Sveriges lantbruksuniversitet
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Kostnad av att ha vildsvin: Skada på jordbruk i Syd-sydöstsverige

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Abstract

In many parts of the world where people engage in farming activities, wildlife is responsible for causing considerable amounts of damage to agriculture thus affecting human economy. Damage to crops is typically caused by ungulates and one species in particular: the Wild boar (*Sus scrofa*). In Europe compensation paid by different governments amount to several million Euros annually, which is part of the reason why the wild boar is now considered a pest in many parts of the world. In Sweden the wild boar was extinct during the 17th century but has later returned and today the population size has increased dramatically, causing damages to Sweden's agriculture. Attempts have been made at estimating the cost of these damages however, most of these studies have had a restricted sample sizes and/or considered only a limited geographic range. The central aim of this study was to quantify the damage, and subsequently the cost, caused by wild boar on agricultural crops in the south and south-eastern parts of Sweden. Given previous work done on the subject I expected to find a relationship between field size and damage level. Furthermore the study provided answer to a central methodological question: whether field sampling done post instead of pre harvest was more time efficient yet produced an estimate similar to that of the pre-harvest method. By using estimates of damage levels on three crops gathered in the field and data from Statistics Sweden I computed the total value of wild boar damages. I found that the value of yield loss to wild boar equals 151.8 – 240 million SEK for the year 2012 in the five LRF regions Skåne, Sydost, Jönköping, Södermanland and Mälardalen. Field sampling done post-harvest produced an equally accurate estimate as that of the pre-harvest method at the same time as it is 3.6 times faster ($p=0.0625$).The wild boar is well established in Sweden and they are here to stay. This calls for further refining of methods to evaluate their damage-causing behavior and both the spatial and temporal characteristics of that behavior if farming is to be considered economically sustainable – and not just for big agricultural corporations.

Sammanfattning

I många delar av världen där man bedriver jordbruk orsakar vilda djur skador på såväl tamdjur som odlad gröda, vilket påverkar ekonomin. Hovdjur associeras ofta med grödskador och då speciellt en art, vildsvin (*Sus scrofa*). I Europa betalar olika regeringar ut ersättning för skador som uppgår till flera miljoner Euro årligen vilket är orsaken till att vildsvinen numera ses som ett skadedjur i många delar av världen. I Sverige utrotades vildsvinet under den senare delen av 1600-talet men har på senare tid återvänt och populationen har ökat kraftigt i storlek med skador på jordbruk som följd. Försök har gjorts att uppskatta skadekostnaden av vildsvin i Sverige. Dock har dessa studier haft en limiterad provstorlek och/eller avsett endast en begränsad geografisk region. Det centrala målet med denna studie var att kvantifiera grödskadorna, samt de efterföljande kostnaderna, som vildsvin orsakar jordbruket i Syd-Sydöst Sverige. Givet tidigare studier inom ämnet förväntade jag mig att finna ett samband mellan mängden skada och fältstorlek. Vidare besvarade även studien en central metodologisk fråga: huruvida provtagning genomförd efter istället för före skörd var mer tidseffektivt medan det samtidigt gav en skadeuppskattning liknande den erhållen från provtagning före skörd. Genom att använda uppskattningar av skadenivå på tre grödor från fältstudier och kombinera dessa med data från Statistiska Centralbyrån beräknade jag det totala värdet av vildssvinsskador. Jag fann att detta, år 2012, uppgick till ett totalt värde av 151.8 – 240 miljoner kronor i de fem LRF-regionerna Skåne, Sydost, Jönköping, Södermanland och Mälardalen. Fältstudier gjorda efter istället för före skörd visade sig vara 3.6 gånger snabbare ($p=0.0625$) samtidigt som det gav en lika precis skadeuppskattning. Vildsvinen är väl etablerade i Sverige och de är här för att stanna. Detta kräver ytterligare förbättring av metoder för att utvärdera vildsvinens skadeorsakande beteende och både de rumsliga och tidsmässiga egenskaperna av det beteendet om jordbruk ska fortsätta att vara ekonomiskt hållbart – och då inte bara för stora jordbruksföretag.

Introduction

In many areas where people are engaged in farming today, wildlife is responsible for causing damages to both livestock, (Chaminuka et al. 2012; Chhangani et al. 2008; Rao et al. 2002; Udaya Sekhar 1998; Young 1997) and crops (Chhangani et al. 2008; Trdan & Vidrih 2008; Pérez & Pacheco 2006; Engeman et al. 2002; Rao et al. 2002; Wywialowski 1996; Conover & Decker 1991), thus affecting human economy. Chaminuka et. al. (2012) reports loss of livestock in South Africa due to depredation by e.g. large cat species (*Panthera, Acinonyx*) and in India people are deprived of livestock as a result of predation by the leopard (*Panthera pardus*) (Chhangani et al. 2008). There are numerous examples of wildlife interacting with farming crops, a few of which are; deer that damage cabbage cultivation in Wisconsin (North America) (Engeman et al. 2002), Andean bears (*Tremarctos ornatus*) which raid corn fields in Bolivia (South America) (Pérez & Pacheco 2006) and Red deer (*Cervus elaphus*) grazing that damage farmer's grasslands in Slovenia (Europe) (Trdan & Vidrih 2008). Damages to crops are typically caused by ungulates and one species in particular that is associated with crop damage is the Wild boar (*Sus scrofa*) (Amici et al. 2012; Bleier et al. 2012; Trdan & Vidrih 2008; Herrero et al. 2006; Rao et al. 2002; Udaya Sekhar 1998). This is also true in Europe where the wild boar often is responsible for causing damage to agricultural crops (Schley et al. 2008; Calenge et al. 2004; Schley & Roper 2003), damages for which compensation amounting to several million Euro annually is paid by governments in several European countries (Schlageter & Haag-Wackernagel 2012). The damages are perceived as an important nuisance to the agricultural sector and researchers are searching for preventative methods (e.g. Schlageter & Haag-Wackernagel 2012; Calenge et al. 2004; Geisser & Reyer 2004) to reduce the extent of damages. This is part of the reason why wild boar is now considered a pest in many parts of the world (Bieber et al. 2005).

In contrast to many other ungulates, the wild boar is an omnivore (Schlageter & Haag-Wackernagel 2012; Cuevas et. el. 2010; Baskin & Danell 2003; Lemel et al. 2003) and inhabits a vast range of habitats (Baskin & Danell 2003; d'Huart 1991). It can be found on all continents except Antarctica (d'Huart 1991). Its omnivorous behavior allows it to adapt well to its surroundings and its diet is to a large extent influenced by what is available (Schley et al. 2008; Herrero et. el. 2005; Calenge et al. 2004; Schley & Roper 2003). Hence in landscapes where agriculture is a common feature, the species may come to rely heavily on agricultural crops as a major food source (Herrero et. el. 2005). There are reports of wild boar feeding on crops such as; corn (*Zea mays*) (Herrero et al. 2006; Schley & Roper 2003), potatoes (*Solanum tuberosum*), beans (*Phaseolus* spp.), peas (*Pisum* spp.), sugar beets (*Beta* spp.) (Schley & Roper 2003) and cereals (Herrero et al. 2006; Schley & Roper 2003), although the trichotomous cereals are less preferred (Anonymous 2010a; Schley et al. 2008). The species have a high reproductive rate (Novillo & Odeja 2008) with females reaching sexual maturity at an age of approximately 7-10 months (Anonymous 2010b) and may undergo several reproductive events during one reproductive season (Dzieciolowski et al. 1992). Litter sizes range between 3-8 piglets (Anonymous 2010a; Anonymous 2010b) and piglet survival is estimated to be approximately 70.9 % (Andersson et al. 2011).

Historically the wild boar is a species native to Sweden although it was extirpated (primarily due to domestication and extensive hunting) during the latter part of the 17th century (Anonymous 2010b; Thurfjell et al. 2009). It was, however, reintroduced during the 1970's and 1980's (mainly from pigs escaping enclosures) (Thurfjell et al. 2009; Lemel et al. 2003) and the Swedish government at that time decided that the species was unwanted (Anonymous 2010b). However in 1987 that view changed and the wild boar once again came to be regarded as a part of the Swedish fauna (Anonymous 2010b). The population has since increased and in 2010 the Swedish wild boar population was estimated to be at 150 000 individuals (Anonymous 2010a). The population increase has been estimated to between 13 % (Lemel & Truvé 2008) and 30% annually (average net increase during the period 2000-2009 estimated from annual bag numbers) (Anonymous 2010a), with potential to reach up to 48 % under optimal conditions (Magnusson 2010). This suggests that the population size today is far greater than it was in 2010. Such an increase is likely to have been possible due to the abundant food provided by agriculture during the frost free period of the year, and by incorrectly practiced baiting and feeding of wild boar (Anonymous 2010b).

The species' high reproductive rate combined with its potential to inflict damage to agriculture is the cause of a human-wildlife conflict which will increase in intensity as the Swedish wild boar population grows larger. In 2010 the Swedish Environmental Protection Agency (EPA; Naturvårdsverket) presented a management plan for the Swedish wild boar population with the long term goal to; "*establish a viable, healthy and controlled population of wild boar, adapted to local and regional conditions*" (Anonymous 2010b). This is to be achieved mainly by reducing the size of the wild boar population in order to limit the damage the species cause (Anonymous 2010b). However due to the relatively uncontrolled situation at present the immediate goal is to *"reduce populations and reduce the damaging effects of too much wild boar"* (Anonymous 2010b). According to Swedish legislation farmers are not entitled to compensation for wildlife damage when this is caused by species that are not protected by law (Anonymous 2010a; Anonymous 1987). In this case landowners are considered to have the means (e.g. hunting) themselves to reduce and prevent the damages. Wild boar is not a protected species (Anonymous 2010a), thus farmers are not entitled to compensation when wild boar enter and damage their crops. Hence, the law regards farmers as having the tools to limit the wild boar damage, but due to the species characteristics this is far from easy. In Germany hunters and farmers share responsibility for reducing wild boar damages to farmed crops and compensation for damages are also paid to farmers when damages exceed 5 % of their total annual yield (BGH 1984).

Predator-prey interactions give rise to what is known as a landscape of fear (Laundré et al. 2010) which means that prey possess the ability to recognize the risk it entails to stay in a certain habitat. This implies that because the wild boars are able to respond to risk, certain areas should be less preferred than others. As is the case in previous studies (Thurfjell et al. 2009, Kornacher 2006) where it has been suggested that wild boar forage with respect to forested edges in order to easily escape into cover, thus avoiding predators. This entails that the risk of crop damage is highest in field edges (Thurfjell et al. 2009, Kornacher 2006). Assuming equal geometry, damage is expected to decrease with increasing field size since wild boars prefer to forage close to edges and because large fields have less edge per unit area. From a human perspective this may be a very important aspect to consider as it has been suggested that damages may be severe where the agricultural landscape is made up of many small fields (Thurfjell et al. 2009).

Attempts have been made to estimate the cost of wild boar damage in Sweden (Lindblom 2011; Anonymous 2010a; Persson 2010; Olsson 2007). In a report by the Swedish Board of

Agriculture (Jordbruksverket) it was estimated that economic loss in Södermanland county to wild boar amounted to 17 300 000 SEK for the year 2009 (Anonymous 2010a). Persson (2010) estimated that damages ranged between 40 000-520 000 SEK annually for farms in Skåne, Blekinge, Småland, Södermanland and Uppland counties, and Lindblom (2011) estimated crop loss on an estate in Södermanland county to be 119 740 SEK in 2010. However, most of these studies have had a restricted sample sizes and/or considered only a limited geographic range. The wild boar issue is important in Sweden, so to be confident that we accurately measure the extent of damages at the national level, we need larger sample sizes and better geographic representation.

The central aim of this study is to quantify the damage, and subsequently the cost, caused by wild boar on agricultural crops in the south and south-eastern parts of Sweden. The study includes only these parts of Sweden since this is where the wild boar population is concentrated (*Appendix 1, Figure 12*). To do this, I A) gathered data by visiting farms and using transects to quantify damage on fields, and B) collected data on damage on many more farms by using a mail survey. Thus, the goal of my study is to: produce a quantitative estimate of the level of wild boar damage in Sweden including income loss by farmers. As previous studies have found measuring damage by wild boar is somewhat problematic, so I also evaluate an innovative method of quantifying wild boar damages in the field. I hypothesize that: 1) given the recent debate regarding wild boar in Sweden, the level of damage is expected to exceed 5 % of the total produce for the majority of the farms I have visited, and 2) the level of damage will decrease with increasing field size. Furthermore, given my study set-up, I will also be able to answer a central methodological question: whether field sampling done post instead of pre harvest is more time efficient yet still produce an estimate similar to pre-harvest. Even if not, being able to sample both pre and post-harvest will improve our ability to quantify the economic damage to Swedish agriculture, which is of great and urgent need in today's society.

Method

Study area

The field work was carried out during August and September of 2012 in five LRF (The Federation of Swedish Farmers; Lantbrukarnas riksförbund) regions (Skåne [Skåne county], Sydost [Kronoberg, Kalmar & Blekinge county], Jönköping [Jönköping county], Södermanland [Södermanland county] & Mälardalen [Stockholm, Uppsala & Västmanland county]; *Appendix 1, Figure 13*) covering the south and southeastern parts of Sweden from approximately N 55° 19.215', E 13° 20.517' to N 60° 39.931', E 17° 19.140'. The landscape varies from being comprised of mainly agricultural fields in some places to be dominated by forests in others. The environment and therefore growing conditions vary within the geographical stretch. This affect the farmer's choice of crop and thus which crops are grown differs between the regions.

Damage inventory

Field sampling was limited to two crop species, wheat (*Triticum aestivum*) (both spring and winter wheat) and oat (*Avena sativa*), in order to allow me to visit more farms in a larger geographical area. The sampling started in Sweden's southern regions and continued further up to the more northern ones in order to follow the time of harvest for crops grown in these regions.

At each farm, I used a random numbers table to randomly select a number of fields of each crop to sample. Selected fields were then sampled using a line-transect method (Sutherland 2006). When possible, transects followed tractor tracks previously made by farmers when spraying the fields, thus avoiding trampling additional crop. However if no tracks were visible I used compass bearings to keep walking on a straight line. I recorded start and stop time and position for each transect with a handheld GPS (Garmin, eTrex® Vista C) and then used the Pythagorean Theorem to calculate transect lengths. Transect width was set to 10 m for the pre-harvest sampling and 20 m for the post-harvest one after ensuring that detection probability was 100 % within these distances. I recorded wild boar damages (both patches and paths made by the boars when walking through the crops) that fell within the given transect width and measured the area of these using a 15 m measuring tape.

Something that potentially could complicate the estimation of damages is presence of other ungulate species which also cause damage to agricultural crop. These occur to different extent within the study area and include: moose (*Alces alces*), red deer, (*Cervus elaphus*) fallow deer (*Dama dama*) and roe deer (*Capreolus capreolus*). However due to the abundance of wild boar tracks and dropping it is very likely that the bulk of the observed damages are caused by wild boar rather than the other species.

Mail Survey

A questionnaire was sent to members of LRF. Recipients were randomly selected from the LRF member list after applying a few selection criteria. From each region 100 farmers with an average acreage exceeding 20 ha in size were randomly selected based on the existing member record. The lower limit on acreage was set as an attempt to target only active farmers. A reminder was sent out four weeks after the initial mail to those farmers that had not yet answered. The full questionnaire is found in *Appendix 2*.

Yield losses

Looking at simple means

In order to make my results comparable with those of previous studies I calculated the cost of yield loss using the average damage level on crops. I did this by combining data from Statistics Sweden (Statistiska Centralbyrån; SCB) on harvest levels for the growing season 2012 and damage levels acquired through field sampling. Farms visited in the region Skåne were affected by a recently erected electric fence. Therefore data from these was excluded from the analysis since the farms cannot be considered to be representative. Calculations were done using below equation.

$$\frac{Harvest(ton)}{(1 - Damage\ level(\%))} - Harvest(ton) * Sale\ price(SEK/ton) = Value\ of\ yield\ loss(SEK)$$

Accounting for variation

When looking at simple means alone one does not account for variation within the data. Therefore I now turn to a method that may be considered more appropriate than the one previously described since it accounts for variation within the data. This is achieved by grouping farms into three groups according to their total damage level and computing an average damage for each of these groups (group 1 = 0 – 5 %, group 2 = 5 – 10 %, group 3 = 10 – 20 %; *Figure 9*). I then use the below equation to compute a third estimate of yield loss to wild boar.

$$C = \sum_{i=1}^{3}\big((d_i * Y) * (a_i * A) * S\big)$$

Where C is the total value of yield loss, d_i is the average damage level in the *i*th group, Y is the average yield in kg/ha, a_i is the percentage of the total cultivated area represented by the *i*th group, A is the sum of total cultivated area of the three crops in all the five regions and S is the approximate average sale price for the three crops. Note that these calculations assume that the situation regarding occurrence of damages and damage levels on the visited farms are representative of the situation in the whole study area. The value for average yield taken from Anonymous 2012a and the data on cultivated area from Statistics Sweden.

Testing variables

Amount of damage is suggested by previous studies (Thurfjell et al. 2009) to be determined by the amount of field edge, supposedly because this enable the wild boar to quickly escape into cover. Thus I perform a correlation analysis of my data compared to field size in order to test for this relationship. Furthermore I suspect there might be differences in damage level for different crops as well as regions. Therefore I use Kruskal-Wallis one-way analysis of variance in order to test for these differences.

Results

In total 44 fields using 147 transects where searched for wild boar damages. The sum of transect lengths was 36.8 km and the average length was 257.7 m. Damage levels vary between 0%-39.8 % (average 6.6%) for individual fields and 0 %-19.6 % (average 6.5%) for whole farms. In total 35.7 % of the farms had damages exceeding 5% of their total produce (*Table 1*) whereas 31.8 % of the fields had damages exceeding 5 %. Regression analysis revealed that 25 % of the variation in amount of damage is explained by field size alone (R^2=0.25) (*Figure 1*), however there is great variation within the data. I later discuss presence of a newly-built electric fence at the farms I sampled in Skåne. Data from this region is therefore missing from the estimates I obtained by walking fields but Skåne data is included in the mail survey.

Table 1. Summary of distribution of damage levels among visited farms.

Farmer ID	**Farm damage level**
A	0,1%
B	0,1%
C	18,2%
D	4,1%
E	2,1%
F	19,6%
G	1,9%
H	1,1%
I	16,7%
J	9,2%
K	4,9%
L	1,1%
M	2,9%
N	8,4%
Tot. No. Farms	14
No. Farms >5% Damage	5
Farms >5% Damage	35,7%

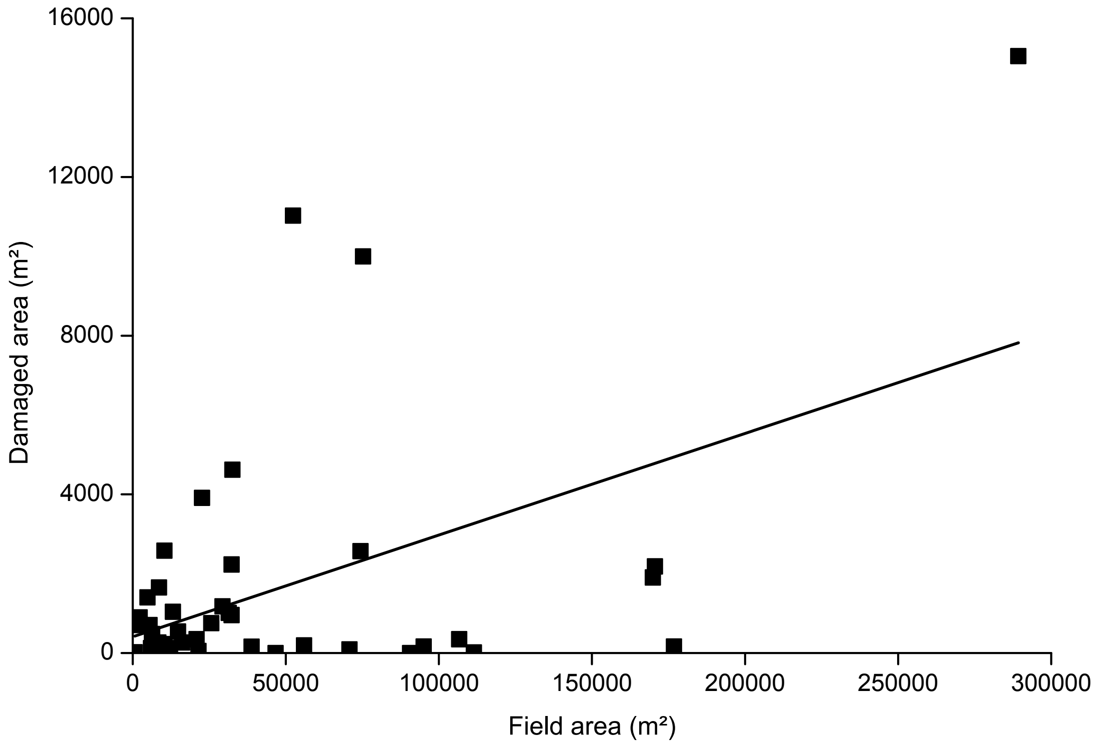

Figure 1. Scatter plot illustrating the regression of damaged area (m²) as explained by field size (m²) ($R^2=0.25$). As a result of the wild boars' behavior of foraging close to edges, the level of damage is expected to decrease as fields get bigger since large fields have less edge per unit area (assuming equal geometry). The amount of damage is related to field size, however there is much variation within the data.

Different crops

I analyzed the data using Kruskal-Wallis test but found no significant difference in damage level within the sample at the 0.05 level ($X^2=2$, df=2, p=0.36788), suggesting that there is little evidence for damage level varying among the crop types (*Figure 2*). Overall damage level on winter wheat was 4.3 %, spring wheat 2.7 % and 5.9 % on oat (data summarized and presented in *Table 2*).

Table 1. Summary of damage levels for the different crops: winter wheat (Triticum aestivum), spring wheat (Triticum aestivum) and oat (Avena sativa) in the LRF-regions Skåne, Sydost, Jönköping, Södermanland and Mälardalen.

Crop	Winter wheat(%)	Spring wheat(%)	Oat(%)
All	4.3	2.7	5.8
Skåne	-	-	-
Sydost	-	4.4	9.1
Jönköping	-	0.9	6.4
Södermanland	-	-	6.9
Mälardalen	4.3	-	1.1

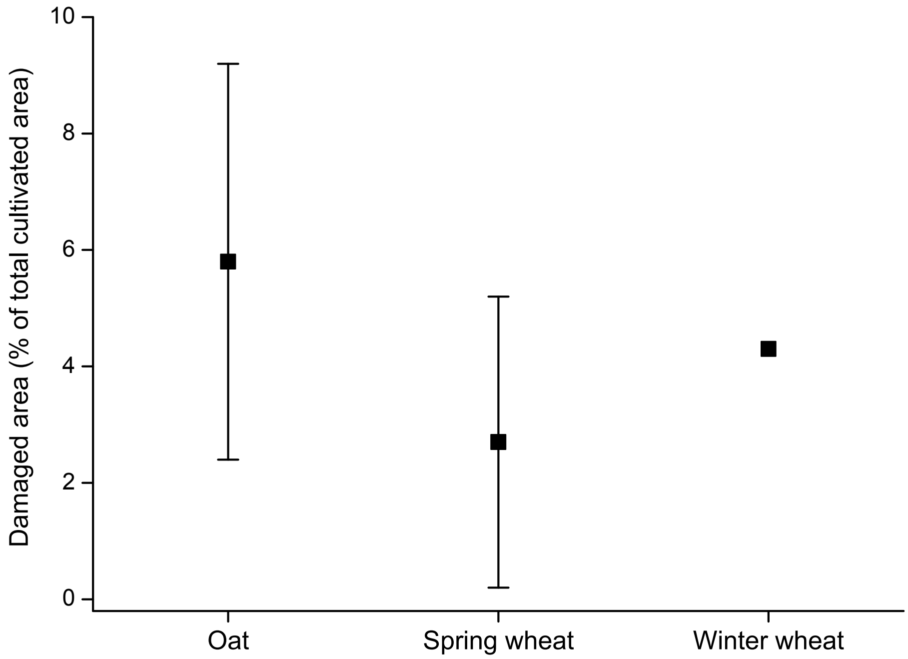

Figure 2. Plot with 95 % confidence limit illustrating the difference in damage level (excluding Skåne county because of a recently-built electric fence at the fields visited there) for the three crops; oat (Avena sativa),winter wheat (Triticum aestivum) and spring wheat (Triticum aestivum). Kruskal-Wallis test revealed no significant difference between the samples ($X^2=2$, df=2, $p=0.36788$).

Different regions

In order to compare damage level between regions I used data on oat (*Figure 3*) since that is the only crop for which I have data from all regions. I tested for differences with Kruskal-Wallis test but found no significant difference within the sample at the 0.05 level ($X^2=4$, df=4, p= 0.40601). The sample size in Södermanland was small, so to double check I also conducted this test with this region excluded from the analysis. The conclusion was unchanged: no significant difference in damage between regions at the 0.05 level ($X^2=3$, df=3, p=0,39163) (*Figure 4*). Damage levels for oat in the different regions were: Sydost 9.1 %, Jönköping 6.4 %, Södermanland 6.9 % and Mälardalen 1.1 % (*Table 2*).

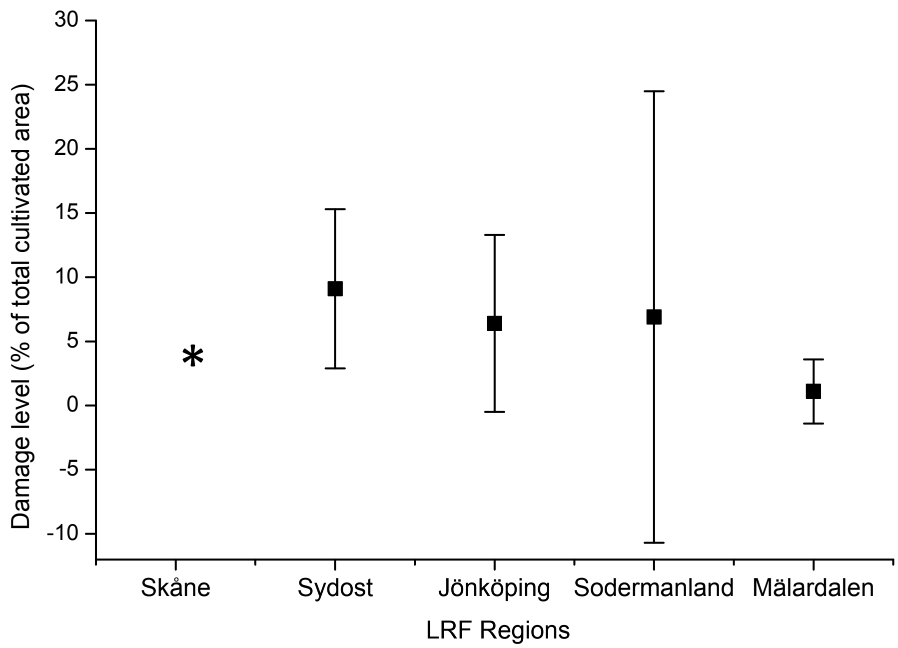

*Figure 3. Plot with 95 % confidence limit illustrating the difference between damage levels on oat (Avena sativa) in five LRF-regions (Skåne, Sydost, Jönköping, Södermanland & Mälardalen). Kruskal-Wallis test revealed no significant difference between the samples (X^2=4, df=4, p= 0.40601) at the 0.05 level.*Data from Skåne excluded because a newly-erected electric fence meant that the visited farms were not representative.*

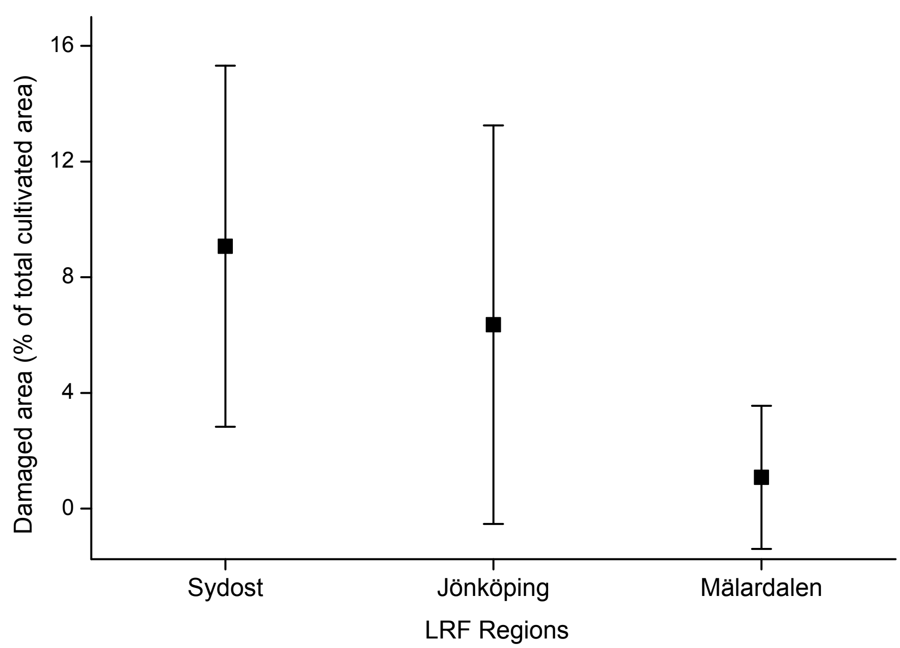

Figure 4. Plot with 95 % confidence limit illustrating the difference between damage levels on oat (Avena sativa) in three LRF-regions (Sydost, Jönköping & Mälardalen). Data from Skåne is excluded due to the visited farms not being representative and data from Södermanland is excluded due to limited sample size. Kruskal-Wallis test revealed no significant difference between the samples at the 0.05 level (X^2=2, df=2, p=0.36788).

Inventory methods

For comparison of the time efficiency between the inventory methods I used Wilcoxon's signed rank test. This revealed that he post-harvest method was 3.6 times more time efficient (*Figure 5*) although not quite at the 0.05 level ($\alpha=0.05$, $Z=-1.88776$, $p=0.0625$). I also compared the damage estimates produced by the two methods to see if they coincided with each other. A correlation between the two revealed an R^2 of 0.99 ($p<0.001$) which suggests that there is an extremely strong relationship between the estimates. I compared the regression to the relation of the variables in an ideal case where a change in X of a given magnitude is matched by a response in Y of equal magnitude (i.e. a slope of 1 with an intercept of 0). The slope of the regression was 1.0376 ± 0.1189 (95 % confidence limit) which encompass 1 and the Y-intercept 0.0094 is not significantly different from 0 ($t=-1.62$, $df=4$, $p>0.2$) (*Figure 6*).

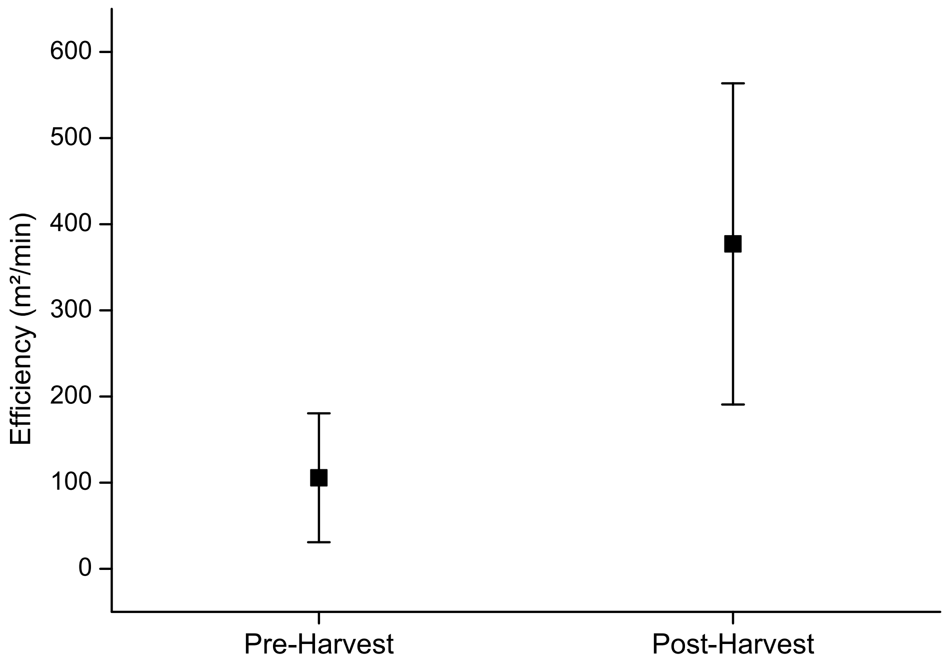

Figure 5. Scatter plot with 95 % confidence limit illustrating the difference in mean efficiency (m²/min searched) of the pre- and post-harvest method. Wilcoxon's signed rank test revealed a difference in efficiency between the methods of 3.6 times, however not quite at the 0.05 level (α=0.05, Z=-1.88776, p=0.0625).

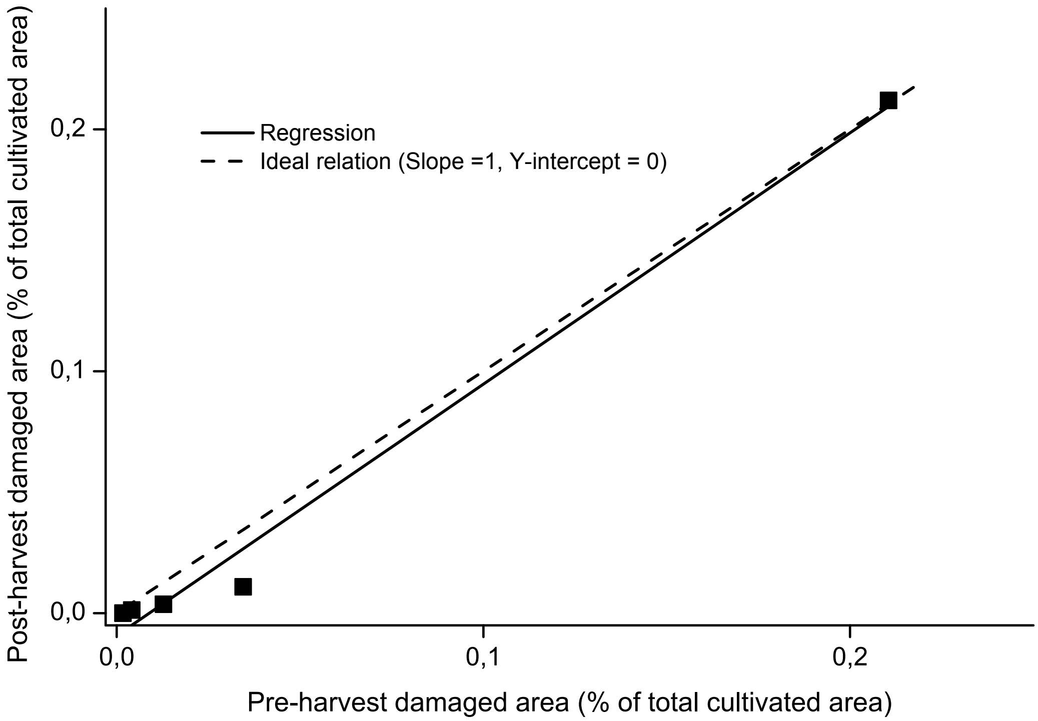

Figure 6. Plot illustrating the correlation between pre- and post-harvest damage estimates (R^2=0,99, p<0,001). The regression line is compared to the line of an ideal relation between the two variables X and Y (i.e. slope of 1, intercept at 0). In this case the slope does not differ from one (the slope and 95 % confidence limits is 1.0376 ± 0.1189) and the intercept of -0.0094 is not different from 0 (t=-1.62, df=4, p>0.2).

Yield losses

From calculations done using simple overall means (to permit a comparison of my results with previous studies which used this simpler method of calculation), I get a value of the loss to wild boar of 151.8 million SEK (or 359 SEK/ha) for the entire study area where winter wheat, spring wheat and oat account for 76.9 %, 0.6 % and 16.8 % respectively (*Figure 7 & 8*). When I performed these calculations using damage classes (which better accounts for the great variation in the data), I estimate the total value of yield loss to wild boar to be 240 million SEK, which is equivalent to a loss of 840 SEK/ha.

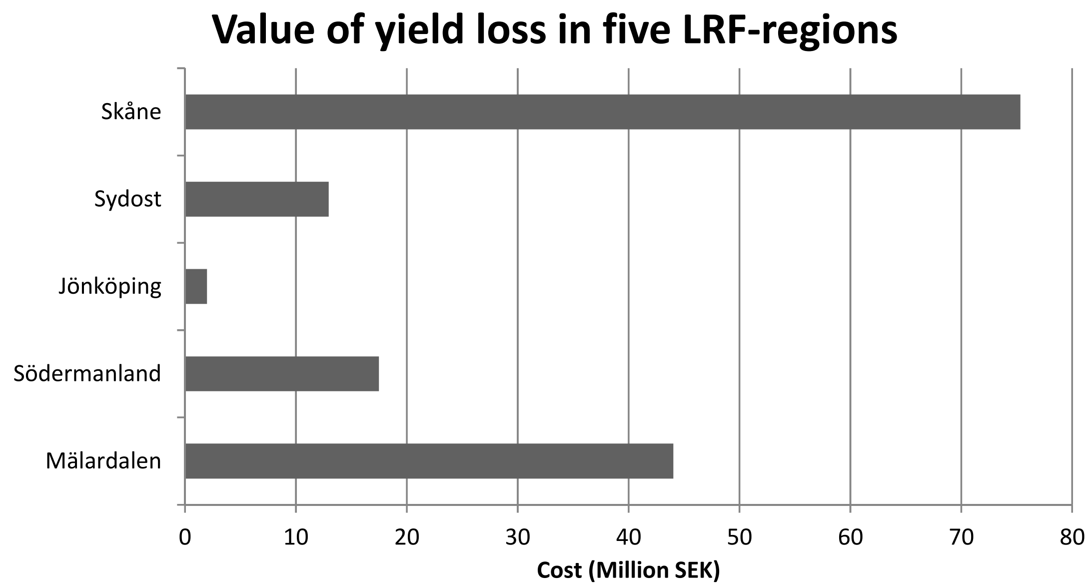

Figure 7. Bar graph showing approximate cost (pooled for all three crops: oat (Avena sativa), winter wheat (Triticum aestivum) and spring wheat (Triticum aestivum)) of wild boar damage in each of the visited regions. Cost estimated from inventory data on average crop damage levels, national statistics on harvest levels in the concerned counties and Lantmännens buyout price at the 31th of January 2013. Total value of damages amount to 151.8 million SEK.

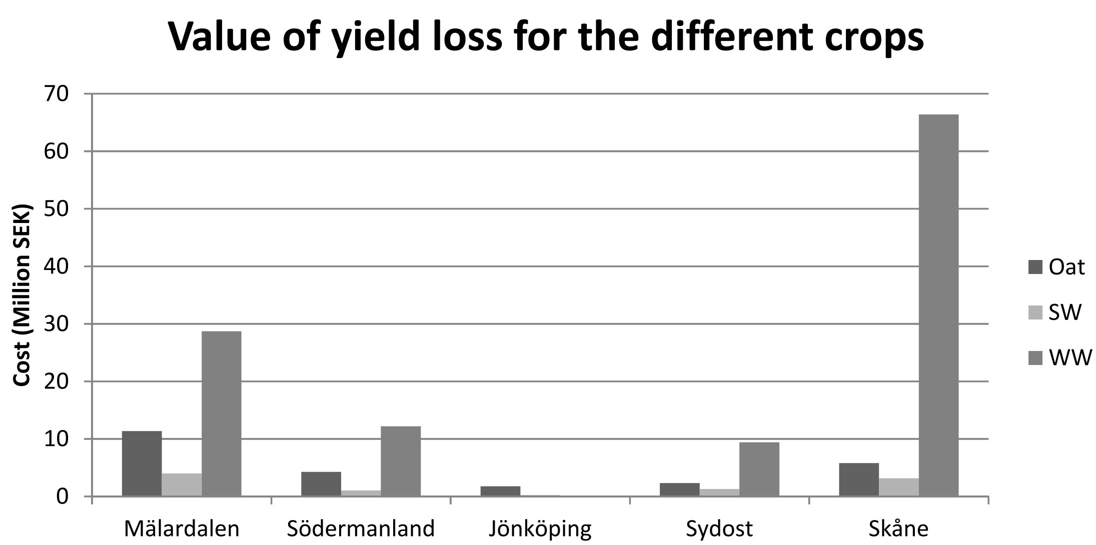

Figure 8. Bar graph showing approximate cost of wild boar damage in each of the visited regions in respect to the three different crops: oat (Avena sativa), winter wheat (Triticum aestivum) and spring wheat (Triticum aestivum). Cost estimated from inventory data on average crop damage levels and national statistics on harvest levels in the concerned counties. SW = spring wheat, WW = winter wheat.

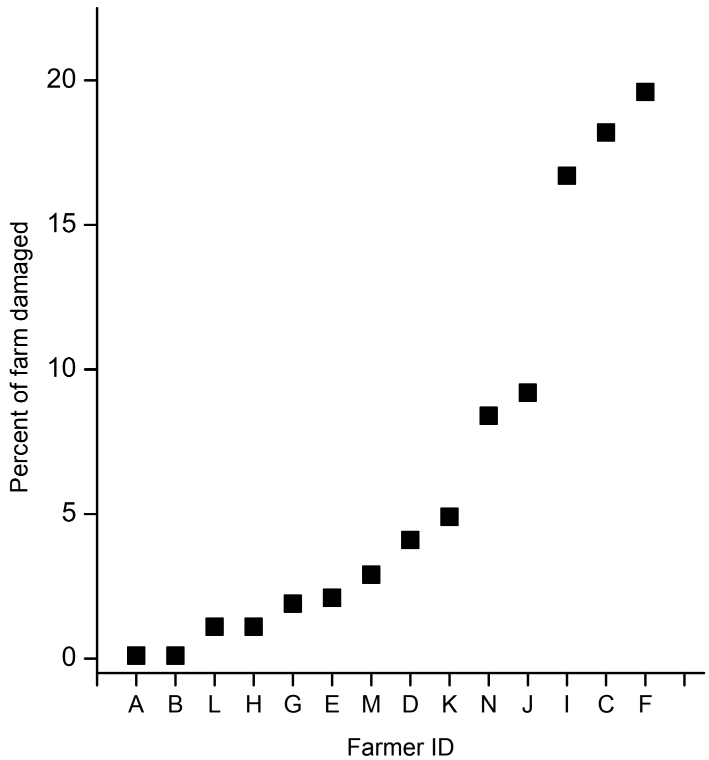

Figure 9. Visualization of data on damage levels on the visited farms. Data is categorized into three groups based on which damage interval data fall within: 0-5 %, 5-10 %, 10-20 %. Data on farm damage levels available in Table 1.

Mail Survey

Overall response rate was 52.8 %, evenly distributed among the regions. 93.7 % of the respondents were male with an average age of 55 years. I received 31.8 % blank answers and of these 24.6 % had been sent to farmers who were unable to answer the survey because they had either leased out or sold their farms. Calculations of the cost of damages are based on Lantmännens sale price of conventionally grown crops. This entails that because 13.7 % of the farmers reported that their crop production was organic, the cost estimate is slightly underestimated since the sale price of organically produced crops may be as much as twice that of those conventionally grown (Anonymous 2010a). *Figure 10* illustrates the distribution of crop damages whilst *Figure 11* illustrates the value of yield loss distributed between the different crops (results from the survey corresponding to *Figure 10 & 11* are reported in *Appendix 1, Table 5 & 6* respectively). The value of total yield loss to wild boar is estimated to be 2 473 900 SEK. For a full summary of survey results see *Appendix 1, Table 4*.

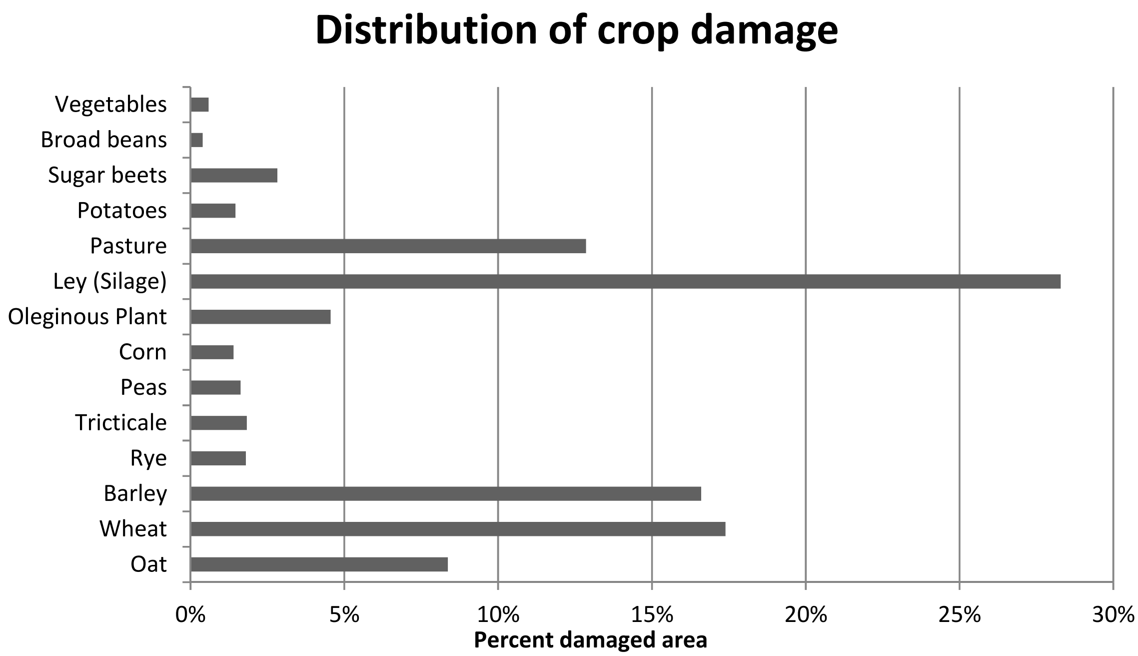

Figure 10. Visualization of damaged area for various crops as reported by farmers in the mail survey. Data available in Appendix 1, Table 5.

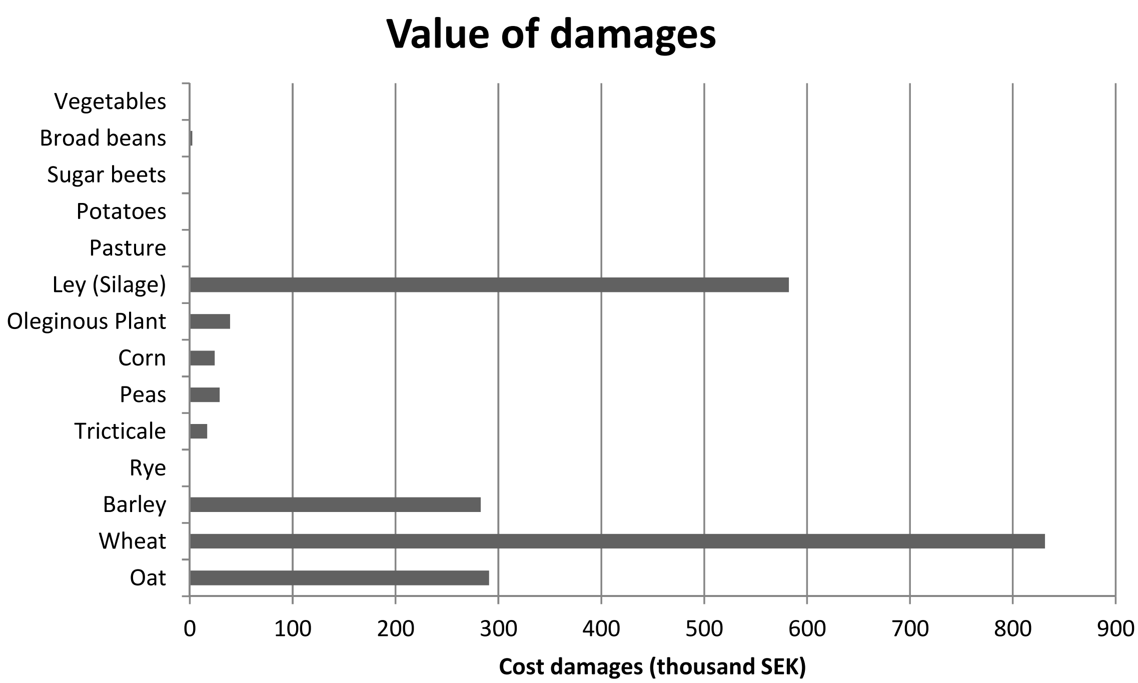

Figure 11. Visualization of yield loss to wild boar on different crops as estimated by farmers in the survey. Data available in Appendix 1, Table 6.

Discussion

In this study I have sought to quantify wild boar damages in five regions covering the south and south-eastern parts of Sweden, both through field sampling and by a mail survey. My findings indicate that damage levels do not differ significantly neither between the different crops nor regions. During the year 2012 I estimate that the overall harvest loss to wild boar was 3.2 % for wheat (winter wheat 4,3 %, spring wheat 2.7 %) and 5.8 % for oat, damages which amount to 151.8 million SEK when extrapolated to the whole study area. When accounting for the big variation in damage levels I found that the total cost may reach 240 million SEK. When asking farmers to estimate the yield loss to wild boar this amounted to approximately 2.5 million SEK for the 176 farmers that answered the questionnaire. I also tested a method of conducting inventory post instead of pre harvest. The post-harvest was 3.6 times faster than the pre-harvest method (377.2 m^2/min versus 105.6 m^2/min, $p=0.0625$; *Figure 5*). This suggests that it is faster yet produces an estimate equal to that of the pre-harvest method (*Figure 6*).

The total agriculture-based income of Sweden's agricultural households in 2005 amounted to 43.2 billion SEK (Anonymous 2007). When the estimated value of damages is put in relation to the economics for the agricultural sector as a whole they cannot be considered to be overly large (≈0.35-0.56 %). Note however that my estimates only consider loss in three crops and also not the whole of Sweden. This makes the comparison less than ideal but the only one possible. The variation in damage level is quite high. Some farms may escape getting damaged almost completely, meanwhile for other farmers the wild boar may be responsible for causing considerable economic damage (e.g. 3 of 14 farms in this study had an average of 18.2 % damage) as is depicted by the second estimate of the value of yield loss which account for this large variation in damages. When damages reach such an extent it is likely that the farmer cannot sustain his business. Assuming that the situation among these farms are representative of the situation in the whole study area, more than 20 % of the farmed area suffer damages equal to approximately 18 % of their total annual yield. Since small fields suffer a greater risk of being relatively more damaged than large fields and because small fields are more likely to be owned by small land holders, those that can least afford it may be the ones getting hit the hardest -- an important aspect of the wild boar issue for the society to consider.

Previous studies have also estimated the cost of wild boar damages. Persson (2010) studied five farms in five LRF regions corresponding to those targeted in this study. He found the total cost of loss in yield to be 40 000-519 000 SEK or 180-962 SEK/ha and that at most 20 % of the cultivated area had been lost to damages from wild boar. Olsson (2009) says that a loss in yield of 30-60 % is not uncommon in some areas of Sweden and for pastures with three harvests per season, damages cost between 1377-7175 SEK/ha depending on the intensity of damages. In a report by Jordbruksverket (Anonymous 2010a) focusing on Södermanland County, the cost of yield loss amounted to 109 SEK/ha which is equal to approximately 14 000 000 SEK for that whole county. Lindblom (2011) used a method similar to the pre-harvest one in this study and found damage levels for wheat, oat and barley to be 2.8 %, 2.2 % and 1.8 % respectively, which was equivalent to a loss of 78 720 kg or 119 740 SEK (summary of previous studies findings in *Table 3*).

*Table 3. Summary of previous studies findings.*Estimated cost of damages on ley (silage) fields depending on damage intensity, including additional costs of wild boar activity. ** Maximum percent damage per farm/field. ***Cost in thousand SEK. **** Damage level for wheat/oat.*

Study	Prop. Lost (%)	Cost (SEK/ha)	Total cost (SEK)
Persson 2010	Up to 20	180–962	40 000–519 000
Olsson 2009	30-60	1377-7175*	-
Anonymous 2010a	-	109	≈14 000 000
Lindblom 2011	1,8-2,8	-	119740
This study	19.6/38.6** 3.2/5.8****	359-840	151 792-240 056***

In accordance with Persson (2010) I find that damage levels for individual farms may reach up to 20 % and the value of damages per hectare is well within the range he reports. For individual fields I have measured damage levels of up to almost 40 % which agrees with Olsson (2009)s' estimate of damage levels reaching 30-60 %, however I did not find the loss per hectare on ley (silage) to be as high as is reported in that study. The damage estimates which I present in this report deals with the value of the loss in yield, however there are additional costs pertaining to wild boar damage. These include both direct costs, such as famers being forced to buy new grain to replant fields or mechanical parts to repair broken machinery, as well as indirect costs such as extra work hours put into e.g. protective hunting, putting up fences and scaring contraptions, additional soil preparation etc. Furthermore to control populations of wild boar and thereby limiting the level of damage collaboration and cooperation between neighboring hunting teams is essential (Lemel et al. 2003), activities which often requires a lot of effort and time from the participants (Anonymous 2010a). This is likely the reason for my cost estimate on ley (silage) to differ from that of Olsson (2009) since I do not consider these kinds of costs in my calculations whilst they did. My estimates differ somewhat from that of Anonymous (2010a). Damage per hectare differ substantially for both of my estimates (my 359-840 SEK/ha; see *Appendix 1, Table 7*; compared to their 109 SEK/ha). However the total value of damages in the county Södermanland is of the same order of magnitude as the value I find (my approximately 17 500 000 SEK compared to their approximately 14 000 000 SEK; *Appendix 1, Table 7*). Lindblom (2011) found damage level for wheat to be 2.8 % and 2.2 % for oat. My estimate of damage level on wheat was 3.2 % which agrees well that of Linblom (2011), however for oat my estimate of 5.8 % is more than twice as large her 2.2 %. Despite the time lag of a few years between the studies and mine, in find that my results conform well to those of previous studies.

In the mail survey the value of damages was greatest for wheat, followed by oat and ley (silage), however when looking at damage level, ley (silage) is by far the crop with the most damage (followed by wheat and barley; *Hordeum vulgare*). This was expected since it seems to be the general opinion that it is on grasslands one find the most extensive damages. Results from the mail survey confirm this notion regarding ley (silage) being subjected to severe damage by wild boar. Voices have been raised requesting evaluation of these damages since they not only result in yield losses, but also costs in term of contaminated fodder and ultimately e.g. lowered milk quality if dairy cows are fed the tainted silage (Anonymous 2010b; Lemel & Truvé 2008). Meanwhile other costs may also come with having wild boar damages. Since they root for invertebrates and couch grass (*Elymus repens*) they occasionally tip up stones which may get caught in machinery when e.g. harvesting crops (Anonymous 2010a). This may cause serious damage to these machines and result in a hefty repair cost for the farmer. In the survey 31 farmers reported economic loss from either lowered milk and/or fodder quality which had an average cost of 22 292 SEK per year. 30.6 % of the respondents say yes when asked if they have had damage to machinery as a result of the wild boar's activity and of these, 25 farmers report an average cost of 13 284 SEK/year for the damages. As previously mentioned there are also other indirect costs connected to wild boar, one of which is requirement of additional work hours. 58.8 % of the farmers in the survey (n=40) said that they had had increased work effort due to the wild boar with the average input of extra time being 2.5 hours per week. Furthermore 77 farmers report an average of 78.5 hours spent on protective hunting of wild boar during the last 12 months. How to value time is not easy, however Olsson (2009) considered the value to be 220 SEK/h which would put the value of extra work hours and time spent hunting, for the farmers in this mail survey, at just below 1.4 million SEK/year. The value of yield loss reported by farmers amount to approximately 2.5 million SEK for the 176 farmers who report damage, which is equal to approximately 14 000 SEK/farmer. The field part of the study focuses on three crops (oat, spring wheat and winter wheat) whereas the survey focuses on total damage on farms and includes most crops. I lack data for the composition of crops for the average farmer, and because of this the two estimates are not directly comparable.

It is not easy to engage in farming and at the same time completely avoid having your crops damaged by wildlife. A zero tolerance to wildlife damages (or 100% compensation from the state) is virtually unattainable and to pursue such a goal does not seem to be promising. It is not the task of society to provide farmers with perfect growing conditions any more than it is the farmer's obligation to endure unlimited damages by the wildlife which has value to Swedish society as a whole. Swedish forestry has agreed to accept damages by moose of up to 2 %/year which is equivalent to 15-20 % damaged trees in the final stand (Arvidsson 2008). Tolerance level within Swedish reindeer husbandry for loss of reindeer (*Rangifer tarandus*) to predators is 5 % (Enoksson 2012) and farmers in Germany have to accept a level of damage equal to 5 % of their total annual produce as the price paid when growing crops in nature (BGH 1984). Perhaps Sweden too should decide on a limit up to which damages are accepted as the price society pay for wildlife, and when damages exceeds this threshold farmers should be compensated (in fact Ahlbäck (2012) reports that 60 % of farmers are positive to the introduction of a compensation system for wild boar damages). Farmers that suffer damages by wild boar are, as previously mentioned, not eligible for financial compensation according to current Swedish legislation. In this study 31.8 % of the fields and 35.7 % of the farms had damages exceeding 5 % of total area. Also as much as 20 % of farms may suffer damages equal to 18 % of their annual produce. If this is a common occurrence, perhaps implementation of a compensation system, inspired by that that used in Germany, should be considered in Sweden as well.

Almost all of Germany is divided into hunting districts within which there are groupings of landowners. The hunting right is undisputedly tied to the ownership of the land (BJagdG: §3) and land owners whom are eligible to hunt (e.g. have a hunting license) also has the right to hunt. Since it is regulated by law that all land has to be hunted (BJagdG: §10) they have two options, either they 1) hunt themselves or 2) lease out the right to hunt (which is the most common practice). The holder of the right to hunt is obliged to prevent game from damaging crops and should damages occur, then it is the hunter that is liable to pay compensation to the farmer (BJagdG: § 26 & § 29). However if efforts for mitigating damages are obstructed by either farmers failing to alert the hunters about damages within 7 days of detecting them (BJagdG: § 34) or by unsound practices, then the liability for the damages does not lie with the hunters and thus farmers are not entitled to any compensation (BJagdG: § 34). What is meant by sound practice is very loosely defined, but things such as e.g. farmers taking into consideration and not growing damage-prone crops close to forest edges since that is where damage is most likely to occur and regularity in checking fields for damages at least every four weeks are examples of what is regarded as sound practice. Thus the system requires both the involved parties (i.e. hunters and land owners) to communicate and cooperate since it is in their own interest to prevent damages from occurring. As previously stated, remunerations are only paid for damages exceeding a certain tolerance level. Commonly used is a level of 5% of the total annual yield (BGH 1984), however when hunters enter a contract with land owners, the land owners may specify other conditions and tolerance levels which must be upheld in order to fulfill the contract.

The spatial patterns of wild boar's movements as well as the damages they cause are determined by many factors (Thurfjell et al. 2009; Schley et al. 2008) which make it difficult to predict where damages will occur. This is likely the reason why some farms and fields, which had been subjected to a high level of damage previous years, to have a very low damage level this year. The spatial distribution of damages led me to expect that the proportion of damage to fields will decrease as field size increase, since damages are more likely to occur in connection to field edges (Thurfjell et al. 2009; Kornacher 2006; Calenge et al. 2004) and because larger fields have less edge per unit area. If wild boars did not stick to edges when foraging then I would expect damages to be uniformly distributed throughout the field and the amount of damage to increase in direct proportion to increasing field sizes. As expected, the amount of damage is related to field size, which is in accordance with the wild boars' behavior of foraging in field edges (Kornacher 2006, and references therein; e.g. Breidermann 1989; Meynhardt 1979; Paslawski 1975). However there is great variation within the data and 25 % of the variation in amount of damage is explained by the variation in field size (*Figure 1*), suggesting that there are other factors influencing the wild boars' damage-causing behavior. Suggestions to which are e.g. that the wild boar remember the distribution of crops during last years' growing season, causing the farmers' choice of crop one year to affect the damage level on the crop grown on the same field following years. Also what may affect the spatial variation of damages is the fact that wild boar live in matriarchal groups (Lemel & Truvé 2008). This cause variability in damages since groups does not give rise to damages which are uniformly distributed throughout the landscape. They aggregate and cause extensive amounts of damages where the group chooses to forage. Thus the distribution of damages is patchy and while some fields suffer extensive amounts of damages, some may avoid getting damaged altogether. This is likely also the reason for the variation within the data. Some of the farms have almost no damages while others have lost almost 20 % of their total harvest to the wild boar.

This information would be good for farmers to consider and implement when planning their growing regime. Crops which are valuable and/or prone to damage should be grown furthest from forest edges. Also a few big fields should better than several small, which means that farmers should consider growing their crops in larger fields and/or fields with less forest-covered edge per unit area. By decreasing their overall edge per unit area, their overall damage level might decrease. Another way of damage reduction is by employing hunting (e.g. Geisser & Reyer 2004 and references therein). In the absence of predators, hunters can mimic the risk of predation with the risk of getting shot (Thurfjell et al. 2009). This entails that by applying the theory of the landscape of fear and by tailoring the hunting practice to fit local conditions, hunting can keep the wild boar out of the center of fields and keep damage within field edges. Here buffer zones could be created where less valuable crops are planted with the intent of being used by wild boar. That way the valuable crop, grown further to the center of the field should suffer minimal amounts of damage, hence lowering the economic impact the wild boar may have for the farmer. These are all important considerations to be considered by today's society if we want to decrease the level of wild boar damage.

If the two inventory methods are similar we would expect an R^2-value of close to one, a slope of one and a Y-intercept of zero. For my data R^2 was 0.99, the slope was not statistically different from one, and the intercept was not statistically different from zero. This suggests that the two methods are interchangeable. Note that the data consists of five data points which cause the data point at 20 % damage to be highly influential. Still it is very likely that my result reveal that there indeed is a relationship between the pre and post-harvest estimates, although not necessarily a one-to-one relation as is assumed in the analysis. The reason for choosing one method over the other is if one is more time efficient. My results show there is a difference in efficiency of the methods of 3.6 times ($p=0.0625$) and thus I suggest that efforts should be made at further evaluate the post-harvest method. Note that strip width for the post-harvest method advantageously can be increased even further from the width I used here which would further increase the methods' efficiency.

Furthermore in this study I measured the damaged area by both patches and paths. Paths made up 0,998 % of the total damaged area and I estimate that approximately 50 % of the total time it took to complete one transect consisted of measuring the area of paths. Thus for practical reasons I recommend others not to measure paths when using these methods in future studies.

The sampling was somewhat limited due to weather conditions (Anonymous 2012b) since this lead to crops ripening at different times than they usually do, thus shortening my sampling period due to overlapping harvest seasons. Ideally each field should be sampled right before it is harvested in order to avoid overlooking damages that occur close to harvest. However due to the geographical constraints of the study this was not possible, although I tried to keep the time at which I sampled fields within two weeks of harvest. Still the time of harvest in the different areas was hard to predict since the time at which crops ripen depend much on the weather in upcoming weeks. Weather conditions also caused crops to ripen late and this was the reason for some fields getting sampled earlier than two weeks prior to harvest. Like previous studies performed in crop fields, I have assumed that the observed damage was caused by wild boar; however other ungulate species (i.e. moose, red deer, fallow deer and roe deer) also cause damage to agricultural crops. Especially in the region Södermanland where all of these species are present, damage estimation becomes complicated since it is not always easy to distinguishing between damages caused by the different species. Note however that the bulk of the observed damages are very likely to have been cause by wild boar due to the abundance of tracks and droppings found. Furthermore a damaged plot trampled by e.g. fallow deer (or even wind- or rain-felled ones) may later on become rooted in by wild boar. Damages may then become attributed to wild boar when in fact the other species are responsible. This will in turn lead to an overestimation of the contribution of wild boar to the total damage level. The question is whether we would receive a more reliable, and possibly more applicable, estimate by assessing total pressure caused by all ungulate species on farmed crops rather than trying to target only one species. The method described in this paper would be suitable to apply when doing damage inventory for all ungulate species. By broadening the scope we would decrease the risk of over- or underestimating the damages since we avoid having to distinguish between damages caused by the different species.

As already mentioned, the spatial occurrence of damages depends on many factors. Suggestions to a few are reported by Schley et al. (2008), one of which is the intensity of supplemental feeding. Supplemental feeding may be used as dissuasive tool to keep wild boar out of crops (Anonymous 2010a; Calenge et al. 2004; Vassant 1994) but also as a way for e.g. hunters to secure hunting opportunities (Thurfjell et al. 2009). Questions have been raised as to whether this really does avert wild boars from farmed crops. Some studies have found evidence that it does work (Calenge et al. 2004; Vassant 1994; Vassant & Breton 1986) whilst others have not (Cellina 2008; Geiser & Reyer 2004). Supplemental feeding is an ongoing practice in Sweden today (Anonymous 2010a; Lemel & Truvé 2003) and it is often the cause for conflicts between different social groups (Anonymous 2010a; Thurfjell et al. 2009). Results from my survey shows that 49.2 % of farmers who report that supplemental feeding is practiced either on their own or neighboring land also say that they do not think supplemental feeding is a good tool for averting wild boar from farmed crops. This reflects the above mentioned conflict which often originates in hunters and farmers aiming for different goals in the management of wild boar. In the wild boar issue Sweden apply an adaptive management system which is anchored at the local level and rely on local support and participation (Lemel & Truvé 2008, Anonymous 2010b). The watchwords of the management are; knowledge, cooperation and communication, meaning that the management is built on the knowledge and participation of many different actors (Anonymous 2009). Although population levels are estimated scientifically before deciding a harvest quota, there is no reliable census method for wild boar available today (Lemel &Truvé 2008) which further complicates the management. However researchers are currently looking for ways to develop the methodology for estimating wild boar populations (Åkerman 2012; Jansson & Månsson 2011). There is also a conflict of interests involved and the purpose of the management might diverge between separate actors (Lemel & Truvé 2008). Those profiting from the positive effects of wild boar (e.g. hunters and those selling hunting rights) may want a large population meanwhile those that suffer from the negative effects want the population to be kept at a lower level (Lemel & Truvé 2008). In a successful management, participants agree upon common management goals (Lemel & Truvé 2008). Actions taken in order to reach such a goal need to be based on accurate and reliable estimates (Lemel & Truvé 2008) of both population size as well as the extent of wildlife damages if the management is to be accepted by those concerned. The aim of this study was to quantify damages caused by wild boar and ultimately by doing so providing a basis for decision-making in management. Both the field-based methods and the mail survey are important tools when estimating wild boar damages. Authorities and managers can utilize methods such as those described in this paper in order to produce estimates of damage caused by wildlife.

Building on previous work this study has improved sample sizes and geographical representation of the Swedish wild boar damage assessment. A novel method for estimating damage to agricultural crops has, as I am aware of, for the first time been tested and evaluated in Sweden. Although further evaluation of the method is needed, it could be used to further refine wild boar damage estimates. The wild boar is well established in Sweden and it appears as if they are here to stay. A comment that came up in the mail survey said: *"As for the future, we must make a choice if we are to have wild boar or meaningful agriculture"*. From meeting with farmers I get the idea that this is indeed how many farmers feel about the Swedish wild boar today. This calls for further refining of methods to evaluate their damage-causing behavior and both the spatial and temporal characteristics of that behavior if farming is to be considered economically sustainable – and not just for big agricultural corporations.

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Appendix 1:

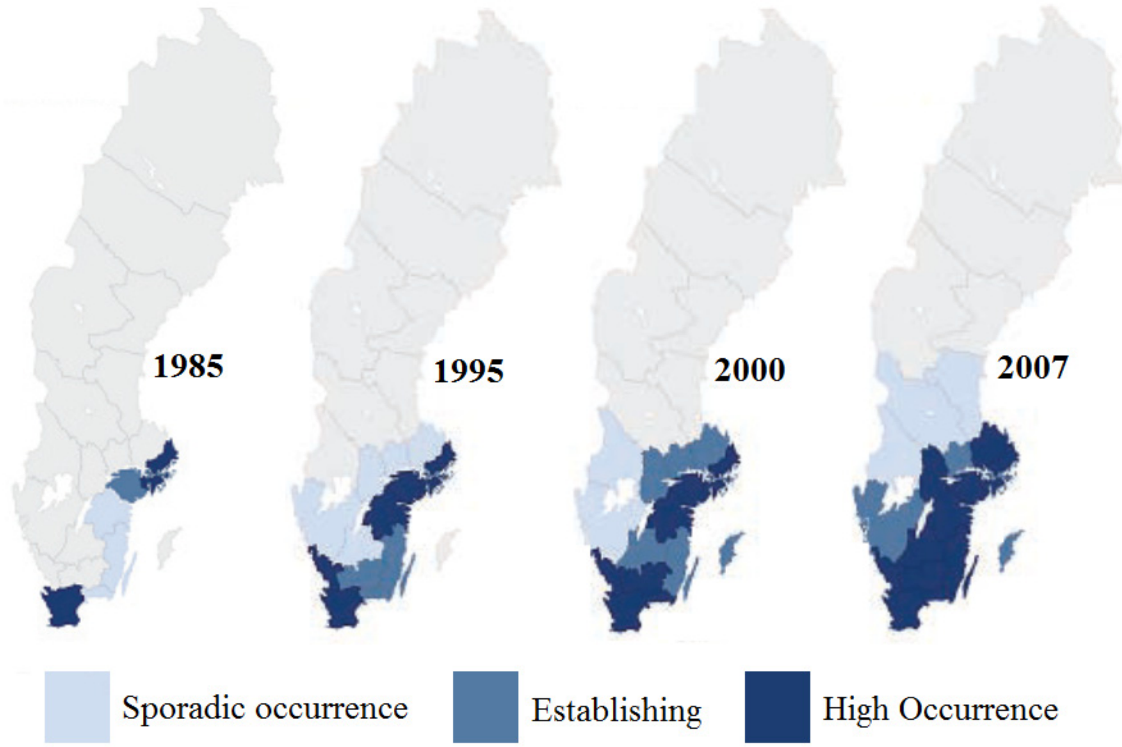

Figure 12. Distribution of wild boar (Sus scrofa) in Sweden the years 1985-2007. (modified from Anonymous 2010a).

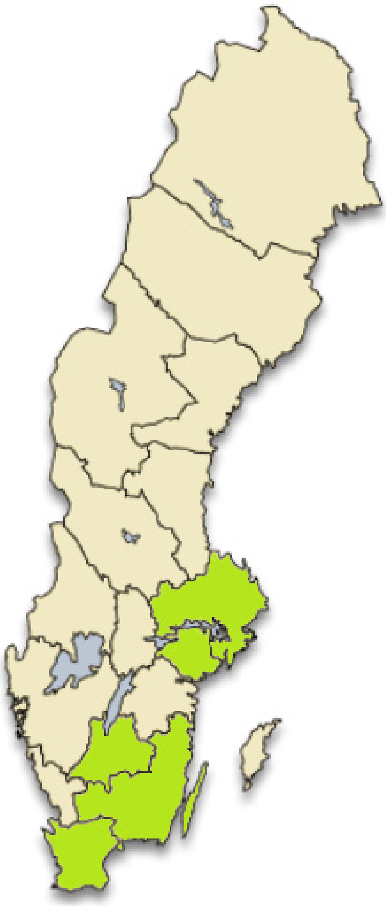

Figure 13. Map showing all LRF regions and the regions covered by this study is highlighted (modified from http://www.lrf.se/Medlem/Regioner/).

Table 4. Answers to the survey sent to 500 members of The Federation of Swedish Farmers (Lantbrukarnas riskförbund; LRF).WB = wild boar. Estimation of economic and effort variables is in relation to previous twelve months.

Question	**Perc.(%)**	**No.**	**Ave.**
WB occurrence			
Yes	68,0		
No	32,0		
Change in numbers since 2000			
Yes	96,4		
No	3,6		
Increased	99,1		
Decreased	0,9		
WB damages			
Yes	91,7		
No	8,3		
Amount of damages changed			
Yes	95,3		
No	4,7		
Increased	100,0		
Decreased	0,0		
Changed crops due to WB			
Yes	28,6		
No	71,4		
Who have hunting rights			
You	52,9		
Other	47,1		
Who hunts			
You	37,3		
Other	54,9		
No hunting	7,7		
Time spent hunting (Hrs)		77	78,5
Question	Perc.(%)	No.	Ave.
Income of WB			
Yes	12,7		
No	87,3		
In the form of			
Sold Hunting right	36,8		
Sold meat	47,4		
Tourism	0,0		
Other	15,8		
Income (SEK)		30	8167
Supplemental feeding			

Yes	53.8		
No	46,2		
functional dissuasive tool			
Yes	37,5		
No	62,5		
Cost lowered quality (SEK)		31	22292
Machinery breakdown			
Yes	30,6		
No	69,4		
Approx. Cost (SEK)		25	13284
Increased work effort			
Yes	58,8		
No	41,2		
Hours/week		40	2,545

Table 5. Distribution of crop damage as reported by farmers. Percentage damage on each crop of total damaged area.

Crop	**Area (ha)**	**Perc.(%)**
Oat	1562,9	8,4
Wheat	3248,3	17,4
Barley	3100,9	16,6
Rye	336,2	1,8
Tricticale	342,3	1,8
Peas	304,2	1,6
Corn	261,8	1,4
Oleginous Plant	850,8	4,6
Ley (Silage)	5283,1	28,3
Pasture	2401,9	12,9
Potatoes	273,1	1,5
Sugar beets	527,4	2,8
Broad beans	74,5	0,4
Vegetables	110,0	0,6
Total	18 677,3	

Table 6. Data on yield losses to wild boar and the estimated cost of damages (thousand SEK), sale price in SEK/ton. WB = wild boar. Value of ley (silage) estimated from sale price of 500 kg silage bale with 40% dry substance.

Harvest loss to WB	Tonnes	Perc.(%)	Sale price	Cost
Oat	399,71	24,6	1665	665,5
Wheat	394,92	24,3	2105	831,3
Barley	168,89	10,4	1675	282,9
Rye	0,00	0,0	1910	0,0
Triticale	8,75	0,5	1920	16,8
Peas	11,80	0,7	2460	29,0
Corn	20,10	1,2	1200	24,1
Oleaginous plant	9,70	0,6	4035	39,1
Ley (Silage)	582,33	35,6	800	582,3
Pasture	37,50	2,3	-	0,0
Potatoes	0,075	0,0	1370	0,1
Sugar beets	0,05	0,0	3000	0,2
Broad beans	1,00	0,1	2500	2,5
Vegetables	0,00	0,0	-	0,0
Total	1627,52			2473,9

Table 7. Summary of value of yield loss in the LRF-regions Skåne, Sydost, Jönköping, Södermanland and Mälardalen. Cost is in thousand SEK, SW = spring wheat, WW = winter wheat. Estimated using the average damage level for each crop.

Sum_Region	Tot. Cost	Cost Oat	Cost SW	Cost WW	Cost_SEK/ha
Mälardalen	44023,9	11359,6	3968,6	28695,6	376,7
Södermanland	17489,4	4248,2	1044,4	12196,8	394,3
Jönköping	1985,6	1746,8	238,7	0,0	166,6
Sydost	12965,6	2305,0	1265,2	9395,4	322,0
Skåne	75327,7	5778,0	3145,1	66404,6	533,9
Total	151792,1	25437,8	9662,0	116692,4	358,7
Percent (%)		16,8	6,4	76,9	

Appendix 2:

Grundfrågor (Markera de alternativ som stämmer in på er verksamhet, gäller samtliga frågor)

1. Vilken produktionsinriktning har ni?

a. Spannmålsproduktion ☐

b. Köttproduktion:

Lamm ☐ Nöt☐ Svin ☐

c. Mjölkproduktion ☐

d. Slaktkycklingsproduktion ☐

e. Äggproduktion ☐

2. Är produktionen (ange fördelning i procent):

a. Konventionell_______%

b. Ekologisk_______%

3. Hur stor total åkerareal (i hektar) brukade ni den gångna odlingssäsongen?____________ha

4. Hur ser ägandeförhållandet ut?

a. Andel ägd mark_________________________ha

b. Andel arrenderad mark_________________________ha

5. Hur såg fördelningen av odlingsgrödor ut den gångna odlingssäsongen? Vi ber er att ange vilka grödor samt odlad areal (ha) av respektive gröda.

Havre________ha Vete________ha Korn________ha Råg________ha

Rågvete________ha Ärtor________ha Majs________ha Oljeväxter________ha

Vall________ha Betesmark________ha Potatis________ha Sockerbetor________ha

Åkerbönor________ha Grönsaker________ha

6. Om ni håller djur, hur stor del av djurens foder producerar ni själva? (i procent)_______%

7. Har ni förekomst av vildsvin på er areal?

Ja ☐ ☐ Nej (om nej, fortsätt med att endast besvara fråga 8, 9, 10 & 11)

a. Hur länge har ni haft förekomst av vildsvin? Sedan år__________________

8. Är ni:

Man ☐ Kvinna ☐

9. Vilket år är ni född?___________

10. Vad är ert företags årsomsättning_________________SEK/år

11. I vilken LRF-region ligger er mark?______________________

Vildsvinskador

12. Förekommer skador av vildsvin på er areal?

Ja ☐ ☐ Nej (om nej, fortsätt till fråga 19)

13. Har antalet vildsvin på er mark, enligt er, förändrats sedan år 2000?

Ja ☐ ☐ Nej (om nej, fortsätt till fråga 15)

14. Om ja på fråga 13, har antalet:

Ökat ☐ Minskat ☐

15. Har mängden vildsvinsskador på er mark förändrats sedan år 2000?

Ja ☐ ☐ Nej (om nej, fortsätt till fråga 17)

16. Om ja på fråga 15, har mängden:

Ökat ☐ Minskat ☐

17. Beskriv skadebilden, vilka grödor påverkas av vildsvinen?

a. Hur ser skadans omfattning ut de senaste 12 månaderna? Vi ber er ange skadad areal av respektive gröda.

Havre________ha Vete________ha Korn________ha Råg________ha

Rågvete________ha Ärtor________ha Majs________ha Oljeväxter________ha

Vall________ha Betesmark________ha Potatis________ha Sockerbetor________ha

Åkerbönor________ha Grönsaker________ha

b. Hur avgjorde ni att skador var orsakade av vildsvin?

i. Spillning ☐

ii. Spår ☐

iii. Bök ☐

iv. Bo ☐

v. Annat, vad?______________________

c. Upptäckte ni skadorna före skörd?

Ja ☐ ☐Nej (om nej, fortsätt till fråga 18)

d. Hur många veckor före skörden______________st

18. Väljer ni idag, p.g.a. vildsvinen, att odla andra grödor än de ni anser önskvärda att odla?

Ja ☐ ☐ Nej (om nej, forstätt till fråga 18)

a. Från och till vilka grödor har ni tvingats skifta?

Vi har slutat med__________________________________på grund av vildsvinen.

Vi har börjat med__________________________________på grund av vildsvinen.

Jakt

19. Vem har jakträtten på arealen där ni odlar?

Ni själv ☐ Någon annan☐

20. Vem jagar vildsvin på er areal?

Ni själv ☐ Någon annan☐ Ingen☐kt

21. Uppskattningsvis hur många timmar har ni lagt ned på vildsvinsjakt det senaste 12 månaderna?____________timmar

22. Förekommer stödutfodring av vildsvin på er eller intilliggande mark?

Ja ☐ ☐Nej

a. Använder ni matningsstationer eller viltåkrar för att avleda vildsvinen från grödan?

i. Matningsstationer ☐

ii. Viltåkrar ☐

b. Anser ni att det fungerar bra som avledning?

Ja ☐ ☐ Nej

23. Har ni någon inkomst från vildsvinen?

Ja ☐ ☐Nej

a. Om ja, i form av:

i. såld jakträtt/jaktarrende ☐

ii. sålt kött ☐

iii. jaktrelaterad turism ☐

iv. Annat, Vad____

b. Ungefär hur stor är den totala vildsvinsrelaterade intäkten per år?_________SEK/år

Kostnader (Senaste 12 månaderna)

24. Uppskatta den vildsvinsrelaterade skördeförlusten (i kg/ha) för respektive gröda.

Havre________kg/ha Vete________kg/ha Korn________kg/ha Råg________kg/ha

Rågvete________kg/ha Ärtor________kg/ha Majs________kg/ha Oljeväxter________kg/ha

Vall________kg/ha Betesmark_______kg/ha Potatis________kg/ha Sockerbetor________kg/ha

Åkerbönor_______kg/ha Grönsaker________kg/ha

25. Uppskatta kostnaden för t.ex. försämrad foder/mjölkkvalité___________SEK

26. Har det uppstått maskinskador till följd av vildsvinens aktivitet?

Ja ☐ ☐Nej

a. Vad har det kostat? (inköp av maskindelar samt ökad arbetstid)___________SEK

27. Har ni fått ökad arbetsinsats pga. Vildsvinens aktivitet? (t.ex. stängsling, ökad markbearbetning osv.)

Ja ☐ ☐Nej

a. Uppskattat antal timmar extra arbetstid per vecka___________timmar

28. Har ni fått ökade kostnader? Uppskatta den totala vildsvinsrelaterade kostnaden. (Ökad arbetsinsats, maskinskador, extra inköp osv.) ___________SEK

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