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Demand and economic potential for working horses in Swedish municipalities

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Abstract/ Summary

The aim of my study is to answer the question whether there *is a potential for services by working horses in the Swedish municipalities.* The Swedish University for Agricultural Sciences (SLU) and Swedish Farmers Union (LRF) has started a cooperation called *Climate School (Klimatskolan)*, with the purpose to increase knowledge in environmental and climate related issues in context of agriculture. This Master thesis is in the framework of the *Climate School*.

Global warming is a problem that gets much attention today. Global warming and climate change are two subjects that are very much in focus on the political agenda. The municipalities of Sweden have a big responsibility concerning environmental work and to develop their own environmental thinking. Today you can see an increase in the use of horses in different work activities in municipalities. These horses can work in places where working machines can't, and at the same time horses are not as harmful to the environment.

The aim with this thesis should not be seen as replacing all tractors with working horses, and go back to a agriculture that reminds of the old days. The working horse could be seen as a tool in the municipalities' environmental work, where work assignments are suitable for both horses and machine driven equipments. Working horses could be seen as a complement and a substitute to motor driven equipments.
The thesis includes a questionnaire with municipalities that have experiences with working horses and analyses of the results from the questionnaire (economic, climate effects, and other benefits). An Internet survey was sent out to all municipalities in Sweden to investigate the interest in working horses. Existing working horse companies that have these kinds of activities have been contacted to get their professional opinions about this topic. By the well-answered Internet inquiry (67 % answering rate), it can be concluded that there are a large interest and willingness to use working horses.

This thesis also includes a Cost – Benefit Analysis (CBA). CBA is a good way of comparing benefits and costs to the society as a whole when the environment is taken into account. In this thesis, it for example means that price will be set for the CO_2 emissions. The CBA of the chosen scenario "small scale forest work", where comparisons were made between working horses and fossil fuel driven forwarders, shows that in the most realistic example it is a lower total cost for the working horse even if the environmental impact from the fossil fuel is not included. If the predicted cost for the CO_2 emissions is included, the cost is even lower for the working horse. Compared to bigger forwarders that are more efficient the cost for the working horse is slightly higher. Even in that context the environmental and climate aspects should be considered when the use of working horses gives a multitude of positive effects, e.g. social impact.

The CBA support that there should be a demand for the use of working horses for small-scale activities in the municipalities' services as the cost for using them are lower both for the actual use and if the environmental impact are considered. According to the survey, not all municipalities know about working horses and if there exist well trained horse equipage in the municipality. This can be one reason for not more municipalities uses working horses today.

From the Internet questionnaire and the personal interviews with some municipalities and working horse companies I conclude, that the marketing of the use of the working horse should be better organised and intensified. According to the survey many municipalities could

imagine to use working horses and the working horse companies that were talked to were positive to work for municipalities. The climate argument should be used considerable more aggressive than today. The municipalities could use the working horse in their local climate policy to decrease the uses of fossil fuel and in that way contribute to combat climate change. As an effect, new jobs can be created both in the rural and peri-urban areas.

Key terms: Climate, cost benefit analysis (CBA), economic, environment, municipalities, working horse.

Sammanfattning

Syftet med min studie är att svara på frågan ifall det existerar en potential för tjänster utförda av arbetshästar i Sveriges kommuner. Denna Masteruppsats ingår i Klimatskolan, ett samarbete mellan Sveriges lantbruksuniversitet (SLU) och Lantbrukarnas Riksförbund (LRF). Klimatskolan syftar till att öka kunskapen kring miljö- och klimatrelaterade frågor i jordbruket.

Global uppvärmning är ett problem som idag får stor uppmärksamhet. Global uppvärmning och klimatförändring är två ämnen som är väldigt aktuell på den politiska agendan. Sveriges kommuner har ett stort ansvar vad gäller miljöarbetet och att utveckla deras eget miljötänk. Idag börjar det synas en ökning i användandet av arbetshästar inom olika arbeten i kommuner. Dessa hästar kan arbeta i områden där en traktor inte kan och samtidigt innebär inte hästen en lika stor belastning på miljön.

Syftet med uppsatsen ska inte ses som att ersätta samtliga traktorer med hästar och gå tillbaka till ett jordbruk som påminner om förr i tiden. Arbetshästarna ska istället ses som ett hjälpmedel i klimatarbetet inom kommunerna där arbetsuppgifter lämpar sig likaväl för hästar som för motordrivna redskap. Arbetshästar torde fungera både som komplement och substitut för motordrivna redskap, beroende på situation

I uppsatsen undersöks efterfrågan på, och potentialen för, arbetshästar inom Sveriges kommuner genom en Internetenkät som skickades ut till samtliga kommuner. Uppsatsen inkluderar också en frågeenkät med kommuner som har erfarenheter av arbetshästar och analys av resultatet (ekonomi, klimat effekt och andra fördelar). Existerande arbetshästföretag som erbjuder dessa typer av tjänster kontaktades för att undersöka och identifiera deras verksamhet och tänkt potential inom detta ämne. Genom den välbesvarade Internetenkäten (67 % svarsfrekvens), kan det konstateras att det finns ett stort intresse och villighet att använda arbetshästar. De intervjuer som gjorts med arbetshästföretag tyder på att det finns arbetskraft och en vilja att jobba för kommuner.

I uppsatsen har även en Cost – Benefit Analys (CBA) gjorts. En CBA är ett bra sätt att jämföra vinster och kostnader för samhället när miljön tas i hänsyn. I denna uppsats sätts till exempel pris på CO_2 utsläpp. Min CBA på det valda området ”småskaligt skogsarbete”, där jämförelser gjordes mellan arbetshäst och fossildriven skotare, visar att i det mest realistiska exemplet en lägre kostnad för arbetshästen även ifall miljöeffekterna från fossilt bränsle var inkluderad. Ifall den uppskattade kostnaden för CO_2 utsläpp var inkluderad blev kostnaden till och med lägre för arbetshästen. Då kostnaden för arbetshästen blev något högre jämfört med en större skotare, eller skotare som är mer effektiva, torde det inte ses som en ursäkt att inte använda hästar i denna typ av arbete. Miljö- och klimataspekter torde behandlas som mer viktigt och användandet av arbetshästar ger en mängd positiva effekter, till exempel social inverkan. Denna CBA stödjer min frågeställning ifall det finns en efterfrågan på arbetshästar för småskaliga aktiviteter i kommuner, eftersom kostnaden för att använda dem är lägre både för den faktiska användningen och ifall hänsyn tas till miljöpåverkan. Enligt enkäten var inte alla kommuner medvetna om arbetshästars möjligheter till arbete i kommunen och inte heller ifall det fanns vältränade hästekipage i deras egen kommun. Detta kan ses som en orsak till varför fler faktiskt inte använder sig av arbetshästar.
Med hjälp av Internetenkäten och personliga intervjuerna med en del kommuner och arbetshästföretag, kom jag fram till att marknadsföringen av arbetshästen borde vara bättre organiserad och intensiv. Enligt enkäten kunde många kommuner tänka sig att använda

arbetshästar och de arbetshästföretag som kontaktades var positiva till att arbeta åt kommunen. Klimatfrågan borde bli sedd på ett mer aggressivt sätt än idag. Kommunerna borde använda arbetshästar i deras klimatpolicy´s för att minska användandet av fossilt bränsle och på så sätt bidra till kampen mot klimatförändringar. Som ett resultat av detta öppnas det upp för nya jobbmöjligheter både inom stads- och landsbygd.

Key terms: Arbetshäst, cost benefit analys (CBA), ekonomi, klimat, kommun, miljö.

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1 Introduction

Global warming is an issue that gets much attention today. Global warming and climate change are two topics that are very high on the political agenda. Especially at this very moment as there will be a meeting in Copenhagen next December during the Swedish EU presidency concerning a new Kyoto agreement.
Intergovernmental Panel on Climate Change (IPCC) is a scientific intergovernmental body set up by the World Meteorological Organization (WMO) and by the United Nations Environment Programme (UNEP).[1] They survey the man-made global warming issue in their report *IPCC Technical Paper on Climate Change and Water*. From observational records and climate projections, they have come up with some important and problematic conclusions:

- Climate change is expected to affect food availability, stability, access and utilisation.
- Several gaps in knowledge exist in terms of observations and research needs relate to climate change and water.
- Water supplies stored in glaciers and snow covers are projected to decline in the course of the century.
- Higher water temperatures and changes in extremes, including floods and droughts, are projected to affect water quality and exacerbate many forms of water pollution

The list can be continued further. The environmental problems are estimated to increase the common years, for example due to population growth and increasing in affluence (IPCC, 2008). (*IPCC Technical Paper on Climate Change and Water, June 2008).*

A central discussion in the context of global warming and climate change is the mitigation of green house gases and the decrease in the use of fossil fuel. Agriculture activities have in this context a key role as both as a source of greenhouse gas emissions and sink for carbon dioxide. With increased research in the field of agriculture and climate change this sector can supply solutions to stop the accelerating global warming as pointed out by the IPCC. Biomass can be used for both energy and renewable bio-products instead of using fossil resources. A new strategy towards a European agriculture research agenda has been presented in a communication by the European Commission (2008) in which all of this is described.[2]

One of Sweden's 16 environmental objects is called "Reduced Climate change"[3]. The purpose is to stabilize greenhouse gases in the atmosphere at levels, which ensure that human activities do not have a harmful impact on the climate system. This objective, or goal, is to be reached in 2050 but at the moment this seems hard to achieve. Global emissions are expected to increase more in the next 20 – 30 years unless something is done. This means that the municipalities in Sweden have much work to do to help achieve this goal. When this thesis was in its final stage, new information came up regarding the diesel taxes and that they are going to increase. *(Miljömål, 2009)*

The Swedish Government has recently presented a two-part bill to the Parliament where proposals are made to substantially decrease of the emissions of carbon dioxide and the use of fossil fuels. In 2050, there will be no net release of green house gases. Taxes and new laws are the instruments. This will increase the cost for companies that are using fossil fuels and the

[1] The IPCC was established to provide the decision-makers and others interested in climate change with an objective source of information about climate change.
[2] http://ec.europa.eu/research/agriculture/scar/pdf/comm_twds_coh_str_4_eara_en.pdf (15 Dec. 2008)
[3] See for example http://www.miljomal.se.

agriculture and forestry sectors will get higher costs than today. The emissions of green house gases from these sectors are very high. Renewable energy and energy effectiveness are favoured.[4]

One possible way to decrease the use of fossil fuel, at least at the local small-scale level, is to use horses for the kind of work where they can replace tractors and other machines driven by fossil fuel. The increasing number of and interest for horses in Sweden would be a suitable situation for highlighting the possibilities to use them in different kinds of work as a contribution to decrease the use of fossil fuels. Horses also have lesser emissions of the aggressive greenhouse gas methane than ruminants but can perform the same environmental work through grazing and thereby stimulating the biodiversity and open landscapes.[5]
A recapitulation of the use of working horses can be a small but important step in the work to combat climate change.

The Swedish University of Agricultural Sciences (SLU) and Swedish Farmers Union (LRF) has started a cooperation called *Climate School (Klimatskolan)*, with the purpose to increase knowledge in environmental and climate related issues in the context of agriculture. This Master thesis is part of the framework of the *Climate School*.

1.1 Problem background

Today you can see an increase in the use of horses in different work activities in municipalities. They can work in places where a tractor can't, and at the same time horses are not as harmful to the environment. (That makes it easier to reach the environmental goals within some municipalities.) An increasing number of municipalities in Sweden use horses for work in forestry, gardening, and garbage collection and to spread sand on the roads in the winter. One actual example is the municipality of Köping where horses in week 5 year 2009 that worked in the forest[6]. Another example is Stockholm where they presently use a horse for garbage collection[7].

In a concept called "plockhygge" (environmental friendly clear-cuts in forestry) horses are also used. Instead of harvesting the forest when they are considered mature, you could wait ten years and let the trees grow larger. This is also good for the carbon dioxide storage. Longer periods between harvests make it more difficult to work with tractors without damaging the trees. That is not the case with horses. The use of horses is more gently to the forest with lesser damage to the trees. Also the use of horses could be motivated with consideration to the mitigation goal[8] for forestry industry. The forest industries in Sweden have agreed to decrease the use of fossil fuel in transportation by 20 % in year 2020. The forests are getting even more attention concerning biodiversity and tourism, and that would also support the use of horses in smaller local forestry to increase the possibility to use the same forest for multiple purposes.

Also worth to mention as part of this former concept is the one called "organic farmers" which brands are marked with a label indicating that horses are used in the production process

[4] En sammanhållen klimat- och energipolitik, prop.2008/09:162 och 163. Swedish Government
[5] Steinfeld et.al. 2006
[6] http://www.koping.se/kopingtemplates/Page.aspx?id=20865
[7] Camilla Linder, LRF.
[8] Goals agreed by forest industries in Sweden.

instead of tractors. In this respect, there is one good example of a company in Uppsala that succeeds with this and markets their products with their own shelf's in the food store COOP. True organic farming should not use fossil fuel in the production and that is why horses could have a central role in organic farming.

One main thing that LRF pointed out was that in the last years the concern of the environment by the common public has raised significantly. The interest in organic products and environmental friendly production methods is very high. One reason for that is probably the awareness of the climate change global warming. People, in general, start to think more about how to be more "climate smart". They start for example to think more about how they travel. "Old fashion" ways of travelling starts to get more popular; for example travelling by horses to discover the landscape.

When I discussed the topic of my Master thesis with LRF, they were interested to get information on the potential use of horses as a labour, for example in forests, in municipalities etc for e.g. more efficient work in the forestry or municipalities that want to be "climate smart". There have been many questions to LRF concerning this issue so this topic is of high interest to LRF. A part of the problem is a survey over the demand for working horses in municipalities. Another question is under what conditions it can be profitable to use horses instead of tractors. The object is of course not to replace all tractors with horses. The project will focus on the present and potential uses of horses in local municipal activities where tractors and other fossil - driven machines are being used. The following questions were addressed for planning the study:

- *What is the demand and availability of working horses today?* Even if a municipality wants to have working horses, it is not certain that there exist proper educated horse drivers with the right equipments.
- *At what prices of diesel or labour cost is there an economic incentive to use horses?In other words: what happens if the price of diesel increases?*
- *If we take environmental "costs" into account; what are the effects?*
- *Are there other profits, economic or societal, when using horses within a municipality?* In short: to *what can a working horse contribute?*
- *Is there any potential for the working horse?*
- *Can it be economically competitive in some cases to use horses as labour work?*
- *If you set a value on the environmental negative effects caused by fossil fuels or negative effects caused by machines use in forestry, what would the result be?*

These questions could be encapsulated into one main topic and / or question; "*A future climate smart policy: Is there a potential demand for services by working horses in the Swedish municipalities?*

1.2 Aim

The aim of this Master thesis is to investigate the question: *Is there a potential for services by working horses in the Swedish municipalities?*
With help of this question this thesis should provide some insights and analysis on the feasibility and future of promoting or expanding this kind of activity with working horses.

2 Method

Different methods have been used to achieve the aim in the best way. Surveys are to prefere when you have many receivers. To get deeper in to one question or subject, personal interviews are preferable. The CBA was chosen to show how much environmental impacts cost.

2.1 Questionnaire

The study includes a questionnaire with municipalities if they have experiences in working horses and analyses of the results (economy, climate effects, and other benefits). An Internet survey was sent out to all municipalities in Sweden in order to examine their interest in working horses. In doing so, the ambition has been to get as many answers as possible. Existing and active working horse companies have been contacted to get their professional opinions about the subject. The interviews with municipalities and companies that offer working horse services have been done by telephone.

In this thesis both interviews and surveys are used. Depending on what that is desirable to know and to what extent, different methods are preferred. To create relevant survey- and interview questions two books were used (*Gillham 2008* and *Ejlertsson 2005*). On the whole, surveys and interviews serve different purposes. If a more large-scale investigation is desirable, surveys are often used. If a deeper understanding is sought, interviews are preferred. The main difference between a survey and an interview is that in the former the interviewee decides what to answer in the questions. In surveys it is most common to have alternative answers. In that way the answers of a survey can be easily presented in the form of percentages. All questions from surveys and interviews are shown in the Appendix.

E-mail survey

A survey was sent out by e-mail to all municipalities in Sweden to investigate the use and demand for working horses. The e-mail consisted of an Internet link where 10 questions were shown. Also included in the e-mail was a letter describing the purpose of the survey. After a few weeks a reminding e-mail was sent out to the municipalities that not had answered. As an Internet link is used, the responders will not have to mail back any answers.

After the survey was closed, ten random municipalities that had not answered were contacted by email. This email consisted of a smaller number of questions than the survey and they were asked if they have used horses, if they could imagine themselves doing it and if they knew about the possibilities.

E-mail interviews

Personal e-mail interviews were done with some selected municipalities that have used, or use, working horses and also to some working horse companies. These questions are more in depth than the survey questions. Municipalities and companies were first contacted by phone and asked if they would be interviewed.

Personal interviews

A personal interview was done at a visit to a working horse entrepreneur. This interview could be called a half - structured interview that is said to be the most important type of research interviews (*Gillham, B. 2008*). It consists of questions but gives at the same time the respondent his own answering space. The questions should be formulated so they can lead to a conversation and not only “yes” and “no” answers. It can also be an advantage if the responder likes to talk much about the subject.

2.2 Cost benefit Analyze (CBA)

The economic analysis will include a cost benefit analyze (CBA) of the use of horses in Swedish municipalities. CBA is a good way of comparing benefits and costs to the society as a whole when the environment is taken into account. In this thesis, for example, it means that price will be set for the CO_2 emissions. The benefits and the costs have been compared to see whether it is economically favourable for municipalities to use working horses instead of fossil fuel driven tractors. Economical costs and benefits have been compared with environmental costs and benefits.

3 Background

This chapter describes the relevant background. It starts with some history about working horses and then some fact about the municipalities in Sweden. After that the environmental and climate issues are described, followed by when working horses are preferable in work..

3.1 Working horse history

When the horse first was put in to work it delivered faster work, foot safety and lively as good qualities. Strength was not that important since bullocks where used and preferred in heavy work as ploughing. Their steady and calm walk and pure rough strength made them particular suitable for the heavy ploughs, that barely changed since the Middle Ages to 18th century. When speed was not an issue, bullocks were superior. Until the Second World War it was not unusual in Europe to see team of six bullocks in front of a plough. After the bullock had worked for about four years, the farmer often fattened them and slaughtered them. In this way he got double dividend. It is believed that until 17th century most of the horses being used were too light to do other things than to pull carriages and harrows. There were particularly used to harrow land because, unlike bullock, did not mind the noise of the harrow. (Churchill et. al. 1997).

Not until 18th century the draft horse got its real position in agriculture. Factors such as better drained soil, pasture and breeding methods resulted in more and stronger working horses. At the same time the new revaluated agriculture equipments became more effective and adaptable animal compared to bullocks. The golden days called for the working horse in agriculture were from the end of the 1800´th century to the First World War in 1914. The development of the engine and the increased production of oil lowered the fuel price and thereby affected the use of the working horses. Agriculture became more and more mechanized and the use of horses declined. Not until the Second World War they started to use them again, at least in Europe. Horses began to take on their old assignments as for example working in agriculture, city transports, barge towing etc. Then the fuel price decreased more and the use of working horses declined. (Churchill et. Al. 1997).

During the early 70´s oil crisis, people again started to argue that working horses, in spite of the mechanical development, had a place in the economy. Farmers started to wonder whether they were over mechanised, if their tractors and harvest threshes had bigger capacity than they needed. It was though noted that in some work and in some soils, the horses were more effective to use than tractors. (Churchill et. al. 1997).

Today people again start to think about the possibilities of using the working horse. A reason for that are perhaps the effect of global warming and the high fuel prices. Another reason is that the horse is less harmful to the land and in some cases more efficient than for example tractors. Forest workers in Canada and Australia often prefer horses when they for example do logging transport with forwarders. That is because the horses are suitable in difficult areas. Nowadays it is also more common to see horses work in European cities and just as show off. In many poor countries today, the horse is one of the most valuable assets for many farmers. (Churchill et. al. 1997).

3.2 The Municipalities in Sweden

In Sweden there are 290 municipalities. They have their own self-government with responsibility for different activities.[9] The municipalities together with the county councils and the regions employ more than one million people. This is about 25 percent of total employment. (SKL 2009).

The 290 municipalities have much more responsibility in public services compared to other countries. 75 percent of the activities in the municipalities are related to the well fare sector. The responsibilities of the municipalities are as follows:

- Health and environmental protection
- Social services.
- Water and sewerage.
- Childcare and preschools.
- Emergency services and emergency preparedness.
- Elderly care.
- Refuse collection and waste management.
- Support for the physically and intellectually disabled.
- Planning and building issues.
- Primary and secondary education.

Other areas on a voluntary basis can for example be:

- Energy.
- Industrial and commercial services.
- Leisure activities.
- Cultural activities. [10]
- Housing.

(SKL 2009)

Many municipalities have adopted environmental goals. Municipal environmental goals exist in about half of Sweden municipalities in different programs or projects.[11]

3.3 Environment and climate issues

The amount of CO_2 in the atmosphere has increased in the last 30 years. That is as a result of the increased discharge of green house gases. [12]

Sweden has 16 environmental objectives. According to the Government Offices of Sweden, *environmental policy is an important part of the Government´s sustainable development policy*. The main goal with this policy is to pass on to the next generation a society in which the major environmental problems in Sweden have been solved. Nature conservation should be seen as a part of our welfare and is an important component of action for a sustainable

[9] Gotland is on exception. Here the municipality also responds for tasks that in normal cases a county council would have.
[10] Apart from libraries, which are statutory responsibilities.
[11] http://kikaren.skl.se/artikel.asp?A=6418&C=2485
[12] http://www.naturvardsverket.se/sv/Nedre-meny/Fragor-och-svar/Klimat/Kan-orsaken-till-okad-koldioxidhalt-i-atmosfaren-vara-okad-uppvarmning/

society *(Swedish Government Offices, 2009)*. To facilitate the environmental work, Sweden has 16 environmental objectives. Four of them are relevant to the horse industry:

- Zero Eutrophication.
- Good-Quality Groundwater.
- A Varied Agricultural Landscape.
- A Rich Diversity of Plant and Animal Life.

(*Hästen i politiken, 2006)*

3.3.1 Climate policy in Sweden and EU

The Swedish Government has given the climate issue a top priority. They have decided that a reduction in emissions of carbon dioxide and other greenhouse gases must be done. Almost five billion SEK is invested with the purpose to reduce climate impact and adaption to climate change between 2009 and 2011. An important part of Sweden's environmental work is cooperation with EU and accomplish EUs climate targets. The targets and measures are based on scientific findings. *(Swedish Government Offices, 2009)*. The Swedish Government has also recently presented a two-part bill to the Parliament where proposals are made to substantially decrease of the emissions of carbon dioxide and the use of fossil fuels.[13]

3.4 Use of horses

The horse is included in an ecological cycle. It has an excellent way of grazing in areas that have thick and overgrown weeds. Horses also work as a "vacuum cleaner" and help to clear out parasites that come from other animals. As pasture animals, horses also help to maintain the pasture, hence benefitting plant species and contribute to open landscapes. In other words, this shows that horses have positive impact on biological values. Pasture land often contains traces from previously generation land use, like for example cairns, stone field farms, arable land, cultivation etc. This is a kind of cultural heritage that has high recreation- and aesthetic experiences. If pasture animals does not keep the areas open, all of this will disappear and loose its value, which leads to a less attractive landscape. In other word there will be more over grown green areas! *(Hästnäringens Nationella Stiftelse. 2008)*

The horse can represent an environmentally friendly alternative when it comes to managing parks and nature sensitive areas. Some examples are:

- Lawn mowing managing
- Managing near population centre forest
- Managing other grass plots
- Irrigation
- Snow clearing
- Garbage collection
- Managing sidewalks and fitness paths.

(Hästnäringens Nationella Stiftelse. 2008).

The type of work the horses can performe depends much on the time of the year. An annual scheme can be:

- Summer: Lawn mowing, park managing, irrigation, garbage collection, tourist- and event driving.
- Autumn: Garbage collection, park managing, carriage rides for the public.

[13] En sammanhållen klimat- och energipolitik, prop.2008/09:162 och 163. Swedish Government

- Winter: Forest work, snow clearing.
- Spring: Park managing, managing of sidewalks and fitness paths.

(Hästnäringens Nationella Stiftelse. 2008

There are no direct limitations of what a horse can perform. Apart from the work that they can perform, the horse also can be a positive picture in the society for inhabitants as well as for the tourist industry. *(Hästnäringens Nationella Stiftelse. 2008).*

3.4.1 The horse industry

It is not really known the exactly number of horses in Sweden today. The latest investigation was done in 2004 which indicated the existence of 283 100 horses *(Jordbruksstatistisk årsbok 2008)*. Since there are probably horses that are not registered, the number can even be higher. The horse sector has an important role in the Swedish society today. It creates social fellowship and activities in our spare time. It also benefits history, culture and engagement. The horse sector also has an economic impact when its turn over is at least 20 billion SEK every year[14]. The contribution to the gross national product (GNP) was eight billion SEK, which is about 0.35 percent of GNP. As a comparison, the agricultural sector contributed with 0.68 percent. The tax income is more than 4 billion SEK. Gambling in harness- and horse racing generates a lot of money. Half of the direct turnover, about eleven billion SEK, comes from this latter kind of activities. The remaining billions come from activities on harness- and horse racing, riding, breeding, horse tourism, commodities and services and agriculture. During the last decades hippology in Sweden has developed and become broader. More alignments have arisen and never before has it been so many different horse races in Sweden. (*Hästnäringens samhällsekonomiska betydelse i Sverige. 2004*)

As the typical working horse company is relatively small and is functioning on a part- or full time basis; the tax question is important. In many cases the multitude of tax rules becomes an obstacle for companies. Therefore it is important to offer good advice to horse companies. (*Hästnäringens Nationella Stiftelse. 2008*). Since the horse sector mainly is represented by small companies and often in cooperation with agricultural activities, it is an important contribution to retain a viable countryside. (*Nationella Stiftelsen för Hästhållningens Främjande. 2003/2004*).

Prices that are charged by working horse companies differ a lot depending on what work that is performed. Most common is to use a fixed cost per hour for the work and then add compensation for travel. According to Lars-Göran Göransson (chairman of Skogshästen[15]) a fixed cost between 300 – 450 SEK per hour is often charged. Compensation for travel is on average recommended 50 SEK / 10 kilometres. They also charge 350 SEK per hour when the activity needs extensive preparing of equipment. All prices mentioned include social expenditures. (Conversation by phone 2009-03-10, webpage of Skogshästen).

3.4.2 Horses used in work

Basically all races of horses can be used in work, but there are some specific breeds that are more suitable than others. In Sweden it is common to use *the Ardenns Horse, the North Swedish Horse* and *the Norwegian Fjord Horse*. Also some crossbreads with these breeds can bee seen as working horses. The resemblance with these breeds is that they are strong and have much stamina, overal a very healthy horse. Also they are very steady on their feet and are known for being willing to work. The fact about the working horses mention in this part

[14] Includes bets in horse- and harness racing.
[15] An association that works for working horses in Sweden.

comes mostly from *Churchill, P et.al, 1997*. As can bee seen in the pictures below the Ardennes Horse are a bit rougher than the other two breeds mentioned in this text.

The Ardennes Horse

The Ardennes Horse has an average height of 155 cm and can have the colours black, brown, bay or gray. This race was developed for about one hundred years ago through a crossbread between the Belgian Ardennes and domestic mares. The Ardennes is known for the calm personalities and for their enormous strength.

Photo: Camilla Källman

The North Swedish Horse

The North Swedish Horse has an average height of 154-156 cm and can have many colours, for example black, brown, bay, dun and yellow brown. They are relatives with the Dølahest that comes from Norway and are very similar to each other. Before 2 000´ th century the Nort Swedish Horse was breeded with many different races. It was in 2 000´ th century it became its own race and got the name. The typical North Swedish horse is medium-sized, muscular with quite a long back. The North Swedish horse also exists as more a lighter model and they are used much in harness racing.

Photo: Ingela Allansson

The Norwegian Fjord Horse

The Norwegian Fjord Horse has an average height of 142 cm and has dun colours in brown, white, red, grey and yellow. They are known for their white, short cut manes with a dark stripe in it. It is one of the world oldest races which has been breeded in centuries and comes from the mountains in western Norway. The typical Fjord horse has a small head, short, strong neck and a powerful, compact body. Fjord horses are known for their personalities and often try to please the owners.

Photo: Camilla Källman

3.4.3 British horse loggers

Working horse companies exist not only in Sweden. One example of a country which has much equipage is Great Britain. *The British Horse Loggers (BHL)* is an independent organisation that represents horse logging[16] contractors and their supporters in Britain. They can be compared to the Swedish association *Skogshästen*. They want to show and inform how horse logging can be a sustainable industry for the 21st century, benefiting our woodlands and make sure that traditional skills and knowledge are not forgotten. In Britain horse loggers contractors are employed all over the country. There are many contractors in Scotland, England and Wales. The most common is that the horse logging contractors work as self employed, but some are also work on estates and on long term contracts. They work in state forests, for statutory agencies, for the woodland and wildlife trusts, national and local bodies and authorities, voluntary groups and for private owners of large and small woodlands. In other words they work in many processes of timber work; from small twigs and firewood through thinning in soft and hard woods up to final crop are some examples.

3.4.4 Allergies

A constantly recurring question is about allergies horses cause. Therefore it is worth mention some about it. The knowledge about how allergies from horses are spread in our environment is highly limited. At the moment there is research going on with a purpose to increase the knowledge about how horse allergens is spread in the environment. Results from research show that the content of horse allergen in outside air decreases drastically on a relative short distance from the horse. The latest results show that the allergens decrease substantial already at 30-50 metres away from the horse. The main issue is instead the fact that people take the allergens with us to different inside environments where animals usual does not exist. For example in trains, busses, homes, schools etc. This concerns all allergens, not only those from horses. *(Hästnäringens Nationella Stiftelse. 2008)*

[16] Extraction of timber with the use of horses with a wide range of traditional and modern implements. *http://www.britishhorseloggers.org*, 2009-04-03

4 Cost Benefit Analysis (CBA)

This chapter shows the result of the Cost Benefit Analysis (CBA). Before the results are shown, a introduction about CBA is presented.

4.1 Foundations

A Cost Benefit Analysis (CBA) means measuring, adding up and comparing all the benefits and cost of a public project or program. In other words; it is a tool of public analysis. A Cost Benefit Analysis has the incentive to consider all of the costs and benefits to society as a whole. Therefore it can also be called *Social Cost Benefit Analysis*. The mathematical term for this can be $NSB = B - C$ and means that net social benefits (NSB) equals social benefits (B) minus social costs (C). This measures the value of theproject or program. There exist two major types of cost-benefit analysis. The first one is called *ex ante* CBA and is done when a project is under consideration. The second one is called *ex post* CBA and is done at the end of a project when all costs are seen as *sunk costs*[17]. In this master thesis an ex ante CBA will be done. There are also two more types of CBA that occur in some cases. The first one is called *in median res* when studies are performed during the course of the life of a project. The second one compare an *ex ante* CBA with an *ex post* CBA or *in medias res* of the same project. *(Field, 2006).*

In a CBA there are mainly four important steps[18]:

1. Specify clearly the project or program.
2. Describe quantitatively the inputs and outputs of the program
3. Estimate the social costs and benefits of these inputs and outputs.
4. Compare these benefits and costs.

(Field, 2006)

In each step there are a set of component steps which are described in more detail below.

4.1.1 Specify clearly the project or program

CBA can be seen as a tool of public analysis. Here one should have in mind that there exist many different publics and therefore different CBA will vary from each other. One example is if a CBA is done for a city or regional planning agency that should investigate a local environmental program. The focus would be on benefits and costs connected to people that live in those areas. Another example would be if a CBA is done in regard of global environmental issues. Then the focus would be worldwide.
Step one also includes key definitions as location, timing, groups involved, connections with other programs etc. CBA is done in two primary types of public environmental programs: *Physical projects* and *Regulatory programs*. The first one involves direct public production as for example coastal restoration projects, habitat improvement projects, land purchase for preservation etc. The second one involve enforcing environmental laws and regulations, for example pollution-control standards, technological choices etc. *(Field, 2006).*

[17] Costs are unrecoverable past expenditures.
[18] Note that it can be divided into more steps!

4.1.2 Describe quantitatively the inputs and outputs of the program

The second step is to determine the full range of consequences that are generated from it. This involves prediction of future events and it requires a good understanding of issues as for example future rates of technological change, growth patterns etc. It can be quite difficult for regulatory programs to estimate this. Much because it involves predicting how members of the regulated community[19] will respond to new regulations.

4.1.3 Estimate the social costs and benefits of these inputs and outputs

The third step involves placing values on the consequences. Benefits and costs are estimated in comparable terms. This is usually done in monetary terms, but can be done in any unit that fits. When measuring in monetary values it does not mean in market-value terms. That is because many cases concerns effects that are not directly registered on markets, especially on the benefit side. To make all of the impacts of a project or a program comparable among themselves and with others types of public activities, it requires a single unit to translate these impacts. *(Field, 2006).*

4.1.4 Compare these benefits and costs

In the fourth and last step, benefits and costs are compared. This can be done in different ways. One way is simply to take the total benefit – total cost = net benefit. Another way is to use a benefit-cost ratio. This is, as it sounds, the ratio of benefits to costs. Benefits and costs can also be comopared by taking the amount of benefits produced per SEK of costs. *(Field, 2006).*

4.2 Limitations

There are some limitations with CBA and there are two types of cases when it can be inappropriate to use. Technical limitations can make it difficult, or even impossible, to quantify and monetize relevant impacts as costs and benefits. When there are limitations in theory, data or analytical resources it can be impossible to measure and value all impacts of a policy. Other limitations concerns goals other than the efficiency matter. Other goals than efficiency can be opportunity or equality, equality of outcome, expenditure constraints, political feasibility and national security. Efficiency is almost always one of the most relevant goals in policy analysis, but these above mentioned goals can sometimes be just as important as efficiency but hard to reach. *(Field, 2006).*

4.3 Willingness to pay

How to interpret costs and benefits also deals with the willingness to pay. A definition of willingness to pay may be as follows: "*the maximum amount of money that a consumer would be willing to pay to avoid a price increase is the amount required to return her to the same level of utility she enjoyed prior to the change in price" (Boardman et.al. 2001).* This can, for example, be interpreted as the willingness to pay to avoid nature disasters. The willingness to pay depends much on our preferences and what relation we have to the problem. This means that for some people it can be worth paying some extra to achieve a certain goal. For others it can be the opposite way. In the same way that people have opinions about things, they also can be indifferent. In that case the outcome does not really matter so much for them. It should be said that all this can come in different levels. The environmental problems that are in focus

[19] Power plants, building contractors etc.

today are one example that people, business etc are motivated to pay a bit more for in order to avoid them. *(Boardman et.al,2001).*

4.4 CBA examples and health

Something that is hard to set figures on is how the environment, like forests, affects people´s well - being. *The Forrest Commission in Scotland* writes in a report that there is growing evidence that trees and woodlands can have a role to play in improving people's health and well - being[20]. They have divided the benefits into three types:

- Physical well - being: the ability to exercise in a pleasant environment (which can lead to more exercise).
- Psychological well - being: stress reduction, mood improvement and restoration in natural environments.
- Social well - being: Participation in health intervention projects that makes people involved and develop social networks (example walking schemes).

A real example can be mention about the country Scotland. When Scotland did a rough estimation for the annual value of health benefits of their woodlands, it was between £10 million and £111 million at 2007/08 prices, depending upon the assumptions being used.[21]

CBA has become a common tool used to examine environmental questions, not only in Sweden. One article in *The Oxford Review of Economic Policy*[22] is about how the use of CBA in British environmental policy has gone through several stages. At early stages, CBA tended to ignore environmental impacts. Later on, it became more common to use by government departments, the Environmental Agency and other agencies that gives advice to government.

Ellen Moons from the *Katholieke Universiteit Leuven, Faculty of Economics and applied economic science*, did a CBA to analyse the location of new forest land.[23] She made use of certain assumptions. For example, that all newly created forests consist of oak and ash trees and the time period is 200 years. She found that when carbon fixation, recreation and non-use values are included, the combination does matter for the results. This is only one of many examples of a are and subject where a CBA can be of use.

4.5 Applied CBA- working horse example

This CBA follows the four steps described earlier. It can be seen as an *ex ante* CBA, as a physical project under consideration. Professor Iwan Wästerlund that works at SLU in Umeå points out that it is very hard to set numbers on advantage and disadvantage concerning working horses. Therefore, several assumptions must be made. Also, there are many activities that can be performed with the help of working horses. This CBA focus on one specific activity that is common when working horses are included in municipalities..

According to the literature all benefits and costs of a project should be taken into account. In this particular example there are some aspects that have not been included in the calculations,

[20] http://www.forestresearch.gov.uk/pdf/fcrn102.pdf/$FILE/fcrn102.pdf
[21] http://www.forestresearch.gov.uk/pdf/fcrn102.pdf/$FILE/fcrn102.pdf
[22] Cost benefit analysis and environmental policy.
[23] http://www.econ.kuleuven.ac.be/ew/academic/energmil/downloads/ete-wp02-05.pdf

because of the lack of the numbers. One example of this is social aspects and benefits from being around horses. There are research showing that horses (and animals overall) have a positive influence on people[24]. Also aspects like keeping the landscape open are hard tod set a number on. It can also be difficult to set numbers on the negative side, for example allergies and the cost of that. One thing that is central for this study is the environmental impact. The CO_2 emissions are a negative aspect and a central part of this CBA example and there fore it should be included. The cost for CO_2 has been valued as the carbon dioxide tax.

4.5.1 Specify clearly the project or program

The activity chosen for this CBA is to drive out timber. This is a common activity where working horses are used. For this activity to be profitable, the distance to drive out timber a storage area should not be too long. One optimum distance is 100-300 metres *(Göransson, 2009)*, which has been taken into consideration into these calculations. This activity is today normally done by forwarders. The forwarders are said to work relative faster than a horse, but are heavier than a horse equipage, which results in more damage to the ground.

The cost to restore the ground that the tractors have damaged can vary a lot depending on the time of the year. It also depends on the type of soil. Here it is assumed that the forest consists mainly of spruce and pine, and is located close to population centre and categorized as a sensitive area. The trees that are cut are assumed to be between 30-60 years old[25].
As different size of forwarders can be used, it is fundamental to see how the costs of these differ. According to the chairperson of *Skogshästen* the same work that the horse performs, often is done by a forwarder (with a tractor) that can load twice as much. The forest area where the horse is most suitable is often too dense for bigger forwarders to work in. In this CBA forwarders that can load 14 and 7 m^3 of wood respectively are chosen as examples. The forwarder that can load 7 m^3 is the one that is best comparable to the horse. In the case when forwarders can load 7 m^3 per load, it is calculated with both 1.5 and 2 loads per hour.

Whether to include taxes or not in the calculations can be discussed. From a municipality perspective it can be of interest to get the total cost and the environmental impact from the activity. The municipality is the “buyer” of a service and will of course have a service made as cost optimal as possible.

When creating a CBA that should calculate the “net social value”, taxes can be viewed as only a transfer within the country that does not directly affect the municipal economy. The tax on the fossil fuels is a state tax. In the long run a decrease in the fossil fuel consumption will lead to a decrease in tax income for the state. Viewed in a national economy perspective this needs to be balanced by other ways to increase the income for the state to keep the same welfare. Other ways are cut - downs in certain areas or savings. This is discussed in a Swedish ministerial report but as it is stated in the recently presented climate and energy bill, the overarching political goal is to decrease the emissions of greenhouse gases.[26,27] If this scenario is realistic it will probably take many years and it should be enough time to adapt.

The tax for diesel and petrol is divided in two parts; one energy tax and one carbon dioxide tax. In this calculations the total diesel tax is set to 4.16 SEK / litre, were about 2.88 SEK is

[24] See for example *Hästen som terapeutiskt verktyg* and *Hästens roll för samhälle och lantbruk.*
[25] In consultation with Professor Iwan Westerlund, SLU Umeå.
[26] En sammanhållen klimat- och energipolitik, prop.2008/09:162 och 163. Swedish Government
[27] Effektivare skatter på klimat- och energiområdet. Ds2009:24 (Finansdepartementet/Ministry of Finance)

carbon dioxide tax and 1.28 SEK is energy tax. The tax for petrol is set to 5.29 SEK / litre, were 2.95 SEK are energy tax and 2.34 SEK are carbon dioxide tax.[28,29]

I have therefore not made any calculations related to the tax part of the used fuel as it does not influence the purpose of this study. Of course does every litre fossil fuel that not are used mean a decreased tax income for the state, but it is line with the Swedish environmental goals and the political climate and energy road map. Each litre of lesser used diesel will e.g. decrease the tax income for the society by 4.16 SEK plus VAT.

The table below summarizes factors that are measurable or not for the activity chosen and can also be related to other activities performed by working horses.

Table 1: Factors that are measurable or not when working horses are used.

	Measurable	Not measurable
Load capacity, horse	X	
Load capacity forwarder	X	
Work capacity, horse	X	
Work capacity, forwarder	X	
CO_2 emissions from fuel	X	
Fuel cost	X	
Fuel consumption	X	
Restoration cost	X	
Value of being around horses, "well – being".		X
Horses affect on health		X
Increased allergy risk or not		X
Value of keeping the landscape open		X

Appendix 1 shows a detailed description of costs for working horse contractors and forwarders contractors.

4.5.2 Describe quantitatively the inputs and outputs of the program

The CBA is based on several assumptions and average values. No actual measures have been made. The calculations and results can therefore not be looked upon as "exact" but give a good indication of the economic activity when using a horse equipage or tractor forwarders. Concerning the possible positive health aspect from horses, no figures have been found that really shows the economic value of "being around horses". However, there are studies that show that horses have a positive health effect on people[30].

Basic facts used for the calculations are shown in table 2. The total cost/h for a forwarder includes all costs (fuel, labour, tax etc.) The cost for restoration of damaged ground is usually covered by the forest owner. The restoration cost for ground damage has only been calculated for forwarders because a horse equipage is often used to avoid this damage or reduce them significantly. Therefore, the repair cost from horses is assumed to be zero in the calculations. The fuel consumption for the horse equipage depends on the motor driven crane.

[28] Joakim Skottheim, The Agriculture and Forestry Division, Ministry of Agriculture.
[29] Vilken koldioxidskatt krävs för att nå framtida utsläppsmål? SIKA PM 2008:4
[30] For example *Hästen som terapeutiskt verktyg*.

Table 2: Basic facts used for CBA calculations

	Load capacity (m^3)	**Loads/h (m^3)**	**Max. capacity/h (m^3)**	**Fuel consumption/h (litre)**	**Cost for restoring damage /m^3 Skr**[31]	**Total cost, SEK/h**[32]
Working horse	3[33]	2.1	6.3	1 (petroleum)[34]		400[35]
Forwarder	7[36]	1.5[37]	10.5	11 (diesel)[38]	3	750[39]
		2	14	12 (diesel)	3	750
	14	1.5	21	13 (diesel)	3	750

Table 3 shows the different facts used for carbon dioxide calculations.

Table 3: Basic facts carbon dioxide (CO_2)

	CO_2 produced	**Cost, 1.50 SEK/kg**[40]
1 litre petroleum	2.77 kg[41]	4.155
1 litre diesel	3.03 kg[42]	4.545

Compared with the Swedish carbon dioxide tax for 1 litre of diesel, the commonly used cost for 1 kg emitted carbon dioxide gives a figure that exceeds the actual tax (2.88 SEK)

4.5.3 Estimate the social costs and benefits of these inputs and outputs

Table 4 shows the results for the costs. To make a the figures comparable they have been calculated as per hour and per m^3. The total cost for a horse equipage is lower than for the lowest capacity forwarder but is slightly higher for the 14 m^3 load. The 21 m^3 forwarder has a significantly lower total cost.

The total fuel consumption is highest for the 21 m^3 forwarder (table 4) but calculated as litre per h and m^3 it is most efficient. The very low fuel consumption for the horse equipage is significantly lower compared to all forwarders.

[31] Professor Iwan Westerlund, SLU Umeå refers to a thesis done by Jansson, H. 2002: *Avverkningar under tjällossningsperioden – är de på uthållig nivå.* Studentuppsatser i skogsteknologi nr 54.
[32] Includes labour cost, fuel, tax etc.
[33] Lars – Göran Göransson, *Skogshästen*.
[34] Professor Iwan Westerlund, SLU Umeå.
[35] Average.
[36] Professor Iwan Westerlund, SLU Umeå.
[37] Professor Iwan Westerlund, SLU Umeå.
[38] From *The Forestry Research Institute of Sweden*. Depends if a medium-sized or large forwarder is used.
[39] Professor Iwan Westerlund, SLU Umeå. Includes machine cost, interest, service/reparation, direct costs as lubricantion, diesel, driver salary, travelling, cabin. A bigger forwarder can even take about 800 SEK / h.
[40] Magnus Nilsson (*SSNC)*, http://www.nordpool.com/, http://www.pointcarbon.com/.
[41] http://www.etanol.nu/forbrukning.php, also *SPI (the Swedish Petroleum Institute).*
[42] http://www.etanol.nu/forbrukning.php, also *SPI (the Swedish Petroleum Institute).*

Table 4: Calculations – costs for transportation

	Max. capacity/h (m^3)	**Total cost[43], SEK/h x m^3**	**Fuel consumption, litre/h x m^3**	**Fuel cost SEK/ h x m^3 (11 SEK/litre)**	**Total cost, incl. restoration SEK/ h x m^3**
Working horse	6.3	63.50	0.17	1.87	63.50
Forwarder	10.5	71.40	1.05	11.55	74.40
	14	53.60	0.86	9.46	56.60
	21	35.70	0.62	6.82	38.70

Table 5 displays the results for the emitted carbon dioxide. The emission of the green house gas is fundamental higher for all forwarders. The emissions from the 21 m^3 forwarder are high but calculated as kg/h and m^3 it is the most effective forwarder. As it is shown the emissions from the horse equipage are very low.

Table 5: Calculations - carbon dioxide (CO_2) emissions and costs

	Max. capacity/h (m^3)	**emitted kg CO_2/h**	**emitted kg CO_2/ h x m^3**	**emission cost, SEK/ h x m^3**
Working horse	6.3	2.77	0.44	0.66
Forwarder	10.5	33.3	3.17	4.76
	14	36.4	2.60	3.90
	21	39.4	1.88	2.82

4.5.4 Compare these (benefits) and costs

To compare the costs for using a forwarder or a horse equipage, the formula $C = C_H - C_F$ has been used were C_H is the cost for the use of working horses and C_F is the cost for the use of a forwarder. The table below shows the net value of cost by using working horses compared to a forwarder in that special category. A positive figure means that it is more expensive with a working horse and a negative one that it is cheaper.

Table 6 summarises the differences between the horse equipage and the forwarders with different load capacities.

Table 6: Summary of the cost

SEK/m^3	**Working horse, 3 m^3, 2.1 loads/h.**	**Forwarder, 14 m^3, 1.5 loads/h**	**Forwarder, 7 m^3, 1.5 loads/h**	**Forwarder, 7 m^3, 2 loads/h**
Total	63.5	38.70 (- 39 %)	74.40 (+ 17.1 %)	56.60 (- 11 %)

The transportation effectiveness for all forwarders is higher than the horse equipage except for the cost for the 10.5 m^3 which is 17 % higher compared to the horse. From a strict economical view the bigger forwarder used, the more cost efficient is the work done. The figures above show that a forwarder that takes 14 m^3 per load and 1.5 load / h is cheaper than both horses and the other forwarders.

The emissions from the 10.5 m^3 forwarder are approx. 720 % higher compared to a horse equipage. All forwarders will give a significantly higher contribution to emissions of carbon

[43] Includes labour cost, fuel, tax etc.

dioxide than the horse equipage. Even for the 21 m^3 forwarder the carbon dioxide emission is approx. 230 % higher than for the horse.

In figure 1 the relationships between emitted carbon dioxide/h and m^3 and maximum load forwarder capacity is shown. With the rough figures used there is a direct relationship between the three different tractor forwarders. An extrapolation shows that you need a forwarder with a capacity for about 32 m^3 per hour to reach the same low emissions as the horse equipage. Such big forwarders (about 16 -17 tons load capacity) belong to the biggest on the market and would be not recommendable to use in small scale forestry.[44] These bigger forwarders can not always work in, for example, dense forests. Most preferable is to compare a working horse equipage with forwarders that usual do the same work as the horses.

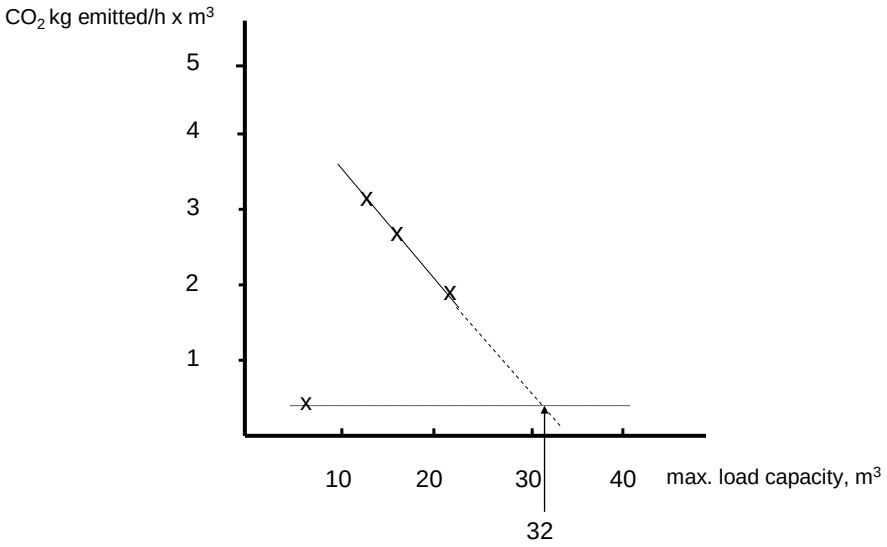

Figure 1: Relation between cost for emitted carbon dioxide (CO_2) (kg/ h x m^3) and maximum forwarder load capacity (m^3/h)

[44] http://www.deere.com/sv_SE/forestry/forestry_equipment/forwarders/machines/1710d.html

5 Survey results

This chapter will show the results from the survey and interviews.

5.1 The survey

The survey was sent out by e-mail to all 290 municipalities in Sweden. It consisted of an Internet link with ten different questions (see Appendix 1). The last five questions were intended for municipalities that were not using horses. The response that came back was more than expected; 199 municipalities out of 290 replied. The response rate is therefore almost 70 % . The response rate was already high the first time the survey was sent out and after the "reminder e-mail" more answers came in. A list of all municipalities that have answered can be seen in Appendix 4. However not all municipalities that answered did identify themselves.

The first question was if the municipalities at any time have used horses to perform work: forest work, mowe lawn, garbage collection etc. (figure 2). As can be seen in the figure 32.7 % have used working horses in some way and 67.3 % have not.

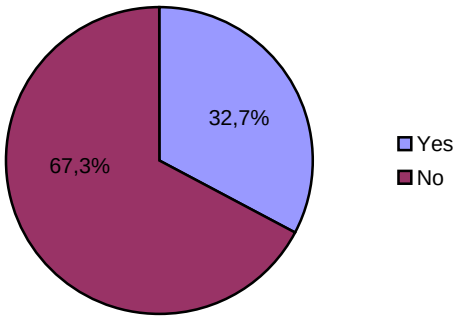

Figure 2: Have your municipality at any time used horses to perform work (forest work, mowe lawn, garbage collection etc.)?

Of those who use/have used horses the service "fell trees" (/drive out wood) is the most common (47.7%). After that come "look after parks" (24.6%), "lawn mowing" (18.5%) and "collecting garbage" (9.2%). There were some municipalities that have used horses to put sands on the roads, made roads for tractors or have horses as a part of the environmental policy.

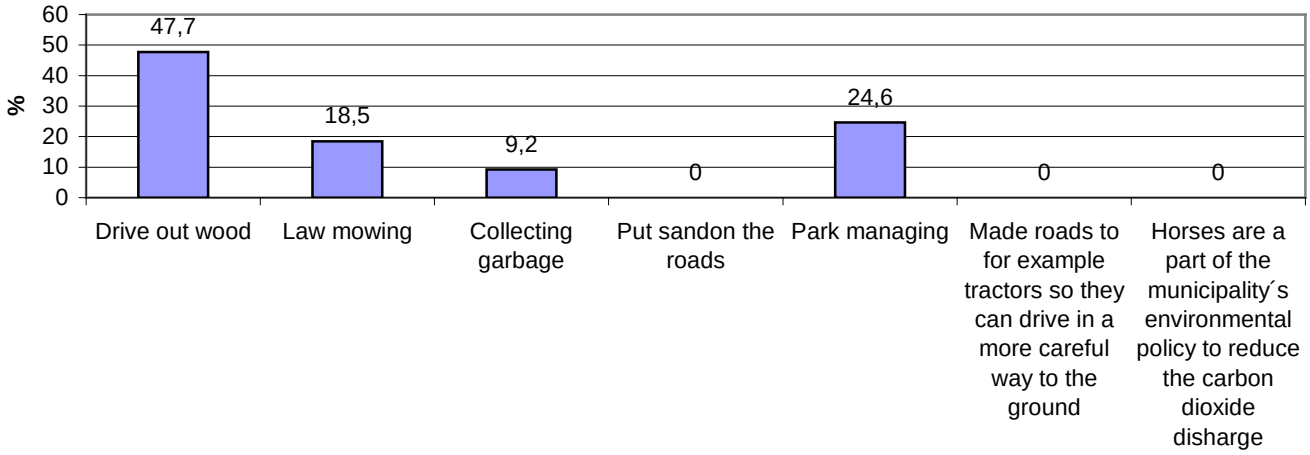

Figure 3: Activities with working horses in municipalities

Other services that have been/are used by the municipalities are:

- Agriculture work.
- Haymaking.
- Forestry in nature reservations.

Of the 32.7 % municipalities that have used/uses working horses, most common was to use between 1 and 2 horses. In most cases, the horse worked in pairs. The main reason for that is that the horses will be able to pull more. The cost is quite the same and varies between 300-450 SEK per hour. It also appears that many contractors were hired at a fixed price. The time a municipality contracted working horses varied. For example one municipality used one horse for 160 hours and paid about 55 625 SEK (about 350 SEK/hour). Another used 1-2 horses during one year and paid 120 000 SEK. This municipality has used horses for about six years and was very positive about it. It varied from one day to two months. A third municipality used two horses for 21 days and paid 10 350 SEK. Even though not many answered what they paid and just how long time they used horses, the interviews with the municipalities and horse companies verified the costs.

Of the 67.3 % municipalities that have not used working horse 34.4 % answered that it was something they could think of. 17. 9 % would not and 47.7 % did not know at the moment. One explanation to why 47.7 % did not have an opinion can be that there is a lack of knowledge in the municipalities today how they can use working horses and the understanding of how they can fit into an environmental policy. Some interesting showed up with this question:

- There is a lack of knowledge about the possibilities and positive aspects with working horses.
- There could be to long distance in large municipalities when there are not enough contractors. There fore they are afraid that the transportation cost will be high.
- In sensitive areas working horses could be of interest.
- Municipalities with nature reserves could consider using working horses.
- Working horses could be used more in forest, forest projects.
- Even if the municipalities want to use horses, the supply of well trained horses does not exist.
- The questions about using working horses have never been discussed.

- The use of working horses depends on the cost and availability.
- Working horses can be of interest if it is cheap and a driver is included.

The Municipality of Upplands-Bro has planned to use a contractor that has north Swedish horses for clearing in areas with oaks. The county administrative board in Upplands - Bro has made an inventory of trees that are included in a governments program (ÅGP). The area is needed to be cleared during a period of four years. A municipality near the city Örebro wants to use horses in a nature reserve that needs to clear out some large moraine and moss.

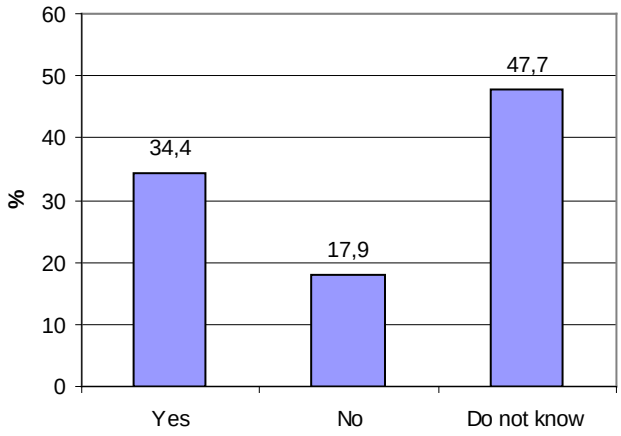

Figure 4: Are working horses something you could think of in your Municipality to use?

The survey shows that there are more municipalities, than the ones that have used/uses, that know about the use of horses for municipal services (fig. 5).

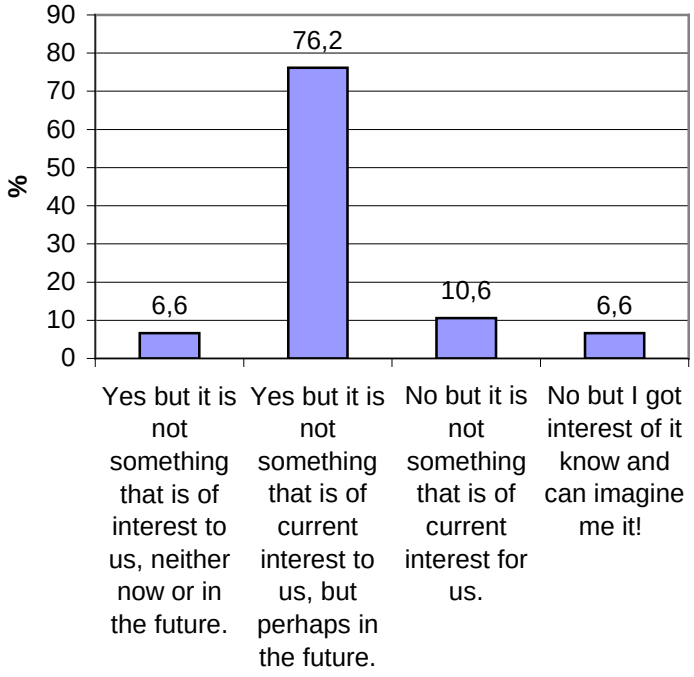

Figure 5: Did you know it was possible to use working horses in the municipalities?

As can be seen most municipalities that did not use working horses (76.2 %) knew about the possibilities and were positive to use them in the future. 10.6 % said that they did not know about it and had no really interest in it. 6.6 % did know about it but said that it is not of interest neither now or in the future. 6.6 % did not know but got interested in it after this survey!

The sixth question was about the reasons for working horses not being used as labour force in municipalities (figure 6).

The reason for working horses not being used is rather diverse. 27.9 % of the municipalities said that it is a time issue. 25 % said that the reason is money, 20.2 % lack of knowledge, 17.8 % no available horses and 9.1 % answered that there is a lack of interest. This question got many interesting comments summarized as follows:

- There are no horses they can use.
- No tradition.
- Lack of competence.
- No one has done marketing on their services.
- Allergies.
- The municipality owns only a small part of land.
- Takes more time with a horse compared with machines.
- Hard to judge the capacity of work and damage on green areas.

The most repeatedly comment was that there were not any horse companies that they know about.

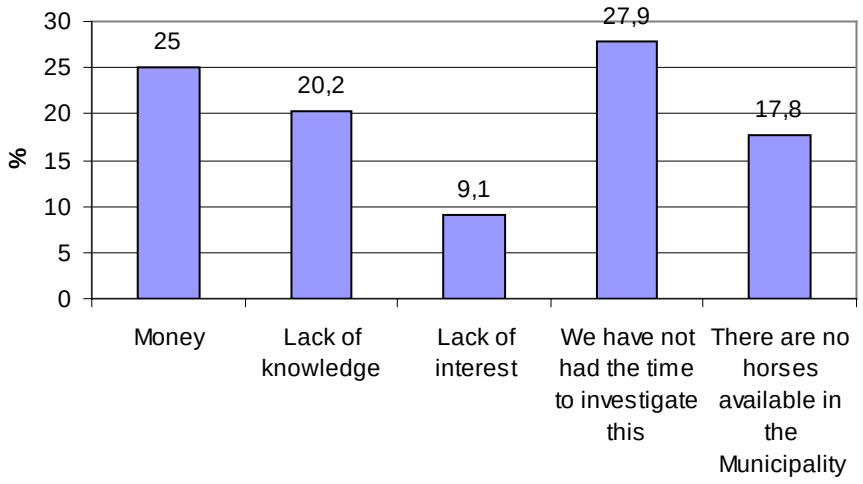

Figure 6: What is the reason / reasons that horses are not used as labour force?

About half (50.9 %) (figure 7) of all the municipalities that did not use working horses did not know if working horses would make their municipality's environmental work easier. 36.7 % said that it would make it easier and 12.4 % said no. In this question there were again comments about working horses would be good to use in sensitive areas and also as goodwill for so called "Eco Municipalities".

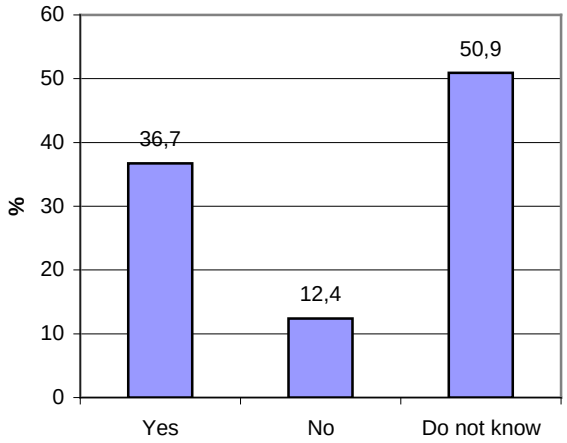

Figure 7: Do you think that working horses would make your municipality's environmental work easier?

The knowledge about working horses in the municipalities that did not use horses was quite even divided between having knowledge and not knowing (figure 8). 43.5 % said that there exists knowledge and 44.7% did not know. Only 11.8 % answered that there existed no knowledge. This latter answer reminds a lot of the one concerning if the municipalities that have not used horses believe that it could make their environmental work easier.

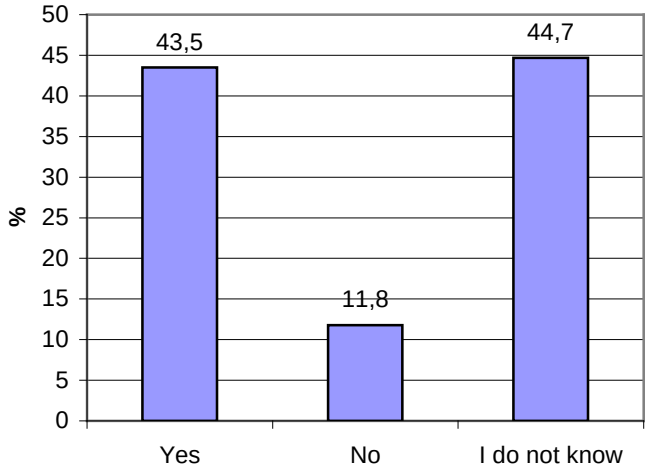

Fig 8: Are there people in the municipality that have knowledge about working horses if needed?

Here it was even divided between Yes (43.5 %) and "I do not know" (44.7 %). Only 11.8 % answered No. As in question 6 there are many municipalities that are not so familiar with this.

About 60.7% of the municipalities (figure 9) that not use horses are willing to pay equal for horses compared with motor driven equipments, if horses would be used. 24.8 % even could pay just a little more and 5.5 % could pay more. Only 9 % could pay less. Some interesting comments that arised from this question were the following ones:

- Present financial crisis makes it hard for someone to pay more.

- Problem with debate concerning allergies.
- Willingness to pay more if it can benefit sensitive areas.
- Political question when the budget is decided political.
- It depends on work and place.

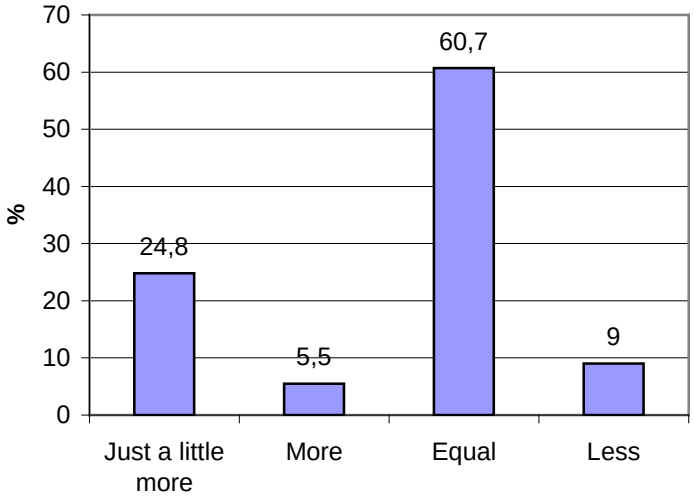

Figure 9: If you would start to use working horses; are you willing to pay more, equal or less than if the same work was done by motor driven equipments?

The purpose the working horses possibly could be used for in municipalities that not use horses (figure 10) were quite even between as a pleasant element in the society (24.7 %), look after parks, park managing (21.8 %) and fell trees (19.4 %). Also 12.9 % thought that it could be good to use horses in their environmental policy to reduce the carbon dioxide discharge. 9.6 % said "grass mowing", 2.4 % "put sands on the roads" and 2.2 % "garbage collection". The comments that arised from this question were:

- Nature reserves and sensitive areas could use horses.
- Clearing up old, growned, grazing lands.
- Constructing of riding paths.

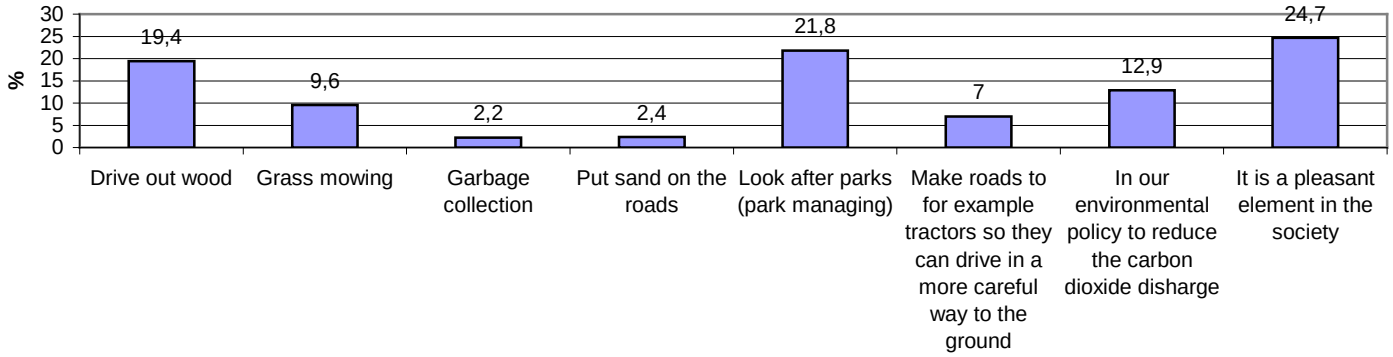

Figure 10: For what purpose would working horses possibly be used for in your municipality?

5.1.1 Random samples of those who did not answer

From those municipalities that did not answering the survey, ten of them were chosen randomly and contact by phone to hear about their opinions. Six municipalities answered; Berg, Gnesta, Lerum, Mjölby, Partille and Ovanåker. All of these had an environmental policy but non included use of horses. Ovanåker admitted that their policy was quite old. Lerum had a vision to be the leading environmental municipality in Sweden in year 2010. They did not know about working horses doing work in municipalities in modern time. Partille was the only municipality that had used working horses. It was for forestry, in sensitive areas and when spreading burnt ashes. All municipalities, except the contact person in Lerum, seemed to know that working horses could be used for different work. Gnesta said that *Banverket* or *Vattenfall* (was not sure of which one) offers possibilities to use horses when cutting for constructing wires. Berg said that working with horses demands a lot of skills from both animals and peoples and, unfortunately, there are not many that live up to these. When the municipalities were asked if they could think of using working horses, Partille and Mjölby answered positively. In their case it could be of interest when driving out wood/logging, especially in sensitive areas. Gnesta was a bit more uncertain. If it was of interest it would be in the forest, but according to the contact person they have little forests and have not seen the need for it. Ovanåker said that it probably not would happen. The reason for that are the contractors that already are hired by the municipality. If they can offer it to a price that is comparable to other "non horse companies", it could work. Berg had problems seeing it function. They could perhaps see the use of it near the population centre with extremely sensitive areas.

These municipalities were also asked if they know about working horse companies in their area. Partille does not have any within their municipality, but the neighbour municipality has. Ovanåker has many tourist companies that have north Swedish horses, so they thought perhaps anyone of these could be used. Berg had not heard about if there exist any but knew that there are forest owners that have horses, so probably they use them sometimes. Earlier there were many working horses, because there has always been an intensive forestry in the municipality. The southern parts of Berg, Klövsjö, have always had horses that are grazing in the forest in the summer months. Gnesta did not know and Lerum said that they are a municipality with many horses but it is for riding.

The answers from the six municipalities were quite alike the other answers in the survey, there was no new opinions that came up. Three of these six municipalities were more positive to use working horses than the others. If these six municipalities represent an average of the 30 percent that did not answer the questions, the final result would not change much. In other words; of those 30 percent that did not answer the survey 50 percent is for working horses and 50 percent is against. This is rough estimations, but it gives a small idea of those who did not answer the survey. It does not have to be the case that those 30 percent that did not answer is non interest in working horses. There can be other reasons for not answering rather than lack of interest. Also it shall be said that the municipalities that did answer the survey were spread all over Sweden. It was no area that neither was over- nor under represented.

5.2 Use of horses in municipalities

It could be of interest to investigate further if there are correlations between municipalities that use working horses and the number of existing horses in that municipality. If there exist a correlation it means that municipalities with many horses use them in work more than those who do not have many horses. This is interesting because it will show if the municipalities that have used/uses working horses have many measure per 1 000 inhabitants. The data that exist about horses are limited. However there is a report that describes the number of horses in Western Gothia (Västra Götaland) in Sweden scaled down to municipality level. The municipalities are mentioned in order after most horses / 1 000 inhabitants.

Table 7: Horses/ 1 000 inhabitants

Municipality	**Horses/ 1 000 inhabitants**	**Use working horses?**
Färgeland	81.2	No
Vara	75	No
Svenljunga	71.9	No
Ulricehamn	66.5	No
Tjörn	60.3	No
Lilla Edet	54.2	No
Strömstad	34.6	No
Uddevalla	26.4	Yes
Alingsås	24.5	Yes
Karlsborg	24.5	No
Mölndal	17.7	No
Mark	14.8	No
Borås	9.9	No
Göteborg	4.1	No
Öckerö	1.2	No
Sweden	31	

Source: Hästlänet Västra Götaland, Hästar och anläggningar med häst 2004.

As can be seen there is no obvious correlation between the amount of horses and the use of them. Only two municipalities use/used working horses.

Another interesting way concerning correlations is if there is a relation between the use of working horse and the amount of green area (including forest) in the municipalities. That is not something that will be handled in this thesis because of the timeschedule.

5.3 Interviews with municipalities with experience in working horses

In this study seven municipalities that have used, or use, working horses were interviewed. They were:

- Falun
- Helsingborg
- Sigtuna
- Stockholm (Royal Court)
- Södertälje
- Tierp
- Upplands – Väsby
- Uppsala

Their answers and attitude to working horses were quite alike and did not differ much from each other. Six of these seven municipalities do not have working horses included in their environmental policy. *Ingemar Carlsson* that works for the municipality of Uppsala answered that horses are included.

The main reason for the municipalities to start using working horses was most of all in special areas which are too sensitive for a tractor. These areas could for example be nature reserve areas, parks, forests near to the municipality etc. They also had in mind that hiring horses to do work would attract more visitors and would be appreciated among the inhabitants. The services they hired were most of all transporting wood from forests, haymaking, cutting grass and meadows, thinning in forests or parks. The contractors are often local and have been hired through local connections or have marketed themselves to the municipalities. *Michael Eriksson* (Sigtuna) said, "If there were more companies and lower prices- more would have the possibility to get assignments". Some municipalities said that it would be of interest if the contractors offered different work. About one to three contractors were most common to use. For how long they usual are hired varies depending on the project. Therefore, it was hard for the municipalities to give an answer of a certain amount of time. The payment varied between 320 and 600 SEK/hour. For two weeks of work one municipality paid 20-25 000 SEK.

The municipalities had very good experience from the use of working horses and they were very positive to use them further on in the future. When they were asked to comment on the experiences of using working horses, they had no problem to list many of them including the following ones:

- Silence. *Nils Oden* (Upplands – Väsby) said that it should be an obvious work method at e.g. cemeteries and quiet parks.
- Less pressure on the ground and sensitive areas.
- More careful to the environment.
- No oil spill
- Not as much damage compared to a tractor.
- Satisfied inhabitants

It was clear that the municipalities have seen results, especially in difficult and sensitive areas. They pointed out that they got more people interested in forest and environmental work when horses were involved. Also they thought it became easier to communicate with the society because of the interest and curiosity this created. The inhabitants in the municipalities have

given very positive response. It attracts more people and there has been an interest from media. The reason why more municipalities do not use more horses could, according to these seven municipalities, depend on lack of knowledge and of available companies. Also default in managing in municipalities was some comments. If there is no interest among the leaders in a municipality it can be a big problem. Where to stable the horses, if it is necessary, and money issue were also some thoughts. Although six of these seven municipalities believed it is economical possible to have more working horses and drivers.

The willingness to pay for working horses was very positive. All could think of paying a bit more just for the fact that horses were used. Mr. *Eriksson* (Sigtuna) estimated that the cost increase will approximately be about ten percent more. There were both positive and negative answers to the question concerning the possibility of money savings from the use of working horses. Mr. *LarsOve Winge* (Falun) pointed out that "the big profit is less damage and better adjustment to the terrain". The municipalities did not fully agree if the use of working horses become a larger cost compared to the same work performed by a tractor. Some answered that it costs more and some that it was cost effective. For some it was marginally equal. Mr. *Winge* commented, "What is cost really?" He meant that the positive effects horses does to the environment can win over the tractor. This was also something that others also mentioned. The cost of handling the environment with care is more valuable than just a figure.

According to these municipalities interviewed, the positive sides with the use of working horses overcome the negative. "It gives much better results than you can think of when it comes to drive out wood" is a quote from *Ulf Samuelsson* (Helsingborg). Other positive comments were that it creates interest for work, revive culture history, facilitate in "tricky" and sensitive areas where it is hard for tractors to work and creates *goodwill*[45]. Mr. *Bjarne Tutturen* (Södertälje) commented, "Exercise at working hour!" Also, people that usually does not get into contact with animals have a chance to experience a completely new environment. Some negative things that were mentioned were the fact of overnight work when needed. Perhaps it could be a problem of finding stables if a "stable on wheels" was not available. The fact that the equipment and horses must be taken away each day after the work is done could also be a negative part. Mr. *Carlsson* and Mr. *Winge* pointed out that they think it has worked just fine!

5.3.1 Gålö

Mr. Sune Ohlsson was responsible for a project with working horses on the island of Gålö that is a nature reserve in the archipelago, forty kilometres southwest of Stockholm. A great part of the forestry work was done near a beach with very sensitive land and to avoid causing damage two horses were hired to do the work; one of the North Swedish Horse and one Ardennes horse. Mr. Ohlsson has figures that show that the work cost for a tractor in this area would be approximately 40 SEK / m^3 and for a horse approximately 155 SEK / m^3, which is a difference of 115 SEK / m^3. A total area of 400 m^3 was managed. Calculations with this figures would indicate that the use of a tractor is (155*400) – (40*400) = 46 000 SEK less expensive than the use of horses. However, the use of a tractor in this sensitive environment would cause damage on the land that they would have been forced to repair. Mr. Ohlsson pointed out that people that uses this environment as recreation area most certain would complain. The cost to replace the damage done by a tractor would have been approximately 50 000 SEK. If it takes into consideration with the cost of using a tractor, the total cost for 400 m^3 would be (40*400) + 50 000 = 66 000 SEK. The use of the working horse then becomes 66 000 – (155*400) = 4 000 SEK less expensive compared to the use of a tractor. In addition,

[45] Creates a positive reputation.

one thing that should be taken into account in this case is the cost of transport for the tractor to this particular location (the beach). The distance to drive would be long and therefore the cost would be quite expensive. When this cost is included into the calculations, the cost of using horses is 13-15 000 SEK less expensive compared to the use of a tractor.

Mr. Ohlson also pointed out that horses can be used to make paths for the tractors. These paths done by horses are much less harmful to the environment compared to the ones done by a tractor.

5.4 Interviews with working horse companies

To get a perspective from a working horse company and hear about their experience about contacts with municipalities, four companies were interviewed. More companies were contacted, but for different reasons they could not answer the questions. In these four companies the owner is the only employee, in short; self – employed businesses The companies have existed between four months and ten years. They have all performed work for municipalities in different ways, for example in forestry, cleaning streets etc. They offer a lot of different services and they are very flexible to adjust to the demands from the customers. Basically all four companies offer work, and have been involved in, nature reserve areas, haymaking, cut and drive away wood/timber and twigs, event-, tourism-, and wedding driving, street cleaning and courses in driving. The service that has the biggest demand varies, much depending on season. Work as for example driving with a forwarder in nature conservation, drive away wood/timber and twigs and forest work in general are often asked for. Their knowledge of working with horses comes from their own experiences as a coachman, different courses or from experienced coachmen. The main reasons for starting the companies are a big interest in animal care, agriculture, forestry and nature conservation. Most common is that the company has been developed from a hobby and the possibility to earn money from something that they have big interest in.

According to these interviewed companies, it seems like there exist a demand and a supply, but the size of it varies a lot. Concerning the supply Mr. *Thomas Gustafsson* (Hästbruket) said that “Since I started in this business I believe the supply has increased”. Mr. *Jonny Nord* had sometimes hard to find other contractors to help him in the area of Stockholm, the times he needed help with an assignment. According to him there are not so many established contractors in the area of Stockholm. That is also something Mr. *Kjell Sjöström* thinks. He thinks that the demand and supply in the area of Stockholm and Uppsala is much smaller than in southern parts of Sweden. Ms. *Camilla Perhult*, which have had her company for ten months, said, “The environmental impact is big today and creates work for the horses”. One thing that relates to this is marketing, which also came up as an important part during the interviews. Ms. *Perhult* is very positive when she talks about the demand for working horses; “If more municipalities get to know about us coachmen, the jobs are a fact”. When the company owners were asked about what can be done to increase the municipalities interest, they put much responsibility on themselves:

- Skilled contractors that become good examples.
- Inform municipalities about what they can benefit from working horses.
- Inform municipalities about how the works are done and so on.

They commented upon the problems if there is a lack of interest among the local municipal politicians. Mr. *Sjöström* said, “It would be much better if the county administrative board and the municipalities were more informed about working horses and let us in”. The opinion about

municipalities' engagement in working horses varies among these four drivers. The municipalities that have hired them have given very positive response and interest. Ms. *Perhult* encourages municipalities to "dare to try" and thinks that working horses stand for the environment and important well-being in the municipality. "Everyone wants to talk to a coachman but no one to a tractor driver!"

How many percent of full time employment do the contractors work was hard for them to say, due to the variation of amount of job. They usually often have another job; e.g. truck driver one day a week, consultant for the electricity industry, sheepherding, services in forestry and nature conservation. Mr. *Nord* has chosen to work 50 % with his working horse company because he wants to have variation on his assignments in forest and nature reserve areas. He though does not find it impossible to work full time if he wants. Ms. *Perhult* is the one that has worked less time, but then she has only had her company for ten months and said that the horses support themselves with this percentage. Some also get EU support in case of farm support and support for holding courses. All four contractors believe that it is possible to work full time within 3-5 years from now. They all believe that it will look better in the long run compared to today. They also all agree on that it is possible to run a profit maximum firm. Again they comment about marketing and that it helps if you are good at it. At the moment these four firms thinks that their profit possibilities look quite good. Some of them even made money over and reinvest it. When they were asked if they ever have considered shutting down their company all answer no. Mr. *Nord* comment; "If my health lasts I will probably do the same thing when I am 70 years old!"

Concerning the cost for hiring these contractors, it varies a lot depending on what the assignment is. The most common is to charge 350 - 450 SEK / hour, which is in line with the recommendations from the organization *Skogshästen*. Event driving can for example cost 5 000 SEK / day. The cost includes salary, all costs for horses, equipment, horse food, tools, depreciation and transportations. *Sjöström* was the only one that did not charge for the transportation. He said that he could have done it if the demand were better.

The four contractors interviewed in this study look quite positive to the future. With the right assignments with skilled contractors, there is a certain market. Marketing and change the attitudes of municipalities are crucial in the future. One potential market is, or a market that could be expand, are nature reserve areas. According to these interviews, there is much work to be done in these areas, which could create more jobs for working horse companies. Mr. *Gustafsson* wished that horses got the same compensation as beef and also working horse companies were more prioritized when it comes to investment support. Ms. *Perhult* wished that the rules for employment would be simplified. All contractors are a bit doubtful if they want to expand their companies in the future. Mr. *Sjöström* thinks it would be fun if he got extra help. Most common is that they try to cooperate with other horse drivers if it is possible if the assignments become too big.

5.4.1 A. Blomergs Naturnära Skogsentreprenad AB

Anneli Blomberg lives in the nord west of Skåne, Dalshult, and runs her company *Blomergs Naturnära Skogsentreprenad AB*. The main activity in her company is to drive out wood. She works with horses full time, between 75 to 125% and it is her main income. She started her company for about 15 years ago when she cut trees in the forest and then drove them out with her horses. Later on she started focusing on just to drive out wood and nowa days she works with her husband who cuts trees. She has done some lawn - mowing for the municipality of Lund, but as she does not live near the area and lawn - mowing is much weather dependent

she quit that job. She chosed to focus on driving out wood instead. She said that if she lived more closely to the town, perhaps garbage collection as they have in Jönköping would be interesting. In the summers Blomberg works about 75 % and that is for the well - being of the horses. In summer there are many vermins in the forests and that is not nice to the horses if they have to work there full time during that period. In the winters however, some days can be more than a full time work day. She said that there are many jobs and nowa days she received many contacts with job offerings. She works for private persons, companies and municipalities. The municipalities that she presently worked for are Helsingborg, Lund and Perstorp.

When she is asked to explain her success and how she has managed to build up a full time company, she said that you "should just have to show everyone what you have!" Still she admits that, as for all new started companies, there can be some hard moments in the beginning. It is important to be visible. One good tip is the local paper that almost every year writes about her. She does not believe that it is easier to get jobs in her area; "there are people that live closer to the town with their horses compared to me". Her experience with working for municipalities is not all pleasant. According to her there were some problems working for one of them when it came to communication. The person responsible in this particular municipality did no talk to her at all; he talked to her through her husband. Blomberg finds this frustrating to see that it nowa days exists this kind of attitude towards woman that works in the forest. Except from this her experience is positive response from people. She said that when people see her work with her horses, they always question why machines should do her work when she obvious has the capacity.

One problem Blomberg talks about is the lack of knowledge that exists in the municipalities especially among the decision makers. She did not think working horse companies get an honest chance to show what they are capable to. People sometimes react hesitantly when they hear about her services; "many people thinks that we still work as in 1920, but there has been a development of lighter carriage and new equipments". She also said that working horses should be compared with forwarders about the same load capacity doing the same work. She said: "sometimes it feels like they compare us to adding a truck in a formal one race!"

There is little competition between her and other working horse companies. One reason can be that there does not exist many in her area. There is one man that also drives horses and they have sometimes worked together and she does not see him as a competitor. Although she admits that she believes that regular forest workers probably do not want her to exist. "As long as I do no harm against the forest workers with my horses, they can not say anything" she said. Blomberg also thinks that forest companies counteract her and others because they often have their own machines and forwarders. She wonders if they feel a bit threaten from her, but that it is no reason for that; "put me on work in sensitive areas and let them do the other!" Still, she has the opinion that the regular forest contractors always will offer "five SEK cheaper than me if I must say my price before them". She is troubled by the fact that the only way to get people interested is to be the cheapest. Looking into the future she can see a huge need for working horses and environmental work. As Blomberg said; "they both save money and the environment which is a win – win situation."

6 Analysis

The answer response rate to the survey that was satisfying. 199 municipalities answered and 65 of them (32.7%) (fig. 1) had used or uses working horses. The fact that 32.7 % had experience of this was also rather unexpected. When ten randomly chosen municipalities were contacted again, which had not answered the survey, six answered and one of them had used working horses. In other words; 205 municipalities gave their opinions about this subject and 66 of them had used working horses.

The most common activity for working horses was to drive out wood / timber (fig. 2). Almost 50 % had used this service and also park managing, lawn mowing and some garbage collection were common activities. One explanation to why most of the services were in the forest is that horses commonly were used in sensitive areas like nature reserves and were a forwarder would cause more damage than use. When looked at the number of working days per municipality each year it did not represent a full time job. Here is a dilemma since many working horse companies see much more work that could be done while they are working for a week or so for the municipality. It seems usual for municipalities that use working horses to set a specified time, for example two weeks in the summer and then no more.

It was interesting to find that 34.4% (fig. 3) of the municipalities that not had used working horses could think of doing so. If all these municipalities did so, over 2/3 could use horses in the future.
17.7 % of the municipalities that not had used horses did not know it was possible. Marketing is clearly a crucial thing in this case, which many contractors interviewed, agreed on. It is a fact that working horse companies compete with “regular” contractors. *Ingemar Carlsson* from the municipality of Uppsala made a good comment when he said that you have to decide that “this kind of work should be done by horses”. Perhaps this is the way to do it because, at present, none of the municipalities that answered the survey had working horses included in their environmental policy.

The CBA showed some interesting figures. When a forwarder with a load capacity of 7 m^3 and 1.5 loads / h is used it is a higher cost compared to a horse equipage (table 6).
A forwarder that can load the same but have the capacity of 2 loads / h has a 11 % lower total cost. The 21 m^3 forwarder has a 39 % lower cost which is logical; the higher capacity per hour the lower is the cost per transported m^3. Though a big forwarder will make more damage to the ground, consumes more fuel and could even be impossible for certain kind of work. Even if the effectiveness is higher the increased fuel consumption will counteract the environmental goals. If you compare the costs including the environmental cost e.g. the cost for emissions of carbon dioxide, you must compare a horse equipage with forwarders with the same transporting capacity. From the calculations in table 5 and figure 1 it is obvious that the working horse equipage is favourable for local and small scale forestry compared to smaller forwarders. Bigger ones are difficult to use and will counteract the environmental and climate goals.

Of those municipalities that have not used working horses about 61 % could imagine paying the same for a forwarder and a horse equipage an about 25 % could even imagine themselves paying more. It would have been interesting to see how they had answered if the cost from the CBA were mentioned.
Almost 50 % of those who have not used working horses did not know if they would use it in the future, about 34 % answered yes and 18 % no. The CBA showed that it not always has to

be more expensive to use working horses. From an environmental view it can be questioned if it is not worth paying a few more SEK per m^3 to facilitate environmental work, create a harmful and an improved environment to the inhabitants. It is also shown in studies[46] that horses have a positive impact on people. The CBA shows that working horses can represent an environmental friendly alternative. The survey strengthens this by the fact that there is an interest, a demand and even a willingness to pay more for work done by horses. On the other hand issues like effectiveness and factors that allows bigger forwarders will also be parts of the decision if working horses will be used.

The results show however that there are some inconsistent problems. On one hand the municipalities are interested of using horses and say that they lack information. On the other hand the interviewed entrepreneurs say that can see low interest from the municipalities. This looks like a common communication problem. A way for municipalities to get more knowledge can be through arranging meetings with working horse companies that offer, or could offer services. 82.6% of the municipalities that not used working horses did know about the possibility, but said that there were no marketing, hard to judge capacity and damage on green areas when using machines. This is clearly a proof that there is a need for more information. The horse entrepreneurs also have an equal information responsibility. They must make the potential buyers aware of their services through information, commercials and by a better organisation between themselves.

Another thing that came up in the survey and interviews is the lack of well trained coachmen and horses. Well trained coachmen and horses are required in order to do everything safe and secure. Some municipalities had good supply of it and some had not. That shows a need for an increased focus on education of driving horses to meet a potential increased demand for working horses.

The interviewed *Anneli Blomberg* illustrates the fact that it is actually possible to have a working horse company as a fulltime job. She managed to develop her hobby into a business that gives her a full time job. As the other working horse companies interviewed she felt that one problem seems to be the lack of interest- and knowledge in the municipalities she works for. This inconsistent is in line with the questionnaire. According to the survey 43.5% of the municipalities that have not used working horses said that they had knowledge and about 45 % did not know. That illustrates the communication problem.

It was quite surprising to notice that none of the working horse companies that were interviewed talked about their role in the climate change context and the need to decrease the use of fossil fuel. The CBA shows very clear that both the emissions and the societal costs for the carbon dioxide from the horse equipage are considerable lower compared to the tractor forwarders. This must be an important marketing factor.
None of the interviewed companies mentioned the possible support from the Rural Development Programme (RDP)[47]. This should be a good way for them to apply for support for development of their horse company.

My CBA showed that that for certain chosen realistic scenario, it was a lower cost for the working horse compared to a comparable fossil driven forwarder. However, even if the comparisons with forwarders with greater capacity makes the working horse slight more

[46] For example *Hästen som terapeutiskt verktyg*.
[47] http://www.sjv.se/amnesomraden/stodtilllandsbygden.4.7502f61001ea08a0c7fff24864.html

expensive, this should not be a reason for not use the working horse for this kind of work in the context of climate change and the need for decreasing carbon dioxide emissions.

I did not involve the loss of fossil fuel tax for the state in my examples and the effects for the society and the welfare. Even if a lesser use of fossil fuel leads to lower tax income for the state, this is of lesser importance according to the Swedish Governments newly released climate bill as the combat against climate change and the release of CO_2 and other green house gases is of greater global importance. The cost for not taking measures against the climate change will be significantly higher in the end as shown e.g. by the Stern-report.[48] The adaptation and adjustment to the ongoing climate change will necessary include new costs. At the same time new climate friendly jobs and products will appear.

[48] http://www.hm-treasury.gov.uk/stern_review_report.htm

7 Discussion

My results show that on one hand there is a potential for working horses in the municipalities, but on the other hand there are signs that counteract that conclusion. To make this demand real, it takes effort from both municipalities and contractors. First of all, the municipalities must have an interest in this so it really happens. With support from the survey and interviews, I conclude there is a lack of knowledge, information or interest in some municipalities. On the other hand it is also up to the working horse companies to let the municipalities know that they exist. Therefore it must be important to increase the knowledge about that working horses can be used for work with environmental issues in municipalities and counties.

Comments were often expressed in interviews and the questionnaire regarding the cost and that it is expensive to use working horses. One explanation for not using working horses is that they are not aware of the cost for using working horses. Other aspects of the potential of using horses such as the social value and use in therapy should be further studied. Horses that work in a municipality can also be a tourist attraction and according to the interviewed municipalities, it is very popular by the inhabitants. The fact that horses contributes to other societal values should also be taken into more consideration.

More emphasis on information to include horse services in environmental policies could also be a way forward. Since the environmental objective about reduced climate impact seems hard to reach, it would be of interest to start up projects that can be used in the local environmental work. Through the Rural development programme,[49] it would be possible to support and improve the use of working horses by local entrepreneurs. Even support for maintaining an old agricultural heritage or use horses for social activities will in the long run develop the horse sector. It also can help municipalities to get more visitors and tourists if they get attention for their environmental work with horses. The County administration boards that administrate the RDP should be made aware of this perfectible sector.

The increased number of horses and a developed use of them in daily work can also contribute to another discussed climate issue. In the climate change debate it is some focus on the green house gas emissions from the animal production and especially cows and their release of the potent green house gas methane. [50] However, to decrease the number of cows for that reason would create problems with some of the Swedish environmental goals set by the Parliament. The grazing animals in agriculture are an important tool for keeping landscapes open and thereby increasing the biodiversity and creating open landscapes. A newly published report summarizes the role of agriculture animals in the climate change context.[51] The fact that also horses help keeping the landscape open by grazing could be highlighted in the debate. The debate focuses on cows even if the number of horses soon will exceed the cows. The fact that ruminants as cows emit the green house gases methane to a greater extent than horses do should be a key fact in this discussion. [52]
Seen from such a perspective horses would be excellent replacers for cows as “environmental workers” because they do not emit any methane. Though, to use working horses would be in line with the Swedish Governments and Parliaments decision to speed up the work to decrease the emission of green house gases as mentioned in the Introduction.

[49] http://www.sjv.se/amnesomraden/stodtilllandsbygden.4.7502f61001ea08a0c7fff24864.html
[50] Mat21 (SLU).
[51] Lantbrukets djur i en föränderlig miljö. SLU 2009
[52] Moss et.al. (2000)

The Swedish government has commissioned to both the Board of Agriculture and the Research Council Formas to support projects and research with the aim to develop the entrepreneurship in the horse sector.[53,54] Hopefully this could will increase the awareness of the horse for other purposes than recreational activities.

Last but no least I finally must stress that working horses not can replace i.e. tractor forwarders or other fossil driven machines in all cases, but in some activities or scenarios they could be a more environmental friendly tool for the same kind of work also giving other benefits to the society.

[53] http://www.sjv.se/amnesomraden/stodtilllandsbygden/livskraftigtforetagandepalandsbygden/hastforetagande/projekt2009.4.78be32b411dd24541d28000528263.html
[54] http://www.formas.se/formas_templates/Page.aspx?id=4648

8 Conclusions

The aim of my study was to answer the question if there *is a demand and potential for services by working horses in the Swedish municipalities.*

From the well-answered internet questionnaire (67 % response rate), we know that there is a great interest and a willingness to use working horses within Swedish municipalities (from 33% to theoretically over 50%). There is a growing potential for working horses even if the cost can be higher compared to more effective fossil driven forwarder as in the chosen example.

However, there exist a communication problem between the municipalities and the horse entrepreneurs to fully develop the potential.

One issue that could improve the motivation for using horses could be the climate issue. The results showed a considerable lower carbon dioxide emission from the horse equipage. The municipalities could use the working horse in their climate policy to help decrease the use of fossil fuel at the local level and in that way contribute to mitigate the emissions of carbon dioxide and in certain kind of activity without increased cost.

In the context of climate change and the need for reducing the use of fossil fuel and mitigate green house gases, horses could contribute. Horses can be used for several purposes in a municipality and could be a natural part of a local smart climate policy.

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Appendix 1: Costs for the contractors

Here follow the most usual costs for the contractors. Note that these numbers are average.

Horse

The depreciation time for the tractor is said to be 10 years, which is often used in bookkeeping. The depreciation of the forwarder is said to be 20 years because they are

Horse	25 000 SEK → 1 785,7 SEK / year[55]
Forwarder	100 000 SEK → 5 000 SEK/year[56]
Harness[57]	800 SEK /year
Insurance	1 200 SEK /year
Veterinay surgeron/vaccin[58]	400 SEK / year
Deworm[59]	450 SEK / year
Shoes[60]	2 600 SEK /year
Hay[61]	1 120 SEK/year
Forage[62]	336 SEK/ year
Petrol[63]	10 560 SEK/hour
Total	**13 691,7 SEK / year**

Tractor

Tractor	300 000[64] → 15 000 SEK/year
Forwarder	75 000[65] → 3 750 SEK/year
Tractor insurance[66]	930 SEK/year
Forwarder insurance[67]	75 SEK/year
Maintenance tractor[68]	28 800 SEK/year
Maintenance forwarder[69]	28 000 SEK/year
Fuel cost[70]	116 160 SEK/year
Total	**192 715 SEK / year**

[55] Depreciation of 14 years according to *Räkna med hästar (calculate with horses)*, LRF Konsult.
[56] Depriciation of 20 years.
[57] Purchase prise: about 8 000 SEK, depreciation of 10 years.
[58] Assumes that the horse has the basic vaccin.
[59] Assumes that the horse is dewormed 3 times/year.
[60] 500 SEK every 10th week.
[61] 8 kilos/day, a' 3,5 SEK/kilo, 10 months (other 2 months on grassing).
[62] Assumes the horse to be feed by 1 kilo oats or similar, once per day in 10 moths.
[63] Assumes 1 l petrol/h at a price of 11 SEK/l. 960 working hours.
[64] Average value estimated with consideration to what tractor that suits for this kind of work, Agriwise. Depreciation 20 years.
[65] Agriwise.se. Depreciation 20 years
[66] Values from Agriwise.
[67] Based on 1% of replacement cost. According to Thord Karlsson, responsible for Agriwise. Base on *Maskinkostnader 2008, underlag och kalkylexempel på timkostnader för lantbruksmaskiner. Maskinkalkylgruppen 2008.*
[68] Assumes: Maintenance (M)=Maintenance factor (Mf) x Replacement cost (R) x Hours used (H) / 1000 = 0,1x300 000 x960 / 1000 = 28 800 SEK
[69] Assumes: Maintenance (M)=Maintenance factor (Mf) x Replacement cost (R) x Hours used (H) / 1000 = 0,4x75 000 x960 / 1000 = 28 800 SEK
[70] Consumes 11 l diesel/h with a price of 11 SEK/l. 960 working hours.

Appendix 2: Survey questions to the municipalities

1. Does the municipality have a environmental policy, for example with purpose to reduce the discharge of greenhouse gas from the municipality´s own activities? Does the use of horses include in that policy to reduce the discharge of carbon dioxide from engine driven tools?

2. What made you start use services within “working horses” and not use motor driven equipments?

3. Describe the horse projects which inculde working horses you have had? How many years have you been active in this?

4. How often is horses used in the municipality?

5. How many horses and companies have so far been working for the municipality, and how did you get in touch with them?

6. In what services are the use of horses most wanted?

7. Do you have any plans for the future to use more working horses?

8. If you compare the work that has been done by horses with a tractor or other motor driven equipments; what is the difference? How much does the outcome affects depending on what is used?

9. Does the use of working horses become a larger cost for the municipality compared to the same worked perfomed by motor driven equipments?

10. How much are you willing to pay for a service? Do you pay more, less or equal as labour perfomed by motor driven equipments?

11. What is the respond from the inhabitants in the municipality?

12. What is positive with the use of horses as labour?

13. What is negative with the use of horses as labour?

14. Have you noticed any improvement within some areas since you started to us horses as labour?

15. Do you believe it is economical possible to have more working horses in your (or other) municipality?

16. What do you think is the main reason that other municipalities does not use working horses?

17. Does municipalities collaborate within this area?

18. Would a special ”net” between (espcially contiguous) municipalities and horsecompanies with working horses be prefereble? Would it make it easier to use working horses?

19. What do you think aout the supply of working horses? Would you employ more if the supply increased?

20. Do you think that there is money to be saved by the use of working horses?

21. What do you think the working horses contributes to the society and municipality?

22. What have you paid för working horses doing work för the municipality? What do you think you should have paid if the same work was done by a tractor or similar?

23. Do you have any numbers, figures or diagrams that you have used to calculate costs and profits?

Own comments:

Appendix 3: Questions to horse companies

1. Describe your company (how long has it existed, what services do you offer with your horses etc.)
2. What is your knowledge within horses (life experience, driving courses etc)?
3. What made you start with offering services within “working horses?
4. How long time have you worked with working horses as a company?
5. What is your opinion about the demand and supply in this area?
6. How many percent do you work within this area?
7. Do you have any other income from other ways, for example EU - support? What / which?
8. Do you see the possibility to work 100 % (full time)?
9. Do you think it requires changes in rules (laws, tax rules etc.) to improve the possibilities to run a horse company?
10. What does your costs include when you perform a job?
11. What is a resonable payment from the municipalities for the type of job you offer?
12. Do you think it is possible to run a profitmaximum company with working horses? (Not riding schools or similar)
13. How does your profit possibilities look like?
14. Have you ever consider to shut down your company?
15. Do you have any plans to expand your company?
16. What services have big demands?
17. Have you performed any work, with horses, for any municipality? What was your assignment?
18. What is your opinion about the municipalities (especially your own) possibilities to benefit by the use of working horses?
19. What is necessary for an increase in the municipalities interests?
20. What is your believes about the future for working horses in the municipalities?

21. Do you have any numbers, figures or diagrams that you have used to calculate costs and profits?

Own comments: