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Sustaining the Public's Positive Feelings towards Ungulates at the Local Level

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ABSTRACT

In Europe, spatial distributions and densities of ungulates have been increasing, triggering both negative and positive feelings. Ecosystem-based and collaborative approaches to wildlife management have been introduced to, among other things, consider the perspectives of the local public. Consequently, it becomes necessary to understand the public's emotional appraisals and feelings toward the presence of moose and other ungulates. We studied four socio-ecological contexts in Sweden. Statistical analyses of a postal questionnaire (N=1111) showed that negative feelings were weak and positive feelings were modest across all settings. In particular, wildlife value orientation of mutualism and perceptions of moose and other ungulates as supporting recreation opportunities sustained positive feelings. Currently there seems to be little need among the public to cope with negative implications of ungulates. Management may benefit from informing about adequate strategies and building social trust if negative impacts of ungulates were to become salient to the public.

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Introduction

The European public may be interacting more with wildlife in their local natural settings, as spatial distributions and densities of ungulates have been increasing (Linnell et al. 2020). In Sweden, moose (*Alces alces*) previously dominated most landscapes (Danell and Bergström 2010), but today, several ungulate species (roe deer [*Capreolus capreolus*], red deer [*Cervus elaphus*], fallow deer [*Dama dama*], mouflon [*Ovis orientalis*], and wild boar [*Sus scrofa*]) co-exist, increasing the likelihood of human-wildlife interactions of various kinds (Neumann et al. 2022). However, understanding of the general public's feelings toward the presence of moose and other ungulates is lacking.

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Such knowledge may be essential, to adapt management in a direction toward local social sustainability (Díaz et al. 2018).

Human-wildlife interactions take place in different forms (Methorst et al. 2020). Some are expected, or even desirable (e.g., wildlife spotting or hunting), and associated with feelings of pleasure and joy, whereas other interactions are a nuisance (e.g., damage to property), causing anger and fear, and potentially leading to social conflict (Eklund et al. 2023). Feelings have been shown to be a significant variable in the public's acceptance of wildlife (wolves and brown bears; Jacobs et al. 2014; Johansson et al. 2012; Slagle, Wilson, and Bruskotter 2022; geese; Eriksson et al. 2020; seals; Waldo et al. 2020) and in management interventions toward these species (e.g., Eklund et al. 2020; Eriksson et al. 2020; Waldo et al. 2020). The focus has largely been on conflict and the public's negative feelings, while recently more attention has been given to opportunities for coexistence and positive feelings (Buijs and Jacobs 2021; Johansson et al. 2024).

All types of human-wildlife interactions take place in a local socio-ecological context, and are interpreted and evaluated (appraised) accordingly by people (Ostrom 2007), thereby building an external *contextual frame of appraisal*. At the same time, internal personal factors, such as wildlife value orientations (Manfredo et al. 2020) and previous experiences (Johansson et al. 2021) build a *personal frame of appraisal*. The processing of both external (contextual frame) and internal (personal frame) information plays into the psychological *process of emotional appraisal*.

This study aims to test the extent to which the contextual and personal frames influence the individual's evaluation of the presence of moose and other ungulates in local areas. Another aim is to analyze the role of the contextual and personal frames of appraisal, and the key factors of the psychological processes (i.e., the emotional appraisal components) in shaping the public's feelings toward local presence of moose and other ungulates (Figure 1). Such systematic understanding of contextual and

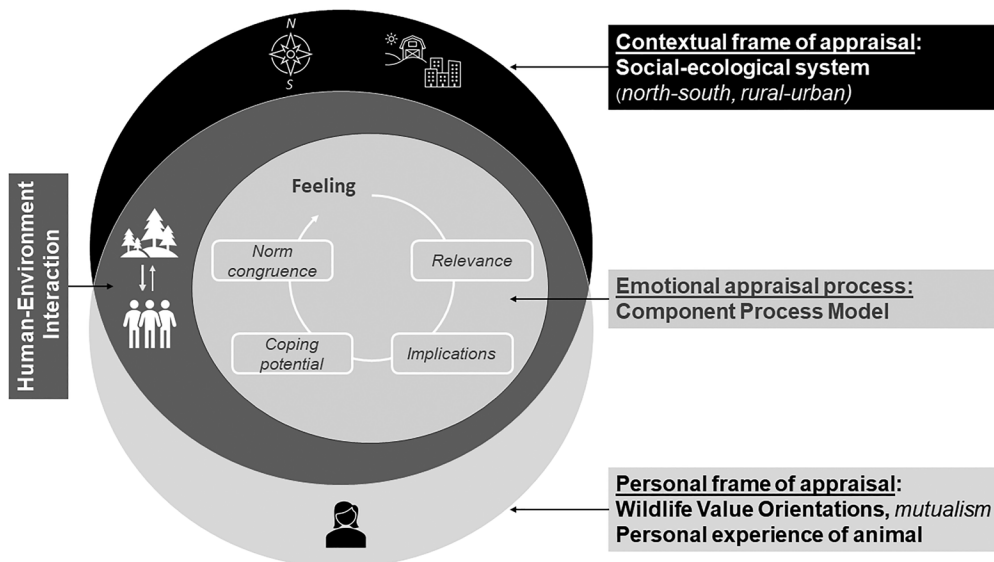


Figure 1. Overview of the theoretical framework.

personal frames of appraisal, and the process of emotional appraisal behind feelings expressed by the public, could alert management as to whether action is needed and in what way.

Theoretical Framework

Human-Environment Interaction and Feelings toward Wildlife

Our starting point is an environmental psychology perspective on human–environment interaction. To complement this analytical frame, we also rely on Ostrom’s (2007) argument that the setting in which people live is part of a socio-ecological system (SES), and the argument that people’s responses to the animals present in this system are guided by wildlife value orientations (WVO; Teel and Manfredi 2009). For the psychological process in which the human-environment interaction takes place, we refer to the component process model of emotional appraisal (CPM; Scherer 2001).

The Human-Environment Interaction model (HEI; Küller 1991) proposes that people’s emotions are affected by different levels of appraisal (see also Leventhal and Scherer 1987). The appraisal processes involve processing of stimuli in the external natural and social environment (the *contextual frame*) as well as processing of stimuli internal to the individual, e.g., value orientations and previous experiences (the *personal frame*) given the demands of the person’s activity at hand. While feelings toward (fear of) snakes and spiders have been explained from an evolutionary point of view as shaping appraisals at a basic psychophysiological level (Leventhal and Scherer 1987; Seligman 1971), feelings toward species that might have posed little phylogenetic threat, such as ungulates (Arrindell 2000), are likely dependent on cognitively elaborated appraisals involving processing of people’s context as well as personal factors (Flykt et al. 2013). Here, we are concerned with the cognitively elaborated level of appraisal, resulting in specific emotions, e.g., fear, anger and joy, that can be verbally expressed and reported as feelings with varying degrees of intensity (Izard 1991).

The Contextual Frame: Wildlife as Part of a SES

Landscapes shared between humans and wildlife can be considered as complex socio-ecological systems (Liu et al. 2007; McGinnis and Ostrom 2014; Ostrom 2007). Natural or human-induced change affects both the ecological system and its inherent dynamics, e.g., interactions between species and their habitats, and the social system involving dynamics between individuals, groups, and society at large (McGinnis and Ostrom 2014; Sjölander-Lindqvist and Sandström 2019).

In the Swedish context, moose have significantly influenced human-wildlife interactions and strongly influenced the wildlife governance system (Danell et al. 2016). A reform in 2012 established an ecosystem-based and adaptive moose management system to balance ecological wildlife dynamics with economic aspects, such as wildlife damage, and social aspects, such as quality of life. Local and regional participation is emphasized, and management should explicitly “take into consideration important public interests” (Government Bill 2009/10:239).

Previous studies on the Swedish moose management system have identified spatial differences between the social system's design and the ecological conditions. A clear north-south gradient emerges, with greater social complexity (involving more local stakeholder groups) in the north and more ecological complexity (e.g., number of ungulate species) in the south (Dressel, Ericsson, and Sandström 2018). Given these geographical differences, stakeholders have different conditions for voluntary engagement in the system (Johansson et al. 2022), potentially affecting management outcomes (Dressel et al. 2021). Therefore, analyses of the public's feelings toward the presence of ungulates should consider these spatial differences.

In landscapes shared by wildlife and humans, changes to the composition and distribution of wildlife populations, such as a smaller presence of moose and increased presence of other ungulates, also implies changes in human-wildlife interactions and patterns. Growing and expanding ungulate populations may alter ecosystems, with cascading effects on food web dynamics and browsing damage (Spitzer et al. 2021). Locally, there may also be differences in the public's emotions toward moose and other ungulates, as those who live in rural areas rather than urban areas may have more direct experience of wildlife impact on forestry, agriculture, and gardening. These spatial differences in the SES provide a contextual frame for the individual's appraisal of local presence of moose and other ungulates.

The Personal Frame: Wildlife Value Orientation and Experiences

How the public fundamentally relate to wildlife can be assessed in terms of wildlife value orientations, described as a set of basic beliefs (Teel and Manfredi 2009), implying that these value orientations are rather stable over time and situations. Individuals with a wildlife value orientation of mutualism are characterized by beliefs about wildlife as being equal to humans and part of an extended family deserving similar rights and care (Teel et al. 2010). Such beliefs have been strengthened in many societies by a modern lifestyle that has removed people from direct contact with wildlife (Manfredi et al. 2021). A wildlife value orientation of mutualism has been shown to be associated with support for various management decisions (reintroduction of bison and migration of wolves; Hermann, Voß, and Menzel 2013; refraining from hunting geese and deer; Jacobs et al. 2014), and acceptance of management practices for deer in cultivated landscapes (Gamborg, Lund, and Jensen 2019). It seems likely that mutualism would also, as a personal frame, play into cognitively elaborated appraisal processes perceived as being prevalent for feelings toward wildlife that might pose little phylogenetic threat (Flykt et al. 2013).

To understand a person's feelings, personal experiences and the perceived impact on human livelihoods and quality of life must be considered. For example, small birds are generally appreciated and associated with positive feelings (Hedblom et al. 2014), but people who have experienced geese grazing in flocks are more prone to express negative feelings (Eriksson et al. 2020). This illustrates that feelings, toward wildlife need to consider a personal frame of appraisal, referring in this study to encounter experiences and a wildlife value orientation of mutualism.

The Psychological Process of Emotional Appraisal

The Component Process Model of emotional appraisal (CPM; Scherer 2001) nuances the understanding of people's cognitively elaborated appraisal of an event (in our case local presence of moose and other ungulates). CPM states that an appraisal process evolves as four interconnected steps that define the feeling (Moors et al. 2013). In the first step, the event is reflected on with respect to its *relevance* in relation to a person's goals (e.g., the presence of moose would be highly relevant for a moose hunter or a person with strong fear of moose, but less so to a person with little interest in nature). Second, if the event is perceived as relevant, the individual considers the *implications* of the new situation in terms of different positive and negative consequences for themselves, their lifestyle, etc. (e.g., likely appraised as positive by the hunter and negative by the fearful person). If these implications are perceived as negative and obstructing the person's goal (e.g., hindering the fearful person from walking in the local nature setting), *ways to cope* with the situation are considered (e.g., taking measures to avoid the moose during the walk). Finally, the situation and possible ways of coping with the situation are evaluated for *congruence with personal and societal norms* (e.g., the extent to which the presence of moose matches what the individual thinks it should be according to personal standards).

Coping potential has a significant role in the appraisal process if the event is goal obstructive (Scherer 2013). Much previous research on wildlife has examined the impact on human interests and social (goal) conflicts over wildlife presence and management (Eklund et al. 2023). Active coping and a planning focus on problem-solving are reported to be associated with reduced stress and positive well-being outcomes (e.g., ensuring someone scares off moose that are too close to inhabited areas), but also seeking social support might be helpful (e.g., talking with someone else about a stressful event; Johansson et al. 2020; Villasana, Alonso-Tapia, and Ruiz 2016). In Sweden, the public can contact representatives of wildlife management authorities, for example County Administrative Boards, for information and advice. Often this contact involves the authority representative listening to concerns about local presence of wildlife, so social trust in those representing wildlife management authorities might facilitate personal contacts and mitigate negative feelings toward wildlife (Johansson et al. 2016).

Objective and Research Questions

Based on our theoretical framework the specific objective is to systematically assess the public's feelings toward presence of moose and other ungulates. Following the appraisal components of the CPM (perceived relevance, implications, coping potential and norm congruence), we ask if the public at local level find that:

- a. moose and other ungulates matter to their life and way of living, i.e., perceived relevance;
- b. their interests are hindered or supported by the presence of moose and other ungulates, i.e., perceived implication;
- c. they have access to coping strategies, know what to do, and have social trust in management authorities, i.e., perceived coping potential;

- d. the presence of the animals is congruent with personal and local norms, i.e., perceived norm congruence.

We wanted to identify differences in the contextual frame of appraisal, so we test for differences between the north-south gradient in socio-ecological contexts with a high (north) and low (south) share of moose among the ungulate population, and rural and urban human residence.

Overall, we expect the appraisal components for moose to be more salient, i.e., assessed as more relevant and with stronger implications, in northern Sweden, and the appraisal components for other ungulates to be assessed as more salient in the south. Regardless of the north-south gradient, we expect the appraisal components to be more salient in rural areas than in urban areas.

We also analyze the relative importance of individual socio-demographics (gender, age, hunter, landowner), the contextual frame of appraisal (north-south, urban-rural), the personal frame of appraisal (wildlife value orientation of mutualism, experience), and the emotional appraisals (relevance, implications, coping potential and norm congruence) of the presence of the species to the public's feelings toward the presence of moose and other ungulates. We expect all variables to contribute to the explanation of the feelings, but expect the emotional appraisal components directly addressing the presence of moose and other ungulates to be stronger explanatory variables.

Methods

Participants and Settings

The study involved N=1111 participants (female 49.8%, male 50.2%), mean age 55 years, divided into four sub-samples representing different settings: North region: Västerbotten, rural municipality of Nordmaling (North-Rural- NR, 7,100 inhabitants) and urban municipality of Umeå (North-Urban - NU, main city, 130,977 inhabitants), and South region: Södermanland, rural municipality of Vingåker (South-Rural-SR, 9,063 inhabitants) and urban municipality of Nyköping (South-Urban -SU, main city, 57,633 inhabitants). Participants' socio-demographic characteristics are given in [Table 1](#). The ecological context in the North region is characterized by a relatively high share of moose and

Table 1. Overview of the participants' socio-demographics.

Setting	North-Rural n=300	North-Urban n=271	South-Rural n=273	South-Urban n=267
Male/female (%)	52.3/47.7	49.5/50.5	52.4/47.6	46.5/53.5
Age (mean, SD)	57.27/13.84	50.86/16.43	55.82/15.16	55.01/15.57
Residence (%)				
<200	49	10.0	31.4	16.9
200-2000	29.9	12.2	25.0	17.7
2001-10 000	21.1	10.0	39.4	5.3
10 001-50 000	–	2.2	3.8	36.8
50 001-100 000	–	13.3	0.4	22.2
>100 000	–	52.4	–	1.1
Hunting (%)				
No	55.3	72.8	77.4	87.7
Yes	44.7	27.2	22.6	12.3
Own land (%)				
No	48.8	61.6	74.6	79.1
Yes	51.2	38.4	25.4	20.9

low share of other ungulates, while in the South region there is a relatively high share of other ungulates and low share of moose (Dressel, Ericsson, and Sandström 2018).

Procedure

A sample of $N = 3000$ addresses ($N = 750$ per setting) was randomly selected from the Swedish national address register SPAR. In total, 2950 valid addresses were obtained for residents aged 18–75 years (on day of sampling). The questionnaire was sent by post with a postage-paid return envelope. An option to complete an online version of the questionnaire was provided. A first reminder was sent by SMS, a second was sent by post and included a copy of the questionnaire, then a final third reminder was sent by SMS. Responses were returned by $N = 1229$, (response rate 41.6%). Of these, 118 questionnaires had a high level of internal drop-out with 30% or more of the items left unanswered and were therefore discarded from further analysis, leaving 1111 valid responses, 37.6% (i.e., in the same range as recent studies on public experiences of wildlife; Eriksson et al. 2020). Only ten percent of the remaining questionnaires had an internal drop-out between 10% and 29%, mostly referring to questions on household characteristics, which are excluded from the present study. Given the missingness per variable (2.4% or below), we replaced missing values for all items with mean values. Substitution with mean values is commonly used and deemed suitable in cases with low levels of missing data and strong relationships among items. A potential disadvantage of this conservative substitution approach is that it reduces data variance and can thereby depress observed correlations (i.e., result in an underestimation rather than overestimation of statistical associations; Hair et al. 2013).

The research complies with the Helsinki Declaration and the APA guidelines for psychological research, and follows the Swedish Research Council's recommendations regarding good research practice. The study did not address personal sensitive information as defined by the Swedish Ethical Review Authority (race or ethnic origin, political views, religious or philosophical convictions, trade union membership, health, a person's sex life or sexual orientation, genetic or biometric information), so no formal ethical approval was needed (<https://etikprovningmyndigheten.se/for-forskare/utbildningsmaterial/>).

Questionnaire

The 8-page questionnaire contained questions referring to socio-demographics: gender, age, having a hunter in household or not, and being a landowner or not.

The personal frame included assessment of:

- the wildlife value orientation, mutualism, by four items (e.g., “Wildlife are like my family, and I want to protect them;” Eriksson et al. 2020; Miller et al. 2018). Responses were given on a five-point scale (1 = totally disagree to 5 = totally agree), and averaged into an index (Cronbach's $\alpha = 0.82$).
- Personal experience of the animal was assessed by the question, “How often do you usually see [animal] close to where you live?” repeated for moose, red deer,

fallow deer, roe deer and wild boar. Mouflon was excluded, as it occurs only in very limited numbers (Artfakta 2023). Response scale: 1 = Never, 2 = Every year 3 = A few times per year, 4 = Several times per year, 5 = Every month. In the analyses, red deer, fallow deer, roe deer and wild boar were collapsed into “other ungulates,” and in all following questions collectively referred to as “other ungulates” to shorten the length of the questionnaire.

Feelings toward moose and other ungulates were assessed by the question: “To what extent does the presence of [moose/other ungulates] in the area where you live elicit the following feelings?” Twelve different discrete emotions were assessed, ranging from 0 = not at all to 6 = very strongly (Figure 1).

Emotional appraisal covered four appraisal components:

- Perceived relevance was assessed by five items (e.g., “the presence of [moose/other ungulates] concerns me personally,” “discussions about [moose/other ungulates] feel close to me,” averaged into an index. Response scale 1 = not at all to 5 = to a high degree.
- The perceived implications for oneself, one’s family, local residents and local stakeholders were covered by ten items further subjected to factor analysis (see [Supplementary material](#)). Response scale 1 = animal hinders to 5 = animal supports. Three items designed to assess the psychological restorative potential of natural settings were also included (“In your experience do [moose/other ungulates] hinder/support your opportunities to - experience and explore, take a break from your daily demands, get fascinated - in your local natural settings.” Response scale 1 = animal hinders to 5 = animal supports (Johansson et al. 2024).
- Perceived coping potential - problem-solving was assessed by six items (“Do you experience that the implications of [moose/other ungulates] in the area where you live are manageable? E.g., I have access to information about how I can prevent risk or damage by [moose/other ungulates], There are preventive measures available that I can use to reduce risks or damage by [moose/other ungulates]”). Coping potential - social trust was assessed by five items: “How do you experience that those who are responsible for the management of moose/other ungulates consider the local residents in issues concerning these animals?” Responses were given for local hunters/landowners/municipality/county administrative board/Swedish EPA. Response scale 1 = not at all to 5 = to a high degree.
- Norm congruence was assessed by four items: “How does the presence of [moose/other ungulates] in the area where you live correspond to your view of how it should be? It agrees with my view of, e.g., how the animals should be managed, norms in my local community.” Response scale 1 = not at all to 5 = to a high degree. The Results section includes an overview of the indices, including Cronbach’s α -values for moose and other ungulates, respectively.

Analyses

Statistical analyses were performed in SPSS Statistics 27. Indices for the theoretical concepts investigated were constructed after checking for internal reliability (Cronbach’s α) $>.70$ was deemed acceptable; Field 2009). Sub-dimensions of the perceived

implications were identified using exploratory factor analysis. Differences in appraisals between the four settings were tested with analysis of variance (ANOVA) and Bonferroni post-hoc tests to identify which groups differed. The partial eta-squared (η^2) was used as a measure of effect size and reported for statistically significant results. Hierarchical multiple linear regression was used to test the possibility of predicting positive feelings toward moose and other ungulates respectively with socio-demographics, contextual and personal frames, and the emotional appraisal components. In the hierarchical analysis, the order in which the explanatory variables are entered is based on theoretical considerations (Field 2009). In all tests, p -values $<.05$ were considered to indicate statistical significance, effect sizes of $\eta^2 = .01$ or below were not considered due to their low practical relevance (Richardson 2011).

Results

The Contextual and Personal Frames of Appraisal

An overview of the contextual and personal frames is given in Table 2. One-way ANOVA with Setting as grouping variable of the personal frame reveals that Mutualism does not differ between Settings. However, Personal Experience of moose and other ungulates respectively reveals significant differences. The post-hoc test showed that the experience of moose (i.e., seeing the species) is higher in NR than all other settings, whereas the experience of other ungulates is higher in SR than in other settings (Table 2).

Feelings toward Moose and Other Ungulates

Participants mostly expressed Positive feelings (pleasure, interest, joy, relief, enthusiasm) for moose and other ungulates, with mean values above 3 (scale 0 = not at all, 6 = very strongly), whereas the Negative feelings (fear, sorrow, worry, irritation, anger, disgust, despair) in general were assessed very low (Figure 2). In subsequent analyses, the focus was on the Positive feelings. Assessments of the different Positive feelings were

Table 2. Overview of contextual and personal frames of appraisals.

Setting	Contextual frame			Personal frame				
	Ecological: share of other ungulates	Social: rural urban	WVO –mutualism: scale 1-5		Experience moose scale 1-5		Experience other ungulates scale 1-5	
			M	SD	M	SD	M	SD
North-Rural (NR)	Low share	Rural	3.36	0.99	3.60	1.05	2.67	0.71
North-Urban (NU)	Low share	Urban	3.24	0.97	2.66	1.27	1.59	0.54
South-Rural (SR)	High share	Rural	3.26	1.02	2.62	1.09	3.41	0.94
South-Urban (SU)	High share	Urban	3.37	0.98	2.49	1.15	2.84	1.09
ANOVA				n.s.	F(3, 1080) = 56.01, $p < .001$, $\eta^2 =$.135, Bonferroni post-hoc NR > than all other settings		F(3, 1013) = 207.05, $p < .001$, $\eta^2 =$.380, Bonferroni post-hoc SR > SU&NR > NU	

inter-correlated and an index created (Moose: $M=3.32$, $SD = 1.73$, Cronbach's $\alpha = .934$; Other ungulates: $M=3.03$, $SD = 1.83$, Cronbach's $\alpha = .946$). One-way ANOVA with Setting as a grouping variable showed that the assessment of Positive feelings toward moose significantly differed (NR: $M=3.41$, $SD = 1.77$; NU: $M=2.99$, $SD = 1.77$; SR: $M=3.45$, $SD = 1.68$; SU: $M=3.42$, $SD = 1.64$; $F(3, 1107) = 4.425$, $p = .004$, $\eta^2 = .012$). Bonferroni post-hoc tests showed that Positive feelings toward moose were assessed lower in NU than all the other settings. Positive feelings toward other ungulates significantly differed (NR: $M=3.38$, $SD = 1.80$; NU: $M=2.73$, $SD = 1.84$; SR: $M=2.93$, $SD = 1.81$; SU: $M=3.07$, $SD = 1.82$; $F(3, 1107) = 6.514$, $p < .001$, $\eta^2 = .012$).

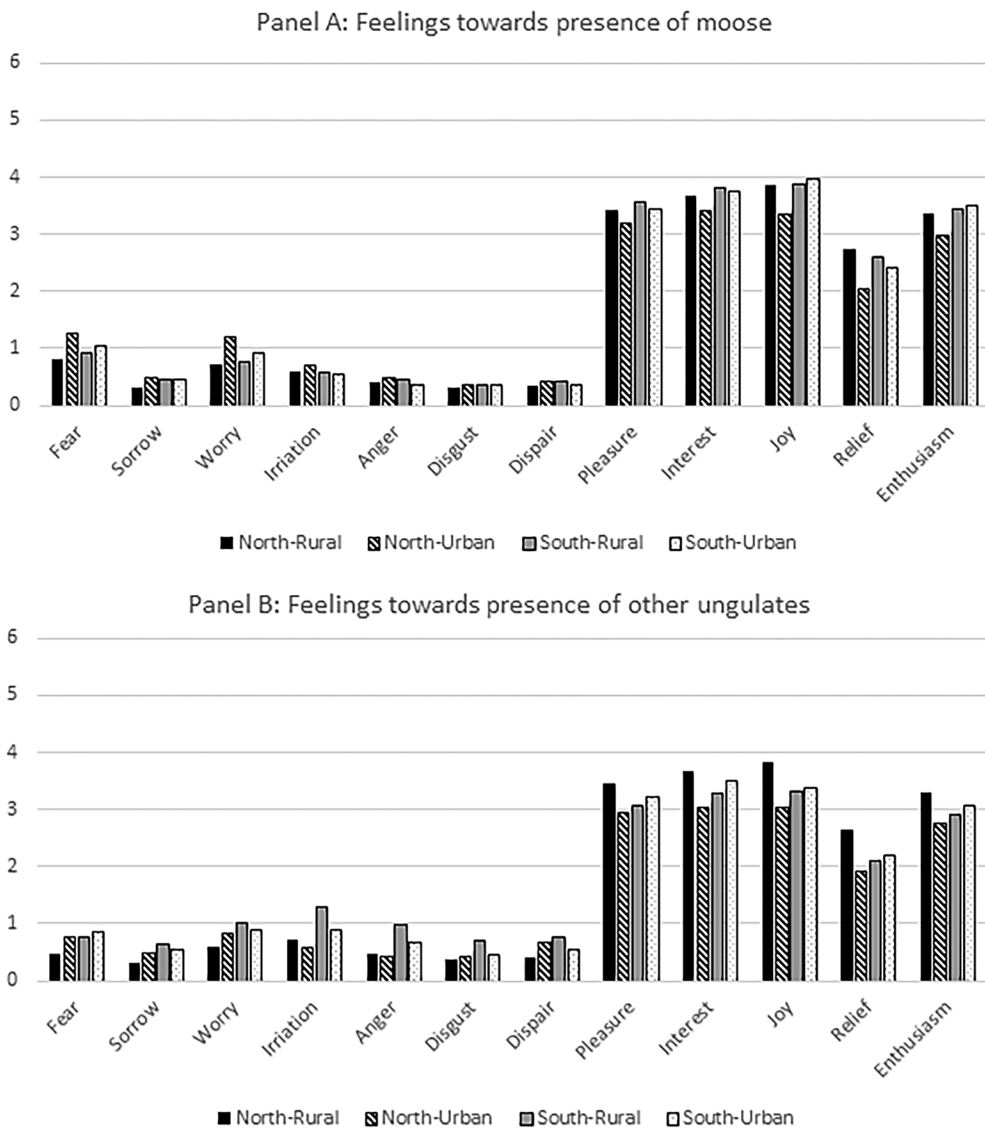


Figure 2. Mean values for the public's negative and positive feelings towards moose (panel A), and negative and positive feelings towards other ungulates (panel B), 0 = not at all, 6 = very strongly.

= .017). Positive feelings toward other ungulates were assessed lower in NU and SR than in NR and SU.

Emotional Appraisal Components: Relevance and Implications

Descriptive statistics for the four emotional appraisal components are shown in [Table 3](#). Perceived relevance of moose and other ungulates respectively to oneself and the local society followed the pattern of the contextual and personal frame of appraisal. One-way ANOVA with Setting as a grouping variable revealed significant differences in Perceived relevance for both moose and other ungulates. Bonferroni post-hoc tests showed that Perceived relevance of moose was higher in NR than SR and SU, and NU was higher than in SU. Perceived relevance of other ungulates was higher in NR and SR than NU.

Of special interest is the appraisal of Perceived implications of moose and other ungulates. As a first step, possible sub-dimensions of implications were investigated by exploratory factor analysis (for statistical details please refer to the [Supplementary material](#)).

Parallel analysis for moose and other ungulates showed a similar pattern. For moose, two components had eigenvalues over Kaiser's criterion of 1 and, in combination, explained most of the variance (moose: 58.82%/other ungulates 59.74%, for factor loadings after rotation). Items that cluster on the first factor for moose but on the second for other ungulates encompass items related to achievement of personal goals, hunting, recreation and tourism goals, and account for 43.52%/15.87% of the total variance. Items that cluster on the second factor for moose and the first for other ungulates relate to gardening, forestry, and agriculture, but also traffic safety and spread of diseases. This factor accounts for 14.89% and 43.86% of the total variance for moose and other ungulates, respectively.

Based on the factor analysis and reliability analyses, averaged indices for the sub-dimensions of implications were constructed. The factors can be broadly described as "Recreation opportunities" (5 items: moose Cronbach's $\alpha=.825$, other ungulates Cronbach's $\alpha=.790$) and "Cultivation impact and perceived risks" (5 items: moose Cronbach's $\alpha=.780$, other ungulates Cronbach's $\alpha=.804$). Recreation opportunities had mean values above three (scale 1=hindering to 5=supporting), reflecting that presence of moose and other ungulates was assessed to have supporting implication for Recreation opportunities.

One-way ANOVA showed that Recreation opportunities for moose were assessed significantly differently between settings. Post-hoc analyses for moose revealed higher mean values in NR than SR and SU, and for other ungulates Recreation opportunities were assessed higher in NR than for all other settings. Cultivation impact and perceived risks had mean values below three for all species in all settings, indicating that the implications were perceived as hindering. For moose, this perception was similar across the settings, whereas a significant difference was identified for other ungulates. Mean values were lower for SR and SU than NR and NU, meaning that the hindering implications were stronger in the southern settings.

Considering the additional aspect of perceived implications, Psychological restorative potential of the animal presence, mean values close to four indicated that presence of moose and other ungulates was clearly perceived as having supporting implications. Restorative potential was assessed as significantly higher in NR than in NU, but effect sizes were low (η^2 below .01).

Table 3. Emotional appraisal components, internal reliability cronbach's alpha, descriptive statistics and results for one-way ANOVAs with Setting as grouping variable.

Setting:	North-Rural (NR)		North-Urban (NU)		South-Rural (SR)		South-Urban (SU)		ANOVA
Appraisal component	M	SD	M	SD	M	SD	M	SD	Df(3, 1107)
Relevance, scale 1-5 M: $\alpha=.848$	2.33	1.17	2.17	1.08	1.99	0.978	1.94	0.92	F=8.63, $p < .001$, $\eta^2 = .023$ Post-hoc: NR>SR&SU
OU: $\alpha=.925$	2.33	1.07	1.96	1.00	2.31	1.13	2.11	0.99	F=7.87, $p < .001$, $\eta^2 = .021$ Post-hoc: NR>NU
Implication, scales 1-5 Recreation M: $\alpha = 825$	3.77	0.76	3.64	0.67	3.51	0.71	3.49	0.72	F=8.77, $p < .001$, $\eta^2 = .023$ Post-hoc: NR>SR&SU
OU: $\alpha=.790$	3.59	0.73	3.39	0.64	3.27	0.71	3.23	0.70	F=15.13, $p < .001$, $\eta^2 = .039$ Post-hoc: NR>NU, SR&SU
Cultivate & risk M: $\alpha=.780$	2.81	0.69	2.78	0.58	2.78	0.64	2.73	0.63	n. s.
OU: $\alpha=.804$	2.74	0.70	2.77	0.59	2.50	0.74	2.50	0.68	F=12.90, $p < .001$, $\eta^2 = .034$ Post-hoc: NR&NU > SR&SU
Restorative M: $\alpha=.95$	3.92	0.87	3.72	0.89	3.85	0.94	3.77	0.83	F=2.98, $p = .300$, $\eta^2 = .008$ Post-hoc: NR>NU
OU: $\alpha=.93$	3.92	0.86	3.70	0.87	3.80	0.96	3.72	0.86	F=3.36, $p = .018$, $\eta^2 = .009$ Post-hoc: NR>NU
Coping potential, scales 1-5 Problem solving M: $\alpha = 0.748$	3.17	0.90	3.08	0.78	3.05	0.83	2.99	0.73	n.s.
OU: $\alpha = 0.757$	3.13	0.90	3.03	0.75	2.97	0.88	2.95	0.75	F=2.730, $p < .043$, $\eta^2 = .007$ Post-hoc: not confirmed
Social trust M: $\alpha=.874$	3.22	0.93	3.31	0.84	3.07	0.94	3.23	0.85	F=3.280, $p = .020$, $\eta^2 = .009$ Post-hoc: NU>SR
OU: $\alpha = 0.882$	3.18	0.96	3.27	0.81	3.01	0.91	3.16	0.89	F=3.882, $p = .009$, $\eta^2 = .01$ Post-hoc: NU>SR
Norm congruence, scale 1-5 M: $\alpha = 0.869$	3.51	0.91	3.44	0.92	3.29	0.84	3.40	0.78	F=2.93, $p = .033$, $\eta^2 = .008$ Post-hoc: NU>SR
U: $\alpha = 0.891$	3.47	0.93	3.39	0.89	3.07	0.93	3.24	0.83	F=10.948, $p < .001$, $\eta^2 = .029$ Post-hoc: NR>NU&SR

M=moose, OU=other ungulates.

Coping Potential and Norm Congruence

Appraisals of coping potential covered two aspects: Problem-solving and Social trust (Table 3). Problem-solving was on average assessed as close to three, meaning that the participants in all settings considered their own potential to deal with the implications of moose and other ungulates as moderate. No significant difference in Problem-solving was identified between Settings with respect to moose, whereas a

significant effect of Setting was identified for other ungulates, but with low effect size, and Bonferroni post-hoc tests did not confirm differences. Social trust was on average assessed as three or slightly above. Significant differences were identified between Settings for both moose and other ungulates, but with low effect sizes. In both cases, post-hoc tests showed assessment of Social trust to be higher in NU than in SR.

The final appraisal component refers to Norm congruence; the present situation with moose was assessed as somewhat in accordance with personal and local norms for how many moose there should be, how they should be managed, and how the local society should be developed. Norm congruence significantly differed between Settings. Norm congruence for moose was higher in NR than in SR, and Norm congruence for other ungulates was higher in NR and NU than in SR.

The Role of Appraisal for Positive Emotions toward Moose and Other Ungulates

Hierarchical multiple regression analyses, with positive feelings toward moose and other ungulates respectively as dependent variables, could explain 37.5% and 40.4% of the variance respectively, primarily by high assessments of mutualism and recreation opportunities.

In the analysis, socio-demographics were first included. In the second step, the contextual variables of north-south as proxy for the ecological context, and urban-rural as a proxy for social context, were introduced as dummy variables. In the subsequent step, indicators of the personal frame of appraisal (i.e., experience and mutualism) were added. The emotional appraisal components were then introduced: relevance, implication recreation, implication cultivation-risk, coping problem-solving, coping social trust, and finally norm congruence. Implication-Restorative potential was excluded due to high inter-correlations with cultivation-risk (N = 1111, moose Pearson $r = .648$, other ungulates Pearson $r = .631$).

Table 4 shows the analysis for moose. In the first step, being male and having a hunter in the household contributed to the variance in positive feelings. Adding the contextual frame in Step II, living in the southern parts of the country further contributed to the explained variance. In Step III, the personal frame, having personal experience of moose and scoring high on mutualism increased the explained variance. In the final step, when the emotional appraisal components were introduced, assessing moose as relevant, recreation implications as positive, and coping-potential problem-solving as high were associated with positive feelings.

Table 5 shows the analysis for other ungulates. In the first step, being male and having a hunter in the household contributed to the explained variance in positive feelings toward other ungulates. Step II, the contextual frame, did not reach significance. In Step III, the personal frame increased the explained variance. In the final step, adding emotional appraisal components, relevance, implication for recreation opportunities, problem-solving coping and norm congruence were associated with positive feelings.

Discussion

This study provides insight into the public's feelings toward local presence of moose and other ungulates. It examines people residing in different socio-ecological contexts,

Table 4. Hierarchical regression analyses examining predictors of positive feelings toward moose in four steps.

Moose	Socio-demographics	Contextual frame	Personal frame	Emotional appraisal components
	β	β	β	β
Step I				
Gender	-.056(*)	-.055(*)	-.068*	-.052*
Age	.007	-.001	-.074	-.035
Hunter	.194***	.209***	.179***	.100***
Landowner	.028	.049	.017	.004
Step II				
North-South		.131***	.156***	.174***
Rural-Urban		-.040	-.013	-.012
Step III				
Experience			.179***	.099***
Mutualism			.436***	.304***
Step IV				
Relevance				.140***
Implication –recreation				.226***
Implication cultivation & risk				.007
Coping problem-solving				.120***
Coping social trust				-.036
Norm congruence				.051(*)
Adj R2	.042***	.058***	.28***	.375***
R2 change	.046***	.017***	.224***	.096***

N=1088, Dummy variables: Gender (Women = 1), Hunter (No hunter in family = 1), Land owner (No landowner = 1), North-South (North = 1), Rural-Urban (Rural = 1).

* $p < .05$, ** $p < .01$, *** $p < .001$.

in northern and southern areas of Sweden, with a larger or smaller share of moose among the ungulates, and spanning an urban-rural gradient.

Following the more general trend of including stakeholders in the management of natural resources (Emerson and Nabatchi 2015; Ostrom 2007), Sweden has introduced an ecosystem-based and collaborative moose management system to acknowledge the public interest (Government Bill 2009/10:239). Efforts have been made to identify success factors for collaboration between stakeholders (Dressel et al. 2020, 2021; Sjölander-Lindqvist and Sandström 2019), and their experiences and motivations (Johansson et al. 2020, 2022). However, from a management perspective, it is important to also understand and assess the public's feelings, as wildlife perceived as negatively impacting people's livelihoods or quality of life tends to trigger emotional responses, which may fuel debate and escalate social conflicts (Eklund et al. 2023).

A main result from this study is that the public have weak negative feelings toward moose and other ungulates and modest positive feelings. These results generally apply across the studied settings, i.e., different socio-ecological contexts, between northern and southern parts of the country, and between rural and urban areas. The feelings seem somewhat similar among people who live in landscapes with different presence of the animal species. In the statistical analyses some differences were identified, but with rather low effect sizes. These differences may therefore be of limited practical relevance. Our results stand in stark contrast to current stakeholder debates on the presence of moose and other ungulates, but in congruence with studies on the public's feelings toward geese (Eriksson et al. 2020) and roe deer (Johansson et al. 2024),

Table 5. Hierarchical regression analyses examining predictors of positive emotions toward other ungulates in four steps.

Other ungulates	Socio-demographics	Contextual frame	Personal frame	Emotional appraisal components
	β	β	β	β
Step I				
Gender	-.067*	-.066*	-.082**	-.063***
Age	.037	.030	-.039	.003
Hunter	.199***	.200***	.188***	.098***
Landowner	.036	.041	.010	.003
Step II				
North-South		.043	-.032	.036
Rural-Urban		-.042	.003	.012
Step III				
Experience			.139***	.076*
Mutualism			.466***	.320***
Step IV				
Relevance				.077**
Implication –recreation				.273***
Implication cultivation & risk				-.014
Coping problem-solving				.166***
Coping social trust				-.055(*)
Norm congruence				.097***
Adj R2	.049***	.050	.280***	.404***
R2 change	.052***	.003	.230***	.127***

N = 1017, Dummy variables: Gender (Women = 1), Hunter (No hunter in family = 1), Land owner (No landowner = 1), North-South (North = 1), Rural-Urban (Rural = 1).

* $p < .05$, ** $p < .01$, *** $p < .001$.

considered as less personally threatening animals than, for example, large carnivores (Arrindell 2000).

Theoretically and methodologically this study offers a much needed integrated approach that simultaneously acknowledges the societal and individual levels (Sjölander-Lindqvist, Johansson, and Sandström 2015). Referring to human – environment interaction (Küller 1991), the study connects theoretical frameworks focusing on the complexity of socio-ecological systems at a societal level (Ostrom 2007) and psychological frameworks addressing both stable personal factors (e.g., wildlife value orientations; Teel and Manfredi 2009) and intra-individual processes (e.g. the component process model of emotional appraisal; Scherer 2001). This approach allows wildlife management authorities to identify not only the direction of expressed feelings (positive or negative) but also the drivers of the feelings, specific issues, locations, and target groups a when planning intervention. The study used simple proxy variables based on a pre-understanding of the variation in socio-ecological systems across the country (Dressel, Ericsson, and Sandström 2018). Future studies may benefit from collecting additional information on ecological features and local management systems.

Examining the components of the emotional appraisals helps to explain *why* the participants assessed their negative feelings as weak and positive as modest. First, the general pattern is that the *relevance appraisal* of moose and other ungulates is relatively low, with averages below the mid-point of the assessment scales. This suggests that, to most participants, these animals do not matter in their everyday lives, or at least they are not what first comes to mind when visiting natural areas (Johansson et al. 2024).

The *implication appraisals* are considered somewhat supportive for recreation opportunities (e.g., recreational activities, hunting, and tourism) and for the psychological restorative potential of local natural areas, but hindering for cultivation and in the increased risks for agriculture, forestry, and gardening, and for traffic accidents and spread of diseases. The dimensions of implication appraisals seem to reflect broad categories of appreciated and unappreciated aspects of local animal presence in the Swedish context. From a psychological perspective this categorization refers to basic approach-avoidance responses to external events (Carver 2006). The two dimensions can also be compared with the material (hunting) and non-material (recreation) benefits provided by wildlife and damage respectively, or “disservices” caused by wildlife (Pereira et al. 2020).

The appraisal of *coping potential* in terms of problem-solving and social trust is intermediate. The presence of ungulates is also considered to be somewhat in line with participants’ personal and societal *norms*. One interpretation could be that the public has limited knowledge of and skills to deal with negative implications. Another interpretation is that the public considers these animals to be of limited relevance, and has not so far faced negative experiences to an extent where they need to cope with the situation (Scherer 2001). Such an interpretation is supported by studies revealing opposite appraisal patterns among stakeholders who are directly and negatively impacted (e.g. by seals Johansson and Waldo 2021).

There are some differences in the appraisal components between the four socio-ecological contexts, likely derived from people’s contextual frame. The northern settings reflect the situation where moose traditionally constitutes the larger share of ungulates, hence there is a congruence between the presence of moose in the local environment and the focus of the management system. In NR, the participants report more experiences of moose than participants from the other settings, and moose and other ungulates have some relevance. The presence of moose is considered to hold favorable implications for recreational aspects, and the cultivation implications are considered less hindering than in the other settings. The assessment of norms shows that the numbers of moose and other ungulates are in line with what the participants consider reasonable. Participants in NU assessed the presence of moose to be of some relevance, whereas the relevance of other ungulates seemed marginal.

The southern settings represent the situation where other ungulates outnumber the moose, so participants find themselves in an ecological context with several different ungulate species that have to be managed together with moose. Participants in SR reported substantially higher experiences of other ungulates than participants from all other settings. Other ungulates are also perceived to have implications hindering cultivation, and the match between the presence of ungulates and participants’ norms is significantly lower than in the northern settings. Also in SU, other ungulates are considered to have implications for cultivation in the direction toward hindering. In parallel, implications of moose as positive for recreation opportunities are assessed as low in both SR and SU.

Overall, from the perspective of the public, the situation seems neither alarming nor exceptionally favorable. This corresponds well with qualitative research on the role of wildlife in the restorative potential of local natural settings, suggesting that wildlife species, if not perceived as threatening, are often not very salient in people’s minds

(Johansson et al. 2024). However, regarding management, it should be noted that in the South the negative implications of other ungulates seem, as expected, to be more salient than in the North, while the positive implications of moose are somewhat lacking compared to the northern settings. As variation in positive feelings toward moose could partly be explained by the north-south gradient, and differences were identified in emotional appraisals components between the settings, this study confirms the need for a moose management system that is both flexible and responsive, to meet changes in local socio-ecological conditions (Dressel, Ericsson, and Sandström 2018; Johansson et al. 2022).

The variation in positive feelings toward moose and other ungulates was analyzed using hierarchical regression, with 37% and 40% respectively of the variation explained. Men and those who have someone in the close family who hunts (themselves or someone else) tended to report higher positive feelings. Considering the contextual frame of appraisal, those who lived in the south tended to report higher positive feelings than those in the north. However, this result may partly be an artifact of relatively low positive feelings among participants in NU.

Personal experience of the animals and mutualism contributed to explaining the variation in the personal frame of appraisal. In fact, mutualism was the single variable that contributed the most. As theoretically stipulated by the CPM, relevance and positive implication for recreation seem congruent with the expressed positive feelings (Scherer 2001). The wildlife value orientation of mutualism and personal perceived benefits seem to be most strongly associated with positive feelings. One interpretation is that there would be two parallel appraisal processes associated with the positive feelings; one process involving more abstract psychological cognitive constructs referring to personal value orientations associated with wildlife, and another involving more concrete experiential references associated with personal benefits in terms of hunting opportunities and recreation (Beery et al. 2023). The (negative) implication for cultivation and risks did not significantly contribute. A coping potential of problem-solving and, in the case of ungulates (but not moose), norms further contributed to the explanation of positive feelings. These results go hand in hand with the relatively low assessments of negative implications, and with the current presence of moose and ungulates most of the public may have little need to take action to cope or be in contact with wildlife management representatives.

Study Limitations

In Sweden, the right of public access makes local nature settings highly available, and many tend to spend their leisure time in nature. This pattern was intensified during the pandemic, the period when this data was collected (Hansen et al. 2022). The response rate of 37% suggests that people are more interested in spending time in nature and that their engagement in the issue of local wildlife is overrepresented. Caution should also be applied when drawing conclusions for people living in larger cities. One potential drawback of the study design is the distinction between moose and other ungulates, with “other” including roe deer, red deer, fallow deer, and wild boar. This categorization was made to reduce the length of the questionnaire and

therefore the participants' burden in responding. However, recent studies suggest that encountering roe deer and wild boar give rise to quite different feelings, and that roe deer are more positively assessed than wild boar (Johansson et al. 2024). Further studies on the public's emotional responses should be careful to distinguish between different ungulate species.

Implications for Practice

Currently, there may be little need for local residents to cope with presence of ungulates. However, management authorities should be aware that this could change if populations of moose and other ungulates increase and their presence becomes more salient in the public's assessments of relevance. Impact could be perceived as more negative if risks of traffic accidents and browsing pressure were to increase. The recent outbreak of African swine fever in central Sweden, as well as increasing awareness of, for example, roe deer contributing to the spread of ticks may influence people's feelings toward these animals. Local presence of moose and other ungulates still seems handleable to the public, but neither problem-solving, coping or social trust are very strong. In parallel to monitoring wildlife distribution and densities, management authorities may benefit from identifying ways that could help the public to cope with interactions appraised to have negative implications, and attending to the public's changing emotional appraisals in response to changes in wildlife populations. This also corresponds well with target 4 in the new Global Biodiversity Framework adopted in December 2022 in Montreal, which specifically focuses on the need to handle human-wildlife interactions to meet the overarching biodiversity targets.

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