well as a gradual involvement of the state and of corporate activities. The increased pressure on the forest resources were guided by the idea that state control and private ownership of land was a prerequisite for economic growth and prosperity, for both people and the country as a whole (Hoppe 1997). Initially, the land reform process was slow and mainly associated with the agricultural land reforms of southern Sweden, but over the 19th century, land reforms were initiated in northern Sweden that resulted in a noticeable shift in the use of the forests and the introduction of firmer property rights and rigid land boundaries (Isacson & Persson 1998). In these land reform processes, land held as commons were transferred to private, state or corporate ownership. It is still possible to note a variety of commons in the rural villages of northern Sweden. They were legislated commons during the land reform and sometimes they are considered to have a long historical continuity (Sandström 2008).

Current Swedish research on commons can be seen as two general fields (*cf.* Olwig 2003). The first field can be characterised as a historical field – including disciplines such as cultural geography, ethnology and economic and agrarian history. The research focuses on understanding the social and economic conditions of the pre-industrial agrarian society and the changes associated with the modernisation of Sweden from medieval times and onwards

4 'Shieling' is often used in archaeological writings as a translation of the Swedish word 'fäbod'. Shieling is not a completely adequate translation, since 'fäbod', *shieling* and the Norwegian 'säter' are fairly contextual expressions, although similar in type of adaptation. *Summer farm* is occasionally used as an English translation of fäbod; however, this term might be even more inadequate, since farm connotes agricultural activities. Farming activities could take place at a 'fäbod', but its main function was still linked to the transhumance of livestock production, as was the case of the Scottish 'shielings' and the Norwegian 'säter'. In this paper, shieling is used as the preferred English translation of fäbod.

(e.g. Holmbäck 1920; Frödin 1954; Bodvall 1959; Hellspong & Löfgren 1994; Runer 2006; Larsson 2009). The second field focuses on contemporary commons and can be situated within the context of sustainable natural resource management, policy discussions and rural development (e.g. Sandström 2008; Zachrisson 2009; Holmgren 2009; Ögmundardottir 2011). To some extent, the latter field can also be related to a current trend in the national nature conservation policies, emphasising decentralisation of environmental management responsibilities. In this context, some local communities have mobilised and shaped decentralised institutions for land management. This has often been done with reference to tradition and history, a process that can be conceptualised as a 'reinvention' of the commons (Sandström 2008). A need for a landscape approach that combines historical and institutional oriented approaches to commons has been argued (Olwig 2003). The advantage of using integrated approaches is that they could draw theoretical conclusions from real-life examples, from the past as well as from the present. Jesper Larsson's study (2009) of the Swedish shieling system can partly be considered an example of an integrated approach. The study applied Ostrom's common pool theory for a historical analysis of the Swedish shieling system and the collective institutions that developed in the aftermath of the late medieval crisis.

Towards an Archaeology of Commons

Although the major framework for the changes of the rural land use systems of northern Sweden are relatively well-known today (e.g. Campbell 1948; Pettersson 1995; Brink 1994; Hoppe 1997; Isacson & Persson 1998; Myrdal 2003; Hansson *et al*. 2005; Larsson 2009), few studies has been devoted to landscape orientated studies aiming at identifying, mapping and visualising the extents and different roles of commons before the industrial era. A large body of official documentation, such as the property maps, mainly from the 1890-1920s, are available from the land reforms, but it can be argued that this documentation does not reveal much concerning past commons, except for some important shielings and meadows. The focus of the documentation was not on the past. Rather, the focus was on the contemporary 'present and future', since the objective was to allocate land and delineate the boundaries of the newly established parcels. In some measure, it is possible to gain insights into the recent past at the time, mainly through the negotiations and court cases that accompanied the land reform. The transfers were often framed by intensive negotiations and tensions between local land users and the new stakeholders that represented the forest industry (Isacson & Persson 1998). Typical examples of complaints involved cases where an individual property owner had received exclusive rights to an area that were considered a common among the other villagers. The complaining villagers could usually only prove their case by calling witnesses having few possibilities of using official records. For this reason, the commons from the pre-industrial era can be considered as 'hidden resources', in the sense of the lacking official documentation.

Consequently, the main idea of this paper is to use archaeology for modelling areas that were managed as commons in the past. The purpose of this is to contribute to an archaeological long-term understanding of joint ownership and cooperative land management. An additional objective is to see to what extent archaeology can provide insights valuable for current discussions regarding commons. The assumption is that an archaeological approach can shed light on different geographical scales of commons and enable a platform for enquiring into the extent to which commons have been associated with certain properties in the landscape. An archaeological analysis can also provide information on the level on which commons have been used for technological and economic innovation. In addition, it may be possible to examine the social organisational principles linked to commons and furthermore to understand how commons were shaped and reproduced over time. Such knowledge could contribute to the key issue in commons research, which addresses the emergence of cooperative behaviour around natural resources.

The forest's archaeological record

The absolute majority of the known archaeological sites in the forested inland region of central Sweden is related to village outfield areas and to the past use of forest resources, such as game, pasture, wood, energy and minerals. Examples of typical sites are pitfalls for hunting elk or reindeer, bloomery furnaces for iron production, sites related to tar- and charcoal production, small mills and various other structures associated with hay-meadows or shielings. The majority of radiocarbon dates associated with archaeological forest sites usually fall within the two last millennia, which points to a long continuity of certain forms of land use, sometimes extending up to the industrial era. It is also possible to observe trends in the radiocarbon curves, which may be taken as indications of variation in intensity of certain forms of land use (e.g. Magnusson 1986; Svensson 1989; Ramqvist 2007; see below Fig. 20).

Only sporadic examples of fossil arable land, burial grounds and mounds similar to those in southern Sweden, along the coastal areas and in the Great Lake region of Jämtland are found in this region. With a few exceptions to prove the rule, the general absence of Iron Age graves and settlements in the interior and the presence of these features at the Coast and in the Great Lake region is usually seen as indicative of two regional contrasting land-use systems during the first millennia; the Coast and the Great Lake regions sustained a settled agrarian land-use system, meanwhile, the people in the forested inland region seem to have maintained a mixed economy based on hunting and/or livestock herding (Liedgren 1992; Ramqvist 2007; Zachrisson 2010). The conventional view on the historical developments of the forested region expresses that permanent settlements were first introduced during the Late Iron Age or in the Early Middle Ages (Magnusson & Segerström 2009). This occurred simultaneously with significant changes in the Scandinavian society,

most notable through the introduction of new agricultural technologies, the establishment of centralised socio-political structures, a general shift in religion and a wide-ranging urbanisation process. The subsequent phases of the Early and the High Middle Ages resulted in population increase and significant economic growth and expansion of settlements from the agricultural regions into the forests. In contrast, the Late Middle Ages are usually characterised by a number of crises; the agrarian crisis, population decline, climate change and general economic stagnation (Myrdal 2003; Hansson *et al*. 2005; Larsson 2009; Stene 2011).

Since the 1990s, a series of projects, such as Eva Svensson's research in Värmland (1998), the Ängersjö research project *Flexibility as Tradition* in the northwestern part of Hälsingland (Johansson 2002), the national survey project *Forest & History* and the *E4 highway* projects in the forested regions of Småland and Uppland (Anglert 2001; Hennius *et al*. 2005) has resulted in an increased interest in the forest's archaeological record. Many of the studies have maintained a strong focus on individual site categories – presumably reflecting a pioneering phase of empirical research – in relation to issues of technology, production estimates or chronology (e.g. Magnusson 1986; Englund 2002; Hennius *et al*. 2005; Stenqvist Millde 2007). The variability of the forest's archaeological record is considered as reflecting flexibility of land use in a marginal agrarian environment (Magnusson & Segerström 2009). The concept of outlying lands – or plainly the outlands – has been used as a conceptual framework for an integrated understanding of the forest's archaeological record (e.g. Liljewall 1996; Andersson *et al*. 1998; Svensson 1998). The outland research has provided an alternative view of the settlement history of the forested region, highlighting that the forested regions contain a complex archaeological record and the possibility of challenging conventional understandings of the historical developments of the northern inland region (e.g. Svensson 1998; Karlsson *et al*. 2010).

The Archaeology of Property

As stated above, the main task of this paper is to test if it is possible to identify areas that were managed as commons in the past by an archaeological approach. In order to do this, it is first necessary to discuss how a common would be manifested archaeologically. In the outland research, property and governing principles have mainly been discussed by geographers and historians while receiving little attention from archaeologists (e.g. Widgren 1995a; Eriksson-Trenter & Persson 2002). A starting point for an archaeological study of property regimes is the fact that a great deal of archaeological sites is the result of the exploitation of natural resources, and this is certainly true for the archaeology of the forested inland region of Sweden. For obvious reasons, such site distributions were structured by the environmental settings they once appeared in. Natural resources are not evenly distributed over the landscape; they are constituted on complex multi-scalar biophysical processes of the environment varying over space and time. In turn, these processes constitute

smaller scale systems entailing series of inter-dependent processes, for example in geomorphology and vegetation dynamics. Hence, the archaeology of natural resource management is strongly linked with a variable and dynamic environment.

However, at the same time it is also important to acknowledge that natural resource management involve several more aspects than merely being a function of the environment. Land use is based on the society's general social and cultural features and the choices that were made by individuals of a society. From this perspective, archaeological sites cannot be seen as static impositions on the environment. Instead, they should be considered socio-environmental features reflecting people, society and the social institutional principles that once framed the land use: knowledge, practice, subsistence, technology, economy and the way in which access to the natural resources was granted. Thus, a landscape study of archaeological sites would – at least theoretically – also have the capacity to provide insights to the property regimes that once constituted the land-use system.

In the literature concerned with property in prehistoric societies, a distinction is made between collective and individual access to land (*cf.* Widgren 1995b; Runer 2006). Collective rights to property are often confused with open access or 'free for all' situations, which complicates the general analysis. The collective—individual dichotomy has also been related to a historical trajectory, which infers that collective rights developed to more individualised rights over time (Holmbäck 1920; Zachrisson 1994; Runer 2006). It has been questioned whether the collective—individual dichotomy is sufficient as an analytical framework for examining property rights in prehistoric societies (Widgren 1995b). The distinction is somewhat arbitrary, since a collective is always constituted on its individual members, which in turn are members of the collective through their individual traits. In addition, it can be argued that the dichotomy mainly reflects a debate of the 19th—20th centuries, which in general favoured private and state property (*cf.* Widgren 1995b; and above).

Nevertheless, regulated access to land has an obvious relationship to concepts of user rights and property. Land ownership can be defined as the power to continuously dispose and make decisions over a distinct area (Myrdal 1996). Without written juridical documents, such land rights would be claimed by establishing continuous presence and tenure. Reference to kinship and hereditary rules would presumably be important features of the claim, and if the rights are threatened, they will be safeguarded, normally by referring to heritage and customary tenure or law or membership of a group. This links to a wider definition of property, which infers the social organisational principles that regulate the relations between people in terms of access to and exclusion from land (Widgren 1995b). Thus, it can be stated that ownership and user rights are social institutional arrangements – including aspects of agreements and negotiation – mutually agreed upon by a defining group of users. This applies both for individual, as well as for collective rights to property.

Consequently, a fruitful approach to property acknowledges that a continuum exists between a wide range of property and land-use regimes, which has overlapped and shifted over time according to social and environmental circumstances, as well as the possibility to observe general trends over time.

How these property arrangements are materialised in the archaeological record is an on-going discussion (e.g. Zachrisson 1994; Runer 2006; Löwenborg 2012, Gräslund 2012). In the Scandinavian Iron Age society, visible graves and rune stones associated with cultivated fields have been considered tangible indications of claims to property in agricultural land (Zachrisson 1994; Runer 2006; Löwenborg 2012; Holm 2012). This relates to the concept of 'odal', which refers to inherited landed property of a family line. In Sweden and Norway, the odal is known from the early Middle Ages, but it has been suggested that the origins of the concept may be sought earlier. The odal has been considered a part of an 'Iron Age mentality', and in the early part of the Iron Age, the odal was expressed by ancestral cult (Gurevich 1985 cited from Zachrisson 1994: 220). Odal can also be considered a matter of being accepted as a member of a group – a group of landowners who maintain a specific set of rules for regulating individual as well as collective rights to land. Later during the Viking Age, the odal was displayed more actively by the practice of placing burials on top of the graves of the ancestors, erecting rune stones and in mound construction. The purpose was to mark and confirm a bloodline's possessions in land (Zachrisson 1994). The fact that land was held as commons in the Iron Age society are generally acknowledged, but few attempts have been made to reconstruct the forms and extents of collective land rights during the time period, which also relates to the general objective of this paper (Holmbäck 1920; Runer 2006). The research relies on written accounts, such as the classical sources and the medieval laws and the extent to which these can be considered as representative for the earlier Iron Age society has been debated (Sjöholm 1988; Sanmark 2004; Runer 2006).

In northern Sweden, few permanent Iron Age settlements have been found in the areas located outside the coastal region and the Great Lake region, while rune stones and grave mounds associated with infields are entirely absent in the archaeological record. This can be taken as an indication of two contrasting land-use systems based on completely different, although interacting, economies during the Iron Age (Ramqvist 2007). At the same time, it can also be seen as an indication of the absence of institutionalised rights to property in the forested inland region during the Iron Age. However, it can also be argued that the conventional models are shaped on the central agricultural regions of Sweden, a geographical scope that does not fully accommodate marginal agricultural land-use systems based on forest resources. Hence, it seems necessary to develop and test an alternative approach for identifying commons through the archaeological record.

In the historical literature concerned with commons in the forested regions of Sweden it is possible to see that the people who possessed land in the village also had common access to the forested outlands, and that this organisation

catered for various forms of cooperation and joint ownership within and between villages (Holmbäck 1920). If these activities were institutionalised and carried out at distinct and claimed resource areas, it can be suggested that they would be archaeologically represented by spatially structured distributions of sites, presumably with a long continuity. In order to claim the resource areas it was necessary to have a more or less continuous presence in them, and joint efforts and cooperation would enable this. Continuous presence can also be solved by the association of various activities to the same general areas. In the 18th century, shielings and iron production were often part of the same land-use system and in the commons literature it has been noted that commons often are multifunctional resources (Steins & Edwards 1999; Sandström 2008; Cleaver 2012).

In order to trace the collective aspects of land use, it is necessary to identify archaeological sites deriving from land use that demanded or stimulated cooperation. Such site clusters mirror groups of people shaped in the interaction between land and people. Labour intensity, together with long distances and presumably small populations made it rational to establish land-use systems and property regimes in cooperation with others (Netting 1976). Consequently, it is suggested that commons are archaeologically manifested by site distributions that contain a variety of cooperatively undertaken land-use activities coupled to distinct areas. This hypothesis will now be tested against the archaeological record of the Ängersjö region in central Sweden.

Research area

The study area centres on the parish of Ängersjö located in a sparsely populated region in the northwestern part of the county of Hälsingland in central Sweden (Fig. 1). The village of Ängersjö is located near Lake Lill-Ängersjö south of the River Ljusnan (Fig. 2). The almost 450 km long the River Ljusnan links the mountainous inland region with the Bothnian Sea to the east. For reasons of comparison, the research area covers an area that also includes the neighbouring parishes of Älvros, Ytterhogdal and Överhogdal. The villages of Älvros and Ytterhogdal are both associated with the River Ljusnan and the village of Överhogdal is associated with the Hoan, a smaller stream, which confluences with Ljusnan at Ytterhogdal. The environment is characterised by boreal forest, which covers a hilly and undulating topography interspersed by numerous lakes, rivers, streams and mires (Fig. 3).

Fig. 1. Map of northern Europe showing the location of the study area. Map data © Esri and as indicated in bottom right of the map. http://www.arkeologi.uu.se/digitalAssets/204/204947_jaah_lindholm_etal_fig_1.jpg

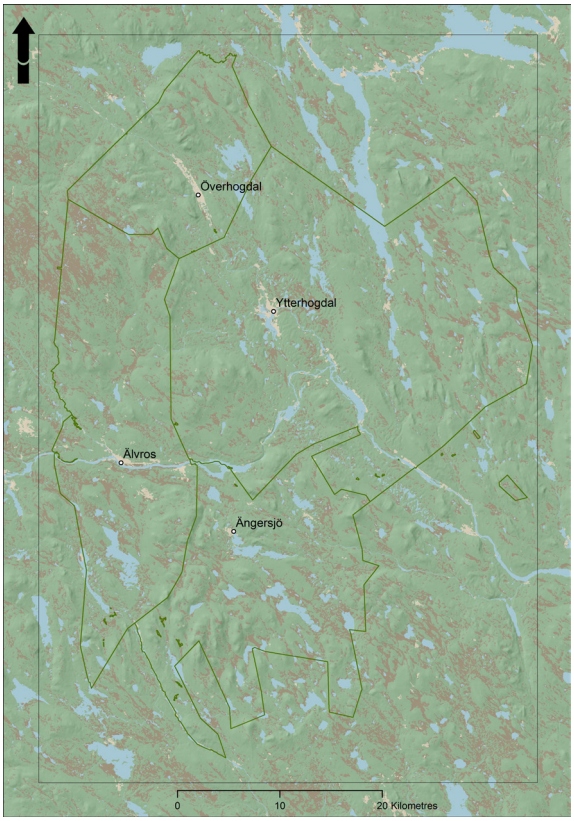

Fig. 2. Map of the study area showing the location of the villages Ängersjö, Älvros, Ytterhogdal and Överhogdal, parish boundaries and land cover. Yellow; open land, light blue; water surface, brown; mires, green; forest. Map data © Lantmäteriet, i2012/901 http://www.arkeologi.uu.se/digitalAssets/204/204949_jaah_lindholm_etal_fig_2.jpg

Fig. 3 The environmental setting. The environment is characterised by the boreal forest, which cover a hilly and undulating topography interspersed by numerous lakes, rivers, streams and mires. Photo: Karl-Johan Lindholm.
http://www.arkeologi.uu.se/digitalAssets/204/204945_jaah_lindholm_etal_fig_3.jpg

Over the last two decades, detailed interdisciplinary research has been undertaken in Ängersjö (see reviews in Johansson 2002; Magnusson & Segerström 2009). The name Ängersjö appears in the cadastral records for the first time in 1542 and archaeological dates associated with the infields of Ängersjö point to an establishment of a village somewhere in the period of 1000–1300 AD (Mogren 1996). The date is to some extent supported by a study of the inheritance, which suggests that the village originates from a single farm established sometime in the 13th century (Wennersten 2002). The date for the establishment of Ängersjö coincides with the traditional opinion concerning the settlement history of the forested inland region, suggesting that permanent settlements were introduced first during the Late Iron Age or in the early medieval period (e.g. Berglund *et al.* 1994).

The traditional opinion rests on historical sources and can be contrasted with the pollen records retrieved from three sites near Ängersjö. These indicate that animal husbandry was present in the area from as early as in the beginning of the first millennia (Emanuelsson *et al.* 2000). Expansions of livestock herding and agriculture associated with permanent and fixed periodic settlements have been deduced from the pollen records associated with the Roman Iron Age to the Vendel Period (Karlsson *et al.* 2010). During the medieval period, it is possible to see a further intensification in farming activities and livestock herding (ibid.).

Nevertheless, in the 17th century when the first census was undertaken, the population of Ängersjö consisted of 13 adults over 15 years of age, divided into

7 households (Wennersten 2002). In the mid-19th century, the forest industry expanded into the region and the Ljusnan was opened for log driving to the coast (Järnankar *et al*. 1991). In the early 20th century, about 0.4% of the parish was under cultivation and almost 500 people lived in the parish; a large number of them were active in the forest industry (Mogren 1996; Isacson & Persson 1998). About 20 people currently reside permanently in Ängersjö, but similar to many other rural places in this part of Sweden, many people reside elsewhere, but maintain links to the village by owning property and being part-time residents (Ekman 2002).

Data

The main data set is constituted on the National Heritage Board's database for archaeological sites and monuments FMIS (Jämtland, Gävleborg, Västernorrland). The selected site categories were chosen from the criteria that it should be possible to relate them to labour intensity and cooperatively undertaken natural resource management. Moreover, it was desirable to use activities that bridge the prehistoric and historical periods, such as large game hunting, livestock herding and iron production. The selection has been established through historical sources, previous research and on inferences drawn from the archaeological record. Additional site categories in FMIS could have been included in the analysis based on the same criteria used for this study, such as various quarries and charcoal production sites. However, the quarries were relatively few and did not alter the outcome of the analysis. The charcoal sites were excluded in the analysis, since it is difficult to distinguish between local and corporate controlled production of charcoal, particularly during the industrial era after the land reform.

In addition, the archaeological site distribution pattern has been compared with the National database over place names, which has been queried for place names in the landscape that reflect the same land-use activities sought for in the archaeological database. The purpose of the comparison was to see to what extent archaeological sites and place names coincide in terms of activities represented and the spatial location in the landscape. Below, a review of the selected site categories will be undertaken.

Large Game Hunting

Pitfalls are structures used for trapping wild reindeer or elk. The pitfall systems are usually located in channelling terrain cutting of the routes of migrating animals or in other favourable positions in the landscape, hence being a material expression of the hunter's knowledge of the relationship between topography and animal behaviour. Activities associated with the pitfalls included the excavation and the maintenance of the pits, which were repeatedly used over time. The pits were usually covered with twigs and branches so that the animals would not discover them. When the pits were in use, some form of fencing between the pits probably took place. Some pitfalls appear as solitaires, often in close vicinity to a settlement. Historical accounts relate

such solitary pitfalls to the trapping of wolves that appeared too close to the settlements. This type of pitfalls has not been added to the database, since they cannot be related to cooperative natural resource management. In some cases, it can be questioned whether certain clusters of pits really functioned as pitfalls. Often they seem too small and not positioned in favourable positions in terms of topography. The absolute majority of the pitfalls in the research area appear in sparsely distributed scatters, but in several places, it is possible to observe systems that extend 1-2 kilometres. One example of such system is a 2 kilometre long system next to the River Ljusnan in Älvros parish (Fig. 4). It contains at least 25 individual pits, sealing off the entrance of a valley leading up the lake system of Ängersjö. Three additional pits are located one kilometre to the east of this system. To the east on the northern side of the river, a similar system is located, and it seems likely that they were part of the same system. Elsewhere in the region, it is possible to see systems that extend 10 kilometres.

Fig. 4 Exposure of the pitfall system RAÄ Älvros 174. Photo: Karl-Johan Lindholm. http://www.arkeologi.uu.se/digitalAssets/204/204953_jaah_lindholm_etal_fig_4.jpg

The scale of the largest pitfall systems indicates that they functioned as mass catches (*cf.* Stene 2011; Risbøl *et al.* 2011:47). It was probably not possible to maintain such a facility effectively as an individual or even as a single household. The size of the systems and the labour involved infer that the production system demanded coordination and the efforts of a relatively large group of people. A further aspect of coordination and regulation is related to the population cycle of the animals. For wild reindeer, it has been estimated that the minimum population equals about 10 % of the maximum population.

The maximum population is reached by gradual increase, the minimum is reached by abrupt decline, and the overall cycle is approximately 60-80 years (Herschend 2012). This infers that long-term use of pitfall systems extending over several population cycles may be considered as an indirect indication of regulation and mutual agreements on the number of animals to be hunted. FMIS contain 262 pitfalls within the research area distributed to several systems. Only one place name, 'Älggropsheden' could be associated with pitfall hunting. 'Älggrop' translates to elk-pit and 'hed' denotes a moor.

Livestock Production

In 16th century archival sources concerned with Ängersjö parish it can be noted that livestock production was the most important part of the subsistence economy and that farming only accounted for a small portion of the subsistence (Lagerstedt 2004). The same situation can be inferred for a large number of inland communities in the same period (Bodvall 1959; Svensson 1998; Larsson 2009). Pastures and hay meadows are in general archaeologically obscure, but some features of the forest's archaeological record can be associated with livestock production for example sheilings, hay-barns and different dam systems for irrigating hay meadows.

A shieling is a periodic settlement established in an outfield area. The shielings were usually located in areas where the grazing was less heavily exploited than near the village or the farm (Frödin 1925; Nyman 1963). The shieling is in general located on such distance from the main settlement that it is necessary to keep people at the place and to build and maintain facilities for the workers and for the livestock (Reinton 1955). One aim of establishing shielings was to increase pasture and land for hay meadows and thus be able to feed more livestock over the winter (ibid.). Karlsson *et al*. (2010; see also Brink 1983) suggest that one of the essential reasons for establishing periodic settlements such as shielings was to demonstrate the extent of the territory of the permanent settlement, i.e. establish control and claim rights to the outland area. The livestock that was brought to the shieling was tended on clearings and on pastures in the surrounding forest. Occasionally it is possible to note that cereals or other crops were grown in small fields associated with the shieling (Levander & Odstedt 1943).

Although the timing for the development of the Swedish shieling system is currently debated, it is generally agreed that the shielings developed on pastures held jointly (Larsson 2009; Karlsson *et al*. 2010). Two or more households from the same or different villages could cooperate in maintaining a shieling. At the shieling, each household usually constructed and maintained their own facilities, but it was not uncommon for the households to share the facilities of a shieling. Depending on sources used, it is possible to identify four or six historical shieling areas in the Ängersjö parish used at the turn of the 18th century (Karlsson *et al*. 2010). Inside the larger research area, FMIS contains 32 sites registered as shielings through archaeological remains. The place name database used for the GIS analysis includes 251 place names containing 'bo/

boda/bu/bua/vall/säter', suggesting shieling areas. It should be noted that one shieling might be represented by more than one place name in the database. For example, 'Messubodarna' indicates a shieling area and in the vicinity, it is possible to find place names containing 'bod', presumably related to the same shieling, e.g. 'Messubodsjön' and 'Messubodviken'. Hence, this shieling area is indicated by three place names. In another area, it is possible to identify the place name cluster: 'Fannbuåsen', 'Fannbubäcken' and 'Fannbuslåtten', although without a place name for the actual shieling, presumably with the name 'Fannbuan', in the vicinity. The existence of many place names indicating the same shieling suggests that a larger group of people who were not always at the shieling still needed the possibility to relate to the different places. If the duplicate names are removed, the minimum number of unique locations gives a value of 181 areas with place names containing 'bo/boda/bu/bua/vall/säter' in the research area.

Meadows and Pastures

A prerequisite for the extensive livestock farming in northern Sweden was the availability of wetlands on which vegetation could be harvested and used for winter fodder. The forage availability determined how many cattle that could pass the 'pastoral bottleneck' during the cold season (Reinton 1955). Most important of these were naturally flooded and/or irrigated hay-meadows (Sw. 'rönningar', 'raningar', 'dammängar', 'silängar') constituted on low-lying areas adjacent to rivers and lakes or mires. Such hay-meadows were widespread and occurred generally over most of northern Sweden in the mid-19th century. In general, they were thoroughly managed in order to provide a high and sustainable yield (Elveland 1979). The practice of managing wetlands for fodder production is described in medieval accounts from Finland, Norway and Iceland (Campbell 1948).

A 'raning' or 'rönning' can be translated to alluvial meadow and can be considered as a semi-natural hay-meadow. The meadow was formed by the removal of woody vegetation species from the upper shore zones along the banks of the drainage system. The annual flooding resulted in the deposition of a thin layer of alluvium, which together with the absence of competing woody species resulted in a lush fodder resource. Moreover, various forms of irrigated hay-meadows of two main types, i.e. flowing water meadows (Sw. 'dammängar') and catchwork water meadows (Sw. 'silängar') were also used for the fodder production. Catchwork water meadows seem to have been more widespread in the inland areas of northern Sweden, since they were associated with undulating and hilly terrain. The dam and irrigation systems of these meadows could cover large areas, sometimes extending several kilometres, and they demanded considerable cooperation, timing and coordination (Matsson 1943; Frödin 1952). Favoured plant species associated with flooded and irrigated hay-meadows were the water horsetail *Equisetum fluviatile* and sedges and grasses, such as the *Carex acuta*, *C. aquatilis*, *C. rostrata* and *Calamagrostis spp*. Forbs and low-growing herbaceous species were highly esteemed plant

resources (Frödin 1952; Elveland 1979). The meadows were scythed every year, usually in early August. Considering the importance of these meadows, surprisingly little research has been devoted to them (Elveland 1979). A recent study describes the processes that underlie and explain the fertilisation effect of alluvial environments (DeLuca *et al*. 2013).

The literature provides some indications that large meadow areas were organised as commons in the pre-industrial era (e.g. Matsson 1943; Frödin 1952). During the late 1800s, the scything was often performed by individual farmers, but often in areas that were designated as commons (Campbell 1948). In general, it seems possible to discern a process of increasingly individualised work during the era of the land reforms.

These meadows tend to be archaeologically obscure, but occasionally barns were built in vicinity to the meadows in order to store the fodder until it was transported to the main settlement in wintertime. Dams and the irrigation channels for irrigating hay meadows should at least theoretically be archaeologically detectable, but here it is important to note that dams have also been constructed for other purposes, such as mills and for the log-driving activities of the forest industry. During the main era for log driving, many inundated hay meadows were abandoned since the log driving changed the nature of the drainage systems and this resulted in many of the inundated meadows becoming obsolete (Frödin 1952). The database contains eight dams, of which two have been associated with inundated meadows in FMIS, while the rest have no provenience indicated. Dams associated with log driving have been removed from the database.

Place names ('rönning/sil/slått') related to hay meadows, as well as pastures ('änge/löt') are spread over the whole research area. The majority of the place names that indicate dam constructions are located adjacent to areas with place names indicating shielings, meadows and pastures. Hence, it can be suggested that dam-names to some extent reflect the landscape of fodder production (*cf*. Matsson 1943).

Iron Production

A prominent part of the forest's archaeological record consists of activity areas, where iron rich soils or ores have been processed to iron. Iron production incorporated a number of activity areas: the lakes and mires from which the lake ore was collected and sites related to the preparation of the iron ore and the smelting process. A bloomery furnace site indicates a place where the ore was smelted to iron. The iron ore was quarried in the spring and dried over the summer. In the autumn, the ore was transported to the smelting site. First, the iron ore was broken into smaller pieces and roasted in a fire to remove organic materials and moisture. Larger impurities in the ore were removed. The bloomery was preheated by burning charcoal, and once hot, iron ore and additional charcoal were introduced to the furnace. The iron smelted and fell to the bottom of the furnace and became welded together to form a spongy bloom. Since slag from previous blooms may have a high iron content, it

was often broken up and recycled into the bloomery with the new ore. The iron production demanded charcoal often produced at or nearby the iron production site (Magnusson 1986; Englund 2002).

The various stages of the iron production – the collection and preparation of the ore, the charcoal production and the actual smelting process – were a labour intensive production chain, which stimulated cooperation. During the medieval time period, shielings and iron production seem to have been parts of the same cooperative organisation of labour (Lagerstedt 2004). Information from 18th century Dalarna indicates that it was normal for several farms to team up to maintain a bloomery and one or several shielings (Pettersson 1982).

In Ängersjö parish, 15 bloomery furnace sites have been recorded. The furnaces are concentrated to the mires in the northwestern parts of the parish, which may be partly explained by the fact that this area is well surveyed archaeologically. One of the sites has been investigated archaeologically. The furnace had an advanced construction with the possibility of losing slag from the furnace, which meant that it could be used repeatedly for a long time (Magnusson 1986: 125-6). In addition to the bloomery furnace sites in Ängersjö, there are other similar clusters of iron production sites situated in the vicinity to the other villages of the larger research area. Altogether, there are 184 archaeological sites related to iron production within the research area. In addition, it is possible to identify 39 place names that contain the equivalents of the terms bloomery (Sw. 'bläst'), iron (Sw. 'järn') and ore (Sw. 'malm'), inferring iron production.

Tar Production

Pine tar production was a labour intensive activity that usually included several levels of cooperation. Tar was used for impregnating and protecting various wooden structures. It is possible to identify several technological developments of tar production during the 16th—17th centuries, which can be related to the fact that tar was one of Sweden's most important exports up until the 18th century (Villstrand 1996; Hennius *et al*. 2005).

Tar production demands considerable amounts of resin rich pine wood. Such wood is formed spontaneously in the forest, but if substantial amounts of tar were needed, tar wood could be produced by removing the bark from standing trees. In the 17th century, it was estimated that 125 litres of tar required c. 15 mature trees (Villstrand 1996). Historical sources show that the trees were cut in the autumn and transported to the production site during the following winter. During the spring, the tar wood was prepared by cutting the wood into small pieces, which were then let to dry.

The main focus of research on tar production has been on the historical time period, but current archaeological research in the forested region of northern Uppland has shown interesting results (Hennius *et al*. 2005). Tar has been produced in small pits associated with farmsteads from as early as the Roman Iron Age. During the Viking Age, the tar production sites increase considerably in size, taking industrial proportions, and they are moved from the farms out to

the forested outland areas, i.e. closer to its resource areas. During the medieval period, a technological development can be noted through the digging of the pits as shallow sloping ditches, a form that is also known from historical accounts. The lower end of the pit was built up of a wall of stone and wood. In the end of the medieval period, large funnel-shaped pits start to be used in the central production areas. The pits were filled with finely cut tar wood and covered with peat and soil. After the fire was lit, the oxygen supply was regulated and the tar was collected in barrels or in other containers located beneath the pits, or by using a gutter placed at the bottom of the pit. The last method meant that tar could be drained during the firing process.

Eight tar production sites are included in the database, but so far, no place names have been related to tar production. It is possible to assume that tar production is underrepresented in FMIS. Judged from the appearance of some smaller pitfall sites that have been documented in the research area, it is feasible to consider that they could be related to tar production instead (i.e. Hennius *et al* 2005: 19pp), but more detailed studies are required to confirm this. Considering the recent findings in northern Uppland, the archaeology of tar production seems to have capacity to contribute to a better understanding of the historical developments of the forested region of Sweden.

Mills & Roads

In addition to large game hunting, livestock production, and production of iron and tar, which should probably be considered as the most prominent parts of the regional land-use system up until the forest industry, indications of roads and mills have also been added to database of this study. These activities imply cooperative aspects, but somewhat differently, if compared with the examples discussed above. In northern Sweden, barley was the most important cereal (Holm 2012). It grew well despite the short summers, but the yields were relatively unpredictable and presumably, it was difficult to reach surplus production. Nevertheless, to get flour the barley must be crushed and the work was facilitated by water-powered water mills. The mills used energy from small dammed-up creeks and streams. However, the mills were very dependent on good water supply and hence associated with quite distinctly localised places that offered the right opportunities for mills. Another aspect that may have influenced the distribution of mills is the nature of the agriculture. Since the farming utilised different microclimates, for example by mobile slash and burn agriculture, it might have been sensible to locate mills out on the resource areas. The mills that are found today were generally constructed during the 1800s and1900s, but some of them may have originated in the Middle Ages. In the literature, it is possible to see it was normal for several households to jointly build and maintain mills. In addition, on the present property map a relationship between areas legislated as commons in the land reforms and the remains of mills can be noted. Eight remains of mills are recorded in the research area and 49 of the place names contain the word mill (Sw. ‘kvarn’).

In order to make use of widely distributed outland resources it was important to maintain paths, trails and minor roadways. Ylva Stenqvist Millde's study has resulted in a detailed analysis of different levels of communication in pre-industrial Ängersjö and the neighbouring parishes (Stenqvist Millde 2007). To construct and maintain a communication and transport system – even of the smallest kind – should be considered a joint enterprise. Nineteen features from FMIS have been added to the database. The five place names that that indicates transportation systems are all associated with wetlands (e.g. 'vintervägsmyren', 'kavelbromyren') and do not indicate roads in use today.

Spatial Analysis

Pitfall systems, bloomery furnaces used for smelting iron ore, tar production sites, mills and pathways, shielings and features related with pastures, inundated meadows and hay-meadows have all been considered as related with cooperative forms of land-use and natural resource management. The FMIS database comprises 1174 registered archaeological sites in the research area and out of these, 564 have been associated with cooperative forms of land-use (Fig. 5). The place-name database comprised 4272 place names; of these, 531 were considered as reflecting the same activities as compiled in the archaeological database (Fig. 6). Figure 7 is a compilation of archaeological sites and place names reflecting cooperative forms of natural resource management.

The assumption is that an integrated view on the point distribution may be a fruitful approach for reconstructing areas that were held as commons in the past. A common should be represented by a distinct multifunctional landscape element characterised by cooperative forms of land-use, i.e. it should be possible to identify a clustering tendency in the point distribution. This hypothesis will now be tested by a spatial analysis using a GIS frame of reference. The downloaded FMIS data has been modified by converting the line and polygon layers to point layers. All the point layers have subsequently been merged to one layer, which has been used as the basis for the analysis.

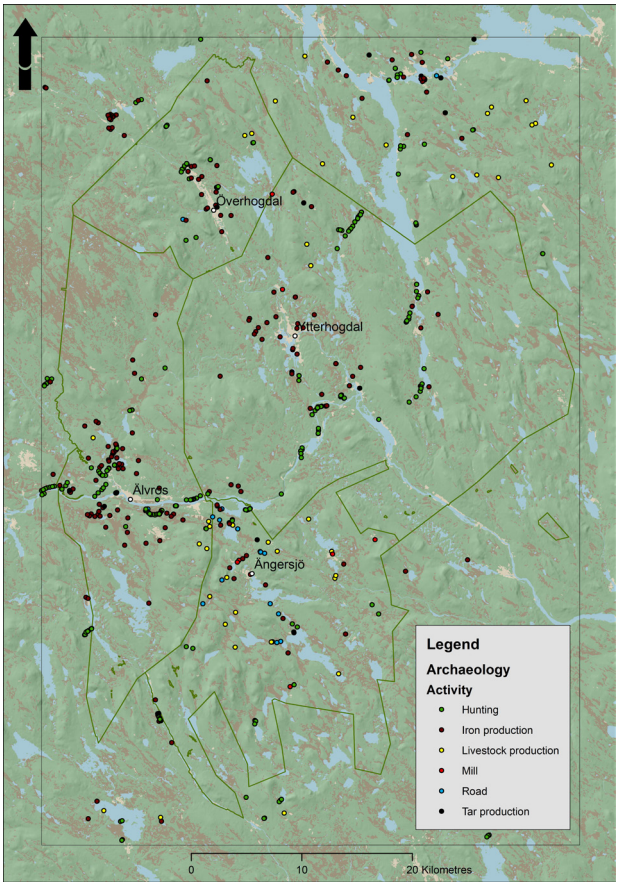

Fig. 5 The distribution of the 564 archaeological sites that has been associated with cooperative forms of land-use. Map data © Lantmäteriet, i2012/901 © Swedish National Heritage Board´s database for archaeological sites and monuments, FMIS.

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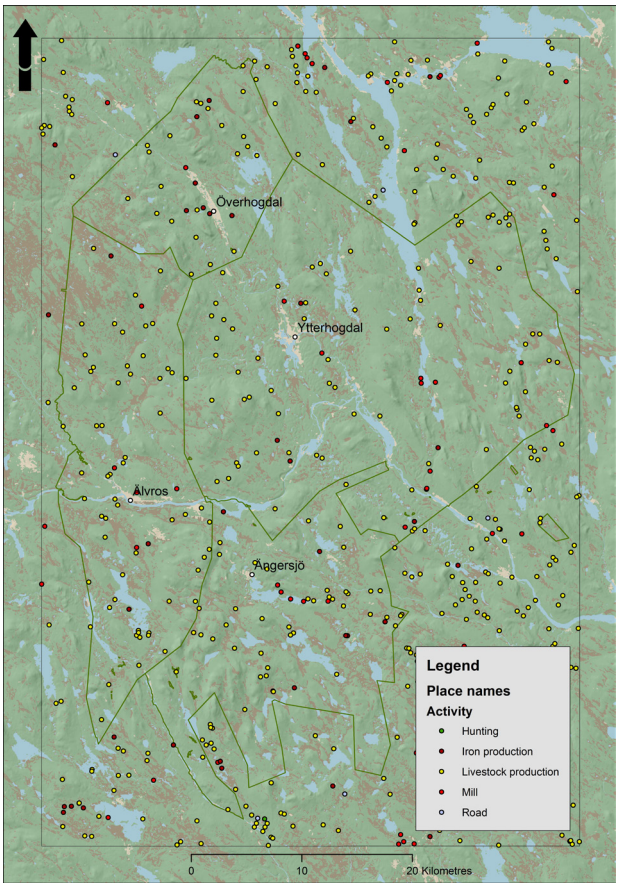

Fig. 6 The distribution of 531 place names considered as reflecting the same activities as compiled in the archaeological database. Map data © Lantmäteriet, i2012/901 http://www.arkeologi.uu.se/digitalAssets/204/204955_jaah_lindholm_etal_fig_6.jpg

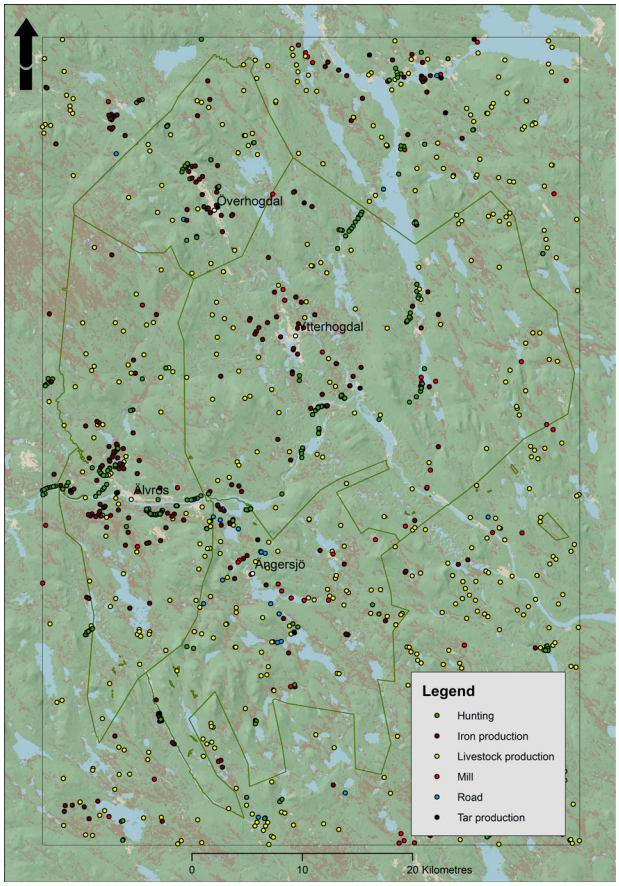

Fig. 7 A combined point distribution of archaeological sites and place names associated with co-operative forms of land-use. Map data © Lantmäteriet, i2012/901 © Swedish National Heritage Board´s database for archaeological sites and monuments, FMIS. http://www.arkeologi.uu.se/digitalAssets/204/204963_jaah_lindholm_etal_fig_7.jpg

Kernel Densities

The first step of the analysis is to 'measure the intensity' of cooperatively undertaken activities in the landscape and to provide a more generalised view of the point distribution. This is done by the modelling of kernel densities, which is a GIS tool that calculates the density of features in a neighbourhood. Densities have been calculated for the archaeological sites, the place names and both data sets in combination and the following patterns can be noted (Figs. 8-10): The kernel density based on the archaeological sites (Fig. 8) seems to be concentrated relatively close to the villages and other minor historical settlement locations. At the villages Ängersjö, Älvros and Ytterhogdal a fairly clear spatial separation can be noted, although an exception can be seen at Överhogdal. The kernel density based on the place names (Fig. 9), shows a similar pattern, but the overall pattern is more widespread and evenly distributed over the landscape. Hence, visual examination indicates that both the archaeology and the place-names tend to reflect clustering tendencies. The combined kernel density confirms that the apparent feature of the distribution is that the majority of the archaeological sites and place names are distributed outside the closest vicinity of the historical villages (Fig. 10). However, Överhogdal seems to be placed just within a density of cooperatively undertaken land-use activities.

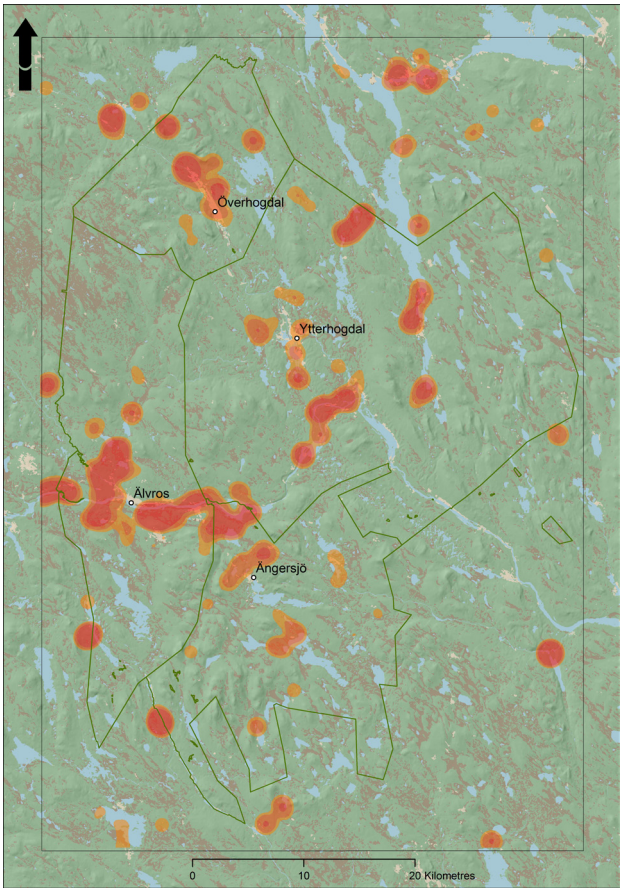

Fig. 8 A more generalised view of the archaeological point distribution done by a kernel density, which reflects the intensity of cooperatively undertaken activities in the landscape. Map data © Lantmäteriet, i2012/901 © Swedish National Heritage Board´s database for archaeological sites and monuments, FMIS. http://www.arkeologi.uu.se/digitalAssets/204/204957_jaah_lindholm_etal_fig_8.jpg

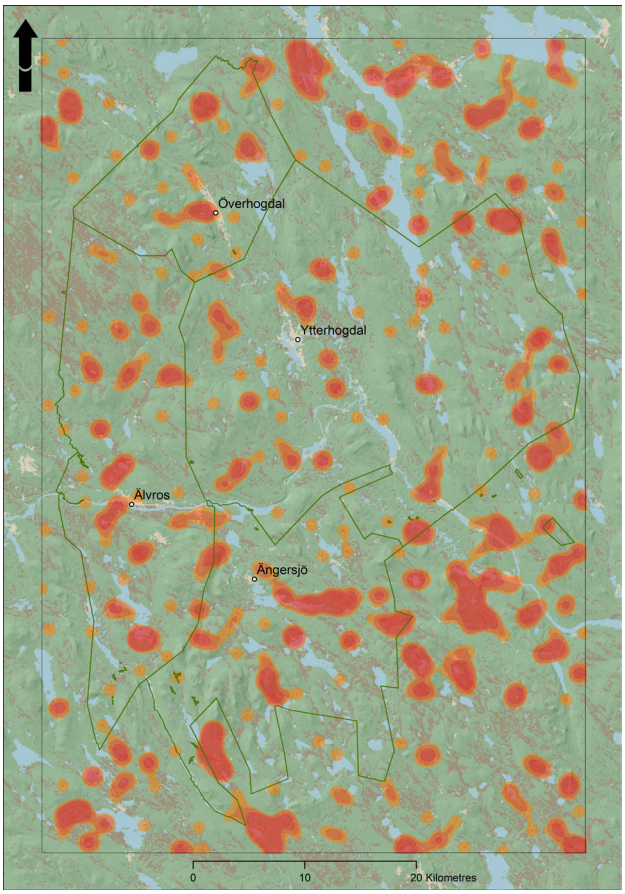

Fig. 9 A more generalised view of the place name point distribution done by a kernel density, which reflects the intensity of cooperatively undertaken activities in the landscape. Map data © Lantmäteriet, i2012/901 © Swedish National Heritage Board´s database for archaeological sites and monuments, FMIS. http://www.arkeologi.uu.se/digitalAssets/204/204959_jaah_lindholm_etal_fig_9.jpg

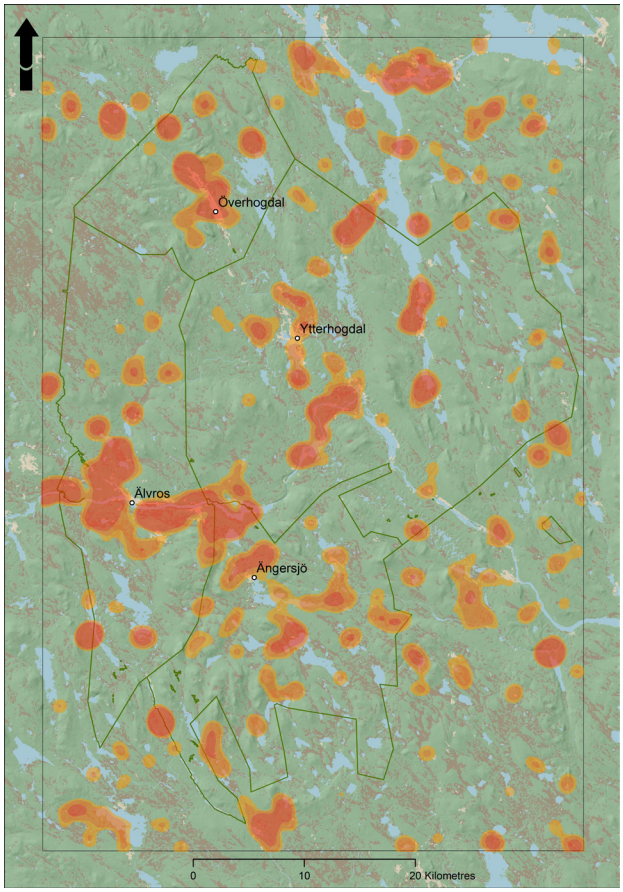

Fig. 10 The kernel density of the combined data-set of archaeological sites and place names. The combined kernel density indicates that the apparent feature of the distribution is that the majority of the archaeological sites and place names are distributed outside the nearest vicinity of the historical villages. Map data © Lantmäteriet, i2012/901 © Swedish National Heritage Board´s database for archaeological sites and monuments, FMIS. http://www.arkeologi.uu.se/digitalAssets/204/204961_jaah_lindholm_etal_fig_10.jpg

The question is whether the duality expressed by the kernel densities is significant. In order to test this, the clustering tendency of the point distributions has been assessed by statistical analysis using spatial autocorrelation Moran's *I* (Dormann *et al.* 2007). The tool measures and analyses the degree of geographical dependency in the point distributions. The purpose is to evaluate whether the geographical pattern is clustered, dispersed, or randomly distributed (Mitchell 2005).

The distribution of the archaeological sites shows a clustering tendency; meanwhile, the place names tend to have a more random distribution (Fig. 11). To explain the difference it is necessary to acknowledge some general patterns of the database (Fig. 12 a-d). Large game hunting and iron production are well represented in the archaeological record, but large game hunting is hardly represented in the place names. In general, pastures and hay meadows associated with livestock production are archaeologically obscure, but the place names related with shielings, pastures and hay meadows tend to show strong persistency in the landscape. In other words, the archaeological sites mainly reflect large game hunting and iron production, which can be considered place-bound activities constituted on relatively fixed points in the landscape. In addition, these activities seem to be concentrated relatively close to the villages and other minor historical settlement locations, but still outside the closest vicinity of the village.

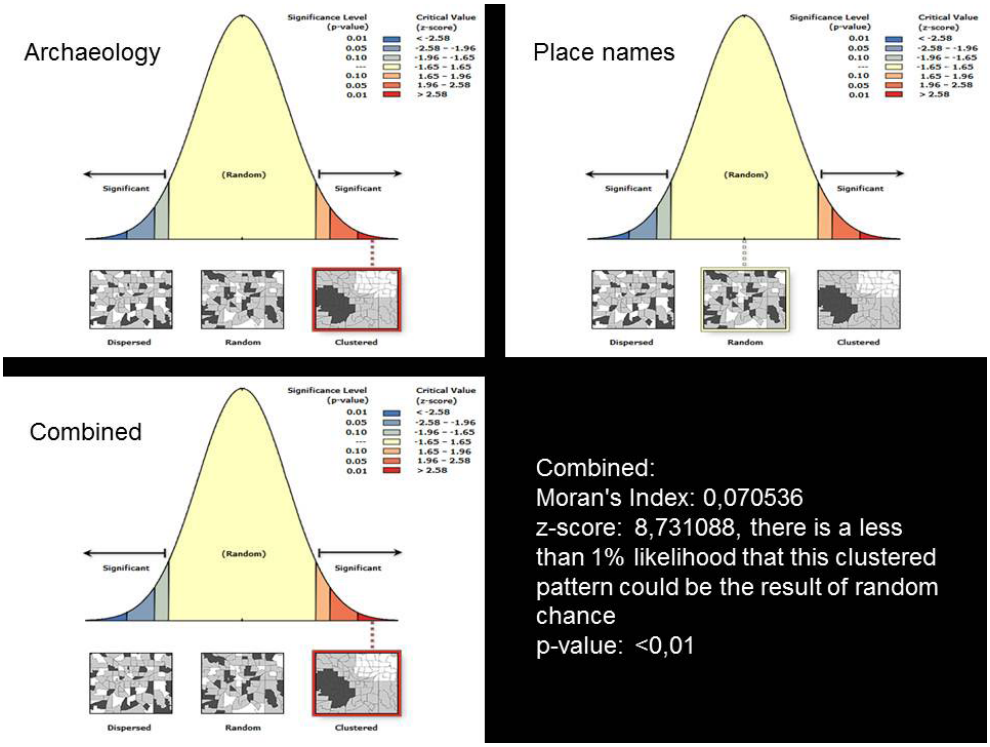

Fig. 11 The result of the statistical analysis using spatial autocorrelation Moran's I. A) The archaeological sites are clustered B) The place names are randomly distributed. C) The combined data set of cooperatively undertaken activities — as reflected in archaeology and place names — is clustered within the research area. Moreover these clusters are not randomly distributed; they are constituted on the same nodes of the landscape and reflect a duality of landscape. http://www.arkeologi.uu.se/digitalAssets/204/204969_jaah_lindholm_etal_fig_11.jpg

The place names, on the other hand, reflect livestock herding, an activity which generally leaves few traces in the conventional archaeological record (Cribb 1991; Petersson 2006; Lindholm 2009), although grazing animals create distinct responses in the vegetation and in the soils through redistribution of soil nutrients and seeds and trampling (e.g. Aronsson 1994; Karlsson *et al.* 2010). Nevertheless, compared with the activities that are represented in the archaeological database, livestock herding is constituted on a greater level of mobility, associated with the exploitation of localised and widespread fodder resources and this pattern is reflected in the spatial distribution of place names. The duality is still apparent in the place name kernel density, which suggests that the locations of the four main settlements cannot be considered livestock related. Hence, place names seem to provide a valuable complement to the archaeological record, especially since the place names also provide a link to the historical accounts (Brink 1983). An overall understanding of the land-use system requires an integrated approach.

The overall result based on the combined archaeology and place name dataset capturing all land-use activities indicates that there is a strong clustering tendency in the data (Fig. 11). In several cases, the clusters overlap, seemingly in areas with historical settlement locations, inferring that the archaeology and the place names are fixed to the same nodes of the landscape, hence having a

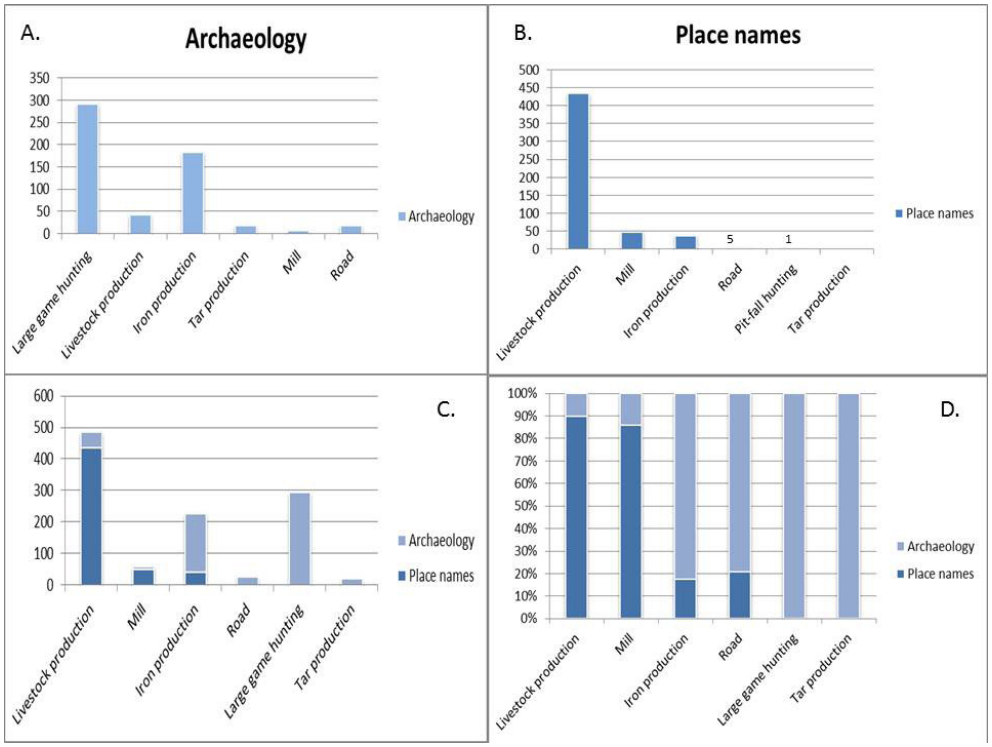

Fig. 12 a-d Diagrams illustrating the structure of the database used for the GIS-analyses. A) Large game hunting and iron production is well represented in the archaeology. B) Livestock production is the main activity reflected in the place names. C) In the combined data-set livestock herding counts for almost half of the data. D) Percentages of representation in archaeology and place names according to activity. The archaeology seems to reflect place bound activities constituted on relatively fixed points in the landscape. Place names reflect mobility associated with the exploitation of localised and widespread fodder resources. http://www.arkeologi.uu.se/digitalAssets/204/204967_jaah_lindholm_etal_fig_12.jpg

mutual relationship. The place name clusters extend and fill up archaeologically empty areas, and it is not impossible that the place names can be used for archaeological site prediction. Preferably, the prediction should be done in combination with laser-scanned elevation data, a method that have shown promising results in the forested region of Dalarna (Jansson *et al*. 2009).

The analysis of the point distribution patterns suggests that cooperatively undertaken activities – as reflected in archaeology and place names – are clustered within the research area. Moreover, these clusters are not randomly distributed; they are constituted on the same nodes of the landscape and reflect a duality of landscape. Next, the modelled pattern will be situated in a historical context.

The Permanent Field-and-Meadow system

Archaeology in combination with pollen analysis suggest that sedentary settlements with agriculture and a permanent 'field-and-meadow system' existed already from the early or the middle part of the Iron Age in the forests of Värmland (Fig. 13; Svensson 1998). The system seems to have developed from already existing land-use practices associated with forest resources. In

comparison, the earlier land use seems to have involved a greater mobility. The field-and-meadow system, on the other hand, was based on a landscape duality of infield areas with permanent farms with cultivation and manured fields, and outland areas with fall-trap systems, tar- and iron production sites, meadows and periodic outland settlements related with livestock herding. Svensson (1998) considers the people who constituted the permanent field-and-meadow system forest farmers, who had formed a land-use system highly adapted to the marginal agricultural lands of the forests. Indications of field-and-meadow systems have also been noted in northwestern Hälsingland, Jämtland and northern Uppland (Svensson 1998; Emanuelsson *et al*. 2003; Lagerstedt 2004; Hennius *et al*. 2005; Karlsson *et al*. 2010; Holm 2012). This points to that the field-and-meadow system was part of a colonisation process incorporating large areas of the forested region of Sweden during the first millennia.

However, it can be suggested that the field-and-meadow system should be associated with a larger shift in Scandinavian culture at the time. Herschend (2009:141) has noted that the most essential change that appears in the shift between the Pre-Roman Iron Age to the Roman Iron Age is the 'transition from the nodal and floating to the focal and fixed landscape'. He associates the focal and fixed landscape organisation with a hierarchical socio-spatial order based on central places, which he in turn relates to an increasing influence of Roman culture in Scandinavia. From this perspective, the permanent field-and-meadow system can be considered a manifestation of a sedentary agricultural cosmology and an ordered landscape organisation, although fashioned to the marginal agricultural environments of the forested region. Such view is supported by the fact that the field-and-meadow system is slightly younger than the first sedentary agricultural settlements along the coast of central Norrland, but contemporary with the first sedentary settlements along the rivers and in the Great Lake region (Ramqvist 2007). In turn, this was also contemporary with the establishment of Scandinavia's first cities.

The GIS analyses of the archaeological sites and the place names establish a pattern, which coincide with the pollen records associated with Ängersjö and a field-and-meadow land-use organisation (Karlsson *et al*. 2010). It is possible to see a clear distinction between the outlands and the historical villages, with the exception of Överhogdal, which judging from the pattern of the other villages should be located c. 2.5 km northwest of its own current location. It is possible that the village developed from a previously periodic outland settlement or a shieling, a process that has been noted elsewhere (Brink 1983, 1994). The field-and-meadow system can be considered a manifestation of an ordered landscape organisation, which in turn implies a regulated and institutionalised land-use system. In addition, the land-use organisation provided labour intensive land tenure that would have required cooperative efforts of several households.

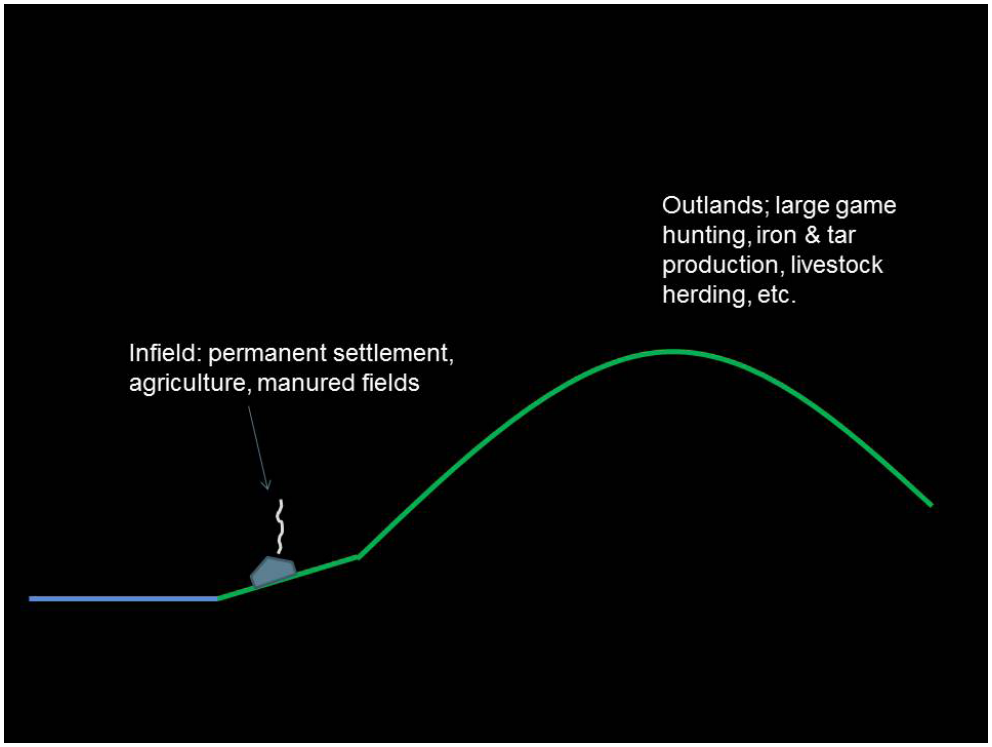

Fig. 13 Diagram illustrating the landscape organisation of the permanent field-and-meadow system.
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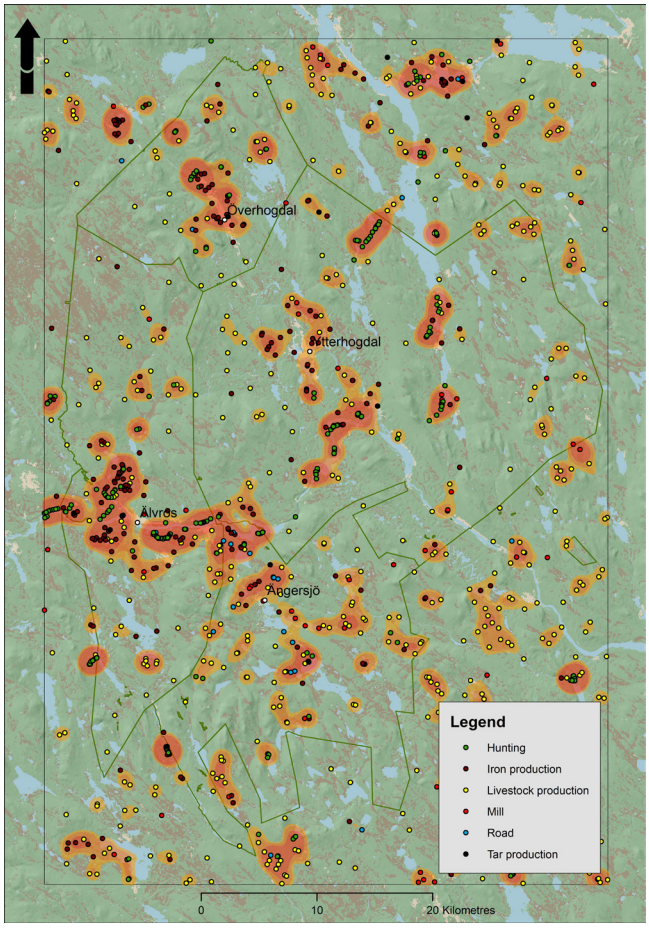

Fig. 14 .Illustrates the modelled kernel densities and the combined data-set. Multifunctionality and regulated use are considered as significant traits of commons in current common pool-theory and hence it seems possible to pinpoint some certain aspects of the forest's archaeology, which can be taken as distinguishing features of commons.
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By taking a closer look at some of the densities, it becomes apparent that most of them contain more than one site category or activity (Fig. 14). It is not uncommon for a cluster to contain all types of activities that are indicative for cooperative resource management. This coincides with the previously discussed historical example of the relationship between iron production and livestock herding at the shielings. Judging by the distribution of the archaeological sites it is possible to assume that this relationship also accommodated additional activities, such as tar production, haymaking and the maintenance of the mills. This in turn can be taken as an indication of claimed or regulated resource areas with diversified land-use for several different purposes and continuous presence over time. At this point, it can be valuable to discuss the archaeological pattern in comparison with one of the first written accounts that mention and regulate commons.

Hälsingelagen is a medieval law that was written down sometime around AD 1320 (Brink 1983, 2010). The law expresses that it was every man's right to settle and establish farms along the riverside or in the forest. The note on the riverside should probably be seen against the background of the colonisation processes in northern Sweden, which progressed up the rivers. Suitable land for fields and meadows were also for the most part located close to the shores of rivers or larger lakes (Holmbäck 1920; Holm 2012). Anyone who wanted to settle and clear land was obliged to do it next to the person who had settled before him. He should also bring two witnesses and walk around the land he wished to claim. If he cleared a large enough area to reap three bushels of barley and if he built a timber house with four corners, it was considered a proper land claim, i.e. a type of 'bol' of the odal system (Holmbäck 1920). The claim could be lost only after three years of inactivity, inferring bol in reverse, and in such cases, the land was transferred to the common. With the claim followed rights to use both the forest and water resources, except for land along the riverbank, which was reserved for future settlers. The land rights extended from the cleared inlands up to the nearest ridge or the 'flat keel' – i.e. the crests of the surrounding highlands – and this area were considered the villager's forest or village land (Fig. 15; Holmbäck 1920: 15).

Hence, the village land contained the settlements, the farm fields and the land that extended from the village up to the crests was considered the villagers forest, presumably mainly used as village pastures (Brink 1983). The law text continues by stating that 'flat keel' and the lands and water sloping away from the village are commons (ibid.). The dual landscape organisation is identical to the field-and-meadow organisation, but according to the law, the outland is associated with the concept of a common. Holmbäck (1920) argued that this distinction between individual land and the commons is among the most archaic elements of the provincial laws. In addition, the individual land rights are limited in several ways by the law, for the benefit of common land, even in cases of disputes.

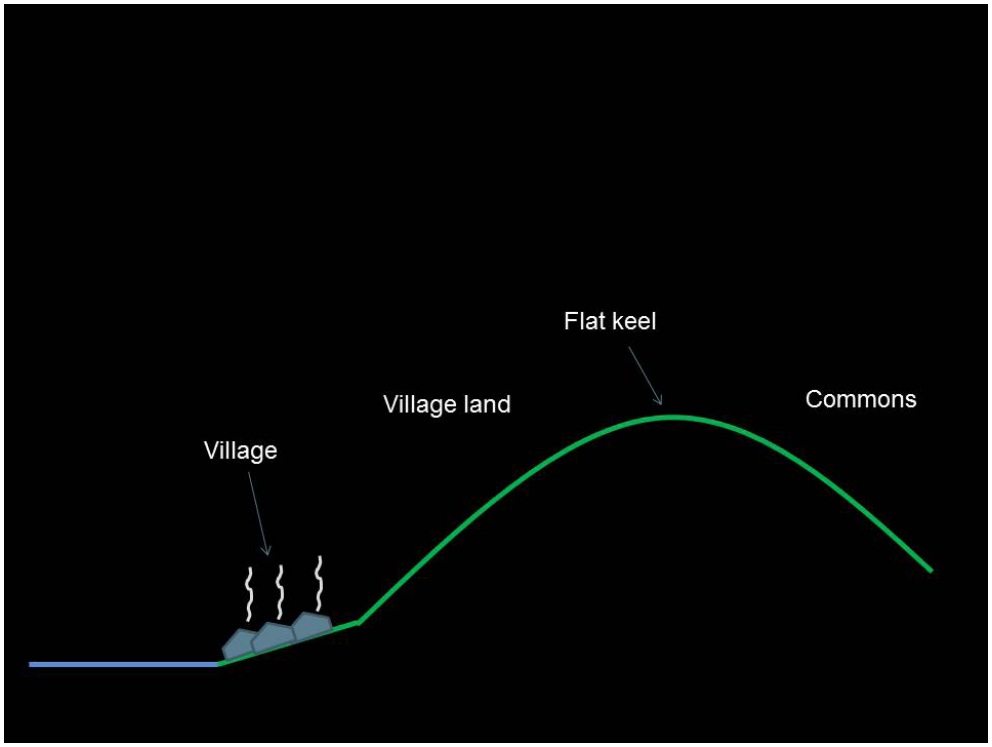

Fig. 15 Diagram illustrating the landscape organisation of the Hälsinge law. The Hälsinge Law (c. 1320 AD) regulate the use of the commons. The law express that land extending from the village inlands up to the "flat keel" – i.e. the crests of the surrounding highlands – were village land. The lands and water sloping away from "flat keel" are commons.
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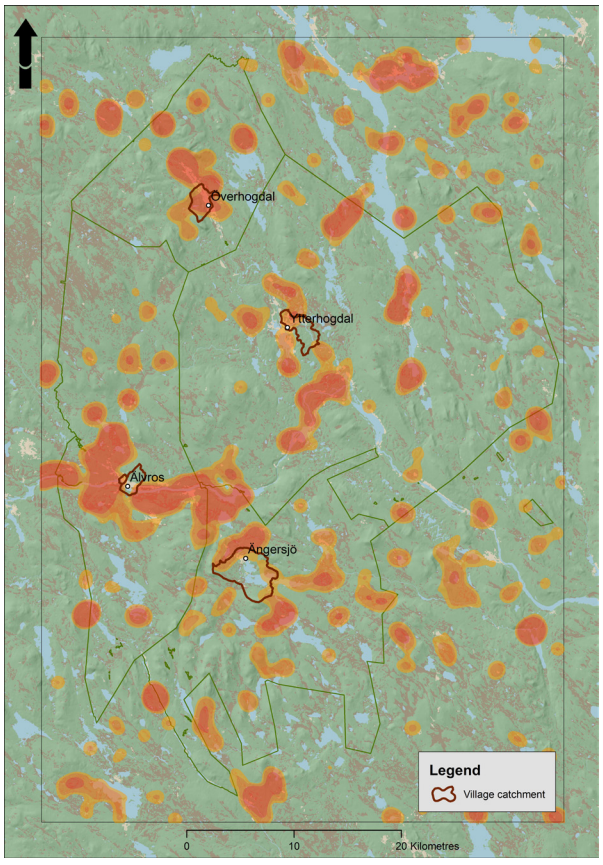

Fig. 16 The villagers land according to the Hälsinge law, i.e. the down sloping land based on water catchment areas. Map data © Lantmäteriet, i2012/901.
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It is apparent that the Hälsinge law establishes boundaries by the location of villages and the surrounding topography, i.e. landscape variables that are possible to model in a GIS. Figure 16 delineates the water catchment areas within which the historical villages are located. These areas indicate land that slope towards the villages and which, according to the Hälsinge law, should be considered as the villager's forest or the village land. Looking at the modelled densities in Ängersjö, Ytterhogdal and Älvros, it becomes apparent that they are located outside the village land. However, the village land of Överhogdal is located within a density. Nevertheless, for three of the villages the density analysis of cooperatively undertaken activities presents a pattern that coincides with the statement of the Hälsinge law. This provides an indication that cooperatively undertaken activities were associated with areas that were considered as commons in the medieval time-period. In turn, the fact that the archaeological sites within the densities are presumably both older and younger than the law can be seen as an indication that the law formalised already established practices and legal customs (*cf.* Brink 2013). Here it is interesting to note that the provincial laws stated terms for manslaughter without a known perpetrator. The main principle was that whoever owned the land where the slaying had occurred would also be liable for the compensation to the victim's family. If the murder had occurred on a common, the associated collective was required to compensate to the victim's family (Holmbäck 1920; Runer 2006). This principle of compensation infers that commons normally were associated with a defined group of owners, which in turn is an indication of that the commons were regulated and not based on open access.

The Property Map

The final part of the spatial analysis is based on a comparison between the reconstructed commons and the structure of the present-day property map (Fig. 17). The property map is the result of the 19th century land reforms, and its general structure has not changed since then. As discussed before, the land allocations were largely initiated by the central government, and they had a clear rationalisation purpose in the sense that one of the rationales behind the reform was to simplify the structure of ownership. The main objective of the reforms was to shape larger cohesive farm units through bounded spaces under separate owners.

However, in spite of the considerable change, it may be assumed that the process was derived from the previous land-use system and that the commons were divided more or less equally among the principal shareholders, i.e. the local villagers. Hence, the assumption is that the villagers are represented by bounded property that to some extent is comparable in size. One way to test this is to calculate the standard deviation in surface area of the properties. Areas in red and orange are areas with a standard deviation smaller than 1.5 (Fig. 18).

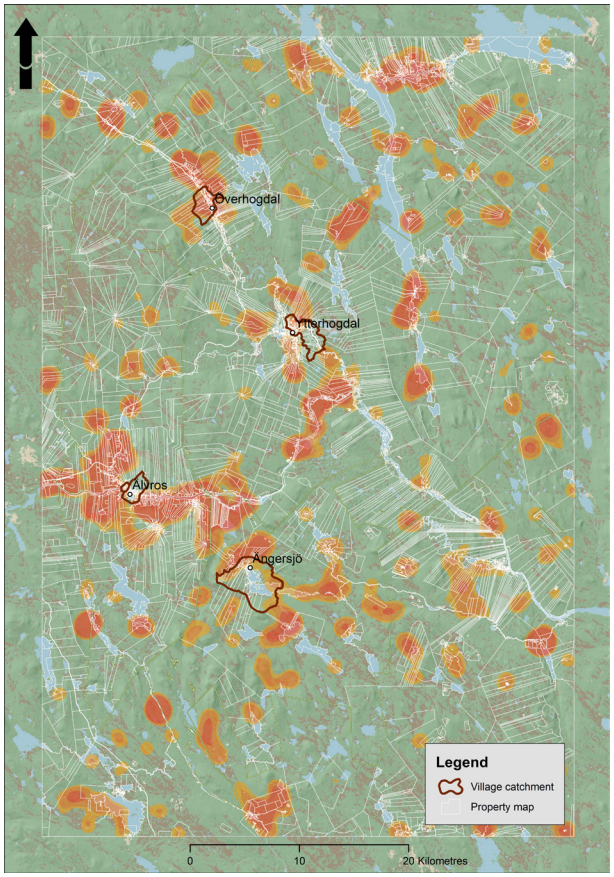

Fig. 17. The present day property map projected on the modelled kernel densities. Map data © Lantmäteriet, i2012/901 © Swedish National Heritage Board´s database for archaeological sites and monuments, FMIS. http://www.arkeologi.uu.se/digitalAssets/204/204977_jaah_lindholm_etal_fig_17.jpg

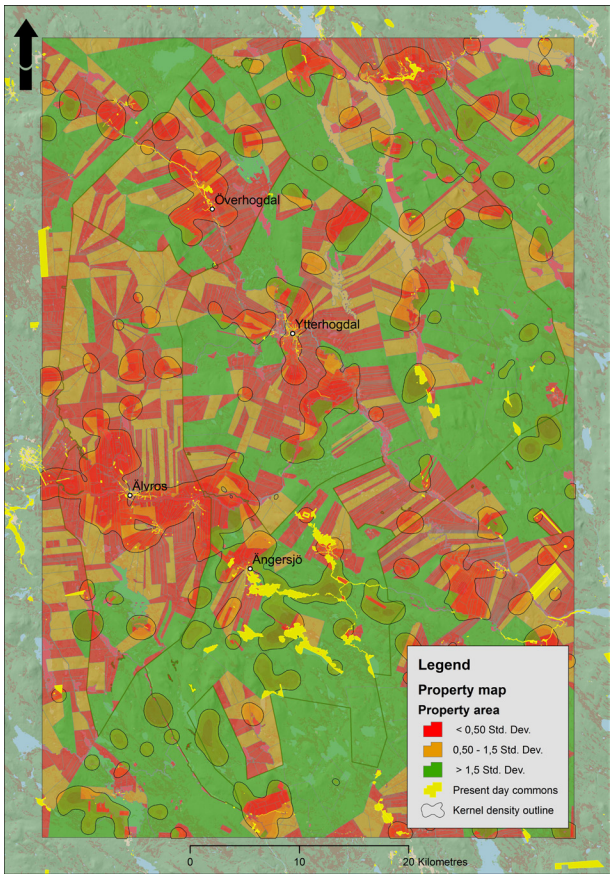

Fig. 18.The standard deviation of property area, present day commons compared with the modelled commons represented by the kernel densities. The map denotes a topology of commons implying a historically rooted landscape, a complex social and ecological structure that marks the actual context of past and present praxis. Map data © Lantmäteriet, i2012/901 © Swedish National Heritage Board´s database for archaeological sites and monuments, FMIS. http://www.arkeologi.uu.se/digitalAssets/204/204979_jaah_lindholm_etal_fig_18.jpg

It can be observed that these areas are mainly associated with the four main villages, other minor settlements and historical shielings. In addition, it can be noted that the parcels with a small standard deviation seem to have a strong spatial correlation with the kernel densities that are interpreted as indicating commons. The correlation can be confirmed by the fact that 85 % of the archaeological sites and 72 % of the place names considered indicative for cooperative natural resource management are located within the areas that are characterised by small parcels with comparable sizes.

In order to solve land dilemmas derived from the land allocation, the reform resulted in the formation of commons with clearly defined boundaries. Olwig describes such process as follows:

> Commons were historically defined in terms of use rights to differing resources making up a plurality of commons, not to a delimited spatial area. As differing farms and social groups held rights to differing resources a commons need not have a clearly defined boundary line in-so-far-as differing resources might be distributed unevenly over differing areas. Enclosure, however, changes this by incorporating the former diversity of the commons, within the uniform space of the cadastral map, as properties within a contiguous space with well-defined boundaries (Olwig 2013:38).

The new commons – often formed with reference to the past – contained crucial community resources, e.g. streams, gravel pits, roads, shielings, lakes, which otherwise could end up on the lands of one of the individual properties. The landholders that were involved in the formation of the common also became the principal shareholders. If we project the commons that are registered in the property map, it is possible to identify some patterns. The present-day commons seem to have been punched out from the kernel densities and present fragments of the land-use system that existed before the land reform (Fig. 18). In a sense, the analysis denotes a topology of commons, which in contrast to topography implies a historically rooted landscape, a complex social and ecological structure that marks the actual context of past, as well as the present praxis (Giddens 1984).

Conclusions: Regulated land-use/claimed resource areas

The spatial analysis has used a GIS frame of reference for examining the structure of a point distribution of archaeological site and place names that can be associated with cooperatively undertaken natural resource management. The main results of the spatial analysis are:

1. The archaeological sites and place names that are considered as indicative for cooperative forms of natural resource management appear in clusters, which are not randomly distributed.
2. The clusters contain sets of different activities: large game hunting, livestock herding, iron smelting, tar production, mills and remains of roads. The clusters can be characterised as claimed multifunctional activity areas.

3. The clusters reflect a field-and-meadow organisation of land-use, an ordered landscape organisation, which seems to have been established in the forested region already in the early or the middle Iron Age, related to a larger trend of social change affecting Scandinavia at the time.
4. The clusters coincide with 'commons' in the medieval Hälsinge law. The clusters contain sites that are presumably both earlier and later than the law, which can be seen as an indication of the law formalising already existing land-use practices.
5. The characteristics presented above suggest that the archaeological site distribution and the place names reflect practices within an ordered landscape organisation containing institutionalised use of commons.
6. The structure of the present-day property map reflects the structure of the reconstructed commons. The commons were the main resource areas that were divided and allocated during the land reforms in the 19th century.

The main conclusion of the spatial analysis is that it is possible to model areas that have been used as commons in the past using an archaeological approach. However, it is obvious that the analysis has favoured the spatial structure before a chronological control. Consequently, the spatial analysis has 'flattened' the time-depth, and enhanced a spatial view of cooperatively undertaken land-use practices. It can be said that the modelling presents a false impression of concurrency in a situation that might have evolved over a considerable time-span. At the same time, it should be acknowledged that the modelled kernel densities are extremely temporal. Additionally, we have no reason to believe that the first written records capture the first significant event in the area (*cf.* Fig. 20). The commons contain time-depths and can be considered the main spatio-temporal frameworks for understanding long-term customary use or 'ecology of practice' in the forested inland region (Nyerges 1997).

Discussion: A Chronology of Commons

An analysis of the temporal relationships is complicated by the fact that very few of the sites in the study area have been archaeologically dated. It is possible that some of the sites within the clusters are contemporary, but it is equally possible that they are the result of several hundred years of land-use that contributes to build up a pattern. The modelled commons will be discussed below in relation to indications of intensified use of forest resources identified elsewhere in the wider region (Figs. 19-20). It must be acknowledged that the discussion is tentative and further research is required.

Fig. 19. Places mentioned in the discussion. Map data © Esri and as indicated in bottom right of the map.
http://www.arkeologi.uu.se/digitalAssets/204/204981_jaah_lindholm_etal_fig_19.jpg

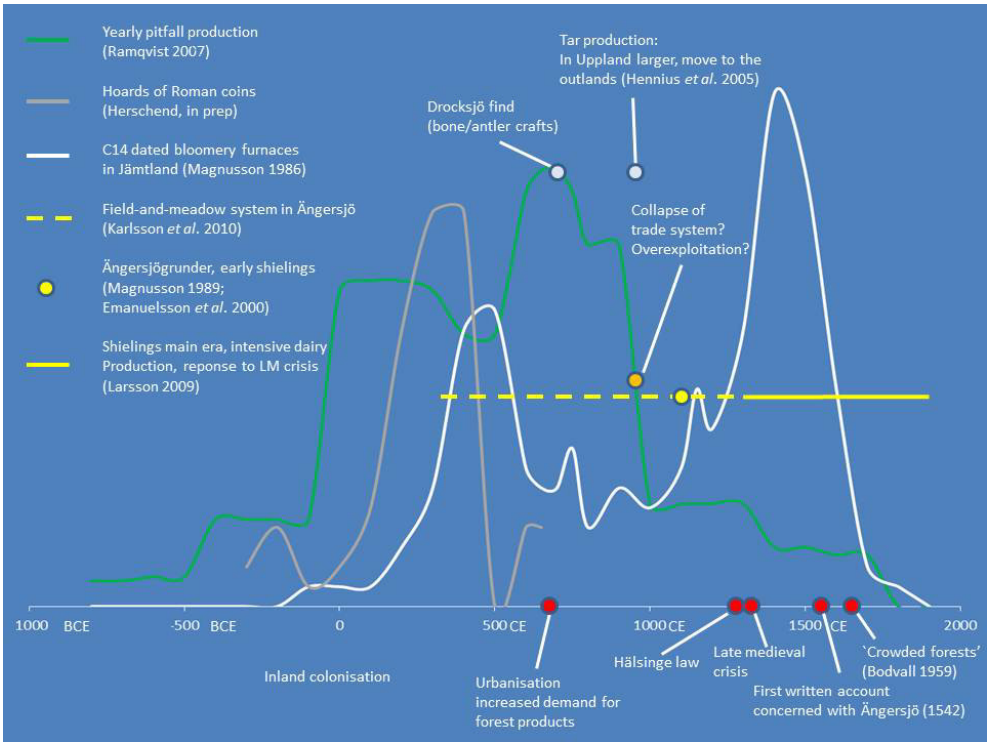

Fig. 20. Diagram based on a compilation of chronological indications that can be associated to commons.
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As already discussed, permanent settlements based on an agricultural economy with a permanent field-and-meadow system was introduced in several places in the forested region during the time period 300—700 AD (Fig. 20; Svensson 1998; Emanuelsson *et al*. 2003; Karlssson *et al*. 2010). Although fashioned to forested regions, the fixed landscape organisation can be related to a proto-world economy and a sedentary agricultural cosmology (Herschend 2009). The reason for an agricultural expansion into the forested inland region can probably not be sought in the region's potential for crop cultivation, although it is possible to identify a range of localised microclimates with the capacity for sustaining crops. The fact that barley was grown and livestock kept should probably only be seen as a manifestation of the agricultural ideology. A farmer without livestock and fields cannot be considered a farmer and a proper feast required beer and oxen. Instead, the explanation for the expansion should be sought in the proto-world economy and in the fact that the forests offered a wide range of resources that were valued in the more densely populated regions of northern Europe.

Ramqvist (2007) has analysed and discussed 98 published radiocarbon dates from pitfalls (Fig. 20). He argues that although some source criticism is required, it is possible to identify patterns in the record that reflect the main periods for pitfall construction, as well as variations in both time and space. The number of radiocarbon dates steadily increases up until the Viking Age, before decreasing abruptly during and after the Middle Ages. Based on an estimate that about 30,000 pitfalls have been constructed in central and northern Sweden, Ramqvist has calculated the annual production of pitfalls according to the archaeological time periods, where the different length of the periods has been taken into account (Ramqvist 2007). The result indicates a significant increase in the production of pitfalls in the beginning of the first century, when the production quadrupled from 4 to 16 pits annually. Most pitfalls were constructed during the Vendel Period, with over 22 pitfall traps produced per year. Ramqvist considers the increased construction of pitfalls as an indication of contact with trade networks linking with the first towns in Scandinavia. The intense pit production continued in the Viking Age (c. 18 pits annually), but after this time, the construction reduced abruptly. The decline he considers a result of changing trade networks and that the foci for the leather and fur trade moved eastwards (ibid.).

However, in Grimsdalen located in eastern Norway c. 250 kilometres west of the study area, a relatively modest use of the outlands can be observed during the early parts of the Iron Age (Fig. 19; Risbøl *et al*. 2011). During the Late Viking Age, a system for intensive exploitation of reindeer and elk developed at the sites of Einsethø and Tøftom (Stene 201). The extent of the mass catches shows that the production was greater than the local demand. This has been taken as an indication of production of meat, hides, antler and bone for an external market. Buildings associated with the hunting system also seem to have been used for crafts and comb making. The systems emerge as well-organised labour intensive systems that required many people and coordinated efforts. In

1300–1350 AD, the hunting activities abruptly end at the site. Based on the scale of the hunting systems it can be discussed whether the intensive hunting had resulted in reduced animal populations; it might be necessary to also consider causes for the abrupt changes in land-use other than the altered trade networks. In the late medieval period, the Einsethø and Tøftom continued to be used as shieling areas (Stene 2011). In addition, there are some indications that an additional pitfall system in Grimsdalen was abandoned already in the 3rd to 5th centuries CE and that the pitfalls had been deliberately refilled with soil. The refilling of the pitfalls is thought to be related to the specific area becoming used for livestock herding (Risbøl *et al*. 2011).

It is possible that the pitfall systems in the study area[5] were linked to the intensive hunting periods of the first millennia, but in order to confirm this view, detailed studies of the pitfall systems are required. The Drocksjö grave located in the southern part of Ängersjö parish can to some extent support the notion (Figs19-20; Sundström 1987). The grave is dated to 700 AD and is thus contemporary with the main phase of pitfall construction in central Sweden. The grave contained the remains of a cremated human and an assemblage of 43 iron tools, a seax and pieces of worked bone (Sundström 1987). The tools have often been associated with iron smelting and metallurgy (ibid.), but it can be suggested that the tools were better adapted to crafts in hides, bone and antler. The grave indicates specialised crafts and it was placed in an area that is characterised of high densities of cooperatively undertaken land-use and pitfall systems. Indications of specialised crafts in bone and antler have been found elsewhere. The site Bjørkum, located in the Lærdal valley southeast of the Sognefjord (Fig. 19; Ramstad *et al*. 2011), provides evidence for specialised comb production in 700–850 AD. The site contains fragments of cut reindeer antler, as well as debris, reflecting all stages of the production chain. Comb production is known from a few other sites in Norway, but is so far absent in the Viking Age town Kaupang in southeastern Norway (Barrett *et al*. 2007). In addition, spindle whorls and loom weights were retrieved at the site and the finds have been related to shielings and increased importance of secondary products and wool production. According to the excavators, the site should be understood in relation to local networks that extended over the inland areas (Ramstad *et al*. 2011).

The demand for leather, fur and antler stimulated labour-intensive and cooperative forms of hunting and crafts specialisation. According to the theoretical discussion earlier in the paper, it can be presumed that it was inevitable to work together in larger groups than the individual household, owing to long distances and the labour-intensive resource utilisation (*cf*. Lagerstedt 2004). Despite the focus on forest resources, the local land-use

5 So far, only one pitfall in the Ängersjö parish has an associated radiocarbon date, c. 1700 BCE. However, two iron points designed for being hafted on spears or poles stuck down at the bottom of a pitfall have been retrieved from Öjingsvallen in Ängersjö parish. This can be considered an indication of that the hunting strategy has been employed much later than the Bronze Age (Magnusson & Segerström 2009). The trapping method was prohibited by law in 1864 (ibid.).

systems was organised in such ways that they harmonised with customs that prevailed in the general agricultural cosmology. Although no archaeological remains of contemporary permanent settlements have been identified in the area, the infields appear indirectly through the pollen records. Presumably, it was in these areas the symbolic features of the cosmology were catered and here the members of the community were defined. The commons contained the resources that generated the wealth.

The Trade

The model suggested above implies that the commons on the outlands were economically more significant than the infields of the villages in the forest agrarian land-use systems. Judged from the long distances and the peripheral locations of the production areas it is possible to suggest that the resources were locally controlled and that the main waterways – like the Ljusnan – were important routes for communication and trade. However, to gain support for the model it is crucial to add some additional indications that can verify that trade took place. One such indication is the hoards of Roman bronze coins that have been found in several places in the inland region (Fig. 19; Zachrisson 2010). Their distribution is different from the distribution of coins made from silver and gold and from other Roman import objects. The bronze coins extends from the 4th century BCE to the 7th century and were derived from trade exchange – mainly in furs – between the inland hunting grounds and the agricultural region along the coast (ibid.).

Herschend (in prep.) has elaborated on this by comparing the inland coins with the composition of hoards found elsewhere in Scandinavia. The comparison enables us to note a filtering process, which also outlines different levels of a trade system (ibid.). The metal value of the inland coins was generally low and in addition, the coins were far beyond the time and space in which they had been used as currency. This in turn suggests that the trade with the inland was based on nominal and/or symbolic coinage and that the inland hoards indicate areas that can be categorised inland hubs, i.e. places where trade middlemen accumulated inland produce for further transportation to shipment areas at the coasts, which is also mirrored in depositions of coins. Interestingly, if the number of coins and their associated dates is compared with the trends of pitfall construction, a correlation can be noted (Fig. 20; Ramqvist 2007; Herschend, in prep.). The two curves reflect each other and this can be considered as a sign that the pitfalls and the Roman coins signify an interregional trading system. Presumably, the system was constituted on trade middlemen linking the inland with the coastal shipment areas.

From around 900 AD, it is possible to see indications of a wealthy elite in the inland hub of the Great Lake region (Fig. 19). The outlook – in place names, farming conditions and archaeological finds – is similar to what can be expected for the central agricultural regions of Sweden (Holm 2012). The outlook is usually explained as a manifestation of *odal* and property in agricultural land and it is true that the Great Lake had relatively good farming

conditions, but more importantly, the region had a strategically good position linking the forested inland region with both the Atlantic and the Bothnian coasts. Hence, it can be argued that the elite at the Great Lake founded their economic position on trading surplus (ibid.). Accumulated evidence suggests that the Sámi transition from hunting and fishing to domesticated reindeer herding was initiated in the same time period during the Late Iron Age (Storli 1993; Aronsson 1994; Bergman *et al*. 2008), hence occurring simultaneously with the significant changes of the Scandinavian society in general at the time. This provides a strong contrast to the view expressing that reindeer pastoralism first developed in the 16th century (e.g. Mulk 1994). The Sámi transition to livestock herding can be noted in the spatial structuring of dwellings and in pollen records (Aronsson 1994; Bergman *et al*. 2008). The change is explained as a consolidation of local Sámi communities in turn related to internal tensions in times of dramatic and substantial change, and the development of reindeer pastoralism can be understood as a part of this process. In this period, it is also possible to see increased indications of stress in the trading systems of the Scandinavian inland region. The stress can be understood as caused by overexploitation or changing trade networks within the proto-world economy. Locally, some activities were abandoned and other types of exploitation were intensified during this time-period. From this perspective, the development of Sámi reindeer pastoralism can to some extent also be understood as a strategy for creating a greater predictability in a society in flux. Changes also occurred in the Sámi religion during the period, as indicated by the emergence of bear graves and silver deposits at the sacrificial sites (Ramqvist 2007).

One further illustration of the inland trading patterns comes from a recent study in South Hedmark, Norway (Fig. 19). Here large-scale iron production is indicated from the Late Viking Age up until 1300 AD. However, the origins of the land-use system can be sought already in the 7th century (Rundberget 2012). The production was based on agriculturally marginal outlands, organised through local communities that focused on surplus production. Towards the end of the medieval period, it is quite certain from the written sources that the King controlled the trade in iron. In the earlier period, however, regional chiefs and nobles probably stood as joint facilitators of the trade. Nevertheless, considering the large area, the control of the iron production could probably not be performed directly; instead, it was necessary to create a mutual relationship with the local inhabitants who produced the iron. Written medieval sources indicate that the region had low tax levels compared to the neighbouring regions. This implies that nobles and later the king exercised tax benefits to encourage the local iron production. The revenues were mainly obtained at a later stage through taxing the trade at the market places (Rundberget 2012). However, the iron production developed as a local joint initiative aiming at an outside market, and in addition, the production shows several features of institutionalised cooperation, or in other words, commons.

Resilient Commons

Two of the historically known shieling areas in Ängersjö, Gammelvallen and Öjingsvallen contain stone and soil constructions, which have been interpreted as cellar pits. At Gammelvallen, one radiocarbon date associated with the cellar pits point to 600–900 CE and four dates indicate the time period of 1100–1600 CE. The cellar pit at Öjingsvallen has provided one radiocarbon date indicating the period of 1000–1650 CE. In addition, a horseshoe has been found near the site, which typologically can be dated to c. 1000–1200 CE (Karlsson *et al*. 2010). It has been suggested that the cellar pit sites at Gammelvallen and Öjingsvallen represent early examples of shielings (Figs. 19-20; Emanuelsson *et al*. 2000). As previously mentioned, researchers have noted a systemic relationship between shielings and iron production (e.g. Lagerstedt 2004).

Regionally, it is possible to distinguish two main phases in the production of iron (Magnusson 1986). The first phase covers the period 500-1100 AD and seems to be associated with the lakeshores. The second phase is generally dated to the period from the Middle Ages to the 1800s. The iron production sites in the study area belong to the later phase; the majority of the dates are associated with the 1300s, and so far, none has been dated to the Iron Age (ibid.). Nevertheless, Figure 20 illustrates the regional trend in radiocarbon dates associated with pitfalls compared with the regional trend in dates associated with iron production. It is possible to deduce that large game hunting and iron production succeeded each other over time. However, the problem with the comparison is that it illustrates a regional process, rather than localised use of outland resources. Nevertheless, similar patterns can be discerned locally in areas where detailed studies have been undertaken. A local case study in Värmland indicates that a shieling and an iron production site were contemporary with a pitfall system in the early medieval time-period. The iron production ended abruptly in the 1200s and this coincided with intensified use of the shieling (Pettersson 2005). The commons can thus be seen as multifunctional features and provided resilient systems that enabled rapid changeovers of production.

An additional example of this view can be sought for in the period after the Late Medieval Crisis, which peaked around the 1450s (Fig. 20). After the crisis, the shieling system known from the historical sources developed. The process can be considered an agrarian response to the crisis based on institutionalised use of commons (Larsson 2009. According to the view presented in this paper, this process was catered by the re-colonisation of already established resource areas, which had been maintained as commons for a considerable time-period. Fundamental aspects of the historical shieling system were the transhumance between permanent villages and periodic summer settlements located on the commons. The shielings contained buildings for the accommodation for people, the livestock and for processing the milk into durable products, which required considerable amounts of firewood. In the historical sources, the

shielings were considered specialised feminine workplaces functioning within the agricultural system of a farm (Larsson 2009). In the near vicinity, winter fodder, iron, meat, furs, tar, and charcoal were produced. The production on the commons allowed local farmers to expand and link with regional trade networks, for example the mining and iron industries, which demanded draught animals, leather, and durable dairy products. The magnitude of the expansion involved that even the most peripheral areas of the forested inland region were 'crowded from at least the early 1600s' (Fig. 20; Bodvall 1959:129).

Although it can be suspected that the production on the commons aimed at an exploitation, which was not necessarily environmentally sustainable, it seems possible to see indications that the commons were socially and economically resilient. Different collective resource management practices have been associated with the same areas in the landscape; they have lasted in parallel or succeeded each other showing a robustness that extends several centuries up until the present day.

The Archaeology of the Commons

The main objective of this paper was to test an archaeological approach for identifying areas that were held as commons in the past. This was done by a landscape analysis of a variable archaeological record located in the forested inland regions of central Sweden. The study suggests that institutionalised use of outlands by the establishment of commons i.e. collectively claimed resource areas with defined users and regulated land rights was established sometime in the first half of the first millennium. An important trait of the modelled commons is that they represent collective action derived from situations characterised by small populations, long distances and labour-intense land use. These features of the land-use system became important for structuring social groups and institutions that cooperated in claimed resource areas. Nevertheless, the commons were not simply a matter of subsistence, since the production linked with external markets and the commons seem to have been essential for innovation and for shaping social and economic change. The commons seem to have been the most fundamental parts of the forest agrarian land-use systems. Although this study presents a general spatio-temporal framework of the commons, further research is required. A more detailed chronological framework, which links various locally based activities with larger interregional trends could contribute considerably to the current understanding of the prehistorical time period in the forested inland region.

An additional objective of the paper was to discuss to what extent an archaeological long-term perspective can contribute to current theoretical discussions concerned with common pool resources. The common pool-theory has been criticised for not fully appreciating aspects of multifunctionality (*cf.* Steins & Edwards 1999). Nonetheless, this study has pinpointed certain aspects of the commons that contribute to current commons theory. The commons in the forested inland region were multifunctional and dynamic landscape

elements, enabling diversification, surplus production, specialised crafts and trade, as well as more general subsistence. Although it is possible to discuss indications inferring negative environmental consequences of the exploitation, the commons seem to have been fundamental and resilient parts of the northern land-use systems up until the industrial era.

This study has focused on identifying commons, but it could be equally interesting to formulate archaeological hypotheses towards situations that are characterised as open access in current commons theory (Acheson 2011). This is a situation where no set of rules regulates the access to the natural resource. A presumption derived from this study is that an open access situation in general would be archaeologically represented through events related to valuable and rather distinctive resources – in space or in time – exploited by individuals or task groups, sometimes in competition with others. The north Atlantic cod fishing and whaling predating the international agreements of the 20th century are cases in point. Hence, current commons theory, which is largely derived from synchronic case studies and game theory experiments, could gain considerably from archaeological long-term studies based on tangible examples of collective action in relation to natural resources.

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