



Master's Thesis  
in Biology

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**Attitudes toward Reintroduction of European Bison  
(*Bison bonasus*) to Sweden**

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**This is an English version of the original translated by the author in May 2014, Mora, Sweden.**





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(*Bison bonasus*) to Sweden**

*Attityder till återintroduktion av visent i Sverige*

**Axel Bergsten**

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Keywords: european bison, bison bonasus, reintroduction, human dimensions, attitude

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## **Abstract**

The European bison (*Bison bonasus*) is no longer present in the wild fauna of Sweden. Reintroduction, an attempt to reestablish a viable population of a species in an area to which it is native, has been discussed. To make such an operation successful it is essential to know the attitudes of the stakeholders involved. This study has sensed the attitudes toward reintroducing E. bison to Sweden. It was done through a survey sent to the Wildlife Management Boards (Boards) and to landowners/farmers (Land users). A majority answered they would vote in favor of a reintroduction project. The most supported motives to reintroduce were if it would aid conservation of E. bison together with the species being native to Sweden. To Boards the primary motive not to reintroduce was if it would be at expense of the state. To Land users it was if E. bison would pose a traffic hazard. Those in Boards representing nature conservation held the most positive attitudes toward a reintroduction project. Those representing stakes with ties to consumptive land use held the least positive attitudes.

## **Introduction**

Nature is in a state of constant change. In many cases it is we, *Homo sapiens*, who are causing these changes. When humans migrated from Africa to the Eurasian continent, they encountered a fauna comparable to the one of present day African savannahs (Vereshchagin & Baryshnikov 1992). From this time on, human migration to new continents have coincided with species mass extinctions (Reed 1970). In many cases, environmental changes are likely the cause, but the human factor is often considered significant (Martin 1973; Alroy 2001; Johnson 2002; Barnosky et al. 2004). Today, the human impact on ecosystems of the earth is thought to be larger than most people are aware of (Vitousek et al. 1997). As a consequence, the number of endangered species is increasing (Vie et al. 2008). The Convention on Biodiversity is an attempt to counteract this. It states that biodiversity is important for all humanity. The main purpose of the Convention is to preserve biodiversity (at genetic, species and ecosystem level) while at the same time ensuring it can be sustainably used. To achieve this, each contracting party shall;

"Adopt measures for the recovery and rehabilitation of threatened species and for their reintroduction into their natural habitats under appropriate conditions" (UN 1992)

There are examples where protection by law and proper management has led to the recovery of a species. This is the case of Eurasian elk/moose (*Alces alces*) and roe deer (*Capreolus capreolus*) in Sweden where both species have gone from near extinct to populations of several hundred thousand individuals (Bergström and Danell 2009). However, many species have become entirely extinct within their native range and have only survived in captivity. One such species is the European bison (*Bison bonasus*, also known as wisent).

## **European bison biology and present state**

The E. bison is the largest terrestrial mammal of Europe. Wild specimens reach an average weight of about 650 kg (bulls)/450 kg (cows) (Krazinska & Krazinski 2002). They usually form herds of 8-13 individuals (Pucek 2004). The species can live in a variety of habitats,

from closed canopy deciduous forest to more or less open land (Daleszczyk et al. 2007, Kuemmerle et al. 2010). Historically, the E. bison have been classified as a forest-dweller. However, analyses of dental and jaw-bone features show an adaptation to grazing which distinguish them from other presently forest dwelling species (Mendoza & Palmqvist 2008). Together with their choice of microhabitats this suggests that they have evolved in and have an adaptation to open land (Kerley et al. 2011). A number of factors indicate that E. bison distribution is primarily a result of where society allows its existence (Kuemmerle et al. 2011). For example, they are nowadays mainly present in reserves even though unoccupied and suitable habitat is abundant also outside of these.

From historically having inhabited most of Europe, including southern Sweden (Ekman 1922; Pucek 2004; Benecke 2005), E. bison gradually became extinct through its range. The last free-living individuals of the lowland subspecies (*B. b. bonasus*) went extinct in the primeval forests of Bialowieza, Poland, 1919, and the caucasian subspecies (*B. b. caucasicus*) in the Caucasus mountains, in 1927. At this point only a few individuals in captivity remained (Raczynski & Bolbot 2009). Today's population descends from only 12 founders (Slatis 1960; Olech 2009).

Conservation efforts are based on the European Bison Conservation Action Plan (Pucek 2004) and include breeding operations documented in the European Bison Pedigree Book (Raczynski & Bolbot 2009). E. bison are preserved within two bloodlines; the Lowland and the Lowland Caucasian. The Lowland line consists of only 7 founders of the lowland subspecies originating from Bialowieza. The Lowland Caucasian line includes all 12 founders. One of these (a male) was of the Caucasian subspecies and the only one thereof to contribute to the current E. bison population (Raczynski & Bolbot 2009). It has been decided to keep the two bloodlines separated in order to preserve their genetic diversity. In Sweden, breeding of the Lowland Caucasian line is recommended (Smith 2010).

### **Reintroduction of the European bison**

Reintroduction is an attempt to establish a population in an area which was once part of the species historical range but from which it has been extirpated or become extinct (IUCN 1995). To only practice ex-situ conservation under captive conditions is associated with several risks and disadvantages that hinder long term conservation. One example is the inevitable domestication process occurring in captivity resulting in a poorer adaptation to the natural environment. (Snyder et al. 1996) Reintroduction of species extinct in the wild is therefore important to ensure long-term survival. Although reintroductions usually have a conservation objective (Fischer & Lind Mayer 2000) there may be additional ecological, economical and social effects motivating a reintroduction.

Reintroduction of the E. bison early proved to be rather successful in comparison to many other mammal species (Kleiman 1989). Including both wild and captive populations there is today a total of about 4400 E. bison. Most populations are, however, very small and only six wild populations count more than 100 individuals (these contain a total of 1600 E. bison). Three of the latter are found in Belarus, two in Poland and one in Russia. The largest of them consists of 470 individuals (Bialowieza, Poland). (EBCC 2010) On the IUCN Red List E. bison are classified as vulnerable (Olech 2008). Limited genetic variability in small populations (Olech and Perzanowski 2002), poaching (Parnikoza et al. 2009, Sipko et al. 2010) and disease able to eliminate whole populations (described by Paszkiewicz 2009) all in all result in the main action of the European Bison Conservation Action Plan being to create more and larger free-living populations (Pucek 2004).

An ongoing large scale reintroduction project is the creation of an E. bison population in the Carpathian Mountain Range (national border between Poland, Ukraine, Romania and Belarus) where large areas of suitable habitat and land use are found (Kuemmerle et al. 2011). Previous releases in this area have contained E. bison from Swedish breeding centers (Svensson 2008). Also in Russia there are large areas with potential to maintain viable populations (Sipko 2009). In recent years, reintroductions in several "western countries" have been discussed. One such is in Germany in a private forest ([www.wisente-rothaargebirge.de](http://www.wisente-rothaargebirge.de)) and another one in Denmark on the island of Bornholm ([www.naturstyrelsen.dk](http://www.naturstyrelsen.dk) / Naturbeskyttelse / Naturprojekter / Projects / Bornholm / Bison). In a summary of Kuemmerle et al. (2011), areas suitable for reintroduction are pointed out mainly in Eastern Europe and Russia but there were also some in the south of Sweden. An expected increase in annual mean temperature (SMHI 2011) could extend these areas to the north since a warmer climate would increase forage in the forests (Eriksson 2007) and also reduce snow cover (SMHI 2011). The latter is considered by Heptner et al. (1966) to limit the distribution of E. bison.

The issue of reintroducing E. bison to Sweden has been discussed in magazines, newspapers and on internet (e.g. Widemo 2009; Andersson 2010; Lindevall 2010; Thulin 2010a; Brynolf 2011). It was also discussed during a conference on fauna restoration in Stockholm, spring 2010 (Thulin 2010b). Large herbivores often have a major ecological, economical and social impact (Gordon et al. 2004). Christienson (2010) found state legislation concerning species introduction to be rather open to interpretation which provides an opportunity to assess pros and cons of such future impacts when considering reintroduction of E. bison.

### **Purpose and framing of the study**

A reasonable goal when managing natural resources, as well as a reintroduction, is to maximize social benefit. This can be achieved by enhancing positive while minimizing negative impacts. To achieve this it is essential to know how different stakeholders are affected by various outcomes (Carpenter et al. 2000). In Germany, the attitudes of two regions toward a proposed reintroduction of E. bison were surveyed. The result revealed a difference that came to guide the proceeding actions. (Decker et al. 2010) In Sweden, wildlife human dimension studies have dealt mainly with human attitudes toward large predators (e.g. Ericsson et al. 2004, Ericsson & Sandström 2005). However, the perception of predators may differ significantly from that of large herbivores (Bowen-Jones & Entwistle 2002). Since decisions based on false assumptions can lead to opposition (Stoll-Kleeman 2001), it is important to obtain correct information. The Swedish Environmental Protection Agency recommends a reintroduction to be preceded by a thorough investigation, including an assessment of stakeholder attitudes (Wetterin 2008).

This paper is an initial study of stakeholder attitudes toward a reintroduction of E. bison to Sweden. Attitudes were explored through a survey sent to the Swedish Wildlife Management Boards and to landowners/farmers. The current attitudes toward a reintroduction project were investigated through issues such as voting to reintroduction and grading of approval. To deeper understand these responses, approval of motives to/not to reintroduce and consequence expectancies were examined. Since consequences are partly dependent on management, acceptance of management practices was also investigated. The paper aims to provide a basis for further discussions on the issue regarding E. bison reintroduction.

## **Method**

Attitudes toward a reintroduction of E. bison to Sweden have been investigated in a web-based survey. Issues and respondents were identified based on literature reviews and interviews. The interviews were semi-structured (Britten 1995), covering various aspects of a reintroduction. Representatives of stakeholders, government bodies and individuals with relevant expertise were interviewed (Appendix 1) from July 2010 to February 2011.

## **Respondents**

Two main groups of respondents were surveyed: Wildlife Management Boards (Boards) and landowners/farmers (Land users) of Sweden.

A Wildlife Management Board is an agency of the provincial government. It is an institution to guide and decide on wildlife related issues within a county. Such issues may be wildlife damage compensation, culling and approval of predator abundance (§ 2 Regulation on Wildlife Management Boards; SFS 2009:1474). Messages were sent to a total of 531 unique email addresses of members and deputies of Boards of all the counties of Sweden. As respondents they are interesting because they represent core stakeholders in wildlife related issues as well as the general public through politicians (Appendix 2). It may also be they who will come to decide about a future reintroduction.

Land users were identified through the register of persons applying for agricultural subsidies in 2010 kept by the Swedish Board of Agriculture. Email addresses were available for 20 273 of the 67 280 registered applications. A random sample (randomization in MS Excel 2007) of 500 addresses was taken evenly distributed over five different classes of applied-for land size: 0-20 ha; > 20-50 ha; > 50-150 ha; > 150-500; and > 500 ha. The distribution between land size classes was done (due to the uneven distribution of applications between the classes, Appendix 3) to obtain a sufficient number in each class to be able to compare differences between them.

## **Survey construction**

The study was designed to determine attitudes toward a reintroduction of E. bison to Sweden as well as associated issues. The survey, named "Attitudes toward wildlife and reintroduction of European bison to Sweden", contained three parts:

- Part 1 - Attitudes toward animals, nature and species introductions
- Part 2 - Attitudes toward reintroduction of E. bison
- Part 3 - Background information

This paper mainly deals with issues in part 2 (Appendix 5). Two fact sheets were included (Appendix 4). One described the concept of species introduction and the other dealt with basic facts about the E. bison. Since the terms introduction and reintroduction were used frequently I wanted respondents to understand their meaning in order for them to provide answers consistent with their views. The necessity of providing basic E. bison facts was pointed out several times in the interviews. There was a concern that the answers would otherwise end up "useless" due to an expected lack of E. bison knowledge. In order to stay objective, the facts were very basic.

Many issues were taken from existing studies whereof a large percentage from a survey of attitudes on E. bison reintroduction in Germany (Decker et al. 2010). Access was given to the original questionnaire (English version). It was translated to Swedish with ambition to retain the original content in order to provide similar conditions for the respondents. The original survey was directed to residents living adjacent to an area in question for reintroduction of E. bison. Therefore, city names in the issues were changed to "Sweden" or "where you live". Since the questionnaire of this study provided a fact sheet, Part C of the original questionnaire (testing prior knowledge of E. bison) was not used. Some of Part G (background information) was used in "Part 3 - Background Information". The remaining constructions of issues and instructions were kept in order to maintain a proven study design and facilitate comparisons with the previous survey.

Several issues from the surveys "A study on animals, nature and hunting" and "A study on animals and nature" (used within the research program FjällMistra and FOMA-vilt, SLU) were included (no. 1.1, 1.2 and 1.3 respectively 1.4, 3.2, 3.3, 3.4, 3.5 and 3.13). Some issues (e.g. 1.9 and 2.3) were modifications from "A study on animals and nature," or used similar wording. Response alternatives were of various types, including Likert scales (Likert 1932) and multiple answers. The questionnaire was pilot tested on students as well as persons similar to the final respondents. To address the risk of new and modified questions not having been tested sufficiently the option "other" accompanied by a field for comments was added. This served to supplement insufficient response alternatives and also allowed for checking respondent issue interpretation.

### **Implementation**

Respondent contacting was done using email (SLU student portal) on three occasions with different information:

1. Information about the survey and contact information
2. Link to the survey and instructions
3. Reminder with a link to the survey and instructions

Internet access was necessary to download and complete the survey. According to pilot tests, it took 15-20 minutes to complete. When the server reported delivery failure the address was checked and the mailing repeated. The survey was open from March 23 (March 31 for Land users) 2011 to April 24 2011. The reminder was sent to Land users April 12 and to Boards April 15. Exact dates of deliverance are not known since some emails had to pass administrators. From receiving the survey the recipients had at least three weeks to complete it. Those of Boards who had not registered their email address at their county board could not participate. Only one reminder was sent in order to not create unnecessary disturbance. As a completed survey could not be linked to an individual person or email address it was not possible to send reminders only to those who had not yet responded. For the same reason, no individual post-survey follow-up and non-response analysis could be done. Instead, I compared attitudes in completed surveys received before and after the reminder was sent and discussed how respondent selection could affect the results.

### **Analyzing data**

Completed surveys were analyzed in Microsoft Office Excel 2007 and IBM SPSS. Doublets were identified and removed. No further manipulation of the original data was done. Results for Boards and Land users were separated throughout the analyses.

Comparisons were made between them as well as between those pro and anti a reintroduction and different stakes represented within Boards. The latter was done only for representatives specified under § 7 in the Regulation on Wildlife Management Delegations (Appendix 2), i.e. representatives of:

- politicians (Politics)
- specific knowledge in traffic safety and illegal hunting issues (Police)
- the hunting and wildlife management stake (Hunting)
- the nature conservation (Conservation)
- the recreational stake (Recreation)
- owners and users of agricultural land (Agriculture)
- local business and tourism (Tourism)
- forestry (Forestry)

Since the general pattern in the study is that a higher number on a scale represents a more positive response to some degree (for example, stronger agreement) responses to issue 2.10 (approval of reintroduction) were inverted in order to enhance understanding of correlations. Statistics are based only on valid responses, i.e. a respondent's failure to reply to a question meant that the respondent was excluded from calculations including the specific issue. This means the proportion reported to give a certain answer is higher than if also those who had not responded to the question would have been included.

Mean values and confidence intervals ( $p = 0.05$ ) were used to describe responses. Relationships were examined using Pearson's chi-square test and Pearson's correlation coefficient. Ordinary linear regression (Ordinary Least Square, Wonnacott and Wonnacott 1985) was used to test the strength of various correlations mutually. Management measures were described with Potential for Conflict Index (PCI: Manfreda et al. 2003a) which describes the risk of conflict based on the polarization of attitudes. The index generates a value between 0 and 1: the higher the value the higher the risk of conflict.

In an attempt to understand attitudes toward reintroduction I created a simple model. I assumed that attitudes were influenced by a cognitive conclusion and of "fear". Decker et al. (2010) found that fear of E. bison may be a factor influencing attitudes toward a reintroduction. The cognitive conclusion was constructed from attitudes toward consequences (motive approval) and consequence expectance. This is based on a cognitive hierarchy where everything from attitudes toward behavior is shaped by core values that act in combination with a perception of the prevailing conditions (Vaske & Donnelly 1999).

Linear multiple regression was performed for responses from Boards with approval of reintroduction as dependent variable and attitudes toward consequences, belief in consequences and fear of E. bison as independent variables (Appendix 5). The most significant explaining independent variable was then used as a dependent variable in another regression analysis with a number of independent background information variables. The later analysis attempted to explain how gender and life history affected attitudes toward reintroduction. Rural communities often have an anthropocentric approach to nature and wildlife focusing on human use (utilitarian) compared to more urbanized communities, which often have a biocentric approach focused on conservation (Kennedy et al. 1995; Manfreda and others, 2003b). In addition to two general background variables

(gender and education) I therefore used a number of parameters dealing with the degree of rural/urban background (size of residence area, share of income from agriculture/forestry, previous employment in rural sector and experience of damage from wildlife. Appendix 5). To investigate if attitudes toward reintroduction varied depending on how much land a person owns or uses, I compared attitudes toward reintroduction among Land users divided upon different land-size classes in hectares (Appendix 5).

## **Results**

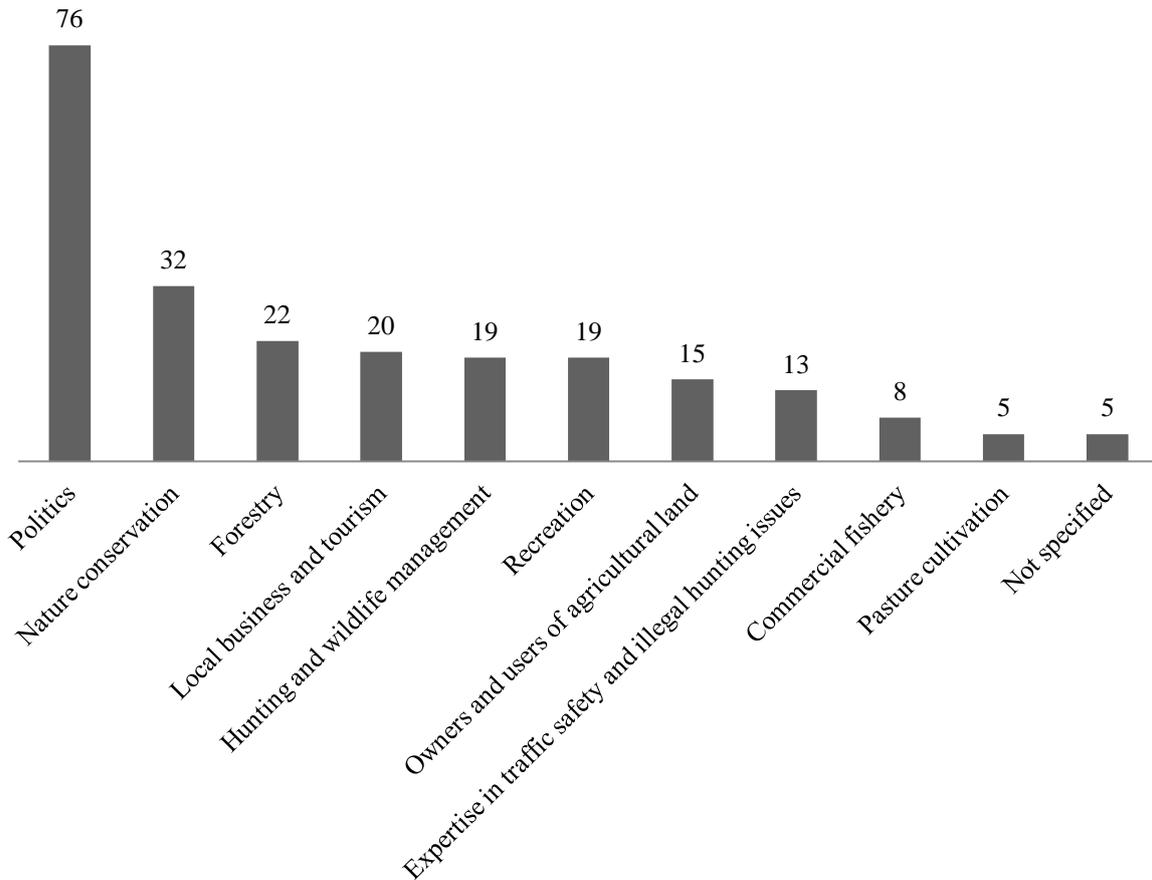
### **Response rate and background information**

#### **Boards**

For Boards the 531 email contacts resulted in 234 returned surveys (Figure 1) after 1 duplicate had been removed. During the first three days 130 surveys were returned and after the reminder 51 more. When the web-survey was closed no surveys had been returned for three days. Of the emails sent on the first occasion; 22 were returned with a notification of delivery failure (16) or absence of the recipient (6). It is possible that some emails did not reach the recipients even though no notifications of delivery failures were returned. A few (5) responded they could not open the survey. They were informed of possible solutions. Since there was no additional correspondence in these cases they were assumed to have solved the problem. One recipient announced that he did not respond to surveys (although to emails it seems) and two that they lacked time to do so. Two of the County Administrative Boards choose to pass on the emails to their wildlife management delegations themselves. This rendered noting of delivery failures impossible. Using the experienced delivery failure rate, the number of recipients who did not receive the survey was calculated to a total of 24. Thus, a total of 507 members and deputies of Boards were estimated to have received the questionnaire rendering a response rate of 46%.

Most returned surveys came from the county of Västerbotten (17) and least from Stockholm (5). A majority of respondents (80%) were born in the period 1937 to 1966 and the number of men was 2.4 times the number of women. Regarding organizational membership, 27.9% belonged to a conservation organization, 53.3% to a hunting organization and 44.7% to a landowner/forestry/agriculture organization. Among Boards 53.8% owned forested land, 44.7% owned agricultural land and 25.6% practiced agriculture.

**Represented interest for survey respondents from wildlife management delegations**



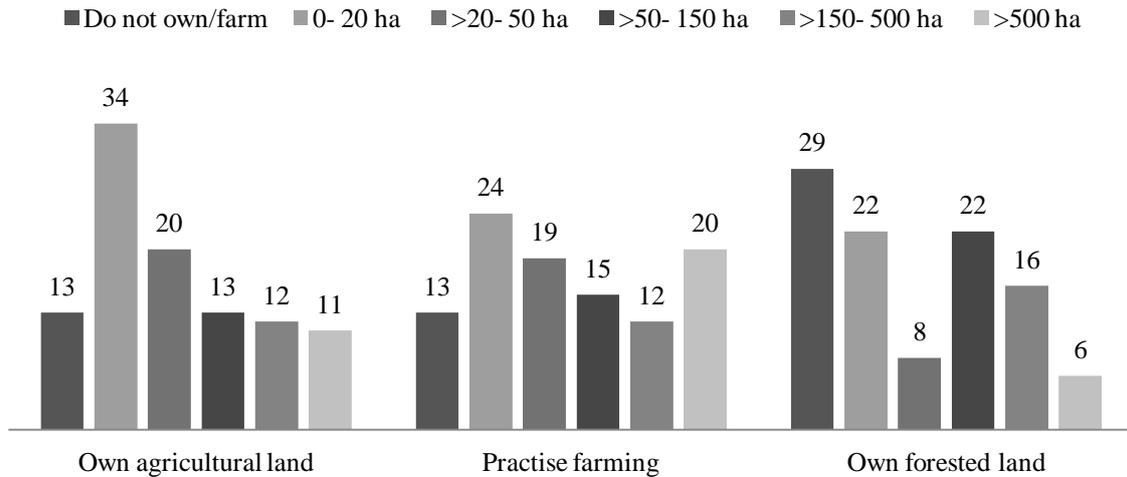
**Figure 1. The number of persons per represented stake in the wildlife management delegations who participated in the survey “Attitudes toward wildlife and reintroduction of European bison to Sweden”.**

**Land users**

For Land users 500 email contacts resulted in 108 returned surveys (seven duplicates removed). The number of delivery failure reports was 53. Excluding those, the response rate was 24%. Three people said they did not have time to participate in the survey and one person that he did not want to be part of "scientific studies". Another did not consider himself a good enough representative of his group. He was informed of the importance of participating in the study and was then assumed to have done so. Yet a respondent reported to have dropped out due to a lack of knowledge in the subject.

Skåne was the county with the most respondents (26.5%), followed by Stockholm (10.8%) and Östergötland (9.8%). No persons under the age of 34 years replied, but five people older than 74 years. 67% were born between 1947 and 1966 and the number of men was 4.5 times the number of women. Of those who responded to organizational belonging 13.9% said they were members of a nature conservation organization, 41.3% in a hunting organization and 84.3% in a landowner/forestry/agriculture organization. Among Land owners 71.8% reported owning forested land, 87.4% agricultural land and 87.4% reported they practiced agriculture (Figure 2).

## Ownership/usage of agricultural and forested land



**Figure 2. The number of people owning agricultural and/or forested land and/or practicing farming in different land size classes (hectares) among applicants for agricultural subsidies in 2010 who participated in the study "Attitudes toward wildlife and reintroduction of European bison to Sweden" (one person may appear in all three categories of land use/owning).**

### Approval of and vote to reintroduction

Voting (issue 2.11, Appendix 5) resulted in 61.6% ( $\pm 6.4$ ,  $n = 224$ , all confidence intervals constructed with  $p = <0.05$ . Sign. hereafter used for significant/significantly) of Boards voting pro reintroduction (Pro). Before and after the second mail contact, the corresponding proportion was 57.7% ( $\pm 7.2$ ,  $n = 183$ ) respectively 77.1% ( $\pm 11.5$ ,  $n = 51$ ). Among Land users, 52.5% ( $\pm 9.7$ ,  $n = 101$ ) was Pro (49.1% [ $\pm 13.5$ ,  $n = 53$ ] before and 56.3% [ $\pm 14.0$ ,  $n = 48$ ] after the second mail contact). The proportion Pro within stakes of Boards was following:

- Police 84.6%
- Conservation 83.9%
- Tourism 78.9%
- Recreation 66.7%
- Politics 61.6%
- Hunting 47.4%
- Forestry 40.9%
- Agriculture 35.7%

Approval of reintroduction (issue 2.10, Appendix 5) had an average score among Boards of 4.52 ( $\pm 0.25$ ,  $n = 227$ ) and 4.03 ( $\pm 0.38$ ,  $n = 102$ ) among Land users. Both were thus on the positive side of the "approval scale". About a third, 27.7% resp. 38.3% gave a neutral answer (meaning they marked 4 on the scale). Of Boards, Conservation were the only with a sign. greater approval of reintroduction than one or more of any of the other stakes (Forestry and Agriculture). Hunting, Forestry and Agriculture had a sign. lower approval than the average of Boards. Approval of reintroduction correlated sign. with motive approval (issue 2.1 respectively 2.2, Appendix 5), consequence expectance (issue 2.8, Appendix 5), and fear of E. bison (issue 2.19, Appendix 5). Approval of reintroduction within Boards was for:

- Conservation 5.66 ( $\pm 0.59$ , n = 32)
- Police 4.85 ( $\pm 0.88$ , n = 13)
- Recreation 4.61 ( $\pm 0.99$ , n = 18)
- Tourism 4.53 ( $\pm 0.77$ , n = 19)
- Politics 4.37 ( $\pm 0.46$ , n = 75)
- Hunting 4.32 ( $\pm 0.97$ , n = 19)
- Forestry 4.23 ( $\pm 0.68$ , n = 22)
- Agriculture 3.33 ( $\pm 1.00$ , n = 15)

The number of respondents was not evenly distributed between represented stakes in Boards. However, using the average of each stake to construct an overall average the amount Pro would be 62.5% compared to 61.6% in the survey total. In real life Politics have 5 representatives in Boards compared to 1 for each other stake. If Politics are given this weight in the example above, i.e.  $5/12$  ( $\approx 0.42$ ), the average of the stakes Pro becomes 62.2%. The corresponding approval of reintroduction (Boards average: 4.52) is 4.49 for averaged representation of stakes and 4.45 when Politics are given increased weight.

### Regression analysis

Motive approval and consequence expectance together with fear of bison explained 63.3% (Adjusted R Square) of the variation in approval of reintroduction (19.5% of Boards felt fear of some degree [30.2% among Land users]). (Reference to sub-issues in issue 2.1, 2.2, 2.7 and 2.8 will be done using cursive type, often shortened using ...) Multiple regression analysis showed that the degree of approval could be explained by agreeing that ... *missing since the 1100s* is a good motive not to reintroduce, ... *become a game animal* is a good motive to reintroduce and ... *conservation* is a consequence to reintroduction (Table 2 and 3). Of these ... *conservation* affected approval the most ( $B = 0.284$ ,  $p = 0.005$ ). When it was used as dependent variable and the various background variables as independent variables, none of the background variables turned out sign. (Adjusted R Square = 0.038). Size of residence had the highest sign. ( $B = 0.178$ ,  $p = 0.104$ ). When the same background variables instead were tested directly towards approval of reintroduction (Adjusted R Square = .098) both size of hometown ( $B = 0.232$ ,  $p = 0.032$ ) and gender ( $B = 1.294$ ,  $p = 0.004$ ) were sign. explanatory.

When different land uses and land size classes among Land users were compared some differences were found (Table 1). Those owning up to 20 hectares of agricultural land had sign. greater approval of reintroduction (4.94) compared to those who farm 150 to 500 ha (3.36). Highest average approval among all land classes was found among those owning more than 500 hectares of forest (5.00).

**Table 1. Approval of E. bison (*Bison bonasus*) reintroduction in Sweden in 2010 among people owning agricultural and/or forested land and/or practicing farming in different land size classes (hectares) among applicants for agricultural subsidies in 2010 who participated in the study "Attitudes toward wildlife and reintroduction of European bison to Sweden" (one person may appear in all three categories of land use/owning). Mean values on a scale from 1 (strongly disapprove) to 7 (strongly approve) where green = significantly > 4, p < 0.05.**

Land size	Approval		
	Own agricultural land	Practice farming	Own agricultural land
Do not own/farm	3,46	4,92	3,93
0- 20 ha	4,94	4,74	4,86
>20- 50 ha	3,67	3,65	3,38
>50- 150 ha	3,83	4,00	4,15
>150- 500 ha	4,00	3,36	3,56
>500 ha	3,40	3,84	5,00

### Motive approval

Among Boards and Land users, the group Pro also sign. approved of all motives to reintroduce (issue 2.1, Appendix 5) (approve = >4, Table 2). For those voting anti reintroduction (Anti) ... *conservation* and ... *native to Sweden* were the only ones that were not sign. disapproved of (disapprove = <4, Table 2). The motive ... *conservation* had the largest mean support among both Boards and Land users and was also the motive most stakes sign. approved of (Table 3). Only for Hunting and Forestry approval was not sign. The average scores for ... *conservation* was sign. higher among Boards and Land users compared to ... *game animal*, ... *promote tourism* or ... *according to EU directives should be reintroduced...*

Those Anti (among both Boards and Land users) approved sign. of all motives not to reintroduce (issue 2.2, Appendix 5) and in a sign. higher degree than those Pro, with one exception: ... *fear among people*. This was considered the poorest motive being the only one that Boards (total mean) sign. disapproved of and Land users Anti not sign. approved of. Those within Boards Pro sign. disapproved of all motives not to reintroduce with the exception of ... *expense of the state*. This can be regarded as the foremost motive not to reintroduce for Boards as it was also on the whole most approved of. The stakes not sign. approving of ... *expense of the state* still had it listed among the top two motives not to reintroduce. Land users approved most of ... *traffic hazard* based on average scores (... *traffic hazard* was sign. disapproved of among those Pro among Boards).

Hunting approved most of ... *game animal* as a motive to reintroduce and Agriculture and Forestry approved most/second most of ... *affect economic activity negatively* as a motive not to. This is in line with what could be expected due to their stakeholder representation. However, there were several cases where Boards did not answer as they could be expected to. Recreation and Tourism, for example, did not consider ... *enhance the nature experience* ... and ... *promote tourism* to be their primary motives to reintroduce. Also, Hunting did not sign. agree that ... *compete with other wildlife* would be a good motive not to reintroduce (second last). The ranking of motives among Boards were in many cases the

same, regardless of stake representation. Notably, Agriculture gave ... *compete with other wildlife* a sign. higher rank compared to Land users.

**Table 2. Approval of motive to/not to reintroduce *E. bison* (*Bison bonasus*) in Sweden among members and deputies of Wildlife Management Boards of Sweden (Boards) and applicants for agricultural subsidies in 2010 (Land users) who participated in the study "Attitudes toward wildlife and reintroduction of European bison to Sweden". Results are also shown separately for those voting pro and anti reintroduction. Mean values on a scale from 1 (fully oppose) to 7 (fully agree) where green = significantly > 4, orange = significantly < 4, p < 0.05.**

Motives	Approval					
	Total	Boards		Total	Land users	
		Pro	Anti		Pro	Anti
<b>If statement is true it is a good motive to reintroduce</b>						
<i>Reintroduction will aid E. bison conservation.</i>	5,2	6,1	3,7	4,8	5,8	3,7
<i>E. bison are native to Sweden.</i>	5,1	6,1	3,6	4,6	5,6	3,7
<i>E. bison will affect biodiversity in a positive way.</i>	4,7	5,7	3,3	4,5	5,5	3,4
<i>E. bison will enhance the nature experience for many people.</i>	4,7	5,6	3,3	4,6	5,6	3,3
<i>E. bison will become a game animal.</i>	4,2	4,8	3,5	4,1	4,8	3,4
<i>E. bison will become a trademark and promote tourism.</i>	4,1	4,9	3,0	4,0	5,0	3,0
<i>E. bison are listed as endangered, thus according to EU directives should be reintroduced to their natural habitats.</i>	4,2	5,3	2,6	3,9	5,0	2,8
<b>If statement is true it is a good motive not to reintroduce</b>						
<i>E. bison have been missing since the 1100s.</i>	4,0	3,1	5,5	4,3	3,7	4,8
<i>E. bison will pose a traffic hazard</i>	4,1	3,5	5,3	4,9	4,3	5,6
<i>E. bison will awake fear among people.</i>	3,5	3,0	4,5	3,9	3,5	4,1
<i>E. bison will affect economic activity negatively (e.g. forestry and agriculture).</i>	4,1	3,3	5,5	4,6	3,9	5,4
<i>Reintroducing E. bison will be at expense of the state.</i>	4,4	3,7	5,6	4,6	3,6	5,8
<i>E. bison will compete with other wildlife.</i>	4,0	3,2	5,2	4,2	3,6	4,8

**Table 3. Approval of motive to/not to reintroduce E. bison (*Bison bonasus*) in Sweden among members and deputies of Wildlife Management Boards of Sweden who participated in the study "Attitudes toward wildlife and reintroduction of European bison to Sweden". Results shown separately for representatives for politicians (Politics), specific knowledge in traffic safety and illegal hunting issues (Police), the hunting and wildlife management stake (Hunt.), the nature conservation (Cons.), the recreational stake (Recr.), owners and users of agricultural land (Agr.), local business and tourism (Tour.) and forestry (For.). Mean values on a scale from 1 (fully oppose) to 7 (fully agree) where green = significantly > 4, orange = significantly < 4, p < 0.05.**

Motives If statement is true it is a good motive to reintroduce	Approval							
	Cons.	Police	Recr.	Tour.	Pol.	Hunt.	For.	Agr.
<i>Reintroduction will aid E. bison conservation.</i>	6,3	5,8	5,2	5,0	5,1	4,2	4,7	5,3
<i>E. bison are native to Sweden.</i>	6,1	5,5	4,9	5,0	5,1	4,7	4,8	4,5
<i>E. bison will affect biodiversity in a positive way.</i>	5,8	5,7	4,6	4,5	4,9	3,7	4,5	3,9
<i>E. bison will enhance the nature experience for many people.</i>	5,6	5,4	4,8	4,7	5,0	4,1	3,9	3,2
<i>E. bison will become a game animal.</i>	3,7	5,4	4,0	4,0	4,2	5,0	4,4	4,3
<i>E. bison will become a trademark and promote tourism.</i>	4,9	4,3	4,3	4,1	4,4	3,3	3,5	3,2
<i>E. bison are listed as endangered, thus according to EU directives should be reintroduced to their natural habitats.</i>	5,9	4,6	4,1	3,3	4,4	3,1	3,7	3,1
<b>If statement is true it is a good motive not to reintroduce</b>								
<i>E. bison have been missing since the 1100s.</i>	2,8	3,9	3,9	4,2	4,0	4,5	4,0	4,8
<i>E. bison will pose a traffic hazard.</i>	2,9	4,4	3,8	4,4	4,3	4,7	4,8	4,7
<i>E. bison will awake fear among people.</i>	2,8	4,3	3,8	3,7	3,5	3,9	3,7	3,7
<i>E. bison will affect economic activity negatively (e.g. forestry and agriculture).</i>	2,8	3,8	3,3	3,7	4,1	4,9	5,0	5,6
<i>Reintroducing E. bison will be at expense of the state.</i>	3,0	4,7	3,9	4,3	4,6	4,9	5,1	5,1
<i>E. bison will compete with other wildlife.</i>	2,5	4,1	3,4	3,8	4,2	4,3	4,7	5,4

### Consequence expectance

Which reintroduction consequences were expected (issue 2.8, Appendix 5) differed sign. between those Pro and Anti within Boards. The same was true for Land users with the exception of *Extensive tree damage* and *Injuries to people* where there was no sign. difference. *Injuries ...* was the consequence considered least likely with only 9.5% of Boards and 13.3% of Land users agreeing to some degree. Even those Anti opposed sign. that it would be a result of reintroduction (Table 4).

One of the most positive groups to reintroduction, Police, expected ... *compete with other game for food* more than both Forestry and Hunting (Table 5). However, Police did not consider ... *compete with other wildlife* a good motive not to reintroduce (Table 3). ... *conservation* was the most expected consequence among Boards where 59.6% agreed to some degree (46.0% among Land users). *Major damage to crops...* was correspondingly considered the most likely among Land users with 47.1% agreeing to some degree (51.8% among Boards). *Extensive tree damage* had the greatest proportion of neutral answers (Boards 46.6% and Land users 48.0%). Comments in the survey indicated that many respondents had experienced damage of wild boar, geese and moose.

**Table 4. Consequence expectance from *E. bison* (*Bison bonasus*) reintroduction among members and deputies of Wildlife Management Boards of Sweden (Boards) and appliers for agricultural subsidies in 2010 (Land users) who participated in the study "Attitudes toward wildlife and reintroduction of European bison to Sweden". Results are also shown separately for those voting pro and anti reintroduction. Mean values on a scale from 1 (fully oppose) to 7 (fully agree) where green = significantly > 4, orange = significantly < 4, p < 0.05.**

Consequence	Expectance					
	Boards			Land users		
	Total	Pro	Anti	Total	Pro	Anti
<i>Important contribution to E. bison conservation</i>	4,8	5,9	3,0	4,4	5,6	3,2
<i>Increase regional tourism</i>	4,3	5,2	2,8	4,0	4,9	3,0
<i>Help to restore a natural environment</i>	3,9	4,9	2,3	3,6	4,8	2,2
<i>Major damage to crops and farmland</i>	4,5	4,1	5,2	4,8	4,3	5,5
<i>Competition with other game for food</i>	4,4	4,0	5,1	4,4	4,0	4,9
<i>Reduced hunting opportunities</i>	3,3	2,9	4,0	3,6	3,3	3,8
<i>Extensive tree damage</i>	4,2	3,8	4,8	4,4	4,0	4,9
<i>Injuries to people</i>	2,6	2,2	3,3	2,8	2,4	3,1
<i>Advantages outweigh economic costs</i>	3,9	4,9	2,2	3,5	4,4	2,5

**Table 5. Consequence expectance from E. bison (*Bison bonasus*) reintroduction among members and deputies of Wildlife Management Boards of Sweden who participated in the study "Attitudes toward wildlife and reintroduction of European bison to Sweden". Results are shown separately for representatives for politicians (Politics), specific knowledge in traffic safety and illegal hunting issues (Police), the hunting and wildlife management stake (Hunt.), the nature conservation (Cons.), the recreational stake (Recr.), owners and users of agricultural land (Agr.), local business and tourism (Tour.) and forestry (For.). Mean values on a scale from 1 (fully oppose) to 7 (fully agree) where green = significantly > 4, orange = significantly < 4, p < 0.05.**

Consequence	Expectance							
	Cons.	Police	Recr.	Tour.	Pol.	Hunt.	For.	Agr.
Important contribution to E. bison conservation	5,8	5,8	5,0	4,5	5,0	3,7	3,9	4,1
Increase regional tourism	5,7	4,5	4,4	4,3	4,4	3,5	3,7	3,5
Help to restore a natural environment	5,3	4,5	3,5	3,2	4,2	3,1	3,2	2,4
Major damage to crops and farmland	3,6	4,3	4,3	4,2	4,7	4,2	4,6	5,4
Competition with other game for food	3,6	4,8	4,1	4,1	4,7	4,2	4,7	5,4
Reduced hunting opportunities	2,5	3,6	3,0	2,9	3,5	3,2	3,7	3,9
Extensive tree damage	3,4	4,5	4,1	3,8	4,1	4,4	4,5	4,9
Injuries to people	1,8	2,6	2,4	2,9	2,6	2,6	3,4	2,9
Advantages outweigh economic costs	5,0	4,2	4,4	3,9	4,0	2,8	3,2	3,4

### Acceptance of management measures

There was a negative correlation for Boards between the average scores of acceptability for a management measure (issue 2.7, Table 6, Appendix 5) and the risk of conflict in it (Figure 3). Acceptability of all measures showed a sign. positive correlation to approval of reintroduction except regarding *Fencing to control ... location*, *Culling problem causing E. bison* and *Hunting non-reproducing individuals*. *Feeding to direct...* was sign. accepted (accepted = >4) in all subgroups except for Agriculture (still a mean above neutral, Table 6). No management measure was sign. rejected by any stake in Boards. *Feeding during ... shortage* and *Continuous resettlements...* were the only to be sign. rejected by any of the other subgroups (by Boards Anti). *Fencing...* was sign. accepted among least of the represented stakes of Boards compared to other measures. The largest percentage of neutral responses among Boards was found in *Scaring off problem causing E. bison* (15.5%) and for Land users in *Hunting non-reproducing individuals* (28.7%). Agriculture had sign. higher acceptance of *Culling problem causing E. bison* and *Hunting non-reproducing individuals*.

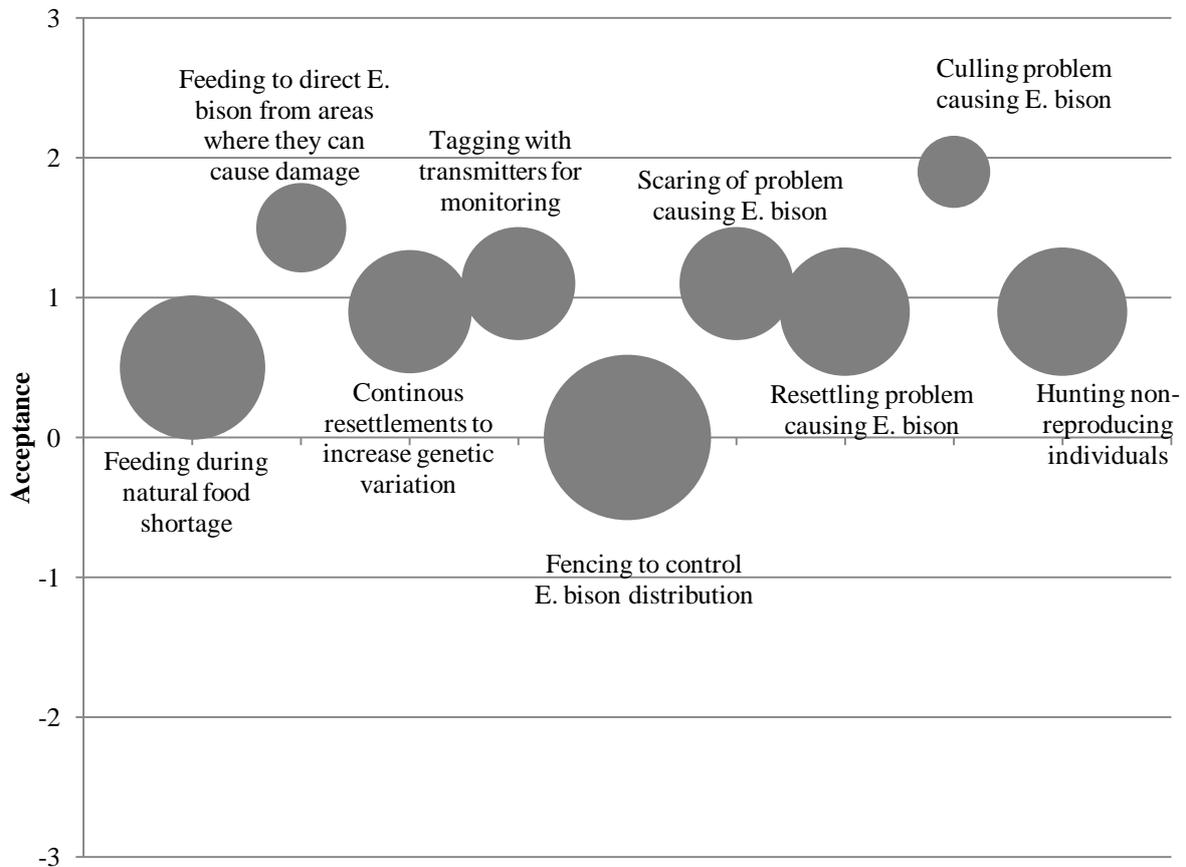
**Table 6. Acceptance of management measures concerning eventual reintroduced E. bison (*Bison bonasus*) among members and deputies of Wildlife Management Boards of Sweden (Boards) and appliers for agricultural subsidies in 2010 (Land users) who participated in the study "Attitudes toward wildlife and reintroduction of European bison to Sweden". Results are also shown separately for those voting pro and anti reintroduction. Mean values on a scale from 1 (fully reject) to 7 (fully accept) where green = significantly > 4, orange = significantly < 4, p < 0.05.**

Management measure	Acceptance					
	Total	Pro	Anti	Total	Pro	Anti
<i>Feeding during natural food shortage</i>	4,5	5,3	3,3	4,4	5,1	3,6
<i>Feeding to direct E. bison from areas where they can cause damage</i>	5,5	5,9	4,8	5,4	5,7	5,1
<i>Continuous resettlements to increase genetic variation</i>	4,9	5,9	3,4	4,3	5,5	3,1
<i>Tagging with transmitters for monitoring</i>	5,1	5,5	4,3	4,8	5,1	4,5
<i>Fencing to control E. bison location</i>	4,0	4,0	4,1	4,4	4,1	4,8
<i>Scaring off problem causing E. bison</i>	5,1	5,3	4,8	4,8	4,6	5,0
<i>Resettling problem causing E. bison</i>	4,9	5,2	4,4	5,2	5,1	5,3
<i>Culling problem causing E. bison</i>	5,9	5,8	6,0	5,8	5,6	6,1
<i>Hunting non-reproducing individuals</i>	4,9	4,8	5,2	4,8	4,7	4,8

**Table 7. Acceptance of management measures concerning eventual reintroduced E. bison (*Bison bonasus*) among members and deputies of Wildlife Management Boards of Sweden who participated in the study "Attitudes toward wildlife and reintroduction of European bison to Sweden". Results are shown separately for representatives for politicians (Politics), specific knowledge in traffic safety and illegal hunting issues (Police), the hunting and wildlife management stake (Hunt.), the nature conservation (Cons.), the recreational stake (Recr.), owners and users of agricultural land (Agr.), local business and tourism (Tour.) and forestry (For.). Mean values on a scale from 1 (fully reject) to 7 (fully accept) where green = significantly > 4, orange = significantly < 4, p < 0.05.**

Management measure	Acceptance							
	Cons.	Police	Recr.	Tour.	Pol.	Hunt.	For.	Agr.
Feeding during natural food shortage	4,5	5,0	4,1	4,8	4,9	4,3	4,3	3,3
Feeding to direct E.bison from areas where they can cause damage	5,4	5,8	5,7	5,7	5,5	5,5	5,1	5,0
Continuous resettlements to increase genetic variation	6,1	5,2	5,0	5,2	5,0	4,2	4,4	3,9
Tagging with transmitters for monitoring	5,6	5,5	4,9	5,7	5,1	4,0	5,2	4,6
Fencing to control E. bison distribution	3,6	3,2	4,1	4,6	4,4	4,2	3,2	5,0
Scaring off problem causing E. bison	5,4	5,0	5,3	5,3	4,7	5,4	5,3	5,6
Resettling problem causing E. bison	5,2	4,5	5,1	5,4	4,7	5,2	4,7	5,2
Culling problem causing E. bison	5,1	6,5	5,3	6,1	5,8	6,5	5,8	6,7
Hunting non-reproducing individuals	3,4	5,7	4,2	5,1	4,9	6,1	5,1	6,1

## Acceptance of management measures and risk of conflict



**Figure 3. Acceptance of management measures and their risk of conflict concerning eventual reintroduced E. bison (*Bison bonasus*) among members and deputies of Wildlife Management Boards of Sweden who participated in the study "Attitudes toward wildlife and reintroduction of European bison to Sweden". Mean values where position of bubbles relative to the scale show acceptance (0 = neutral perception) and area correlates to the risk of conflict (Potential for Conflict Index, Manfredro et al. 2003a).**

## Discussion

### Respondent representativeness

Attention has been paid to design contact letters not to be selective to people with certain attitudes. Yet, there are elements in the sampling that may have influenced the results. For instance, only people with an email address have been able to participate in the survey. Since the use of advanced technology is often associated with a high degree of urbanization, it could mean that selection has been towards more urbanized individuals. If so, the actual population (as discussed in "Influence of core values" beneath) could be less positive to a reintroduction than the results of this study suggest. If this is the case, it would probably have affected the results of Land users most since a greater proportion of them did not have email addresses.

It is also of stake whether those who chose not to participate in the study differed in their attitudes compared to those who did participate. Morzillo (et al. 2007) suggested "lack of knowledge" might be a reason not to participate in a survey which was also claimed to be the reason to discontinue the survey by one of the respondents. Lower knowledge of a species might be associated with less positive attitudes (Ericsson & Heberlein 2004, Decker et al. 2010) although this is not always the case (Ericsson & Heberlein 2004, Morgan & Gramann 1989). Results from other studies show that the non-responding portion usually has more neutral opinions concerning a subject compared to the ones who do respond (Riley & Decker 2000). The sign. greater pro-reintroduction portion within Boards after the second message being sent indicates that responses received after further reminders actually could increase the share in favor of a reintroduction. Additional reminders could perhaps have confirmed such a trend.

Some results suggest that respondents in the study differ from the general population. For instance, the management measure gaining the highest acceptance was culling problem individuals, even though fatal management practices usually encounter low acceptance (Ericsson & Sandstrom 2005; Reiter et al. 2009). However, recent studies have shown there might be a difference between rural and urban areas (Sandström pers. contact 2011). An aspect to consider regarding Boards and also Land users is that they are already fairly familiar with many of the issues associated with management of large ungulates and endangered species. Previous experience of "drastic" management measures can increase acceptance of them (Bremner 2007). The acceptance of various management measures can also vary depending on the need (Ericsson et al. 2004; Treves & Naughton-Treves 2005). A clarification of what situations would call for the different measures could have influenced the results.

Differences between Agriculture and Land users is an interesting example of how representatives may differ from the group they represent. Despite sign. differences being rare, Land users were closer than Agriculture to the mean values of Boards on most issues. This could indicate that those representing a stake tend to express more radical views than the stakeholders themselves. For example, Agriculture expressed sign. higher acceptance compared to Land users for various forms of hunting as a management measure. Whether it is important how well Boards represent their respective stakeholders depends on to what degree we are looking for a true representative voice. As for the importance of representing the population in whole, however, Ericsson & Sandström (2005) found a general support of those with a high stake having more influence.

### **Response interpretation**

Motive approval and consequence expectance seems to be what mainly explains attitudes toward a reintroduction of E. bison. Maybe this is because a lack of personal experience means there is no clear emotional part and therefore the attitude is primarily determined by cognitive evaluation. However, neither motive approval nor consequence expectance alone does necessarily explain attitudes. Someone believing conservation is very important should be more positive if he/she believes a reintroduction will actually result in conservation then if he/she thought it wouldn't. Correspondingly, consequence expectance alone should not be enough to determine an attitude. A person expecting a consequence which is in some sense considered negative does not necessarily gain a negative attitude. This could be seen for Police who thought competition with other game was rather likely while they did not approve of it as a motive not to reintroduce. Drawing conclusions beyond the scope of the questions can obviously lead to false assumptions.

The fact that many respondents have an expectance of various consequences, although they could not reasonably have experienced them from E. bison themselves, is probably due to the application of experience and knowledge regarding other species. This is indicated in the survey comments. Previous experience may affect attitudes in several ways. Perhaps encounters of large wildlife in your neighborhood (e.g. moose) could reduce the fear of wild E. bison. Negative experience from other species can also create a prior negative attitude. The Department of Agriculture representative (Appendix 1) highlighted in the interview that a reintroduction might be difficult given the experience of damage by certain species already present.

### **Influence of core values**

Three represented stakes among Boards: Hunting, Forestry and Agriculture, may be considered to have a strong rural profile due to their direct use of natural resources. Those are also the stakes (especially Agriculture) that express the most negative attitudes toward a reintroduction. Even though also Tourism is often directly dependent on natural resources their potential focus towards services (rather than products such as grain, lumber or meat) and non-consumptive uses might be a difference that distinguishes them from the previous. Differences in attitudes could be due to a difference in fundamental values. Rural societies are often characterized by a relatively utilitarian approach toward natural resources (Kennedy et al. 1995; Manfredo et al. 2003b) which, combined with the expected negative impact on economic activity (such as damage to trees and agriculture), could lead to a negative attitude (Vaske & Donnelly 1999). Urbanization as explaining factor is further reinforced by the correlation of approval of reintroduction and size of community one being raised in.

Although conservation/protectionist values are often linked to urbanity it seems like Agriculture, Forestry and Agriculture still favors this kind of values over utilitarian. Species conservation and E. bison previously existing in Sweden were more approved-of motives to reintroduce than E. bison becoming a game species or that they would promote tourism. The internal order of how motives to and not to reintroduce are valued seems to largely be the same for different stakes. Maybe this is because Sweden in terms of values is a relatively homogeneous country.

### **Summary of results**

(Applies to both Boards and Land users unless stated otherwise)

A majority of Boards are positive to a reintroduction of E. bison to Sweden:

- Conservation is among the most positive
- Agriculture is among the least positive

Among Land users the proportion of positive and negative to a reintroduction is about the same.

The most approved motives to reintroduce are:

- *if the reintroduction will lead to conservation of E. bison*
- *if E. bison are native to Sweden*

The most approved motives not to reintroduce are:

- (for Boards) *if it would be at expense of the state*
- (for Land users) *if E. bison would pose a traffic hazard*

It is believed that a reintroduction of E. bison:

- *would be an important contribution to the conservation of the species*
- *would lead to significant damage to crops and farmland*
- *would not lead to people getting injured*

Among different management practices:

- *controlled hunting and feeding to prevent damage* are relatively acceptable with low potential for conflict
- *fencing* is less acceptable with higher potential for conflict

## **Implications for management**

### **Decision-making**

To ensure society's interest in a reintroduction, a study similar to this can be addressed to a wider audience. How, though, should one determine whether the project has enough support to be implemented? The percentages of positive in this study (52.5% resp. 61.6%) were between those of the two investigated locations in Germany (44.8% and 73.5%). In the later case it was decided to proceed with reintroduction in the more positive area. (Decker et al. 2010) It is more difficult to decide on an absolute value when support is sufficient to proceed. One way to do this is to apply democratic principles, such as "majority wins". However, these may be inadequate if the goal is to maximize social benefit.

If the respondents in this study had known the true consequences of a reintroduction, answered truthfully and been representative of all stakeholders, their mean score on issue 2.10, approval of a reintroduction, could determine whether such a project would be optimal from a social benefit point of view. However, the survey revealed sign. differences regarding what consequences were expected. If the expectations are incorrect then decisions based on these will not maximize social benefit. Instead, action could be taken on the "true" consequences in combination with the known values (i.e. approval of motives) to thereby achieve the greatest social benefit. However, this implies acting without public support.

To not consider the public opinion when making decisions might have severe consequences, such as a diminished public confidence (Stoll-Kleeman 2001). If the mandate is not strong, it can be lost. In addition, there is a risk of creating and contributing to negative attitudes toward for example E. bison due to associated dissatisfaction with the decision-making. The sometimes strong local resistance to wolf (*Canis lupus*) in Sweden can in part be explained by these kinds of associations. People experience marginalization because decisions are made by the urban majority. The discontent with the process is then projected on wolves which are turned into a symbol of the dominating society (Ericsson &

Heberlein 2003). To avoid setbacks, sufficient support should therefore exist before acting. If reintroduction is found to have potential to lead to utility maximization but the support is considered insufficient then one can try to change attitudes to gain support.

### **Attitude change**

Trying to change attitudes by providing (correct) information is usually widely accepted but unfortunately also tends to be time consuming, expensive and often unsuccessful (Heberlein pers. contact 2010). In the case of since long formed attitudes, the prospect of change is poor. It is much better if the attitudes concern a fresh subject that an individual have not yet formed strong opinions about. A large portion in the survey expressed neutral attitudes on many issues of the survey. These are likely the ones who primarily could be affected by new information. Another way to create more positive attitudes is to provide incentives for support, e.g. through financial subsidies or compensation. This type of structural measures can often be effective but risk facing low public acceptance (Reiter et al. 2009).

Positive attitudes on beforehand is unfortunately no guarantee for their continuance also after a reintroduction. Attitudes shift as people gain experience. When wolves return to an area, attitudes can shift from positive to predominantly negative as the consequences of wolf presence are showing (Heberlein & Ericsson 2008). In Sweden for example, the largest support for wolf reintroduction used to be found among hunters. However, since the return of the species they have become more negative than the general public (Ericsson & Heberlein 2003). Meanwhile, a reestablishment of a species in a new area leads to a greater degree of perceived problems than in places where it already exists. It has been suggested to be due to a time-changed perception of the species and an embracement of damage preventing techniques. (Mörner & Weberyd 2009) In North America attitudes toward wolves have been observed to be more negative in areas where wolves recently returned compared to areas where they have existed for a long time. It is believed to be due mainly to fear of a new phenomenon which eventually diminishes. (Houston et al. 2010) In short, it takes a thorough knowledge of people and the environment acting on them to understand the nature of attitudes.

### **Utility maximization**

If attitudes are formed by how consequences are valued and expected, then they could be changed by controlling consequences and successfully communicating this to the public. Communicating goals (i.e. positive consequences) considered positive should reasonably constitute a first step in an E. bison reintroduction to Sweden. Species conservation and the restitution of a native species are such objectives that could be included in a public message seeking to promote reintroduction. Counteracting these desirable outcomes are potentially negative consequences which may create resistance. One important such is expense of the state. Because of this efforts should be made to finance the project with other than state funds.

A reintroduction could over all be managed to provide as many benefits as possible while avoiding negative effects. The acceptance of the available management measures could therefore determine whether a reintroduction project is socially feasible. To give an example, the high acceptance of feeding to control E. bison location enables creative management that could be used to maximize feasibility. When bison are fed in winter, a larger number of individuals can be concentrated in the area around the feeding sites, their home ranges being much smaller than otherwise (Krazinska & Krazinski 1995, Krazinska

& Krazinski 2000). By choosing the right allocation of these sites, damage to agriculture, forestry and traffic could be minimized (examples of damages can be found in Balciauskas 1999 and Paszkiewicz & Januszczak 2010). Since E. bison are often considered to impact biodiversity in a positive way (discussed in Lindblad 2011), concentration of a population to conservation areas or land threatened by shrub overgrowth could achieve ecologically desirable interference, such as bark gnaw and browsing. If managed properly, these areas could also provide opportunities for ecotourism. Put like this, it may seem easy to control the outcome of a reintroduction. However, the effects of management measures can be difficult to predict (Gordon et al. 2004) and should therefore be handled with caution in the light of international experience.

## **Conclusion**

Wildlife management is often said to deal with people and their feelings primarily rather than wildlife. This applies also to a reintroduction of E. bison to Sweden. The challenge of such a project mainly lies in arousing interest, overcoming resistance and gaining support. Would a reintroduction become reality, a proactive approach providing the right information and management measures would minimize negative attitudes toward the reintroduced species. Project support and success can be increased using existing knowledge to enhance positive effects on the ecological, economical and social level. This should imply on reintroductions of E. bison as well as other species. Creating positive associations and benefits to conservation is critical to reverse the current trend of species loss. By highlighting stakeholder attitudes it is possible to speed up and facilitate actions necessary to achieve desired goals such as preserving biodiversity.

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## **Appendix 1**

### **Interviewed stakeholders/competence, organization and location**

Swedish Biodiversity Centre, Swedish University of Agricultural Sciences, Uppsala  
Ungulate interactions, Swedish University of Agricultural Sciences, Uppsala  
European Bison Conservation Center, Scandinavian coordinator, Eriksberg  
Swedish Department of Agriculture, Stockholm  
County Administrative Board, Jönköping  
Nationella viltolycksrådet, Stockholm  
Environmental Protection Agency, Stockholm  
Grimsö Wildlife Research Station, Department of ecology, Swedish University of  
Agricultural Sciences, Grimsö  
Swedish Biodiversity Centre, Swedish University of Agricultural Sciences, Uppsala  
Population genetics, Institution of Zoology, Stockholm University, Stockholm  
Private land owners, Skåne/Västergötland  
Swedish Forest Agency, Jönköping  
Veterinarian with E. bison experience, Avesta  
Wildlife Damage to Forestry, Skogforsk, Uppsala  
E. bison breeding centre, Avesta  
E. bison breeding centre, Eriksberg  
WWF, Stockholm  
Zoologist, Skansen, Stockholm

## Appendix 2

### **Regulation on wildlife management delegations; SFS 2009:1474**

§ 6 A wildlife management delegation is, in addition to the Chairman, composed of

1. five members who are political representatives and are appointed after a proposal by the country council,
2. one member who has specific knowledge on issues of road safety and illegal hunting and is appointed after a proposal by the police authority in the county,
3. one member representing the hunting and wildlife management stake,
4. one member representing the nature conservation stake,
5. one member representing the recreational stake,
6. one member representing owners and users of agricultural land,
7. one member representing local business and tourism, and
8. one member representing the forestry industry.

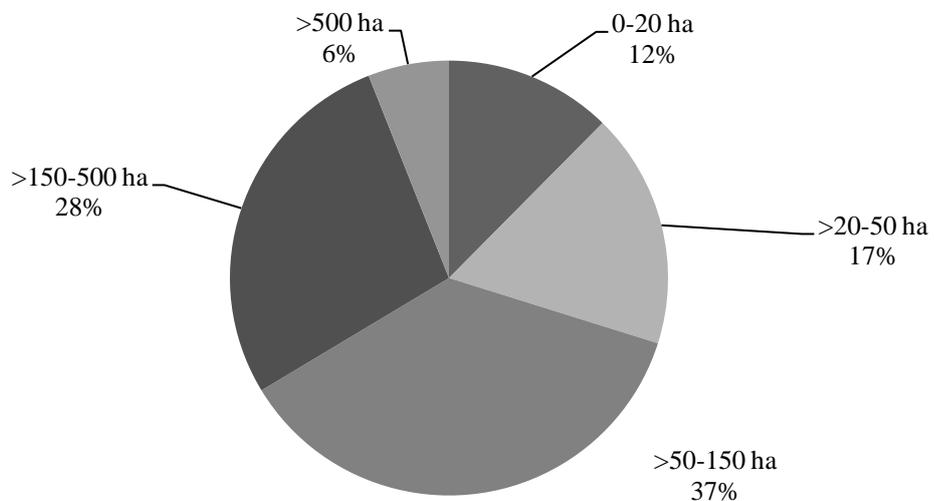
§ 7 In addition to what is specified in § 6, a delegation in a county with

1. commercial fishing shall have a member representing commercial fishing,
2. pasture cultivation shall have a member representing pasture use,
3. a reindeer husbandry delegation shall have one member representing the reindeer husbandry, and
4. reindeer husbandry should have one member who is appointed after consultation with the Sami Parliament

8 § For each member, there shall be a substitute. What is specified for members in § 6 and § 7 also applies to their substitutes.

### Appendix 3

**Applications for agricultural subsidies in 2010 categorized on what land size they concerned (hectares)** Source: Register from the Swedish Board of Agriculture.



## Appendix 4

### Fact sheets in the survey "Attitudes toward wildlife and reintroduction of E. bison to Sweden"

#### *Fact sheet: Species introduction*

Species introduction means locating individuals of a species into an area where it does not currently exist in order to create a wild population. Captive or wild individuals may be used. The concept includes reintroduction and (new) introduction. Reintroduction concerns an introduction of a native species to an area it previously inhabited but has been eradicated from. An example is the Eurasian beaver which was hunted to extinction in Sweden in the 1800s. Through the relocation of Norwegian animals in the 20's and 30's, there are now about 100,000 beavers in Sweden. A (new) introduction is to introduce an alien species to an area where it has not previously existed. Examples are the introduction of European hare in the 1600 - and 1800's, fallow deer in the 1500s and the pheasants in the 1800's. These species had not previously existed in Sweden.

#### *Fact sheet: European bison (Bison bonasus)*

The European bison is the largest of Europe's terrestrial mammals. The bulls reach an average weight of 640kg and the cows 430kg. They often stay in herds of about 10 individuals composed of cows, calves, youngsters and an older bull. The E. bison feed on grasses, herbs, shoots and leaves. The species was extirpated in the wild in 1927. Reintroductions using captive animals have been done in several countries. Today there is about 1500 captive and 2800 more or less free-living E. bison. The E. bison has previously existed in the south of Sweden. The youngest archeological remains to be found are 8700 years old but the species might have remained present until the 11<sup>th</sup> century. The E. bison is categorized as vulnerable on the European Red List.

## Appendix 5

### Issues, statements and response scales used in Attitudes toward Reintroduction of European bison to Sweden

The value in parenthesis is used for calculations.

#### Part 2

##### 2.1 If statement is true it is a good motive to reintroduce E. bison to Sweden?

- Reintroduction will aid E. bison conservation.
- E. bison are native to Sweden.
- E. bison will affect biodiversity in a positive way.
- E. bison will enhance the nature experience for many people.
- E. bison will become a game animal.
- E. bison will become a trademark and promote tourism.
- E. bison are listed as endangered, thus according to EU directives should be reintroduced to their natural habitats.

*Seven-point scale from I fully oppose (1) to I fully agree (7)*

##### 2.2 If statement is true it is a good motive not to reintroduce E. bison to Sweden?

- E. bison have been missing since the 1100s.
- E. bison will pose a traffic hazard.
- E. bison will awake fear among people.
- E. bison will affect economic activity negatively (e.g. forestry and agriculture).
- Reintroducing E. bison will be at expense of the state.
- E. bison will compete with other wildlife.

*Seven-point scale from I fully oppose (1) to I fully agree (7)*

##### 2.7 Are following management measures acceptable?

- Feeding during natural food shortage
- Feeding to direct E. bison from areas where they can cause damage
- Continuous resettlements to increase genetic variation
- Tagging with transmitters for monitoring
- Fencing to control E. bison
- Scaring off problem causing E. bison
- Moving problem causing E. bison
- Culling problem causing E. bison
- Hunting non-reproducing individuals

*Seven-point scale from I fully oppose (1) to I fully agree (7)*

##### 2.8 Do you oppose or do you agree with the following statements?

- Reintroduction would be an important contribution to E. bison conservation.
- Reintroduction of E. bison would increase regional tourism.
- Reintroduction of E. Bison would help to restore a natural environment
- Reintroduction of E. bison would cause major damage to crops and farmland.
- E. bison will compete with roe deer and other game for food.
- Reintroduction of E. bison would reduce hunting opportunities.
- Reintroduction of E. bison will lead to extensive tree damage.
- Reintroduction of E. bison will result in people getting hurt.

- The advantages of E. bison in Sweden outweigh economic costs  
*Seven-point scale from I fully oppose (1) to I fully agree (7)*

**2.10 To what extent do you “Approve” or “Disapprove” of reintroduction of E. bison to Sweden?**

*Seven-point scale from Strongly approve (1) to Strongly disapprove (7)*

**2.11 If you were given the opportunity to vote pro or anti reintroduction of E. bison to Sweden, how would you vote?**

*Pro reintroduction*

*Anti reintroduction*

**2.19 Give your opinion on the following statement: "I would be afraid to walk in the woods if there were wild E. bison"**

*Very afraid (3)*

*A little afraid (2)*

*Not afraid (1)*

*Do not know (-)*

**Part 3**

**3.2 What gender are you?**

*Man (2)*

*Woman (1)*

**3.3 What education do you have?**

*Compulsory primary education (1)*

*Secondary education (2)*

*Professional development (2)*

*University/University College (3)*

**3.4 Where was your main residence before the age of 18?**

*On a farm (1)*

*In rural areas, but not on a farm (1)*

*Place with less than 2000 inhabitants (2)*

*Place with 2000-10000 inhabitants (3)*

*Place with 10,001 to 150,000 inhabitants (4)*

*Stockholm, Gothenburg or Malmö, or any other foreign city with more than 150,000 inhabitants (5)*

*Do not know (-)*

**3.5 Where is your main residence now?**

*On a farm (1)*

*In rural areas, but not on a farm (1)*

*Place with less than 2000 inhabitants (2)*

*Place with 2000-10000 inhabitants (3)*

*Place with 10,001 to 150,000 inhabitants (4)*

*Stockholm, Gothenburg or Malmö, or any other foreign city with more than 150,000 inhabitants (5)*

*Do not know (-)*

**3.9 Do you own forested land?**

*No, I do not own forested land (0)*

*Yes, 0-20 ha (1)*

*Yes, 21-50 ha (2)*

*Yes, 51-150 ha (3)*

*Yes, 151-500 ha (4)*

*Yes, more than 500 ha (5)*

**3.10 Do you own agricultural land?**

*No, I do not own agricultural land (0)*

*Yes, 0- 20 ha (1)*

*Yes, 21- 50 ha (2)*

*Yes, 51- 150 ha (3)*

*Yes, 151- 500 ha (4)*

*Yes, more than 500 ha (5)*

**3.11 Do you farm/cultivate land?**

*No, I do not farm/cultivate land (0)*

*Yes, 0- 20 ha (1)*

*Yes, 21- 50 ha (2)*

*Yes, 51- 150 ha (3)*

*Yes, 151- 500 ha (4)*

*Yes, more than 500 ha (5)*

**3.12 About how much of your total annual income is from forested/agricultural land that you own or cultivate?**

*I do not own or cultivate forested or agricultural land (1)*

*0-10 % (2)*

*10- 50 % (3)*

*50-100 % (4)*

*Do not know (-)*

**3.14 Are you or have you ever been working with agriculture, forestry, fishing or mining?**

*Yes (2)*

*No (1)*

**3.18 Have you ever suffered from damage to property caused by wild animals?**

*Yes (2)*

*No (1)*

*Do not know (-)*