Analysing prehistoric and historic wood remains
A study of nomadic wood usage in northern Fennoscandia and applicable methods of analysing wooden remains

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Abstract

Målet med denna uppsats var att undersöka de nomadiska folkets användning av trä i norra Fennoscandien, samt möjliga analytiska metoder att studera arkeologiskt trämaterial. Detta möjliggjordes genom relevanta etnografiska, historiska och arkeologiska studier och en genomgång av analytiska metoder. De nomadiska folken använde trämaterial i en stor del av deras vardag så som mat i form av den näringsrika inner barken, ved för eldning, till både temporära och permanenta kåtor, förvarning samt jakt. De analytiska metoder som presenteras var träidentifikation, dendrochronologi och $^{14}$C-metoden. Träidentifikation möjliggör de två senare metoderna som kan förse tillförlitlig datering beroende på trämaterialets struktur samt tafonomiska processer.

The aim of this thesis was to investigate the nomadic people’s wood usage in northern Fennoscandia, as well as possible analytical methods of investigating wooden remains. This was achieved through relevant ethnographic, historical and archaeological studies and a review of analytical methods. Wooden material played a big role in the life of the nomadic people in the shape of food, firewood, storage, construction material for both temporary and permanent huts, and for hunting. The analytical methods presented are species identification, dendrochronology and $^{14}$C-method. Species identification enables the latter methods of which provides reliable dating of wood, depending on the structure and taphonomic processes.
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1. Introduction

People have used wood for everything. Wood was needed for human survival but it was also made for various purposes such as ritualistic, communicative and ornamental. Especially in the northern hemisphere where cool climate occurs for extended periods, the gathering of wood was essential. Northern Fennoscandia is a highly interesting case for studying wood remains as it provides different environments where organic material can be preserved. Snow patch areas and the many lakes are both ideal preservation environments. Furthermore, the people and their use of wood in northern Fennoscandia throughout history is not fully analysed.

Most studies of the nomadic people in Fennoscandia have been concerning fishing, hunting, and herding of animals. Fewer investigations of the use of plants and tree have been conducted (Rautio 2014:12). Analysing wooden remains can unlock the evidence for as it is the main material for fuel, artefacts, and structures. According to recent suggestions, as much as 90 – 95% of organic material is lost in typical dry archaeological sites (Brunning 2010:3). This leaves very few wood or other organic material for us to find and investigate. Preservation of remains in the soil in Fennoscandia is generally considered poor. Therefore, it is crucial to know how to sample, analyse and understand the few that has stood the test of time. Analysis of wood can further help in palaeoenvironmental investigations and reconstruct past vegetations of the complex landscape history that northern Fennoscandia has (Nelle et al. 2010).
1.2 Aims and research questions

The aim of the thesis is an attempt to theoretically investigate different analytical methods on wooden objects of the nomadic people in northern Fennoscandia, as well as investigating the current state of knowledge of said nomads’ use of trees.

1. How did the nomadic people in northern Fennoscandia utilize the forest in terms of wood usage?

2. How can different analytical methods help to investigate the preserved wooden remains found in northern Fennoscandia?

3. How does different parts of the tree and taphonomic processes affect the methods of analysing wooden remains?

1.4 Theoretical perspective and scope

A potential conflict exists when dealing with the archaeology of existing indigenous cultures. Archaeologists tend to look at such cultures as a passive and homogenous culture (Smith & Wobst 2005). Therefore, investigation of Sami culture can be potentially controversial and a difficult task for archaeologists. The term Sápmi, which is the area the Sami people inhabit in northern Fennoscandia, can mean different things for many people. It can be a cultural, ethnically and politically loaded word. The complexity of the term Sápmi term is further enhanced by the fact that the region covers four countries which have been changing throughout history (see figure 1) (Ojala 2014).
Dealing with Sami prehistory and history is a complex and somewhat controversial topic in archaeology (Ojala 2014). For the sake of simplicity in this research context, the author has purposely grouped together the two main Sámi culture, the forest Sámi and mountain Sámi as one and refers to both groups as the nomadic culture of Fennoscandia. This was done because of simplicity and the lack of time to investigate a more in-depth difference in wood usage between the two cultures. Their wood usage is generally the same, although depending on the local material available at hand. The major difference between the two Sámi culture is where they lived, their dietary practices and how their nomadic practices functioned. The mountain Sámi’s migrated from their summer pastures in the mountain down with a larger herd to the low-land forest while the forest Sámi lived in the lowlands throughout the year with smaller herds. However, transition zones between these cultures and practices existed, which would result in mixed practices in reindeer herding and wood gathering and usage (Rautio 2014:18).

The author is aware that there is still a large amount of reindeer herding practices taking place in northern Fennoscandia. Therefore, another restriction in this thesis will be aiming to only deal with archaeological remains and other culturally affected forest utilization up until the late 19th century when large forest management started as this affected the forest on a much larger scale and without nomadic people’s participation.
In archaeology, there is a distinction between Sami archaeology and archaeology practiced on sedentary sites. The transition zone between two different archaeology terms is convoluted as there can be difficult to draw clear terms as to what is a “nomadic site” and what a “sedentary site” in archaeology. A sedentary site is more often found in the coastal areas and has a much greater influence from southern Scandinavia and later practised permanent agriculture (Ramqvist 2007:159). The author will not include the “sedentary archaeological sites” in this thesis, even though they can occupy the same area.

Hunter-gather societies used to be perceived as inferior to those cultures that relied heavily on agriculture. This, in turn, would affect the interpretation of hunter-gather societies as less culturally developed (Rautio 2014:10). In according to this, the first historical, ethnographical and even archaeological studies of the Sámi people can be heavily outdated. Moreover, the early Sámi historical research was not intended for the Sámi people but instead, it was for non-Sámi people (Ruong 1975:229).

A way of helping to interpret peoples choices in the past is to assume that people most often acts with logical reasoning and makes aware choices, not only when it comes to the gathering of plants and wood, but also in their day to day life (Jones 2008:151). The prehistoric people did not act out of random, but of well-thought-out ideas and efficient methods e.g. which tree to cut down and with what tools, and which is the best and most efficient way to traverse the landscape. Least Cost analysis and the theory behind mans’ way of efficiently using time and space is an approach which helps to investigate prehistoric and historical actions. There are cases where man acte d according to the way of least effort or cost possible to achieve a goal. This does not only affect traversing landscapes but also acquiring resources. Least Costs theory is, therefore, an applicable theoretical analysis when considering the acquiring of wood material since the gathering of wood was a sizable effort (Surface-Evans & White 2014:1). Furthermore, the strategy for optimal gathering based economies has often been put forward as a driving force for cultures in colder climates, as the environment tends to have less exploitable resources (Jordan 2008:85). Least Cost is, however, not usable in every scenario since the easiest way of obtaining something may not be the way the humans did and will be discussed further down.

In order to fully investigate the complicated relationship that a culture had with nature, in terms of wood utilization, a broad range scientific, historical and ethnological analysis has to be applied. This is so that the analysis gets as much information as possible before any
assumptions can be made. A combination of historical and ecological methods is thus necessary in order to survey human and plant tradition (Rautio 2014:33).

The gathering of wood is also an important aspect to consider. Théry-Parisot (2010:145) advocates that nomadic people would have to rely on a more accessible wood material as they would have a harder time storing it. Therefore, driftwood and deadwood would have been preferred. In permanent or seasonal settlements, the gathering of firewood would have been in the nearby vicinity (Carcaillet 2017:1376). As the Sámi were seasonal migrants, they would have to alter between gathering methods.

Taphonomy in an archaeological sense is both the natural and cultural processes/filters that have an impact on the deposited organic material up until human analysing (Lyman 2010). This includes the (1) human practices of collecting, handling of wood, (2) the actual burning of the wood material and (3) both depositional and post-depositional processes. Arguably, a (4) human filter when sampling and analysing charcoal should be a considering factor as it may distort the final results (see fig. 1) (Théry-Parisot 2010:142). There is also a question of different preservation of wood material. Charcoal tends to be preserved for a longer period than fresh and dry wood, although, in anaerobic, freezing and waterlogged environment, the latter two can still occur as the decay processes are slowed down (Brinning 2010, Spicer 1991:77). These different environments wood can be preserved in will be discussed later.

Figure 2 Taphonomic sequence processes (Figure: Théry-Parisot et al. 2010)
2. Background

2.1 The vegetation of Fennoscandia

The Preboreal period was warmer but also an unstable time in Fennoscandia, both in temperature and geology, compared to modern times (Hörnberg et al 2005). The areas were the glacier was the thickest and the crust pressed down the furthest, where areas prone to earthquakes. This would have led to environmental changes with mudslides and flooding of areas. Together with the land upheaval, earth movement affected not only the vegetation and animals but also how the humans interacted with the environment (Bergman et al. 2004).

The environment in the Mesolithic Fennoscandia had brief periods of tundra-like vegetations (Wallin 1986). When the organic material began to accumulate and the soil layers got thicker, semi-open forests of birch (*Betula pubescens*) and pine (*Pinus sylvestris*) formed. Elm (*Ulmus* sp.) followed around 6000 BC while spruce (*Picea* sp.) migrated to northern Fennoscandia around 2500 BP and by 2000 BP it was one of the dominating tree species (Wallin 1986). Trees like Larch (*Larix* sp.) and apple (*Malus* sp.) followed afterward in closing the landscapes with Scots pine (*Pinus sylvestris*), spruce (*Picea* sp.) and birch (*Betula pubescens*) being the dominant trees (Hörnberg et al 2005).

Species such as willow (*Salix* sp.) sea buckthorn (*Hippophaë rhamnoides*), bog myrtle (*Myrica gale*) and juniper (*Juniperus communis*) made up the shrub vegetation. Although the field layer was dominated by different grasses (Poaceae), ferns (Polypodiaceae) and sedges (*Carex* spp.), alpine vetch (*Astragalus alpinus*), twinflower (*Linnaea borealis*), cow-wheat (*Melampyrum* spp.), mountain avens (*Dryas octopetala*), hemp (*Humulus lupulus*) and bog asphodel (*Narthecium ossifragum*) were also existing (Bergman et al. 2004).

Parts of the vegetation was partly untouched by people, except for brief resource gathering, until the late 19th century when forest clearing started to emerge. However, there are still forested areas untouched by modern commercial forest machinery, such as north of the nomadic people of Luokta-Mavas village (Lidgren et al. 2009:122-123).

The contemporary vegetation of northern Fennoscandia is old coniferous forest, boreal forest with taiga-looking landscaped in the north-eastern parts. The forests are dominated by pine (*Pinus sylvestris*) trees, although deciduous trees like birch (*Betula* spp.) and grey alder (*Alnus incana*) and the coniferous tree Norwegian spruce (*Picea abies* L.) exists in many areas
(Wiegolaski 1997). Many of the prehistoric species exist, although few have disappeared and some have migrated in due to the climate. The habitation zone for some deciduous trees has also migrated further south (Wallin 1986).

The North Swedish mountain- and highland area is influenced by the oceanic weather of the Atlantic Ocean. This is characterized by low summer temperature somewhat milder winters than continental winter climate. The length of the vegetation period is around 150 days with an average of temperature of +13 - +14 in the summers (Wallin 1986). The humidity of the ocean climate is favourable for the birch to grow on the alpine area (Wielgolaski 2005).

The northern parts of Fennoscandia are Finnmark and characterized by an environment similar to taiga with low and sparse birch woodland and with old pine forests in the more eastern regions. The region is a dry Subarctic inland climate with summers reaching up to 30 °C and up to -40 °C in the winter (Skandfer 2009).

2.2 Early human settlements in Fennoscandia

The glaciation reached its peak around 20 000 BC and had pressed down the crust of the earth with its weight. The Weichselian glaciation ended around 11 700 years ago and marked the end of the Pleistocene era and the Holocene era begun (Clark et al. 2009). When the ice cap melted the environment and the shoreline was immensely different. The newly created land opened up possibilities to expand and settle into northern Europe. There are, however, a few indications that humans and Neanderthals might have lived by the glacier or in the warmer intervals of the glaciation during the Pleistocene era (Bergman et al. 2004:2).

Humans migrated from the neighbouring areas to northern Sweden. The central Norwegian coastline became inhabited within a few hundred years after arrival around 9500 B.P. by mobile hunter-gather communities. The relatively fast colonization of Norway’s coast is believed to have been greatly sped up by advancement in arctic living and technology (Blankholm 2008:16). The earliest settlements in Finland are from the Suomusjärvi culture and dating to 9500 – 8300 B.P. These sites are dating roughly to the same time as settlements in eastern central Sweden (9000 B.P) (Bergman et al. 2004). The lack of surveys and excavated sites in Norrland shows that the immigration is a complex matter with people migration from adjacent areas forming a melting of different cultures (Bergman 2004. Kuntsson & Knutsson 2012).
The inner parts of northern Sweden were the last areas to be deglaciated, and subsequently, last to be inhabited by humans. Although the iced remained until 9000 B.P in northern Sweden, there have human activities from Late Paleolithic and Early Mesolithic in the surrounding areas, who now could migrate into the uninhabited areas. One of the oldest Mesolithic sites, Dumpokjauratj, in northern Sweden is dated to 8600 B.P. The oldest coastal settlement in Norrbotten is dated to 7555 B.P. and shows similar material usage (Hedman 2009:11). The material of the sites consisted of lithic material and tools from rocktypes such as quartz and slate of various shapes and technologies, showing the long-term use of the site. The osteology of the sites showed a presence of reindeer (*Rangifer tarandus*) in the identified bone material. There was also a presence of pike (*Esox lucius*) and beaver (*Castor fiber*). Reindeer, elks and beavers are perhaps the animals who would have impacted the forest and landscape the most.

Small based hunter-gather communities would be the norm until a shift in the economy and settlements around 2000 BC. Going from smaller groups of people in the inland areas towards a more of a long way of procurement of resources along the river and inland areas. The vegetation impact of smaller groups would have been less than of bigger groups. Around 2500 BC by the coast of Norrland is also a potential expansion of the Corded Ware culture, with subsequent agrarian and pastoral influences. However, the hunting and gathering of food resources still play a major role. There were also constant influences coming from east. (Forsberg 1996:172).
2.3 People in northern Fennoscandia and lifestyle in prehistory

Before the nomadic people started herding reindeers, the main source of food resources came from the hunting of wild animals. Before the switch to a herding lifestyle, reindeer is believed to have had a smaller part of the nomadic people’s lifestyle, mostly used for transporting materials and as decoys for catching of wild reindeers (Bergman et al. 2013). Although the general view of the nomadic people is that hunter-gather and pastoralism lifestyles were the norm during the prehistoric times (Josefsson et al. 2010), few recent palynological results could potentially indicate that early cultivation existed in the Late Iron Age and Early Medieval period in the nomadic culture (Bergman & Hörnberg 2015). It is also around this time, it has been suggested that the nomadic people start to switch from a hunter-gather lifestyle to pastoral practices and herding reindeers (Bergman et al. 2013) and subsequently developing a nomadic ethnicity (Rautio 2014:17). Herding together with hunting and gathering of wild animals and plants formed the basic need for the people in northern Fennoscandia in the Medieval Period. At the end of the 16th century, the transition from solely hunting and gathering to a nomadic lifestyle with the herding of reindeers was completed (Josefsson et al. 2010).

The nomadic lifestyle brought on a new set of challenges and opportunities. Indeed, the herding of reindeer (*Rangifer tarandus* L.) from the alpine area to the coast demanded seasonal settlements be erected in both places (Lundmark 1982. Ruong 1975:77, 125). Along the journey, there would be temporary settlements and hearths built. It was usual for the mountain Sámi to have a more seasonal based hut construction at both ends of the migration, while the forest Sámi enjoyed a permanent house construction throughout the year. The hut called *kåta* is tent-like construction made of wood beams with hide, bark or turf covering (Ruong 1975:125). To be able to migrate back to the mountains, the nomadic people made road marks on their way. Specific locations in the route to point out the direction was created with small piles of stones or blazes on trees (Josefsson et al. 2010). The wood usage of the nomadic people will be discussed in more depth later.

Stállo huts in the alpine areas, dated to 700 – 1200 AD, are considered to the earliest phases of reindeer herding. The Stállo huts are entirely located in the alpine region of Sweden and have sunken floor layer with a circular embankment. These settlements evolved over the next hundred years to a well-adaptation of the mountainous ecosystem (Bergman & Hörnberg 2015). When the Stállo huts were no longer a viable option, tent-like constructions started appearing in the mountainous region. Going from a relatively closed social settlement that the
Stållo constructions were, to a geographically large settlement with light constructions (Bergman et al. 2013).

In comparison with the older Stållo house constructions that were located above the tree zone, the more recent Sami settlements, from 19th and early 20th century, are generally located by lakes. The most common type of huts used in this time was the four-cornered timbered huts with layers of beams place horizontally on the ground (Liedgren et al. 2009). The need for constant supervising the herd for milking them allowed for a larger herd that was used for meat production (Bergman et al. 2013). This later gave away for even more extensive herding which is still practiced in modern times (Josefsson et al. 2010).

After the Medieval period in Sweden, farmers would be offered tax reduction and the military service duty would be postponed for 15 years if they moved to the northern parts of Sweden. The benefits of moving to northern Sweden resulted in a minor colonization of the coastal areas. In the 17th century, Lutheran missionaries were sent to remote parts of Fennoscandia to baptize the Sami people. This was most likely in order to get a more administrative rule over the regions (Skandfer 2009). In the latter half of 19th century, a considerable number of farmers started to settle in the inland of northern Sweden. The expanding colonization led to increases in struggles and conflicts of the diminishing land and resources (Bergman & Hörnberg 2015). The reindeer migration of the nomadic people was affected by demising land and forest areas that were traversable.

2.4 Sampling wood from different environments

Preservation of organic material depends mostly on the environments it has been deposited in. These environments include waterlogged environments (Brunning 2010), areas with permafrost or freezing temperatures throughout the year (Dixon et al. 2014), but also charred or charcoalificated wood (Scott 2010). Although affected by fungi and insects, wood can also be preserved if combined with copper (Brunning 2010:4) and in rarer cases terrestrial sites with alkaline conditions (Blanchette 2000:196).

The snow patch areas of the Scandinavian mountains exist in the central region of Norway and Sweden and upwards along the mountain range. These regions are home
to some extraordinary finds of archaeological material that has been preserved with remarkable quality as a result of the perennial snow and ice coverage (Dixon et al. 2014:1). Although the weathering processes take their toll, the frozen conditions allow not just more durable archaeological material to be preserved but even organic material has been found numerous times (Callanan 2010). The finds are usually of the Iron Age to the Medieval period but they can nearly go as far back as 2500 BC (Callanan 2010:43).

There are more than 100 fragments of arrow-shafts, bow fragments and sewels preserved in the central Norwegian snow-patches. A sewel is a thin wooden pole arranged like a fence to herd reindeers in to favourable hunting positions (Callanan 2012:180). These are therefore presumed to be of a reindeer-hunting practice (Callanan 2010:43). The arrow shaft encountered in the Oppdal region of Norway was chronologically dated by their arrowheads. This showed that the arrows from the Migration Period were most often made out of birch (Betula) while the arrows from the Late Iron Age were more often made out of other tree species and seldom birch. The sewel encountered were also made out of birch (Nesje et al. 2011:487).

The ground beneath the snow patches in the mountain range usually have permafrost (Nesje et al. 2011:486) or are waterlogged (Callanan 2012:181). The latter environment can preserve excellent organic matter as well (Nesje et al. 2011:486). As it is rare to find waterlogged wood material, they require extra care, both in terms of handling the on-site excavation and the subsequent analysis in a laboratory. Waterlogged wood does not have the same durability as fresh and modern wood does, especially the bark and sapwood tends to be easily damaged when waterlogged. It is, therefore, best to keep them wet throughout the excavation (Brunning 2010).

There are three main ways of deterioration of waterlogged wood. They all affect the tree structure and can thus in extreme cases render useless. A bacterial infestation on the wood sample causes the cell wall material to decay, while other bacterial infection causes lignin disintegration. Fungi require oxygen to exist and thus also allows air circulation to the wood, in otherwise wet environments. The fungus, like the bacteria, leads to a loss of cell walls and ultimately deterioration. The insects burrow into the wood and leaves the wood filled with holes and cavities (Brunning 2010).

There have been a number of findings of skis in bog and mires in northern Sweden. To mention two is the so-called Kalvträsk-ski and Bygdeträsk-ski, the former being the oldest ski (3200 BC). The bog the Kalvträsk-ski was found in, persevered both skis and the ski pole, all made out of pine (Baudou 1992:106). Bygdeträsk-ski had
only the tip of the ski preserved and was also made out of pine. The ski is dated by radiocarbon dating to 640 – 900 AD. The Bydgeträsk-ski had a carving of St. Hans cross, and together with Kalvträsk-ski it shows that bog finds of wood in northern Fennoscandia is possible (Huggert 2010:170).

2.5 Different parts of the wood structure

Deciduous and coniferous tree differs from each other in their structures. In gymnosperms, or softwood species, the axial system is mostly made up of vertical cells called tracheids. These are in charge of water transportation in the trunk and will vary in size depending on the season. They contain different amount of cell walls which is used to determine the tree species. Another tell-tale sign is the cells called ray pits or cross-field. These cells lay horizontal to the tracheid cells and transports water outwards in the trunk. Spruce and pine are the most common softwood species in northern Fennoscandia (Hather 2000:6). The cold climate of Fennoscandia makes trees grow in a slower pace which develops a denser fibre structure (Aikio & Müller-Wille 2005:262).

The hardwood species, or Dicotyledons, are more complex than the softwood species’ structure as it has many more cell types. One such difference is the vascular cells, or pores, that are parallel to the tree ring curve and stacked upon each other. These are very useful to help with analysing the different tree species. Different hardwood species also vary from each other, where some have different sized pores throughout the season, whereas other have relatively the same sized pores. There are, however, transitions zones between these two groups (Hather 2000:6).

The tree ring growth is a complex development inside the tree. It depends on both internal and external natural processes of which the environment and climate are arguably the greatest factors. Environmental factors such as nutritional and water availability are among the greatest factors (Hather 2000:10). The tree rings are made up of differently formed cells, earlywood cells, and latewood cells. The earlywood cells are formed in the beginning of the seasonal growth period and differs, depending on climate and genetics. The latewood cells start to develop in a thicker dark tree ring at the end of the growth season. This process results in different colours and size of the tree rings (Schweingruber 2007:7). Young trees may not have
developed sufficient latewood to able to be determined (Hather 2000:11). This will be discussed further along with sapwood and heartwood in the thesis.

The inner bark is located underneath the crude outer bark. It consists of vascular cambium and secondary phloem and acts as the transport corridor of photosynthates between the cambial zone and the needles. The cambial zone is where the radial growth of the tree occurs. It also stores excess carbohydrates when there is a surplus of photosynthesis (Pomeroy et al. 1970).

The burning processes of a tree have many different factors; however, some components have a bigger influence on the process. One that of greater matters is the state the wood is in, if it is dry, humid, decayed will determine of it burns. The chemical composition and the density of the wood are also factors to consider (Théry-Parisot 2010:144). Wood in oxygen-free environment but exposed to heat results in carbonization. The temperature required for this to happen is 400 °C and results in a reduction in weight and shrinking. Charring of wood is a result of burning of wood in an oxygen-rich environment. Both, however, is the processes of charcoalification (Théry-Parisot 2010:146). The cell walls of the charcoal fragment become ordered and subsequently more resistant to taphonomic processes. Both charred and charcoalified wood can still be analysed (Scott 2010:11, 15). Waterlogged and freeze-thawed charcoal of decayed wood tends to fragment more easily but it is not a necessity (Henry & Théry-Parisot 2014:333).
3. Method

Online journal databases, library of Umeå university and the authors supervisor has supplied relevant books, articles and other reading material for this thesis. Keywords that were searched for includes “Sámi”, “wood”, “tree”, “forest” and “wood gathering” but also longer such as “prehistoric wood utilization”. Although not every written paper concerning the nomadic wood usage was found, a selection of scientific, historical and ecological peer-reviewed articles, journals and books were gathered and read.

The author of this thesis has attempted to apply ethnographical, archaeological and historical accounts in order to understand the complex relationship between the nomadic culture in northern Fennoscandia, both prehistoric and historic, and their use and exploitation of trees. Even though the ethnographic texts might be wrong, or even contradictory, they can still hold valuable information. It is, therefore, necessary to be sceptical not only when reading older literature, but also when dealing with modern scientific literature as it can have been conducted with flawed methods.

A comprehensive survey of scientific methods applicable on the wooden material has also been conducted by analysing relevant literature including peer-reviewed articles and books describing various methods of analysing wooden remains. A number of case studies of different analytical methods of wood material from around the world are used for comparison.
4. Results

4.1 Nomadic cultures wood usage in Fennoscandia during prehistory and historical times

The nomadic people used the forest and their landscape in many various ways, both for their own benefit and for their reindeers. Just as with hunting and fishing, each family had their own area and territories for acquiring the specific need, such as picking berries and mushrooms and collecting twigs and firewood (Aikio & Müller-Wille 2005:259). The short growth season in northern Fennoscandia made the gathering of wild plants essential in order to acquire important vitamins and minerals for the winter periods (Bergman et al. 2004:163).

Although plant gathering was more seasonal gathering, the gathering of firewood was a continues harvest of material (Rautio 2014:53). The moon cycle had a significant part, as the felling of a tree for fire usage when it was a new moon, was considered to be inferior (Aikio & Müller-Wille 2005:263). Another aspect of the felling of a tree was to warn the spirits in the tree by knocking on it before cutting it down (Östlund et al. 2009:106).

Figure 3 Excavated nomadic hearth in Härnösand, Sweden (Photo: David Loeffler)
Dead, dried and fresh wood could be used as fuelwood. Birchwood (*Betula* spp.) was prized for burning by the nomadic people in Ohcejohka. But it was not only used as firewood. Birch together with pine was the most used firewood. Bark from birch used as kindling material was taken in such manner that the tree could survive (Ryd 2005:63). Utensils and skies were amongst the things made out of birch wood, although not exclusive (Josefsson et al. 2010:874). Trees that were being used for birch wood, as it is believed to have a denser fibre structure (Aikio & Müller-Wille 2005:263). Norwegian spruce (*Picea abies*) was not a preferred species to burn with but could be used as kindling material (Ryd 2005:166-167).

The nomadic people used dwarf birch (*Betula nana* L.) in the alpine region to heat the Stálló huts but also shrubs plants like willow (*Salix* sp.) juniper (*Juniperus communis*) and heather (*Calluna vulgaris*) (Liedgren & Östlund 2011:904). Experimental design of firewood usage showed that both different wood species and the construction of the hearth plays a major role in the longevity of temperature of the fire. An investigation of this done by Liedgren and Östlund (2011) during a winter in a stálló hut concluded that 3,6 kg of dry wood was needed per hour to sustain an ongoing comfortable fire. Comparing this to an assumed number of 5 people inhabiting a stálló hut results in six cubic meters per year per person.

The seasonality based herding of the domesticated animals forced the nomadic people to migrate inside forested areas. This required well thought out way of travelling, which could include culturally modified trees and wooden fences. The latter was also used both when marking and slaughtering calves (Josefsson et al. 2010:874). Culturally modified trees also include burn marks in trees as they were used to mark a path. Burn marks in trees could also indicate border lines between two nomadic settlements (Östlund et al. 2003:87).

Cut marks on Scots pine (*Pinus sylvestris*) trees can indicate the harvesting of the relatively nutritious inner bark (Josefsson et al. 2010:874). In historic times, documented by the priest Rheen, nomadic people have been known to harvest the inner bark in order to survive as the bark is rich both in fibre and in energy, and contains a high amount of mineral such as potassium and calcium (Rautio et al. 2013). Rautio (2014:14) suggests that the inner bark of pine, along with garden angelica (*Angelica archangelica*) have been the most important plants used by the nomadic people. Trees that had parts of the inner bark stripped could also be used to gather dry kindling, as the exposed sapwood dried (Ryd 2005:133).
Trees were selected and cut down as they had lichens, *Bryoria* spp., which were used as food for reindeers when times were tough and there was little else food (Josefsson et al. 2010). It has been estimated that at the end of 18th century, as much as 600 – 1000 trees were cut down each decade for the lichens (Berg et al. 2011).

The building of a nomadic hut used raw material that existed in the local area. This meant that pine (*Pinus sylvestris*) and spruce (*Picea abies*) trees were usually used to construct huts in the coniferous forest areas, while birch (*Betula* spp.) trees were used to make huts in alpine areas. There are, however, transition zones where both materials have been used (Liedgren et al. 2009:115). The huts erected in the forested areas could be constructed both as temporary tent-like dwellings and a more permanent construction, depending on which nomadic culture one belonged to. Wall beams held up the roof, which was covered with bark from pine, birch, spruce, turfs and mosses (Liedgren et al. 2009). The floor and bedding used twigs from both spruce and birch (Karlsson et al. 2005). A great deal of nomadic huts had inscriptions of names of the walls (Liedgren et al. 2009:134).

The forest Sámi relied heavily on the milk of the reindeer herd. As the reindeer could only be milked during summer to autumn, the milked had to be preserved for later use. Certain plants such as garden angelica (*Angelica archangelica*), common lady’s mantel (*Alchemilla vulgaris* L.) and meadow sorrel (*Rumex acetosa*) were added after preparation to the milk in a wooden barrel and dug down (Rauio 2014:20).

A type of hunting strategy used in northern Fennoscandia is the pit falls. Ruong (1975:37) suggests some nomads utilized this way of trapping reindeers, but the system of pits could also have been used by the coastal farmers for elk (*Alces alces*) (Hansson & Rathje 1999:25). The pits are usually rectangular with a size of 1,8 meters and have a dating span from 2000 BC – 1864 AD, when they were forbidden (Hansson & Rathje 1999:36). Whether or not pikes have been used inside of the traps, wooden remains have been found. Wooden constructions in the pits have been used to both keep the pit from collapsing and to prevent the animal for escaping (Hansson & Rathje 1999:28).
4.2 Different methods of analysing wooden remains

Wooden remains found in environments that are preserved or in cases where charcoalification processes preserves the anatomical structure of the tree, a whole range of analytical methods can be applied to investigate woody materials. They are not limited to just archaeology but can provide useful information about cultures and even past climates (Scott 2010: 35). Sampling for insect attacks, bacterial and fungus in the wood material is also beneficial to help determine the local past environment (Brunning 2010:18). The author will not explain every potential method, but rather focus on the ones that are most used in.

4.2.1 Wood identification

Wood identification is perhaps one of the first assessments that will be done when analysing wood. It is also perhaps the most common for that reason. The determination of species allows for many subsequent analyses of the wood sample as it is crucial to know which species one is dealing with. The analysis is commonly performed in a laboratory as only oak (Quercus) heartwood can be identified in the field by its ray and pore patterns, hardness and distinctive colour (Brunning 2010: 18). For other species, the pores diameter, tracheids and ray patterns of softwood or hardwood are investigated to determine species (Timar et al. 2012).

For the analysis of the cells and pores to be achieved, three planes, transverse section, radial longitudinal section and tangential longitudinal section, needs to be examined under a microscope. A transverse plane is cut across a branch or a trunk. The radial cut is perpendicular to the tree rings, while the tangential is cut somewhat parallel to the tree ring curve (see figure 3) (Hather 2000:4). The best results will be achieved from samples that are knot-free and well-preserved. Ideally only a 20mm specimen of the wood is needed, unless it is badly preserved, which will require a larger piece (Brunning 2010:18). Microtome slides of charcoal of the three different sections under a light reflecting microscope has been argued to give better results (Hather 2000:12). Scanning electron microscopy works in a similar way but can give a more detailed image of surfaces (Hubau et al. 2013:148). If the set of samples to be analysed is huge, a fixed number of samples should be identified as it can be expensive to analyse all the samples. A randomly selected amount should be analysed in order to avoid bias.
Taphonomic degradation of the wood, such as rotten wood, can be identified in the same process as species identification in both charcoal and unburnt wood (Timar et al. 2012). Investigating the cell wall structure not only determines the species, fungi infestation in the wood usually leads to weakened cell structure which can be detected. This can show what the state the wood was in when used (Henry & Théry-Parisot 2014:325).
4.2.2 $^{14}$C dating of wood

Radiocarbon dating is perhaps the most well-known method of dating organic material in archaeology. The isotope 14 in Carbon ($^{14}$C) is formed in the atmosphere and absorbed into living things. When a living organism dies, the $^{14}$C isotope starts to decay, while other isotopes remains stable (Taylor & Bar-Yosef 2014:21). The isotope $^{12}$C is stable while $^{14}$C is a decaying radioactive isotope and through analysing these carbon isotopes in an organism, a calculation of when death occurred can be concluded. The $^{14}$C is varying through centuries and subsequently different amounts of $^{14}$C in the organisms. However, all terrestrial living organisms will have roughly the same amount of $^{14}$C in the same period. Thus the 3 main factors of $^{14}$C depend on 1) the amount of $^{14}$C the living organism has before death, 2) how fast the decay rate is, and 3) how much $^{14}$C remains (Smart & Frances 1991:16).

Accelerator Mass Spectrometry (AMS) is based on the same $^{14}$C, but instead of measuring the decay, the AMS method measures the mass through ions of the $^{14}$C isotope. Whereas the radiocarbon dating is using bigger samples, the AMS dating can date smaller samples (Smart & Frances 1991:19). Both methods of dating can potentially provide a date as far back as 60 000 years (Taylor & Bar-Yosef 2014:19).

Besides the obvious problem of bioturbation, dating wood through radiocarbon and AMS has another precarious aspect. The annual rings of the tree contain the annual amount of $^{14}$C in the atmosphere, and this, in turn, will affect which part of the wood that is dated (Smart & Frances 1991:22). Heartwood can be several centuries old before being used or fire occurs and preserves wood fragments. Wood samples used for $^{14}$C dating is best taken of sapwood or young branches (Huggert 2012:170). Fungi infestation in organic material give a complex date as the dead trees carbon dating is mixed with fungi that could have lived on the trees for years (Brunning 2010:4). Furthermore, waterlogged wood contains a higher amount water, and therefore a larger amount of datable wood is needed (Brunning 2010:19).

Since the variation in $^{14}$C in the atmosphere, a calibration using dendrochronology has been used. Known dates of wood samples have been radiocarbon dated in order to get a better calibration (Smart & Frances 1991:28).
4.2.3 Dendrochronology

Dendrochronology is the study of tree-ring growth and most often used to date wooden objects. The tree-rings can help determine both the age and growth rate of the tree. The analysis method is built upon the seasonality of temperate regions and its influence on the tree growth. As the climate and the seasons, both affect the tree ring growth, this can, in turn, be analysed and subsequently be given a date. The warmer the temperature has been, the larger the growth rings are. The local tree ring will have similar ring growth and can, therefore, be matched together. Older wood can use an overlapping tree-ring curve with a more modern tree, and thus be able to chronologically go back in time. Although a local tree ring curve is generally better, trees from other places in northern Europe performs just as well since the climate is similar (Brunning 2010:23).

The best samples for dendrochronology should be 50 – 100mm thick and are taken from where most annual rings occur i.e. roundwood. If the sample contains sapwood, a dating of the felling can be achieved. The trunk of the tree can also help interpret the woodland management. Straight, long and branch-free stems believed to be from coppiced or pollarded wood provide excellent roundwood for dating a managed woodland (Brunning 2010:18). Trunk with large growth rings with many branches could indicate trees from pasture woodlands or hedgerows, while initially large followed by thinner rings indicates a tightly packed forest (Brunning 2010:23).

Oak is arguably most used for dendrochronology but as it does not grow naturally anymore in northern Fennoscandia, other trees such as ash (Fraxinus spp.), pine (Pinus spp.), elm (Ulmus spp.) and beech (Fagus spp.) have been used (Brunning 2010:19). Ideally, samples should contain more than 100 tree-rings, but samples with bark or sapwood can provide results with only 30 – 50 tree rings. Samples with less than 30 rings cannot provide a solid foundation for the dating as the rings might not be unique (Brunning 2010:19).

The sampling of the wood is done with a saw, by hand or machine, and when necessary can be bandaged in order not to crack or split apart. Another way of sampling for dendrochronological samples is by a core drill. This can be done on waterlogged wood, living and deadwood. Coring should be avoided when sapwood is present (Brunning 2010:19).
5. Discussion

Throughout prehistory, humans have used wooden materials for almost everything. There have even been suggestions whether the Neolithic should be called the Wood Age (Bocquet & Noël 1985). Therefore, it is not surprising that, presented in the result part of the thesis, nomadic people in northern Fennoscandia used the forest and wood material for many of their daily needs. Although as pointed out, the geographical area lacks in preserved wooden remains and excavated sites, there is still much to investigate.

Culturally modified trees

In the forest, daily necessities of the nomadic people were gathered such as berries, plants and wood material. Certain trees were also selected for their nutritional qualities. Especially the inner bark of the pine tree was sought out for dietary practices (Rautio 2014). As it appears, only pine (*Pinus sylvestris*) was harvested for the inner bark for food, while birch bark has been for both kindling material (Liedgren & Östlund 2011:904) and for constructing buildings (Liedgren et al. 2009). The harvesting of inner bark is believed to a very common phenomenon amongst the nomadic people around 1450 – 1890 AD and ended when dried fruits and sugar became common (Zackrisson et al. 2000:103).

The bark harvesting practices between the nomadic and sedentary people in northern Fennoscandia differs as well. When gathering the inner parts of pine bark, the nomads only harvested a small part was taken so that the tree could survive. The sedentary people who lived in northern Fennoscandia felled the whole tree in order to acquire the inner bark. The nomadic people dried the inner bark and used it with reindeer milk in buried caskets and other dietary practices, while sedentary groups ground it and used it in breadmaking (Viklund 2005:416). For the nomadic people, it does not seem to be a famine food option, rather a quite common food. Documented cases from the latter half of the 18th century shows that sedentary people, on the other hand, used it mostly as a supplement in bad times (Rautio 2014:27). Sedentary people also harvested bark from birch (*Betula*), lime (*Tilia cordata*), beech (*Fagus sylvatica*) and goat willow (*Salix caprea L.*) (Rautio 2014:27). The inner bark has also been described as health food, a staple food, famine food and even a delicacy meal in circumpolar areas (Turner et al. 2009).
Another culturally modified tree in northern Fennoscandia is trees that were cut down for the reindeers. These trees had a large number of the lichen *Bryoria* spp. growing on them. In harsh winter times, they were cut down, about 1.5 meters of the ground so that the reindeers could have access to the lichens. These vary from the trees that have been harvested for inner bark as they are found as big tree stumps and grouped together as a lot of trees were cut down in an area to feed a large herd (Berg et al. 2011).

Blaze trails made with fires can signal both paths made for the nomadic travels and borders between different groups. Marks used as trails are found in easily traversable environments. While single blaze marks can indicate a route, multiple blaze marks on trees can signal the area of settlement of nomadic people. These marking can still be visible in nature and subsequently show areas where the nomadic people traversed and had settlements (Östlund et al. 2003:85-86).

Most wooden remains that have at least 50 tree rings can be dendrochronologically dated (Brunning 2010:18). The trees that have been partly stripped of bark can still be found in the forest. Coring a living pine tree for dendrochronological analysis that has been harvested for bark has not only the potential to show the year the bark was gathered, but also the age of the tree (Rautio 2014:35). The harvesting of inner bark has been done for thousands of years, and thus dendrochronology can show the settlement pattern and the time a site was active. Living process of the tree will slowly start from the sides to cover the exposed sapwood with bark while the sapwood turns grey and decays. Therefore, very old trees might have healed over the stripped bark and felling of the tree is necessary find and conduct dendrochronology. A tree can remains standing for centuries after it died (Josefsson et al. 2010:882) which can be also be used for dendrochronology. Blaze mark could be done on exposed sapwood and thus have a similar taphonomic process as trees harvested for inner bark (Östlund et al. 2003:85-86). Radiocarbon dating would perhaps not be as useful in dating a thicker piece of wood, as dendrochronology could provide a more accurate dating.

Dating wooden remains using dendrochronology does not mean that one gets the exact year of the felling of the tree. The tree itself might have a high age before being cut down and used. Furthermore, the tree might have been dead or dried for a few years before being handled. As stated above, the use of sapwood, preferably as close as possible to the bark, is favoured as is provides a more precise year of the felling of the tree. This means that the archaeological feature dated is possibly younger than the actual dated wood (Brunning 2010:19). Insectile burrowing in trees is another potential harm that might result in missing tree rings and if enough tree rings are gone, there can be a harder time getting a proper analysis. Missing rings
can also be the case of extreme weather conditions such as drouths and late spring frosts. Therefore, a cross-dating of tree rings from other local trees might be needed to get a dateable ring curve of a site (Grundmann et al. 2008:111).

Dead trees are prone to taphonomic processes such as fungal, bacterial and insect infestations, which will affect analytical methods. Radiocarbon dating wood and charcoal remains of rotten wood should be avoided as the trees can stand upright for centuries (Josefsson 2010, Niklasson and Granström 2000). Rotten trees will give a complex date as the dead trees carbon dating is mixed with fungi that could have lived on the trees for years (Brunning 2010:4). The brown and white fungi that lives of rotten wood are detectable under a microscope with reflecting light as the fungus creates small cavities in the cell structures (Henry & Théry-Parisot 2014:326).

Firewood and gathering

For mobile groups that rely on hunting and gathering resources, gathering of dead wood has been argued as a favourable strategy as it is easy to obtain and ready to be used in hearths (Henry & Théry-Parisot 2014:334). This strategy could arguably be used for the nomadic culture in northern Fennoscandia also as it has been suggested by Ryd (2005:138). As the nomadic culture of northern Fennoscandia used temporary settlements during the annual migration with the reindeers, the gathering of dead trees would be reasonable as a short-term strategy. The easy gathered dried dead and decayed tree provided the people with efficient fuel. At the more permanent settlements, at the end and start of the migration, living trees would have to be used after decayed trees were depleted (Henry & Théry-Parisot 2014:334).

The nomadic people did not carry firewood with them as it would be too great of a burden to transport (Ryd 2005). As the nomadic people did not know exactly where the reindeer would stop for grazing, wood was gathered when the kåta was to be raised (Ryd 2005:130). Dry bark, however, can easily be carried between camping sites, as it is both light and very good kindling material (Ryd 2005: 67). In according to the explained strategy of gathering deadwood for fire, Least Cost theory of obtaining firewood is applicable and could further be investigated similar to the case study of Asouti & Austin (2005), where easy obtainable wood resources were identified through species identification of charcoal fragments.

Although the nomadic people gathered firewood in a sustainable way as suggested by Aikio & Müller-Wille (2005), the extensive use of mountain birch in Stállo huts in the alpine region,
however, relatively quickly had a dramatic impact and depleted the dwarf birches in the mountain region (Karlsson et al. 2009).

The selection of fuel seems to differ between the nomadic people in northern Fennoscandia. This is no doubt a complex matter depending on the local material at hand and what provides good fuel. Both pine and birch are dominant tree species in northern Fennoscandia. Birch was considered to be the best wood for fire according to Aikio & Müller-Wille (2005), while Josefssson et al. (2010) and Forsberg (1985:28) suggests that dry pine was the most preferred fuelwood for fire. The difference in the tree usage for fires in northern Fennoscandia could potentially be what has been easily obtained in the local vegetation. Not only does the specie and the state the wood is in determines the heating quality for fuel, but also the way the fire is constructed (Henry & Théry-Parisot 2014:321. Liedgren & Östlund 2011).

Spruce and juniper are also burnable wood and shrub species but seems to be of less importance as they are not mentioned or studied as much as birch and pine. Studies conducted on spruce trees focuses more on the migration and earliest introduction (e.g. Kullman 1996). Dry spruce wood crackles when burnt and embers are released. Hence in an easily flammable hut, spruce is avoided. Rotten spruce does not crackle but creates extensive smoke which is not always preferred (Ryd 2005).

The Evenk culture in Siberia shares similar environments i.e. boreal forests, though different dominating coniferous species (Henry & Théry-Parisot 2014) with the nomadic people of northern Fennoscandia. Both groups practiced reindeer herding along with hunter gather strategies. Furthermore, they shared a similar belief in sustainability of the forest with a nomadic lifestyle (Grøn et al. 2008). Henry and Théry-Parisot (2014) concluded that Evenks had a preference for dead and rotten larch (Larix spp.) when used for smoking hides as the wood produces large amounts of smoke. The nomadic people of northern Fennoscandia burned rotten spruce when smoke was needed (Ryd 2005:172). Larch is the dominant species in the region of the research of the Evenk culture (Henry & Théry-Parisot 2014:322), while spruce is one of the dominating coniferous tree species in northern Fennoscandia (von Stedingk 2006).

There are cases where people practiced selective gathering of firewood. In Jura, in France, during the Neolithic period, people selected wood that was below 10 cm in diameter for domesticated fires, while larger trees and wood parts were selected for house construction. Smaller wood was opportunistically gathered along the cultivated land (Dufraisse 2008).
Another potential method of gathering wood, either for fires or for construction, is the use of collection points and base camp system. This will be discussed further down.

Least Cost analysis has been conducted in many types of archaeological setting but one of the most used scenarios it has been used in, is pathways analysis (Howey 2011. Taliaferro et al. 2010). It has also been used in wood gathering models (Surface-Evans & White 2014). There are however factors that Least Cost does not factor in such as environmental, ethnological and physiological (Surface-Evans & White 2014:4). As no ethnographical, nor historical, investigations have resulted in restriction or forbidden use of certain trees and wood in the nomadic culture, the culture factor will not matter. Physiological or environmental factors will not play any substantial roles either as the existing tree have all been able to be cut down and used.

One might argue that proving whether or not a certain wood gathering strategy is hard since there is not a big variety of tree species in northern Fennoscandia. A way to test if the nomadic people used Least Cost strategies for gathering wood, would be to conduct a comprehensive analysis of the used wood of archaeological remains and then compare it to the past local vegetation. Species identification investigations of nomadic hearths could potentially reveal if any species are used more extensively and thus show a preference in material. Hearts are a very common feature in northern Fennoscandia and thus provide an ideal feature type. If an abundance for a certain material exists in a heterogenic environment, then it is arguably no longer a case of Least Cost since it was most likely deliberately gathered. A single heart would not suffice for a compelling evidence of Least Cost, but several could indicate. As easy gathered dead trees are sometimes infested by fungi, which can be identified, Least Cost acquisition of firewood could be investigated.

Combining the fine spatial vegetation composition that species identification studies can provide with palynological analysis provides a very solid foundation for interpreting the local vegetation (Nelle et al. 2010). As the nomadic people of northern Fennoscandia seldom transported trees for fire and heating purposes longer ways (Ryd 2005), charcoal fragments can show which tree existed in a specific place. Pollen analysis can then provide a broader picture of the vegetation composition. A change in the pollen and charcoal occurrence of a certain wood species could show natural or human-made impact in the vegetation. If a great number of a certain tree species in a local area were used as firewood, a decrease in pollen would occur and subsequently an increase in frequency of that tree species in charcoal finds (Robin et al. 2013:85). This could indicate if certain tree species has been used more frequently in prehistoric or historical times.
If the nomadic people gathered fire wood that was of similar size as the people in Jura during the Neolithic period, there would not be a sufficient amount of tree rings. Charred or charcoalified wood is possible to use for dendrochronology provided that a sufficient number of tree rings remains (Brunning 2010). However, charcoal pieces in hearths are often small and fragmented through taphonomic processes and thus cannot be used for dendrochronology since the fragments lack sufficient amount of tree rings (Hather 2000:18). Then radiocarbon dating of the charcoal would be a better choice. However, if the charcoal sample is of heartwood, the radiocarbon dating can be several decades old. As the sapwood turns to heartwood, the sapwood no longer is alive and subsequently no longer obtains $^{14}\text{C}$ resulting in isotopic decay. Therefore, sapwood with bark had a more recent accumulation of $^{14}\text{C}$ and thus is much better for radiocarbon dating than heartwood (Taylor & Bar-Yosef 2014:21). Both methods perform better using sapwood, but $^{14}\text{C}$ is able to provide a date with a smaller sample. Dendrochronology, on the other hand, can provide a more accurate date. Therefore, dendrochronology is arguably better, but there are fewer instances when dendrochronology can be applied.

*Construction*

In nomadic culture several types of dwellings have existed. Lighter temporary huts were constructed along the migration between the alpine areas and the coastal areas with more permanent huts at the end of the seasonal migration. Temporary huts could be transported along with the nomadic people with sleds pulled by reindeers, while the more stationary huts would be permanently erected (Ruong 1975). Even though taphonomic processes are extensive in environments without either freezing or waterlogged conditions, finds of huts from the middle of the 16th century have been encountered with preserved wall beams, bark from the roof and charcoal fragments from the centrally located hearth (Liedgren et al. 2009). This is due to that beams were often placed on stones instead of directly on the ground. Huts that have a wall embankment such as *Stállo* huts and built directly on the ground are generally preserved in a worse state, if at all (Liedgren et al. 2009). There are alternative interpretations of the *Stállo* huts concerning their origins and functions than that they are used reindeer herding huts (Pers. Com. Buckland).

Cut marks have been found in beams which would prove useful in analysing the technological choices and strategies when building the hut (Liedgren et al. 2009). Depending on the cut and saw marks, it is possible to find out features such as joint types to determine how huts were
built (Brunning 2010:11). Inscriptions of names inside the huts can also provide interesting information.

Gathering of wood for construction of huts has been used by the locally available material (Liedgren et al. 2009:115). Since the nomadic people used the locally available material, Least Cost theory is arguably reasonable. The use of collection points and base camps for the optimal wood is also possible, similar to described by Binford (1980). This would allow the nomadic people to venture out longer for acquiring well-suited wood material. Bringing wood material to a collection point for crude processing would make transportation easier to the base camp. Acquiring wood, in the end, is a question of labour effort compared to the availability of the resource (Marston 2009:2193).

There are cases where people have not used to local material for construction houses. In central Anatolia, people seem to have to some degree used pine for construction even though it was not a local material (Marston 2009). The expected amount of time spent in one site has also played a role in the construction of dwellings as shown in ethnographical studies. The longer a group intended to stay, the more focus was put into constructing a hut or a house (Kroll & Price 1991:43). This can also be seen in the temporary huts and the more permanent huts of the nomadic people in northern Fennoscandia.

Radiocarbon dating huts have been done on nomadic huts in northern Fennoscandia and yielded acceptable results (Liedgren et al. 2009), but as with the other cases, dendrochronology can also provide accurate results. Beams can be large enough to be able to be dated using dendrochronology, while the small twigs from the floor and bark from the roof generally need radiocarbon dating in order to give a date (Brunning 2010:19). There may be problems with dendrochronology dating wood used for construction of houses and huts. The timber used to build with may have been stored for seasons before being used. Furthermore, beams and other parts may have been re-used after a certain amount of time and thus the dating of the hut may be many years younger than the felling of the tree (Eckstein 1972:5).

**Hunting arrows, trapping pits and wooden barrels**

The hunting traps and wooden barrels used for storing reindeer milk are both dug down into the ground and left by the nomadic people. To the authors knowledge there are no preserved wooden barrels as of yet found although believed storage pits have been found (Liedgren & Bergman 2009:6). Since the hunting pits can contain wooden remains, an expectation to find
remains of the wooden barrels in storage pits are arguably justified. The hunting pit seldom contain any wooden remains, even though some have argued that pikes or wooden walls have been used (Hansson & Rathje 1999). The few fragments of charcoal that can be found in trapping pits are too small for any other presented method besides $^{14}$C and species analysis (Hansson & Rathje 1999).

The wooden arrow shafts and sewels found in the alpine areas are well preserved because of the snow patches. The encountered arrow shaft not only allows for analysis but the technological choices (Callanan 2012:180). The difference of the wooden material used for the shafts and the craftsmanship of the shaft is achievable. As with the wall beams of the nomadic people, it is possible to find cuts and other technological markings (Nesje et al. 2011:487). $^{14}$C dating is a possible dating method and most likely is not dendrochronology as an arrow would not be sawn perpendicular out of the wood and thus lack sufficient amount or tree rings.

**Skis**

The two different skis where found in wet environments that preserved them for decaying (Huggert 2012). The northern Finnish nomadic people preferred to use birch wood as skis (Aikio & Müller-Wille 2005), while the preserved bog finds of the skis in Sweden were all made out of pine (Huggert 2012). Both types of trees exist in these areas, so a preference in materials is possible. Hence in this scenario, Least Cost theory is not entirely possible to use.

The ski from Kalvträsk was quarter-sawn which enables dendrochronological dating, as this technique of cutting is perpendicular to the growth rings. This, of course, depends on the width of the ski as well as if it is made from sapwood, as it allows for dendrochronological analysis with fewer tree rings. The Bydgeträsk ski has parallels to skis found in Siberia. The ski from Bygdeträsk was flat-sawn and thus not able to be dated using dendrochronology, as the cut is roughly parallel to the tree rings (see figure 4) (Huggert 2012:170). Therefore, dendrochronology should be done if the ski is quarter-sawn while skis that are flat-sawn can only be dated using radiocarbon dating.
6. Conclusion

The different analytical methods and the nomadic peoples wood usage in northern Fennoscandia is a complex matter that is worth investigating. By compiling the current state of knowledge concerning the nomadic peoples wood usage and different analytical methods, the author found out that the presented analytical methods are most often used to date wooden material and archaeological remains.

The nomadic people in northern Fennoscandia collected many resources if the forest and wood is not an exception. Understanding the relatively few wooden remains from prehistoric up until 20th century of the nomadic people is important as studying the remains can get a deeper understanding of the people. Wooden materials were used for much in their day to day life such as harvesting, heating, storing, constructing and transportation which the presented cases of wooden remains clearly shows.

The thesis shows that the wooden remains displays how the nomadic people used the forest, this includes the culturally modified trees for food, both for humans and for reindeers, which
are found in great numbers in northern Fennoscandia. This includes harvesting of inner bark, cutting the tree for lichens and blaze marks. Dead and dry wood are most likely gathered first as it is the easiest gathered and the fresh trees followed. Huts, both temporary and more permanent ones, are still be encountered preserved in soil. Remains of skis found preserved in mires, while arrow shafts and sewels are found in good conditions in the snow patches.

The complex wood usage of nomadic people was compared ethnographically to a similar culture, Evenks, in eastern Siberia. The similarities extend also to their wood usage. Besides ethnographical studies, scientific methods have been investigated in order to shed more light on the nomadic cultures’ wooden remains.

Species identification of wooden remains is proven to be important as tree species and part of the tree provides different date. $^{14}$C is one of the most used method of dating organic remains as it does not require a big amount of organic material. Provided that sufficient amounts of tree rings exist in wooden remains, most remains can be dendrochronologically dated, even flatter objects such as skis. Sapwood was considered the best part of the wood for dendrochronology and radiocarbon dating as it provides the youngest date besides bark. The bark is however not dendrochronologically datable unless encountered with sufficient sapwood. There is, however, a problem with taphonomic processes in all organic matter such as fungal, bacterial and insect infestations. It further encompasses the processes in both living trees and wooden remains left both in and on top of the soil.

Furthermore, gathering techniques such as Least Cost is shown to be a usable theory of analysing wooden remains. Other potential methods of acquiring wood are the use of base camps and collection points. These theories are worth exploring in a deeper depth in futures studies as they can be applied in situation as presented. Future studies and excavations should be conducted concerning the nomadic peoples’ archaeological features and their wood usage as it is most often the actual remains that can investigate the past. Especially potential places where wooden remains can be preserved to a higher degree, as wooden remains can show patterns, preferences and gathering strategies, and techniques in selection of materials.
References


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*Personal communications*

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