

The Return of the King or Bringing Snails to the Garden? The Human Dimensions of a Proposed Restoration of European Bison (*Bison bonasus*) in Germany

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Abstract

Human dimensions research can help resource and wildlife managers make informed decisions, target information efforts, and gain a greater understanding of the factors that comprise attitudes toward wildlife management efforts. Despite these often-stated merits, studies addressing the human dimensions of resource and wildlife management efforts are rare in Europe. A proposed restoration of free-ranging European bison (*Bison bonasus*) in North Rhine-Westphalia, Germany has presented an opportunity to help address this research gap. During May-July, 2006, we used a randomly distributed, self-administered questionnaire (n=398), to assess local residents' attitudes, beliefs, and levels of support or opposition towards the proposed restoration. These factors were compared across two administrative regions spanned by the proposed restoration area. We found that respondents from the Siegen-Wittgenstein region held significantly more positive attitudes and significantly higher knowledge levels than respondents from the Hochsauerlandkreis region. Principal components analysis revealed that attitudes comprised a general attitude factor pertaining to issues such as the importance of conserving bison for future generations and a lifestyle impact factor, which included items pertaining to bison-caused damages to trees and crops. Logistic regression was used to show the influence of fear of bison on attitudes. We discuss the likely causes and management implications of our findings and provide suggestions to managers wishing to target information efforts and address the concerns of those affected by the proposed restoration.

Key words: fear, knowledge levels, large herbivores, public attitudes, public involvement.

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Introduction

Despite numerous endorsements for the benefits of due consideration of the human dimensions of resource and wildlife management, examples of such research are notably rare in Europe when compared with North America (Bath & Majić 2001). Where European human dimensions research does exist, it tends to focus on large carnivore management and restoration efforts (Schröder 1998; Bjerke et al. 1998; Kaltenborn et al. 1999; Bath 2000; Bath & Majić 2001; Williams et al. 2002; Kleiven et al. 2004), not on large herbivores despite the fact that numerous large herbivore management issues exist throughout Europe (Hofer 2002; Pucek et al. 2004; Perzanowski et al. 2004). In Germany, Europe's second most populous country (Central Intelligence Agency 2006), human dimensions research regarding any wildlife issue is extremely rare. Stoll-Kleemann (2001 p. 9) has commented on this research gap and suggests that "In Germany a widespread lack of participation during the process of planning and implementing of nature conservation measures is an important factor that fuels opposition".

Opposition to resource or wildlife management efforts is often borne of some form of conflict. Such conflicts are generally identified as cognitive, value, cost/benefit, or behavioral conflicts (Mitchell 1989; Bath 2000; Bath & Majić 2001). Human dimensions research can help managers address these conflicts by providing a better understanding of the attitudes, beliefs, expectations, levels of support or opposition, demographic characteristics, and factors affecting attitudes of the publics and interest groups associated with resource management situations (Bath & Enck 2003). In the absence of such information, unfounded assumptions about the positions of the public and interest groups abound which may lead to unsupported decisions and contribute to public opposition to nature and wildlife conservation efforts (Stoll-Kleemann 2001).

With Germany's lack of human dimensions of resource and wildlife management research, a possible restoration of free-ranging European bison (*Bison bonasus*) in the country has presented an opportunity to begin to address this research gap and gain a greater understanding of beliefs and attitudes concerning the proposed restoration. Referred to in the local media as *Die Rückkehr des Königs* (The Return of the King) (Taurus Naturentwicklung e.V. 2006), the current effort to restore bison to the state of North Rhine-Westphalia was initiated by Taurus Naturentwicklung e.V., an environmental nongovernmental organization working to restore large herbivores to their former ranges in Germany. The bison restoration effort is supported by a number of groups including the German Federal Agency for Nature Conservation, the Frankfurt Zoological Society, and the Large Herbivore Foundation. The proposed restoration is not only the first of its kind in Western Europe (Taurus Naturentwicklung e.V. 2006), but is also one of the first European large herbivore conservation efforts to consider the human dimension in a structured manner. Reaction to the proposed restoration effort reaches both ends of the spectrum of attitudes. While restoration proponents talk of the 'Return of the King', those opposed have concerns about the possible negative impacts of bison, an opinion voiced by a local farmer who equated bison restoration with 'bringing snails to his garden'.

In the current study, attitudes, beliefs, and levels of support or opposition towards the proposed bison restoration were explored using a random sample of residents living in the 17 towns and villages bordering the proposed restoration area. Differences in

residents' attitudes and knowledge levels between two administrative regions are examined as well as the factors that comprise and influence attitudes. Special attention is given to the issue of fear of bison and its influence on attitudes towards bison and their perceived impacts. This information will assist restoration managers both in making informed decisions and targeting information and education efforts to address the concerns of respondents, while at the same time providing residents with the information they need to develop informed opinions regarding the proposed restoration.

History and Status of the European Bison

European bison once ranged throughout Europe and parts of Asia. However, by the end of World War I, a combination of unregulated hunting, poaching, fragmentation of habitat, and the decimation of food sources by artificially high red deer populations had reduced the total number of European bison to 54 individuals and caused the extinction of all wild populations, including those that were once found in Germany (Pucek et al. 2004). These 54 individuals, and consequently, today's population of approximately 3000 animals, are the descendants of only 12 ancestors (Pucek et al. 2004). Today, approximately 27% of the world population of European bison live in several central and eastern European countries in large herds of 25 or more animals, with the largest free-ranging herd located in Poland's Bialowieza Forest. Approximately 80% of the captive portion of the population live in enclosed breeding centers, zoological gardens, and special reserves throughout several countries in central and eastern Europe (Pucek et al. 2004).

European bison, similar to other species with small, fragmented populations, face a number of genetic problems, which threaten their long-term survival (Litvaitis et al. 1996; Pucek et al. 2004). Some biologists, concerned about the bison's genetic variability, have promoted the restoration of free-ranging herds to various locations within the bison's former range. However, until now, there has never been a serious attempt to reintroduce a free-ranging herd into their former range in Germany (Taurus Naturentwicklung e.V. 2006). Such restorations provide a reservoir of genetic material in the event of a catastrophic loss of individuals from other populations, restore ecosystem functions of large herbivores in natural landscapes, and can help diversify the gene pool (Kleiman 1989; Balčlauskas 1999; Pucek et al. 2004). A restoration of free-ranging bison to Germany would also contribute to the goals of the Habitats Directive of the European Commission which requires European Union Member States to identify and protect important wildlife species and their habitats (European Commission, 2006) and give due consideration to the feasibility of restoring endangered species native to their region (Schofield, 2005).

Methods

Study Area

The study area is located in west-central Germany, in the southeastern corner of the state of North Rhine-Westphalia (Figure 1). The proposed bison restoration area comprises a 7.2 km² section of the 1,355 km² Rothaargebirge, or Red Hair Mountains, Nature Park.

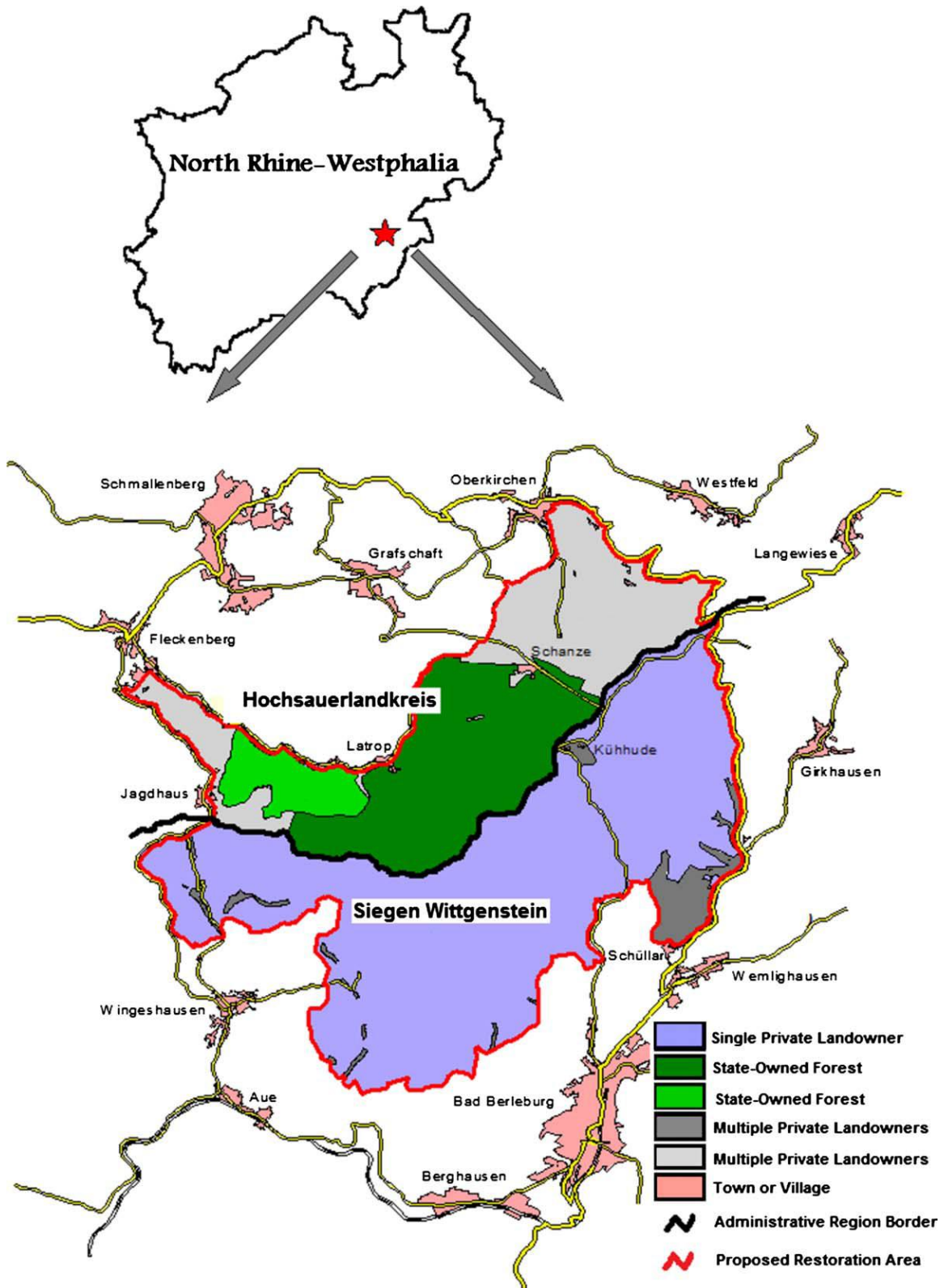


Figure 1. Study area. Landownership in the proposed bison restoration area in the state of North Rhine-Westphalia, Germany. The proposed bison restoration area originally extended into the administrative regions of HSK and Siegen-Wittgenstein but was later reduced to the area within the region of Siegen-Wittgenstein only.

Restoration proponents plan to release 10 to 15 bison in this area and, eventually, maintain a single family-sized herd of between 20 and 25 animals. (Taurus Naturentwicklung e.V. 2006).

Approximately 25,000 people live on the fringes of the Rothaargebirge area in 17 towns and villages (Landesamt für Datenverarbeitung und Statistik 2005) (Figure 1). The proposed restoration area spans the administrative regions of Siegen Wittgenstein and Hochsauerlandkreis (HSK). These regions are adjacent to one another and share a number of socio-demographic characteristics. For example, the regions of HSK and Siegen-Wittgenstein share similar populations (227,219 in HSK versus 291,372 in Siegen-Wittgenstein), similar unemployment rates (11.9% in HSK versus 11.0% in Siegen-Wittgenstein), similar average household incomes (€18,531 in HSK versus €18,297 in Siegen-Wittgenstein), similar numbers of residents with a professional education (122,000 in HSK versus 128,000 in Siegen-Wittgenstein), and similar numbers of residents collecting pension benefits (59,000 in HSK versus 57,000 in Siegen-Wittgenstein) (Landesamt für Datenverarbeitung und Statistik 2005).

These regions differ, however, with respect to land ownership characteristics. In terms of land area, 55% (~16 km²) of the proposed restoration area within the administrative region of HSK is state-owned forest while the remaining 45% (~13 km²) is owned by private landowners. In Siegen-Wittgenstein, however, 93% (~40 km²) of the proposed restoration area is owned by a single landowner with the remaining 7% (~2.90 km²) belonging to other, smaller private landowners (Figure 1). There are almost twice as many private agricultural enterprises registered in the northern region of HSK (2,200) compared with Siegen-Wittgenstein (1,207) (Landesamt für Datenverarbeitung und Statistik 2005). With a larger number of private landowners in HSK, it follows that a larger proportion of HSK residents (37.1%) rely on their farms for their main source of income than Siegen-Wittgenstein residents (21.8%). (Landesamt für Datenverarbeitung und Statistik 2005). Daley et al. (2004) suggest that there is a strong link between reliance on the land for direct economic income and attitudes toward wildlife. We expect that a similar link exists in the regions of Siegen-Wittgenstein and HSK. We hypothesize that residents of HSK will hold more negative attitudes regarding the proposed restoration as they have a greater perception of perceived negative impacts of bison on their livelihood than residents in Siegen-Wittgenstein.

Data Collection and Analysis

Over the course of several months and with assistance from Canadian, German, and Dutch experts, a self-administered questionnaire was developed to be distributed to residents surrounding the proposed restoration area. The questionnaire was designed to address respondents' attitudes, beliefs, changes in forest visitation if bison were present, levels of fear of bison, and demographic variables. The research instrument was pre-tested in the study area from October to December 2005. The final version of the questionnaire consisted of 48 items and was administered between May and July of 2006 to a random, proportionate sample of the approximately 25,000 residents living in the 17 towns and villages bordering the proposed bison restoration area. Of the 1620 questionnaires distributed to eligible households, 398 completed, useable questionnaires were returned. Very similar response rates were recorded in both the Siegen-Wittgenstein and HSK regions. Unfortunately time and financial constraints prevented the authors

from utilizing any of the pre-contact or follow-up measures, which have been identified by Dillman (2000) and Fowler (2002) as important for increasing response rates. As human dimensions of resource and wildlife management research becomes more common in Europe, project proponents will likely develop a better understanding of associated research methodology and will likely be more willing to support established and accepted research techniques. Population and demographic data for the towns within the study area, current to 2005, were obtained from the Landesamt für Datenverarbeitung und Statistik (State Office for Data Processing and Statistics).

Places of residence were randomly selected using large-scale village maps overlain with a grid system. Questionnaires were distributed by hand and deposited in randomly chosen mailboxes. Pre-addressed, postage-paid envelopes were distributed with the questionnaires. Questionnaires also included a cover letter that briefly outlined the study and informed participants of the participating organizations, confidentiality arrangements, questionnaire length, and who to contact concerning any questions that might arise from the study. The cover letter also included information on the postage paid, mail-back procedure.

As suggested by Tabachnick and Fidell (2001), descriptive statistical techniques were used to identify any improperly coded data, which were subsequently removed from the data set. Descriptive statistics were used to illustrate proportions and overall patterns in the data. T tests and Chi-square tests were used to examine differences between groups and between observed and expected frequencies, respectively. Principal components analysis (PCA) with varimax rotation was used to identify underlying processes or themes in attitudinal data (Tabachnick & Fidell 2001). Finally, logistic regression was used to explore whether or not fear of bison influenced respondents' attitudes toward bison and the proposed restoration.

As multivariate analyses are sensitive to negatively skewed data (Tabachnick & Fidell 2001), transformations were performed where necessary to remove negative skewness. Multicollinear variables were removed from the PCA. To ensure principal components and logistic regression analysis were not biased by differing sample sizes, a random sample of respondents with no fear of bison was taken to ensure sample sizes were the same for those respondents who feared bison and those who did not.

PCA revealed that attitudes were composed of a general attitude (GA) factor and a lifestyle impact (LI) factor. The variables loading on each factor were used to calculate GA and LI scores, which ranged from 1, strongly negative to 7, strongly positive. No one item was used in the calculation of more than one attitude score. Cronbach's alpha (α) was used to provide a reliability estimate of the internal consistency of the subsets of variables identified in the PCA. Extracted regression factor scores were saved for use in logistic regression analysis. Knowledge scores (KS) were also calculated for each respondent. The knowledge section of the self-administered questionnaire contained 6 items. The resulting KS ranged from zero to 1. Correct responses to the factual knowledge items were determined from the available literature and bison restoration managers. Data were analyzed using version 15.0 of the Statistical Package for the Social Sciences (SPSS 2006).

Results

The 398 respondents consisted of 225 respondents from the Siegen-Wittgenstein administrative region, 170 respondents from the administrative region of HSK, and three respondents with an unknown place of residence, which were removed from any analysis concerning place of residence. Samples taken from each region were similar with respect to the proportions of males and females and the proportion of respondents in each age category. Most residents were male (67.6%) while females comprised 32.4% of the sample. The distribution of participants among the three age categories (18-34, 35-54, 55+) was 12.4%, 48.3%, and 39.3% respectively.

As the actual population in the two regions spanned by the proposed restoration area is almost evenly divided between males and females (males = 49%, females = 51%) (Landesamt für Datenverarbeitung und Statistik 2005), the sample used in the current study is, biased toward the opinions of males, like many studies concerning wildlife management issues (see Riley 1998; Chavez et al. 2005; Majić 2007). It is also important to note that in the regions of Siegen-Wittgenstein and HSK, the actual distribution of residents among the three age categories (18-34, 35-54, 55+) is 24%, 38%, and 38% respectively (Landesamt für Datenverarbeitung und Statistik 2005). Thus, our sample under represents residents aged 18-34 years, and over represents middle-aged residents (35-54 years). In the current research, however, subgroup analysis was not a research objective as the focus was on documenting and explaining attitudes toward bison and the proposed restoration and exploring attitude differences between regions, not between age groups or genders.

Attitudes by Region

The regions of Siegen-Wittgenstein and HSK differed significantly in their attitudes concerning bison and the proposed restoration. Siegen-Wittgenstein respondents tended to hold more positive attitudes than HSK respondents regarding a number of topics associated with the proposed restoration (Table 1).

While fear is further explored later regarding its influence on attitudes of respondents in general, it is interesting to note that significantly more HSK respondents than Siegen-Wittgenstein respondents indicated that they would be afraid while walking in the forest if free-ranging bison were present and that the number of times they visit the forest area would decrease if free-ranging bison were present (Table 1). Correspondingly, HSK respondents indicated significantly stronger agreement than Siegen-Wittgenstein respondents with statements suggesting that a bison restoration would result in both damage to trees and injuries to humans (Table 1). When asked to vote for or against bison restoration, 73.5% of Siegen-Wittgenstein respondents indicated that they would vote yes while significantly fewer (44.8%) respondents from HSK indicated that they would be in favour of the restoration (Table 1). Regional differences were also recorded concerning existence value of bison. Siegen-Wittgenstein respondents indicated significantly stronger agreement than HSK respondents with statements suggesting that bison are an important part of the ecosystem, that bison have a right to exist in Germany, and that they should be allowed to exist in the country for the enjoyment of future generations (Table 1).

Human Dimensions of Bison Restoration

Table 1. Significant differences in mean attitude scores by administrative region.

<i>Attitude Item</i>		<i>S-W^a</i>	<i>HSK</i>
In general, how do you feel about bison? (1 = strongly dislike, 7 = strongly like) ^b	Mean	5.24	4.28
Reintroducing the European bison is important for the conservation of the species (1 = strongly disagree, 7 = strongly agree) ^b	Mean	5.20	3.84
Reintroducing the European bison would increase tourism in the region (1 = strongly disagree, 7 = strongly agree) ^b	Mean	5.23	3.68
Reintroducing the European bison would help return the environment to a more natural state (1 = strongly disagree, 7 = strongly agree) ^b	Mean	4.43	3.29
Reintroducing the European bison will result in damage to trees in the area (1 = strongly disagree, 7 = strongly agree) ^b	Mean	3.82	4.42
Reintroducing the European bison will result in bison-caused injuries to humans (1 = strongly disagree, 7 = strongly agree) ^b	Mean	2.92	4.42
The benefits of reintroduction will balance the monetary costs (1 = strongly disagree, 7 = strongly agree) ^b	Mean	4.35	3.50
To what extent do you “support” or “oppose” efforts to reintroduce bison? (1 = strongly oppose, 7 = strongly support) ^b	Mean	4.83	3.46
Bison should exist in Germany for enjoyment of future generations (1 = strongly disagree, 7 = strongly agree) ^b	Mean	5.26	4.05
European bison have a right to exist in Germany (1 = strongly disagree, 7 = strongly agree) ^b	Mean	5.00	4.10
The European bison is an important part of the ecosystem (1 = strongly disagree, 7 = strongly agree) ^b	Mean	4.54	3.76
I would like to see free-living European bison (1 = strongly disagree, 7 = strongly agree) ^b	Mean	5.75	4.46
Bison are often shy and difficult to see in the forest but restoration is still important (1 = strongly disagree, 7 = strongly agree) ^b	Mean	5.39	4.04
If free-ranging bison were present, the number of times I would visit the forest per month would ... (1 = decrease significantly, 5 = increase significantly) ^b	Mean	3.05	2.44
Reintroducing the European bison would result in much destruction of crops and farmland (1 = strongly disagree, 7 = strongly agree)	Mean	3.74	4.08
Reintroducing the European bison will result in a decrease in hunting opportunities in the area (1 = strongly disagree, 7 = strongly agree)	Mean	3.41	3.55
European bison will compete with roe deer and other game animals for food (1 = strongly disagree, 7 = strongly agree)	Mean	3.60	3.83
Vote for or against reintroducing bison into the Rothaargebirge area? ^b	For	73.5%	44.8%
	Against	26.5%	55.2%
If I were walking in the forest where free-ranging bison were present, I would have ... ^b	No fear	86.5%	58.5%
	Fear	13.5%	41.5%

^a Indicates data from the region of Siegen-Wittgenstein.

^b Indicates significant difference between groups, $p < 0.05$ —tested using *t* tests and chi-square tests.

Similarities in Attitudes Between Regions

Respondents from the regions of Siegen-Wittgenstein and HSK differed significantly in their responses to 16 of the 19 attitudinal items presented (Table 1). However, responses to three items concerning possible lifestyle impacts of bison were found to be similar between the regions considered. While not significantly different, slightly more HSK respondents than Siegen-Wittgenstein respondents had concerns about whether a restoration of bison would result in the destruction of crops and farmland, cause a decrease in hunting opportunities in the area, and result in competition for food between bison and roe deer or other game animals (Table 1).

Exploring Attitudes

Bath (2000 p. 9) suggests that “[i]f managers can understand the nature of the attitudes held, it is then possible to develop appropriate messages to address the concerns causing those attitudes”. A PCA using those attitudinal items with seven-point response scales, identified two interpretable factors with eigenvalues of greater than 1 (Table 2). The item pertaining to whether bison restoration would result in bison-caused injuries to humans was removed from the analysis as it loaded on both factors (loading of 0.494 and 0.608 on first and second factors respectively). The remaining 15 items accounted for 75.196%

of variation in attitude scores (Table 2). The first factor (Table 2), General Attitudes (GA), had an internal consistency of 0.969 (Cronbach’s α) which shows that, together, these 11 items are a good measure of general attitudes toward bison and the proposed restoration. GA scores were calculated for each respondent using these 11 items.

The second factor contained four items pertaining to possible bison-caused impacts on respondents’ lifestyles (Table 2). The internal consistency of these four items was also acceptable (Cronbach’s $\alpha = 0.736$), suggesting that the items comprising this second factor were a good measure of ‘lifestyle impacts’ (LI). These items were used to calculate LI scores.

As was the case above regarding reaction to most individual attitude items, Siegen-Wittgenstein respondents held significantly more positive GA scores (Mean GA score = 5.06) than their counterparts in HSK (Mean GA score = 3.93) [$t(278) = 5.768, p < 0.001$]. Similarly, Siegen-Wittgenstein respondents indicated significantly less concern regarding lifestyle impacts (Mean LI score = 3.64) than HSK residents (Mean LI score = 3.98) [$t(306) = -2.080, p < 0.038$].

Table 2. PCA of attitudinal items using varimax rotation.^{a,b}

<i>Items</i>	<i>Components</i>	
	<i>General Attitude</i>	<i>Lifestyle Impact</i>
Eigenvalues	8.119	3.161
% of variance	54.125	21.071
General feeling about bison	0.812	
Restoration important for bison species	0.880	
Restoration will increase tourism	0.867	
Bison help restore natural environment	0.839	
Benefits of restoration will balance cost	0.692	
Extent support/oppose restoration	0.886	
Bison important for future generations	0.909	
Bison have a right to exist in Germany	0.873	
Bison is important part of the ecosystem	0.798	
Would like to see free-living bison	0.867	
Bison often shy but restoration still important	0.894	
Bison will destroy crops and farmland		0.776
Bison will compete with deer for food		0.880
Bison will reduce hunting opportunities		0.804
Bison will damage trees in the area		0.810

^a $n = 398$.

^b Only those loadings greater than 0.32 are included in the table.

Bison-Related Knowledge

Knowledge scores (KN) were calculated from responses to six factual knowledge items. Knowledge scores ranged from 0 (all responses incorrect) to 1 (all responses correct). Mean knowledge scores were 0.5699 and 0.5130 for Siegen-Wittgenstein and HSK respectively indicating that while generally low overall, bison-related knowledge was significantly lower in HSK than in Siegen-Wittgenstein [$t(305) = 2.161, p = 0.031$]. While Siegen-Wittgenstein respondents outscored HSK respondents on all but one knowledge item (Figure 2), significant differences were recorded for only two out of the six items: those knowledge items pertaining to direct bison impacts. Significantly more Siegen-Wittgenstein respondents than HSK respondents correctly answered the factual knowledge items pertaining to whether bison commonly transfer diseases to cows and whether bison-caused injuries to humans are common in areas where bison currently exist (Figure 2).

Anecdotal comments suggested that many respondents were concerned about direct bison impacts such as disease transmission, interbreeding between bison and cows, and injuries to humans, however, most respondents correctly answered that such incidents do not commonly occur (Figure 2). Conversely, less than half of Siegen-Wittgenstein respondents (45.7%) and just 38.7% of HSK respondents correctly answered that bison had indeed once lived in NRW. Further, just 20.9% of Siegen-Wittgenstein respondents and 26.7% of HSK respondents correctly answered the question pertaining to the size of an average adult bison (Figure 2) as most respondents (77.5% in Siegen-Wittgenstein and 72.6% in HSK) overestimated the size of an average bison and incorrectly indicated that they were larger than an average cow.

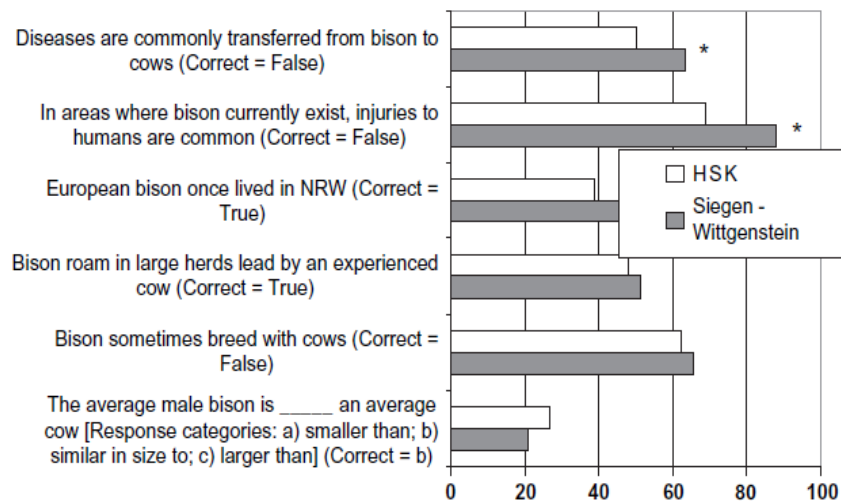


Figure 2. Percentage of correct responses to knowledge items. NRW = North Rhine-Westphalia.

* Indicates significant difference in percentage of correct responses between regions at $p < 0.05$.

Understanding Attitudes

Fear of bison played a large role in the beliefs and opinions of respondents. GA, LI, and KN scores all correlated significantly with fear of bison such that fear of bison corresponded with less positive attitudes [$r = +0.813$, $n=132$, $p < 0.001$], greater concerns regarding lifestyle impacts [$r = +0.336$, $n=132$, $p < 0.001$], and lower knowledge levels [$r = -0.478$, $n=108$, $p < 0.001$]. Using a logistic regression of extracted regression factor scores, we found that those respondents who feared bison were 21.682 times more likely than no fear respondents to hold negative attitudes regarding bison and were 3.242 times more likely to have concerns regarding possible lifestyle impacts such as injuries to humans and the destruction of crops and farmland. Based on responses to the subsets of variables comprising the GA and LI factors, this logistic regression model correctly classified respondents' in the fear category 90.9% of the time.

Correspondingly, responses to individual attitude items differed significantly between those respondents who feared bison and those who did not. For instance, while 78% of no fear respondents indicated some level of support for the proposed restoration, none of the randomly sampled respondents who feared bison (0%) supported the restoration [$X^2 (6, n = 143) = 108.078$ $p < 0.01$]. When asked if bison should be allowed to exist so that future generations could enjoy them, 79.4% of no fear respondents slightly, moderately, or strongly felt that they should, while just three randomly sampled fear respondents (4.3%) indicated only slight agreement with the statement [$X^2 (6, n = 142) = 104.292$ $p < 0.01$].

Discussion

Research associated with the human dimensions of wildlife management seeks a better understanding of how people view wildlife species and explores the reasons behind public support of, and opposition to, management efforts (Decker et al. 2001). We have shown that, for the groups surveyed, the regions of Siegen-Wittgenstein and HSK are fundamentally different in their beliefs, attitudes, and levels of support or opposition regarding bison and the proposed restoration. We also show that attitudes toward bison and the proposed restoration consist of two independent factors: general attitudes and lifestyle impacts. Fear of bison was found to have a large influence on attitudes. Fear scores correlated with lower knowledge scores, less positive attitudes, and greater concerns regarding lifestyle impacts.

Attitude Differences Between Regions

From a comparison of mean GA and LI scores by region we determined that respondents from the region of Siegen-Wittgenstein held significantly more positive attitudes and had significantly less concern regarding lifestyle impacts than HSK respondents thus confirming our hypothesis. We feel that these differences in attitudes are likely due to the fact that a greater proportion of HSK residents than Siegen-Wittgenstein residents rely on the natural environment for their livelihood and thus have greater concerns regarding bison-caused impacts.

This assumption supports findings by a number of other researchers. For instance, Daley et al. (2004 p. 216) found that “[l]andowner attitudes toward wildlife in North Carolina appear closely linked to property use and reliance on land for direct economic

income”. Similarly, West and Parkhurst (2002) found that people who use their land for the production of various agricultural products were less tolerant of deer damage than those who did not produce agricultural products.

Knowledge Differences Between Regions

Though formal education levels were similar in Siegen-Wittgenstein and HSK and despite the fact that restoration proponents held public meetings, information and photo exhibitions, and published numerous newspaper articles in both regions, Siegen-Wittgenstein respondents scored significantly higher than HSK respondents on two out of six items pertaining to knowledge of bison and their characteristics. These findings suggest that information must continue to be provided to residents to help address issues of fear of bison, especially in the region of HSK. As suggested by Mankin et al. (1999 p. 471), “[m]embers of the public can make sound, informed decisions on natural resource issues only if they are provided with accurate information accompanied by ecological comprehension”. These findings, however, also beg the question of the credibility of the restoration proponents and whether HSK residents simply do not believe the information presented to them. Freddy et al. (2004) have found that the credibility of groups associated with wildlife management efforts can result in disagreement about even the number of animals in the area to be managed. Future research should therefore attempt to measure the perceived credibility of differing information sources to help identify trusted and also untrustworthy groups and or individuals.

There are differing opinions, regarding the effectiveness of such information efforts. While some researchers suggest that education and information efforts positively influence attitudes and opinions (Hughes & Saunders 2005; Marks & Zadoroznyj 2005; Trumbo & O’Keefe 2005), others assert that such efforts rarely result in attitude change (Stoll-Kleemann 2001; Meadow et al. 2005). While the linkages between the information presented and opinions are complex and sometimes difficult to define (Mazur 1998), these differences of opinion between the regions studied may be due to the nature of the information presented. A number of researchers have found that information efforts tailored to the interests and concerns of the intended audience are more likely to be accepted and more effective in influencing attitudes and contributing to increased knowledge levels (Weeks & Packard 1997; Lauber & Knuth 2004).

In issues concerning resource and wildlife management, effective targeting of information efforts is especially important as members of the public often reconstruct or ‘cherry pick’ information presented to them to make it coincide with their value system (Stoll-Kleemann 2001; as cited in Freddy et al. 2004). Such confirmation bias may, similar to the situation regarding regional differences in attitudes, be influenced by differences in landownership characteristics between regions and contribute to the observed differences in knowledge scores between regions. As a greater proportion of HSK respondents than Siegen-Wittgenstein respondents rely on the natural environment for their livelihood, HSK respondents are more likely than Siegen-Wittgenstein respondents to be subject to confirmation bias and to skew or reconstruct the general information presented by restoration proponents to make it coincide with their perceptions of threats from direct bison impacts.

For managers in North Rhine-Westphalia, future information and education efforts aimed at promoting the bison restoration should be presented by trusted

messengers and should concentrate on providing accurate information regarding those issues that can be perceived as a threat to both lifestyles in general and agricultural or livestock production, especially in the region of HSK. Our research suggests that such targeted messages should address issues such as disease transmission from bison to cows and bison-caused injuries to humans. Messages should also focus on items that may contribute to fear of bison as results have shown that those respondents who feared bison were 21.682 times more likely than no fear respondents to hold negative attitudes.

Factors Comprising Attitudes

As suggested by West and Parkhurst (2002 p. 144) regarding attitudes toward deer damage in Virginia, “to successfully manage deer populations, managers must understand the factors that produce attitudes of intolerance among stakeholders”. While Siegen-Wittgenstein respondents held significantly lower mean LI scores (i.e. were less concerned about bison-caused lifestyle impacts) than HSK respondents, regional differences in GA scores were even more pronounced. This finding was somewhat unexpected as the large differences in landownership characteristics between regions were expected to translate into regional differences in LI scores that would surpass regional differences in GA scores. Thus it seems that attitudes toward bison and the proposed restoration are influenced by factors other than those concerning bison-caused lifestyle impacts. We suggest that such factors pertain to a general fear of bison.

In the case of deer management in Virginia, West and Parkhurst (2002) suggested that respondents’ opinions may not only be influenced by concerns regarding personal experiences (or in the case of the current research: hypothetical personal experiences) but also may be influenced by information from the media and acquaintances. Thus the lower than expected GA scores (relative to LI scores) of HSK respondents may represent those respondents who, while not personally anticipating bison-caused lifestyle impacts, share in the concerns of others who feel they are at risk of such impacts. Such concerns also may translate into a general fear of bison. This assumption is supported by the fact that while the attitude item specifically addressing fear of bison correlated with both LI and KN scores it was most strongly correlated with GA scores.

Conclusions

Similar to findings by Daley et al. (2004) in North Carolina, a ‘one-size-fits-all’ approach will not likely be successful in effectively promoting the proposed bison restoration and addressing the concerns of respondents in the regions of Siegen-Wittgenstein and HSK. Fundamental differences between the two regions call for region-specific and focused efforts by restoration managers. In fact, restoration proponents recently took the first, albeit large, step toward such region-specific management. The significantly less positive reaction from respondents in the region of HSK, has prompted managers to remove those areas within the region of HSK from the proposed restoration area. While managers still hope to restore 20-25 free-ranging bison in the remaining 4.3 km² area within the region of Siegen-Wittgenstein, this significant decision by restoration proponents to exclude areas within HSK from the proposed restoration site reaffirms the importance of understanding public opposition to large mammal management efforts.

This action also highlights the need for open dialogue between affected interest groups to gain a clearer understanding of the reasons behind some the opinions identified in this study. While HSK residents were found to hold significantly less positive attitudes than Siegen-Wittgenstein respondents it is important to note that, while generally negative, the attitudes of HSK respondents actually hovered close to neutral on many issues. Thus, while restoration proponents plan to move ahead with restoration efforts in Siegen-Wittgenstein, practitioners should be aware that the findings of the current study, and human dimensions research more generally, provide a basis and opportunity for continued dialogue with those opposed to restoration efforts. Further, as the current study has identified those issues most closely related to attitudes, proponents would be wise to incorporate such information into future information and awareness campaigns to more effectively address the concerns of restoration opponents.

Our research concerning reaction to the proposed restoration in Germany has shown that while concerns regarding bison-caused damage or lifestyle impacts do play a role in the formation of attitudes, the bigger issue is fear. Thus, similar to previous studies, which illustrate the importance of fear in predicting attitudes toward large carnivores, reaction to a large herbivore like bison is no different. The influence of fear on attitudes toward large carnivores has been studied by numerous researchers throughout areas of Europe (Bath & Farmer 2000; Røskraft et al. 2003; Linnell et al. 2003; Kleiven et al. 2004; Majić 2007) and North America (Lohr et al. 1996; Bath & Enck 2003; Meadow et al. 2005). However, researchers studying the human dimensions of large herbivore management have given little consideration to the issue of fear, preferring instead to focus on livelihood impacts or damage to personal property. This is especially evident in North America where, though research concerning attitudes toward deer damage is very common (see: Christoffel & Craven 2000; West & Parkhurst 2002; Lee & Miller 2003; Fulton et al. 2004, Lauber & Brown 2006), the issue of fear of the large herbivore species receives little or no attention. Future human dimensions researchers working with large mammals should build into their methodology specific measures of fear as this may be the most important variable in understanding support or opposition to large mammal restoration efforts.

Implications for Practice

*Practitioners in the area of human dimensions of large herbivore restoration and management should assess levels of fear of the animal in question to gain a deeper understanding of public attitudes regarding management efforts.

*Practitioners should also explore ways to reduce fear of large herbivore species. Researchers studying beliefs and attitudes regarding large carnivore species have found that viewing captive animals can result in increased public knowledge levels and more positive attitudes. A comparison of public attitudes and knowledge levels pre and post viewing of captive large herbivores may reveal similar changes in attitudes and beliefs regarding large herbivore species.

*The decision by restoration managers in the current study to exclude areas within HSK from the proposed restoration site highlights the importance of an in-depth understanding of the reasons behind the opinions voiced by study participants. Informal dialogue between interest groups can be an effective tool for reducing conflict and identifying areas of common ground between diverse groups

*Practitioners should be sure to learn of the credibility of groups providing information regarding the wildlife management effort in question. Accurate information presented by a credible source will provide members of the public and interest groups with the information needed to make sound decisions and formulate accurate opinions.

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