Johansson, M., A. Sjölander-Lindqvist, S. Dressel, G. Ericsson, and C. Sandström. 2022. Expectations about voluntary efforts in collaborative governance and the fit with perceived prerequisites of intrinsic motivation in Sweden's ecosystem-based moose management system. Ecology and Society 27(2):20. https://doi.org/10.5751/ES-13257-270220

Research

Expectations about voluntary efforts in collaborative governance and the fit with perceived prerequisites of intrinsic motivation in Sweden's ecosystem-based moose management system

Maria Johansson [1], *Annelie Sjölander-Lindqvist* [2], *Sabrina Dressel* [3,4], *Göran Ericsson* [3] *and* *Camilla Sandström* [4]

ABSTRACT. Collaborative governance regimes may be vulnerable because of dependency on stakeholders' voluntary engagement and efforts. This study focuses on the Swedish moose management system, a multi-level collaborative governance regime inspired by the ecosystem approach. Self-determination theory is used to explore perceived prerequisites of basic needs for intrinsic motivation across sub-groups of stakeholder representatives who are engaged across different social-ecological contexts. Questionnaire data collected among representatives at two governance levels, moose management groups (n = 624) and moose management units (n = 979), were subjected to two-step cluster analysis. The analyses revealed two sub-groups of representatives, characterized by differences in species composition and land ownership structure: managers of multi-ungulate areas and managers of large-carnivore areas. In several respects, these groups significantly differed in how they perceived the prerequisites. This included prerequisites of perceived competence with regard to their need for knowledge of topics and usefulness of monitoring methods, perceived autonomy operationalized as possibilities to perform their tasks with sufficient time, resources, and support from their organizations, and perceived relatedness to different groups of actors. Further efforts should be made to understand the conditions required for representatives to energize and direct their behavior. The institutional system must better fit the needs of stakeholder representatives across various local contexts, otherwise the space for local voluntary engagement might be hampered.

Key Words: *collaborative governance; ecosystem approach moose management; perceived prerequisites of basic needs; self-determination theory*

INTRODUCTION

The ecosystem approach (EA) has been promoted by the Convention on Biological Diversity to sustainably manage natural resources, protect ecosystems in their entirety, and recognize all interactions among an ecosystem's ecological and social components (Convention on Biological Diversity 2000). EA assumes that co-production of objectives and integrated management plans will help secure the long-term delivery of a variety of benefits that support both natural environments and human societies (Waylen et al. 2014). This requires alignment of stakeholders and cross-sectoral collaboration to manage species and habitats, conduct economic activities, and balance multiple, sometimes even conflicting, objectives related to different resource uses. This move toward considering multiple objectives requires the active involvement of various stakeholders, decentralization, and the creation of learning opportunities, both short-term and long-term (Sandström 2012). We use Sweden's adoption of EA for moose management to explore how this approach, which is largely based on institutional acceptance (e.g., Ostrom 2008), may be vulnerable because of the dependency on individual stakeholders' motivation to voluntarily engage in management.

The Swedish moose management system, created in 2012, can be described as a multi-level collaborative governance regime (Dressel et al. 2020a). It builds on the EA idea that co-production of knowledge and co-creation of objectives and measures at an ecosystem level will contribute to a more holistic perspective, leading to sustainable moose management (Swedish Government Bill 2009/2010, SEPA 2011). However, the promises of the EA have been difficult to meet in practice for the management of moose, where hunting quotas have to achieve a balance between local moose densities and forage availability. Despite increasing effectiveness in terms of fulfilment of hunting quotas, browsing damages and traffic accidents are still above nationally set goals (Naturvårdsverket 2018).

The regional variation and complexity of social-ecological contexts subjects the management system to varied outcomes in terms of goal achievement (Dressel et al. 2020a). Natural variation in weather between years, uncertainty in the estimation of moose population and available fodder, as well as different interpretations of ecological data fuel conflict, thwarting consensus among representatives and stakeholder groups regarding size of moose population, hunting quotas, and degree of browsing damages (Sjölander-Lindqvist and Sandström 2019). Variations in land ownership, land use patterns across the country, and thereby a diversity in management objectives, require local adaptations (Dressel et al. 2018). Altogether, the system creates stressful situations for those involved (Johansson et al. 2020). This may potentially have further negative impacts on the effectiveness of the regime, which is largely based on voluntary activities and stakeholders' long-term commitment to being part of the management system (Dressel et al. 2021).

Individual motivation is therefore likely a decisive factor in upholding the system, as representatives' time investment has shown positive effects on goal fulfilment (Dressel et al. 2020a). It has been argued that collaborative governance regimes would speak to individual motivation to a larger degree than

[1]Environmental Psychology, Department of Architecture and Built Environment, Lund University, Lund, Sweden, [2]School of Global Studies & Gothenburg Research Institute (GRI), University of Gothenburg, Gothenburg, Sweden, [3]Department of Wildlife, Fish & Environmental Studies, Swedish University of Agricultural Sciences, Umeå, Sweden, [4]Department of Political Science, Umeå University, Umeå, Sweden

authoritative systems (e.g., DeCaro et al. 2017, Emerson and Nabatchi 2015, Marshall et al. 2017). Inherent in the expected function of collaborative governance systems is a reliance on social-psychological processes to "do the job" (e.g., DeCaro and Stokes 2008). This implies, in psychological terms, that the representatives' engagement and effort preferably should be intrinsically rather than externally motivated. In other words, the representatives' engagement should rely on the human inherent tendency "to seek out novelty and challenges, to extend and exercise one's capacities, to explore and to learn" rather than being paid "to do the job" (Ryan and Deci 2000:70). Nevertheless, knowledge gaps remain about the perceived existence of prerequisites motivating stakeholders to voluntarily participate in collaborative governance systems. Based on the self-determination theory on motivation (SDT), we seek to understand the extent to which representatives in the Swedish moose management system, across the country, perceive that the characteristics and set-up of the regime provide the necessary prerequisites to support their motivation to voluntarily engage in the governance regime.

Study context

Swedish wildlife management has a long tradition of collaboration and voluntary efforts of stakeholders (Danell et al. 2016). Most hunters (77%) are members of one of the two major hunting organizations, and moose, as the iconic species of the country, has partly been the driver for this engagement (Ericsson et al. 2010). At the end of the 19th century, the moose population was very low, triggering collective actions to restore it (Liberg et al. 2010, Sandström et al. 2013). In 1938, the Swedish Association for Hunting and Wildlife Management (SAHWM), an interest organization for the majority of Swedish hunters, entered into a partnership with the state and received the national mandate to engage, educate, and lead the practical aspects of hunting and wildlife management (Danell et al. 2016). After an initial phase of restricted and limited moose hunting to promote the small remaining population, gradual changes to the regulations encouraged voluntary collaboration among hunters to allow moose hunting across larger areas. Additionally, monitoring regimes were introduced, also largely based on voluntary efforts by hunters (Singh et al. 2014). Since the beginning of the 1990s, collaboration has been further formalized to balance different stakeholder interests and to allow locally adapted moose management strategies (Wennberg DiGasper 2008). This trend culminated in the introduction of the collaborative governance regime in 2012.

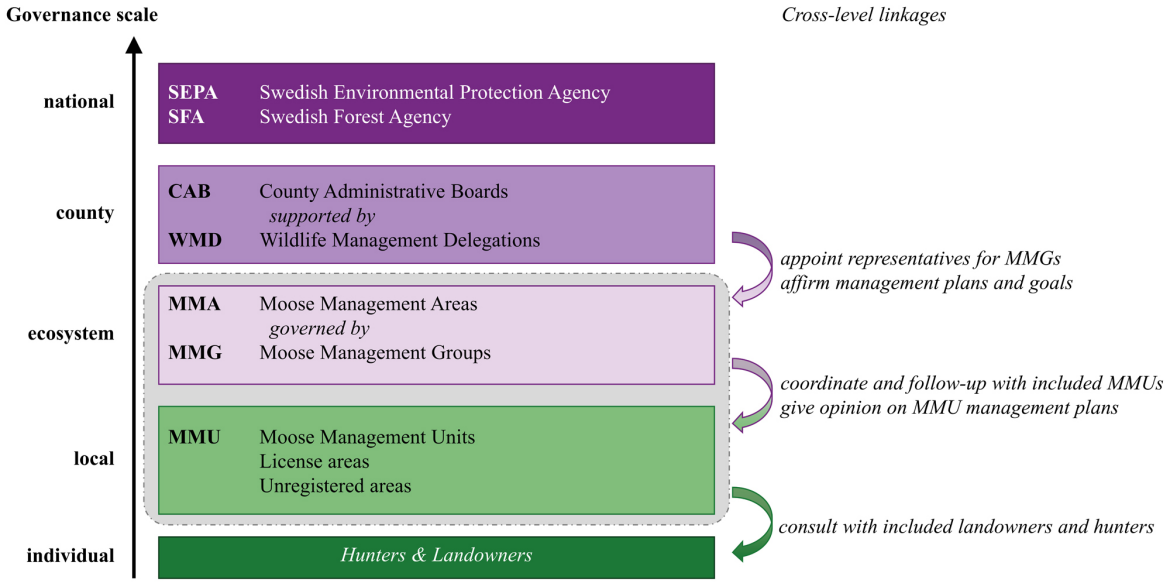
Although moose has been the focal species for the design of the governance regime, other ungulate species can locally outnumber moose and have bigger impacts on stakeholders (Dressel et al. 2018). In the southern and central parts of Sweden, moose co-occur with multiple ungulate species such as red deer (*Cervus elaphus*), fallow deer (*Dama dama*), roe deer (*Capreolus capreolus*), wild boar (*Sus scrofa*), and locally with mouflon (*Ovis ammon*; Linnell et al. 2020). From mid-Sweden northward, moose co-occur with roe deer and multiple large carnivore species, where in particular grey wolves (*Canis lupus*) and brown bear (*Ursus arctos*) prey on moose (Wikenros et al. 2015, Tallian et al. 2017). Northern Sweden also overlaps with the Swedish reindeer husbandry area, the traditional land of the indigenous Sami population, who have held the right since time immemorial to use private and public land as pastures for their reindeer (*Rangifer tarandus tarandus*), including hunting and fishing. This social-ecological complexity creates different planning conditions that call for adjustments to management strategies depending on context (Dressel et al. 2018). Such differences in planning conditions have in turn been shown to influence outcomes of the system (Dressel et al. 2020a). The complexity also creates multiple and conflicting objectives that require the management system to identify mutually acceptable management outcomes and working relations (Sjölander-Lindqvist et al. 2020). Moose occur across the country and require large home ranges so, in the future, the collaborative governance regime for moose could potentially function as an umbrella under which the other species are co-managed.

According to the EA, the Swedish moose management system has been designed to span several governance and geographic levels, and involves a number of actors (see Fig. 1). On a national level, the Swedish Environmental Protection Agency (SEPA) has overarching responsibility for wildlife and wildlife management, while the Swedish Forest Agency is in charge of forest-related issues, including monitoring of browsing damage. On the county level, the County Administrative Boards (CAB) have authoritative responsibility for moose management and associated regulations. The 21 CABs regularly consult the Wildlife Management Delegations (WMDs), comprising representatives of different land use and public interest groups, on general guidelines on wildlife management and regional population goals.

Regional moose management areas (MMA), 148 in total, have been set up to cover the whole country and to match the ecosystem level. A moose management group (MMG) governs each MMA (SOU 2009, Swedish Government Bill 2009/2010). The MMG consists of three landowner and three hunting representatives, nominated by their respective stakeholder interest group. In the northernmost regions, one representative for reindeer husbandry replaces a hunting representative. The main task of the MMGs is to autonomously create ecosystem-based moose management plans, including annual harvest quotas, with respect to the local conditions in their MMA, which they submit to the CAB and the WMD for final adoption in their respective counties. In line with an adaptive management philosophy, MMGs continuously revise their plans by evaluating the previous year's goal fulfilment, and by compiling and analyzing monitoring data about moose numbers, population dynamics, and forestry damage. MMGs should also coordinate moose management in the area through annual consultation with the moose management units (MMU) at the local level and by allocating quotas to license areas (SEPA 2011).

The MMUs (N = 993 units) are voluntary groups of local landowners and hunting teams that collaborate under varying organizational structures, because no mandatory regulations exist for their governance. The MMUs are an optional component of the governance system because hunting rights in Sweden are linked with land ownership, and the government has no constitutional right to force landowners to collaborate. When landowners and hunters agree to organize collectively over larger areas, they are granted, in exchange, some freedom to develop plans and organize moose management within the MMU. The only requirement is that MMUs are large enough to sustain a

Fig. 1. Systematic overview of the governance regime for Swedish moose management. Purple boxes are obligatory elements of the system, while green indicates the voluntary level on which individuals engage. The dashed grey line highlights the governance levels considered in this study, namely moose management groups (MMG) and moose management units (MMU).



yearly cull of at least 10 adult moose (Swedish Government Bill 2009/2010). Given the difference in moose densities and migration patterns this led to MMUs ranging in size from 1000 ha to 200,000 ha.

The MMGs and the MMUs are therefore part of the same multi-level governance regime for moose, but in their everyday work, they manage moose across different spatial scales and within different socio-cultural settings, including a diversity of stakeholders. Their work is dependent on available resources, and they need to consider different expectations about the management system, regardless of where they are located or the governance level at which they are operating.

An important dimension, and the focus of this study, is the regime's dependence on the voluntary engagement and efforts of landowners and hunters at both the MMG and MMU level. We can assume that the regime is at least partly dependent on their personal motivation, as they volunteer and receive only a symbolic sum as compensation for their work. Although the regime is based on participation, it is designed to allow for a degree of local autonomy, and relies on standardized procedures and methods to achieve fairness. Questions arise regarding the fit between the national institutional system, the local social-ecological contexts, and stakeholder representatives' motivation to contribute on a voluntary basis. Do representatives' perceive that the collaborative governance regime provide prerequisites that potentially support their motivation to voluntarily engage.

THEORY

Self-determination theory

Self-determination theory (SDT) offers a well-established theoretical basis for the analysis of human motivation (Deci and Ryan 1985, 2000), and can contribute valuable insight for collaborative environmental governance. However, perceived governmental style and leadership could facilitate or hinder self-determination in the environmental domain (Lavergne et al. 2010). An important feature of SDT is that it is people's inherent growth tendencies and innate psychological needs that are the basis for self-motivation, that is, their intrinsic motivation (Ryan and Deci 2004).

Three psychological processes seem to elicit and sustain, rather than subdue and diminish, intrinsic motivation: the basic need for competence, autonomy, and relatedness (Deci and Ryan 2000, Ryan and Deci 2000). Competence refers to a person's feeling of being effective in interactions with the social environment, and experiencing opportunities to exercise and express their capacities. Challenges are sought that match their perceived capacities and enhance the skills they need, such as capacity to provide effectance-promoting feedback, freedom from being demeaned, and evaluations supporting their perceived competence. Autonomy refers to the feeling that a person is acting from their own interest and integrated values, and that their behavior is an expression of the self, even if the behavior is guided or influenced by an external source. Relatedness refers to feeling connected to others, to caring for and being cared for by those others, and to having a sense of belonging and security both in relation to other individuals and within the community.

Self-determination toward the environment has been proposed to be strongly associated with people's performance of pro-environmental behavior (Pelletier 2004, Aitken et al. 2016, Cooke et al. 2016), indicating that the theoretical approach could be relevant in the context of environmental management. Dedeurwaerdere et al. (2016) report that successful initiatives for

biodiversity conservation and ecosystem services provision across Europe rely on a fine-tuned balance of intrinsically (providing enjoyment, pleasure from experimentation and learning, aesthetic satisfaction) and extrinsically (related to the identification with the collective goals of conservation policy) motivated behavior. Such balance can be realized through governance features, such as inclusive decision-making processes, involving people beyond the core staff in different management initiatives, and an institutional context that is supportive for the building of autonomous actor skills. DeCaro and Stokes (2013) suggest that perceived fairness and autonomy supportiveness are critical to the so-called social fit or institutional acceptance under a governance regime, and thereby the public's motivation to engage in social-ecological systems. In this article we argue that an important characteristic of the governance regime for moose would be to provide not only opportunities for fairness and participation but also to provide the prerequisites that can allow representatives to be part of a social context that supports and sustains their basic need for competence, autonomy, and relatedness. We focus on characteristics of the fundamental set-up of the governance regime, and how individual representatives perceive potential prerequisites of the basic need for competence, autonomy, and relatedness in the moose management system.

Perceived prerequisites for basic need satisfaction among representatives in the moose management system

Each of the three overarching basic needs can take different operationalization in the analysis of real-world settings (e.g., Deci et al. 2017). In the moose management system, with regard to competence, it may be especially important to focus on the representatives' perceived prerequisites to develop sufficient knowledge and competence access across a variety of topics and tasks, such as the overarching national policy objectives for wildlife, forests, agriculture, and reindeer husbandry (in the north), but also moose-vehicle collisions. They will also need knowledge about, e.g., moose population dynamics, predator-prey relations, available food resources, and competition between ungulate species, as well as knowledge about rather advanced and qualified tasks such as applications of various monitoring techniques and hunting strategies with respect to their local conditions. As an example, in the north, with a long winter and low hunter population density, monitoring has to take place over larger acreages than in the south. In the south, with forestry being less important compared to the north, monitoring of impact by moose has to acknowledge the effect on other sectors of society and take into account the effect of competition from other ungulates (Singh et al. 2014).

Considering perceived prerequisites of autonomy refers to representatives' opportunities to act in accordance with their values and of the stakeholder group to be represented, and what they believe is a good contribution to the collaborative setting. While representing their respective interest organization (forest owners, hunters, and reindeer husbandry) they need, as in any representative organization, adequate resources and support from their organization to be able to autonomously negotiate and to apply adaptive management. A recent study of good examples in the system has shown the crucial role of individual representatives as well as the groups having enough discretionary power to adjust management strategies to the overarching goals stated in their plans (Dressel et al. 2021). This could mean having sufficient resources and support from the stakeholder organization in terms of time, knowledge, power, and finances.

As for the perceived prerequisites of relatedness, representatives' perceived possibilities to positively relate to other persons and groups involved in the system would be important. Our previous research has addressed qualities of linking and bonding social capital in relation to other groups within the system (Dressel et al. 2020b). However, representatives also need to be able to relate to people in the economic sectors concerned, such as agriculture, forestry, reindeer husbandry, and tourism. Finally, as one important task is to coordinate and collaborate in particular across governance levels, they also need to be able to establish relations with actors at the local level. Representatives in the moose management groups in particular need to establish relations with hunters and landowners but indirectly also with the local communities, business sectors, and politics. Representatives in the moose management units need to develop meaningful relations to collaborate with hunting teams, landowners, and, in the north, reindeer husbandry, to organize monitoring activities.

Despite the variety and complexity of the social-ecological system, the governance regime for moose management in Sweden is based on the idea that one size fits all. Implicitly this means that the set-up of the regime should motivate representatives equally across the country to voluntarily engage in the system. Our previous research highlighted an emerging problem of fit, as the social-ecological diversity across the country creates different challenges that the moose management has to address (Dressel et al. 2018), which in turn might challenge the potential prerequisites of competence, autonomy, and relatedness of involved representatives. Ecological factors such as the co-occurrence of other ungulate species and carnivores require novel management approaches and increased knowledge, while social complexity in terms of land use patterns and landownership might challenge consensus on management decisions. Several of these context characteristics have also shown to directly influence collaboration dynamics and outcomes of the system (Dressel et al 2020a).

In this article we depart from the variety and complexity of the social-ecological contexts, and use self-determination theory to examine how representatives perceive instrumental characteristics of the governance regime to provide potential prerequisites of basic needs. We analyze discrepancies among representatives in their views on the prerequisites to hold the necessary skill (perceived knowledge and usefulness of methods), to allow for autonomy in the collaborations (perceived support and access to resources), and to allow for relatedness to external stakeholders (perceived relatedness). We acknowledge that, in the enactment of the regime, social psychological processes involving values, norms, attitudes, and trust also play into the function of the groups and management outcome (Dressel et al. 2020b, Johansson et al. 2020) but this article is limited to the characteristics of the governance regime itself.

We acknowledge that the individual representative's perceptions of competence, autonomy, and relatedness do not directly rely on the perceived prerequisites investigated. Instead, the perceived prerequisites are part of psychological processes, so the significance of the studied prerequisites to competence, autonomy, and relatedness, and any intrinsic motivation, may vary between individuals and situations.

Specifically, with this study we aim to (a) identify any sub-groups at the MMG and MMU levels, based on the perceived composition of their local social-ecological context, and (b) examine the extent to which these sub-groups differ in perceived prerequisites of basic need satisfaction: competence, autonomy, and relatedness. Because of the geographic variation within the country, spanning several social-ecological contexts, this information is important to understand whether the characteristics of the governance regime have the inherent potential to be equally efficient in motivating representatives to voluntarily engage in moose management.

METHOD

Participants and procedures

The study involved questionnaire surveys administered to two different samples, one drawn from the MMGs and one drawn from the MMUs (see also Dressel et al. 2020b). The MMG sample comprised 765 representatives, representing 139 of the 140 moose management groups across the country at the time. The representatives received a questionnaire first distributed online via Limesurvey, followed up with a printed version. Three personalized contacts were made from April until May 2016. An individualized invitation and a reminder (5 days after initial contact) were sent via e-mail. Two weeks later, the paper version and a postage-paid return envelope were sent by post. The overall response rate was 82% (n = 624) and was high across all regions (regional response rates 73–94%) and represented interests (hunter response rate 82%, landowner response rate 81%). A non-response follow-up by telephone showed no significant difference between non-respondents and respondents for any item.

The MMU sample comprised 1380 representatives from 245 MMUs in six counties throughout Sweden (Norrbotten and Västerbotten in the northern parts, Jämtland and Västernorrland in central Sweden, and Södermanland and Kronoberg in the southern parts of the country). Similar to the MMG sample, we administered the survey online with three personalized contacts during June 2017. After the second reminder, we supplemented our sample frame with postal addresses for non-respondents. We distributed 646 paper questionnaires together with postage-paid return envelopes. The overall response rate was 71% (n = 979), ranging from 62% in Södermanland county to 80% in Västerbotten county. A non-response follow-up was not possible because no telephone information was available for the respondents. The empirical research complies in all instances with the Helsinki Declaration, the APA guidelines for psychological research, and follows the Swedish research council's recommendations for good research practice.

Questionnaire

A 16-page questionnaire in Swedish was used for data collection, first developed for the MMG sample. For the MMU sample, we kept the items as similar as possible, but some sets of questions, and specific wordings, required adaptation to be relevant for this management level. Both questionnaires were extensively piloted with representatives of different interest organizations, researchers, and wildlife managers. The development of the questionnaire is described in detail by Dressel et al. 2020b.

In order to understand how the representatives perceived the ecological context they were working within, respondents were asked to assess the presence of nine mammal species other than moose (roe deer, wild boar, red deer, fallow deer, mouflon, brown bear, Eurasian lynx [*Lynx lynx*], grey wolves, and wolverine [*Gulo gulo*]) within their area from 1 = totally missing, 2 = sporadic, single animals, 3 = regular presence. A "don't know" alternative was available.

Two different proxies for social complexity were used to examine perceived social context. In the MMG questionnaire, representatives were asked to assess the size of the area they cover (1 = less than 50,000 ha, 2 = 50,000–99,000 ha, 3 = 100,000–499,000 ha, 4 = 500,000 ha or more), because previous research (Dressel et al. 2018) showed a link between MMA size and ownership (larger MMAs are associated with more homogeneous landownership, dominated by forest companies). In the MMU it was considered more feasible to ask directly about ownership structures to assess social complexity, so representatives were asked to assess the share of the area owned by forest companies, (1 = none, 2 = 1–25%, 3 = 26–50%, 4 = 51–75%, 5 = 76–100%).

We investigated the prerequisites for representatives' intrinsic motivation by assessing the perceived prerequisites for fulfilment of the need for competence. We examined the representatives' perceived need of knowledge within moose management, with eight items concerning moose, forestry, hunting, agriculture, monitoring methods, co-existence with other ungulate species, co-existence with large carnivores, and adaptive management. Responses were given on 5-point Likert scales (1 = totally disagree, 5 = totally agree), and the perceived usefulness of seven current monitoring methods (bag statistics, moose observations, dung pellet counts, calf weights, aerial surveys, moose browsing damage, monitoring, forage availability estimates). Responses were given on 3-point scales (1 = little, 2 = intermediate, 3 = large).

We assessed the prerequisites for fulfilment of the need for autonomy by asking about the respondents' possibilities to perform their tasks within the MMG/MMU. The questions investigated the sufficiency of three different aspects allowing for autonomy: sufficient time, resources, and support from my organization to do a good job. Responses were given on 5-point scales (1 = totally disagree, 5 = totally agree).

The prerequisites for fulfilment of the need for relatedness concerned relations with those external actors that the MMG and MMU representatives were expected to interact with according to the government regime. These actors partly differ between these two governance levels, as MMGs and MMUs operate on different spatial scales and have varying roles within the system. The MMG representatives were asked how they related to three main groups in terms of the extent to which they could respond to the needs and desires from five local actors (MMUs, hunters, local community, private small scale landowners, and private large-scale landowners), four sectors (agriculture, reindeer husbandry, forestry, and tourism), and six institutions (CAB, SEPA, the Swedish Parliament and Government, the Swedish Forestry Board, the Swedish Transport Administration, and WMD). Responses were given on 5-point scales (1 = not at all, 5 = to very high degree). The MMU representatives were asked about how they related to six different local actors that they can be expected to interact with. "How do you usually work within your area?" "In our work we collaborate with ... (local landowners, local

Table 1. Socio-demographics and representation in moose management groups (MMG) of the two clusters.

	Managers of Multi-Ungulate Areas	Managers of Large-Carnivore Areas
Gender, male	95.5%	94.6%
Age, mean, range	58 yrs, 34–90 yrs	60 yrs, 39–85 yrs
University education	46.3%	53.0%
Residential area countryside or small village, less than 2000 inhabitant	78.6%	78.8%
Working context		
Forestry	63.7%	60.9%
Agriculture	37.7%	12.6%
Stakeholder representation		
Landowners	42.7	41.1
Hunters	57.3	58.7
Elected representative	94.5	78.0
Employed	5.5	22.0
More than 1 year in MMG	80.3%	84%
Education in moose management system	92.3%	92.7%

hunting teams, adjacent moose management units, adjacent license areas, moose management groups, reindeer husbandry)." The 3-point response scale ranged from 1 = never, 2 = sometimes, and 3 = regularly. "I do not know" options were available. The formulation of all items used in the present study are listed in Appendix 1.

Statistical analyses

We used hierarchical clustering analysis techniques to identify sub-groups of representatives based on their social-ecological context in the MMG and the MMU samples (Norušis 2012). Cluster analysis allowed us to group together respondents, e.g., cases, according to similarities in their profiles of responses to the variables covering ecological and social context. In addition, we employed the SPSS two-step cluster component, which allows for both continuous and categorical variables. This analysis uses a model-based distance measure, which defines the distance between two clusters as the corresponding decrease in log-likelihood by combining them (Norušis 2012). In the first step of the cluster analysis, the cases are sorted into pre-clusters, which reduces the size of the matrix containing the distances between all possible pairs of cases. In the second step, pre-clusters are clustered using a hierarchical clustering algorithm. The Bayesian information criterion (BIC) was then used to select the "best" cluster solution, with smaller BIC values indicating better models. Naming of clusters is a subjective process, and the clusters were assessed to determine the best possible name to represent the clusters. Once the clusters were retrieved, multivariate ANOVAs were used to test for differences in the perceived satisfaction of the need for competence, autonomy, and relatedness. We followed up the significant multivariate analyses with univariate ANOVAs for single items (Field 2009). The level of significance was set to $p < 0.05$. All analyses were carried out in IBM SPSS, 24.

RESULTS

Clusters of MMG representatives

Two-step cluster analysis identified two distinct cluster groups in the MMG sample with homogeneous patterns of social-ecological contexts. The analyses included 451 participants when we excluded cases with "do not know" responses for one or several species. The predictor importance of discriminating between the two clusters was highest for the perceived presence of the species brown bear, wild boar, wolverine, and fallow deer. Size of area, presence of wolf, lynx, red deer, mouflon, and deer were predictors of relatively less importance. Of the participants, 66.5% (n = 300) were classified as managers of multi-ungulate areas (MUAs) of relatively small units, and 33.5% (n = 150) of the participants were classified as managers of large-carnivore areas (LCAs) of relatively large units. The group of MUAs is characterized by being active within a moose management area smaller than 500,000 ha and with reported regular presence of wild boar, fallow deer, red deer, mouflon, and roe deer. The LCAs are characterized by being active within an MMA larger than 500,000 ha and with reported regular presence of brown bear, wolverine, wolf, and lynx. The two clusters thereby implicitly represent a geographical divide, with implications for the ecological as well as the social context of moose management.

Further analyses of the socio-demographic characteristics of the two clusters show no major differences. Representatives of both MUAs and LCAs were predominantly men with a relatively high mean age close to 60 years. This corresponds to the MMG population (Dressel et al. 2020b). Most of the representatives in both clusters lived in rural areas. Among MUAs 46% have a university education, whereas for LCAs the corresponding figure is approximately 53%. Sixty percent worked in the forestry sector but a substantial proportion (37.7%) in the MUAs worked in the agriculture sector. In both clusters, hunters were somewhat overrepresented, 57.3% and 58.7%, respectively. Most representatives were experienced, they had participated in the MMGs for more than one year, and over 90% had been trained in the moose management system. A notable difference between the clusters is that the LCAs were more involved in the management system as part of their employment, 22.0%, as compared to the MUAs 5.5% (Table 1).

Prerequisites for basic need satisfaction among MMG representatives

The perceived prerequisites for competence

The perceived prerequisites for competence as assessed by reported need of knowledge in moose management showed that representatives reported an extensive need for more knowledge,

Table 2. Statistics for all univariate tests for moose management groups (MMG). MUAs, multi-ungulate areas; LCAs, large-carnivore areas; M, Mean; SD, Standard Deviation; F, F-statistic; P, P-value.

	MUAs M, SD	LCAs M, SD	F	p	Partial-eta squared
Competence					
Need of knowledge (scale 1–5)					
Moose as a species	4.79, 0.52	4.77, 0.55	0.04	n.s.	
Forestry	4.79, 0.50	4.72, 0.59	0.49	n.s.	
Hunting	4.65, 0.69	4.67, 0.66	0.04	n.s.	
Agriculture	4.46, 0.80	3.97, 0.89	23.77	< 0.001	0.070
Monitoring methods	4.68, 0.64	4.51, 0.79	2.81	0.017	0.013
Interaction with other ungulate species	4.75, 0.56	4.38, 0.81	13.94	< 0.001	0.067
Interaction with large carnivores	4.35, 0.99	4.51, 0.95	2.39	n.s.	
Adaptive management	4.70, 0.64	4.70, 0.71	0.01	n.s.	
Usefulness of monitoring methods (scale 1–3)					
Hunting bag statistics	2.88, 0.32	2.91, 0.35	0.71	n.s.	
Moose observations	2.84, 0.43	2.79, 0.46	2.28	n.s.	
Pellet count	2.34, 0.76	1.89, 0.81	34.05	< 0.001	0.070
Calf weights	2.61, 0.58	2.40, 0.63	11.62	= 0.001	0.025
Areal inventories	1.84, 0.78	1.91, 0.80	0.63	n.s.	
Browsing damages	2.52, 0.63	2.53, 0.62	0.05	n.s.	
Forage availability estimates	2.43, 0.63	2.35, 0.63	1.98	n.s.	
Autonomy (scale 1–5)					
Resources					
Time	3.85, 1.08	3.87, 1.09	0.037	n.s.	
Resources	3.76, 1.04	3.76, 1.05	< 0.001	n.s.	
Support	3.96, 1.10	4.10, 1.01	1.610	n.s.	
Relatedness					
Fulfil local actor needs (scale 1–5)					
Moose management units	3.84, 0.77	4.01, 0.74	5.20	0.023	0.011
Hunters	3.77, 0.82	3.85, 0.86	0.79	n.s.	
Local communities	3.11, 0.88	3.17, 0.87	0.36	n.s.	
Private landowners (small-scale)	3.25, 1.00	3.27, 1.11	0.03	n.s.	
Private landowners large scale	3.48, 0.88	3.54, 1.00	0.42	n.s.	
Fulfil business sector needs (scale 1–5)					
Agricultural sector	3.38, 0.86	3.03, 1.01	15.02	< 0.001	0.032
Reindeer herding sector	1.27, 0.63	2.17, 1.31	96.65	< 0.001	0.177
Forest sector	3.55, 0.89	3.80, 0.92	7.53	0.006	0.017
Tourism sector	2.38, 0.96	2.53, 1.05	2.17	n.s.	
Fulfil institution needs (scale 1–5)					
County Administrative Board	3.82, 0.80	3.73, 0.86	1.16	n.s.	
Swedish Environmental Protection Agency	3.00, 0.96	2.88, 0.98	1.53	n.s.	
Parliament and Government	2.40, 1.19	2.70, 1.19	6.21	0.013	0.014
The Swedish Forest Agency	3.25, 0.95	3.30, 0.97	0.33	n.s.	
Swedish Transport Administration	2.88, 1.01	2.92, 1.01	0.17	n.s.	
Wildlife Management Delegations	3.43, 1.02	3.52, 0.93	0.69	n.s.	

with mean values above four (scale ranging from 1 corresponding to low need to 5 corresponding to high need) for most aspects (Table 2). However, the two clusters significantly differed in the reported need for knowledge (Pillai's trace $V = 0.164$ $F(8, 442) = 10.83$, $p < 0.001$). Separate ANOVAs on the outcome variables revealed significant effects on three of the individual eight dependent variables. The need of knowledge with regard to agriculture, monitoring methods, and interaction with other ungulates were all assessed significantly higher by MUAs than by LCAs (Table 2). Perceived prerequisites for competence as assessed by the perceived usefulness of monitoring methods revealed that most of the existing methods were considered somewhat useful, especially hunting bag statistics and moose counting, whereas the usefulness of aerial photos was questioned (Table 2). The perceived usefulness of monitoring methods also significantly differed in the two clusters (Pillai's trace $V = 0.102$ $F(7, 443) = 7.615$, $p < 0.001$). The subsequent univariate ANOVAs on the outcome variables revealed significant effects on two of the individual seven dependent variables. More MUAs than LCAs regarded pellet count methods and inventories of calf weights as useful.

Table 3. Socio-demographics and representation in moose management units (MMU) of the two clusters.

	Managers of Multi-Ungulate Areas	Managers of Large-Carnivore Areas
Gender, male	99%	98%
Age	55 yrs, 24–83	56 yrs, 30–81
Education: University	33%	44%
Residential area Countryside or village, less than 2000 inhabitants	78%	75%
Work in		
Forestry	53%	54%
Agriculture	25%	11%
Represent		
Landowners	78%	72%
Hunters	93%	83%
Reindeer husbandry	0%	3%
Yourself only	1%	1%
Education about moose management system	29%	43%

The perceived prerequisites for autonomy
The representatives generally agreed that they perceived prerequisites for autonomy to do the expected tasks, as assessed by available resources (time, financial resources, support from stakeholder organization). The perceptions did not significantly differ between the two clusters (Pillai's trace V = 0.005 F(3, 447) = 0.69, n.s.; Table 2).

The perceived prerequisites for relatedness
The perceived prerequisites for relatedness considered the opportunities to meet needs and desires from three levels of actors: the local actors (MMU, hunters, small-scale landowners, and large-scale landowners), sectors (agriculture, reindeer herding, forest, tourism), and the institutional system (CAB, SEPA, Parliament and Government, Swedish Forest Agency, Swedish Transport Administration, and Wildlife Management Delegations). The assessments of perceived prerequisites for relatedness revealed large variation between actors, sectors, and institutional system. The lowest prerequisites were reported for the reindeer herding sector, and the highest prerequisites were unsurprisingly reported for the local actor of MMU (Table 2). No significant difference could be identified between the two clusters of local actors (Pillai's trace V = 0.013 F(5, 445) = 1.78, n.s), but the perceived relatedness differed in relation to sectors (Pillai's trace V = 0.232 F(4, 446) = 33.63, $p < 0.001$). Separate univariate ANOVAs on the outcome variables revealed significant effects on three of the individual four dependent variables. MUAs perceived that they related better to the needs and desires from agriculture than did LCAs. In contrast, the LCAs reported that they better related to reindeer herding and forestry. The relatedness to the institutional system also differed between the clusters (Pillai's trace V = 0.033 F(6, 444) = 2.54, p = 0.02). The univariate analyses revealed that this difference can be attributed to LCAs perceiving a better relatedness to the parliament and government than the MUAs.

Clusters of MMU representatives
A similar two-step cluster analysis was employed to identify distinct cluster groups within the MMU sample with homogeneous patterns of social-ecological contexts. In the MMU sample, n = 692 of the participants remained when "do not know" responses had been excluded for one or several species. Two clusters were also identified in the MMU sample, almost identical to those obtained in the MMG sample. The predictor importance of discriminating between the two clusters was highest for presence of wild boar and brown bear, followed by fallow deer and wolverine. Size of area, presence of deer, mouflon, roe deer, and wolf were predictors of relatively less importance. In the MMU sample, the largest cluster included 50.9% (n = 352) of the participants classified as managers of LCAs and 49.1% (n = 340) classified as managers of MUAs. The group of MUAs is characterized by primarily being active within an MMU with most of the area privately owned (a proxy for small scale) and with reported regular presence of wild boar, fallow deer, red deer, mouflon, and roe deer. The LCAs are characterized by being active within an MMA of which at least 50% of the area is owned by a forest company (a proxy for large scale) and with reported regular presence of brown bear, wolverine, wolf, and lynx.

The socio-demographic characteristics in the two clusters of MMU representatives were very similar to the MMG representatives, with almost all representatives being male and with a mean age of approximately 55 years, reflecting the population. Among the MUAs, 33% had a university education, with the figure somewhat higher (44%) among the LCAs. In both clusters a majority lived in rural areas (78% and 75%, respectively) and about half of the clusters worked in forestry. In the cluster of MUAs, 25% worked in agriculture, but this was less common among the LCAs (11%). In the MMU sample most of the participants in both clusters commonly considered themselves to represent both landowner and hunter interests. Among the MUAs, 29% had participated in education about the moose management system as compared to 43% of the LCAs (Table 3).

Perceived prerequisites of basic need satisfaction among MMU representatives

The perceived prerequisites for competence
The perceived prerequisites for competence as assessed by reported need of knowledge in moose management revealed a high need of knowledge also among the MMUs representatives (Table 4). The multivariate ANOVAs of reported need of knowledge revealed a significant difference between the two clusters (Pillai's trace V = 0.470 F(9, 682) = 67.33, $p < 0.001$). Separate univariate ANOVAs on the outcome variables showed significant effects on most of the individual nine dependent

Table 4. Statistics for all univariate tests, moose management units (MMU). MUAs, multi-ungulate areas; LCAs, large-carnivore areas; M, Mean; SD, Standard Deviation; F, F-statistic; P, P-value.

	MUAs M, SD	LCAs M, SD	F	p	Partial-eta squared
Competence					
Need of knowledge (scale 1–5)					
Moose as a species	4.62, 0.71	4.73, 0.57	5.18	0.023	0.007
Forestry	4.64, 0.66	4.69, 0.61	1.30	n.s.	
Hunting	4.57, 0.75	4.60, 0.69	0.28	n.s.	
Agriculture	4.29, 0.86	3.92, 0.89	31.42	< 0.001	0.044
Monitoring methods	2.96, 0.31	3.45, 0.38	343.43	< 0.001	0.332
Interaction with other ungulate species	4.32, 0.89	4.54, 0.73	12.22	= 0.001	0.017
Interaction with large carnivores	4.18, 0.84	4.54, 0.73	36.12	< 0.001	0.050
Adaptive management	3.95, 1.18	4.42, 0.79	37.95	< 0.001	0.052
Usefulness of monitoring methods (scale 1–3)					
Hunting bag statistics	2.77, 0.47	2.80, 0.42	0.78	n.s.	
Moose observations	2.68, 0.52	2.76, 0.47	4.35	0.037	0.006
Pellet count	1.76, 0.73	1.58, 0.63	12.34	< 0.001	0.018
Calf weights	2.55, 0.59	2.24, 0.70	39.52	< 0.001	0.054
Areal inventories	1.91, 0.79	2.07, 0.80	7.36	0.007	0.011
Browsing damages	2.14, 0.68	2.23, 0.73	3.17	n.s.	
Forage availability estimates	2.03, 0.65	2.04, 0.68	0.02	n.s.	
Autonomy					
Resources (scale 1–5)					
Time	3.68, 0.98	3.84, 0.98	4.05	0.044	0.006
Resources	3.72, 0.93	3.78, 1.03	0.61	n.s.	
Support	3.88, 0.89	4.03, 0.93	4.74	0.030	0.007
Relatedness (N = 538) "Don't know" % (scale 1–3)					
Local landowners	2.82 (0.40) 0.9%	2.40 (0.52) 2.3%	5.42	0.023	0.010
Local hunting teams	2.93 (0.27) 1.8%	2.86 (0.41) 1.4%	5.64	0.047	0.008
Adjacent moose management units	2.38 (0.62) 5.6%	2.32 (0.65) 6.5%	1.16	n.s.	
Adjacent license areas.	1.75 (0.77) 16.2%	1.93 (0.73) 7.4%	8.04	0.001	0.02
Moose management groups	2.59 (0.57) 7.4%	2.65 (0.56) 4.5%	1.85	n.s.	
Reindeer husbandry	1.00 (0.00) 9.7%	1.56 (0.70) 10.2%	157.84	> 0.001	0.227

variables, the exceptions being knowledge about forestry and hunting, which were assessed similarly by the two clusters. The need of knowledge on agriculture, interactions with other ungulates, and adaptive management was assessed as significantly higher among MUAs than LCAs. In contrast, the need of knowledge with regard to the species moose, reindeer herding, monitoring methods, and interactions with large carnivores was assessed as significantly higher among LCAs than MUAs (Table 4).

In the assessment of the usefulness of monitoring methods, there was a large variation in the perceived usefulness. Hunting bag statistics and moose observations were assessed as highly useful whereas the usefulness of pellet count was generally reported as low. The perceived usefulness of monitoring methods significantly differed in the two clusters using Pillai's trace (V = 0.097 $F(7, 684) = 10.523$, $p < 0.001$). The subsequent univariate ANOVAs on the outcome variables revealed significant effects on three of the individual variables. The MUAs found the monitoring methods of dung pellet counts and calf weights as relatively more useful in their work, while LCAs assessed aerial surveys and moose observations as more useful. However, the effect size for the difference in moose observations was very low.

The perceived prerequisites for autonomy

The reported prerequisites of perceived autonomy to carry out the tasks assigned to the MMUs, as assessed by available resources (time, financial resources, support from stakeholder organization), revealed that the representatives partly agreed that the resources were sufficient (Table 4). Prerequisites of perceived autonomy significantly differed between the two groups (Pillai's trace V =

0.012 F(3, 668) = 2.76, p = 0.041). The MUAs reported they had less time and support for their tasks than did the LCAs. However, the effect sizes were very small, below .01.

The perceived prerequisites for relatedness

The reported prerequisites of perceived relatedness in the MMU sample concerned the existence of dialogue with different groups at the local level. A "do not know" option was available for these items, and this response alternative was excluded in the analysis, thereby reducing the total sample to n = 538. Dialogue was reported to exist with most of the investigated groups, the expectations being adjacent license areas and reindeer herding (relevant only in the northern parts of the country). A significant difference in reported dialogue could be identified between the two clusters (Pillai's trace V = 0.275 F(6, 531) = 33.59, p < 0.001). Separate ANOVAs on the outcome variables revealed that the MUAs reported that they better related to local landowners and hunting teams than did the LCAs. In contrast, the LCAs reported stronger relatedness to adjacent license areas and reindeer husbandry than the MUAs (Table 4).

DISCUSSION

The governance regime for Swedish moose management is inspired by the EA, so it should be adaptable to fit the diversity of social-ecological contexts at the regional and local management levels across the country. The set-up of this regime implicitly assumes that the system provides representatives with the same prerequisites for perceived competence, autonomy, and relatedness, thereby supporting their motivation to voluntarily contribute. The regime allows for a high degree of participation and collaboration between levels to strengthen local agency. The regime has set procedures and methods that strive to be transparent and fair. On the surface, the regime seems capable of a good fit (DeCaro and Stokes 2013), yet the regime has been questioned in terms of its adaptive capacity and goal fulfilment (Dressel et al 2020a, b). There could be several explanations for this. From the psychological perspective, it might be worth addressing how the characteristics of the set-up of the regime in practice may provide different perceived prerequisites for involved stakeholder representatives to support important aspects of intrinsic motivation, i.e., the representatives' perceived competence, autonomy, and relatedness.

This study used a bottom-up perspective to identify sub-groups of representatives based on their own perceptions of the social-ecological context of their work. We also looked into the implications for the perceived prerequisites regarding the three aspects of intrinsic motivation to voluntarily contribute with engagement and efforts in the system. The results consistently revealed two sub-groups across two governance levels, the regional MMGs and the local MMUs. This study thereby confirms the contextual variation previously found by analyzing documented ecological and social parameters (Dressel et al. 2018).

Important distinctions were shown between these sub-groups accounting for species composition and social complexity represented by ownership structures. At both investigated governance levels there is a distinction between representatives who consider that they work with moose management in an ecosystem including multiple ungulate species in relatively complex owner structures—managers of MUAs—and representatives who find themselves working in ecosystems where also large carnivores may be present and the areas of land they manage are relatively large and with only a few owners—managers of LCAs. Considering that Sweden stretches over approximately 13 degrees of latitude and 7 degrees of longitude, that several vegetation zones are suitable for different species, and that it has an uneven division of its human population from < 1 inhabitant/km² to over 250 inhabitant/km², the two clusters come as no surprise. For example, in the south the vegetation period is 100 days longer than in the north and there may be four additional ungulates besides moose.

Importantly, the two sub-groups of representatives crossed stakeholder organization, meaning that their perceptions cannot be attributed to stakeholder organization politics or attitudes. Instead, the sub-groups reflect the representatives' experiences of their day-to-day work in the management system. Despite their different contexts of moose management, MUAs and LCAs are faced with the same institutional set-up steering their tasks. Currently the governance regime does not take into account that representatives may experience such differences in the social-ecological context. Extensive communication and participation involving diverse groups of local actors seems to be critical to positive perceptions of the governance process, engagement, and sustained local efforts for environmental management (Druschke and Hychka 2015, Turner et al. 2014). The differences identified between the two sub-groups must be acknowledged in rules, norms, and regulations of the moose management system to obtain a good fit between the governance regime, the local social-ecological contexts, and the people involved.

The perception of the people involved becomes critical in an institutional system, as the moose management system largely depends on representatives' voluntary engagement and efforts. In the literature on collaborative governance, such engagement has from a collective perspective been discussed as the social capital of a regime (e.g., Emerson and Nabatchi 2015). Here we focused on the implications of the institutional set-up for the people involved from the individual's perspective.

Following self-determination theory, our analyses served to identify the respects in which the set-up of the moose management system, and the individual representatives' perception of the social-ecological context, could potentially promote people's intrinsic motivation (Ryan and Deci 2004). Our focus was on the representatives' perceived prerequisites of perceived competence, autonomy, and relatedness. The prerequisites should be seen as mechanisms that may facilitate fulfilment of perceived competence, autonomy, and relatedness rather than the actual fulfilment of the needs. At both system levels, the two groups perceived a high need for knowledge, but the need was associated with different topics. As an example, the need was somewhat more pronounced regarding knowledge on agriculture, monitoring methods, and interaction with other ungulates among MUAs than among LCAs. In contrast, the LCAs reported less that some of the key monitoring methods (pellet count and calf weights) supported their need for knowledge. Consequently, the MUAs call for more knowledge on topics that have not traditionally been covered within moose management. It seems important that the institutional system identifies and covers perceived knowledge

gaps and provides adequate inventory method to support the need for representatives to grow and develop their competence.

The differences in need of knowledge between the sub-groups at the lower level of MMUs seemed more pronounced. This was shown by several significant differences between the two sub-groups. The call for further knowledge and perception of monitoring methods as useful was more closely related to their own social-ecological context. LCAs wanted more knowledge about moose and large carnivores rather than other ungulates. This result is most likely due to the MMUs working hands-on with moose management at a more local scale than the MMGs.

In order to strengthen the perceived prerequisites of competence, the EA of the Swedish Moose Management System should ensure that MMGs are given better access to ecological knowledge and monitoring methods that provide relevant information. There should be development opportunities to improve understanding of the available factual knowledge, and skills training in using and interpreting data from monitoring. In accordance with SDT, another strategy would be to reduce the demands on the representativeness, but this would likely weaken the representatives' opportunities to actively participate in activities such as setting goals. We conclude that the monitoring methods used must also fit the perception of how collecting data on a voluntary basis can be upheld and motivated.

Representatives at both MMG and MMU level tended to partly agree that the perceived prerequisites for fulfilling autonomy, as assessed in terms of access to resources, was sufficient. At the MMG level, this perception was shared between the two groups. In contrast, the two sub-groups at the MMU level showed significant differences in perceived prerequisites of autonomy, with the LCAs assessing the perceived prerequisites higher than the MUAs. This could be the result of a higher corporate ownership in LCAs, securing similar financial resources and/or infrastructure, compared to MUAs with their high number of private small-scale owners. The perceived prerequisites of autonomy might be strengthened by looking into the representatives' autonomy in the collaborative process and decision making, such as land-ownership patterns, access to financial resources, and integrated management across landscapes. Further studies should strive to extend the number of items and explore perceived autonomy more directly.

At the MMG level, the perceived prerequisites for relatedness can be considered to be supported in the interaction within the local context, although it comes across as better between the LCAs and the moose management units than between the MUAs and the moose management units. There are clear discrepancies between the two sub-groups in terms of interaction with sectors. These differences seem to be dependent on local contexts—the presence of agriculture, forestry, and reindeer herding. Both sub-groups judge the relatedness to the tourism sector as low. An interesting observation regarding the interaction with institutions is that the perceived requisites of relatedness to the Swedish Parliament and Government is low, and significantly lower among MUAs. The reason for this can only be speculated, but might reflect current challenges and tensions in multi-ungulate management (Sjölander-Lindqvist and Sandström 2019). At MMU levels, representatives need to respond more closely to various local actors—landowners, hunting teams and, in the north, reindeer husbandry. Perceived prerequisites for relatedness seem to be stronger among MUAs, possibly reflecting interaction when managing moose among many other ungulates. Perceived prerequisites for relatedness between the two sub-groups and different organizations varied considerably at both levels. To some extent, these differences seem to be adaptive, with, for example, stronger relatedness between LCAs and reindeer herding, both being located in the north of Sweden. When examining the perceived prerequisites of relatedness with various societal actors from the perspective of intrinsic motivation there should be a balance between relatedness at different societal levels to avoid tensions in the system.

A strength of the present study is that it covers parallel samples with high response rates at two governance levels. The application of self-determination theory was inspired by the literature in collaborative governance, pointing at motivation for voluntary engagement as a critical factor in the success of such systems (DeCaro et al. 2017, Marshall et al. 2017). The operationalization of the theory reflects the empirical context focusing on perceived prerequisites to fulfil basic needs, without strictly adhering to the underlying psychological concepts. This is a weakness, and we encourage further item development to more closely align to the operationalization of concept to theory. Here inspiration could be sought from other fields of application (see for example Mallett et al. 2007 for careful item development of the sport motivation scale-6). It should also be noted that the focus has solely been on intrinsic motivation and basic needs, but Ryan and Deci (2004), point out that extrinsic motivational factors could become internalized under certain circumstances. Dedeurwaerdere et al. (2016) argue that a combination of intrinsic and extrinsic motivation in multi-actor collaborations would be the most effective. These are relevant aspects that should be studied to improve understanding of possible differences and similarities in the motivational structure between representatives from landowners, hunters, and reindeer herders on the one hand, and representatives who participate in the management when employed in forest companies on the other.

CONCLUSIONS AND IMPLICATIONS

Collaborative governance approaches have been proposed as being more suitable for encouraging people's intrinsic motivation than authoritarian governmental approaches in promoting people's care for the environment (e.g. DeCaro et al. 2017, Emerson and Nabatchi, 2015, Marshall et al. 2017). Our results suggest that, when a collaborative approach is initiated from a top-down perspective, as is the case with the Swedish moose management system, the collaborative approach may not provide representatives with enough psychological space to become energized and engaged to cope with the local challenges. The system should make more effort to understand the conditions required for representatives to energize and direct their behavior, and then strive to offer the necessary prerequisites (Reeve 2018). This means that expectations and tools made available via the institutional system must fit the needs of stakeholder representatives across local social-ecological contexts, otherwise the space for local voluntary engagement might be hampered (Sjölander-Lindqvist and Sandström, 2019, Johansson et al. 2020). Using the idea of basic need satisfaction for intrinsic motivation in self-determination theory can provide valuable insights for the EA of Swedish moose management system. As

previously shown among other stakeholder groups drawing on representatives' voluntary efforts, it would be important to monitor and reflect upon how representatives experience their personal roles and situations in the system (Triste et al. 2018). It would be valuable to invite representatives to reflect upon the existing prerequisites and their opportunities to develop their competence and retain and exercise autonomy in their work (discretion) and experience positive social relations. The system must be flexible and adaptable to local social-ecological contexts and consider the needs of different sub-groups, otherwise the system may be a drain on people's voluntary engagement, and the pleasure of being involved.

Responses to this article can be read online at:
https://www.ecologyandsociety.org/issues/responses.php/13257

Acknowledgments:

The authors thank the Swedish Environmental Protection Agency's Wildlife Management Fund [Naturvårdsverket Viltvårdsfonden, Grant Number 802-0161-15] and the Swedish Association for Hunting and Wildlife Management [Svenska Jägareförbundet, Grant Number 5871/2018].

Data Availability:

The data that support the findings of this study are available on request from the corresponding author, MJ. None of the data are publicly available because of their containing information that could compromise the privacy of research participants. According to Swedish legislation (i.e., Act concerning the Ethical Review of Research Involving Humans), only human subjects research that involves sampling biological material, affects subjects' physical or mental well-being, or collects sensitive personal data requires an ethical approval from the national Swedish Ethical Review Authority (Sv:Etikprövningsmyndighetern). Sensitive personal data is defined as information about race or ethnicity, political, philosophical, or religious views, membership in unions, health, or sexual orientation. The current study did not include any collection of such data as specified by the Review Authority. Therefore no ethical review was required. The research still complies in all instances with the Helsinki Declaration, and the APA guidelines for psychological research and follows the Swedish research council's recommendations for good research practice. The handling of personal information was registered with the Swedish University of Agricultural Sciences in accordance to the data protection ordinance.

LITERATURE CITED

Aitken, N. M., L. G. Pelletier, and D. E. Baxter. 2016. Doing the difficult stuff: influence of self-determined motivation toward the environment on transportation proenvironmental behavior. Ecopsychology 8(2):153-162. https://doi.org/10.1089/eco.2015.0079

Convention on Biological Diversity. 2000. Recommendation V/10 ecosystem approach - further conceptual elaboration. Recommendations adopted by the SBSTTA fifth meeting, 31 January-4 February 2000. Convention on Biological Diversity, Montreal, Quebec, Canada.

Cooke, A. N., K. S. Fielding, and W. R. Louis. 2016. Environmentally active people: the role of autonomy, relatedness, competence and self-determined motivation. Environmental Education Research 22(5):631-657. https://doi.org/10.1080/1350-4622.2015.1054262

Danell, K., R. Bergström, L. Mattsson, and S. Sörlin. 2016. Jaktens historia i Sverige: vilt-människa-samhälle-kultur. Liber AB, Stockholm, Sweden.

DeCaro, D. A., C. A. (T.) Arnold, E. F. Boamah, and A. S. Garmestani. 2017. Understanding and applying principles of social cognition and decision making in adaptive environmental governance. Ecology and Society 22(1):33. https://doi.org/10.5751/ES-09154-220133

DeCaro, D., and M. Stokes. 2008. Social-psychological principles of community-based conservation and conservancy motivation: attaining goals within an autonomy-supportive environment. Conservation Biology 22(6):1443-1451. https://doi.org/10.1111/j.1523-1739.2008.00996.x

DeCaro, D. A., and M. K. Stokes. 2013. Public participation and institutional fit: a social-psychological perspective. Ecology and Society 18(4):40. https://doi.org/10.5751/ES-05837-180440

Deci, E. L., A. H. Olafsen, and R. M. Ryan. 2017. Self-determination theory in work organizations: the state of a science. Annual Review of Organizational Psychology and Organizational Behavior 4:19-43. https://doi.org/10.1146/annurev-orgpsych-032516-113108

Deci, E. L., and R. M. Ryan.1985. Intrinsic motivation and self-determination in human behaviour. Plenum, New York, New York, USA. https://doi.org/10.1007/978-1-4899-2271-7

Deci, E. L., and R. M. Ryan. 2000. The "what" and "why" of goal pursuits: human needs and the self-determination of behavior. Psychological Inquiry 11(4):227-268. https://doi.org/10.1207/S15327965PLI1104_01

Dedeurwaerdere, T., J. Admiraal, A. Beringer, F. Bonaiuto, L. Cicero, P. Fernandez-Wulff, J. Hagens, J. Hiedanpää, P. Knights, E. Molinario, et al. 2016. Combining internal and external motivations in multi-actor governance arrangements for biodiversity and ecosystem services. Environmental Science and Policy 58:1-10. https://doi.org/10.1016/j.envsci.2015.12.003

Dressel, S., G. Ericsson, M. Johansson, C. Kalén, S. E. Pfeffer, and C. Sandström. 2020a. Evaluating the outcomes of collaborative wildlife governance: the role of social-ecological system context and collaboration dynamics. Land use Policy 99:105028. https://doi.org/10.1016/j.landusepol.2020.105028

Dressel, S., G. Ericsson, and C. Sandström. 2018. Mapping social-ecological systems to understand the challenges underlying wildlife management. Environmental Science and Policy 84:105-112. https://doi.org/10.1016/j.envsci.2018.03.007

Dressel, S., M. Johansson, G. Ericsson, and C. Sandström. 2020b. Perceived adaptive capacity within a multi-level governance setting: the role of bonding, bridging, and linking social capital. Environmental Science and Policy 104:88-97. https://doi.org/10.1016/j.envsci.2019.11.011

Dressel, S., A. Sjölander-Lindqvist, M. Johansson, G. Ericsson, and C. Sandström. 2021. Achieving social and ecological outcomes in collaborative environmental governance: good examples from Swedish moose management. Sustainability 13:2329. https://doi.org/10.3390/su13042329

Druschke, C. G., and K. C. Hychka. 2015. Manager perspectives on communication and public engagement in ecological restoration project success. Ecology and Society 20(1):58. https://doi.org/10.5751/ES-07451-200158

Emerson, K., and T. Nabatchi. 2015. Collaborative governance regimes. Georgetown University Press, Washington, D.C., USA.

Ericsson, G., K. Danell, M. Boman, L. Mattsson, and U. Weinberg. 2010. Viltet och människan. Pages 158-171 in K. Danelland and R. Bergström, editors. Vilt, människa, samhälle. Liber, Stockholm, Sweden.

Field, A. 2009. Discovering statistics using SPSS. Third edition. SAGE, London, UK.

Johansson, M., S. Dressel, G. Ericsson, A. Sjölander-Lindqvist, and C. Sandström. 2020. How stakeholder representatives cope with collaboration in the Swedish moose management system. Human Dimensions of Wildlife 25(2):154-170. https://doi.org/10.1080/10871209.2019.1698081

Lavergne, K. J., E. C. Sharp, L. G. Pelletier, and A. Holtby. 2010. The role of perceived government style in the facilitation of self-determined and non self-determined motivation for pro-environmental behaviour. Journal of Environmental Psychology 30(2):169-177. https://doi.org/10.1016/j.jenvp.2009.11.002

Liberg, O., R. Bergström, J. Kindberg, and H. von Essen. 2010. Ungulates and their management in Sweden. Pages 37-70 in M. Apollonio, O. Andersen, and R. Putman, editors. European ungulates and their management in the 21st century. Cambridge University Press, Cambridge, UK.

Linnell, J. D. C., B. Cretois, E. B. Nilsen, C. M. Rolandsen, E. J. Solberg, V. Veiberg, P. Kaczensky, B. Van Moorter, M. Panzacchi, G. R. Rauset, and B. Kaltenborn. 2020. The challenges and opportunities of coexisting with wild ungulates in the human-dominated landscapes of Europe's Anthropocene. Biological Conservation 244:108500. https://doi.org/10.1016/j.biocon.2020.108500

Malett, C., M. Kawabata., P. Newcombe, A. Otero-Forero, and S. Jackson. 2007. Sport motivation scale-6 (SMS-6): a revised six-factor sport motivation scale. Psychology of Sport and Exercise 8:600-614. https://doi.org/10.1016/j.psychsport.2006.12.005

Marshall, G. R., D. W. Hine, and M. J. East. 2017. Can community-based governance strengthen citizenship in support of climate change adaptation? Testing insights from self-determination theory. Environmental Science and Policy 72:1-9. https://doi.org/10.1016/j.envsci.2017.02.010

Naturvårdsverket. 2018. Uppföljning av mål inom älgförvaltningen - Redovisning av regeringsuppdrag. (NV-08872-17). Swedish Environmental Protection Agency, Stockholm, Sweden. https://www.naturvardsverket.se/contentassets/ac564e2be39b46bcac473-4f7559b838e/181127-redovisning-ru-uppfoljning-av-mal-inom-algforvaltningen.pdf

Norušis, M. 2012. IBM SPSS Statistics 19 Statistical Procedures Companion. US: Prentice Hall.

Ostrom, E. 2008. Institutions and the environment. Economic Affairs 28(3):24-31. https://doi.org/10.1111/j.1468-0270.2008.00840.x

Pelletier L. G. 2004. A motivational analysis of self-determination for pro-environmental behaviors. Pages 205-232 in E. L. Deci and R. M. Ryan, editors. Handbook of self-determination research. University Rochester Press, Rochester, New York, USA.

Reeve, J. M. 2018. Understanding motivation and emotion. Seventh edition. Wiley, Hoboken, New Jersey, USA.

Ryan, R. M., and E. L. Deci. 2000. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist 55(1):68-78. https://doi.org/10.1037/0003-066X.55.1.68

Ryan, R. M., and E. L. Deci. 2004. An overview of self-determination theory: an organismic-dialectic perspective. Pages 3-36 in E. L. Deci and R. M. Ryan, editors. Handbook of self-determination research. University Rochester Press, Rochester, New York, USA.

Sandström, C. 2012. Managing large ungulates in Europe: the need to address institutional challenges of wildlife management. Human Dimensions of Wildlife 17(5):320-332. https://doi.org/10.1080/10871209.2012.710710

Sandström, C., S. Wennberg DiGasper, and K. Öhman. 2013. Conflict resolution through ecosystem-based management: the case of Swedish moose management. International Journal of the Commons 7(2):549-570. https://doi.org/10.18352/ijc.349

Singh, N. J., K. Danell, L. Edenius, and G. Ericsson. 2014. Tackling the motivation to monitor: success and sustainability of a participatory monitoring program. Ecology and Society 19(4):7. https://doi.org/10.5751/ES-06665-190407

Sjölander-Lindqvist, A., and C. Sandström. 2019. Shaking hands: balancing tensions in the Swedish forested landscape. Conservation and Society 17(4):319-330.

Sjölander-Lindqvist, A., C. Risvoll, R. Kaarhus, A. K. Lundberg and C. Sandström. 2020. Knowledge claims and struggles in decentralized large carnivore governance: insights from Norway and Sweden. Frontiers in Ecology and Evolution 8:120. https://doi.org/10.3389/fevo.2020.00120

SOU (Swedish Government Official Reports). 2009. Uthållig älgförvaltning i samverkan [Sustainable moose management in collaboration]. Utredningen om en bättre älgförvaltning. [The investigation for an improved moose management]. SOU, Stockholm, Sweden. https://www.regeringen.se/49bbac/contentassets/4c1931e996684c168b45c6bfc8df13d8/uthallig-algforvaltning-i-samverkan-sou-200954

Swedish Environmental Protection Agency (SEPA). 2011. Naturvårdsverkets föreskrifter och allmänna råd om jakt efter älg och kronhjort. NFS 2011:7. SEPA, Stockholm, Sweden. https://www.naturvardsverket.se/globalassets/nfs/2011/nfs-2011-07.pdf

Swedish Government Bill. 2009/2010. Älgförvaltningen [Moose management]. 2009/10:239. Swedish Government, Stockholm, Sweden. https://data.riksdagen.se/fil/230D87ED-6737-4110-A452-351BC5A2002C

Tallian, J., A. Ordiz, M. C. Metz, C. Milleret, C. Wikenros, D. W. Smith, D. R. Stahler, Kindberg, D. R. MacNulty, P. Wabakken, J. E. Swenson, and H. Sand. 2017. Competition between apex predators? Brown bears decrease wolf kill rate on two continents. Proceedings of the Royal Society B: Biological Sciences 284 (1848). https://doi.org/10.1098/rspb.2016.2368

Triste, L., J. Vandenabeele, F. van Winsen, L. Debruyne, L. Lauwers, and F. Marchand. 2018. Exploring participation in a sustainable farming initiative with self-determination theory. International Journal of Agricultural Sustainability 16 (1):106-123. https://doi.org/10.1080/14735903.2018.1424305

Turner, R. A., C. Fitzsimmons, J. Forster, R. Mahon, A. Peterson, and S. M. Stead. 2014. Measuring good governance for complex ecosystems: perceptions of coral reef-dependent communities in the Caribbean. Global Environmental Change 29:105-117. https://doi.org/10.1016/j.gloenvcha.2014.08.004

Waylen, K. A., E. J. Hastings, E. A. Banks, K. L. Holstead, R. J. Irvine, and K. L. Blackstock. 2014. The need to disentangle key concepts from ecosystem-approach jargon. Conservation Biology 28(5):1215-1224. https://doi.org/10.1111/cobi.12331

Wennberg DiGasper, S. 2008. Natural resource management in an institutional disorder: the development of adaptive co-management systems of moose in Sweden. Dissertation. Luleå University of Technology, Luleå, Sweden. https://www.diva-portal.org/smash/get/diva2:999637/FULLTEXT01.pdf

Wikenros, C., H. Sand, R. Bergström, O. Liberg, and G. Chapron, G. 2015. Response of moose hunters to predation following wolf return in Sweden. PLoS ONE 10(4):e0119957-e0119957. https://doi.org/10.1371/journal.pone.0119957

Appendix 1. List of survey items

Survey to Moose Management Areas

Competence

In moose management there is a need of knowledge regarding…

	Totally disagree	Partly disagree	Neither nor	Partly agree	Totally agree
moose	□	□	□	□	□
forestry	□	□	□	□	□
hunting	□	□	□	□	□
agriculture	□	□	□	□	□
monitoring methods	□	□	□	□	□
co-existence with other ungulate species	□	□	□	□	□
co-existence with large carnivores	□	□	□	□	□
adaptive management	□	□	□	□	□

How do you perceive the usefulness of the monitoring methods in moose management?

	Little	Intermediate	Large
Bag statistics	□	□	□
Moose observations (älgobs)	□	□	□
Dung pellet counts	□	□	□
Calf weight collection	□	□	□
Aerial surveys	□	□	□
Moose browsing damage monitoring (ÄBIN)	□	□	□
Forage availability estimates	□	□	□

Autonomy

Which prerequisite do you have to conduct your work in the moose management group? In my role, I have enough…

	Totally disagree	Partly disagree	Neither nor	Partly agree	Totally agree
time to do a good job	□	□	□	□	□
resources to do a good job	□	□	□	□	□
support from my organization to do a good job	□	□	□	□	□

Relatedness

As member of a Moose Management Group, how do you perceive your possibilities to meet the needs and desires of

	Not at all	To low degree	Neither nor	To relatively high degree	To very high degree
Moose Management Units	□	□	□	□	□
Hunters	□	□	□	□	□
Agriculture	□	□	□	□	□
County Administrative Boards	□	□	□	□	□
Local community	□	□	□	□	□
Swedish Environmental Protection Agency	□	□	□	□	□
Private landowners (less than 100 ha)	□	□	□	□	□
Private landowners (more than 100 ha)	□	□	□	□	□
Reindeer husbandry	□	□	□	□	□
Swedish Parliament and Government	□	□	□	□	□
Forest sector	□	□	□	□	□
Swedish Forest Agency	□	□	□	□	□
Swedish Transport Administration	□	□	□	□	□
Tourism sector	□	□	□	□	□
Wildlife Management Delegations	□	□	□	□	□

Ecological context

Which of the following game species are present in your Moose Management Area?

	Totally missing	Sporadically, single animals	Regular presence	Don't know
Moose	□	□	□	□
Roe deer	□	□	□	□
Wild boar	□	□	□	□
Red deer	□	□	□	□
Fallow deer	□	□	□	□
Mouflon	□	□	□	□
Bear	□	□	□	□
Lynx	□	□	□	□
Wolf	□	□	□	□
Wolverine	□	□	□	□

Social context

Approximately how many hectares has the Moose Management Area you are working in?

Less than 50.000 ha	□
50.000 - 99.000 ha	□
100.000 - 499.000 ha	□
500.000 ha or more	□

Survey to Moose Management Units

Competence

In moose management there is a need of knowledge regarding…

	Totally disagree	Partly disagree	Neither nor	Partly agree	Totally agree
moose	□	□	□	□	□
forestry	□	□	□	□	□
hunting	□	□	□	□	□
agriculture	□	□	□	□	□
monitoring methods	□	□	□	□	□
co-existence with other ungulate species	□	□	□	□	□
co-existence with large carnivores	□	□	□	□	□
adaptive management	□	□	□	□	□

How do you perceive the usefulness of the monitoring methods in moose management?

	Little	Intermediate	Large
Bag statistics	□	□	□
Moose observations (älgobs)	□	□	□
Dung pellet counts	□	□	□
Calf weight collection	□	□	□
Aerial surveys	□	□	□
Moose browsing damage monitoring (ÄBIN)	□	□	□
Forage availability estimates	□	□	□

Autonomy

Which prerequisite do you have to conduct your work in the moose management unit? In my role, I have enough…

	Totally disagree	Partly disagree	Neither nor	Partly agree	Totally agree
time to do a good job	□	□	□	□	□
resources to do a good job	□	□	□	□	□
support from the interest I represent to do a good job	□	□	□	□	□

Relatedness

How are you normally working in your Moose Management Unit? In our work, we collaborate with...

	Never	Sometimes	Regularly	Don't know
Local landowners	□	□	□	□
Local hunting teams	□	□	□	□
Adjacent moose management units	□	□	□	□
Adjacent licence areas	□	□	□	□
Moose management groups	□	□	□	□
Reindeer husbandry	□	□	□	□

Ecological context

Which of the following game species are present in your Moose Management Unit?

	Totally missing	Sporadically, single animals	Regular presence	Don't know
Moose	□	□	□	□
Roe deer	□	□	□	□
Wild boar	□	□	□	□
Red deer	□	□	□	□
Fallow deer	□	□	□	□
Mouflon	□	□	□	□
Bear	□	□	□	□
Lynx	□	□	□	□
Wolf	□	□	□	□
Wolverine	□	□	□	□

Social context

What proportion of the Moose Management Unit is owned by forest companies?

None	□
1 - 25 %	□
26 - 50 %	□
51 - 75 %	□
76 - 100 %	□